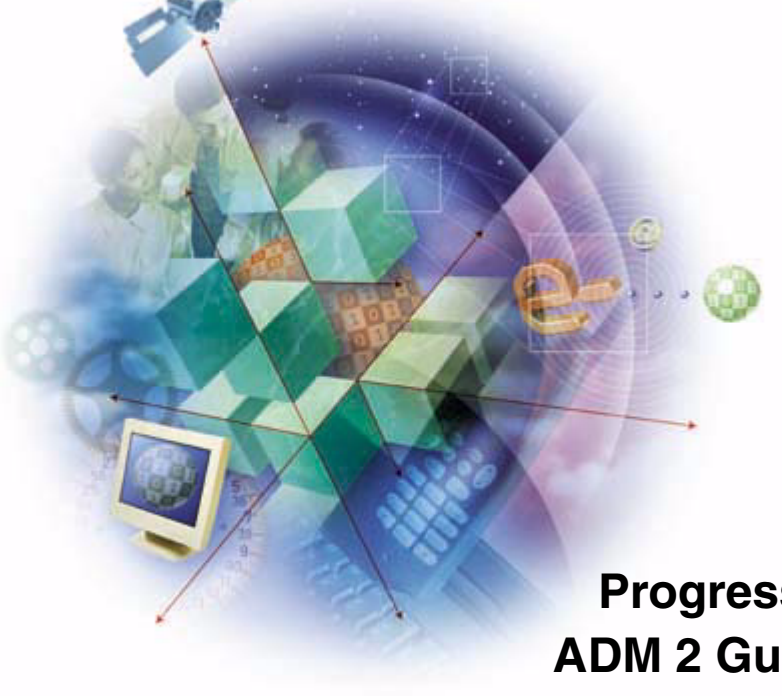


Progress
ADM 2 Guide

© 2001 Progress Software Corporation. All rights reserved.

Progress® software products are copyrighted and all rights are reserved by Progress Software Corporation. This manual is also copyrighted and all rights are reserved. This manual may not, in whole or in part, be copied, photocopied, translated, or reduced to any electronic medium or machine-readable form without prior consent, in writing, from Progress Software Corporation.

The information in this manual is subject to change without notice, and Progress Software Corporation assumes no responsibility for any errors that may appear in this document.

The references in this manual to specific platforms supported are subject to change.

Progress, Progress Results, Provision and WebSpeed are registered trademarks of Progress Software Corporation in the United States and other countries. Apptivity, AppServer, ProVision Plus, SmartObjects, IntelliStream, and other Progress product names are trademarks of Progress Software Corporation.

SonicMQ is a trademark of Sonic Software Corporation in the United States and other countries.

Progress Software Corporation acknowledges the use of Raster Imaging Technology copyrighted by Snowbound Software 1993-1997 and the IBM XML Parser for Java Edition.

© IBM Corporation 1998-1999. All rights reserved. U.S. Government Users Restricted Rights — Use, duplication or disclosure restricted by GSA ADP Schedule Contract with IBM Corp.

Progress is a registered trademark of Progress Software Corporation and is used by IBM Corporation in the mark Progress/400 under license. Progress/400 AND 400® are trademarks of IBM Corporation and are used by Progress Software Corporation under license.

Java and all Java-based marks are trademarks or registered trademarks of Sun Microsystems, Inc. in the United States and other countries.

Any other trademarks and/or service marks contained herein are the property of their respective owners.

.

May 2001



Product Code: 4604
Item Number: 81107:9.1C

Contents

Preface . . . . . **xiii**
Purpose xiii
Audience xiii
Organization of This Manual xiii
Typographical Conventions xv
Syntax Notation xvi
Example Procedures xx
Progress Messages xxiii
Other Useful Documentation xxiv
Getting Started xxiv
Development Tools xxvi
Reporting Tools xxvii
4GL xxviii
Database xxix
DataServers xxix
SQL-89/Open Access xxx
SQL-92 xxx
Deployment xxxi
WebSpeed xxxi
Reference xxxii

1. Overview **1–1**
1.1 Introduction 1–2
1.1.1 SmartObject Application Benefits 1–3
1.1.2 Enhanced Code Reusability 1–4
1.1.3 Customizing SmartObjects 1–4
1.2 ADM Classes 1–4
1.2.1 Standard ADM Class Files and Templates 1–6
1.2.2 Custom ADM Class Files 1–8

1.3 SmartObjects 1–10
1.3.1 SmartObject Types 1–11
1.3.2 The Life Cycle of a SmartObject 1–12
1.3.3 SmartObject Templates and Masters 1–13
1.3.4 Instantiation 1–14
1.4 SmartLinks 1–15
1.5 Properties 1–16
1.6 Super Procedures 1–16
1.6.1 External Procedures, Internal Procedures, and Functions 1–16
1.6.2 Super Procedures in the ADM 1–18

2. SmartObjects 2–1
2.1 SmartObject Summary 2–2
2.1.1 Accessing SmartObjects 2–3
2.1.2 SmartObject Instance Properties 2–4
2.1.3 AppBuilder-maintained Procedures 2–4
2.2 SmartContainers 2–4
2.2.1 SmartContainers and Their Contents 2–5
2.2.2 Paging 2–6
2.2.3 Pass-through Links 2–6
2.2.4 SmartWindows 2–6
2.2.5 SmartFrames 2–7
2.2.6 SmartDialogs 2–7
2.3 SmartDataObjects 2–8
2.3.1 SmartDataObject Instance Properties Dialog Box 2–9
2.3.2 SmartDataObject Usage Notes 2–10
2.4 SmartDataBrowsers 2–14
2.4.1 SmartDataBrowser Instance Properties 2–16
2.4.2 Dynamic and Static SmartDataBrowsers Compared 2–18
2.4.3 SmartDataBrowser Usage Notes 2–20
2.5 SmartDataViewers 2–23
2.5.1 SmartDataViewer Instance Property Dialog Box 2–24
2.5.2 SmartDataViewer Usage Notes 2–25
2.6 SmartDataFields 2–25
2.6.1 SmartDataField Instance Property Dialog Box 2–27
2.6.2 SmartDataField Usage Notes 2–27
2.7 SmartPanels 2–28
2.7.1 SmartPanel Instance Property Dialog Boxes 2–30
2.7.2 SmartPanel Usage Notes 2–32
2.8 SmartFolders 2–33
2.8.1 SmartFolder Instance Property Dialog Box 2–34
2.8.2 SmartFolder Usage Notes 2–35

2.9 SmartFilters . . . 2–35
2.9.1 SmartFilter Instance Property Dialog Box . . . 2–37
2.9.2 SmartFilter Usage Notes . . . 2–44
2.10 SmartToolbars . . . 2–45
2.10.1 SmartToolbar Instance Property Dialog Box . . . 2–46
2.10.2 SmartToolbar Usage Notes . . . 2–49
2.11 SmartSelects . . . 2–50
2.11.1 SmartSelect Instance Properties . . . 2–51
2.11.2 SmartSelect Usage Notes . . . 2–58
2.12 Simple SmartObjects . . . 2–60

3. SmartLinks . . . 3–1
3.1 SmartLink Overview . . . 3–2
3.2 SmartLink Summary . . . 3–2
3.3 Source and Target Objects . . . 3–4
3.4 SmartLink Events . . . 3–4
3.4.1 Container SmartLink . . . 3–5
3.4.2 Navigation SmartLink . . . 3–7
3.4.3 Page SmartLink . . . 3–8
3.4.4 PageN SmartLink . . . 3–8
3.4.5 TableIO SmartLink . . . 3–9
3.4.6 GroupAssign SmartLink . . . 3–10
3.4.7 Data SmartLink . . . 3–11
3.4.8 Update SmartLink . . . 3–11
3.4.9 Commit SmartLink . . . 3–12
3.4.10 Filter SmartLink . . . 3–12
3.5 Invoking Behavior in Other Linked Objects . . . 3–13
3.5.1 Pass-through Links . . . 3–14
3.5.2 Getting Records from an Additional Source . . . 3–18
3.6 Using Data SmartLinks . . . 3–19
3.7 Defining SmartLinks in Progress Applications . . . 3–20
3.7.1 Defining Static SmartLinks . . . 3–20
3.7.2 Defining Dynamic SmartLinks . . . 3–22

4. Data Management in the ADM . . . 4–1
4.1 Displaying and Browsing Data Sets . . . 4–2
4.1.1 SmartDataObjects . . . 4–2
4.1.2 SmartDataViewers . . . 4–3
4.1.3 SmartDataBrowsers . . . 4–4
4.1.4 Initializing the Foreign Key Fields . . . 4–4
4.1.5 Compatibility Checking . . . 4–5
4.2 Filtering Records . . . 4–10

4.3 Using SmartPanels and the SmartToolbar 4–12
4.3.1 Using SmartPanels 4–12
4.3.2 Using SmartToolbars 4–17
4.4 Transactions and Record Locking 4–19

5. SmartObject Interactions 5–1
5.1 General Structure of a SmartObject 5–2
5.1.1 Directory and File Structure 5–2
5.1.2 Support Include Files 5–2
5.1.3 Super Procedures 5–3
5.1.4 Property and Prototype Include Files 5–5
5.1.5 Prototype Include Files 5–5
5.1.6 SmartObject File Relationships 5–6
5.2 RUN Protocol 5–9
5.2.1 RUN Statement 5–9
5.2.2 Localizing Standard SmartObject Behavior 5–11
5.3 ADM Properties 5–14
5.3.1 ADMProps Temp–table and Object Properties 5–15
5.3.2 Get and Set Functions for Object Properties 5–19
5.3.3 {get} and {set} Pseudo-syntax for Object Properties 5–20
5.3.4 Instance Properties 5–23
5.3.5 Translatable Properties 5–23
5.3.6 Functions for Accessing Properties 5–24
5.3.7 Dynamic Properties 5–25

6. Advanced ADM Topics 6–1
6.1 Parameterizing SmartObject Instances as Variables 6–2
6.2 Writing Local Event Procedures and Functions 6–4
6.2.1 Writing a Local Event Procedure 6–5
6.2.2 Writing a Local Event Function 6–6
6.3 Monitoring SmartObject Applications 6–6
6.3.1 Procedure Object Viewer 6–6
6.3.2 The Progress Debugger 6–9
6.3.3 PRO*Spy for Version 9 6–10
6.4 AppBuilder Requirements for SmartObjects 6–12
6.5 Using GroupAssign SmartLinks 6–14

7. Developing Your Application's Business Logic 7–1
7.1 SmartDataObject Features and Operating Characteristics 7–2
7.2 SmartDataObject Query and Update Operations 7–3
7.2.1 Query Operations and the RowObject Temp–table 7–4
7.2.2 Update Operations and the RowObjUpd Temp–table 7–4
7.2.3 Nondata Fields in the RowObject and RowObjUpd Temp–tables 7–5

7.3 ADM Event Procedures and Functions in the SmartDataObject 7–7
7.3.1 Opening a Database Query 7–7
7.3.2 Dynamic Query Manipulation 7–7
7.4 SmartDataObjects and SmartLinks 7–13
7.5 Validation Procedures 7–14
7.5.1 Data Dictionary Validation 7–14
7.5.2 Field-level Validation Procedures 7–15
7.5.3 Record-level Validation Procedures 7–16
7.5.4 Transaction-level Validation Procedures 7–19
7.5.5 Database Trigger Procedures 7–22
7.6 Running SmartDataObjects in a Distributed Environment 7–23
7.6.1 Setting Up the SmartDataObject Master for Conditional Compilation 7–24
7.6.2 AppBuilder Modifications to the SmartDataObject Master . . . 7–25
7.6.3 Initializing the SmartDataObject 7–27
7.7 Managing SmartDataObjects in Distributed Mode 7–28
7.7.1 SmartDataObject Deployment Files 7–29
7.7.2 Service Choices and SmartDataObject Execution 7–30
7.7.3 AppServer Session Operating Modes and SmartDataObjects 7–32
7.8 AppServer-related SmartDataObject Properties 7–33
7.9 Running SmartDataObjects from a Non-Progress Client 7–33
7.9.1 Batch-mode Operations 7–34
7.9.2 Single-row Operations 7–34
7.10 Java Applications and SmartDataObjects 7–35

8. Developing ADM Extensions 8–1
8.1 Introduction 8–2
8.2 Creating a New Class at the Bottom of the ADM Class Hierarchy 8–4
8.2.1 Planning Issues 8–4
8.2.2 Creating the New Class Files 8–5
8.2.3 Modifying the New Class Files 8–12
8.3 Customizing an Existing ADM Class 8–13
8.4 Adding Application Logic to Your New or Customized ADM Class 8–13
8.4.1 Custom Class Files 8–14
8.4.2 Design Rules 8–15
8.4.3 Adding Properties 8–16
8.4.4 Writing Super Procedures 8–18
8.5 Examples 8–22
8.5.1 Creating the myviewer Class 8–22
8.5.2 Customizing the Visual Class 8–30

A. ADM Standard and Custom Class Files A–1
A.1 Container Class Files A–2
A.1.1 Standard Class Files A–2
A.1.2 Templates A–14
A.1.3 Custom Class Files A–21

B. Version 8 to Version 9 Conversion Utility B–1
B.1 Conversion Support for Version 8.1/8.2 SmartObjects in Version 9 . . . . B–2
B.1.1 Code Changes to SmartObject Container Type Objects B–3
B.1.2 Additional Miscellaneous Points B–3
B.2 Version 8 to Version 9 Conversion Utility B–4
B.2.1 Accessing the Conversion Utility B–5
B.2.2 Defining Conversion Options B–6
B.2.3 Building the List of Files to Process B–8
B.2.4 Performing the Conversion B–10
B.2.5 Reviewing Conversion Results B–12
B.2.6 Customizing the Conversion Utility B–16

