PowerPlant X 1.0 Migration Guide

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metrowerks
Software Starts Here

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1

Introduction

PowerPlant™ X is the latest edition of PowerPlant, Metrowerks' application framework for developing software for Apple® Macintosh® computers. As its name suggests, PowerPlant X helps you create applications for the Mac OS X operating system.

PowerPlant X lets you take advantage of Mac OS X capabilities that Original PowerPlant does not. However, moving to PowerPlant X is not without cost. For example, the PowerPlant X version of your program will not run on any Mac OS version prior to Mac OS X 10.2. Further, migration to PowerPlant X entails significant changes to your current application.

The *PowerPlant X 1.0 Migration Guide* helps you decide whether to migrate your program to PowerPlant X. In addition, the manual explains how to perform the most common migration tasks.

This chapter contains these topics:

- Before You Begin
- How to Use this Manual
- Related Documentation

Before You Begin

Before you migrate to PowerPlant X, you must first decide whether you *can* migrate to PowerPlant X. If you can migrate your program, you must next decide whether you should.

Can You Migrate to PowerPlant™ X?

If your application must run on a version of Mac OS prior to Mac OS X 10.2, you *cannot* use PowerPlant X. This restriction stems from the fact that PowerPlant X uses features introduced in version 10.2 of Mac OS X, most notably, HIViews.

Should You Migrate to PowerPlant™ X?

You may not have to change your Original PowerPlant program at all for it to run on Mac OS X, 10.2. If your program is carbonized, it will run natively on Mac OS X without modification.

That said, if you can migrate to PowerPlant X, you probably should because the new framework lets your program take advantage of many powerful features introduced by Mac OS X, 10.2. Here are just two examples:

- Carbon Event support

  PowerPlant X includes a class for *every* Carbon Event along with a mechanism that lets you attach a custom handler for any or all of these events to any pane and view in your program.

  Original PowerPlant let you customize behavior using attachments. However, because attachments let you augment or replace default behavior in just a few places (for example, just before default click behavior), they are much less powerful than PowerPlant X's Carbon Event classes.

  See the *PowerPlant™ X 1.0 Developer's Guide* for instructions that explain how to use PowerPlant X's Carbon Event support.

- Preemptive threads

  Original PowerPlant programs are executed by cooperative threads. In this system, a thread repeatedly polls the OS for events and "cooperates" by yielding the processor when the thread has no work to do. This approach wastes processor cycles and interferes with the execution of other programs, thereby degrading the performance of the overall system.

  PowerPlant X programs are executed by preemptive threads. Mac OS X suspends execution of an application's preemptive thread until an event occurs to which the application must respond. When such an event occurs, Mac OS X lets the program's thread process the event and then preempts the thread again. This approach uses system resources more economically.

Fortunately, migration to PowerPlant X is not an all or nothing proposition. You can migrate an Original PowerPlant program in phases, taking advantage of the most beneficial PowerPlant X features first and adding other features as time permits.

How to Use this Manual

The first step in migrating your Original PowerPlant program to PowerPlant X is to compile a list of migration tasks you want to perform.

To build this list, read “Identifying Migration Tasks”. This chapter contains a series of “migration questions.” Each question helps you decide whether to perform a particular migration task and points to the chapter that explains how to accomplish this task. For each question to which you answer yes, add its migration task to your task list.

Once you have completed your task list, you have defined what you must do. The next step is to read the chapter associated with each task in your list and perform the code changes described in each chapter.

Related Documentation

While this manual provides most of the information you need to migrate your Original PowerPlant programs to the PowerPlant X framework, it does not contain all the answers. In particular, you may find the Metrowerks manuals listed below helpful.

NOTE Each of these documents is in this folder:

`InstallDir/CodeWarrior Manuals/PDF`

where `InstallDir` is a placeholder for the folder in which you installed the CodeWarrior IDE.

- *PowerPlant™ X 1.0 Developer’s Guide*

  This manual explains how to create a Mac OS X 10.2 application using the PowerPlant X framework.

- *PowerPlant™ X 1.0 API Reference*

  This manual documents the methods and data members of each class in the PowerPlant X framework.

- *The PowerPlant™ Book*

  This manual explains how to create an Classic Mac OS program using the Original PowerPlant framework.

- *PowerPlant™ Advanced Topics*

  This manual explains how to use advanced features of the Original PowerPlant framework, such as networking, drag and drop, and profiling.

- *PowerPlant™ Framework API Reference*

  This manual documents the methods and data members of each class in the Original PowerPlant framework.

- *PowerPlant™ Carbon Porting Guide*

  This manual explains how to carbonize an Original PowerPlant program.

- *IDE 5.5 User's Guide*

  This manual explains how to use the CodeWarrior IDE.

2

Identifying Migration Tasks

This chapter contains a set of migration task identification questions. Answer these questions to identify the programming tasks you will perform to migrate your Original PowerPlant program to PowerPlant X.

This chapter contains these sections:

- Required Task Identification Questions
- Optional Task Identification Questions

Required Task Identification Questions

For each of these questions to which you answer yes, you must perform the related migration task. Until you do, you cannot build and run the PowerPlant X version of your program.

1. Does your Original PowerPlant program use any Classic Mac OS API functions?

   If yes, you must convert each Classic function call to its equivalent Carbon call.

   Until you carbonize your program, you cannot use PowerPlant X. Refer to "Migrating from the Classic API to the Carbon API" for instructions.

2. Does your Original PowerPlant program use the Code Fragment Manager API?

   If yes, you must re-code your program to use the Mach-O executable format.

   Until convert to Mach-O, you cannot use PowerPlant X. Refer to "Migrating from PEF to the Mach-O Executable Format" for instructions.

3. Does your Original PowerPlant program use character data encoded in ASCII?

   If yes, you must re-code your program to use the PowerPlant X Unicode string class.

   This modification is required because PowerPlant X does not support ASCII characters. Refer to "Migrating to Unicode" for instructions.

4. Do you want to migrate your custom `LPane` subclasses to PowerPlant X but continue to draw them using QuickDraw?

   If yes, you must add coordinate conversion code before each QuickDraw call.

   If you migrate a custom pane and want to continue to use QuickDraw, you must make these modifications. Refer to “Using the QuickDraw API with PowerPlant™ X” for instructions.

Optional Task Identification Questions

For each of these questions to which you answer yes, you have the option to perform the related migration task. If you perform an optional task, your program will run better on Mac OS X 10.2 than if you do not complete the task.

1. Does your program include custom `LPane` subclasses that you want to migrate to PowerPlant X?

   If yes, you must reimplement these classes such that their custom behavior is provided by means of mixin and attachable Carbon Event handlers.

   This task is optional. If you choose to migrate a custom pane, refer to “Migrating Custom LPanes” for instructions.

2. Do you want to convert some or all of your program’s `LWindow` objects to a PowerPlant X windows?

   If yes, for each window you choose to convert, you must also convert each pane within this window. Further, you must convert the window’s layout information from PPob (PowerPlant object) to XML format.

   This task is optional. If you choose to migrate a window, refer to “Migrating a User Interface to PowerPlant™ X” for instructions.

3. Does your Original PowerPlant program contain code that assumes an `LWindow` is a type of `LView`?

   If yes, and you have changed this window to a PowerPlant X window, you must remove this assumption from your code.

   This task is optional. You must make this change only for windows that you migrate to PowerPlant X and for which your code assumes the window is a type of view. Refer to “Using PowerPlant™ X Windows” for instructions.

4. Do you have a program that directly reads/writes a PPob file?

   If yes, and you have converted the PPob file to XML, you must modify the program to manipulate PowerPlant X XML files.

   This task is optional. You must perform this task only if you have a program that operates directly on a PPob file and have converted the PPob to XML. Refer to “Migrating Programs that Manipulate PPob Files” for instructions.

5. Does your program use Original PowerPlant’s grayscale appearance (GA) controls?

   If yes, and you have changed the containing window to PowerPlant X and/or you want the GA controls to look Aqua, you must change your code as described in “Migrating Grayscale Appearance Controls”.

   This task is optional. The GA controls work without change as long as they are in an Original PowerPlant window.

6. Does your Original PowerPlant program rely on the event loop architecture?

   If yes, and you want to take advantage of Mac OS X’s preemptive scheduler, you must recode your program such that it waits for system-dispatched Carbon Events instead of polling for and dispatching events itself.

   This task is optional. You must make this change only if your program’s performance on Mac OS X is unacceptable. Refer to “Migrating from Polling to Carbon Event Dispatch” for instructions.

7. Does your Original PowerPlant program use `LPeriodical` subclasses?

   If yes, and you have removed your program’s event loop, you must recode your program such that its periodic behavior is implemented by PowerPlant X Timers and IdleTimers.

   This task is optional. You must make these changes only if you have removed your program’s `WaitNextEvent` loop. Refer to “Migrating from Periodicals to Timers and IdleTimers” for instructions.

8. Does your Original PowerPlant program use `LCommander` subclasses?

   If yes, and you want to take advantage of the PowerPlant X's more powerful and efficient command dispatch mechanism, you must replace your `LCommander` subclasses with equivalent Carbon Event handlers.

   This task is optional. You must make these changes only if you have removed your program's `WaitNextEvent` loop. Refer to "Migrating from LCommanders to Carbon Event Handlers" for instructions.

9. Does your Original PowerPlant program use the broadcast/listen mechanism?

   If yes, and you want to take advantage of the PowerPlant X's more powerful and efficient inter-object messaging mechanism, you must replace your broadcast/listen code with equivalent Carbon Event handlers.

   This task is optional. You must make these changes only if you have removed your program's WaitNextEvent loop. Refer to "Migrating from Broadcast/Listen to Carbon Events" for instructions.

10. Does your program use the Original PowerPlant threading classes?

    If yes, and you want to take advantage of Mac OS X's preemptive scheduler, you must recode your program to use the threading classes in the MSL C++ library.

    This task is optional. You must make these changes only if you want to take advantage of the preemptive scheduler. Refer to "Migrating from Cooperative to Preemptive Threading" for instructions.

11. Does your Original PowerPlant program throw `LException` instances?

    If yes, and you want to take advantage of the PowerPlant X's more powerful exception classes, you must change the type of the exception object thrown to your `catch` blocks to the appropriate PowerPlant X exception class.

