

ooRexx Documentation

ooDialog User Guide 4.2.1

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Open Object Rexx™

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Edition 1

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Preface	v
1. Document Conventions	v
1.1. Typographic Conventions	v
1.2. Pull-quote Conventions	vi
1.3. Notes and Warnings	vii
2. How to Read the Syntax Diagrams	vii
3. Getting Help and Submitting Feedback	ix
3.1. The Open Object Rexx SourceForge Site	ix
3.2. The Rexx Language Association Mailing List	xi
3.3. comp.lang.rexx Newsgroup	xi
4. Related Information	xi
1. In The Beginning	1
1.1. Getting Started	1
1.2. Visible Behavior	3
1.2.1. Adding Controls to the Dialog	3
1.2.2. Making The Controls Work	5
2. Re-Structuring the Code	7
2.1. Fixing the Structure	8
2.1.1. The "View" Component	8
2.1.2. The "Model" Component	9
2.1.3. The "Data" Component	9
2.2. Reducing Coupling	9
3. Using Resource Dialogs	13
3.1. Naming and Coding Conventions	14
3.1.1. Naming Conventions	14
3.1.2. Coding Conventions	14
3.2. Resource Scripts and Resource File Editors	15
3.3. Coding an RcDialog Class	16
3.3.1. Setting Up the Dialog Window	17
3.3.2. Specifying the Active Controls	18
3.3.3. Application Data and Function	21
4. Using Binary Resource Dialogs	25
4.1. Dialog Initiation	25
4.2. Using a Binary Resource File	25
4.2.1. DLL Compilation	25
4.2.2. Differences between RcDialog and ResDialog	27
4.3. Dialog Controls	27
4.3.1. Radiobuttons	27
4.3.2. The Numeric Edit Control	28
4.3.3. Menu Accelerators	28
4.3.4. The "About" Dialog	29
4.3.5. Minimize and Maximize Buttons	30
4.4. Code Structure	31
4.4.1. Data Types	31
4.4.2. View Data vs Application data	31
4.4.3. Multiple Dialogs per File	32
4.4.4. Externalized Strings	32
4.5. Designing a Dialog	32
4.6. Controlling Dialog Cancel	33
5. An Application Workplace	35
5.1. Program Structure	35

5.1.1. Overview	35
5.1.2. Some Implications	36
5.1.3. Application Function and Naming	38
5.2. Popups and Parents	38
5.2.1. Starting a Popup Dialog	38
5.2.2. Offsetting Dialogs	40
5.2.3. Use of Interpret	41
5.3. Icons and Lists	41
5.3.1. The Icon View	42
5.3.2. The Report View	44
5.4. Re-sizing Dialogs	46
5.5. Creating Icons	47
5.6. Utility Dialogs	48
6. A Working Application	51
6.1. Introduction	51
6.2. A Model-View Framework	51
6.2.1. MVF Objective	51
6.2.2. Using the MVF	52
6.2.3. MVF Underlying Operations	52
6.2.4. MVF Superclasses	52
6.3. The Message Sender	52
6.4. The Order Form	52
A. Dialog Attributes and AutoDetection	53
B. Testing Popups in Stand-Alone Mode	57
B.1. Stand-Alone Testing	57
B.2. Visual Offsetting	59
C. Dialog Creation Methods	61
D. Model-View Framework Internals	63
D.1. The Object Manager	63
D.2. Some Title	63
D.3. The Requires List	64
E. Notices	65
E.1. Trademarks	65
E.2. Source Code For This Document	66
F. Common Public License Version 1.0	67
F.1. Definitions	67
F.2. Grant of Rights	67
F.3. Requirements	68
F.4. Commercial Distribution	68
F.5. No Warranty	69
F.6. Disclaimer of Liability	69
F.7. General	69
G. Revision History	71
Index	73

Preface

This book provides a general user's guide to the ooDialog framework, and is a companion book to the *ooDialog Reference*. The ooDialog framework is part of the Open Object Rexx distribution on the Windows® platform. The *User Guide* discusses the general ideas needed to use the framework to its best advantage.

1. Document Conventions

This manual uses several conventions to highlight certain words and phrases and draw attention to specific pieces of information.

In PDF and paper editions, this manual uses typefaces drawn from the *Liberation Fonts*¹ set. The Liberation Fonts set is also used in HTML editions if the set is installed on your system. If not, alternative but equivalent typefaces are displayed. Note: Red Hat Enterprise Linux 5 and later includes the Liberation Fonts set by default.

1.1. Typographic Conventions

Four typographic conventions are used to call attention to specific words and phrases. These conventions, and the circumstances they apply to, are as follows.

Mono-spaced Bold

Used to highlight system input, including shell commands, file names and paths. Also used to highlight keycaps and key combinations. For example:

To see the contents of the file **my_next_bestselling_novel** in your current working directory, enter the **cat my_next_bestselling_novel** command at the shell prompt and press **Enter** to execute the command.

The above includes a file name, a shell command and a keycap, all presented in mono-spaced bold and all distinguishable thanks to context.

Key combinations can be distinguished from keycaps by the hyphen connecting each part of a key combination. For example:

Press **Enter** to execute the command.

Press **Ctrl+Alt+F2** to switch to the first virtual terminal. Press **Ctrl+Alt+F1** to return to your X-Windows session.

The first paragraph highlights the particular keycap to press. The second highlights two key combinations (each a set of three keycaps with each set pressed simultaneously).

If source code is discussed, class names, methods, functions, variable names and returned values mentioned within a paragraph will be presented as above, in **mono-spaced bold**. For example:

File-related classes include **filesystem** for file systems, **file** for files, and **dir** for directories. Each class has its own associated set of permissions.

Proportional Bold

This denotes words or phrases encountered on a system, including application names; dialog box text; labeled buttons; check-box and radio button labels; menu titles and sub-menu titles. For example:

¹ <https://fedorahosted.org/liberation-fonts/>

Choose **System → Preferences → Mouse** from the main menu bar to launch **Mouse Preferences**. In the **Buttons** tab, click the **Left-handed mouse** check box and click **Close** to switch the primary mouse button from the left to the right (making the mouse suitable for use in the left hand).

To insert a special character into a **gedit** file, choose **Applications → Accessories → Character Map** from the main menu bar. Next, choose **Search → Find...** from the **Character Map** menu bar, type the name of the character in the **Search** field and click **Next**. The character you sought will be highlighted in the **Character Table**. Double-click this highlighted character to place it in the **Text to copy** field and then click the **Copy** button. Now switch back to your document and choose **Edit → Paste** from the **gedit** menu bar.

The above text includes application names; system-wide menu names and items; application-specific menu names; and buttons and text found within a GUI interface, all presented in proportional bold and all distinguishable by context.

Mono-spaced Bold Italic or Proportional Bold Italic

Whether mono-spaced bold or proportional bold, the addition of italics indicates replaceable or variable text. Italics denotes text you do not input literally or displayed text that changes depending on circumstance. For example:

To connect to a remote machine using ssh, type **ssh *username@domain.name*** at a shell prompt. If the remote machine is **example.com** and your username on that machine is john, type **ssh john@example.com**.

The **mount -o remount file-system** command remounts the named file system. For example, to remount the **/home** file system, the command is **mount -o remount /home**.

To see the version of a currently installed package, use the **rpm -q package** command. It will return a result as follows: ***package-version-release***.

Note the words in bold italics above — *username*, *domain.name*, *file-system*, *package*, *version* and *release*. Each word is a placeholder, either for text you enter when issuing a command or for text displayed by the system.

Aside from standard usage for presenting the title of a work, italics denotes the first use of a new and important term. For example:

Publican is a *DocBook* publishing system.

1.2. Pull-quote Conventions

Terminal output and source code listings are set off visually from the surrounding text.

Output sent to a terminal is set in **mono-spaced roman** and presented thus:

```
books      Desktop   documentation  drafts  mss    photos  stuff  svn
books_tests  Desktop1  downloads       images  notes  scripts  svgs
```

Source-code listings are also set in **mono-spaced roman** but add syntax highlighting as follows:

```
package org.jboss.book.jca.ex1;
import javax.naming.InitialContext;
```

```

public class ExClient
{
    public static void main(String args[])
        throws Exception
    {
        InitialContext iniCtx = new InitialContext();
        Object ref = iniCtx.lookup("EchoBean");
        EchoHome home = (EchoHome) ref;
        Echo echo = home.create();

        System.out.println("Created Echo");

        System.out.println("Echo.echo('Hello') = " + echo.echo("Hello"));
    }
}

```

1.3. Notes and Warnings

Finally, we use three visual styles to draw attention to information that might otherwise be overlooked.



Note

Notes are tips, shortcuts or alternative approaches to the task at hand. Ignoring a note should have no negative consequences, but you might miss out on a trick that makes your life easier.



Important

Important boxes detail things that are easily missed: configuration changes that only apply to the current session, or services that need restarting before an update will apply. Ignoring a box labeled 'Important' will not cause data loss but may cause irritation and frustration.



Warning

Warnings should not be ignored. Ignoring warnings will most likely cause data loss.

2. How to Read the Syntax Diagrams

Throughout this book, syntax is described using the structure defined below.

- Read the syntax diagrams from left to right, from top to bottom, following the path of the line.

The **>>---** symbol indicates the beginning of a statement.

The **--->** symbol indicates that the statement syntax is continued on the next line.

The **>---** symbol indicates that a statement is continued from the previous line.

The **---><** symbol indicates the end of a statement.

Preface

Diagrams of syntactical units other than complete statements start with the >--- symbol and end with the ---> symbol.

- Required items appear on the horizontal line (the main path).

```
>>-STATEMENT--required_item-----><
```

- Optional items appear below the main path.

```
>>-STATEMENT---+-----+-----><  
      +-optional_item-+
```

- If you can choose from two or more items, they appear vertically, in a stack. If you must choose one of the items, one item of the stack appears on the main path.

```
>>-STATEMENT---+-required_choice1---+-----><  
      +-required_choice2-+
```

- If choosing one of the items is optional, the entire stack appears below the main path.

```
>>-STATEMENT---+-----+-----><  
      +-optional_choice1-+  
      +-optional_choice2-+
```

- If one of the items is the default, it appears above the main path and the remaining choices are shown below.

```
+default_choice---  
>>-STATEMENT---+-----+-----><  
      +-optional_choice-+  
      +-optional_choice-+
```

- An arrow returning to the left above the main line indicates an item that can be repeated.

```
+-----+  
|  
>>-STATEMENT---repeatable_item---><
```

A repeat arrow above a stack indicates that you can repeat the items in the stack.

- A set of vertical bars around an item indicates that the item is a fragment, a part of the syntax diagram that appears in greater detail below the main diagram.

```
>>-STATEMENT--| fragment |-----><
```

fragment:

```
|--expansion_provides_greater_detail-----|
```

- Keywords appear in uppercase (for example, **PARM1**). They must be spelled exactly as shown but you can type them in upper, lower, or mixed case. Variables appear in all lowercase letters (for example, **parm1**). They represent user-supplied names or values.
- If punctuation marks, parentheses, arithmetic operators, or such symbols are shown, you must enter them as part of the syntax.

The following example shows how the syntax is described:

```
+-,-----+
v      |
>>-MAX(-----number-----)><
```

3. Getting Help and Submitting Feedback

The Open Object Rexx Project has a number of methods to obtain help and submit feedback for ooRexx and the extension packages that are part of ooRexx. These methods, in no particular order of preference, are listed below.

3.1. The Open Object Rexx SourceForge Site

The [Open Object Rexx Project](#)² utilizes [SourceForge](#)³ to house the [ooRexx Project](#)⁴ source repositories, mailing lists and other project features. Over time it has become apparent that the Developer and User mailing lists are better tools for carrying on discussions concerning ooRexx and that the Forums provided by SourceForge are cumbersome to use. The ooRexx user is most likely to get timely replies from one of the mailing lists.

Here is a list of some of the most useful facilities provided by SourceForge.

² <http://www.oorexx.org/>

³ <http://sourceforge.net/>

⁴ <http://sourceforge.net/projects/oorexx>

The Developer Mailing List

You can subscribe to the oorexx-devel mailing list at [ooRexx Mailing List Subscriptions](#)⁵ page. This list is for discussing ooRexx project development activities and future interpreter enhancements. It also supports a historical archive of past messages.

The Users Mailing List

You can subscribe to the oorexx-users mailing list at [ooRexx Mailing List Subscriptions](#)⁶ page. This list is for discussing using ooRexx. It also supports a historical archive of past messages.

The Announcements Mailing List

You can subscribe to the oorexx-announce mailing list at [ooRexx Mailing List Subscriptions](#)⁷ page. This list is only used to announce significant ooRexx project events.

The Bug Mailing List

You can subscribe to the oorexx-bugs mailing list at [ooRexx Mailing List Subscriptions](#)⁸ page. This list is only used for monitoring changes to the ooRexx bug tracking system.

Bug Reports

You can create a bug report at [ooRexx Bug Report](#)⁹ page. Please try to provide as much information in the bug report as possible so that the developers can determine the problem as quickly as possible. Sample programs that can reproduce your problem will make it easier to debug reported problems.

Documentation Feedback

You can submit feedback for, or report errors in, the documentation at [ooRexx Documentation Report](#)¹⁰ page. Please try to provide as much information in a documentation report as possible. In addition to listing the document and section the report concerns, direct quotes of the text will help the developers locate the text in the source code for the document. (Section numbers are generated when the document is produced and are not available in the source code itself.) Suggestions as to how to reword or fix the existing text should also be included.

Request For Enhancement

You can suggest ooRexx features at the [ooRexx Feature Requests](#)¹¹ page.

Patch Reports

If you create an enhancement patch for ooRexx please post the patch using the [ooRexx Patch Report](#)¹² page. Please provide as much information in the patch report as possible so that the developers can evaluate the enhancement as quickly as possible.

Please do not post bug fix patches here, instead you should open a bug report and attach the patch to it.

⁵ http://sourceforge.net/mail/?group_id=119701

⁶ http://sourceforge.net/mail/?group_id=119701

⁷ http://sourceforge.net/mail/?group_id=119701

⁸ http://sourceforge.net/mail/?group_id=119701

⁹ http://sourceforge.net/tracker/?group_id=119701&atid=684730

¹⁰ http://sourceforge.net/tracker/?group_id=119701&atid=1001880

¹¹ http://sourceforge.net/tracker/?group_id=119701&atid=684733

¹² http://sourceforge.net/tracker/?group_id=119701&atid=684732

The ooRexx Forums

The ooRexx project maintains a set of forums that anyone may contribute to or monitor. They are located on the [ooRexx Forums](#)¹³ page. There are currently three forums available: Help, Developers and Open Discussion. In addition, you can monitor the forums via email.

3.2. The Rexx Language Association Mailing List

The [Rexx Language Association](#)¹⁴ maintains a mailing list for its members. This mailing list is only available to RexxLA members thus you will need to join RexxLA in order to get on the list. The dues for RexxLA membership are small and are charged on a yearly basis. For details on joining RexxLA please refer to the [RexxLA Home Page](#)¹⁵ or the [RexxLA Membership Application](#)¹⁶ page.

3.3. comp.lang.rexx Newsgroup

The [comp.lang.rexx](#)¹⁷ newsgroup is a good place to obtain help from many individuals within the Rexx community. You can obtain help on Open Object Rexx or on any number of other Rexx interpreters and tools.

4. Related Information

See also: *Open Object Rexx: Reference*

¹³ http://sourceforge.net/forum/?group_id=119701

¹⁴ <http://www.rexxla.org/>

¹⁵ <http://rexxla.org/>

¹⁶ <http://www.rexxla.org/rexxla/join.html>

¹⁷ <http://groups.google.com/group/comp.lang.rexx/topics?hl=en>

In The Beginning

The whole purpose of ooDialog is to enable ooRexx developers to provide users with a graphical user interface or "GUI". A GUI is a collection of windows and dialogs. Each contains a number of controls, such as edit controls, push buttons, list boxes, and so forth. The user keys data into controls (e.g. types into an edit control) or manipulates controls with a mouse (e.g. selects an item in a listbox). Some of these actions invoke application code which in turn makes some change to the window or dialog, or causes some other action such as data access, or both.

Before continuing, it's worth distinguishing between a "window" and a "dialog". A dialog is a stylized form of window that is familiar to most users. As dialogs have evolved they have become more useful, and can now provide the user interface function for many applications. Also, a dialog is drawn by the operating system, while drawing a normal window is mostly the programmer's responsibility. Thus producing an application needs much less programming work because the ooRexx programmer doesn't need to know or understand the low-level mechanics of drawing to the screen. In summary, dialogs now have many window functions, and are much easier to produce. And it's this that makes ooDialog a particularly useful extension to ooRexx.

There are three general areas of concern in designing an ooDialog application:

- Designing the appearance of a dialog
- Designing the desired user interactions with the dialog
- Designing the code that implements both appearance and interactions

And there are three corresponding areas of implementation concern:

- Laying out the dialog
- Implementing the actions requested by users of a dialog
- Showing the results of those actions to the user.

This document does not pretend to be a guide to best practice in the areas of design, although it tries to conform with good design principles. However, this document *does* aim to familiarize readers with the essentials of ooDialog application implementation.

So, before starting the first exercise, please make sure that you have downloaded and installed the latest versions of ooRexx and ooDialog. Please also run one or more of the samples in **Start --> All Programs --> Open Object Rexx --> ooRexx Samples --> ooDialog** to ensure that your installation works properly.

And please do use the ooDialog Reference for details on any ooDialog class, method or function mentioned in this Guide.

1.1. Getting Started

The first exercise creates and displays a blank dialog with the title "Hello World!". Try running it - it's the file **HelloWorld.rex** in the folder **C:\Program Files\ooRexx\samples\oodialog\userGuide\exercises\Exercise02** (exercise numbers map to chapter numbers). [Figure 1.1, "The "Hello World" Dialog"](#) shows what you should see.

The Command Prompt window that appears with the *Hello World* dialog can be useful for debugging, but it can be dispensed with, and later we'll find out how. For now, let's look at the *Hello World* code (excluding comments):

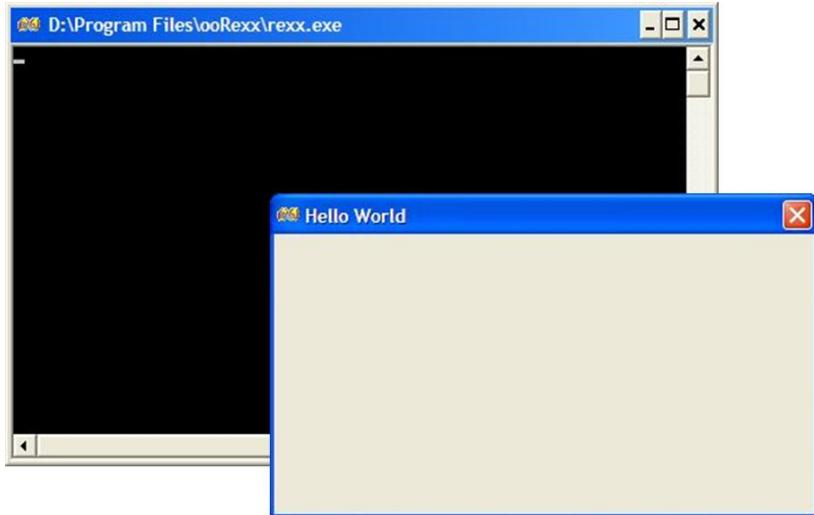


Figure 1.1. The "Hello World" Dialog

First, there's code that kicks things off:

```
dlg = .HelloWorld~new
dlg~execute("SHOWTOP", IDI_DLG_OOREXX)
```

The first statement creates an instance of the class **HelloWorld**, and assigns the instance to the variable *dlg* (the **HelloWorld** class is defined in the third part of the code). The second statement invokes the *execute* method of **HelloWorld**, and it is this that displays the dialog. The first parameter *SHOWTOP* is one of several ways of defining how the dialog is surfaced (see the ooDialog Reference for details). The second parameter states that the icon at the extreme top left of the dialog should be the normal ooRexx icon. This graphic is termed a "resource" in ooDialog, and there are a number of such predefined constants (again, see the ooDialog Reference for details).

Note that the usual naming conventions are observed: upper camel case for classes (e.g. **HelloWorld**) and lower camel case for variables (including of course instance variables - e.g. *dlg*).

Second, there's a directive to ooRexx to use ooDialog:

```
::REQUIRES "ooDialog.cls"
```

This directive allows all the classes defined by ooDialog to be accessible to our program. If this statement is absent, then the following error appears on the initiating command prompt:

```
16 -*- ::class 'HelloWorld' subclass UserDialog
Error 98 running ... Exercise02\HelloWorld.rex line 58: Execution error
Error 98.909: Class "USERDIALOG" not found
```

Note that it's **UserDialog** (the superclass for **HelloWorld**) that's not found. This is because the *::requires ooDialog.cls* statement not only says we're using ooDialog, but also provides access to all the classes provided by ooDialog.