Index Index–1

Figures

Figure 1–1: ADM Hierarchical Class Structure 1–5
Figure 1–2: SmartObject Life Cycle 1–13
Figure 1–3: External procedures, Internal Procedures, and Functions 1–17
Figure 1–4: Inheritance and the Super Procedure Stack 1–18
Figure 2–1: SmartContainer and Contained SmartObject 2–5
Figure 2–2: SmartDataObject Properties Dialog Box 2–9
Figure 2–3: Dynamic SmartDataBrowser Properties Dialog Box 2–16
Figure 2–4: Static SmartDataBrowser Properties Dialog Box 2–18
Figure 2–5: SmartDataViewer Properties Dialog Box 2–24
Figure 2–6: SmartDataField Properties Dialog Box 2–27
Figure 2–7: Navigation SmartPanel Properties Dialog Box 2–30
Figure 2–8: Update SmartPanel Properties Dialog Box 2–31
Figure 2–9: SmartFolder Instance Property Dialog Box 2–34
Figure 2–10: SmartFolder Page 0 2–35
Figure 2–11: SmartFilter Properties Dialog Box 2–37
Figure 2–12: SmartToolbar Instance Properties Dialog Box 2–46
Figure 2–13: SmartToolbar Menus 2–47
Figure 2–14: SmartToolbar Toolbar 2–47
Figure 2–15: SmartSelect Instance Properties Dialog Box 2–51
Figure 2–16: Keyboard Event Dialog Box 2–57
Figure 2–17: Simple SmartObject 2–60
Figure 3–1: Pass-through Link 3–14
Figure 3–2: Pass-through Link: Inner Connection 3–16
Figure 3–3: Pass-through Link: Inner and Outer Connections 3–17
Figure 4–1: Inheriting Foreign Key Field Values 4–5
Figure 5–1: Super Procedures and Master Interactions 5–4
Figure 5–2: Include File Structure for SmartDataViewer 5–6
Figure 5–3: Super Procedure Schematic for SmartDataViewer 5–8
Figure 6–1: Procedure Object Viewer Icon on PRO*Tools Palette 6–7
Figure 6–2: Procedure Object Viewer 6–7
Figure 6–3: Selecting Procedure Objects and Internal Entries 6–8
Figure 6–4: PRO*Spy for Version 9 Icon on PRO*Tools Palette 6–10
Figure 6–5: PRO*Spy for Version 9 Window 6–11
Figure 6–6: Grouping Updates with GroupAssign SmartLinks 6–14
Figure 7–1: The SmartDataObject and Its Temp–tables 7–3
Figure 7–2: Java Open Client Access to a Remote SmartDataObject 7–35
Figure 8–1: ADM Hierarchical Class Structure for SmartFrames 8–3
Figure 8–2: New ADM Class Menu Option 8–5
Figure 8–3: New ADM Class (Initial) 8–6
Figure 8–4: Basic Tab with Fill-in Fields 8–7
Figure 8–5: Custom Files Tab 8–9
Figure B–1: Version 8 to Version 9 Conversion Utility Icon B–5
Figure B–2: Version 8 to Version 9 Conversion Utility Window B–5

Tables

Table 1–1: SmartObject Application Benefits 1–3
Table 1–2: Standard ADM Class Files 1–7
Table 1–3: Custom ADM Class Files 1–9
Table 1–4: SmartObject Summary 1–11
Table 2–1: SmartObject Types 2–2
Table 2–2: SmartWindow Files 2–6
Table 2–3: SmartFrame Files 2–7
Table 2–4: SmartDialog Files 2–7
Table 2–5: SmartDataObject Files 2–8
Table 2–6: SmartDataBrowser Files 2–14
Table 2–7: SmartDataViewer Files 2–23
Table 2–8: SmartDataField Files 2–26
Table 2–9: SmartPanel Files 2–29
Table 2–10: SmartFolder Files 2–33
Table 2–11: SmartFilter Files 2–36
Table 2–12: SmartToolbar Files 2–45
Table 2–13: SmartSelect Files 2–50
Table 3–1: ADM-recognized SmartLink Types 3–2
Table 3–2: Container Events 3–6
Table 3–3: Navigation Events 3–7
Table 3–4: Page Events 3–8
Table 3–5: TableIO Internal Procedures 3–9
Table 3–6: GroupAssign Events 3–10
Table 3–7: Data Events 3–11
Table 3–8: Commit Events 3–12
Table 8–1: Basic Tab Fill-in Fields 8–8
Table B–1: Setting Up File Conversion Options B–6
Table B–2: Files in the Browser B–9
Table B–3: Refining File Selection Actions B–10
Table B–4: Conversion Status Labels Displayed in the Browser B–12
Table B–5: Version 8 to Version 9 SmartObject Conversions B–13
Table B–6: Specific File Conversion Changes B–14

Procedures

dcust.i 4–7
dcust.i 4–8
dcustreverse.i 4–8
smrtprop.i 5–15
dataprop.i 5–17
containr.i A–2
cntnprop.i A–4
containr.p A–7
cntnprto.i A–12
cntnrfrm.w A–15
containrcustom.i A–22
cntnpropcustom.i A–24
containrcustom.p A–26
cntnprtocustom.i A–27
containrexclcustom.i A–28
containrdefscustom.i A–28

Preface

Purpose

This book describes the Application Development Model, Version 2 (ADM 2) and explains how to use Progress SmartObjects in Progress 4GL database applications.

Audience

This book is intended for Progress 4GL application developers.

Organization of This Manual

Chapter 1, "Overview"

Provides an overview of the Application Development Model, Version 2, and Progress SmartObjects.

Chapter 2, "SmartObjects"

Provides a summary of SmartObject capabilities and types, followed by a description of each SmartObject.

Chapter 3, "SmartLinks"

Provides an overview of SmartLinks and a list of types, followed by a description of the relationship established for each SmartLink type and some programming considerations.

Chapter 4, "Data Management in the ADM"

Describes how various SmartObjects work together to manage database records in your applications.

Chapter 5, “SmartObject Interactions”

Describes how SmartObjects interact; in particular, how they communicate, get and set ADM properties, and pass data.

Chapter 6, “Advanced ADM Topics”

Discusses advanced ADM topics, including parameterizing SmartObject instances as variables, customizing ADM internal procedures and functions, adding your own SmartObjects, monitoring SmartObjects applications, and AppBuilder requirements for SmartObjects.

Chapter 7, “Developing Your Application’s Business Logic”

Provides information on developing and deploying SmartObject-based applications in heterogeneous (single or combined client/server, n-tier, or Web-enabled) environments.

Chapter 8, “Developing ADM Extensions”

Describes how to use the AppBuilder’s New ADM2 Class tool and ADM custom class files to extend the ADM classes.

Appendix A, “ADM Standard and Custom Class Files”

Shows the contents of the class files for the viewer class, as an example of the class files for all ADM classes.

Appendix B, “Version 8 to Version 9 Conversion Utility”

Describes how to use the Conversion Utility to convert Version 8.1 (and later) SmartObjects to Version 9 SmartObjects.

Typographical Conventions

Writers: Required for all books.

This manual uses the following typographical conventions:

- **Bold typeface** indicates:
  - Commands or characters that the user types
  - That a word carries particular weight or emphasis
- *Italic typeface* indicates:
  - Progress variable information that the user supplies
  - New terms
  - Titles of complete publications
- `Monospaced typeface` indicates:
  - Code examples
  - System output
  - Operating system filenames and pathnames

The following typographical conventions are used to represent keystrokes:

- Small capitals are used for Progress key functions and generic keyboard keys.

  END-ERROR, **GET**, **GO**
  ALT, **CTRL**, **SPACEBAR**, **TAB**

- When you have to press a combination of keys, they are joined by a dash. You press and hold down the first key, then press the second key.

  CTRL-X

- When you have to press and release one key, then press another key, the key names are separated with a space.

  ESCAPE H
  ESCAPE CURSOR-LEFT

Syntax Notation

The syntax for each component follows a set of conventions:

- Uppercase words are keywords. Although they are always shown in uppercase, you can use either uppercase or lowercase when using them in a procedure.

  In this example, ACCUM is a keyword:

  SYNTAX

  ```
  ACCUM aggregate expression
  ```

- Italics identify options or arguments that you must supply. These options can be defined as part of the syntax or in a separate syntax identified by the name in italics. In the ACCUM function above, the *aggregate* and *expression* options are defined with the syntax for the ACCUM function in the *Progress Language Reference*.

- You must end all statements (except for DO, FOR, FUNCTION, PROCEDURE, and REPEAT) with a period. DO, FOR, FUNCTION, PROCEDURE, and REPEAT statements can end with either a period or a colon, as in this example:

  ```
  FOR EACH Customer:
     DISPLAY Name.
  END.
  ```

- Square brackets (**[ ]**) around an item indicate that the item, or a choice of one of the enclosed items, is optional.

  In this example, STREAM *stream*, UNLESS-HIDDEN, and NO-ERROR are optional:

  SYNTAX

  ```
  DISPLAY [ STREAM stream ] [ UNLESS-HIDDEN ] [ NO-ERROR ]
  ```

In some instances, square brackets are not a syntax notation, but part of the language.

For example, this syntax for the INITIAL option uses brackets to bound an initial value list for an array variable definition. In these cases, normal text brackets ([ ]) are used:

SYNTAX

```
INITIAL [ constant [ , constant ] ... ]
```

NOTE: The ellipsis (**...**) indicates repetition, as shown in a following description.

- Braces (**{ }**) around an item indicate that the item, or a choice of one of the enclosed items, is required.

  In this example, you must specify the items BY and *expression* and can optionally specify the item DESCENDING, in that order:

  SYNTAX

  ```
  { BY expression [ DESCENDING ] }
  ```

  In some cases, braces are not a syntax notation, but part of the language.

  For example, a called external procedure must use braces when referencing arguments passed by a calling procedure. In these cases, normal text braces ({ }) are used:

  SYNTAX

  ```
  { &argument-name }
  ```

- A vertical bar (**|**) indicates a choice.

  In this example, EACH, FIRST, and LAST are optional, but you can only choose one:

  SYNTAX

  ```
  PRESELECT [ EACH | FIRST | LAST ] record-phrase
  ```

In this example, you must select one of *logical-name* or *alias*:

SYNTAX

```
CONNECTED ( { logical-name | alias } )
```

- Ellipses (**. . .**) indicate that you can choose one or more of the preceding items. If a group of items is enclosed in braces and followed by ellipses, you must choose one or more of those items. If a group of items is enclosed in brackets and followed by ellipses, you can optionally choose one or more of those items.

  In this example, you must include two expressions, but you can optionally include more. Note that each subsequent expression must be preceded by a comma:

  SYNTAX

  ```
  MAXIMUM ( expression , expression [ , expression ] ... )
  ```

  In this example, you must specify MESSAGE, then at least one of *expression* or SKIP, but any additional number of *expression* or SKIP is allowed:

  SYNTAX

  ```
  MESSAGE { expression | SKIP [ (n) ] } ...
  ```

  In this example, you must specify {*include-file*, then optionally any number of *argument* or &*argument-name* = "*argument-value*", and then terminate with }:

  SYNTAX

  ```
  { include-file
      [ argument | &argument-name = "argument-value" ] ... }
  ```

- In some examples, the syntax is too long to place in one horizontal row. In such cases, **optional** items appear individually bracketed in multiple rows in order, left-to-right and top-to-bottom. This order generally applies, unless otherwise specified. **Required** items also appear on multiple rows in the required order, left-to-right and top-to-bottom. In cases where grouping and order might otherwise be ambiguous, braced (required) or bracketed (optional) groups clarify the groupings.

  In this example, WITH is followed by several optional items:

  SYNTAX

```
WITH [ ACCUM max-length ] [ expression DOWN ]
  [ CENTERED ] [ n COLUMNS ] [ SIDE-LABELS ]
  [ STREAM-IO ]
```

  In this example, ASSIGN requires one of two choices: either one or more of *field*, or one of *record*. Other options available with either *field* or *record* are grouped with braces and brackets. The open and close braces indicate the required order of options:

  SYNTAX

```
ASSIGN {   { [ FRAME frame ]
               { field [ = expression ] }
               [ WHEN expression ]
           } ...
         | { record [ EXCEPT field ... ] }
       }
```

Example Procedures

This manual provides numerous example procedures that illustrate syntax and concepts. Examples use the following conventions:

- They appear in boxes with borders.
- If they are available online, the name of the procedure appears above the left corner of the box and starts with a prefix associated with the manual that references it, as follows:
  - `e-` —*Progress External Program Interfaces*, for example, `e-ddeex1.p`
  - `lt-` —*Progress Language Tutorial*, for example, `lt-05-s3.p`
  - `p-` —*Progress Programming Handbook*, for example, `p-br01.p`
  - `r-` —*Progress Language Reference*, for example, `r-dynbut.p`

  If the name does not start with a listed prefix, the procedure is not available online.
- If they are not available online, they compile as shown, but might not execute for lack of completeness.

Accessing Files in Procedure Libraries on Windows Platforms

Documentation examples are stored in procedure libraries, `prodoc.pl` and `prohelp.pl`, in the `src` directory where Progress is installed.

You must first create all subdirectories required by a library before attempting to extract files from the library. You can see what directories and subdirectories a library needs by using the PROLIB -list command to view the contents of the library. See the *Progress Client Deployment Guide* for more details on the PROLIB utility.

Extracting source files from a procedure library involves running PROENV to set up your Progress environment, creating the directory structure for the files you want to extract, and running PROLIB.

1 ♦ From the Control Panel or the Progress Program Group, double-click the Proenv icon.

2 ♦ The Proenv Window appears, with the proenv prompt.

Running Proenv sets the DLC environment variable to the directory where you installed Progress (by default, `C:\Program Files\Progress`). Proenv also adds the DLC environment variable to your PATH environment variable and adds the bin directory `(PATH=%DLC%;%DLC%\bin;%PATH%)`.

3 ♦ Enter the following command at the proenv prompt to create the `prodoc` directory in your Progress working directory (by default, `C:\Progress\Wrk`):

```
MKDIR prodoc
```

4 ♦ Create the `langref` directory under `prodoc`:

```
MKDIR prodoc\langref
```

5 ♦ To extract all examples in a procedure library directory, run the PROLIB utility. Note that you must use double quotes because “Program Files” contains an embedded space:

```
PROLIB "%DLC%\src\prodoc.pl" -extract prodoc\langref\*.*
```

PROLIB extracts all examples into `prodoc\langref`.

To extract one example, run PROLIB and specify the file that you want to extract as it is stored in the procedure library:

```
PROLIB "%DLC%\src\prodoc.pl" -extract prodoc/langref/r-syshlp.p
```

PROLIB extracts `r-syshlp.p` into `prodoc\langref`.

Extracting Source Files from Procedure Libraries on UNIX Platforms

To extract p-wrk1.p from prodoc.pl, a procedure library, follow these steps at the UNIX system prompt:

1 ♦ Run the PROENV utility:

```
install-dir/dlc/bin/proenv
```

Running proenv sets the DLC environment variable to the directory where you installed Progress (by default, /usr/dlc). The proenv utility also adds the DLC environment variable to your PATH environment variable and adds the bin directory (PATH=%DLC%;%DLC%\bin;%PATH%).

2 ♦ At the proenv prompt, create the prodoc directory in your Progress working directory:

```
mkdir prodoc
```

3 ♦ Create the proghand directory under prodoc:

```
mkdir prodoc/proghand
```

4 ♦ To extract all examples in a procedure library directory, run the PROLIB utility:

```
prolib $DLC/src/prodoc.pl -extract prodoc/proghand/*.*
```

PROLIB extracts all examples into prodoc\langref.