    This task is optional. You must make these changes only if you want to take advantage of PowerPlant X's richer exception handling capabilities. Refer to "Using PowerPlant™ X Exception Handling" for instructions.

3

Migrating from the Classic API to the Carbon API

This chapter explains why you must carbonize your Original PowerPlant program before using PowerPlant™ X. In addition, the chapter lists the benefits a carbonized program gains when run on Mac OS X.

This chapter contains these sections:

- Why Carbonize?
- Carbonizing Your Program

Why Carbonize?

While Original PowerPlant supports both Classic and Carbon APIs, PowerPlant X supports Carbon exclusively. If your Original PowerPlant program uses any Classic APIs, you must convert them to their Carbon equivalents before you can use PowerPlant X.

Further, if your program relies on an OS feature not in Carbon, such as Standard File dialogs or the Classic printing architecture, you must switch to this feature's Carbon equivalent (for example, Navigation Services and Carbon session printing).

NOTE	Despite the fact that they are Carbon applications, PowerPlant X programs will *not* run on Classic Mac OS (Mac OS 8.1/9) or on releases of Mac OS X before 10.2. This is because PowerPlant X uses features unavailable before Mac OS X 10.2.

A Carbon application running on Mac OS X gains these benefits:

- Greater stability

  Mac OS X protects each native application's address space. This helps prevent an errant application from crashing the system or other applications.

- Improved responsiveness

  Mac OS X schedules a native application's threads preemptively. Further, Mac OS X does not place a Carbon thread in the run queue unless the thread has work to do. This makes the overall system more responsive.

- Efficient use of system resources

  A native Mac OS X application can dynamically allocate memory and other shared resources. Thus, a Carbon application can allocate resources based on actual need rather than on predetermined values.

- Aqua look and feel

  A carbonized application runs natively on Mac OS X. Only native Mac OS applications have the Aqua look and feel.

Carbonizing Your Program

For instructions that explain how to carbonize an Original PowerPlant program, read the *PowerPlant™ Carbon Porting Guide*. The path to this document is:

`InstallDir/CodeWarrior Manuals/PDF/PP_Carbon_Porting_Guide.pdf`

where *`InstallDir`* is a placeholder for the folder in which you installed your CodeWarrior product.

In addition, you can find Apple Carbon porting tools and information at this URL:

http://developer.apple.com/techpubs/macosx/Carbon/CarbonPortingTools/carbonportingtools.html

4

Migrating from PEF to the Mach-O Executable Format

This chapter explains how to modify an Original PowerPlant™ CodeWarrior project such that it generates a Mach-O executable instead of a Preferred Executable Format (PEF) executable.

This chapter contains these sections:

- Mach-O Migration Issues
- Converting a PEF Project to a Mach-O Project

Mach-O Migration Issues

PowerPlant X supports just the Mach-O executable format and the dynamic link editor; the new framework does not support the Preferred Executable Format (PEF) and Code Fragment Manager (CFM). Why?

Many of the new APIs introduced by Apple in Mac OS X 10.2 do not include CFM libraries. Because PowerPlant X uses these APIs, it cannot support PEF/CFM.

Consequently, if your Original PowerPlant project generates PEF output, you must modify the files and target settings of each build target in your project such that each generates a Mach-O executable.

Further, if your program uses the CFM API to manipulate a PEF file, you must replace this code with equivalent dynamic link editor calls. For instructions that explain how to make these changes, click this link (or enter it in your browser):

http://developer.apple.com/documentation/DeveloperTools/Conceptual/MachORuntime/5rt_api_reference/index.html

Converting a PEF Project to a Mach-O Project

To convert a project that outputs PEF to one that generates Mach-O, you must change some of the project's target settings and add the correct libraries. Use the following procedure to accomplish the conversion.

Modifying a PEF Project Such That It Generates Mach-O Output

To modify a PEF project such that it generates Mach-O, follow these steps:

1. Copy the file `CommonMach-OPrefix.h`

   from `Compiler/(Project Stationery)/`
   `Mac OS PowerPlant/Mac OS X Mach-O/Basic/Source/Prefix`

   to your project's prefix folder.

2. Start the CodeWarrior IDE.

3. Open the Original PowerPlant project to be modified.

4. For each build target in the project:

   a. Remove all libraries.

   b. Remove the console stub file (if present).

   c. Open the **Target Settings** window.

   d. Display the **Target Settings** panel of the **Target Settings** window.

   e. Use the **Linker** popup menu to change the linker

      from `Macintosh PowerPC`

      to `Mac OS X PowerPC Mach-O`

   f. Click **Save**

   g. A warning dialog box appears.

   h. Click **OK**

      A tab labeled **Frameworks** appears in the project window.

   i. Display the **File Mappings** panel.

j. Click **Factory Settings**

The IDE selects file mappings appropriate for the Mach-O linker.

k. Click **Save**

l. Display the **Access Paths** settings panel.

m. Remove these system access paths:

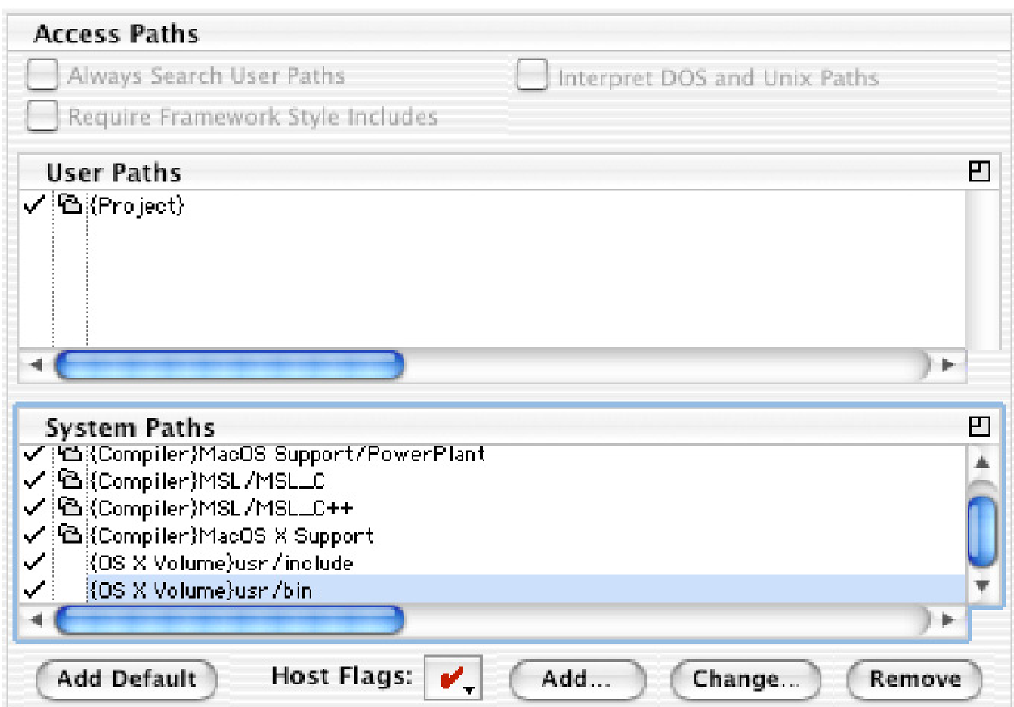
```
{Compiler}MacOS Support
{Compiler}MSL
```

n. Add these system access paths:

```
{Compiler}MSL/MSL_C
{Compiler}MSL/MSL_C++
{Compiler}MacOS X Support
{OS X Volume}usr/include  (non-recursive)
{OS X Volume}usr/bin         (non-recursive)
```

Figure 4.1 shows the **Access Paths** target settings panel with the system access paths defined as required.

Figure 4.1 System Access Paths Set as Required for a Mach-O Project



o. Click **Save**

p. Display the **PPC Mac OS X Linker** settings panel.

q. Type `start` in the **Main Entry Point** text box.

r. Click **Save**

s. Close the target settings window.

t. Add the file `crt1.o`

This file is here:

`OS X Volume/usr/lib`

where *`OS X Volume`* is a placeholder for the drive on which you installed Mac OS X.

u. If the build target is a debug target, add the file `MSL_All_Mach-O_D.lib`

This file is here:

`Compiler/MacOS X Support/Libraries/Runtime/Libs`

where *`Compiler`* is a placeholder for the folder in which you installed the CodeWarrior IDE.

v. If the build target is a release target, add the file `MSL_All_Mach-O.lib`

This file is here:

`Compiler/MacOS X Support/Libraries/Runtime/Libs`

w. Add these frameworks to the **Frameworks** tab of the project window.

```
Carbon.framework
System.framework
```

These frameworks are here:

`OS X Volume/System/Library/Frameworks`

x. Open the build target's prefix file in a CodeWarrior editor window.

y. Modify the prefix file as show in Listing 4.1.

Listing 4.1 Changes to Build Target Prefix Files

```
... // leave preceeding statements unchanged

// -----------------------------------------------------
// Common Settings

//#include "CommonCarbonPrefix.h"  //<-- comment out this statement
#include "CommonMach-OPrefix.h"    //<-- add this statement

... // leave statements that follow unchanged
```

z. Close and save the prefix file.

aa. Select **Project > Make**

The CodeWarrior IDE makes the current build target and outputs a Mach-O executable.

ab. Select **Project > Run**

The IDE runs the generated executable.

Your have now modified your Original PowerPlant project such that each of its build targets generates a Mach-O executable.

5

Migrating to Unicode

This chapter shows you how to modify your Original PowerPlant™ code such that it uses Unicode for its character data.

This chapter contains these sections:

- Unicode Migration Issues
- Example Code

Unicode Migration Issues

PowerPlant X's native string class is based on the CoreFoundation class CFString. Class CFString encapsulate Unicode characters. As a result, you must convert all ASCII character data in your Original PowerPlant program to use class CFString.

Important points:

- Use the `PPx::CFString` in place of Original PowerPlant's custom string classes (for example, `LString` and `LStr255`).
- Use Apple's `CFSTR` macro to create Unicode string literals from C string literals.

Listing 5.1 shows Original PowerPlant string handling code. Listing 5.2 shows equivalent PowerPlant X string handling code.