Finally, there's the definition of the class **HelloWorld**:

```
::CLASS HelloWorld SUBCLASS UserDialog
::METHOD init
    forward class (super) continue
    self~create(30, 30, 257, 123, "Hello World", "CENTER")
```

The first line defines a class called **HelloWorld** as a subclass of the ooDialog-provided class **UserDialog** (and yet again, but finally, see the ooDialog Reference for full details). Among other things, **UserDialog** enables the programmer to define the dialog layout in code. This can get cumbersome in more complex dialogs, and later we'll meet a simpler way of defining the dialog layout.

The second line defines the *init* method of **HelloWorld**, and the third line forwards the *init* message to the superclass which then does the heavy work of creating the dialog. But why use *forward* instead of *self~init:super*? The reason is that *forward* applies not only to the method but also to all its arguments, whatever these may be. Which is exactly what's required here.

Finally, the last line sends a *create* message to *self* and hence to **UserDialog**. This method defines the "template" to be used for the dialog. The parameters are as follows:

- The first two parameters define, in "dialog units", the x and y position on the screen of the top left corner of the dialog. Dialog units (rather than pels) are used to provide device independence.
- The third and fourth parameters define the width and height of the dialog, again in dialog units.
- The fifth parameter is the dialog's title, and the last parameter - **CENTER** - is the dialog "style" (of which there are several). **CENTER** states that regardless of the first two parameters, the dialog will be positioned in the center of the screen. Styles are an important part of dialog definition. Try removing the **CENTER** parameter (and its preceding comma of course) and see what happens. Then replace the **CENTER** parameter, and (just to make sure that you've replaced it correctly) run the program again, and this time try to re-size the dialog. You can't. Then replace "**CENTER**" by "**CENTER THICKFRAME**" and re-run the program. The dialog now has a sizable border. Thus styles not only affect appearance, they can also define behavior.

With this instance of the **HelloWorld** class having been set up properly, the dialog is actually surfaced (made visible) by the *execute* message (handled by **HelloWorld**'s superclass) sent by the second statement in the program which was:

```
dlg~execute("SHOWTOP", IDI_DLG_OOREXX)
```

Now let's add some behavior to the dialog. We're going to build a "Words of Wisdom" dialog that will display words of wisdom when a button is pressed.

1.2. Visible Behavior

This section is in two parts. First we create a dialog that invites the user to press a button for more "words of wisdom" - but the button doesn't work. Second, we make the button work. In this way, we both add to the way dialogs are populated with controls, and also show how user input is handled.

1.2.1. Adding Controls to the Dialog

First, try running **Wow.rex** from the **Exercises\Exercise02** folder ("Wow" being short for "Words of Wisdom"). You should see a dialog entitled "Words of Wisdom" which is blank with the exception

Chapter 1. In The Beginning

of some (alleged) words of wisdom and two push-buttons. One of these does nothing, the other (Cancel) closes the dialog. These buttons are examples of "controls" - sometimes called "widgets" - that populate a dialog and enable both display of information and user interaction with the dialog.

Now let's look at the code. The first seven lines (excluding comments and blank lines) are essentially the same as the first seven in **HelloWorld.rex**:

```
dlg = .WordsOfWisdom~new
dlg~execute("SHOWTOP", IDI_DLG_OOREXX)
::REQUIRES "ooDialog.cls"
::CLASS 'WordsOfWisdom' SUBCLASS UserDialog
::METHOD init
    forward class (super) continue
    self~create(30, 30, 257, 123, "Words of Wisdom", "CENTER")
```

However, a *defineDialog* method has been added:

```
::METHOD defineDialog
self~createPushButton(901, 142, 99, 50, 14, "DEFAULT", "More wisdom")
self~createPushButton(IDCANCEL, 197, 99, 50, 14, , "Cancel")
self~createStaticText(-1, 40, 40, 200, 20, ,
"Complex problems have simple solutions"||.endofline||"- which are wrong.")
```

This method is invoked automatically by the superclass, and consists of three statements each of which creates a control. The first two each create a pushbutton:

- A "More Wisdom" pushbutton, which has been given the resource ID of "901" (the first parameter). Controls are identified by numbers (IDs) or, as we'll see later, by symbolic names. You can pick any number although numbers -1 and 1 through 50 are pre-defined by ooDialog. For example, resource ID "1" is an "OK" button. Resource numbers or IDs identify controls to the underlying Windows platform, and can be given in either numeric or symbolic form, as will be discussed in Chapter 3. Each control should have a different number (although there are some situations, which will be met later, where it's useful for two or more controls to have the same number). The next four parameters define the position of the button in the dialog, and the sixth ("DEFAULT") specifies that this button is to be the default action for pressing the enter key. The seventh parameter is the text shown on the button.
- A "Cancel" pushbutton, whose ID *IDCANCEL* makes this button perform the standard dialog cancel action - that is, close the dialog without saving any changes. (An OK button should save any changes made by the user, and then close the dialog - preferably with an intervening "Save changes?" message box with options "Yes", "No, and "Cancel".)

The third statement creates some static text (text that cannot be changed by the user), with the text itself as the last parameter. The first parameter is the resource number "-1" which is the pre-defined resource ID for a Static Text control (although you can use other numbers above 50 - for example if you want to distinguish between different static text controls or when you want to programmatically change the text - neither of which is a requirement here). The next four parameters define the size and position of the static text control. Last but not least is the text to be displayed. This text comprises the initial (and so far only) "words of wisdom".

Now we need to make the *More wisdom* button work, which we now do in **Wow2.rex**.

1.2.2. Making The Controls Work

First, run **Wow2.rex**. When you click the *More wisdom* pushbutton, you see different text appearing in the center of the screen, replacing the previous text. By the way, you'll also see debug information appear on the command prompt each time you click the *More wisdom* button - there's a "say" statement in the code that's not mentioned here, but you can easily find it. The real question at the moment is: how do we create the pushbutton's visible behavior?

When a control is actioned by a user (e.g. pressing a pushbutton), we need some way in the program of kicking off a method that provides a visible response. Remember that a key principle of UI design is that of least astonishment: if the user is astonished by what the computer is doing in response to a wholly innocent user interaction with some UI widget, then that principle is breached. Of course, astonishment can be pleasant or unpleasant; and if you can create ooDialog GUIs which *pleasantly* astonish their users, then you probably don't need to read this Guide.

In ooDialog, there are a number of ways of connecting a user action to a method. Now ooDialog depends on the underlying Windows GUI software infrastructure, so a user action is actually signaled by that infrastructure, and ooDialog connects that event to a method in the ooRexx dialog object. So the source of the event (the user action) is not ooDialog. This means that if you want to capture a user action that the Windows infrastructure doesn't capture (for example hovering the mouse over an edit control), then there's no way ooDialog can do it either.

Having said that, one of the simplest ways of having a user action connected to an ooRexx method is by supplying the name of the method as a parameter of the actionable widget. And, since a pushbutton control provides for just such an approach, that's what we'll do here. The first lines of code in **Wow2.rex** - down to the *defineDialog* method - are almost identical to those of **wow.rex**, with two significant changes. The method is as follows:

```
::method defineDialog
    self~createPushButton(901, 142, 99, 50, 14, "DEFAULT", "More wisdom", OkClicked)
    self~createPushButton(IDCANCEL, 197, 99, 50, 14, , "Cancel")
    self~createStaticText(101, 40, 40, 200, 40, , "Click 'More wisdom'")
```

The two significant changes are as follows. Firstly, the statement *self~createPushButton* has an additional parameter *okClicked*. This is the name of the method that is automatically invoked by ooDialog when the user clicks on the *More wisdom* pushbutton. Secondly, the statement *self~createStaticText* has the ID 101 rather than -1 since we want to have the text changed when the "More Wisdom" button is pressed. Also, the space for text to be displayed has increased from 20 to 40, and the initial text has been changed to "Click 'More wisdom'".

However, the major change to the program is the new *okClicked* method that picks a "words of wisdom" text and displays it. Pseudocode for this method is as follows:

```
Method okClicked
    Create array 'arrWow' and add a 'words of wisdom' text strings to each of seven
    array elements.
    Create an object representing the static text field
    Pick a "words of wisdom" text randomly from 'arrWow'
    Show that text in the static text field.
    return
```

Have a look at the code that implements this method in **Wow2.rex**. Note that the penultimate pseudocode statement above - "show that text in the static text field" - is implemented in two steps.

Chapter 1. In The Beginning

First the statement `newText = self~newStatic(101)` creates an object that represents the static text control, the resource number 101 defining the control to be represented. Second, that object is used to change the control's text in the statement `newText~setText(arrWow[i])`.

Finally, you may ask why a full code listing is not shown here. The reason is that I'd really rather not. Why not? Doesn't it work? Well, yes, the code works OK. But the design is not good. Aside from performance considerations (the code creates and populates a new array each time the button is clicked), there is absolutely no separation of design concerns. And this is arguably the most important thing for any application - especially one with a GUI. There are three important areas of design concern - UI display and interaction, the "business" that the dialog performs (here the business of selecting the text), and the provision of persistent data (here the seven strings comprising the "words of wisdom"). But we'll start to fix this in the next chapter.

Re-Structuring the Code

The current code is not good. It works - but only because it's very simple. The problem is its design - its structure. There are three quite different concerns which, for all but the simplest of programs, should be separated. These are: the user interface (aka UI or GUI) including both presentation and user action; the data (in our case a set of text strings); and the "business" concept that we're implementing. And the "business" of this code is picking a single text string from a set of "words of wisdom" strings. The code in the **Exercise03** folder separates these concerns, with no change as far as the user's concerned.

The three areas of concern have a relationship with the Model-View-Controller or MVC concept (see [Model-View-Controller](#)¹). However, the role of the Controller in classic MVC is handled largely by ooDialog and the underlying Windows UI platform. This leaves us with the View and the Model, where the Model is the "business" - that is, an implementation of the relevant part of the real business - and the View is the part that provides for user interaction. But these two concepts - View and Model - are insufficient. To these two must be added data - that is, data-on-disk (aka "persistent data"). So three areas of concern are required: View, Model, and Data.

At this point, the reader may wish to skip the next three paragraphs which provide a rationale for the View-Model-Data terminology, and introduce the concept of software "components". However, please come back here if later the use of the term "component" is not obvious.

While the model-view-data scheme works well for the PC-resident single-user applications introduced in this Guide, it does not scale to distributed systems with multiple concurrent users where, aside from anything else, the data is on a remote server or available from a remote service. For such systems, additional architectural concepts are required. See, for example, chapters 1 and 2 of "Enterprise Service Oriented Architectures" by McGovern, Sims, Jain & Little; or "Business Component Factory" by Herzum & Sims. Dealing with large-scale distributed systems, both of these references use the terms "user", "workspace" and "workspace-resource" instead of "view", "model" and "data". Although the semantics are identical, this document uses the latter terms since they are both simpler and shorter.

Model components implement the essence of an application. Views enable the user to take action and see the result. Data components know where the data is, and handle the mechanics of reading and writing to disk. (For distributed multi-user applications, the Model would invoke some service on a back-end server, where there would probably be another kind of Model component which in turn would use a separate Data component that accesses a corporate database or remote service).

But why use the term "component" instead of "class"? The answer is (as will be seen in later exercises) that for industrial-strength apps, a component generally consists of a number of classes. And a single class can seldom be independently "plugged in" to a runtime environment without the other classes required fully to implement a single business concept in its View, Model or Data role. A component, however, is intended to be "pluggable" into the runtime, since it is all and only the implementation of one of the "view", "model", or "data" aspect of a business concept. This distinction between class and component is not so obvious using ooRexx as it is with compiled languages, where classes are seen by the developer in source code, but the artifact that is loaded into the runtime is a compiled *.exe or *.dll. Thus one of the purposes of a component is to extend the concept of low coupling and high cohesion into the runtime. Finally, the name given to the set of "view", "model" and "data" components that implement a given business concept such as "Customer" is "Business Component". The interface of a Business Component is defined as the interface of the "model" component.

¹ <http://en.wikipedia.org/wiki/model-view-controller>

Let's now look at the implementation of each of these three areas of concern. In the second part of this chapter, we'll further reduce coupling.

2.1. Fixing the Structure

First, re-run **Wow2.rex** in the **Exercise02** folder, and then run **Wow3.rex** from the **Exercise03** folder. To the user, they're identical. However, in **Wow3.rex** the code has been re-structured so that there are now three different classes, each implementing one of the three areas of concern. We'll look at each class in turn, but first here's a whiteboard-level picture of how the three classes interact to produce a "words of wisdom" string on the screen.

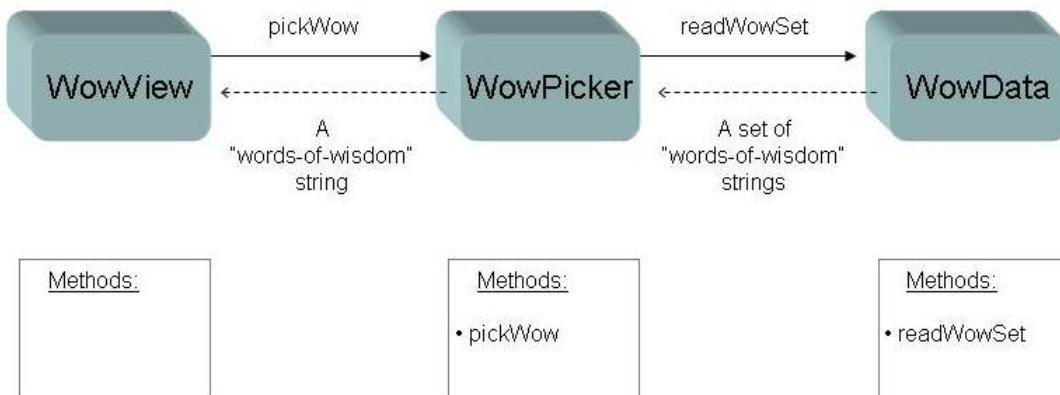


Figure 2.1. Exercise03 Structure

Now look at the **Wow3.rex** code. It consists of the three classes shown in the diagram: **WowView**, **WowPicker**, and **WowData**. "Wow" in the names is short for "words of wisdom".

2.1.1. The "View" Component

The **WowView** class implements the UI area of concern (it's a single-class component). The `init` method is identical to that of Exercise02's **Wow2** except that it also creates an instance of **WowPicker** called (unsurprisingly) `wowPicker`. There's also an `expose` statement to make the `wowPicker` object available to other methods.

The `defineDialog` method has not changed. But the `okClicked` method is different - and much shorter:

```

::method okClicked
expose wowPicker newText
wow = wowPicker~pickWow
newText~setText(wow)
return
    
```

To get the "words of wisdom" to display, it now merely asks `wowPicker` for a string to display.

One other change is that instead of creating a new static text control every time the button is pressed, the control is created once in the new `initDialog` method and re-used in the `okClicked` method. The `initDialog` method is called automatically by `ooDialog` after the dialog has been created in order to allow controls to be initialized (the "init" in "initDialog" stands for "initialize").

In summary, all knowledge of picking a string, and of the set from which to pick, has been exported elsewhere. The **WowView** class now addresses only the areas of GUI display and GUI interaction. This is crucially important. A good way to make a complex task hopelessly complicated is to mix "model" and "data" concerns with the "view" concerns.

2.1.2. The "Model" Component

The class implementing the model component - **WowPicker** - is very simple:

```
::METHOD init
    expose wowSet
    dataSource = .WowData~new
    wowSet = dataSource~readWowSet
    return

::METHOD pickWow
    expose wowSet
    i = random(1,7)
    return wowSet[i]
```

The *init* method gets a reference to an instance of the class **WowData** - which handles the data area of concern - and then gets a set of Words of Wisdom into the array variable *wowSet*. Then in the method *pickWow* a Words of Wisdom string is picked randomly from *wowSet* and returned.

2.1.3. The "Data" Component

The last (extremely simple) class in **Wow3.rex** is **WowData**. In its *init* method, it loads up an array of seven text strings into the instance variable *arrWow*, and in its *readWowSet* method returns that array to the caller. One can see how this it might be enhanced, for example by providing a method that renews the set of "words of wisdom" from a larger set in a disk file. But that is nothing to do with ooDialog, so we'll leave it as it is.

2.2. Reducing Coupling

The three classes in **Wow3.rex** are reasonably decoupled: the dialog is in one class, the business logic (such as it is) in another, and the data in a third. Notice however that both **WowView** and **WowPicker** create a reference to another class (**WowPicker** and **WowData** respectively) in order to invoke them. Each of these three classes can be called a "main" class, since each is the main (and in this case only) class implementing a separate area of responsibility. In more complex applications, each component (area of responsibility) will have one main class and a number of subsidiary classes - for example, a (main) SalesOrder class with subsidiary OrderLine and DeliveryInstructions classes. The intent of a component is to be, as much as possible, a self-contained unit of business function.

Now, when considering more complex applications, it is arguable that it is not the responsibility of either class to know about the creation of instances of other classes. Later we will see that, for each important business concept (such as SalesOrder, Customer, or Product), each component (view, model, and data) will have a number of classes, and each will have one main class expressing the core of the business concept. If these three kinds of component are to be as independent as possible, then each should know as little as possible about the others. Such independence is usefully enhanced if a way is found to move the knowledge of how to get references to the main classes to a fourth area. And there is just such an area - the application.

Chapter 2. Re-Structuring the Code

In ooDialog programs, there is often a block of code at the beginning of the program file that kicks off a dialog by instantiating an ooDialog class. From there, all the behavior is in the dialog classes. This "kick-off" block of code can be used to reduce coupling by pre-instantiating the main classes, and storing the object references in `.local`. Thus no main class has to know how to instantiate any other main class. But, when a main class gets the object reference for another main class instance, doesn't the first class have to know the correct name of the object reference in `.local`? Well, yes, but even that could be fixed - for example by providing a business-oriented instance reference such as Customer Number, and having some third party object handle the instantiation.

An example of decoupling the three areas of concern is provided in the **Exercise03** folder. Try running **Startup.rex**. It behaves exactly as **Wow3.rex** does. However, the code is now structured into four *.rex files: **Startup**, **WowView**, **WowModel**, and **WowData**. The code in **Startup.rex** is very simple:

```
.local~my.idWowData = .WowData~new
.local~my.idWowPicker = .WowPicker~new
dlg = .WowView~new

.local~my.idWowData~activate
.local~my.idWowPicker~activate
dlg~activate

::REQUIRES "WowView.rex"
::REQUIRES "WowModel.rex"
::REQUIRES "WowData.rex"
```

The first three statements create the three classes, with the ids of the first two being stored in `.local`. Creation of the dialog is done by the third statement (`dlg = .WowView~new`). The next three statements send an *activate* message to each of the three classes. This is because when dealing with complex applications with "main" classes (each in their own component), it is very useful to distinguish between two kinds of class setups: firstly the technical creation of a class (done by invoking the *init* method), and secondly the setup of various required application-related things (done by invoking an *activate* method).

Notice that **WowView**'s *init* method returns to the caller. The *activate* method, on the other hand, does not return until the dialog is closed. This is because the statement that actually surfaces the dialog - `self~execute("SHOWTOP", IDI_DLG_OOREXX)` is the last statement in **WowView**'s *activate* method. And once the dialog is surfaced using **SHOWTOP**, control only returns to the application (that is, to **Startup.rex**) when the dialog is closed (although, as will be discussed later, there are ways to return control much sooner).

But why move the `self~execute("SHOWTOP")` statement into the *activate* method of the **MyDialog** class? After all, it would work just as well if it were the last statement in the **Startup** file. The reason is that the business of surfacing the dialog window is arguably not that of the application; rather it's the business of the dialog class. Thus the application is reduced as much as possible to a simple "kickoff" script, while the real work is done by the classes that are kicked off.

There is, however, one important consequence of this move. Since the `self~execute("SHOWTOP")` statement does not return until the dialog is closed, the method blocks on this statement, and there is potential for a hang. In **Wow3.rex**, this statement was at the end of the "application" part of the program, and as there was nothing after it, the block didn't matter. But refactoring the classes into different files has moved it to the *activate* method of **WowView**. This introduces a concurrency issue. If not dealt with, then when the user clicks the *More wisdom* button, the *okClicked* method can not run until the *activate* method ends - that is, until the user closes the dialog window - a real catch 22, where the result is that no words of wisdom will appear.

The reason **WowView** works is because its *activate* method has the *unguarded* option specified on its method statement. Try commenting "UNGUARDED" out and running the exercise without it.

As a general rule, event handling methods such as *okClicked* should be unguarded. Indeed, **WowView** runs happily if the "unguarded" option is moved to the *okClicked* method statement - or indeed if it's on both method statements.

In the next chapter, we leave "words of wisdom", and start building a more realistic application.

