

Navigating the Playground SDK™

A User and Reference Guide
For Playground SDK 4.0

by Tim Mensch

Navigating the Playground SDK™

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Playground SDK™ Design

Tim Mensch is the Playground SDK™ lead at PlayFirst, and he provides much of the design direction, but he doesn't work in a vacuum.

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Part I

User's Guide

Chapter 1

Introduction

1.1 Welcome to the Playground SDK™!

The Playground SDK™ is designed to provide all of the core features you'll need to create a polished, successful downloadable game while handling many of the distractions that would otherwise slow you down. A game written in Playground will run on multiple platforms, including Windows, Windows-ActiveX, and Mac OS X 10.4. Playground is an object-oriented C++ library that relies on Lua for scripting support. Familiarity with Lua is helpful, but not a requirement, since most of the game is written in C++. Like C++ itself, Playground exposes both low-level and high-level functionality, giving you the ability to directly modify textures and map them on polygons at the lowest level, and a game-centric GUI/windowing system at the highest level.

While the Playground team has its own ideas as to how Playground should be used, we've tried not to overly restrict the number of development paradigms that make sense. For example, button messages can be set up to run entirely in Lua, or you can ignore Lua and simply process button messages in C++. Dialogs can easily be specified in a human-friendly format based on Lua, or they can be completely constructed by hand. Some developers are using their own custom libraries to do just about everything, handing only polygons to Playground to render, though in those cases it's often harder to guarantee cross-platform portability.

We're also constantly working on the Playground SDK™ to improve it; if you have a suggestion, idea, or complaint about the SDK, please let us know so that we can address it! Internally the code has been written for easy modification, so we're not afraid to add new features if they seem useful.

You can learn more about Playground and share your ideas with others at the developer web site and forum at <https://developer.playfirst.com>. Between active discussions, important announcements, and the latest released version of the SDK, it's a place any active Playground developer should visit frequently.

1.2 What's on the Playground?

1.2.1 Basic Features

Playground currently supports Windows 98, Windows 98SE, Windows ME, Windows 2000, and Windows XP, both in stand-alone and ActiveX modes; and Mac OS X. Development is currently supported on Windows platforms using Visual Studio 2005 (8.0) or Visual C++ 2005, and on Mac OS X using Xcode.

The Playground SDK™ provides basic GUI features via its [TWindow](#) system, which supports message passing, Lua dialog/screen layout files, buttons, scroll bars, text entry, and image layering. The [Lua script subsystem](#) is integrated so as to be an optional component, though most developers choose to take advantage of it.

Playground supports the reading and display of JPG and PNG files, the latter with optional transparency. Animations are handled through an animated texture and sprite system. For finer grained control, the `TPlatform::DrawVertices()` API exposes full 3d triangle rendering with color, pre-lit, or pre-transformed-and-lit vertices, for those

developers who have their own graphics library and who want to take advantage of the portability that Playground offers. Triangle rendering is also the most supported path to 3d game development at present. For sound playback, Playground supports the OGG/Vorbis sound format, a free format (no royalties required) that produces better quality sound than MP3 at similar bit rates.

There is a resource editor under development, with a planned completion of Q2 2007. A particle editor and very limited animation editor are included in the current distribution, but will be expanded gradually in Q2-Q4 2007.

1.2.2 Design Goals

The Playground SDK™ has several important design goals:

1. **Portable** to multiple platforms (OpenGL/DirectX, Mac/Windows, potentially others)
2. **Small**, to keep download size small.
3. **Robust**.
4. **Complete**.
5. **Separable**, so that features not needed by a client are not linked in.
6. **Readable**. The coding practices include readable design, judicious use of macros, comments on any code whose purpose isn't obvious, and class and member names that clearly indicate functionality.

1.2.3 Portability Concerns

There is a list of Coding Standards on the developer web site that, if you follow it, will help make your game completely and immediately portable to other platforms. The Coding Standards page is a living document—developers are a creative bunch, and from time to time they come up with new and interesting ways to write code that's not portable. As that happens, we add new standards. In addition, in order to ensure that the Playground SDK™ is portable, all platform-specific functionality you should need resides in the library. If there's anything missing, please ask for it!

All APIs exposed by the SDK hide platform-specific complexity behind an abstraction that specifies the intent of the request rather than the specific platform feature you need. For example, application configuration data should be managed by the library with no reference in the API to application-specific information such as a path. The [TFile](#) file abstraction allows you to read and write files with no knowledge of the local file-system topology.

1.2.4 On Making a Library Robust

There's more to making a library robust than just expunging the bugs; the design needs to take into account how the library is likely to be used, making it as easy as possible for the user to write correct code. Any time we come across a point in SDK design where we feel the need to warn the user about a potential pitfall, we try to step back and reevaluate the design to see if there is a way we can eliminate the need for a warning by making an architecture change. Warnings remain in the documentation only in instances where we decide that the additional flexibility is worth the risk.

Designing a robust SDK also involves evaluating the entire process of writing a game, keeping track of the places that bugs tend to develop, and then handling as many of those problem domains as possible *in the library*. While we can't offload your game logic, we can make sure your game will run on any target architecture, that you have access to container classes that are well documented and thoroughly tested, and that the problems you do face concern the game you're writing and not the environment.

1.2.5 When is a Library Complete?

The Playground SDK™ will probably always be growing and evolving; how can we have completeness as a design goal? Conceptually, we intend Playground to be able to create any typical casual downloadable game. We hope to make available in Playground any feature that you would need to create any current game.

As we extend Playground in the future, improvements will fall into one of three categories. We'll be refining the core library, extending the API and making Playground more robust. We will augment the core library judiciously, when new features would have broad utility or require hardware support. And we will be creating more specialized features that exist in layers on top of the current library. Since these specialized components will be helpful to some, but not all, developers, the game developer will have the option whether to link them into their game. This keeps Playground's download footprint smaller for developers who don't need the optional functionality.

Chapter 2

Getting Started

2.1 Playground SDK™ User Guide

2.1.1 How to Play on the Playground

The easiest way to get started with the Playground SDK™ is to start with the skeleton application, modifying the window name and splash screen sequence as appropriate for your product. Most of the substance of your application will live in, or be spawned from, a class derived from [TWindow](#)—the skeleton application creates several TWindow-derived classes.

The TWindow base class provides the functionality you would expect of a hierarchical window class: Add children, set a position, draw, send and respond to messages or events, and other standard supporting members and interfaces. Generic messages can be handled using [TWindow::OnMessage\(\)](#); other events trigger specific On*() calls: [TWindow::OnChar\(\)](#), [TWindow::OnMouseDown\(\)](#), etc. Note that your window will only get keyboard events if the window currently has focus; see [TWindowManager::SetFocus\(\)](#).

Custom windows are created from Lua resource files using dynamic creation; since C++ doesn't support named dynamic creation natively, we've added some support macros to enable that functionality. Here's an example of what that looks like:

```
// The TGame window definition header C++
class TGame : public TWindow
{
    PFTYPEDEF_DC(TGame,TWindow) // Add the dynamic creation functions
    ...
}

// In the .cpp file:
PFTYPEIMPL_DC(TGame) // Define the TGame dynamic creation functions
```

Among other things, these macros will declare a `ClassId()` function that will return the unique class of the window type. To add a new window type, you register it by passing the `ClassId()` of the window to [TWindowManager::AddWindowType](#). From `main.cpp` in the skeleton:

```
TWindowManager * wm = TWindowManager::GetInstance(); C++
wm->AddWindowType("GameWindow",TGame::ClassId());
```

This sequence allows you to specify the position and size of the game window in a Lua resource file, which (minimally) looks something like this:

```
GameWindow Lua
{
    x=20, y=20, w=600, h=600
}
```

In this file you would also define any buttons that are children of that window, or alternately any background or status windows that are separate from the game window. The hierarchy can work however you like—a bunch of sibling windows that sit exactly next to each other, a strict hierarchy, or a hybrid. See [Using TWindows](#) for more information on deriving a class from TWindow.

A number of window types are defined for you by Playground, including buttons ([TButton](#)), text ([TText](#)), editable text ([TTextEdit](#)), and bitmaps ([TImage](#)). Look at the derived classes in the TWindow documentation to see a complete list.

Assets are loaded and managed by Playground in reference-counted containers. The T*Ref classes are the containers, e.g., a [TTextureRef](#) holds a [TTexture](#) that you acquire from [TTexture::Get\(\)](#). See [Game Assets](#) for more information.

See [TTexture::Draw](#) and [TTexture::DrawSprite](#) for ways to draw your texture on the screen. These draw calls should only be called in your derived [TWindow::Draw\(\)](#) function, in a [TBegin2d](#) block.

3d models and sounds are handled similarly to textures: A [TSound](#) is acquired with [TSound::Get\(\)](#) and stored in a [TSoundRef](#), and a [TModel](#) is acquired using [TModel::Get\(\)](#) and is stored in a [TModelRef](#). You can play a [TSound](#) with [TSound::Play\(\)](#). Drawing the [TModel](#) is done with [TModel::Draw\(\)](#) after setting up the model's texture, matrices, and lighting. See the section in [TRenderer](#) on 3d-related functions for more information.

2.2 An Example

2.2.1 A First Example Program

The Main Program: Part One

In this section I will walk you through a skeleton application that demonstrates some basic functionality. First, a bit of sample code:

```
void Main(TPlatform* pPlatform, const char* /*cmdLine*/) C++
{

    // Default to the new subtractive renderer behavior, which is
    // correctly cross-platform to the Mac.
    TRenderer::GetInstance()->SetOption("new_subtractive","1");

    // Set the application name
    pPlatform->SetWindowTitle(
        pPlatform->GetStringTable()->GetString("windowtitle").c_str()
    );

    TSettings::CreateSettings();
    TSettings::GetInstance()->InitGameToSettings();
}
```

This code is from `main.cpp` in the skeleton project. The functions are straightforward: The window title is the text that appears in the bar at the top of the window. The `InitGameToSettings()` call loads the application's saved settings and initializes the window to full screen or windowed mode, depending on the user's saved preferences.

```
pPlatform->SetCursor( TTexture::GetSimple("cursor/cursor"), TPoint(1,1) ); C++

pPlatform->SetCursor( TTexture::Get("cursor/thumb.png"), TPoint(12,2), true );

TWindowManager * wm = TWindowManager::GetInstance();
wm->AddWindowType("GameWindow", TGame::ClassId());
wm->AddWindowType("MainMenu", TMainMenu::ClassId());
wm->AddWindowType("OptionsWindow", TOptions::ClassId());
wm->AddWindowType("Slider", TSlider::ClassId());
wm->AddWindowType("HiscoreWindow", THiscore::ClassId());
wm->AddWindowType("ChoosePlayerWindow", TChoosePlayer::ClassId());
wm->AddWindowType("CreditsWindow", TCredits::ClassId());
wm->AddWindowType("Swarm", TSwarm::ClassId());
wm->AddWindowType("ChessPiece", TChessPiece::ClassId());
```

Here we set up a custom cursor for the application. Then, for convenience, we grab a pointer to the window manager. Then we register several window creation commands, which will allow us to easily specify our custom windows later.

```
// Start the Lua GUI script; this script will never exit C++
// in a typical Playground application.
wm->GetScript()->RunScript("scripts/mainloop.lua");
```

This last call to `TScript::RunScript()` causes our Lua main loop to begin.

What's a Window Creation Command?

The window creation commands mentioned above are simple classes that are overridden to create the custom game window. By "custom game window", we mean the window in which you plan to do all of the interesting stuff that makes your game fun—drawing sprites and/or 3d objects that dance around in response to user interaction. You can have more than one of these window classes in your application, and you can even specify that several coexist on the same screen—but in order for the screen building code to know how to create your custom window, your window needs to have [dynamic creation](#) enabled.

First, in the class definition:

```
class TGame : public TWindow
{
    PFTYPEDEF_DC(TGame, TWindow)
```

C++

Then, in the implementation file:

```
PFTYPEIMPL_DC(TGame);
```

C++

Pretty simple. If something needs to happen after the window has been created, you can override either the `TWindow::Init` function, or the `TWindow::PostChildrenInit` function, depending on when it needs to happen.

To enable the custom window in the window scripts, you just need to call `TWindowManager::AddWindowType()` with the window name and class id:

```
wm->AddWindowType("GameWindow", TGame::ClassId());
```

C++

And then the window will be created in the script with a simple:

```
...
GameWindow
{
    x=300,y=100,w=400,h=400
},
...
```

Lua

Lua Main Loop? Custom Window Creation? What's this about?

The Playground SDK™ uses Lua as a way to achieve light cooperative multithreading, as well as for dialog/window layout. In the Lua main loop script, you can specify the order of windows you want to display, or a simple animation sequence, or pop up a modal dialog. When it's time for the script to pause (to wait for an animation or user input), you call a command that returns control to the C++ code. Some commands, like `DisplaySplash()`, implicitly return control and wait for a specified amount of time before continuing. Others, like `DoModal()`, pause to wait for a particular event, such as the closing of a window. Here is the main Lua GUI loop:

```
-- Main game loop
function Main()

    DisplaySplash(
        "splash/playfirst_animated_logo.swf",
        "splash/playfirst_logo", 4000
    );
    DisplaySplash("", "splash/distributor_logo", 4000);

    -- Push the game selection screen
    while true do
        DoMainWindow("scripts/mainmenu.lua");
        -- DoMainWindow will exit only if there are NO windows pushed on the stack, so
        -- a PopModal()/PushModal() combination will not cause this to loop.
    end
end

-- Return a function to be executed in a thread
return Main
```

Lua

That last return statement is important: When you call `TScript::RunScript`, it just runs through the script once and returns. What we want to happen is for it to be able to run in a threaded manner. So `TScript::RunScript` watches for a return value from the script that it just ran, and if it finds one that's a function, it runs the function as a thread.

So what's happening here? First, a call to `DisplaySplash()` displays a splash screen for 4000ms (or until the user hits a key). A second call to `DisplaySplash()` brings up the second screen for 2000ms. Then an endless loop starts that consists entirely of bringing up the game selection screen. Why is it an endless loop? Because the game selection screen destroys itself when someone selects a game, and so when the user is done playing and the `DoModal()` subroutine finally exits, the game will need to create a new game selection screen.

The Main Program: Part Two

Back to `main.cpp` to show you the rest of the main loop:

```
// The main C++ loop
TEvent event;
while(true)
{
    pPlatform->GetEvent(&event);
    if(event.mType == TEvent::kQuit)
    {
        break;
    }

    if (event.mType == TEvent::kClose)
    {
        // Here you can display a "Do you want to exit?" dialog...or just quit.
        // We just quit.
        break;
    }

    if (event.mType == TEvent::kFullScreenToggle)
    {
        TSettings::GetInstance()->UpdateFullScreen();
    }

    // Pass the event to the Window manager for further processing
    TPlatform::GetInstance()->GetWindowManager()->HandleEvent(&event);
}
}
C++
```

Here we have our "message pump," the place where top level application messages get processed. This code is pretty straightforward: Get an event, do something if we know how to react to it (i.e., if it's a `kClose` event), and pass the event on to `TWindowManager::HandleEvent()` for further processing. `TWindowManagerHandleEvent()` then propagates events appropriately; for example, it triggers mouse and keyboard events on appropriate windows.

2.3 Let's See Some Graphics

2.3.1 Game Assets

Game assets are loaded and managed by the library. Internally, they are reference counted, but the reference count is updated entirely by C++ container classes. To use a bitmap texture loaded from disk, for instance, you would acquire it from the library using `TTextureGet()` and keep it in a `TTextureRef` instance. The `TTextureRef` handles the reference counting.

Here's some code to illustrate:

```
class MyGame : public TWindow C++
{
...

    void LoadAssets()
    {
        // Load myimage.png or myimage.jpg
        mMyImage = TTexture::Get("images/myimage");
    }

    void Draw()
    {
        // Draw the image to the middle of an 800x600 screen
        mMyImage->DrawSprite(400,300);
    }

    TTextureRef mMyImage ;
}
```

The basic idea is that you keep around a persistent `TTextureRef` for each image you need. If you call `TTextureGet` more than once for the image you've already loaded, it will hand you a second reference to the same image. When the last `TTextureRef` to a particular image is destroyed, the image will be deallocated. Note that when you destroy a window and create a new window, as when you are switching between game modes, it doesn't actually delete the old window until you have created the new window—so any assets in common are simply referenced and won't need to be reloaded.

A `TTexture` can currently be loaded from a JPG or a PNG file, and will be auto-converted to a bit depth compatible with the current screen resolution. A `TTextureRef` acts like a pointer:

```
TTextureRef t = TTexture::Get("my.jpg"); C++
t->Draw( ... )
```

The example with `TTexture` above works similarly for `TModel/TModelRef`, if you plan to use 3d models.

2.3.2 The Game Window

The skeleton is built of a number of custom window classes derived from `TWindow`. In a real game, each of these windows could be used to display a different part of the game or user interface.

For example, in the Playground skeleton application the `TSwarm` class draws a swarm of butterflies. The butterflies are managed as sprites; here we create the sprites and assign them to a container:

```
TSwarm::TSwarm() : C++
    mLastUpdate(0)
{
    mSpriteHolder = TSprite::Create();

    mTexture = TAnimatedTexture::Get("anim/cardinal.xml");
    if (mTexture)
    {
```

```

    for (int i = 0 ;i<kNumSprites; ++i)
    {
        mSprites[i] = TAnimatedSprite::Create(i);
        mSprites[i]->SetTexture(mTexture);
        mSprites[i]->Play();
        TDrawSpec drawSpec(
            TVec2( (float)((float)kBoundary+i*(float)(kWidth-kBoundary*2)/10.0F),
                 (float)((float)kBoundary+i*(float)(kHeight-kBoundary*2)/10.0F) ),
            1,0.8F
        );
        drawSpec.mMatrix.Scale( 0.5F + TPlatform::GetInstance()->Rand()%1000/1000.0F );

        mSprites[i]->GetDrawSpec()= drawSpec;
        mVelocity[i]= TVec2(0,0);

        mSpriteHolder->AddChild(mSprites[i]);
    }
    mHitCount = 0;
}

```

The member `mSpriteHolder` is a sprite itself, though it doesn't have a texture assigned—rather it's only being used as a container. The same `TAnimatedTexture` is being assigned to each sprite, but since each `TAnimatedSprite` keeps track of its frames independently, and the script throws in some randomness, each butterfly flaps its wings independently.

Now that we have a bunch of butterfly sprites, let's draw them. Here's the start of the skeleton application's `TSwarm::Draw`:

```

void TSwarm::Draw() C++
{
    TRenderer * r = TRenderer::GetInstance();
    TBegin2d begin2d ;

    mSpriteHolder->Draw();

    mParticles.Draw( TVec3(0,0,0) );
    mParticles2.Draw( TVec3(0,0,0) );
}

```

That's it—now the sprites are drawn on the screen. The `particles` also get drawn here. We'll go into more detail about them later.

Let's Move!

Timed event processing is easy in Playground: You can either derive a class from `TAnimTask` and hand it to the current top modal window, or simply activate the internal `TWindow` animation timer. Moving the sprites around in the skeleton is handled in `TSwarm::OnTaskAnimate`—here is a simplified version for illustrative purposes:

```

bool TSwarm::OnTaskAnimate() C++
{
    // Mark the screen as dirty so it will update
    TWindowManager::GetInstance()->InvalidateScreen();

    uint32_t now = GetWindowAnim()->GetClock()->GetTime();
    TReal elapsedTime = (float)(now - mLastUpdate)/1000.0f;
    mLastUpdate = now;

    for (int i=0; i<kNumSprites; ++i)
    {
        // Get the distance from this butterfly to the mouse cursor.
        TVec3 delta = TVec3(mLastMouse)-mSprites[i]->GetDrawSpec().mMatrix[2] ;

        // Add the mouse "pull" to the velocity.
        mVelocity[i] += delta * elapsedTime * mPull;
    }
}

```

```

    // Move the sprite position by the velocity
    mSprites[i]->GetDrawSpec().mMatrix[2] += TVec3(mVelocity[i] * elapsedTime,0);
}
// Update the particle systems (pretend it's always 16ms)
mParticles.Update(16);
mParticles2.Update(16);
return true;
}

```

Here `TSwarm::OnTaskAnimate()` iterates through the sprites and performs some simple math to move the sprites around. Then it calls `TLuaParticleSystemUpdate()` on each particle system to process their animation. Note that it's calling those systems with a constant value; this tends to keep the particle system looking more consistent.

To enable `OnTaskAnimate()`, you have to do one more thing:

```

void TSwarm::Init(TWindowStyle &style) C++
{
    // Start the window animation to be called
    // (at most) every 15 milliseconds
    StartWindowAnimation( 15 );
}

```

The excerpt above is a simplified version of the code in the skeleton application (which also bounces the butterflies off the edge, damps the velocity, and tries to prevent the butterflies from clustering).

This is where the ongoing game logic typically takes place: In a routine that's called at a particular rate, so your game can always run at the same speed.

Be careful not to put more processing in a call like this than can comfortably be crunched in its given time slot. If this call were to take longer than 15ms, for instance, then it would be executed again on the very next update pass, and the game would slow down. You can prevent this and keep your game at a constant speed by increasing the delay step so that it's always longer than the call takes.

Drawing 3d Objects

Here's the start of a function in the skeleton responsible for rendering the chess piece window, `TChessPiece::Draw`.

```

void TChessPiece::Draw() C++
{
    // Getting a copy of TPlatform for convenience
    TRenderer * r = TRenderer::GetInstance();
    TRect screenRect ;
    GetWindowRect (&screenRect);

    {
        TBegin3d begin3d;

        // Set up our perspective projection matrix
        r->SetPerspectiveProjection(0.1F,100.0F,PI/5.0f);

        // Set up our rendering texture
        r->SetTexture(mTexture);

        // Set up our light
        r->SetLight(0,&mLight);

        // Set up our material
        r->SetMaterial (&mMat);
    }
}

```

So far it sets up a perspective projection matrix, a default texture, and a default material. Next it needs to set up the world matrix and a light:

```

C++
    TMat4 localMatrix ;
    localMatrix.Identity();

```

```

// Build transform for yaw about board-y axis
localMatrix.RotateY(mYaw);

// Build transform for pitch about view-x axis

TMat4 pitch, view;
TRenderer::GetInstance()->GetViewMatrix(&view);
pitch.RotateAxis((TVec3)view[0], PI/6);

localMatrix = pitch*localMatrix ;

localMatrix[3][0] = 0;
localMatrix[3][1] = -0.75;
localMatrix[3][2] = 3;

mSpinLight.mDir.x = cos(mYaw*2) ;
mSpinLight.mDir.y = sin(mYaw*3) ;
mSpinLight.mDir.z = cos(mYaw*2) ;
mSpinLight.mDir.Normalize();

// Set up our light
r->SetLight(1,&mSpinLight);
r->SetWorldMatrix(&localMatrix);

```

We're spinning our chess piece around to `mYaw` radians and setting up a light at some other orbit for interesting reflections here. Next we do the actual drawing of the model:

```

if (mModel)
{
    mModel->Draw();
}
begin3d.Done();
}

```

C++

Note the `TBegin3d`: It's necessary to tell Playground whether you want it to be in 2d or 3d mode before you actually do any drawing. This allows us to optimize certain aspects of set-up, and makes this necessary overhead more explicit so that a game programmer knows that switching between these modes is expensive.

Finally, we're simply drawing a box around the window. Not brain surgery. Note `TBegin2d`, which is analogous to the `TBegin3d` above. `TBegin2d` and `TBegin3d` are helper classes that automatically release the state on close of scope.

That's all there is to it. So where did `mModel` come from? It was initialized in the `TChessPiece` constructor along with `mTexture`:

```

mModel = TModel::Get("mesh/king.mesh");
mTexture = TTexture::Get("mesh/white");

```

C++

And there you have it!

2.3.3 Dealing With User Input

A `TWindow`-derived class will receive user input via the `On*()` class of functions. If a user clicks in a window, it will receive an `TWindow::OnMouseDown()` - `TWindow::OnMouseUp()` pair. When a mouse moves over a window, it will receive `TWindow::OnMouseMove()`. Messages are passed from child to parent if the child doesn't handle them.

Similarly, the window with the keyboard focus gets `TWindow::OnChar` when a key is hit. For finer-grained control, `TWindow::OnKeyDown` and `TWindow::OnKeyUp` are fired when a key is pressed and released. Messages sent from child windows, like the "button pressed" message sent by `TButton`, can be fielded by `TWindow::OnMessage()`.

2.3.4 Why Modal Windows Are Your Friend

In the Playground SDK™ framework, when a message or event arrives at the window hierarchy, it typically starts at a window and works its way up through parents looking for a handler. It always stops looking if it encounters a [TModalWindow](#), however; modal windows act as boundaries to the game context, and input never travels past them on the stack. In fact, the [TWindowManager](#) maintains a stack of just TModalWindows, and you can query the top modal window using [TWindowManager::GetTopModalWindow\(\)](#).

When Playground starts up, it pushes a special modal window called [TScreen](#) on the top of the window stack. This window must never be popped from the stack, or the game will exit.

The standard paradigm when switching between game modes is to pop the current modal window off the stack and push your new window; alternately, you can use the Lua function [SwapToModal\(\)](#) if you are not creating custom-derived TModalWindows.

If you need to bring up a game-pausing event ("Are you sure you want to quit?"), you can push another modal window onto the stack, and pop it when you're finished. If you have a game with sub-games, you can push a sub-game window onto the stack. When a new modal window is on the stack, the previous window gets *no* messages, its [TTask](#) events stop firing, and its clock stops. Messages and [TTask](#) events resume when the child modal window closes. Note that in order to take advantage of its clock you need to explicitly assign the clock to the class that needs it, e.g., [TAnimTask](#) or [TAnimatedSprite](#).

Modal window have no technical limit as to their depth; however it's probably not wise to push more than two to three levels, just from a user interface perspective.

2.4 Play Structures You'll Find

2.4.1 How to use Playground SDK™ features.

Using TSprites

The [TSprite](#) class can be used to help manage the display of game objects. TSprite objects are stored in reference-counted variables. You can use them individually, or you can create a hierarchy of them.

A [TSprite](#) is an encapsulation of the following items:

- A texture to render.
- A layer value.
- A [TDrawSpec](#) for position/orientation/tint/scaling/alpha.
- A list of children.

When you create a TSprite you give it a layer, which is used only for sorting relative to its siblings and parent: Higher numbered layers appear in front of lower numbered layers among siblings, and negative layers appear behind the parent TSprite.

Each TSprite has an associated [TTexture](#), and an inherent [TDrawSpec](#). The latter is used to position and orient the sprite relative to its parent, and in general to determine how to draw the texture. See the documentation on [TDrawSpec](#) for more details.

A related object, the [TAnimatedSprite](#), is identical to the TSprite with two exceptions: It's designed to be able to handle [TAnimatedTexture](#) particularly well, and it contains a [TScript](#) for animating the TAnimatedTexture. A normal TSprite can have a TAnimatedTexture assigned to it, since TAnimatedTexture inherits the TTexture interface, and therefore in object-oriented terms is-a TTexture. However, since TAnimatedTexture objects can be reused, any animation state has to be kept with each instance—in this case with the TAnimatedSprite object.

Why a TAnimatedSprite and a TAnimatedTexture? A [TAnimatedTexture](#) is simply a list of frames. A [TAnimatedSprite](#) has a script that plays back the frames. So there's no concept of "Play" on [TAnimatedTexture](#), but there is on [TAnimatedSprite](#).

Using TDrawSpec

A [TDrawSpec](#) includes the following information:

- A position.
- An orientation/scaling matrix
- A logical center to render the texture relative to.
- A tint value (that's local to this sprite).
- An alpha value (that's inherited by children).

There are two overloaded versions of [TTexture::DrawSprite](#). The first takes a set of simplified parameters, and the second takes a [TDrawSpec](#) for increased control over how the image is drawn. [TDrawSpec](#) comes with a convenience constructor that will allow you to set most common values in-place. After it's constructed, you can modify it with much more sophisticated requests if you need to.

There were three reasons for the decision to migrate to a TDrawSpec-style interface: One, [TTexture::DrawSprite](#) was really getting over-overloaded with confusingly similar parameter lists. Two, the parameter lists were getting so long that it became quite annoying to set the ones later in the list if you just needed to set one or two. And third, the DrawSprite parameters simply weren't flexible enough to do full inheritance of rotation/scale matrices, which is what we wanted for the sprite system.

Using TWindows

TWindow and its descendants are for GUI elements. The typical Playground SDK™ model is one where you create your game in a TWindow, possibly layered with **TText** windows for score and other messages, and **TImage** windows for interface elements. The TWindowDraw() call is where you do the heavy lifting, actually drawing elements of your game. Depending on your preferences, you can manage that part yourself entirely, drawing textures exactly where you want them, or you can use a support class like **TSprite** to help manage the display of your game objects for you.

TWindows clip what they and their children draw to their rectangle. For a GUI element, that's a feature: You can draw a block of text that's clipped to the window, or you can draw an image that's zoomed so that its boundaries clip to the window. TWindows will receive mouse messages when the mouse is within their bounds (note that mouse messages are also clipped to parent windows), and TWindows can also receive the keyboard focus and thereby receive key events (see **TWindowManager::SetFocus()**).

Many functions return a TWindow*, and you will often need a derived class. The function **TWindow::Get-Cast<>()** will get you that pointer with type safety (see **Type Information and Casting** for details). Windows can optionally draw their contents (**TWindow::Draw()**), contain other child windows, and respond to events or messages. Window updates and messages are handled by the **TWindowManager** class, which is available from the singleton accessor **TWindowManagerGetInstance()**.

To assist in debugging window hierarchies, in debug builds on Windows pressing "F2" will dump the current hierarchy to the debug log.

Modifying TTexture Objects

When you've modified a texture in the game, you need to set up a texture-refresh-listener to monitor whether the texture contents have been lost.

When DirectX loses a texture, it needs to be re-rendered. This is handled by the library for textures loaded from files that haven't been modified, but any modified by the game via **TRendererCopyPixels**, **TTextGraphicDraw**, or **TRendererBeginRenderTarget** need to be redrawn if they are lost.

The process is simple enough. Create a TTask-derived class and override DoTask:

```
class MyTextureListener: public TTask C++
{
public:
    virtual bool DoTask()
    {
        RenderMyPrivateTextures();
    }
};
```

Then call:

```
TPlatform::GetInstance()->AdoptTextureRefreshListener( new MyTextureListener() ); C++
```

Now any time that your texture needs to be redrawn (because of lost surfaces), your function **RenderMyPrivateTextures()** will be called.

Using TTextGraphic Objects

You can use **TTextGraphic** to render to any texture, not only a render target. In this example, assume the following class definition:

```
TTextureRef mTextTexture ; C++
```

And then the code:

```
mTextTexture = TTexture::Create(512, 512, true); C++
```

```
TColor color(1,1,1,0); // White background that's transparent (alpha 0)
TPlatform::GetInstance()->FillRect(0,0,512,512,&color,mTextTexture);

TTextGraphic * tg = TTextGraphic::Create(
    "<outline_color=\\\"000000\\\"_size=\\\"3\\\">SWEET_PAUSE</outline>",
    512,512,TTextGraphic::kHAlignCenter,"fonts/arial.mvec", 60, TColor(1, 1, 1, 1) );
tg->SetNoBlend();
tg->Draw( TRect(0,0,512,512), 1, 0, 1, mTextTexture );
tg->Destroy();
```

When this is complete, `mTextTexture` ends up with SWEET PAUSE rendered in Arial font and a black outline in a texture that's transparent except for the text itself which is opaque. The `TRect` in `TTextGraphic::Draw` can be used to position the text: Just bump down the top Y coordinate for each successive render. The text size is determined in the `TTextGraphic::Create` call—I arbitrarily chose 60 pixels tall, but feel free to customize to the appropriate height.

2.5 Why Use Lua?

2.5.1 What is Lua?

Lua is a compact, fast, flexible, and extendable scripting language that is included as part of the Playground SDK™. Its syntax has a few quirks that we put up with because we love it so much. You can read more about Lua at <http://www.lua.org>. We're currently using version 5.0x of Lua in Playground, though we're investigating an upgrade to the latest, 5.1.

2.5.2 Lua Makes it Easy

Using a scripting language to write the basic control flow of a game is a very powerful technique. Take, for example the following code:

```

-- Main game loop
function Main()

    DisplaySplash(
        "splash/playfirst_animated_logo.swf",
        "splash/playfirst_logo",4000
    );
    DisplaySplash("", "splash/distributor_logo",4000);

    -- Push the game selection screen
    while true do
        DoMainWindow("scripts/mainmenu.lua");
        -- DoMainWindow will exit only if there are NO windows pushed on the stack, so
        -- a PopModal()/PushModal() combination will not cause this to loop.
    end
end

-- Return a function to be executed in a thread
return Main

```

Lua

Here the sequence is clear: Display one splash screen, then another, then enter main options loop. There's no jumping around from one place to another to see what happens next; it's right there in front of you. If you want to change the sequence, it's a simple matter of adding or moving a line of Lua code.

Or this code excerpt from a window definition:

```

Button
{
    x=40, y=40,      -- Position of the button
    label="Start_Game", -- Button text
    command=function()
        SwapToModal("gamescreen.lua"); -- switch to the game screen
    end;
}

```

Lua

Curly-braces in Lua define a table—they're not used for scope, though they may appear to in the previous example. The above syntax is a shortcut for calling the function "Button" with a single table as the only parameter: `Button({ x=40 ... })`.

In this table we're setting a few button characteristics, including its position, label, and a command to execute when it's pressed. The Lua command "function" actually defines a function right there in the Button definition. It's an anonymous function, in that it doesn't have a name of its own, but that's OK, because in Lua functions are first-class data: You can assign them to variables, return them from functions, or, as in the case above, add them to a table entry.

If the above example used `DoModal()` instead of `SwapToModal()`, it would have simply brought a window up on top of the current window—a standard "Modal" dialog, possibly asking for user input. And that window could

have its own actions embedded in its buttons.

2.5.3 What About Speed?

There are those who worry about the speed of a scripting language to write a game. And they're right: It's not as fast as raw C++ code. But there are plenty of places in your code where you don't need the most speed possible: Responding to a button click and deciding what splash screen to display next are two examples from above. The general 80/20 rule usually holds: more than 80% of the execution time is spent in 20% of the code. Some go further and say that 90% of the execution time is spent in less than 10% of the code. So don't write that part in Lua.

Lua interfaces to C and C++ very easily: It was written to be an embedded scripting language (originally a configuration language). We've included template wrapper functions that allow you to painlessly drop a member function of a class right into Lua. And it's actually not that slow: It compiles to an interpreted byte code. It benchmarks favorably against Perl, Ruby, PHP, JavaScript, and Python. And it adds less than 40k of object code to the executable.

2.5.4 What are the pitfalls?

So what's the catch? Well, we're using the Lua "coroutine" feature to run the main window thread—most of the time the main loop thread is waiting for a message to tell it what to do next. We can use the Lua interpreter to run simple functions from our C code at that point, but that code can't itself yield, because that particular interpreter has already yielded. You can call a function using `TLuaFunction::Call()` even if there's a currently yielded function on the Lua stack, but that function can't itself yield. Nor can the function that you call directly or indirectly attempt to resume the original yielded function, which by that point is buried under both the Lua and system stacks.

The Playground SDK™ handles the first problem internally for the GUI script (the one you get from [TWindow-Manager::GetScript](#)), so you don't need to worry about it, since it will take any code you run and inject it into the currently paused script, if it's in a state where it can do this.

The second problem, trying to yield across a C call, comes up most frequently when C/C++ code that the Lua script calls attempts to inject its own function or pass a message into the running Lua stack. Avoiding this is easy, though: Any calls that you expose to Lua should be restricted to manipulating C++ data entirely, which could include, for instance, adding a message to a queue that will later be injected in a Lua script or processed by your game.

In fact, the [TMessage](#) system works great for this; just create a message type for your game with whatever payload you want, and trigger complex events in your game using those messages rather than just calling the necessary code directly. By "complex", I mean events that themselves may rely on the Lua interpreter to do something that might require a `Yield` or `Resume`.

2.6 FirstPeek and Beta Builds

2.6.1 How to Create Limited Builds for Beta Testers

When it's time to send out your game to hordes of beta testers, the last thing you want to do is send them your entire high-profile moneymaker: Even with copy-protection wrapped around it, you'll only slow down the crackers, who will have an unprotected version of your game up as soon as a few days or a week after you've distributed it.

This may also be true of the final build once you post it on your site, but in the case of particularly popular games, if a user really wants to play it sooner than later, they'll be willing to download a cracked version if the real build isn't available.

Playground supports the development of limited builds using the same source and assets as your final build. It does this by parsing one of two text files that indicate files and folders that the internal file system should ignore; in the build you send out, if those files aren't included in the package, then that's content that they can't pirate. Using the text files you can simulate that content being removed without creating a new entire development environment, or a second copy of your assets tree.

To enable this feature, you need a settings.xml file if you don't have one already. It should look like:

```
<verbatim> <?xml version="1.0" ?> <settings> <firstpeek>1</firstpeek> </settings> </verbatim>
```

...or if you already have one, then just add the <firstpeek> line above.

If it isn't obvious, the number should be '1' for FirstPeek and '0' for the normal release build. This file goes in the assets folder next to strings.xml.

In the folder that CONTAINS assets you need two more files:

```
final.txt firstpeek.txt
```

These files list asset filenames or that should be EXCLUDED from each view. This way you can exclude files or folders from FirstPeek using firstpeek.txt, and you can exclude FirstPeek-only assets from the final build.

The files are each read in and fed through strtok with " \t\n\r" as the tokens: Any whitespace will separate filenames. The filename needs to match EXACTLY the filename on disk. Be careful with case sensitivity here—Playground doesn't normalize the case, so your case will need to match exactly.

There are no wildcards. You must name a complete path to a file:

```
path/to/file.jpg
```

...or the path to a folder:

```
path/to/folder
```

If you want to exclude a glob of files, you'll need to pipe the glob to a text file and the list into the above format. The paths are all relative to the assets folder.

At runtime, to tell the difference between FirstPeek and normal builds, you can use: `TPlatform::GetInstance()->IsEnabled(TPlatform::kFirstPeek)`. That way you can make runtime game-play decisions—though that's not completely safe as a protection method on its own, since the cracker would only need to change one value to

On the Mac, in order to make this work, you'll need to add a build step that copies final.txt and firstpeek.txt to the application bundle so the game can read them. On the build machine, these files will need to be deleted, since we don't want them in the package.

Chapter 3

Playground Fundamentals

3.1 Type Information and Casting

3.1.1 Dynamic Casting

C++ has support for runtime type information (RTTI), which includes the ability to safely dynamically cast from one type to another, but there are several shortcomings to the standard RTTI support. For one, there is no dynamic creation support. For another, when classes are contained in smart pointers, a straight `dynamic_cast` won't work, because as far as C++ is concerned the objects have no relationship to each other. Finally, there is no reflection in C++ classes—you can't ask a class what type it is and get a predictable response.

The Playground SDK™ RTTI system supports dynamic creation of classes, safe casting between smart pointers to related classes, and identifying classes by name.

3.1.2 RTTI in TWindow

The [TWindow](#) hierarchy doesn't require the use of the smart-pointer features, but does use dynamic creation. Every TWindow-derived type includes a static member function `ClassId()`. `TButtonClassId()` will return the class identifier for the [TButton](#) class, for instance.

To find out if a `TWindow*` is a `TButton`, use the following pattern:

```
TWindow * window = .... C++  
  
if (window->IsKindOf( TButton::ClassId() ))  
{  
    // Our window is a button  
}
```

Most of the time you'll probably need to get a `TButton` directly. That's where `GetCast()` comes in—it works like `dynamic_cast` to cast our `TWindow*` to an appropriate type, returning a `NULL` pointer if the cast is inappropriate:

```
TWindow * window = .... C++  
  
TButton * button = window->GetCast<TButton>();  
  
if (button)  
{  
    // Our window is a button, and now we have a button to play with  
}
```

3.2 Reference-Counted Pointers

3.2.1 How to Share and Play Well With Others

When writing a game, some objects have clear owners: In the case of a button, it's fine to allow the enclosing window to own it and clean it up when it's destroyed. But there are some situations where an object or resource has no clear owner. The texture to draw on the button is one simple example: You wouldn't want the button to destroy the texture when it's deleted for fear another button on the screen is still using it.

One solution to this problem is to use reference-counted pointers: Smart containers that keep track of how many references are currently held to them. The above example would keep the button texture around until the last button window holding the texture container was deleted. Additional tricks can allow you to keep a list of currently loaded textures, so that when each button requests its texture they all get shared instances of the same texture.

You can use reference-counted pointers to manage your own game objects as well, but it's important to thoroughly understand the implications of using smart pointers before using them. It's not really that difficult, but there are a few common traps that you need to be aware of in order to avoid stumbling into them.

3.2.2 Using `shared_ptr` (TClassRef) Classes

When you include [pf/ref.h](#), you gain access to the `shared_ptr` template class. Several Playground classes use `shared_ptr` internally, and provide convenience typedefs of the form `TFooRef`, indicating that it's a reference-counted container for a `Foo`. A few common examples include:

- `TTextureRef`
- `TModelRef`
- `TSoundRef`
- `TSpriteRef`

The full set of Playground `shared_ptr` typedefs is defined in [pf/forward.h](#). In each case where Playground intends you to use `shared_ptr`s, the associated class has a static member factory named `Get()` (or prefixed by `Get`) when the class manages sharing of instances of the asset, or `Create()` for when you need a new, unique item. See [TTexture::Get\(\)](#) or [TTexture::Create\(\)](#) for two examples.

Part of the reason to have factories like this instead of allowing you to new objects and assign them to `shared_ptr`s is to help avoid common reference-counted-pointer errors by never encouraging you to operate on the raw pointers. If you always hold one of these objects in an appropriate `Ref` (e.g., `TTextureRef`) container for as long as you intend to use it, passing it from place to place as a `Ref`, and never converting it to a pointer at all, then it's really hard to make a mistake that would cause the reference counting mechanism to fail.

3.2.3 Managing Assets

Another common strategy to handle assets is to have an asset pool that a particular portion of your game can draw assets from. Sometimes that portion is the entire game, where you can load up assets at the beginning during a loading screen. Sometimes you want to load some assets at the start of a level, and then release them when the next level starts.

Playground also supports this pattern: Create a [TAssetMap](#) for your level, or for the whole game, or both, and use it to hold references to all of your game assets. When you're done with that portion of the game, destroy the `TAssetMap` and all of those assets will be released. Here's the best part: If you "load" the next section of your game before you delete the old `TAssetMap`, any assets in common will simply be referenced and not reloaded!

You can use a `TAssetMap` in either a strict mode where it requires that any asset you request through it must already be referenced, or in a more forgiving mode where you can request an asset it doesn't have yet and it will both load and hold a reference to the asset. See `TAssetMap::SetAutoLoad()` for details.

3.2.4 Common Mistakes

So what are the common mistakes you need to be aware of? Well, here's one:

```
// This is BAD! Don't do it!
TTexture* someTexture = TTexture::Get("foo.png").get();
```

C++

Assuming the texture isn't referenced elsewhere, the code above will assign a dangling pointer to `someTexture`. By the time the assignment occurs, the texture object will have been destroyed.

```
// Correct
TTextureRef someTexture = TTexture::Get("foo.png");
```

C++

Keeping it in a `TTextureRef` ensures that you keep a reference to it when the temporary on the right hand side of the assignment operator is destroyed.

```
// This is also BAD! Don't do it either!
void Foo( TTexture* texture )
{
    TTextureRef textureRef(texture); // ERROR!
}

TTextureRef someTexture = TTexture::Get("foo.png");
Foo( someTexture.get() ); // BAD BAD BAD
```

C++

In the example above, when `someTexture` leaves scope, it will delete the texture. Funny thing is, when `textureRef` leaves scope, it will *also* delete the texture. This is not considered a good thing. If you have a good memory debug tool in place, you'll find this right away because it will alert you right when it happens. Without malloc debugging active, some time later, in an unrelated part of your game, it will probably crash when allocating or freeing memory. And where it crashes may change between debug and release builds, because the memory allocators work differently in debug and release. In other words, this is a bug you never want to lay the groundwork for by using raw pointers when you should be using `shared_ptr`s.

Again, simply passing the reference around as a reference solves the problem:

```
// Correct
void Foo( TTextureRef texture )
{
    ...
}

TTextureRef someTexture = TTexture::Get("foo.png");
Foo( someTexture ); // No pointer necessary
```

C++

3.2.5 Your Very Own `shared_ptr`

The `shared_ptr` template class can be used to manage game assets as well. If you're using `shared_ptr`s in your own classes, though, you can end up with a cyclic reference that never gets freed: A holds a reference to B and vice versa. When all references to A and B are freed, you still have these two referring to each other. All is not lost, however. One or both of these references can be a "weak" reference. If A owns B, but B needs a reference back to A, then you can make the pointer in A a `shared_ptr` and the one in B a `weak_ptr`. That way when the last reference to A is released, it will destroy A. If another object still holds a reference to B, it won't be destroyed when A releases its reference—but B's weak reference to A will magically NULL itself, so that B knows A has been destroyed.

3.2.6 Implementation Details

Technical details for the current implementation can be found at http://boost.org/libs/smart_ptr/smart_ptr.htm

Feel free to look at the documentation there to understand more about the philosophy and design decisions behind smart pointers. However, we are using a subset of the full Boost libraries, so don't expect all of the features they describe to be available. We do use `weak_ptr` internally to handle our `Get()` functions (so we know if an asset has already been loaded, and to correctly return the existing `shared_ptr`), but we reserve the right to reimplement the `shared_ptr` if we decide there's a compelling reason.

3.3 PlayFirst Global High Scores

3.3.1 About the Playground SDK™ Hiscore System

Playground includes a hiscore management system that can be used to keep track of your players' highest scores in multiple categories in your game. For games that are published by PlayFirst, the system also includes the ability to connect with PlayFirst servers and share high scores globally.

3.3.2 Initialize The System

For PlayFirst published builds, you'll need to set the PlayFirst-provided encryption key using `TPlatform::SetConfig()`.

```
// This line typically appears in TSettings/settings.cpp C++  
TPlatform::GetInstance()->SetConfig(TPlatform::kEncryptionKey, ENCRYPTION_KEY);  
  
TPfHiscores *pHiscores = new TPfHiscores();
```

The game name on Windows is extracted from the program's resource: look in the project's `.RC` file for the `ProductName` to set the name.

3.3.3 Connecting to a debug server

Until your game is officially launched, the PlayFirst hiscore server will not know how to accept submissions from your game. Therefore, to test your implementation of the hiscore system, you need to use a local server.

To connect to the fake local server:

1. Place the `pfservlet_stub.dll` in the same folder you are loading the `pfhiscore.dll` from (or in the same folder as your `.exe` if you are using a static lib). The system will detect the existence of this dll, and if it can find it, it will use a local server instead of connecting to one over the Internet.
2. Make sure that you are correctly setting up the `TPlatform::SetConfig` settings for `kPFGameHandle`, `kPFGameModeName`, and `kEncryptionKey`. This is done in `PlaygroundInit()` in the Playground Skeleton sample application.
3. You are now set up to use the hiscore system without connecting to a server. Note that this will create a file called "serverdata.txt" file in the same folder as the dll that will store information between executions so you can test building up long lists of scores. Also, note that this local server does not contain all the functionality as the real online server (i.e. it does not contain the profanity name filter and it will also not correctly filter the scores by "daily", "weekly", etc.) but it does have enough functionality for you to fully test your game.
4. The `pfservlet_stub.dll` comes with 2 user accounts created for testing PlayFirst user submissions. They are "testname" with password "testpass" and "testname2" with "testpass2".

3.3.4 Set Properties

As the user plays the game, you need to set various properties with the hiscore system. If the user changes player names/profiles, call:

```
pHiscores->SetProperty(TPfHiscores::ePlayerName, PLAYERNAME);
```

C++

If the user changes game modes, call:

```
pHiscores->SetProperty(TPfHiscores::eGameMode, GAMEMODE);
```

C++

If the user changes languages, call:

```
pHiscores->SetProperty(TPfHiscores::eLanguage, LANGUAGE);
```

C++

3.3.5 Logging Scores

At the end of a game (or when quitting a story-mode game where you want to log a score), you need to log the players score so it will be eligible for a hiscore. In addition to logging a score, you should also log game specific data (i.e. "5" for someone who has reached level 5, etc.). Please do not put text inside the game specific data, as it makes it difficult to localize. The game has the chance to parse out this game specific data later on and put it in visible form. The server currently supports up to 60 characters of data.

```
// Log a score of 500 points, replace existing score by this player,  
// and pass in the GAMEDATA string defined elsewhere...  
pHiscores->LogScore(500, true, GAMEDATA);
```

C++

3.3.6 Viewing local scores

On the local score screen, you can view all the logged local scores. To view the local scores for the current game mode:

```
pHiscores->GetScoreCount(true);  
for (int i = 0; i < numScores; i++)  
{  
    int rank;  
    char name[16];  
    bool anon;  
    int score;  
    char gameData[64];  
  
    if (pHiscores->GetScore(true, i, &rank, name, 16, &anon, &score, gameData, 64))  
    {  
        char outputTest[512];  
        sprintf(outputTest, "%d_%s_(%d)_%d\n", rank, name, anon, score);  
        DEBUG_WRITE((outputTest));  
    }  
}
```

C++

In the local scores screen, you can also change the game mode by setting the game mode property, and then recalling the code above for the new game mode.

3.3.7 Figuring out what score the user can submit

Once in the local score screen, you can figure out if the current player has a score eligible to submit:

```
if (pHiscores->GetUserBestScore(TPfHiscores::eLocalEligible,&score, &rank, gameData, 32))
```

C++

```

{
    // display what the users current eligible score is to submit
}
else
{
    // user has no eligible scores to submit
}

```

3.3.8 Submitting a score

To submit a score, you either submit an anonymous score or a user/password official score. They both use the same call. Once you submit the score, you need to poll for the status of the submission to check for any errors:

```

pHiscores->SubmitScore(USERNAME, PASSWORD, REMEMBERSETTINGS); C++

TPfHiscores::EStatus status;
char errorMsg[256];
bool qualified
status = mpHiscores->GetServerRequestStatus(errorMsg, 256, &qualified);
while (status == TPfHiscores::ePending)
{
    status = mpHiscores->GetServerRequestStatus(errorMsg, 256, NULL);
}
if (status == TPfHiscores::eError)
{
    DEBUG_WRITE((errorMsg));
}
else if (status == TPfHiscores::eSuccess)
{
    if (qualified)
    {
        // inform user of qualified score
    }
    else
    {
        // inform user that score did not qualify
    }
}
}

```

3.3.9 Switching to the global score view

The first thing you need to do when switching to the global score view is get the available categories from the server. The categories are things like "last 24 hours" or "all time records".

```

pHiscores->RequestCategoryInformation(); C++

TPfHiscores::EStatus status;
char errorMsg[256];
status = mpHiscores->GetServerRequestStatus(errorMsg, 256, NULL);
while (status == TPfHiscores::ePending)
{
    status = mpHiscores->GetServerRequestStatus(errorMsg, 256, NULL);
}

if (status == TPfHiscores::eError)
{
    DEBUG_WRITE((errorMsg));
}
else if (status == TPfHiscores::eSuccess)
{
    int numTables = pHiscores->GetCategoryCount();
}

```

```

    for (int i = 0; i < numTables; i++)
    {
        char name[16];
        if (pHiscores->GetCategoryName(i, name, 16))
        {
            char outputTest[512];
            sprintf(outputTest, "TABLE:_%s\n", name);
            DEBUG_WRITE((outputTest));
        }
    }
}

```

Now that you've obtained the categories, you can request scores for a specific category. Note that before you call `RequestScores()` you must have set a proper game mode with `SetProperty()` and you must have received the category information with `RequestCategoryInformation()`.

```

pHiscores->RequestScores(CATEGORYNUM);
                                                                    C++

TPfHiscores::EStatus status;
char errorMsg[256];
status = mpHiscores->GetServerRequestStatus(errorMsg, 256, NULL);
while (status == TPfHiscores::ePending)
{
    status = mpHiscores->GetServerRequestStatus(errorMsg, 256, NULL);
}
if (status == TPfHiscores::eError)
{
    DEBUG_WRITE((errorMsg));
}
else if (status == TPfHiscores::eSuccess)
{
    int numScores = pHiscores->GetScoreCount(false);

    for (int i = 0; i < numScores; i++)
    {
        int rank;
        char name[16];
        bool anon;
        int score;
        char gameData[64];

        if (pHiscores->GetScore(false, i, &rank, name, 16, &anon, &score, gameData, 64))
        {
            char outputTest[512];
            sprintf(outputTest, "%d)_%s_(%d)_%d)_%s\n", rank, name, anon, score, gameData);
            DEBUG_WRITE((outputTest));
        }
    }
}

```

Finally, you can determine the user's current ranking in the currently fetched table from:

```

int score;
int rank;
char gameData[64];

if (mpHiscores->GetUserBestScore(TPfHiscores::eGlobalBest, &score, &rank, gameData, 64))
{
    // user is ranked
}
else
{
    // user is not ranked
}

```

3.3.10 Hiscore FAQ

Question: How can I connect to the PlayFirst hiscore server to test my implementation?

Answer: You should be able to fully test your hiscore implementation against the `pfervlet_stub`. If it works with this stub (and you have configured `TPlatform::SetConfig` just like the Playground Skeleton does in `Playground-Init()`), it will work when your game goes "live".

Question: Hiscores is not working. Can I get any information about why it is failing?

Answer: You should check your logfile. Depending on the error, some information may be displayed in the logfile which may make it obvious why your hiscore submission is failing.

Question: QA is telling me that hiscores fail on their server, but they work fine on my stub. What is the difference?

Answer: Make sure that you are using the PlayFirst provided `key.h` file, which correctly specifies the exact names for:

- The game handle (in Windows, this is set in the resource file)
- The encryption key
- The game modes
- The medal names

Question: I can view global hiscores, but all the submissions fail. What is wrong?

Answer: If you can successfully view hiscores but not submit them, then your encryption key is incorrect.

Question: When I submit a hiscore with medals in it, I get an error in my logfile about invalid XML. What does that mean?

Answer: XML must be "well-formed". A common mistake is to forget to close the XML tag with a forward slash.

Question: I am seeing weird results when I submit a score and medals. Sometimes I see the "Did Not Qualify" response, but then the score gets recorded anyway. Other times the system lets me submit the same score over and over again. What is going on?

Answer: This is most likely because you are issuing several server requests but only looking for one response. Each call to the server must then poll `GetServerRequestStatus()` before the next call should take place. One specific situation that can cause this behavior is if you submit a score, then submit medals, and then poll the server. The response you get back from the server will be the response to the medals submission only. Therefore, the response to the score submission is lost completely. The correct thing to do in this situation would be to submit a score, then poll the server. Once a response is received, a medal submission could continue, polling for a response to that as well.

Question: Why are there 2 different ways of submitting medals?

Answer: Medals can be associated with a score (by using the `serverData` parameter in `TPfHiscores::LogScore()`), or they can be submitted independently by using `TPfHiscores::SubmitMedals()`. In some games, you can only earn a new medal at the same time you earn a new hiscore (i.e. you can only earn a medal by beating a new level, which also means your total score goes up). In this case, by associating a medal with a score in `TPfHiscores::LogScore()`, you don't have to worry about how to submit medals - they will be submitted when the user submits their score. In other games, you can earn a medal without earning a new score (i.e. by replaying a previous level and completing a series of events that unlocks a new medal). In this case, the user needs to submit their medals separately from their hiscore, because they may not have any hiscores to submit. In this case, more UI needs to be added to the game to inform the user when they have a medal to submit, since you cannot depend on the existence of a submittable hiscore in order to submit medals. Note that `TPfHiscores::submitScore()` and `TPfHiscores::SubmitMedals()` should never be called immediately one after the other - you always need to poll `TPfHiscores::GetServerRequestStatus()` after each hiscore server call.

Question: How do I know if I should be running in full hiscore mode, anonymous hiscore mode, or local hiscore mode?

Answer: You can use the following to determine which mode to run in:

- `TPlatform::GetInstance()->IsEnabled(TPlatform::kHiscoreAnonymous)` - use this to detect anonymous mode
- `TPlatform::GetInstance()->IsEnabled(TPlatform::kHiscoreLocalOnly)` - use this to detect local mode

Question: What is the difference between the full, anonymous, and local hiscore modes?

Answer: This is described in the Production Guidelines document, and your PlayFirst producer can provide you with the full details about this. Additionally, the Playground Skeleton application demonstrates each of these 3 modes, which you can test by changing the settings.xml file. The basic differences between the modes are:

- In "full" mode the user can use a PlayFirst account and password to submit their hiscore. Scores associated with a PlayFirst account have a special icon displayed next to them. There is a text description about the PlayFirst global hiscores system, and a description of how to register for an account.
- In "anonymous" mode users can submit hiscores only with an "anonymous" account. There is no mention of PlayFirst in the hiscore system, though some text about a Privacy Policy may be displayed. Please contact your producer for the exact text.
- In "local" mode there is no way to submit a hiscore to the global hiscore system. The user can only see scores that they have earned on their local computer. There is no mention of the PlayFirst hiscore system in this mode.

3.4 Useful Debugging Features

The Playground SDK™ defines a number of useful macros for debugging your code:

- `DEBUG_WRITE()` Writes messages to the debug log in debug builds.
- `ERROR_WRITE()` Writes messages to the debug log in debug and release builds.
- `TRACE_WRITE()` Writes the current line, function, and file to the debug log (in debug builds only).
- `ASSERT()` Breaks in debug builds and prints ASSERT condition to the debug log; removed in release build.
- `VERIFY()` Breaks in debug builds and prints VERIFY condition to the debug log; just prints the condition to the log in release build. Guaranteed NOT to be removed in release build. Useful for evaluating a function return value where the function has side effects (it does something important).

On Windows, all printing to the log is mirrored in the debugger output window in debug build. In release builds, the debug log is capped at 100k, but in debug build it is not limited in size.

3.5 About Game Versioning

3.5.1 Game Version Numbers

The version number for your game is read from the file version.h into your resource file (e.g., skeleton.rc, via version.rch).

If you're developing a game for PlayFirst, then when it is submitted to PlayFirst to be built, **your copy of version.h is replaced by a machine generated version for each new build.**

Considering this is true, if you're working with PlayFirst to publish your Playground SDK game, you should be sure to:

- Only edit right hand side values in version.h

- Not add additional definitions to version.h
- Not change your game's resource file (e.g., skeleton.rc or version.rch) to have a hard-coded version number, or otherwise prevent it from reading and using the version number in version.h

You may change the version information defined in version.h for your own purposes, as long as you keep to the same format. However, please remember that for games released through PlayFirst, this file is overwritten by PlayFirst's release engineering process. This means that the build numbers that your game has for your own builds will differ from the official builds that PlayFirst generates. This is by design. If you violate the guidelines here, you will be asked to change your code back, so that your game source code will not break the PlayFirst release engineering process.

Chapter 4

Lua

4.1 Lua Scripting

4.1.1 About Lua

Lua is an embedded scripting language that's very fast and has a very small footprint. It's also very extensible, and very easy to link to C or C++ functions.

A few Lua quirks you should know to make reading Lua code easier:

- Line comments in Lua start with double-dash (--)
- Block comments are between -- [[and --]].
- Lua's syntax is free-form—whitespace is irrelevant in most circumstances.
- Use of semi-colon to terminate a statement is optional, though it can enhance readability.
- Single or double quotes can be used to frame a string. [[and]] will frame a multi-lined string.

You can read more about Lua syntax at <http://www.lua.org> . We're linking with the base library, the string library, and the table manipulation library at present. In debug builds of the library, the debug library is also linked in. [TLuaParticleSystem](#) additionally links with the math library.

4.1.2 Using Lua to Script Your Game

The examples that are covered in [Why Use Lua?](#) are entirely concerned with scripting the overall game state flow and in-game events. But what if you want to use Lua to script more interesting behaviors in your game? The Playground SDK™ fully supports arbitrary Lua threads running at whatever rates you specify, which can control anything from game AI to animations. The set-up requirements have been minimized wherever we can, but you should still expect to put some effort into connecting your C++ code to Lua. The benefits are great, and the effort will be worth it.

At the most basic level, you need to create a TScript-derived class with your added functionality. Here is an example:

```
class MyClass
{
    public:
        int MyMemberFunction( str param1, int param2 );
}
...
```

C++

```
TScript * script = new TScript ;
MyClass * myClass = new MyClass ;

ScriptRegisterMemberDirect(
    script, "LuaNameForMyMemberFunction", myClass, MyClass::MyMemberFunction );

script->DoLuaString("_a=_LuaNameForMyMemberFunction('test_param',_4_);");
```

See how the constructor binds the C++ member functions directly to Lua functions. See RegisterMemberDirect() for a list of the valid parameter types you can use. For an explanation of TMessage, see the advanced topic [Sending Custom Application Messages](#).

When to Yield

The Lua interpreter supports cooperative multithreading. In practice, this means that a script that is going to persist needs to explicitly or implicitly yield periodically. The most basic yield command is Yield, which returns control to the C++ code immediately.

But that doesn't take into account when your script may want to be run next; TScript derives from TAnimTask so that it can resume running on a schedule. You can register your TScript as a task, either at the TModalWindow level or at a global level in TPlatform. Conceptually the difference is that TModalWindow tasks are only executed when the TModalWindow is the *top* modal window; another modal window will pause the tasks of any windows beneath it. Note that the "Adopt" semantics (TPlatform::AdoptTask) means that you are relinquishing control of the script. It won't be deleted when it's done executing, because it never flags itself as "done" animating, but if the context that owns it is destroyed (i.e., the TPlatform or TModalWindow), it will be deleted at that point.

Running Your Script

Discussion of adding the TScript to either the current top modal or the system timer.

Subclassing Existing Window Types

To subclass from an existing window type (for example, if you want to have a button that has some custom behavior in it), all you need to do is be sure that your derived class calls the base class for any virtual functions it overrides. For example, if you derive from TButton and create a PostChildrenInit() call in your derived class, you'll need to call TButtonPostChildrenInit() to ensure that the base class gets properly initialized.

Lua Dialog Creation Internals

Here is a brief description of the syntax of the internals of dialog-description Lua files. The first thing to note is that instead of calling functions with ordered parameter lists, which is the norm in Lua, we're calling with the table (Lua's map/hash/dictionary) syntax: Function{}. This allows us to have both positional and named parameters.

At the most basic, in the Lua script you need to use the function MakeDialog:

```
MakeDialog C++
{
    ...
}
```

Inside the body of MakeDialog is a list of (potentially nested) window creation commands. A typical window will start with an image background:

```
MakeDialog C++
{
    Bitmap
    {
```

```

        image="background.png"
    }
}

```

This is pretty simple so far. The `Bitmap` command will create a `TImage` window scaled to the size of `background.png`. There are ways to override this, but we'll get to that later.

Now say that you also want a button:

```

PropFont = {
    "fonts/prop.mvec",
    15,
    Color(0,0,91,255)
};

BasicButtonGraphics =
{
    "controls/lozengeup.png",
    "controls/lozengedown.png",
    "controls/lozengeover.png"
};

MakeDialog
{
    Bitmap
    {
        image="background.png", -- Note that this is a list, and needs commas

        -- The optional mask tag says to use "backgroundmask.png" as the
        -- alpha channel for the "background.png" image.
        mask="backgroundmask.png",

        Button
        {
            x=kCenter, y=-40, -- See below for coordinate options
            name="button3", -- The name used to look up the button
            font=PropFont, -- The button text font
            graphics=BasicButtonGraphics, -- The button graphics
            label="foo", -- The default button label
            sound="click.ogg", -- Sound to play when button is clicked
            rolloversound="over.ogg", -- Sound to play when button is rolled over
            scale=0.7 -- scales the size of the button
        }
    }
}

```

There are several new things here worth mentioning. We've added a font for the button text, and graphic images for the various button states. Note that the `graphics` entry is a table with three items: The first is the "up" image, the second is the "down" image, and the third is the roll-over image. You can skip the third image if the down and roll-over image should be the same.

The font itself is a table with three entries: The font filename (relative to the assets directory), the font height in pixels, and the font color.

The `x` and `y` coordinates can be simple coordinates from the upper left corner of their window, but there are also other convenient options:

- Positive `x` and `y` are normal positions.
- A constant, `kCenter`, added to `x` or `y` will position the window relative to the center (based on width or height) in `x` or `y` directions. For example, `kCenter+0` centers the window, and `kCenter+3` centers the window 3 pixels to the right of the center of the parent.
- You can subtract a value from `kMax` to specify the window origin from the right or bottom of the parent window. `x=kMax-20` means to put the window twenty pixels from the right edge, for instance.

- You can set alignment values using the align tag and one (or two, added together) of the window alignment constants. See [Text and Window Alignment](#). The alignment values change what edge or corner you're specifying: If you say align=kHAlignRight+kVAlignBottom, then x and y will specify the bottom right corner of the window. Mixing alignment values with the kMax constant is supported, but kCenter overrides any alignment setting for that dimension.
- Negative x and y are relative to the opposite edges. *This feature is deprecated and will be removed from Playground 4.1. Instead use offsets from kMax, or alignment settings. When using "align" tag, this feature is disabled.*

Now let's add a text field:

```
...
    Text
    {
        x=0,y=kMax-80,w=kMax,h=-kMax, -- The entire dialog, minus the bottom 80 pixels
        font=PropFont,             -- The text font
        label="This_is_text"
    },

```

The x and y coordinates work the same for the text field as above. We've chosen not to name this field, which is okay since it's just static text (it will get a window id of -1). But we have two new fields: w and h for width and height. Similar to x and y, a positive number is a number of pixels. In addition:

- A constant, kMax, specifies that the rectangle should grow to fill available space.
- A positive width or height grows from the right of or down from the corresponding position, while a negative width or height grows the opposite direction.
- The kMax constant can be negated as well, filling to the left or up from the x,y coordinate.

Styles

Repeating information for each and every widget is tiresome and mistake prone. To address this, there is a concept of a current style. It's recommended that most features in your project are defined using styles.

```
PropFont = {
    "fonts/prop.mvec",
    15,
    Color(0,0,91,255)
};

BasicButtonGraphics = {
    "controls/lozengeup.png",
    "controls/lozengedown.png",
    "controls/lozengeover.png"
};

DefaultStyle = {
    font=PropFont,
    graphics=BasicButtonGraphics,
    x=0,y=0,w=kMax,h=kMax
}

BottomEdgeButton = {
    parent = DefaultStyle,
    y=-40
}

BodyText= {
    parent = DefaultStyle,
    y=-80,h=-kMax
}

MakeDialog
```

```

{
  SetStyle(DefaultStyle),
  Bitmap
  {
    image="background.png",
    SetStyle(BodyText),
    Text
    {
      label="This_is_text_that_goes_in_the_body"
    },
    SetStyle(BottomEdgeButton),
    Button
    {
      x=kCenter,          -- The y coordinate is set already.
      name="button3",    -- The name used to look up the button
      label="foo"        -- The default button label
      sound="click.ogg"  -- Sound to play when button is clicked
      rolloversound="over.ogg", -- Sound to play when button is rolled over
    },
    TextEdit            -- creates a user editable text edit field
    {
      password=true,    -- "*" instead of letters to hide passwords
      length=26         -- max characters user can type into edit field
      ignore="#!@"      -- ignore '#','!', and '@' if typed by the user
    };
  }
}

```

There are several new things in this example: The styles are also Lua tables, with one notable extra field: "parent" refers to the parent of a style. When `MakeDialog` is looking for a property, it looks first in the table passed to the creator function (e.g., `Bitmap{}`), and then in the current style, and then in the parent style(s).

The current style only exists in the "scope" of the list it's defined in.

So we start by setting the `DefaultStyle`, because that's just a good habit to have. Next we set a style for the `BodyText`, and the `Text{}` creator function suddenly gets much simpler. Finally we set the style for the `Button`, and it also ends up simpler.

There are two notable advantages to styles: One is that you can apply one style to many widgets, and then when you change the style it affects all of the widgets. Another is that you can then move these styles to another file entirely and apply them to all of the dialogs in your entire project. See the Lua command "require", which includes another Lua file in the current file.

If you want buttons that are radio or toggle style, you can specify those as follows:

```

...
Button
{
  type=kToggle,
  graphics= {
    "offImage.png",
    "onImage.png",
    "offRolloverImage.png",
    "onRolloverImage.png"
  }
},

-- Mark the start of a new radio group. Every radio button from this
-- tag to the next BeginGroup() will be in the same group.
BeginInit(),

Button
{
  type=kRadio,
  graphics= {
    "offImage.png",
    "onImage.png",
    "offRolloverImage.png",

```

Lua

```
        "onRolloverImage.png"  
    }  
}
```

4.2 How Much Lua is Appropriate?

Lua is a language that's designed to be easy to edit and to have flexible data representations.

As such, it makes a great place to put data that you need for your game. It's easy enough to understand that your game designers/level editors can easily tweak parameters for various levels. If you have an in-game level editor, it might make more sense to have it save out XML, since then it can read and write exactly the same file, as well as retain human readability.

On the other hand, if your game needs scripted actions to occur, scripting those actions in Lua is very attractive. But how much Lua is appropriate? More the point, how much Lua can you use and still expect to be supported by PlayFirst? The answer, approximately, is a lot—as long as the usage falls into a few patterns:

1. Retrieving data. You can have as many Lua files containing game data as you want.
2. Game-play subroutines that execute and quit. This is the classic scripted action. When some event in the game occurs, then you call a Lua function that determines what happens.
3. Simple animation behaviors. Animations in the Playground SDK™ are handled via Lua scripts, and the animations can call very simple C++ functions or set Lua variables at specific points.

The main game thread shouldn't live in Lua—yet. There isn't enough support for our engineers to track what's going on if there's a problem that we need to diagnose. When would we be fixing problems in your game? PlayFirst frequently assigns engineers to fix compatibility problems that crop up on a system in our lab—if you can't reproduce the problem on your system, how can you fix it?

In addition, we're missing one of the most important game development tools in Lua at the moment: A profiler. Lua is fast for a scripting language, but still much slower than C++. If a lot of your game is written in Lua, you'll likely eventually need to optimize it. The first step in optimization should always be to profile, and we have no way to profile your Lua code yet.

One more problematic issue occurs when you end up with a stack that looks like: C->Lua->C->Lua and the Lua code tries to yield control back to C. The problem appears when your Lua code calls a C function that then calls more Lua code that tries to yield. Since pushing a modal dialog within Lua has an implicit yield, this happens more often than you'd expect. This won't happen in Lua code that doesn't use Lua threads, but the Lua UI thread in the Playground SDK™ depends on Lua threads to function, and the logical place for your game code to exist would be in the same engine as the UI thread—and that would require you to yield execution from time to time for the UI thread to function. We're investigating Lua Coco to see if it will work with Playground on the PC and Mac, which, if it works as advertised, will eliminate this issue. Again, stay tuned.

So, while we encourage you to use Lua for the three patterns listed above, we ask that the majority of the game logic exist in C++ until our Lua tools improve.

4.3 C++ Lua Wrappers

4.3.1 How do I get Lua data in my C++ code?

Say you'd like to use Lua scripts to do some of your configuration, or you have some Lua code that generates a table that you'd like to access in C++. How do you get to the data? Well, one way is to use the Lua API described at <http://www.lua.org>, and there are some things that you will have to do that way. But there's an easier way: the Playground SDK™ has a number of simple wrappers that allow you direct access to Lua data. The wrappers are very light in code impact, but not heavily optimized.