Example Code

Listing 5.1 Original PowerPlant™ String Handling Code

```
LStr255 myString("Here is my text"); // Create a string object

LWindow* myWindow;

// Code to get window pointer
myWindow->SetTitle("\pWindow Title");    // Set title of window
```

Listing 5.2 PowerPlant™ X String Handling Code

```
  PPx::CFString myString("Here is my text"); // Create a string object

  PPx::Window* myWindow;

// Code to get window pointer
  myWindow->SetTitle(CFSTR("Window Title");      // Set title of window
```

6

Using the QuickDraw API with PowerPlant™ X

This chapter explains how to migrate custom `LPane` subclasses to PowerPlant™ X, while continuing to use the QuickDraw API to render these panes.

This chapter contains these sections:

- QuickDraw vs. CoreGraphics
- Example Code

QuickDraw vs. CoreGraphics

If your Original PowerPlant program includes custom `LPane` subclasses, the code that draws these panes includes QuickDraw calls. As long the window that contains such subclasses is an `LWindow`, your custom drawing code (including all QuickDraw calls) will work in the PowerPlant X version of your program.

However, if you switch the window that contains custom panes to a `PPx::Window`, you must also switch each contained custom pane to a `PPx::View`. This change makes each custom pane a HIView. Because points in the HIView coordinate space are type `float` while QuickDraw functions require `SInt16` coordinates, you must make one of these changes to your drawing code:

1. Convert `float` coordinates to `SInt16` coordinates before each QuickDraw call.

   Typically, this option requires that you convert a `HIPoint` to a `Point` or a `HIRect` to a `Rect` and pass the `Point` or `Rect` to subsequent QuickDraw calls.

2. Replace each QuickDraw call with the corresponding CoreGraphics call.

   This choice is preferred because Mac OS X and all built-in PowerPlant X SystemViews use the CoreGraphics API.

Costs and benefits of using QuickDraw in PowerPlant X windows:

- Costs:
  - Coordinate conversion statements waste memory and processor cycles.
  - Coordinate conversion statements makes your source code harder to read and maintain.
  - Text drawn using QuickDraw looks different from text drawn by the system and by PowerPlant X's built in panes.

    This difference results from the fact that CoreGraphics uses a different anti-aliasing algorithm than does QuickDraw.
- Benefits:
  - You do not have to learn how to use the CoreGraphics API.
  - You do not have to write-test-debug as much new code.

Example Code

Listing 6.1 Using the QuickDraw API in PowerPlant™ X Code

```
// HI2QDRect is a view utility function.
// It converts the float coordinates of a HIRect to SInt16 values
// and returns the result in an out parameter of type Rect
void
ViewUtils::HIToQDRect(
    const HIRect& inHIRect,
    Rect&         outQDRect)
{

  // Truncate the HIPoint coordinates
  // passed in from 32 to 16 bits and return in out parameter

  outQDRect.left   = inHIRect.origin.x;
  outQDRect.top    = inHIRect.origin.y;

  outQDRect.right  = inHIRect.origin.x +
                     inHIRect.size.width;
  outQDRect.bottom = inHIRect.origin.y +
                     inHIRect.size.height;

}
```

```
// Draw a PowerPlant X pane using a function in the QuickDraw API
OSStatus
MyFrameView::DoControlDraw(
    ControlRef          /* inControl */,
    ControlPartCode     /* inPartCode */,
    RgnHandle           /* inClipRgn */,
    CGContextRef        /* inContext */)  // Don't need CGContext
{
  // Create a HIRect.
  // Set its coordinates to the frame of this MyFrameView instance.
  // Because a MyFrameView is a HIView, the returned coords are floats.
  HIRect frame;
  GetLocalFrame(frame); // frame contains float coords

  // Upon return from HI2QDRect, qdFrame contains
  // SInt16 equivalents of the float coordinates passed in frame
  Rect qdFrame;
  PPx::ViewUtils::HI2QDRect(frame, qdFrame);

  // Finally, pass qdFrame to the QuickDraw function FrameRect
  ::FrameRect(&qdFrame);

  return noErr;
}
```

Listing 6.2 Using the CoreGraphics API in PowerPlant™ X Code

```
// Draw a control using a CoreGraphics function
OSStatus
MyFrameView::DoControlDraw(
    ControlRef          /* inControl */,
    ControlPartCode     /* inPartCode */,
    RgnHandle           /* inClipRgn */,
    CGContextRef        inContext)
{
  HIRect frame;
  GetLocalFrame(frame);

  // NOTE: no coordinate data type conversion required

  ::CGContextStrokeRect(inContext, frame); // make CoreGraphics call

  return noErr;
}
```

7

Migrating Custom LPanes

This chapter explains how to migrate a custom `LPane` subclass to a PowerPlant X SystemView.

NOTE	You do not have to make the changes discussed in this chapter because your custom `LPane` classes will work in the PowerPlant X version of your project. However, until you migrate your interface code to PowerPlant X, your program must keep its `WaitNextEvent` loop. On Mac OS X, such a loop is unnecessary and harms system performance.

This chapter contains these sections:

- Custom Pane Migration Issues
- Example Code

Custom Pane Migration Issues

Original PowerPlant includes the `LPane` and `LView` classes. These classes have "fat" interfaces that include many virtual functions.

In Original PowerPlant, you create a custom pane by subclassing `LPane` or `LView`. To add custom behavior, you override the appropriate virtual functions inherited from `LPane` or `LView`.

In PowerPlant X, you create a custom *view* by subclassing class `PPx::BaseView`. However, `PPx::BaseView` does not include lots of virtual functions that you can override to implement custom behavior. Instead, in PowerPlant X, you endow a view with custom behavior in one of two ways:

- Include the desired Carbon "event doer" classes in your `PPx::BaseView` subclass.
- Add (and remove) event-handling attachments to a `PPx::BaseView` object at runtime.

To add custom behavior using the mixin approach, include the desired PowerPlant X event doer classes in your `PPx::BaseView` subclass using multiple inheritance. Next, implement the required custom behavior in each pure virtual “Do*XYZ*Event” method inherited from an event doer base class. (*XYZ* is a placeholder for the name of a specific Carbon Event).

To use the attachment approach, create a subclass of `PPx::TargetAttachment` that mixes in the desired event doer classes. Again, implement the desired custom behavior in each pure virtual “Do*XYZ*Event” method inherited from an event doer base class. Finally, instantiate the attachment subclass and attach it to your custom view by calling the view’s `AddAttachment()` method.

The attachment approach is a very powerful because it lets you attach Carbon Event handlers to “stock” PowerPlant X views as well as to custom views. Further, because PowerPlant X includes so many event doer classes, you can easily add exactly the behavior you require to an existing PowerPlant X view using an attachment. As a result, when programming with PowerPlant X, you do not have to create custom views very often.

The `LAttachment` class of Original PowerPlant also lets you customize pane behavior at runtime. However, an `LAttachment` subclass lets you override just a few behaviors (such as clicking and drawing). PowerPlant X attachments let you associate custom behavior with any Carbon Event.

The code example in Listing 7.1 shows the Original PowerPlant technique for implementing custom pane behavior. Listing 7.2 shows how to achieve the same result using the PowerPlant X mixin approach.

Example Code

Listing 7.1 Original PowerPlant™ Custom Panes—Override Base Class Virtuals

```
// Custom pane class declaration
class MyPane : public LPane {
public:
  enum { class_ID = FOUR_CHAR_CODE('MyPn') };

  MyPane();
  MyPane( LStream* inStream );

  // Override LPane’s versions of DrawSelf() and ClickSelf()
  virtual void DrawSelf();
  virtual void ClickSelf( const SMouseDownEvent& inMouseDown );
```

```
private:
  SInt16  mLineThickness;
};// end declaration of class MyPane

// Custom pane class implementation

// Default ctor
MyPane::MyPane()
{
  mLineThickness = 1;
}

// Stream ctor
MyPane::MyPane(
    LStream* inStream)
    : LPane(inStream)
{
  *inStream >> mLineWidth;  // Read line thickness option
}

// Implementation of DrawSelf() override
// Defines how each MyPane instance appears on the screen
void
MyPane::DrawSelf()
{
  // Draw box using line thickness
  Rect frame;
  CalcLocalFrameRect( frame );

  ::PenNormal();
  ::PenSize( mLineThickness, mLineThickness );

  ::FrameRect(&frame);
}

// Implementation of ClickSelf() override
// Defines how each MyPane instance behaves when clicked
void
MyPane::ClickSelf(
  const SMouseDownEvent&  /* inMouseDown */)
{
  ::SysBeep(1);  // Beep when clicked
}
```