To extract one example, run PROLIB and specify the file that you want to extract as it is stored in the procedure library:

```
prolib $DLC/src/prodoc.pl -extract prodoc/proghand/p-wrk-1.p
```

PROLIB extracts p-wrk-1.p into prodoc/proghand.

Progress Messages

Progress displays several types of messages to inform you of routine and unusual occurrences:

- Execution messages inform you of errors encountered while Progress is running a procedure (for example, if Progress cannot find a record with a specified index field value).
- Compile messages inform you of errors found while Progress is reading and analyzing a procedure prior to running it (for example, if a procedure references a table name that is not defined in the database).
- Startup messages inform you of unusual conditions detected while Progress is getting ready to execute (for example, if you entered an invalid startup parameter).

After displaying a message, Progress proceeds in one of several ways:

- Continues execution, subject to the error-processing actions that you specify, or that are assumed, as part of the procedure. This is the most common action taken following execution messages.
- Returns to the Progress Procedure Editor so that you can correct an error in a procedure. This is the usual action taken following compiler messages.
- Halts processing of a procedure and returns immediately to the Procedure Editor. This does not happen often.
- Terminates the current session.

Progress messages end with a message number in parentheses. In this example, the message number is 200:

```
** Unknown table name table. (200)
```

Use Progress online help to get more information about Progress messages. On the Windows platform, many Progress tools include the following Help menu options to provide information about messages:

- Choose Help→Recent Messages to display detailed descriptions of the most recent Progress message and all other messages returned in the current session.
- Choose Help→Messages, then enter the message number to display a description of any Progress message. (If you encounter an error that terminates Progress, make a note of the message number before restarting.)
- In the Procedure Editor, press the **HELP** key (**F2** or **CTRL-W**).

On the UNIX platform, you can use the Progress PRO command to start a single-user mode character Progress client session and view a brief description of a message by providing its number. Follow these steps:

1 ♦ Start the Progress Procedure Editor:

```
install-dir/dlc/bin/pro
```

2 ♦ Press **F3** to access the menu bar, then choose Help→Messages.

3 ♦ Type the message number, and press **ENTER**. Details about that message number appear.

4 ♦ Press **F4** to close the message, press **F3** to access the Procedure Editor menu, and choose File→Exit.

Other Useful Documentation

This section lists Progress Software Corporation documentation that you might find useful. Unless otherwise specified, these manuals support both Windows **and** Character platforms and are provided in electronic documentation format on CD-ROM.

Getting Started

Progress Electronic Documentation Installation and Configuration Guide (Hard copy only)

A booklet that describes how to install the Progress EDOC viewer and collection on UNIX and Windows.

Progress Installation and Configuration Guide Version 9 for UNIX

A manual that describes how to install and set up Progress Version 9.1 for the UNIX operating system.

Progress Installation and Configuration Guide Version 9 for Windows

A manual that describes how to install and set up Progress Version 9.1 for all supported Windows and Citrix MetaFrame operating systems.

Progress Version 9 Product Update Bulletin

A guide that provides a brief description of each new feature of the release. The booklet also explains where to find more detailed information in the documentation set about each new feature.

Progress Application Development Environment — Getting Started (Windows only)

A practical guide to graphical application development within the Progress Application Development Environment (ADE). This guide includes an overview of the ADE and its tools, an overview of Progress SmartObject technology, and tutorials and exercises that help you better understand SmartObject technology and how to use the ADE to develop applications.

Progress Language Tutorial for Windows and *Progress Language Tutorial for Character*

Platform-specific tutorials designed for new Progress users. The tutorials use a step-by-step approach to explore the Progress application development environment using the 4GL.

Progress Master Glossary for Windows and *Progress Master Glossary for Character* (EDOC only)

Platform-specific master glossaries for the Progress documentation set. These books are in electronic format only.

Progress Master Index and Glossary for Windows and *Progress Master Index and Glossary for Character* (Hard copy only)

Platform-specific master indexes and glossaries for the Progress hard-copy documentation set.

Progress Startup Command and Parameter Reference

A reference manual that describes the Progress startup commands and parameters in alphabetical order.

Welcome to Progress (Hard copy only)

A booklet that explains how Progress software and media are packaged. An icon-based map groups the documentation by functionality, providing an overall view of the documentation set. *Welcome to Progress* also provides descriptions of the various services Progress Software Corporation offers.

Development Tools

Progress ADM 2 Reference

A reference for the Application Development Model, Version 2 (ADM 2) application. It includes descriptions of ADM 2 functions and procedures.

Progress AppBuilder Developer's Guide (Windows only)

A programmer's guide to using the Progress AppBuilder visual layout editor. AppBuilder is a Rapid Application Development (RAD) tool that can significantly reduce the time and effort required to create Progress applications.

Progress Basic Database Tools (Character only; information for Windows is in online help)

A guide for the Progress Database Administration tools, such as the Data Dictionary.

Progress Basic Development Tools (Character only; information for Windows is in online help)

A guide for the Progress development toolset, including the Progress Procedure Editor and the Application Compiler.

Progress Debugger Guide

A guide for the Progress Application Debugger. The Debugger helps you trace and correct programming errors by allowing you to monitor and modify procedure execution as it happens.

Progress Help Development Guide (Windows only)

A guide that describes how to develop and integrate an online help system for a Progress application.

Progress Translation Manager Guide (Windows only)

A guide that describes how to use the Progress Translation Manager tool to manage the entire process of translating the text phrases in Progress applications.

Progress Visual Translator Guide (Windows only)

A guide that describes how to use the Progress Visual Translator tool to translate text phrases from procedures into one or more spoken languages.

Reporting Tools

Progress Report Builder Deployment Guide (Windows only)

An administration and development guide for generating Report Builder reports using the Progress Report Engine.

Progress Report Builder Tutorial (Windows only)

A tutorial that provides step-by-step instructions for creating eight sample Report Builder reports.

Progress Report Builder User's Guide (Windows only)

A guide for generating reports with the Progress Report Builder.

Progress Results Administration and Development Guide (Windows only)

A guide for system administrators that describes how to set up and maintain the Results product in a graphical environment. This guide also describes how to program, customize, and package Results with your own products. In addition, it describes how to convert character-based Results applications to graphical Results applications.

Progress Results User's Guide for Windows and *Progress Results User's Guide for UNIX*

Platform-specific guides for users with little or no programming experience that explain how to query, report, and update information with Results. Each guide also helps advanced users and application developers customize and integrate Results into their own applications.

4GL

Building Distributed Applications Using the Progress AppServer

A guide that provides comprehensive information about building and implementing distributed applications using the Progress AppServer. Topics include basic product information and terminology, design options and issues, setup and maintenance considerations, 4GL programming details, and remote debugging.

Progress External Program Interfaces

A guide to accessing non-Progress applications from Progress. This guide describes how to use system clipboards, UNIX named pipes, Windows dynamic link libraries, Windows dynamic data exchange, Windows ActiveX controls, and the Progress Host Language Call Interface to communicate with non-Progress applications and extend Progress functionality.

Progress Internationalization Guide

A guide to developing Progress applications for markets worldwide. The guide covers both internationalization—writing an application so that it adapts readily to different locales (languages, cultures, or regions)—and localization—adapting an application to different locales.

Progress Language Reference

A three-volume reference set that contains extensive descriptions and examples for each statement, phrase, function, operator, widget, attribute, method, and event in the Progress language.

Progress Programming Handbook

A two-volume handbook that details advanced Progress programming techniques.

Database

Progress Database Design Guide

A guide that uses a sample database and the Progress Data Dictionary to illustrate the fundamental principles of relational database design. Topics include relationships, normalization, indexing, and database triggers.

Progress Database Administration Guide and Reference

This guide describes Progress database administration concepts and procedures. The procedures allow you to create and maintain your Progress databases and manage their performance.

DataServers

Progress DataServer Guides

These guides describe how to use the DataServers to access non-Progress databases. They provide instructions for building the DataServer modules, a discussion of programming considerations, and a tutorial. Each DataServer has its own guide, for example, the *Progress DataServer for ODBC Guide*, the *Progress DataServer for ORACLE Guide*, or the *Progress/400 Product Guide*.

MERANT ODBC Branded Driver Reference

The Enterprise DataServer for ODBC includes MERANT ODBC drivers for all the supported data sources. For configuration information, see the MERANT documentation, which is available as a PDF file in *installation-path*\odbc. To read this file you must have the Adobe Acrobat Reader Version 3.1 or higher installed on your system. If you do not have the Adobe Acrobat Reader, you can download it from the Adobe Web site at: http://www.adobe.com/prodindex/acrobat/readstep.html.

SQL-89/Open Access

Progress Embedded SQL-89 Guide and Reference

A guide to Progress Embedded SQL-89 for C, including step-by-step instructions on building ESQL-89 applications and reference information on all Embedded SQL-89 Preprocessor statements and supporting function calls. This guide also describes the relationship between ESQL-89 and the ANSI standards upon which it is based.

Progress Open Client Developer's Guide

A guide that describes how to write and deploy Java and ActiveX applications that run as clients of the Progress AppServer. The guide includes information about how to expose the AppServer as a set of Java classes or as an ActiveX server.

Progress SQL-89 Guide and Reference

A user guide and reference for programmers who use interactive Progress/SQL-89. It includes information on all supported SQL-89 statements, SQL-89 Data Manipulation Language components, SQL-89 Data Definition Language components, and supported Progress functions.

SQL-92

Progress Embedded SQL-92 Guide and Reference

A guide to Progress Embedded SQL-92 for C, including step-by-step instructions for building ESQL-92 applications and reference information about all Embedded SQL-92 Preprocessor statements and supporting function calls. This guide also describes the relationship between ESQL-92 and the ANSI standards upon which it is based.

Progress JDBC Driver Guide

A guide to the Java Database Connectivity (JDBC) interface and the Progress SQL-92 JDBC driver. It describes how to set up and use the driver and details the driver's support for the JDBC interface.

Progress ODBC Driver Guide

A guide to the ODBC interface and the Progress SQL-92 ODBC driver. It describes how to set up and use the driver and details the driver's support for the ODBC interface.

Progress SQL-92 Guide and Reference

A user guide and reference for programmers who use Progress SQL-92. It includes information on all supported SQL-92 statements, SQL-92 Data Manipulation Language components, SQL-92 Data Definition Language components, and Progress functions. The guide describes how to use the Progress SQL-92 Java classes and how to create and use Java stored procedures and triggers.

Deployment

Progress Client Deployment Guide

A guide that describes the client deployment process and application administration concepts and procedures.

Progress Developer's Toolkit

A guide to using the Developer's Toolkit. This guide describes the advantages and disadvantages of different strategies for deploying Progress applications and explains how you can use the Toolkit to deploy applications with your selected strategy.

Progress Portability Guide

A guide that explains how to use the Progress toolset to build applications that are portable across all supported operating systems, user interfaces, and databases, following the Progress programming model.

WebSpeed

Getting Started with WebSpeed

Provides an introduction to the WebSpeed Workshop tools for creating Web applications. It introduces you to all the components of the WebSpeed Workshop and takes you through the process of creating your own Intranet application.

WebSpeed Installation and Configuration Guide

Provides instructions for installing WebSpeed on Windows and UNIX systems. It also discusses designing WebSpeed environments, configuring WebSpeed Brokers, WebSpeed Agents, and the NameServer, and connecting to a variety of data sources.

WebSpeed Developer's Guide

Provides a complete overview of WebSpeed and the guidance necessary to develop and deploy WebSpeed applications on the Web.

WebSpeed Version 3 Product Update Bulletin

A booklet that provides a brief description of each new feature of the release. The booklet also explains where to find more detailed information in the documentation set about each new feature.

Welcome to WebSpeed! (Hard copy only)

A booklet that explains how WebSpeed software and media are packaged. *Welcome to WebSpeed!* also provides descriptions of the various services Progress Software Corporation offers.

Reference

Pocket Progress (Hard copy only)

A reference that lets you quickly look up information about the Progress language or programming environment.

Pocket WebSpeed (Hard copy only)

A reference that lets you quickly look up information about the SpeedScript language or the WebSpeed programming environment.

1

Overview

This chapter provides an overview of the Application Development Model (ADM), Version 2. It discusses these topics:

- Introduction
- ADM classes
- SmartObjects
- SmartLinks
- Properties
- Super procedures

1.1 Introduction

The Application Development Model (ADM) is a methodology for building Progress 4GL applications based on reusable components called SmartObjects. It has been extensively updated for Progress Version 9 to take advantage of numerous enhancements to the Progress 4GL; this enhanced version is sometimes called ADM 2 to indicate Application Development Model, Version 2.

NOTE: In the remainder of this manual, all uses of the expression ADM refer to the enhanced (Version 2) ADM architecture unless otherwise noted.

All support files for the enhanced (Version 9) ADM architecture reside in a directory structure under `src/adm2`. However, Progress also maintains support for SmartObject applications built in Version 8 by including the ADM Version 1.1 support files under a separate directory structure under `src/adm` and parallel `gui` directories.

The ADM architecture has four basic components:

- A hierarchical set of object classes from which to develop SmartObjects: reusable application objects (visualizable or nonvisualizable) that map to source files or compilation units
- SmartLinks, to establish a messaging system by defining links (communication paths) among SmartObjects
- Properties, to define the public data associated with SmartObjects and to get and set these data values
- Super procedures, to perform SmartObject actions

The design of this architecture relies on several important features of the Progress 4GL: super procedures, persistent procedures, internal procedures and functions, preprocessor names, temporary tables, and include files. This design is implemented in the body of the architecture's support code and is fully supported by the AppBuilder. For information about the AppBuilder, see the *Progress AppBuilder Developer's Guide*.

The following sections summarize the benefits of using SmartObjects in Progress 4GL applications and provide notes on some additional SmartObjects advantages. The rest of this chapter provides an overview of the components of the ADM architecture.

1.1.1 SmartObject Application Benefits

SmartObjects offer a dimension of object integration and flexibility of use that you cannot achieve with basic objects (Progress 4GL widgets). Unlike basic objects, which are built into the 4GL, each SmartObject is represented by an entire 4GL procedure file.

Table 1–1 summarizes the benefits of using SmartObjects in Progress 4GL applications.

Table 1–1: SmartObject Application Benefits

Benefit	How Achieved
Application assembly	Each SmartObject master is a predefined application component that can encapsulate more complex functionality than an individual basic object, so you can assemble more sophisticated applications in less time.
Object interoperability	Because the ADM gives SmartObjects standardized ways of interacting with each other, it is easier to integrate individual object instances into applications.
Code reusability	Because a single object can have multiple run-time instances, you can create code that can be used repeatedly.
Maintainability	Your development process is organized so as to make complex applications easy to maintain. SmartObject code is easily maintainable because changes to a single SmartObject master are reflected in all instances of that SmartObject.
Standard look	Different applications can instantiate the same SmartObject master, so you can establish a consistent look and feel across multiple applications.
Module independence	You can write each object without specific knowledge of other objects, thus reducing large-scale problems into application components that you can work on independently.