Using Resource Dialogs

In this chapter, we start to build components of the eventual sample application. The completed application will be a rather simplistic sales order processing application, and will look something like this:



Figure 3.1. The Sales Order Management Application

The purpose of this application is to provide a vehicle for exploring various ooDialog concepts and facilities, and this chapter addresses the use of "resource files" in the context of a "View" component called "CustomerView" - that is, a view of a customer.

Designing what a dialog will look like on the screen involves positioning and sizing various controls such as edit fields, lists, buttons, menus, etc., as well as defining how the window itself will appear. The resulting set of control and window definitions is called a "resource definition" or "dialog template". A file that contains a dialog template is called a "resource file". There are two kinds of resource file: a "resource script file" that's human-readable with (say) Notepad, and a compiled "binary resource file".

ooDialog provides two classes that read their dialog template from a resource file: **RcDialog** and **ResDialog**. The former gets its resource template from a resource script file, the latter from a compiled binary resource file (a dll). This chapter addresses the use of **RcDialog**; the next chapter discusses **ResDialog**.

The easiest and arguably the best way to define the layout of a dialog template is to use a "resource editor". A resource editor is a "wysiwyg" (what you see is what you get) development tool that allows a developer to design a window layout visually. The output is a resource file. This avoids the sometimes tortuous effort of laying out the dialog programmatically. Although using a resource editor is certainly not the be-all and end-all of ooDialog programming, it's very useful for getting started quickly, and is the recommended way to define ooDialog window layouts.

The vehicles for exploring resource files will be the Customer View and (in the next chapter) the Product View parts of the sample application. Although simplistic, these parts of the eventual order management application are sufficiently complex for some naming and coding conventions to be useful, and the next section describes these conventions. Then the use of a resource script is introduced in the context of the "CustomerView" dialog. Finally, the three major parts of a dialog are discussed.

3.1. Naming and Coding Conventions

3.1.1. Naming Conventions

Readers may prefer to skip this section, at least for the time being, and go straight to Resource Scripts and Resource File Editors ([Section 3.2, "Resource Scripts and Resource File Editors"](#)).

In Chapter 3 there was a brief discussion about separation of concerns into three areas: the UI including both presentation and user action, the "business" or rather the "model" of the business, and accessing data. From here onwards, this approach becomes an important convention for the structure of the sample Order Management application. Essentially we adopt a "component" approach to the application. Thus the "customer" concept is implemented by three "main" classes: **CustomerView**, **CustomerModel**, and **CustomerData**. That is, the naming convention used to distinguish between the three different kinds of "main" classes is to provide one of the suffices "View", "Model", or "Data" to the class name. Each of these main classes is a component in its own right, as opposed to subsidiary classes such as an "address" class used within a Customer View main class. Such subsidiary classes are generally included in the same file as the main class (but in cases where several main classes use the same subsidiary class, they are usually stored in a separate file). The name given to the group of main classes that contribute to a single important business concept such as "customer" is "business component". Thus in the sample application, CustomerView, CustomerModel and CustomerData are three "main" component parts of the "Customer Business Component". (By the way, the interface of a business component is generally the interface of the Model main class). So - components can be made up of other components.

Normally, each main class (plus any subsidiary classes) would be in its own file. However, since the focus is on View components, the Model and Data components are placed in a single file, called **xxxModelData.rex**, where "xxx" is the business component name such as "Customer".

By the way, in real-life systems there would probably be four parts to a concept such as "Customer" - a view and a user-oriented model both supporting the user, and, supporting multiple concurrent users on a server or back-end system, a business-oriented "model" plus a data part that accesses the corporate database. Also by the way, in real-life supply chain management applications, addresses are typically treated as separate entities rather than being lumped in with such concepts as Customer, Employee or Supplier.

Finally, variables often have a prefix that indicates what the variable is. For example, an edit control that holds a customer number would be named **ecCustNo**, the **ec** being short for "edit control". And a data-only class such as an address is prefixed by **bt** for "business type"; so an address class would be named **btAddress**.

3.1.2. Coding Conventions

The following coding conventions are used in the exercise code. First, ooRexx directives and options are capitalized. Second, classes, methods, and routines are separated from each other by dotted or solid lines which in some editors are displayed in a different color from the executable code. This provides visual separation of methods and classes which is useful in larger programs. Third, camel case is used for variable names, with class names having their first letter capitalized. Finally, when an ooRexx program in one of the exercises is run, comments produced with an ooRexx "say" instruction may appear in the command prompt window. The format used as a prefix for such comments is **class-method-nn** - a little excessive for simple single-class programs, but useful for larger multi-class applications.

3.2. Resource Scripts and Resource File Editors

Our first foray into the sample Order Management application is to examine a simple Customer View component built using a resource editor.

But which resource editor? Well, if you happen to have Microsoft's development kit, you'll find it has a resource editor. Alternatively, there are a number of fee and free resource editors available on the web. The author of this Guide happened to use a freeware product called "ResEdit", available from this link:

[ResEdit Home Page](http://www.resedit.net/)¹

Occasional hints about ResEdit usage will appear from time to time. In addition, comments about the use of resource file editors will assume ResEdit, and may well be inapplicable to other resource editors. If you plan to use ResEdit, please be aware that a number of Microsoft header files are required. These can be obtained at no charge from Microsoft Windows SDK under "Developer Tools" at this link:

[Microsoft Windows Software Development](http://msdn.microsoft.com/en-us/windows/bb980924)²

Or do a web search for "microsoft windows sdk". The header files should be downloaded into a folder, and the full path name of that folder must be specified to ResEdit in "Options - Preferences - General - Include paths".

A resource file editor outputs a window layout to a "resource file", which ooDialog can then use to lay out controls on a dialog automatically. There are two kinds of resource file: a human-readable file with the extension ".rc" (and sometimes ".dlg"), and a binary (compiled) file with the extension ".dll".

Locate the folder **Exercise04**, and run **Startup.rex**. You see a "Customer" dialog. Explore the menu and behavior of this dialog. Note the following:

- A number of comments appear on the console; ignore them for the time being.
- The title bar (the blue bar right at the top of the dialog window) shows the string "*CustomerName*" rather than the Customer's name, suggesting that the programmer has either made an error or (as in this case) has left a marker for future modification.
- Edit controls are shown grayed out or "disabled" - that is, not editable.
- The "Action" menu has four items.
- One button - "Record Changes" is disabled, the other is not.

Make sure you exercise the menu items and buttons to explore the dialog's behavior. You'll find that some expected behavior is not implemented, and results in a message-box - for example "The 'Print...' menu item is not yet implemented.". Note also the tab order - that is, the order of controls reached as you press the tab key. This is defined by the sequence in which controls appear in the *.rc file. If the tab order is not as you'd like it, you can edit the *.rc file with NotePad (or some other text editor) and use cut-and-paste to achieve the desired tab order.

By the way, note that the menu item "Last Order" and the pushbutton "Show Last Order" should produce the same result, but they don't. This is nothing more than a development trick to check whether the right event-handler is invoked by the right control. An alternative is to use a say instruction. And, of course, a given function should use a single method, no matter how many different ways it's invoked.

¹ <http://www.resedit.net/>

² <http://msdn.microsoft.com/en-us/windows/bb980924>

Chapter 3. Using Resource Dialogs

Now double-click the file **CustomerView.rc** in the **Exercise04a** folder. The file should open in ResEdit (or your own preferred resource editor). In the ResEdit "Resources" window, click on **IDD_CUST_DIALOG** and the dialog layout tool opens, looking like this:

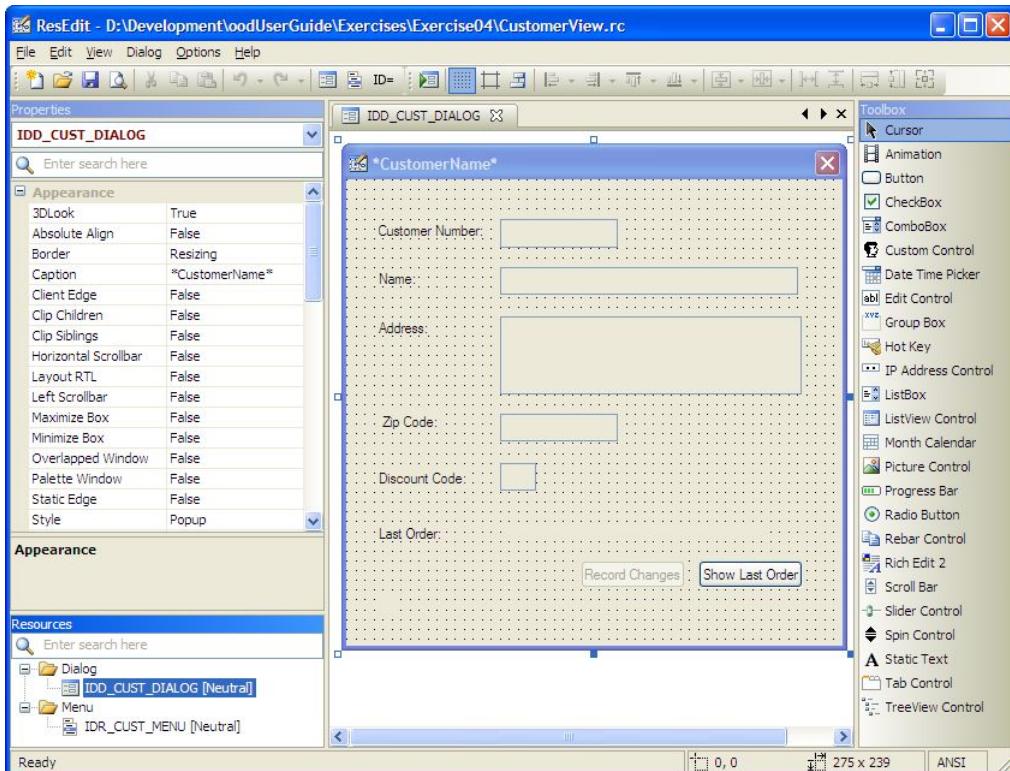


Figure 3.2. A Resource Editor

You might move or re-size some of the controls, save the file, then re-run to see your changes implemented. Check the files in the **Exercise04** folder. The files needed by ooDialog to create the window are **CustomerView.rc** and **CustomerView.h**. Both of these are generated by the resource editor. Why two files? Well, names for resources in the .rc file are intended to be reasonably comprehensible - e.g. IDC_CUST_EDT_CUSTNO. But Windows requires resources at run-time to be identified by numbers. The mapping between resource names and resource numbers is done in the .h file. (ResEdit tip: to cause the .h file to be named the same as the .rc file, on the menu bar select Options - Preferences - Code Generation - Files, then set the "Header file name" to "%barefilename %.h".)

Finally, a hint from hard experience. Some resource editors have been known, very occasionally, to assign the same ID number to two different controls in the .h file, or to omit a resource from the .rc file. So, if some error occurs which, on re-checking the code, seems inexplicable, it could be worth checking the .h file to see whether the same number has been assigned to two symbolic IDs. If so, you can try hand-editing the .h file then re-starting the resource editor. If the .h file looks OK, then you might check the .rc file to see if all the resources are there.

3.3. Coding an RcDialog Class

Having discussed coding conventions and resource editors, this section now looks in detail at the code in the **Exercise04** folder. First, look at **Startup.rex** in an editor. Aside from creating and activating **CustomerData** and **CustomerModel** classes in the same way as in the previous exercise, there's only one other executable statement: *call startCustomerView*. This routine is in the **CustomerView.rex** file (it's generally good practice to separate application startup concerns - such as (in this case) creating new dialogs - from the various working parts of the application).

Now look at **CustomerView.rex** in an editor. Look for the **CLASS** statement:

```
::CLASS "CustomerView" SUBCLASS RcDialog PUBLIC
```

CustomerView is a subclass of the ooDialog built-in class **RcDialog**, which gets its dialog layout from a resource script file that is human-readable (using a text editor). **RcDialog** is one of two important ooDialog classes that use resource scripts; the other is **ResDialog**, which uses a binary (compiled) resource file as illustrated in the next chapter. More information on resource files can be found in the ooDialog Reference.

View classes can be seen as consisting of three major parts: setting up the dialog window, specifying the "active" controls (i.e. controls that need to be accessed programmatically), and handling the application data and function. Let's look at each of these in the context of **CustomerView.rex**.

3.3.1. Setting Up the Dialog Window

When you ran **StartUp.rex**, there were an initial set of comments displayed in the command prompt window, as follows:

```
StartCustomerView Routine-01: Start.
CustomerView-init-01.
CustomerView-createMenuBar-01.
StartCustomerView Routine-02: dlg-activate.
CustomerView-activate-01.
CustomerView-initDialog-01.
CustomerView-getData-01.
CustomerModel-query-01.
CustomerData-getData-01.
CustomerView-showData-01.
```

These comments trace the process of establishing the dialog to the point of making the dialog visible and getting the application data to display - in other words, setting up the dialog. One routine and seven methods of **CustomerView** are involved, as follows:

1. First, the routine (at the end of the **CustomerView.rex** file) uses the **.Application** class to set application defaults in the statement **.Application-setDefaults(...)**. The first parameter - "O" for "only" - specifies that only the *.h file provided as the second parameter is to be used for symbolic IDs. The IDs in this file are added to the application's global constants directory (aka "globalConstDir"). The third (optional) parameter turns autoDetection off. Try commenting out this third parameter to see the result of leaving autodetection switched on (which is the default). Also, see [Appendix A, Dialog Attributes and AutoDetection](#) for a discussion of what autodetection is and where it may be useful.

The routine then creates an instance of the **CustomerView** class as a subclass of **RcDialog**.

2. In the *init* method of the new view instance, first the superclass is invoked (this is an ooDialog requirement), and then the *createMenuBar* method is called. Note that if the menubar creation fails (i.e. returns **false**), then arguably the dialog should not be created. In this case, *initCode*, which is an attribute of the **.Dialog** class, should be set to a non-zero value. This attribute represents the success of initialization of a dialog object. After the *init* method of the **RcDialog** superclass has executed, *initCode* will be zero if the dialog initialization detected no errors, but will be non-zero if initialization failed or an error was detected.

3. The `createMenuBar` method creates a menubar (in this case an instance of the `.ScriptMenuBar` class) that specifies the name of the `*.rc` file and also the menubar's symbolic ID in both the `*.h` file and the `*.rc` file. Note that after creation, the menubar is just another object, and is not yet associated with the dialog. The code at this point boldly assumes that the menubar instance was successfully created (not really best practice) and returns to the `init` method and from there back to the ...
4. ...**StartCustomerView** routine, which invokes the dialog's `activate` method.
5. The `activate` method issues **SHOWTOP** to the view's superclass, which then sends itself an `initDialog` message.
6. The `initDialog` method attaches the menubar to itself (that is, to the dialog instance). The remainder of the method specifies the active controls (addressed in the next section), and finally invokes the `getData` and `showData` methods.

The above sequence may seem a little heavy just to show a dialog. But much of it is concerned not only with getting the data to show in the dialog's controls, but also with providing for the user to modify that data. Focusing only on what is required to display the dialog with no data, then the process requires only four methods and a total of 20 ooRexx statements including the `::Method` statements but excluding the `say` instructions. And if we didn't care too much for effective program structure or error checking, it could be squished down to just ten instructions as follows:

```
::ROUTINE startCustomerView PUBLIC
    .Application-setDefaults("0", "CustomerView.h", .false)
    dlg = .CustomerView-new("customerView.rc", IDD_CUST_DIALOG)
    dlg-activate
::CLASS CustomerView SUBCLASS RcDialog PUBLIC
    ::METHOD init
        forward class (super) continue
        self-execute("SHOWTOP")
    ::METHOD initDialog
        menuBar = .scriptMenuBar-new("CustomerView.rc", IDR_CUST_MENU, , , .true)
        menuBar~attachTo(self)
```

And if the `::class`, `::method`, and `::routine` directives are excluded, only six statements are required: defining `CustomerView.h` as the `*.h` file, the `.CustomerView-new` to create a dialog instance, the call to super in the `init` method, issuing `execute("SHOWTOP")`, creating a menubar, and attaching the menubar to the dialog.

In other words, dialogs of significant complexity can be created and displayed with only six executable statements. And *that* is the real power of resource dialogs.

3.3.2. Specifying the Active Controls

An "active control" is a control that requires behavior to be programmed, while a "passive" control (such as text that never changes) appears only in the resource file, and is of no concern to the program. The behavior associated with an active control is of two kinds: outbound or program-to-screen - i.e. providing the user with information; and inbound or keyboard/mouse-to-program - i.e. signaling the program about a user event. Outbound behavior means changing the state of a control - for example, disabling a pushbutton, or displaying text in an edit control. Inbound behavior is a user event that requires the program to take some action - e.g. the user selects a menu item, or clicks a pushbutton. Much inbound behavior is ignored by the program (e.g. the user placing the cursor in an edit control). For both inbound behavior that is relevant to the program, and also for outbound behavior, the relevant controls must be made available to the programmer as ooRexx objects.

Now controls are actually created by Windows, based on information in the resource file, with each control being created and managed by facilities built into the Windows operating system. However, the ooRexx programmer accesses controls via instances of ooDialog classes, so that each control on a window is represented by an ooRexx object in the ooRexx dialog code that serves as a proxy for the underlying Windows control. And it is ooDialog that creates the required link between such ooRexx objects and the underlying Windows controls - and hence between the ooRexx object and the visible controls on the screen. This is illustrated in the following diagram

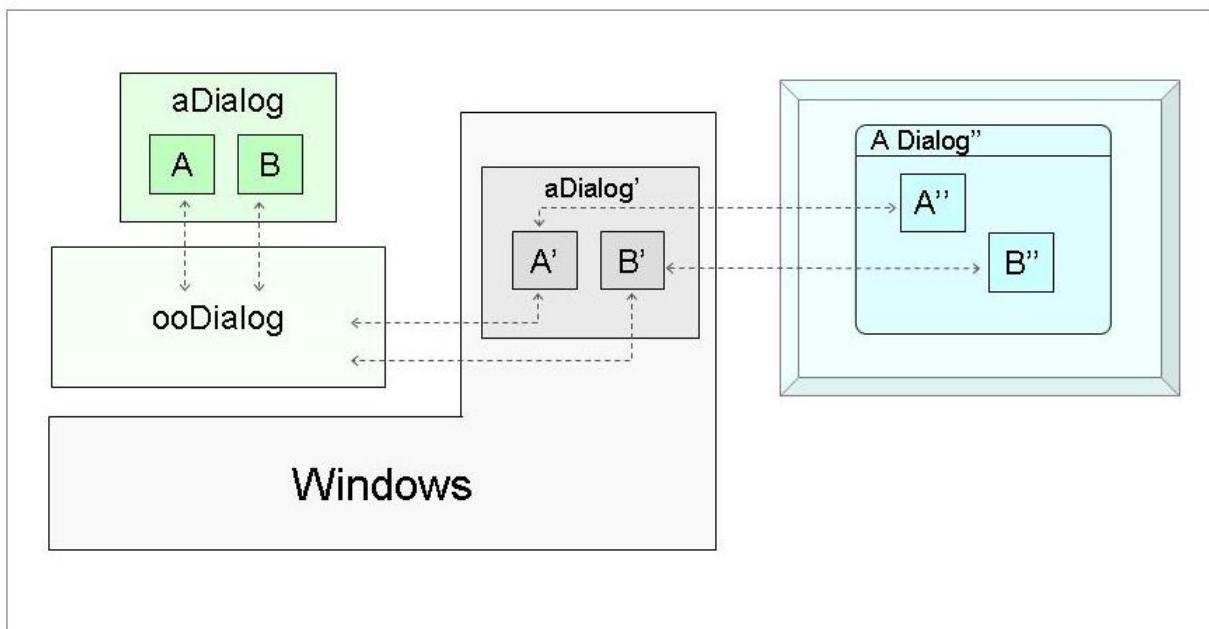


Figure 3.3. ooRexx Proxy Controls and Real Windows Controls

In the diagram, A and B are the ooRexx proxy controls in an ooRexx dialog instance (aDialog). When the dialog is to be displayed, ooDialog communicates with the Windows runtime and directs it to create a native Windows dialog (aDialog'), complete with controls A' and B'. This is known as the "underlying dialog" (see the ooDialog Reference). Windows then displays this dialog on the screen (A Dialog''), where the controls (A'' and B'') are visible to the user. From then, any user interaction with the visible dialog goes between the screen and the underlying dialog. Of course, ooDialog hooks into these interactions, and makes them available to the ooRexx dialog (e.g. by invoking its event handler methods). By the way, and rather obviously (but we'll say it anyway), this means that ooDialog cannot provide any GUI function that is not already provided by the underlying Windows facilities.