The Lua object wrapper base class is `TLuaObjectWrapper`, and it pulls the top object off of the Lua stack and wraps it in a C++ structure. During the life of the `TLuaObjectWrapper` object, the wrapped object is guaranteed not to be deleted by the Lua garbage collection or reference counter. The `TLuaObjectWrapper` class can only perform basic operations on a Lua object: Push it on the Lua stack, query whether it is a string or number, or attempt to convert it to a string or number. The derived class `TLuaTable` is intended to manage and read a Lua table.

Chapter 5

Particle System

5.1 A Lua-Driven Particle System

5.1.1 Particles in a Scripting Language?

A Particle "Shader Language"

The Playground SDK™ particle system uses Lua as its definition language. On learning this, the first question that comes to any developer's mind who has been around the block more than once is often, "Particles need to be driven by very fast code—how can one be driven by a scripting language?" Lua is possibly the best data-definition language in common use today, and it's designed to be embedded. It's quite fast, but it's still not as fast as some tightly written C++ code. So yes, if the particles were *simulated* in Lua, it would be nowhere near as fast as a particle system written in C++. And with particles, you really want them to be as fast as possible, so you can support as many particles as possible.

So what if you just use Lua to define the structures you need for the particle system? That way you get to lean on the user-friendliness and interactivity of a scripting language, while still taking advantage of the speed of C++ by having the actual particle processing done in the faster language.

That's what we've done: The Lua code defines a number of operations that are then performed in a tight C++ loop on each particle. In some sense this is similar to writing a vertex or pixel shader, only for particles. Basing the language in Lua allows us to take advantage of the existing scripting engine in Playground.

Playing With Particles

The easiest way to get a feel for a new system is to see it in action. Let's start with a very simple particle script:

```
-----  
-- Initialization phase  
  
-- Set the particle texture  
SetTexture("star");  
  
-- Initialize the raw particles--do this last in the Initialization Phase  
SetNumParticles(1);  
  
-----  
-- Action phase  
  
-- Create an initial particle  
CreateParticles( 1 );
```

Lua

So far our particle system isn't very interesting. It creates one particle in the middle of the screen that just sits there. Let's make it fall:

```

-----
-- Initialization phase
-- Allocate a velocity particle property as a Vec2
pVelocity = Allocate(2) ;
-- Set the particle texture
SetTexture("star");
-- Initialize the raw particles--do this last in the Initialization Phase
SetNumParticles(1);
-----
-- Action Phase
-- Animate the velocity
pVelocity:Anim( pVelocity + fTimeScale(Vec2(0,800)) );
-- Animate the position
pPosition:Anim( pPosition + fTimeScale(pVelocity) );
-- Create an initial particle
CreateParticles( 1 );

```

There are two new things here. First, we're allocating a velocity. While we can move the particle without giving it a velocity (by adding a constant value to the pPosition property), it's more interesting if each particle can keep track of a velocity value.

Second, we add two animation lines. These add actions to the particles that occur in declaration order to every particle on every `TLuaParticleSystem::Update()` call. Let's break down one of these lines more carefully:

```

-- Animate the velocity
pVelocity:Anim( pVelocity + fTimeScale(Vec2(0,800)) );

```

Translated into English, this says: On each step of the animation, assign the property pVelocity the value (pVelocity + fTimeScale(Vec2(0,800))). The part with fTimeScale(Vec2(0,800)) says to scale the value Vec2(0,800) by the current elapsed time, so you can give it a number in units/second and it will scale the value appropriately.

Similarly, the next line adds a time-scaled pVelocity to pPosition. What is a pPosition? I'm glad you asked...

Particle Properties

Each particle in a system has a number of programmable properties. Each property is a set of one to four floating point values. The default particle type is a [T2dParticle](#), which has a number of innate properties, listed below along with their Lua names and sizes:

- A 2d Position (pPosition, TReal[2])
- A 2d Up-vector where 0,-1 make a particle "upright" (pUp, TReal[2])
- A scale (pScale, TReal[1])
- An RGBA color (pColor, TReal[4])
- A frame (pFrame, TReal[1]) for use with animated particles.

The actual texture isn't a particle property in the same sense, in that all of the particles in a system share the same texture. The texture can be a [TAnimatedTexture](#) to allow for animated particles, but it has to be one texture shared by all the particles due to the nature of the rendering.

The basic idea is that the particle script sets down how to initialize these properties for each particle as it's created, and then how to animate these properties on each frame.

The Particle Lua File

The order of operations in a typical particle configuration file is:

1. Create any custom particle properties.
2. Set the particle texture and blend mode.
3. Set the number of particles in the system.
4. Set up the particle initializer functions.
5. Set up the particle animation functions.
6. Define an Update function that creates particles.

The order of the first three operations above is strict; the rest are just by convention. In addition to the innate properties of a 2d particle, you can create custom properties and use them however you like. A common property to create would be a particle velocity, for instance, to give each particle its own motion. Another common property is an age: Some animated effects rely on a particle's age to calculate, so that a particle can, for example, fade from one color to another.

But not all particle systems need velocity (a set of twinkling stars wouldn't move, for example), and simple particles don't need an age, so you can add just the extra values you need. When you do need a custom particle property, you can name it however you like—this is Lua, after all.

Operations in the Particle Script

When you create a particle property like `pVelocity`, you get an object instance that you've seen do a few things. First, it can add particle initialization functions using the `:Init()` member function. Second, it can add particle animation functions using the `:Anim()` member function. The third thing that it does is a bit more subtle: When you put it in an equation, it returns an object that references the particle property that it represents.

Let's bring back the `:Anim` example:

```
pVelocity:Anim( pVelocity + fTimeScale(Vec2(0,800)) );
```

Lua

The equation `pVelocity + fTimeScale(Vec2(0,800))`

A More Interesting Example

Here's an example from the sample application that includes a data source:

```
-- -----  
-- Initialization phase  
  
-- Define our custom particle properties  
pVelocity = Allocate(2) ; -- Allocate a Vec2 velocity member  
pAge = Allocate(1) ; -- Allocate a TReal age member  
pSpin = Allocate(1); -- Allocate a TReal spin member  
pSpinSpeed = Allocate(1); -- Allocate a TReal spin member
```

Lua

Here we create more particle members; first the familiar `pVelocity`, and then three others. `pAge` keeps track of the age of a particle, `pSpin` keeps track of an initial orientation, and `pSpinSpeed` keeps track of a particle's rotational velocity. These elements are each unique for each particle in this particle system.

```
-- dLocus is a data source: An external connection to the particle  
-- system. Here we define dLocus for FluidFX, since FluidFX doesn't know  
-- to provide the data source; in the game it's defined in  
-- swarm.cpp as a data source, and it gets the mouse position.  
if not dLocus then  
    dLocus= Vec2(0,0) ;  
end
```

Lua

In the sample application we add a data source to the particle system and call it dLocus. We still want the sample to work in FluidFX, however, since we don't want to give up the ability to edit the particle system in real time, so we add these lines of code to conditionally define dLocus to just be Vec2(0,0) when it hasn't been defined already.

```
-- Set the particle texture Lua
SetTexture("star");

-- Set the blend mode
SetBlendMode(kBlendNormal);

-- Set the size of the particle pool.
SetNumParticles(400);
```

Here we're setting the blend mode, though it's not necessary since kBlendNormal is the default. See the section on [TRenderer::SetBlendMode\(\)](#) for more information on blend modes. We're also setting the number of available particles in the pool to a higher number so that we don't run out too quickly.

```
-- ----- Lua
-- Action Phase

pPosition:Init( fPick( Vec2(-10,0), Vec2(10,0) ) + dLocus );

-- Pick a velocity from a range
pVelocity:Init( fRange( Vec2(-200,-300), Vec2(200,120) ) );
```

Here we set the initialize function for pPosition to select a point 10 pixels to the left or 10 pixels to the right of the mouse, which is retrieved from the data source dLocus. Then we select a velocity in the given range: the fRange function will take its arguments and return values randomly within the range in each dimension. So for a Vec2() with the parameters above, it will return -200...200 in the X direction and -300...120 in the Y direction.

The function fRange will work with scalars, Vec3 and Vec4 values similarly.

```
-- Start color (tint) off as white (natural color of image) Lua
pColor:Init( Color(1,1,1,1) );

-- Start scale out as 0.5
pScale:Init( 0.5 );

-- Start age as 0 milliseconds
pAge:Init(0);
```

These are simple enough: Set the initial pColor to a constant white color value, the initial pScale to a constant 0.5, and the initial pAge to 0 seconds.

```
-- Start initial rotation as a random angle Lua
pSpin:Init( fRange( 0, 2*3.1415927 ) );

-- Start spin velocity random from -10 to 10
pSpinSpeed:Init( fRange( -10, 10 ) );
```

Here we're again using fRange, this time with scalars, to initialize the particle parameters with values within a range.

```
-- ----- Lua
-- Particle Parameter Animation Functions

pVelocity:Anim( pVelocity + fTimeScale(Vec2(0,400)) );
pPosition:Anim( pPosition + fTimeScale(pVelocity) );
pScale:Anim( pScale + fTimeScale(1) );
```

First we see the familiar velocity and position equations. Then we see something new: Animating the scale value. This equation will add one to scale per second: fTimeScale() again scales its parameter to the fraction of time that's passed, so after a second pScale will go from 0.5 to 1.5.

```
pAge:Anim( pAge+fAge() );
pColor:Anim( fFade( pAge,Color(1,1,1,1), 500, Color(1,0,0,1), 1000, Color(1,1,1,0) ) );
pSpin:Anim( pSpin + fTimeScale( pSpinSpeed ) );
pUp:Anim( f2dRotation( pSpin ) );
```

Lua

Three new functions here. First is `fAge`, which takes no parameters. Instead it just returns the amount of time in the current update step in milliseconds, so with the equation above the `pAge` parameter will always equal the particle's age in milliseconds.

The second new function is `fFade`, which performs a linear interpolation between multiple values. The first parameter to `fFade` is the current age in milliseconds, the next is the initial value, and following that are pairs of deltas and values to interpolate between. In this case, it starts with `Color(1,1,1,1)`, and then over the next 500ms interpolates to `Color(1,0,0,1)`, then over the next 1000ms interpolates to `Color(1,1,1,0)`. There isn't a limit to how many pairs you can add to this sequence, as long as you end with a value and not a delta.

The next line calculates a new `pSpin` value by using `fTimeScale` to increment `pSpin` by the value of `pSpinSpeed` once per second. The last new function is `f2dRotation`, which produces a 2d vector based on a value in radians, which is what we've been calculating in `pSpin`.

```
Anim( fExpire( fGreater(pAge,2500) ) );
```

Lua

Here's a different concept: A function that doesn't return a value. Each of the functions so far has been implicitly assigned to a particle parameter. This one just executes its function and ignores any return value.

Which is fine, because it is a function with a side effect. From the inside of the parenthesis: `fGreater` returns true (a non-zero value) if its first parameter is greater than its second. Then the function `fExpire` tests its parameter, and if true, flags the particle for destruction. In other words: If the particle's age parameter exceeds 2500ms, kill it.

```
-- A global variable that we can set from outside
gActive = 1

-- A function to run as we're executing
-- seconds - how many seconds have elapsed
function Update(seconds)
  if gActive>0 then
    -- Create 10 particles per second
    CreateParticles( seconds * 10 );
  end
end
```

Lua

What's all this then? OK, more fun stuff. First, we're setting a global Lua variable. There's nothing magical about this—nothing you can't read about in a Lua manual, anyway. We're just setting the variable `gActive` to a value of 1. Thing is, from C++ you can use `TScript::SetGlobalNumber("gActive",0)` to turn off new particle generation without stopping the animation.

It's important *not* to add any more animation or initialization rules in the `Update()` function. Every time you call `Anim()` or `Init()` it adds another animation or initialization function to the particle processing chain, so if you add additional functions in `Update()` the processing chain will get longer and longer, and your particle processing will get slower and slower.

Chapter 6

Localization and Web Versions

6.1 Translation Issues and the String Table

6.1.1 The String Table

Playground SDK™ applications rely on a single XML file that contains all of the strings used in the application. This XML file is easily modified by translators for localization. The XML file is stored in the Microsoft Excel XML save format, which can also be edited using OpenOffice Calc.

When an app launches, it automatically attempts to load in a string table from the assets directory. Note that the file will contain other XML that supports the Excel save format, and the Cell and Data tags can contain attributes.

A single string mapping looks like:

```
<Row>
<Cell><Data>title</Data></Cell>
<Cell><Data>My Game Title</Data></Cell>
</Row>
```

XML

The file is expected in the root of the assets folder, and should be called strings.xml.

See [TStringTable](#) for more information. The global string table is available from [TPlatform::GetStringTable\(\)](#).

6.2 Building a Web Version

Running your game as a web application with Playground is simple - you don't even need to recompile your game.

For more information about how to run your game as a web application, please read the [axtool: Testing Your Game in a Browser](#) section under the [Playground Utilities](#) section.

However, there are a few things to keep in mind when developing the web version of your game:

- It is important that your web version not have a completely functional game executable. It is not enough to remove data from your game and use the same executable as the download version. This would allow users to simply copy over their web version executable and unlock a full version of the download game. Please make sure to limit the functionality of your web game with code changes as well as data changes.
- Playground will automatically resize your game to fit in whatever window the website puts your game in. An average window size is 480x360, though some sites will use smaller windows and others will use larger windows. You do not have to do any extra work to get your game to show up properly in that size window. However, because your game will be running in a smaller window, you may want to shrink your assets and then scale them up dynamically in-game (i.e. using the scale parameter in `DrawSprite`). For example, if you shrink your assets by 25% and then scale them up in code by 25%, your game will run in a 600x450 window with no visual loss. If you do the same thing by 40%, your game will run in a 480x360 window with no visual loss. Shrinking your assets in this manner can help you reduce the size of your web game download.
- To implement the "Download" button functionality, you need to do two things:
 - The download url will be passed in through the command line to the `main()` function, as `-url=http://www.somesite.com/somepage.html`. You need to parse that information out of the command line.
 - To launch the download page, use `TPlatform::OpenBrowser()`
- If your game uses the hiscore system, it is important that your game be allowed to run in "anonymous" hiscore mode. The command line to `main()` will contain a `-anon #` parameter, which you need to parse. If `#` is 0, you can run the full hiscore system. If it is 1, you need to run anonymous mode. If it is 2, you need to run in local high score mode.
- If your game displays the PlayFirst logo anywhere aside from the splash screen, you need to look for the `"-hidelogo 1"` parameter being passed into the command line. If this value is present, you need to hide these logos on every screen except the main menu screen, where this logo is allowed to remain.
- Avoid saving data between sessions. The `TPrefs` and `TPfHiscores` constructors have optional arguments that will disable session data saving.
- You will likely need to revisit some of your UI and increase the size of text to make sure it is readable in the small 480x360 windows.
- If your game uses the [PlayFirst Hiscore System](#), you will want to add separate hiscore modes for your web game, but make sure the web game can still view the downloadable game modes hiscores when connected to the global hiscore system.
- In order for your game to be accepted for use on MSN, you need to:
 - Implement all the functionality described in [msnzone.h](#).
 - Submit two builds of your game, one with cheats on, one with cheats off, so it is easy to test the functionality in [msnzone.h](#).
 - Detect if the game is an MSN build by checking for the `-msn` flag on the command line.
 - When in MSN mode:

1. Instead of calling `TPlatform::OpenBrowser()` to launch a download, you need to call `MsnZone-DownloadButton()`
 2. Remove all "Try Again" buttons from your game - at the end of your game the only option should be to quit.
 3. Because MSN has their own high score system, you should not go to the high score screen in game. Instead, you should either go to an upsell screen if the user presses the high score button, or you should remove the high score buttons from your game.
 4. Whenever a game ends (either by being over or by the user quitting the game in progress), you need to call `MsnZoneScoreSubmit()` and `MsnZoneGameEnd()`. At this point, MSN zone may switch to an upsell screen and then redirect your game to either go to the main menu, or possibly restart the current game mode (you need to poll the `IsMsnZoneRestartGameRequested()` and `IsMsnZoneGameMenuRequested()` functions to determine whether or not to do this).
- In order for your game to be accepted for use on the AOL.com® site, you will need to do the following:
 - Detect for the flag `-aol` on the command line in `main()`, which means you are running an AOL service build.
 - If you are in AOL service mode, you need to:
 1. Display the AOL logo on the splash screen. An AOL logo has been included with your Playground delivery, and is located in the `addons/webgames/AOL` folder (two logos have been provided, one that is baked onto the `PlayFirst` splash screen, and one that is separate - you can use whichever file is easier for you). If you are using the `DisplaySplash()` Lua function to display your splash screen, you can put logic in the Lua script to determine which splash screen to display. For instructions on how to use an overlay with `DisplaySplash`, refer to the `DisplaySplash` documentation.
 2. Only have download buttons on 2 screens: the main menu, and the upsell screen.

Chapter 7

Game Footprint

7.1 How to Reduce Asset Size

7.1.1 Smaller is Better

When shipping a downloadable game, the smaller it is, the more likely it is that people will successfully download it. More than that, bandwidth also costs money, and though you may not see that cost directly, a larger footprint may mean your game gets promoted less than a game with an equivalent conversion rate but with a smaller footprint.

7.1.2 Shrinking Your Game

There are a number of strategies you can use to reduce footprint without reducing perceived content. Here we'll go into a few of them.

Reducing PNG Footprint

PNG32 files offer less-than-ideal compression for images that have photographic detail or gradients, but sometimes you need a mask layer for an image. There are two common ways to approach this problem.

First, you can run your PNG files through a conversion script that splits the RGB layers from the mask layer, and then place the RGB layers into a much-better-compressed JPG file, leaving the mask in a monochrome PNG8 file. The key advantage of this technique is that you get a high quality image attached to a lossless mask at a much better compression ratio. Masks tend to compress especially well in PNG. The disadvantage of this technique is that your source code (or at least Lua code) needs to change to load the masks—it's not automatic.

Second, you can run your PNG files through a conversion process to convert them to PNG8-with-transparency. This is a bit more difficult than it seems, because most popular tools don't correctly read files saved in this format. Adobe Fireworks is one of the few that can successfully read and write this format, though there is also a free command line tool called pngquant that we use at PlayFirst to reduce PNG32 to PNG8 files. The advantage of this conversion is that your files become 1/4 of their previous size, with no change of source code; the disadvantage is that they're reduced to an 8-bit palette, so if the image consists of many different color gradients, it may hurt image quality.

It's easy enough to experiment and figure out which of these two techniques works with each of your image types.

Small Files Can Be Smaller!

Just because you have a directory of 2-4k PNG files that together add up to a megabyte, don't assume that they're already small and shrinking them won't help. Files like that are almost always going to compress well to PNG8-with-transparency, as described above. And we've frequently pulled an extra 768k out of one of those megabyte-sized folders, even though the individual files are small.

Reducing JPEG and OGG Footprint

JPEG and OGG/Vorbis files each have variable compression ratio. During development it's tempting to save each of these files at a high quality, but when it comes time to ship and you're looking for some extra room, it pays to experiment with higher compression settings. Due to the nature of the lossy compression of both JPG and OGG/Vorbis, some files will compress much better than others with no perceivable loss in quality.

Reducing Image Size in Web Games

If you're producing a Web version of your game, you might want to consider reducing asset dimensions to reduce your footprint even more. While the game will work just fine with original assets, and will automatically shrink down to the smaller dimensions required by web sites, this means that you're sending 800x600 images to the site even though it's only displaying them at 400x300 or 640x480.

One easy way to reduce asset size when the assets are specified in a Lua `Bitmap{}` call is to add an appropriate "scale" parameter to `Bitmap{}`. Say you're reducing your assets to 640x480. $800/640 = 1.25$, so if you add a scale parameter of 1.25 to each bitmap you downsize, the asset will display at the same logical size in the game. If the web game is actually displayed at 640x480, it will end up displaying the resulting bits at 1:1; if it's displayed smaller (down to 400x300 on some sites) then it still ends up being scaled down, but not as much as if you were sending original 800x600 artwork.

Chapter 8

Utilities

8.1 Playground Utilities

8.1.1 sidewalk: Command Line Animation Creation

The sidewalk command line tool will take a sequence of bitmaps and convert it to an image (or a pair of images) and an XML file with the offsets necessary to reproduce the original sequence.

To create a new animation, you need to start with a sequence of frames; PNG files are best, because they can have an embedded transparency layer. Note that if they are PNG files stored with an embedded transparency layer, that layer needs to be non-empty or the resulting PNG file will be completely empty. They should also all be the same size; if your animation moves, the initial frame should be large enough to encompass the entire animation, unless you want the motion to be handled at runtime.

Once you have this sequence, save it in a folder by itself. The frames should alphabetize to be the correct sequence; if they're numbered, the numbers should have leading zeros (0001,0002, etc.) to ensure they come out in the right order if there are more than 10 frames.

Example Usage

If you run sidewalk.exe with no parameters, you'll get the usage statement:

```
sidewalk v4.0.4.3
Usage:
  sidewalk [options] animdesc.xml [ folder/fileroot* ]

Options:
  --mask      : Separate output into two layers, image and mask
  --opaque    : No transparency in PNG file.
  --reg=x,y   : Force registration point to x,y.
  -8          : Output 8 bit png
  -f #        : 'fuzzy' bounding box value, between 0 and 1.
  -o          : Output individual frames as well as combined frames into
               'frames' folder.
  -p          : Reorder frames for optimal packing. This does not .
               reorder the way frames are indexed, only reorders them in
               the output file.
  -i          : Ignore size restrictions. This disables the requirement that
               all images fit into a 1024x1024 texture. Note that if you use
               this flag, the resulting image cannot be used directly to draw
               in a game, but it may be used to hold data, etc.
```

For a new animdesc.xml file, you need to specify the source file wildcard or name.

Let's say we want to create an animation out of a series of PNG files: frame00.png, frame01.png, etc. To convert these files to a new animation control file "myanim.xml", you would call:

```
C:\dust devil>sidewalk.exe myanim.xml frame*.png
Processing frame: frame00.png
Processing frame: frame01.png
Processing frame: frame03.png
Processing frame: frame04.png
Compositing frame: frame00.png
Compositing frame: frame01.png
Compositing frame: frame03.png
Compositing frame: frame04.png
```

```
C:\dust devil>dir myanim*
Volume in drive C has no label.
Volume Serial Number is C4A8-160F

Directory of C:\dust devil

09/12/2006  03:42 PM                2,
270 myanim.png
09/12/2006  03:42 PM            497 myanim.xml
           2 File(s)                2,
767 bytes
```

You can see above that it created myanim.xml and myanim.png. You need to copy these to the same folder in your assets/ tree. All you need to do to load the file is reference myanim.xml, however—it knows what its external files are called.

Here we assume that both of the above files are copied to "assets/anim":

```
TAnimatedTextureRef anim = TAnimatedTexture::Get("anim/myanim").
```

C++

And that's it, now we have an animation in the game.

8.1.2 Filmstrip: Creating and Editing Animations

The Filmstrip tool is a tool for doing basic manipulations on multi-image animation strips. It can load an existing animation file that was created by using sidewalk, or create a new animation file for you using default sidewalk parameters.

The "Create" button creates a new animation given a sequence of images. See the details on the [sidewalk tool](#) for how to create an animation; Filmstrip simply runs sidewalk with default parameters for you to create a animation strip. For more control you can run the sidewalk tool directly on the animation.

Once you have an animation, it should show you a screen with a script on the left and the first frame of your animation on the right. On the left you'll see the basic script that is generated by default.

8.1.3 3dsconvert: Creating 3d Models For Playground

To create models for use in Playground, you convert .3ds files into a .mesh file. The utility for doing this is called 3dsconvert. Options for this utility are:

- -i [input]: name of .3ds file to convert.
- -id [inputdir]: name of directory to convert all .3ds files from.
- -o [outputfile]: name of file to output (default uses name of .3ds file) If there is more than one mesh in the file, and -m is not used, the files will be named [outputfile]1.mesh [outputfile]2.mesh ...
- -m: use names of .3ds meshes for output file name if both -m and -o are used, output names will be of form [outputfile]_[meshname].mesh.

- -od [outputdir]: name of directory to output files in.
- -s [amount]: how much to scale the model by (default 1.0).
- -center [xyz]: recenter across an axis - specify any combination of xyz. This happens before the yzflip.
- -invert [xyz]: invert across an axis - specify any combination of xyz. This happens before the yz flip, so -invert z first inverts the z axis, then flips it with y.
- -uvflip [uv]: This will flip texture coordinates from 0-1 to 1-0 - specify any combination of uv.
- -yzflip: this will flip the y and z axis (default off)

8.1.4 Creating a Playground Font

To create a font you need the Macromedia® Flash® software. In the Playground SDK™ distribution is a bin folder, where you can find two different font template .fla files, one for Flash® MX and one for Flash® 8.

To create the font, first, from within the Flash® software:

1. Open the appropriate font template in your version of Flash®.
2. Select the text field and change it to be the font you want.
3. Publish the swf.

After you've completed the above, you need to drag and drop the resulting swf file onto the swf2mvec.exe program, also within the bin distribution. That program will emit an mvec file next to the swf file. Name that mvec file and add it to your assets folder, and then you can load it as a font.

8.1.5 axtool: Testing Your Game in a Browser

The axtool utility can help you configure your system to be able to run your game in an Internet Explorer browser on your system. Here are the basic steps you need to follow:

1. Create two files in your game build directory, activex.bat and activextest.bat, based on the example files included under the utilities\bin\axtool folder. Copy these files into your game folder and add the appropriate information for your game. You can generate the GUIDs using a tool that ships with the Microsoft® Developer Studio® development system called guidgen.exe, which is installed in the Common7\Tools folder in your Developer Studio installation folder.
2. Create an empty text file at c:\pfxdebug.txt. Without this text file at the root of your C drive, the game will not run.
3. Open up a command prompt window (in Vista, ensure that you're running the command prompt as administrator).
4. Run the axtool.bat script that is in your utilities\bin\axtool folder. Run the utility like this: axtool [gamefolder] test debug
 - The gamefolder should be the path to your gamefolder (the folder that contains the activex.bat file, etc.)
 - test and debug are required parameters for testing the game locally.
 - Note that this script assumes you have Visual Studio® 2005 installed in the default location. If you do not, you can override where it looks for Visual Studio by defining a VSNETPATH environment variable to the path. For example:

```
set VSNETPATH="C:\Program_Files\Microsoft_Visual_Studio_2005"
```

C++

or

```
set \c VSNETPATH="C:\\msdev\\install"
```

C++

After you've completed the above steps, you'll have an html file in your game folder. To test your game in a window:

1. Open up the html file in Internet Explorer (it will not run in other browsers).
2. Internet Explorer may ask you if you want to install the ActiveX® control; allow it to install.
3. A window will appear that will say something like "Run with -wnd=123456." This means your game is now ready to run in the window. You can now launch your game in the debugger, and instead of running in its own window, it will show up in the Internet Explorer window.

8.1.6 xml2anm: Convert XML to ANM

The ANM format was created to help speed the loading of animation files. As a binary format it can be loaded by Playground much more quickly than the more verbose and human readable XML format.

Currently you need to modify your game source to look for ANM files instead of XML files, so you'll need to perform the conversion in your development builds—it can't be done automatically at build time. We're considering changing this in a future release.

To use, you call it on the command line with one or more of the following options:

```
<verbatim> xml2anm: converts an animation XML file into a binary ANM file flags: -f <filename> - converts one
file from xml to anm -o <outputname> - if using -f, optional argument to specify outputfile -d <directoryname>
- converts all xml files in directory to anm files -r - turns on recursion for -d option -1 - writes old version 1 file
</verbatim>
```

Chapter 9

Advanced Features

9.1 Advanced Concepts

9.1.1 Playing With the Big Kids

This section has a number of quick examples and how-tos that cover more advanced concepts. Most Playground SDK™ games contain few or none of these techniques, but some problem domains have very simple solutions when you have the right tools. Here are some of the more sophisticated tools for you to use when the situations arise.

Some of the examples are very brief—after all, if you’re reading this section, you’re an expert looking for an example of an advanced technique. If you’re not sure why you’d want to do some of these things, then you likely don’t need to do them.

9.1.2 Deriving a Custom Sprite Type

As part of a discussion on the forums about attaching text to a sprite, it became obvious that one easy way would be to create a custom sprite type that, instead of (or in addition to) drawing a texture, also drew a line of text.

If you want your own custom-derived sprite, here’s a quick approximation of what that code would need to look like. Our derived class will be called TTextSprite.

First a declaration:

```
// Forward declaration
class TTextSprite ;

// Reference counted pointer wrapper
typedef shared_ptr<TTextSprite> TTextSpriteRef ;

class PFLIB_API TTextSprite : public TSprite
{
    PFSHAREDTYPEDEF(TSprite);
protected:
    // Internal Constructor. Use TTextSprite::Create() to get a new sprite.
    TTextSprite(int32_t layer);
public:
    // Destructor.
    virtual ~TSprite();

    // Factory method
    static TTextSpriteRef Create(int32_t layer=0);

    // Our Draw call
```

C++

```

virtual void Draw(const TDrawSpec & drawSpec=TDrawSpec(), int32_t depth=-1);

private:
    TTextGraphic mTextGraphic ;
    TRect        mTextRect;
}

```

And then highlights from the implementation:

```

// Call the protected TSprite constructor
TTextSprite::TTextSprite( int32_t layer ) : TSprite( layer )
{
}

// Public creation call, to ensure all TTextSprites are wrapped
// in TTextSpriteRefs correctly
TTextSpriteRef TTextSprite::Create( int32_t layer )
{
    TTextSprite * as = new TTextSprite(layer);
    TTextSpriteRef ref( as );

    return ref ;
}

// The actual Draw call
void TTextSprite::Draw(const TDrawSpec & drawSpec, int32_t depth)
{
    if (!mEnabled)
    {
        return;
    }
    TDrawSpec localSpec = mDrawSpec.GetRelative(drawSpec);

    // This assumes you have an mTextRect which is the desired rectangle size
    // for your text.
    TRect rect = mTextRect+TPoint(localSpec.mMatrix[2].x,localSpec.mMatrix[2].y) ;
    mTextGraphic->Draw( rect, 1, 0, localSpec.mAlpha );

    TSprite::Draw(drawSpec,depth);
}

```

Note that I didn't include the math for extracting the rotation from the matrix, so this text will draw at the location but not the rotation of a sprite. I leave the extraction of the rotation as an exercise for the reader.

9.1.3 Sending Custom Application Messages

The [TMessage](#) type is intended to encapsulate any complex client message. The Playground SDK™ encapsulates [TMessage](#) as a Lua user-type, so you can pass a [TMessage](#) object around within Lua. If you want to have Lua pass complex message objects back to your C++ game, you can easily have a Lua object send a message to your game window where you can interpret its contents and trigger the correct game actions.

To start, derive your message type from [TMessage](#) and add any extra information to your derived class. For example, say you have a script that triggers an explosion animation that requires some additional processing in C++ code:

```

// A custom user message with information about an explosion
class TriggerExplosion : public TMessage
{
    // This allows the class to have run time type id information
    PFTYPEDEF_DC(TriggerExplosion,TMessage);
public:
    int x,y;
    float size ;
};

```

```
...

// In a C++ file, define the runtime type id
PFTYPEIMPL(TriggerExplosion);
```

Now we have a new custom message type, and we need a way to create it from within Lua. Since we can use [ScriptRegisterDirect\(\)](#) to expose a C++ function to Lua, we can create an instance in C++ and return it to Lua directly:

```
// A function that creates a new explosion message C++
TMessage * NewExplosion( int x, int y, float size )
{
    TriggerExplosion * te = new TriggerExplosion;
    te.x = x ;
    te.y = y ;
    te.size = size ;
    te.mName = "TriggerExplosion";
    return te ;
}
```

The TMessage* will be deleted by the Lua garbage collection when it is no longer used, so you won't need to delete it yourself.

Here's how you might use the above code:

```
// The main game class (excerpts of relevant parts) C++
class MainGameWindow
{
public:
    MainGameWindow()
    {
        // ...
        ScriptRegisterDirect(
            TWindowManager::GetInstance()->GetScript(),
            "NewExplosion",
            NewExplosion);

        // Make sure that messages are routed to us.
        TWindowManager::GetInstance()->GetTopModalWindow()->SetDefaultFocus(this);
        // ...
    }

    // ...
    virtual bool OnMessage(TMessage * message)
    {
        TriggerExplosion * te = message->GetCast<TriggerExplosion>() ;

        if (te) // this is a TriggerExplosion, so process it
        {
            x = te->x ;
            y = te->y ;
            size = te->size ;
            HandleExplosion(x,y,size) ; // This would do the extra work
            return true ;
        }

        // Check for other message types here...

        // ...

        return false ; // We didn't handle the message
    }
    // ...
}
```

Then, in a Lua script:

```
-- Send a message that indicates we want an explosion at this location
PostMessage( NewExplosion(12,32,0.232) );
```

Lua

This will send a message that will be delivered to the "default focus" window (see [TModalWindow::SetDefaultFocus](#)), and from there can be handled by your custom game window class. If you need a message to go to more than one destination, then you should set up a default focus window that can dispatch the message to the appropriate destination. The [TMessage](#) will be deleted by Lua in a normal garbage collection pass.

9.1.4 Calling a Lua Function from C++

For a simple example of calling a Lua function from C++, see the following.

```
function DoSomething()
    DebugOut("I've_been_called");
end

Foo = { fn=DoSomething };
```

Lua

```
TWindowManager::GetInstance()->GetScript()->RunScript("test.lua");
```

C++

```
TLuaTable * table = TWindowManager::GetInstance()->GetScript()->GetGlobalTable("Foo");
TLuaFunction * fn = table->GetFunction("fn");
fn->Call();
delete fn;
delete table;
```

C++

This prints out "Lua: I've been called" in the debug log. You should be able to keep around the fn pointer indefinitely—I just delete it here since I'm creating it in a local pointer.

If your routine returns values, they will be pushed onto the stack in order—and this Call function only supports one result, so you'll only get the first one. You can use the [TScript::PopString\(\)](#), [TScript::PopNumber\(\)](#), or direct Lua C stack access functions to extract the return value from the stack.

Part II

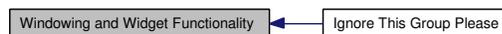
Reference

Chapter 10

Windowing Reference

10.1 Windowing and Widget Functionality

Collaboration diagram for Windowing and Widget Functionality:



10.1.1 Detailed Description

Everything related to windows and their descendents: buttons, sliders, image windows, and custom windows.

Modules

- [Ignore This Group Please](#)
Interface for class [T2dParticleRenderer](#).

Classes

- class [TButton](#)
Encapsulation for button functionality.
- class [TDialog](#)
A generic modal dialog.
- class [TImage](#)
The [TImage](#) class is a [TWindow](#) that contains and draws a [TTexture](#).
- class [TLayeredWindow](#)
A [TLayeredWindow](#) is a [TWindow](#) with multiple layers which can be switched between.
- class [TScreen](#)
The base level modal window.
- class [TText](#)

A text window.

- class [TTextEdit](#)

The [TTextEdit](#) class represents an editable text [TWindow](#).

- class [TWindow](#)

The [TWindow](#) class is the base class of any object that needs to draw to the screen.

- class [TWindowSpider](#)

A class used with [TWindow::ForEachChild](#) to iterate over the children of a window with a single "callback" function.

- class [TWindowHoverHandler](#)

A callback that receives notification that a window has had the mouse hover over it.

- class [TWindowManager](#)

The [TWindowManager](#) class manages, controls, and delegates messages to the window system.

Chapter 11

Lua Reference

11.1 Lua-Related Documentation

11.1.1 Detailed Description

Documentation on predefined Lua constants and functions, as well as C++ interfaces to Lua. See the section on [Lua Scripting](#) for more information.

Files

- file [luapluscd.h](#)
Playfirst-modified LuaPlus Call Dispatcher.

Classes

- class [TLuaTable](#)
A wrapper for Lua table access in C++.
- class [TLuaObjectWrapper](#)
Wrap a Lua object for use within C++ code.
- class [TLuaFunction](#)
A wrapper for a Lua function.
- class [TScript](#)
An encapsulation for a Lua script context.
- class [TScriptCode](#)
An encapsulation of a compiled Lua source file.

Defines

- #define [ScriptRegisterMemberFunc](#)(script, name, ptr, functor)

Register a member function with the standard Lua signature.

- #define `ScriptRegisterFunc`(script, name, functor)
Register a function with the standard Lua signature.
- #define `ScriptRegisterMemberDirect`(script, name, ptr, directfunctor)
Register a "Direct" called function: A function that will be called by Lua directly with appropriate parameters.
- #define `ScriptRegisterDirect`(script, name, directfunctor)
Register a "Direct" called function: A function that will be called by Lua directly with appropriate parameters.
- #define `ScriptUnregisterFunction`(script, name)
Unregister a function that was previously registered using `ScriptRegisterDirect()`, `ScriptRegisterMemberDirect()`, `ScriptRegisterFunc()` or `ScriptRegisterMemberFunc()`.

Functions

- template<typename Func> void `lua_pushdirectclosure` (lua_State *L, Func func, unsigned int nupvalues)
Push a function on the Lua stack that will be called "directly" with a custom parameter list and return value ("directly").
- template<typename Callee, typename Func> void `lua_pushdirectclosure` (lua_State *L, Callee *callee, Func func, unsigned int nupvalues)
Push a function on the Lua stack that will be called "directly" with a custom parameter list and return value ("directly").
- template<typename Callee> void `lua_pushfunclosure` (lua_State *L, Callee *callee, int(Callee::*func)(lua_State *), unsigned int nupvalues)
Push a member function on the Lua stack that will be called as a standard Lua callback function.

11.1.2 Define Documentation

#define `ScriptRegisterDirect`(script, name, directfunctor)

Register a "Direct" called function: A function that will be called by Lua directly with appropriate parameters.

This can be contrasted with `ScriptRegisterMemberFunc()`, which calls a function with the standard Lua function signature.

Supported parameter types include:

- bool
- [unsigned] char
- [unsigned] [short] int (unsigned and short are optional)
- [unsigned] long
- lua_Number
- float
- const char*
- str
- const LuaNil&
- lua_CFunction

- `const void*`
- [TLuaTable *](#) (see below for important notes)
- `TMessage*`
- `const LuaLightUserData&`

For `TLuaTable *` as parameter, the pointer will exist for the duration of your function, but will be deleted in the next application event loop, so don't keep it around.

For `TLuaTable *` as a return type, you will need to return a [TLuaTable](#) pointer that persists past the end of the function; you are still responsible for deleting the pointer.

See also:

[Using Lua to Script Your Game](#) (p 33)

#define ScriptRegisterFunctor(script, name, functor)

Register a function with the standard Lua signature.

The function signature should match:

```
int FN( lua_State * L );
```

Parameters:

script Script to add functor to.
name Lua name of function.
functor The function to call.

See also:

[Using Lua to Script Your Game](#) (p 33)

#define ScriptRegisterMemberDirect(script, name, ptr, directfunctor)

Register a "Direct" called function: A function that will be called by Lua directly with appropriate parameters.

Parameters:

script Script to add functor to.
name Lua name of function.
ptr Pointer to "this" in the class we're binding to.
directfunctor The member function to call.

See `ScriptRegisterDirect` for supported parameter types.

See also:

[ScriptRegisterDirect](#)
[Using Lua to Script Your Game](#) (p 33)

#define ScriptRegisterMemberFunctor(script, name, ptr, functor)

Register a member function with the standard Lua signature.

The function signature should match:

```
int FN( lua_State * L );
```

Parameters:

script Script to add functor to.
name Lua name of function.
ptr Pointer to "this" in the class we're binding to.

functor The member function to call.

See also:

[Using Lua to Script Your Game](#) (p 33)

11.1.3 Function Documentation

```
template<typename Callee, typename Func> void lua_pushdirectclosure (lua_State * L, Callee * callee, Func func, unsigned int nupvalues)
```

Push a function on the Lua stack that will be called "directly" with a custom parameter list and return value ("directly").

More details are available in [lua_pushdirectclosure\(lua_State* L, Func func, unsigned int nupvalues\)](#)

See [ScriptRegisterMemberDirect\(\)](#) for a simplified wrapper to this function.

Advanced user function; can be safely ignored by most users.

See the disclaimer on the [LuaPlusCD.h](#) description page.

Parameters:

L Lua state.

callee A pointer to the class instance you want to bind your caller to.

func Member function to call.

nupvalues Number of upvalues (usually 0; see Lua docs)

See also:

[lua_pushdirectclosure\(lua_State* L, Func func, unsigned int nupvalues\)](#)

[ScriptRegisterMemberDirect](#)

```
template<typename Func> void lua_pushdirectclosure (lua_State * L, Func func, unsigned int nupvalues)
```

Push a function on the Lua stack that will be called "directly" with a custom parameter list and return value ("directly").

See [ScriptRegisterDirect\(\)](#) for a simplified wrapper macro.

Advanced user function; can be safely ignored by most users.

See the disclaimer on the [LuaPlusCD.h](#) description page.

With this function you can expose *any* class member function that uses the supported parameter and return value types to a Lua script.

See [ScriptRegisterDirect\(\)](#) for supported parameter types.

Parameters:

L Lua state.

func Function to call.

nupvalues Number of upvalues (usually 0; see Lua docs)

See also:

[ScriptRegisterDirect](#)

```
template<typename Callee> void lua_pushfunctorclosure (lua_State * L, Callee * callee, int(Callee::*)(lua_State *) func, unsigned int nupvalues)
```

Push a member function on the Lua stack that will be called as a standard Lua callback function.

The standard function signature takes a parameter lua_State* and returns int.

This will allow you to create a member function and have Lua call it directly.

Advanced user function; can be safely ignored by most users.

See the disclaimer on the [LuaPlusCD.h](#) description page.

Parameters:

L Lua state.

callee A pointer to the class that your function is a member of.

func Function to call.

nupvalues Number of upvalues (usually 0; see Lua docs)

11.2 Query Values for Current Configuration in Lua.

11.2.1 Detailed Description

These values are passed to `GetConfig()` to query various configuration states. See `GetConfig()` for more information.

Constants

- `kCheatMode` = "cheatmode"
Cheat mode enabled?
- `kComputerId` = "computerid"
This computer's unique ID.
- `kInstallKey` = "installkey"
The key that indicates how this game was installed.
- `kGameName` = "gamename"
The name of the game.
- `kGameVersion` = "version"
The version number of this build.
- `kEncryptionKey` = "encryptionkey"
The encryption key.
- `kHiscoreLocalOnly` = "hiscorelocal"
This is a local hiscore build.
- `kHiscoreAnonymous` = "hiscoreanon"
This is an anonymous hiscore build.

11.3 GUI-Related Constants in Lua.

11.3.1 Detailed Description

These constants are available in the Lua GUI script.

Constants

- **kPush** = 0
Button Type: Push button.
- **kToggle** = 1
Button Type: Toggle button.
- **kRadio** = 2
Button Type: Radio button.
- **kAllLayers** = -1
SelectLayer() constant to select all layers for edit.
- **kCenter** = 80000
Position-relative-to-center: Add this constant to an x/y position to make it relative to a centered object.
- **kMax** = 160000
Width or position maximum.
- **kDefault** = 128
Button Text Alignment: Default for type of button.

11.3.2 Constant Documentation

kCenter = 80000

Position-relative-to-center: Add this constant to an x/y position to make it relative to a centered object.

In other words, if you make $x=kCenter$, the object will be centered horizontally. If you add one ($x=kCenter+1$), the object will be one pixel to the right of where it would have been centered.

kMax = 160000

Width or position maximum.

In the case of position, you can subtract an amount from kMax to make the position relative to the opposite edge. For a width or height, you can use -kMax to indicate the window should "grow" in the opposite direction of the x or y position: $w=-kMax$ means that x specifies the right edge of the window, and that it should grow to the left edge of the parent.

11.4 Text and Window Alignment.

11.4.1 Detailed Description

These Lua constants are used both as text alignment in `Text()` windows, and general `Window()` alignment using the `align` tag.

Combine flags in Lua using normal addition (+), since Lua doesn't support bitwise or.

Constants

- `kHAlignLeft` = 0
Horizontal alignment: Left.
- `kHAlignCenter` = 1
Horizontal alignment: Center.
- `kHAlignRight` = 2
Horizontal alignment: Right.
- `kVAlignTop` = 0
Vertical alignment: Top.
- `kVAlignCenter` = 4
Vertical alignment: Center.
- `kVAlignBottom` = 8
Vertical alignment: Bottom.

11.5 Defined Message Types in Lua.

Constants

- `kCloseWindow = 1`
A request to close a window.
- `kDefaultAction = kCloseWindow+1`
A request for the default window action.
- `kButtonPress = kDefaultAction+1`
A button was pressed.
- `kPressAnyKey = kButtonPress+1`
An "any key" was pressed.
- `kQuitNow = kPressAnyKey+1`
A request to terminate the application with prejudice.
- `kModalClosed = kQuitNow`
A notification that a modal window was closed.

11.5.1 Constant Documentation

`kCloseWindow = 1`

A request to close a window.

Name of message must be window ID to close (`TWindow::GetID()`)

11.6 Lua GUI Command Reference

Lua GUI script function and constant documentation.

These functions and constants are available in the Lua script available from `TWindowManager::GetScript()`.

Functions

- function `Color` (r, g, b, a)
Return a color given r,g,b and optionally alpha.
- function `FColor` (r, g, b, a)
Return a color given floating point r,g,b and optionally alpha.
- function `DoWindow` (window)
Note:
This function is for advanced users only.
- function `MakeDialog` (dialogcommands)
Create a dialog.
- function `Window` (table)
Create a generic window.
- function `Text` (table)
Create a `TText` window.
- function `TextEdit` (table)
Create an editable text (`TTextEdit`) window.
- function `Button` (button)
Create a `TButton`.
- function `Bitmap` (table)
Create a bitmap window (`TImage`).
- function `EnableWindow` (name, enable)
Enable or disable a window by name.
- function `BeginGroup` ()
Begin a group of radio buttons.
- function `GetTag` (tab, tag,...)
Get a tag from the table or environment.
- function `SetDefaultStyle` (style)
Set the current default style at a global level.
- function `SetStyle` (style)
Set the default style within a window definition.

- function [AppendStyle](#) (style)
Add a table of traits to the current style.
- function [SetFocus](#) (name)
Set the focus to be window "name".
- function [WaitForCloseMessage](#) (id)
Pause to wait for a particular modal window to close.
- function [DoModal](#) (fileToRead)
Push a modal window onto the window stack.
- function [ModalReturn](#) (value)
Return a value from a modal dialog.
- function [DisplaySplash](#) (splashMovie, splashGraphic, time)
Display a splash movie or bitmap.
- function [Yield](#) ()
Yield control to C++ code.
- function [ReadFile](#) (fileToRead)
Read and run a Lua file in the assets folder.
- function [CloseWindow](#) (param)
Ask the current level of modal window to close and return.
- function [CustomCreator](#) (s)
A function to call with any custom window types, to allow FirstStage to parse the window description.
- function [GetString](#) (id, p1, p2, p3, p4, p5)
Get a string from the string localization table.
- function [CreateNamedMessage](#) (type, name)
Create a named message
 - type The integer type of the message.
- function [PostMessage](#) (message)
Post a message to the current top modal window.
- function [PostMessageToParent](#) (message)
Post a message to the parent of the current top modal window.
- function [GetTimer](#) ()
Get the global timer value (TPlatform::Timer)
 - return Number of milliseconds since the game was started.
- function [PushModal](#) (name)
Push a modal window onto the modal window stack.

- function [GetLabel](#) (name)
Get a label from a TText- or TTextEdit-derived window.
- function [SetLabel](#) (name, label)
Set a label on a TText- or TTextEdit-derived window.
- function [SetButton](#) (name, command)
Set a command on a TButton-derived window.
- function [GetButtonToggleState](#) (name)
Get the toggle state of a button
 - name Name of the button to query
 - Return True if the button is "On", false if "Off".
- function [SetButtonToggleState](#) (name, state)
Set the toggle state of a button
 - name Name of the button to query
 - state True to set the button to "On" ([TButton::SetOn](#)), false for "Off".
- function [SetBitmap](#) (name, image, scale)
Set an image on a TImage-derived window.
- function [PopModal](#) (r)
Pop the current modal window NOW.
- function [SwapToModal](#) (name)
Swap the contents of the top level modal window with the window elements contained in an external definition.
- function [DisplayDialog](#) (t)
Present a modal dialog.
- function [SelectLayer](#) (layer)
Select a layer in a TLayeredWindow (like a TButton).
- function [Group](#) (t)
Group a set of windows together.
- function [FitToChildren](#) ()
Cause a window to be resize to encompass current children.
- function [Pause](#) (time, waitForKey)
Pause for a specified amount of time.

11.6.1 Function Documentation

function AppendStyle (style)

Add a table of traits to the current style.

– Add two traits to the current active style `AppendStyle{ font="fonts/myfont.mvec", x=123 }`;

The added elements are only added locally; when another style is selected, the appended elements are discarded.

If you want to permanently change a named style, it's actually pretty easy: Styles are actually Lua tables, which are passed around as references, so modifications are always to the original table. So, to add a trait to a style `MyDefaultStyle`, you would just use the Lua member accessor:

```
MyDefaultStyle.font = "fonts/myfont.mvec";
```

Lua

...or...

```
MyDefaultStyle["font"] = "fonts/myfont.mvec";
```

Lua

function BeginGroup ()

Begin a group of radio buttons.

Use before the first radio button in a group.

function Bitmap (table)

Create a bitmap window ([TImage](#)).

Remarks:

Supported tags include:

- `alpha` (boolean) True to force the image to have an alpha channel. (default=false)
- `hflip` (boolean) True to horizontally flip the image. (default=false)
- `image` (string) Name of the file to load.
- `mask` (string) Optional image mask (transparency layer) to apply.
- `mipmap` (boolean) True to force the image to be created with mipmaps. (default=false)
- `rotate` (boolean) Rotate the image by 90 degrees.
- `scale` (number) Scale to apply to the image. 1.0==normal image size. (default=1.0)
- `vflip` (boolean) True to vertically flip the image. (default=false)
- Other generic window tags.

See also:

[Window\(\)](#)

function Button (button)

Create a [TButton](#).

This function is defined, by default, in the `style.lua` file that is included with the Playground Skeleton application.

Remarks:

Tags Supported tags include:

- `beginGroup` (boolean) This button is the first in a radio-button group.

- `close` (boolean) This button closes its window/dialog if true.
- `command` (function) The function to call when the button is clicked. During the function you can call `GetButtonName()` to determine the name of the calling button.
- `default` (boolean) Button is a default button.
- `flags` (number) Button label text alignment.
- `graphics` (table) An array of up to four images for the button: Three for push-buttons (Up, RollOver, Down), Four for toggle and radio buttons (Up, RollOver-Up, Down, RollOver-Down). If the array has fewer than 3 or 4 images, additional images are duplicated from the last given image.
- `hflip` (boolean) Horizontally flip the button images.
- `label` (string) Default button text label.
- `mask` (string) Specify a click mask for the button.
- `on` (boolean) True if the (toggle or radio) button should default to being "on".
- `rotate` (boolean) Rotate the button image by 90 degrees.
- `sendToParent` (boolean) Send any button message to the parent of the current top modal window.
- `scale` (number) Scale to apply to the button graphics.
- `sound` (string) Name of sound to play when button pressed.
- `rolloversound` (string) Name of sound to play when mouse rolls over the button.
- `type` (number) Button type (kPush, kToggle, kRadio).
- `vflip` (boolean) Vertically flip the button images.
- Other generic window tags.

See also:

[Window\(\)](#)
[BeginGroup\(\)](#)

function `Color (r, g, b, a)`

Return a color given r,g,b and optionally alpha.

Values should run from 0-255.

function `CreateNamedMessage (type, name)`

Create a named message

- `type` The integer type of the message.
- `name` Name of the message.
- **Return** a `TMessage` *. Pass to `PostMessage` or `PostMessageToParent`.

See also:

[PostMessage](#)
[kCloseWindow](#)
[kDefaultAction](#)
[kButtonPress](#)
[kPressAnyKey](#)
[kQuitNow](#)
[kModalClosed](#)

function CustomCreator (s)

A function to call with any custom window types, to allow FirstStage to parse the window description.

- s (string) Name of custom window creator.

function DisplayDialog (t)

Present a modal dialog.

- t (table) A table, with a string as the first array element that names a Lua file that describes the dialog, and additional optional parameters to pass to the dialog. Parameters are passed in global gDialogTable.

function DisplaySplash (splashMovie, splashGraphic, time)

Display a splash movie or bitmap.

Note: It is possible to have an overlay display on top of the splash screen bitmap (i.e. for a distributor logo). This can only be done on top of a bitmap, not a SWF. To do this, you should have a definition for a variable called "splashoverlay" inside your current default style. For example:

```
SplashOverlayStyle = {
  splashoverlay= Bitmap{ x=30, y=50, image="playfirstlogo" };
};
Then before you call DisplaySplash, call:
SetDefaultStyle(SplashOverlayStyle);
```

Lua

Note that you can also use the default style to control the overall scale of your splash screen graphic (i.e. scale it up or down):

```
SplashOverlayStyle = {
  splashoverlay= Bitmap{ x=30, y=50, image="playfirstlogo" };
  scale=1.3333333
};
```

Lua

There are three tags you can specify in the style before displaying a splash: disableAbort - (default is false) - if this is true, the user cannot click through the splash screen. translate - (default is false) - if this is true, the movie will trigger the Flash translation pipeline (see TFlashHost::Play). allowInput - (default is false) - if this is true, the flash movie will display the system cursor and accept mouse clicks.

- splashMovie (string)Name of SWF file to play.
- splashGraphic (string)Name of bitmap to display if Flash fails.
- time (number)Time to show bitmap.

function DoModal (fileToRead)

Push a modal window onto the window stack.

- fileToRead A lua file to read that describes the window to push.

function DoWindow (window)

Note:

This function is for advanced users only.

Internal function that actually creates the window. This is the function that the script commands ultimately call to create the window.

function EnableWindow (name, enable)

Enable or disable a window by name.

- name Name of the window to enable or disable
- enable True to enable, false to disable window

Returns:

True if window was found and enabled/disabled, false if no window by this name found.

function FColor (r, g, b, a)

Return a color given floating point r,g,b and optionally alpha.

Values should run from 0-1.

function FitToChildren ()

Cause a window to be resize to encompass current children.

Intended to be used in a [MakeDialog\(\)](#) context: Actually returns a function that, when called, will resize the top window on the stack.

function GetLabel (name)

Get a label from a TText- or TTextEdit-derived window.

- name Name of the window to retrieve the label.

function GetString (id, p1, p2, p3, p4, p5)

Get a string from the string localization table.

- id ID of string to look up.
- p1..5 Optional parameters for string substitution. See [TStringTable::GetString](#) for more information.
- **Return** a string from the string table, or ##### if no string is found

function GetTag (tab, tag, ...)

Get a tag from the table or environment.

In normal usage, pass only two parameters.

- tab Table with window definition.
- tag Tag to query.

function Group (t)

Group a set of windows together.

- t The table containing the windows to group.

Example

Code that creates two buttons based on a common name.

```

function TwoButtons( name )
  -- First create a table of the window parts using name
  t = {
    Button { name=name.."buttona", ... },
    Button { name=name.."buttonb", ... }
  };
  -- Return the table
  return Group(t);
end
...
-- Then use your function
MakeDialog
{
  Bitmap
  {
    x=0,y=0,
    TwoButtons( "test" ),
    ... -- The rest of the dialog definition can go here
  }
}

```

Lua

function MakeDialog (dialogcommands)

Create a dialog.

Parses through a table (dialogcommands) which is made up of creator functions like `Bitmap` and `Button`.

The internal operation of `MakeDialog` assumes that actual function closures are in the table. Window creation functions like `Bitmap()` actually return a function closure that is added to the table.

function ModalReturn (value)

Return a value from a modal dialog.

- value A value to return from a modal window.

function Pause (time, waitForKey)

Pause for a specified amount of time.

time Number of milliseconds to wait. `waitForKey` [optional] True to abort on a keypress. Defaults to false.

function PopModal (r)

Pop the current modal window NOW.

- r Window ID or name to pop.

function PostMessage (message)

Post a message to the current top modal window.

- A message created with `CreateNamedMessage` or a user function that returns a `TMessage` *.

See also:

[CreateNamedMessage](#)

function PostMessageToParent (message)

Post a message to the parent of the current top modal window.

- A message created with `CreateNamedMessage` or a user function that returns a [TMessage](#) *.

See also:

[CreateNamedMessage](#)

function PushModal (name)

Push a modal window onto the modal window stack.

Name the window.

- name (string) Name of the new modal window
- **Return** an id that can be passed to [WaitForCloseMessage\(\)](#).

function SetBitmap (name, image, scale)

Set an image on a `TImage`-derived window.

- name Name of the [TImage](#) window.
- image New image name.
- scale Optional scale.

function SetButton (name, command)

Set a command on a `TButton`-derived window.

- name Name of the button.
- command New command.

function SetDefaultStyle (style)

Set the current default style at a global level.

Do not call within a window definition.

function SetFocus (name)

Set the focus to be window "name".

- name Name of window to receive the input focus. Usually a `TextEdit` window.

function SetLabel (name, label)

Set a label on a `TText`- or `TTextEdit`-derived window.

- name Name of the window to set the label.
- label New label value.

function SetStyle (style)

Set the default style within a window definition.

The style is selected in the current layer only; after the closing brace of the current layer, the previously selected style will be restored.

A style is a Lua table with the following form:

```
MyStyle =  
{  
  parent=DefaultStyle, --- Optionally inherit from style table "DefaultStyle".  
  tag=value,           --- Set tag to value. Any window tag can be set in a style.  
  tag2=value2,        --- etc...  
  tag3=value3,  
};
```

Lua

When the window creation code searches for a tag, it first searches the window creation script table, then the current style, then parent of the style, and so forth until it finds the tag. Most tags have a default value that they fall back to when not defined.

function SwapToModal (name)

Swap the contents of the top level modal window with the window elements contained in an external definition.

- name (string) Name of Lua file to load with new definition.

function Text (table)

Create a [TText](#) window.

Remarks:

Tags Supported tags include:

- flags Text alignment flags.
- label Text to render.
- Other generic window tags.

See also:

[Window\(\)](#)
[GUI-Related Constants in Lua.](#)

function TextEdit (table)

Create an editable text ([TTextEdit](#)) window.

Remarks:

Tags Supported tags include:

- flags Text alignment flags.
- label Initial text.
- password A password field that should be shown as '*'s
- length Maximum length of editable field.
- ignore Characters to disallow in edit field.
- Other generic window and text tags.

See also:

[Text\(\)](#)
[Window\(\)](#)
[GUI-Related Constants in Lua.](#)

function WaitForCloseMessage (id)

Pause to wait for a particular modal window to close.

Pass in the id that was returned from [PushModal\(\)](#), and when that modal window closes this routine will fall out.

- id The modal window id, returned from [PushModal\(\)](#)

function Window (table)

Create a generic window.

Remarks:

Tags are Lua table entries that contain data that define how the window will be created. Tags that are not specified in a particular window table are sought in the current style and its parents.

Supported tags include:

- x, y Window position. Can be specified as an offset from kCenter or kMax.
- w, h Window width and height. Can be specified as an offset from kMax.
- name Window name (used as a handle to search for window and identify it at runtime).
- align Window alignment: A combination of horizontal and vertical alignment flags. See [Text and Window Alignment](#).. Disables special processing of negative position values.

To center a window, specify its x or y position as kCenter, or specify align=kHAlignCenter or align=kVAlignCenter. To have a window fill its maximum width or height, specify kMax for that dimension. You can add offsets to either kCenter or kMax to specify a position relative to that logical anchor. See [kCenter](#) or [kMax](#) documentation for details.

Using kCenter will override any alignment flags for that axis.

Window position can be specified as negative, which indicates an offset from the opposite edge (similar to kMax-position). *Negative x and y use is deprecated, and will be removed from 4.1. This feature is disabled if you add an align tag to the window.*

Window width and height can be specified as negative, which indicates that x and y are describing the right or bottom edge of the window.

See also:

[kCenter](#)
[kMax](#)

function Yield ()

Yield control to C++ code.

Returns any parameters passed to Resume().

Chapter 12

Vertex Rendering Reference

12.1 Vertex Support for Triangle Rendering

12.1.1 Detailed Description

When rendering to triangles or lines using `TRenderer::DrawVertices()`, you need to set up your vertices using functionality provided in this section.

Classes

- struct `TVert`
3d untransformed, unlit vertex.
- struct `TLitVert`
3d untransformed, lit vertex.
- struct `TTransformedLitVert`
Transformed and lit vertex.
- class `TVertexSet`
A helper/wrapper for the [Vertex Types](#) which allows `TPlatform::DrawVertices` to identify the vertex type being passed in without making the vertex types polymorphic.

Functions

- void `CreateVertsFromRect` (const `TVec2` &pos, `TTransformedLitVert` *vertices, `TVec2` *corners, const `TVec2` *uv, const `TMat3` &matrix, float alpha, const `TColor` &tint)
Create some vertices based on a rectangle and some transformation information.

12.1.2 Function Documentation

`void CreateVertsFromRect` (const `TVec2` & pos, `TTransformedLitVert` * vertices, `TVec2` * corners, const `TVec2` * uv, const `TMat3` & matrix, float alpha, const `TColor` & tint)

Create some vertices based on a rectangle and some transformation information.

This is a utility function that is used by several parts of the library internally, but has been exposed because of its general usefulness.

The resulting vertices can be passed to `TRenderer::DrawVertices()` with the rendering type of `TRenderer::kDrawTriFan`.

Parameters:

pos Position on screen to anchor rectangle.

vertices An array of four vertices to fill.

corners An array of four corners (first is upper left, then clockwise) relative to x,y that define the rectangle to create vertices for. Will be transformed by `CreateVertsFromRect`.

uv An array of two uv coordinates (upper left/lower right).

matrix A transformation matrix to apply to the rectangle.

alpha An alpha value to encode in the vertices.

tint A tint value to encode into the vertices.

Chapter 13

Class and File Reference

13.1 str Class Reference

```
#include <pf/str.h>
```

13.1.1 Detailed Description

Reference-counted string class.

Public Types

- enum `eFlags` { `kCaseInsensitive` = 1, `kReplaceAll` = 2, `kReverse` = 4 }
Flags for `str::find` and `str::replace`.

Public Member Functions

- `str` ()
Create an empty string.
- `str` (const char *s)
Create a string from a null-terminated string.
- `str` (const char *s, size_t len)
Create a string from a buffer and length.
- `str` (const `str` &s)
Copy constructor.
- `~str` ()
Destructor.
- `int_fast8_t compare` (const `str` &s) const
Compare this string with another.

- `uint32_t length () const`
Get the current string length.
- `uint32_t size () const`
Get the current string length.
- `bool empty () const`
Test whether the string is empty.
- `str & assign (const char *s, size_t len)`
Assign a certain number of characters to str.
- `str & append (const char *s, size_t len)`
Append a certain number of characters to str.
- `str substr (uint32_t pos, int32_t length=npos) const`
Extract a substring.
- `int32_t to_int () const`
Convert a string to an integer.
- `TReal to_float () const`
Convert a string to a floating point value.
- `void reserve (uint32_t size)`
Reserve at least size bytes in the internal string buffer.
- `const char * c_str () const`
*Get a const char *.*
- `void format (const char *formatstring,...)`
Format a string using a printf-style format string.
- `int32_t find (str searchString, uint32_t flags=0, uint32_t start=0) const`
Find a substring.
- `int32_t find (char searchChar, uint32_t flags=0, uint32_t start=0) const`
Find a character in this string.
- `str & replace (str searchString, str replaceString, uint32_t flags=0, uint32_t start=0)`
Search-and-replace a substring.
- `void erase (uint32_t start, int32_t count=npow)`
Erase a range of characters in the string.
- `void unique ()`
Force this instance of this string to be unique; prepare for modification.
- `uint32_t overlay (int32_t start, const char *buffer, uint32_t count, bool bTerminate=true)`
Overlay a string into the current string.

- void `downcase` ()
Convert this string to lower-case in place.
- unsigned int `find_first_of` (str s, unsigned int start=0)
Find the first character that matches the set given by s.
- unsigned int `find_first_not_of` (str s, unsigned int start=0)
Find the first character that doesn't match any in the set given by s.

Operator Definitions

- const char `operator[]` (uint32_t i) const
Read-only character access.
- `str & operator=` (const str &s)
Assignment operator.
- `str & operator=` (const char *p)
Assignment operator.
- `str operator+` (const str &)
Concatenation.
- `str operator+` (char)
Concatenation.
- bool `operator==` (const str &) const
Equality/inequality.
- bool `operator<` (const str &) const
- bool `operator>` (const str &) const
- bool `operator<=` (const str &) const
- bool `operator>=` (const str &) const
- bool `operator!=` (const str &s) const
Equality/inequality.
- `str & operator+=` (const str &s)
Concatenation.
- `str & operator+=` (const char c)

Static Public Member Functions

- static `str dupchar` (uint32_t number, char c=' ')
Create a string consisting of a number of identical characters.
- static `str getFormatted` (const char *formatstring,...)
Create a formatted string using a printf-style format.
- static `str getFormattedV` (const char *formatstring, va_list va)
Create a formatted string using a printf-style format.

- static int `sizeof_utf8_char` (const char *s)
Calculate the size of a UTF8 character.

Static Public Attributes

- static const int32_t `npos` = -1
Non-position in string. Similar to STL.

Classes

- class `TStringData`

13.1.2 Member Enumeration Documentation

enum `str::eFlags`

Flags for `str::find` and `str::replace`.

Enumerator:

kCaseInsensitive Case insensitive search.

kReplaceAll Replace all instead of just the first match.

kReverse Search starting from end of string and working backwards. `start` in this case means characters from end of string.

13.1.3 Constructor & Destructor Documentation

`str::str (const char * s)`

Create a string from a null-terminated string.

Parameters:

s Pointer to a null terminated string.

`str::str (const char * s, size_t len)`

Create a string from a buffer and length.

Embedded zeros in the source buffer will cause `length()` to return shorter than `len`.

Parameters:

s Pointer to a buffer.

len Length of buffer. String will be created at this length.

`str::str (const str & s)`

Copy constructor.

Parameters:

s String to copy and add a reference to.

13.1.4 Member Function Documentation

int_fast8_t str::compare (const str & s) const

Compare this string with another.

Parameters:

s String to compare with.

Returns:

Similar to strcmp

- -1 when this string is less than other string
- 0 when strings are equal
- 1 when this string is greater than other string

str& str::operator= (const str & s)

Assignment operator.

Parameters:

s Source string.

Returns:

A reference to this string.

str& str::operator= (const char * p)

Assignment operator.

Parameters:

p Source char * (c-style string).

Returns:

A reference to this string.

bool str::operator!= (const str & s) const

Equality/inequality.

Parameters:

s String to compare against.

uint32_t str::length () const

Get the current string length.

Returns:

Length of string not counting null character.

uint32_t str::size () const

Get the current string length.

Returns:

Length of string not counting null character.

bool str::empty () const

Test whether the string is empty.

Returns:

True if empty.

str& str::assign (const char * s, size_t len)

Assign a certain number of characters to str.

Parameters:

s Base of string to copy.
len Number of characters.

Returns:

A reference to this.

str& str::append (const char * s, size_t len)

Append a certain number of characters to str.

Parameters:

s Base of string to copy.
len Number of characters.

Returns:

A reference to this.

str str::substr (uint32_t pos, int32_t length = npos) const

Extract a substring.

Parameters:

pos Position to start extracting.
length Number of characters to extract.

Returns:

A new string with the specified characters.

int32_t str::to_int () const

Convert a string to an integer.

Returns:

An integer conversion of the string. If the string begins with non-digits, returns 0.

TReal str::to_float () const

Convert a string to a floating point value.

Returns:

A float conversion of the string. If the string begins with non-digits, returns 0.

void str::reserve (uint32_t size)

Reserve at least size bytes in the internal string buffer.

Parameters:

size Number of bytes to reserve.

const char* str::c_str () const

Get a const char *.

Returns:

A const char * to the internal data.

void str::format (const char * formatstring, ...)

Format a string using a printf-style format string.

Warning:

Strings for %s must be passed as char* arguments!

Parameters:

formatstring Format string.

static str str::dupchar (uint32_t number, char c = ' ') [static]

Create a string consisting of a number of identical characters.

Parameters:

number Number of characters.
c Character to duplicate.

Returns:

A str with the requested duplicated characters.

static str str::getFormatted (const char * formatstring, ...) [static]

Create a formatted string using a printf-style format.

Warning:

Strings for %s must be passed as char* arguments!

Parameters:

formatstring Format string.

static str str::getFormattedV (const char * formatstring, va_list va) [static]

Create a formatted string using a printf-style format.

Warning:

Strings for %s must be passed as char* arguments!

Parameters:

formatstring Format string.
va var-args argument list.

`int32_t str::find (str searchString, uint32_t flags = 0, uint32_t start = 0) const`

Find a substring.

Parameters:

searchString String to find.
flags eFlags for options.
start Search start.

Returns:

An offset into the string where found; npos if not found.

`int32_t str::find (char searchChar, uint32_t flags = 0, uint32_t start = 0) const`

Find a character in this string.

Parameters:

searchChar Character to search for.
flags eFlags for options.
start Start search position.

Returns:

An offset into the string where found; npos if not found.

`str& str::replace (str searchString, str replaceString, uint32_t flags = 0, uint32_t start = 0)`

Search-and-replace a substring.

Parameters:

searchString String to find.
replaceString String to replace found string with (can be empty).
flags eFlags for options.
start Search start.

Returns:

An offset into the string where found; npos if not found.

`void str::erase (uint32_t start, int32_t count = npos)`

Erase a range of characters in the string.

Parameters:

start First character to erase.
count Number of characters to erase. npos for the rest of the string.

`uint32_t str::overlay (int32_t start, const char * buffer, uint32_t count, bool bTerminate = true)`

Overlay a string into the current string.

Parameters:

start Start of the new overlay as an index into the current string. Can be (or extend) beyond the end of the string. Can also be `npos`, to indicate the end of the string.
buffer String to overlay. Is 8-bit safe (can contain NULL bytes).
count Size of string to overlay.
bTerminate True to add a NULL character in the str at the end of this overlay.

Returns:

The character index past the end of the overlaid characters.

unsigned int str::find_first_of (str s, unsigned int start = 0)

Find the first character that matches the set given by s.

Parameters:

s Set of characters to search for.
start First character to inspect.

Returns:

The offset of the first character that matches, or `str::length()` no characters match.

unsigned int str::find_first_not_of (str s, unsigned int start = 0)

Find the first character that doesn't match any in the set given by s.

Parameters:

s Set of characters to compare with.
start First character to inspect.

Returns:

The offset of the first character that does not match, or `str::length()` if all characters match.

static int str::sizeof_utf8_char (const char * s) [static]

Calculate the size of a UTF8 character.

Parameters:

s Pointer to the character.

Returns:

Number of bytes in this character. Zero if the character is a null terminator.

13.2 T2dParticle Class Reference

```
#include <pf/2dparticlerenderer.h>
```

13.2.1 Detailed Description

Basic Particle Values.

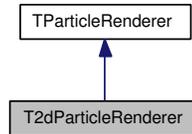
Public Attributes

- [TVec2 mPosition](#)
Particle position.
- [TVec2 mUp](#)
Current up vector of particle.
- [TReal mScale](#)
Current scale of particle.
- [TColor mColor](#)
Current particle color.
- [TReal mFrame](#)
Current frame of the particle animation (as int).

13.3 T2dParticleRenderer Class Reference

```
#include <pf/2dparticlerenderer.h>
```

Inheritance diagram for T2dParticleRenderer:



13.3.1 Detailed Description

A particle renderer that expects 2d particles.