1.1.2 Enhanced Code Reusability

SmartObjects are defined in external procedures, thus creating a potential for code reuse far greater than that afforded by basic objects alone. There is no limit to the number of different application files that can instantiate the same SmartObject master. Moreover, you can assign different run-time properties to each instance while still creating each from a single master.

The potential for code reuse that SmartObjects create makes it much easier to maintain complex, enterprise-wide applications, because a change you make in a SmartObject master is reflected in every instance of the SmartObject in every application that uses it.

1.1.3 Customizing SmartObjects

Once you become familiar with the mechanics of the ADM, you can customize a SmartObject type or override its default behaviors. You can also create new SmartObjects (represented by new SmartObject templates), giving them different behaviors better suited to the needs of your applications. For information about creating new SmartObject types and customizing existing types, see Chapter 6, "Advanced ADM Topics."

1.2 ADM Classes

The ADM classes, collectively, are a system of Progress include files and collections of internal procedures and functions. Each class comprises a particular subset of these files that defines a standard behavior specific to that class. The various classes reference each other through include files, and relate to each other in a hierarchical fashion: lower-level classes inherit behavior and properties from higher-level classes.

Figure 1–1 illustrates the ADM classes and their hierarchical structure.

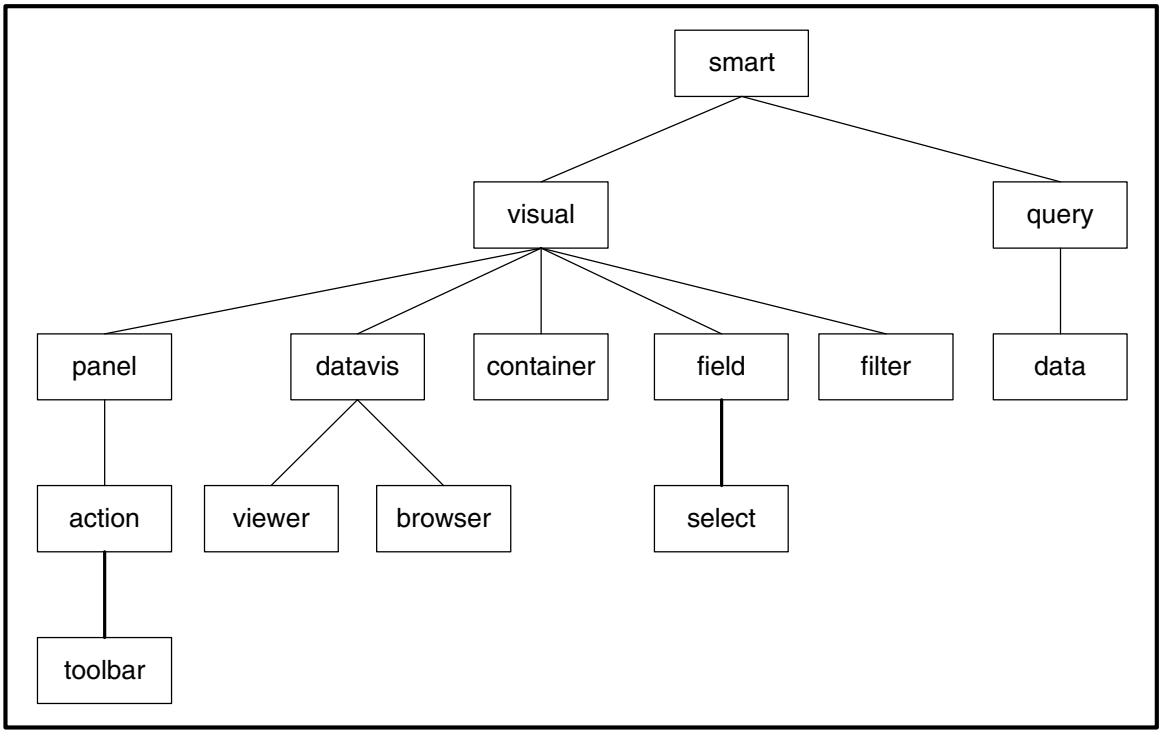


Figure 1–1: ADM Hierarchical Class Structure

The objects that are derived from a particular ADM class are described according to the class from which they inherit. For example:

- Objects derived from the visual class or the classes that inherit from it—panel, datavis, container, field, filter, action, viewer, browser, toolbar—are called visual objects.
- Objects derived from the datavis class and the viewer and browser classes that inherit from it are called data visualization objects.
- Objects derived from the query class and the data class that inherits from it are called query objects.

User-defined classes that inherit from an existing class use the same terminology; for example, a user-defined class that inherits from the filter class is a visual object.

Each ADM class is supported by two sets of class files: a standard set and a custom set. In addition to the class files, the ADM provides a set of templates, each of which references the primary include file of a specific class and serves as a base class for developing one of the many types of SmartObjects that you can use, along with basic and ActiveX objects, to build a Progress 4GL application. See the next several sections for details on standard and class files and on templates.

The body of code that supports ADM classes resides in the directory `%DLC%/src/adm2` and its subdirectories and is installed as part of Progress. For details, see the *Progress Installation and Configuration Guide Version 9 for Windows* or the *Progress Language Tutorial for Character*, as appropriate for your system.

1.2.1 Standard ADM Class Files and Templates

Each ADM class is supported by a set of standard class files of specific types: a primary include file, a property file, a super procedure, and a prototype file. These files, along with a set of templates, provide the basis for the standard SmartObjects available in the ADM. Each ADM class contains one standard class file of each type, but class files of the same type are set up differently for different classes. For example, the property file for the panel class is different from the property file for the viewer class. The standard class files for all ADM classes reside in the `%DLC%/src/adm2` directory.

Table 1–2 describes the standard class files for each class. Note that in the File Name column, *type* is a character string that indicates the particular class; for example, `view` or `viewer` for the viewer class.

Table 1–2: Standard ADM Class Files

File Type	Filename	Description
Primary include file	*type*.i	• Starts the super procedure for the class • Can initialize some properties • References the property file • Is referenced directly in a template or in another class' primary include file • References the custom primary include file,[1] if relevant
Property file	*type*prop.i	• Defines properties • References the prototype file • Can define instance properties • Can define the instance property dialog • References the custom instance definition file,[1] if relevant • References the custom property file,[1] if relevant
Super procedure file	*type*.p	• Contains functions and internal procedures that define the behavior for the class • References the property file • Is run only once for the entire session • References the custom exclude definition file,[1] if relevant
Prototype file	*type*prto.i	• Defines prototypes for all internal entries (functions, internal procedures) of the super procedure for the class

[1] This custom class file is described in the "Custom ADM Class Files" section.

For example, the following standard class files support the viewer class:

- Primary include file: `viewer.i`
- Property file: `viewprop.i`
- Super procedure: `viewer.p`
- Prototype file: `viewprto.i`

For examples of the contents of standard class files, see Appendix A, "ADM Standard and Custom Class Files."

Templates

Unlike the standard class files, templates reside in the `template` subdirectory of the `%DLC%/src/adm2` directory. They are files that have at least a design-time visualization in the AppBuilder and, accordingly, have the suffix .w; for example, `viewer.w`. A SmartObject template serves as a basis for including a SmartObject in your application. Conceptually, it is a procedure file that serves as a general starting point for building one or more specific SmartObject masters (SmartObject external procedures).

A template contains very little code. Generally, it contains only the following:

- A reference to the primary include file of the class on which the associated SmartObjects are based
- Definitions of Procedure Type, Supported Links, and other constant values
- A base definition of the SmartObject's frame or visualization, if appropriate
- The code used to execute the template's development Wizard, if any

For a description of how SmartObject masters and templates relate, see the "SmartObject Templates and Masters" section. For an example of the contents of a template file, see Appendix A, "ADM Standard and Custom Class Files."

1.2.2 Custom ADM Class Files

Each ADM class is also supported by a set of custom class files of specific types: a primary include file, a property file, a super procedure, a prototype file, an exclude definition file, and an instance definition file. These files can provide the basis for developing custom SmartObjects and/or classes based on existing SmartObjects and classes. As with the standard class files, each ADM class contains one file of each type. Custom ADM class files reside in the `custom` subdirectory of the `%DLC%/src/adm2` directory.

Table 1–3 describes the custom class files for each class. As in Table 1–2, *type* in the Filename column is a character string that indicates the particular class; for example, `view` or `viewer` for the viewer class.

Table 1–3: Custom ADM Class Files

File Type	Filename	Description
Custom primary include file	*type*custom.i	• Starts the custom super procedure for the class (commented out in the standard primary include file) • Can initialize some properties
Custom property file	*type*propcustom.i	• Defines properties • References the custom prototype file
Custom super procedure file	*type*custom.p	• Contains functions and internal procedures that define additional behavior for the class • References the property file • Is run only once for the entire session
Custom prototype file	*type*prtocustom.i	• References all internal entries (functions, internal procedures) of the super procedure for the class
Custom exclude definition file	*type*exclcustom.i	• Defines EXCLUDE–*xxx* preprocessor variables that exclude functions or internal procedures from the super procedure for the class
Custom instance definition file	*type*defscustom.i	• References definitions for instance properties • References the definition of the instance property dialog box

For example, the following custom class files support the viewer class:

- Custom primary include file: `viewercustom.i`
- Custom property file: `viewpropcustom.i`
- Custom super procedure: `viewercustom.p`
- Custom prototype file: `viewprtocustom.i`
- Custom exclude definition file: `viewerexclcustom.i`
- Custom instance definition file: `viewerdefscustom.i`

For examples of the contents of custom class files, see Appendix A, "ADM Standard and Custom Class Files." For information on using custom class files to extend the ADM, see Chapter 8, "Developing ADM Extensions."

1.3 SmartObjects

The ADM is grounded in the idea that you can create external procedure objects, called SmartObjects, that represent standardized components with useful behavior. A SmartObject is defined by a procedure file called a SmartObject master, which is external to the application that instantiates the SmartObject.

SmartObjects are smart because they provide the essential functionality required for building an application. A SmartObject application component is *encapsulated*: it contains all of the information relevant to itself and all of the actions that it can perform. It gets its visual features, user input capabilities, and database access abilities by encapsulating the functionality of basic objects and 4GL constructs in its procedure files within the communication framework of the ADM. Note the difference between using a basic object and a SmartObject in an application:

- When an application uses a basic object directly, the 4GL statements that define that object are written into the application's procedure file.
- When an application uses a SmartObject that encapsulates a basic object, the 4GL statements that define the basic object are written into the SmartObject's procedure file.

The ADM achieves encapsulation by providing a standard architecture (described in the "ADM Classes" section) for building reusable and maintainable objects, and by providing a standard communication interface (see the "SmartLinks" section) that allows these objects to interoperate.

The external procedure file that defines a particular SmartObject—the SmartObject *master*—begins as a copy of one of a number of SmartObject templates that the ADM provides. With certain exceptions, each SmartObject type corresponds to a different SmartObject *template*. Each SmartObject also has one or more standard include files (see the "ADM Classes" section) that define its properties and other aspects of its functionality. In addition, each SmartObject has one or more *super procedures*, which contain the internal procedures and functions that provide the SmartObject with its smart behavior. Any entity that interacts with a SmartObject—another object in the application or a user running the application—does so by telling the SmartObject to perform an action of some type.

1.3.1 SmartObject Types

The ADM provides the SmartObjects described in Table 1–4.

Table 1–4: SmartObject Summary *(1 of 2)*

SmartObject Type	Description	ADM Class
SmartContainer: SmartDialog, SmartFrame, SmartWindow	Holds instances of other SmartObjects, including other SmartContainers.	container
SmartDataBrowser	Browses records and allows updates to records in a browse widget; includes static and dynamic versions.	browser
SmartDataField	Displays a single data field in a SmartDataViewer.	field
SmartDataObject	Defines a set of records to fetch from a database and the update logic for those records.	data
SmartDataViewer	Displays data fields in a frame and coordinates their display with other SmartObjects. Can serve as a highly specialized type of SmartContainer.	viewer
SmartFilter	Displays data fields in a frame, to allow filtering of a data set by user-specified selection criteria.	filter

Table 1–4: SmartObject Summary *(2 of 2)*

SmartObject Type	Description	ADM Class
SmartFolder	Provides an interface (tab folder and paging mechanism) for selecting pages in a SmartContainer.	folder
SmartPanel	Groups functionally related buttons (for example, navigation or update buttons) on a frame.	panel
SmartSelect	A SmartDataField that performs a “lookup” on a single data field.	select
SmartToolbar	Provides a toolbar and/or menu interface to application commands.	toolbar
Simple SmartObject	Provides a template for creating new visual SmartObjects.	smart

For detailed descriptions, see Chapter 2, “SmartObjects.”

1.3.2 The Life Cycle of a SmartObject

The life cycle of a SmartObject begins with its creation and ends when a user instantiates it in an application screen at run time. Figure 1–2 depicts the life cycle of a typical SmartObject. Note that this is a **general** picture; the life cycle of some specific SmartObjects might be different.