Listing 7.2 PowerPlant™ X Custom Views—Override Event Doer Virtual Functions

```
// Custom view class declaration
class MyView : public PPx::BaseView,
               public PPx::ControlDrawDoer, // mixin two event doers
               public PPx::ControlClickDoer {
public:
  MyView();

protected:
  // override PPx::ControlDrawDoer's version of DoControlDraw
  virtual OSStatus DoControlDraw(
                      PPx::SysCarbonEvent& ioEvent,
                      ControlRef           inControl,
                      ControlPartCode      inPartCode,
                      RgnHandle            inClipRgn,
                      CGContextRef         inContext);

  // override PPx::ControlClickDoer's version of DoControlClick
  virtual OSStatus DoControlClick(
                      PPx::SysCarbonEvent& ioEvent,
                      ControlRef           inControl,
                      const HIPoint&       inMouseLocation);

private:
  // Override these PPx::BaseView virtual functions
  virtual void        FinishInit();
  virtual CFStringRef ClassName() const;
  virtual void        InitState( const PPx::DataReader& inReader );
  virtual void        WriteState( PPx::DataWriter& ioWriter ) const;

private:
  SInt16  mLineThickness;
};// end declaration of class MyView

//
// Custom view implementation
//
const CFStringRef key_Thickness = CFSTR("Thickness");

// default ctor
MyView::MyView()
{
  mLineThickness = 1;
}
```

```
void
MyView::FinishInit()
{ // Install event handlers
  EventTargetRef targetRef = GetSysEventTarget();
  PPx::ControlDrawDoer::Install(targetRef);
  PPx::ControlClickDoer::Install(targetRef);
}

// Implementation of ClassName() override
CFStringRef
MyView::ClassName() const
{
  // Instead of a four char code class_ID,
  // PPx classes are identified by the class name as a CFString
  return CFSTR("MyView");
}

// Implementation of InitState() override
void
MyView::InitState(
    const PPx::DataReader& inReader)
{
  // Data values are obtained from
  // a DataReader object instead of from an an LStream
  inReader.ReadOptional( key_Thickness, mLineThickness )
}

// Implementation of WriteState() override
void
MyView::WriteState(
    PPx::DataWriter& ioWriter ) const
{
  // Unlike Original PowerPlant, PPx views can write their state
  ioWriter.WriteValue(key_Thickness, mLineThickness);
}

// Implementation of DoControlDraw() override
// Defines how each MyView instance appears on the screen
OSStatus
MyView::DoControlDraw(
    PPx::SysCarbonEvent& /* ioEvent */,
    ControlRef           /* inControl */,
    ControlPartCode      /* inPartCode */,
    RgnHandle            /* inClipRgn */,
    CGContextRef         inContext)
```

```
{
  HIRect frame; // Draw box using line thickness
  GetLocalFrame(frame);

  ::CGContextStrokeRectWithWidth(inContext, frame, mLineThickness);

  return noErr;
}

// Implementation of DoControlClick() override
// Defines how each MyView instance behaves when clicked
OSStatus
MyView::DoControlClick(
    PPx::SysCarbonEvent&    /* ioEvent */,
    ControlRef              /* inControl */,
    const HIPoint&          /* inMouseLocation */)
{
  ::SysBeep(1); // Beep when clicked

return noErr;
}
```

8

Migrating a User Interface to PowerPlant™ X

This chapter explains how to migrate your Original PowerPlant™ program's user interface to PowerPlant X.

NOTE	You do not have to make the changes discussed in this chapter because your Original PowerPlant user interface code will work in the PowerPlant X version of your program. That said, until you migrate all your interface code to PowerPlant X, your program must keep its WaitNextEvent loop. On Mac OS X, such a loop is unnecessary and harms system performance.

This chapter contains these sections:

- User Interface Migration Issues
- Example Code

User Interface Migration Issues

As mentioned above, you do not have to migrate your Original PowerPlant program's user interface to PowerPlant X. Your existing user interface and related event handling code will work in the PowerPlant X version of your project.

So, why change code that already works? Because a PowerPlant X user interface runs more efficiently on Mac OS X than does an Original PowerPlant interface.

Once you have migrated all your interface code to PowerPlant X and switched to Carbon Events for handling user interaction with this interface, you can remove your program's event loop. Removing this loop reduces the load your program places on the system because it lets Mac OS X preempt your program's execution until an event occurs to which your program must respond.

Leaving the WaitNextEvent loop in your program places a heavy load on the system because the thread that executes this loop must run continuously to check for queued events. Because the event queue is usually empty, this approach is very wasteful.

That said, as long as you are willing to accept the performance penalty, you do not have to migrate your user interface to PowerPlant X. You can leave all or part of your interface code as is.

TIP	A single PowerPlant X program can include both Original PowerPlant and PowerPlant X UI resources. The only restriction is that code for a given resource must be entirely Original PowerPlant or entirely PowerPlant X. As a result, if you do not have time to migrate your entire interface, you can just update as many UI resources as time permits.

To convert an Original PowerPlant user interface resource to PowerPlant X, follow these steps:

1. Use the `PPobToXML` utility to convert the resource's PPob to XML.

   Refer to "Converting a PPob to XML" for instructions.

2. Add each XML file produced by the conversion utility to the **Package** tab of your PowerPlant X project.

3. For each Original PowerPlant class that implements a converted resource, write a replacement PowerPlant X class.

4. Throughout your project's source code, replace each reference to an Original PowerPlant class that implements a converted resource with its replacement PowerPlant X class.

NOTE	For resources that contain other resources, such as views and windows, you must replace code for both the top-level resource and for all resources it contains.

5. Create event doer subclasses for each custom behavior currently implemented using `LCommander`, `LBroadcaster` and `LListener`, and `LAttachment`.

6. Attach these Carbon Event handlers to your new PowerPlant X interface elements.

7. Remove your commander, broadcast/listener, and attachment code.

8. Optionally, in your custom pane subclasses, replace QuickDraw calls with equivalent CoreGraphics calls.

   Refer to “Using the QuickDraw API with PowerPlant™ X” for more information.

The code example in Listing 8.1 shows typical Original PowerPlant user interface code. Listing 8.2 shows the PowerPlant X code that achieves the same result.

Example Code

Listing 8.1 Original PowerPlant™ User Interface Code

```
// header file
#include <LView.h>

class MyView : public LView {

protected:
  // Override LView's DrawSelf method
  virtual void DrawSelf();

  // ... rest of class declaration
};

// source file ...

// Implementation of DrawSelf override
void
MyView::DrawSelf()
{
  // Get frame of view
  Rect frame;
  CalcLocalFrameRect(frame);

  // Create new color context
  RGBColor color = { 50, 220, 50 };
  ::RGBForeColor(&color);
```

```
  // Fill in view with color
  ::PaintRect(&frame);
}
```

Listing 8.2 Equivalent PowerPlant™ X User Interface Code

```
// header file

#include <PPxBaseView.h>
#include <PPxViewEvents.h>

class MyPPxView : public PPx::BaseView,
                  public PPx::ControlDrawDoer {
                  // ... other base classes
{
public:
  // ... other public methods

  // Override PPx::View's FinishSelf method
  virtual void FinishSelf();

  // Override PPx::ControlDrawDoer's DoControlDraw method
  virtual OSStatus DoControlDraw(
                      PPx::SysCarbonEvent& ioEvent,
                      ControlRef           inControl,
                      ControlPartCode      inPartCode,
                      RgnHandle            inClipRgn,
                      CGContextRef         inContext);

  // rest of class declaration ...
};

// Implementation of FinishSelf override
void
MyPPxView::FinishSelf()
{
  // Get SysEvent target and install event handler
  EventTargetRef targetRef = GetSysEventTarget();
  PPx::ControlDrawDoer::Install(targetRef);

  // rest of FinishSelf function ...
}
```

```
// Implementation of DoControlDraw override
OSStatus
MyPPxView::DoControlDraw(
    PPx::SysCarbonEvent& /* ioEvent */,
    ControlRef           /* inControl */,
    ControlPartCode      /* inPartCode */,
    RgnHandle            /* inClipRgn */,
    CGContextRef         inContext)
{
  // Get frame of view
  HIRect frame;
  GetLocalFrame(frame);

  // Use the CoreGraphics API to draw b/c PPx views are HIViews

  // Create new color context
  ::CGContextSetRGBFillColor( inContext,
                              0.3,  // Red
                              0.75, // Green
                              0.3,  // Blue
                              0.5); // Alpha

  // Fill in view with color
  ::CGContextFillRect(inContext, frame);

  return noErr;
}
```

9

Using PowerPlant™ X Windows

This chapter shows you how to modify code in your Original PowerPlant™ program that assumes that a window is a type of view.

NOTE	You must change only code associated with a window that you have migrated to PowerPlant X. Code associated with Original PowerPlant windows works in a PowerPlant X program without change.

This chapter contains these sections:

- Manipulating PowerPlant™ X Windows
- Example Code

Manipulating PowerPlant™ X Windows

In the Original PowerPlant framework, class `LWindow` is a subclass of `LView`.

In PowerPlant X, however, class `PPx::Window` is not a subclass of `PPx::View`. Instead, `PPx::Window` has a content view that occupies a window's content area and contains subviews.

This arrangement matches the HIView architecture of Mac OS X, 10.2: a window contains a root view that contains subviews.

For each Original PowerPlant window that you migrate to PowerPlant X, you must modify any code that traverses the window's view hierarchy. Specifically, you must change such code to handle the fact that a PowerPlant X window is not a type of view.

The code example in Listing 9.1 shows Original PowerPlant code that traverses a view hierarchy. Listing 9.2 shows the PowerPlant X way to achieve the same result.

Example Code

Listing 9.1 Original PowerPlant™ Code that Traverses a View Hierarchy

```
// The Original PowerPlant code shown below works
// even if theView is eventually assigned a pointer to an LWindow

  // ... preceeding code

  LView* theView = this;

  do {

    theView = theView->GetSuperView();

  } while (theView != nil);

  // subsequent code ...
```

Listing 9.2 PowerPlant™ X Code that Traverses a View Hierarchy

```
// In Original PowerPlant, a window is also a view,
// so you can call FindPaneByID or FindViewByID directly on a window.
// However, to traverse into a window in
// PowerPlant X, you must use code like that shown below

  // ... preceeding code

  WindowRef theWindow = GetSysWindow();

  PPx::Window theWindow = PPx::Window::GetWindowObject(theWindowRef);
  PPx::View theView = theWindow->GetContentView();

  // 'View' is the FOUR_CHAR_CODE of the view to find
  theView = theView->FindViewByID('View');

  // subsequent code ...
```

10

Migrating Programs that Manipulate PPob Files

This chapter explains how to modify a program that directly manipulates a PPob file so the program works with the XML version of this PPob.

NOTE	You must make the changes described in this chapter only if you have written a program that directly manipulates a PPob, and you have translated this PPob to XML.

XML Resource File Manipulation

Original PowerPlant uses PPob resources to store object descriptions. PowerPlant X uses text-based XML files to store this information.

The PowerPlant X framework includes a utility that converts a PPob to XML format. See "Converting a PPob to XML" for instructions that explain how to use this utility.

If you have a program that operates directly on a PPob file, once you convert the PPob to XML, your program is broken. How to handle this problem depends upon the nature of the original program. Consider these options:

- Replace the program with a script and/or command line text processing utility (like grep).

  This option is viable because XML files are text files. As a result, manipulating these files with scripts or with grep might suffice, particularly if the required processing is not complex.

- Modify the existing program to manipulate the XML file.

  How you accomplish this depends on the development tools used to create the original program. Because XML files are text files, you can use the text file I/O and string parsing routines/classes included with your development tools.