This is the default particle renderer used by [TLuaParticleSystem](#)

See also:

[T2dParticle](#)
[TLuaParticleSystem](#)

Public Member Functions

- [T2dParticleRenderer](#) ()
Default Constructor.
- virtual [~T2dParticleRenderer](#) ()
Destructor.
- virtual void [Draw](#) (const [TVec3](#) &at, [TReal](#) alpha, const ParticleList &particles, int maxParticles)
Render the particles.
- void [SetParticleSize](#) (const [TVec2](#) &size)
Size of the particle object to render.
- void [SetBlendMode](#) ([TRenderer::EBlendMode](#) mode)
Set the blend mode for a particular layer.
- virtual void [SetTexture](#) ([TTextureRef](#) texture)
Set the texture for the particle.
- virtual void [SetRendererOption](#) (str option, const [TReal](#)(&value)[4])
Set a renderer-specific option.
- virtual uint32_t [GetPrototypeParticleSize](#) ()
Size of the array of TReals returned by GetPrototypeParticle.
- virtual [TReal](#) * [GetPrototypeParticle](#) ()
Get an initialized particle that will be copied over each particle after creation but before running initializers.

13.3.2 Member Function Documentation

virtual void T2dParticleRenderer::Draw (const **TVec3** & *at*, **TReal** *alpha*, const ParticleList & *particles*, int *maxParticles*) **[virtual]**

Render the particles.

Parameters:

at Location to render particles.

alpha Alpha to render particles with.

particles The list of particles to render.

maxParticles The maximum number of particles this particle system is expecting to render. MUST be greater than the number of particles or Bad Things will happen.

Implements [TParticleRenderer](#).

void T2dParticleRenderer::SetParticleSize (const **TVec2** & *size*)

Size of the particle object to render.

Parameters:

size Width and height of particle square on screen in pixels.

void T2dParticleRenderer::SetBlendMode (**TRenderer::EBlendMode** *mode*)

Set the blend mode for a particular layer.

Parameters:

mode Blend mode

virtual void T2dParticleRenderer::SetTexture (**TTextureRef** *texture*) **[virtual]**

Set the texture for the particle.

Parameters:

texture Texture to use.

Implements [TParticleRenderer](#).

virtual void T2dParticleRenderer::SetRendererOption (**str** *option*, const **TReal** & *value*[4]) **[virtual]**

Set a renderer-specific option.

Parameters:

option Option to set.

value Value to set option to, in the form of an array of TReals. Not all values in array are relevant for all options.

Implements [TParticleRenderer](#).

virtual uint32_t T2dParticleRenderer::GetPrototypeParticleSize () **[virtual]**

Size of the array of TReals returned by GetPrototypeParticle.

Returns:

Number of reals.

Implements [TParticleRenderer](#).

virtual TReal* T2dParticleRenderer::GetPrototypeParticle () [virtual]

Get an initialized particle that will be copied over each particle after creation but before running initializers.

Returns:

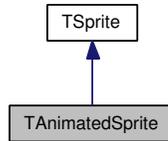
A pointer to an array of TReals.

Implements [TParticleRenderer](#).

13.4 TAnimatedSprite Class Reference

```
#include <pf/animatedsprite.h>
```

Inheritance diagram for TAnimatedSprite:



13.4.1 Detailed Description

A [TSprite](#) with an attached [TScript](#).

Similar to [TSprite](#), a [TAnimatedSprite](#) should only ever be stored as a reference, but it will work to store one in either a [TAnimatedSpriteRef](#) or a [TSpriteRef](#).

Typically you will assign a [TAnimatedTexture](#) to a [TAnimatedSprite](#); however, it is legal to assign a normal [TTexture](#) to a [TAnimatedSprite](#) instead. Obviously the animation script will be unable to change "frames" if a normal [TTexture](#) is attached, however.

Initialization/Destruction

- void [SetClock](#) ([TClock](#) *clock)
Set the animation to use the passed in clock as its timer.
- virtual [~TAnimatedSprite](#) ()
Destructor.
- static [TAnimatedSpriteRef](#) [Create](#) (int32_t layer=0)
Factory.

Public Member Functions

- virtual [TRect](#) [GetRect](#) (const [TDrawSpec](#) &parentContext, int32_t depth=-1)
Get the rect of this sprite.

Drawing

- virtual void [Draw](#) (const [TDrawSpec](#) &drawSpec=[TDrawSpec](#)(), int32_t depth=-1)
Draw the sprite and its children.

Animation Control

- void [Play](#) (str functionName="DoAnim")
Plays an animation script.
- void [Stop](#) ()
Stops an animation script that's already playing.

- void **Pause** (bool pause, int32_t depth=-1)
Pauses/un-pauses a specific animation.
- void **Die** ()
Stop and eradicate the script associated with an animation.
- bool **IsPlaying** (int32_t depth=-1)
Test whether or not the animation is currently playing.
- bool **IsDone** (int32_t depth=-1)
Return whether or not the animation has signalled done().

Frame Access

- void **SetCurrentFrame** (int32_t frame)
Set the current animation frame.
- int32_t **GetCurrentFrame** ()
Get the current animation frame.

Script and Texture Access

- **TScript *** **GetScript** ()
Gets the current script associated with this animation.
- **TScriptCodeRef** **GetScriptCode** ()
Get a reference to the compiled script code, to allow you to keep a reference to it so that it won't be reloaded next time you run the same animation.
- void **NewScript** ()
Reset the script to a virgin one that has been initialized with the proper animation functions.
- void **NewThread** ()
Create a new playback thread.
- virtual void **SetTexture** (TTextureRef texture)
Set the texture of the sprite object.
- **TAnimatedTextureRef** **GetAnimatedTexture** ()
Return an animated texture, if one is attached.
- uint32_t **GetNumAnchors** ()
Get the number of anchors in the bound animation.
- uint32_t **GetNumFrames** ()
Get the number of frames in the bound animation.

Utility

- **TAnimatedSpriteRef** **GetRef** ()
Get the TAnimatedSpriteRef for this TAnimatedSprite.

Protected Member Functions

- [TAnimatedSprite](#) (int32_t layer)

Default Constructor.

13.4.2 Member Function Documentation

virtual [TRect](#) TAnimatedSprite::GetRect (const [TDrawSpec](#) & parentContext, int32_t depth = -1)
[virtual]

Get the rect of this sprite.

Parameters:

parentContext The parent context to test within—where is this sprite being drawn, and with what matrix? Alpha and color information is ignored.
depth Depth of children to test

Returns:

Rectangle that includes this sprite.

Reimplemented from [TSprite](#).

static [TAnimatedSpriteRef](#) TAnimatedSprite::Create (int32_t layer = 0) [static]

Factory.

Parameters:

layer Layer of sprite.

Returns:

A reference to a new sprite.

void TAnimatedSprite::SetClock ([TClock](#) * clock)

Set the animation to use the passed in clock as its timer.

To be effective, must be called before a call to [Play\(\)](#) is issued.

Parameters:

clock Clock to use for timing. If NULL, then the global timer is used.

virtual void TAnimatedSprite::Draw (const [TDrawSpec](#) & drawSpec = [TDrawSpec](#) (), int32_t depth = -1)
[virtual]

Draw the sprite and its children.

Parameters:

drawSpec The 'parent' drawspec—the frame of reference that this sprite is to be rendered in. Defaults to a default-constructed [TDrawSpec](#). See [TDrawSpec](#) for more details on what is inherited.
depth How many generations of children to draw; -1 means all children.

See also:

[TDrawSpec](#)

Reimplemented from [TSprite](#).

void TAnimatedSprite::Play (str *functionName* = "DoAnim")

Plays an animation script.

Parameters:

functionName Name of lua function to run. By default this is "DoAnim"

void TAnimatedSprite::Stop ()

Stops an animation script that's already playing.

Scripts will retain global variable settings even after they're stopped.

void TAnimatedSprite::Pause (bool *pause*, int32_t *depth* = -1)

Pauses/un-pauses a specific animation.

An alternative to calling [Pause\(\)](#) on several different TAnimatedTextures is to have them all use the same [TClock](#), and pause the clock instead.

Parameters:

pause true to pause/false to un-pause

depth How many levels to recurse in modifying child animations.

void TAnimatedSprite::Die ()

Stop and eradicate the script associated with an animation.

Any variables saved in the global environment will be erased. The next time you call [Play\(\)](#) or [GetScript\(\)](#) it will reload any associated TAnimatedTexture() script.

bool TAnimatedSprite::IsPlaying (int32_t *depth* = -1)

Test whether or not the animation is currently playing.

Parameters:

depth How many levels to recurse in testing child sprite animations to see if they're playing. Default is -1 which means to recurse with no limit.

Returns:

True if the animation or one of its children is playing.

bool TAnimatedSprite::IsDone (int32_t *depth* = -1)

Return whether or not the animation has signalled done().

Parameters:

depth How many levels to recurse in testing child animations.

Returns:

true if the animation is done.

void TAnimatedSprite::SetCurrentFrame (int32_t *frame*)

Set the current animation frame.

Does not affect children.

Parameters:

frame Frame number.

int32_t TAnimatedSprite::GetCurrentFrame ()

Get the current animation frame.

Returns:

Current animation frame number.

TScript* TAnimatedSprite::GetScript ()

Gets the current script associated with this animation.

Creates a script if one doesn't exist already.

DO NOT CACHE this pointer: this script can change over time. As long as you don't call [Die\(\)](#) on this animation or reload it from a file, it will copy its environment across scripts, so you can set global variables and be reasonably assured that when you hit "Play" it will retain them—even if it's running in a different [TScript](#) (technically a different thread).

Returns:

The current script.

TScriptCodeRef TAnimatedSprite::GetScriptCode ()

Get a reference to the compiled script code, to allow you to keep a reference to it so that it won't be reloaded next time you run the same animation.

Returns:

A reference to the loaded script, or an empty reference if no script was loaded, or if the script was run from a string or XML file.

void TAnimatedSprite::NewScript ()

Reset the script to a virgin one that has been initialized with the proper animation functions.

Not necessary to call prior to [LoadScript](#) or [InitXML](#), as these functions will call it if no script has been loaded. However, if you want a clean interpreter state, you can call this function.

void TAnimatedSprite::NewThread ()

Create a new playback thread.

Kills current playback thread, if any.

virtual void TAnimatedSprite::SetTexture (TTextureRef *texture*) [virtual]

Set the texture of the sprite object.

Can be a [TAnimatedTexture](#) or a regular [TTexture](#); if it's a [TTexture](#), the script and animation control functions will only be relevant to any child sprites that have [TAnimatedTextures](#) assigned.

Parameters:

texture Texture to use.

Reimplemented from [TSprite](#).

[TAnimatedTextureRef](#) TAnimatedSprite::GetAnimatedTexture ()

Return an animated texture, if one is attached.

If no texture is attached, or if a normal [TTexture](#) is attached, return an empty reference.

Returns:

A [TAnimatedTextureRef](#), if one is bound to this sprite.

uint32_t TAnimatedSprite::GetNumAnchors ()

Get the number of anchors in the bound animation.

Returns:

Number of anchors. Returns zero if there is no animated texture attached.

uint32_t TAnimatedSprite::GetNumFrames ()

Get the number of frames in the bound animation.

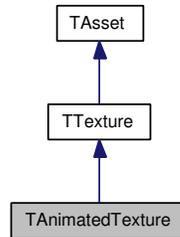
Returns:

Number of frames in the animation. Returns one (1) if there is no animated texture attached.

13.5 TAnimatedTexture Class Reference

```
#include <pf/animatedtexture.h>
```

Inheritance diagram for TAnimatedTexture:



13.5.1 Detailed Description

This class encapsulates the concept of an animated texture.

This kind of texture is placed directly in video RAM, so be conservative about how large you allow concurrent game animations to become: Consider that a 1024x1024x32 bit texture takes up 4Mb of video RAM, so if you are trying to display more than 10 such textures simultaneously you may start getting performance problems as textures are swapped in and out of video RAM.

A [TAnimatedTexture](#) loads in an xml (or anm) file describing the animation, and an image file with multiple source frames.

Additionally, the xml file can describe hot spots, where other textures can be attached.

A Lua script can be embedded in the [TAnimatedTexture](#) which can be played back by a [TAnimatedSprite](#). The [TAnimatedTexture](#) doesn't have playback capability itself because it represents the raw texture object, and you can have multiple instances of it on the screen at once.

When you use [TTexture::Lock\(\)](#) on a [TAnimatedTexture](#), you will lock the full texture surface—which means that [TAnimatedTexture::GetWidth\(\)](#) and [TAnimatedTexture::GetHeight\(\)](#) will return the wrong values. Instead, you should call [TTexture::GetWidth\(\)](#) and [TTexture::GetHeight\(\)](#). For example:

```
TAnimatedTextureRef at = ...;
uint32_t w = at->TTexture::GetWidth(); // This gives you the real texture width
```

C++

Factory Methods/Destruction

- static [TAnimatedTextureRef Get](#) ([str](#) assetName, [str](#) imageOverride="", [str](#) maskOverride="")
Get a TAnimatedTextureRef given an animation name.
- static [str GetHandle](#) ([str](#) assetName, [str](#) imageOverride="", [str](#) maskOverride="")
Get the handle that an animated texture will be registered in the global asset manager as.
- virtual [~TAnimatedTexture](#) ()
Destructor.

Public Types

- enum { [kNoFrame](#) = -1 }

Public Member Functions

Drawing Methods

- virtual void [CopyPixels](#) (int32_t x, int32_t y, const [TRect](#) *sourceRect, [TTextureRef](#) _dst)
Delegates to [TTexture::CopyPixels\(\)](#), which means that it will copy from the multi-frame source image, not from the individual frame.
- virtual void [DrawSprite](#) ([TReal](#) x, [TReal](#) y, [TReal](#) alpha, [TReal](#) scale, [TReal](#) rotRad, uint32_t flags)
Draw a normal texture to a render target surface as a sprite.
- virtual void [DrawSprite](#) (const [TDrawSpec](#) &drawSpec)
Draw an animated texture.

Frame Sequence Information/Update

- uint32_t [GetNumFrames](#) ()
Get number of frames in this animation.
- void [SetCurrentFrame](#) (int32_t frame)
Set the current frame of the animation.
- int32_t [GetCurrentFrame](#) ()
Get the current frame of the animation.
- int32_t [GetFrameByName](#) (str name)
Get a frame by the frame's name.
- [TRect](#) [GetAnimationBoundingBox](#) ()
Get the bounding rectangle for this animation.
- [TRect](#) [GetBoundingBox](#) (int32_t frame)
Get the bounding rectangle for a specific animation frame.
- [TRect](#) [GetFrameRect](#) (int32_t frame)
Get the location of a specific frame inside the animation texture.
- [TReal](#) [GetFrameAlpha](#) (int32_t frame)
Get the alpha value associated with a frame.

Anchor Point Support (not needed for most animations).

Anchor points are used to track animated offsets; for instance, the hand of a character that needs to have an object attached might get an animated anchor.

- bool [GetAnchorPoint](#) (str name, int32_t *x, int32_t *y)
Get anchor point information for the current frame of the animation.
- bool [GetAnchorPoint](#) (int32_t frame, str name, int32_t *x, int32_t *y)
Get anchor point information for the selected frame of the animation.
- uint32_t [GetNumAnchors](#) ()
Get number of anchors in this frame of animation.
- bool [GetAnchorInfo](#) (int32_t anchorNum, int32_t *x, int32_t *y, str *name)

Get anchor information.

Image and Frame Data

The data that specifies how each frame needs to be rendered.

- [TPoint GetRegistrationPoint \(\)](#)
Get the initial image registration point.
- [TPoint GetRegistrationPoint \(int32_t frame\)](#)
Get the registration point of a frame.
- virtual uint32_t [GetWidth \(\)](#)
Get the width of the texture.
- virtual uint32_t [GetHeight \(\)](#)
Get the height of the texture.

Utility Functions

- [str GetScript \(\)](#)
Get the animation script that was embedded in the XML file.
- [TAnimatedTextureRef GetRef \(\)](#)
Get a shared pointer (TAnimatedTextureRef) to this texture.

Protected Member Functions

- [TAnimatedTexture \(\)](#)
Construction is through the factory method.
- virtual void [Restore \(\)](#)
Restore an asset.

Protected Attributes

- TAnimatedTextureData * [mATData](#)
Internal implementation data.

13.5.2 Member Function Documentation

```
static TAnimatedTextureRef TAnimatedTexture::Get (str assetName, str imageOverride = "", str maskOverride = "") [static]
```

Get a TAnimatedTextureRef given an animation name.

The animation name should be an xml or anm file describing the animation.

Parameters:

assetName Name of the xml file describing all other animation information

imageOverride Optional image file name to load for this texture, instead of using image named in the xml file

maskOverride Optional mask file name to load for this texture, instead of using mask named in the xml file

Returns:

A TAnimatedTextureRef. This ref will be NULL if it is unable to load.

```
static str TAnimatedTexture::GetHandle (str assetName, str imageOverride = "", str maskOverride = "")
[static]
```

Get the handle that an animated texture will be registered in the global asset manager as.

Parameters:

assetName Name of asset.

imageOverride Image Override (if any)

maskOverride Mask Override (if any)

Returns:

A string that represents the handle of the object.

```
virtual void TAnimatedTexture::CopyPixels (int32_t x, int32_t y, const TRect * sourceRect, TTextureRef _dst)
[virtual]
```

Delegates to [TTexture::CopyPixels\(\)](#), which means that it will copy from the multi-frame source image, not from the individual frame.

Parameters:

x Left side of resulting rectangle.

y Top edge of resulting rectangle.

sourceRect Source rectangle to blit. NULL to blit the entire surface.

_dst Destination texture. NULL to draw to back buffer.

See also:

[TTexture::CopyPixels](#)

Reimplemented from [TTexture](#).

```
virtual void TAnimatedTexture::DrawSprite (TReal x, TReal y, TReal alpha, TReal scale, TReal rotRad,
uint32_t flags) [virtual]
```

Draw a normal texture to a render target surface as a sprite.

This draws a texture with optional rotation and scaling. Only capable of drawing an entire surface—not a sub-rectangle.

Will draw the sprite within the currently active viewport. X and Y are relative to the upper left corner of the current viewport.

DrawSprite can be called inside [TWindow::Draw\(\)](#) or a BeginRenderTarget/EndRenderTarget block.

Parameters:

x x Position where center of sprite is to be drawn.

y y Position where center of sprite is to be drawn.

alpha Alpha to apply to the entire texture. Set to a negative value to entirely disable alpha during blit, including alpha within the source [TTexture](#).

scale Scaling to apply to the texture. 1.0 is no scaling.

rotRad Rotation in radians.

flags Define how textures are drawn. Use `ETextureDrawFlags` for the flags. Default behavior is `eDefaultDraw`.

Reimplemented from [TTexture](#).

virtual void TAnimatedTexture::DrawSprite (const [TDrawSpec](#) & *drawSpec*) **[virtual]**

Draw an animated texture.

Draws the current frame of the animated texture.

Parameters:

drawSpec The [TDrawSpec](#) to use to draw the sprite.

See also:

[TTexture::DrawSprite](#)

Reimplemented from [TTexture](#).

uint32_t TAnimatedTexture::GetNumFrames ()

Get number of frames in this animation.

Returns:

Number of frames in animation.

void TAnimatedTexture::SetCurrentFrame (int32_t *frame*)

Set the current frame of the animation.

Parameters:

frame Frame to set animation to, from 0 to n-1, where n is the number of frames.

int32_t TAnimatedTexture::GetCurrentFrame ()

Get the current frame of the animation.

Returns:

frame Current frame of animation, from 0 to n-1, where n is the number of frames.

int32_t TAnimatedTexture::GetFrameByName (str *name*)

Get a frame by the frame's name.

Parameters:

name Name of frame to retrieve.

Returns:

frame Frame number, or -1 if it doesn't exist;

[TRect](#) TAnimatedTexture::GetAnimationBoundingBox ()

Get the bounding rectangle for this animation.

Returns:

a [TRect](#) that would contain the entire animation.

TRect TAnimatedTexture::GetBoundingBox (int32_t *frame*)

Get the bounding rectangle for a specific animation frame.

Returns:

a **TRect** that would contain the current frame of the animation

Parameters:

frame Frame to query.

Returns:

The bounding box of this frame.

TRect TAnimatedTexture::GetFrameRect (int32_t *frame*)

Get the location of a specific frame inside the animation texture.

Returns:

a **TRect** that would contain the frame inside the animation texture

Parameters:

frame Frame to query.

Returns:

The location of this frame inside the animation texture.

TReal TAnimatedTexture::GetFrameAlpha (int32_t *frame*)

Get the alpha value associated with a frame.

Parameters:

frame Frame to retrieve the alpha value from.

Returns:

0.0 (transparent) - 1.0 (opaque).

bool TAnimatedTexture::GetAnchorPoint (str *name*, int32_t * *x*, int32_t * *y*)

Get anchor point information for the current frame of the animation.

Parameters:

name Name of anchor point to retrieve

x [out] Fills in with x coordinate of anchor point if it exists

y [out] Fills in with y coordinate of anchor point if it exists

Returns:

true if the anchor point exists, false otherwise

bool TAnimatedTexture::GetAnchorPoint (int32_t *frame*, str *name*, int32_t * *x*, int32_t * *y*)

Get anchor point information for the selected frame of the animation.

Parameters:

frame Frame index of frame to query.

name Name of anchor point to retrieve

x [out] Fills in with x coordinate of anchor point if it exists

y [out] Fills in with y coordinate of anchor point if it exists

Returns:

true if the anchor point exists, false otherwise

uint32_t TAnimatedTexture::GetNumAnchors ()

Get number of anchors in this frame of animation.

Returns:

Number of anchors in this frame of animation.

bool TAnimatedTexture::GetAnchorInfo (int32_t *anchorNum*, int32_t * *x*, int32_t * *y*, str * *name*)

Get anchor information.

Parameters:

anchorNum Which anchor to fetch

x [out] Fills in with x coordinate of anchor point if it exists

y [out] Fills in with y coordinate of anchor point if it exists

name [out] Fills in name of anchor

Returns:

true if *anchorNum* is valid, false otherwise

TPoint TAnimatedTexture::GetRegistrationPoint ()

Get the initial image registration point.

The registration point is point from which the image coordinates are calculated.

Returns:

Registration point

TPoint TAnimatedTexture::GetRegistrationPoint (int32_t *frame*)

Get the registration point of a frame.

Parameters:

frame Frame number

Returns:

Registration point

virtual uint32_t TAnimatedTexture::GetWidth () [virtual]

Get the width of the texture.

This gets the size of the texture as requested at creation or load; the actual internal size of the texture may vary. If you're using this texture as a source for `TPlatform::DrawVertices`, see `GetInternalSize`.

Returns:

Width of the texture in pixels.

Reimplemented from [TTexture](#).

virtual uint32_t TAnimatedTexture::GetHeight () [virtual]

Get the height of the texture.

This gets the size of the texture as requested at creation or load; the actual internal size of the texture may vary. If you're using this texture as a source for TPlatform::DrawVertices, see GetInternalSize.

Returns:

Height of the texture in pixels.

Reimplemented from [TTexture](#).

str TAnimatedTexture::GetScript ()

Get the animation script that was embedded in the XML file.

Returns:

Animation script

TAnimatedTextureRef TAnimatedTexture::GetRef ()

Get a shared pointer (TAnimatedTextureRef) to this texture.

Returns:

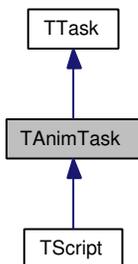
A TAnimatedTextureRef that shares ownership with other Refs to this texture.

Reimplemented from [TTexture](#).

13.6 TAnimTask Class Reference

```
#include <pf/animtask.h>
```

Inheritance diagram for TAnimTask:



13.6.1 Detailed Description

The [TAnimTask](#) interface.

Used as a "callback" for animation or other timed repeating tasks. Can also be used as a simple delayed task: You can call [TPlatform::AdoptTask\(\)](#) to adopt a TAnimTask-derived class that will trigger after its delay expires, and then just have its [Animate\(\)](#) call return false to let it be destroyed.

See also:

[TTask](#)

Public Member Functions

- [TAnimTask](#) ([TClock](#) *clock=NULL)
Constructor.
- void [SetDelay](#) (uint32_t delay, bool autoRepeat=true, bool resetTime=true, bool forceFrequency=false)
Set the animation delay.
- void [Pause](#) ()
Pause the current task.
- uint32_t [GetTimeUntilReady](#) ()
Get the number of milliseconds before this task will be ready to trigger again.
- virtual bool [Animate](#) ()=0
Define this function to add the actual animation task.
- void [RunOnDraw](#) (bool enable)
Enable the "Run on Draw" feature, which executes this task prior to every actual screen update.
- void [SetClock](#) ([TClock](#) *clock)
Set the reference clock.
- [TClock](#) * [GetClock](#) ()
Get the reference clock.

- `uint32_t GetTime ()`

Get the current elapsed time of the attached clock.

13.6.2 Constructor & Destructor Documentation

TAnimTask::TAnimTask (TClock * clock = NULL)

Constructor.

Parameters:

clock Clock that this anim task uses to determine how much time has passed. If this parameter is null then the global clock is used.

13.6.3 Member Function Documentation

void TAnimTask::SetDelay (uint32_t delay, bool autoRepeat = true, bool resetTime = true, bool forceFrequency = false)

Set the animation delay.

Parameters:

delay Number of milliseconds to wait to call DoTask().

autoRepeat Repeat this delay after every task.

resetTime Reset the time so that the (initial) delay is counted from *now* rather than from the last task event time.

forceFrequency Force the frequency to be the same as the delay implies; will run the [Animate\(\)](#) call multiple times if more than twice the time of delay has elapsed since the last call.

void TAnimTask::Pause ()

Pause the current task.

Prevents the Animate task from being called.

Resume by calling [SetDelay\(\)](#) or [RunOnDraw\(\)](#), as appropriate.

uint32_t TAnimTask::GetTimeUntilReady ()

Get the number of milliseconds before this task will be ready to trigger again.

Returns a negative number if the next call to Ready() would be true immediately.

Returns:

Number of milliseconds before this task is ready. Returns UINT_MAX if task is disabled.

virtual bool TAnimTask::Animate () [pure virtual]

Define this function to add the actual animation task.

Returns:

True to continue, false when we're done.

Implemented in [TScript](#).

void TAnimTask::RunOnDraw (bool *enable*)

Enable the "Run on Draw" feature, which executes this task prior to every actual screen update.

If you want the task to run on draw as well as on a timer, set up the timer using [SetDelay\(\)](#) normally. If you want to only get called when the screen is about to update, then call [Pause\(\)](#) *before* you call [RunOnDraw\(\)](#). Calling [Pause](#) after you call [RunOnDraw](#) will disable [RunOnDraw](#).

Parameters:

enable True to enable "Run on Draw", false to disable.

void TAnimTask::SetClock (TClock * *clock*)

Set the reference clock.

Useful for having one clock that can be paused and resumed to pause and resume a set or class of TAnimTasks.

Parameters:

clock Clock to use to time animations.

TClock* TAnimTask::GetClock ()

Get the reference clock.

Returns:

A pointer to the currently associated clock.

uint32_t TAnimTask::GetTime ()

Get the current elapsed time of the attached clock.

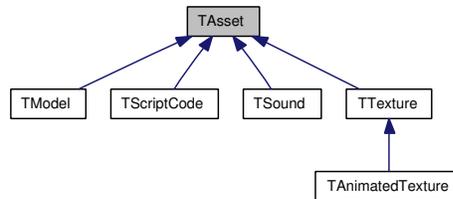
Returns:

Current elapsed time.

13.7 TAsset Class Reference

```
#include <pf/asset.h>
```

Inheritance diagram for TAsset:



13.7.1 Detailed Description

The interface class for game assets.

Playground-defined TAssets are managed internally by the engine such that if you have a reference to one anywhere in your game, and you request a new one by the same name, it will retrieve the reference rather than reloading the asset.

Public Member Functions

- virtual `~TAsset ()`
Destructor.
- `TAssetRef GetRef ()`
Get a reference to this asset. Do not call in a constructor!

Protected Member Functions

- virtual void `Release ()`
Release an asset.
- virtual void `Restore ()`
Restore an asset.

13.8 TAssetMap Class Reference

```
#include <pf/assetmap.h>
```

13.8.1 Detailed Description

A collection of assets that simplifies asset reference-holding.

If your game has sections or levels that use a particular set of assets, you can allocate them and store them into a [TAssetMap](#). Then when the level is complete you can release the [TAssetMap](#). This will prevent any glitches from dynamically loading art while the game is running.

Simple usage looks like:

```
// In your class:
TAssetMap mMyMap ;

// In your initialization code:
mMyMap.AddAsset ("image1");
mMyMap.AddAsset ("image2");

// Later in your game code:
TTextureRef myImage = mMyMap.GetTexture("image1");
```

After you've referenced an image, calling [TTexture::Get\(\)](#) on that image will retrieve the reference; however, calling [TAssetMap::GetTexture](#) will help you in one of two ways, depending on the state of [TAssetMap::SetAutoLoad\(\)](#):

- If [SetAutoLoad](#) is false (default), it will ASSERT in debug build that the texture isn't found if you forgot to add it to the map.
- If [SetAutoLoad](#) is true, it will load it and *hold* the reference until the map is destroyed. That way the next time you reference it, it will be able to retrieve the already loaded version, even if you've released the in-game reference.

Public Member Functions

- [TAssetMap \(\)](#)
Default Constructor.
- [virtual ~TAssetMap \(\)](#)
Destructor.
- [void SetAutoLoad \(bool autoLoad\)](#)
Activate auto-loading of textures.
- [void AddAsset \(str assetHandle, TAssetRef asset=TAssetRef\(\)\)](#)
Add an asset to the map.
- [void AddAssets \(const char *assets\[\]\)](#)
Add an array of assets to the map.
- [TSoundRef GetSound \(str asset\)](#)
Get a sound asset from the map.

- [TModelRef GetModel](#) ([str](#) asset)
Get a model asset from the map.
- [TTextureRef GetTexture](#) ([str](#) asset)
Get a texture asset from the map.
- `void Release ()`
Release ALL managed assets.

13.8.2 Member Function Documentation

`void TAssetMap::SetAutoLoad (bool autoLoad)`

Activate auto-loading of textures.

When this flag is false, requesting a texture that doesn't exist will assert. When it's true, it will simply attempt to load it on demand.

Parameters:

autoLoad True to auto-load.

`void TAssetMap::AddAsset (str assetHandle, TAssetRef asset = TAssetRef ())`

Add an asset to the map.

Parameters:

assetHandle Name of asset to add.

asset Pointer to asset to associate with *assetHandle*. Optional.

`void TAssetMap::AddAssets (const char * assets[])`

Add an array of assets to the map.

Array is NULL terminated.

For example:

```
const char * assets[]=  
{  
    "checkers/flipper",  
    "checkers/exploder",  
    "checkers/heavy",  
    "checkers/helium",  
    "checkers/rowClear",  
    NULL  
}  
  
TAssetMap map;  
map.AddAssets (assets);
```

C++

Parameters:

assets Array of assets to add.

`TSoundRef TAssetMap::GetSound (str asset)`

Get a sound asset from the map.

Parameters:

asset Asset handle to add. Must be exactly the same string that was specified to add the asset.

Returns:

A TSoundRef. Will be empty (NULL) if the asset is not found.

TModelRef TAssetMap::GetModel (str *asset*)

Get a model asset from the map.

Parameters:

asset Asset handle to add. Must be exactly the same string that was specified to add the asset.

Returns:

A TModelRef. Will be empty (NULL) if the asset is not found.

TTextureRef TAssetMap::GetTexture (str *asset*)

Get a texture asset from the map.

Parameters:

asset Asset handle to add. Must be exactly the same string that was specified to add the asset.

Returns:

A TTextureRef. Will be empty (NULL) if the asset is not found.

void TAssetMap::Release ()

Release ALL managed assets.

All previously added assets are released and their records are purged. After calling this you can again add assets as usual.

A release will happen implicitly on destruction of the [TAssetMap](#).

13.9 TBegin2d Class Reference

```
#include <pf/renderer.h>
```

13.9.1 Detailed Description

Helper class to wrap 2d rendering.

When you construct this class it activates a [TRenderer::Begin2d\(\)](#) state, and when it's destroyed, it calls [TRenderer::End2d\(\)](#). You can also stop the state early by calling [TBegin2d::Done\(\)](#).

This allows you to create a local stack variable that will automatically disable [TRenderer::Begin2d\(\)](#) mode when it leaves scope.

Public Member Functions

- [TBegin2d \(\)](#)
Default constructor.
- [~TBegin2d \(\)](#)
Destructor.
- void [Done \(\)](#)
We're done with 2d for now!

13.10 TBegin3d Class Reference

```
#include <pf/renderer.h>
```

13.10.1 Detailed Description

Helper class to wrap 3d rendering.

When you construct this class it activates a [TRenderer::Begin3d\(\)](#) state, and when it's destroyed, it calls [TRenderer::End3d\(\)](#). You can also stop the state early by calling [TBegin3d::Done\(\)](#).

This allows you to create a local stack variable that will automatically disable [TRenderer::Begin3d\(\)](#) mode when it leaves scope.

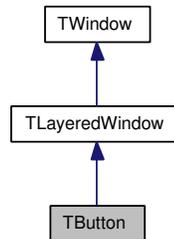
Public Member Functions

- [TBegin3d \(\)](#)
Default constructor.
- [~TBegin3d \(\)](#)
Destructor.
- void [Done \(\)](#)
We're done with 3d for now!

13.11 TButton Class Reference

```
#include <pf/button.h>
```

Inheritance diagram for TButton:



13.11.1 Detailed Description

Encapsulation for button functionality.

Handles push-buttons, radio buttons, and toggles. Also handles mouse-over highlighting.

A **TButton** is implemented as a **TLayeredWindow** with 3 or 4 layers, depending on the type of button (a **kPush** button only needs three layers, while the other types need four).

If you define a button in Lua, you can use the special options defined in the documentation of the Lua call `Button(button)`.

Public Types

- enum **EButtonType** { **kPush** = 0, **kToggle**, **kRadio**, **kNumTypes** }
The type of a TButton.
- enum **EButtonLayer** { **kUp** = 0, **kDown**, **kOver**, **kOverOn** }
The button layers.
- enum **EMouseState** { **kMouseIdle** = 0, **kMousePush**, **kMouseOver**, **kMouseActivated** }
TButton internal dynamic state.
- enum **EButtonCreateFlags** { **kGroupStart** = 1, **kSendMessageToParent** = 2, **kCloseWindow** = 4, **kDefaultButton** = 8 }
Button creation flags.

Public Member Functions

- **TButton** ()
Constructor.
- **~TButton** ()
Destructor.
- void **SetType** (**EButtonType** type)
Set the button's type.

- void `Toggle ()`
Toggle the button's state.
- `EButtonType GetType ()`
Get the button's type.
- `EMouseState GetState ()`
Get the current mouse state of the button.
- void `SetOn (bool on)`
Set a toggle or radio button on.
- bool `GetOn ()`
Return whether a particular radio button is on.
- bool `IsDefault ()`
Return true if this is a default button.
- void `AddFlags (uint32_t flags)`
Add flags to the current button.
- void `SetTooltip (str tooltip)`
Set the tooltip for this button.
- void `SetLabel (str label)`
Set the label for this button.
- `str GetLabel ()`
Get the label for this button.
- virtual bool `OnMouseLeave ()`
Notification that the mouse has left the window.
- virtual bool `OnMouseUp (const TPoint &point)`
Mouse up handler.
- virtual bool `OnMouseDown (const TPoint &point)`
Mouse down handler.
- virtual bool `OnMouseMove (const TPoint &point)`
Mouse motion handler.
- void `SetCommand (TButton::Action *action)`
Set the current `TButton::Action` associated with the button's action.
- bool `DoCommand ()`
Do the command associated with this button.
- void `SetSound (EMouseState state, str sound)`

Set a sound for a specific button state.

- void [SetClickMask](#) (TTextureRef texture)
Set a click mask for the button.
- virtual void [Init](#) (TWindowState &style)
Do Lua initialization.
- virtual bool [OnNewParent](#) ()
Handle any initialization or setup that is required when this window is assigned to a new parent.
- virtual void [PostChildrenInit](#) (TWindowState &style)
Do post-children-added initialization when being created from Lua.

Derived Button virtual functions.

Functions that a derived [TButton](#) class can override to respond to button state changes with custom behaviors and/or animations.

- virtual void [StateUpdate](#) (EMouseState newState, EMouseState previousState)
Called when the button is activated so that a derived class may trigger an animation or change the button's state.

Classes

- class [Action](#)
An abstract action class for button actions.
- class [LuaAction](#)
A class that wraps a Lua command in an action.

13.11.2 Member Enumeration Documentation

enum [TButton::EButtonType](#)

The type of a [TButton](#).

These constants are also available in the Lua GUI thread.

Enumerator:

kPush A normal "push" button.

kToggle A 2-state toggle button.

kRadio One of several "radio" buttons in a group.

Must call [BeginGroup\(\)](#) before the first button in the Lua script, or call [TButton::AddFlags\(kGroupStart\)](#) on the first button in the group.

kNumTypes Number of button types (not a real type).

enum [TButton::EButtonLayer](#)

The button layers.

Enumerator:

kUp Button is in "up" or "off" state.

kDown Button is in "down" or "on" state.

kOver Button is in roll-over state (and is off for toggles and radio buttons).

kOverOn Button is in roll-over state and is "on".

enum [TButton::EMouseState](#)

[TButton](#) internal dynamic state.

Enumerator:

kMouseIdle Button mouse state is idle.

kMousePush Button is being pushed by a mouse click.

kMouseOver Button is being rolled over by the mouse.

kMouseActivated A transient state indicating that the button has been activated. Reverts immediately to *kMouseIdle*.

enum [TButton::EButtonCreateFlags](#)

Button creation flags.

Enumerator:

kGroupStart This button is the first in a group.

kSendMessageToParent Send the button's message to the parent modal.

kCloseWindow Automatically send the parent [TModalWindow](#) a close message when this button is pushed.

kDefaultButton This button is default button in the local context.

13.11.3 Member Function Documentation

void [TButton::SetType](#) ([EButtonType](#) *type*)

Set the button's type.

Parameters:

type New type for button.

void [TButton::Toggle](#) ()

Toggle the button's state.

Button must be of type *kToggle*, or this method will ASSERT.

[EButtonType](#) [TButton::GetType](#) ()

Get the button's type.

Returns:

Type of the button.

[EMouseState](#) [TButton::GetState](#) ()

Get the current mouse state of the button.

Returns:

The state of the button with regards to the mouse.

void TButton::SetOn (bool *on*)

Set a toggle or radio button on.

Parameters:

on True to set to on. False to set to off (toggle only).

bool TButton::GetOn ()

Return whether a particular radio button is on.

Returns:

True for on.

bool TButton::IsDefault ()

Return true if this is a default button.

Returns:

True if default.

void TButton::AddFlags (uint32_t *flags*)

Add flags to the current button.

Parameters:

flags Flags to add. Does not erase flags.

void TButton::SetTooltip (str *tooltip*)

Set the tooltip for this button.

Warning:

Not implemented yet!
Specification subject to change.

Parameters:

tooltip A string for the tooltip.

void TButton::SetLabel (str *label*)

Set the label for this button.

Parameters:

label Text to place in the label for this button

str TButton::GetLabel ()

Get the label for this button.

Returns:

The button's label.

void TButton::SetCommand (TButton::Action * action)

Set the current [TButton::Action](#) associated with the button's action.

Create a [TButton::LuaAction](#) to wrap a Lua command.

Parameters:

action [Action](#) to bind to button.

bool TButton::DoCommand ()

Do the command associated with this button.

Returns:

True if the window was deleted as a result of the command.

void TButton::SetSound (EMouseState state, str sound)

Set a sound for a specific button state.

Parameters:

state Which mouse state triggers the sound

sound name of sound file to play

void TButton::SetClickMask (TTextureRef texture)

Set a click mask for the button.

A click mask is an image where anything black (all pixels have RGB of less than 20) in the image is considered outside the button, and the mouse will not activate the button if it is in a black area.

Parameters:

texture texture to use as the click mask

virtual void TButton::StateUpdate (EMouseState newState, EMouseState previousState) [virtual]

Called when the button is activated so that a derived class may trigger an animation or change the button's state.

Call the base class if you want to add behavior to the default behavior; otherwise you will need to take responsibility for changing the button's appearance.

Parameters:

newState State we're transitioning to.

previousState State we're transitioning from.

virtual void TButton::Init (TWindowState & style) [virtual]

Do Lua initialization.

Supported tags include:

- close (bool) This button closes its window/dialog if true.
- flags (number) Button label text alignment.
- graphics (table) An array of up to four images for the button: Three for push-buttons (Up, RollOver, Down), Four for toggle and radio buttons (Up, RollOver-Up, Down, RollOver-Down). If the array has fewer than 3 or 4 images, additional images are duplicated from the last given image.

- `label` (string) Default button text label.
- `scale` (number) Scale to apply to the button graphics.
- `sound` (string) Name of sound to play when button pressed.
- `rolloversound` (string) Name of sound to play when mouse rolls over the button.
- `type` (number) Button type (kPush, kToggle, kRadio).
- Other generic window tags.

Parameters:

style Style definition for button.

Reimplemented from [TWindow](#).

virtual bool TButton::OnNewParent () [virtual]

Handle any initialization or setup that is required when this window is assigned to a new parent. No initialization of the window has happened prior to this call.

Returns:

True on success; false on failure.

See also:

[Init](#)
[PostChildrenInit](#)

Reimplemented from [TWindow](#).

virtual void TButton::PostChildrenInit (TWindowStyle & style) [virtual]

Do post-children-added initialization when being created from Lua.

Any initialization that needs to happen after a window's children have been added can be placed in a derived version of this function.

Warning:

Remember to always call the base class if you're overriding this function.

Parameters:

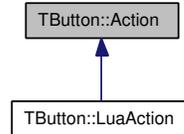
style Current style environment that this window was created in.

Reimplemented from [TWindow](#).

13.12 TButton::Action Class Reference

```
#include <pf/button.h>
```

Inheritance diagram for TButton::Action:



13.12.1 Detailed Description

An abstract action class for button actions.

Public Member Functions

- virtual void [DoAction](#) (TButton *button)=0
Override this member to perform the action.

13.12.2 Member Function Documentation

virtual void TButton::Action::DoAction (TButton * button) [pure virtual]

Override this member to perform the action.

Parameters:

button A pointer to the button triggering the action.

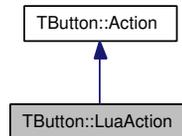
Returns:

Implemented in [TButton::LuaAction](#).

13.13 TButton::LuaAction Class Reference

```
#include <pf/button.h>
```

Inheritance diagram for TButton::LuaAction:



13.13.1 Detailed Description

A class that wraps a Lua command in an action.

Public Member Functions

- [LuaAction](#) ([TLuaFunction](#) *action)
Constructor.
- [~LuaAction](#) ()
Destructor.
- virtual void [DoAction](#) ([TButton](#) *button)
Override this member to perform the action.

Public Attributes

- [TLuaFunction](#) * [mAction](#)
The wrapped action.

13.13.2 Constructor & Destructor Documentation

TButton::LuaAction::LuaAction ([TLuaFunction](#) * *action*)

Constructor.

Parameters:

action A [TLuaFunction](#) to wrap.

13.13.3 Member Function Documentation

virtual void **TButton::LuaAction::DoAction** ([TButton](#) * *button*) **[virtual]**

Override this member to perform the action.

Parameters:

button A pointer to the button triggering the action.

Returns:

Implements [TButton::Action](#).

13.14 TClock Class Reference

```
#include <pf/clock.h>
```

13.14.1 Detailed Description

The [TClock](#) class encapsulates timer functionality.

When you have a need for a time source in your game, you can instantiate a [TClock](#) object that has its own Start, Stop, Reset, and Pause controls.

TClocks can be assigned to [TAnimTask](#) objects to control when they animate.

For example, if you create a [TClock](#) in your game, you can use it to time the animations your game employs. When implementing game-pause functionality, if all animations that should pause reference the game [TClock](#) object, then you can pause your game by simply pausing the [TClock](#).

Public Member Functions

- [TClock](#) ()
Constructor.
- virtual [~TClock](#) ()
Destructor.
- void [Start](#) (void)
Start the timer.
- bool [Pause](#) (void)
Pause the timer.
- void [Reset](#) (void)
Pauses and zeros a timer.
- uint32_t [GetTime](#) (void)
Get the current running millisecond count.
- void [SetTime](#) (uint32_t t)
Set the current clock time.

13.14.2 Member Function Documentation

void TClock::Start (void)

Start the timer.

Has no effect on a running timer.

bool TClock::Pause (void)

Pause the timer.

Will have no effect on a paused timer.

Returns:

true if timer was paused already.

uint32_t TClock::GetTime (void)

Get the current running millisecond count.

Returns:

Number of milliseconds clock has been allowed to run.

void TClock::SetTime (uint32_t *t*)

Set the current clock time.

Resets the clock and sets the current elapsed time.

Parameters:

t Value to set the current time to.

13.15 TColor Class Reference

```
#include <pf/pftypes.h>
```

13.15.1 Detailed Description

An RGBA color value.

[TColor](#) stores the color values as [TReals](#).

See also:

[TColor32](#)

Public Member Functions

- [TColor](#) ()
Constructor.
- [TColor](#) ([TReal](#) R, [TReal](#) G, [TReal](#) B, [TReal](#) A)
Construct from floating point values.
- void [Init](#) (uint32_t R, uint32_t G, uint32_t B, uint32_t A)
Integer initializer; expects color values from 0-255.
- bool [operator==](#) (const [TColor](#) &color) const
Compare two colors.
- bool [operator!=](#) (const [TColor](#) &color) const
Compare two colors.

Public Attributes

- [TReal](#) r
Red value, 0-1.
- [TReal](#) g
Green value, 0-1.
- [TReal](#) b
Blue value, 0-1.
- [TReal](#) a
Alpha value, 0-1.

13.15.2 Constructor & Destructor Documentation

[TColor::TColor](#) ()

Constructor.

Zeros colors by default.

TColor::TColor (TReal R, TReal G, TReal B, TReal A)

Construct from floating point values.

Values are expected to range from zero to one.

Parameters:

- R* Red.
- G* Green.
- B* Blue.
- A* Alpha, where 0 is transparent and 1 is opaque.

13.15.3 Member Function Documentation

void TColor::Init (uint32_t R, uint32_t G, uint32_t B, uint32_t A)

Integer initializer; expects color values from 0-255.

Parameters:

- R* Red (0-255)
- G* Green (0-255)
- B* Blue (0-255)
- A* Alpha (0-255)

bool TColor::operator== (const TColor & color) const

Compare two colors.

Parameters:

- color* Right-hand color to compare with.

Returns:

- True on equality.

bool TColor::operator!= (const TColor & color) const

Compare two colors.

Parameters:

- color* Right-hand color to compare with.

Returns:

- True on non-equality.

13.16 TColor32 Struct Reference

```
#include <pf/pftypes.h>
```

13.16.1 Detailed Description

A 32-bit platform native color value.

Used in some structures to save space and/or map to platform-specific structure layouts. (RGBA in OpenGL, ARGB in others).

Public Member Functions

- [TColor32 \(\)](#)
Default constructor.
- [TColor32 \(const TColor &c\)](#)
Build a TColor32 from a TColor.
- [TColor32 \(uint8_t r, uint8_t g, uint8_t b, uint8_t a\)](#)
Build a TColor32 from ARGB values.
- [TColor32 \(uint32_t c\)](#)
Build a TColor32 from an unsigned long ARGB (A is highest byte).
- [uint8_t Alpha \(\)](#)
- [uint8_t Red \(\)](#)
- [uint8_t Green \(\)](#)
- [uint8_t Blue \(\)](#)
- [void SetAlpha \(uint8_t a\)](#)
- [void SetRed \(uint8_t r\)](#)
- [void SetGreen \(uint8_t g\)](#)
- [void SetBlue \(uint8_t b\)](#)

Public Attributes

- [uint32_t color](#)

13.16.2 Constructor & Destructor Documentation

[TColor32::TColor32 \(const TColor &c\)](#)

Build a [TColor32](#) from a [TColor](#).

Parameters:

c Source color.

TColor32::TColor32 (*uint8_t r, uint8_t g, uint8_t b, uint8_t a*)

Build a [TColor32](#) from ARGB values.

Parameters:

r R (0-255)

g G (0-255)

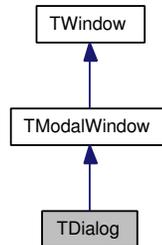
b B (0-255)

a A (0-255)

13.17 TDialog Class Reference

```
#include <pf/dialog.h>
```

Inheritance diagram for TDialog:



13.17.1 Detailed Description

A generic modal dialog.

Public Types

- enum { `kResponseOK` }

Public Member Functions

- `TDialog` (`str` *initFileName*, `str` *bodyText*, `str` *titleText*)
Default Constructor.
- virtual `~TDialog` ()
Destructor.
- virtual bool `OnMessage` (`TMessage` **message*)
Handle a message.
- virtual bool `OnNewParent` ()
Do the real initialization on being added to the hierarchy.

Protected Types

- enum { `kHttpLink = 30000` }

13.17.2 Constructor & Destructor Documentation

`TDialog::TDialog` (`str` *initFileName*, `str` *bodyText*, `str` *titleText*)

Default Constructor.

Parameters:

initFileName Dialog spec file.
bodyText Text for the body of the dialog
titleText Text for the title of the dialog.

13.17.3 Member Function Documentation

virtual bool TDialog::OnMessage (TMessage * message) [virtual]

Handle a message.

Parameters:

message Payload of message.

Returns:

True if message handled; false otherwise.

Reimplemented from [TModalWindow](#).

virtual bool TDialog::OnNewParent () [virtual]

Do the real initialization on being added to the hierarchy.

Returns:

true on success.

Reimplemented from [TModalWindow](#).

13.18 TDrawSpec Class Reference

```
#include <pf/drawspec.h>
```

13.18.1 Detailed Description

2d drawing parameters for use in DrawSprite.

Public Member Functions

- [TDrawSpec](#) (const [TVec2](#) &at=[TVec2](#)(), [TReal](#) alpha=1, [TReal](#) scale=1, [uint32_t](#) flags=0)
Default constructor with optional arguments for convenience.
- [TDrawSpec GetRelative](#) (const [TDrawSpec](#) &parent) const
Create a new [TDrawSpec](#) that is a combination of this [TDrawSpec](#) and a parent reference frame.

Public Attributes

- [TMat3 mMatrix](#)
3x3 matrix including the offset and relative orientation (and scaling) of the sprite.
- [TVec2 mCenter](#)
Logical center of the texture in pixels; can be outside of the texture.
- [TColor mTint](#)
Vertex coloring for the texture.
- [TReal mAlpha](#)
Alpha to use to draw sprite.
- [TRect mSourceRect](#)
Source rectangle to extract image from.
- [uint32_t mFlags](#)
ETextureDrawFlags for drawing flags.
- [TRenderer::EBlendMode mBlendMode](#)
Blend mode to use, if any; set to TPlatform::kBlendINVALID to use current mode (default).

Static Public Attributes

- static const [int32_t kFlipHorizontal](#) = 1<<0
Flip texture horizontally.
- static const [int32_t kFlipVertical](#) = 1<<1
Flip texture vertically.

- static const int32_t `kUseSourceRect` = 1<<2
Use the source rectangle field.
- static const int32_t `kUseCenter` = 1<<3
Use the center field.

13.18.2 Member Function Documentation

`TDrawSpec` `TDrawSpec::GetRelative` (const `TDrawSpec` & *parent*) const

Create a new `TDrawSpec` that is a combination of this `TDrawSpec` and a parent reference frame.

The new `TDrawSpec` will have a combined matrix, combined alpha, and inherited relative flip flags (`kFlipVertical` + `kFlipVertical` = no flip, same for `kFlipHorizontal`). Blend modes are inherited only if this `TDrawSpec` is set to `kBlendINVALID`.

Other parameters stay the same as this class and are NOT inherited.

Parameters:

parent Parent to combine

Returns:

New combined `TDrawSpec`

13.18.3 Member Data Documentation

`TMat3` `TDrawSpec::mMatrix`

3x3 matrix including the offset and relative orientation (and scaling) of the sprite.

Use `mMatrix[2]` to set the position where the center of sprite is to be drawn.

Use `mMatrix.Scale()` to set the scale of the sprite.

`TVec2` `TDrawSpec::mCenter`

Logical center of the texture in pixels; can be outside of the texture.

Drawing of the texture will be done relative to this point: If this point is (0,0), it will draw relative to the upper left corner of the image, for instance.

This parameter is NOT inherited when used with `TSprite::Draw()`, so if you want to modify the center of a sprite you need to modify the sprite's `TSprite::GetDrawSpec()` and not the environment passed in to `TSprite::Draw()`.

`mFlags` must have `kUseCenter` set to cause this field to be valid. Otherwise the actual center of the texture is used.

`TColor` `TDrawSpec::mTint`

Vertex coloring for the texture.

The alpha channel of this color is ignored. Default value on construction is pure white.

Applies only to this object—for sprites, does NOT get inherited by child sprites.

`TReal` `TDrawSpec::mAlpha`

Alpha to use to draw sprite.

Zero is completely transparent and one is completely opaque (subject to blend mode and texture alpha values). This value is multiplicatively inherited in child sprites using [GetRelative\(\)](#).

[TRect TDrawSpec::mSourceRect](#)

Source rectangle to extract image from.

This parameter is NOT inherited when used with [TSprite::Draw\(\)](#), so if you want to modify the source rectangle of a sprite you need to modify the sprite's [TSprite::GetDrawSpec\(\)](#) and not the environment passed in to [TSprite::Draw\(\)](#).

mFlags must have `kUseSourceRect` set to activate.

[uint32_t TDrawSpec::mFlags](#)

`ETextureDrawFlags` for drawing flags.

Inherits flip flags with an XOR, so if a parent and child are, e.g., both horizontally flipped, the child will be drawn normally.

[TRenderer::EBlendMode TDrawSpec::mBlendMode](#)

Blend mode to use, if any; set to `TPlatform::kBlendINVALID` to use current mode (default).

Inherited when parent mode set and child is `kBlendINVALID`.

13.19 TEncrypt Class Reference

```
#include <pf/encrypt.h>
```

13.19.1 Detailed Description

A class that encapsulates an encryption engine.

Public Member Functions

- [TEncrypt](#) ([str](#) encryptionKey)
Constructor.
- [~TEncrypt](#) ()
Destructor.
- [str EncryptStr](#) ([str](#) input)
Parameters:
input Str to encrypt.
- [str DecryptStr](#) ([str](#) input)
Parameters:
input Str to decrypt.
- [uint32_t EncryptBinary](#) (const void *input, [uint32_t](#) inLength, void *output, [uint32_t](#) outLength, bool base64)
Parameters:
input Data to encrypt
- [uint32_t DecryptBinary](#) (const void *input, [uint32_t](#) inLength, void *output, [uint32_t](#) outLength, bool base64)
Parameters:
input Data to decrypt.
- [uint32_t GetLastSize](#) ()
Get the last decrypted or encrypted data size.

13.19.2 Constructor & Destructor Documentation

TEncrypt::TEncrypt ([str](#) encryptionKey)

Constructor.

Parameters:

encryptionKey Key to use for encrypting/decrypting. The key should consist of valid Base64 characters(0-9,a-z,A-Z,+,/) and be correctly formatted (i.e. user proper '=' suffix).

13.19.3 Member Function Documentation

str TEncrypt::EncryptStr (**str** *input*)

Parameters:

input Str to encrypt.

Returns:

returns the input encrypted as a Str.

str TEncrypt::DecryptStr (**str** *input*)

Parameters:

input Str to decrypt.

This str must have been created with EncryptStr to ensure proper decryption.

Returns:

returns the decrypted str.

uint32_t TEncrypt::EncryptBinary (**const void *** *input*, **uint32_t** *inLength*, **void *** *output*, **uint32_t** *outLength*, **bool** *base64*)

Parameters:

input Data to encrypt

Parameters:

inLength Length of input in bytes

output Buffer to place encrypted data into.

outLength Size of output buffer.

base64 true to fill the buffer with base64 characters, so it can be passed around as a string. false will fill the buffer with binary data.

Returns:

returns 0 if successful. Otherwise, if output is NULL or outLength is too small for the resulting data, then returns the size in bytes that the output buffer must be to hold the encrypted data.

uint32_t TEncrypt::DecryptBinary (**const void *** *input*, **uint32_t** *inLength*, **void *** *output*, **uint32_t** *outLength*, **bool** *base64*)

Parameters:

input Data to decrypt.

This data must have been encrypted with EncryptBinary to ensure proper decryption.

Parameters:

inLength Length of input in bytes

output Buffer to place decrypted data into.

outLength Size of output buffer.

base64 true if the incoming buffer is in base64, false if the incoming buffer is in binary

Returns:

returns 0 if successful. Otherwise, if output is NULL or outLength is too small for the resulting data, then returns the size in bytes that the output buffer must be to hold the decrypted data.

uint32_t TEncrypt::GetLastSize ()

Get the last decrypted or encrypted data size.

Returns:

Size of last encrypted or decrypted data.

13.20 TEvent Class Reference

```
#include <pf/event.h>
```

13.20.1 Detailed Description

System event encapsulation.

Public Types

- enum `EEventCode` {
`kIdle = 1, kNull, kClose, kQuit,`
`kMouseDown, kExtendedMouseEvent, kMouseUp, kMouseMove,`
`kMouseLeave, kMouseHover, kKeyDown, kKeyUp,`
`kChar, kRedraw, kTimer, kDisplayModeChange,`
`kActivate, kFullscreenToggle` }
Event codes.
- enum `EKeyFlags` { `kShift = 1, kControl = 2, kAlt = 4, kExtended = 8` }
Event key flags.

Public Attributes

- `int32_t mType`
Type of event.
- `int32_t mKey`
Key for keyboard events.
- `TPoint mPoint`
Point for mouse events.
- `EKeyFlags mKeyFlags`
Flags for key events.

Static Public Attributes

Key Codes

these are ints so that they can be assigned to platform specific contents without pulling platform specific headers into client code

- `static int32_t kUp`
- `static int32_t kDown`
- `static int32_t kLeft`
- `static int32_t kRight`
- `static int32_t kEnter`
- `static int32_t kEscape`

- static int32_t **kTab**
- static int32_t **kPaste**
- static int32_t **kPageUp**
- static int32_t **kPageDown**
- static int32_t **kBackspace**
- static int32_t **kDelete**

13.20.2 Member Enumeration Documentation

enum [TEvent::EEventCode](#)

Event codes.

Enumerator:

kIdle Idle event processing time.

kNull EMPTY event.

kClose A close request (Alt-F4, clicking close button).

kQuit A QUIT NOW event.

kMouseDown Mouse down.

kExtendedMouseEvent Right Mouse Button/Wheel down.

kMouseUp Mouse up.

kMouseMove Mouse move.

kMouseLeave Mouse has left the window. You must `TWindowManager::SetCapture()` the mouse to receive this message; note that `TButton`-derived classes automatically capture the mouse on mouse-over.

kMouseHover Mouse has hovered over a point on the window.

kKeyDown Key down.

kKeyUp Key up.

kChar translated character event

kRedraw Redraw the screen now.

kTimer A timer has triggered.

kDisplayModeChange The display mode has changed.

kActivate Our application has activated/deactivated. `mKey` is set to 0 on deactivate, or 1 on activate.

kFullScreenToggle The user has toggled full screen mode. `mKey` is set to 0 on windowed mode, or non-zero on full screen mode.

enum [TEvent::EKeyFlags](#)

Event key flags.

Enumerator:

kShift Shift is pressed.

kControl Control (or command) is pressed.

kAlt Alt key is pressed.

kExtended Reserved.

13.20.3 Member Data Documentation

int32_t [TEvent::mType](#)

Type of event.

See also:

[EEventCode](#)

13.21 TFile Struct Reference

```
#include <pf/file.h>
```

13.21.1 Detailed Description

A file reading abstraction.

All file access from Playground games should be handled through this abstraction.

File names must consist ONLY of the following characters:

- a-z : Lowercase letters
- 0-9 : Digits
- - : Hyphen
- _ : Underscore
- . : Dot

Paths must be separated by forward slash ("/"). All files must be specified without a leading slash.

A file in "assets/bitmaps/" called "my.png" would be loaded with the handle "bitmaps/my.png".

To access a writable folder, prefix the file name with either user:, common:, or desktop: to get to either the user's personal data folder, the system's common data folder, or the desktop folder. You may NOT write to the assets folder during the game –it will ASSERT in debug build if you try.

There is a set of C stdio-compatible routines that you can use to port existing fopen-style interfaces:

- pf_open()
- pf_close()
- pf_seek()
- pf_tell()
- pf_getc()
- pf_gets()
- pf_read()
- pf_write() (only to user:, common: and desktop: folders)
- pf_eof()
- pf_error()
- pf_ungetc()

If you absolutely must use fscanf(), you can use pf_fgets to get a line of text, and then use sscanf() to parse the line. However, in general it is much better to read and write the data as XML using [TXmlNode](#).

Public Member Functions

- **TFile** ()
Default constructor.
- **~TFile** ()
Destructor.
- **bool Open** (**str** path, **eFileMode** mode=kReadBinary)
Open an existing file.
- **bool IsValid** ()
Return true if the file was opened successfully.
- **bool AtEOF** ()
Return true if the file is at the EOF.
- **void Close** ()
Close a file.
- **void Seek** (**long** offset, **eFileSeek** seek)
Seek to a specific file position.
- **long Tell** ()
Get the current file position.
- **long Size** ()
Get the file's size.
- **long Read** (**void** *buffer, **unsigned long** bytes)
Read bytes into buffer.
- **long Write** (**const void** *buffer, **unsigned long** bytes)
Write bytes to file from buffer.
- **void Unget** ()
"Unget" one character.

Static Public Member Functions

- **static bool Exists** (**str** handle)
Test to see if a file exists.
- **static str Source** (**str** handle)
Return the source of the file.
- **static str GetCWD** ()
Get the current working directory.

- static bool [GetNextFile](#) (str folder, str *file, bool subfolders=false)
Iterate through the files in a folder.
- static void [ScanForResources](#) ()
- static void [SetUserDataDirs](#) (str userData, str commonData, str desktopData)
- static void [ShutDownFileSystem](#) ()
Clear out the file system cache.
- static void [ScanFolderForResources](#) (str folder, str prefix="")
Scan a folder (and subfolder) for files.
- static void [SetFirstPeek](#) (bool bOn)
Flag to tell the file system that we're in "First Peek" mode: i.e., a limited-functionality beta.
- static void [AddMemoryFile](#) (str memoryFileName, void *base, uint32_t size)
Add a virtual file to the file system.
- static void [AddFileMask](#) (const char *mask, bool add=true)
Add a set of files-to-be-ignored to TFile.
- static bool [DeleteFile](#) (str filename)
Delete a file from user: or common:, or dereference a memory file.

13.21.2 Member Function Documentation

bool TFile::Open (str path, eFileMode mode = kReadBinary)

Open an existing file.

Closes any file this [TFile](#) previously had open, and attempts to open the given file.

Parameters:

path Path to file

mode Mode to open file

Returns:

true on success.

bool TFile::IsValid ()

Return true if the file was opened successfully.

Returns:

True on success; false on failure.

bool TFile::AtEOF ()

Return true if the file is at the EOF.

Returns:

True on EOF.

void TFile::Close ()

Close a file.

Optional; file is automatically closed on destruction of the [TFile](#)

void TFile::Seek (long *offset*, eFileSeek *seek*)

Seek to a specific file position.

Parameters:

offset Offset from reference position.
seek Which reference position to use.

long TFile::Tell ()

Get the current file position.

Returns:

Current offset into the file.

long TFile::Size ()

Get the file's size.

Returns:

File size in bytes.

long TFile::Read (void * *buffer*, unsigned long *bytes*)

Read bytes into buffer.

Parameters:

buffer Buffer to fill.
bytes Bytes to read.

Returns:

bytes read

long TFile::Write (const void * *buffer*, unsigned long *bytes*)

Write bytes to file from buffer.

Parameters:

buffer Buffer to read bytes from.
bytes Bytes to write.

Returns:

bytes written

void TFile::Unget ()

"Unget" one character.

Semantics are similar to `ungetc`, in that you can only ever "unget" one character.

Unlike `ungetc`, it will only `ungetc` exactly the previous character you just read—there is no option to select a character to `ungetc`.

Ungetting past the beginning of the file is not allowed.

static bool TFile::Exists (str handle) [static]

Test to see if a file exists.

Expects a standard resource handle.

Parameters:

handle Resource handle.

Returns:

True if file exists

static str TFile::Source (str handle) [static]

Return the source of the file.

Parameters:

handle Handle of the file to query.

Returns:

"filesystem" if it's a normal file, "memoryfile" if it's a memory file, an empty string if file isn't found, or the name of the source .pfp file.

static str TFile::GetCWD () [static]

Get the current working directory.

Returns:

Current working directory.

static bool TFile::GetNextFile (str folder, str * file, bool subfolders = false) [static]

Iterate through the files in a folder.

Parameters:

folder Folder to search. File globs are NOT supported currently.

file Pointer to a string to receive each file name.

Start iteration with an empty string, and pass the value you received previously to get the next value in the iteration.

Parameters:

subfolders True to return files in subfolders as well.

Returns:

True if successful; false to signal end of iteration.

static void TFile::AddMemoryFile (str memoryFileName, void * base, uint32_t size) [static]

Add a virtual file to the file system.

After you call this function, opening a file with the given name for read will supply the given data. The data is not copied, so you are responsible for ensuring that the data buffer continues to exist for as long as the memory file is available. In other words, the client owns the memory block, and must ensure its lifetime exceeds that of the memory file entry.

Opening the file for write is not currently supported.

Parameters:

memoryFileName Name of the virtual file to add.
base Pointer to the start of the virtual file data. Pass NULL to delete the virtual file.
size Size of the virtual file.

static void TFile::AddFileMask (const char * *mask*, bool *add* = true) [static]

Add a set of files-to-be-ignored to [TFile](#).

These files will not be "visible" to the [TFile](#) file system.

Paths should be given the same as a path would be given to [TFile::Open\(\)](#).

Entries in this string are space (or line) separated.

Each entry matches either one complete file path, or one complete folder path. Folders are NOT matched in user: or common:—only complete file paths are matched.

Passing in an entry of -* will clear the entire file mask. If you put this at the start of your string, it will clear the file mask before adding the rest of the files in your string.

Parameters:

mask A space-delimited string of complete file or folder paths.
add True to add the files to the mask (ignore the files in the list); false to remove the files from the mask (to make them show up again).

static bool TFile::DeleteFile (str *filename*) [static]

Delete a file from user: or common:, or dereference a memory file.

For a memory file, just removes the entry in the file table: No memory is deallocated, as the client owns the memory.

Parameters:

filename Filename to delete. Must be prefixed by user: or common:.

Returns:

True on success.

13.22 TFlashHost Class Reference

```
#include <pf/flashhost.h>
```

13.22.1 Detailed Description

An embedded flash-playback routine.

Can be used in-game for cut-scenes. Flash animation will play until it's "done", at which point control will return to the game.

From within Lua, you can call [DisplaySplash\(\)](#) to display a Flash animation and an optional replacement bitmap.

Public Member Functions

- [TFlashHost](#) (const char *filename)
Constructor.
- [~TFlashHost](#) ()
Destructor.
- bool [Start](#) (bool bLoop=false, bool bTranslate=false, bool bAllowInput=false)
Start Flash file.
- void [Stop](#) ()
Stop playing file.
- long [GetTotalFrames](#) ()
Get the total number of frames.
- long [GetFrameNum](#) ()
Get the current frame number.
- bool [IsPlaying](#) ()
Test to see whether the animation is playing.

13.22.2 Constructor & Destructor Documentation

TFlashHost::TFlashHost (const char * filename)

Constructor.

Parameters:

filename Flash file to play.

13.22.3 Member Function Documentation

bool TFlashHost::Start (bool bLoop = false, bool bTranslate = false, bool bAllowInput = false)

Start Flash file.

Flash movies need to be in Flash 4 format to provide the most compatibility across all systems. Translatable movies need to be Flash 6.

It is possible to translate a Flash movie by setting the `bTranslate` parameter to true. When translate mode is turned on, any string in the string table that begins with "FLASH_" will be sent to the Flash movie for translation. If all of the text in the Flash movie is set up as dynamic text, and each text box references a variable that is named after an entry in your strings.xml file (minus the "FLASH_"), then translation will succeed. You will also want to embed the font you want inside of your movie, so that if the user doesn't have the font installed on their system the font will still show up correctly.

For example, if you have a dynamic text variable in your movie named "text_box_1", and have an entry in your strings.xml table named "FLASH_text_box_1", then at run time, "text_box_1" in your flash movie will be set to whatever the value of "FLASH_text_box_1" is in your strings.xml file.

It is recommended that inside the Flash movie itself, incomplete text is used when doing layouts. That way it will be obvious if it has been forgotten to add any text to the translation pipeline. If the text inside the movie is correct, it is not clear whether or not the movie is using the original text or the translated text until someone actually goes in to translate the strings.xml file.

Parameters:

bLoop Loop file.

bTranslate Send translated strings to the movie.

bAllowInput If this is true, the system cursor will be shown and mouse clicks will be sent to the flash movie. If it is false, the cursor will be hidden and clicks will be sent to the game only.

Returns:

True on success.

long TFlashHost::GetTotalFrames ()

Get the total number of frames.

Returns:

Number of frames.

long TFlashHost::GetFrameNum ()

Get the current frame number.

Returns:

Frame number.

bool TFlashHost::IsPlaying ()

Test to see whether the animation is playing.

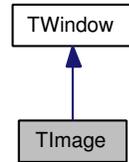
Returns:

True if playing.

13.23 TImage Class Reference

```
#include <pf/image.h>
```

Inheritance diagram for TImage:



13.23.1 Detailed Description

The **TImage** class is a **TWindow** that contains and draws a **TTexture**.

It is not intended that the windowing system be used to render sprites in your game—that's what the sprite system is for. Among other things, there is a limited flexibility in rendering options.

A **TImage** will automatically set its `kOpaque` flag based on `SetAlpha()`—a `SetAlpha()` of less than 1 will reset the flag. In Lua initialization you can also use "alpha=true" to reset the flag.

Public Member Functions

- **TImage** (bool staticImage=true)
Default Constructor.
- virtual **~TImage** ()
Destructor.
- void **SetTexture** (TTextureRef texture, TReal scale=1.0f)
Set the image texture.
- TTextureRef **GetTexture** ()
Get the current image texture.
- void **SetAlpha** (TReal alpha)
Set the alpha for this image.
- TReal **GetAlpha** ()
Get the current alpha of this image.
- TReal **GetScale** ()
Get the current scale of this TImage.
- void **SetRotate** (bool rotate)
Set this image to be rotated right (clockwise) by 90 degrees.
- void **SetDrawFlags** (uint32_t flags)
Set the draw flags for this image (including flip horizontal and flip vertical).

- virtual void [Init](#) ([TWindowStyle](#) &style)
Initialize the Window.

Event Handlers

Functions to override to handle events in a window.

- virtual void [Draw](#) ()
Draw the window.

13.23.2 Constructor & Destructor Documentation

[TImage::TImage](#) (bool *staticImage* = true)

Default Constructor.

Parameters:

staticImage Default behavior assumes that the image will change infrequently, and therefore sets `kInfrequentChanges` and tries to cache the image.

Create a [TImage](#) with `staticImage` set to false for an image that will change frequently.

13.23.3 Member Function Documentation

virtual void [TImage::Draw](#) () [virtual]

Draw the window.

[TImage](#) can draw only a portion of the window when only a part of the image needs to be redrawn.

Reimplemented from [TWindow](#).

void [TImage::SetTexture](#) ([TTextureRef](#) *texture*, [TReal](#) *scale* = 1.0f)

Set the image texture.