To manage controls, ooDialog provides an ooRexx class for each control type. The link between an ooRexx proxy control and the corresponding control in the underlying dialog is created via the control's symbolic ID in the **.rc** and **.h** files. Creating the ooRexx control proxies is typically done in the *initDialog* method. In the **CustomerView** code for example, in order to display the Customer Number in an edit control (outbound active behavior) an ooRexx proxy is created in the *initDialog* method as follows (where *custControls* is a directory object that makes the *expose* statements shorter):

```
custControls[ecCustNo] = self->newEdit("IDC_CUST_EDT_CUSTNO")
```

The item associated with the index *ecCustNo* is the proxy ooRexx object for the Windows edit control that will contain the customer number; *self* is the dialog instance; *newEdit* is the method of the Dialog Object (see the ooDialog Reference) that creates the ooRexx proxy for the underlying Windows control; and *IDC_CUST_EDT_CUSTNO* is the control's symbolic ID from the **.h** file. After execution of

Chapter 3. Using Resource Dialogs

the statement, `custControls[ecCustNo]` is an instance of the `ooDialog Edit` class (that is, an instance of the proxy edit control), and `ooDialog` has made sure, in the instance's creation, that it is internally linked via the underlying dialog to the edit control on the screen identified in the .h and .rc files as `IDC_CUST_EDT_CUSTNO`.

To avoid tedious repetition, from now on this document will assume an understanding of the relationship between an ooRexx proxy instance and the instance in the underlying dialog.

A number of other outbound active controls are created in the `initDialog` method - as many as there are fields on the dialog that need to have data placed in them when the dialog opens. In addition, a "Record Changes" pushbutton proxy is created so that the button can be enabled (outbound active behavior) when a user chooses the menu option "Update..." (inbound active behavior).

After this, the following statement appears:

```
self~connectButtonEvent("IDC_CUST_BTN_RECORDCHANGES", "CLICKED", recordChanges)
```

This is an example of specifying an "event handler" (inbound active behavior). Suppose the user presses the "Record Changes" button. The Windows runtime signals the event, which `ooDialog` picks up. The above statement declares that this event - i.e. that the pushbutton identified in the .h file as **IDC_CUST_BTN_RECORDCHANGES** has just been **CLICKED** - will invoke the `recordChanges` method. In other words, the statement defines `recordChanges` as the event-handling method for the "Record Changes" pushbutton. The same is done for the "Show Last Order" pushbutton, where the event handler is specified to be the method `showLastOrder`.

Notice that each of the event handler methods are specified as **UNGUARDED**. In general, an event handler should be unguarded to preclude the possibility that some guarded method in the dialog object is executing at the time the event notification is generated. For further information, see the `ooDialog` Reference. Note also that event-handling methods must be PUBLIC, since they are invoked from outside the ooRexx dialog class by the underlying `ooDialog` code (and of course an ooRexx method is public unless PRIVATE is specified).

Specification of active controls is generally done in the `initDialog` method. Indeed, in the **CustomerView** class, specification of active controls occupies most of this method.

Note that menubar actions are not specified. This is because the menu items in **CustomerView.rex** are "auto-connected" (see "Menu Command Event Connections" in the `ooDialog` Reference). Auto-connection is specified in the last parameter of the following `.ScriptMenuBar~new` statement in the `createMenuBar` method:

```
menuBar = .ScriptMenuBar~new("CustomerView.rc", "IDR_CUST_MENU", , , .true)
```

Setting this parameter to **.true** (the default is **.false**) specifies that all menu items will be connected automatically to a method with the same name as the visible caption or text. In **CustomerView.rc** the "Actions" sub-menu is:

```
MENUITEM "New Customer...", IDM_CUST_NEW
MENUITEM "Update...", IDM_CUST_UPDATE
MENUITEM "Print...", IDM_CUST_PRINT
MENUITEM "Last Order", IDM_CUST_LAST_ORDER
```

Spaces and trailing dots are stripped, giving method names of "NewCustomer", "Update", "Print", and "LastOrder". In the "MenuBar Methods" part of the **CustomerView** code, a method is provided for each of these menu items. Note that the "print" and "newCustomer" methods do nothing other than show a messagebox saying that the function is not implemented. Best practice suggests that an explanatory message is much better than the alternative (to see what this alternative is, try commenting out the *print* method).

But before the menu actions will work, the *menuBar* object must be associated with the dialog object. This is done by this statement (at the beginning of the *initDialog* method):

```
menuBar~attachTo(self)
```

By the way, an alternative approach is to create the menubar in the *initDialog* method, and attach the menu at the same time using the previously omitted 6th parameter, *self*: *menuBar* = *.ScriptMenuBar~new("CustomerView.rc", "IDR_CUST_MENU", , , .true, self)* In this case, the statement *menuBar~attachTo(self)* should be omitted. The point here is that while the menubar can be created any time, it cannot be attached until the underlying dialog has been created; that is in the *initDialog* method at the earliest.

At this point, the dialog is displayed complete with all its controls. But there is no data shown. When executed, it looks as if the data appears at the same time as the window, but it does not. To illustrate this, insert two *call SysSleep(2)* statements, one just before the statement *menuBar~attachTo(self)* and one just after. Run the program and you'll see the window without menubar, then the menubar will appear, and then the data.

The last two statements in the *initDialog* method kick off the initial parts of the Application and Data Function category. The first invokes a method to retrieve the data for this customer, the second to display it. At which point the dialog sits back and waits for the user to do something.

3.3.3. Application Data and Function

Designing the application function/data-handling part of a main view class is more complex than is often thought. The designer has to consider the various possible states of the dialog, and also which state transitions are valid. Sometimes state and state transition charts are used to plan and record UI interactions. And, in doing this design work, the first consideration is the user. Indeed, providing what the user needs and likes is probably the most difficult aspect of GUI development. But who is "the user"? Well, this document would be going well outside its remit to embark on addressing this question. Suffice to say that there are a number of sources for information on usability, among which one of the author's favorites is "The Inmates Are Running The Asylum" by Alan Cooper. But here, the main concern is use of *ooDialog* rather than UI design per se, and so in this document, the subject of UI design must take a back seat.

In the case of **.CustomerView**, the application behavior is very simple:

- On initial display of the CustomerView instance, populate the controls with data. This is done by invoking (at the end of the *initDialog* method) the *getData* and *showData* methods. The first gets the data for this customer (hard-coded in the **CustomerData** class), and the second displays that data. The dialog then waits for user input.
- On "Update" being menu-selected, the *update* method is automatically invoked. This method first enables the edit controls so that the user can modify the data, and then enables the "Record Changes" button. Looking at the code, you'll see that some methods operate directly on the control,

while others operate on the dialog, with the control's symbolic ID being provided as a parameter. Although not a hard and fast principle, the distinction, loosely, is that operating directly is done where there is no ambiguity (e.g. changing the state of an edit control from read-only to read/write), whereas operating indirectly through the dialog is done where the action is in the context of the window (e.g. setting the input focus on a control and hence off another).

- When the "Record Changes" button is pressed, the *recordChanges* method is invoked. This first checks whether anything has in fact been changed. If it has, a comment is output to the console, and the state is set back to the starting position with the "Record Changes" button and edit controls disabled. If nothing has been changed, a message box is displayed.
- Finally, several minimal or dummy actions are provided as place-markers for possible future use: three menu items (New Customer..., Print..., and Last Order) and a "Show Last Order" pushbutton.

The above function is delivered through nine methods: five event handler methods (three for menu items and two for pushbuttons) and four methods supporting the event handlers. Between them, they deliver the application and data function. The next section examines the ooDialog aspects of the application function.

3.3.3.1. The *getData* and *showData* Methods

The *getData* method retrieves data from an instance of **CustomerModel** (which in turn gets the data from an instance of **CustomerData**).

The *showData* method uses the *setText* method (see the ooDialog Reference) to set the text of the various controls to the customer's data. There are two things to note here:

- First, each control is in fact a separate window in its own right. Thus the *setText* method can be used to set the text for any control. For example, the text on a pushbutton can be changed using this method. To check this out, try inserting this statement at the end of the *update* method:

```
custControls[btnRecordChanges]~setText("Press me")
```

When "Update" is menu-selected, the text on the button changes.

- Second, the Customer Address data is an array, which for display in a multi-line edit control must be transformed into a text string with line-ends inserted at appropriate places. This is done in the *showData* method. Data transformation of this sort is very usual within view classes; after all, it's the responsibility of any View class (or of its subsidiary classes or routines) to handle any re-formatting for display purposes.

3.3.3.2. The *update* and *recordChanges* Methods

The *update* method "enables" the edit controls and the "Record Changes" button so that the user can make changes and then make the changes permanent (i.e. "record" them). Enabling edit controls is done by sending them the message *setReadOnly* with the parameter **.false**. For example:

```
custControls[ecCustName]~setReadOnly(.false)
```

Pushbuttons are enabled by invoking *enableControl* on the dialog with the control's symbolic ID as the single parameter, as shown in the first statement below. The second statement below puts focus on

the push-button - in this case by invoking the button's *state* method. Finally, the cursor is placed in the Customer Name edit control by invoking the dialog's *focusControl* method.

```
self~enableControl("IDC_CUST_BTN_RECORDCHANGES")
custControls[btnRecordChanges]~state = "FOCUS"      -- Put focus on the button
self~focusControl("IDC_CUST_EDT_CUSTNAME")          -- place cursor in the CustName edit
control.
```

The dialog is now in a state whereby the user can make changes to the data. When the user presses the "Record Changes" button, the *recordChanges* method is invoked. Processing from this point is almost all plain ooRexx with little ooDialog involvement:

- The *recordChanges* method reads data from dialog controls using the *getText* and *getLine* methods of the Edit Control. Any view-formatted data is transformed into application format (in this case, the Address needs to be transformed from strings with line-end characters to an array).
- Then the *checkForChanges* method is invoked with, as a parameter, the data just read in from the dialog controls.
- If the data has not changed, a message box is displayed. If it has changed, then the old data is replaced with the new. Finally, in either case, the edit controls are set to read-only, and the "Record Changes" button is disabled.

Suppose in the middle of updating, the user presses the Escape key by mistake? Try it. The dialog disappears - together with any changes made. This is certainly not best practice, and is addressed in the next chapter (see [Section 4.6, "Controlling Dialog Cancel"](#)) which discusses the use of ooDialog's **ResDialog** class. A dialog subclassed from **ResDialog** uses a compiled resource file (a *.dll file) instead of the *.rc file required by an **RcDialog** subclass.

Using Binary Resource Dialogs

This chapter uses a "Product View" class as the context for discussing the following topics: first, dialog initiation ([Section 4.1, "Dialog Initiation"](#)); second the use of binary resource files ([Section 4.2, "Using a Binary Resource File"](#)) (that is, *.dll files) and the differences in using these as opposed to script resource files; third dialog controls ([Section 4.3, "Dialog Controls"](#)) not met in previous exercises; fourth some changes to program structure ([Section 4.4, "Code Structure"](#)); fifth a brief visit to some dialog design considerations ([Section 4.5, "Designing a Dialog"](#)); and sixth, controlling cancel ([Section 4.6, "Controlling Dialog Cancel"](#)).

But first, run **Startup.rex** in the **Exercise05** folder. A ProductView dialog appears. Check out the behavior of the dialog - there are several new behaviors compared to **CustomerView**. In particular, aside from controls not used in previous exercises, the behavior includes more realistic application-level edit checks - that is, implementation of some (fairly trivial) "business rules". For example, menu-select "Actions - "Update Product", then change the UOM (Unit of Measure) from 6 to 20, and then press the "Save Changes" button.

4.1. Dialog Initiation

Previous exercise have used either the "application" or "startup" program, or a separate ooRexx routine, for dialog initiation. By "initiation" is meant the two statements **"dlg=**.

[DialogClassName]~new and **"dlg~execute(#)"**. In other words, the responsibility for issuing these two initiation statements - which are essential for the creation of the dialog - have previously been outside the dialog class. If they could be moved *within* the class, then encapsulation would be enhanced - always a desirable thing. The question is, how? Well, ooRexx has a mature implementation of OO that (among other things) allows for class methods (as opposed to instance methods). Using this feature of ooRexx, the initiation statements can be quite happily moved into a class method. Thus the **ProductView** class has a method called *newInstance* which, with comments and "say" instructions removed, is as follows:

```
::METHOD newInstance CLASS PUBLIC UNGUARDED
    .Application~setDefaults("0", "ProductView.h", .false)
    dlg = .ProductView-new("res\ProductView.dll", IDD_PRODUCT_VIEW)
    dlg-activate
```

The *newInstance* method is invoked from **Startup.rex** by the statement **.ProductView~newInstance**. So all knowledge about initiating a dialog is moved inside that dialog's class, and from now on this approach will be used. Note also that the first parameter of the **.ProductView~new()** statement allows file paths to be specified.

4.2. Using a Binary Resource File

4.2.1. DLL Compilation

ooDialog's **ResDialog** class (a subclass of **UserDialog**) requires a resource-only DLL. A resource-only DLL is a resource script (*.rc) file that has been compiled into binary (or *.dll) format. Most resource editors have this function. ResEdit is capable compiling a *.rc file, but with three caveats:

- It must be done from the command line:

```
resedit -convert filename.rc filename.dll
```

- At compile time, the *.h file and any *.bmp files must be in the same directory as the .rc file. If present and referenced by the .rc file, *.bmp and *.ico files are compiled into the DLL.
- The version of ResEdit used at the time of writing was 1.5.10-Win32. Comments about usage of ResEdit apply to this version, and may vary in later versions.

At run-time, a ResDialog class needs only the *.dll and the *.h files.

Finally, it's worth mentioning the freely-available Microsoft SDK available at [Microsoft Windows Software Development](#)¹ which can also be used for compiling resource-only DLLs. The resource compiler is called **RC.exe**, and outputs a *.res file. This is then linked using **link.exe** to produce the DLL. For example, the following illustrates **ProductView.rc** being compiled then linked to produce **ProductView.dll**:

```
C:#>rc ProductView.rc
Microsoft (R) Windows (R) Resource Compiler Version 6.1.7600.16385
Copyright (C) Microsoft Corporation. All rights reserved.

C:#>link ProductView.res /NOENTRY /DLL /MACHINE:X86 /OUT:ProductView.dll
Microsoft (R) Incremental Linker Version 10.00.30319.01
Copyright (C) Microsoft Corporation. All rights reserved.
```

Successful compilation depends on both the PATH and the "INCLUDE" environment variable containing the appropriate settings, as follows (at the time of writing and assuming everything is on the C: drive):

```
PATHS
C:\Program Files\Microsoft SDKs\Windows\v7.0A\bin;
C:\Program Files\Microsoft Visual Studio 10.0\VC\BIN;
C:\Program Files\Microsoft Visual Studio 10.0\Common7\IDE

'Include' Environment Variable:
INCLUDE=C:\Program Files\Microsoft SDKs\Windows\v7.0A\Include;
C:\Program Files\Microsoft Visual Studio 10.0\VC\include
```

The first two paths should be added automatically when the SDK is installed. If the third (or any of the other two) is/are missing, then add it/them using the PATH command, e.g.:

```
path=%PATH%;C:\Program Files\Microsoft Visual Studio 10.0\Common7\IDE
```

To see if the INCLUDE environment variable is present, enter **set** on the command prompt and examine the output. If it is not present, then enter the following in the command prompt:

```
C:\>set INCLUDE=C:\Program Files\Microsoft SDKs\Windows\v7.0A\Include;C:
\Program Files\Microsoft Visual Studio 10.0\VC\include
```

¹ <http://msdn.microsoft.com/en-us/windows/desktop/bb980924>

4.2.2. Differences between RcDialog and ResDialog

The Exercise05 folder contains a Product View component, the main class **ProductView** being a subclass of the ooDialog **ResDialog** class. The difference between **ResDialog** and **RcDialog** (aside from the resource file) is mainly in the handling of the menubar. Console outputs from dialog creation for **CustomerView** (an **RcDialog** subclass) and ProductView (a **ResDialog** subclass) are as follows:

CustomerView	ProductView
StartCustomerView Routine-01: Start.	.ProductView-newInstance-01: Start.
CustomerView-init-01.	ProductView-init-01.
CustomerView-createMenuBar-01.	
StartCustomerView Routine-02: dlg-activate.	.ProductView-newInstance-02:
dlg-Activate.	ProductView-activate-01.
CustomerView-activate-01.	ProductView-initDialog-01
CustomerView-initDialog-01.	

There are two visible differences. First, as discussed above, instead of creating the **ProductView** instance in a routine, as was the case for CustomerView, the startup file invokes a class method - *newInstance* which does much the same as CustomerView's routine.

The second difference is the absence of a *createMenuBar* method. Now this method was not strictly necessary in **CustomerView** - the menu could have been created in the *init* or the *initDialog* methods. (See [Appendix C, Dialog Creation Methods](#) for a comparison of dialog startup methods in an **RcDialog**, a **ResDialog** and a **UserDialog**.)

A third and less visible difference is that when a dialog has multiple resources such as bitmaps and/or icons, the number of files required for an **RcDialog** class can result in a minor file management challenge in the runtime environment. A **ResDialog** class, on the other hand, needs only two files: the *.dll and the *.h.

4.3. Dialog Controls

There are five features of **ProductView**'s controls that have not yet been introduced in this Guide. They are: radio buttons, a numeric-only edit field, menu accelerators, an image control (in the "About" dialog), and providing the dialog with minimize and maximize buttons (not really controls, but useful to discuss here).

4.3.1. Radiobuttons

For Radio Buttons to operate automatically - i.e. when an "off" button is clicked the previously "on" button goes off - they must be within a Group Box. This is defined in the *.rc file first as a GROUPBOX control with the style WS_GROUP. After this is defined, the radio buttons (which must have the AUTORADIOBUTTON style) are placed in the groupbox. However, the containment is done through the order of controls in the *.rc file. To achieve this using ResEdit, first drag a Group Box control onto the dialog, and set the "Group" property to "True". Then drag the radio buttons from the controls palette into the group box. Finally, and importantly, set the "Auto" behavior of each radio button to "True" (this sets its style in the *rc file to AUTORADIOBUTTON rather than just RADIOBUTTON). For a single group, it is not necessary to set the "Group" property to "True". However, if there are two or more independent group boxes, then it is required in order to differentiate between the groups.

When initially displayed, no radiobuttons are "on". In the Product View, radiobuttons show whether the size of the product is small, medium or large. Since size is an attribute of the particular product

being displayed (i.e. it's a field in the data that was supposedly read from some database), the correct radiobutton must be turned on. This is done in the `showData` method.

4.3.2. The Numeric Edit Control

If you haven't tried entering an invalid number into the List Price or UOM fields of Product View, then try it. You'll find that keying a non-digit (including "-" or "+"), or keying more than two decimal digits in the Price field, or trying to key any decimals in the UOM field, will all result in a warning balloon being displayed. This behavior is provided by a mixin class called **NumberOnlyEditEx.cls**, available from the ooDialog "Samples" folder and copied into this User Guide's **Exercises\Support** folder for convenience. **NumberOnlyEditEx** illustrates how a control can be extended through ooRexx's mixin capability. The mixin is applied when **NumberOnlyEditEx** is "::required" - its first executable statement being: `.Edit~inherit(.NumberOnlyEditEx, .EditControl)`, with "Edit" being the name of ooDialog's Edit Control class.

Briefly, numeric-only edit controls are set up as follows (full details are in the comments at the front of the **NumberOnlyEditEx.cls** file):

1. Specify `::requires "... \Support\NumberOnlyEditEx.cls"` at the top of the dialog class file.
2. Initialize the edit control (the one that's to be restricted to numeric-only entry) in the `initDialog` method by invoking the mixin's `initDecimalOnly` method on the control instance. In **ProductView** this is done for the product price control by this statement:

```
prodControls[ecProdPrice]~initDecimalOnly(2, .false)
```

The first parameter of `initDecimalOnly` defines the allowable number of decimal places, the second whether or not a sign is allowed. As in **CustomerView** the controls are grouped in the directory object `prodControls` for ease of "exposing" them across methods; also, edit control instances have the prefix "ec" in conformance with the naming conventions ([Section 3.1.1, "Naming Conventions"](#)) mentioned in Chapter 4.

3. For each decimal-only edit control, a character event must be connected to an event handler method in the dialog object (ooDialog's edit control sends an event to the dialog when each character is entered). In **ProductView**, this is done in the `initDialog` method as follows:

```
prodControls[ecProdPrice]~connectCharEvent(onChar)
```

4. Provide the event handler method. The event handler method `onChar` in **ProductView** is as follows:

```
::METHOD onChar UNGUARDED
-- called for each character entered in the price or UOM fields.
forward to (arg(6))
```

The sixth argument to the event handler is the control object where the character event occurred, and the event must be forwarded to that object - that is, to the eventful edit control. The event is then handled by the mixin class, where the numeric-only editing is done.