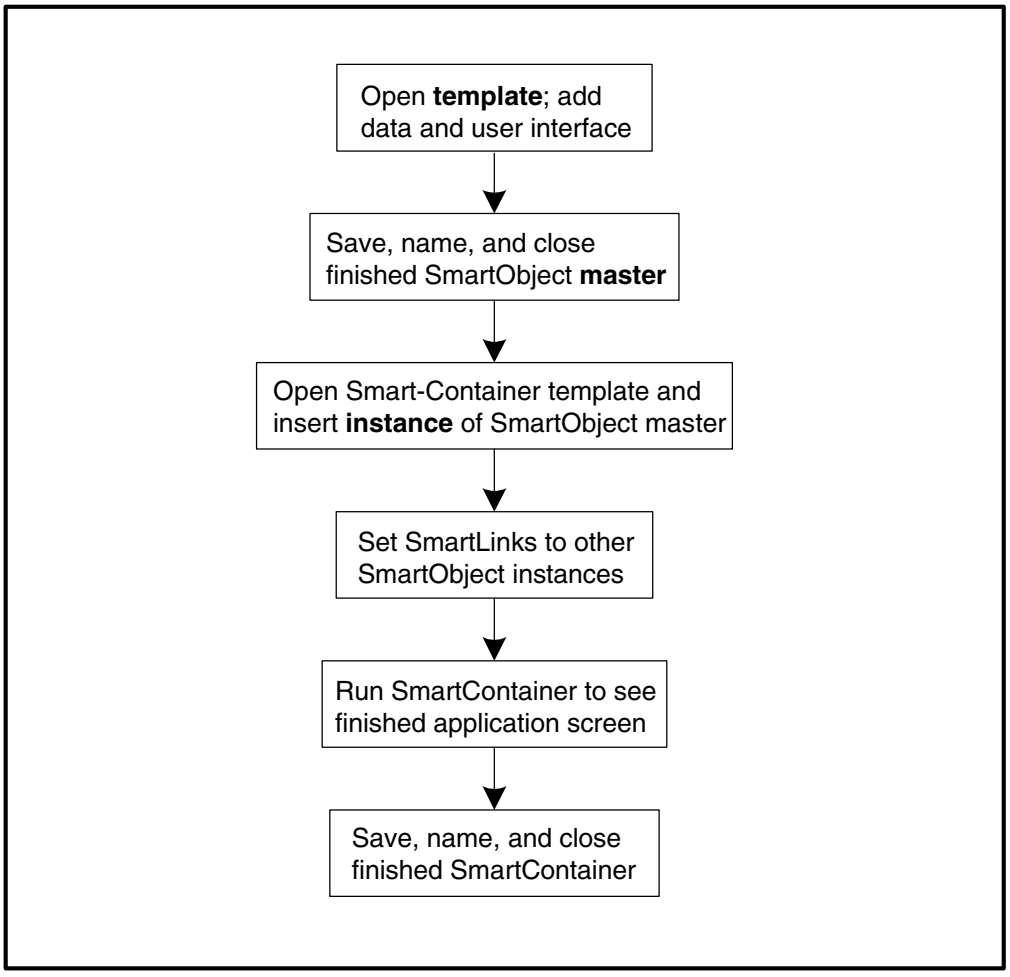


Figure 1–2: SmartObject Life Cycle

1.3.3 SmartObject Templates and Masters

You can designate a SmartObject procedure as a persistent procedure; that is, a procedure that is run persistently. You do this from the AppBuilder, in the Procedure Settings dialog box for that procedure. For more information about persistent procedures and the WAIT–FOR statement, see the *Progress Programming Handbook* and the *Progress Language Reference*.

Before you can run persistent instances of a SmartObject, however, you must build its external procedure (its SmartObject master). You can build an individual SmartObject master from a template, which the AppBuilder reads into memory as an untitled procedure. (You can either use one of the templates provided with the AppBuilder or build your own templates.)

Alternatively, you can create a new master by saving an existing file as another file while in the AppBuilder (choose File→ Save As on the AppBuilder menu bar).

Recall that conceptually, a SmartObject template is a procedure file that serves as a general starting point for building one or more specific SmartObjects masters. A template usually has minimal user-interface features and very little code (other than included code) and therefore is not meant to be run directly. Adding too much data and too many user-interface features to a template might hinder its general usefulness and maintainability; however, certain templates have associated data and user-interface elements, as appropriate. For example, the template for a SmartDialog has OK, Cancel, and Help buttons—user-interface elements that are standard to dialog boxes.

A SmartObject template generally includes a single support include file: the primary include file for the class on which the SmartObject is based. This include file has the same name as the template but the filename suffix .i instead of .w. For instance, the SmartDataViewer template `viewer.w` includes the primary include file `viewer.i`. A primary include file such as `viewer.i` does **not** directly contain most of the code needed to support the SmartObject. It contains only those program elements required to compile a master built from that template; all other support code for an object type resides in a super procedure. (See the "Super Procedures" section.)

1.3.4 Instantiation

At run-time, the top-level application procedure (a SmartContainer; typically, a SmartWindow) *instantiates* the other SmartObjects that it contains. Instantiation has several steps:

1. The top-level SmartContainer runs the master for each SmartObject persistently to create an instance of that SmartObject.

2. It sets instance properties in each SmartObject and sets the position of each SmartObject relative to the SmartContainer.

3. It tells the SmartObject how it relates to the other objects in the SmartContainer.

4. It instructs the SmartObject to initialize and display itself. This is done in the generated procedure adm–create–objects.

Note that the SmartContainer does not directly dictate the contents of SmartObjects when it tells them to initialize themselves. Each SmartObject responds differently to this request according to its type. The SmartContainer does not need to be aware of this; it sends exactly the same request to all of the SmartObjects and allows them to handle the details themselves.

1.4 SmartLinks

An important feature of the ADM is the messaging system that it provides: you use objects called *SmartLinks* to create communication paths between pairs of SmartObjects. The ADM includes the following SmartLink types:

- **Container**—Links a containing object to an object that it contains
- **Navigation**—Links an object that provides a navigation interface to an object that supplies a query through which to navigate
- **TableIO**—Links an object that provides a record-modification interface to an object through which to enter changes
- **Page**—Links an object that provides a page-selection interface to an object that manages the hiding and viewing of pages
- **PageN**—Links an object that manages the hiding and viewing of a numbered set of pages to the SmartObjects on a specific page
- **GroupAssign**—Links an object that manages a record to an object that manages a related record or another view of the same record
- **Data**—Links an object that finds records to a visualization object or to another object that manages records
- **Update**—Links a visualization object to a SmartDataObject for the purpose of submitting modifications to the data
- **Commit**—Links a Commit SmartPanel to a SmartDataObject (for committing multiple updates in a single transaction)
- **Filter**—Links a SmartFilter to an object that directly or indirectly supplies a query to filter (SmartDataObject or SmartDataBrowser).

When you connect objects with a SmartLink, the SmartObject from which the link originates is the *Source object* and the object to which it connects is the *Target object*.

The ADM implements SmartLinks using the Progress 4GL general PUBLISH/SUBSCRIBE event mechanism. For basic information on PUBLISH/SUBSCRIBE, see the *Progress Language Reference*. For more information on linking in the ADM and detailed descriptions of specific SmartLinks, see Chapter 3, "SmartLinks."

1.5 Properties

The property file, an include file, defines the basic properties of a SmartObject and starts its super procedure, if necessary. Properties are stored in a temp–table defined for each SmartObject and are accessed using get and set property functions defined for each property (one get/set pair for each property). In addition, you can define additional properties for a SmartObject based on your application needs. For more information on properties and property files, see Chapter 5, "SmartObject Interactions."

1.6 Super Procedures

In the ADM methodology, most of the support code for an object type resides in a *super procedure*: a separately compiled procedure that is built as a structured .p file. For instance, the super procedure for SmartDataViewers is `viewer.p`. A super procedure can include both object-specific routines and object-specific versions of standard routines defined further up the ADM class hierarchy. (See Figure 1–1.)

Super procedures are a Progress 4GL concept rather than an ADM concept. For basic information on using super procedures, see the *Progress Programming Handbook*. The remainder of this section describes how the ADM uses Progress 4GL super procedures.

1.6.1 External Procedures, Internal Procedures, and Functions

An understanding of Progress 4GL procedure types is basic to an understanding of ADM super procedures. The ADM uses two Progress 4GL procedure types: external procedures and internal procedures. In addition, it uses 4GL functions. Internal procedures and functions are collectively referred to as *methods*:

- *External procedures* are procedure files that typically have a .w or .p extension. External procedures can become *persistent procedures* at run time. A persistent procedure is a run-time instance of an external procedure that stays in memory until it is explicitly deleted. SmartObjects are implemented as run-time instances of external procedures.
- *Internal procedures* are contained by external procedures. An internal procedure is a named entry point that can be executed by its containing external procedure or by other external procedures. Internal procedures represent actions that a SmartObject can perform.
- *Functions* are also contained by external procedures. A function, like an internal procedure, can be executed by its containing external procedure or by other external procedures. Functions also represent actions that a SmartObject can perform.

Figure 1–3 illustrates the relationship among external procedures, internal procedures, and functions.

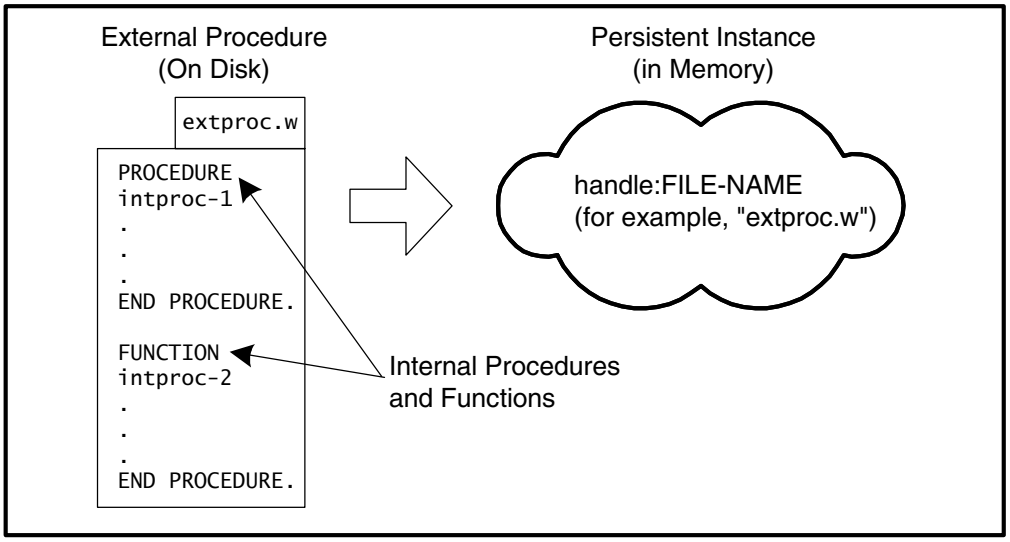


Figure 1–3: External procedures, Internal Procedures, and Functions

For more information on procedure types, see the *Progress Programming Handbook*.

1.6.2 Super Procedures in the ADM

In the ADM, a super procedure is a persistent procedure that contains versions of internal procedures or functions designed to be run remotely on behalf of SmartObjects. The use of super procedures provides a measure of inheritance and the ability to customize each internal procedure or function. Figure 1–4, which illustrates the inheritance process, shows how different versions of the same internal entry (in this example, the initializeObject procedure) exist in different super procedures.

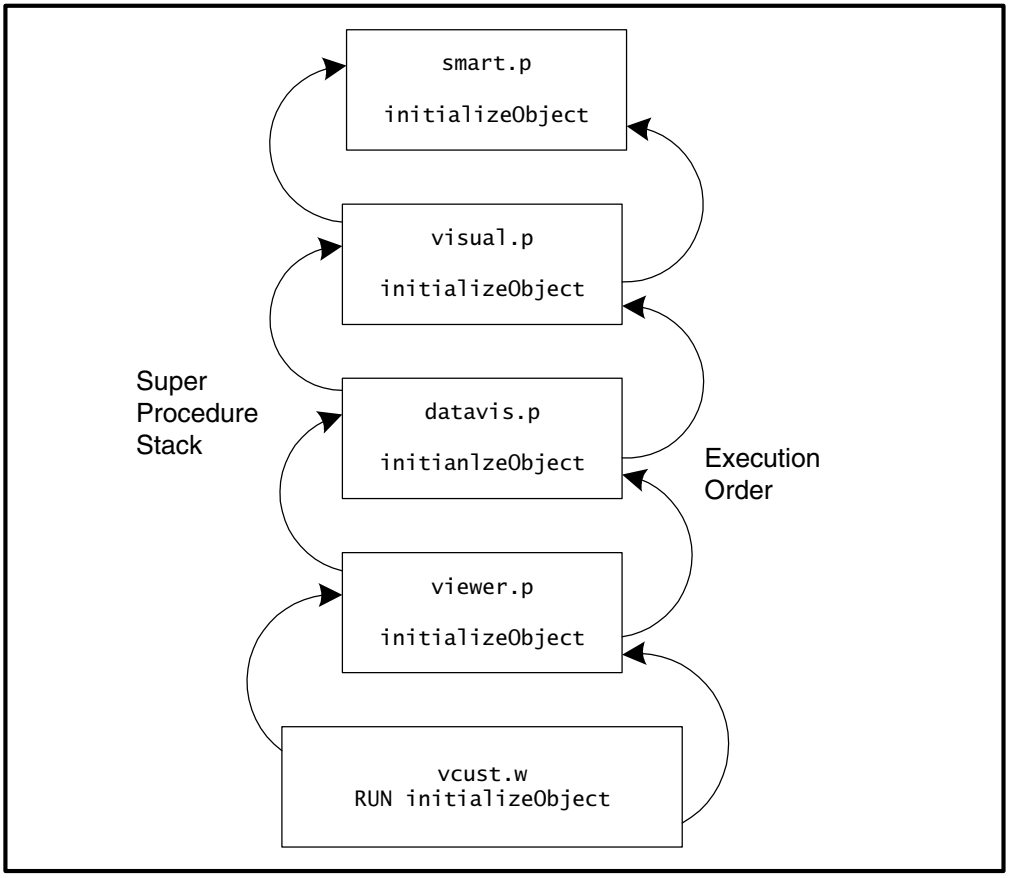


Figure 1–4: Inheritance and the Super Procedure Stack

The super procedures designed for SmartObjects are designed to be shared and stateless. This means that a given super procedure such as `viewer.p` is run only once in a session, no matter how many SmartDataViewers there are; each SmartDataViewer designates the same instance of the compiled code for `viewer.p` as its super procedure.

ADM super procedures utilize the Progress 4GL SOURCE–PROCEDURE and TARGET–PROCEDURE functions to provide information to their routines about who called them and for whom:

- The SOURCE–PROCEDURE function allows a routine in a super procedure to know who ran it, eliminating the need to pass THIS–PROCEDURE as a handle to the routine.
- The TARGET–PROCEDURE function allows a routine in a super procedure to know on whose behalf it was invoked.

For more information on the SOURCE–PROCEDURE and TARGET–PROCEDURE functions, see the *Progress Language Reference*.

2

SmartObjects

This chapter provides detailed descriptions of the Progress-supplied SmartObjects. It discusses these topics:

- A SmartObject summary, including general capabilities, brief descriptions, and information on include files and several special SmartObject-related procedures
- The following information, as applicable, for each SmartObject:
  - Related template procedure files or master procedure files
  - Primary include files
  - ADM/Progress Advisor-supported SmartLinks
  - Instance property dialog box files
  - Main Block code section include files
  - Instance property dialog box and its properties
  - Usage notes

2.1 SmartObject Summary

All SmartObjects have a set of common capabilities that allows them to participate smoothly in an application. They can initialize and destroy themselves

- Get and set properties
- Add and remove SmartLinks
- Communicate using the ADM's standard communication interface

These capabilities provide a standard interface for creating and destroying SmartObject instances and for making SmartObjects interact. A procedure object that does not have these capabilities is not a SmartObject.

NOTE: When the AppBuilder reads procedure files, it looks for specific information to determine whether a procedure is a SmartObject. For details, see Chapter 6, "Advanced ADM Topics."

The Progress ADM provides the SmartObjects described in Table 2–1. Much of this table appears in Chapter 1, "Overview,", but it is repeated in this chapter for reference.