Parameters:

texture New texture.
scale Amount to scale texture by when drawing

[TTextureRef](#) [TImage::GetTexture](#) ()

Get the current image texture.

Returns:

A reference to the bound image.

void [TImage::SetAlpha](#) ([TReal](#) *alpha*)

Set the alpha for this image.

Parameters:

alpha Alpha value. 1.0==opaque.

TReal TImage::GetAlpha ()

Get the current alpha of this image.

Returns:

A value from 0 (transparent) to 1 (opaque).

TReal TImage::GetScale ()

Get the current scale of this [TImage](#).

Returns:

Scale from 0 - 1

void TImage::SetRotate (bool *rotate*)

Set this image to be rotated right (clockwise) by 90 degrees.

Parameters:

rotate True to rotate.

void TImage::SetDrawFlags (uint32_t *flags*)

Set the draw flags for this image (including flip horizontal and flip vertical).

Parameters:

flags Draw flags to use: A combination of [TDrawSpec::kFlipVertical](#) and/or [TDrawSpec::kFlipHorizontal](#).

virtual void TImage::Init (TWindowStyle & *style*) [virtual]

Initialize the Window.

Called by the system only in Lua initialization.

When you create your own custom window, this is where you put your own custom initialization that needs to happen before children are created. Fundamental window initialization is handled in every class by this function, so **when you override this function you almost always want to call your base class to handle base class initialization.**

Parameters:

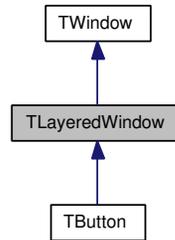
style The Lua style that was in effect when this window was created. This style contains all parameters specified explicitly for the window as well as parameters defined in the current style. Parameters set locally override ones in the style.

Reimplemented from [TWindow](#).

13.24 TLayeredWindow Class Reference

```
#include <pf/layeredwindow.h>
```

Inheritance diagram for TLayeredWindow:



13.24.1 Detailed Description

A [TLayeredWindow](#) is a [TWindow](#) with multiple layers which can be switched between. This can be used for animation, or for button presses, for instance.

Public Types

- enum { [kAll](#) = -1 }

Public Member Functions

- [TLayeredWindow](#) (uint32_t numberOfLayers)
Default Constructor.
- virtual [~TLayeredWindow](#) ()
Destructor.
- void [SetCurrentLayer](#) (int32_t layer=kAll)
Select the layer of this window to display.
- int32_t [GetCurrentLayer](#) ()
Get the current active layer.
- uint32_t [GetNumLayers](#) ()
Get the number of layers.
- virtual void [OrphanChild](#) ([TWindow](#) *child)
Remove a child from this window, releasing ownership.
- virtual bool [AdoptChild](#) ([TWindow](#) *child, bool initWindow=true)
Add a child to this window.

13.24.2 Member Function Documentation

void TLayeredWindow::SetCurrentLayer (int32_t *layer* = kAll)

Select the layer of this window to display.

Parameters:

layer The new active layer. Set to kAll to add children to all layers; layer 0 will be displayed in that state.

int32_t TLayeredWindow::GetCurrentLayer ()

Get the current active layer.

Returns:

An zero-based index to the current active layer.

uint32_t TLayeredWindow::GetNumLayers ()

Get the number of layers.

Returns:

The number of layers associated with this window.

virtual void TLayeredWindow::OrphanChild (TWindow * *child*) [virtual]

Remove a child from this window, releasing ownership.

Removes this child from *all* window layers.

Parameters:

child child to remove.

See also:

[TWindow::OrphanChild](#)

Reimplemented from [TWindow](#).

virtual bool TLayeredWindow::AdoptChild (TWindow * *child*, bool *initWindow* = true) [virtual]

Add a child to this window.

Adds it to the current window layer only.

Parameters:

child Child to add.

initWindow Whether to run the init function [OnNewParent\(\)](#) on this window.

Returns:

True if successful. False if [OnNewParent\(\)](#) returned false, in which case child was NOT added.

See also:

[TWindow::AdoptChild](#)

Reimplemented from [TWindow](#).

13.25 TLight Struct Reference

```
#include <pf/light.h>
```

13.25.1 Detailed Description

A 3d light.

Public Types

- enum [ELightType](#) { [kDirectional](#), [kPointSource](#), [kSpotLight](#) }
Light types.

Public Member Functions

- [TLight](#) ()
Default constructor, which resets the light parameters to a white directional light.

Public Attributes

- [ELightType](#) [mType](#)
Type of light.
- [TColor](#) [mDiff](#)
Diffuse value.
- [TColor](#) [mSpec](#)
Specular value.
- [TColor](#) [mAmb](#)
Ambient value.
- [TVec3](#) [mPos](#)
Position of light. No meaning for directional light sources.
- [TVec3](#) [mDir](#)
Direction of light. No meaning for point source light sources.
- [TReal](#) [mRange](#)
Effective range of light. No meaning for directional light sources.
- [TReal](#) [mAttenuation](#) [3]
Attenuation factors: Constant, Linear, and Quadratic.
- [TReal](#) [mTheta](#)
Angle of inner cone of spotlight, in radians.

- [TReal mPhi](#)

Angle of outer edge of spotlight dropoff, in radians.

13.25.2 Member Enumeration Documentation

enum [TLight::ELightType](#)

Light types.

Enumerator:

kDirectional A directional light source.

kPointSource A point source light.

kSpotLight A spotlight.

13.25.3 Member Data Documentation

[TReal TLight::mAttenuation\[3\]](#)

Attenuation factors: Constant, Linear, and Quadratic.

Attenuation is calculated based on the following equation:

$$A = \frac{1}{a_0 + a_1D + a_2D^2}$$

Where $a_0 - a_2$ are `mAttenuation[0]-mAttenuation[2]`, and D is the distance of the light source to the vertex, normalized to 0,1 over the range of the light.

13.26 TLitVert Struct Reference

```
#include <pf/vertexset.h>
```

13.26.1 Detailed Description

3d untransformed, lit vertex.

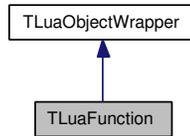
Public Attributes

- [TVec3 pos](#)
Position in 3d space.
- `uint32_t RESERVED`
UNUSED (must be zero).
- [TColor32 color](#)
Vertex color.
- [TColor32 specular](#)
Vertex specular component.
- [TVec2 uv](#)
Vertex texture coordinate.

13.27 TLuaFunction Class Reference

```
#include <pf/pflua.h>
```

Inheritance diagram for TLuaFunction:



13.27.1 Detailed Description

A wrapper for a Lua function.

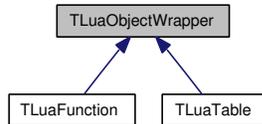
Public Member Functions

- **TLuaFunction** (lua_State *state)
- void **Call** ()
- bool **IsFunction** ()

13.28 TLuaObjectWrapper Class Reference

```
#include <pf/pflua.h>
```

Inheritance diagram for TLuaObjectWrapper:



13.28.1 Detailed Description

Wrap a Lua object for use within C++ code.

Keeps a reference to the Lua object so it won't be garbage collected.

Public Member Functions

- [TLuaObjectWrapper](#) (lua_State *state)
Initialize our function with the object found on top of the stack.
- [TLuaObjectWrapper](#) ([TLuaObjectWrapper](#) &other)
- virtual [~TLuaObjectWrapper](#) ()
Destructor.
- void [Push](#) ()
Push our object onto the stack.
- bool [IsString](#) ()
Is this object a string?
- bool [IsNumber](#) ()
Is the object a number?
- bool [IsTable](#) ()
Is the object a table?
- [str](#) [AsString](#) ()
Convert the object to a string.
- lua_Number [AsNumber](#) ()
Convert the object to a number.
- lua_State * [GetState](#) ()
Get the current state associated with this object.

Protected Attributes

- lua_State * [mState](#)

13.28.2 Constructor & Destructor Documentation

TLuaObjectWrapper::TLuaObjectWrapper (lua_State * state)

Initialize our function with the object found on top of the stack.

Pops object from stack.

Parameters:

state Lua state.

13.28.3 Member Function Documentation

void TLuaObjectWrapper::Push ()

Push our object onto the stack.

Note a Lua object can only be pushed onto the stack of the Lua interpreter that it was extracted from and originally created in.

bool TLuaObjectWrapper::IsString ()

Is this object a string?

Returns:

True if it is a string.

bool TLuaObjectWrapper::IsNumber ()

Is the object a number?

Returns:

True if the object is a number.

bool TLuaObjectWrapper::IsTable ()

Is the object a table?

Returns:

True if a table

str TLuaObjectWrapper::AsString ()

Convert the object to a string.

Returns:

A string representation of the object, if one is available.

lua_Number TLuaObjectWrapper::AsNumber ()

Convert the object to a number.

Returns:

A numeric representation of the object, if one is available.

lua_State* TLuaObjectWrapper::GetState ()

Get the current state associated with this object.

Returns:

A Lua state.

13.29 TLuaParticleSystem Class Reference

```
#include <pf/luaparticlesystem.h>
```

13.29.1 Detailed Description

A particle system driven by Lua scripts.

Particle system documentation is at [A Lua-Driven Particle System](#)

Public Member Functions

- [TLuaParticleSystem](#) ([TParticleRenderer](#) *r=NULL)
Default Constructor.
- virtual [~TLuaParticleSystem](#) ()
Destructor.
- void [Draw](#) (const [TVec3](#) &at)
Draw the system.
- virtual bool [Init](#) (str spec)
An initializer with a client-defined specification.
- void [NewScript](#) ()
Reset the script to a virgin state.
- virtual void [Update](#) (int ms)
Update particle system.
- void [RegisterFunction](#) (str name, PFClassId processId)
Register a function type with the particle system.
- void [AdoptFunctionInstance](#) (str name, [TParticleFunction](#) *function)
Register a function type with the particle system.
- int32_t [RegisterDataSource](#) (str name, [TParticleFunction](#) *function)
Register a data source.
- [TParticleFunction](#) * [GetDataSource](#) (int32_t source)
Get a registered data source by index.
- [ParticleMember](#) [Allocate](#) (uint8_t size)
Allocate a particle variable.
- [TParticleFunctionRef](#) [GetParticleFunction](#) (str type)
Get a new instance of a particle function associated with a named type.
- [TScript](#) * [GetScript](#) ()
Get a pointer to the attached particle system script.

- [TScriptCodeRef GetScriptCode \(\)](#)
Get a reference to the asset-type TScriptCodeRef.
- [bool IsDone \(\)](#)
Is the particle system done?
- [void SetDone \(\)](#)
Flag the particle system as done.
- [void ResetDone \(\)](#)
Not done any more!
- [void SetAlpha \(float a\)](#)
Set the alpha of this particle system.

Static Public Member Functions

- [static TRandom * GetRandom \(\)](#)
Get the particle system random number generator.

Classes

- [struct PInstruction](#)

13.29.2 Constructor & Destructor Documentation

TLuaParticleSystem::TLuaParticleSystem (TParticleRenderer * r = NULL)

Default Constructor.

Parameters:

r Particle renderer to use. If NULL, will create a [T2dParticleRenderer](#).

13.29.3 Member Function Documentation

void TLuaParticleSystem::Draw (const TVec3 & at)

Draw the system.

Parameters:

at Where to draw it. For 2d particles, the third component just sets the Z-depth to draw the particles.

virtual bool TLuaParticleSystem::Init (str spec) [virtual]

An initializer with a client-defined specification.

Parameters:

spec Client spec.

virtual void TLuaParticleSystem::Update (int *ms*) [**virtual**]

Update particle system.

Parameters:

ms Number of milliseconds to advance system.

void TLuaParticleSystem::RegisterFunction (str *name*, PFClassId *processId*)

Register a function type with the particle system.

This interface allows you to create a new operator that can be used in the particle system.

Parameters:

name Name of process to use (or to replace).

processId The PFClassId of the class that provides the function. See [Type Information and Casting](#) for more information.

See also:

[AdoptFunctionInstance](#)

void TLuaParticleSystem::AdoptFunctionInstance (str *name*, TParticleFunction * *function*)

Register a function type with the particle system.

This interface allows you to create a new operator that can be used in the particle system.

Adopt semantics are used: You need to create a TParticleFunction-derived class instance and pass it in. Lifetime management is then handled by the [TLuaParticleSystem](#).

For example:

```
AdoptFunctionInstance("fNewFunction", new MyParticleFunction );
```

C++

Parameters:

name Name of process to use (or to replace).

processId The PFClassId of the class that provides the function. See [Type Information and Casting](#) for more information.

See also:

[RegisterFunction](#)

int32_t TLuaParticleSystem::RegisterDataSource (str *name*, TParticleFunction * *function*)

Register a data source.

Parameters:

name Name of data source in Lua, e.g., "dSpriteVelocity"

function Class that contains the data accessor

Returns:

Data source index.

TParticleFunction* TLuaParticleSystem::GetDataSource (int32_t *source*)

Get a registered data source by index.

Parameters:

source Data source index to read (must be negative).

Returns:

The data source.

ParticleMember TLuaParticleSystem::Allocate (uint8_t size)

Allocate a particle variable.

This function is typically called from Lua to allocate custom particle variables, and by the renderer to allocate the default particle members.

Parameters:

size Size of particle variable (1-4) in TReal values.

Returns:

A [ParticleMember](#) struct that refers to the newly allocated member.

TParticleFunctionRef TLuaParticleSystem::GetParticleFunction (str type)

Get a new instance of a particle function associated with a named type.

Parameters:

type A registered particle function type.

Returns:

A reference-counted pointer to a newly created particle function.

TScript* TLuaParticleSystem::GetScript ()

Get a pointer to the attached particle system script.

Returns:

A pointer to the current script.

TScriptCodeRef TLuaParticleSystem::GetScriptCode ()

Get a reference to the asset-type TScriptCodeRef.

This allows Lua scripts to be pre-loaded once and maintained in the asset system.

Returns:

A reference to the [TScriptCode](#) object that contains the (compiled) Lua code.

bool TLuaParticleSystem::IsDone ()

Is the particle system done?

Returns:

True if done; false otherwise.

void TLuaParticleSystem::SetAlpha (float a)

Set the alpha of this particle system.

Parameters:

a Alpha (transparency) of this system. 0 is transparent, 1 opaque.

static TRandom* TLuaParticleSystem::GetRandom () **[static]**

Get the particle system random number generator.

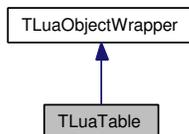
Returns:

A pointer to the particle system random generator.

13.30 TLuaTable Class Reference

```
#include <pf/luatable.h>
```

Inheritance diagram for TLuaTable:



13.30.1 Detailed Description

A wrapper for Lua table access in C++.

Public Member Functions

- [TLuaTable](#) (lua_State *state)
Constructor.
- [TLuaTable](#) (TLuaObjectWrapper &lobj)
Construct from a TLuaObjectWrapper.
- uint32_t [GetSize](#) ()
How many elements in the indexed portion of the table?
- str [GetString](#) (const char *key, str defaultValue="")
Get a string from the table.
- str [GetString](#) (lua_Number key, str defaultValue="")
Get a string from the table.
- lua_Number [GetNumber](#) (const char *key, lua_Number defaultValue=0)
Get a lua_Number from a key in the table.
- lua_Number [GetNumber](#) (lua_Number key, lua_Number defaultValue=0)
Get a lua_Number from a key in the table.
- bool [GetBoolean](#) (const char *key, bool defaultValue=false)
Get a boolean value from a key in the table.
- TLuaFunction * [GetFunction](#) (const char *key)
Get a TLuaFunction from a key in the table.
- TLuaTable * [GetTable](#) (const char *key)
Acquire an embedded Lua table from within this table.
- TLuaTable * [GetTable](#) (lua_Number key)
Acquire an embedded Lua table from within this table.

- [TColor GetColor](#) (str key, const [TColor](#) &defaultValue=[TColor](#)(0, 0, 0, 0))
Get a [TColor](#) from a table of four values.
- [TColor GetColor](#) (lua_Number key, const [TColor](#) &defaultValue=[TColor](#)(0, 0, 0, 0))
Get a [TColor](#) from a table of four values.
- [TLuaObjectWrapper * GetNext](#) ([TLuaObjectWrapper **key](#))
Takes a key and returns the key/value pair for the next key in the table.
- bool [PushValue](#) (const char *key)
Push the value at a particular string key onto the Lua stack.
- bool [PushValue](#) (lua_Number key)
Push the value at a particular numeric key onto the Lua stack.

Static Public Member Functions

- static [TLuaTable * Create](#) (lua_State *state)
Create a new table, and wrap it in a [TLuaTable](#).
- static void [DeferDelete](#) ([TLuaTable *table](#))
Internal function to defer the delete of a table until the next event loop.

13.30.2 Constructor & Destructor Documentation

[TLuaTable::TLuaTable](#) (lua_State * state)

Constructor.

Parameters:

state The lua_State pointer of the table. Use [GetState\(\)](#) on a [TScript](#) to get the current state.

[TLuaTable::TLuaTable](#) ([TLuaObjectWrapper & lobj](#))

Construct from a [TLuaObjectWrapper](#).

Parameters:

lobj Object wrapper that presumably wraps a table.

13.30.3 Member Function Documentation

static [TLuaTable*](#) [TLuaTable::Create](#) (lua_State * state) **[static]**

Create a new table, and wrap it in a [TLuaTable](#).

Parameters:

state State of Lua interpreter to use.

Returns:

A new (empty) [TLuaTable](#). You're responsible for deleting it.

uint32_t TLuaTable::GetSize ()

How many elements in the indexed portion of the table?

Returns:

Number of elements in the array portion of the table.

str TLuaTable::GetString (const char * key, str defaultValue = "")

Get a string from the table.

Parameters:

key The key to the string.
defaultValue Default value if key isn't found.

Returns:

A copy of the string, if one exists at that key. Otherwise an empty string.

str TLuaTable::GetString (lua_Number key, str defaultValue = "")

Get a string from the table.

Parameters:

key The key to the string.
defaultValue Default value if key isn't found.

Returns:

A copy of the string, if one exists at that key. Otherwise an empty string.

lua_Number TLuaTable::GetNumber (const char * key, lua_Number defaultValue = 0)

Get a lua_Number from a key in the table.

Parameters:

key Key to look up.
defaultValue Default value if key isn't found.

Returns:

A lua_Number, if one is found. Zero otherwise.

lua_Number TLuaTable::GetNumber (lua_Number key, lua_Number defaultValue = 0)

Get a lua_Number from a key in the table.

Parameters:

key Key to look up.
defaultValue Default value if key isn't found.

Returns:

A lua_Number, if one is found. Zero otherwise.

bool TLuaTable::GetBoolean (const char * key, bool defaultValue = false)

Get a boolean value from a key in the table.

Parameters:

key Key to look up.
defaultValue Default value if key isn't found.

Returns:

The value of the key as a boolean (using lua_toboolean()) if the key is found. False otherwise.

TLuaFunction* TLuaTable::GetFunction (const char * key)

Get a TLuaFunction from a key in the table.

Parameters:

key Key to look up.

Returns:

A TLuaFunction, if that slot in the table has a lua function. NULL otherwise.

TLuaTable* TLuaTable::GetTable (const char * key)

Acquire an embedded Lua table from within this table.

Parameters:

key Key where table is stored.

Returns:

A new TLuaTable pointer which you must eventually delete.

TLuaTable* TLuaTable::GetTable (lua_Number key)

Acquire an embedded Lua table from within this table.

Parameters:

key Key where table is stored.

Returns:

A new TLuaTable pointer which you must eventually delete.

TColor TLuaTable::GetColor (str key, const TColor & defaultValue = TColor (0, 0, 0, 0))

Get a TColor from a table of four values.

In Lua, if you define a color using the Color() function, you define it using values from 0-255. If you define using FColor(), the values are from 0-1.

Parameters:

key Key of table.
defaultValue Default value to return if no table found.

Returns:

A TColor.

TColor TLuaTable::GetColor (lua_Number key, const TColor & defaultValue = TColor (0, 0, 0, 0))

Get a TColor from a table of four values.

In Lua, if you define a color using the `Color()` function, you define it using values from 0-255. If you define using `FColor()`, the values are from 0-1.

Parameters:

key Key of table.
defaultValue Default value to return if no table found.

Returns:

A `TColor`.

`TLuaObjectWrapper* TLuaTable::GetNext (TLuaObjectWrapper ** key)`

Takes a key and returns the key/value pair for the next key in the table.

The key you pass in should start out NULL to start the iteration.

Warning:

If you stop an iteration in the middle, you're responsible for deleting the last key you've received in addition to the normal deletion of the last value.

Parameters:

key Pointer to variable to receive next key. Initialize it to NULL to start the iteration, and leave the previous key in place to iterate.

Returns:

A pointer to a `TLuaObjectWrapper`. You must delete this pointer when you're done with it. Returns NULL after the last table item.

`bool TLuaTable::PushValue (const char * key)`

Push the value at a particular string key onto the Lua stack.

Parameters:

key Key of value to retrieve.

`bool TLuaTable::PushValue (lua_Number key)`

Push the value at a particular numeric key onto the Lua stack.

Parameters:

key Key of value to retrieve.

`static void TLuaTable::DeferDelete (TLuaTable * table) [static]`

Internal function to defer the delete of a table until the next event loop.

Parameters:

table Table to delete later.

13.31 TMat3 Class Reference

```
#include <pf/mat.h>
```

13.31.1 Detailed Description

2d Matrix with 2x2 rotation component and [TVec2](#) offset component.

Construction and Initialization.

- [TMat3 \(\)](#)
Default constructor.
- [TMat3 \(TReal m00, TReal m01, TReal m02, TReal m10, TReal m11, TReal m12, TReal m20, TReal m21, TReal m22\)](#)
Construct from individual values.
- [TMat3 \(TVec3 v0, TVec3 v1, TVec3 v2\)](#)
Construct from three vectors.
- [TMat3 \(const TMat3 &rhs\)](#)
Copy construction.
- [TMat3 & operator= \(const TMat3 &rhs\)](#)
Assignment.
- [TMat3 & Identity \(\)](#)
Initialize to an identity.

Scaling and rotation

- [TMat3 & Scale \(TReal x, TReal y\)](#)
Scale this matrix in two dimensions.
- [TMat3 & Scale \(TReal s\)](#)
Scale this matrix.
- [TMat3 & Rotate \(TReal radians\)](#)
Rotate this matrix in place.
- [static TMat3 GetRotation \(TReal radians\)](#)
Get a rotation matrix.

Public Member Functions

Accessors

- `TVec3 & operator[] (TIndex i)`
Array Accessor.
- `const TVec3 & operator[] (TIndex i) const`
Array Accessor.
- `TIndex Dim () const`
Dimensions of this array.

Assignment Operators

- `TMat3 & operator+= (const TMat3 &rhs)`
Assignment operator.
- `TMat3 & operator-= (const TMat3 &rhs)`
Assignment operator.
- `TMat3 & operator *= (const TMat3 &rhs)`
Assignment operator.
- `TMat3 & operator *= (TReal rhs)`
Assignment operator.
- `TMat3 & operator /= (TReal rhs)`
Assignment operator.

Related Functions

(Note that these are not member functions.)

- `bool operator== (const TMat3 &lhs, const TMat3 &rhs)`
Equality.
- `bool operator!= (const TMat3 &lhs, const TMat3 &rhs)`
Inequality.
- `TVec3 operator * (const TMat3 &lhs, const TVec3 &rhs)`
Matrix multiplication with a vector.
- `TVec2 operator * (const TMat3 &lhs, const TVec2 &rhs)`
Matrix multiplication with a vector.
- `TVec3 operator * (const TVec3 &lhs, const TMat3 &rhs)`
Matrix multiplication with a vector.
- `TVec2 operator * (const TVec2 &lhs, const TMat3 &rhs)`
Matrix multiplication with a vector.

- **TMat3 operator *** (const TMat3 &lhs, TReal rhs)
Member-wise scaling of the vector.
- **TVec2 Multiply2x2** (const TMat3 &lhs, const TVec2 &rhs)
A restricted 2x2 matrix vector multiply.
- **TVec2 Multiply2x2** (const TVec2 &lhs, const TMat3 &rhs)
A restricted 2x2 matrix vector multiply.
- **TMat3 Multiply2x2** (const TMat3 &lhs, const TMat3 &rhs)
A restricted 2x2 matrix-matrix multiply.
- **TVec2 operator%** (const TVec2 &lhs, const TMat3 &rhs)
Restricted-multiply operator.
- **TVec2 operator%** (const TMat3 &lhs, const TVec2 &rhs)
Restricted-multiply operator.
- **TMat3 operator%** (const TMat3 &lhs, const TMat3 &rhs)
Restricted-multiply operator.
- **TVec3 operator *** (const TVec3 &lhs, const TMat4 &rhs)
Matrix multiplication with a vector.

13.31.2 Constructor & Destructor Documentation

TMat3::TMat3 ()

Default constructor.

Initializes to identity.

13.31.3 Member Function Documentation

]

TVec3& TMat3::operator[] (TIndex *i*)

Array Accessor.

Parameters:

i The row number, from 0-2.

Returns:

a reference to the **TVec3** that represents the row.

]

const **TVec3&** TMat3::operator[] (TIndex *i*) const

Array Accessor.

Parameters:

i The row number, from 0-2.

Returns:

a reference to the [TVec3](#) that represents the row.

[TMat3](#)& [TMat3::operator+=](#) (const [TMat3](#) & *rhs*)

Assignment operator.

Parameters:

rhs The right-hand-side of the assignment.

Returns:

a reference to this.

[TMat3](#)& [TMat3::operator-=](#) (const [TMat3](#) & *rhs*)

Assignment operator.

Parameters:

rhs The right-hand-side of the assignment.

Returns:

a reference to this.

[TMat3](#)& [TMat3::operator *=](#) (const [TMat3](#) & *rhs*)

Assignment operator.

Parameters:

rhs The right-hand-side of the assignment.

Returns:

a reference to this.

[TMat3](#)& [TMat3::operator *=](#) ([TReal](#) *rhs*)

Assignment operator.

Parameters:

rhs The right-hand-side of the assignment.

Returns:

a reference to this.

[TMat3](#)& [TMat3::operator/=](#) ([TReal](#) *rhs*)

Assignment operator.

Parameters:

rhs The right-hand-side of the assignment.

Returns:

a reference to this.

TMat3& TMat3::Scale (TReal *x*, TReal *y*)

Scale this matrix in two dimensions.

Assumes that this matrix is used as a 2d matrix.

Parameters:

x Scale in X dimension.

y Scale in Y dimension.

Returns:

this matrix.

TMat3& TMat3::Scale (TReal *s*)

Scale this matrix.

Assumes this matrix is used as a 2d matrix.

Parameters:

s Amount to scale X and Y axes.

Returns:

this matrix.

static TMat3 TMat3::GetRotation (TReal *radians*) [static]

Get a rotation matrix.

Parameters:

radians Rotation in radians.

Returns:

A new matrix that represents the given rotation frame.

TMat3& TMat3::Rotate (TReal *radians*)

Rotate this matrix in place.

Parameters:

radians Radians to rotate the matrix by. Only changes the orientation portion of the matrix; position is unchanged.

Returns:

A reference to this matrix.

13.31.4 Friends And Related Function Documentation

bool operator==(const TMat3 & *lhs*, const TMat3 & *rhs*) [related]

Equality.

Returns:

True on equal.

bool operator!= (const TMat3 & lhs, const TMat3 & rhs) [related]

Inequality.

Returns:

True on not equal.

TVec3 operator * (const TMat3 & lhs, const TVec3 & rhs) [related]

Matrix multiplication with a vector.

Returns:

$M * v$

TVec2 operator * (const TMat3 & lhs, const TVec2 & rhs) [related]

Matrix multiplication with a vector.

Returns:

$M * v$

TVec3 operator * (const TVec3 & lhs, const TMat3 & rhs) [related]

Matrix multiplication with a vector.

Returns:

$v^T * M$

TVec2 operator * (const TVec2 & lhs, const TMat3 & rhs) [related]

Matrix multiplication with a vector.

Returns:

$v^T * M$

TMat3 operator * (const TMat3 & lhs, TReal rhs) [related]

Member-wise scaling of the vector.

Note this won't necessarily do what you want if you're trying to produce a scale vector. See [TMat3::Scale\(\)](#).

Returns:

$$\begin{vmatrix} a_{00} * s & a_{10} * s & a_{20} * s \\ a_{01} * s & a_{11} * s & a_{21} * s \\ a_{02} * s & a_{12} * s & a_{22} * s \end{vmatrix}$$

TVec2 Multiply2x2 (const TMat3 & lhs, const TVec2 & rhs) [related]

A restricted 2x2 matrix vector multiply.

Does the rotation/scaling but no translation of the vector.

Parameters:

lhs Matrix left-hand-side of the multiply
rhs Vector right-hand-side.

Returns:

Matrix[2x2]*Vector

[TVec2 Multiply2x2 \(const TVec2 & lhs, const TMat3 & rhs\)](#) [related]

A restricted 2x2 matrix vector multiply.

Does the rotation/scaling but no translation of the vector.

Parameters:

lhs Vector left-hand-side of the multiply
rhs Matrix right-hand-side.

Returns:

Vector*Matrix[2x2]

[TMat3 Multiply2x2 \(const TMat3 & lhs, const TMat3 & rhs\)](#) [related]

A restricted 2x2 matrix-matrix multiply.

Parameters:

lhs Matrix left-hand-side.
rhs Matrix right-hand-side.

Returns:

Matrix[2x2]*Matrix[2x2], with lhs[2] as the translation component.

[TVec2 operator% \(const TVec2 & lhs, const TMat3 & rhs\)](#) [related]

Restricted-multiply operator.

See also:

[Multiply2x2\(\)](#)

Returns:

Multiply2x2(lhs,rhs)

[TVec2 operator% \(const TMat3 & lhs, const TVec2 & rhs\)](#) [related]

Restricted-multiply operator.

See also:

[Multiply2x2\(\)](#)

Returns:

Multiply2x2(lhs,rhs)

[TMat3 operator% \(const TMat3 & lhs, const TMat3 & rhs\)](#) [related]

Restricted-multiply operator.

See also:[Multiply2x2\(\)](#)**Returns:**

Multiply2x2(lhs,rhs)

[TVec3](#) operator * (const [TVec3](#) & lhs, const [TMat4](#) & rhs) [related]

Matrix multiplication with a vector.

Returns: $v^T * M$

13.32 TMat4 Class Reference

```
#include <pf/mat.h>
```

13.32.1 Detailed Description

3d Matrix with 3x3 rotation component and [TVec3](#) offset component.

Construction and Initialization.

- [TMat4](#) ()
Default constructor.
- [TMat4](#) ([TReal](#) m00, [TReal](#) m01, [TReal](#) m02, [TReal](#) m03, [TReal](#) m10, [TReal](#) m11, [TReal](#) m12, [TReal](#) m13, [TReal](#) m20, [TReal](#) m21, [TReal](#) m22, [TReal](#) m23, [TReal](#) m30, [TReal](#) m31, [TReal](#) m32, [TReal](#) m33)
Construct from individual values.
- [TMat4](#) ([TVec4](#) v0, [TVec4](#) v1, [TVec4](#) v2, [TVec4](#) v3)
Construct from vectors.
- [TMat4](#) (const [TMat4](#) &rhs)
Copy construction.
- [TMat4](#) & [operator=](#) (const [TMat4](#) &rhs)
Assignment operator.
- [~TMat4](#) ()
Destruction.

Public Types

- enum { [kDIM](#) = 4 }

Public Member Functions

Accessors

- [TVec4](#) & [operator\[\]](#) ([TIndex](#) i)
Array Accessor.
- const [TVec4](#) & [operator\[\]](#) ([TIndex](#) i) const
Array Accessor.

Assignment operators.

- [TMat4](#) & [operator+=](#) (const [TMat4](#) &rhs)
Assignment.
- [TMat4](#) & [operator-=](#) (const [TMat4](#) &rhs)

Assignment.

- **TMat4 & operator *=** (const TMat4 &rhs)
Assignment.
- **TMat4 & operator *=** (TReal rhs)
Assignment.
- **TMat4 & operator /=** (TReal rhs)
Assignment.

Initializers.

- **TMat4 & Identity** ()
Make this matrix the identity.
- **TMat4 & LookAt** (const TVec3 &pos, const TVec3 &at, const TVec3 &up)
Change this matrix to be a view matrix that's oriented to "look at" a point.
- **TMat4 & Perspective** (TReal nearPlane, TReal farPlane, TReal fov, TReal aspect)
Make this matrix a perspective matrix.
- **TMat4 & OffsetPerspective** (TReal nearPlane, TReal farPlane, TReal fov, TReal aspect, const TVec2 &offsets)
Make this matrix an offset perspective matrix.
- **TMat4 & Orthogonal** (TReal left, TReal right, TReal bottom, TReal top, TReal zNear, TReal zFar)
Make this matrix an orthogonal projection matrix that transforms objects within the given box into view coordinates.

Manipulators

- **TMat4 & RotateAxis** (const TVec3 &axis, TReal a)
Rotate this matrix around an axis.
- **TMat4 & RotateX** (TReal a)
Rotate this matrix around the X axis.
- **TMat4 & RotateY** (TReal a)
Rotate this matrix around the Y axis.
- **TMat4 & RotateYPR** (TReal yaw, TReal pitch, TReal roll)
Rotate this matrix around all three axes, given as Yaw, Pitch, and Roll.
- **TMat4 & RotateZ** (TReal a)
Rotate this matrix around the Z axis.
- **TMat4 & Scale** (TReal x, TReal y, TReal z)
Scale this matrix.
- **TMat4 & Translate** (const TVec3 &v)
Translate this matrix by a vector.

Utility Mmbers

- [TMat4 Transpose \(\)](#) const
Return a transposed matrix.
- [TMat4 Adjoint \(\)](#) const
Matrix adjoint function.
- [TMat4 Inverse \(\)](#) const
Return an inverse of the matrix.
- [TReal Determinant \(\)](#) const
Calculate the determinant of the matrix.

Related Functions

(Note that these are not member functions.)

- [TMat3 operator *](#) (const [TMat3](#) &lhs, const [TMat3](#) &rhs)
Matrix multiplication.
- [bool operator==](#) (const [TMat4](#) &lhs, const [TMat4](#) &rhs)
Equality.
- [bool operator!=](#) (const [TMat4](#) &lhs, const [TMat4](#) &rhs)
Inequality.
- [TMat4 operator *](#) (const [TMat4](#) &lhs, const [TMat4](#) &rhs)
Matrix multiplication.
- [TVec4 operator *](#) (const [TMat4](#) &lhs, const [TVec4](#) &rhs)
Matrix multiplication with a vector.
- [TVec3 operator *](#) (const [TMat4](#) &lhs, const [TVec3](#) &rhs)
Matrix multiplication with a vector.
- [TVec4 operator *](#) (const [TVec4](#) &lhs, const [TMat4](#) &rhs)
Matrix multiplication with a vector.
- [TMat4 operator *](#) (const [TMat4](#) &lhs, [TReal](#) s)
Matrix scaling.
- [TMat4 operator/](#) (const [TMat4](#) &lhs, [TReal](#) s)
Matrix scaling.

13.32.2 Constructor & Destructor Documentation

[TMat4::TMat4 \(\)](#)

Default constructor.

Initializes to identity.

TMat4::TMat4 (const [TMat4](#) & *rhs*)

Copy construction.

Parameters:

rhs Copy source.

13.32.3 Member Function Documentation

TMat4& TMat4::operator= (const [TMat4](#) & *rhs*)

Assignment operator.

Parameters:

rhs Right hand side of the equation.

]

TVec4& TMat4::operator[] ([TIndex](#) *i*)

Array Accessor.

Parameters:

i The row number, from 0-2.

Returns:

a reference to the [TVec4](#) that represents the row.

]

const **TVec4& TMat4::operator[]** ([TIndex](#) *i*) const

Array Accessor.

Parameters:

i The row number, from 0-2.

Returns:

a reference to the [TVec4](#) that represents the row.

TMat4& TMat4::Identity ()

Make this matrix the identity.

Returns:

A reference to this.

TMat4& TMat4::LookAt (const [TVec3](#) & *pos*, const [TVec3](#) & *at*, const [TVec3](#) & *up*)

Change this matrix to be a view matrix that's oriented to "look at" a point.

Parameters:

pos Viewer position.

at Point we're looking at.

up Local "up" vector.

Returns:

A reference to this.

TMat4& TMat4::Perspective (TReal nearPlane, TReal farPlane, TReal fov, TReal aspect)

Make this matrix a perspective matrix.

Parameters:

nearPlane Distance from viewer to the near plane.

farPlane Distance from viewer to the far plane. The smaller your ratio of far to near, the higher Z-buffer resolution you get.

fov The field of view in radians.

aspect The aspect ratio of the resulting view.

Returns:

A reference to this.

TMat4& TMat4::OffsetPerspective (TReal nearPlane, TReal farPlane, TReal fov, TReal aspect, const TVec2 & offsets)

Make this matrix an offset perspective matrix.

In order to display a partially clipped 3d window (say you wanted to allow a window to scroll off the screen), you need to have a perspective matrix that has been skewed to display part of a larger projection.

Parameters:

nearPlane Distance from viewer to the near plane.

farPlane Distance from viewer to the far plane. The smaller your ratio of far to near, the higher Z-buffer resolution you get.

fov The field of view in radians.

aspect The aspect ratio of the resulting view.

offsets The amounts to skew the x and y portions of the matrix. If you want to clip 20% of the left edge, you'd set *offsets.x* to 0.2. Similarly if you want to clip 20% of the bottom edge, you'd set *y* to -0.2.

Returns:

A reference to this.

TMat4& TMat4::Orthogonal (TReal left, TReal right, TReal bottom, TReal top, TReal zNear, TReal zFar)

Make this matrix an orthogonal projection matrix that transforms objects within the given box into view coordinates.

Parameters:

left Left side of box.

right Right side of box.

bottom Bottom of box.

top Top of box.

zNear Near side of box.

zFar Far side of box.

Returns:

A reference to this.

TMat4& TMat4::RotateAxis (const TVec3 & axis, TReal a)

Rotate this matrix around an axis.

Parameters:

axis A unit vector that defines an axis to rotate around.
a Number of radians to rotate matrix.

Returns:

A reference to this.

TMat4& TMat4::RotateX (TReal a)

Rotate this matrix around the X axis.

Parameters:

a Number of radians to rotate matrix.

Returns:

A reference to this.

TMat4& TMat4::RotateY (TReal a)

Rotate this matrix around the Y axis.

Parameters:

a Number of radians to rotate matrix.

Returns:

A reference to this.

TMat4& TMat4::RotateYPR (TReal yaw, TReal pitch, TReal roll)

Rotate this matrix around all three axes, given as Yaw, Pitch, and Roll.

Parameters:

yaw Number of radians to rotate matrix around Y axis.
pitch Number of radians to rotate matrix around X axis.
roll Number of radians to rotate matrix around Z axis.

Returns:

A reference to this.

TMat4& TMat4::RotateZ (TReal a)

Rotate this matrix around the Z axis.

Parameters:

a Number of radians to rotate matrix.

Returns:

A reference to this.

TMat4& TMat4::Scale (TReal x, TReal y, TReal z)

Scale this matrix.

Parameters:

x Scale to apply to X axis.
y Scale to apply to Y axis.

z Scale to apply to Z axis.

Returns:

A reference to this.

TMat4& TMat4::Translate (const TVec3 & v)

Translate this matrix by a vector.

Parameters:

v Amount to translate.

Returns:

A reference to this.

TMat4 TMat4::Transpose () const

Return a transposed matrix.

Returns:

A new transposed matrix.

TMat4 TMat4::Inverse () const

Return an inverse of the matrix.

Returns:

An inverse copy of the matrix.

TReal TMat4::Determinant () const

Calculate the determinant of the matrix.

Returns:

The determinant.

13.32.4 Friends And Related Function Documentation

TMat3 operator * (const TMat3 & lhs , const TMat3 & rhs) [related]

Matrix multiplication.

Returns:

$M_1 * M_2$

bool operator== (const TMat4 & lhs , const TMat4 & rhs) [related]

Equality.

Returns:

True on equal.

bool operator!= (const TMat4 & lhs, const TMat4 & rhs) [related]

Inequality.

Returns:

True on not equal.

TMat4 operator * (const TMat4 & lhs, const TMat4 & rhs) [related]

Matrix multiplication.

Returns:

$M_1 * M_2$

TVec4 operator * (const TMat4 & lhs, const TVec4 & rhs) [related]

Matrix multiplication with a vector.

Returns:

$M * v$

TVec3 operator * (const TMat4 & lhs, const TVec3 & rhs) [related]

Matrix multiplication with a vector.

Returns:

$M * v$

TVec4 operator * (const TVec4 & lhs, const TMat4 & rhs) [related]

Matrix multiplication with a vector.

Returns:

$M * v$

TMat4 operator * (const TMat4 & lhs, TReal s) [related]

Matrix scaling.

Returns:

$$\begin{vmatrix} a_{00} * s & a_{10} * s & a_{20} * s & a_{30} * s \\ a_{01} * s & a_{11} * s & a_{21} * s & a_{31} * s \\ a_{02} * s & a_{12} * s & a_{22} * s & a_{32} * s \\ a_{03} * s & a_{13} * s & a_{23} * s & a_{33} * s \end{vmatrix}$$

TMat4 operator/ (const TMat4 & lhs, TReal s) [related]

Matrix scaling.

Returns:

$(1/s) * M$

13.33 TMaterial Struct Reference

```
#include <pf/pftypes.h>
```

13.33.1 Detailed Description

A rendering material.

Public Attributes

- [TColor mcDiff](#)
Diffuse value.
- [TColor mcAmb](#)
Ambient value.
- [TColor mcSpec](#)
Specular value.
- [TColor mcEmit](#)
Emit (glow) value.
- [TReal mfPower](#)
Specular reflectance. Zero to disable specular.

13.34 TMessage Class Reference

```
#include <pf/message.h>
```

13.34.1 Detailed Description

Application message base class.

Actual messages being passed around by the application will either use [TMessage](#) directly or derive from [TMessage](#), depending on whether they need additional payload.

Warning:

Never use C++ or C style casting to coerce a [TMessage](#) to another type; always use [GetCast<>\(\)](#). When a message is sent from Lua, it is wrapped in a [TLuaMessageWrapper](#), which will report the `mType` of the contained [TMessage](#)-derived message—and it has a `GetCast` operator that will give you the actual contained message. But casting it to your target object will result in undefined (and certainly incorrect) behavior, so it's best to always use `GetCast`.

Public Types

- enum [EMessageID](#) {
[kGeneric](#) = 0, [kCloseWindow](#) = 1, [kDefaultAction](#), [kButtonPress](#),
[kPressAnyKey](#), [kQuitNow](#), [kModalClosed](#), [kTextEditChanged](#),
[kCommandOnly](#), [kSliderValChanged](#), [kSliderMouseUp](#), [kSliderPageUp](#),
[kSliderPageDown](#), [kUserMessageBase](#) = 1000 }

System-level predefined message IDs.

Public Member Functions

- [TMessage](#) (int32_t type=[kGeneric](#), str name="", [TWindow](#) *destination=NULL)
Constructor.
- virtual [~TMessage](#) ()
Destructor.

Type Information and Casting

- [PFClassId](#) [ClassId](#) ()
Get the ClassId.
- virtual bool [IsKindOf](#) ([PFClassId](#) type)
Determine whether this message is derived from type.
- template<class TO> TO * [GetCast](#) ()
Safely cast this message to another type.

Public Attributes

- `int32_t mType`
The `EMessageID` of this message, or a user defined type (starting at `kUserMessageBase`).
- `str mName`
Name of this message.
- `TWindow * mDestination`
Optional `TWindow` destination.

13.34.2 Member Enumeration Documentation

enum `TMessage::EMessageID`

System-level predefined message IDs.

Start user message IDs at `kUserMessageBase`

Enumerator:

- kGeneric* A generic message—the derived class determines the type.
- kCloseWindow* Close the current window if you get this message ID.
- kDefaultAction* Trigger the default action (done by pressing "enter" equivalent).
- kButtonPress* Button pressed.
- kPressAnyKey* Unhandled user input.
- kQuitNow* Time to exit the application.
- kModalClosed* A modal window closed.
- kTextEditChanged* New information has been typed into/removed from a text edit field.
- kCommandOnly* This message is empty; it's being sent to run the accompanying command.
- kSliderValChanged* A slider value changed.
- kSliderMouseUp* The mouse has been released on a slider.
- kSliderPageUp* Someone clicked above the slider handle to create a virtual page-up.
- kSliderPageDown* Someone clicked below the slider handle to create a virtual page-down.
- kUserMessageBase* First ID available for client applications.

13.34.3 Member Function Documentation

`PFClassId TMessage::ClassId ()`

Get the `ClassId`.

Returns:

A `ClassId` that can be passed to `IsKindOf`.

See also:

[Type Information and Casting](#)

`bool TMessage::IsKindOf (PFClassId type) [virtual]`

Determine whether this message is derived from type.

Parameters:

type `ClassId()` of type to test.

See also:

[Type Information and Casting](#)

template<class TO> template< class TO > TO * TMessage::GetCast ()

Safely cast this message to another type.

Returns:

A cast pointer, or NULL.

See also:

[Type Information and Casting](#)

13.34.4 Member Data Documentation

str TMessage::mName

Name of this message.

For a button message, this is the name of the button that is sending the message.

13.35 TMessageListener Class Reference

```
#include <pf/messageListener.h>
```

13.35.1 Detailed Description

A message listener—a class that you override and register with the [TWindowManager](#) if you want to listen for broadcast messages.

Public Member Functions

- virtual [~TMessageListener](#) ()
Destructor.
- virtual bool [OnMessage](#) (TMessage *message)=0
This function will be called for each broadcast message that's delivered.

13.35.2 Member Function Documentation

virtual bool TMessageListener::OnMessage (TMessage * message) [pure virtual]

This function will be called for each broadcast message that's delivered.

Parameters:

message The message being delivered.

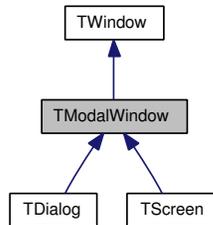
Returns:

True if the message was processed. No more searching for handlers will occur, and the message will be deleted by the caller if necessary.

13.36 TModalWindow Class Reference

```
#include <pf/modalwindow.h>
```

Inheritance diagram for TModalWindow:



13.36.1 Detailed Description

Base class for any window that can be a modal window.

Adds a number of functions to the default [TWindow](#):

- Handles tasks that are associated with a modal window.
- Manages a [TClock](#) that automatically gets paused when the modal is covered by another modal.
- Does some internal bookkeeping relevant to the window stack and opaque full-screen windows.
- Handles dispatching key messages to a default focus window.

Public Member Functions

- virtual bool [OnNewParent](#) ()
Handle any initialization or setup that is required when this window is assigned to a new parent.
- [TClock](#) * [GetClock](#) ()
Get a reference to the clock associated with this modal window.
- virtual void [PostChildrenInit](#) ([TWindowState](#) &style)
Do post-children-added initialization when being created from Lua.

Modal Window Task Handling

- void [AdoptTask](#) ([TTask](#) *task)
Add a task to the modal window's task list.
- bool [OrphanTask](#) ([TTask](#) *task)
Remove a task from the task list.
- void [DestroyTasks](#) ()
Destroy all tasks this window owns.

Focus Handling

- void [SetDefaultFocus](#) ([TWindow](#) *focus)

Set the window that will receive an "implicit" focus when no other window has the focus.

- [TWindow * GetDefaultFocus \(\)](#)

Get the current default focus.

Message handlers

TModalWindow handles these messages for you.

- virtual void [OnSetFocus \(TWindow *previous\)](#)
This window is receiving the keyboard focus.
- virtual bool [OnMessage \(TMessage *message\)](#)
Handle a message.
- virtual bool [OnChar \(char key\)](#)
Translated character handler.
- void [DoModalProcess \(TTask::ETaskContext context=TTask::eNormal\)](#)
Handles any modal processing that needs to happen.

13.36.2 Constructor & Destructor Documentation

TModalWindow::TModalWindow ()

Default constructor.

Sets window type to include kModal.

TModalWindow::TModalWindow ()

Default constructor.

Sets window type to include kModal.

13.36.3 Member Function Documentation

virtual bool TModalWindow::OnNewParent () [virtual]

Handle any initialization or setup that is required when this window is assigned to a new parent.

No initialization of the window has happened prior to this call.

Returns:

True on success; false on failure.

See also:

[Init](#)
[PostChildrenInit](#)

Reimplemented from [TWindow](#).

Reimplemented in [TDialog](#).

void TModalWindow::AdoptTask (TTask * task)

Add a task to the modal window's task list.

Task list takes ownership of the task and will delete it when the task notifies that it is complete.

Parameters:

task Task to add.

bool TModalWindow::OrphanTask (TTask * task)

Remove a task from the task list.

Does not delete the task, but rather releases ownership; calling function now owns task.

Parameters:

task Task to remove.

Returns:

true if task was removed, false if task was not found

void TModalWindow::DestroyTasks ()

Destroy all tasks this window owns.

Used when the window is about to be destroyed.

Destruction is "safe"—tasks will be added to a destroy list if the list is being iterated.

void TModalWindow::SetDefaultFocus (TWindow * focus)

Set the window that will receive an "implicit" focus when no other window has the focus.

Parameters:

focus Default focus target. NULL to remove the default focus.

virtual void TModalWindow::OnSetFocus (TWindow * previous) [virtual]

This window is receiving the keyboard focus.

Parameters:

previous The window that was previously focused. Can be NULL.

Reimplemented from [TWindow](#).

virtual bool TModalWindow::OnMessage (TMessage * message) [virtual]

Handle a message.

Parameters:

message Payload of message.

Returns:

True if message handled; false otherwise.

Reimplemented from [TWindow](#).

Reimplemented in [TDialog](#).

virtual bool TModalWindow::OnChar (char *key*) [virtual]

Translated character handler.

Parameters:

key Key hit on keyboard, along with shift translations.

Returns:

true if message was handled, false to keep searching for a handler.

Reimplemented from [TWindow](#).

void TModalWindow::DoModalProcess (TTask::ETaskContext *context* = TTask::eNormal)

Handles any modal processing that needs to happen.

Processes tasks in the task list. This is called internally by the system once per frame in [TTask::eNormal](#) state and once in [TTask::eOnDraw](#) state.

Parameters:

context The context the processes should be called in.

TClock* TModalWindow::GetClock ()

Get a reference to the clock associated with this modal window.

This clock will be automatically paused and unpaused when other modal windows hide and reveal this modal window.

Returns:

A pointer to the clock.

virtual void TModalWindow::PostChildrenInit (TWindowStyle & *style*) [virtual]

Do post-children-added initialization when being created from Lua.

Any initialization that needs to happen after a window's children have been added can be placed in a derived version of this function.

Warning:

Remember to always call the base class if you're overriding this function.

Parameters:

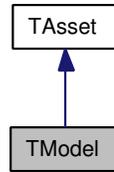
style Current style environment that this window was created in.

Reimplemented from [TWindow](#).

13.37 TModel Class Reference

```
#include <pf/model.h>
```

Inheritance diagram for TModel:



13.37.1 Detailed Description

A 3d model.

Public Member Functions

- void [Draw](#) ()
Draw the model using the current texture, material, and transformation matrix.
- bool [Pick](#) (uint32_t iWndX, uint32_t iWndY, TReal *pfPickDist, TVec3 *pvHit)
Cast a ray at the model and determine whether it's been hit.
- str [GetName](#) ()
Get the name of the asset as it was created.
- long [GetPolyCount](#) ()
Get the number of polygons (triangles) in the model.
- uint32_t [GetTriangleCount](#) ()
Get the number of triangles in the triangle array.
- const uint16_t * [GetTriangles](#) ()
Get a pointer to an array of uint16_t values triples that indicate vertex indices that define triangles.
- const TVert * [GetVertices](#) ()
Get an array of the model's vertices.
- uint32_t [GetVertexCount](#) ()
Get the number of vertices in the model.
- TModelRef [GetRef](#) ()
Get a reference to this asset. Do not call in a constructor!

Static Public Member Functions

- static TModelRef [Get](#) (str assetName)
Factory.

Public Attributes

- TModelData * [mData](#)
Implementation details.

Protected Member Functions

- virtual void [Restore](#) ()
Restore an asset.
- virtual void [Release](#) ()
Release an asset.

13.37.2 Member Function Documentation

void TModel::Draw ()

Draw the model using the current texture, material, and transformation matrix.

Any texture used with [TModel::Draw](#) must be square and have dimensions that are powers of two.

bool TModel::Pick (uint32_t iWndX, uint32_t iWndY, TReal * pfPickDist, TVec3 * pvHit)

Cast a ray at the model and determine whether it's been hit.

Uses current transformation matrix to position model.

Parameters:

iWndX X in [TScreen](#) coordinates.

iWndY Y in [TScreen](#) coordinates.

pfPickDist Pointer to a float that starts out initialized to the maximum distance the cast ray should collide with polygons. On return contains the actual distance from the screen to the model.

pvHit The 3d point where the cast ray intersects the model.

Returns:

True if model hit; false otherwise.

str TModel::GetName ()

Get the name of the asset as it was created.

Returns:

The name of the asset.

long TModel::GetPolyCount ()

Get the number of polygons (triangles) in the model.

Deprecated

This function will be replaced by [GetTriangleCount\(\)](#).

Returns:

Number of triangles.

uint32_t TModel::GetTriangleCount ()

Get the number of triangles in the triangle array.

Returns:

Number of triangles.

const uint16_t* TModel::GetTriangles ()

Get a pointer to an array of uint16_t values triples that indicate vertex indices that define triangles.

Returns:

A pointer to triangle indices.

const TVert* TModel::GetVertices ()

Get an array of the model's vertices.

Returns:

A pointer to an array of [TVert](#) vertices.

See also:

[GetVertexCount](#)

uint32_t TModel::GetVertexCount ()

Get the number of vertices in the model.

Returns:

A count of vertices in the vertex array.

See also:

[GetVertices](#)

static TModelRef TModel::Get (str *assetName*) [static]

Factory.

Parameters:

assetName Asset id of the model

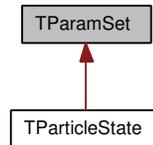
Returns:

A TModelRef of the model

13.38 TParamSet Class Reference

```
#include <pf/luaparticlesystem.h>
```

Inheritance diagram for TParamSet:



13.38.1 Detailed Description

A set of parameters or return values, depending on context.

Public Member Functions

- void [ResetPartial](#) (uint32_t base, uint8_t *s, uint32_t count)
Reload part of a ParamSet with return parameters.
- void [Reset](#) (uint8_t *s, uint32_t count)
Reload a ParamSet with return parameters.
- [TParamSet](#) (TReal *p, uint8_t *s, uint32_t count)
Create a TParamSet.
- uint8_t [GetCount](#) ()
Get the current parameter count.
- uint32_t [GetOffset](#) (uint8_t param)
Get the offset of the nth entry in the set.
- uint8_t [GetSize](#) (uint8_t entry)
Get the size of a particular entry.
- void [Redirect](#) (TReal *p)
Point this at a new parameter set (typically a new particle).
- template<typename Type> Type & [Param](#) (uint8_t param)
Parameter extractor.
- TReal & [GetReal](#) (uint32_t index)
Get a raw real value.
- TReal [GetReal](#) (uint32_t index) const
Get a raw real value.

Static Public Attributes

- static const uint32_t `kMaxParams` = 255
The maximum number of parameters that can be passed.

13.38.2 Constructor & Destructor Documentation

TParamSet::TParamSet (TReal * *p*, uint8_t * *s*, uint32_t *count*)

Create a [TParamSet](#).

Parameters:

- p* Set of parameter values (must be count*4 in TReals)
- s* Sizes of parameters (must be count int8_t values)
- count* Number of parameters.

13.38.3 Member Function Documentation

void TParamSet::ResetPartial (uint32_t *base*, uint8_t * *s*, uint32_t *count*)

Reload part of a ParamSet with return parameters.

Parameters:

- base* New first parameter in set
- s* A pointer to a local list of parameter sizes (number of floats in each parameter).
- count* Number of parameters. Must be less than or equal to original parameter count.

void TParamSet::Reset (uint8_t * *s*, uint32_t *count*)

Reload a ParamSet with return parameters.

Parameters:

- s* A pointer to a local list of parameter sizes (number of floats in each parameter).
- count* Number of parameters. Must be less than or equal to original parameter count.

uint8_t TParamSet::GetCount ()

Get the current parameter count.

Returns:

Number of parameters in the set.

Reimplemented in [TParticleState](#).

uint32_t TParamSet::GetOffset (uint8_t *param*)

Get the offset of the nth entry in the set.

Parameters:

- param* Parameter entry to query.

Returns:

Offset (in TReals) into the set.

Reimplemented in [TParticleState](#).

uint8_t TParamSet::GetSize (uint8_t *entry*)

Get the size of a particular entry.

Parameters:

entry Entry to query.

Returns:

Size (in TReals) of entry.

void TParamSet::Redirect (TReal * *p*)

Point this at a new parameter set (typically a new particle).

Parameters:

p

Reimplemented in [TParticleState](#).

template<typename Type> Type& TParamSet::Param (uint8_t *param*)

Parameter extractor.

Parameters:

Type Type of parameter to extract.

param Parameter base (which parameter number this is)

Returns:

A reference of type Type to the parameter that can be read or written to.

Reimplemented in [TParticleState](#).

TReal& TParamSet::GetReal (uint32_t *index*)

Get a raw real value.

Parameters:

index Index of real to extract.

Returns:

A value in the set.

Reimplemented in [TParticleState](#).

TReal TParamSet::GetReal (uint32_t *index*) const

Get a raw real value.

Parameters:

index Index of real to extract.

Returns:

A value in the set.

13.39 TParticleFunction Class Reference

```
#include <pf/luaparticlesystem.h>
```

13.39.1 Detailed Description

A user data source.

Public Member Functions

- virtual void [InitFrame](#) ()
Optional initializer that's called once per particle render frame.
- virtual uint8_t [GetReturnSize](#) (int paramCount, uint8_t *sizes)=0
Initialize parameters.
- virtual bool [Process](#) (TParticleState &particle, TParticleMachineState ¶ms)=0
Process function or fetch data.
- PFClassId [ClassId](#) ()
The class id of this class.
- virtual bool [IsKindOf](#) (int type)
Query whether this class IsKindOf another class.
- template<class TO> TO * [GetCast](#) ()
Safely cast this class to another class.

Static Public Member Functions

- static TParticleFunction * [CreateFromId](#) (PFClassId id)
Dynamic creation.

13.39.2 Member Function Documentation

virtual uint8_t TParticleFunction::GetReturnSize (int paramCount, uint8_t * sizes) [pure virtual]

Initialize parameters.

For DataSource functions, incoming parameters will always be

Parameters:

paramCount Number of parameters in array.
sizes Pointer to size array (NULL for registered data sources).

Returns:

Size of parameter in TReals.

virtual bool TParticleFunction::Process (TParticleState & *particle*, TParticleMachineState & *params*) [pure virtual]

Process function or fetch data.

Parameters:

particle Particle being processed.

params [in/out] parameters

Returns:

True on success; false if parameters are incorrect.

virtual bool TParticleFunction::IsKindOf (int *type*) [virtual]

Query whether this class IsKindOf another class.

Parameters:

type The ClassId of the class to compare to.

Returns:

True if class is, or is derived from, target class.

template<class TO> TO* TParticleFunction::GetCast ()

Safely cast this class to another class.

Parameters:

TO Class to convert to.

Returns:

A cast pointer, or NULL if this class is unrelated to the target.

13.40 TParticleMachineState Class Reference

```
#include <pf/luaparticlesystem.h>
```

13.40.1 Detailed Description

The internal state of a [TLuaParticleSystem](#).

Public Member Functions

- [TParticleMachineState](#) (TParamSet ¶mSet, TLuaParticleSystem *lps)
A set of function parameters.
- `template<typename Type> Type & Param` (int8_t param)
Parameter extractor.
- `TReal & GetReal` (uint32_t index)
Get a TReal value directly from the stack.
- `uint8_t GetSize` (int8_t param)
Get the size of one of the parameters.
- `void Push` (TReal *r, uint8_t size)
Push a value onto the stack.
- `template<typename Type> void Push` (Type value)
Push a value onto the stack.
- `void Leave` ()
Exit a function (removes any remaining parameters; a NOP if the function pushed any return values).
- `uint8_t GetCount` ()
Get the local parameter count.
- `uint32_t GetOffset` (uint8_t param)
Get the offset of a parameter on the stack.
- `void InitReturnValues` (uint8_t *s, uint32_t count)
Reload with return parameters.
- `void SetNumParams` (uint8_t num)
Set the number of parameters being passed to the current function.
- `uint8_t GetNumParams` ()
Get the number of parameters passed.
- `TParticleFunction * GetDataSource` (int32_t source)
Get a registered data source by index.

13.40.2 Constructor & Destructor Documentation

TParticleMachineState::TParticleMachineState (TParamSet & paramSet, TLuaParticleSystem * lps)

A set of function parameters.

Parameters:

paramSet The stack to initialize function parameters from.
lps A pointer to the associated TLuaParticleSystem.

13.40.3 Member Function Documentation

template<typename Type> Type& TParticleMachineState::Param (int8_t param)

Parameter extractor.

Parameters:

Type Type of parameter to extract.
param Parameter base (which parameter number this is)

Returns:

A Type reference that can be read or written to.

TReal& TParticleMachineState::GetReal (uint32_t index)

Get a TReal value directly from the stack.

Parameters:

index Index of value.

Returns:

The value from the stack.

uint8_t TParticleMachineState::GetSize (int8_t param)

Get the size of one of the parameters.

Parameters:

param Parameter to query.

Returns:

Size of parameter.

void TParticleMachineState::Push (TReal * r, uint8_t size)

Push a value onto the stack.

Parameters:

r Pointer to the value array.
size Size of the value array.

template<typename Type> void TParticleMachineState::Push (Type value)

Push a value onto the stack.

Invalidates incoming parameter list.

Parameters:

Type
value

uint8_t TParticleMachineState::GetCount ()

Get the local parameter count.

Returns:

Number of parameters in the set.

uint32_t TParticleMachineState::GetOffset (uint8_t param)

Get the offset of a parameter on the stack.

Parameters:

param The parameter number to retrieve. The stack is an array of TReal values, but they logically group into parameters, so if the first parameter is a Vec3(), the second parameter offset will be 3.

Returns:

The offset to the requested parameter.

void TParticleMachineState::InitReturnValues (uint8_t * s, uint32_t count)

Reload with return parameters.

Parameters:

s A pointer to a local list of parameter sizes (number of floats in each parameter).
count Number of return values.

void TParticleMachineState::SetNumParams (uint8_t num)

Set the number of parameters being passed to the current function.

Parameters:

num Number of parameters

uint8_t TParticleMachineState::GetNumParams ()

Get the number of parameters passed.

Returns:

The number of incoming parameters.

TParticleFunction* TParticleMachineState::GetDataSource (int32_t source)

Get a registered data source by index.

Parameters:

source Data source index to read (must be negative).

Returns:

The data source.

13.41 ParticleMember Struct Reference

```
#include <pf/luaparticlesystem.h>
```

13.41.1 Detailed Description

A particle member value.

When additional values are added to a particle (beyond what exists in the base particle values), each is allocated as a [ParticleMember](#).

Public Member Functions

- [ParticleMember](#) (int16_t base=0, uint16_t size=0)
Constructor.

Public Attributes

- int16_t [mBase](#)
Index in TReals into the particle.
- uint16_t [mSize](#)
Size of this member.

13.41.2 Constructor & Destructor Documentation

ParticleMember::ParticleMember (int16_t *base* = 0, uint16_t *size* = 0)

Constructor.

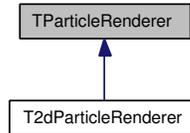
Parameters:

- base* Base index (in TReals) of this member.
- size* Size of this member in TReals.

13.42 TParticleRenderer Class Reference

```
#include <pf/particlerenderer.h>
```

Inheritance diagram for TParticleRenderer:



13.42.1 Detailed Description

The abstract particle renderer class: This class is used by [TLuaParticleSystem](#) to wrap an actual particle renderer. This way you can use [TLuaParticleSystem](#) to drive the default 2d particle system or other more complex systems.

Public Member Functions

- virtual void [Draw](#) (const [TVec3](#) &at, [TReal](#) alpha, const ParticleList &particles, int maxParticles)=0
Render the particles.
- virtual void [SetTexture](#) ([TTextureRef](#) texture)=0
Set the texture for the particle.
- virtual void [SetRendererOption](#) (str option, const [TReal](#)(&value)[4])=0
Set a renderer-specific option.
- virtual [TReal](#) * [GetPrototypeParticle](#) ()=0
Get an initialized particle that will be copied over each particle after creation but before running initializers.
- virtual uint32_t [GetPrototypeParticleSize](#) ()=0
Size of the array of TReals returned by GetPrototypeParticle.

13.42.2 Member Function Documentation

virtual void TParticleRenderer::Draw (const [TVec3](#) & at, [TReal](#) alpha, const ParticleList & particles, int maxParticles) **[pure virtual]**

Render the particles.

Parameters:

at Location to render particles.

alpha Alpha to render particles with.

particles The list of particles to render.

maxParticles The maximum number of particles this particle system is expecting to render. MUST be greater than the number of particles or Bad Things will happen.

Implemented in [T2dParticleRenderer](#).

virtual void TParticleRenderer::SetTexture (TTextureRef *texture*) [pure virtual]

Set the texture for the particle.

Parameters:

texture Texture to use.

Implemented in [T2dParticleRenderer](#).

virtual void TParticleRenderer::SetRendererOption (str *option*, const TReal & *value*[4]) [pure virtual]

Set a renderer-specific option.

Parameters:

option Option to set.

value Value to set option to, in the form of an array of TReals. Not all values in array are relevant for all options.

Implemented in [T2dParticleRenderer](#).

virtual TReal* TParticleRenderer::GetPrototypeParticle () [pure virtual]

Get an initialized particle that will be copied over each particle after creation but before running initializers.

Returns:

A pointer to an array of TReals.

Implemented in [T2dParticleRenderer](#).

virtual uint32_t TParticleRenderer::GetPrototypeParticleSize () [pure virtual]

Size of the array of TReals returned by GetPrototypeParticle.

Returns:

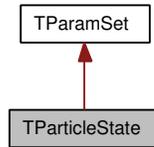
Number of reals.

Implemented in [T2dParticleRenderer](#).

13.43 TParticleState Class Reference

```
#include <pf/luaparticlesystem.h>
```

Inheritance diagram for TParticleState:



13.43.1 Detailed Description

A particle state.

A particle state is made up of some number of floating point values and an indication of elapsed milliseconds.

Note the private inheritance: We don't want to expose [TParamSet::Reset](#) on a [TParticleState](#), but we want the [TParamSet](#) implementation.

Public Member Functions

- [TParticleState](#) ([TReal](#) *p, [uint8_t](#) *s, [uint32_t](#) count, [uint32_t](#) ms)
Constructor.
- `template<typename Type> Type & Param (uint8_t param)`
Parameter extractor.
- [TReal](#) & [GetReal](#) ([uint32_t](#) index)
Get a raw real value.
- [uint32_t](#) [GetOffset](#) ([uint8_t](#) param)
Get the offset of the nth entry in the set.
- `void Redirect (TReal *p)`
Point this at a new parameter set (typically a new particle).
- [uint32_t](#) [GetCount](#) ()
Get the current parameter count.
- [uint32_t](#) [GetMS](#) ()
Get the number of milliseconds being processed.
- `bool GetAlive ()`
Query whether this particle is still alive.
- `void KillParticle ()`
Kill this particle (mark for destruction).

13.43.2 Constructor & Destructor Documentation

TParticleState::TParticleState (TReal * *p*, uint8_t * *s*, uint32_t *count*, uint32_t *ms*)

Constructor.

Parameters:

- p* A pointer to an array of TReals that will be used as the dynamic particle state. Must be count*4 TReals.
- s* A pointer to an array of bytes that indicate parameter sizes.
- count* The number of members in the particle.
- ms* The number of milliseconds that have passed in this time step.

13.43.3 Member Function Documentation

template<typename Type> Type& TParticleState::Param (uint8_t *param*)

Parameter extractor.

Parameters:

- Type* Type of parameter to extract.
- param* Parameter base (which parameter number this is)

Returns:

A Type reference that can be read or written to.

Reimplemented from [TParamSet](#).

TReal& TParticleState::GetReal (uint32_t *index*)

Get a raw real value.

Parameters:

- index* Index of real to extract.

Returns:

A value in the set.

Reimplemented from [TParamSet](#).

uint32_t TParticleState::GetOffset (uint8_t *param*)

Get the offset of the nth entry in the set.

Parameters:

- param* Parameter entry to query.

Returns:

Offset (in TReals) into the set.

Reimplemented from [TParamSet](#).

void TParticleState::Redirect (TReal * *p*)

Point this at a new parameter set (typically a new particle).

Parameters:

- p*

Reimplemented from [TParamSet](#).

uint32_t TParticleState::GetCount ()

Get the current parameter count.

Returns:

Number of parameters in the set.

Reimplemented from [TParamSet](#).

uint32_t TParticleState::GetMS ()

Get the number of milliseconds being processed.

Returns:

Time elapsed in milliseconds.

bool TParticleState::GetAlive ()

Query whether this particle is still alive.

Returns:

True if alive.

13.44 TPfHiscores Class Reference

```
#include <pf/pfhiscores.h>
```

13.44.1 Detailed Description

TPfHiScores - class that manages local and global hiscore saving and viewing.

This is the backend class for managing hiscores. It has the ability to save and load local hiscores as well as submit and retrieve hiscores from the server.

For information about how to test your hiscore implementation against a debug server, please see the [PlayFirst Global High Scores](#) information.

Localization - the hiscore system can be localized by including a file called "hiscore.xml" in the same data directory as the .dll or the .exe if you are using a static lib. The contents of this xml file should be:

<pre><hiscore> <language>en</language> <defaulterror>Unable to connect to server. Please try again later.</defaulterror> </hiscore></pre>	XML
---	-----

The language parameter will override any setting used with eLanguage property in [SetProperty\(\)](#). Language should be ISO-639 (e.g. "en", "jp", "fr", "en_CA"). The default error string is what is displayed in the case of not being able to connect to the server.

Public Types

- enum [EStatus](#) { [eSuccess](#) = 0, [ePending](#), [eError](#) }
After sending a request to the hiscore server, this is the status of the request.
- enum [EProperty](#) { [eLanguage](#) = 0, [ePlayerName](#), [eGameMode](#) }
The various properties that can be set for the hiscore module.
- enum [EUserScore](#) { [eLocalEligible](#) = 0, [eGlobalBest](#) }
The various modes for calling [GetUserBestScore\(\)](#).

Public Member Functions

- [TPfHiscores](#) (bool saveData=true)
Default constructor.
- [~TPfHiscores](#) ()
Default destructor.
- void [SetProperty](#) ([EProperty](#) property, const char *value)
Sets a given property.
- void [LogScore](#) (int32_t score, bool replaceExisting, const char *gameData, const char *serverData=NULL)
Log a score for the current player.
- bool [GetRememberedUserInfo](#) (str *userName, str *password)

Retrieves a username and password if one has been saved.