4.3.3. Menu Accelerators

Open the Product View dialog, and then press the Alt key on the keyboard, followed by the down-arrow key. The "Actions" menu is first highlighted and then opened. The top menu item is "Update Product" - with an underscore beneath the "U". Pressing the "U" key will then initiate the Update Product behavior. The underlined letter is known as an "accelerator" key. It is produced by placing an ampersand (&) immediately before the letter that's to be the accelerator key in the *.rc file. In **ProductView.rc**, you'll see the Update menu item defined as **MENUITEM "&Update Product", IDM_PROD_UPDATE.**

Interestingly, if you mouse-click on the "Actions" menu to open it, the "U" is not underscored - although pressing the "U" key still initiates the update action. This is standard Windows behavior, and ooDialog does not change it (although some third-party Windows apps such as Adobe's Reader do preserve the underscore when a menu is mouse-opened).

4.3.4. The "About" Dialog

Product View has a "Help" menu with one entry: "About#". Clicking this menu item surfaces a simple "about" dialog, containing an image of a well-wrapped product. Double-clicking the image results in a message box acknowledging the action. This section discusses firstly how the image is created, and second making the image "active". The code for the About dialog is in the class **AboutDialog** towards the end of the **ProductView.rex** file.

4.3.4.1. Creating the Image

An image is created by placing a bitmap (a file of type "*.bmp") into a "Picture Control". The bitmap and Picture control are both defined in the *.rc file, but placing the image into the picture control is done in code. The following sections provide more detail.

4.3.4.1.1. Defining the Image

Assuming the bitmap image is already created as a bitmap file (a *.bmp file), then, using ResEdit, the *.rc file is created as follows (assuming you've already created a ResEdit project):

1. Select File --> Add a resource# --> Bitmap. Two options are presented: "create from an existing file", or "create a new resource". Click the former, which results in a File Open dialog.
2. Select the bitmap file and click "Open". This produces a "Path designation" messagebox with two options: "Absolute path" or "Relative path". It is usually best to choose "relative path". On clicking "OK" #
3. #a bitmap resource (named "IDB_BITMAP1" or some such) is added to the project and the bitmap image is displayed. If you want to change the name, then right-click on the bitmap in the Resources pane and select "Rename". Note that the bitmap file is shown in the bitmap resource's "Path" property
4. Finally, drag a Picture Control from the controls palette and place it in the dialog. Then change the Picture Control's "Notify", "Type", and "RealSizeControl" attributes to "True", "Bitmap" and "True" respectively. These attributes define the "styles" of the control to (respectively) issuing a mouse event, allowing a file of type "bmp" to be displayed, and fitting the bitmap to the space available.

It's worth mentioning that the Picture Control is one of four types of Static Control - text, graphics, image, and owner-drawn. In the *.rc file, these are defined by their "styles". A "style" is an essential and basic concept in Windows. While many styles are shown in the ooDialog Reference,

the full authoritative list of styles is found in the [Microsoft Control Library](#)². Look up the Static Control, and you'll find around thirty different styles.

4.3.4.1.2. Mapping an Image to a Picture Control

As mentioned above, the image (of a parcel) displayed in the About dialog is referenced in the *.rc file, and hence is referenced in the *.dll file. What now needs to happen is to associate the image with the static control that will contain it. This is done in the dialog's *initDialog* method as follows:

```
resImage = .ResourceImage~new( "", self)
image = resImage~getImage(IDB_PROD_ICON)
stImage = self~newStatic(IDC_PROD_ABT_ICON_PLACE)~setImage(image)
```

The first statement creates an instance of ooDialog's **ResourceImage** class. The second statement uses the **ResourceImage**'s *getImage* method to return an instance of the **Image** class. The last statement creates a static control proxy and sets the image in it. (And the following two statements in the method create a font and apply it to the static text in the dialog).

4.3.4.2. Making the Image "Active"

Making the image respond to mouse clicks is merely a matter of defining the image-static control in the *.rc file as having the style "SS_NOTIFY" which, using ResEdit (and as mentioned in [Section 4.3.4.1.1, "Defining the Image"](#)), merely requires the "Notify" attribute to be set to "True". When the image is double-clicked, the dialog is sent an event. This event is connected to the *showMsgBox* event-handler method by the statement *self~connectStaticNotify(# showMsgBox)*. The *showMsgBox* method then displays a messagebox.

You may notice the *leaving* method. This is invoked automatically when the underlying Windows dialog is being closed. Its purpose is to allow for clean-up. In the case of the About dialog, the two resources used (an image and a font) are released. This is not really necessary in this simple application, but is a good habit to get into.

4.3.5. Minimize and Maximize Buttons

The Product View dialog has a minimize button and a disabled maximize button, both at the top right of the dialog to the right of the title bar and to the left of the close button. The minimize button is defined in the *.rc file. When only one button is specified, Windows automatically includes both buttons, but with the non-specified button being disabled.

If you look in **ProductView.rc** file, you will see the following styles defined for the dialog (slightly reformatted for readability):

```
STYLE DS_3DLOOK | DS_CENTER | DS_SHELLFONT | WS_CAPTION | WS_VISIBLE |
WS_GROUP | WS_POPUP | WS_THICKFRAME | WS_SYSMENU
```

So where is the **WS_MINIMIZEBOX** style (as mentioned in the ooDialog Reference)? Well, one of the curiosities of Windows, probably historical, is that both the **WS_MINIMIZEBOX** style and the **WS_GROUP**

² <http://msdn.microsoft.com/en-us/library/bb773169%28v=VS.85%29.aspx>

style (defined in the Windows **WinUser.h** file) map to the same numeric value (0x00020000L). Also, the **WS_MAXIMIZEBOX** and **WS_TABSTOP** styles both map the same number (0x00010000L). Clearly ResEdit likes the older form, and includes a **WS_GROUP** when you specify a Minimize Box. Luckily, ooDialog accepts either.

You might try adding either or both of the styles **WS_MINIMIZEBOX** and **WS_MAXIMIZEBOX** to **CustomerView.rc** in Exercise04. The line to change is the one starting: **STYLE DS_3DLOOK**. Then run the exercise, and check the result. You should see the Customer dialog as before except for the minimize and/or maximize buttons.

4.4. Code Structure

Although broadly similar to the code structure in Exercise04, Exercise05 introduces several new structural concepts (at least new in this Guide). These are: the use of "data types", differentiation between view data and application data, more than one dialog in a file, externalized strings, and a more complex dialog design.

4.4.1. Data Types

Most non-trivial software systems consist of a number of components. Each of these could in principle be written in a different programming language (assuming of course that all the languages share are supported by common invocation mechanisms). Within each component there are typically some number of classes, and these interact privately. Because interaction between components tends to be "data-heavy", it is usual to define specific "data-only" classes, so that everyone can be sure of using the same data structures. Examples are: a Customer data class, an Address data class, and a SalesOrder data class. Each such class is often referred to as a "type" (a term that in some quarters is a synonym for "class").

Our sample Sales Order application conforms with this idea, and so a number of "data types" will be introduced. In Exercise05, the Product Data type (the class **ProductDT** at the end of the **ProductModelData.rex** file) specifies the attributes or fields required to fully define product data. This class needs no methods, since the data elements of **ProductDT** are defined as ooRexx attributes. Indeed, the single method in this class is merely a convenience method that lists the contents of a **ProductDT** instance on the console. This method is used (for illustration purposes only) in **ProductView** at the end of the **saveChanges** method.

4.4.2. View Data vs Application data

There is often a difference between data that the user sees or enters on a dialog and the data that flows between components in data types (just as there are differences between data in a normalized database and data as used by application code). For example, on the Product View dialog, a price is shown with two decimal digits after a decimal point. Price in the **ProductDT** data type, on the other hand, has no decimal places - it's expressed in units of 1/100s of the currency unit (that is, in cents if the currency unit is the Dollar). Thus the price data type must be transformed both when displayed to the user and when read in by the program.

The principle for where to do the transformation is simple: do it as close to the screen as possible (just as, at the other end, transformation to database formats are done as close to the DB programming interface (e.g. SQL) as possible, meaning that most of the application code across the system can use the same normative data formats.) Following this principle, the first thing the event handler method **saveChanges** does is to invoke the dialog's method **xformView2App** (transform view to app format). For example, a new price may have been entered with one or zero decimal digits, and so needs to be converted correctly to a whole number of cents. Conversely, reformatting for display is handled in the

showData method. The end result is that all other methods in **ProductView** can assume that data is in the format defined by the data type. And this simplifies things a great deal - especially given that one never wants to confuse 10000 for ten thousand dollars when it's really 100 dollars!

4.4.3. Multiple Dialogs per File

The file **ProductView.rex** contains two dialogs - the main **ProductView** class and the **AboutDialog** class. Note that the resources for both dialogs are defined in the same ResEdit project, and hence in the same *.rc file. Thus both are compiled into the **ProductView.dll** file. This means that the single statement **.Application-setDefaults("0", "ProductView.h", .false)** in the *newInstance* method of the **ProductView** class applies to the **About** dialog as well.

You may notice that the "About" dialog launched in **ProductView**'s *about* method is modal. That is, the Product View window cannot be accessed while the About window is open. This is because "About" was launched using the *execute(..)* method. Making an "about box" modal seems quite reasonable. But in the next chapter, alternatives to *execute* will be used in order to launch non-modal dialogs.

4.4.4. Externalized Strings

It is generally deemed to be good practice to externalize any strings that are visible to the user. This enables someone who needs to translate the application for use by speakers of a different language to do so without touching any executable code. Providing such a facility is often called "internationalization" or "I18N" for short. While this Guide does not pretend to have addressed all I18N requirements, at least it indicates an understanding of the need. Thus the human-readable strings that appear in the **HRS** class ("HRS" = "Human-Readable Strings") at the end of the **ProductView.rex** file are used for messages in messageboxes. Other strings such as the static text on the dialogs, and text in the About dialog are hard-coded either in code or in the *.rc file (and hence in the *.dll file). While not good practice, this is done in the Exercises for code readability reasons - the alternative being to add more code to the dialogs.

4.5. Designing a Dialog

A program does only what its programmer specifies. But a user could do anything. This is why designing dialogs is often quite complicated. What could the user do? What must the dialog do? These are two questions that sometimes seem to intertwine into an irresolvable mess. In **ProductView**, the most complex piece of behavior is when the user chooses the *update* menu item. A useful way to plot the possible interactions is to use a UML Activity Diagram, with user actions on one side and the corresponding program actions on the other. The following figure shows one such diagram.

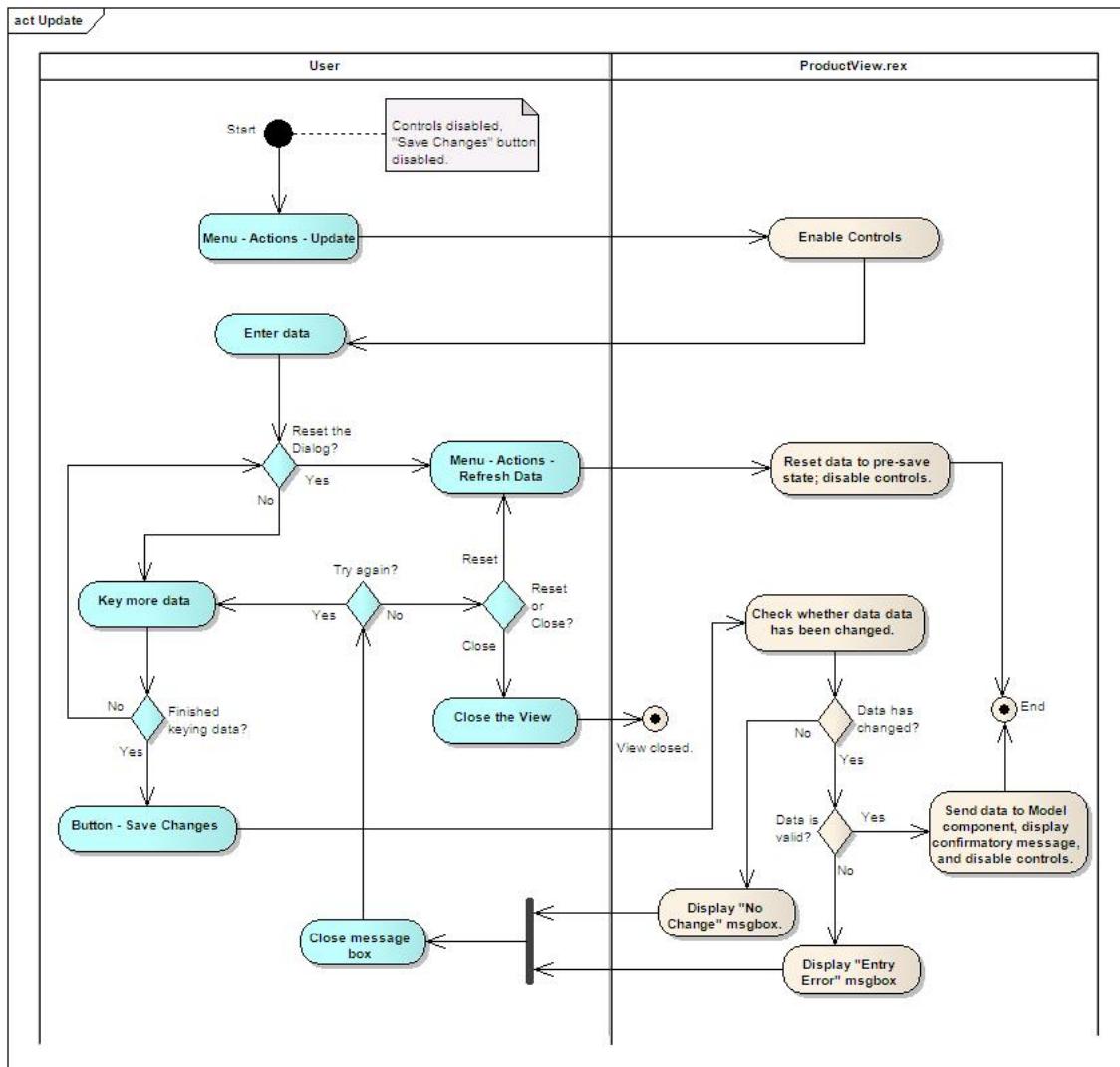


Figure 4.1. ProductView Behavior Diagram

The main thing this diagram illustrates is how the user can go in circles (should he/she wish to) without affecting what the code needs to do. This is helped a great deal by providing a "refresh" function, so that if the user gets mixed up in entering data, s/he can go back to the beginning and start again.

4.6. Controlling Dialog Cancel

Windows provides three ways for the user to cancel a dialog: by pressing the Esc key, by clicking on the "close" icon at the extreme top right of the dialog, or by clicking the "close" action on the system menu (click the icon at the extreme top left of the window). All three of these actions result in a "cancel" message being sent to the dialog, and the default superclass behavior is silently to close the dialog. In general, since these default actions are standard for all Windows dialogs, they should not be over-ridden except perhaps to display an "are you sure?" message if, for example, the user is half-way through some unit of work.

The Product View code provides a simple illustration of this in that, depending on the state of the dialog, a modal "are you sure you want to exit" message is displayed. ProductView can be said to have three states, as illustrated by the UML state diagram below. In the diagram, ovals are states, and the lines between them are state transitions. A solid circle is the start, and a smaller solid circle with a ring around it is the end.

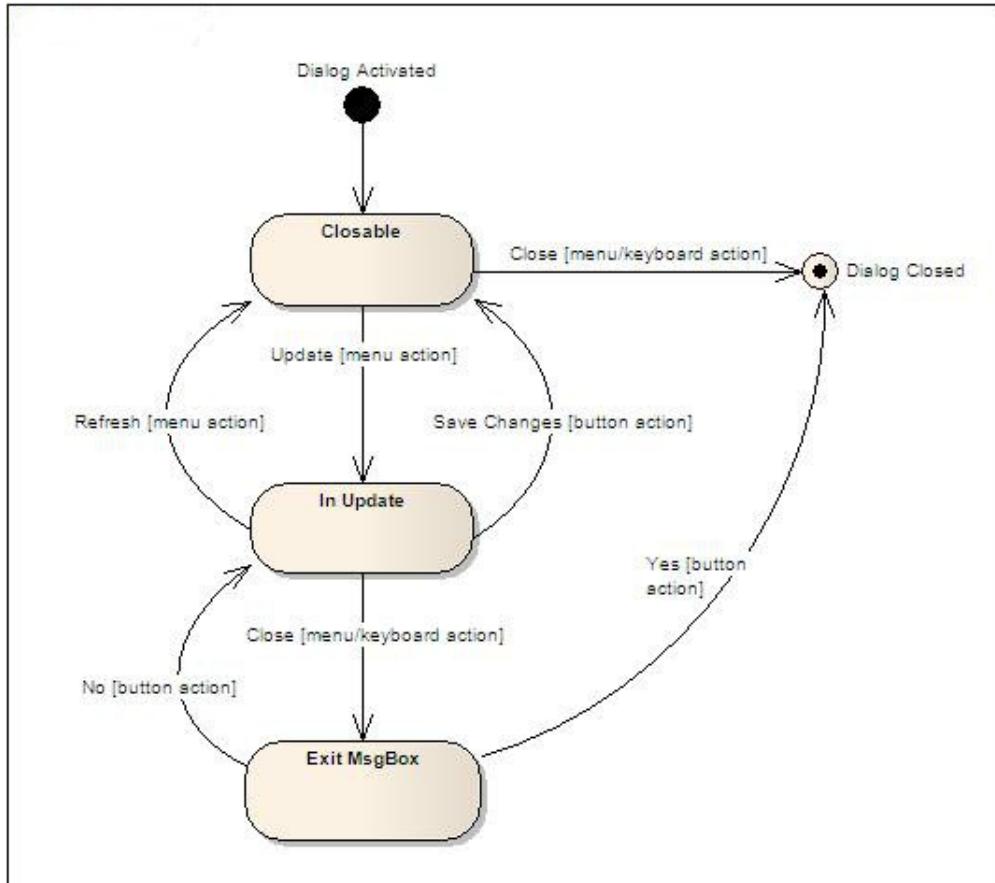


Figure 4.2. ProductView State Diagram

The three states are as follows:

1. The first state is called "closable" - that is, not in the process of being updated. This state is entered when the value of the attribute `dialogState` (defined in the `::attribute` directive immediately after the `::class` directive) is "closable".
2. The second state is called "in update" and is entered when the value of the `dialogState` attribute is "inUpdate". If the user selects any of the close actions in this state, then the third state is entered. The "InUpdate" state is terminated by the user selecting "refresh" or "save changes", either of which causes the dialog to return to the "Closable" state.
3. The third state is the modal "exit messagebox" state which, depending on the user's choice, either closes the dialog or returns to the "inUpdate" state. If the user selects "close", then the dialog closes immediately.

An Application Workplace

This chapter introduces the Order Management application, which is designed as a "workplace" for a user handling sales orders. As such, it provides access to the required components - customers, products, orders, and order forms. A common approach for a "workplace" dialog is to provide an icon for each component that the user may wish to use. In the **Exercise06** folder, run **startup.rex**. The **OrderMgr** dialog opens, and consists mainly of a List View containing four icons. Move the icons around; double-click them and if a Customer, Product, or Order List appears then double-click a list item; re-size the "Order Management" window; check out the menu items and the pushbuttons. As you see, while much of the application function is absent, the data is hard-coded, and there is some redundancy (e.g. every time you double-click on an item in a list view a new Model and Data object is created), the essential parts of the Order Management application mentioned in [Chapter 3, Using Resource Dialogs](#) are visible. This chapter addresses the following topics in the context of the Order Management application:

- [Section 5.1, "Program Structure"](#)
- [Section 5.2, "Popups and Parents"](#)
- [Section 5.3, "Icons and Lists"](#)
- [Section 5.4, "Re-sizing Dialogs"](#)
- [Section 5.5, "Creating Icons"](#)
- [Section 5.6, "Utility Dialogs"](#)

5.1. Program Structure

5.1.1. Overview

In Exercise 6, each business component has its own folder: Customer, Order, OrderMgr, and Product. Customer and Product are more or less identical to the same components introduced in Exercises 4 and 5 except for the addition of a list view (**CustomerListView.rex** and **ProductListView.rex**). Placing each business component into a separate folder helps promote high cohesion and low coupling in the software, since the internals of each business component should be opaque to other business components. Thus another application (e.g. Customer Relationship Management) could well be able to make use of the Customer business component without change. The Order Manager (**OrderMgr**) business component is unlikely to be re-used in other applications as it is a kind of "process" business component that "choreographs" the other business components. To the user, creating a new sales order consists of "choreographing" the various business aspects required - creating an Order Form (used to assemble the customer order), searching for and selecting a specific Customer, searching for and selecting one or more Products, recording the quantities ordered, and producing a Sales Order that is the "contract" between supplier and customer. Of course, the **OrderMgr** component could be used by "higher-level" components such as business processes or workflows (for example a fulfilment process). In systems organized according to these principles, invocation of components takes the form of a directed acyclic graph.