11

Migrating Grayscale Appearance Controls

This chapter presents options for modifying an Original PowerPlant™ program that uses Grayscale Appearance (GA) controls so these controls look the way you want in the PowerPlant X version of the program.

NOTE	Unless you change the window that contains a GA control from an Original PowerPlant window to a PowerPlant X window, you do not have to make the changes discussed in this chapter.

This chapter contains these sections:

- GA Controls vs. the Aqua Look and Feel
- Migration Options

GA Controls vs. the Aqua Look and Feel

Original PowerPlant includes Grayscale Appearance (GA) implementation classes. These classes implement Appearance Manager controls that have a grayscale appearance.

The GA controls look fine in a Classic Mac OS program because on this OS, genuine Appearance Manager controls are also grayscale. In a Mac OS X program, however, GA controls may look unattractive because any Appearance Manager controls in the interface take on the Aqua look and feel while all GA controls remain grayscale.

Migration Options

The changes you must make to your GA controls so they work as desired in the PowerPlant X version of your program depends on your objectives.

Objective 1

Maintain the grayscale look of the GA controls;
Leave the containing window as an Original PowerPlant window.

- Required changes:
  - None
- Benefit:
  - Time savings. This choice requires no work, so it takes no time.
- Cost:
  - Inefficiency. Because your program still contains at least one Original PowerPlant window, you cannot remove the program's `WaitNextEvent` loop. This loop harms the performance of a Mac OS X system.

Objective 2

Switch the grayscale look of the GA controls to Aqua;
Leave the containing window as an Original PowerPlant window.

- Required changes:
  - Replace each GA implementation object with the corresponding Appearance Manager implementation object.
- Benefit:
  - Pleasing user interface. All controls within the window share the Aqua look and feel.
- Cost:
  - Inefficiency. Because your program still contains at least one Original PowerPlant window, you cannot remove the program's `WaitNextEvent` loop. This loop harms the performance of a Mac OS X system.

Objective 3

Maintain the grayscale look of the GA controls;
Change the containing window to a PowerPlant X window.

- Required changes:
  - Change the type of the window that contains the GA controls from `LWindow` to `PPx::Window`.
  - Convert the window's PPob to XML. Refer to "Converting a PPob to XML" for instructions.
  - For each GA control, create a custom PowerPlant X SystemView class that renders the desired grayscale look.
- Benefit:
  - Efficiency. Because you removed the Original PowerPlant window, you can remove the program's `WaitNextEvent` loop (provided you have removed all LPeriodicals, LCommanders, LAttachments, and other LWindows).
- Cost:
  - Time consumption. Code that renders a convincing grayscale appearance is complex and therefore takes time to write. To speed this effort, you might use the drawing code in Original PowerPlant's GA implementation classes as a starting point.

Objective 4

Switch the grayscale look of the GA controls to Aqua;
Change the containing window to a PowerPlant X window.

- Required changes:
  - Change the type of the window that contains the GA controls from `LWindow` to `PPx::Window.`
  - Convert the window's PPob to XML. Refer to "Converting a PPob to XML" for instructions.
  - Replace each GA control with its corresponding PowerPlant X SystemView.
- Benefit:
  - Efficiency. Because you removed the Original PowerPlant window, you can remove the program's `WaitNextEvent` loop (provided you have removed all LPeriodicals, LCommanders, LAttachments, and other LWindows).
- Cost:
  - Time consumption. You must write, test, and debug a lot of new code.

12

Migrating from Polling to Carbon Event Dispatch

This chapter discusses the changes you must make to your Original PowerPlant program so you can remove its event dispatch loop.

NOTE	You do not have to make the changes discussed in this chapter because your Original PowerPlant program's polling loop and the features that rely upon it will work in the PowerPlant X version of your program. That said, it is recommended that you remove your program's polling loop because, on Mac OS X, such a loop is unnecessary and harms system performance.

This chapter contains these sections:

- Polling vs. Carbon Event Dispatch
- Example Code

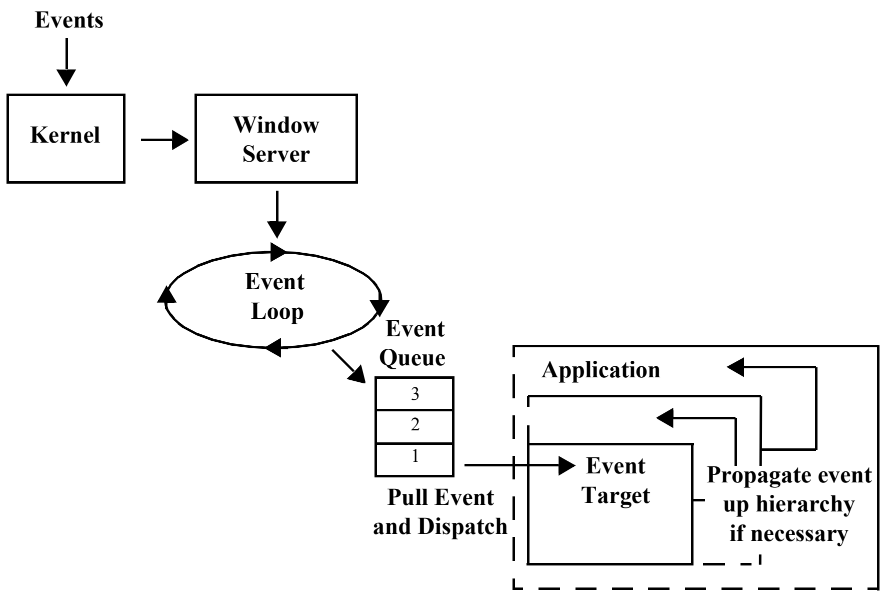
Polling vs. Carbon Event Dispatch

An Original PowerPlant program includes a polling loop. This loop retrieves events from a queue and dispatches them to the appropriate target for handling. In addition, the loop performs pre- and post- event dispatch tasks, such as displaying the appropriate mouse cursor and executing periodicals.

A PowerPlant X program, in contrast, has no polling loop. Instead, a PowerPlant X program waits for Mac OS X to "wake it up" when an event occurs to which the program must respond.

The system described above is called the Carbon Event model (see Figure 12.1). Each event that can appear in the queue is called a Carbon Event. A "carbonized" program consists in large part of callback routines. A particular callback is invoked when the Carbon Event associated with that callback appears in the event queue.

Figure 12.1 The Carbon Event Model



A program that uses the Carbon Event model is more efficient than one that uses a polling loop. Polling is wasteful because the thread that executes the loop runs continuously in order to check for queued events. Because the event queue is usually empty, this thread wastes lots of processor cycles. A carbon program's thread, on the other hand, is preempted by Mac OS X until there is work for the thread to do.

Consequently, for efficiency's sake, you should remove your Original PowerPlant program's polling loop. Before you can do this, however, you must replace all parts of your program that rely on Original PowerPlant's polling loop and event dispatching mechanism. These classes are:

- `LCommander`
- `LAttachment`
- `LPeriodical` (both repeater and idler periodicals)
- All classes that receive and respond to events

There is a downside, however, to the absence of a polling loop in PowerPlant X: There is no easy way to implement custom pre- and post- event dispatch behavior. If your PowerPlant X program requires such behavior, try using a PowerPlant X Timer or sending Carbon Events to yourself.

Listing 12.1 shows the Original PowerPlant's `ProcessNextEvent` method. This method is called once per iteration of an application's polling loop. The method contains the code upon which commanders, attachments, periodicals, and event handlers rely.

Listing 12.2 shows the "main loop" of a PowerPlant X program. Mac OS X preempts the thread that runs this loop until there is a Carbon Event for the thread to process.

Example Code

Listing 12.1 Original PowerPlant's ProcessNextEvent Method

```
// Original PowerPlant's LApplication::Run() method contains a loop.
// This loop calls LApplication::ProcessNextEvent once per interation.
void
LApplication::ProcessNextEvent()
{
  EventRecord macEvent;

  // When on duty (application is in the foreground), adjust the
  // cursor shape before waiting for the next event.
  if (IsOnDuty()) {
    UEventMgr::GetMouseAndModifiers(macEvent);
    AdjustCursor(macEvent);
  }

  // Retrieve the next event. A context switch could occur here.
  SetUpdateCommandStatus(false);
  Boolean gotEvent = ::WaitNextEvent(everyEvent, &macEvent,
                                     mSleepTime, mMouseRgn);

  // Let Attachments process the event. Continue with normal
  // event dispatching unless suppressed by an Attachment.
  if (LAttachable::ExecuteAttachments(msg_Event, &macEvent)) {
    if (gotEvent) {
      DispatchEvent(macEvent);
    } else {
      UseIdleTime(macEvent);
    }
  }

  // Repeaters get time after every event
  LPeriodical::DevoteTimeToRepeaters(macEvent);
```

```
  // Update status of menu items
  if (IsOnDuty() && GetUpdateCommandStatus()) {
    UpdateMenus();
  }
}
```

Listing 12.2 PowerPlant™ X's Run Method

```
// The PowerPlant X Run() method simply calls the Carbon Execution
// Environment function ::RunApplicationEventLoop().
// This function does not return until the application terminates.
void
PPx::Application::Run() {
  ::RunApplicationEventLoop();
}
```

13

Migrating from Periodicals to Timers and IdleTimers

This chapter explains how to modify your Original PowerPlant™ program such that it uses PowerPlant X timers for periodic and idle time tasks instead of Original PowerPlant's `LPeriodical` class.

NOTE	You do not have to make the changes discussed in this chapter because your Original PowerPlant periodicals will work in the PowerPlant X version of your project. That said, until you migrate your periodical code to PowerPlant X, your program must keep its WaitNextEvent loop. On Mac OS X, such a loop is unnecessary and wastes CPU cycles.

This chapter contains these sections:

- LPeriodical Migration Issues
- Example Code

LPeriodical Migration Issues

Most of Original PowerPlant and of PowerPlant X is devoted to helping you write code that displays a graphical user interface and that responds as required to user interaction with this interface.

That said, another thing each framework lets you do is write code that is invoked at regular intervals and/or only when there is nothing of higher priority to do.

In Original PowerPlant, you use the `LPeriodical` class to implement such behavior. In more detail, you subclass `LPeriodical`, override its `SpendTime()` method to implement the required periodic behavior, instantiate the subclass, and add it to your program's repeater queue, its idler queue, or both.