- void **SetRememberedUserInfo** (const char *userName, const char *password)
Saves a user name and password.
- void **RequestCategoryInformation** ()
Submit a request to the server to retrieve category information.
- int32_t **GetCategoryCount** ()
Return the number of categories available for hiscores.
- bool **GetCategoryName** (int32_t n, char *name, uint32_t bufSize)
Fill in a table name.
- void **RequestScores** (int32_t categoryIndex)
Submit a request to the server to retrieve hiscores.
- **EStatus** **GetServerRequestStatus** (char *msg, uint32_t bufLen, bool *pQualified)
Return the status of the last server request.
- int32_t **GetScoreCount** (bool local)
Retrieve the number of scores currently downloaded from the server.
- bool **GetScore** (bool local, int32_t n, int32_t *pRank, char *name, uint32_t bufSize, bool *pAnonymous, int32_t *pScore, char *gameData, uint32_t gameDataBufferSize)
Fill in all the various score information for a given score.
- bool **GetUserBestScore** (**EUserScore** userScore, int32_t *pScore, int32_t *pRank, char *gameData, uint32_t gameDataBufferSize)
Fill in all the various score information for a given user.
- bool **SubmitScore** (const char *username, const char *password, bool bRemember)
Submit a new score to the server.
- bool **SubmitMedals** (const char *medalsData, const char *username, const char *password, bool bRemember)
Submit medal information for the current player to the server.
- void **ClearScores** ()
Clear the local scores for the current game mode.
- uint32_t **EncryptData** (const void *toEncrypt, uint32_t len, char *buf, uint32_t bufLen)
Encrypt a byte stream.
- uint32_t **DecryptData** (const char *toDecrypt, void *buf, uint32_t bufLen)
Decrypt a string.

13.44.2 Constructor & Destructor Documentation

TPfHiscores::TPfHiscores (bool *saveData* = true)

Default constructor.

This initializes the hiscores system. Among other things, it loads in a preference file off disk which contains all the stored local scores.

The game name and encryption key must be set in the global configuration prior to constructing. See [TPlatform::SetConfig\(\)](#) for details. For standalone builds, see the standalone hiscore documentation.

Parameters:

saveData Whether or not data should be saved between sessions, default is true. For example, in a web game you might not want scores to persist between sessions, in which case *saveData* should be false.

13.44.3 Member Function Documentation

void TPfHiscores::SetProperty (EProperty *property*, const char * *value*)

Sets a given property.

Parameters:

property Which property to set. eLanguage - which language to set (ISO-639 (e.g. "en", "jp", "fr", "en_CA")). The default language is "en". Note that this property will have no effect if you are using the "hiscore.xml" localization file described above. ePlayerName - This is the local player name. This will be used for logging and returning local scores. eGameMode - Once the game mode is set, it will be used for all score submission and retrievals.

value Value to set the property to (for example, if *property* is eLanguage, *value* might be "en").

void TPfHiscores::LogScore (int32_t *score*, bool *replaceExisting*, const char * *gameData*, const char * *serverData* = NULL)

Log a score for the current player.

This stores a score fore the current player into the local score table. A score must be logged before it can be submitted. The score is logged for the player name set with SetPlayerName()

Parameters:

score the score the user is submitting

replaceExisting should this score submission replace an existing user score, or create a new one? Typical usage is that story/career mode games replace an existing score, whereas arcade modes allow a new score with each submission.

gameData game specific scoring information (up to 60 chars supported by server) - it is important that this be data that is additional scoring information (i.e. last level reached) and not scoring interpretation information (i.e. awarded the "Best Ever" trophy) so that the server can adjust awards later on. Also, this game data should not include any text that would need to be localized. Therefore, it should just be numbers if at all possible.

serverData an optional XML formatted string that will enable certain hiscore-related features on the hiscore server. The XML must be well-formed.

Currently available features are:

Medals: Medals are awards given to users that complete certain tasks in the game. A medal has two parameters. The "name" parameter is the identification name of the medal. The "per" parameter can either be "type" or "game" - "type" means that this medal is specific to the current game mode, whereas "game" means that this medal is a global medal awarded across all game modes.

Examples: To submit 2 medals for this score:

```
<medal name="medal1" per="game"/>
<medal name="medal2" per="type"/>
```

XML

bool TPfHiscres::GetRememberedUserInfo (str * *userName*, str * *password*)

Retrieves a username and password if one has been saved.

If the user submits their score with the bRemember flag set to true, then the username and password are saved, so that next time the user does not have to type them again.

Parameters:

userName str to hold user name
password str to hold password

Returns:

- if the user/pass have been saved, this returns true and fills in the user/pass. if it has not been saved, it returns false and does nothing to username and password.
 If the user/pass have been saved, this returns true and fills in the user/pass. If it has not been saved, it returns false and does nothing to the username and password.

void TPfHiscres::SetRememberedUserInfo (const char * *userName*, const char * *password*)

Saves a user name and password.

Saves a user name and password without logging any score information.

Parameters:

userName If NULL or "" will delete any previously saved information.
password If NULL or "" will delete any previously saved information.

void TPfHiscres::RequestCategoryInformation ()

Submit a request to the server to retrieve category information.

After calling this function, [GetServerRequestStatus\(\)](#) must be polled until a result is ready.

int32_t TPfHiscres::GetCategoryCount ()

Return the number of categories available for hiscores.

You must have retrieved the category information with [RequestCategoryInformation\(\)](#) first.

Returns:

Number of categories available.

bool TPfHiscres::GetCategoryName (int32_t *n*, char * *name*, uint32_t *bufSize*)

Fill in a table name.

You must have retrieved the category information with [RequestCategoryInformation\(\)](#) first.

Parameters:

n Which category to fetch.
 → *name* Fills in category's name
bufSize Size of name buffer.

Returns:

Returns false if category information has not been properly initialized.

void TPfHiscores::RequestScores (int32_t categoryIndex)

Submit a request to the server to retrieve hiscores.

After calling this function, [GetServerRequestStatus\(\)](#) must be polled until a result is ready.

Parameters:

categoryIndex Which category is requested (use [GetCategoryCount\(\)](#) to see how many categories are available)

EStatus TPfHiscores::GetServerRequestStatus (char * msg, uint32_t bufLen, bool * pQualified)

Return the status of the last server request.

After calling any function that contacts the server, this function must be polled until a result is ready.

Parameters:

msg If EStatus is eError, an error message will be placed inside msg

bufLen Buffer length of msg.

pQualified For [SubmitScore\(\)](#), if EStatus is eSuccess, this fills in whether or not the score qualified for a global record.

Returns:

The current status of the request. If it is eError, the request failed and the message inside msg should be displayed to the user.

int32_t TPfHiscores::GetScoreCount (bool local)

Retrieve the number of scores currently downloaded from the server.

To retrieve a server score, you must have retrieved the score information with [RequestScores\(\)](#) first.

Parameters:

local True to retrieve for local scores.

Returns:

Number of scores.

bool TPfHiscores::GetScore (bool local, int32_t n, int32_t * pRank, char * name, uint32_t bufSize, bool * pAnonymous, int32_t * pScore, char * gameData, uint32_t gameDataBufferSize)

Fill in all the various score information for a given score.

To retrieve a server score, you must have retrieved the score information with [RequestScores\(\)](#) first.

Parameters:

local True for local high scores, false for global.

n Index into the score table.

→ *pRank* Fills in score's rank in current table.

→ *name* Fills in player's name.

bufSize Size of name buffer.

→ *pAnonymous* Fills in whether score is anonymous or not.

→ *pScore* Fills in score

→ *gameData* Fills in game specific data

gameDataBufferSize Size of gameData buffer that can be filled in.

Returns:

Returns false if scores are not properly initialized.

bool TPfHiscores::GetUserBestScore (EUserScore userScore, int32_t * pScore, int32_t * pRank, char * gameData, uint32_t gameDataBufferSize)

Fill in all the various score information for a given user.

Depending on the userScore type passed in, different score information will be filled in.

Parameters:

userScore Type of score to fetch: eLocalEligible - the user's best local score eligible for submission (one that has not already been submitted). eGlobalBest - the user's best score on the current global score table (obtained from [RequestScores\(\)](#)).

→ *pScore* Fills in the user's score.

→ *pRank* Fills in score's rank in current table.

→ *gameData* Fills in game specific data.

gameDataBufferSize Size of gameData buffer that can be filled in.

Returns:

Returns false if the user has no eligible score, or if the game cannot find a user score in the current table.

bool TPfHiscores::SubmitScore (const char * username, const char * password, bool bRemember)

Submit a new score to the server.

After calling this, you should poll [GetServerRequestStatus\(\)](#) to check for errors or successful submission.

Parameters:

username Name to submit the score under.

password The user's playfirst password. If this is NULL or "", then an anonymous submission is issued.

bRemember If this is true, then the module saves the username and password for future use. If it is false, it deletes any previously saved username and password.

Returns:

If score submission is not possible, this returns false (i.e. the player has already submitted their best score, or if they do not have any scores for this game mode, etc.).

bool TPfHiscores::SubmitMedals (const char * medalsData, const char * username, const char * password, bool bRemember)

Submit medal information for the current player to the server.

After calling this, you should poll [GetServerRequestStatus\(\)](#) to check for errors or successful submission

This stores the medals information for the current player into the local score table. The medals information must be logged before it can be submitted. The medals are logged for the player name set with [SetPlayerName\(\)](#)

Parameters:

medalsData A well-formed XML string that specifies medal information to be stored on the server.

username Name to submit the score under.

password The user's playfirst password.

bRemember If this is true, then the module saves the username and password for future use. if it is false, it deletes any previously saved username and password.

Returns:

If the medals submission is not possible, this returns false.

Medals are awards given to users that complete certain tasks in the game. A medal has two parameters. The "name" parameter is the identification name of the medal. The "per" parameter can either be "type" or "game" - "type" means that this medal is specific to the current game mode, whereas "game" means that this medal is a global medal awarded across all game modes.

Examples:

```
<medal name="dinerdash7_frag50" per="type" type="dinerdash7_counterstrike"/>
<medal name="dinerdash7_frag50" per="type" type="dinerdash7_fragfest"/>
<medal name="dinerdash7_frag100" per="type" type="dinerdash7_fragfest"/>
<medal name="dinerdash7_killedRonaldMcDonald" per="game"/>
<medal name="dinerdash7_killedBurgerKing" per="game"/>
```

XML

void TPfHiscores::ClearScores ()

Clear the local scores for the current game mode.

This will delete the current local scores for the current game mode. It cannot be undone.

uint32_t TPfHiscores::EncryptData (const void * toEncrypt, uint32_t len, char * buf, uint32_t bufLen)

Encrypt a byte stream.

This will encrypt the passed in byte stream, and returns a string encoded in base64 (so it can be passed around like a string).

Parameters:

toEncrypt The bytestream that is to be encrypted.

len The length of data to encrypt - note that if you are encrypting a text string you will want to encrypt the null terminator too, so you should pass in `strlen(toEncrypt) + 1`.

→ *buf* The buffer to fill in with the encrypted string.

bufLen The size of the buffer. If this is too small, the function will return the size needed to encrypt the string, and will not fill in *buf* at all.

Returns:

0 on success, or else returns the length of the buffer needed to encrypt this string.

uint32_t TPfHiscores::DecryptData (const char * toDecrypt, void * buf, uint32_t bufLen)

Decrypt a string.

This will decrypt a null terminated Base64 string into a byte stream.

Parameters:

toDecrypt A null terminated Base64 string to decrypt.

→ *buf* The buffer to fill in with the decrypted string.

bufLen The size of the buffer. If this is too small, the function will return the size needed to decrypt the string, and will not fill in *buf* at all.

Returns:

0 on success, or else returns the length of the buffer needed to encrypt this string.

13.45 TPlatform Class Reference

```
#include <pf/platform.h>
```

13.45.1 Detailed Description

The platform-specific functionality encapsulation class.

This class is created within the library and exists in one global instance that can be acquired anywhere in the application using the static function [TPlatform::GetInstance\(\)](#).

Display Related Functions

- enum [ECursorMode](#) { [kCursorModeAbsolute](#), [kCursorModeDelta](#) }
These mouse button constants are here to allow you to respond to the use of other mouse buttons.
- void [SetDisplay](#) (uint32_t width, uint32_t height, bool fullscreen)
Initialize the current display mode.
- void [GetDisplay](#) (uint32_t *pWidth, uint32_t *pHeight, bool *pbFullscreen)
Get the current display parameters.
- void [SetCursor](#) (TTextureRef texture, TPoint hotSpot, bool hardware=false)
Set a mouse cursor to an image.
- void [ShowCursor](#) (bool show)
Show or hide the cursor.
- void [SetCursorPos](#) (const TPoint &at)
Set the cursor position.
- void [SetCursorMode](#) (ECursorMode mode)
Set the cursor mode.
- [ECursorMode GetCursorMode](#) () const
Get the cursor mode.
- bool [IsForeground](#) ()
Return true if the application is currently the foreground window.
- void [SetForeground](#) ()
Set the game window to the foreground.
- bool [SetFullscreen](#) (bool bFullscreen)
Convenience function for toggling fullscreen.
- bool [IsFullscreen](#) ()
True if the window is full screen.
- void [AdoptTextureRefreshListener](#) (TTask *rn)

Add a Texture Refresh Listener: On some platforms (DirectX) there are situations that cause all textures to be destroyed.

- bool [OrphanTextureRefreshListener](#) (TTask *rn)
Remove a Texture Refresh Listener.

Platform Environment and Information

- static TPlatform * [GetInstance](#) ()
Get the singleton TPlatform.
- static str [GetConfig](#) (str setting, str defaultSetting="")
Query for a configuration setting.
- static void [SetConfig](#) (str setting, str value)
Set a client configuration value.
- bool [IsEnabled](#) (str setting)
Query as to whether a setting is enabled.
- TSoundManager * [GetSoundManager](#) ()
Get the sound manager.
- TWindowManager * [GetWindowManager](#) ()
Get the application window manager.
- TTaskList * [GetTaskList](#) ()
Get the application task list.
- TStringTable * [GetStringTable](#) ()
Get the string table.

Public Types

- enum [ExtendedMouseEvents](#) {
[kMouseRightUp](#), [kMouseRightDown](#), [kMouseMiddleUp](#), [kMouseMiddleDown](#),
[kMouseScrollLeft](#), [kMouseScrollRight](#), [kMouseScrollUp](#), [kMouseScrollDown](#) }
These mouse button constants are here to allow you to respond to the use of other mouse buttons.

Public Member Functions

System Commands

Commands that interact with the operating system.

- void [SetWindowTitle](#) (const char *title)
Set the window application title.
- void [OpenBrowser](#) (const char *url)

Open a URL in a Web browser on the target system.

- void **GetEvent** (TEvent *pEvent)
Get an event from the application event queue.
- bool **StringToClipboard** (str copyString)
Send a string to the system clipboard.
- str **StringFromClipboard** ()
Retrieve a string, if any, from the current clipboard.
- void **Exit** (int32_t exitValue=0)
Exit the program.

Timer and user event functions

Functions that can be used to set up and cancel timers, query elapsed time, and pause the application.

- uint32_t **Timer** ()
A count in milliseconds since the program has initialized,.
- void **Sleep** (uint32_t ms)
Sleep the program for a number of milliseconds.
- bool **OrphanTask** (TTask *task)
Release a task from the global task list.
- void **AdoptTask** (TTask *task)
Add a task to the global task list.

Randomness

*/** Return a random integer.*

Clients are encouraged to use this as opposed to the stdlib version for maximum compatibility, and this random number generator is randomly seeded at application startup.

Returns:

A random integer from 0 to 0xFFFFFFFF.

- uint32_t **Rand** ()

Static Public Attributes

Configuration values

Use these values in `GetConfig()` to get the related setting.

- static const char * **kComputerId**
Unique Computer Identifier.
- static const char * **kCheatMode**
Cheat mode.
- static const char * **kInstallKey**
A key unique to the install of this application.

- static const char * [kEncryptionKey](#)
The application's encryption key.
- static const char * [kHiscoreLocalOnly](#)
Query as to whether hiscore mode is local-only.
- static const char * [kHiscoreAnonymous](#)
Query as to whether hiscore mode is anonymous only.
- static const char * [kBuildTag](#)
Query how this particular build has been tagged.
- static const char * [kFirstPeek](#)
Query whether this build is a "first peek" build: A limited-functionality public beta version.
- static const char * [kGameName](#)
What is the name of this game? Defined to be the string "gamename".
- static const char * [kPublisherName](#)
What is the name of the publisher of this game?
- static const char * [kGameVersion](#)
What version/build is this EXE? Defined to be the string "version".
- static const char * [kPFGGameHandle](#)
This value is the game handle that the game uses to communicate with any PlayFirst services, such as the hiscore system.
- static const char * [kPFGGameModeName](#)
This value is the prefix to the game mode names used to communicate with the PlayFirst Hiscore system.
- static const char * [kPFGGameMedalName](#)
This value is the prefix to the medal names used to communicate with the PlayFirst Hiscore system.
- static const char * [kVsyncWindowedMode](#)
Instruct Playground to wait for the vertical blanking period to start prior to drawing to the screen in windowed mode.

13.45.2 Member Enumeration Documentation

enum [TPlatform::ExtendedMouseEvents](#)

These mouse button constants are here to allow you to respond to the use of other mouse buttons.

PlayFirst game design constraints forbid the use of any other than the left mouse button as a "necessary" part of the user interface. In other words, any other buttons on the mouse or mouse wheel needs to be a supplemental interface for convenience of power users.

Enumerator:

kMouseRightUp Mouse right-button-up event.
kMouseRightDown Mouse right-button-down event.
kMouseMiddleUp Mouse middle-button-up event.
kMouseMiddleDown Mouse middle-button-down event.
kMouseScrollLeft Mouse scroll-left-button event.
kMouseScrollRight Mouse scroll-right-button event.
kMouseScrollUp Mouse scroll-up-button event.
kMouseScrollDown Mouse scroll-down-button event.

enum [TPlatform::ECursorMode](#)

These mouse button constants are here to allow you to respond to the use of other mouse buttons.

PlayFirst game design constraints forbid the use of any other than the left mouse button as a "necessary" part of the user interface. In other words, any other buttons on the mouse or mouse wheel needs to be a supplemental interface for convenience of power users.

13.45.3 Member Function Documentation

static [TPlatform*](#) [TPlatform::GetInstance](#) () **[static]**

Get the singleton [TPlatform](#).

Returns:

The one-and-only [TPlatform](#).

During normal game operation, it can be assumed that [TPlatform](#) always exists.

static **str** [TPlatform::GetConfig](#) (**str** *setting*, **str** *defaultSetting* = "") **[static]**

Query for a configuration setting.

Settings are collected from settings.xml, and can be overridden by command line options.

Options are set on the command line using one command line parameter, **options**. Options are concatenated using HTTP-GET semantics: Multiple options are appended using &.

For example, to set option "first" to 1 and option "second" to 2, you would use the command line:

```
options=first=1&second=2
```

This somewhat odd syntax allows us to pass in a stream of arbitrary options from HTML through the ActiveX wrapper code.

Parameters:

setting Setting to query.

Returns:

Value of that setting, or empty string if setting not found.

See also:

- [kCheatMode](#)
- [kComputerId](#)
- [kInstallKey](#)
- [kBuildTag](#)
- [kGameName](#)
- [kGameVersion](#)
- [kEncryptionKey](#)
- [kHiscoreLocalOnly](#)
- [kHiscoreAnonymous](#)
- [kPublisherName](#)

bool [TPlatform::IsEnabled](#) (**str** *setting*)

Query as to whether a setting is enabled.

Uses the same settings as [GetConfig\(\)](#).

Parameters:

setting Setting to query.

Returns:

True if setting is enabled.

See also:

[GetConfig\(\)](#)

static void TPlatform::SetConfig (str *setting*, str *value*) [static]

Set a client configuration value.

Use this to set the encryption key, or to store a value to later be retrieved by [GetConfig\(\)](#).

Parameters:

setting Setting to modify
value New value for setting.

See also:

[GetConfig\(\)](#)

class TSoundManager* TPlatform::GetSoundManager ()

Get the sound manager.

Returns:

The application sound manager.

class TWindowManager* TPlatform::GetWindowManager ()

Get the application window manager.

Returns:

The [TWindowManager](#) created by [TPlatform](#).

TTaskList* TPlatform::GetTaskList ()

Get the application task list.

Returns:

The [TTaskList](#) that holds the system's tasks.

class TStringTable* TPlatform::GetStringTable ()

Get the string table.

Returns:

The [TStringTable](#) created by [TPlatform](#)

void TPlatform::SetWindowTitle (const char * *title*)

Set the window application title.

Parameters:

title Title of application.

void TPlatform::OpenBrowser (const char * url)

Open a URL in a Web browser on the target system.

Parameters:

url URL to open.

void TPlatform::GetEvent (TEvent * pEvent)

Get an event from the application event queue.

See also:

[TWindowManager::HandleEvent\(\)](#)

Parameters:

pEvent Event to process.

bool TPlatform::StringToClipboard (str copyString)

Send a string to the system clipboard.

Parameters:

copyString String to copy.

str TPlatform::StringFromClipboard ()

Retrieve a string, if any, from the current clipboard.

Returns:

A string representation of the current copy buffer.

void TPlatform::Exit (int32_t exitValue = 0)

Exit the program.

This function does return, but the program will exit on its next pass through the main event loop.

Parameters:

exitValue Exit code.

void TPlatform::SetDisplay (uint32_t width, uint32_t height, bool fullscreen)

Initialize the current display mode.

Parameters:

width Width of target display

height Height of target display

fullscreen True for fullscreen.

void TPlatform::GetDisplay (uint32_t * *pWidth*, uint32_t * *pHeight*, bool * *pbFullscreen*)

Get the current display parameters.

Parameters:

pWidth Width of display.
pHeight Height of display.
pbFullscreen True for fullscreen.

void TPlatform::SetCursor (TTextureRef *texture*, TPoint *hotSpot*, bool *hardware* = **false)**

Set a mouse cursor to an image.

Use 100% magenta (RGB=255,0,255) for transparent color in a software cursor.

Parameters:

texture Texture to use. Set to TTextureRef() (i.e., NULL) to disable software cursor. A software texture should be created as a "simple" texture (TTexture::GetSimple, or loaded using ?simple flag). A software cursor texture also needs to be a power-of-two in size and square. A hardware texture must be exactly 32x32 pixels, must *not* be simple, and uses normal alpha transparency (magenta will be magenta!).

Since hardware cursors are not supported on some platforms, and do not work at all in full-screen mode, you should always supply a software cursor if you want a custom cursor to be available.

Parameters:

hotSpot Point within texture that the hot spot should be (i.e., the point where the clicking happens).
hardware True to set a hardware cursor.

void TPlatform::ShowCursor (bool *show*)

Show or hide the cursor.

Parameters:

show True to show the cursor.

void TPlatform::SetCursorPos (const TPoint & *at*)

Set the cursor position.

Deprecated

This API doesn't quite work as expected on the Mac, and so will be removed from a future version of Playground. To achieve relative cursor functionality, please use SetCursorMode(TPlatform::kCursorModeDelta) instead.

Parameters:

at Position to set mouse cursor, in application window coordinates.

void TPlatform::SetCursorMode (ECursorMode *mode*)

Set the cursor mode.

Parameters:

mode Set the data mode for kMouseMove events.

ECursorMode TPlatform::GetCursorMode () const

Get the cursor mode.

Parameters:

mode Set the data mode for kMouseMove events.

bool TPlatform::IsForeground ()

Return true if the application is currently the foreground window.

Returns:

True if application is in the foreground.

void TPlatform::SetForeground ()

Set the game window to the foreground.

On some systems, this is more of a request than an action, but it will get the user's attention.

bool TPlatform::IsFullscreen ()

True if the window is full screen.

Returns:

True on full screen.

void TPlatform::AdoptTextureRefreshListener (TTask * *m*)

Add a Texture Refresh Listener: On some platforms (DirectX) there are situations that cause all textures to be destroyed.

If you have a texture that was created by loading it from a file or resource, it will be automatically rebuilt by the library. If your texture is created programmatically, however, you will need to recreate it manually when a texture-loss event occurs.

The library internally maintains a list of Texture Refresh Listeners that all get called when system textures need to be rebuilt. Add a [TTask](#) listener to the list using this function.

Note that the [TTask::DoTask\(\)](#) return value is respected, so be sure to return true unless you want your refresh listener to self-destruct.

Parameters:

m A Texture Refresh listener to add to the internal list of functions to call when all textures (surfaces) are lost.

bool TPlatform::OrphanTextureRefreshListener (TTask * *m*)

Remove a Texture Refresh Listener.

Parameters:

m The Listener to remove.

Returns:

true if listener was removed, false if listener was not found

See also:

AddTextureRefreshListener()

uint32_t TPlatform::Timer ()

A count in milliseconds since the program has initialized,.

Returns:

Time value in milliseconds.

void TPlatform::Sleep (uint32_t *ms*)

Sleep the program for a number of milliseconds.

Parameters:

ms Number of milliseconds to sleep.

bool TPlatform::OrphanTask (TTask * *task*)

Release a task from the global task list.

Releases ownership of the [TTask](#) pointer to the calling function.

Parameters:

task Task to release.

Returns:

true if task was removed, false if task was not found

void TPlatform::AdoptTask (TTask * *task*)

Add a task to the global task list.

Transfers ownership to the global task list, which will expect to destroy the task when it is complete.

Parameters:

task Task to adopt.

13.45.4 Member Data Documentation

const char* TPlatform::kComputerId [static]

Unique Computer Identifier.

See also:

[GetConfig](#)

const char* TPlatform::kCheatMode [static]

Cheat mode.

Be sure to set your kEncryptionKey before querying this value.

See also:

[GetConfig](#)
[kEncryptionKey](#)

const char* TPlatform::kInstallKey [static]

A key unique to the install of this application.

Used to detect which portal the game was installed from.

const char* TPlatform::kEncryptionKey [static]

The application's encryption key.

The application MUST set this key to a key assigned by PlayFirst to function correctly with preferences, high scores, and the cheat enabler.

See also:

[kCheatMode](#)

const char* TPlatform::kBuildTag [static]

Query how this particular build has been tagged.

Build tagging may be used to enable/disable certain feature sets.

const char* TPlatform::kGameName [static]

What is the name of this game? Defined to be the string "gamename".

Set this in your "Main" routine to set the name your game should report to the high score server. If you want to change the name your game gets in the data folder, you must call this function from [PlaygroundInit\(\)](#).

See also:

[PlaygroundInit](#)

const char* TPlatform::kPublisherName [static]

What is the name of the publisher of this game?

In order for this setting to have an effect on the user folders for the application, it must be set in the special initialization routine [PlaygroundInit\(\)](#).

See also:

[PlaygroundInit](#)

const char* TPlatform::kPFGameHandle [static]

This value is the game handle that the game uses to communicate with any PlayFirst services, such as the hiscore system.

This value should be set with the PFGAMEHANDLE value in key.h on application startup. See the Playground Skeleton sample for code that does this.

const char* TPlatform::kPFGameModeName [static]

This value is the prefix to the game mode names used to communicate with the PlayFirst Hiscore system.

To get the game mode name, you need to add on the number for the game mode you want, starting with index 1. So for example, to get the first game mode, you could ask for `str(kPFGameModeName) + "1"`. This value should be set with the PFGAMEMODENAMES value in key.h on application startup. See the Playground Skeleton sample for code that does this.

const char* TPlatform::kPFGameMedalName [static]

This value is the prefix to the medal names used to communicate with the PlayFirst Hiscore system.

To get the medal name, you need to add on the number for the game mode you want, starting with index 1. So for example, to get the first medale, you could ask for `str(kPFGameMedalName) + "1"`. This value should be set with the `PFGAMEMEDALNAMES` value in `key.h` on application startup. See the Playground Skeleton sample for code that does this.

const char* TPlatform::kVsyncWindowedMode [static]

Instruct Playground to wait for the vertical blanking period to start prior to drawing to the screen in windowed mode.

Has no effect on full-screen mode, which always flips its buffer at the vertical refresh.

Can minimize "tearing" when enabled. Does cause the game to pause to wait for the screen vertical refresh to happen, which can seriously slow down the frame rate of your game by causing it to skip frames when the time to compute core logic and render a frame takes slightly longer than one video frame to calculate.

For instance, if the game takes 1/60 of a second (16.66ms) to perform all calculations and finish rendering, but the monitor is set to a 70Hz update, setting this flag will cause the screen to update at only 35FPS (half of 70FPS), since by the time one frame is complete, it will have already missed the next video synchronization. As a result, the game will need to wait for the following frame vertical refresh to draw. If you can only draw once every two frames at 70Hz, you'll get a 35Hz (35FPS) update.

Set the value to "1" to enable, or "0" to disable this feature. Defaults to being disabled.

13.46 TPoint Class Reference

```
#include <pf/point.h>
```

13.46.1 Detailed Description

The [TPoint](#) class is a 2d integer point representation.

Public Member Functions

- [TPoint \(\)](#)
Default constructor. Zeros all members.
- [TPoint \(int32_t x, int32_t y\)](#)
Initializing constructor.
- `bool operator== (const TPoint &point) const`
Equality.
- `bool operator!= (const TPoint &point) const`
Inequality.
- `TPoint & operator+= (const TPoint &point)`
Add a point to this point.
- `TPoint operator+ (const TPoint &point) const`
Memberwise addition.
- `TPoint & operator-= (const TPoint &point)`
Subtract a point from this point.
- `TPoint operator- (const TPoint &point) const`
Memberwise subtraction.
- `TPoint operator- ()`
Negation.

Public Attributes

- `int32_t x`
Horizontal coordinate.
- `int32_t y`
Vertical coordinate.

13.47 TPrefs Class Reference

```
#include <pf/prefs.h>
```

13.47.1 Detailed Description

The [TPrefs](#) class is designed to help with the saving of preferences for a game.

Preferences can be stored at either a global level or a user level.

See note about unique installs in the [TPrefs\(\)](#) constructor comments.

Public Member Functions

- [TPrefs](#) (bool saveData=true)
Constructor.
- [~TPrefs](#) ()
Destructor.
- [uint32_t GetNumUsers](#) ()
Get the number of users.
- [void DeleteUser](#) (uint32_t userNum)
Deletes the current user at the specified slot, and slides all users above that slot down.
- [int32_t GetInt](#) (str prefName, int32_t defaultValue, int32_t userIndex=kGlobalIndex)
Gets an int from the preferences.
- [void SetInt](#) (str prefName, int32_t value, int32_t userIndex=kGlobalIndex, bool save=true)
Sets an int in the preferences.
- [str GetStr](#) (str prefName, str defaultValue, int32_t userIndex=kGlobalIndex)
Gets a str from the preferences.
- [void SetStr](#) (str prefName, str value, int32_t userIndex=kGlobalIndex, bool save=true)
Sets a str in the preferences.
- [int32_t GetBinary](#) (str prefName, void *buffer, uint32_t bufferLen, int32_t userIndex=kGlobalIndex)
Gets a binary block from the preferences.
- [void SetBinary](#) (str prefName, const void *data, uint32_t dataLength, int32_t userIndex=kGlobalIndex, bool save=true)
Sets a block of binary data in the preferences.
- [void SavePrefs](#) ()
Commit preferences to permanent storage.
- [str GetUserStr](#) (int32_t userIndex)
Gets all the user data as a str.

- void **SetUserStr** (int32_t userIndex, str data)
Sets a user data from a passed in str.
- void **PlayedTimes** (std::map< str, uint32_t > &playedTimes)

Static Public Attributes

- static const int32_t **kGlobalIndex** = -1
An index to pass in as a userIndex parameter to any get/set function to get/set a global preference.

13.47.2 Constructor & Destructor Documentation

TPrefs::TPrefs (bool saveData = true)

Constructor.

Prior to calling the constructor, you need to set the application encryption key. See [TPlatform::SetConfig\(\)](#).

In order to prevent games from being downloaded multiple times and being able to use the same saved games, a [TPrefs](#) object attempts to distinguish between unique installs of the game. It does this by looking at the directory the game is running from.

Therefore, for debugging purposes, if you want your game to always be treated as the same install, you can hand create an install.txt file in the assets folder. This file can do two things:

- 1) If the file is empty, [TPrefs](#) will load/save preferences as if it was running from the most recently created preferences location (or create a new location if one doesn't exist).
- 2) If the file is not empty, it will treat the contents of this file as the install path, and read/save games as if it was that install. (example: putting C:/game/mygame in the install.txt file will make the [TPrefs](#) object pretend the game is running from c:/game/mygame)

Parameters:

saveData Whether or not data should be saved between sessions, default is true. For example, in a web game you might not want scores to persist between sessions, in which case saveData should be false.

13.47.3 Member Function Documentation

uint32_t TPrefs::GetNumUsers ()

Get the number of users.

Users must be numbered sequentially, and there may not be more than 1023 users.

Returns:

The number of currently created users in the preferences.

void TPrefs::DeleteUser (uint32_t userNum)

Deletes the current user at the specified slot, and slides all users above that slot down.

If user 2 is deleted, then user 3 becomes user 2, 4 becomes 3, etc.

Parameters:

userNum Which user to delete

int32_t TPrefs::GetInt (str prefName, int32_t defaultValue, int32_t userIndex = kGlobalIndex)

Gets an int from the preferences.

Parameters:

prefName Name of preference to get.

defaultValue If this preference has not been set, what value should be returned.

userIndex Which user to get from, or if this is kGlobalIndex then get from the global preferences. Users must be numbered sequentially, and there may not be more than 1023 users.

Returns:

Returns the stored int if it exists, or else defaultValue if it does not exist.

void TPrefs::SetInt (str prefName, int32_t value, int32_t userIndex = kGlobalIndex, bool save = true)

Sets an int in the preferences.

Parameters:

prefName Name of preference to set.

value Value to set preference to.

userIndex Which user to set, or if this is kGlobalIndex then set a global preference. Users must be numbered sequentially, and there may not be more than 1023 users.

save If this is true, commits preferences to disk. if false, preferences are changed in memory only, until a different preference is set with save set to true, or until [SavePrefs\(\)](#) is called.

str TPrefs::GetStr (str prefName, str defaultValue, int32_t userIndex = kGlobalIndex)

Gets a str from the preferences.

Parameters:

prefName Name of preference to Get.

defaultValue If this preference has not been set, what value should be returned.

userIndex Which user to get from, or if this is kGlobalIndex then get from the global preferences. Users must be numbered sequentially, and there may not be more than 1023 users.

Returns:

Returns the stored str if it exists, or else defaultValue if it does not exist.

void TPrefs::SetStr (str prefName, str value, int32_t userIndex = kGlobalIndex, bool save = true)

Sets a str in the preferences.

String length is limited to 4Mb-16 bytes.

Parameters:

prefName Name of preference to set.

value Value to set preference to.

userIndex Which user to set, or if this is kGlobalIndex then set a global preference. Users must be numbered sequentially, and there may not be more than 1023 users.

save If this is true, commits preferences to disk. if false, preferences are changed in memory only, until a different preference is set with save set to true, or until [SavePrefs\(\)](#) is called.

int32_t TPrefs::GetBinary (str prefName, void * buffer, uint32_t bufferLen, int32_t userIndex = kGlobalIndex)

Gets a binary block from the preferences.

Parameters:

prefName Name of preference to get.
buffer Address of location to store data in.
bufferLen Size of buffer in bytes.
userIndex Which user to get from, or if this is `kGlobalIndex` then get from the global preferences. Users must be numbered sequentially, and there may not be more than 1023 users.

Returns:

If the preference does not exist, -1 is returned. If *buffer* is successfully filled in with the preference, 0 is returned. If the preference exists and *buffer* is NULL or *bufferLen* is too small to store the data, then the size that the buffer needs to be is returned.

void TPrefs::SetBinary (str *prefName*, const void * *data*, uint32_t *dataLength*, int32_t *userIndex* = `kGlobalIndex`, bool *save* = `true`)

Sets a block of binary data in the preferences.

Binary data size is limited to 4Mb-16 bytes.

Parameters:

prefName Name of preference to set.
data Address of data to set in preferences.
dataLength Size of data in bytes.
userIndex Which user to set, or if this is `kGlobalIndex` then set a global preference. Users must be numbered sequentially, and there may not be more than 1023 users.
save If this is true, commits preferences to disk. If false, preferences are changed in memory only, until a different preference is set with *save* set to true, or until `SavePrefs()` is called.

str TPrefs::GetUserStr (int32_t *userIndex*)

Gets all the user data as a str.

Parameters:

userIndex Which user to get data from.

Returns:

A str containing all the user's data.

void TPrefs::SetUserStr (int32_t *userIndex*, str *data*)

Sets a user data from a passed in str.

In order to maintain proper functionality this should only be called with a str return from `GetUserStr`.

Parameters:

userIndex Which user to set data.
data String to set.

13.48 TRandom Class Reference

```
#include <pf/random.h>
```

13.48.1 Detailed Description

A deterministic random number generator.

Based on the Mersenne Twister algorithm, it has a period of $2^{19937} - 1$ iterations, it's as fast as or faster than `rand()`, and it's equally distributed in 623 dimensions.

Public Member Functions

- [TRandom \(\)](#)
Default Constructor.
- void [Seed](#) (uint32_t s)
Seed.
- void [SeedArray](#) (unsigned long init_key[], uint32_t key_length)
Seed with array.
- uint32_t [SaveState](#) (void *buffer, uint32_t bufferLength)
Get the current random number generator state, which you can then use to restore to a known state using RestoreState.
- void [RestoreState](#) (void *buffer)
Restore random number generator state from SaveState.
- unsigned long [Rand32](#) ()
Generates a random unsigned long.
- [TReal RandFloat](#) ()
Generates a random number on [0,1)-real-interval.
- double [RandDouble](#) ()
Generates a random number on [0,1)-real-interval, that is random out to double-precision granularity.
- uint32_t [RandRange](#) (uint32_t bottom, uint32_t top)
Generates a random integer between the two parameters, inclusive.

13.48.2 Member Function Documentation

uint32_t TRandom::SaveState (void * *buffer*, uint32_t *bufferLength*)

Get the current random number generator state, which you can then use to restore to a known state using RestoreState.

Parameters:

buffer - buffer to store state in
bufferLength - number of bytes in buffer

Returns:

0 if successful, otherwise returns the length that buffer needs to be for success;

TReal TRandom::RandFloat ()

Generates a random number on [0,1)-real-interval.

Returns:

A number between zero and one, never equalling 1.0

double TRandom::RandDouble ()

Generates a random number on [0,1)-real-interval, that is random out to double-precision granularity.

Since a double has (on the Wintel reference platform) more bits of precision than an int/long, it takes two calls from Rand32 and combines them into a double precision random number.

Returns:

A number between zero and one, never equalling 1.0

uint32_t TRandom::RandRange (uint32_t *bottom*, uint32_t *top*)

Generates a random integer between the two parameters, inclusive.

Will generate all options equally, including bottom and top.

Parameters:

bottom Lowest number that will be returned.

top Highest number that will be returned.

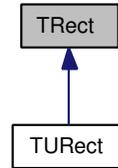
Returns:

A random integer.

13.49 TRect Class Reference

```
#include <pf/rect.h>
```

Inheritance diagram for TRect:



13.49.1 Detailed Description

A rectangle.

Like the Windows RECT class, the right and bottom (X2/Y2) coordinates are one past the edge of the rectangle.

Public Member Functions

- [TRect \(\)](#)
Default constructor. Zeros all members.
- [TRect \(int32_t X1, int32_t Y1, int32_t X2, int32_t Y2\)](#)
Initializing constructor.
- [TRect \(const TPoint &topLeft, const TPoint &bottomRight\)](#)
Construct a TRect from two points.
- [int32_t GetWidth \(\) const](#)
Get the width of the rectangle.
- [int32_t GetHeight \(\) const](#)
Get the height of the rectangle.
- [bool operator== \(const TRect &r\) const](#)
Equality.
- [bool operator!= \(const TRect &r\) const](#)
Inequality.
- [TRect & operator+= \(const TPoint &p\)](#)
Move a rect by a point.
- [TRect & operator-= \(const TPoint &p\)](#)
Move a rect by a point.
- [bool Contains \(const TRect &r\) const](#)
Test to see whether a rectangle is inside this rectangle.

- bool **Contains** (const **TPoint** &p) const
Test to see whether a point is inside this rectangle.
- bool **IsInside** (const **TPoint** &p) const
Test to see whether a point is inside this rectangle.
- bool **Overlaps** (const **TRect** &rect) const
Test to see if another rectangle overlaps this rectangle.
- void **Union** (const **TRect** &rect1, const **TRect** &rect2)
Make this rectangle the union of the two parameter rectangles.
- void **Intersect** (const **TRect** &rect1, const **TRect** &rect2)
Make this rectangle the intersection of the two parameter rectangles.
- **TPoint** & **GetTopLeft** ()
*Get a **TPoint** that represents the upper left corner of the rectangle.*
- const **TPoint** & **GetTopLeft** () const
*Get a **TPoint** that represents the upper left corner of the rectangle.*
- **TPoint** & **GetBottomRight** ()
*Get a **TPoint** that represents the lower right corner of the rectangle.*
- const **TPoint** & **GetBottomRight** () const
*Get a **TPoint** that represents the lower right corner of the rectangle.*

Static Public Member Functions

- static **TRect FromXYWH** (int32_t x, int32_t y, int32_t w, int32_t h)
*Build a **TRect** from the upper left corner and the desired width and height.*

Public Attributes

- int32_t **x1**
Upper left corner x coordinate.
- int32_t **y1**
Upper left corner y coordinate.
- int32_t **x2**
Lower right corner x coordinate.
- int32_t **y2**
Lower right corner y coordinate.

13.49.2 Constructor & Destructor Documentation

TRect::TRect (const TPoint & *topLeft*, const TPoint & *bottomRight*)

Construct a TRect from two points.

Parameters:

topLeft Upper left corner of the TRect.
bottomRight Lower right corner of the TRect.

13.49.3 Member Function Documentation

static TRect TRect::FromXYWH (int32_t *x*, int32_t *y*, int32_t *w*, int32_t *h*) [static]

Build a TRect from the upper left corner and the desired width and height.

Parameters:

x X coordinate of the upper left corner.
y Y coordinate of the upper left corner.
w Width
h Height

Returns:

A new TRect calculated from X,Y,W,H

int32_t TRect::GetWidth () const

Get the width of the rectangle.

Returns:

Exclusive width of the rectangle. ($x_2 - x_1$)

int32_t TRect::GetHeight () const

Get the height of the rectangle.

Returns:

Exclusive height of the rectangle. ($y_2 - y_1$)

TRect& TRect::operator+= (const TPoint & *p*)

Move a rect by a point.

Parameters:

p Point to offset rect by.

Returns:

A reference to this.

TRect& TRect::operator-= (const TPoint & *p*)

Move a rect by a point.

Parameters:

p Point to offset rect by.

Returns:

A reference to this.

bool TRect::Contains (const TRect & r) const

Test to see whether a rectangle is inside this rectangle.

Parameters:

r TRect to test.

Returns:

True if r is inside this.

bool TRect::Contains (const TPoint & p) const

Test to see whether a point is inside this rectangle.

Parameters:

p Point to test.

Returns:

True if inside. If $p.x == x2$ or $p.y == y2$, the test fails.

bool TRect::IsInside (const TPoint & p) const

Test to see whether a point is inside this rectangle.

Deprecated

This function is going to be deleted in favor of the more clearly named [TRect::Contains\(\)](#).

Parameters:

p Point to test.

Returns:

True if inside. If $p.x == x2$ or $p.y == y2$, the test fails.

bool TRect::Overlaps (const TRect & rect) const

Test to see if another rectangle overlaps this rectangle.

Parameters:

rect Rectangle to test.

Returns:

True on overlap.

void TRect::Union (const TRect & rect1, const TRect & rect2)

Make this rectangle the union of the two parameter rectangles.

Can pass this rectangle as either parameter.

Parameters:

rect1 First

rect2 Second

void TRect::Intersect (const TRect & rect1, const TRect & rect2)

Make this rectangle the intersection of the two parameter rectangles.

Can pass this rectangle as either parameter.

Warning:

Assumes the two rectangles overlap. Resulting value is undefined if the original rectangles do not overlap.

Parameters:

rect1 First
rect2 Second

TPoint& TRect::GetTopLeft ()

Get a [TPoint](#) that represents the upper left corner of the rectangle.

Returns:

Corner point

const TPoint& TRect::GetTopLeft () const

Get a [TPoint](#) that represents the upper left corner of the rectangle.

Returns:

Corner point

TPoint& TRect::GetBottomRight ()

Get a [TPoint](#) that represents the lower right corner of the rectangle.

Returns:

Corner point

const TPoint& TRect::GetBottomRight () const

Get a [TPoint](#) that represents the lower right corner of the rectangle.

Returns:

Corner point

13.50 TRenderer Class Reference

```
#include <pf/renderer.h>
```

13.50.1 Detailed Description

The interface to the rendering subsystem.

Available as a singleton while the game is running using [TRenderer::GetInstance\(\)](#).

Raw Primitive Drawing.

Routines for drawing groups of lines or triangles, given either 2d or 3d vertex data.

Must be called in a window `Draw()` function, or between `BeginRenderTarget/EndRenderTarget`.

Respects the currently active 2d or 3d rendering environment. Functions are indifferent to `Begin2d/Begin3d/End2d/End3d`.

- enum [EDrawType](#) {
[kDrawPoints](#) = 1, [kDrawLines](#), [kDrawLineStrip](#), [kDrawTriangles](#),
[kDrawTriStrip](#), [kDrawTriFan](#) }
Type for DrawVertices.
- static const int [kMaxIndices](#) = 65535
The maximum number of indices that can be passed into DrawIndexedVertices().
- void [DrawVertices](#) ([EDrawType](#) type, const [TVertexSet](#) &vertices)
Draw a set of vertices using the current environment.
- void [DrawIndexedVertices](#) ([EDrawType](#) type, const [TVertexSet](#) &vertices, uint16_t *indices, uint32_t index-Count)
Draw a set of vertices using the current environment.

2d/3d Agnostic Code

These functions allow you to modify the 2d or 3d rendering environment.

Some of these states are cleared/reset by calling `Begin2d` or `Begin3d`, so don't expect any state to be preserved across those calls.

- enum [EShadeMode](#) { [kShadeFlat](#) = 1, [kShadeGouraud](#) }
Shading modes.
- enum [EBlendMode](#) {
[kBlendNormal](#), [kBlendOpaque](#), [kBlendAdditiveAlpha](#), [kBlendSubtractive](#),
[kBlendMultiplicative](#), [kBlendINVALID](#) = -1 }
Blending modes for SetBlendMode().
- enum [EFilteringMode](#) { [kFilterPoint](#), [kFilterLinear](#) }
Filtering modes.

- enum [ETextureMapMode](#) { [kMapClamp](#), [kMapWrap](#), [kMapMirror](#) }
The various texture map modes.
- void [SetShadeMode](#) ([EShadeMode](#) shadeMode)
Set the shade mode.
- bool [RenderTargetIsScreen](#) ()
Query as to whether the current render target is the screen.
- void [SetTexture](#) ([TTextureRef](#) pTexture=[TTextureRef](#)())
Set the current rendering texture.
- [TTextureRef](#) [GetTexture](#) ()
Get the currently assigned texture.
- void [SetBlendMode](#) ([EBlendMode](#) blendMode)
Set the current blend mode.
- void [SetFilteringMode](#) ([EFilteringMode](#) filteringMode)
Set the current filtering mode to use when scaling images.
- void [SetTextureMapMode](#) ([ETextureMapMode](#) umap, [ETextureMapMode](#) vmap)
Set the texture map mode for use when texture coordinates extend beyond the edge of the internal texture.
- void [SetZBufferWrite](#) (bool writeToZbuffer)
Enable or disable writing to zbuffer.
- void [SetZBufferTest](#) (bool testZbuffer)
Enable zbuffer test.

Scene Management Functions

Enable drawing to a render target or the backbuffer, or set up a 2d or 3d rendering context.

Drawing to the backbuffer is usually handled by the system; by the time a [TWindow::Draw\(\)](#) function is called, you are already in a rendering state.

- enum [ERenderTargetMode](#) {
[kFullRenderRGB1](#), [kFullRenderRGBX](#), [kMergeRenderRGB1](#), [kMergeRenderRGBX](#),
[kMergeRenderXXXX](#) }
Modes for [TRenderer::BeginRenderTarget](#).
- bool [BeginRenderTarget](#) ([TTextureRef](#) texture, [ERenderTargetMode](#) mode)
Start rendering to a texture.
- void [EndRenderTarget](#) ()
Complete the rendering to a texture.

- bool [BeginDraw](#) (bool needRefresh)
Open an internal draw context.
- void [EndDraw](#) (bool flip=true)
Close and complete an internal draw context.
- bool [Begin2d](#) ()
Begin 2d rendering.
- void [End2d](#) ()
Finish a 2d rendering set.
- bool [Begin3d](#) ()
Begin 3d rendering.
- void [End3d](#) ()
Finish a 3d rendering set.
- bool [InDraw](#) () const
Query as to whether we're currently in a drawing mode.

3d-Related functions

- enum [ECullMode](#) { [kCullNone](#) = 1, [kCullCW](#), [kCullCCW](#) }
Possible cull modes.
- void [SetWorldMatrix](#) (TMat4 *pMatrix)
Set the world matrix.
- void [SetViewMatrix](#) (TMat4 *pMatrix)
Set the view matrix.
- void [SetProjectionMatrix](#) (TMat4 *pMatrix)
Set the projection matrix.
- void [SetView](#) (const TVec3 &eye, const TVec3 &at, const TVec3 &up)
Set the view matrix based on the viewer location, a target location, and an up vector.
- void [SetPerspectiveProjection](#) (TReal nearPlane, TReal farPlane, TReal fov=PI/4.0f, TReal aspect=0)
Set a perspective projection matrix.
- void [SetOrthogonalProjection](#) (TReal nearPlane, TReal farPlane)
Set an orthogonal projection matrix.
- void [GetWorldMatrix](#) (TMat4 *m)
Get the current world matrix.
- void [GetViewMatrix](#) (TMat4 *m)
Get the current view matrix.

- void [GetProjectionMatrix](#) (TMat4 *m)
Get the current projection matrix.
- void [SetAmbientColor](#) (const TColor &color)
Set the scene's ambient color.
- void [SetCullMode](#) (ECullMode cullMode)
Set the current cull mode of the 3d render.
- void [SetMaterial](#) (TMaterial *pMat)
Set the current rendering material.
- void [SetLight](#) (uint32_t index, TLight *light)
Set up one of the scene lights.
- bool [ToggleHUD](#) ()
Toggle the HUD.
- bool [In2d](#) () const
Currently in Begin2d mode.
- bool [In3d](#) () const
Currently in Begin3d mode.
- void [SetOption](#) (str option, str value)
Set a renderer option.
- [str](#) [GetOption](#) (str option)
Get a renderer option.

Public Member Functions

- [~TRenderer](#) ()
Destructor.
- void [SetViewport](#) (const TRect &viewport)
Set the current rendering viewport.
- void [GetViewport](#) (TRect *viewport)
Get the current rendering viewport.
- void [SetClippingRectangle](#) (const TUREct &clip)
Set the current screen clipping rectangle.
- TRect [GetClippingRectangle](#) ()
Get the current screen clipping rectangle.
- void [PushClippingRectangle](#) (const TUREct &clip)

Push a clipping rectangle onto the internal stack.

- void [PopClippingRectangle](#) ()
Pop a clipping rectangle from the internal stack.
- void [PushViewport](#) (const [TRect](#) &viewport)
Push a viewport on the internal viewport stack.
- void [PopViewport](#) ()
Restore a viewport from the viewport stack.

Information

- [str](#) [GetSystemData](#) ()
Get data about the current system.
- [bool](#) [GetTextureSquareFlag](#) ()
Query whether all manually created textures must be square.

2d-Related Functions

- void [FillRect](#) (const [TURect](#) &rect, const [TColor](#) &color, [TTextureRef](#) dst=[TTextureRef](#)())
Fill a rectangle, optionally specifying a destination texture.

Static Public Member Functions

- [static TRenderer *](#) [GetInstance](#) ()
Accessor.

13.50.2 Member Enumeration Documentation

enum [TRenderer::EDrawType](#)

Type for DrawVertices.

Enumerator:

kDrawPoints DrawVertices renders the vertices as a collection of isolated points.
kDrawLines DrawVertices renders the vertices as a set of isolated line segments.
kDrawLineStrip DrawVertices renders the vertices as a line strip.
kDrawTriangles DrawVertices renders each group of 3 vertices as a triangle.
kDrawTriStrip DrawVertices renders the vertices as a triangle strip.
kDrawTriFan DrawVertices renders the vertices as a triangle fan.

enum [TRenderer::EShadeMode](#)

Shading modes.

See also:

[TRenderer::SetShadeMode](#)

Enumerator:

kShadeFlat Flat shading with no shading across a polygon.
kShadeGouraud Gouraud shading with smooth shading across a polygon.

enum TRenderer::EBlendMode

Blending modes for [SetBlendMode\(\)](#).

Enumerator:

kBlendNormal Normal alpha drawing.
kBlendOpaque Draw with no alpha.
 This mode requires your texture to be square and each side be a power of two in order to work consistently.
kBlendAdditiveAlpha Additive drawing, respecting source alpha. Useful for "glowing" effects.
kBlendSubtractive Subtractive drawing; useful for shadows or special effects.
kBlendMultiplicative Multiplicative drawing; can also be used for shadows or special effects.
kBlendINVALID Invalid blend mode.

enum TRenderer::EFilteringMode

Filtering modes.

See also:

[SetFilteringMode](#)

Enumerator:

kFilterPoint Point-filtering: Select the nearest pixel.
kFilterLinear Bilinear (or trilinear for MIPMAPs) filtering: Blend the nearest pixels.

enum TRenderer::ETextureMapMode

The various texture map modes.

See also:

[TRenderer::SetTextureMapMode\(\)](#)

Enumerator:

kMapClamp Clamp the texture to 0,1.
kMapWrap Repeat texture coordinates.
 Uses the fractional part of the texture coordinates only. Do not expect wrap to work with arbitrarily large numbers, as some video cards limit wrapping to as little as ± 4 .
kMapMirror Mirror coordinate: 0->1->0->1.

enum TRenderer::ERenderTargetMode

Modes for [TRenderer::BeginRenderTarget](#).

Enumerator:

kFullRenderRGB1 Render RGB with an opaque alpha.
 Does not preserve the current texture contents.
kFullRenderRGBX Render RGB with an undefined alpha.
 Does not preserve the current texture contents. Alpha contents are **undefined**.
kMergeRenderRGB1 Render RGB with an opaque alpha, preserving the current texture contents; entire final surface (not just areas that are overdrawn) will get an opaque alpha.

Note that this call is actually slower than `kFullRenderRGB1`, since the existing texture data needs to be copied to the render surface.

kMergeRenderRGBX Render RGB with an opaque alpha, preserving the current texture contents; final surface alpha is unchanged.

Note that this call is actually slower than `kFullRenderRGBX`, since the existing texture data needs to be copied to the render surface.

kMergeRenderXXXX Render Alpha without modifying RGB pixels.
 RGB of original image will be preserved.

enum `TRenderer::ECullMode`

Possible cull modes.

Enumerator:

kCullNone No culling.

kCullCW Cull faces with clockwise vertices.

kCullCCW Cull faces with counterclockwise vertices.

13.50.3 Member Function Documentation

`void TRenderer::SetViewport (const TRect & viewport)`

Set the current rendering viewport.

Only affects the 3d rendering functions, as the viewport is overridden internally by the `TTexture::Draw` functions.

Parameters:

viewport Viewport

`void TRenderer::GetViewport (TRect * viewport)`

Get the current rendering viewport.

Parameters:

viewport Viewport

`void TRenderer::SetClippingRectangle (const TURect & clip)`

Set the current screen clipping rectangle.

Parameters:

clip Rectangle to clip to in screen coordinates.

`void TRenderer::PushClippingRectangle (const TURect & clip)`

Push a clipping rectangle onto the internal stack.

Parameters:

clip Clipping rectangle to push.

`void TRenderer::PushViewport (const TRect & viewport)`

Push a viewport on the internal viewport stack.

Parameters:

viewport Viewport

void TRenderer::DrawVertices (EDrawType type, const TVertexSet & vertices)

Draw a set of vertices using the current environment.

There is a hard limit on the number of vertices of `TVertexSet::kMaxVertices`.

Parameters:

type Type of data to draw.

vertices A set of vertices.

void TRenderer::DrawIndexedVertices (EDrawType type, const TVertexSet & vertices, uint16_t * indices, uint32_t indexCount)

Draw a set of vertices using the current environment.

There is a hard limit on the number of vertices of `TVertexSet::kMaxVertices`, and on the number of indices of `kMaxIndices`.

Parameters:

type Type of data to draw.

vertices A set of vertices.

indices An array of indices into the set of vertices.

indexCount The number of indices.

void TRenderer::SetTexture (TTextureRef pTexture = TTextureRef ())

Set the current rendering texture.

Parameters:

pTexture Texture to assign. Default parameter is NULL texture.

TTextureRef TRenderer::GetTexture ()

Get the currently assigned texture.

Returns:

The current texture.

void TRenderer::SetBlendMode (EBlendMode blendMode)

Set the current blend mode.

The blend mode is reset to "normal" when calling either `Begin2d` or `Begin3d`.

Parameters:

blendMode The new blend mode.

void TRenderer::SetFilteringMode (EFilteringMode filteringMode)

Set the current filtering mode to use when scaling images.

Parameters:

filteringMode Mode to use.

void TRenderer::SetTextureMapMode (ETextureMapMode *umap*, ETextureMapMode *vmap*)

Set the texture map mode for use when texture coordinates extend beyond the edge of the internal texture.

NOTE that the internal texture is almost always square and a power of two, so most textures should be limited to those constraints when using wrapping modes.

Parameters:

umap Texture map mode for U coordinates.
vmap Texture map mode for V coordinates.

void TRenderer::SetZBufferWrite (bool *writeToZbuffer*)

Enable or disable writing to zbuffer.

Parameters:

writeToZbuffer True to write to zbuffer.

See also:

[SetZBufferTest](#)

void TRenderer::SetZBufferTest (bool *testZbuffer*)

Enable zbuffer test.

Parameters:

testZbuffer True to test zbuffer when drawing.

See also:

[SetZBufferWrite](#)

str TRenderer::GetSystemData ()

Get data about the current system.

Returns:

A system data string.

bool TRenderer::GetTextureSquareFlag ()

Query whether all *manually* created textures must be square.

Textures loaded from files will always work even if they're non-square.

Returns:

True if textures created with [TTexture::Create\(\)](#) must be square.

bool TRenderer::BeginRenderTarget (TTextureRef *texture*, ERenderTargetMode *mode*)

Start rendering to a texture.

Must NOT be called during a Draw() update. After being called, all rendering commands without a texture target will be directed instead to the texture passed in to [BeginRenderTarget\(\)](#).

If you are rendering to a texture that you will be completely covering with content, use one of the "full" render modes (kFullRenderRGB1 or kFullRenderRGBX). Note that in a full mode that if you don't cover the surface you may get garbage left over in the rendering buffer in any untouched areas of the image.

If your image already has content that you want to render on top of, use one of the merge modes.

If you want your resulting image to have an alpha component, you'll need to render it in two passes. This is because a lot of video cards don't have the ability to render alpha to a buffer—but they do have the ability to redirect alpha to the RGB channels. So that's what `kMergeRenderXXXXA` does: It sets up the rendering pipeline to render just the alpha to the RGB channels, and then copies the resulting data back into your texture alpha channel. The usage pattern looks like this:

```

TextureRef myTexture = ... ; // Create your texture
Renderer * r = Renderer::GetInstance();
if (r->BeginRenderTarget(myTexture,Renderer::kFullRenderRGBX))
{
    DoRendering(); // Paint the full texture
    r->EndRenderTarget();
}

if (r->BeginRenderTarget(myTexture,Renderer::kMergeRenderXXXXA))
{
    DoRendering(); // Paint the full texture again, this time
    r->EndRenderTarget(); // to get alpha information
}

```

Warning:

Will not render to areas of a surface beyond the extents of the screen surface (800x600 by default). This allows us to use the most compatible render-to-surface modes.

Parameters:

texture Texture to render to.
mode Render target mode.

Returns:

True on success.

void TRenderer::EndRenderTarget ()

Complete the rendering to a texture.

See also:

[BeginRenderTarget](#)

bool TRenderer::BeginDraw (bool needRefresh)

Open an internal draw context.

Called automatically by the system.

Typically internal use only. This function is called by the system prior to your [TWindow::Draw\(\)](#) and [TWindow::PostDraw\(\)](#) calls.

Parameters:

needRefresh True if we should refresh the screen (for support of dirty-rectangle drawing). Usually false, meaning you're redrawing the entire screen.

Returns:

True on success. If [BeginDraw\(\)](#) returns false, do not call [EndDraw\(\)](#).

void TRenderer::EndDraw (bool flip = true)

Close and complete an internal draw context.

Also presents the completed rendered screen.

Parameters:

flip Flip or blit the back buffer to the screen.

bool TRenderer::Begin2d ()

Begin 2d rendering.

Any calls to `TTexture::Draw*()` functions should happen between a `Begin2d()` and `End2d()` call.

It's a good idea to minimize renderer state changes, as they can be expensive on some cards. Try to group most of your 2d rendering together in as few `Begin2d()` groups as possible.

Clears all 3d matrices when called. You can set the view and world matrix between `Begin2d()` and `End2d()`, but they will be cleared again on `End2d()`.

You can use the helper class `TBegin2d` to automatically close the block on exiting the scope.

Returns:

True on success. False on failure, which can mean that you are already in a `Begin2d()` state, you are in a `Begin3d()` state, or some other aspect of the engine has gotten into a bad state. Check log file messages for details.

See also:

[TBegin2d](#)

void TRenderer::End2d ()

Finish a 2d rendering set.

See also:

[Begin2d](#)

bool TRenderer::Begin3d ()

Begin 3d rendering.

Any calls to `TModel::Draw*()` functions should happen between a `Begin3d()` and `End3d()` call. Also, calls to `DrawVertices()` with vertex types `TLitVert` or `TVert` should be within a `Begin3d()` block.

It's a good idea to minimize renderer state changes, as they can be expensive on some cards. Try to group most of your 3d rendering together in as few `Begin3d()` groups as possible.

You can use the helper class `TBegin3d` to automatically close the block on exiting the scope.

Returns:

True on success. False on failure, which can mean that you are already in a `Begin3d()` state, you are in a `Begin2d()` state, or some other aspect of the engine has gotten into a bad state. Check log file messages for details.

See also:

[TBegin3d](#)

void TRenderer::End3d ()

Finish a 3d rendering set.

See also:

[Begin3d](#)

bool TRenderer::InDraw () const

Query as to whether we're currently in a drawing mode.

Returns:

True if we're between [BeginDraw\(\)](#) and [EndDraw\(\)](#), or [BeginRenderTarget\(\)](#) and [EndRenderTarget\(\)](#).

void TRenderer::FillRect (const TRect & rect, const TColor & color, TTextureRef dst = TTextureRef ())

Fill a rectangle, optionally specifying a destination texture.

Unlike [TTexture::Draw*\(\)](#) calls, [FillRect](#) can be used to draw a rectangle in any texture type, and does not depend on the [Begin2d/End2d](#) state. **Will not blend** using the alpha value; instead it writes the alpha value as part of the color into the destination, when the destination texture supports alpha.

In the case of screen fills, the alpha value **is never used**, since to draw an alpha value to the screen is meaningless (the screen surface is never used as a source texture).

Parameters:

rect Rectangle to fill; this rectangle is either relative to the upper left corner of the current viewport or window (when *dst* is NULL), or is relative to the upper left corner of the texture.

color Color to draw—this color (RGBA) will be written verbatim into the surface across the rectangle with no blending, such that all pixels in the rectangle will exactly equal the RGBA color specified.

dst Optional destination texture. Current viewport and window coordinates are ignored when *dst* is non-NULL.

void TRenderer::SetWorldMatrix (TMat4 * pMatrix)

Set the world matrix.

Playground uses a World/View/Projection transformation model. This method allows you to set the current world matrix.

Parameters:

pMatrix New world matrix.

void TRenderer::SetViewMatrix (TMat4 * pMatrix)

Set the view matrix.

Playground uses a World/View/Projection transformation model. This method allows you to set the current view matrix.

Helper function [SetView\(\)](#) can be used to set the view matrix based on a location, a look-at target, and an up vector.

Parameters:

pMatrix New view matrix.

void TRenderer::SetProjectionMatrix (TMat4 * pMatrix)

Set the projection matrix.

Playground uses a World/View/Projection transformation model. This method allows you to set the current projection matrix.

Projection can be set up automatically using `SetPerspectiveProjection`.

See also:

[SetPerspectiveProjection](#)

Parameters:

pMatrix New projection matrix.

void TRenderer::SetView (const TVec3 & eye, const TVec3 & at, const TVec3 & up)

Set the view matrix based on the viewer location, a target location, and an up vector.

Parameters:

eye The viewer's location.

at The target location.

up Up vector.

void TRenderer::SetPerspectiveProjection (TReal nearPlane, TReal farPlane, TReal fov = PI/4.0f, TReal aspect = 0)

Set a perspective projection matrix.

Parameters:

nearPlane Distance to near plane.

farPlane Distance to far plane.

fov Field of view in radians.

aspect Aspect ratio of view (0 to calculate the aspect ration from the viewport size).

void TRenderer::SetOrthogonalProjection (TReal nearPlane, TReal farPlane)

Set an orthogonal projection matrix.

Parameters:

nearPlane Distance to the near plane.

farPlane Distance to the far plane.

void TRenderer::GetWorldMatrix (TMat4 * m)

Get the current world matrix.

Parameters:

m A matrix to fill with the current world matrix.

void TRenderer::GetViewMatrix (TMat4 * m)

Get the current view matrix.

Parameters:

m A matrix to fill with the current view matrix.

void TRenderer::GetProjectionMatrix (TMat4 * m)

Get the current projection matrix.

Parameters:

m A matrix to fill with the current projection matrix.

void TRenderer::SetAmbientColor (const TColor & color)

Set the scene's ambient color.

Parameters:

color New ambient color.

void TRenderer::SetCullMode (ECullMode cullMode)

Set the current cull mode of the 3d render.

Parameters:

cullMode The new cull mode.

void TRenderer::SetLight (uint32_t index, TLight * light)

Set up one of the scene lights.

Parameters:

index Index to light to initialize.

light Light data.

bool TRenderer::ToggleHUD ()

Toggle the HUD.

Returns:

true if HUD was previously active.

bool TRenderer::In2d () const

Currently in Begin2d mode.

Returns:

True if in Begin2d mode.

bool TRenderer::In3d () const

Currently in Begin3d mode.

Returns:

True if in Begin3d mode.

void TRenderer::SetOption (str option, str value)

Set a renderer option.

Parameters:

option Option to set.

value Value to set.

str TRenderer::GetOption (str *option*)

Get a renderer option.

Parameters:

option Option to get.

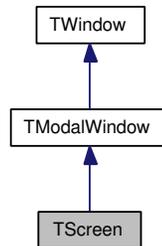
Returns:

Value.

13.51 TScreen Class Reference

```
#include <pf/screen.h>
```

Inheritance diagram for TScreen:



13.51.1 Detailed Description

The base level modal window.

Top-level application control logic can be handled at this level by deriving from [TScreen](#) and implementing a handler for `DoModalProcess`.

[TScreen](#) also handles caching of the window background, so `TScreen::Draw` should NOT be overridden.

Public Member Functions

- void [ClearBackground](#) (bool clear)
Tell the screen to clear its background.
- void [NeverClearBackground](#) (bool neverClear)
Tell the screen to never clear its background.
- void [SetBackgroundColor](#) (const [TColor](#) &color)
Set the background color.
- [TColor](#) [GetBackgroundColor](#) ()

13.51.2 Member Function Documentation

void TScreen::ClearBackground (bool clear)

Tell the screen to clear its background.

This should only be done in a situation where you have a sparse set of windows covering the background.

Parameters:

clear True to clear the background.

void TScreen::NeverClearBackground (bool neverClear)

Tell the screen to never clear its background.

This causes the screen to never redraw the background, even if it is the only window.

Parameters:

clear True to never clear the background.

void TScreen::SetBackgroundColor (const TColor & color)

Set the background color.

Note this will only have an effect if [ClearBackground\(\)](#) is set to true.

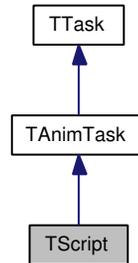
Parameters:

color Color to clear the background.

13.52 TScript Class Reference

```
#include <pf/script.h>
```

Inheritance diagram for TScript:



13.52.1 Detailed Description

An encapsulation for a Lua script context.

A [TScript](#) can be used in multiple ways. If you create a thread that yields, then you can either use [TScript::Resume](#) to explicitly resume the thread, or you can register it as a [TAnimTask](#) with an appropriate dispatch (commonly [TPlatform::AdoptTask](#) or [TModalWindow::AdoptTask](#)). If you're calling functions that exit normally, then you don't need to do anything beyond calling the function or executing Lua code using [DoLuaString\(\)](#), [RunScript\(\)](#), or [RunFunction\(\)](#).

See also:

[Lua Scripting](#)

<http://www.lua.org>

Global Script Settings

Set the path that all Lua scripts will search.

- void [SetLuaPath](#) (str luaPath)
Set the global Lua search path.
- int32_t [RunFunction](#) (int32_t nargs=0, int32_t nresults=1)
Run the function with parameters on the Lua stack.
- static str [GetLuaPath](#) ()
Get the global Lua search path.

Public Member Functions

Lua Data Constructors

Functions that are used to push new data on the Lua stack.

- void [PushLightUserData](#) (const char *name, void *userData)
Push a new Light User Data on the Lua stack.

Lua Data Accessors

Functions that are used to access parameters from the Lua table on the top of the stack.

- lua_State * [GetState](#) ()
Get the current Lua state.
- [TColor PopColor](#) ()
Pop a [TColor](#) from the stack.
- [TFont PopFont](#) ()
Pop a [TFont](#) from the stack.
- [str PopString](#) ()
Pop a string from the stack.
- [TRect PopRect](#) ()
Pop a [TRect](#) off the top of the stack.
- lua_Number [PopNumber](#) ()
Pop a number from the stack.
- bool [PopBool](#) ()
Pop a boolean from the stack.

Client Interface

Functions that are commonly used by a client.

- bool [RunScript](#) (str filename)
Run a Lua script in the current environment.
- [TScript * NewThread](#) ()
Create a new [TScript](#)-derived class of the same type as this class, but running in a new Lua thread.
- void [DoLuaString](#) (str luaCommand, int32_t length=-1)
Execute a string in the Lua interpreter.
- virtual bool [InjectFunction](#) ()
Inject a function into a running Lua script.
- int32_t [Resume](#) (int32_t narg=0)
Resume a thread that has been suspended by a coroutine yield.
- bool [CoroutineActive](#) (int32_t narg=0)
Test to see if a coroutine can currently be successfully resumed.

Lua Global Data Accessors

Functions that read global data from the Lua state.

These are used both inside a creator and globally.

- [str GetGlobalString](#) (str name)
Get a string from a global Lua variable.
- [str GetGlobalTableString](#) (str name, int32_t index)

Get a string from a global Lua table.

- **TLuaTable * GetGlobalTable** (**str** name)
Get a global table from a Lua state.
- **void SetGlobalString** (**str** name, **str** value)
Set a string global in a Lua environment.
- **void SetGlobalNumber** (**str** name, lua_Number value)
Set a numeric global in a Lua environment.
- **lua_Number GetGlobalNumber** (**str** name)
Get a number from a global Lua variable.

TTask Overrides

Functions that handle TTask behavior.

- **virtual bool Animate** ()
This function is called when it's time to execute this task.

13.52.2 Member Function Documentation

TColor TScript::PopColor ()

Pop a **TColor** from the stack.

Returns:

A **TColor** from the top of the Lua stack.

class TFont TScript::PopFont ()

Pop a **TFont** from the stack.

Returns:

A **TFont** from the top of the Lua stack.

str TScript::PopString ()

Pop a string from the stack.

Returns:

A string from the top of the Lua stack.

TRect TScript::PopRect ()

Pop a **TRect** off the top of the stack.