Table 2–1: SmartObject Types *(1 of 2)*

SmartObject Type	Description
SmartContainer: SmartWindow, SmartFrame, SmartDialog	Holds instances of other SmartObjects, including other SmartContainers. The SmartContainer types are: – SmartWindow: Provides a frame **and** a window for grouping widgets or SmartObjects – SmartFrame: Provides a frame **but not** a window for grouping widgets or SmartObjects – SmartDialog: Displays a dialog box and three default buttons (OK, Cancel, Help); also used for grouping widgets or SmartObjects
SmartDataObject	Defines a set of records to fetch from a database and the update logic for those records.
SmartDataBrowser	Browses records and allows updates to records in a browse widget; includes dynamic and static versions.

Table 2–1: SmartObject Types *(2 of 2)*

SmartObject Type	Description
SmartDataViewer	Displays data fields in a frame and coordinates their display with other SmartObjects. Although a SmartDataViewer can be a type of SmartContainer, it is a highly specialized type and so is discussed separately.
SmartDataField	Displays a single data field in a SmartDataViewer.
SmartPanel	Groups functionally related buttons (for example, navigation or update buttons) on a frame.
SmartFolder	Provides an interface (tab folder and paging mechanism) for selecting pages in a SmartContainer.
SmartFilter	Displays data fields in a frame, to allow filtering of a data set by user-specified selection criteria.
SmartToolbar	Provides a toolbar and/or menu interface to application commands.
SmartSelect	A SmartDataField that performs a lookup on a single data field.
Simple SmartObject	Provides a template for creating new visual SmartObjects.

2.1.1 Accessing SmartObjects

SmartObjects are available either as an icon on the AppBuilder palette or from the selection list in the File→ New dialog box. For detailed instructions on using the AppBuilder to incorporate SmartObjects into Progress applications and modify them at design time, see the *Progress AppBuilder Developer's Guide*.

2.1.2 SmartObject Instance Properties

Because SmartObjects are procedure instances, they have different properties than basic objects (widgets). The instance properties for each SmartObject type are accessible in its instance properties dialog box in the AppBuilder. This manual describes the instance properties available from the instance properties dialog box for a given SmartObject type. Note that descriptions of the instance properties are also available in the online help.

This manual does not describe the mechanics of using instance property dialog boxes. For instructions, see the *Progress AppBuilder Developer's Guide*. It does, however, describe how to modify existing SmartObject instance properties dialog boxes and write your own instance dialog boxes. For details, see Chapter 6, "Advanced ADM Topics."

2.1.3 AppBuilder-maintained Procedures

The ADM provides several procedures that are generated by the AppBuilder at design time for use by SmartObjects. These procedures are as follows:

- **adm–create–objects**—Used by SmartContainers to start instances of contained objects
- **disable_UI—**Deletes the SmartObject procedure handle (run from destroyObject)
- **enable_UI**—Enables basic objects in a SmartContainer being built; that is, makes them sensitive to user input (run from enableObject)

The AppBuilder handles these procedures specially, generating the appropriate code for them as it is needed. You can view these procedures in the AppBuilder's Section Editor but they are marked Read Only. For information on using the Section Editor, see the *Progress AppBuilder Developer's Guide*.

2.2 SmartContainers

SmartContainers are ADM container-class objects that are designed to hold instances of other SmartObjects. There are four types of SmartContainers: SmartDataViewers, SmartDialogs, SmartFrames, and SmartWindows, each of which provides a different type of container widget. A SmartContainer can hold any other SmartObjects, including other SmartContainers; however, SmartDataViewers are intended to contain very specific types of objects. See the "SmartDataViewers" section for details.

When you build a Progress application, the step immediately after creating your SmartObject masters is to build an application screen. The first step in assembling this screen is to open a SmartContainer. You then insert instances of SmartObjects into the SmartContainer and link them together to produce your application screen.

SmartContainers have three important functions in a SmartObject application:

- Creating, initializing, and destroying their contents
- Managing paging
- Defining links between SmartObjects

The following sections describe these functions, as well as the SmartWindow, SmartFrame, and SmartDialog types of SmartContainers. However, because the SmartDataViewer is a highly specialized type of SmartContainer, it is described separately in the "SmartDataViewers" section.

2.2.1 SmartContainers and Their Contents

All SmartObjects that a SmartContainer contains are linked to it by a Container SmartLink. (For more information, see Chapter 3, "SmartLinks.") Figure 2–1 illustrates this relationship.

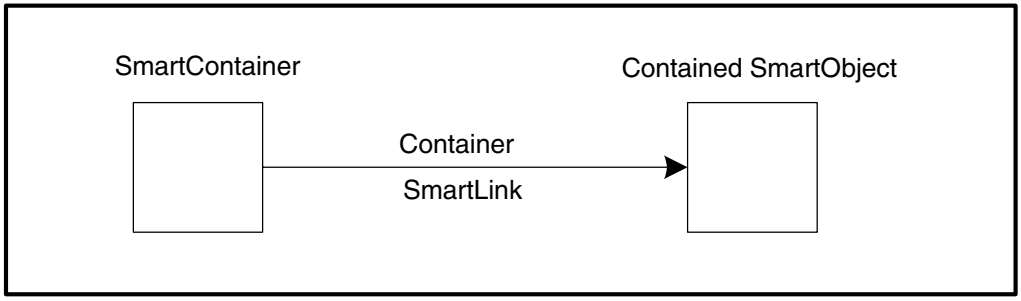


Figure 2–1: SmartContainer and Contained SmartObject

The term SmartContainer suggests a visual relationship similar to that of a frame and the widgets inside that frame. This kind of relationship is typical between a SmartContainer and the object it contains. However, the container relationship extends beyond this—especially when a SmartWindow contains another SmartWindow. In this situation, although the two SmartWindows appear separately on your screen, the ADM parents one SmartWindow to the other. As a result, if you minimize or destroy the parent window, you also minimize or destroy the contained window.

The container relationship is, therefore, a logical relationship and not necessarily a visual relationship. Another example is a SmartContainer that contains a SmartDataObject. The SmartDataObject has no visualization, so at run time, you cannot see a visual relationship. Nevertheless, the SmartDataObject is contained in the SmartContainer.

At design time, when you insert SmartObject instances into a SmartContainer, the AppBuilder generates an adm–create–objects procedure in the SmartContainer. This procedure runs persistent instances of the SmartObjects contained in the SmartContainer and performs other initializations for those SmartObjects, such as setting their relative position, parenting them correctly to the SmartContainer, and adding links.

2.2.2 Paging

All SmartContainers can manage application pages: logical groupings of SmartObjects. When you select a given page, the ADM automatically hides all other pages (except page 0). Pages provide an easy-to-use mechanism for viewing and hiding objects, and help to conserve screen space. For more information, see the *Progress AppBuilder Developer's Guide*.

2.2.3 Pass-through Links

A SmartObject inside a SmartContainer cannot link directly to a SmartObject external to the SmartContainer. However, you can create a link called a *pass-through link* that allows the two objects to communicate. For details, see the "Pass-through Links" section in Chapter 3, "SmartLinks."

2.2.4 SmartWindows

A SmartWindow is a SmartContainer that has a default frame **and** a window. A SmartWindow can be the main window of an application or a subwindow. It is an ADM container-class object.

Table 2–2 lists the SmartWindow files.

Table 2–2: SmartWindow Files

File Type	Filename
Template file	`src/adm2/template/cntnrwin.w`
Primary include file	`src/adm2/containr.i`
Main block include file	`src/adm2/windowmn.i`

2.2.5 SmartFrames

A SmartFrame is a SmartContainer that has a default frame **but not** a window. A SmartFrame groups logically related widgets (or SmartObjects) onto a frame that the AppBuilder can visualize in other SmartContainers. You can also use it to group SmartObjects into a single object that can be used as a logical unit. It is an ADM container-class object.

Table 2–3 lists the SmartFrame files.

Table 2–3: SmartFrame Files

File Type	Filename
Template file	src/adm2/template/cntnrfrm.w
Primary include file	src/adm2/containr.i

2.2.6 SmartDialogs

A SmartDialog is a SmartContainer that has a default frame viewed as a dialog box and three default buttons: OK, Cancel, and Help. SmartDialogs are not designed to run persistently, be inserted in other SmartContainers, or have SmartLinks from other SmartObjects. Typically, you use a SmartDialog if you want to build a dialog box that contains other SmartObjects or widgets. It is an ADM container-class object.

Table 2–4 lists the SmartDialog files.

Table 2–4: SmartDialog Files

File Type	Filename
Template file	src/adm2/template/cntnrdlg.w
Primary include file	src/adm2/containr.i
Main block include file	src/adm2/dialogmn.i

2.3 SmartDataObjects

A SmartDataObject is an ADM data-class SmartObject that defines a set of records to fetch from a database. SmartDataObjects coordinate with other SmartObjects such as SmartDataViewers and SmartDataBrowsers to manage records in an application. Also, SmartDataObjects respond to navigation controls such as those available in SmartPanels and SmartToolbars.

The SmartDataObject is a nonvisual object; it has no run-time visualization and needs a visualization or user-interface (UI) object to display data. The visualization can exist in many forms, both Progress and non-Progress, and is defined independently of the SmartDataObject itself.

Table 2–5 lists the SmartDataObject files.

Table 2–5: SmartDataObject Files

File Type	Filename
Template file	`src/adm2/template/data.w` (standard SmartDataObject template with Wizard)
Primary include file	`src/adm2/data.i`
ADM/Progress Advisor-supported SmartLinks	Commit–Target Data–Source Data–Target Filter–Target Navigation–Target Update–Target
Instance property dialog box	`src/adm2/support/datad.w` (source code) `gui/adm2/support/datad.r` (compiled code)

2.3.1 SmartDataObject Instance Properties Dialog Box

Figure 2–2 shows the instance property dialog box for a SmartDataObject.

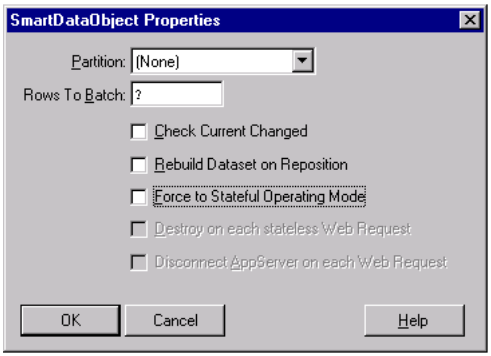


Figure 2–2: SmartDataObject Properties Dialog Box

You use the instance properties in this dialog box as follows:

- **Partition**—The name of a *partition*: a logical grouping of one or more Progress procedures; for example, a set of procedures for managing inventory. The Partition Deployment Tool maps a partition to an Application Service, which defines where the SmartDataObject runs (which could be on an AppServer).

- **Rows To Batch—**The number of rows to retrieve at a time from the data source and be stored by the client. The AppBuilder assigns the specified value to the RowsToBatch property. The default is 200.

- **Check Current Changed**—If checked, Progress checks on update whether records in the data source have been changed since they were retrieved by this instance of the SmartDataObject. The AppBuilder sets the value for the CheckCurrentChanged property to YES if this toggle box is checked and NO otherwise. The default is YES.

- **Rebuild Dataset on Reposition**—If checked, Progress rebuilds the temp–table on reposition starting with the specified record. If unchecked, the temp–table is rebuilt starting from the beginning of the data set. The AppBuilder sets the value for the RebuildOnRepos property to YES if this toggle box is checked and NO otherwise. The default is NO.

- **Force to Stateful Operating Mode—**If checked, the SmartDataObject runs in state-aware mode regardless of the AppServer's operating mode. If unchecked, the SmartDataObject inherits its operating mode from the AppServer. The default is NO.

- **Destroy on each stateless Web Request**—If checked, destroys the SmartDataObject between requests. The default (unchecked) behavior is to keep the SmartDataObject alive between requests. Checking this property disables the Disconnect AppServer on each Web Request property.

  NOTE: This property is disabled when the instance property dialog box is used for non-Web SmartDataObjects.

- **Disconnect AppServer on each Web Request**—If checked, specifies that the AppServer part of the SmartDataObject is destroyed on each request but the client part of the SmartDataObject remains alive. This allows you to use the Force to Stateful Operating Mode property without locking the AppServer for the lifetime of the SmartDataObject.

  NOTE: This property is disabled when the Destroy on each stateless Web Request property is checked. It is also disabled when the instance property dialog box is used for non-Web SmartDataObjects.

2.3.2 SmartDataObject Usage Notes

This section provides specific usage notes on several SmartDataObject issues. However, because SmartDataObjects are the heart of any Progress ADM application, all of the remaining chapters of this manual (except Chapter 3, “SmartLinks”, “SmartLinks”) provide additional information on using them. In particular, see the following sections in Chapter 7, “Developing Your Application’s Business Logic”:

- “SmartDataObject Query and Update Operations” (RowObject and RowObjUpd temp–tables)
- “Managing SmartDataObjects in Distributed Mode” (Partition property)
- “AppServer Session Operating Modes and SmartDataObjects” (AppServer operating modes and the Force to Stateful Operating Mode property)
- “Running SmartDataObjects in a Distributed Environment” (the client/AppServer configuration for SmartDataObjects)

Setting the Number of Database Rows to Batch

The result set retrieved by a SmartDataObject's database query is transferred into a Progress temp–table called RowObject that consists of the columns defined for the SmartDataObject. For a description of the RowObject temp–table, see the "SmartDataObject Query and Update Operations" section in Chapter 7, "Developing Your Application's Business Logic."

If the query defines a large data set, it might take Progress a considerable amount of time to load all of the database records into this temp–table for transmission to the client. For this reason, Progress transfers rows to the RowObject table a batch at a time, rather than one at a time. The default number of rows to batch, which is stored in the RowsToBatch property, is 200. In many cases, this is a reasonable number. However, you might want to adjust the value of this property up or down depending on your expectations about the database query and how it will be used. You do this by specifying a value for the RowsToBatch fill-in field in the SmartDataObject's instance property dialog box.

Suppose, for example, that you expect your SmartDataObject's query to yield a data set that is slightly larger than 200 rows. In this case, you might want to set the RowsToBatch property high enough to retrieve the entire data set when the query first opens. This ensures that there are no further delays if it is necessary to fetch more rows later. Conversely, if the startup time for your application screen is very sensitive, you might be able to improve startup performance noticeably by setting the RowsToBatch property to a very small number, to display the first batch of rows to the user as quickly as possible.

Note that once you set this value at design time, you are not locked into that value for the entire time the application is run. You might choose to set the RowsToBatch property to an initial value at design time, then modify it programmatically at run time, based on the particular query being executed or on other factors.