Once added to a queue, your Original PowerPlant program's WaitNextEvent loop checks the periodical's "fire interval" once per iteration. If it is time to fire the periodical, the loop calls the periodical's `SpendTime()` function.

However, a WaitNextEvent loop is not necessary on Mac OS X because this OS can dispatch events directly to your program. In fact, a WaitNextEvent loop actually impairs Mac OS X's responsiveness. This is so because, on Mac OS X, the thread that executes a WaitNextEvent loop is always ready to run and so competes with other threads for CPU time.

Of course, there is nothing wrong with a thread using the CPU to do work. However, when a WaitNextEvent loop gets the CPU, it just checks its queue for events and checks its periodicals to see if its time to execute them. Because its queue is usually empty and it is usually not time to execute its periodicals, most of the cycles allocated to this loop are wasted.

So, even though a WaitNextEvent loop works in a PowerPlant X program, you want to eliminate it so your program does not degrade system performance. However, once this loop is gone, so is the mechanism that executes your periodicals.

Fortunately, PowerPlant X provides an alternate way to implement periodic behavior: Timers and IdleTimers. Mac OS X automatically executes the handler associated with a PowerPlant X timer at the specified interval. To initiate this functionality, all you must do is register the timer with the OS.

In addition, unlike periodicals, PowerPlant X timers execute "at the same time" that other things are happening. For example, a PowerPlant X timer can execute while the user holds down the mouse while navigating a menu. In contrast, execution of an Original PowerPlant periodical is blocked until the user releases the mouse.

To migrate `LPeriodical` subclasses to PowerPlant X timers, follow these steps:

1. For each repeater `LPeriodical` in your program, implement an empty PowerPlant X Timer following the instructions in the *PowerPlant™ X 1.0 Developer's Guide*.

2. For each idler `LPeriodical` in your program, implement an empty PowerPlant X IdleTimer following the instructions in the *PowerPlant™ X 1.0 Developer's Guide*.

3. Copy the code from each `LPeriodical` subclass's `SpendTime()` method to the callback function of the corresponding empty PowerPlant X Timer or IdleTimer.

4. Remove all `LPeriodical` code from your CodeWarrior project.

5. Add code that instantiates and installs each of your PowerPlant X Timers and IdleTimers to the appropriate place in your program's logic.

NOTE	You may need to adjust your program's architecture to account for differences in how and when PowerPlant X Timers are called vs. Original PowerPlant periodicals. In a PowerPlant X program, Timers execute upon return from an event handler (and program control is within `ReceiveNextEvent`) or when tracking the mouse (and program control is within `TrackMouseLocation`). In an Original PowerPlant program, the "fire interval" of a repeater periodical is checked once per iteration of the `WaitNextEvent` loop. If the loop retrieves an event, however, a repeater periodical is not checked (much less executed) until after event processing completes.

The code example in Listing 13.1 shows the Original PowerPlant's `LPeriodical` class used to implement a repeated behavior, that is, a behavior that occurs once per event.

Listing 13.2 shows the PowerPlant X way to achieve a similar result. Note that a PowerPlant X Timer is not executed once per event, so the result produced by this technique is not identical to the result produced by the Original PowerPlant approach.

Example Code

Listing 13.1 Example of an Original PowerPlant™ Repeater Periodical

```
// Declaration of class MyRepeater
class MyRepeater : public LPeriodical { // mixin LPeriodical
public:
  MyRepeater();

  // Override LPeriodical's version of the SpendTime method
  virtual void SpendTime( const EventRecord& inMacEvent );

private:
  UInt32 mLastActionTime;
};// end class declaration
```

```
// Implementation of class MyRepeater

// default ctor
MyRepeater::MyRepeater()
{
  mLastActionTime = 0;
}

// Implementation of SpendTime override
void
MyRepeater::SpendTime(const EventRecord& /* inMacEvent */)
{
  UInt32 currentTime = ::TickCount();

  if (currentTime >= mLastActionTime + 300) {
    mLastActionTime = currentTime;

    // ... Do something every 300 ticks (5 seconds)
  }
}

int main() {
  // Initialization code ...

  // Create a MyRepeater instance
  MyRepeater* repeater = new MyRepeater;

  // Start the repeater, that is, add it to the repeater queue
  repeater->StartRepeating();

  // rest of main() ...
}
```

Listing 13.2 Example of a PowerPlant™ X Timer

```
// Declaration of class MyTimer
class MyTimer : public PPx::Timer { // mixin PPx::Timer
private:

  // Override PPx::Timer's pure virtual declartion of this method
  virtual void DoTimer();

};
```

```
// Implementation of DoTimer override
void
MyTimer::DoTimer()
{
// ... Do something
}

int main() {
  // Initialization code ...

  // Create a MyTimer instance
  MyTimer* timer = new MyTimer;

  // Install MyTimer instance. Set it up so it fires every 5 seconds
  timer.Install(::GetMainEventLoop(), 0, 5);

  // rest of main() ...
}
```

Figure 13.1 Example of an Original PowerPlant™ Idler Periodical

```
// A Pane which does something (for example,
// some kind of animation) during idle time when the pane is active

// Declaration of class MyPane
class MyPane : public LPane,
               public LPeriodical { // mixin class LPeriodical
public:
  // Override these LPane methods
  virtual void ActivateSelf();
  virtual void DeactivateSelf();

  // Override LPeriodical’s SpendTime method
  virtual void SpendTime( const EventRecord& inMacEvent );
};

// Implementation of ActivateSelf() override
void
MyPane::ActivateSelf()
{
  // Start idling, i.e., add this MyPane instance to the idler queue
  StartIdling();
}
```

```
// Implementation of DeactivateSelf() override
void
MyPane::DeactivateSelf()
{
  // Stop idling, i.e., remove this MyPane instance from the idler queue
  StopIdling();
}

// Implementation of SpendTime() override
void
MyPane::SpendTime(const EventRecord& /* inMacEvent */)
{
  // ... Do something at idle time
  // ... For example, animate a graphic in the MyPane instance
}
```

Listing 13.3 Example of a PowerPlant™ X IdleTimer

```
// Declaration of class MyPane
class MyPane : public PPx::BaseView,
               public PPx::ControlActivateDoer,
               public PPx::ControlDeactivateDoer {
private:
  // ... other methods

  // Override PPx::View's FinishSelf method
  virtual void FinishSelf();

  // Override these Carbon Event "doer" methods
  virtual OSStatus DoControlActivate(
             PPx::SysCarbonEvent& ioEvent,
             ControlRef           inControl);

  virtual OSStatus DoControlDeactivate(
              PPx::SysCarbonEvent& ioEvent,
               ControlRef          inControl);

  // This method is called each time the IdleTimer fires
  void SpendIdleTime( EventLoopIdleTimerMessage inMessage );

private:
  PPx::IdleTimerCallback<MyPane> mIdleTimer;
};
```

```
// Implementation of FinishSelf() override
void
MyPane::FinishSelf()
{
  // Install event handlers
  EventTargetRef targetRef = GetSysEventTarget();

  PPx::ControlActivateDoer::Install(targetRef);
  PPx::ControlDeactivateDoer::Install(targetRef);
}

// Implementation of DoControlActivate() override
OSStatus
MyPane::DoControlActivate(PPx::SysCarbonEvent& /* ioEvent */,
                          ControlRef           /* inControl */)
{
 mIdleTimer.Install(this,
                    &SpendIdleTime, ::GetCurrentEventLoop(), 0.1, 0.1);
}

// Implementation of DoControlDeactivate() override
OSStatus
MyPane::DoControlDeactivate(PPx::SysCarbonEvent& /* ioEvent */,
                            ControlRef           /* inControl */)
{
  mIdleTimer.Remove();
}

// Implementation of SpendIdleTime
// Called each time the IdleTimer mIdleTimer fires
// Defines the idle time behavior of a MyPane instance
void
MyPane::SpendIdleTime(EventLoopIdleTimerMessage /* inMessage */)
{
  // Do something at idle time ...
  // For example, animate a graphic in the MyPane instance ...
}
```

14

Migrating from LCommanders to Carbon Event Handlers

This chapter explains how to modify your Original PowerPlant™ program such that it uses PowerPlant X Carbon Event handler classes to process commands instead of subclasses of the Original PowerPlant `LCommander` class.

NOTE	You do not have to make the changes discussed in this chapter because your Original PowerPlant commanders will work in the PowerPlant X version of your project. That said, until you migrate your command handling code to PowerPlant X, your program must keep its WaitNextEvent loop. On Mac OS X, such a loop is unnecessary and harms system performance.

This chapter contains these sections:

- Commanders vs. Carbon Event Handlers
- Example Code

Commanders vs. Carbon Event Handlers

In Original PowerPlant, you handle commands and keyboard input by creating a custom class that mixes in the `LCommander` class. You then override the `ObeyCommand()` method to implement custom “on command selected” and “on key pressed” behavior.

Each time your WaitNextEvent loop retrieves a menu or keyboard event, it dispatches it to the commander "on duty." This commander either handles the event or passes it to it up the chain to its supercommander.

This processing depends on the presence of a WaitNextEvent loop. As discussed in previous chapters, such a loop is unnecessary and wasteful on Mac OS X. Consequently, you should remove each of your `LCommander` subclasses so you can eliminate your program's `WaitNextEvent` loop.

PowerPlant X uses Carbon Event handlers for command handling. Carbon Event handlers have a chain that is similar to Original PowerPlant's commander chain. Events propagate from the element with user focus up the event handler chain.

To replace your program's `LCommander` subclasses with PowerPlant X Carbon Event handlers, follow these steps:

1. For each `LCommander` subclass in your program, create a corresponding PowerPlant X class that mixes in the appropriate command "event doer" class (often class `PPx::CommandHander<Command_ID>`).

   Refer to the *PowerPlant™ X 1.0 Developer's Guide* for instructions that explain how to implement a PowerPlant X command handler.

2. In each PowerPlant X command handler subclass, override the required methods of the mixed-in event doer class (at a minimum `DoSpecificCommand()`).

3. Copy the code from each `LCommander` subclass's `ObeyCommand()` method to the `DoSpecificCommand()` method of the corresponding event doer subclass.