Returns:

A **TRect**

lua_Number TScript::PopNumber ()

Pop a number from the stack.

Returns:

A number from the top of the Lua stack.

bool TScript::PopBool ()

Pop a boolean from the stack.

Returns:

A bool from the top of the Lua stack.

bool TScript::RunScript (str filename)

Run a Lua script in the current environment.

If the Lua script returns a value at the top level, that value is assumed to be a function that is to be run as a thread.

RunScript loads the script from the resource and then runs it using RunFunction. See RunFunction for important restrictions and limitations.

Parameters:

filename Filename to read

Returns:

true on success.

See also:

[RunFunction](#)

TScript* TScript::NewThread ()

Create a new TScript-derived class of the same type as this class, but running in a new Lua thread.

Lua threading is cooperative multithreading: It is non-preemptive, and as such requires that you "yield" to pause processing.

Returns:

A TScript-derived class constructed with similar parameters as the host class.

void TScript::DoLuaString (str luaCommand, int32_t length = -1)

Execute a string in the Lua interpreter.

Is not executed as a thread, so will not interfere with an existing thread that has yielded.

Parameters:

luaCommand Command to execute.

length Optional length, for binary buffers.

virtual bool TScript::InjectFunction () [virtual]

Inject a function into a running Lua script.

Default implementation is empty, but the [TWindowManager::GetScript\(\)](#) script has a derived implementation.

Attempts to inject the function on the top of the Lua stack into the current coroutine.

The Lua function can take parameters, but is assumed to not return any results.

Returns:

True on success, false on failure.

See also:

[TScript::RunScript](#)

int32_t TScript::Resume (int32_t *narg* = 0)

Resume a thread that has been suspended by a coroutine yield.

Parameters:

narg Number of arguments being passed in on the stack; these arguments are returned as the results of the previous yield.

Returns:

0 if there are no errors running the coroutine, or an error code. See http://www.lua.org/manual/5.0/manual.html#lua_pcall for error codes.

bool TScript::CoroutineActive (int32_t *narg* = 0)

Test to see if a coroutine can currently be successfully resumed.

Parameters:

narg Number of arguments you were planning to pass in to the coroutine.

Returns:

True if a coroutine exists and is ready to be resumed. False otherwise.

str TScript::GetGlobalString (str *name*)

Get a string from a global Lua variable.

Parameters:

name Name of the Lua variable.

Returns:

The string, if found. An empty string otherwise.

str TScript::GetGlobalTableString (str *name*, int32_t *index*)

Get a string from a global Lua table.

Parameters:

name Name of the Lua table.

index Index of item to extract.

Returns:

The string, if table and index found. An empty string otherwise.

TLuaTable* TScript::GetGlobalTable (str *name*)

Get a global table from a Lua state.

The table is created with `new`, and must be deleted when you are done with it.

Parameters:

name Name of table to retrieve.

Returns:

A [TLuaTable](#) wrapping the global table.

void TScript::SetGlobalString (str name, str value)

Set a string global in a Lua environment.

Parameters:

name Name of the string variable.

value Value to set the string variable.

void TScript::SetGlobalNumber (str name, lua_Number value)

Set a numeric global in a Lua environment.

Parameters:

name Name of the lua_Number variable.

value Value to set the variable.

lua_Number TScript::GetGlobalNumber (str name)

Get a number from a global Lua variable.

Parameters:

name Name of the Lua variable.

Returns:

The corresponding number, or 0 if not found.

virtual bool TScript::Animate () [virtual]

This function is called when it's time to execute this task.

Returns:

True to keep the task alive. False to destroy the task.

Implements [TAnimTask](#).

void TScript::SetLuaPath (str luaPath)

Set the global Lua search path.

Parameters:

luaPath New path for Lua.

int32_t TScript::RunFunction (int32_t nargs = 0, int32_t nresults = 1)

Run the function with parameters on the Lua stack.

This is different than the Lua APIs `lua_call` and `lua_pcall` in that it relies on `InjectFunction` to pass a function into a currently paused coroutine. `InjectFunction` is implemented in the [TWindowManager](#) script, but not in the base class. See [Implementation Details](#) below.

Example usage:

```
TScript * s = TWindowManager::GetInstance()->GetScript();
// Push the function on the stack.
lua_getglobal( s->GetState(), "MyLuaFunction" );
// Run the function with no parameters or results.
s->RunFunction(0,0);
```

C++

The above will call `MyLuaFunction()` in Lua with no parameters.

Example with parameters and a return value:

```
TScript * s = TWindowManager::GetInstance()->GetScript();
// Push the function on the stack.
lua_getglobal( s->GetState(), "StopGame" );
// Push the number 25 onto the stack.
lua_pushnumber( s->GetState(), 25 );
// Run the function with one parameter and one result.
s->RunFunction(1,1);
// Get the return value from the top of the stack.
int32_t result = (int32_t)lua_tonumber( s->GetState(), -1 );
```

C++

See Lua API documentation from <http://www.lua.org> for more information on `lua_getglobal`, `lua_pushnumber`, and the rest of the internal Lua API.

Warning:

If you need more than one return value from your function, it cannot yield control, nor call any function that yields control of the coroutine. A single return value is supported by the current API.

13.52.3 Details

When Lua has paused a script using the "coroutine.yield" function or the C call `lua_yield`, it remains in a suspended state until one calls `lua_resume` or `coroutine.resume`. In this state you can actually still use the same interpreter to execute Lua functions, but those functions may not themselves yield, nor can a Lua function that was called via C resume the previous Lua coroutine.

To allow arbitrary function execution from C, the Playground Lua "message loop" takes an extra parameter which is a function to call. In other words, whenever the Lua message loop has yielded to wait for a message, you can pass it in a message and/or a command to execute. The [TWindowManager](#) version of `InjectFunction` calls `Resume` with that command as a parameter, and it's executed as part of the main thread—so it can therefore enter its own wait loops, call other script functions, etc. However, that function that's passed in as a parameter can take no parameters of its own; `RunFunction` uses a Playground Lua call `GetClosure` to wrap your function plus any parameters in a Lua closure, and then passes that closure in to be executed.

In the case that a coroutine is not currently active, `RunFunction` does the trivial thing and calls `lua_pcall` with the standard error handler.

Note that the base class implementation of `InjectFunction` does nothing, and it's only the derived window UI script that `InjectFunction` will work.

This is not to hide the implementation, but instead because the injection relies on how the Lua script that yielded treats the return values of the yield statement. We can't make any assumptions about how your own custom scripts will process yield results; if you want to create your own version of `InjectFunction`, derive from [TScript](#) and add your own implementation. As an example:

```
bool InjectFunction()
{
    return Resume(1)==0;
```

C++

```
}  
}
```

This would assume that your Lua code interpreted the first return value from `yield` as a function, and then ran the function:

```
f = yield();  
if (f) then  
    f();  
end Lua
```

That way, the function is executed as part of your thread, rather than outside of it. If you need multiple threads, see [TScript::NewThread\(\)](#).

Parameters:

nargs Number of arguments.

nresults Number of results. If there's a chance your function will be executed during a paused coroutine, *and* your function needs to be able to yield, then this number should be zero or one.

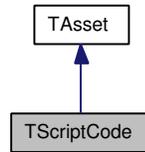
Returns:

0 on success. Lua error code otherwise.

13.53 TScriptCode Class Reference

```
#include <pf/script.h>
```

Inheritance diagram for TScriptCode:



13.53.1 Detailed Description

An encapsulation of a compiled Lua source file.

Public Member Functions

- [str GetCode \(\)](#)
Get the (compiled) script code.
- [uint32_t GetCodeLength \(\)](#)
Get the length of the compiled code block.

Static Public Member Functions

- [static TScriptCodeRef Get \(str handle, str luaPath="", str *error=NULL\)](#)
Accessor function for Lua script-code asset.

13.53.2 Member Function Documentation

```
static TScriptCodeRef TScriptCode::Get (str handle, str luaPath = "", str * error = NULL) [static]
```

Accessor function for Lua script-code asset.

Internally, when loading a Lua script from a file, the internal routines use [TScriptCode::Get\(\)](#) to load it. If you keep a reference to the [TScriptCode](#), then when the routine calls [TScriptCode::Get\(\)](#), it will retrieve the cached (and precompiled) copy rather than reloading it from disk.

Parameters:

handle File handle to load.
luaPath Any additional Lua search path necessary.
error An optional str that gets set with an error string.

Returns:

A reference to the compiled code object.

str TScriptCode::GetCode ()

Get the (compiled) script code.

Returns:

A pre-compiled Lua block. Can have embedded null characters; use [TScriptCode::GetCodeLength\(\)](#) to determine the length.

uint32_t TScriptCode::GetCodeLength ()

Get the length of the compiled code block.

Returns:

Code block length.

13.54 TSimpleHttp Class Reference

```
#include <pf/simplehttp.h>
```

13.54.1 Detailed Description

The [TSimpleHttp](#) class implements a basic HTTP connection.

Public Types

- enum [ERequestFlags](#) { [eNoFlag](#) = 0x00000000, [eDoNotWriteCache](#) = 0x00000001, [eIgnoreCNInvalid](#) = 0x00000002 }
Request modifiers.
- enum [EStatus](#) { [eNetWait](#), [eNetDone](#), [eNetError](#), [eFileError](#) }
Status enumeration.

Public Member Functions

- [TSimpleHttp](#) ()
Construction.
- virtual [~TSimpleHttp](#) ()
Destruction.
- void [Init](#) (const char *url, bool bPost=false, const char *path=NULL)
specify path name to download to, otherwise goes to memory
- void [AddArg](#) (const char *name, const char *value)
Add a POST or GET argument to the query.
- void [AddArg](#) (const char *name, int32_t value)
Add a POST or GET argument to the query.
- void [DoRequest](#) (int32_t flags)
Start the request.
- [EStatus](#) [GetStatus](#) ()
Get the current status.
- unsigned long [GetContentLengthHeader](#) ()
Returns the "content-length" field of the HTTP header, if available.
- unsigned long [GetBytesReceived](#) ()
Get the total number of bytes received.
- char * [GetContents](#) ()
Get the content of the reply.

Static Public Member Functions

- static `str HttpSafeString` (const char *unsafeString)
HTTP cleanup.

13.54.2 Member Enumeration Documentation

enum `TSimpleHttp::ERequestFlags`

Request modifiers.

Enumerator:

- eNoFlag* No modifier.
- eDoNotWriteCache* Do not write the request to the cache.
- eIgnoreCNInvalid* Ignore an invalid certificate.

enum `TSimpleHttp::EStatus`

Status enumeration.

Enumerator:

- eNetWait* Waiting for a reply.
- eNetDone* Reply complete and successful.
- eNetError* Error communicating with server.
- eFileError* Error writing file.

13.54.3 Member Function Documentation

void `TSimpleHttp::AddArg` (const char * name, const char * value)

Add a POST or GET argument to the query.

Parameters:

- name* Name of argument.
- value* Value of argument.

void `TSimpleHttp::AddArg` (const char * name, int32_t value)

Add a POST or GET argument to the query.

Parameters:

- name* Name of argument.
- value* Value of argument.

static `str TSimpleHttp::HttpSafeString` (const char * unsafeString) **[static]**

HTTP cleanup.

Parameters:

- unsafeString* String to clean.

Returns:

- Newly cleaned string.

void TSimpleHttp::DoRequest (int32_t *flags*)

Start the request.

Parameters:

flags One or more ERequestFlags bitwise-ORed together.

EStatus TSimpleHttp::GetStatus ()

Get the current status.

Returns:

The status.

unsigned long TSimpleHttp::GetContentLengthHeader ()

Returns the "content-length" field of the HTTP header, if available.

This value is the expected total download size.

Returns:

Expected size of the content.

See also:

[GetBytesReceived\(\)](#)

unsigned long TSimpleHttp::GetBytesReceived ()

Get the total number of bytes received.

If the download is complete, this is the same as [GetContentLengthHeader\(\)](#); if the download is still in progress, this will be a lower number that you can use to display a progress bar.

Returns:

Bytes received.

See also:

[GetContentLengthHeader\(\)](#)

char* TSimpleHttp::GetContents ()

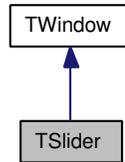
Get the content of the reply.

Available only if downloading to memory: Will fail until status is eNetDone.

13.55 TSlider Class Reference

```
#include <pf/slider.h>
```

Inheritance diagram for TSlider:



13.55.1 Detailed Description

Slider class.

A class that implements a UI slider that is scalable. It consists of two parts, the rail and the slider. The rail consists of three graphics, the top, middle, and bottom. The middle is stretched to be as long as it needs to match the height or width of the slider. You can set the width or height of the slider to be the long dimension, and the other dimension will be taken from the width of the rail images.

Attributes:

- railtop - Top of the rail. Rail graphics are vertical.
- railmid - Middle of the rail. This part gets stretched.
- railbot - Bottom of the rail.
- sliderimage - Image to use as the slider handle.
- sliderrollimage - Image to use as the rollover for the slider handle.
- yoffset - An offset to use to adjust the centering of the slider handle.

Public Types

- enum [ESliderState](#) { **eIdle** = 0, **eMoving** }
The current state of the slider.

Public Member Functions

- void [ShowHandle](#) (bool show)
Show the slider widget.
- virtual void [Draw](#) ()
Draw the window.
- void [SetRailTexture](#) (TTextureRef top, TTextureRef mid, TTextureRef bot)
Set the textures for the rail.
- void [SetSliderTexture](#) (TTextureRef texture, TTextureRef rollover)
Set the textures for the slider knobs.

- [TReal GetValue \(\)](#)
Get the current slider handle position.
- void [SetValue \(TReal value, bool silent=false\)](#)
Set the current slider handle position.
- void [SetScale \(TReal scale\)](#)
Set the slider scale.
- virtual bool [OnMouseDown \(const TPoint &point\)](#)
Mouse handler.
- virtual bool [OnMouseUp \(const TPoint &point\)](#)
Mouse handler.
- virtual bool [OnMouseMove \(const TPoint &point\)](#)
Mouse handler.
- virtual bool [OnMouseLeave \(\)](#)
Mouse handler.
- virtual void [Init \(TWindowState &style\)](#)
Window initialization handler.
- [ESliderState GetState \(\)](#)
Get the current slider state (whether it's moving or idle).

Static Public Member Functions

- static void [Register \(\)](#)
Register [TSlider](#) with the windowing system.

13.55.2 Member Function Documentation

void TSlider::ShowHandle (bool show)

Show the slider widget.

Defaults to being visible.

Parameters:

show True to show handle.

virtual void TSlider::Draw () [virtual]

Draw the window.

Derived classes will override this function and provide the draw functionality.

Optionally only redraw portions that have been invalidated since the previous draw.

Reimplemented from [TWindow](#).

void TSlider::SetRailTexture (TTextureRef *top*, TTextureRef *mid*, TTextureRef *bot*)

Set the textures for the rail.

The textures are oriented vertically, as if for a vertical slider, and will be rotated counter-clockwise for horizontal sliders.

To ensure compatibility across renderers, the height each texture should be a power of two and greater than its width.

Parameters:

top Top of the slider.

mid Middle of the slider. This one gets stretched out to make the slider the right height or width.

bot Bottom of the slider.

void TSlider::SetSliderTexture (TTextureRef *texture*, TTextureRef *rollover*)

Set the textures for the slider knobs.

Parameters:

texture Normal state slider knob.

rollover Rollover state slider knob.

TReal TSlider::GetValue ()

Get the current slider handle position.

Returns:

The position as a value from 0 to 1.

void TSlider::SetValue (TReal *value*, bool *silent* = false)

Set the current slider handle position.

Parameters:

value Position from 0 to 1 inclusive.

silent True to prevent a "slider-changed" message from being sent.

void TSlider::SetScale (TReal *scale*)

Set the slider scale.

Parameters:

scale The scale of the slider.

virtual bool TSlider::OnMouseDown (const TPoint & *point*) [virtual]

Mouse handler.

Parameters:

point Mouse position.

Returns:

True if handled.

Reimplemented from [TWindow](#).

virtual bool TSlider::OnMouseUp (const [TPoint](#) & *point*) [virtual]

Mouse handler.

Parameters:

point Mouse position.

Returns:

True if handled.

Reimplemented from [TWindow](#).

virtual bool TSlider::OnMouseMove (const [TPoint](#) & *point*) [virtual]

Mouse handler.

Parameters:

point Mouse position.

Returns:

True if handled.

Reimplemented from [TWindow](#).

virtual bool TSlider::OnMouseLeave () [virtual]

Mouse handler.

Returns:

True if handled.

Reimplemented from [TWindow](#).

virtual void TSlider::Init ([TWindowStyle](#) & *style*) [virtual]

Window initialization handler.

Parameters:

style Window style.

Reimplemented from [TWindow](#).

[ESliderState](#) TSlider::GetState ()

Get the current slider state (whether it's moving or idle).

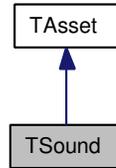
Returns:

The state of the slider.

13.56 TSound Class Reference

```
#include <pf/sound.h>
```

Inheritance diagram for TSound:



13.56.1 Detailed Description

The [TSound](#) class represents an object that can play a sound asset.

Public Types

- enum { **kButtonSound** = 0, **kUserSoundBase** = 1000 }

Public Member Functions

- [TSoundInstanceRef Play](#) (bool bLoop=false)
Play a sound.
- bool [Pause](#) (bool bPause)
Pause all instances of this sound.
- bool [Kill](#) ()
Kill all instances of this sound - once a sound is killed it must be restarted with [Play\(\)](#), it cannot be unpaused.
- [TReal GetSoundLength](#) ()
Get the length of the sound in seconds.
- [TSoundRef GetRef](#) ()
Get a reference to this sound.
- [str GetName](#) ()

Static Public Member Functions

Factory Methods

- static [TSoundRef Get](#) (str filename, bool bInMemory=true, int32_t type=-1)
Get a sound from a name.

13.56.2 Member Function Documentation

static TSoundRef TSound::Get (str filename, bool bInMemory = true, int32_t type = -1) [static]

Get a sound from a name.

Parameters:

filename Name of the sound file.

bInMemory True to load entire sound into memory, false to stream it

type Type of sound, or -1 to be part of a global group. Sounds with the same type will all play at the same volume. User defined groups should start at kUserSoundBase. Anything below that value is reserved for internal library use.

Returns:

A TSoundRef to the sound.

TSoundInstanceRef TSound::Play (bool bLoop = false)

Play a sound.

Parameters:

bLoop Whether or not to loop a sound

Returns:

A reference to the spawned instance of the sound. To modify or update that instance once it's spawned, keep a reference to the [TSoundInstance](#) and use it to modify the instance.

bool TSound::Pause (bool bPause)

Pause all instances of this sound.

Parameters:

bPause True to pause, false to unpause

Returns:

true on success, false on failure

bool TSound::Kill ()

Kill all instances of this sound - once a sound is killed it must be restarted with [Play\(\)](#), it cannot be unpause.

If a sound is set as a "continuation" of another sound it will also be killed, even if it hasn't started yet.

Returns:

true if any sounds were killed, false otherwise.

TReal TSound::GetSoundLength ()

Get the length of the sound in seconds.

Returns:

Number of seconds.

TSoundRef TSound::GetRef ()

Get a reference to this sound.

Returns:

A reference to this.

Reimplemented from [TAsset](#).

13.57 TSoundCallBack Class Reference

```
#include <pf/sound.h>
```

13.57.1 Detailed Description

[TSoundCallBack](#) –a class that you override and attach to a [TSound](#) if you want to know when the sound has finished playing.

Public Member Functions

- [TSoundCallBack](#) ()
Constructor.
- virtual [~TSoundCallBack](#) ()
Destructor.
- virtual void [OnComplete](#) ([TSoundInstanceRef](#) soundInstance, [TSoundRef](#) nextSound)=0
Function called when a sound has finished playing.

13.57.2 Member Function Documentation

virtual void TSoundCallBack::OnComplete ([TSoundInstanceRef](#) soundInstance, [TSoundRef](#) nextSound)
[pure virtual]

Function called when a sound has finished playing.

This function is guaranteed to be called during the main thread, but may be called up to one second later due to buffering.

Parameters:

soundInstance TSoundInstanceRef of sound that just finished

nextSound TSoundRef of sound that has been queued up to play next with TSound::SetCompleteAction

13.58 TSoundInstance Class Reference

```
#include <pf/soundinstance.h>
```

13.58.1 Detailed Description

An instance of a sound.

Returned as a TSoundInstanceRef from [TSound::Play\(\)](#), you can then control the playback of that instance using this class.

See also:

[TSound](#)

Public Member Functions

- virtual [~TSoundInstance](#) ()
Destructor.
- void [Play](#) ()
Play the sound!
- void [Pause](#) (bool bPause)
Pause the sound!
- void [Kill](#) ()
Kill the sound instance.
- void [SetPosition](#) (TReal seconds)
Set a sound to a specific play position.
- void [SetVolume](#) (float volume)
Set the volume of the sound.
- int [GetGroupId](#) ()
Get the group this stream belongs to.
- void [SetCompleteAction](#) (TSoundCallBack *pCallback, TSoundRef playNext=TSoundRef())
Setup a sound callback - the sound will call the passed in callback class when the sound has finished playing.
- TSoundRef [GetSound](#) ()
Get a reference to the original sound that spawned this instance.
- TSoundRef [GetNextSound](#) ()
Get a reference to the next sound to be streamed after the current one completes.

13.58.2 Member Function Documentation

void TSoundInstance::Pause (bool *bPause*)

Pause the sound!

Parameters:

bPause True to pause the sound; false to resume.

void TSoundInstance::Kill ()

Kill the sound instance.

Sound instances normally live until they complete or until they are killed. Simply releasing the TSoundInstance-Ref will not itself kill a sound.

void TSoundInstance::SetPosition (TReal *seconds*)

Set a sound to a specific play position.

Parameters:

seconds The position, in seconds, to set the play position of the sound.

void TSoundInstance::SetVolume (float *volume*)

Set the volume of the sound.

Parameters:

volume Volume level 0.0-1.0f

int TSoundInstance::GetGroupId ()

Get the group this stream belongs to.

Returns:

The current group id.

void TSoundInstance::SetCompleteAction (TSoundCallback * *pCallback*, TSoundRef *playNext* = TSoundRef ())

Setup a sound callback - the sound will call the passed in callback class when the sound has finished playing.

The client maintains ownership of the callback, and it is their responsibility to delete it when no longer needed. Deleting the callback automatically unregisters it. A TSoundCallback contains references to the current sound and the playNext sound. Therefore, you do not need to keep a reference around to a sound used in a sound callback, and the sound can be killed by deleting the sound callback (However - in practice it is wise to keep around your own sound reference so you can pause it, kill it, etc.) This call can also be used to setup a sound to play immediately after this sound is done. Note that because a callback is called during the main thread, in order to play a sound seamlessly, it is better to setup a 2nd sound with playNext instead of having the pCallback play another sound.

Warning:

When queueing up sounds with the next parameter, the sound must be of the same number of channels (i.e. mono or stereo).

If you queue up a sound with a different number of channels, an ASSERT will trigger in a debug build. In a release build, the resulting sound will likely be incorrect.

Parameters:

pCallback Pointer to callback object that will be called when the sound is done. This parameter can be NULL if the client just wants to setup a `playNext` sound.

playNext - what sound to play after the current sound finishes. Default is a NULL [TSoundRef\(\)](#). (See note above about `playNext` restrictions)

[TSoundRef](#) TSoundInstance::GetSound ()

Get a reference to the original sound that spawned this instance.

Returns:

A sound reference, or NULL if the sound has been deleted.

13.59 TSoundManager Class Reference

```
#include <pf/soundmanager.h>
```

13.59.1 Detailed Description

The [TSoundManager](#) class controls access to the sound subsystem.

Public Member Functions

- void [SetVolume](#) (float volume)
set the global sound volume
- void [SetTypeVolume](#) (int32_t type, float volume)
set the volume for a specific group of sounds.
- void [PauseAllSounds](#) (bool bPause, int32_t type=-1)
Pause or unpause all sounds.
- void [KillAllSounds](#) (int32_t type=-1)
Kill all sounds.

13.59.2 Member Function Documentation

void TSoundManager::SetVolume (float *volume*)

set the global sound volume

Parameters:

volume Global sound volume, 0.0 is off, 1.0 is full volume

void TSoundManager::SetTypeVolume (int32_t *type*, float *volume*)

set the volume for a specific group of sounds.

This is multiplied with the global volume setting

Parameters:

type id of sound group to set

volume Volume to set, 0.0 is off, 1.0 is full volume

void TSoundManager::PauseAllSounds (bool *bPause*, int32_t *type* = -1)

Pause or unpause all sounds.

Parameters:

bPause true to pause, false to resume

type -1 to pause all sounds, or specify a specific sound group ID

void TSoundManager::KillAllSounds (int32_t *type* = -1)

Kill all sounds.

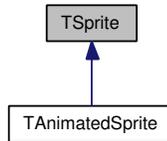
Parameters:

type -1 to pause all sounds, or specify a specific sound group ID

13.60 TSprite Class Reference

```
#include <pf/sprite.h>
```

Inheritance diagram for TSprite:



13.60.1 Detailed Description

A 2d sprite object.

A [TSprite](#) functions both as an individual display object and a container for child [TSprite](#) objects. Typically a [TSprite](#) with no [TTexture](#) is used as a container for all of the [TSprites](#) in one screen of a game.

[TSprites](#) are always stored in the client as [TSpriteRef](#)—reference counted objects. To destroy a [TSprite](#), simply call `reset()` on the last [TSpriteRef](#) that refers to that sprite.

It's worth noting that a [TSprite](#) holds a reference to any of its children, so you don't need to worry about keeping an external reference to a child sprite that can be passively attached to an object. An example of this usage would be a shadow that stays at a constant offset from the parent sprite. To make the shadow appear behind the parent you can give it a negative "layer" when you create it.

A [TSprite](#) has a concept of a layer which indicates how it will be rendered relative to its siblings. For the top sprite in a hierarchy (the one you're calling `Draw` on yourself), the layer parameter is meaningless—it only applies to sprites with siblings or a parent. The layer determines the relative order of drawing of a sprite with its siblings and parent.

Here are the rules that determine the order of drawing:

- When siblings have the same layer, they will render in an arbitrary order—it is assumed not to matter what order they're in.
- When siblings have different layers, the higher layered siblings will be rendered above the lower layered siblings.
- When a child sprite has a negative layer, it will be rendered *behind* its parent; otherwise it will be rendered in front of its parent.

Changing the layer of a sprite requires that the parent's child list be resorted. In other words, it's a relatively heavy operation if there are a lot of siblings, so try not to do it frequently.

See also:

[TAnimatedSprite](#)

Initialization/Destruction

- static [TSpriteRef Create](#) (int32_t layer=0, [TTextureRef](#) texture=[TTextureRef](#)())
Allocation of a new sprite.
- virtual [~TSprite](#) ()
Destructor.

Public Types

- typedef std::list< [TSpriteRef](#) > [SpriteList](#)
A list of sprites.

Public Member Functions

- virtual void [SetTexture](#) ([TTextureRef](#) texture)
Set the texture of the sprite object.
- [TTextureRef](#) [GetTexture](#) ()
Get the current texture.
- [TDrawSpec](#) & [GetDrawSpec](#) ()
Get the associated [TDrawSpec](#).
- void [SetVisible](#) (bool visible)
Set a sprite to be visible and enabled.
- bool [IsVisible](#) ()
Is the sprite visible/enabled?
- [TSprite](#) * [GetParent](#) ()
Get the current parent of this sprite.

Drawing and Layers

- virtual void [Draw](#) (const [TDrawSpec](#) &environmentSpec=[TDrawSpec](#)(), int32_t depth=-1)
Draw the sprite and its children.
- void [SetLayer](#) (int32_t layer)
Set the layer of the sprite.
- int32_t [GetLayer](#) ()
Get the current sprite layer.

Parent/Child Access and Management

- void [AddChild](#) ([TSpriteRef](#) child)
Add a child sprite.
- virtual bool [RemoveChild](#) ([TSpriteRef](#) sprite)
Remove a child sprite.
- void [RemoveChildren](#) ()
Release all children of the sprite.

Bounding Rectangles and Hit Tests.

- virtual [TRect](#) [GetRect](#) (const [TDrawSpec](#) &parentContext, int32_t depth=-1)

Get the rect of this sprite.

- `bool HitTest (const TPoint &at, const TDrawSpec &parentContext, int32_t opacity=-1, int32_t depth=-1)`
Test to see if a point is within our sprite.

Protected Member Functions

- `TSprite (int32_t layer)`
Internal Constructor. Use `TSprite::Create()` to get a new sprite.
- `virtual void ResortSprites ()`
Resort my children because one of them has changed layer (priority).

Protected Attributes

- `SpriteList mChildren`
Sprite children.

Friends

- `bool operator< (TSpriteRef first, TSpriteRef second)`
Comparison operator for layer sorting.

13.60.2 Member Function Documentation

`static TSpriteRef TSprite::Create (int32_t layer = 0, TTextureRef texture = TTextureRef ())` **[static]**

Allocation of a new sprite.

Construction is restricted to help "encourage" the use of TSpriteRefs to hold your TSprites (as well as to encapsulate the TSpriteRef creation pattern).

Parameters:

layer Initial sprite layer.
texture Initial sprite texture.

Returns:

A newly allocated `TSprite` wrapped in a `TSpriteRef`.

See also:

[SetLayer](#)
[SetTexture](#)

`virtual void TSprite::Draw (const TDrawSpec &environmentSpec = TDrawSpec (), int32_t depth = -1)` **[virtual]**

Draw the sprite and its children.

A common mistake is to assume that the incoming [TDrawSpec](#) here is what you use to position and configure this sprite. The way to position a sprite is to modify its internal [TDrawSpec](#), which you retrieve with [GetDrawSpec\(\)](#). The environment parameter is combined with the local [TDrawSpec](#) to determine the actual position of the sprite, though it only inherits those features marked in [TDrawSpec](#) as inheritable. See [TDrawSpec::GetRelative\(\)](#) for more details.

Parameters:

environmentSpec The 'parent' or environment drawspec—the frame of reference that this sprite is to be rendered in. In general you shouldn't pass anything in for this parameter and instead should modify the position of the sprite using its [GetDrawSpec\(\)](#) member.

Defaults to a default-constructed [TDrawSpec](#). See [TDrawSpec](#) for more details on what is inherited.

Parameters:

depth How many generations of children to draw; -1 means all children.

See also:

[TDrawSpec](#)

Reimplemented in [TAnimatedSprite](#).

void TSprite::SetLayer (int32_t layer)

Set the layer of the sprite.

A relatively expensive call; use with care.

The sprite's layer determines the order in which it will be rendered relative to its immediate parent and siblings. A negative layer will be rendered behind its parent, while a positive layer will be rendered in front. Higher layer numbers are rendered in front of lower layer numbers.

Parameters:

layer New sprite layer.

void TSprite::AddChild (TSpriteRef child)

Add a child sprite.

Children are drawn relative to the parent sprite: When you set the position, it will be added to the position of the parent.

The child should *not* be added independently to the sprite manager.

Children with a negative sprite layer are drawn behind the parent sprite. Zero or positive layers are drawn after the parent sprite.

Parameters:

child The sprite to add as a child of this sprite.

virtual bool TSprite::RemoveChild (TSpriteRef sprite) [virtual]

Remove a child sprite.

Returns true if child found.

Parameters:

sprite Child to remove.

Returns:

True if child found.

void TSprite::RemoveChildren ()

Release all children of the sprite.

"If you love them, set them free."

virtual TRect TSprite::GetRect (const TDrawSpec & parentContext, int32_t depth = -1) [virtual]

Get the rect of this sprite.

Parameters:

parentContext The parent context to test within—where is this sprite being drawn, and with what matrix?
Alpha and color information is ignored.
depth Depth of children to test

Returns:

Rectangle that includes this sprite.

Reimplemented in [TAnimatedSprite](#).

bool TSprite::HitTest (const TPoint & at, const TDrawSpec & parentContext, int32_t opacity = -1, int32_t depth = -1)

Test to see if a point is within our sprite.

Parameters:

at Point to test.
parentContext The parent context to test within—where is this sprite being drawn, and with what matrix?
Alpha and color information is ignored.
opacity Level of opacity to test for; -1 for a simple bounding box test, or 0-255 for alpha color value, where 0 is transparent (and will therefore always succeed).
depth Depth of children to test. Zero means only test this sprite. -1 means test

Returns:

true if point hits us.

virtual void TSprite::SetTexture (TTextureRef texture) [virtual]

Set the texture of the sprite object.

Parameters:

texture Texture to use.

Reimplemented in [TAnimatedSprite](#).

TTextureRef TSprite::GetTexture ()

Get the current texture.

Returns:

A reference to the current texture.

TDDrawSpec& TSprite::GetDrawSpec ()

Get the associated [TDDrawSpec](#).

Returns:

A modifiable reference to the [TDDrawSpec](#) associated with this sprite.

void TSprite::SetVisible (bool *visible*)

Set a sprite to be visible and enabled.

Sprites are initially visible.

Parameters:

visible True to set visible.

bool TSprite::IsVisible ()

Is the sprite visible/enabled?

Returns:

True if it's enabled.

TSprite* TSprite::GetParent ()

Get the current parent of this sprite.

Returns:

A pointer to the current parent, or NULL if this sprite is free.

13.60.3 Friends And Related Function Documentation

bool operator< (TSpriteRef *first*, TSpriteRef *second*) [friend]

Comparison operator for layer sorting.

Parameters:

first Left hand item to compare.

second Right hand item to compare.

Returns:

True if first sprite has a lower layer than the second.

13.61 TStringTable Class Reference

```
#include <pf/stringtable.h>
```

13.61.1 Detailed Description

The interface class for a string table.

The global string table contains a mapping of string identifiers to localized strings. When each string is requested at run time using [GetString\(\)](#), the parameters passed into [GetString\(\)](#) are substituted into slots specified by %1%, %2%, %3%... etc.

You can also use 's to reference other lookups, such as "Today's date is %date%", where date is another string to look up in the table.

To create "%" in a string, use "%%".

Each string supports up to 9 parameters.

A string can contain formatting information as described in the documentation for [TTextGraphic](#).

See [Translation Issues and the String Table](#) for a general description of the string table requirements.

Public Member Functions

- [str GetString](#) ([str](#) id, [str](#) param1=[str](#)(), [str](#) param2=[str](#)(), [str](#) param3=[str](#)(), [str](#) param4=[str](#)(), [str](#) param5=[str](#)())

Get a string - get a string from the string table, filling in the string with passed in strings.

- [str GetString](#) ([str](#) id, [uint32_t](#) numStr, [str](#) *strArray)

Get a string - get a string from the string table, filling in the string with passed in array of strings.

- [bool SetSilent](#) ([bool](#) silent)

Set the string table to not write errors for missing strings.

13.61.2 Member Function Documentation

[str](#) [TStringTable::GetString](#) ([str](#) id, [str](#) param1 = [str](#) (), [str](#) param2 = [str](#) (), [str](#) param3 = [str](#) (), [str](#) param4 = [str](#) (), [str](#) param5 = [str](#) ())

Get a string - get a string from the string table, filling in the string with passed in strings.

Parameters:

id id of string to look up in the string table.

param1-5 Optional strings used to fill in the placeholders in the string returned from the string table. If you want a parameter to be looked up in the string table as well, enclose it with %param% to signify that it should be looked up in the string table (use "%%" to just output a "%").

Returns:

a formatted str that is the result of looking up the id in the string table and adding in all the optional parameters. If any of the ids do not exist in the str table, the string returned will be "#####" to signify an invalid lookup.

str TStringTable::GetString (**str** *id*, **uint32_t** *numStr*, **str** * *strArray*)

Get a string - get a string from the string table, filling in the string with passed in array of strings.

Parameters:

id id of string to look up in the string table.

numStr number of Str in the str array

strArray Pointer to array of strings used to fill in the placeholders in the string returned from the string table.

If you want a parameter to be looked up in the string table as well, enclose it with %param% to signify that it should be looked up in the string table (use "%%" to just output a "%").

Returns:

a formatted str that is the result of looking up the id in the string table and adding in all the optional parameters. If any of the ids do not exist in the str table, the string returned will be "#####" to signify an invalid lookup.

bool TStringTable::SetSilent (**bool** *silent*)

Set the string table to not write errors for missing strings.

Parameters:

silent True to suppress errors.

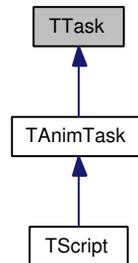
Returns:

Old value of silent.

13.62 TTask Class Reference

```
#include <pf/task.h>
```

Inheritance diagram for TTask:



13.62.1 Detailed Description

The task interface.

Used as a "callback" for events and periodic tasks.

Public Types

- enum [ETaskContext](#) { [eNormal](#), [eOnDraw](#) }
- Task context.*

Public Member Functions

- virtual [~TTask](#) ()
Virtual Destructor.
- virtual bool [Ready](#) ([ETaskContext](#) context=eNormal)
Is this task ready?
- virtual bool [DoTask](#) ()=0
This function is called when it's time to execute this task.

13.62.2 Member Enumeration Documentation

enum [TTask::ETaskContext](#)

Task context.

Enumerator:

- eNormal* Normal update context.
- eOnDraw* Immediately prior to the next screen draw context.

13.62.3 Member Function Documentation

virtual bool TTask::Ready (ETaskContext context = eNormal) [virtual]

Is this task ready?

A virtual function that returns whether this task is ready to be executed. Derived classes should override this function to provide more control over when a task is executed.

Parameters:

context The context in which we're being called.

Returns:

eReady if it's ready, eNotReady to wait, or eOnDraw to execute prior to the next screen draw. Default implementation returns eReady.

virtual bool TTask::DoTask () [pure virtual]

This function is called when it's time to execute this task.

Returns:

True to keep the task alive. False to destroy the task.

13.63 TTaskList Class Reference

```
#include <pf/tasklist.h>
```

13.63.1 Detailed Description

A list of TTask-derived objects.

Public Types

- `typedef std::list< TTask * > TaskList`
The internal task list type.

Public Member Functions

- `~TTaskList ()`
Destructor.
- `bool OrphanTask (TTask *task)`
Remove a task from the task list.
- `void AdoptTask (TTask *task)`
Add a task to the task list.
- `void DoAll (TTask::ETaskContext context=TTask::eNormal)`
Perform all of the tasks in the task list.
- `void DestroyAll ()`
Destroy all the tasks in the list.

13.63.2 Member Function Documentation

bool TTaskList::OrphanTask (TTask * task)

Remove a task from the task list.

Does not delete the task, but rather releases ownership; calling function now owns task.

Parameters:

task Task to remove.

Returns:

true if task was removed, false if task was not found

void TTaskList::AdoptTask (TTask * task)

Add a task to the task list.

Task list takes ownership of the task and will delete it when the task notifies that it is complete.

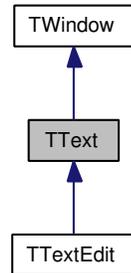
Parameters:

task Task to add.

13.64 TText Class Reference

```
#include <pf/text.h>
```

Inheritance diagram for TText:



13.64.1 Detailed Description

A text window.

Contains a [TTextGraphic](#) and renders it transparently.

See also:

[TTextGraphic](#)

Public Types

- enum [EFlags](#) {
 - [kHAlignLeft](#) = [TTextGraphic::kHAlignLeft](#), [kHAlignCenter](#) = [TTextGraphic::kHAlignCenter](#), [kHAlignRight](#) = [TTextGraphic::kHAlignRight](#), [kVAlignTop](#) = [TTextGraphic::kVAlignTop](#), [kVAlignCenter](#) = [TTextGraphic::kVAlignCenter](#), [kVAlignBottom](#) = [TTextGraphic::kVAlignBottom](#) }
 - TText window child flags.*

Public Member Functions

- [TText](#) (bool staticText=false)
 - Constructor.*
- [~TText](#) ()
 - Destructor.*
- bool [Create](#) (str text, uint32_t w, uint32_t h, uint32_t flags, const char *fontFilename, uint32_t lineHeight, const [TColor](#) &textColor)
 - Create a TText window.*
- virtual void [Draw](#) ()
 - TWindow::Draw handler.*
- uint32_t [GetLineCount](#) ()
 - Get the number of lines in the text output.*

- void `SetStartLine` (TReal startLine=0)
Set the first line in the text output.
- void `GetTextBounds` (TRect *pBounds)
Get the actual boundary of the rendered text.
- virtual void `SetText` (str text)
Set the current text content.
- virtual str `GetText` ()
Get the current text content.
- TTextGraphic * `GetTextGraphic` ()
Get the associated TTextGraphic object.
- void `SetColor` (const TColor &color)
Set the current text color.
- void `SetAlpha` (TReal alpha)
Set the text alpha.
- void `SetScale` (TReal scale)
Set the current text scale.
- void `SetLinePadding` (int32_t linePadding)
Set the current line padding.
- virtual bool `OnMouseUp` (const TPoint &point)
Mouse up handler.
- virtual bool `OnMouseDown` (const TPoint &point)
Mouse down handler.
- virtual bool `OnMouseMove` (const TPoint &point)
Mouse motion handler.
- virtual bool `OnMouseLeave` ()
Notification that the mouse has left the window.
- void `SetRotation` (TReal degrees, int32_t originX, int32_t originY)
Change the rotation - default is 0 degrees, 0,0 origin.
- uint32_t `GetMaxScroll` ()
Get the maximum line you need to scroll the text to in order to display the last line of text.
- virtual void `SetScroll` (TReal vScroll, TReal hScroll=0)
A virtual function to override if your window can scroll.
- void `SetScrollPadding` (TReal pad)

This value controls how far past (in lines) the end of the text the scroll can go.

- virtual void [Init](#) ([TWindowStyle](#) &style)

Initialize the Window.

13.64.2 Member Enumeration Documentation

enum [TText::EFlags](#)

[TText](#) window child flags.

Enumerator:

kHAlignLeft Align horizontally with the left edge.
kHAlignCenter Align horizontally with the center.
kHAlignRight Align horizontally with the right edge.
kVAlignTop Align vertically with the top.
kVAlignCenter Align vertically with the center.
kVAlignBottom Align vertically with the bottom.

13.64.3 Constructor & Destructor Documentation

[TText::TText](#) (bool *staticText* = **false**)

Constructor.

Parameters:

staticText True if this is a static text field.

13.64.4 Member Function Documentation

bool [TText::Create](#) (str *text*, uint32_t *w*, uint32_t *h*, uint32_t *flags*, const char * *fontFilename*, uint32_t *lineHeight*, const [TColor](#) & *textColor*)

Create a [TText](#) window.

Parameters:

text Initial text for window.
w Width of client rectangle.
h Height of client rectangle.
flags Flags from [TText::EFlags](#)
fontFilename Font name.
lineHeight Font size.
textColor Font color.

Returns:

True on success.

uint32_t [TText::GetLineCount](#) ()

Get the number of lines in the text output.

Returns:

Number of lines.

void TText::SetStartLine (TReal startLine = 0)

Set the first line in the text output.

Lines are 0 -> linecount-1.

Parameters:

startLine Line to display as the first line of text.

void TText::GetTextBounds (TRect * pBounds)

Get the actual boundary of the rendered text.

Parameters:

pBounds A rectangle in client coordinates.

virtual void TText::SetText (str text) [virtual]

Set the current text content.

Parameters:

text Text to set.

Reimplemented in [TTextEdit](#).

virtual str TText::GetText () [virtual]

Get the current text content.

Returns:

A string containing the current text.

Reimplemented in [TTextEdit](#).

TTextGraphic* TText::GetTextGraphic ()

Get the associated [TTextGraphic](#) object.

Returns:

The [TTextGraphic](#) that draws this window's text.

void TText::SetColor (const TColor & color)

Set the current text color.

Parameters:

color New text color.

void TText::SetAlpha (TReal alpha)

Set the text alpha.

Parameters:

alpha Opacity of text. 1.0==opaque. Multiplied by alpha component of color.

void TText::SetScale (TReal *scale*)

Set the current text scale.

Default is 1.0. Useful for zooming effects.

Parameters:

scale New text scale.

void TText::SetLinePadding (int32_t *linePadding*)

Set the current line padding.

Default is 0. Can be positive or negative - extends/compresses a fonts natural line spacing

Parameters:

linePadding New Line Padding.

virtual bool TText::OnMouseUp (const TPoint & *point*) [virtual]

Mouse up handler.

Used to detect clicks on embedded text links. Returns false if no text link was previously clicked on.

Parameters:

point Location of mouse release in client coordinates.

Returns:

true if message was handled, false to keep searching for a handler.

Reimplemented from [TWindow](#).

virtual bool TText::OnMouseDown (const TPoint & *point*) [virtual]

Mouse down handler.

Used to detect clicks on embedded text links. Returns false if no text link is found.

Parameters:

point Location of mouse press in client coordinates.

Returns:

true if message was handled, false to keep searching for a handler.

Reimplemented from [TWindow](#).

virtual bool TText::OnMouseMove (const TPoint & *point*) [virtual]

Mouse motion handler.

Parameters:

point Location of mouse in client coordinates.

Returns:

true if message was handled, false to keep searching for a handler.

Reimplemented from [TWindow](#).

virtual bool TText::OnMouseLeave () [virtual]

Notification that the mouse has left the window.

Warning:

This message is only sent if `SetCapture()` has been called for this window previously.

Returns:

True if handled.

Reimplemented from [TWindow](#).

void TText::SetRotation (TReal degrees, int32_t originX, int32_t originY)

Change the rotation - default is 0 degrees, 0,0 origin.

Parameters:

degrees rotation angle in degrees (not radians because degrees are friendlier)
originX offset from left of text rect to use as center point of rotation
originY offset from top of text rect to use as center point of rotation

uint32_t TText::GetMaxScroll ()

Get the maximum line you need to scroll the text to in order to display the last line of text.

Returns:

The highest integer you need to set the top line to.

virtual void TText::SetScroll (TReal vScroll, TReal hScroll = 0) [virtual]

A virtual function to override if your window can scroll.

Parameters:

vScroll Vertical scroll percentage (0.0-1.0).
hScroll Horizontal scroll percentage (0.0-1.0).

Reimplemented from [TWindow](#).

void TText::SetScrollPadding (TReal pad)

This value controls how far past (in lines) the end of the text the scroll can go.

The default value is 0.5f, so this means that if you called `SetScroll(1.0f)`, then the text would scroll so it was 0.5 lines up off the bottom of the window.

Parameters:

pad How many lines to pad the scrolling text

virtual void TText::Init (TWindowStyle & style) [virtual]

Initialize the Window.

Called by the system only in Lua initialization.

When you create your own custom window, this is where you put your own custom initialization that needs to happen before children are created. Fundamental window initialization is handled in every class by this func-

tion, so **when you override this function you almost always want to call your base class to handle base class initialization.**

Parameters:

style The Lua style that was in effect when this window was created. This style contains all parameters specified explicitly for the window as well as parameters defined in the current style. Parameters set locally override ones in the style.

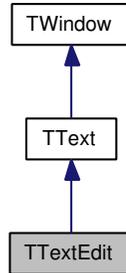
Reimplemented from [TWindow](#).

Reimplemented in [TTextEdit](#).

13.65 TTextEdit Class Reference

```
#include <pf/textedit.h>
```

Inheritance diagram for TTextEdit:



13.65.1 Detailed Description

The [TTextEdit](#) class represents an editable text [TWindow](#).

Warning:

Once this class finds an ancestor modal window, it will register itself with the modal and link itself to any other [TTextEdit](#) windows it finds under that modal window. If you then remove it (or a parent) from the hierarchy without destroying it or calling [Unregister\(\)](#), the resulting behavior is **undefined**.

Public Types

- enum [eKeyType](#) {
[kKeyChar](#), [kKeyMove](#), [kKeyEnter](#), [kKeyTab](#),
[kKeyPaste](#), [kKeyIllegal](#) }
Key category.

Public Member Functions

- [TTextEdit \(\)](#)
Default Constructor.
- virtual [~TTextEdit \(\)](#)
Destructor.
- virtual bool [KeyHit](#) ([eKeyType](#) type, char key=0)
Virtual function to notify child that a key was pressed.
- virtual bool [OnKeyDown](#) (char key, uint32_t flags)
Raw key hit on keyboard.
- virtual void [Init](#) ([TWindowStyle](#) &style)
Initialize the Window.

- virtual bool **OnChar** (char key)
Translated character handler.
- void **Unregister** ()
Tell this TTextEdit that it should unlink itself from its parent modal window and any related TTextEdit windows in its tab ring.
- void **SetPassword** (bool bPassword)
Sets the textedit field into password mode, meaning that the displayed text will be all asterisks.
- void **SetEditable** (bool bEditable)
Set this field to be editable.
- void **UpdateText** ()
Update the text in the text field.
- void **Backspace** ()
Call this function to simulate pressing "Backspace" in the text field.
- void **SetIgnoreChars** (str ignoreStr)
Any character in ignoreStr will be ignored and not entered into the textedit field.
- virtual str **GetText** ()
Get the current editable text.
- virtual void **SetText** (str newText)
Set the current editable text.
- virtual void **Draw** ()
Function to draw dynamic elements.
- void **SetMaxLength** (uint32_t maxLength)
Set the maximum length of the input field.

Static Public Attributes

- static const int **kCursorFlashMS** = 800
Speed of the cursor flash.
- static const int **kDefaultMaxLength** = 10
Default length if none given.

Protected Member Functions

- virtual bool **OnTaskAnimate** ()
Animate the cursor flashing.
- uint32_t **GetCursor** ()

Retrieve the current cursor position.

- void [SetCursor](#) (uint32_t cursor)

Set the current cursor position.

Protected Attributes

- uint32_t [mMaxLength](#)

Maximum number of characters in a string.

13.65.2 Member Enumeration Documentation

enum [TTextEdit::eKeyType](#)

Key category.

Enumerator:

kKeyChar Key is a normal character.
kKeyMove Key is a cursor or backspace character.
kKeyEnter Key is enter or return.
kKeyTab Key is the tab character.
kKeyPaste Key is the "Paste" character.
kKeyIllegal Key is illegal.

13.65.3 Member Function Documentation

virtual bool [TTextEdit::KeyHit](#) ([eKeyType](#) type, char key = 0) **[virtual]**

Virtual function to notify child that a key was pressed.

Parameters:

type key type
key key that was hit when appropriate

Returns:

True to accept the key. False to ignore.

virtual bool [TTextEdit::OnKeyDown](#) (char key, uint32_t flags) **[virtual]**

Raw key hit on keyboard.

Parameters:

key Key pressed on keyboard.
flags [TEvent::EKeyFlags](#) mask representing the state of other keys on the keyboard when this key was hit.

Returns:

true if message was handled, false to keep searching for a handler.

Reimplemented from [TWindow](#).

virtual void TTextEdit::Init (TWindowState & style) [virtual]

Initialize the Window.

Called by the system only in Lua initialization.

When you create your own custom window, this is where you put your own custom initialization that needs to happen before children are created. Fundamental window initialization is handled in every class by this function, so **when you override this function you almost always want to call your base class to handle base class initialization.**

Parameters:

style The Lua style that was in effect when this window was created. This style contains all parameters specified explicitly for the window as well as parameters defined in the current style. Parameters set locally override ones in the style.

Reimplemented from [TText](#).

virtual bool TTextEdit::OnChar (char key) [virtual]

Translated character handler.

Parameters:

key Key hit on keyboard, along with shift translations.

Returns:

true if message was handled, false to keep searching for a handler.

Reimplemented from [TWindow](#).

void TTextEdit::SetPassword (bool bPassword)

Sets the textedit field into password mode, meaning that the displayed text will be all asterisks.

Parameters:

bPassword - true to enable, false to disable

void TTextEdit::SetEditable (bool bEditable)

Set this field to be editable.

Enables the cursor, which will display when the [TTextEdit](#) is focused.

Parameters:

bEditable True to make the field editable.

virtual str TTextEdit::GetText () [virtual]

Get the current editable text.

Returns:

The text in the edit box.

Reimplemented from [TText](#).

virtual void TTextEdit::SetText (str newText) [virtual]

Set the current editable text.

Parameters:

newText Text to set to.

Reimplemented from [TText](#).

void TTextEdit::SetMaxLength (uint32_t *maxLength*)

Set the maximum length of the input field.

Current field is not evaluated to test the new length.

Parameters:

maxLength Maximum number of characters you can type.

virtual bool TTextEdit::OnTaskAnimate () [protected, virtual]

Animate the cursor flashing.

Returns:

True to continue animating. False to stop.

Reimplemented from [TWindow](#).

13.66 TTextGraphic Class Reference

```
#include <pf/textgraphic.h>
```

13.66.1 Detailed Description

Formatted text class.

A class that allows you to format text using the following tags:

- `
` Line break
- `<p></p>` Paragraph
- `` Bold
- `<i></i>` Italic
- `<u></u>` Underline
- `<center></center>` Center
- `<left></left>` Left Justify
- `<right></right>` Right Justify
- `<outline color="ff0000" size=2>` Outline text
- `` Font characteristics
- `` Trigger a button named 'buttonname' when clicking this text.
- `<cursor>` Cursor icon

Text can be rendered directly to screen. For text that is automatically rendered in a window, use the [TText](#) class. Use the static function [TTextGraphic::Create](#) to create a new instance of a [TTextGraphic](#).

See also:

[TText](#)

Public Types

- enum [EFlags](#) {
 [kHAlignLeft](#) = 0x00, [kHAlignCenter](#) = 0x01, [kHAlignRight](#) = 0x02, [kVAlignTop](#) = 0x00,
 [kVAlignCenter](#) = 0x04, [kVAlignBottom](#) = 0x08 }
 TTextGraphic window child flags.

Public Member Functions

- void [Destroy](#) ()
 Call to destroy a TTextGraphic.
- void [Draw](#) (const [TRect](#) &destRect, [TReal](#) scale=1.0, int32_t linePadding=0, [TReal](#) alpha=1.0, [TTextureRef](#) target=[TTextureRef](#)())

Draw the text to a rectangle on the screen.

- void **SetNoBlend** ()
When drawing to an offscreen texture, copy pixels to the texture, instead of alpha blending them.
- void **SetAlphaBlend** ()
When drawing to an offscreen texture, blend pixels into the texture and accumulate alpha.
- uint32_t **GetLineCount** ()
Get the number of lines in the text output.
- void **SetStartLine** (TReal startLine=0)
Set the first line in the text output.
- TReal **GetStartLine** ()
Get the index of the first line of text output.
- void **GetTextBounds** (TRect *pBounds)
Get the actual boundary of the rendered text.
- void **SetText** (str text)
Set the current text content.
- str **GetText** ()
Get the current text content.
- void **SetColor** (const TColor &color)
Set the current text color.
- void **SetLineHeight** (uint32_t newHeight)
Set a new line height for this text.
- void **SetTextRect** (uint32_t w, uint32_t h)
Change the text rectangle.
- void **SetRotation** (TReal degrees, uint32_t originX, uint32_t originY)
Change the rotation - default is 0 degrees, 0,0 origin.
- const TColor & **GetColor** ()
Get the current text color.
- str **Pick** (const TPoint &point, int32_t linePadding=0)
Pick an anchor record within text.
- bool **Rollover** (const TPoint *pPoint, int32_t linePadding=0)
Handle rollover state for links.
- uint32_t **GetMaxScroll** (TReal scale, int32_t linePadding)
Get the number of lines this text needs to be scrolled to fit in the current text region.

Static Public Member Functions

- static [TTextGraphic](#) * [Create](#) ([str](#) text, [uint32_t](#) w, [uint32_t](#) h, [uint32_t](#) flags, const char *fontFilename, [uint32_t](#) lineHeight, const [TColor](#) &textColor)

Create a [TTextGraphic](#).

13.66.2 Member Enumeration Documentation

enum [TTextGraphic::EFlags](#)

[TTextGraphic](#) window child flags.

Enumerator:

kHAlignLeft Align horizontally with the left edge.
kHAlignCenter Align horizontally with the center.
kHAlignRight Align horizontally with the right edge.
kVAlignTop Align vertically with the top.
kVAlignCenter Align vertically with the center.
kVAlignBottom Align vertically with the bottom.

13.66.3 Member Function Documentation

static [TTextGraphic](#)* [TTextGraphic::Create](#) ([str](#) text, [uint32_t](#) w, [uint32_t](#) h, [uint32_t](#) flags, const char *fontFilename, [uint32_t](#) lineHeight, const [TColor](#) & textColor) **[static]**

Create a [TTextGraphic](#).

Parameters:

text Initial text for graphic. Can be empty.
w Width of client rectangle. Must be non-zero.
h Height of client rectangle. Must be non-zero.
flags Flags from [TTextGraphic::EFlags](#)
fontFilename Font name.
lineHeight Font size.
textColor Font color.

Returns:

True on success.

void [TTextGraphic::Destroy](#) ()

Call to destroy a [TTextGraphic](#).

Deletes the object and releases all resources.

void [TTextGraphic::Draw](#) (const [TRect](#) & destRect, [TReal](#) scale = 1.0, [int32_t](#) linePadding = 0, [TReal](#) alpha = 1.0, [TTextureRef](#) target = [TTextureRef](#) ())

Draw the text to a rectangle on the screen.

Must be called between a [TPlatform::Begin2d](#)/[TPlatformEnd2d](#) pair.

Parameters:

destRect Destination rectangle in screen coordinates.
scale Scale factor - useful for zooming effects.

linePadding Additional spacing between text lines.

alpha Alpha multiplier. 1.0 is opaque.

target [optional] Target texture to draw to. Leave as default to draw to current context.

void TTextGraphic::SetNoBlend ()

When drawing to an offscreen texture, copy pixels to the texture, instead of alpha blending them.

Does not work with text outlines, since the text and outline need to be blended with each other.

The default state is to blend the pixels into the destination texture, leaving alpha alone. If you call [SetNoBlend\(\)](#), then pixels will be set directly to the colors and alpha values, so that the texture can then be used blended with an arbitrary background. [TTextGraphic::SetAlphaBlend\(\)](#) is similar, but uses a more complex (i.e., slower) blend algorithm that supports text outlines.

This setting has no effect when drawing to the screen.

See also:

[TTextGraphic::SetAlphaBlend\(\)](#)

void TTextGraphic::SetAlphaBlend ()

When drawing to an offscreen texture, blend pixels into the texture and accumulate alpha.

[SetAlphaBlend\(\)](#) uses a more sophisticated (and slower) blend algorithm than [TTextGraphic::SetNoBlend\(\)](#) that causes it to work correctly with text outlines, as well as blending the text in with other translucent layers.

This setting has no effect when drawing to the screen.

See also:

[TTextGraphic::SetNoBlend\(\)](#)

uint32_t TTextGraphic::GetLineCount ()

Get the number of lines in the text output.

Returns:

Number of lines.

void TTextGraphic::SetStartLine (TReal *startLine* = 0)

Set the first line in the text output.

Parameters:

startLine Line to display as the first line of text. First line is 0.

TReal TTextGraphic::GetStartLine ()

Get the index of the first line of text output.

Returns:

An index between 0 and [GetLineCount\(\)](#)-1.

void TTextGraphic::GetTextBounds (TRect * *pBounds*)

Get the actual boundary of the rendered text.

Parameters:

pBounds A rectangle in client coordinates.

void TTextGraphic::SetText (str text)

Set the current text content.

Will return immediately if the text hasn't changed.

Parameters:

text Text to set.

str TTextGraphic::GetText ()

Get the current text content.

Returns:

A string containing the current text.

void TTextGraphic::SetColor (const TColor & color)

Set the current text color.

Parameters:

color New text color.

void TTextGraphic::SetLineHeight (uint32_t newHeight)

Set a new line height for this text.

Text is re-calculated as to line wraps and tags based on new height value.

Parameters:

newHeight New text height.

void TTextGraphic::SetTextRect (uint32_t w, uint32_t h)

Change the text rectangle.

Parameters:

w Width of client rectangle. Must be non-zero.

h Height of client rectangle. Must be non-zero.

void TTextGraphic::SetRotation (TReal degrees, uint32_t originX, uint32_t originY)

Change the rotation - default is 0 degrees, 0,0 origin.

Parameters:

degrees rotation angle in degrees (not radians because degrees are friendlier)

originX offset from left of text rect to use as center point of rotation

originY offset from top of text rect to use as center point of rotation

const TColor& TTextGraphic::GetColor ()

Get the current text color.

Returns:

The current default text color. Note this can be changed by the text markup.

str TTextGraphic::Pick (const TPoint & *point*, int32_t *linePadding* = 0)

Pick an anchor record within text.

(link)

Parameters:

point Point to test within text.

linePadding Line padding to use when Picking.

Returns:

A button name to trigger, if one is found. An empty string if no button is found.

bool TTextGraphic::Rollover (const TPoint * *pPoint*, int32_t *linePadding* = 0)

Handle rollover state for links.

Parameters:

pPoint Point to test within text, or NULL to clear the state.

linePadding Line padding to use when handling roll-over.

Returns:

True if a rollover link was triggered.

uint32_t TTextGraphic::GetMaxScroll (TReal *scale*, int32_t *linePadding*)

Get the number of lines this text needs to be scrolled to fit in the current text region.

Parameters:

scale Scale of text.

linePadding Line padding.

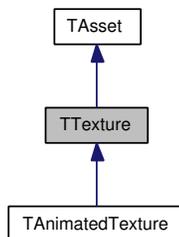
Returns:

Number of lines to scroll to get to bottom.

13.67 TTexture Class Reference

```
#include <pf/texture.h>
```

Inheritance diagram for TTexture:



13.67.1 Detailed Description

This class encapsulates the concept of a texture.

A [TTexture](#) can be used to:

- Texture a 3d object on the screen
- Draw a sprite
- Draw a screen widget (background, button, etc.)
- Be a target for 3d rendering (*which will restrict it to being a 2d blit source*)

Texture size is limited to 1024x1024 for textures that are in video RAM (i.e., any texture that isn't created as "slow"). Additionally, some textures are created from bitmaps, and those bitmaps can be dynamically MIPMAPped. Bitmaps can be read from JPG or PNG files, and the PNG files will correctly read the transparency information, if present.

The image extension can be omitted to allow the decision between JPG and PNG to be made on an image-by-image basis without needing to change code.

Public Types

- enum [ETextureCreateFlags](#) { [eDefaultAlpha](#) = 0, [eGenerateMipmaps](#) = 1, [eForceAlpha](#) = 2, [eForceNoAlpha](#) = 4 }

Texture loading flags used with [TTexture::Get](#) and [TTexture::GetMerged](#).

Public Member Functions

Drawing Methods

- virtual void [DrawSprite](#) (TReal x, TReal y, TReal alpha=1, TReal scale=1, TReal rotRad=0, uint32_t flags=0)
Draw a normal texture to a render target surface as a sprite.
- virtual void [DrawSprite](#) (const [TDrawSpec](#) &drawSpec)
Draw a normal texture to a render target surface or backbuffer as a sprite.

- virtual void [CopyPixels](#) (int32_t x, int32_t y, const [TRect](#) *sourceRect=NULL, [TTextureRef](#) _dst=[TTextureRef](#)())
Draw a normal or simple texture to any target [TTexture](#) surface with the same alpha as this surface.

Surface access.

- bool [Lock](#) ([TColor32](#) **data, uint32_t *pixelPitch)
Lock a surface for reading and writing pixel data.
- void [Unlock](#) ()
Unlock a surface.

Information Query.

- virtual uint32_t [GetWidth](#) ()
Get the width of the texture.
- virtual uint32_t [GetHeight](#) ()
Get the height of the texture.
- [TPoint](#) [GetInternalSize](#) ()
Gets the internal width and height of the texture in pixels, rather than the requested width and height.
- str [GetName](#) ()
Get the name of the texture.
- bool [IsSimple](#) ()
Query whether this texture is a "simple" type; simple textures can not be used in [DrawSprite\(\)](#), but can be locked and can be used in [CopyPixels\(\)](#).
- bool [HasAlpha](#) ()
Query whether this texture has an alpha channel.
- void [Clear](#) ()
Clear the texture to black and transparent alpha.
- bool [Save](#) (str fileName, [TReal](#) quality=1.0f)
Save the texture to a file.
- [TTextureRef](#) [GetRef](#) ()
Get a shared pointer ([TTextureRef](#)) to this texture.

Static Public Member Functions

Factory Methods

- static [TTextureRef](#) [Get](#) (str assetName, uint32_t flags=eDefaultAlpha)
Get a texture from a handle with optional alpha information and optional auto-generated mipmaps.
- static [TTextureRef](#) [GetMerged](#) (str colorAssetName, str alphaAssetName, uint32_t flags=eDefaultAlpha)
Get a texture from 2 assets, one which specifies the color map and one which specifies the alpha map.

- static [TTextureRef Create](#) (uint32_t width, uint32_t height, bool alpha)
Create a texture at a particular size.
- static [TTextureRef GetSimple](#) (str assetName)
Get a simple texture from an asset name.
- static [TTextureRef CreateSimple](#) (uint32_t width, uint32_t height, bool slow=false)
Create a simple texture surface.

Public Attributes

- TTextureData * [mData](#)
Internal implementation data.

Static Protected Member Functions

- static [TTextureRef InternalNew](#) (str handle="")
Internal function to create a TTexture.

13.67.2 Member Enumeration Documentation

enum [TTexture::ETextureCreateFlags](#)

Texture loading flags used with [TTexture::Get](#) and [TTexture::GetMerged](#).

Enumerator:

eDefaultAlpha Select alpha based on the image content.

In the case of a PNG image that contains alpha information, alpha will be enabled; otherwise it will be disabled.

eGenerateMipmaps Generate MIPMAPs for the image.

eForceAlpha Force the image to have an alpha channel.

eForceNoAlpha Force the image to not have an alpha channel.

13.67.3 Member Function Documentation

static [TTextureRef](#) [TTexture::Get](#) (str *assetName*, uint32_t *flags* = [eDefaultAlpha](#)) [static]

Get a texture from a handle with optional alpha information and optional auto-generated mipmaps.

The handle refers to a file in the assets folder.

When passing in an *assetName*, flags can be passed following a "?" and separated by commas. Example "texture.png?slow"

Maximum texture size for non-slow textures is 1024x1024.

Available flags are:

- slow - Load this texture into slow system RAM. Allows for non-square, non-power-of-two textures, as well as textures larger than 1024x1024. This flag implies "simple"—no direct drawing from this surface is allowed.
- simple - Create this texture as a simple surface. See [GetSimple\(\)](#) for an explanation.

- alpha - Create this texture with an alpha layer.
- mipmap - Create this texture with mipmaps.

Parameters:

assetName Name of the asset. File extension (.jpg, .png) is not necessary.
flags ETextureCreateFlags

Returns:

A TTextureRef to the texture.

static TTextureRef TTexture::GetMerged (str colorAssetName, str alphaAssetName, uint32_t flags = eDefaultAlpha) [static]

Get a texture from 2 assets, one which specifies the color map and one which specifies the alpha map.

So that the alpha map can be a highly compressed image, the alpha value will be pulled from the "red" channel of the alpha asset.

See TTexture::Get() for information on passing flags inside of asset names.

Note that eForceNoAlpha has no effect, since the point of this function is to add an alpha channel.

Warning:

The two assets must be the same dimensions, or the alpha map will not show up correctly.

Parameters:

colorAssetName Name of the asset used for the color map. File extension (.jpg, .png) is not necessary.
alphaAssetName Name of the asset used for the alpha map. File extension (.jpg, .png) is not necessary.
flags ETextureCreateFlags

Returns:

A TTextureRef to the texture.

static TTextureRef TTexture::Create (uint32_t width, uint32_t height, bool alpha) [static]

Create a texture at a particular size.

Maximum texture size for a created texture is 1024x1024.

Parameters:

width Width
height Height
alpha Create with alpha channel

Returns:

A TTextureRef to the texture.

static TTextureRef TTexture::GetSimple (str assetName) [static]

Get a simple texture from an asset name.

Simple textures are not usable as 3d textures, and in fact can only be copied with CopyPixels(). Advantages include speed and decreased memory usage: A "Simple" texture can be created without the common restrictions of 3d textures, which often need to be powers of two in size and square.

Maximum texture size for non-slow textures is 1024x1024; slow textures have problems with either dimension larger than 4096.

Look in the documentation for TTexture::Get for information on flags that can be appended to the asset name.

Parameters:

assetName Name of the asset to load or acquire a reference to. File extension (.jpg, .png) is not necessary.

See also:

[TTexture::Get\(\)](#)

Returns:

A TTextureRef to the texture.

static TTextureRef TTexture::CreateSimple (uint32_t width, uint32_t height, bool slow = false) [static]

Create a simple texture surface.

See GetSimple for more information on "simple" textures.

Maximum texture size for non-slow textures is 1024x1024; slow textures have problems with either dimension larger than 4096.

Parameters:

width Width

height Height

slow True to create a slow (RAM based) texture.

See also:

[TTexture::GetSimple](#)

Returns:

A TTextureRef to the created texture.

virtual void TTexture::DrawSprite (TReal x, TReal y, TReal alpha = 1, TReal scale = 1, TReal rotRad = 0, uint32_t flags = 0) [virtual]

Draw a normal texture to a render target surface as a sprite.

This draws a texture with optional rotation and scaling. Only capable of drawing an entire surface—not a sub-rectangle. See [TTexture::DrawSprite\(const TDrawSpec&\)](#) for more drawing control.

Will draw the sprite within the currently active viewport. X and Y are relative to the upper left corner of the current viewport.

DrawSprite can be called inside [TWindow::Draw\(\)](#) or a BeginRenderTarget/EndRenderTarget block.

Parameters:

x X of Center.

y Y of Center.

alpha Alpha to apply to the entire texture. Set to a negative value to entirely disable alpha during blit, including alpha within the source [TTexture](#).

scale Scaling to apply to the texture. 1.0 is no scaling.

rotRad Rotation in radians around center point.

flags Define how textures are drawn. Use ETextureDrawFlags for the flags. Default behavior is eDefault-Draw.

Reimplemented in [TAnimatedTexture](#).

virtual void TTexture::DrawSprite (const TDrawSpec & drawSpec) [virtual]

Draw a normal texture to a render target surface or backbuffer as a sprite.

Uses the TDrawSpec to decide where to put the texture and how to draw it. See [TDrawSpec](#) for details.

Will draw the sprite within the currently active viewport. `TDrawSpec` position is relative to the upper left corner of the current viewport.

`DrawSprite` can be called inside `TWindow::Draw()` or a `TRenderer::BeginRenderTarget()/EndRenderTarget` block.

Parameters:

drawSpec The `TDrawSpec` to use to draw the sprite.

Reimplemented in [TAnimatedTexture](#).

virtual void TTexture::CopyPixels (int32_t x, int32_t y, const TRect * sourceRect = NULL, TTextureRef _dst = TTextureRef ()) [virtual]

Draw a normal or simple texture to any target `TTexture` surface with the same alpha as this surface.

In other words, `CopyPixels` can go from an alpha surface to another alpha surface, or to a non-alpha to another non-alpha surface, but not between the two.

There are no restrictions on the blit source rectangle or the destination of the blit within the target surface.

`CopyPixels()` does not respect alpha in its copy; it performs a bitwise, opaque copy only.

Unlike the other texture calls, `CopyPixels()` can be called outside of a `TWindow::Draw()` or a `BeginRenderTarget/EndRenderTarget` block.

Parameters:

x Left side of resulting rectangle.

y Top edge of resulting rectangle.

sourceRect Source rectangle to blit. NULL to blit the entire surface.

_dst Destination texture. NULL to draw to back buffer.

Reimplemented in [TAnimatedTexture](#).

bool TTexture::Lock (TColor32 ** data, uint32_t * pixelPitch)

Lock a surface for reading and writing pixel data.

Surface will be stored in 32 bit pixels, in the binary order defined by `TColor32`.