As a general rule, you should limit the size of the data set that the application code retrieves. Allowing users to browse thousands of records to make a selection is often an inefficient and ineffective way to present data, especially if the records must all be passed across an AppServer connection. Using a SmartFilter or SmartSelect SmartObject or other technique to refine the retrieval to the actual records needed can greatly increase the efficiency of an application and essentially eliminate issues with the size of the data set.

Checking Database Records on Update Attempts

By default, when an application user tries to update a SmartDataObject row, Progress checks whether the database record from which the row was derived has been modified since the record was read into the RowObject temp–table. If so, Progress rejects the update attempt and returns to the client the values that result from the update that occurred since the record was read (by another user) along with an error message, so that the user can make and save the later updates.

NOTE: This check does not include a field-by-field comparison of fields modified by a later user with fields modified by an earlier user. Unless the check is disabled, any change to **any** field in the record will cause the rejection of a later update.

In general, this check for other updates is valuable because it prevents making conflicting changes to a record; specifically, having a later set of changes overwrite an earlier set. In some cases, however, it might not matter whether a record was changed since it was read into the RowObject temp–table. You can set the CheckCurrentChanged property to instruct Progress not to check for earlier updates. Suppose, for example, that your database table contains information such as address data, and it does not matter whether one user changes a field value in this table after another user changes a field value (either the same field or another one in the same table). In this case, the check is not necessary, and you can disable it by unchecking the Check Current Changed toggle box in the SmartDataObject's instance property dialog box.

Changing How Progress Reloads the RowObject Temp–table

By default, Progress loads the RowObject temp–table from beginning to end. If a SmartDataObject's query defines a large data set, a fetchLast operation or other reposition to a place far down the data set can result in a significant wait while Progress loads this temp–table. This is because Progress might need to load many batches of rows before it reaches the desired row.

To eliminate this delay, use the SmartDataObject's RebuildOnRepos property, accessible through the Rebuild Dataset on Reposition toggle box in the instance property dialog box. If you check this toggle box, then whenever a reposition moves to a record that is not already in the RowObject table, Progress performs the reposition in the database query directly and rebuilds the RowObject temp–table from that point.

For example, if the RowsToBatch property is set to 200 for a particular SmartDataObject, the first 200 rows in the database query data set are transferred into the RowObject temp–table when the SmartDataObject's query is opened. Now, suppose that an application user presses the Last button in an associated SmartPanel or SmartToolbar. Progress repositions the database query directly to the last row, and the RowObject table is rebuilt to contain the last 200 rows in the query. (Note that repositioning to the last row is a very fast operation if the INDEXED–REPOSITION query attribute is set to on and the query can use an index to locate the last record.) Progress extends the RowObject temp–table in both directions as the user scrolls forward or backward.

In general, if a SmartDataObject's query returns a large data set, you should turn the RebuildOnRepos property to on. However, if the likely number of rows in the data set is not much larger than the setting for RowsToBatch, it is better to leave this property off and get the entire data set.

The Define Temp–Tables Option

Typically, a SmartDataObject directly accesses the database tables for which it is defined. However, the SmartDataObject Wizard provides an option called Define Temp–Tables that you can use at design time to define your own data source. With this option, you define Progress temp–tables for the database tables, which the SmartDataObject accesses instead of the database; each of these temp–tables can contain a subset of the fields in the corresponding database table as well as summary and calculated fields.

NOTE: The temp–tables that this option creates have no connection to the RowObject and RowObjUpd temp–tables that a SmartDataObject uses to manage database data. Those temp–tables are created and maintained automatically.

Follow these steps in the AppBuilder to define temp–tables for a SmartDataObject:

1 ♦ Select the SmartDataObject icon from the AppBuilder palette and specify New. The SmartDataObject Wizard appears.

2 ♦ Click Next to go to Page 2 of the SmartDataObject Wizard, then click Define Temp–Tables. The Temp–Table Maintenance dialog box appears.

3 ♦ In the Temp–Table Maintenance dialog box, specify the database tables that you want the SmartDataObject to access, using the Add and Remove buttons as necessary. The AppBuilder will create temp–tables for the tables that you specify.

4 ♦ Click OK to return to the SmartDataObject Wizard, then click Define Query. The Query Builder appears.

5 ♦ In the Query Builder's Database field of the Query Builder, select Temp–Tables from the drop-down list, then proceed as usual to build the SmartDataObject's query.

NOTE: The compiler does not support the VALIDATE option on a temp–table field that is defined to be LIKE another temp–table field.

6 ♦ Click OK to return to the SmartDataObject Wizard, click Next to go to Page 3, then click Add fields. The Column Editor appears.

7 ♦ In the Column Editor, specify the fields to be included in the SmartDataObject, then click OK to return to the SmartDataObject Wizard.

8 ♦ Click Next to finish creating the SmartDataObject.

You must be connected to a database with the name of the temp–table you create to use it. When the SmartDataObject executes the query, it accesses these temp–tables rather than accessing the database tables directly.

NOTE: Progress neither populates the tables that this option creates nor manages any other of their interactions with the database, so you must write the code to perform these activities. If you do not, you will receive a warning message when you run the application, and any visual objects connected to the SmartDataObject will not display data in their fields.

2.4 SmartDataBrowsers

A SmartDataBrowser is an ADM browser-class SmartObject that displays records and allows updates to records in a browse widget. In addition, it coordinates the display and updating of records with other SmartObjects, typically SmartDataViewers and SmartDataObjects. A SmartDataBrowser uses a SmartDataObject as a data source.

Table 2–6 lists the SmartDataBrowser files.

Table 2–6: SmartDataBrowser Files *(1 of 2)*

File Type	Filename

Template file and master file[1]	`src/adm2/dynbrowser.w`
	(master for dynamic SmartDataBrowser; no Wizard)
	`src/adm2/template/browser.w`
	(template for static SmartDataBrowser; includes Wizard)

Primary include file	src/adm2/browser.i

Table 2–6: SmartDataBrowser Files *(2 of 2)*

File Type	Filename
ADM/Progress Advisor-supported SmartLinks	Data–Source Data–Target Navigation–Target TableIO–Target

Instance property dialog box	`src/adm2/support/dynbrowserd.w`
	(source code for dynamic SmartDataBrowser)
	`gui/adm2/support/dynbrowserd.r`
	(compiled code for dynamic SmartDataBrowser)
	`src/adm2/support/visuald.w`
	(source code for static SmartDataBrowser)
	`gui/adm2/support/visuald.r`
	(compiled code for static SmartDataBrowser)

[1] Because dynamic SmartDataBrowsers are customized at design time or even at run time, a template is not necessary.

2.4.1 SmartDataBrowser Instance Properties

As the first row in Table 2–6 indicates, there are two types of SmartDataBrowsers: dynamic and static. Each has a different set of instance properties and, therefore, instance properties dialog box.

Figure 2–3 shows the instance property dialog box for a dynamic SmartDataBrowser.

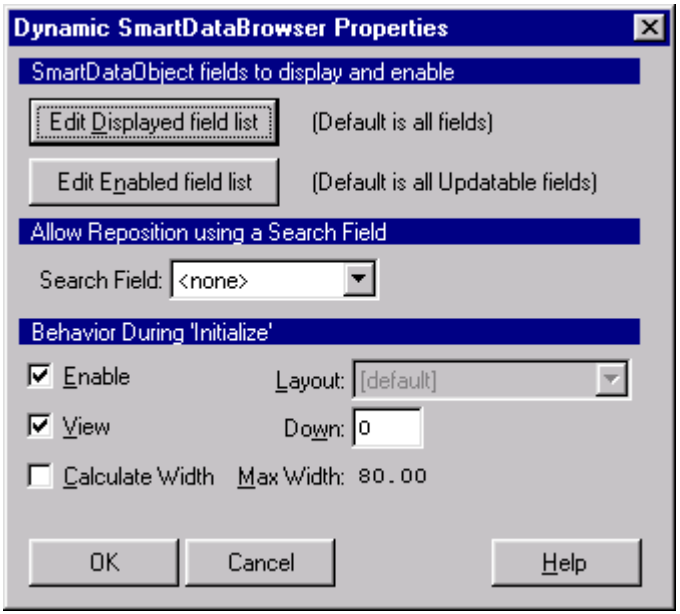


Figure 2–3: Dynamic SmartDataBrowser Properties Dialog Box

You use the instance properties in this dialog box as follows:

- **Edit displayed field list**—Opens a list box that lists the fields in the SmartDataObject that is the SmartDataBrowser's Data–Source, from which you can select the fields to be displayed in the dynamic SmartDataBrowser.
- **Edit enabled field list—**Opens a list box that lists the fields in the SmartDataObject that is the SmartDataBrowser's Data–Source, from which you can select the fields to be enabled for update.
- **Search Field—**If a field is specified, the first line of the SmartDataBrowser's frame is allocated to a fill-in field in which the application user can enter a value for a search field. The SmartDataObject query is automatically re-sorted by the search field, and on each keystroke entered, the browse is repositioned to the first row in which the specified field has a value greater than or equal to what has been typed so far.

- **Enable—**If checked (the default), enables the dynamic SmartDataBrowser for use.
- **Layout—**This property is disabled for dynamic SmartDataBrowsers.
- **View**—If checked (the default), makes the dynamic SmartDataBrowser visible.
- **Down**—Determines the number of rows to display in the dynamic SmartDataBrowser.
  - If zero (the default), Progress calculates the number of rows displayed in the dynamic SmartDataBrowser based on the size of the browser. Note that this might result in the display of a partial row at the bottom of the browse. (You can adjust the height of the browse manually to compensate.)
  - If a positive integer, Progress displays exactly this many rows in the browse. You cannot specify a decimal value, so the browse never displays a partial row.

  The value of this property is assigned to the browse's DOWN attribute.
- **Calculate Width**—Determines the width of the dynamic SmartDataBrowser.
  - If unchecked (the default), the browse's EXPANDABLE property is turned on, and Progress sets the width of the browse based on the width of the dynamic SmartDataBrowser. In this case, if the width of the browse columns is less than the width of the browse, the last column is expanded to fit the width of the browser.
  - If checked, Progress calculates the exact width of the dynamic SmartDataBrowser's columns, compares the result with the Max Width value, and uses the smaller of the two values as the width of the browse. Checking this box turns off the browse's EXPANDABLE attribute.
- **Max Width**—Specifies the maximum width of the browse (the default is 80.00). If you check Calculate Width and the calculated width is greater than Max Width, Max Width is used instead. This field is enabled only when Calculate Width is checked.

The static SmartDataBrowser uses the visual SmartObject instance property dialog box, shown in Figure 2–4.

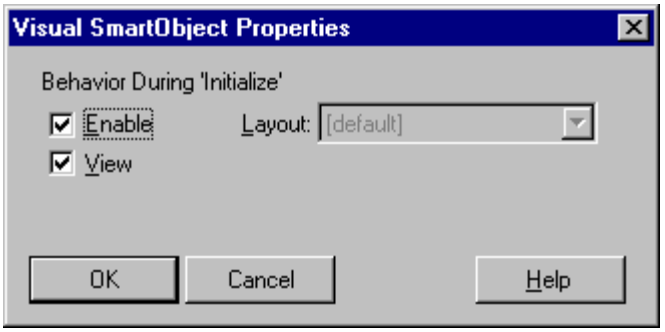


Figure 2–4: Static SmartDataBrowser Properties Dialog Box

You use the instance properties in this dialog box as follows:

- **Enable**—If checked (the default), enables the static SmartDataBrowser for use.

  NOTE: Do not uncheck (turn off) this property.

- **Layout**—This property is enabled for static SmartDataBrowsers when an alternate layout has been defined in the SmartDataBrowser master.

- **View**—If checked (the default), makes the static SmartDataBrowser visible.

2.4.2 Dynamic and Static SmartDataBrowsers Compared

The primary difference between a dynamic SmartDataBrowser and a static SmartDataBrowser is that a given dynamic SmartDataBrowser can be configured to display and update the query of **any** SmartDataObject, while a static SmartDataBrowser is specific to a particular SmartDataObject:

- The dynamic SmartDataBrowser displays and updates records from a set of fields that are determined at run time, rather than at design time, as is the case for the static SmartDataBrowser. At run time, the ADM assigns the display and update fields based on the current values of the SmartDataBrowser's DisplayedFields and EnabledFields instance properties and takes the query from the SmartDataObject to which the SmartDataBrowser is linked. This is why you can configure a dynamic SmartDataBrowser to display and update the query of any SmartDataObject.

  Note that you can set the DisplayedFields and EnabledFields properties of the dynamic SmartDataBrowser at design time through the Instance Properties dialog box. If DisplayedFields and EnabledFields are unset at run time, their values are taken from the associated SmartDataObject's DataColumns and UpdatableColumns properties. For details, see the "Setting the Dynamic SmartDataBrowser Field Properties" section.

  Because a dynamic SmartDataBrowser instance's display and update fields are not assigned until run time, it appears at design time as a browse widget with no columns.

- The static SmartDataBrowser displays and updates records from a set of fields that are assigned at design time, rather than at run time, as is the case for the dynamic SmartDataBrowser. At design time, the Wizard sets the display and update fields, as well as the data source's query, based upon the SmartDataObject to which the SmartDataBrowser is linked. This is why a given static SmartDataBrowser is specific to a particular SmartDataObject.

  Because a static SmartDataBrowser instance's display and update fields are assigned at design time, it appears at design time as a browse widget with one column for each field selected in the Wizard.

Another significant difference is that you create masters for static SmartDataBrowsers but not for dynamic SmartDataBrowsers. This is because a dynamic SmartDataBrowser uses the SmartDataObject to which it is linked at run time and does not, therefore, need a master.

2.4.3 SmartDataBrowser Usage Notes

This section discusses special programming considerations for using SmartDataBrowsers.

The NO–ASSIGN Property

The NO–ASSIGN property in the design window of a SmartDataBrowser master or the property sheet for the browse widget is set to TRUE. This allows the ADM code to handle all record updates.

CAUTION: Do not set NO–ASSIGN to FALSE, or the SmartDataBrowser will not be able to use the ADM methods to perform record updates.