Within each business component are a number of components. For example, the Customer business component contains a Customer View and a CustomerList View, as well as CustomerModel and CustomerData components. Also in the folder are the other files (.h, .rc, .bmp and .ico) required. As in Exercise 04, **CustomerView** gets its data from **CustomerModel**, which in turn gets its data from **CustomerData**. However, **CustomerListView** is rather skeletal, and its data is hard-coded. In a later exercise, this will be modified, and will get its data directly from **CustomerData** (there being no need, in this simple example, for a ListModel component). Note that aside from the list views,

the Customer and Product business components are essentially the same as in Exercises 4 and 5 respectively.

The Order Manager business component is, in this Exercise, implemented by two view classes, each in its own .rex file: **OrderMgrView** and a superclass **OrderMgrBaseView**. **OrderMgrBaseView** contains the code for handling a re-sizable dialog, and is a subclass of **UserDialog** which is required for any dialog that is dynamically re-sizable (see [Section 5.4, "Re-sizing Dialogs"](#)). **OrderMgrView** contains the code specific to the Order Management application. The only reason for splitting the code like this is that it seems to fall happily into these two parts. This reduces the amount of code in any one class or file, and so (arguably) makes for better readability.

Note that the "data" of the OrderMgr business component is the set of icons and their associated data. Examples of possible additional components could be a "commodities" component which shows the commodities required to produce a given product; or a credit-check component that links to an external credit-check agency.

The Order business component is extremely skeletal, but will be developed further in the next exercise.

Finally, it's worth noting that the folder structure, while useful for development, is not necessarily the most appropriate structure for a deployed application. A more appropriate deployment structure will be described in a later chapter.

5.1.2. Some Implications

Choosing this folder structure for the development of the application has certain design implications worth mentioning. These are: file paths, the use of **.Application**, and the handling of externalized human-readable strings.

5.1.2.1. File Paths

When an ooRexx program is run, the current (or "home") directory is that from which the program is started. That is, if a program is started on a command prompt like this: **c:\aaa\bbb>myprog.rex**, then the current directory will be **c:\aaa\bbb**. However, if the program is started like this: **c:\aaaa>bbb\myprog.rex**, then the current directory will be **c:\aaa**. In Exercise 6, all programs are started from the **Exercise06** folder. Thus any relative paths must be relative to the **Exercise06** folder. However, using ResEdit with relative paths, the path for a resource such as a dialog icon is relative to the folder in which the *.rc file is created. For example, if **CustomerView.rc** is created in the **Customer** folder, then the icon will be specified in **CustomerView.rc** with the path "**.\\bmp\\Customer.ico**". So the path to the icon resource in the *.rc file will be wrong, and the dialog icon will not be shown.

The solution is either to edit the *.rc file and change the icon resource's path, or (better) create the *.rc file in the **Exercise06** folder and then move it into the **Customer** folder.

Considering the implication of paths also applies to other parts of the code, such as header files specified in the **.Application~addToConstDir(...)** statement and dialog creation statements such as **dlg = .CustomerView~new(...)**.

In summary, all paths (if not absolute) must be relative to the folder from which the program is started. This is why, when running a stand-alone test such as **startupCustomer.rex**, the program must be started from the **Exercise06** folder, since the design decision was taken to make all paths relative to **Exercise06** folder.

This discussion on paths prompts two thoughts (at least). First, is there not a way to have some support code manage paths, so that each component asks this support code for the path it should

use? While this may be feasible, it's not specifically an ooDialog question, and so is not pursued here. Second, using the **ResDialog** class instead of **RcDialog** reduces the problem of paths, since resources such as icons and bitmaps are placed in the *.dll file.

5.1.2.2. Application Usage

The **startup.rex** file applies application-wide defaults through the statement `.Application~setDefaults("O", , .false)`. However, the header file for each view class is included at the beginning of its file. For example, `.Application~addToConstDir("Customer\CustomerView.h")` is the first executable statement in **CustomerView.rex**. For a shipped application that includes multiple classes, it would be much better to provide all the `~addToConstDir()` statements in the startup file after, say, the `~setDefaults()` statement. However, because at this stage the application is still in a pre-deployment state, and each component needs to be able to be unit-tested (see [Appendix B, Testing Popups in Stand-Alone Mode](#)), it was deemed better to include the `~addToConstDir()` statements in each view file. An alternative was to duplicate them in the unit-test startup programs, but code duplication is generally not the best strategy.

5.1.2.3. Externalized Strings

All components that display information to the user have the displayed strings separated from code either in a class whose name is prefaced "HRS" for "Human-Readable Strings" or in a *.rc file. Each such class name has a suffix - e.g. "HRSCv" for the **CustomerView** class. The reason for the suffix is to distinguish the various HRS classes if the various files were later to be placed into a single file for application deployment purposes.

Human-readable strings in *.rc classes are a problem when internationalization is a requirement. "Internationalization" (often referred to as I18N - there are 20 letters in the word) is the term given to providing for translation of human-readable text into other languages. An immediate solution is to display the translated strings from within the program rather than from the *.rc file. The `initDialog` method is a good place to do this. Try inserting the following in **CustomerView.rex**, say just before the statement `self~getData` in the `initDialog` method:

```
custNameLabel = self~newStatic("IDC_CUST_LBL_CUSTNAME")
custNameLabel~setText("Namen:")
```

The Customer View will be displayed with "Namen" (German) instead of "Name" (English).

Of course, this text should come from an HRS class or better from a proper I18N resource file. Such files would be produced using special I18N tools. These tools take account of the many considerations and gotchas of internationalization. For example, in our trivial attempt to change the label from English "Name" to German "Namen", we've lost the colon at the end. This is because the horizontal space given to this particular static text in **CustomerView.rc** is not big enough. Some authorities suggest that 150% of the space required for English is needed to allow for proper translations to other languages. And this is only one of the lesser considerations in the task of internationalization. The following quote from the Wikipedia entry illustrates something of the full complexity of I18N: "It should be noted that 'internationalized' does not necessarily mean that a system can be used absolutely anywhere, since simultaneous support for all possible locales is both practically almost impossible and commercially very hard to justify. In many cases an internationalized system includes full support only for the most spoken languages, plus any others of particular relevance to the application."

5.1.3. Application Function and Naming

One of the first things to notice about Exercise 6 is that there is very little application function. For example, data is all hard-coded, and all Customers have identical data, as do all Products and all Orders (this will be fixed in the next exercise). The second thing is that while there's an **Order** component to display and change existing sales orders, there's a separate **OrderForm** component for creating new sales orders. But there is no way to create new Customers or Products. This will not be fixed in the next exercise, mainly because providing this function would not exercise any new ooDialog features. However, trivially, in the next exercise data will be able to be changed or added by updating a data file.

The reason for having a different dialog for creating as opposed to viewing and updating is that in real applications, creating a Customer, or Product, or Order generally requires a more complex process than updating. For example, creating a Customer often cannot be done without a credit check and establishing the customer's bank details in the accounting system. In our Order Management application, only the **Order** component has a separate Order Creation dialog, in order to exercise, in the next chapter, more ooDialog capabilities. So, for present purposes, we assume that Customer and Product creation takes place outside of the sample Order Management application.

Although perhaps not immediately apparent, a specific naming convention has been used. This convention is useful to differentiate between the various parts of the application. Thus "X Management" is the name given to the application as a whole (in our case "X" is "Sales Order"). Generally, a componentized application has one or more "coordinator" or "process" components that arrange for the "choreographing" of other components. These are often called "Managers" - hence the "Order Manager" component that provides the framework for the application. Finally, entities such as Customer are given the entity name - "Customer", "Product", "OrderList", etc. - followed by the suffix "View", "Model", or "Data" as discussed in [Chapter 2, Re-Structuring the Code](#).

Finally, starting an application that can make changes to a business is generally guarded by some form of security. When starting the sample application, this is trivially represented by a password dialog, which is visible if you start the application (in the **Exercise06** folder) with the command *startup enterPW* instead of just *startup*. Yes, this is the wrong way round, but its purpose is to illustrate the code required for a password prompt. It is very simple, and uses one of the many and useful ooDialog built-in dialogs - **PasswordBox(. . .)** - as follows:

```
parse arg pwOption
if pwOption = "enterPW" then do
    pwd = PasswordBox("Please enter your password", "Sign In")
    if pwd \= "Password" then exit
end
```

5.2. Popups and Parents

This section addresses how the various dialogs in the Order Management application are launched. First, the way in which dialogs are started is addressed. Second, the use of the *interpret* statement in displaying dialogs by double-clicking an icon in the "Order Management" window is discussed.

5.2.1. Starting a Popup Dialog

In previous chapters, dialogs have been started using the statement *self-execute(...)*. The *-execute* method makes the dialogs "modal", that is, access to other dialogs is blocked until the dialog is closed.

A good example of a modal dialog is the Help-About dialog in Exercise 5. While this is open, the Product View dialog is blocked.

The dialogs in Exercise 6 are not modal; they are "amodal" or "modeless". Any of them can be accessed by the user at any time. A modeless dialog is created by using the `-popup` or `-popupAsChild` methods in place of `-execute`.

The difference between a dialog started with `-popup` as opposed to `-popupAsChild` is as follows.

- **`-popup()`** - If dialog A pops up dialog B, then B exists independently of A. Either can be accessed by the user at any time. Either can be closed without affecting the other. The application ends only when both are closed.
- **`-popupAsChild(parentDlg)`** - If dialog A pops up dialog B as its child, then B's existence depends on A's. If A is closed, so does B. However, as with `-popup` either can be accessed by the user at any time. Note that the only required argument for `-popupAsChild(parentDlg)` is the parent dialog.

It's `-popupAsChild` that best fits the requirements of the Order Management application. Thus while **OrderMgrView** is started with `-execute`, all other dialogs in the Order Management application are started with `-popupAsChild(rootDlg)` where the "root" (or parent) dialog is always **OrderMgrView**. So all dialogs are modeless and independent of each other, except that when **OrderMgrView** is closed, everything else closes and the application ends. (Note that **ProductView**'s "About" dialog is still modal: it blocks access to the specific instance of **ProductView** from which it is launched; other instances of **ProductView** are unaffected, as are other dialogs.)

So, for a dialog to be "popped up as child", there has to be a parent dialog that was surfaced with either `-popup` or `-execute`. This presents a problem for stand-alone testing. The solution adopted in the sample Order Management application is illustrated in the following code fragment, taken from **CustomerListView**'s `activate` method (which is called from its `newInstance` class method):

```
::METHOD activate UNGUARDED
expose rootDlg
use arg rootDlg
if rootDlg = "SA" then do -- If standalone operation required
    rootDlg = self -- To pass on to children
    self~execute("SHOWTOP", "IDI_CUSTLIST_DLGINCON")
end
else self~popupAsChild(rootDlg, "SHOWTOP", , "IDI_CUSTLIST_DLGINCON")
return
```

This code illustrates the two ways of starting a dialog. For stand-alone testing (see [Appendix B, Testing Popups in Stand-Alone Mode](#)), the dialog is started using `self~execute()`. In normal operation, however, it is started by `self~popupAsChild(...)`. Notice that the first parameter of `-popupAsChild(rootDlg, ...)` is the **OrderMgrView** dialog, which is passed to the `newInstance` class method and thence as the parameter `rootDlg` to the `activate` method. Thus **CustomerListView** is both a child of **OrderMgrView** and parent of **CustomerView**. Later in **CustomerListView**, a Customer is displayed by the user double-clicking on an item in the List View. The event handler method (`showCustomer`) that surfaces the Customer is as follows:

```
::METHOD showCustomer UNGUARDED
expose lvCustomers rootDlg
item = lvCustomers~selected
```

```

if item = -1 then do -- if no item selected.
    ret = MessageDialog(.HRSclv~nilSelected, self~hwnd, title, 'WARNING')
    return
end
info=Directory~new
if lvCustomers~getSelectedItem(item, info) then do
    .local~my.idCustomerData = .CustomerData~new      -- create Customer Data instance
    .local~my.idCustomerModel = .CustomerModel~new     -- create Customer Model instance
    .local~my.idCustomerData~activate
    .local~my.idCustomerModel~activate
    .CustomerView~newInstance(rootDlg, "CU003")
    self~disableControl("IDC_CUSTLIST_SHOWCUST")
end
else do
    say "CustomerListView-showCustomer-04: ~getSelectedItem returned .false."
end

```

The list of customers is shown in a ListView control (see [Section 5.3, “Icons and Lists”](#) below).

The *showCustomer* method is invoked when the user double-clicks on an item in the list.

This item is identified by the statement *item = lvCustomers~selected*, the proxy object for the list control being *lvCustomers* (an item is automatically selected when it is double-clicked). If no item is selected, an error message is displayed, and the method returns. The data in the selected row is then placed in a directory (with an error check in case *~getSelectedItem* returns **.false**). The next statements (*.local~my...*) create instances of the **CustomerModel** and **CustomerData** classes. Then an instance of **CustomerView** is created by the statement *.CustomerView~newInstance(rootDlg, "CU003")*. The second parameter is the Customer Number, which is ignored in Exercise 6 (but which will be used in a later exercise). Finally, the "Show Customer" pushbutton is disabled.

The approach to establishing the model and data objects shown here is not ideal. Indeed, the above code merely satisfies the requirement for a **CustomerView** object to have access to a **CustomerModel** instance which in turn needs access to an instance of **CustomerView**. And, in this exercise, the data is all hard-coded. The next exercise will illustrate a much better way of doing this, with data being read from a disk file (a notional "data base").

5.2.2. Offsetting Dialogs

When creating a resource file for a dialog, it is unusual to define the position of the dialog on the screen. Instead, the option to center the dialog in the screen is often used. This is the option applied in Exercise 6. However, when a number of different dialogs are all surfaced in the same place they tend to overlap each other, so making things difficult for the user who has to continually move dialogs away from the center. A better approach is to offset newly-surfaced dialogs from existing ones such that the new dialog pops up in the best place from a user point of view. This is possible with ooDialog, but is not simple.

However, ooDialog also provides a half-way house, where simple code produces a useful result. This simpler code, which will be used in Exercise 7, is discussed in [Section B.2, “Visual Offsetting”](#) in [Appendix B, Testing Popups in Stand-Alone Mode](#). The following code illustrates the key functions:

```

-- In 'parent' dialog:
::METHOD getPopupPos
popupPos = self~getRealPos
popupPos~incr(100,100)
return popupPos

-- In 'child' dialog:
::METHOD offset

```

```
use arg popupPos
self~moveTo(popupPos, 'SHOWWINDOW')
self~ensureVisible()
```

The "parent" dialog finds its own position on the screen with `parentPos=self~getRealPos` (where `parentPos` is an instance of the **Point** class). It then increments the point's x and y coordinates using the point's `incr` method. The result is the child dialog's desired position. When the parent dialog pops up a "child" dialog, it passes this desired position to the child dialog. From the child dialog's `initDialog` method, either in-line or with a method call, the instruction `self~moveTo(popupPos,...)` moves the child dialog to the desired position. Finally, the instruction `self~ensureVisible()` ensures that the child dialog is wholly on the screen and not partly invisible.

5.2.3. Use of Interpret

When an icon in the "Order Management" dialog is double-clicked, a child dialog is surfaced. This is handled by two methods in the **OrderMgrView** class. First, the event-handling method `onDoubleClick` catches the double-click, works out which icon (or "record" - see [Section 5.3, "Icons and Lists"](#) below) was double-clicked, and then calls the `showModel` method. This method uses an *interpret* instruction to launch a view of the component represented by chosen icon, as follows:

```
use arg record
className = record~ID
viewClassName = className||"View"
interpret ".||viewClassName||"~newInstance(self)"
```

Thus in principle icons for additional components can be added without changing the code. An alternative to using *interpret* would be to use the ooRexx **Message** class. Then again, an arguably better approach could have been to hold the class object in the record, and to invoke `newInstance` directly on the class object. However, in the next exercise, the mechanics of invoking the various components (given a class name and an "instance name" such as a customer number) will be moved to a support class.

Finally, a separate file - **RequiresList.rex** - contains the set of `::requires` statements for the components that might be surfaced. This is why the first executable statement in the file **OrderMgrView.rex** is `call "OrderMgrRequiresList.rex"`. While these statements could have been included in **OrderMgrView.rex**, they were separated as they can be thought of as "configuration", and it's arguably better to keep configuration separate from code.

5.3. Icons and Lists

A **ListView** should not be confused with a **ListBox**. A ListView is a souped-up ListBox with lots of additional features. In particular:

- An item in a ListView can be a complex structure or "record" containing multiple fields. One of these fields is termed the "label" of the item.
- ListView items can be displayed in four different styles (or modes):
 - Icon view - each item appears as a full-sized icon with a label below it. Items can be dragged around the ListView.
 - Small-icon view - each item appears as a small icon with a label to its right. Items can be dragged around the ListView.

- List view - each item appears as a label with an optional small icon to its left.
- Report view - each item appears as a row in a table with an optional small icon to its left.

The four different modes are well illustrated by the sample program **oodListViews.rex** located in the **ooRexx\samples\oodialog** folder.

In the Order Management application, a ListView control in the "Icon" style provides the main area of the **OrderMgrView** dialog where dragable icons represent the various components of the application. (The ListView control in the "Report" style is used to provide the tabular lists for the **CustomerListView**, **ProductListView**, and **OrderListView** dialogs.)

5.3.1. The Icon View

The Order Manager dialog is provided by two classes: **OrderMgrBaseView** and **OrderMgrView**. The former handles re-sizing, and to do this it needs to know about the ListView control. But the latter also needs to know about the ListView control. To provide for both requirements, the proxy for the ListView control is stored in **OrderMgrBaseView** as a private attribute named *lv*.

Five things are needed to produce an icon view: first, create (or obtain) some icons; second, specify the **ICON** style for the ListView control; third, create an ImageList from the icons (required by the ListView control); fourth, create a set of records (one record per icon) to be loaded into the ListView; and fifth, load the icons and records into the ListView.

1. Produce the Icons

The large "icons" in the ListView are actually bitmaps. Icons and bitmaps have different formats, and different uses, and there are a number of differences between them. The bitmaps themselves are in the folders of the relevant business components, so the "icon" for the Customer List, for example, is **Exercise06\Customer\bmp\CustList.bmp** (the *.ico files are the dialog icons). See [Section 5.5, "Creating Icons"](#) for further information.

2. Specify the ICON Style

The icon style for a ListView control is specified either in the * .rc file as the **LVS_ICON** (in ResEdit, set the "View" property to "Icon"), or in a UserDialog, by creating the ListView control in the *initDialog* method using the **ICON** style - e.g.: **self~createListView(IDC_ORDMgmt_ICONS, ... "ICON")** where the first parameter is the ID for the ListView control.

3. Create an ImageList

The ListView documentation provides several ways to load icons. Probably the easiest is to create an instance of the **ImageList** class which is then loaded into the ListView. In **OrderMgrView**, this is done in the *createIconList* method (invoked from the *init* method) as follows:

```
    ::METHOD createIconList PRIVATE
    expose iconList
    imgCustList = .Image~getImage("customer\bmp\CustList.bmp")
    imgProdList = .Image~getImage("product\res\ProdList.bmp")
    imgOrderList = .Image~getImage("order\bmp\OrderList.bmp")
    imgOrderForm = .Image~getImage("order\bmp\OrderForm.bmp")
    -- Boldly assume no errors in creating the Image List or in the ~getImage
    statements.
    iconList = .ImageList~create(.Size~new(64, 64), .Image~toID(ILC_COLOR4), 4,
    0)
```

```

iconList~add(imgCustList)    -- item 0 in the list
iconList~add(imgProdList)    -- item 1 in the list
iconList~add(imgOrderList)   -- item 2 in the list
iconList~add(imgOrderForm)   -- item 3 in the list
imgCustList~release
imgProdList~release
imgOrderList~release
imgOrderForm~release
return

```

For each icon, only two statements are required: create an Image from file, and then copy it to the ImageList (and a third, if you're a polite programmer, clean up afterwards by releasing the image).

4. Create Records

Records are typically created in the *init* method (or in a method invoked from there). In **OrderMgrView** the records are created in the *initRecords* method which is invoked from *init*. Each record has two fields: the class name of the dialog to be surfaced when a user double-clicks on an icon, and the text to appear beneath the icon. The design choice for these records is that each record is a directory, and each directory is stored in an array. The array index of a record is equivalent to the position of its icon in the ImageList (remembering that arrays are 1-based while ImageLists are 0-based). The code for creating the record array is as follows (showing only the Sales Orders item for brevity):

```

::METHOD initRecords PRIVATE
expose records
records = .array~new()
...
rec = .directory~new
rec~ID = "OrderList"           -- Class Name
rec~name = "Sales Orders"      -- Text to display under the icon
records[3] = rec
...
return records

```

5. Load the ImageList and the Records

Loading icon images and records into the ListView is done in **OrderMgrView**'s *initDialog* method:

```

::METHOD initDialog
expose records iconList
self~initDialog:super
self~lv~setImageList(iconList, .Image~toID(LVSIL_NORMAL))
do i=1 to records~items
    self~lv~addRow(, i-1, records[i]~name)
end

```

After invoking the **OrderMgrBaseView** superclass (which creates the ListView control as the attribute *lv*), the icons in the ImageList are all applied to the ListView control in the single statement, *self~lv~setImageList(...)*. The second parameter of the *setImageList* method specifies the size of the icons by invoking the *toID* method of the Image class with the parameter *LVSIL_NORMAL*. This is the flag for the icon view as opposed to the list, report, or small icon views. The Image class is used to work with and manipulate images. The icons having been set,

the records are then added using the ListView's *addRow* method. The first parameter is the index of the list item (if omitted, the record is added after the last). The second parameter is the index of the icon to be used with this record, and the last parameter is the label for the list item - the string "Customer List" in the case of the first item added.