Parameters:

data [out] Receives a pointer to the locked data.

pixelPitch Number of pixels to add to a pointer to advance one row.

Returns:

True on success.

virtual uint32_t TTexture::GetWidth () [virtual]

Get the width of the texture.

This gets the width of the texture as requested at creation or load; the actual internal width of the texture may vary. If you're using this texture as a source for `TPlatform::DrawVertices`, see [GetInternalSize\(\)](#).

Returns:

Width of the texture in pixels.

Reimplemented in [TAnimatedTexture](#).

virtual uint32_t TTexture::GetHeight () [virtual]

Get the height of the texture.

This gets the height of the texture as requested at creation or load; the actual internal height of the texture may vary. If you're using this texture as a source for TPlatform::DrawVertices, see [GetInternalSize\(\)](#).

Returns:

Height of the texture in pixels.

Reimplemented in [TAnimatedTexture](#).

TPoint TTexture::GetInternalSize ()

Gets the internal width and height of the texture in pixels, rather than the requested width and height.

Relevant if you're using the texture as a texture source for TPlatform::DrawVertices.

The texture coordinates that you set in vertices that refer to this texture need to be calculated based on the internal representation size, and not the "logical" size that [GetWidth\(\)](#) and [GetHeight\(\)](#) return. In other words, if the original width is 800, and the internal width is 1024, then your U coordinate for the right edge would be 800.0F/1024.0F.

If your textures are always powers of two and square in size (equal width and height), GetInternalSize should always return the same values as [GetWidth\(\)](#) and [GetHeight\(\)](#).

Returns:

A point with width and height of the internal texture size, in pixels.

str TTexture::GetName ()

Get the name of the texture.

Returns:

The handle of the image used to create the texture, along with any alpha texture handle.

bool TTexture::IsSimple ()

Query whether this texture is a "simple" type; simple textures can not be used in [DrawSprite\(\)](#), but can be locked and can be used in [CopyPixels\(\)](#).

See also:

[TTexture::GetSimple](#)

Returns:

True if simple

bool TTexture::HasAlpha ()

Query whether this texture has an alpha channel.

Returns:

True if the texture has an alpha channel, false otherwise.

bool TTexture::Save (str fileName, TReal quality = 1.0f)

Save the texture to a file.

Parameters:

fileName path of file to create including extension that defines what format to save the file as. Currently supported file extensions are: ".jpg" and ".png".

quality For file formats that use image compression, this specifies what level of compression to use (1.0 means highest quality, 0.0 means lowest quality) .png files currently ignore the quality parameter

Returns:

true if file was successfully saved, false otherwise.

[TTextureRef](#) [TTexture::GetRef \(\)](#)

Get a shared pointer ([TTextureRef](#)) to this texture.

Returns:

A [TTextureRef](#) that shares ownership with other Refs to this texture.

Reimplemented from [TAsset](#).

Reimplemented in [TAnimatedTexture](#).

`static TTextureRef TTexture::InternalNew \(str handle = ""\) [static, protected]`

Internal function to create a [TTexture](#).

Parameters:

handle (optional) Handle of asset to add to asset manager. Empty to create a unique [TTexture](#).

Returns:

A [TTextureRef](#) to the new texture.

13.68 TTransformedLitVert Struct Reference

```
#include <pf/vertexset.h>
```

13.68.1 Detailed Description

Transformed and lit vertex.

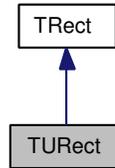
Public Attributes

- [TVec3 pos](#)
Position in screen coordinates.
- [TReal rhw](#)
RESERVED; must set to 0.5F.
- [TColor32 color](#)
Vertex color.
- [TColor32 specular](#)
Vertex specular component.
- [TVec2 uv](#)
Vertex texture coordinate.

13.69 TRect Class Reference

```
#include <pf/rect.h>
```

Inheritance diagram for TRect:



13.69.1 Detailed Description

A [TRect](#) that's forced to be unsigned at all times.

Will ASSERT in debug builds if you construct a [TUREct](#) with a [TRect](#) that has negative values.

See also:

[TRect](#)

Public Member Functions

- [TUREct](#) ()
Default constructor.
- [TUREct](#) (uint32_t X1, uint32_t Y1, uint32_t X2, uint32_t Y2)
Construct from four values.
- [TUREct](#) (const [TRect](#) &rect)
Construct from a [TRect](#).
- [TUREct](#) & operator= (const [TRect](#) &rect)
Assign from a [TRect](#).
- [TUREct](#) & operator= (const [TUREct](#) &rect)
Assign from a [TUREct](#).
- [TUREct](#) (const [TPoint](#) &topLeft, const [TPoint](#) &bottomRight)
Construct a [TRect](#) from two points.

13.69.2 Constructor & Destructor Documentation

TUREct::TUREct (uint32_t X1, uint32_t Y1, uint32_t X2, uint32_t Y2)

Construct from four values.

Parameters:

- X1* Left edge.
- Y1* Top edge.
- X2* One past right edge.

Y2 One past bottom edge.

TUREct::TUREct (const TRect & rect)

Construct from a [TRect](#).

Parameters:

rect Source [TRect](#) to construct from.

TUREct::TUREct (const TPoint & topLeft, const TPoint & bottomRight)

Construct a [TRect](#) from two points.

Parameters:

topLeft Upper left corner of the [TRect](#).

bottomRight Lower right corner of the [TRect](#).

See also:

[TPoint](#)

13.69.3 Member Function Documentation

TUREct& TUREct::operator= (const TRect & rect)

Assign from a [TRect](#).

Parameters:

rect Source rectangle.

TUREct& TUREct::operator= (const TUREct & rect)

Assign from a [TUREct](#).

Parameters:

rect Source rectangle.

13.70 TVec2 Class Reference

```
#include <pf/vec.h>
```

13.70.1 Detailed Description

A 2d vector class.

This class is a POD (plain-old-data) type with public member data.

Public Member Functions

- [TVec2 \(\)](#)
Constructor.
- [TVec2 \(TReal X, TReal Y\)](#)
Initializing constructor.
- [TVec2 \(const TVec2 &rhs\)](#)
Copy construction.
- [TVec2 \(const TVec3 &rhs\)](#)
Conversion from a TVec3.
- [TVec2 & operator= \(const TVec2 &rhs\)](#)
Assignment.
- [TReal & operator\[\] \(TIndex i\)](#)
Member accessor.
- [const TReal & operator\[\] \(TIndex i\) const](#)
Member accessor.
- [TIndex Dim \(\) const](#)
The dimension of this vector (2).
- [TReal LengthSquared \(\) const](#)
The length of this vector squared.
- [TReal Length \(\) const](#)
The length of this vector.
- [TVec2 & operator+= \(const TVec2 &rhs\)](#)
Addition-assignment operator.
- [TVec2 & operator-= \(const TVec2 &rhs\)](#)
Subtraction-assignment operator.
- [TVec2 & operator *= \(TReal s\)](#)
Scaling operator.

- [TVec2 & operator/= \(TReal s\)](#)
Scaling operator.
- [TVec2 & Normalize \(\)](#)
Normalize this vector.
- [TVec2 operator- \(\) const](#)
Unary negation.

Public Attributes

- [TReal x](#)
Public X dimension.
- [TReal y](#)
Public Y dimension.

Related Functions

(Note that these are not member functions.)

- [bool operator== \(const TVec2 &lhs, const TVec2 &rhs\)](#)
Equality operator.
- [bool operator!= \(const TVec2 &lhs, const TVec2 &rhs\)](#)
Inequality operator.
- [TVec2 operator+ \(const TVec2 &lhs, const TVec2 &rhs\)](#)
Addition operator.
- [TVec2 operator- \(const TVec2 &lhs, const TVec2 &rhs\)](#)
Subtraction operator.
- [TVec2 operator * \(const TVec2 &lhs, TReal s\)](#)
Scaling operator.
- [TVec2 operator * \(TReal s, const TVec2 &rhs\)](#)
Scaling operator.
- [TVec2 operator / \(const TVec2 &lhs, TReal s\)](#)
Scaling operator.
- [TReal DotProduct \(const TVec2 &lhs, const TVec2 &rhs\)](#)
Dot product function.

13.70.2 Constructor & Destructor Documentation

`TVec2::TVec2 (TReal X, TReal Y)`

Initializing constructor.

Parameters:

X X value
Y Y value

`TVec2::TVec2 (const TVec3 & rhs) [explicit]`

Conversion from a `TVec3`.

Parameters:

rhs Source `TVec3`. Constructor drops the z parameter.

13.70.3 Member Function Documentation

`TVec2& TVec2::operator= (const TVec2 & rhs)`

Assignment.

Returns:

A reference to this.

]

`TReal& TVec2::operator[] (TIndex i)`

Member accessor.

Parameters:

i Zero-based index.

Returns:

A reference to the *i*'th member.

]

`const TReal& TVec2::operator[] (TIndex i) const`

Member accessor.

Parameters:

i Zero-based index.

Returns:

A reference to the *i*'th member.

`TIndex TVec2::Dim () const`

The dimension of this vector (2).

Returns:

2

TReal TVec2::LengthSquared () const

The length of this vector squared.

Returns:

$$x^2 + y^2$$

TReal TVec2::Length () const

The length of this vector.

Returns:

$$\sqrt{x^2 + y^2}$$

TVec2& TVec2::operator+= (const TVec2 & rhs)

Addition-assignment operator.

Returns:

A reference to this.

TVec2& TVec2::operator-= (const TVec2 & rhs)

Subtraction-assignment operator.

Returns:

A reference to this.

TVec2& TVec2::operator *= (TReal s)

Scaling operator.

Parameters:

s Scale factor.

Returns:

A reference to this, scaled as $(x*s, y*s)$

TVec2& TVec2::operator/= (TReal s)

Scaling operator.

Parameters:

s Scale divisor.

Returns:

A reference to this, scaled as $(x/s, y/s)$

TVec2& TVec2::Normalize ()

Normalize this vector.

Changes this vector to $(x/Length(), y/Length())$

Returns:

A reference to this.

TVec2 TVec2::operator- () const

Unary negation.

Returns:

$(-x, -y)$

13.70.4 Friends And Related Function Documentation**bool** operator== (const **TVec2** & *lhs*, const **TVec2** & *rhs*) [related]

Equality operator.

Returns:

True if equal.

bool operator!= (const **TVec2** & *lhs*, const **TVec2** & *rhs*) [related]

Inequality operator.

Returns:

True if not equal.

TVec2 operator+ (const **TVec2** & *lhs*, const **TVec2** & *rhs*) [related]

Addition operator.

Returns:

$(x_1 + x_2, y_1 + y_2)$

TVec2 operator- (const **TVec2** & *lhs*, const **TVec2** & *rhs*) [related]

Subtraction operator.

Returns:

$(x_1 - x_2, y_1 - y_2)$

TVec2 operator * (const **TVec2** & *lhs*, **TReal** *s*) [related]

Scaling operator.

Returns:

$(x * s, y * s)$

TVec2 operator * (**TReal** *s*, const **TVec2** & *rhs*) [related]

Scaling operator.

Returns:

$(x * s, y * s)$

TVec2 operator/ (const **TVec2** & *lhs*, **TReal** *s*) [related]

Scaling operator.

Returns: $(x/s, y/s)$ **TReal DotProduct** (const **TVec2** & *lhs*, const **TVec2** & *rhs*) **[related]**

Dot product function.

Returns:The dot product of the two vectors: $(x_1 * x_2 + y_1 * y_2)$.

13.71 TVec3 Class Reference

```
#include <pf/vec.h>
```

13.71.1 Detailed Description

A 3d vector class.

This class is a POD (plain-old-data) type with public member data.

Public Member Functions

- [TVec3 \(\)](#)
Constructor.
- [TVec3 \(TReal X, TReal Y, TReal Z\)](#)
Initializing constructor.
- [TVec3 \(const TVec2 &rhs, TReal z=0\)](#)
Conversion constructor.
- [TVec3 \(const TVec4 &rhs\)](#)
Conversion constructor.
- [TVec3 \(const TVec3 &rhs\)](#)
Copy construction.
- [TVec3 & operator= \(const TVec3 &rhs\)](#)
Assignment.
- [TReal & operator\[\] \(TIndex i\)](#)
Member accessor.
- [const TReal & operator\[\] \(TIndex i\) const](#)
Member accessor.
- [TIndex Dim \(\) const](#)
The dimension of this vector (3).
- [TReal LengthSquared \(\) const](#)
The length of this vector squared.
- [TReal Length \(\) const](#)
The length of this vector.
- [TVec3 & Normalize \(\)](#)
Normalize this vector.
- [TVec3 & operator+= \(const TVec3 &rhs\)](#)
Addition-assignment operator.

- **TVec3 & operator-=** (const **TVec3** &rhs)
Subtraction-assignment operator.
- **TVec3 & operator *=** (**TReal** rhs)
Scaling operator.
- **TVec3 & operator /=** (**TReal** rhs)
Scaling operator.
- **TVec3 operator-** () const
Unary negation.

Public Attributes

- **TReal x**
X dimension.
- **TReal y**
Y dimension.
- **TReal z**
Z dimension.

Related Functions

(Note that these are not member functions.)

- **bool operator==** (const **TVec3** &lhs, const **TVec3** &rhs)
Equality operator.
- **bool operator!=** (const **TVec3** &lhs, const **TVec3** &rhs)
Inequality operator.
- **TVec3 operator+** (const **TVec3** &lhs, const **TVec3** &rhs)
Addition operator.
- **TVec3 operator-** (const **TVec3** &lhs, const **TVec3** &rhs)
Subtraction operator.
- **TVec3 operator *** (const **TVec3** &lhs, **TReal** s)
Scaling operator.
- **TVec3 operator *** (**TReal** s, const **TVec3** &rhs)
Scaling operator.
- **TVec3 operator/** (const **TVec3** &lhs, **TReal** s)
Scaling operator.

- **TReal DotProduct** (const **TVec3** &lhs, const **TVec3** &rhs)
Dot product function.
- **TVec3 CrossProduct** (const **TVec3** &lhs, const **TVec3** &rhs)
Cross product function.
- bool **IntersectTriangle** (const **TVec3** &pvOrig, const **TVec3** &pvDir, const **TVec3** &pv0, const **TVec3** &pv1, const **TVec3** &pv2, **TReal** *pfDist, **TVec3** *pvHit)
Detects if a ray intersects a triangle.

13.71.2 Constructor & Destructor Documentation

TVec3::TVec3 (TReal X, TReal Y, TReal Z)

Initializing constructor.

Parameters:

X X value.
Y Y value.
Z Z value.

TVec3::TVec3 (const TVec2 & rhs, TReal z = 0) [explicit]

Conversion constructor.

Parameters:

rhs **TVec2** to convert from.
z Additional z component to add; defaults to zero.

TVec3::TVec3 (const TVec4 & rhs) [explicit]

Conversion constructor.

Parameters:

rhs **TVec4** to convert from. Drops the w component.

13.71.3 Member Function Documentation

TVec3& TVec3::operator= (const TVec3 & rhs)

Assignment.

Returns:

A reference to this.

]

TReal& TVec3::operator[] (TIndex i)

Member accessor.

Parameters:

i Zero-based index.

Returns:

A reference to the i 'th member.

]

const **TReal**& TVec3::operator[] (**TIndex** i) const

Member accessor.

Parameters:

i Zero-based index.

Returns:

A reference to the i 'th member.

TIndex TVec3::Dim () const

The dimension of this vector (3).

Returns:

3

TReal TVec3::LengthSquared () const

The length of this vector squared.

Returns:

$$x^2 + y^2 + z^2$$

TReal TVec3::Length () const

The length of this vector.

Returns:

$$\sqrt{x^2 + y^2 + z^2}$$

TVec3& TVec3::Normalize ()

Normalize this vector.

Changes this vector to $(x/Length(), y/Length(), z/Length())$

Returns:

A reference to this.

TVec3& TVec3::operator+= (const TVec3 & rhs)

Addition-assignment operator.

Returns:

A reference to this.

TVec3& TVec3::operator-= (const TVec3 & rhs)

Subtraction-assignment operator.

Returns:

A reference to this.

TVec3& TVec3::operator *= (TReal rhs)

Scaling operator.

Parameters:

s Scale factor.

Returns:

A reference to this, scaled as $(x * s, y * s, z * s)$

TVec3& TVec3::operator /= (TReal rhs)

Scaling operator.

Parameters:

s Scale divisor.

Returns:

A reference to this, scaled as $(x/s, y/s, z/s)$

TVec3 TVec3::operator- () const

Unary negation.

Returns:

$(-x, -y, -z)$

13.71.4 Friends And Related Function Documentation

bool operator== (const TVec3 & lhs, const TVec3 & rhs) [related]

Equality operator.

Returns:

True if equal.

bool operator!= (const TVec3 & lhs, const TVec3 & rhs) [related]

Inequality operator.

Returns:

True if not equal.

TVec3 operator+ (const TVec3 & lhs, const TVec3 & rhs) [related]

Addition operator.

Returns:

$(x_1 + x_2, y_1 + y_2, z_1 + z_2)$

TVec3 operator- (const **TVec3** & *lhs*, const **TVec3** & *rhs*) [related]

Subtraction operator.

Returns:

$$(x_1 - x_2, y_1 - y_2, z_1 - z_2)$$

TVec3 operator * (const **TVec3** & *lhs*, **TReal** *s*) [related]

Scaling operator.

Returns:

$$(x * s, y * s, z * s)$$

TVec3 operator * (**TReal** *s*, const **TVec3** & *rhs*) [related]

Scaling operator.

Returns:

$$(x * s, y * s, z * s)$$

TVec3 operator/ (const **TVec3** & *lhs*, **TReal** *s*) [related]

Scaling operator.

Returns:

$$(x/s, y/s, z/s)$$

TReal DotProduct (const **TVec3** & *lhs*, const **TVec3** & *rhs*) [related]

Dot product function.

Returns:

The dot product of the two vectors: $(x_1 * x_2 + y_1 * y_2 + z_1 * z_2)$.

TVec3 CrossProduct (const **TVec3** & *lhs*, const **TVec3** & *rhs*) [related]

Cross product function.

Returns:

The cross product of the two vectors.

bool IntersectTriangle (const **TVec3** & *pvOrig*, const **TVec3** & *pvDir*, const **TVec3** & *pv0*, const **TVec3** & *pv1*, const **TVec3** & *pv2*, **TReal** * *pfDist*, **TVec3** * *pvHit*) [related]

Detects if a ray intersects a triangle.

Parameters:

- ← *pvOrig* Points to ray origin.
- ← *pvDir* Points to ray direction from origin.
- ← *pv0* Points to triangle vertex0.
- ← *pv1* Points to triangle vertex1.
- ← *pv2* Points to triangle vertex2.
- *pfDist* Points to where the distance from vOrig to the point of intersection gets stored.
- *pvHit* Points to where the actual point of intersection gets stored.

Returns:

true if ray intersects triangle.

13.72 TVec4 Class Reference

```
#include <pf/vec.h>
```

13.72.1 Detailed Description

A 4d vector class.

This class is a POD with public member data.

Public Member Functions

- [TVec4 \(\)](#)
Constructor.
- [TVec4 \(TReal X, TReal Y, TReal Z, TReal W\)](#)
Initializing constructor.
- [TVec4 \(const TVec3 &rhs, TReal W=0.0\)](#)
Conversion from a TVec3.
- [TVec4 \(const TVec4 &rhs\)](#)
Copy construction.
- [TVec4 & operator= \(const TVec4 &rhs\)](#)
Assignment.
- [TReal & operator\[\] \(TIndex i\)](#)
Member accessor.
- [const TReal & operator\[\] \(TIndex i\) const](#)
Member accessor.
- [TIndex Dim \(\) const](#)
The dimension of this vector (4).
- [TReal LengthSquared \(\) const](#)
The length of this vector squared.
- [TReal Length \(\) const](#)
The length of this vector.
- [TVec4 & Normalize \(\)](#)
Normalize this vector.
- [TVec4 & operator+= \(const TVec4 &rhs\)](#)
Addition-assignment operator.
- [TVec4 & operator-= \(const TVec4 &rhs\)](#)
Subtraction-assignment operator.

- `TVec4 & operator *= (TReal rhs)`
Scaling operator.
- `TVec4 & operator /= (TReal rhs)`
Scaling operator.
- `TVec4 operator- () const`
Unary negation.

Public Attributes

- `TReal x`
X dimension.
- `TReal y`
Y dimension.
- `TReal z`
Z dimension.
- `TReal w`
W dimension.

Related Functions

(Note that these are not member functions.)

- `bool operator== (const TVec4 &lhs, const TVec4 &rhs)`
Equality operator.
- `bool operator!= (const TVec4 &lhs, const TVec4 &rhs)`
Inequality operator.
- `TVec4 operator+ (const TVec4 &lhs, const TVec4 &rhs)`
Addition operator.
- `TVec4 operator- (const TVec4 &lhs, const TVec4 &rhs)`
Subtraction operator.
- `TVec4 operator * (const TVec4 &lhs, TReal s)`
Scaling operator.
- `TVec4 operator * (TReal s, const TVec4 &rhs)`
Scaling operator.
- `TVec4 operator/ (const TVec4 &lhs, TReal rhs)`
Scaling operator.

- [TReal DotProduct](#) (const [TVec4](#) &lhs, const [TVec4](#) &rhs)
Dot product function.
- [TVec4 CrossProduct](#) (const [TVec4](#) &a, const [TVec4](#) &b, const [TVec4](#) &c)
Cross product function.

13.72.2 Constructor & Destructor Documentation

[TVec4::TVec4](#) ([TReal](#) X, [TReal](#) Y, [TReal](#) Z, [TReal](#) W)

Initializing constructor.

Parameters:

X X value (v[0]).
Y Y value (v[1]).
Z Z value (v[2]).
W W value (v[3]).

[TVec4::TVec4](#) (const [TVec3](#) & rhs, [TReal](#) W = 0.0) **[explicit]**

Conversion from a [TVec3](#).

Parameters:

rhs Source [TVec3](#).
W W component to add. Defaults to zero.

13.72.3 Member Function Documentation

[TVec4&](#) [TVec4::operator=](#) (const [TVec4](#) & rhs)

Assignment.

Returns:

A reference to this.

]

[TReal&](#) [TVec4::operator\[\]](#) ([TIndex](#) i)

Member accessor.

Parameters:

i Zero-based index.

Returns:

A reference to the i'th member.

]

const [TReal&](#) [TVec4::operator\[\]](#) ([TIndex](#) i) const

Member accessor.

Parameters:

i Zero-based index.

Returns:

A reference to the *i*'th member.

TIndex TVec4::Dim () const

The dimension of this vector (4).

Returns:

4

TReal TVec4::LengthSquared () const

The length of this vector squared.

Returns:

$$x^2 + y^2 + z^2 + w^2$$

TReal TVec4::Length () const

The length of this vector.

Returns:

$$\sqrt{x^2 + y^2 + z^2 + w^2}$$

TVec4& TVec4::Normalize ()

Normalize this vector.

Changes vector to $(x/Length(), y/Length(), z/Length(), w/Length())$

Returns:

A reference to this.

TVec4& TVec4::operator+= (const TVec4 & rhs)

Addition-assignment operator.

Returns:

A reference to this.

TVec4& TVec4::operator-= (const TVec4 & rhs)

Subtraction-assignment operator.

Returns:

A reference to this.

TVec4& TVec4::operator *= (TReal rhs)

Scaling operator.

Parameters:

s Scale factor.

Returns:

A reference to this, scaled as $(x * s, y * s)$

TVec4& TVec4::operator/= (TReal rhs)

Scaling operator.

Parameters:

s Scale divisor.

Returns:

A reference to this, scaled as $(x/s, y/s)$

TVec4 TVec4::operator- () const

Unary negation.

Returns:

$(-x, -y, -z, -w)$

13.72.4 Friends And Related Function Documentation

bool operator==(const TVec4 & lhs, const TVec4 & rhs) [related]

Equality operator.

Returns:

True if equal.

bool operator!=(const TVec4 & lhs, const TVec4 & rhs) [related]

Inequality operator.

Returns:

True if not equal.

TVec4 operator+(const TVec4 & lhs, const TVec4 & rhs) [related]

Addition operator.

Returns:

$(x_1 + x_2, y_1 + y_2, z_1 + z_2, w_1 + w_2)$

TVec4 operator-(const TVec4 & lhs, const TVec4 & rhs) [related]

Subtraction operator.

Returns:

$(x_1 - x_2, y_1 - y_2, z_1 - z_2, w_1 - w_2)$

TVec4 operator * (const TVec4 & lhs, TReal s) [related]

Scaling operator.

Returns:

$(x * s, y * s)$

TVec4 operator * (TReal s, const TVec4 & rhs) [related]

Scaling operator.

Returns:

$(x * s, y * s)$

TVec4 operator / (const TVec4 & lhs, TReal rhs) [related]

Scaling operator.

Returns:

$(x / s, y / s, z / s, w / s)$

TReal DotProduct (const TVec4 & lhs, const TVec4 & rhs) [related]

Dot product function.

Returns:

The dot product of the two vectors: $(x_1 * x_2 + y_1 * y_2 + z_1 * z_2 + w_1 * w_2)$.

TVec4 CrossProduct (const TVec4 & a, const TVec4 & b, const TVec4 & c) [related]

Cross product function.

Returns:

The cross product of the two vectors.

13.73 TVert Struct Reference

```
#include <pf/vertexset.h>
```

13.73.1 Detailed Description

3d untransformed, unlit vertex.

Public Attributes

- [TVec3 pos](#)
Position in 3d space.
- [TVec3 normal](#)
Vertex normal. Must not be (0,0,0), and must be normalized.
- [TVec2 uv](#)
Vertex texture coordinate.

13.74 TVertexSet Class Reference

```
#include <pf/vertexset.h>
```

13.74.1 Detailed Description

A helper/wrapper for the [Vertex Types](#) which allows TPlatform::DrawVertices to identify the vertex type being passed in without making the vertex types polymorphic.

Public Member Functions

- [TVertexSet](#) ([TTransformedLitVert](#) *v, uint32_t count)
Create a vertex set from an existing external array of TTransformedLitVerts.
- [TVertexSet](#) ([TLitVert](#) *v, uint32_t count)
Create a vertex set from an existing external array of TLitVerts.
- [TVertexSet](#) ([TVert](#) *v, uint32_t count)
Create a vertex set from an existing, external array of TVerts.
- [TVertexSet](#) (const [TVertexSet](#) &)
Copy construction: Needs to be implemented because of an inane rule in the ISO standard.
- [TVertexSet](#) & [operator=](#) (const [TVertexSet](#) &)
Assignment.
- [~TVertexSet](#) ()
Destructor.
- void [SetCount](#) (uint32_t count)
Change the vertex count.

Static Public Attributes

- static const uint32_t [kMaxVertices](#) = 65535
A hard limit on the number of vertices that you can specify.

13.74.2 Constructor & Destructor Documentation

TVertexSet::TVertexSet ([TTransformedLitVert](#) * v, uint32_t count)

Create a vertex set from an existing external array of TTransformedLitVerts.

Does NOT copy the vertices—only keeps a pointer to them.

Parameters:

- v* Pointer to array of vertices.
- count* Number of vertices in array. Must not be more than kMaxVertices.

TVertexSet::TVertexSet (TLitVert * *v*, uint32_t *count*)

Create a vertex set from an existing external array of TLitVerts.

Does NOT copy the vertices—only keeps a pointer to them.

Parameters:

v Pointer to array of vertices.

count Number of vertices in array. Must not be more than kMaxVertices.

TVertexSet::TVertexSet (TVert * *v*, uint32_t *count*)

Create a vertex set from an existing, external array of TVerts.

Does NOT copy the vertices—only keeps a pointer to them.

Parameters:

v Pointer to array of vertices.

count Number of vertices in array. Must not be more than kMaxVertices.

TVertexSet::TVertexSet (const TVertexSet &)

Copy construction: Needs to be implemented because of an inane rule in the ISO standard.

See <https://developer.playfirst.com/node/158> for details.

13.74.3 Member Function Documentation

TVertexSet& TVertexSet::operator= (const TVertexSet &)

Assignment.

Returns:

A reference to this

void TVertexSet::SetCount (uint32_t *count*)

Change the vertex count.

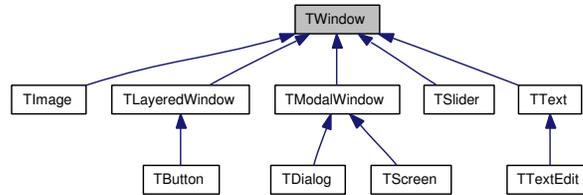
This allows you to create a single TVertexSet and reuse its data repeatedly without reconstructing it.

Maximum count is kMaxVertices.

13.75 TWindow Class Reference

```
#include <pf/window.h>
```

Inheritance diagram for TWindow:



13.75.1 Detailed Description

The [TWindow](#) class is the base class of any object that needs to draw to the screen.

As you create your own custom TWindow-derived classes, you should be aware that a [TWindow](#) "owns" its children: When a [TWindow](#) is destroyed, it expects to be able to delete its children. Therefore a [TWindow](#) should never be allocated on the stack. If you want a window to persist longer than its parent, you need to ensure that it is removed from the parent prior to the parent's destruction.

Child and Parent Window Functions.

Functions to find child windows and to retrieve and set parent windows.

- virtual bool [AdoptChild](#) ([TWindow](#) *child, bool initWindow=true)
Add a child to this window.
- virtual void [OrphanChild](#) ([TWindow](#) *child)
Remove a child from this window.
- void [DestroyAllChildren](#) ()
Destroy (delete) all child windows.
- void [FitToChildren](#) ()
Fit this window to its childrens' sizes.
- [TWindow](#) * [ChildWindowFromPoint](#) (const [TPoint](#) &point, int32_t depth=1)
Recursively find a child window from the given point.
- [TModalWindow](#) * [FindParentModal](#) ()
Find the nearest direct-ancestor modal window.
- virtual void [OnParentModalPopped](#) ()
This method is called when this window's parent modal has been removed from the window stack.
- void [ForEachChild](#) ([TWindowSpider](#) *spider, bool reverse=false)
Iterate through all children and call the Process() member function of TWindowSpider.
- bool [HasChildren](#) ()

Return true if this window has children.

- **TWindow * GetChildWindow** (str name, int32_t depth=-1)
Return the descendant window with the given name, if one exists.
- **TWindow * GetParent** ()
Get the current window parent.
- void **SetWindowDepth** (TWindow *inFrontOf=NULL)
Reposition this window to be immediately in front of a given sibling.
- void **SetWindowDepth** (EDepth depth)
Reposition this window to be in the position specified by the given constant.

Construction and Initialization

- **TWindow** ()
Default Constructor.
- virtual **~TWindow** ()
Destructor.
- virtual bool **OnNewParent** ()
Handle any initialization or setup that is required when this window is assigned to a new parent.
- virtual void **Init** (TWindowStyle &style)
Initialize the Window.
- virtual void **PostChildrenInit** (TWindowStyle &style)
Do post-children-added initialization when being created from Lua.
- void **SizeAndPositionFromStyle** (TWindowStyle &style)
A function that takes the default window parameters and applies them to the window's position and size.

Public Types

Locally Defined Types

Types defined in the TWindow scope.

- enum **ETypeFlags** {
kModal = 0x00000001, kFocusTarget = 0x00000002, kInfrequentChanges = 0x00000004, kStartGroup = 0x00000008,
kTypeMask = 0x000000FF }
Static Window Types.
- enum **EDepth** {
kBackMost, kFrontMost, kOneHigher, kOneLower,
kDepthCount }

Position constants for SetWindowDepth.

- enum **EStateFlags** {
kEnabled = 0x00000100, **kChecked** = 0x00000200, **kCached** = 0x00000400, **kOpaque** = 0x00000800,
kStateMask = 0x0000FF00 }
Dynamic Window States.
- enum **EDrawMode** { **eAll** = 0, **eCached**, **eDynamic** }
Window drawing mode.
- typedef std::list< **TWindow** * > **WindowList**
A list of owned windows. Used for children.
- typedef std::list< **TRect** > **RectList**
List of rectangles.

Public Member Functions

Type Information and Casting

- PFClassId **ClassId** ()
Get the ClassId.
- virtual bool **IsKindOf** (PFClassId type)
Determine whether this window is derived from type.
- template<class TO> TO * **GetCast** ()
Safely cast this window to another type.

Update Functions

Functions related to the drawing of windows.

- virtual void **Draw** ()
Draw the window.
- virtual void **PostDraw** ()
Draw any overlays that should appear on top of this window's children.

Window Coordinates and Rectangles.

Functions to calculate window point conversions relative to two windows, and to acquire the window and client rectangles.

- void **GetWindowRect** (**TRect** *rect)
*Get the rectangle that specifies the current window in top-level **TScreen** coordinates.*
- void **SetWindowPos** (const **TPoint** &point)
Set the position of the upper left corner of the window in parent client coordinates.
- void **SetWindowPos** (int32_t x, int32_t y)
Set the position of the upper left corner of the window in parent client coordinates.
- const **TPoint** & **GetWindowPos** ()

Get the current window position.

- void [SetWindowSize](#) (uint32_t width, uint32_t height)
Set the size of the window.
- void [GetClientRect](#) (TRect *rect)
Get the "client" rectangle of the current window.
- uint32_t [GetWindowWidth](#) ()
Get the width of the client area of this window.
- uint32_t [GetWindowHeight](#) ()
Get the height of the client area of this window.
- void [ScreenToClient](#) (TPoint *point)
Convert between top-level screen and client coordinates.
- void [ScreenToClient](#) (TRect *rect)
Convert between top-level screen and client coordinates.
- void [ClientToScreen](#) (TPoint *point)
Convert between client and top-level screen coordinates.
- void [ClientToScreen](#) (TRect *rect)
Convert between client and top-level screen coordinates.
- void [ParentToClient](#) (TPoint *point) const
Convert between parent and client coordinates.
- void [ParentToClient](#) (TRect *rect) const
Convert between parent and client coordinates.
- void [ClientToParent](#) (TPoint *point)
Convert between client and parent coordinates.
- void [ClientToParent](#) (TRect *rect)
Convert between parent and client coordinates.
- void [GetParentRelativeRect](#) (TRect *rect)
Get the rectangle that represents this window in the client space of its parent window.
- const TRect & [GetParentRelativeRect](#) ()
Get the rectangle that represents this window in the client space of its parent window.

Window Information Accessors.

Functions to get or set information about a window.

- virtual void [SetScroll](#) (float vScroll, float hScroll=0)
A virtual function to override if your window can scroll.
- uint32_t [GetFlags](#) () const
Get the window's state and style flags.
- void [SetFlags](#) (uint32_t flags)
Set the state flags of the window.

- `str GetName ()`
Get the window name, if any.
- `void SetName (str name)`
Set the window name.
- `bool IsOpaque ()`
Query this window's opacity.
- `bool IsModal ()`
Query this window's modal status.
- `bool IsEnabled ()`
Return whether this window and all of its ancestors are enabled.

Event Handlers

Functions to override to handle events in a window, and functions to trigger events on a window.

- `void SendWindowMessage (TMessage *message)`
Send a message to a window (or its ancestor).
- `void StartWindowAnimation (int32_t delay, bool autoRepeat=true, bool resetTime=true, bool forceFrequency=false)`
Start a window animation.
- `void StopWindowAnimation ()`
Stop a window from receiving OnTaskAnimate calls.
- `virtual bool OnMessage (TMessage *message)`
Handle a message.
- `virtual bool OnTaskAnimate ()`
Called if you have initiated a window animation with TWindow::StartWindowAnimation.
- `virtual bool OnMouseDown (const TPoint &point)`
Mouse down handler.
- `virtual bool OnExtendedMouseEvent (const TPoint &point, TPlatform::ExtendedMouseEvents event)`
Extended mouse button handler.
- `virtual bool OnMouseUp (const TPoint &point)`
Mouse up handler.
- `virtual bool OnMouseMove (const TPoint &point)`
Mouse motion handler.
- `virtual bool OnMouseLeave ()`
Notification that the mouse has left the window.
- `virtual bool CanAcceptFocus ()`
Returns true if this window can accept the keyboard focus.
- `virtual bool OnChar (char key)`
Translated character handler.

- virtual bool [OnKeyDown](#) (char key, uint32_t flags)
Raw key hit on keyboard.
- virtual bool [OnKeyUp](#) (char key)
Raw key released on keyboard.
- virtual bool [OnMouseHover](#) (const [TPoint](#) &point)
Called if the mouse hovers over a point on the window.
- virtual void [OnSetFocus](#) ([TWindow](#) *previous)
This window is receiving the keyboard focus.
- virtual void [OnKillFocus](#) ([TWindow](#) *newFocus)
This window is losing the keyboard focus.

Protected Member Functions

- [TWindow](#) * [SetParent](#) ([TWindow](#) *newParent)
Set the current parent window.
- void [AddWindowType](#) (uint32_t type)
Function that allows a derived window to add type flags to the [TWindow](#).
- [TAnimTask](#) * [GetWindowAnim](#) ()
Get the associated [TAnimTask](#).

Protected Attributes

- [WindowList](#) mChildren
We own our children. Our descendants can play with our children, though.

13.75.2 Member Enumeration Documentation

enum [TWindow::ETypeFlags](#)

Static Window Types.

Flags that define what type and/or class a window is. These do not change after window creation.

Enumerator:

kModal Flag that this window is modal.

kFocusTarget Flag that this window can accept focus.

kInfrequentChanges Hint that we could cache this window. Only works if all ancestors are also flagged.

kStartGroup This window is the start of a group of siblings (i.e. for radio buttons).

kTypeMask A flag mask that isolates the window types.

enum TWindow::EDepth

Position constants for SetWindowDepth.

See also:

[TWindow::SetWindowDepth](#)

Enumerator:

- kBackMost* Set this window to be the backmost window.
- kFrontMost* Set this window to be the frontmost window.
- kOneHigher* Set this window to be one higher than its current position.
- kOneLower* Set this window to be one lower than its current position.
- kDepthCount* Number of depth options.

enum TWindow::EStateFlags

Dynamic Window States.

States that may change frequently after window creation.

Enumerator:

- kEnabled* This window is enabled, and therefore can be rendered to and clicked upon.
- kChecked* This window is in its "selected" or "checked" state.
- kCached* This window is rendered to the cache.
- kOpaque* This window uses no alpha blending when it draws itself, and covers its rectangle completely.
It's important to set this flag on a window when it's full screen and should completely obscure the windows behind it—this will allow Playground to prevent the deeper window from drawing.
- kStateMask* A flag mask that isolates the window states.

enum TWindow::EDrawMode

Window drawing mode.

Enumerator:

- eAll* Draw all layers.
- eCached* Draw only cacheable layers.
- eDynamic* Draw only dynamic layers.

13.75.3 Member Function Documentation

virtual bool TWindow::OnNewParent () [virtual]

Handle any initialization or setup that is required when this window is assigned to a new parent.

No initialization of the window has happened prior to this call.

Returns:

True on success; false on failure.

See also:

[Init](#)
[PostChildrenInit](#)

Reimplemented in [TButton](#), [TDialog](#), and [TModalWindow](#).

virtual void TWindow::Init (TWindowStyle & style) [virtual]

Initialize the Window.

Called by the system only in Lua initialization.

When you create your own custom window, this is where you put your own custom initialization that needs to happen before children are created. Fundamental window initialization is handled in every class by this function, so **when you override this function you almost always want to call your base class to handle base class initialization.**

Parameters:

style The Lua style that was in effect when this window was created. This style contains all parameters specified explicitly for the window as well as parameters defined in the current style. Parameters set locally override ones in the style.

Reimplemented in [TButton](#), [TImage](#), [TSlider](#), [TText](#), and [TTextEdit](#).

virtual void TWindow::PostChildrenInit (TWindowStyle & style) [virtual]

Do post-children-added initialization when being created from Lua.

Any initialization that needs to happen after a window's children have been added can be placed in a derived version of this function.

Warning:

Remember to always call the base class if you're overriding this function.

Parameters:

style Current style environment that this window was created in.

Reimplemented in [TButton](#), and [TModalWindow](#).

void TWindow::SizeAndPositionFromStyle (TWindowStyle & style) [protected]

A function that takes the default window parameters and applies them to the window's position and size.

Note:

This function is for advanced users only.

Called by `TWindow::Init()` and by `TWindow::PostChildrenInit()`.

Has no effect if it can't calculate the position and size based on current information available: If a position is set to `kCenter`, or a size set to `kMax`, but the parent window size hasn't yet been calculated, this function won't do anything.

Note:

Implementation details.

Since some windows set their size based on their calculated children's sizes (using [TWindow::FitToChildren](#)), [TWindow::PostChildrenInit\(\)](#) needs to call this to adjust the position after the size has been calculated. Since other windows must have their full position and size specified in order to properly initialize, `TWindow::Init()` needs to call this function.

Parameters:

style The style of the window to apply.

PFClassId TWindow::ClassId ()

Get the ClassId.

Returns:

A ClassId that can be passed to IsKindOf.

See also:

[Type Information and Casting](#)

bool TWindow::IsKindOf (PFClassId *type*) [virtual]

Determine whether this window is derived from type.

Parameters:

type [ClassId\(\)](#) of type to test.

See also:

[Type Information and Casting](#)

template<class TO> template< class TO > TO * TWindow::GetCast ()

Safely cast this window to another type.

Returns:

A cast pointer, or an empty reference.

See also:

[Type Information and Casting](#)

virtual void TWindow::Draw () [virtual]

Draw the window.

Derived classes will override this function and provide the draw functionality.

Reimplemented in [TImage](#), [TSlider](#), [TText](#), and [TTextEdit](#).

virtual bool TWindow::AdoptChild (TWindow * *child*, bool *initWindow* = true) [virtual]

Add a child to this window.

Warning:

If you override this in a derived class, be sure to call the base class to actually add the child from the list of children.

Parameters:

child Child that's being added.

initWindow True to call [OnNewParent\(\)](#).

Returns:

True if successful. On false, the window has NOT been adopted and the calling class still has responsibility for destruction.

Reimplemented in [TLayeredWindow](#).

virtual void TWindow::OrphanChild (TWindow * *child*) [virtual]

Remove a child from this window.

Warning:

If you override this in a derived class, be sure to call the base class to actually remove the child from the list of children.

Parameters:

child Child that's being removed.

Reimplemented in [TLayeredWindow](#).

void TWindow::DestroyAllChildren ()

Destroy (delete) all child windows.

Those windows will destroy their own children. Actual deletion is deferred using [TWindowManager::SafeDestroyWindow\(\)](#), so the windows will be actually deleted in the next event loop.

TWindow* TWindow::ChildWindowFromPoint (const TPoint & *point*, int32_t *depth* = 1)

Recursively find a child window from the given point.

The point is assumed to be inside *this* window.

Parameters:

point Point to test in client coordinates.

depth The number of times to recurse. 1 gives you only immediate children. -1 gives you the deepest child. Defaults to 1.

Returns:

A pointer to the window containing the point. If the point is not inside any of the child windows, the function will return this.

TModalWindow* TWindow::FindParentModal ()

Find the nearest direct-ancestor modal window.

Returns:

A pointer to a modal window, or NULL if none is found.

virtual void TWindow::OnParentModalPopped () [virtual]

This method is called when this window's parent modal has been removed from the window stack.

Because window deletion is delayed until it is safe to delete the window, this method can be used to detect immediately when a window has been removed from the stack, whereas the destructor will only be called when the window is actually deleted.

void TWindow::ForEachChild (TWindowSpider * *spider*, bool *reverse* = false)

Iterate through all children and call the Process() member function of [TWindowSpider](#).

Iteration happens in front-to-back order by default, or back-to-front if reverse is true

Parameters:

spider The derived class which contains a Process() function to be called on each child window.

reverse If this is true, back-to-front order is used, default is false

bool TWindow::HasChildren ()

Return true if this window has children.

Returns:

True if we're parents; false otherwise.

TWindow* TWindow::GetChildWindow (str name, int32_t depth = -1)

Return the descendant window with the given name, if one exists.

Parameters:

name Window name to search for.

depth Number of levels deep to look. Set to -1 for no limit. Defaults to -1.

Returns:

A [TWindow](#) to the descendant with the given name. Children are searched recursively up to the level indicated in depth.

TWindow* TWindow::GetParent ()

Get the current window parent.

Returns:

A shared pointer to the current parent window.

Note:

This will return NULL if the current window has no parent.

void TWindow::SetWindowDepth (TWindow * inFrontOf = NULL)

Reposition this window to be immediately in front of a given sibling.

Pass the results of [GetParent\(\)](#)->[GetFirstChild\(\)](#) to bring this window to the front.

Parameters:

inFrontOf Sibling we should be visually in front of. If NULL, will place this window in the back.

void TWindow::SetWindowDepth (EDepth depth)

Reposition this window to be in the position specified by the given constant.

Parameters:

depth Enumeration that specifies a logical window depth.

See also:

[EDepth](#)

void TWindow::GetWindowRect (TRect * rect)

Get the rectangle that specifies the current window in top-level [TScreen](#) coordinates.

Parameters:

rect [TRect](#) to fill with resulting rectangle.

void TWindow::SetWindowPos (const [TPoint](#) & *point*)

Set the position of the upper left corner of the window in parent client coordinates.

Parameters:

point New window position.

See also:

[SetWindowSize](#)
[SetWindowDepth](#)

void TWindow::SetWindowPos (int32_t *x*, int32_t *y*)

Set the position of the upper left corner of the window in parent client coordinates.

Parameters:

x New window x coordinate.
y New window y coordinate.

See also:

[SetWindowSize](#)
[SetWindowDepth](#)

const [TPoint](#)& TWindow::GetWindowPos ()

Get the current window position.

Returns:

The current window position relative to its parent.

void TWindow::SetWindowSize (uint32_t *width*, uint32_t *height*)

Set the size of the window.

Parameters:

width New window width.
height New window height.

void TWindow::GetClientRect ([TRect](#) * *rect*)

Get the "client" rectangle of the current window.

This mimics the Windows functionality of getting a rect that has top and left set to 0, with right and bottom set to width and height, respectively.

Parameters:

rect The [TRect](#) to fill with the client rectangle.

uint32_t TWindow::GetWindowWidth ()

Get the width of the client area of this window.

Returns:

Window client width in pixels.

uint32_t TWindow::GetWindowHeight ()

Get the height of the client area of this window.

Returns:

Window client height in pixels.

void TWindow::ScreenToClient (TPoint * point)

Convert between top-level screen and client coordinates.

Parameters:

point in: Screen coordinates, out:client coordinates.

void TWindow::ScreenToClient (TRect * rect)

Convert between top-level screen and client coordinates.

Parameters:

rect in: Screen coordinates, out:client coordinates.

void TWindow::ClientToScreen (TPoint * point)

Convert between client and top-level screen coordinates.

Parameters:

point in: client coordinates, out: screen coordinates.

void TWindow::ClientToScreen (TRect * rect)

Convert between client and top-level screen coordinates.

Parameters:

rect in: client coordinates, out: screen coordinates.

void TWindow::ParentToClient (TPoint * point) const

Convert between parent and client coordinates.

Parameters:

point in: a point in parent's coordinate system, out:client coordinates

void TWindow::ParentToClient (TRect * rect) const

Convert between parent and client coordinates.

Parameters:

rect in: a rect in parent's coordinate system, out:client coordinates

void TWindow::ClientToParent (TPoint * point)

Convert between client and parent coordinates.

Parameters:

point in: client coordinates, out:a point in parent's coordinate system.

void TWindow::ClientToParent (TRect * rect)

Convert between parent and client coordinates.

Parameters:

rect in: a rect in parent's coordinate system, out:client coordinates

void TWindow::GetParentRelativeRect (TRect * rect)

Get the rectangle that represents this window in the client space of its parent window.

Parameters:

rect A rectangle to fill with the window's rectangle in it's parent's coordinate system.

const TRect& TWindow::GetParentRelativeRect ()

Get the rectangle that represents this window in the client space of its parent window.

Returns:

A reference to a [TRect](#) that describes this window in its parents coordinates.

virtual void TWindow::SetScroll (float vScroll, float hScroll = 0) [virtual]

A virtual function to override if your window can scroll.

Parameters:

vScroll Vertical scroll ratio (0.0-1.0).

hScroll Horizontal scroll percentage (0.0-1.0).

Reimplemented in [TText](#).

uint32_t TWindow::GetFlags () const

Get the window's state and style flags.

Returns:

Current state and style of the window.

void TWindow::SetFlags (uint32_t flags)

Set the state flags of the window.

Does not change the "type" or style flags of the window.

Parameters:

flags Complete set of flags to update.

str TWindow::GetName ()

Get the window name, if any.

Returns:

A str containing the window's name.

void TWindow::SetName (str name)

Set the window name.

Parameters:

name New name for the window.

bool TWindow::IsOpaque ()

Query this window's opacity.

Returns:

true if the window is "opaque": When it draws, none of the background will show through. If any part of the window is transparent, it should not have the kOpaque style set.

bool TWindow::IsModal ()

Query this window's modal status.

A modal window blocks further event handling by its parent and receives DoModalProcess() calls.

Returns:

Return true if this is a modal window, false if it is not.

bool TWindow::IsEnabled ()

Return whether this window and all of its ancestors are enabled.

Returns:

True if this window is really enabled and (eventual) child of a [TModalWindow](#).

void TWindow::SendMessage (TMessage * message)

Send a message to a window (or its ancestor).

Takes ownership of message and will delete it after it has been delivered.

Calls OnMessage for this window and its parents until one returns "true", indicating the message has been handled. Stops searching at the first modal window.

Parameters:

message Message to send, including potential payload. Will be deleted after delivery.

void TWindow::StartWindowAnimation (int32_t delay, bool autoRepeat = true, bool resetTime = true, bool forceFrequency = false)

Start a window animation.

Can be called to reset an animation delay. The virtual function [OnTaskAnimate\(\)](#) will be called at the frequency given by the parameters to StartWindowAnimation until StopWindowAnimation is called or this window is destroyed.

This window must already be in a hierarchy and have a parent [TModalWindow](#) to attach its animation to, or [StartWindowAnimation\(\)](#) will ASSERT (or crash in release build). In other words, you cannot call this function in a constructor.

Parameters:

delay Delay, in ms., before OnTaskAnimate will be called.

autoRepeat True to cause delay to be auto-reset, i.e., to call OnTaskAnimate every delay ms. instead of just once.

resetTime Reset the time after each call. See [TAnimTask::SetDelay](#) for details.

forceFrequency Force the animation frequency. See [TAnimTask::SetDelay](#) for details.

See also:

[TWindow::StopWindowAnimation](#)

[TWindow::OnTaskAnimate](#)

void TWindow::StopWindowAnimation ()

Stop a window from receiving OnTaskAnimate calls.

See also:

[TWindow::StartWindowAnimation](#)

[TWindow::OnTaskAnimate](#)

virtual bool TWindow::OnMessage (TMessage * message) [virtual]

Handle a message.

Parameters:

message Payload of message.

Returns:

True if message handled; false otherwise.

Reimplemented in [TDialog](#), and [TModalWindow](#).

virtual bool TWindow::OnTaskAnimate () [virtual]

Called if you have initiated a window animation with [TWindow::StartWindowAnimation](#).

Returns:

True to continue animating. False to stop.

Reimplemented in [TTextEdit](#).

virtual bool TWindow::OnMouseDown (const TPoint & point) [virtual]

Mouse down handler.

Parameters:

point Location of mouse press in client coordinates.

Returns:

true if message was handled, false to keep searching for a handler.

Reimplemented in [TButton](#), [TSlider](#), and [TText](#).

virtual bool TWindow::OnExtendedMouseEvent (const [TPoint](#) & *point*, [TPlatform::ExtendedMouseEvents](#) *event*) [virtual]

Extended mouse button handler.

Parameters:

point Location of mouse event in client coordinates.

event Event that happened.

Returns:

true if message was handled, false to keep searching for a handler.

virtual bool TWindow::OnMouseUp (const [TPoint](#) & *point*) [virtual]

Mouse up handler.

Parameters:

point Location of mouse release in client coordinates.

Returns:

true if message was handled, false to keep searching for a handler.

Reimplemented in [TButton](#), [TSlider](#), and [TText](#).

virtual bool TWindow::OnMouseMove (const [TPoint](#) & *point*) [virtual]

Mouse motion handler.

Parameters:

point Location of mouse in client coordinates.

Returns:

true if message was handled, false to keep searching for a handler.

Reimplemented in [TButton](#), [TSlider](#), and [TText](#).

virtual bool TWindow::OnMouseLeave () [virtual]

Notification that the mouse has left the window.

Warning:

This message is only sent if `SetCapture()` has been called for this window previously.

Returns:

True if handled.

Reimplemented in [TButton](#), [TSlider](#), and [TText](#).

virtual bool TWindow::CanAcceptFocus () [virtual]

Returns true if this window can accept the keyboard focus.

Override to return true if your derived window can accept focus.

Returns:

Return true if this window can accept keyboard focus. If it can accept keyboard focus, it should respond to the `On*Focus()` message to update its appearance when its focus state changes.

virtual bool TWindow::OnChar (char *key*) [virtual]

Translated character handler.

Parameters:

key Key hit on keyboard, along with shift translations.

Returns:

true if message was handled, false to keep searching for a handler.

Reimplemented in [TModalWindow](#), and [TTextEdit](#).

virtual bool TWindow::OnKeyDown (char *key*, uint32_t *flags*) [virtual]

Raw key hit on keyboard.

Parameters:

key Key pressed on keyboard.

flags [TEvent::EKeyFlags](#) mask representing the state of other keys on the keyboard when this key was hit.

Returns:

true if message was handled, false to keep searching for a handler.

Reimplemented in [TTextEdit](#).

virtual bool TWindow::OnKeyUp (char *key*) [virtual]

Raw key released on keyboard.

Parameters:

key Key released.

Returns:

true if message was handled, false to keep searching for a handler.

virtual bool TWindow::OnMouseHover (const [TPoint](#) & *point*) [virtual]

Called if the mouse hovers over a point on the window.

Parameters:

point Point the mouse was last hovering over.

Returns:

True if processed; false to keep looking.

virtual void TWindow::OnSetFocus ([TWindow](#) * *previous*) [virtual]

This window is receiving the keyboard focus.

Parameters:

previous The window that was previously focused. Can be NULL.

Reimplemented in [TModalWindow](#).

virtual void TWindow::OnKillFocus (TWindow * newFocus) [virtual]

This window is losing the keyboard focus.

Parameters:

newFocus The window that's receiving focus.

TWindow* TWindow::SetParent (TWindow * newParent) [protected]

Set the current parent window.

Parameters:

newParent A [TWindow](#) * to the new parent window.

Returns:

A [TWindow](#) * to the old parent window.

void TWindow::AddWindowType (uint32_t type) [protected]

Function that allows a derived window to add type flags to the [TWindow](#).

This isn't public because in most circumstances a window's type should be invariant once created.

Parameters:

type Flags to add.

TAnimTask* TWindow::GetWindowAnim () [protected]

Get the associated [TAnimTask](#).

A [TAnimTask](#) is associated with this [TWindow](#) when [StartWindowAnimation\(\)](#) is called.

Returns:

A pointer to a [TAnimTask](#), or NULL if none exists.

See also:

[StartWindowAnimation](#)

13.76 TWindowHoverHandler Class Reference

```
#include <pf/windowmanager.h>
```

13.76.1 Detailed Description

A callback that receives notification that a window has had the mouse hover over it.

See also:

[TWindowManager::AdoptHoverHandler](#)

Public Member Functions

- virtual bool [Handle](#) (TWindow *window, const TPoint &point)=0
Abstract virtual function for handling hover events.

13.76.2 Member Function Documentation

virtual bool TWindowHoverHandler::Handle (TWindow * window, const TPoint & point) [pure virtual]

Abstract virtual function for handling hover events.

Parameters:

window Window that mouse is hovering over.
point Point in window client coordinates.

Returns:

True if event handled; false to continue processing.

13.77 TWindowManager Class Reference

```
#include <pf/windowmanager.h>
```

13.77.1 Detailed Description

The [TWindowManager](#) class manages, controls, and delegates messages to the window system.

[TWindowManager](#) contains a stack of [TModalWindows](#), the top of which is considered to be the active window in the system. If the a [TModalWindow](#) covers the entire viewable area and is flagged as opaque, only the top modal window and its children are drawn.

The main message pump hands messages to [TWindowManager](#) using [TWindowManager::HandleEvent\(\)](#), which then dispatches the event to the appropriate listener(s).

Construction, Destruction, and Singleton Access

- [TWindowManager](#) ()
Default Constructor.
- virtual [~TWindowManager](#) ()
Destructor.
- static [TWindowManager *GetInstance](#) ()
Get the global [TWindowManager](#) instance.

Public Member Functions

Message handling.

- void [PostWindowMessage](#) ([TMessage *message](#))
Post a message to the queue.
- void [AdoptMessageListener](#) ([TMessageListener *messageListener](#))
Add a message listener that will be able to receive messages that aren't targeted at a specific window.
- bool [OrphanMessageListener](#) ([TMessageListener *messageListener](#))
Remove a message listener from the [TWindowManager](#).

Top-level Screen Related Functions

- [TScreen *GetScreen](#) ()
Get the global screen object (the top level application [TWindow](#)).
- void [InvalidateScreen](#) ()
Mark the current screen as needing to be redrawn.

Modal window handling and supporting functions.

- void [PushModal](#) ([TModalWindow *w](#))
Push a modal window onto the modal window stack.

- void [PopModal](#) (str windowName)
Pop a modal window off the modal window stack.
- str [GetModalReturnStr](#) ()
Get the return value from a modal window.
- int32_t [GetModalReturnInt](#) ()
Get the return value from a modal window.
- TDialog * [DisplayDialog](#) (str dialogSpec, str body, str title, str name="")
Display a modal dialog box.
- TModalWindow * [GetTopModalWindow](#) ()
Get the current top-most modal window.
- void [SetTopModalOnly](#) (bool enable)
Enable "Draw Top Modal Window Only" mode.

Pop-up help handling

Customize the default pop-up help features of your application.

- void [AdoptHoverHandler](#) (TWindowHoverHandler *handler)
Set the current pop-up default help handler.
- TWindowHoverHandler * [GetHoverHandler](#) ()
Get the current pop-up help handler.

Overlay Window management.

An overlay window allows you to draw to a window that lives "on top" of the hierarchy.

- void [AdoptOverlayWindow](#) (TWindow *overlay)
Add an overlay window to the TWindowManager.
- bool [OrphanOverlayWindow](#) (TWindow *overlay)
Release an overlay window from the TWindowManager.

Event Management and Routing

Member functions that manipulate how messages are routed through the system.

- void [HandleEvent](#) (TEvent *e)
Handle a system event.
- void [AddMouseListener](#) (TWindow *window)
Capture the mouse and other input events.
- void [RemoveMouseListener](#) (TWindow *window)
Stop listening to all mouse messages.
- void [SetFocus](#) (TWindow *focus)
Set the window that is to receive the keyboard focus.
- TWindow * [GetFocus](#) ()

Get the window that is currently receiving keyboard events.

Lua GUI Script Access

Functions that access and manipulate the Lua GUI script supplied by *TWindowManager*.

- **TScript * GetScript ()**
Get the current TWindowManager GUI script.
- **void RunScript (TWindow *window, const char *filename)**
Use a Lua Script in an external resource to populate a Window.
- **void DoLuaString (TWindow *window, str script)**
Use a Lua Script in a str to populate a Window.
- **void OnScriptMessage (TMessage *message, TLuaFunction *command=NULL)**
Dispatch a message to the GUI script.
- **void AddWindowType (str command, PFClassId classId)**
Add a custom-defined window type to the script context.
- **bool EnableStringTable (bool bEnable)**
Toggle on/off using the string table to convert labels found in LUA to properly localized strings (see TStringTable for more information).

Utility Functions

- **void AddText (TWindow *window, str bodyText, str style)**
Convenience function that creates a TText child of the given window, using the given bodyText, in the given Lua style.
- **void SafeDestroyWindow (TWindow *window)**
Safely destroy a window at the beginning of an event loop.

13.77.2 Member Function Documentation

static TWindowManager* TWindowManager::GetInstance () [static]

Get the global *TWindowManager* instance.

Returns:

A pointer to the *TWindowManager*.

void TWindowManager::PostWindowMessage (TMessage * message)

Post a message to the queue.

Takes ownership of the message, and will expect to be able to delete the message when it has been delivered.

Parameters:

message Message to post.

void TWindowManager::AdoptMessageListener (TMessageListener * *messageListener*)

Add a message listener that will be able to receive messages that aren't targeted at a specific window.

Parameters:

messageListener Listener to adopt. Will be destroyed by TWindowManager unless it is orphaned prior to the destruction of the TWindowManager.

bool TWindowManager::OrphanMessageListener (TMessageListener * *messageListener*)

Remove a message listener from the TWindowManager.

Parameters:

messageListener Listener to remove.

Returns:

True if it was found and removed; false otherwise. If true it's safe to delete, otherwise it's been deleted already.

class TScreen* TWindowManager::GetScreen ()

Get the global screen object (the top level application TWindow).

Returns:

A pointer to the application TScreen.

void TWindowManager::PushModal (TModalWindow * *w*)

Push a modal window onto the modal window stack.

Parameters:

w Window to push.

void TWindowManager::PopModal (str *windowName*)

Pop a modal window off the modal window stack.

Safe to do at any time—window will be deleted at next event.

Parameters:

windowName Name of the window to pop. Will pop that window and any of its descendents from the stack, if found.

str TWindowManager::GetModalReturnStr ()

Get the return value from a modal window.

Returns:

A string return value.

int32_t TWindowManager::GetModalReturnInt ()

Get the return value from a modal window.

Returns:

An integer return value.

class [TDialog](#)* [TWindowManager::DisplayDialog](#) (**str** *dialogSpec*, **str** *body*, **str** *title*, **str** *name* = "")

Display a modal dialog box.

Parameters:

dialogSpec Lua dialog specification

body String to be placed in the dialog body. Selects style DialogBodyText and sets gDialogTable.body to the given body. The Lua dialog specification can then use gDialogTable.body to set the text of the body of the dialog.

title Title of dialog. Selects style DialogTitleText and adds the text to the dialog as gDialogTable.title.

name The name to be given to the resulting dialog window.

Returns:

A pointer to the dialog. The dialog will already have been pushed as the top modal window, but you may need this pointer to set additional fields.

class [TModalWindow](#)* [TWindowManager::GetTopModalWindow](#) ()

Get the current top-most modal window.

Note that this window may have some number of children—this is just the modal window that is currently receiving the processing.

Returns:

A reference to the top-most modal window.

void [TWindowManager::SetTopModalOnly](#) (**bool** *enable*)

Enable "Draw Top Modal Window Only" mode.

Only the top layer will be drawn when true.

Parameters:

enable True to enable.

void [TWindowManager::AdoptHoverHandler](#) ([TWindowHoverHandler](#) * *handler*)

Set the current pop-up default help handler.

To add pop-up help to your application, you can either override individual [TWindow::OnMouseHover](#) handlers, or you can allow [TWindow](#) to call the default handler, which you can set using this function.

The previous handler, if any, is deleted when you call this function.

Parameters:

handler A handler to add.

[TWindowHoverHandler](#)* [TWindowManager::GetHoverHandler](#) ()

Get the current pop-up help handler.

Returns:

A pointer to the current handler, if any.

void [TWindowManager::AdoptOverlayWindow](#) ([TWindow](#) * *overlay*)

Add an overlay window to the [TWindowManager](#).

As always, the "Adopt" semantics implies ownership, so when [TWindowManager](#) is destroyed, it will attempt to delete this window. To prevent this behavior, call [OrphanOverlayWindow](#) to release it from [TWindowManager](#).

An overlay window allows you to draw to a window that lives "on top" of the hierarchy. Set the window rectangle to the area that should be redrawn next frame.

Parameters:

overlay An overlay window to add.

bool TWindowManager::OrphanOverlayWindow (TWindow * *overlay*)

Release an overlay window from the [TWindowManager](#).

Parameters:

overlay Window to release.

Returns:

True if it was found and released. False if it was not found.

void TWindowManager::HandleEvent (TEvent * *e*)

Handle a system event.

Processes the event and passes it along as a message or a callback to the appropriate window. Typically called in the main loop message pump.

Parameters:

e Event.

void TWindowManager::AddMouseListener (TWindow * *window*)

Capture the mouse and other input events.

Implementation is low-overhead, and so can be safely called in [OnMouseMove\(\)](#). If you request capture a second time with the same window pointer, the new window will not be added to the list of listeners, so a window that wants capture does not need to remember whether it has called [AddMouseListener\(\)](#) already—it can just add itself again.

Events are dispatched to all registered mouse listeners, regardless of return values from handled functions.

Parameters:

window Window that wants to receive all mouse events.

void TWindowManager::RemoveMouseListener (TWindow * *window*)

Stop listening to all mouse messages.

Parameters:

window Window to release from capturing the mouse. Silently fails if window is not currently a mouse listener.

void TWindowManager::SetFocus (TWindow * *focus*)

Set the window that is to receive the keyboard focus.

Note that the window will lose the focus if someone clicks unless it has the style [kFocusTarget](#). On construction of a window that is to receive the focus, call

```
AddWindowType( kFocusTarget );
```

C++

...and this will flag that window as being able to accept focus when clicked. Otherwise focus goes to its nearest `kFocusTarget` ancestor, or is delegated to the default-focus defined by the window's parent modal.

Parameters:

focus New focus window.

TWindow* TWindowManager::GetFocus ()

Get the window that is currently receiving keyboard events.

Returns:

A reference to the current focused window.

TScript* TWindowManager::GetScript ()

Get the current `TWindowManager` GUI script.

Returns:

A pointer to the current script.

void TWindowManager::RunScript (TWindow * window, const char * filename)

Use a Lua Script in an external resource to populate a Window.

Parameters:

window Window to apply script to.
filename Name of Lua file.

void TWindowManager::DoLuaString (TWindow * window, str script)

Use a Lua Script in a str to populate a Window.

Parameters:

window Window to apply script to.
script Lua commands to run.

void TWindowManager::OnScriptMessage (TMessage * message, TLuaFunction * command = NULL)

Dispatch a message to the GUI script.

Parameters:

message Message to pass to Lua.
command Command to pass to Lua to execute in GUI thread.

void TWindowManager::AddWindowType (str command, PFClassId classId)

Add a custom-defined window type to the script context.

Parameters:

command Window type name.
classId The `TWindow::ClassId()` of the custom defined window. Note that the window needs to have `PFTYPEDEF_DC()` in the header and `PFTYPEIMPL_DC()` in the implementation file for this to work.

bool TWindowManager::EnableStringTable (bool *bEnable*)

Toggle on/off using the string table to convert labels found in LUA to properly localized strings (see [TStringTable](#) for more information).

Parameters:

bEnable true to use the table, false to not use the table

Returns:

returns true if string table was previously enabled, false otherwise

void TWindowManager::AddText (TWindow * *window*, str *bodyText*, str *style*)

Convenience function that creates a [TText](#) child of the given window, using the given *bodyText*, in the given Lua style.

Parameters:

window The window to add a new [TText](#) child to.

bodyText Text to add.

style Name of the Lua style to use (must already be loaded in the [TWindowManager::GetScript\(\)](#) Lua script), or a style definition in curly brackets.

void TWindowManager::SafeDestroyWindow (TWindow * *window*)

Safely destroy a window at the beginning of an event loop.

Allows you to mark a window for destruction when processing an event that may need to continue accessing the window.

Parameters:

window Window to destroy.

13.78 TWindowSpider Class Reference

```
#include <pf/window.h>
```

13.78.1 Detailed Description

A class used with [TWindow::ForEachChild](#) to iterate over the children of a window with a single "callback" function.

Public Member Functions

- virtual [~TWindowSpider](#) ()
Virtual destructor.
- virtual bool [Process](#) ([TWindow](#) *window)=0
The function called once for each window.

13.78.2 Member Function Documentation

virtual bool TWindowSpider::Process ([TWindow](#) * window) [pure virtual]

The function called once for each window.

Parameters:

window The window being iterated.

Returns:

True to continue the traversal.

13.79 TWindowState Class Reference

```
#include <pf/windowstyle.h>
```

13.79.1 Detailed Description

An encapsulation of a Lua window style.

Public Types

Local Types

- enum {
 kCenter = 80000, **kMax** = 160000, **kHAlignLeft** = 0, **kHAlignCenter** = 1,
 kHAlignRight = 2, **kVAlignTop** = 0, **kVAlignCenter** = 4, **kVAlignBottom** = 8,
 kDefault = 128, **kPushButtonAlignment** = kHAlignCenter+kVAlignCenter, **kRadioButtonAlignment** =
 kHAlignLeft+kVAlignCenter, **kToggleButtonAlignment** = kHAlignLeft+kVAlignCenter }
 Various window constants.

Public Member Functions

- TWindowState** (**TLuaTable** *table)
 Construction.
- virtual **~TWindowState** ()
 Destructor.
- str** **GetString** (**str** key, **str** defaultValue="") const
 Get a string parameter from the style.
- double** **GetNumber** (**str** key, **double** defaultValue=0) const
 Get a numeric parameter from the style.
- bool** **GetBool** (**str** key, **bool** defaultValue=false) const
 Get a boolean parameter from the style.
- TColor** **GetColor** (**str** key, **TColor** defaultValue=**TColor**(0, 0, 0, 1)) const
 Get a color parameter from the style.
- TLuaFunction** * **GetFunction** (**str** key) const
 Get a Lua function closure from the style.
- TLuaTable** * **GetTable** (**str** key)
 Get a Lua table from the style.
- int32_t** **GetInt** (**str** key, **int32_t** defaultValue=0) const
 Get an integer parameter from the style.

13.79.2 Member Enumeration Documentation

anonymous enum

Various window constants.

Enumerator:

kCenter Select center for a coordinate.
kMax Select max for a width or height.
kHAlignLeft Align text to the left.
kHAlignCenter Align text to the center.
kHAlignRight Align text to the right.
kVAlignTop Align text to the top.
kVAlignCenter Align text vertically to the center.
kVAlignBottom Align text to the bottom.
kDefault Default text alignment.

13.79.3 Member Function Documentation

str TWindowState::GetString (**str** key, **str** defaultValue = "") const

Get a string parameter from the style.

Parameters:

key Name of the parameter to query.
defaultValue Default if parameter value not found.

Returns:

Value if found; defaultValue otherwise.

double TWindowState::GetNumber (**str** key, **double** defaultValue = 0) const

Get a numeric parameter from the style.

Parameters:

key Name of the parameter to query.
defaultValue Default if parameter value not found.

Returns:

Value if found; defaultValue otherwise.

bool TWindowState::GetBool (**str** key, **bool** defaultValue = false) const

Get a boolean parameter from the style.

Parameters:

key Name of the parameter to query.
defaultValue Default if parameter value not found.

Returns:

Value if found; defaultValue otherwise.

TColor TWindowState::GetColor (**str** key, **TColor** defaultValue = TColor(0, 0, 0, 1)) const

Get a color parameter from the style.

Parameters:

key Name of the parameter to query.
defaultValue Default if parameter value not found.

Returns:

Value if found; defaultValue otherwise.

TLuaFunction* TWindowState::GetFunction (str key) const

Get a Lua function closure from the style.

Parameters:

key Name of the parameter to query.

Returns:

Function if found; NULL otherwise.

TLuaTable* TWindowState::GetTable (str key)

Get a Lua table from the style.

You will need to delete the table when you're done with it.

Parameters:

key Name of the parameter to query.

Returns:

Table if found; NULL otherwise.

int32_t TWindowState::GetInt (str key, int32_t defaultValue = 0) const

Get an integer parameter from the style.

Parameters:

key Name of the parameter to query.
defaultValue Default if parameter value not found.

Returns:

Value if found; defaultValue otherwise.

13.80 TXmlNode Class Reference

```
#include <pf/simplexml.h>
```

13.80.1 Detailed Description

The [TXmlNode](#) class is a limited XML parser.