4. Delete all your `LCommander` code.

5. Add code that instantiates and activates each of your command event doer subclasses to the appropriate place in your program's logic.

NOTE	Once you have removed all LCommanders, LAttachments, and LPeriodicals and recoded your user interface to use PowerPlant X views, you can remove your program's WaitNextEvent loop.

The code example in Listing 14.1 shows Original PowerPlant command handling code. Listing 14.2 shows the PowerPlant X way to achieve the same result.

Example Code

Listing 14.1 Original PowerPlant™ Command Handling Code

```
// Delcaration of class MyApplication
class MyApplication : public LApplication {
public:
  // ... Other methods

  // Override of LCommander's ObeyCommand method
  virtual Boolean ObeyCommand(
                     CommandT  inCommand,
                     void*     ioParam);

  // Override of LCommander's FindCommandStatus method
  virtual void    FindCommandStatus(
                     CommandT  inCommand,
                     Boolean&  outEnabled,
                     Boolean&  outUsesMark,
                     UInt16&   outMark,
                     Str255    outName);

private:
  void DoCommandNew();
  void DoCommandFirst();
  void DoCommandSecond();
};

// Implementation of ObeyCommand override
Boolean
MyApplication::ObeyCommand(
    CommandT inCommand,
    void*    ioParam)
{
  Boolean cmdHandled = true;

  switch (inCommand) {
    case cmd_New:
      DoCommandNew();
      break;

    case Cmd_First:
      DoCommandFirst();
      break;
```

```
    case Cmd_Second:
      DoCommandSecond();
      break;

    default:
      cmdHandled = LApplication::ObeyCommand(inCommand, ioParam);
      break;
  }// end switch
  return cmdHandled;
}

// Implementation of FindCommandStatus override
void
MyApplication::FindCommandStatus(
    CommandT  inCommand,
    Boolean&  outEnabled,
    Boolean&  outUsesMark,
    UInt16&   outMark,
    Str255    outName)
{
  switch (inCommand) {

    case cmd_New:

      outEnabled = true;
      break;

    case Cmd_First:

      outEnabled = ::FrontWindow() != nil;
      break;

    case Cmd_Second:

      outEnabled = ::FrontWindow() == nil;
      break;

    default:

      LApplication::FindCommandStatus(inCommand, outEnabled,
                                       outUsesMark, outMark, outName);
      break;
  }// end switch
}
```

```
// Implementation of “on new command selected” behavior
void
MyApplication::DoCommandNew()
{
  // Code that performs "New" command
}

// Implementation of “on first command selected” behavior
void
MyApplication::DoCommandFirst()
{
  // Code that performs "First" command
}

// Implementation of “on second command selected” behavior
void
MyApplication::DoCommandSecond()
{
  // Code to perform "Second" command
}
```

Listing 14.2 PowerPlant™ X Carbon Event Command Handling Code

```
// Declaration fo class MyApplication
class MyApplication :
    public PPx::Application,
    public PPx::SpecificMenuCommandDoer<kHICommandNew>,
    public PPx::CommandHandler<Cmd_First>,
    public PPx::CommandHandler<Cmd_Second> {

  // ... Other functions
private:
  // Override of class SpecificMenuCommandDoer<kHICommandNew>’s
  // DoSpecificCommand method
  virtual OSStatus DoSpecificCommand(
             PPx::CommandIDType<kHICommandNew>,
             PPx::SysCarbonEvent& ioEvent);

  // Override of class CommandHandler<Cmd_First>’s
  // DoSpecificCommand method
  virtual OSStatus DoSpecificCommand(
             PPx::CommandIDType<Cmd_First>,
             PPx::SysCarbonEvent& ioEvent);
```

```
  // Override of class CommandHandler<Cmd_First>'s
  // DoSpecificCommandStatus method
  virtual OSStatus DoSpecificCommandStatus(
             PPx::CommandIDType<Cmd_First>,
             PPx::SysCarbonEvent& ioEvent);

  // Override of class CommandHandler<Cmd_Second>'s
  // DoSpecificCommand method
  virtual OSStatus DoSpecificCommand(
             PPx::CommandIDType<Cmd_Second>,
             PPx::SysCarbonEvent& ioEvent);

  // Override of class CommandHandler<Cmd_Second>'s
  // DoSpecificCommandStatus method
  virtual OSStatus DoSpecificCommandStatus(
             PPx::CommandIDType<Cmd_Second>,
             PPx::SysCarbonEvent& ioEvent);
};//end class declaration


// Sets status of Cmd_First menu item
OSStatus
MyApplication::DoSpecificCommandStatus(
    PPx::CommandIDType<Cmd_First>,
    PPx::SysCarbonEvent& /* ioEvent */)
{

  PPx::EventUtils::SetMenuCommandStatus( Cmd_First,
                                         (::FrontWindow() != nil) );
  return noErr;
}

// Sets status of Cmd_Second menu item
OSStatus
MyApplication::DoSpecificCommandStatus(
    PPx::CommandIDType<Cmd_Second>,
    PPx::SysCarbonEvent& /* ioEvent */)
{

  PPx::EventUtils::SetMenuCommandStatus( Cmd_Second,
                                         (::FrontWindow() == nil) );

  return noErr;
}
```

```
// Implements “on new menu item selected” behavior
OSStatus
MyApplication::DoSpecificCommand(
     PPx::ComandIDType<kHICommandNew>,
     PPx::SysCarbonEvent& ioEvent)
{
  // Code that performs the "New" command

  return noErr;
}

// Implements “on first menu item selected” behavior
OSStatus
MyApplication::DoSpecificCommand(
     PPx::ComandIDType<Cmd_First>,
     PPx::SysCarbonEvent& ioEvent)
{
  // Code that performs the "First" command

  return noErr;
}

/ Implements “on second menu item selected” behavior
OSStatus
MyApplication::DoSpecificCommand(
     PPx::ComandIDType<Cmd_Second>,
     PPx::SysCarbonEvent& ioEvent)
{
  // Code that performs the "Second" command

  return noErr;
}
```

15

Migrating from Broadcast/ Listen to Carbon Events

This chapter explains how to modify your Original PowerPlant program such that it uses PowerPlant X Carbon Event handlers to notify program objects that an event has occurred.

NOTE	You do not have to make the changes discussed in this chapter because your Original PowerPlant broadcasters and listeners will work in the PowerPlant X version of your project.

This chapter contains these sections:

- Broadcast/Listen Migration Issues
- Example Code

Broadcast/Listen Migration Issues

In Original PowerPlant programs, you use the `LBroadcaster` mixin class to create subclasses that can send messages. Similarly, you use the `LListener` mixin class to create subclasses that can receive and respond to messages sent by broadcasters.

The PowerPlant X framework, in contrast, does not include broadcaster and listener classes. Instead, PowerPlant X uses Carbon Events for messaging. PowerPlant X listeners are derived from `PPx::EventTarget`.

In PowerPlant X, you implement inter-object communication by attaching a Carbon Event handler that “listens” for the object to which it is attached to receive a particular Carbon Event. When the object receives this event, the attached handler sends a notification Carbon Event to other “listener” objects in your program.

The PowerPlant X broadcast mechanism has advantages over its Original PowerPlant counterpart:

- PowerPlant X messaging and command handling is more flexible.

  Original PowerPlant messages are single 32-bit values. A PowerPlant X message is a Carbon Event. A Carbon Event can contain multiple parameters.

- In PowerPlant X, all views can receive messages by installing a Carbon Event handler that is invoked by the OS on the specified event types.

The code example in Listing 15.1 shows code that uses Original PowerPlant's broadcast/listen inter-object messaging mechanism. Listing 15.2 shows the PowerPlant X way to achieve the same result.

Example Code

Listing 15.1 Original PowerPlant™ Broadcast/Listen Code

```
// Declaration of application class. Object of this class can listen
class MyApp : public LApplication,
              public LListener { // mixin LListener
public:
  MyApp();
  virtual ~MyApp();

  // Override LListener's ListenToMessage method
  virtual void ListenToMessage();

private:
  LWindow* mMainWin;
};

// Implemenation of MyApp
// ctor
MyApp::MyApp() {
  // Create app object's window from a PPob. The window contains a check
  // box. Check boxes are LControls. LControl mixes in LBroadcaster
  mMainWin = LWindow::CreateWindow(rPPob_MainWindow, this);

  // Find the check box and set up the app object listen to it
  LStdCheckBox* cb1;
  cb1 = dynamic_cast<LStdCheckBox*>(mMainWin->FindPaneByID(kCB_1));
  cb1->AddListener( this );
}
```

```
// METHOD MyApp::ListenToMessage:
//
// The check box broadcasts a message each time it's checked/unchecked
// ListenToMessage is called each time the check box's state changes b/c
// the app object is listening to the check box
void MyApp::ListenToMessage(
    MessageT inMessage,
    void*    ioParam)
{
  if (inMessage == msg_CheckBoxClicked) {
    SInt32  checkBoxValue = * (SInt32*)(ioParam);

    if (checkBox Value == 1) {
      DoCheckedProcessing();
    } else {
      DoUncheckedProcessing();
    }
  }
}
```

Listing 15.2 PowerPlant™ X Carbon Event Handler Used for Messaging

```
// class declaration in header file
class MyApp : public PPx::Application
              public PPx::ControlValueFieldChangedDoer
              // ... other base classes {

public:
  MyApp();

  // Override class PPx::ControlValueFieldChangedDoer's DoXYZ method
  virtual OSStatus DoControlValueFieldChanged(
                    PPx::SysCarbonEvent&  ioEvent,
                    ControlRef            inControl);

  // rest of class declaration ...
};

// In a source file ...
// ctor
MyApp::MyApp()
{
  PPx::Window* myWind =
    PPx::XMLSerializer::ResourceToObjects<PPx::Window>(pobj_MyWindow);
```

```
  EventTargetRef controlTarget =
   myWind->GetControlView()->FindViewByID(kCB_1)->GetSysEventTarget();

  PPx::ControlValueFieldChangedDoer::Install(controlTarget);
}

// Implementation of DoControlValueFieldChanged
// Each time the check box’s state changes, this method is called.
// The method notifies the app object of the state change. In a sense,
// the app object is listening for changes to the check box’s state
OSStatus
MyApp::DoControlValueFieldChanged(
    PPx::SysCarbonEvent&  /* ioEvent*/,
    ControlRef            inControl)
{
  if (::GetControlValue(inControl) == PPx::value_On) {
    DoCheckedProcessing();
  } else {
    DoUncheckedProcessing();
  }
}
```

16

Migrating from Cooperative to Preemptive Threading

This chapter explains how to migrate from Original PowerPlant threading classes to the Metrowerks Standard Library (MSL) threading classes.