5.3.2. The Report View

Three of the icons in the "Order Management" dialog surface a list when double-clicked - the Customer List, Product List, and Order List. These three components are technically very similar - so that a "list superclass" could perhaps be useful. However, in Exercise 6 this is not done, and each list is quite separate. Nevertheless, their similarity means that discussing one list - the Customer List - effectively addresses all three.

A list view with the "Report View" style provides for a variable number of columns, each item appearing on a separate line with information arranged in columns. Each line may have a small icon at the left of each line. Note that the fields in a ListView must be defined in code, since a Windows resource file does not support the definition of columns within the list view.

The following code fragment from the **CustomerListView** class shows how the List View (without small icons) is defined:

```
::METHOD initDialog
    expose menuBar lvCustomers btnShowCustomer
    ...
    lvCustomers = self~newListView("IDC_CUSTLIST_LIST");
    lvCustomers~addExtendedStyle(GRIDLINES FULLROWSELECT)
    lvCustomers~insertColumnPX(0, "Number", 60, "LEFT")
    lvCustomers~insertColumnPX(1, "Name", 220, "LEFT")
    lvCustomers~insertColumnPX(2, "Zip", 80, "LEFT")
    self~connectListViewEvent("IDC_CUSTLIST_LIST", "CLICK", itemSelected) -- Single click
    self~connectListViewEvent("IDC_CUSTLIST_LIST", "ACTIVATE", openItem) -- Double-click
    self~connectButtonEvent("IDC_CUSTLIST_SHOWCUST", "CLICKED", showCustomer)
    self~loadList
```

First, a proxy for the ListView control, *lvCustomers*, is created. Then, in the second statement, the list view is formatted using "extended styles" (of which there are around twenty). Extended styles are defined by Microsoft, and can only be added after the underlying Windows control has been created - that is, (normally) in the *initDialog* method. In the above code, only two extended styles are applied: GRIDLINES and FULLROWSELECT. Both apply only to the Report View. The former draws gridlines around all items; the latter defines that, when a row is selected by the user, the whole row is highlighted rather than just the first column. Then there are three *~insertColumnPX* statements, each adding a column to the list view - "Number", "Name", and "Zip". Following these are two *~connectListViewEvent* statements that define event handler methods for single click and a double-click - *itemSelected* and *openItem*. The latter merely invokes the *showCustomer* method, as does the second-to-last statement *~connectButtonEvent* which defines the event handler method for the pushbutton.

The last statement in the above invokes the *loadList* method, which loads the list view with data, as follows:

```
::METHOD loadList
    expose lvCustomers
    lvCustomers~addRow( , , "CU001", "ABC Inc.", "TX 20152")
```

```

lvCustomers~addRow( , , "CU002", "Frith Inc.", "CA 30543")
lvCustomers~addRow( , , "CU003", "LMN & Co", "NY 47290-1201")
lvCustomers~addRow( , , "CU005", "EJ Smith", "NJ 12345")
lvCustomers~addRow( , , "CU010", "Red-On Inc.", "AZ 12345")
lvCustomers~addRow( , , "AB15784", "Joe Bloggs & Co Ltd", "LB7 4EJ")
lvCustomers~setColumnWidth(1)

```

The `~addRow` method adds a row of data into the list view. As can be seen, the data in the list is hard-coded. This will be fixed in Exercise 7. The first parameter is the 0-based index of the item, and defaults to the index of the last item added plus 1 (if no items already in the list view, this defaults to 0). Note however that when the user creates the dialog, the last item appears first not last. This is because the *.rc file specifies the style **LVS_SORTASCENDING**. The second parameter is the index (in an ImageList) of the item's icon should that be required. Finally, the last statement sets the width of the second column to that of the longest text entry. Note that loading the list view with data could have been done in the `initDialog` method. However, the separation of concerns principle points strongly to separating the formatting of the list view from loading data into the list view.

Surfacing a Customer from the Customer List is done in one of two ways: either double click on an item, or select the item and then press the "Show Customer" button. Both invoke the `showCustomer` method. These two approaches are implemented by the following code (error-handling code omitted):

```

-- 1. Double-Click:

::METHOD initDialog
...
self~connectListViewEvent("IDC_CUSTLIST_LIST", "ACTIVATE", openItem) -- Double-click
...

::METHOD openItem UNGUARDED
self~showCustomer

-- 2. Select (single click) then press button:

::METHOD initDialog
...
self~connectListViewEvent("IDC_CUSTLIST_LIST", "CLICK", itemSelected) -- Single click
self~connectButtonEvent("IDC_CUSTLIST_SHOWCUST", "CLICKED", showCustomer)
...

::METHOD itemSelected UNGUARDED
use arg id, itemIndex, columnIndex, keyState
if itemIndex > -1 then self~enableControl("IDC_CUSTLIST_SHOWCUST")
else self~disableControl("IDC_CUSTLIST_SHOWCUST")

```

In the first approach, If the user double-clicks on a row, and the row is empty, the second click of the double-click is ignored, else the double-click method (`openItem`) is invoked. This in turn invokes `showCustomer`. In the second approach, the `itemSelected` method is fired when the user clicks on a row in the ListView. If the user clicks on an empty row, then `itemIndex` is set to -1, else it is set to the 0-based row number. As can be seen, both approaches invoke the `showCustomer` method, which is as follows (where `lvCustomers` is the proxy for the List View control):

```

::METHOD showCustomer UNGUARDED
expose lvCustomers rootDlg
item = lvCustomers~selected

```

```
info=Directory-new
lvCustomers~getItemInfo(item, info)
.local-my.idCustomerData = .CustomerData~new -- create CustomerData instance
.local-my.idCustomerModel = .CustomerModel~new -- create CustomerModel instance
.local-my.idCustomerData~activate
.local-my.idCustomerModel~activate
.CustomerView~newInstance(rootDlg, "CU003")
self~disableControl("IDC_CUSTLIST_SHOWCUST")
```

First, the relevant row (*item*) is found using the `~selected` method of the List View. Then a directory is created, and the data from the selected row is placed into the directory by the List View's `getItemInfo` method. Thirdly, the Customer Data and Model objects are instantiated, and then the CustomerView is instantiated (`CustomerView` depends on `CustomerModel` being available). As can be seen, in this version of `CustomerListView` the data from the ListView is ignored, and the same Customer is surfaced regardless. This is also true for the other List Views. In Exercise 7 this will be fixed so that instantiation of the Model and Data objects will be handled elsewhere, and the correct instance will be shown.

Finally, two items about ListViews. First, to change the font for the data in a ListView, use the `createFont` method of the dialog (actually a method in ooDialog's "WindowsExtensions" mixin). For example, try inserting the following in `CustomerListView`'s `initDialog` method, immediately before the statement `self~loadList`:

```
font = self~createFontEx("Ariel", 10)
lvCustomers~setFont(font)
```

Save and run. You should see the data in the ListView displayed using the Arial 10-pitch font.

The second item concerns the appearance of the ListView control. If you place the mouse over one of the headers, its appearance changes and if you click it, it acts rather like a pushbutton. But nothing happens, although you might expect it to sort the list according to values in the clicked column). The reason it does not is that `CustomerListView.rc` does not include the style `LVS_NOSORTHEADER`. Try adding this to the resource file (change "... LVS_SORTASCENDING, ..." to "... LVS_SORTASCENDING | LVS_NOSORTHEADER, ..."), then re-run. On the other hand, should you wish to change things so that the data is sorted, then check out the `sortItems` method in the "ListView Controls" chapter in the ooDialog reference.

5.4. Re-sizing Dialogs

If you haven't already done so, try re-sizing the "Order Management" dialog. The ListView containing the icons expands to match the new window size, and one of the two pushbuttons moves as well, although their size - unlike the size of the List View - does not change. This re-sizing function is only available for a `UserDialog`, and requires a number of methods and lines of code. ooDialog provides three samples of the resizing function in the folder `ooRexx\samples\oodialog`, the relevant programs being `dlgAreaUDemo.rex`, `dlgAreaUDemoTwo.rex`, and `dlgAreaUDemoThree.rex`. `OrderMgrBaseView.rex` includes much of the code from the last of these three samples.

The re-sizing function is provided by two ooDialog-provided classes: `dlgAreaU` and `dlgArea`. An important constraint is that, because `dlgAreaU` parses the source code of the `defineDialog` method in order to handle re-sizing, it will only work with `UserDialog`, where the dialog template is created through explicit control creation statements. In addition, since the source code is required at run-time, it will not work if the source code is tokenized using `rexxc`. For information about using the re-sizing function, see the copious comments in `dlgAreaUDemoThree.rex`.

5.5. Creating Icons

This section discusses first the creation of icons and bitmaps, and secondly how the icons in the **OrderMgrView** dialog are loaded into its icon-style List view.

Various questions arise when creating icons for the first time - especially since the whole area of images in Windows is not, at first glance, simple. This section lists some of the main points about creating icons.

First, it's important to establish whether what's required is an icon (file type .ico) or a bitmap (file type *.bmp). The "icons" in **OrderMgrView** dialog are actually bitmaps. But a "dialog icon" (the icon displayed in the left hand corner of the title bar of a dialog) is an icon, not a bitmap. A number of tools are available for creating and editing images, icons, bitmaps etc., some of them providing conversion and re-sizing capabilities. One such is GIMP (GNU Image Manipulation Program), a freely distributed piece of software, from <http://www.gimp.org>.

Second, the size of a dialog icon is variable. That is, an icon larger than the space available will be shrunk to fit. The dialog icons in Exercise 6 are all 64x64 in size, and are automatically shrunk to fit. For resource dialogs, the dialog icon is specified in the resource file, and its ID in the resource file is specified in the *self-execute(...)* method. For UserDialog dialogs, the dialog icon is loaded by the *addIconResource* method. The two arguments to this method are a resource ID and the file name of the icon, for example: *dlg~addIconResource(105, "MyPicture.ico")*. The resource ID is then specified in the *dlg~execute("SHOWTOP, 105)* statement.

Finally, the "icons" in the "Order Management" dialog are bitmaps of size 64x64. These are not shrunk; a smaller icon will look smaller. These bitmaps are loaded into the ListView programmatically. (As mentioned above, the ListView control is created in the **OrderMgrBaseView** class and is stored as an attribute of that class; its name is *lv*.) The code that loads the bitmaps into the ListView is as follows (with repetitive statements removed):

```

::METHOD createIconList PRIVATE
expose iconList
imgCustList = .Image~getImage("customer\bmp\CustList.bmp")
...
iconList = .ImageList~create(.Size~new(64, 64), .Image~toID(ILC_COLOR4), 4, 0)
iconList~add(imgCustList)
...
imgCustList~release
...
return

::METHOD initRecords PRIVATE
-- Called from init - This method simulates getting the "data" for the OrderMgr view.
expose records
records = .array~new()
...
rec = .directory~new
rec~ID = "ProductList"
rec~name = "Product List"
records[2] = rec
...
return records

::METHOD initDialog
expose records iconList
self~initDialog:super
self~lv~setImageList(iconList, .Image~toID(LVSIL_NORMAL))
do i=1 to records~items
    self~lv~addRow(, i-1, records[i]~name)
end

```

The icon view requires icons to be loaded from an "image list" - that is, an instance of the **ImageList** class. It is the function of the *createIconList* method (invoked from *init*) to produce such an image list. To build the image list - called *iconList* in the above - each bitmap is first loaded from disk into an instance of the **Image** class using the *getImage* method. Then the statement *iconList=ImageList~create(...)* creates an empty image list, into which each of the four images is loaded using the *add* method. Finally, each separate image is released. By the end of this method, an image list has been created, but has not yet been loaded into the list view.

As with the "Record View" used for **CustomerListView**, items in an "Icon View" are loaded as "records". In this case, each record consists of an icon and a text label for that icon. The *initRecords* method does just that - sets up the records in an array called *records*. The record id is used to hold the class name (e.g. "ProductList") of the component to be launched when the user double-clicks an icon.

Finally, in the *initDialog* method, the image list (*lv*) is first set into (added to) the list view, following which the records are added. It is a user responsibility to make sure the sequence of icons in the icon list matches the sequence of text data in the records array.

To complete the behavior of the **OrderMgrView** component, there remains the task, when the user double-clicks on an icon, of surfacing the required component. This is done by the following code in **OrderMgrView**:

```
::METHOD onDoubleClick UNGUARDED
expose records
index = self~lv~focused -- lv is an attribute of the superclass.
record = records[index+1]
self~showModel(record)

::METHOD showModel UNGUARDED
use arg record
className = record~ID
viewClassName = className||"View"
interpret ".||viewClassName||`~newInstance(self)"
say "OrderMgrView-showModel-02:"
```

The *onDoubleClick* method is the event handler method defined for the list view, and is specified in the **OrderMgrBaseView** superclass. The first statement (after *expose records*) finds which icon has focus - that is, which was double-clicked. The second retrieves the corresponding record, and then *showModel* is invoked with the appropriate record. In *showModel* an appropriate view is created and surfaced using the *interpret* instruction in much the same way that *CustomerList* did for individual Customer views (see [Section 5.2.3, "Use of Interpret"](#)).

It remains only to mention that the above code will allow as many lists to be created and surfaced as the user wishes. This may or may not be what's required. In the next exercise, only a single list for each of Customers, Products and Orders will be allowed. When the user double-clicks on an icon, the appropriate list will be "surfaced" in the proper sense of the word - that is, created and shown as the top-level dialog, or, if already created, will have focus put on it so that, if hidden under other dialogs, it will pop to the "surface" - that is, become the topmost window on the screen.

5.6. Utility Dialogs

A subject not yet mentioned is the use of ooDialog utility classes and routines in any ooRexx programs. The routines are very simple, and are often one-liners. As an example, the Exercise 6

startup program provides for entry of a password using the (one-line) **PasswordBox** routine. Invoking *startup enterPW* produces a password box that will accept the password "Password". If you get the password wrong, the startup routine will silently end. The code is as follows:

```
parse arg pwOption
if pwOption = "enterPW" then do
  pwd = PasswordBox("Please enter your password", "Sign In")
  if pwd \= "Password" then exit
end
.OrderMgmtView~newInstance
::REQUIRES "OrderMgmt\OrderMgmtView.rex"
```

Check out the ooDialog Reference for the whole set of classes and routines.

A Working Application

6.1. Introduction

Open the **Exercise07** folder and start the Order Management application by double-clicking on **startup.rex**. Try it out. Change some data. Explore the function which, while not complete, is much more complete than in the previous exercise. In particular, note that application data is read from files - for example, the Customer data is read from the file **CustomerFile.txt** (in which fields in a record are separated by a vertical bar character, and field names are defined in the first line of the file). However, although the data can be changed in dialogs, the changed data does not (in this exercise) update the files.

Finally, note that the "Help" menu on the main "Sales Order Management" dialog now includes an option "Message Sender" (discussed in more detail in section 7.3. Click this and a "Message Sender" dialog opens. This can be used to send messages to (invoke methods on) the various components, and is a very useful debugging tool. For example, try sending a "query" message to the Customer whose key is BA0314. To do this, key "CustomerModel BA0314" in the "Target" field, "query" in the Method field, and then press the "Send" button. The customer's data is returned in the "Reply" field in a name-value string.

Now try using the Message Sender to surface a Product dialog - say the view for Product CU003. To do this, enter "ObjectMgr The" in the Target field of the Message Sender, enter "showModel" in the "method" field, enter "ProductModel CU003" in the Data field, and then press the "Send" button. The Product dialog for instance CU003 appears. (The Message Sender is discussed in [Section 6.3, "The Message Sender"](#).)

The "ObjectMgr" (which should really be called "ComponentManager" since it manages application components as opposed to any object) is a support class that instantiates components by invoking a component's *newInstance* class method. It also keeps track of which components are already instantiated. For more detail see [Appendix D, Model-View Framework Internals](#)

Consider now what has to happen to display the Product View. First, a **ProductData** instance is created, and its data read from disk (in this exercise, the whole file is read in by the data components). Then the appropriate **ProductModel1** component is instantiated and its data retrieved from the **ProductData** component. Finally, an instance of **ProductView** is created and its data retrieved from the **ProductModel1** component by invoking its *query* method.

This sequence is a pattern that can be applied to most business components, and hence can be placed in superclasses so that the application components do not each have to provide the same duplicated code. The pattern is called the "Model-View Framework", which is discussed in the next section. After that, the Message Sender is briefly discussed, following which the details of the Order Form component are addressed.

6.2. A Model-View Framework

6.2.1. MVF Objective

The objective of the ModelView Framework (MVF) is to provide a simple mechanism whereby application components can read and write data and display views without needing to be aware of how this is done. The MVF supports the view-model-data separation of concerns in application-level components. For example, if a user double-clicks on an item in say the Product List dialog, then it is expected that a product dialog displaying the data associated with that item in the list view will be displayed. Consider that retrieving data and displaying it requires the following actions:

1. Create the appropriate Data component, which:
2. Opens the data file and reads the data.
3. Create the Model component and pass it its "key" (e.g. product number)
4. Get a reference to the Data component
5. Invoke a "get" on the Data component to retrieve the data associated with the Model's key
6. Create a View component
7. Provide that view component with the data to be displayed in the dialog.
8. Make the dialog visible.

This set of actions assumes that none of the component instances involved are yet activated. However, the MVF must work when some or all are activated. For example, if a View exists but is minimized, then if a user double-clicks on that item in a list, the MVF need only surface the view. Thus the MVF distinguishes between a number of different states, thus relieving the programmer from having to code such logic for each component.

For an overview of MVF internals, see [Appendix D, Model-View Framework Internals](#)

6.2.2. Using the MVF

The MVF must handle the three different kinds of component - view, model, and data. Each model gets its data from its data component, and each model has a single view. (In principle, the MVF could support multiple views of the same model by providing an "Open as..." option for a given icon or list item. This could display a selection of views, similar to the "Open with..." function provided by a button-2 click on an item in Windows Explorer.)

6.2.3. MVF Underlying Operations

- Underlying operations provided by MVF (i.e. overview of how MVF works). - Ref appendix for detail.

6.2.4. MVF Superclasses

6.3. The Message Sender

Message Sender - get rid of "stand-alone" testing code.

6.4. The Order Form

Order Form - use of ControlObjects - multiple dialogs, one main one, one for each tab. Why? To allow controls on the form itself.

Appendix A. Dialog Attributes and AutoDetection

Since the early days of ooDialog, a dialog's controls (listboxes, edit controls, radio buttons, etc.) have been treated as attributes of the dialog object. An ooRexx program could set the attributes' data values in an ooRexx compound symbol (aka stem variable or compound variable) before the dialog was created. Then, when the dialog was created, those values were automatically passed to the controls in the underlying Windows dialog and so were visible to the user. Data could then be entered or modified by the user. When the user closed the dialog, the data (whether changed or unchanged) was automatically communicated from the underlying Windows dialog to the ooRexx dialog and placed in the compound symbol, after which the dialog closed and returned control to the next ooRexx statement in the program. The data was then available to the ooRexx programmer in the same compound symbol.

This function is still supported by ooDialog. The compound symbol is often referred to as "dialog data", and the process of automatically moving data between the ooRexx dialog and the underlying Windows constructs is called "automatic data detection" or "auto detection" for short. The aim of this appendix is to illustrate, through a simple example, how automatic data detection is coded. The example, **ASimpleDialog.rex**, can be found in the **Samples\DlgData** folder. When executed, the dialog looks like this:



Figure A.1. A Simple Dialog

The program does the following:

- Sets the value "It's a fine day today." in a dialog attribute value in an edit control.
- Creates and then displays the dialog.
- When the dialog is closed, retrieves the attribute value as modified (or not) by the user.
- Sets up an appropriate message (this is straight ooRexx and forms the bulk of the program!).
- Displays the message in a message box.