It does not support comments with nested tags, nor most non-trivial XML extensions.

Any XML files in your assets folder will be obfuscated by default (in addition to being included in the flat file) in a production build, so if you need them to remain human-readable, let your producer know.

Public Member Functions

- [TXmlNode](#) ()
Default constructor.
- [TXmlNode](#) (const char *name)
Create this node with a name.
- virtual [~TXmlNode](#) ()
Destructor.
- uint32_t [ParseStream](#) (const char *data, uint32_t len, bool bOneTag=false)
Parse a stream as XML, loading contents as children of this node.
- void [ParseString](#) (const char *data)
Parse a string as XML, loading contents as children of this node.
- void [ParseFile](#) (const char *filename)
Parse a file as XML, loading contents as children of this node.
- void [Clear](#) ()
Remove all children and attributes.
- bool [HasChildren](#) () const
Query whether this node has children.
- [TXmlNode](#) * [GetChild](#) (const char *name)
Get a pointer to a child of the node.
- void [OrphanChild](#) ([TXmlNode](#) *child)
Remove a child from the parent and take ownership.
- void [DeleteChild](#) ([TXmlNode](#) *child)
Delete a child from this node.
- void [ResetChildren](#) ()
Reset internal child iterator.

- `bool GetNextChild (str *pName, TXmlNode **pChild)`
Iterate through children.
- `TXmlNode * CreateChild (const char *name)`
Create a new child and add it to our list of children.
- `void SetName (const char *name)`
Set the name of this node.
- `str GetName () const`
Get the name of this node.
- `str GetContent ()`
Get the content of this node (the part between the opening and closing tags).
- `void SetContent (const char *content)`
Set the content of this node.
- `str GetAttribute (const char *name, bool *pbQuoted=NULL)`
Get an attribute of this node's tag.
- `void SetAttribute (const char *name, const char *value)`
Set an attribute to a particular value.
- `void SetAttribute (const char *name, int32_t value)`
Set an attribute to a particular value.
- `void ResetAttributes ()`
Reset the internal attribute iterator.
- `bool GetNextAttribute (str *pName, str *pValue)`
Get the next attribute in an iteration.
- `str GetChildContent (const char *name)`
Get the content of a child node.
- `str AsString ()`
Parse the XML tree into an XML formatted string that can be written to a file.

13.80.2 Constructor & Destructor Documentation

`TXmlNode::TXmlNode (const char * name)`

Create this node with a name.

Parameters:

name Initial name for the node.

13.80.3 Member Function Documentation

uint32_t TXmlNode::ParseStream (const char * *data*, uint32_t *len*, bool *bOneTag* = false)

Parse a stream as XML, loading contents as children of this node.

Does not consume all data. Consumes a balanced open/close tag (and everything in between)

Parameters:

data buffer to parse

len length of buffer

bOneTag normally false, set to true to consume just one tag, not a balanced open/close

Returns:

Number of Characters consumed from the buffer - will be 0, if not enough data available

void TXmlNode::ParseString (const char * *data*)

Parse a string as XML, loading contents as children of this node.

Parameters:

data String to parse.

void TXmlNode::ParseFile (const char * *filename*)

Parse a file as XML, loading contents as children of this node.

Parameters:

filename File to read.

bool TXmlNode::HasChildren () const

Query whether this node has children.

Returns:

True if has children.

[TXmlNode*](#) TXmlNode::GetChild (const char * *name*)

Get a pointer to a child of the node.

Parameters:

name The name of the child to find.

Returns:

A pointer to the child. The child is still owned by the parent, so this pointer will become invalid when the parent is deleted.

void TXmlNode::OrphanChild ([TXmlNode](#) * *child*)

Remove a child from the parent and take ownership.

Parameters:

child A pointer to the child.

void TXmlNode::DeleteChild (TXmlNode * *child*)

Delete a child from this node.

Parameters:

child Child to delete.

void TXmlNode::ResetChildren ()

Reset internal child iterator.

See also:

[GetNextChild](#)

bool TXmlNode::GetNextChild (str * *pName*, TXmlNode ** *pChild*)

Iterate through children.

MUST call [ResetChildren\(\)](#) to start iteration.

Parameters:

pName Pointer to str to receive name of child that was found
pChild Pointer to receive next child in iteration.

Returns:

TXmlNode* TXmlNode::CreateChild (const char * *name*)

Create a new child and add it to our list of children.

Parameters:

name Name of the new child.

Returns:

A pointer to the new child.

void TXmlNode::SetName (const char * *name*)

Set the name of this node.

Parameters:

name New name.

str TXmlNode::GetName () const

Get the name of this node.

Returns:

The node's name.

str TXmlNode::GetContent ()

Get the content of this node (the part between the opening and closing tags).

Returns:

The node content.

void TXmlNode::SetContent (const char * *content*)

Set the content of this node.

Parameters:

content New content.

str TXmlNode::GetAttribute (const char * *name*, bool * *pbQuoted* = NULL)

Get an attribute of this node's tag.

Parameters:

name Name of attribute to query.

pbQuoted Whether the attribute's value is surrounded by quotes.

Returns:

The value of the attribute, if found. Otherwise an empty string.

void TXmlNode::SetAttribute (const char * *name*, const char * *value*)

Set an attribute to a particular value.

Parameters:

name Name of the attribute to set.

value New value for that attribute.

void TXmlNode::SetAttribute (const char * *name*, int32_t *value*)

Set an attribute to a particular value.

Parameters:

name Name of the attribute to set.

value New value for that attribute.

bool TXmlNode::GetNextAttribute (str * *pName*, str * *pValue*)

Get the next attribute in an iteration.

Call [ResetAttributes\(\)](#) to reset the iteration.

Parameters:

pName [return] Name of the attribute.

pValue [return] Value of the attribute.

Returns:

True if another attribute was found.

str TXmlNode::GetChildContent (const char * *name*)

Get the content of a child node.

Parameters:

name Node of child to find.

Returns:

Child content.

str TXmlNode::AsString ()

Parse the XML tree into an XML formatted string that can be written to a file.

Returns:

The data as a string.

13.81 pftypeinfo.h File Reference

13.81.1 Detailed Description

Runtime type information handling support macros.

This file contains a number of macros that add a more flexible runtime-type information facility than is supported natively by C++. For any class you want to decorate with additional runtime information, you'll need one call in the class definition, with a corresponding call in the implementation file. The base class definition has its own call as well.

The basic form is [PFTYPEDEF\(\)](#) in the class, [PFTYPEIMPL\(\)](#) in the implementation file, with the base class using [PFTYPEDEFBASE\(\)](#). This set would be used in classes that do not need dynamic creation or to be stored in shared pointers.

The [PFSHAREDTYPEDEF\(\)](#) variation is used in classes that will be held in shared pointers. It requires that you use [PFSHAREDTYPEDEFBASE\(\)](#) in the base class, and that the base class be derived from `enable_shared_from_this<BASECLASS>`. In the implementation files you can use [PFTYPEIMPL\(\)](#) with [PFSHAREDTYPEDEF\(\)](#) or [PFSHAREDTYPEDEFBASE\(\)](#).

The `_DC` variations are similar to the ones described above, only they also support dynamic creation by defining a function `CreateFromId()` that takes the `ClassId()` of a class and creates a new instance of the class. [PFTYPEDEF_DC\(\)](#) matches [PFTYPEIMPL_DC\(\)](#). The [PFTYPEIMPL_DCA\(\)](#) variation needs to be used for any abstract class.

See also:

[Type Information and Casting](#)

Defines

- `#define PFTYPEDEF(THISCLASS, BASECLASS)`
Additional definitions for a class that needs run time type information.
- `#define PFTYPEDEF_DC(THISCLASS, BASECLASS)`
Additional definitions for a class that needs run time type information and dynamic creation.
- `#define PFSHAREDTYPEDEF(BASECLASS)`
Additional definitions for a class that needs run time type information, and that is controlled through shared pointers.
- `#define PFSHAREDTYPEDEF_DC(THISCLASS, BASECLASS)`
Additional definitions for a class that needs run time type information and dynamic creation, and that is controlled through shared pointers.
- `#define PFTYPEDEFBASE()`
Additional definitions for the base class of a polymorphic type that needs run time type information.
- `#define PFTYPEDEFBASE_DC(THISCLASS)`
Additional definitions for the base class of a polymorphic type that needs run time type information and dynamic creation.
- `#define PFSHAREDTYPEDEFBASE(THISCLASS)`
Additional definitions for the base class of a polymorphic type that needs run time type information, and that will be stored in shared pointers (reference counted, like `TTextureRef`).
- `#define PFSHAREDTYPEDEFBASE_DC(THISCLASS)`
Additional definitions for the base class of a polymorphic type that needs run time type information and dynamic creation, and that will be stored in shared pointers (reference counted, like `TTextureRef`).

- `#define PFTYPEIMPL(THISCLASS)`
Implementation for run time type information.
- `#define PFTYPEIMPL_DC(THISCLASS)`
Implementation for run time type information for a class with dynamic creation.
- `#define PFTYPEIMPL_DCA(THISCLASS)`
Implementation for run time type information for an abstract class, descendents of which will require dynamic creation.

13.81.2 Define Documentation

#define PFSHAREDTYPEDEF(BASECLASS)

Additional definitions for a class that needs run time type information, and that is controlled through shared pointers.

Putting this macro in a class will declare and define `IsKindOf()`, `GetCast()` and `ClassId()` for that class.

Parameters:

BASECLASS Our base class.

See also:

[Type Information and Casting](#)

#define PFSHAREDTYPEDEF_DC(THISCLASS, BASECLASS)

Additional definitions for a class that needs run time type information and dynamic creation, and that is controlled through shared pointers.

Putting this macro in a class will declare and define `DynamicCreate()`, `IsKindOf()`, `GetCast()` and `ClassId()` for that class.

Parameters:

THISCLASS The class we're defining.

BASECLASS The (single) base class.

See also:

[Type Information and Casting](#)

#define PFSHAREDTYPEDEFBASE(THISCLASS)

Additional definitions for the base class of a polymorphic type that needs run time type information, and that will be stored in shared pointers (reference counted, like `TTextureRef`).

Putting this macro in a class will declare and define `IsKindOf()`, `GetCast()` and `ClassId()` for that class.

Parameters:

THISCLASS The current class to declare.

#define PFSHAREDTYPEDEFBASE_DC(THISCLASS)

Additional definitions for the base class of a polymorphic type that needs run time type information and dynamic creation, and that will be stored in shared pointers (reference counted, like `TTextureRef`).

Putting this macro in a class will declare and define `IsKindOf()`, `GetCast()` and `ClassId()` for that class.

#define PFTYPEDEF(THISCLASS, BASECLASS)

Additional definitions for a class that needs run time type information.

Putting this macro in a class will declare and define `IsKindOf()`, `GetCast()` and `ClassId()` for that class.

See also:

[Type Information and Casting](#)

#define PFTYPEDEF_DC(THISCLASS, BASECLASS)

Additional definitions for a class that needs run time type information and dynamic creation.

Putting this macro in a class will declare and define `DynamicCreate()`, `IsKindOf()`, `GetCast()` and `ClassId()` for that class.

See also:

[Type Information and Casting](#)

#define PFTYPEDEFBASE()

Additional definitions for the base class of a polymorphic type that needs run time type information.

Putting this macro in a class will declare and define `IsKindOf()`, `GetCast()` and `ClassId()` for that class.

#define PFTYPEDEFBASE_DC(THISCLASS)

Additional definitions for the base class of a polymorphic type that needs run time type information and dynamic creation.

Putting this macro in a class definition file will declare and define `IsKindOf()`, `GetCast()` and `ClassId()` for that class.

Parameters:

THISCLASS The current class to declare.

#define PFTYPEIMPL(THISCLASS)

Implementation for run time type information.

Use this macro in the implementation file.

#define PFTYPEIMPL_DC(THISCLASS)

Implementation for run time type information for a class with dynamic creation.

Use this macro in the implementation file.

#define PFTYPEIMPL_DCA(THISCLASS)

Implementation for run time type information for an abstract class, descendents of which will require dynamic creation.

Use this macro in the implementation file.

13.82 pflibcore.h File Reference

13.82.1 Detailed Description

Include file that PFLIB requires you load before anything else.

Functions

- void [PlaygroundInit](#) ()
A user-defined function that will be called by Playground before [TPlatform](#) is initialized.

13.82.2 Function Documentation

void [PlaygroundInit](#) ()

A user-defined function that will be called by Playground *before [TPlatform](#) is initialized.*

No non-static calls on [TPlatform](#) are allowed.

In order for this function to be called, you must define `PLAYGROUND_INIT` in the file where you're defining `PLAYFIRST_MAIN`, before you include [pflibcore.h](#).

This function is really designed only for setting up values with [TPlatform::SetConfig\(\)](#) that [TPlatform](#) will need during initialization; most application initialization still belongs in `Main()`.

Appendix A

Forward Declarations

A.1 forward.h File Reference

A.1.1 Detailed Description

Forward declarations for PFLIB and a Ref casting helper.

Typedefs

- typedef shared_ptr< [TSprite](#) > [TSpriteRef](#)
A reference to a [TSprite](#).
- typedef shared_ptr< [TAnimatedSprite](#) > [TAnimatedSpriteRef](#)
A reference to a [TAnimatedSprite](#).
- typedef shared_ptr< [TTexture](#) > [TTextureRef](#)
A reference to a [TTexture](#).
- typedef shared_ptr< [TScriptCode](#) > [TScriptCodeRef](#)
A reference to a [TScriptCode](#) object.
- typedef shared_ptr< [TAnimatedTexture](#) > [TAnimatedTextureRef](#)
A reference to a [TAnimatedTexture](#).
- typedef shared_ptr< [TSound](#) > [TSoundRef](#)
A reference to a [TSound](#).
- typedef shared_ptr< [TSoundInstance](#) > [TSoundInstanceRef](#)
A reference to a [TSoundInstance](#).
- typedef shared_ptr< [TModel](#) > [TModelRef](#)
A reference to a [TModel](#).
- typedef shared_ptr< [TAsset](#) > [TAssetRef](#)
A reference to a [TAsset](#).

Appendix B

Change History

B.1 Playground Game SDK™ Change Log and Migration Information

B.1.1 Playground SDK Change Log

New Features in Playground 4.0.11

- Added a new rendering option that enables a more cross-platform style of subtractive render that we recommend all games activate: `TRenderer::GetInstance()->SetOption("new_subtractive","1");`
- Implemented hard limit on number of vertices that can be rendered using `DrawVertices`, and hard limit on vertices and indices for `DrawIndexedVertices`. Will ASSERT in debug build if you exceed either limit.
- Added new `kVsyncWindowedMode` option that instructs Playground to wait for a vertical blanking period before copying to the screen (on Windows, in windowed mode).
- Added `TSlider::GetState()` to expose the current state of the slider.
- In order to avoid many of the common bugs that are happening with the use of `TPfHiscores`, more information regarding the hiscore system has been added to `key.h`. All new PlayFirst games MUST use this version of `key.h`, and will be sent updated versions of `key.h` specific to their game. In addition, code has been added to the Playground Skeleton to show how to properly use this data in `PlaygroundInit()`. Again, all Playfirst games MUST use this initialization procedure. Finally, the need to use `serverdef.txt` to configure `pfServlet_stub.dll` has been removed. The `pfServlet_stub.dll` will now automatically configure itself based on the settings in `key.h`.
- Added a new tool to the distribution, `xml2anm`, that will allow you to create binary versions of xml animation files that will load more quickly than their xml versions.
- New version of `FilmStrip-2.0!` Many new and cool features!
- In skeleton application, created new file, `version.rch`, that contains the version information for the application. This prevents a common error where someone edits the `.rc` file with the IDE and overwrites the `VERSION` macros.

Fixes in Playground 4.0.11

- Fixed issue in the `xsellkit` addon where `xsell.lua` assumed that "label" was defined for `Button` (like the Playground Skeleton defines it). This assumption is now removed.
- Fixed `TLuaTable::Create` to be static.
- Plenty of documentation bugs are now fixed.

- Fix "mouse cursor doesn't display when game window isn't top window" bug.
- Fixed `SetClippingRectangle()` to work correctly on the Mac when using render targets; this allows you to draw to render targets using `TWindow`-derived classes.
- Fixed a render-target-related system-specific failure case where the primary and fallback copy-to-texture routines were both failing; added a secondary fallback copy routine that's slower but that always works.
- Fixed skeleton application Enter Name screen based on comments in forum.
- Fixed Mac sound looping bug.

New Features in Playground 4.0.10

- `TAnimatedTexture` can now support animated alpha.
- New `TTextGraphic::SetAlphaBlend()` enables a more sophisticated render-text-to-texture mode.
- Support for Decoda Lua debugger.

Fixes in Playground 4.0.10

- Correctly send full-screen-toggle event on Mac.
- Fix of particle register member indexing (`pVelocity[2]`).
- Fixed a problem with flickering on high-end video cards.
- Fixed a potential leak/behavior problem that could occur when calling `BeginRenderTarget()` right when the DirectX state fails.
- Fixed a bug in `TSprite::HitTest()` where `BeginRenderTarget()` was called, and the return value was ignored.
- Prevent `EndRenderTarget()` from crashing in release build if it's mistakenly called (it should only be called after a successful `BeginRenderTarget()`).
- Fix Mac command line to be constructed more like the Windows command line.
- Fix Mac bug that caused render-targets, `TTexture::Lock()`, and `TTexture::CopyPixels()` from working deterministically on some video cards.
- Fix recover-from-sleep-in-full-screen issue with semi-private `TRenderer::BeginDraw()` function when its parameter is true.
- Fixed a bug in `TTextGraphic` that would improperly crop text that was centered or bottom-justified if the text included a tag that reduced its size.
- Fix `TTextGraphic` rendering of outlined fonts to a texture.
- Prevent `TWindowStyle` from being copied.
- Prevent a crash in `TAnimatedSprite` if you call `Pause()` before calling `Play()`.
- Fix `TAnimatedTexture` to properly use the transform values in the XML file if present.
- In `TSprite::HitTest()`, properly fail if internal `BeginRenderTarget()` fails (such as if DirectX has failed).
- Improved Playground support for Max OS X 10.5 (Leopard) and Microsoft Windows Vista (several fixes for each).
- Fixed an ActiveX issue where mouse would leave trails when MSN requested the game to pause.
- Fixed a problem in the skeleton where the name of the application didn't match the name in `serverdef.txt`.

Migration to Playground 4.0.9

- Your Mac project will need a new NIB file if it was created using previous versions of the Playground SDK. Open up the Playground Skeleton project, and open up English.lproj. If you're in a shell, it's just a folder, but if you're using Finder, you need to right click (control-click for you single-button users) and tell it to "Show Package Contents" to open it. Copy the FlashWindow.nib folder into your project's English.lproj. Then, in Xcode, select the project window, and drag (from a finder window) FlashWindow.nib into the "resources" group in the project. Tell it to "copy if necessary", "Recursively create group", and then click the "Add" button. Now you should be able to play Flash files using the new version of Playground.
- If you use the "align" property in `TText` or `TTextEdit` objects, *and* you use the little-known "negative offset means measure from the right/bottom edge" feature in those same objects, then you'll need to decide to use one or the other: "align" disables the negative-offset feature now, and negative positions will just position the window off the screen to left/above.
- To increase the security of an ActiveX build, we added another GUID that's used as the encryption key (GUID3) to the activex.bat configuration file.

New Features in Playground 4.0.9

- Hardware cursor support for Windows XP and Vista; Mac support is not in yet, nor will this ever be supported on older platforms, so supplying a software cursor is still required for full compatibility.
- An optional user-defined function `PlaygroundInit()` can be created to set the name of the application user and common folder names, as well as to change the name of the publisher for non-PlayFirst-published games. See the new skeleton code for an example, and documentation on the constant `TPlatform::kPublisherName`.
- New `TWindow` virtual function: `TWindow::OnParentModalPopped()`, which is called when a window's parent (or ancestor) modal is popped from the modal stack.
- Added new accessors to `TModel`, to allow access to model triangles.
- Added `TFile::DeleteFile()`.
- Gave `TPlatform::GetConfig()` a new, optional default parameter.

Fixes in Playground 4.0.9

- 4.0.9.6 patch: Fixed more sleep- and resolution-change-related crashes in Vista and XP.
- Fixed several sleep and Ctrl-Alt-Del related crashes in Vista.
- Fixed word-wrapping for words longer than a single line of text (previously it would lose a character when it wrapped). Also will now display a cropped character if a single character is wider than an entire line of text.
- Fixed a Mac chained-sound problem where killing the sound didn't work correctly.
- Fixed two sidewalk bugs: First, images with opacity are now always cropped to opaque pixels, even if the opaque pixels go right out to the edge. In other words, if the entire source image is opaque, it won't crop the image at all. Second, there was a bug where if you give sidewalk a single image with an exact power-of-two width (or if your existing image exactly fit in a current row), it would bump the image to the next line. In the single-image case, this caused an invalid state and crash of sidewalk.
- Fixed some Flash playback issues on the Mac.
- Fixed a problem with `TFile::AtEOF()` for flat files, where `AtEOF()` would report EOF when you're read the last byte of the file, while traditional `feof()` (called by the normal `TFile::AtEOF()`) returns EOF only after a failed read past end of file. Changed the behavior to match.

- Fixed an issue in `axtool.bat` that caused long game names to fail.
- Fixed a Mac render-to-texture bug in XXXA mode, where it wasn't properly clearing the backbuffer before rendering.
- Fixed a bug in `TSlider` that caused it to render more "blurry" than it should have on some platforms.
- Fixed declaration of `CreateVertsFromRect()` to be accessible from client applications.
- Fixed an uninitialized member in `TTextGraphic` that could cause it to report bad information about its contents before a call to `RenderText()` (which is called implicitly in `SetText()` and a few other places).
- Fixed a problem on the Mac where the cursor wouldn't update on static screens when the mouse was being dragged (the mouse button was down).

New Features in Playground 4.0.8

- Force simple and slow textures to NOT be valid drawing sources; now they correctly fail (and ASSERT) when attempting to `DrawSprite()` or `SetTexture()` with them. Note `TImage` uses `DrawSprite()`, so slow textures are also forbidden in `Bitmap{}` calls.
- Added an "antialiasing" hint to Playground.
- Added `TTextEdit::GetCursor` and `TTextEdit::SetCursor`, to enable `TTextEdit` overriding.
- In the skeleton application, add a `Text{}` field to the credits screen that shows the game version.
- The function `TPlatform::Rand()` is now fully documented and supported. `Rand()` is seeded using the system time, and returns a stream of pseudo-random 32-bit numbers using `TRandom` internally.
- `TRenderer::SetOption('fps', '0')` will disable FPS output.
- Added `TWindow::GetWindowPos()`
- Added `TImage::GetAlpha()`
- Playground Skeleton now has a shrink-to-fit hiscore name feature: When presented with really long Play-First user names, the Skeleton will shrink the name until it fits.
- `TTextGraphic::SetLineHeight()` can now change the font size after construction.
- `TText::GetTextGraphic()` can now access the `TTextGraphic` hidden in a `TText`.
- Added `str::sizeof_utf8_char()` so that it's possible to iterate through UTF8 characters in a translated string.
- Fixed Lua-binding of functions returning void with 4 or more parameters.

Fixes in Playground 4.0.8

- Fixed sound chaining on Mac.
- Fixed `CopyPixels()` bug on nVidia cards on Mac.
- Fixed package size on Mac (was accidentally including packages twice).
- Added a hack to work-around a bug in Vista that caused it to think a Playground game had stopped responding, despite the fact that it was actively pumping messages.
- Fixed 4+ parameter Lua function binding for functions with a void return type.
- Fixed crash bug in FluidFX.
- Fix Windows Playground to not allow drawing from "slow" textures.

- Fix DrawSprite() clipping on Mac.
- Fix SetFullscreen() to properly return false when attempting to set windowed mode on a system that has been flagged as having insufficient video memory for 32-bit mode.
- Reduce the aggressiveness of the low-video-memory flag, so that it doesn't get triggered when the initial display is being initialized, as sometimes happens on a resume from sleep.
- Fix problem with render targets in 16-bit display depth (in windowed mode) on some hardware.
- Expand some fixed path lengths internally, and convert others to use str, to attempt to address a very-long-path-length issue.
- Fix toggle-style TButtons to work correctly when the toggle has a command that brings up a dialog. Also fix bug where pressing mouse down on one button and then moving it over a toggle would cause the toggle to flip states but not call the command.
- Fixed crash bug in FluidFX
- Prevented DisplaySplash() from accidentally eating up close messages from other windows.
- Fixed a small TSound memory leak.
- Fixed TStringTable to read empty rows as strings that translate to "", rather than not including them in the table at all.
- Clean up an fix a minor bug in chooseplayer.lua in the skeleton.
- Fix Mac bug where right- and middle-button-up messages were being sent as left-button-up messages.
- Fixed a z-render-depth issue on Mac.

New Features in Playground 4.0.7

- Added the ability to mask out files from the local filesystem (TFile::AddFileMask).
- Added a new key in settings.xml that selects one of two file masks: when the <firstpeek> tag is set to 0, the file system looks for final.txt next to the executable, and if found, passes the contents to AddFileMask(). Alternately, if <firstpeek> is set to 1, it reads firstpeek.txt.
- New Flash translation technique that also works correctly on Mac.
- TTextEdit can now delay its registration with its parent modal window, and you can call TTextEdit::Unregister() to cause it to release its connection with the modal window. This allows a TTextEdit to exist in a detached window hierarchy that is periodically attached when needed.

Fixes in Playground 4.0.7

- Fixed TLuaParticleSystem to properly load and display animated textures.
- Fixed Mac TColor32 implementation to work correctly with locked textures.
- Fixed Mac text calibration bug.
- Fixed TSlider to create correctly from C++.
- Fixed TTextGraphic to not corrupt the screen when rendering to a texture during a Draw() phase.
- Fixed Mac TTexture::Lock() to return the correct pitch on non-power-of-two texture surfaces.
- Fixed Mac 3d cull order.

- Fixed Mac render-target blending to match Windows behavior.
- Removed some hard-coded values to allow Playground to scale larger than 800x600 on Windows.
- Added a missing `TRenderer::SetShadeMode()` implementation.
- Properly test to see if a file exists in user: or common: when opening it for read.
- Fix two crash bugs when shutting down the app while playing an SWF.
- Fix a memory leak that occurs if someone forgets to call `TTexture::Unlock()` after `TTexture::Lock()`.
- Correctly set `TTextGraphic` to be noncopyable.
- Improved comments and removed cruft from skeleton style.lua.
- Fix ActiveX version to never write a log file.
- Prevent right-justified text from being cut off by one pixel.
- Prevent right-clicking on SWF file from bringing up Flash menu when "allow input" is enabled.
- Fixed a bug where the cheat-enabling application didn't work with Together.
- Added a few missing items to the 4.0.6 changelog below.

New Features in Playground 4.0.6

- Added `TLuaParticleSystem::AdoptFunctionInstance()`.
- `TRect::Contains()`, which deprecates `TRect::IsInside()`.
- Added a line to the skeleton credits file that gives proper credit to the Playground SDK.

Changes in Playground 4.0.6

- Changed `GetTypeNames()` to be available in debug and release builds.
- Documentation typo fixes and updates, including lots of additional docs on `TDrawSpec` usage.
- Removed include of Carbon headers in `debug.h`—they shouldn't have been there to begin with.
- `TPrefs`: Handle bad encryption key or corrupt file more gracefully.
- On Mac, fill screen with black when starting up.

Fixes in Playground 4.0.6

- Fix `pfServlet_stub` to behave like actual hiscore server when `SubmitMedals()` is used immediately after `SubmitScore()` without first waiting for a server response. It is recommended that you use the new `pfServlet_stub.dll` when testing your hiscore functionality.
- Fix `BeginRenderTarget()` on Windows to reset internal state if it's called when DirectX is disabled (e.g., when the window is minimized).
- Fix bug in hiscore system where ranking values returned in `TPfHiscores::GetScore()` were not always correct when scores were logged using the `replaceExisting` flag in `TPfHiscores::LogScore()`.
- Fix Mac sound bug.
- Fix bigendian reading of new `TPrefs` format.
- Fix Crash/ASSERT in `simplexml`.

- Fix const-correctness of [TDrawSpec::GetRelative\(\)](#)
- Fix test for kCenter in [TAnimatedSprite::GetRect](#) to actually test the right mFlags.
- Remove some long-unused debug info.
- Fix Lua hex conversion to use unsigned int internally (GCC was truncating a negative signed value to 0).
- Fixed [IsForeground\(\)](#) return result when running under Together.

New Features in Playground 4.0.5

- Added "desktop:" file prefix, for saving files to the desktop
- Added [TTexture::Save](#) for saving textures to a .jpg file.

Migration to Playground 4.0.5

- Mac developers must now link against WebKit.framework.

Fixes in Playground 4.0.5

- Fixed an intermittent bug in the optimized [TXmlNode](#).
- Fixed Mac Flash playback to not rely on Apple's broken QuickTime Flash player.
- Fixed [TFile::Exists\(\)](#) for user: and common: files.

Changes in Playground 4.0.4

Be sure you do a complete rebuild and replace `pflibDebug.dll` when you get 4.0.4!

- str, [TXmlNode](#) (simplexml), and [TPrefs](#) have been internally optimized.
 - [TPrefs](#) in particular now runs much faster with larger data sets—there were a few unintentional $O(n^2)$ algorithms in the load and save data paths. Also, [TPrefs](#) binary data is now saved directly in the file (encrypted), and doesn't need to be uuencoded—so it should also be a lot faster.
 - Parts of str were inlined.
- Several str APIs now take or return `size_t` parameters to closer match `std::string`.

New Features in Playground 4.0.4

- Include Visual Studio 2005 plugin that displays the contents of str variables in the debugger. See `bin/pfaddinReadme.txt`.
- [TEncrypt::GetLastSize\(\)](#) gets the actual size of the last encrypted or decrypted data.
- [TFile::AddMemoryFile\(\)](#) allows you to add a virtual file to the file system.
- New str APIs were added to bring str closer to `std::string`.

Fixes in Playground 4.0.4

- [TSound::Get\(\)](#) now takes a str as its first parameter instead of a char*, which makes the interface more consistent.
- Fixed clipping rectangle issues: Prevent upper-left corner of clipping rectangle from causing an offset in rendering, and allow clipping rectangle to be updated dynamically.
- Fix [ScriptRegisterDirect\(\)](#) to support functions with more than three parameters.
- Fix bug in [TTextGraphic::GetTextBounds\(\)](#) in handling of zero length strings.
- Fix Flash rendering bug when [TFlashHost::Start](#) called in BeginDraw/EndDraw.
- Fix swf2mvec parameter processing bugs.
- Const-correctness fix in [str::find](#).
- Cursor delta mode won't let the cursor escape on PC.
- An OnKeyDown() problem with key flags was fixed.
- [TFile](#) now reads subfolders in user: and common: correctly.

New Features in Playground 4.0.3

- [TFlashHost::Start\(\)](#) now has an optional bAllowInput parameter to allow interactive flash movies.
- The [TScriptCode::Get\(\)](#) function has a new, optional parameter that retrieves any error message related to the loading of the Lua file.
- Support for delete key in [TTextEdit](#).
- Sidewalk now puts a 1-pixel border between images to prevent bleed in rendering.
- Sidewalk now has a -reg= option to allow a fixed registration point to be specified.
- Changed Begin2d() to reset 3d matrices on entry and exit, but respect them for doing 2d transforms. Perspective matrix is coerced into being a 2d perspective transform, and cannot be changed.
- Optimized DrawVertices() to not set the matrices as often.

Fixes in Playground 4.0.3

- Fixes for anonymous hiscore demonstration in the Playground Skeleton application.
- Previously DrawVertices() stomped on the matrices in some cases accidentally; now changed the design so that Begin2d() stomps on matrices intentionally, and DrawVertices() never does.
- Fixed back button bug in the xsellkit addon.
- [TScript::RunScript\(\)](#) now correctly prints the error message generated when parsing and compiling a Lua file.
- Scroll-wheel messages now work as advertised.
- SetTextureMapMode() link error fixed.
- Fixed some internal sound resource lifetime issues.
- Fixed memory leak in sound notifications.
- On Mac, fixed [TPlatform::Exit](#) to not immediately exit application.

- On Mac, fixed render-target clipping.
- On Mac, include default soft-cursor.
- On PC, forced default cursor to only be initialized once.

New Features in Playground 4.0.2

- When creating new files in user: or common:, any folders specified will be auto-created if they don't already exist.

Fixes in Playground 4.0.2

- Fix `TLuaTable(TLuaObjectWrapper)` constructor.
- Fix Windows fullscreen Flash bug.
- Fix documentation re custom `TMessage` creation.
- Fix QuickTime/Flash enable detection on the Mac, so that when Flash is enabled in QuickTime on Intel-based Macs it will display them again. Still pending is a switch to WebKit that will allow Flash to work on ALL Macs.
- Fix to `TLuaParticleSystem` that allows complex expressions in `Vec*()` and `Color()` definitions.
- Fix `TMessage` delivery so that `OnMessage()` gets an unwrapped message pointer.
- Fix `TLuaMessageWrapper` to properly be set `PFLIB_API`, so that client code can call `TLuaMessageWrapper::ClassId()`.
- Fix `TLuaMessageWrapper::IsKindOf()` to properly take a `PFClassId` type.
- Fix cursor-delta mode to work in ActiveX mode.
- Fix `TTextGraphic::GetTextBounds()` to correctly read bounds of justified text.

Migration Notes for Playground 4.0.1

- The signature for the sound notification callback `OnComplete()` has changed.
- Setting a viewport with zero size will now FAIL—so don't do that any more.

New Features in Playground 4.0.1

- `TPlatform::SetCursorMode()` can set the mouse to be in a "delta" gathering mode. `OnMouseMove()` then only provides mouse-deltas, the mouse is hidden, and the mouse is prevented from leaving the application window. Note that you need to make your window a mouse listener if you want to get the mouse events.
- Some minor optimizations of `TAnimatedSprite()`. More to come.
- Documentation updates, including the `animatedsprite.lua` file documentation that includes documentation on Lua calls available in `TAnimatedSprite` scripts.

Fixes in Playground 4.0.1.4

- Updated `axtool` to 4.0 source

Fixes in Playground 4.0.1

- Compatibility bugs in the render-target support on some systems have been fixed.
- A bug in sound-complete notification has been fixed.
- Fix a bug in the particle system that caused particle systems to interfere with each other.
- Fix a compatibility bug in FillRect() that caused problems on some DirectX cards.
- Fix crash-when-closing-during-splash-movie bug.
- Fix a Mac compatibility problem with TColor32 accessors.
- Make kInstallKey always return the same value no matter how the game is launched.
- A render-target problem with textures larger than 600x600 was fixed.
- A bug in the TTexture::Create() call that caused some systems to report the wrong width and height has been fixed.
- Mac render-target support bugs fixed.
- Mac CopyPixels() bug when drawing texture-to-texture fixed.
- Fixed skeleton Release DLL linkage.

New Features in Playground 4.0.0 Beta 1

- All new features up to 3.5.0.6 are included in this 4.0 beta.
- A TSoundInstanceRef is returned for each sound instance that's played.

Fixes in Playground 4.0.0 Beta 1

- Screen now refreshes right away when swapping screen resolutions.
- Writable is now set to a default ("Playground Application") if the resource info isn't found.
- Render target support works correctly on the Macintosh.

Migration Notes for Playground 4.0.0 Final

- Several TRenderer enums have been standardized as singular:
 - EBlendMode
 - ECullMode
 - EFilteringMode
 - ERenderTargetMode
 - EShadeMode
 - ETextureMapMode

New features in Playground 4.0.0 Final

- Major documentation rework.

Migration Notes for Playground 4.0.0 Beta

- [TSound::Play\(\)](#) now returns a `TSoundInstanceRef` instead of an `int`. You now need to use the `TSoundInstanceRef` to modify an individual sound once it's playing.
- [TRenderer::BeginRenderTarget\(\)](#) now takes a mode parameter that you must specify to indicate how you will use it. The safest (though slow) mode to use is `kMergeRenderRGB1`, which will allow you to render onto an existing texture and will make the alpha of the entire image opaque. See [TRenderer::BeginRenderTarget\(\)](#) for more information.

Migration Notes for Playground 4.0.0 Alpha 3

- [TWindow::OnKeyDown](#) now takes a `uint32_t`, which means you need to update the signature of any classes that override it if you want it to be called.
- [TLuaParticleSystem::Draw2d\(\)](#) was changed to [TLuaParticleSystem::Draw\(\)](#).
- Folders have changed location. In your project file you should make the following substitution:
 - `utilities\bin -> bin`

Fixes in Playground 4.0.0 Alpha 3

- [TMatrix::Rotate\(\)](#) now properly rotates the 2x2 transformation portion of the matrix without changing the position, and it uses a pre-transform so that scaling is also properly rotated.

Migration to Playground 4.0.0 Alpha from Playground 3.5.X

The list below is long because of the many aspects of Playground that have been improved or cleaned up between 3.5 and 4.0. A number of the changes listed below will not show up as compile errors, and will likely manifest as parts of the program not working. The good news is that most of the changes tend to involve the removal of code or tweaking of calling conventions or include paths.

APIs that draw to the screen are now respecting the screen's viewport settings. This makes the library more consistent, in that some functions already respected the viewport ([TTexture::DrawSprite](#), for instance). However, if your game is on the 3.5 branch and uses any of the modified APIs, you should check to make sure that you're really using [TWindow](#) client coordinates, since the [TWindow::Draw\(\)](#) function is called with the viewport set to be the size of the [TWindow](#).

If you're working on a development contract with PlayFirst, be sure that you talk with your PlayFirst producers about any schedule impact that converting to 4.0 might entail—and don't even try if you've already submitted a beta candidate, because PlayFirst has already done too much testing on your current build to wind back the clock and start testing on 4.0.

As always, direct questions or issues to the forums! PlayFirst employees monitor the forums, and Playground developers frequently are able and willing to provide help with issues they've already encountered.

- All Playground library files are now in a "pf" subfolder. Loading include Playground include files should look like:

```
#include <pf/pfconfig.h>
```

C++

- Add an `SDK.txt` to your project along with related support, including copying the Pre-Build step from the skeleton application.
- [TTransformedLitVert](#) type has changed its behavior: Now when drawing using [TTransformedLitVert](#) vertices, the coordinates specified will be relative to the current viewport.

- [TTextGraphic](#) objects will also be drawn relative to the current viewport. Note that the standard `credits.cpp` will need to be changed to match the new skeleton `credits.cpp` in order for credits to continue to function correctly. The `scripts/credits.lua` file may also need to be updated.
- The blend mode `kBlendAdditive` has been eliminated in favor of `kBlendAdditiveAlpha`. Subtle differences between DirectX and OpenGL encouraged us to simplify and support only the alpha variant of additive blending.
- [TWindow](#) initialization has changed:
 - The semantics of `TWindow::Init()` has changed. It is only called during Lua window construction, and is now called after window position and size have been initialized. Its signature has changed to return void and take a [TWindowStyle&](#) parameter. Search your code for `Init()` overrides and update the signatures or your `Init()` function won't be called because of the new signature! If you need behavior similar to the previous `TWindow::Init()`, change your call to [TWindow::OnNewParent\(\)](#) (see below).
 - [TWindow::PostChildrenInit\(\)](#) also takes a [TWindowStyle&](#) parameter, so you need to change its signature in client code as well.
 - You **must** call the base class of `TWindow::Init()` and [TWindow::PostChildrenInit\(\)](#) in the new initialization model.
 - Windows no longer automatically resize to fit their children. In Lua, you can add the tag "fit=true" to a window definition to let it know you want it to grow to encompass its children. Or you can add that tag to your default style if you want all windows to grow in a way similar to the 3.X behavior. In C++ code, you can call [TWindow::FitToChildren](#) to request that a window resize itself to encompass its children. If suddenly no mouse messages are going to window children, hit F2 and look at your window hierarchy: Probably one of your custom windows isn't getting a size. That one needs `fit=true`.
 - `TWindow::PostInit()` has been removed. You can safely replace it with `TWindow::Init()` if you're building windows with Lua; otherwise you'll need to use `PostChildrenInit` or create your own post-init call.
 - [TWindow::OnNewParent\(\)](#) is a new API that's called at the same time as the previous `TWindow::Init()`, though it no longer has the style information available to it that it had in 3.X, so most initialization should be moved to the new [TWindow::Init](#) virtual function.
- `TWindow::OnDirtyRect()`, `TWindow::InvalidateRect()`, and all dirty-rectangle management functions have been removed. To cause a screen refresh, you can call [TWindowManager::InvalidateScreen\(\)](#).
- [TPlatform::GetConfig\(\)](#) now returns the game's version with `GetConfig(kGameVersion)`. This was previously handled by `TPlatform::GetVersion()`.
- A new singleton class, [TRenderer](#), is now the container for all screen rendering related functions, so any reference to any of the following functions or their associated types as part of [TPlatform](#) will need to be changed to refer to [TRenderer::GetInstance\(\)](#):

```

bool TRenderer::Begin2d();
bool TRenderer::Begin3d();
bool TRenderer::BeginDraw(bool needRefresh);
bool TRenderer::BeginRenderTarget( TTextureRef texture,
                                   bool fullCoverage=false );
void TRenderer::DrawIndexedVertices( EDrawType type,
                                     const TVertexSet & vertices,
                                     uint16_t * indices,
                                     uint32_t indexCount );
void TRenderer::DrawVertices( EDrawType type, const TVertexSet & vertices );
void TRenderer::End2d();
void TRenderer::End3d();
void TRenderer::EndDraw(bool flip=true);
void TRenderer::EndRenderTarget();
void TRenderer::FillRect( uint32_t x1,
                          uint32_t y1,

```

C++

```

        uint32_t x2,
        uint32_t y2,
        const TColor & color,
        TTextureRef dst=TTextureRef());
void TRenderer::GetProjectionMatrix(TMat4* m);
bool TRenderer::GetTextureSquareFlag();
void TRenderer::GetViewMatrix(TMat4* m);
void TRenderer::GetViewport( TScreenRect * viewport );
void TRenderer::GetWorldMatrix(TMat4* m);
bool TRenderer::In2d() const ;
bool TRenderer::InDraw() const ;
void TRenderer::PopViewport();
void TRenderer::PushViewport( const TScreenRect & viewport );
bool TRenderer::RenderTargetIsScreen();
void TRenderer::SetAmbientColor(const TColor & color);
void TRenderer::SetBlendMode( EBlendModes blendMode );
void TRenderer::SetCullMode(ECullModes cullMode);
void TRenderer::SetFilteringMode( EFilteringModes filteringMode );
void TRenderer::SetLight( uint32_t index, TLight * light );
void TRenderer::SetMaterial(TMaterial* pMat);
void TRenderer::SetOrthogonalProjection(TReal nearPlane, TReal farPlane);
void TRenderer::SetPerspectiveProjection( TReal nearPlane,
                                           TReal farPlane,
                                           TReal fov=PI/4.0f,
                                           TReal aspect=0);
void TRenderer::SetProjectionMatrix(TMat4* pMatrix);
void TRenderer::SetShadeMode( EShadeModes shadeMode);
void TRenderer::SetTexture(TTextureRef pTexture=TTextureRef());
void TRenderer::SetTextureMapMode( ETextureMapMode umap, ETextureMapMode vmap );
void TRenderer::SetView( const TVec3 & eye, const TVec3 & at, const TVec3 & up );
void TRenderer::SetViewMatrix(TMat4* pMatrix);
void TRenderer::SetWorldMatrix(TMat4* pMatrix);
void TRenderer::SetZBufferTest( bool testZbuffer );
void TRenderer::SetZBufferWrite( bool writeToZbuffer );

```

- `TWindowManager::SetCapture()` and `TWindowManager::ReleaseCapture()` have been renamed to `TWindowManager::AddMouseListener()` and `TWindowManager::RemoveMouseListener()`, respectively. These names are more indicative of their actual behavior, since you're not *capturing* the mouse—you're just becoming one of many listeners.
- `PopModal` has a new behavior: You need to give it the ID or name of the window you're popping. If you were previously using it to return a value, instead call `ModalReturn(value)` and then `PopModal(id)` or `PopModal(name)`. `PopModal` is also more aggressive, in that it *will* pop the window you name, along with any modal windows that have been pushed on top of it.
- Construction of `TPfHiscors` has changed (again); game name and version are now extracted from `TPlatform::GetConfig()`. If you need to change the game name, you should edit the resource file (.rc) *with a text editor* to change the `ProductName`. If you edit the .rc file with the Developer Studio resource editor, it will break the version string macro, which must stay in place.
- `Button{}` has changed: The default Lua `Button{}` function only creates a very basic `TButton`. The skeleton includes a replacement `Button{}` that behaves similarly to how the 3.X `Button{}` worked; include that definition in your `style.lua` in order to keep the same behavior. If your buttons are showing up with missing text, this is what you need to add.
- The `TSlider` class has become a part of the library. If you are using `TSlider` in your game from 3.3.X, then if it's heavily modified, you should rename the files and class to not conflict with the library version. If it's not modified and you want the new functionality, then you can use the new `TSlider` in your game. The new `TSlider` needs different graphics: The two end caps and a scalable mid-section. To upgrade, delete `slider.cpp` and `slider.h` from your project, modify the slider assets so that you have top, middle, and bottom images, and then change the slider Lua instantiations to match the ones given in the `anitest` sample application. Be sure to get the style from `playgroundskeleton/assets/scripts/styles.lua` and select that style before you create new sliders (see `playgroundskeleton/assets/scripts/options.lua` for an example).

- `TPlatform::HideCursor()` was renamed to `TPlatform::ShowCursor()`, and its parameter meaning was flipped.
- `TTexture::DrawFast()` has been renamed to `TTexture::CopyPixels()`, and is now explicitly forbidden during a `Draw()`. This prevents problems on some video cards related to interleaving 2d copy methods with 3d render calls (like `TTexture::DrawSprite()`).
- `TLuaTable::PushValue()` now pushes **nothing** and returns false instead of pushing nil if the key isn't found, so be sure to update any uses of `TLuaTable::PushValue` in game code.
- `TLight` has been broken out into its own new header. Any files that use it must include the new header:

```
#include <pf/light.h>
```

C++

- `TRenderer::FillRect` now takes a `TURect` parameter rather than four separate parameters. Additionally, when using `TRenderer::FillRect` to draw to the screen, the current viewport offset is taken into account—so coordinates will be relative to the upper-left of the current window.
- When a `TWindow` is marked as `TWindow::kOpaque` and it fills the entire screen, no modal windows behind its parent modal window will render. A `TImage` with 100% opacity will assume it's opaque. If you have any full screen `TImages` that have translucent or transparent on a modal window that is supposed to layer on top of another modal window, you may need to explicitly mark the `TImage` as non-opaque. You can do this from Lua by specifying `alpha=true` explicitly.
- Many integer types throughout Playground have been changed to unsigned in cases where negative values would have been illegal. Client code may need to be updated to reflect the new integer types (to eliminate new warnings).

New Functionality in Playground 4.0.0 Alpha 3

- `TMat3` now has a 2x2 matrix multiply operator (`%`, or `Multiply2x2`) that ignores the translation component.
- `TAnimatedSprite` now has a `Stop()` function that will stop the animation but not kill its script. This way you can add functions or set persistent data within the script and it won't be killed every time you play it.
- An embedded cursor image will be used as the default cursor on Windows to avoid bugs with the hardware cursor.
- Debug logs will not be limited by size in debug builds.

New Functionality in Playground 4.0.0 Alpha 2

- `TFile` has two new append modes: `kAppendBinary` and `kAppendText`.
- Round out `TAnimatedSprite` and `TAnimatedTexture`.
- Fixed build and packaging script to properly include docs and two more utilities.

New Functionality in Playground 4.0.0 Alpha 1

- The `TRandom` class allows you to get high quality and very fast random number streams with configurable state and seed. You can instantiate a `TRandom` class for each independent random number stream you need. The generator has a period of $2^{19937}-1$, and distributes its pseudo-random numbers evenly across 623 dimensions. And it's faster than `rand()`, if you're worried about speed.
- Completely hidden `TModalWindows` are no longer drawn. "Completely hidden" is defined as being behind a `TModalWindow` that has a child that covers the screen and has the `kOpaque` flag set. The flag is set automatically by the `TImage` class.

- The [TSlider](#) class gives you scalable slider (like a volume slider or scroll bar) functionality—it's an improved version of the slider in the sample game. Specifically, you give it a height or width, and it scales to the given size. A height means it's drawn vertically, and a width indicates it's to be drawn horizontally. It's drawn using top, stretchable middle, and bottom images.
- [TTexture::CreateSimple\(\)](#) can create a "slow" (system RAM) texture with an optional third parameter now. This allows you to create large or oddly shaped textures which you can use as a source for [TTexture::CopyPixels\(\)](#).
- A new [pftypes.h](#) that includes C99-style types for use in library functions as well as Playground-specific types.
- [TWindow::FitToChildren](#) will grow a window's boundaries to encompass its children.
- [TWindow::PostDraw](#) can be used to draw on top of a window's children.
- A new [TRenderer](#) class that encapsulates all rendering-related functions (except those on [TTexture](#)).

Major Changes to Playground 4.0.0

- Much cleaner [TWindow](#) initialization.
- The magic behind `Button{}` is exposed in client Lua code now, making it easier to create Buttons with custom behaviors.
- Screen saver functionality has been removed from Playground.
- Support for paletted textures has been removed from Playground due to compatibility issues.
- The call [TTexture::DrawFast\(\)](#) has been changed to [TTexture::CopyPixels\(\)](#), which more clearly describes its semantics.
- Window-style specific functions have been removed from [TScript](#): All of the `Get*()` (though not `GetGlobal*`) functions that extracted information from a window table or style have all been moved to [TWindowStyle](#).
- Dirty rectangle support has been removed.

Minor Changes to Playground 4.0.0

- [TLuaTable::PushValue\(\)](#) now pushes **nothing** and returns false instead of pushing nil if the key isn't found.

New Features in 3.5.0.6

- [TSound::GetSoundLength\(\)](#)

Fixes in 3.5.0.6

- Fix a [TTexture::DrawSprite](#) clipping problem.
- Fix [TAnimTask](#) to correctly only call its animation once per frame.

New Features in 3.5.0.5

- Set the cursor position with [TPlatform::SetCursorPos](#). This enables relative mouse addressing.

Fixes in 3.5.0.5

- Change [TImage](#) to always use [TTexture::Draw](#), which fixes flickering on some really annoying video cards with terrible drivers.

New Features in 3.5.0.4

- New [TFile](#) open modes:
 - `kAppendText`
 - `kAppendBinary`

Fixes in 3.5.0.4

- Patch to fix problem with flat file system in Windows 98.

Fixes in 3.5.0.3

- Updated anitest sample to have the newer animated sprite and animated texture code.
- Fixed a bug in text scaling so that it now scales more smoothly.

New features in 3.5.0.2

- [str::downcase\(\)](#)
- [str::find_first_of\(\)](#)
- [str::find_first_not_of\(\)](#)

Fixes in 3.5.0.2

- Fixed release build for anitest sample.
- Handle encryption keys of any length.
- Fix a bug where [PopModal\(\)](#) during draw could cause a crash.
- Add a missing [TVec2](#) operator implementations.
- Removed empty `TVec*` destructors.
- Fixed [TSoundManager::KillAllSounds\(\)](#) crash bug.
- Fixed anitest sample code to properly position animated image that changes size.
- Fixed [TFile](#) bug where attempting to open a file that didn't exist would add an entry to the cache with that file name, improperly indicating when asked again that it did exist.
- Fixed bug in [TTexture::GetInternalSize\(\)](#) where it would sometimes return the wrong size.

Migration to Playground 3.5.0 from Playground 3.3.X

- Be SURE to delete your old Playground distribution before you install the new one! Files have been deleted that, if you don't remove them, can hinder your efforts at becoming compliant.
- Remove the `STLport` includes from debug and release builds of your application.
- Release builds of your game now need to link to `iphlpapi.lib`.
- `ENCRYPTION_KEY` definition needs to be moved to file `key.h` in your `src` folder. This is to allow automated creation of the new cheat-enabler application. See the sample application for an example of the new `key.h` file. Typically this file is included in your `settings.cpp` file.

- Construction of [TPrefs](#) and [TPfHiscres](#) has changed, with the encryption key now in a [TPlatform](#) configuration setting. If you are using settings.cpp from the sample, there should now be a line that reads:

```
TPlatform::GetInstance()->SetConfig(TPlatform::kEncryptionKey, ENCRYPTION_KEY);
```

C++

And this line should appear before [TPrefs](#) or [TPfHiscres](#) is created. The ENCRYPTION_KEY parameter has been removed from each of those constructors.

- In Release builds, your game needs to get its cheat mode setting from `TPlatform::IsEnabled(TPlatform::kCheatMode)`. You will be supplied with an application (cheat.exe) that has your game's encryption key burned into it for enabling cheat mode. This call will only succeed after the application encryption key is set, as per above instructions.
- Any code that uses `TranslateResource` to test for a file's existence must be changed to use the new [TFile::Exists\(\)](#) API.
- Any code that uses `GetDataDirectory()` can be trivially changed by removing all path mangling and instead use the "user:file.ext" or "common:file.exe" URI format in any file name given to [TFile::Open\(\)](#) or any library resource request.
- Paths in your game need to be modified to assume that they are accessing a file relative to the assets folder. Including "assets" in the path is no longer allowed.
- There is a new required parameter in `TPfHiscres::LogScores()` - `replaceExisting`. This parameter tells the hiscore system whether or not to replace the existing hiscore (for use in story/career mode games) or create a new one (for use in arcade mode games). If you are in doubt about what to use for this parameter, please contact your PlayFirst producer.
- If you're not already using Visual Studio 2005, then there are changes you need to make:
 - In Release Build, on the Linker properties page, select Optimization, "Don't Remove Redundant COMDATs". That optimization, as implemented in VS2005, is not compatible with Playground.
 - In all builds turn on C++ Exception Handling in C++ code generation.
 - The statically linked Playground release build needs to be linked against DirectX 7 libraries. If you don't have the DirectX 7 libraries (e.g., from MSDN subscription CDs), then you'll need to switch your project over to use the Release DLL build: 1 Remove `PFLIB_STATIC_LINK` from your Preprocessor Definitions. 1 Change the Linker Input from `pflibStatic.lib` to `pflib.lib`. 1 Copy the `pflib.dll` from `pflib/lib` into the folder of your executable.
- If you're using the old Playground Skeleton sample as your base, the credits.cpp file used `fopen()` style file access. Please update your credits.cpp to the new version.
- Be sure to read the new Coding Standards on the site at <https://developer.playfirst.com/standards> and update your code to the new standards. Important things to note:
 - Your code must build with warning level 4 with no warnings in release build.
 - You must remove FILE- and fopen-based code from release builds.

New Functionality in Playground 3.5.0

- Transition to Visual Studio 2005: support for Visual Studio 2003 has been dropped. You'll need to upgrade to 2005 to get official support on Playground.
- New [TFile](#) file abstraction. *All direct file access in 3.5 must be done using this file abstraction.* See the [TFile](#) documentation for details. Internally all file accesses are handled using this new abstraction. A set of functions is available as a drop-in replacement for `fopen/fclose` style usage, as well as a C++ style interface.
- Transparent support for collapsing the assets tree into a single flat file; the flat files are created as part of the build process. XML and Lua source files are also compressed/obfuscated in packaged builds.

- Added `TPlatform::SetTextureMapMode` to allow the client to switch between WRAP, CLAMP, and MIRROR texture mapping modes.
- New parameter (`replaceExisting`) added to `TPfHiscores::LogScore()`
- Lots of new documentation

Major Changes to Playground 3.5.0

- Removed STLport support and libraries. Moving forward we are only going to support the containers supplied in both the VS2005 STL and the GCC STL.
- Removed all APIs dealing with paths: `TranslateResource()`, `GetDataDirectory()`, `TDirectorySearch`, and everything in `fileio.h`.

Fixes and Minor Changes in Playground 3.5.0

- Added a copy constructor to `TVertexSet` to work around a bug in the C++ spec.
- Changed undocumented `str::insert` to the more understandable `str::overlay`, since the function allows you to overlay or extend a string with an existing `const char *`. Also added documentation.

What happened to 3.4?

Playground version 3.4 was a feature-freeze of the main development trunk for use in Diner Dash Flo on the Go. The Macintosh port was also finalized on 3.4 internally, and several Mac titles shipped on 3.4. However, it never became fully productized—this documentation, for instance, languished—so 3.3 continued as the public release, sometimes getting features and patches that didn't make it to 3.4.

Now that we have GM products on 3.4, we don't want to change it—it's completely frozen except for bug fixes. But we wanted to get the new file abstraction and other new features out to our users soon, so we just bumped the library version to 3.5, rolled in the 3.4 updates, and added the new features listed above.

New Functionality in Playground 3.4.0

- Constants for Page-Up and Page-Down keys added to `event.h`
- `TPFHiScores::SetRememberedUserInfo` to save persistent user data.
- `TPrefs::SetUserStr` and `TPrefs::GetUserStr` to get encapsulated user data.
- `TTextGraphic::SetBoldOverride`, to set up a font that can be used as the font for bold text.

Fixes and Minor Changes in Playground 3.4.0

- `TWindowNotify` gets a proper virtual destructor

New Functionality in Playground 3.3.0.4

- Add an ActiveX test command line parameter: `-axtest` brings up your game small for testing.
- Added `fixbyteorder.h` to include folder to allow client code to support cross-platform save and networking.
- Add new samples folder with `anitest` and `TSprite/TAnimatedSprite/TAnimatedTexture/TDrawSpec` source.
- Updated documentation.
- Added 3x3 matrix to `mat.h`.

- Added sidewalk.exe animation creation tool.
- Added dirSync.exe, SDK synchronization tool.
- Changed [TVec3](#)(TVec2(),z) constructor to have a default z parameter.

Fixes for Playground 3.3.0.4

- Fixed an ActiveX scaling bug when rendering transformed lit vertices.
- Fixed some MSN ActiveX integration problems.

New Functionality in Playground 3.3.0.3

- Alt-F1 brings up Playground version # and frames-per-second

New Functionality in Playground 3.3.0.2

- Debug output that identifies the video card for improved customer issue tracking.

Fixes and Minor Changes in Playground 3.3.0.2

- Fixed problem where forcing alpha wasn't working if you loaded a PNG with no alpha.
- Made message passing to Lua GUI thread more aggressive, which improves GUI performance in some circumstances.
- Fix problem that allowed a button sound to trigger after the button had been disabled.
- DrawVertices lighting fix.
- Fixes to ActiveX to support DrawVertices calls.
- Eliminate spurious warnings for a call to FillRect with an empty rect.
- Fix software mouse rendering in cases where screen is not entirely updated and normal Playground render path isn't used.

New Functionality in Playground 3.3.0

- New file: [mat.h](#) - defines [TMat4](#) class (replaces old matrix.h file and matrixstack.h file)
- New file: [vec.h](#) - defines [TVec2](#), [TVec3](#), [TVec4](#)

Fixes and Minor Changes in Playground 3.3.0

- Text calibration fix where text got cut off by 1 pixel
- Fixed bug where child windows bigger than their parents caused a drawing issue
- Fixed bug where SetWindowSize() would not always properly clip the window.

B.1.2 Changes to Playground 3.2.1 from Playground 3.2.0

1. [New Functionality in Playground 3.2.1](#)
2. [Fixes and Minor Changes in Playground 3.2.1](#)

New Functionality in Playground 3.2.1

- Added xsellkit addon for creating Cross Sell screens in games.

Fixes and Minor Changes in Playground 3.2.1

- Prevent some non-critical warning messages from flooding the log file in certain circumstances.
- [TSimpleHttp](#) threading fixes.
- [TWindow](#) close button bug fixed.
- Bug in Lua [Pause\(\)](#) fixed.
- ActiveX fixes for [FillRect](#) and [TTexture::Draw](#).
- Allow ActiveX games to run in software rendering mode when there is no fallback option.
- ActiveX fix where right mouse button could crash Internet Explorer.
-

B.1.3 Changes to Playground 3.2.0 from Playground 3.1.5

1. [New Functionality in Playground 3.2](#)
2. [Fixes and Minor Changes in Playground 3.2](#)

New Functionality in Playground 3.2

- Behavior of [TWindowManager::SetCapture](#) changed to search current list of capture windows for [Set...\(\)](#) and [Release...\(\)](#) so that you can't have windows fighting for capture and ending up on the stack A-B-A-B-etc. It then broadcasts all mouse events to all windows in the capture chain, i.e., make [SetCapture\(\)](#) a request to be a mouse-message-listener.
- [kBlendLit](#) is now marked as deprecated, and is a synonym for [kBlendNormal](#). This is to ensure that alpha blending works on all graphics cards. This means that vertex colors must be specified for all vertices drawn with [DrawVertices\(\)](#).
- Removed - unused [TTexture::DrawSprite](#) flags [eBottomHalf](#) and [eTopHalf](#).
- Multiple app instances are allowed if "-multiple" is passed on the command line.

Fixes and Minor Changes in Playground 3.2

- typo fixed [TSimpleXml::GetNextAttriubte](#) renamed to [TSimpleXml::GetNextAttribute](#)
- Fixed potential crash when modal window stack is empty
- Fixed italic/underline text combination bug
- Fixed really long text underlining bug.
- Fix for "face" font tag.
- Fixed [FlushMessages\(\)](#) Lua command
- Fixed crash in script, if the script fails to run.
- [FillRect](#) clipping fixed.

- Fixed assert in `TTexture::DrawFast` that was firing incorrectly.
- Fixed crash that occurs when font is missing.
- Fix for DirectX filtering initialization in `Begin2D()`
- Fix to `TText::SetScroll` to work better with last line of text.
- Fix for characters in `TTextEdit` fields that are not low ASCII.
- Fix for handling a NULL script file without crashing
- Fix fallback method in `TTexture::DrawFast()`
- Fix cropping of rectangle in `TTexture::DrawFast()`
- Fix `TImage` to correctly choose `DrawFast()` when it's possible to use in lieu of `DrawSprite()`.
- Fix out-of-memory 16-bit fall back condition
- Bring up message box to let users know when shifting to 16 bit mode.
- Record when app has shifted to 16 bit mode, so app does not try to shift each time the app runs.
- Fix for inappropriately picking 8/3/3/2 A/R/G/B modes
- Better documentation for `TStringTable`
- Fix for rarely used code path in `TTexture::Draw()`
- Fix case where mouse would not update on second monitor.
- Fix case where mouse cache was failing.

B.1.4 Changes to Playground 3.1.5 from Playground 3.1.4

- Bug fixes for `DisplaySplash`.

B.1.5 Changes to Playground 3.1.4 from Playground 3.1.3

- Added `TTextGraphic::SetNoBlend` to resolve rendering text to texture bugs.

B.1.6 Changes to Playground 3.1.3 from Playground 3.1.2

- Clipping of bad viewports to prevent DirectX errors
- Fix sound looping bug when looping sounds that are in memory

B.1.7 Changes to Playground 3.1.2 from Playground 3.1.1

- More aggressive message dispatch strategy to speed up Lua responses to events.

B.1.8 Changes to Playground 3.1.1 from Playground 3.1.0

- Disable log file for ActiveX mode
- MSNZone fixes, documentation
- Fix sub-pixel rendering when calling DrawSprite()
- ActiveX window size fix for running on machines with 800x600 resolution
- Allow negative viewports
- ActiveX text scaling fix
- Fix Unlock() bug for 16 bit textures that did not have alpha
- Fix Unlock() crash for 16 bit textures with 1x1 dimensions

B.1.9 Changes to Playground 3.1 from Playground 3.0.x

1. [Changes in Playground 3.1](#)
2. [Compatibility fixes in Playground 3.1](#)

Changes in Playground 3.1

- Major text rendering optimizations made
- Added TPlatform::SetFilteringMode() for texture filtering.
- Added TPlatform::HideCursor()
- Added TSound::SetPostion()
- [TTextGraphic::Draw](#) can now take in an optional parameter to specify a target texture to render the text into.
- Added optional parameter to [TTexture::DrawSprite](#) for a source rect.
- Added [TTexture::HasAlpha](#)
- File loading optimizations made.
- Fix memory leak involving lua tables
- Fix text layout problem when text uses outlines
- [TXmlNode](#) destructor made virtual
- Various mouse cursor bugs fixed, including dual monitor support and invalid mouse cache issues.
- Fix issue where default buttons were still considered defaults even if they were not enabled
- Fix crash that would occur if two button messages were triggered before window stack was updated.
- on parameter added to button creation via Lua
- Fixes made to mouse tracking/hovering
- Added Text::GetMaxScroll
- Added [TTextGraphic::GetStartLine](#)
- Added support for tabs in [TTextGraphic](#) tagging

- Fixes to `TTextGraphic::GetMaxScroll`
- Made `\` an escape character for `TTextGraphics`.
- Fix to text picking where it was ignoring the line padding parameter.
- Fix viewport clipping issue in ActiveX mode.
- [TPrefs](#) and [TPfHiscores](#) now have an optional parameter to disable file saving.
- Fixed issue where windows would flicker when a window went outside the 800x600 screen.
- MSNZone support added.
- Added axtool utility for support in developing web games.
- Added [TImage::GetScale\(\)](#)
- Fix for crash when `SetCursor` is called during application shutdown.
- Fix for [TTextGraphic::GetTextBounds \(\)](#) in case where the string is empty
- Fix crash for `TPlatform::OpenFile` when file name is empty.

Compatibility fixes in Playground 3.1

- Fix various software cursor compatibility issues, including disabling software cursor support on machines that do not report allowing color key capabilities.
- Fix for full screen conflict where Playground would try to keep app on top of a window that wasn't visible, causing unpredictable performance.
- Fix for full screen performance issue where Playground was running slower than it should have been.
- Fix to screen saver installation on Windows 98.
- Playground now requires that a hardware renderer be found in order to run.

B.1.10 Changes to Playground 3.0 from Playground 2.3.x

1. [Changes in Playground 3.0](#)
2. [Compatibility fixes in Playground 3.0](#)

Changes in Playground 3.0

- Text drawing fixes for ActiveX mode, text rotation, and some text optimization.
- New `Window{}` functionality for specifying non-functional windows in LUA
- Added mask parameter to `Bitmaps` in lua for specifying alpha masks.
- Fix problem with looping sounds that are shorter than 1 second long.
- Fix scaling the center location in `DrawSprite`.

Compatibility fixes in Playground 3.0

- Require that video cards allow 1024x1024 textures
- Display restore fixes for low end cards
- Sound callback crash fixes

Appendix C

Annotated Class Listing

C.1 Playground Game SDK Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

ParticleMember (A particle member value)	215
str (Reference-counted string class)	87
T2dParticle (Basic Particle Values)	96
T2dParticleRenderer (A particle renderer that expects 2d particles)	97
TAnimatedSprite (A TSprite with an attached TScript)	100
TAnimatedTexture (This class encapsulates the concept of an animated texture)	106
TAnimTask (The TAnimTask interface)	114
TAsset (The interface class for game assets)	117
TAssetMap (A collection of assets that simplifies asset reference-holding)	118
TBegin2d (Helper class to wrap 2d rendering)	121
TBegin3d (Helper class to wrap 3d rendering)	122
TButton (Encapsulation for button functionality)	123
TButton::Action (An abstract action class for button actions)	130
TButton::LuaAction (A class that wraps a Lua command in an action)	131
TClock (Encapsulates timer functionality)	133
TColor (An RGBA color value)	135
TColor32 (A 32-bit platform native color value)	137
TDialog (A generic modal dialog)	139
TDrawSpec (2d drawing parameters for use in DrawSprite)	141
TEncrypt (A class that encapsulates an encryption engine)	144
TEvent (System event encapsulation)	147
TFile (A file reading abstraction)	149
TFlashHost (An embedded flash-playback routine)	155
TImage (TWindow that contains and draws a TTexture)	157
TLayeredWindow (A TLayeredWindow is a TWindow with multiple layers which can be switched between)	160
TLight (A 3d light)	162
TLitVert (3d untransformed, lit vertex)	164
TLuaFunction (A wrapper for a Lua function)	165
TLuaObjectWrapper (Wrap a Lua object for use within C++ code)	166
TLuaParticleSystem (A particle system driven by Lua scripts)	169
TLuaTable (A wrapper for Lua table access in C++)	174
TMat3 (2d Matrix with 2x2 rotation component and TVec2 offset component)	179
TMat4 (3d Matrix with 3x3 rotation component and TVec3 offset component)	187
TMaterial (A rendering material)	195

TMessage (Application message base class)	196
TMessageListener (A message listener—a class that you override and register with the TWindowManager if you want to listen for broadcast messages)	199
TModalWindow (Base class for any window that can be a modal window)	200
TModel (A 3d model)	204
TParamSet (A set of parameters or return values, depending on context)	207
TParticleFunction (A user data source)	210
TParticleMachineState (The internal state of a TLuaParticleSystem)	212
TParticleRenderer (The abstract particle renderer class: This class is used by TLuaParticleSystem to wrap an actual particle renderer)	216
TParticleState (A particle state)	218
TPfHiScores (TPfHiScores - class that manages local and global hiscore saving and viewing)	221
TPlatform (The platform-specific functionality encapsulation class)	228
TPoint (2d integer point representation)	240
TPrefs (Designed to help with the saving of preferences for a game)	241
TRandom (A deterministic random number generator)	245
TRect (A rectangle)	247
TRenderer (The interface to the rendering subsystem)	252
TScreen (The base level modal window)	267
TScript (An encapsulation for a Lua script context)	269
TScriptCode (An encapsulation of a compiled Lua source file)	277
TSimpleHttp (Implements a basic HTTP connection)	279
TSlider (Slider class)	282
TSound (Object that can play a sound asset)	286
TSoundCallback (TSoundCallback –a class that you override and attach to a TSound if you want to know when the sound has finished playing)	289
TSoundInstance (An instance of a sound)	290
TSoundManager (Controls access to the sound subsystem)	293
TSprite (A 2d sprite object)	295
TStringTable (The interface class for a string table)	301
TTask (The task interface)	303
TTaskList (A list of TTask-derived objects)	305
TText (A text window)	307
TTextEdit (Editable text TWindow)	314
TTextGraphic (Formatted text class)	319
TTexture (This class encapsulates the concept of a texture)	325
TTransformedLitVert (Transformed and lit vertex)	333
TURect (A TRect that’s forced to be unsigned at all times)	334
TVec2 (A 2d vector class)	336
TVec3 (A 3d vector class)	342
TVec4 (A 4d vector class)	349
TVert (3d untransformed, unlit vertex)	355
TVertexSet (A helper/wrapper for the Vertex Types which allows TPlatform::DrawVertices to identify the vertex type being passed in without making the vertex types polymorphic)	356
TWindow (Base class of any object that needs to draw to the screen)	358
TWindowHoverHandler (A callback that receives notification that a window has had the mouse hover over it)	377
TWindowManager (Manages, controls, and delegates messages to the window system)	378
TWindowSpider (A class used with TWindow::ForEachChild to iterate over the children of a window with a single "callback" function)	386
TWindowStyle (An encapsulation of a Lua window style)	387
TXmlNode (Limited XML parser)	390

About the Author

Tim Mensch has honed his library-design skills over more than 20 years in the games industry, working with companies such as Lucasfilm Games, Disney Interactive, Sega, Maxis, Velocity, Hasbro Interactive, Digital Eclipse, 3d6 Games, and Activision, and also running his own development house. Now he is the lead architect of the Playground SDK™. Tim has a degree in cognitive science from the University of California at San Diego, and now lives in Boulder, Colorado, with his wife and their daughter. In his free time he enjoys his family, seeks technological solutions to the world's problems, works on his digital photography skills, and plays badminton and ultimate frisbee.