This chapter contains these sections:

- Threading Migration Issues
- Cooperative vs. Preemptive Threading

Threading Migration Issues

Threads provide a way for you to divide your program's work into discrete, independent subtasks.

Original PowerPlant's threading classes (see Figure 16.1 and Figure 16.2) are built on the Thread Manager. These classes implement cooperative threads. In this kind of threading system, each thread must "cooperate" by yielding control of the processor regularly so that other threads can run. If a thread fails to regularly call `Yield()` during a lengthy computation, other threads with work to do are blocked.

Figure 16.1 Original PowerPlant™ Threading Classes

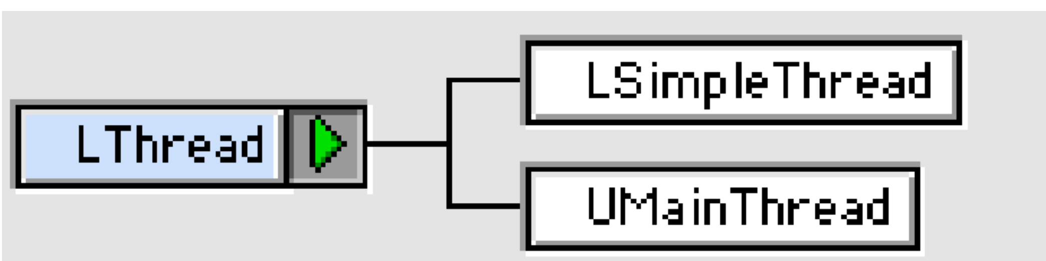


Figure 16.2 Original PowerPlant™ Semaphore Classes

Unlike Original PowerPlant, the PowerPlant X framework does not include its own threading classes. because MSL (Metrowerks Standard Libraries) now includes powerful threading classes. Including threading classes in PowerPlant X would therefore be redundant.

To migrate to PowerPlant X, use MSL's threading classes in place of the Original PowerPlant threading classes. Refer to the *MSL C++ Reference* manual for instructions.

Cooperative vs. Preemptive Threading

MSL's threading classes implement preemptive threads. In a preemptive system, the operating system controls access to the processor. As a result, a poorly written program cannot bring the overall system to a halt.

In one way, preemptive threading simplifies your programming task because you do not have to write code that explicitly yields control of the CPU. Instead, Mac OS X preempts the thread that is currently executing when its time slice expires and awards the processor to the next thread in the run queue.

In other ways, preemptive threading increases your burden. For example, in a preemptive environment, you must take greater care to ensure that you synchronize the access of your threads to shared data.

Of course, you must synchronize cooperative threads too, but preventing simultaneous access is easier in a cooperative system because a cooperative thread controls when its yields. In contrast, a preemptive thread loses control of the processor when that thread's time slice expires, no matter what the thread is doing at the time.

17

Using PowerPlant™ X Exception Handling

This chapter explains how to use the PowerPlant™ X framework's exception handling classes and macros.

NOTE	You do not have use the PowerPlant X exception handling classes: Original PowerPlant exception handling code will work in the PowerPlant X version of your project. That said, it is recommended that you migrate to PowerPlant X exception handling because it is more powerful.

This chapter contains these sections:

- Exception Handling Migration Issues
- Example Code

Exception Handling Migration Issues

Original PowerPlant has a single exception handling class, `LException`. This class is derived from `std::exception`.

PowerPlant X includes a small hierarchy of exception handling classes. These classes are *not* are not derived from `std::exception`. See Figure 17.1.

Each PowerPlant X exception class is designed to handle a particular class of errors, such as logic errors or runtime errors. This finer granularity makes it easier to diagnose the cause of a problem.

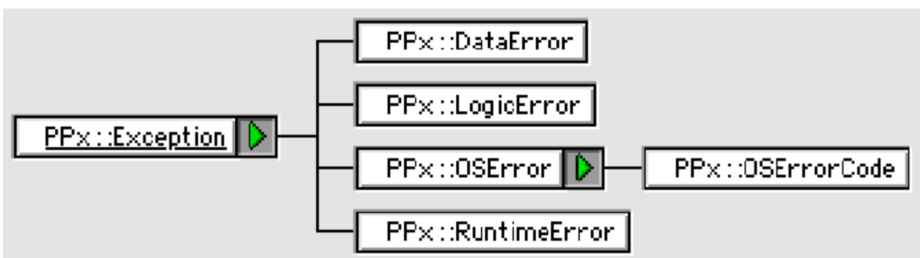
Further, PowerPlant X's exception throwing macros let you include a debug string. A `catch` block that receives an instance of a PowerPlant X exception class has access to this string. You can use this information to help debug your program.

NOTE	The preprocessor removes the debug string from each "throw macro" if the constant `PPX_Debug_Exceptions` is turned off.

The code example in Listing 17.1 shows typical Original PowerPlant exception handling code. In this example, the `try` block contains a PowerPlant macro that throws an `LException` instance if there is an error. The `catch` block catches a reference to an `LException` instance when a routine "below" it on the stack throws one.

Listing 17.2 shows typical PowerPlant X exception handling. The `try` block contains a debug macro that not only throws an instance of `PPx::OSError`, but also includes a debug string that is available within the `catch` block. Code in the catch block can retrieve the debug string from the caught exception object.

Figure 17.1 PowerPlant™ X Exception Handling Class Hierarchy



Example Code

Listing 17.1 Original PowerPlant™ Exception Handling Code

```
try {
  ThrowIfOSErr_(err);
} catch (const LException& inErr) {
  // exception handling code goes here...
}
```

Listing 17.2 PowerPlant™ X Exception Handling Code

```
try {
  PPX_ThrowIfOSErr_(err, "Debugging error message here");
} catch (const PPx::OSError& inErr) {
  // exception handling code goes here...
}
```

A

Converting a PPob to XML

Original PowerPlant™ stores resource information in PPob files. PowerPlant X stores this information in text files marked up with XML tags.

Before you can use an Original PowerPlant resource in a PowerPlant X program, you must convert the resource's PPob to XML with a utility named `PPobToXML`. Then you must change your source code to use the XML resource information.

The `PPobToXML` utility is in this folder:

```
InstallDir/Metrowerks CodeWarrior/Mac OS X Support
```

where *`InstallDir`* stands for the folder in which you installed your CodeWarrior product.

NOTE	`PPobToXML` cannot convert every resource it finds in a PPob file. In particular, the utility cannot handle Original PowerPlant views that have no PowerPlant X equivalent. Nor can it handle views that have custom data. For each view the utility does not recognize, it gets the view's bounds and creates a `PPx::GrayBox` in place of the unrecognized view.

Use the following procedure to convert a PPob file to XML.

Using the PPobToXML Utility to Convert a PPob to XML

To convert a PPob (or PPob's) to XML, follow these steps:

1. Drag the PPob file(s) onto the `PPobToXML` utility's icon.

   The `PPobToXML` utility creates a folder for each PPob file in the same directory as the PPob file itself. For each window processed, the utility briefly displays the window.

The name of each folder created begins with the name of its source PPob file and ends with the string “ `Views`”.

Each folder contains a separate XML file for each PPob resource in the folder’s PPob file. Each file name begins with a PPob resource ID number, followed by the PPob resource name (if any), followed by the extension `.pobj`.

For example, consider a file named `MyProgram.ppob` that contains two PPob resources. The first resource is named “Main Window” and has the ID 128. The second resource is named “Prefs Dialog” and has the ID 129.

`PPobToXML` generates this output for the file `MyProgram.ppob`:

```
MyProgram.ppob Views
  000128-Main Window.pobj
  000129-Prefs Dialog.pobj
```

2. Rename each XML file, if desired.

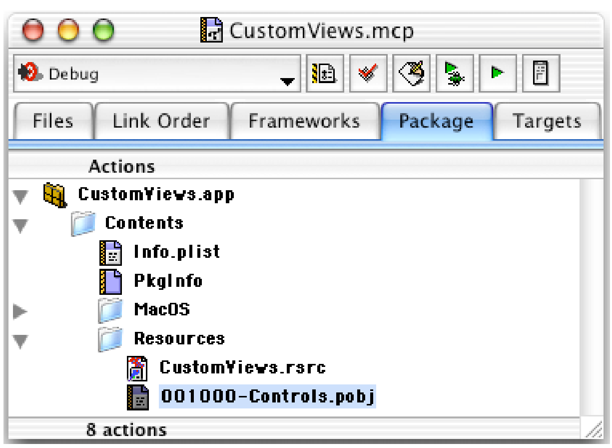
3. Start the CodeWarrior IDE.

4. Open the project in which you want to use an XML resource.

5. Click the **Package** tab of the project window.

6. Add the `.pobj` file for each resource you want to use to the `Resources` folder of the **Package** tab. See Figure A.1.

Figure A.1 A .pobj File Displayed in the Packages Tab of a PowerPlant™ X Project



7. Select **Project > Make**

   The IDE builds your project and copies each `.pobj` file listed in the **Package** tab into your program's package.

8. For items that are windows, add code to your project that creates a PowerPlant X window from the window's `.pobj` file.

   To do this, follow these steps:

   a. Open the source file in which you want to create a window.

   b. Add code like the following to the appropriate place in your program logic:

   ```
   PPx::Window* myWindow =
   PPx::XMLSerializer::ResourceToObjects<PPx::Window>
                                          (CFSTR("FileName");
   ```

   where *`FileName`* is the name of the XML file excluding the `.pobj` extension.

   c. Register the classes for all views used in the window.

   In Original PowerPlant, you use:

   ```
   RegisterClass_(LWindow);
   ```

   In PowerPlant X, you use:

   ```
   PPx_RegisterPersistent_(PPx::Window);
   ```

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