The ooDialog content of the program is very simple, and is as follows:

```
-- (1) Set text in the edit control:  
statement = "It's a fine day today."  
dlgData.IDC_EDIT1 = statement  
  
-- (2a) Create the dialog defined by the .rc file:  
dlg = .ASimpleDialog-new("ASimpleDialog.rc", IDD_DIALOG1, dlgData., "ASimpleDialog.h" )
```

Appendix A. Dialog Attributes and AutoDetection

```
-- (2b) Display the dialog:  
ret = dlg~execute("SHOWTOP", IDI_DLG_OOREXX)  
  
-- (3) When the dialog is closed, and if the user pressed OK, then retrieve  
--     the data provided by the user:  
if ret == 1 then do -- if the user pressed OK  
    statement2 = dlgData.1002 -- get data from the edit control  
    agree = dlgData.IDC_RADIO1 -- get the state of the radio buttons:  
    disagree = dlgData.1004  
  
-- (4) Set up the appropriate message to display:  
  
    /* a number of lines of ooRexx code */  
  
-- (5) Display a message to respond to the user's choices:  
ret = MessageDialog(msg, 0, title, 'OK', icon, 'TOPMOST')  
  
::requires "ooDialog.cls"  
  
::CLASS ASimpleDialog SUBCLASS RcDialog
```

As illustrated by section (1) of the code, data is first set up in the stem *dlgData*. by the statement: **dlgData.IDC_EDIT1 = statement**. Note that the name *dlgData*. is not reserved - it could be any name. When the dialog is created, the text "It's a fine day today." is automatically placed in the edit control identified by the symbolic ID **IDC_EDIT1**.

Section (2) creates and displays the dialog. Only two statements are required to do this:

```
dlg = .ASimpleDialog-new("ASimpleDialog.rc", IDD_DIALOG1, dlgData., "ASimpleDialog.h" )  
ret = dlg~execute("SHOWTOP", IDI_DLG_OOREXX)
```

The first parameter of the dialog creation statement is the name of the .rc file, and the second the symbolic ID of the dialog as defined in that file. The third parameter - *dlgData*. - is the stem variable that contains the data - that is the attribute values - to be placed in the dialog's controls. Finally, the fourth parameter is the header file, which can be omitted if the statement **.application~useGlobalConstDir("0", "ASimpleDialog.h")** is placed at the start of the program.

The class **ASimpleDialog** is defined at the end of the program. Note the extreme simplicity of coding a simple form-filling dialog class. No methods are needed - the dialog consists of a single **::CLASS** statement. The superclass, **RcDialog**, provides all the function needed.

Section (3) of the code shows how data is retrieved from the controls via *dlgData* after the dialog has been closed by the user. Note that a mixture of numeric and symbolic IDs can be used, as illustrated by statements such as *disagree = dlgData.1004*. Indeed, a control can be referenced by its symbolic ID in one place and by its numeric ID in another, as illustrated by the use of both **IDC_EDIT1** and **1002** to refer to the edit control. However, from a program comprehensibility point of view, it is not good practice to mix symbolic and numeric resource IDs in the same program. Further, it is generally held that using only symbolic IDs is best practice.

Section (4) of the code analyzes the user's input. Finally, section (5) displays a message box to inform the user of the results.

In order to illustrate the same function using **.ResDialog** the program **ASimpleDialog2.rex** is included in the **samples\DlgData** folder together with its *.dll file.

Finally, when desired, there are two ways to turn auto detection off (by default it is turned on). First, by the Application Manager (see the ooDialog Reference), and second programmatically by intercepting the *initAutoDetection* message. This is automatically sent to the dialog by the ooDialog framework when the dialog is instantiated. To turn auto detection off, just invoke *noAutoDetection* on *self*. Try adding the following method to **ASimpleDialog**

```
::CLASS ASimpleDialog SUBCLASS RcDialog
::method initAutoDetection
    self-noAutoDetection
```

When the program is run, the edit control is blank. On pressing "OK", the dialog closes and an error is reported on the console. The error occurs because the radio button "data" (i.e. a boolean) is not returned, and so an "if" statement fails because it's expecting a boolean value to be tested.

Appendix B. Testing Popups in Stand-Alone Mode

This appendix discusses two separate aspects of "popup" dialogs. The first aspect is testing popped-up dialogs in stand-alone mode - that is, without having to run the "parent" dialog from which the popped-up dialog is launched. The second aspect is the issue of how a popped-up dialog can be visually offset from its "parent" so that it does not obscure the parent.

B.1. Stand-Alone Testing

Consider four dialogs called Parent, Child, Grandchild, and GreatGrandChild. Parent is the "application" - the dialog that opens first, and from which other dialogs are directly or indirectly surfaced. Parent can thus be called the "root" dialog, and is designed to run in "standalone" mode - that is, it is not surfaced by some other dialog. It pops up Child dialogs, each of which may pop-up Grandchild dialogs, which in turn may pop-up GreatGrandchild dialogs, and so on.

When testing an application, there is often a need to test an individual dialog which, in the application, is a "child" that's invoked by a "parent" dialog which issues `self~popUpAsChild(...)` - rather than `self~execute(...)` - to surface the child dialog. In addition, popping-up requires the parent dialog to be specified as a method argument: `self~popUpAsChild(parent,...)`.

In the Order Management application, the **OrderMgrView** class is the parent for all child dialogs. The reason for using `popupAsChild` is so that, for example, a `CustomerList` can be closed without automatically closing any `Customer` dialogs that might have been opened from it.

Now, using the parent dialog (Order Manager in our case) as some sort of test-harness that will eventually surface the child dialog to be tested can be time-consuming and irritating. However, if a child dialog is started without the parent first being run, it must still be able to invoke subordinate dialogs in the same way as if it were running as part of the full application. Thus there is a need to enable individual child dialogs to be tested in "stand-alone" mode, without using the parent dialog just to surface them, but invoking other "subordinate" dialogs as if it was not being run stand-alone. In addition, a stand-alone test of what is normally a "child" dialog will require the child to act as the parent of any "grandchild" dialogs that it invokes, which means that the child must pass its own id to the grandchild instead of passing the parent's.

One approach to resolving this problem is to have two versions of each child dialog - one using `~execute(...)` and one using `~popUpAsChild(...)`. This results in two code bases for each dialog - which can quickly get out of sync. Not the best idea.

An arguably better solution is to build each dialog so it can be run either individually (stand-alone) or within the application. The file **Popups.rex** in the folder **Samples\Popups** shows a way of doing this, using dialogs that are as simple as possible.

The rules illustrated by the code in **Popups.rex** are as follows, assuming an application consisting of a single Parent dialog that invokes one or more Child dialogs, each of which may invoke one or more Grandchild dialogs, each of which may invoke one or more GreatGrandChild dialogs. The child and grandchild dialogs are "intermediate" dialogs. The GreatGrandChild dialog is a "leaf" dialog - that is, it does not invoke any other dialog (except of course those integral to its own functioning such as an About box or a data entry sub-dialog).

The Parent Dialog:

Appendix B. Testing Popups in Stand-Alone Mode

(1) Is invoked from a Startup script with:
.ParentDialog~newInstance

(2) Provides an event handling method that surfaces a Child dialog:

```
::METHOD popup UNGUARDED  
...  
.ChildDialog~newInstance(self)  
...
```

An Intermediate Dialog:

(1) For stand-alone testing is invoked from a Startup script with:
.AnIntermediateDlg~newInstance("SA")

(2) Provides the following methods (among others):

```
::METHOD newInstance CLASS  
use arg rootDlg  
...  
dlg = self~new  
dlg~activate(rootDlg)  
  
::METHOD activate UNGUARDED  
expose rootDlg  
use arg rootDlg  
...  
if rootDlg = "SA" then do -- If standalone operation required  
    rootDlg = self -- To pass on to subordinates  
    self~execute("SHOWTOP")  
end  
else self~popupAsChild(rootDlg, "SHOWTOP")  
  
::METHOD popup UNGUARDED -- An event handler method  
expose rootDlg  
.ASubordinateDlg~newInstance(rootDlg)
```

A Leaf Dialog:

(1) For standalone testing is invoked from a Startup script with:
.ALeafDlg~newInstance("SA")

(2) Provides the following methods (among others):

```
::METHOD newInstance CLASS  
use arg rootDlg  
...  
dlg = self~new  
dlg~activate(rootDlg)  
  
::METHOD activate  
use arg rootDlg  
if rootDlg = "SA" then self~execute("SHOWTOP")  
else self~popupAsChild(rootDlg, "SHOWTOP")
```

Try running the **Popups.rex** program without any parameters. Note that as each "junior" dialog is created (by pressing the pushbutton in the "senior" dialog) it completely obscures its parent. This is because all dialogs are coded to surface in the center of the screen (by the style "**CENTER**" in the *create* method), and second all dialogs are the same size. The next section illustrates a useful way to offset the subordinate dialogs so that at least some part of the senior dialog is still visible.

B.2. Visual Offsetting

The program **OffsetPopups.rex** in the **Exercises\Samples\Popups** folder is a copy of **Popups.rex** with added code to handle dialog offsetting (comments show where statements have been added or modified). If no parameters are provided, the offset defaults to zero and the behavior is identical to that of **Popups.rex**. Try running the program with an offset of 100 by entering **OffsetPopups 100** on a command prompt. You'll see that popped-up dialogs are offset from the dialogs from which they're popped up, and do not now obscure them. Entering **OffsetPopups ?** provides help.

In **OffsetPopups.rex**, all classes are subclassed from a **View** class (itself subclassed from **UserDialog**) which has one class attribute and two methods, *getPopupPos* and *offset*, as follows:

```

::CLASS View SUBCLASS UserDialog

::ATTRIBUTE offsetAmount CLASS PUBLIC

::METHOD getPopupPos
popupPos = self~getRealpos
offset = .View~offsetAmount
popupPos~incr(offset,offset)
return popupPos

::METHOD offset
use arg dlgPos
self~moveTo(dlgPos, 'SHOWWINDOW')
self~ensureVisible()

```

The class attribute *offsetAmount* is set at the start of the program, and defines the amount of space by which to offset a junior dialog. The term "junior dialog" in this section refers to a dialog that is popped up by a "senior dialog", and in the sample code refers to any of the classes **Child**, **GrandChild**, and **GreatGrandChild**. "Senior dialog" refers to the dialog that pops up a junior dialog, and in the sample code refers to any of the classes **Parent**, **Child**, and **GrandChild**.

In brief, the method *getPopupPos* is used by a senior dialog to establish where it wants a junior dialog to pop up. The junior dialog then uses the *offset* method to (a) move itself to the desired position, and (b) to ensure that it is wholly visible on the screen and not partly off the screen.

In detail:

- **getPopupPos** - This method is used by the senior dialog to establish where on the screen the junior dialog is to appear (relative to the senior dialog). The first statement *popupPos = self~getRealPos* gets the position of the senior dialog as a point object (see ooDialog Reference) whose attributes are the point's x and y screen coordinates (that is, the top-left corner of the dialog). The point object is assigned to *popupPos*.
- The second statement, *offset = .View~offsetAmount* gets the offset amount stored in the class attribute.
- Then the statement *popupPos~incr(offset,offset)* increments each coordinate of the *popupPos* object by the amount defined by *offset*. That is, *popupPos* is now the desired new position of the junior dialog.
- Finally, the desired junior dialog's position is returned, and the senior dialog then passes it to the junior dialog when the latter is created via its *newInstance* method.

Appendix B. Testing Popups in Stand-Alone Mode

- **offset** - This method is invoked from the junior dialog's *initDialog* method in order to move itself to the position (*dlgPos*) defined by the senior dialog. The first statement (*self~moveTo(dlgPos,'SHOWWINDOW')*) moves the dialog. However, if the senior dialog is near the bottom or right-hand edge of the screen, the junior dialog could surface half-off the screen in the correct offset position. But half-off the screen is not particularly friendly. So...
• ... the last statement (*self~ensureVisible()*) ensures that the current dialog is wholly visible. However, because it's so fast, you don't see this re-positioning. To see the re-positioning, insert *call sysSleep(2)* just before the last statement, run the program, and move the parent dialog to the bottom of the screen. Then popup the child dialog. It appears half-off the screen, then after two seconds it snaps up to a wholly-visible position. Neat.

Appendix C. Dialog Creation Methods

This appendix provides a programmer's aide-memoire for the methods required to create and set up a dialog using one of the more usual superclasses - **UserDialog**, **RcDialog** or **ResDialog**. Menu creation is included even though this is technically quite separate from dialog creation, and does not have to be done in the *init* method.

The following table shows, for each of the three main dialog types, the method invocations that the programmer must code and the methods (invoked by ooDialog-provided superclasses as part of the dialog creation framework) that the programmer must provide.

Table C.1. Dialog Creation - Method Sequences

Methods / ~Invocations	UserDialog	RcDialog	ResDialog	Comment
<i>.Dlg~new(...)</i>	Yes.	Yes.	Yes.	Class Method
<i>init</i>	Yes.	Yes. Create Menubar .ScriptMenuBar~new	Yes.	Must be passed to the superclass using <i>forward class (super) continue</i>
<i>defineDialog</i>	Yes. Programmer creates the Dialog Template using <i>self~create...(...)</i>	Optional. Dialog Template is defined by the *.rc file, but additional controls (or menu items) can be added here.	No. Not invoked - Dialog Template is defined by the *.dll file - so controls or menu items cannot be added.	Called by super's <i>init</i> method (but not for ResDialogs) Purpose: create the Dialog Template.
<i>dlg~execute</i>	Yes.	Yes.	Yes.	Creates the Underlying Dialog based on the Dialog Template
<i>initDialog</i>	Create "proxies" for controls and initialize them using <i>ctl=self~new...(...)</i> Create Menubar .BinaryMenuBar~new()	Create "proxies" for controls and initialize them using <i>ctl=self~new...(...)</i> Attach Menubar using ~attachTo(self)	Create "proxies" for controls and initialize them using <i>ctl=self~new...(...)</i> Create Menubar .BinaryMenuBar~new()	Called automatically after ~execute is invoked.

First, as for all ooRexx objects, the *~new* method creates an instance of a dialog class, and the *init* method is then invoked on the new instance, which must invoke the superclass' *init* using *forward class (super) continue*. For **RcDialog** subclasses, a menubar could be created in this method, but could also be created later.

The *defineDialog* method (see the ooDialog Reference) is invoked automatically by the superclass' *init* method. This method provides for the creation of the "Dialog Template" (see the ooDialog Reference) - that is, the layout of controls on the dialog. For a **UserDialog** the dialog template must be created using *self~create(...)* instructions. For an **RcDialog** the dialog template is normally fully-defined by the *.rc file, but can optionally be enhanced here. However, in the case of **ResDialog**, the dialog template is fully-defined by the *.dll file, and cannot be changed programmatically. Therefore, a *defineDialog* message is not sent to a **ResDialog**.

Appendix C. Dialog Creation Methods

On exit from the *defineDialog* method, the dialog template is established.

The "underlying dialog" (see the ooDialog Reference) is then created and surfaced (made visible to the user) by invoking the superclass' *execute* method.

The last method in the table - *initDialog* - is provided for the programmer to initialize the various controls, e.g. setting an edit control to its initial data value, or pre-selecting a radio button. This is done by creating "proxies" for those controls that need to be manipulated within the program, typically using *proxy = self-new...(...)* statements. It's worth remembering that the "init" in *initDialog* means "initialize" - not to be confused with the ooRexx *init* method.

Finally, although the creation of a menubar is mentioned in the table, technically it is not part of dialog creation. A menubar can be created any time. However, it can only be attached to a dialog after the underlying dialog is created. Thus the first opportunity to attach a menubar to the dialog is in the *initDialog* method; but it can be done later.

Appendix D. Model-View Framework Internals

This appendix provides an overview of the internals of the Model-View Framework (MVF) introduced in [Chapter 6, A Working Application](#). It should really be called "Model-View-Data Framework", since it also encompasses data components; however, historically such frameworks have omitted the term "data" in their names, and here we lazily conform with history.

*** Intro to sections here if required. *****

D.1. The Object Manager

The Model-View Framework (MVF) manages the components that are assembled to make up an application. There are two main parts to the MVF: first a management object (an ooRexx class) called the "Object Manager", and secondly a set of superclasses that provide functions common to all components. A "component" is a Model, a View, or a Data program. An example is the "ProductView" component, which consists of three ooRexx classes: **ProductView**, **AboutDialog**, and **HRSpv**.

This component, together with the Product List component, the ProductData component, and a Product datatype, make up a Product Data Business Component. For each component, one class is made known by name to ObjectMgr by name.

D.2. Some Title

```
</programlisting>

showModel(class-inst)  ->  ObjectMgr
    self~getcreate model

View components:  subclass RcView
- newInstance [class method]:
    use arg modelInstancName, rootDlg
    dlg = .ModelView~new(rc-file, "IDD_...")
    dlg~activate(modelInstancName,rootDlg)
    return dlg

- activate
    expose modelData
    use arg modelInstanceName, rootDlg
    forward class (super) continue  Required for MVF
    modelData = RESULT  - personData returned by super
        - ('forward' returns any result via 'RESULT'.)
    self~popUpAsChild(rootDlg,"SHOWTOP,,icon-resource-id>

- initDialog
    expose modelData

Model components:
- newInstance (class method):
    use strict arg instanceName
    check id data component is up and running
    get component id of data component from objectMgr
    send "find(instanceName)" to data component - returns "dirData"
    modelId = self~new(dirData)
```

```
return modelID

- init (instance Method)
  - since no separate setup, 'activate' is same as 'init' so just use 'init'.

Data components:      - subclassed from GenericFile
- newInstance (class method):
  use strict arg instanceName  - instanceName is "The".
  dataID = self~new(instanceName)
  return dataID

- init
  use arg instanceName
  filename = "file-name"; columns = num-columns
  records = self~init:super(fileName, columns)

Some component X wants to send 'query' to PersonModel. So:
(a) X sends getComponentId('PersonModel PA150') to ObjectMgr.
(b) ObjMgr: if exists, then return cmptId
(c) Else
Sends 'query' to a PersonModel on Message Sender.
Messagesender asks ObjectMgr for id of the PersonModel
If not in object bag, ObjMgr sends 'newInstance' to Model with inst name
as param.
.Model~newInstance asks ObjMgr for id for "PersonData The"
If not found, then set noDataError to .true.
Else do
  send a "find" to "PersonData The"
  "PersonData The" returns the Model's instance's data.
  If data found, then id = .PersonModel~new(data)
  Return Id (to ObjectMgr)
end
```

D.3. The Requires List

To be completed.

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Appendix G. Revision History

Revision 0-0 Tue Aug 7 2012

Initial creation of book by publican

David Ashley

Index

Symbols

.Application
and Unit-Testing, 37
setDefaults, 17

A

Accelerator key
in menus, 28
Attributes, of a dialog, 53
Autoconnection, 20
AutoDetection
turning off, 55
Automatic data detection, 53

B

Binary Resource Dialogs, 25
Binary resource files, 25
Bitmap Editor, 47
Blocking
concurrency issue, 11
Business Component, 7

C

Class methods
newInstance, 25
Code structure, 7
Common Public License, 67
Compilation
DLLs, 25
Compiling a resource file, 26
Component, 9
Component concepts, 7
Reference, 7
Component names
Naming convention, 38
Concurrency issue, 11
Controls
ListView, 41
RadioButton, 27
Styles, 30
Controls Library, 30
Convention
Naming, 14
Coupling, 9
CPL, 67
Creating an Image, 29
CustomerView component, 13

D

Data Types, 31

Design, of dialogs, 13
Dialog
Creation, 61
Dialog Attributes, 53
Dialog Data, 53
Dialog template, 13
dlgdata, 53
DLL
Compiling, 25

E

Event handler, 20
Public method, 20
Exercise location, 1

F

File path, 36
Font
in a ListView, 46

G

globalConstDir, 17

I

Icon editor, 47
Icons
in a ListView, 41
Image
creating, 29
Internationalization, 37

L

leaving
method, 30
License, Common Public, 67
License, Open Object Rexx, 67
List View
Sorting, 46
ListView, 41
Font, 46
Location
of Exercises>, 1

M

Maximize Button, 30
menuBar
RcDialog, 20
Menus
Accelerator key, 28
methods
leaving, 30
Methods
Dialog Creation, 61

Index

Microsoft
 Controls Library, 30
Minimize Button, 30
Model-View Framework
 Internals, 63

N

Naming convention
 Components, 38
Naming conventions, 14
newInstance
 Class method, 25
Notices, 65

O

ooRexx License, 67
Open Object Rexx License, 67
OrderMgr component, 35
overview, 1

P

Parents
 Popups, 38
Password dialog, 48
Point object, 59
PopupAsChild, 39
Popups
 Parents, 38
 PopupAsChild, 39
 Stand-alone Testing, 57
ProductView component, 25
Proxy for controls, 19

R

Radio Button, 27
RcDialog
 menuBar, 20
ResDialog, 25
 Resource files needed, 26
Resource definition, 13
Resource Dialogs, 13
Resource File, 13
Resource file
 Binary, 25
 Compiling, 25
Resource files
 ResDialog, 26
Resource numbers, 4

S

setDefaults, 17
Standalone testing, 57
Styles

Controls, 30

T

Tab order, 15
Testing
 Popups, 57

U

Unguarded, 11
Unguarded method, 20
Unit-testing
 Placement of .Application statement, 37
Utility routine
 PasswordBox, 48