Default Triggers for SmartDataBrowsers

The master procedure file for a SmartDataBrowser defines a variety of triggers for the browse widget that it contains:

- OFF–END (`{src/adm2/brsoffnd.i}`)—Checks whether there are more rows in the query in the forward direction
- OFF–HOME (`{src/adm2/brsoffhm.i}`)—Checks whether there are more rows in the query in the backward direction
- END (`{src/adm2/brsend.i}`)–Performs a fetchLast operation
- HOME (`{src/adm2/brshome.i}`)—Performs a fetchFirst operation
- CTRL–END—Applies the END trigger, which performs a fetchLast operation, to the browse (does not have an include file of its own)
- CTRL–HOME (`{src/adm2/brshome.i}`)—Applies the HOME trigger, which performs a fetchFirst operation, to the browse (does not have an include file of its own)
- ROW–ENTRY (`{src/adm2/brsentry.i}`)—Displays the initial values for newly added or copied rows
- ROW–LEAVE (`{src/adm2/brsleave.i}`)—If the selected object is not a SmartPanel button (for example, a Cancel or Reset button), saves any changes made to the row, otherwise the button takes the action associated with the button
- VALUE–CHANGED (`{src/adm2/brschnge.i}`)—Instructs the SmartDataObject linked to the browse to let other objects know that the record has changed
- SCROLL–NOTIFY (`{src/adm2/brsscrol.i}`)—Checks whether there are more rows in the query in the forward direction

Scrolling Past the End of the Result Set

The SmartDataBrowser's OFF–END and OFF–HOME triggers produce certain visual anomalies when your users browse the associated SmartDataObject query's result set and try to scroll past the end of the result set.

When a SmartDataBrowser browses a SmartDataObject query, the associated RowObject temp–table might contain only a subset of the entire database query result set at any given time, so the SmartDataBrowser might browse only that subset. Although the supporting trigger code for the SmartDataBrowser is designed to make this as transparent as possible, the retrieval of multiple batches of rows into the SmartDataObject's RowObject temp–table has some visible impact on the SmartDataBrowser.

In particular, the OFF–END trigger fires when the browse is scrolled to the bottom of the current result set, which happens when the application user does one of the following:

- Presses the **DOWN** arrow on the keyboard in an attempt to scroll beyond the last row in the current result set
- Presses the Down arrow on the SmartDataBrowser's vertical scroll bar until the last row is reached, then releases the arrow

When the OFF–END event occurs, the SmartDataBrowser code asks the SmartDataObject whether there are more rows to retrieve from the database. If so, an additional batch of rows is added to the RowObject temp–table, the temp–table's query is reopened, and the browse is repositioned to the same row as before the event. This causes a delay (normally a brief one) while the records are retrieved and the query is reopened. It also means that the user must release the scroll bar arrow to see more rows.

If the SmartDataObject's RebuildOnRepos instance property is set to YES, an attempt to scroll past the end of the result set might occur in either a forward or a backward direction. For example, if RebuildOnRepos is set to YES, and the application user either presses the Last button on a SmartPanel or SmartToolbar or presses **CTRL–END** on the keyboard to move to the last row in the result set, the RowObject table in the SmartDataObject is rebuilt from the end. Thus, if the user scrolls backwards (upwards) to the first row in the current result set, the OFF–HOME event causes the retrieval of the next batch of rows before the current result set, which causes a similar delay as the user scrolls up through the data. The vertical scroll bar might be similarly inconsistent and not reflect the size of the complete data set.

These visual anomalies are necessary to allow a client without a database connection to browse a potentially large result set without the entire data set being moved to the client at one time. If you do not want them to occur in your application, do one of the following:

- Set the SmartDataObject's RowsToBatch instance property to retrieve the entire data set at one time.
- Set its RebuildOnRepos instance property to build the result set in a single direction from beginning to end.

Multiple Selection

Multiple selection is not supported for SmartDataBrowsers. If you want to use this option, you must add supporting code to communicate the multiple selection to other SmartObjects as needed.

Setting the Dynamic SmartDataBrowser Field Properties

Once you link a dynamic SmartDataBrowser to a SmartDataObject, you can set the SmartDataBrowser's DisplayedFields and EnabledFields instance properties in its instance property dialog box. The ADM uses the values at run time to determine the display and update fields for the SmartDataBrowser. Setting only one or neither property has these results:

- If you set DisplayedFields but not EnabledFields, and the SmartDataBrowser has a TableIO–Source (an Update SmartPanel), EnabledFields is set at run time to a list of all of the specified DisplayedFields in the associated SmartDataObject's UpdatableColumns property. Otherwise it is made blank (that is, there are no EnabledFields).
- If you set EnabledFields but not DisplayedFields, and the SmartDataBrowser has a TableIO–Source (an Update SmartPanel), DisplayedFields is set at run time to a list of all of the fields in the associated SmartDataObject's DataColumns property.
- If you leave both properties unset, the UpdatableColumns property is set only if there is a TableIO–Source.

The Dynamic SmartDataBrowser SearchField Property

The dynamic SmartDataBrowser has a property called SearchField that is not available in the static SmartDataBrowser. This property allows you to specify a field on which to search at run time. If you specify a value, the first line of the SmartDataBrowser frame is allocated to a fill-in field in which the user can enter a search value at run time. The SmartDataObject query is automatically re-sorted by the SearchField value, and on each keystroke entered, the browse is repositioned to the first row whose search field has a value greater than or equal to the user-specified search value.

Displaying Row Markers in the Dynamic SmartDataBrowser

Unchecking the NO–ROW–MARKERS property in the property sheet for the dynamic SmartDataBrowser does not display row markers (the expected behavior of this browser). However, you can get row markers by explicitly setting ROW–MARKERS to YES in `dynbrowser.w`. Specifically, you should add the following code to the main block of `dynbrowser.w`:

```
ASSIGN BROWSE {&BROWSE-NAME}:ROW-MARKERS = yes.
```

2.5 SmartDataViewers

A SmartDataViewer is an ADM viewer-class SmartObject that displays database fields in a frame. A SmartDataViewer uses a SmartDataObject as a data source. A SmartDataViewer can be a type of SmartContainer; however, because it is a highly specialized SmartContainer, it is described separately in this section. For a general description of SmartContainers, see the "SmartContainers" section.

In addition to displaying database fields in a frame, a SmartDataViewer coordinates its display of records with other SmartObjects, typically SmartDataBrowsers and SmartDataObjects. SmartDataViewers can also coordinate with SmartPanels to modify records. SmartDataViewers typically use SmartDataObjects as data sources. For more information, see Chapter 4, "Data Management in the ADM."

A SmartDataViewer is intended to contain only basic objects, SmartDataObjects that will be used with SmartSelects, and/or SmartDataFields. (SmartSelects and SmartDataFields are described in the "SmartSelects" and "SmartDataFields" sections, respectively.) You typically use contained SmartDataFields to provide specially formatted displays of data in selected fields in the SmartDataViewer. For example, you might develop a SmartDataField that appears as a calendar and use it in a SmartDataViewer to display a date field.

Table 2–7 lists the SmartDataViewer files.

Table 2–7: SmartDataViewer Files *(1 of 2)*

File Type	Filename
Template file	`src/adm2/template/viewer.w` (standard SmartDataViewer template with Wizard)
Primary include file	`src/adm2/viewer.i`

Table 2–7: SmartDataViewer Files *(2 of 2)*

File Type	Filename
ADM/Progress Advisor-supported SmartLinks	Data–Target GroupAssign–Source GroupAssign–Target TableIO–Target Update–Source
Instance property dialog box	`src/adm2/support/visuald.w` (source code) `gui/adm2/support/visuald.r` (compiled code)

2.5.1 SmartDataViewer Instance Property Dialog Box

The SmartDataViewer uses the visual SmartObject instance property dialog box, shown in Figure 2–5.

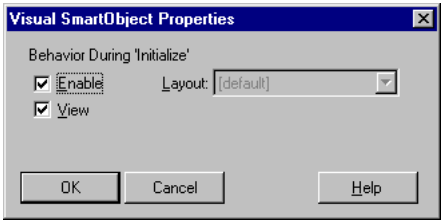


Figure 2–5: SmartDataViewer Properties Dialog Box

You use the instance properties in this dialog box as follows:

- **Enable**—If checked (the default), enables the dynamic SmartDataViewer for use.
- **View**—If checked (the default), makes the dynamic SmartDataViewer visible.
- **Layout**—This property is disabled for SmartDataViewers when an alternate layout has been defined in the SmartDataViewer master.

2.5.2 SmartDataViewer Usage Notes

This section discusses special programming considerations for using SmartDataViewers.

Adding SmartObjects to SmartDataViewers

You add SmartDataFields to a SmartDataViewer after you pick all of the fields that will appear in the viewer. For details on how to add SmartDataFields, see the "Adding SmartDataFields to SmartDataViewers" section.

The SmartDataViewer does not support communications with contained SmartObjects other than SmartDataFields. It is possible to drop other SmartObjects onto a SmartDataViewer—its adm–create–objects procedure will run and initialize them—but there is no built-in support for doing so.

Inheriting Data Dictionary Validation Expressions

The SmartDataViewer's template is defined with the USE–DICT–EXPS property to allow the viewer's fields to inherit Data Dictionary validation expressions and help messages. If this property is not enabled, the SmartDataViewer does not inherit Data Dictionary validation settings regardless of the Inherit Dictionary Validation Expressions column option of the viewer's SmartDataObject.

2.6 SmartDataFields

A SmartDataField is an ADM field-class SmartObject that displays a single data field. It is intended for inclusion only in a SmartDataViewer. You typically use a SmartDataField to provide a specially formatted display of the data in a selected field in the SmartDataViewer. To do this, you replace the field on the SmartDataViewer with your SmartDataField. For example, you might develop a SmartDataField that appears as a calendar and use it in a SmartDataViewer to display a date field.

NOTE: The field to be replaced with a SmartDataField must be a RowObject field chosen from a SmartDataObject.

Because there is no standard representation for a SmartDataField, it does not have a Wizard and opens initially as a frame. You, as the application developer, determine how to represent your SmartDataField; for example, as a pick list or an ActiveX Control. You can create any user interface as long as it does the following:

- Retrieves the containing SmartDataViewer's DataValue property value for the associated field and assigns it to the SmartDataField's visualization of the field
- Accepts a modified value from the visualization and assigns it to the DataValue property for the associated field

For information about creating a SmartDataField and adding it to a SmartDataViewer, see the "SmartDataField Usage Notes" section.

Note that you might want to add any special SmartDataFields that you create to the AppBuilder palette so that you can easily reuse them in your applications. The ADM already includes one special SmartDataField: a SmartSelect. This SmartDataField, which is available from the menu that appears when you right-click on the SmartDataField icon, performs a field lookup. See the "SmartSelects" section.

Table 2–8 lists the SmartDataField files.

Table 2–8: SmartDataField Files

File Type	Filename
Template file	`src/adm2/template/field.w`
Primary include file	`src/adm2/field.i`
ADM/Progress Advisor-supported SmartLinks	None
Instance property dialog box	Implementation dependent

2.6.1 SmartDataField Instance Property Dialog Box

Figure 2–6 shows an example of an instance property dialog box for a SmartDataField:

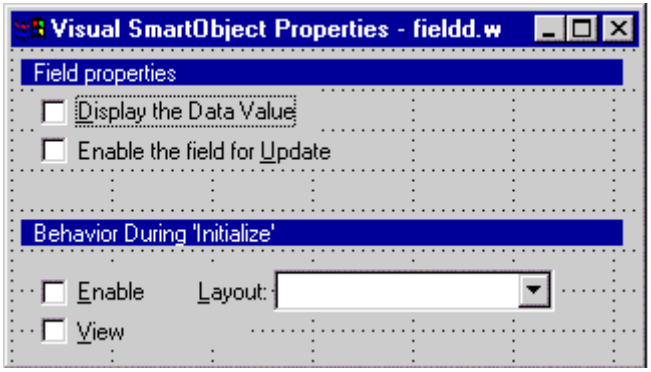


Figure 2–6: SmartDataField Properties Dialog Box

Recall that there is not a standard instance property dialog box for a SmartDataField; therefore, the appearance of the instance property dialog box for a SmartDataField—and the properties available from it—are implementation dependent.

2.6.2 SmartDataField Usage Notes

This section discusses special programming considerations for using SmartDataFields.

Creating SmartDataFields

Because SmartDataFields do not have a Wizard, you must create them yourself. Here are the general steps for creating a SmartDataField, which you perform in the AppBuilder:

1. Define the visualization of the SmartDataField; for example, by dropping an ActiveX Control onto it.

2. Write code to set the DataModified property; for example, when the field's value is changed in an AfterUpdate ActiveX event trigger.

3. Implement the setDataValue and getDataValue functions (the template includes stubs for these functions):

   - The setDataValue function, which is run from displayFields in the SmartDataViewer, sets the value of the field's visualization by passing in the SmartDataObject field value to be assigned to the visualization.

   - The getDataValue function returns the current value of the field's visualization to the caller (typically collectChanges in the SmartDataViewer).

4. Implement the disableField and enableField procedures to enable and disable the visualization (the template includes stubs for these procedures). There are also DisplayField and EnableField properties:

   - The displayField property specifies whether the data value for the field is assigned to the SmartDataField automatically.
   - The enableField property specifies whether the SmartDataField is updateable.

   By default, these properties are set based on the corresponding properties for the original SmartDataObject field, but they can be set in the instance property dialog box.

5. Modify the use list for the SmartDataField icon in the `smart.cst` file to include your special SmartDataField. This enables you to reuse your SmartObject by selecting it from the AppBuilder palette.

For instructions on using the AppBuilder, see the *Progress AppBuilder Developer's Guide*.

Adding SmartDataFields to SmartDataViewers

You add SmartDataFields to a SmartDataViewer after you pick all of the fields that will appear in the viewer (using the Wizard). To add a SmartDataField, select it from the AppBuilder palette and drop it onto the SmartDataObject field that it is to replace. As when you add SmartObjects to other SmartContainers, the AppBuilder then generates an adm–create–objects procedure to start the SmartDataField, including a FieldName property whose value is the name of the original SmartDataObject field.

2.7 SmartPanels

SmartPanels are ADM panel-class SmartObjects that group a number of functionally related buttons onto a frame. The ADM provides separate SmartPanel masters that support specific types of record-management activities, as follows:

- Navigation SmartPanel masters support navigating records. There are two Navigation SmartPanel masters: an Icon SmartPanel master that contains buttons using icons to indicate the navigation direction and a Labels SmartPanel master that uses text labels instead of icons. You link instances created from these masters to one or more SmartDataObjects with Navigation SmartLinks.
- The Update SmartPanel master supports modifications to database records. It runs in either save or update mode. You link an instance created from this master to one or more updateable objects, such as SmartDataViewers or SmartDataBrowsers, with TableIO SmartLinks.

- The Commit SmartPanel master supports committing multiple updates to database records in a single transaction. You link an instance created from this master to one or more SmartDataObjects with Commit SmartLinks.

For more information about using SmartPanels to manage records in the ADM, see Chapter 4, "Data Management in the ADM."

Table 2–9 lists SmartPanel files.

Table 2–9: SmartPanel Files *(1 of 2)*

File Type	Filename

Master files[1]	`src/adm2/pnavico.w`
	(source code for Navigation with Icons master)
	`gui/adm2/pnavico.r`
	(compiled code for Navigation with Icons master)
	`src/adm2/pnavlbl.w`
	(source code for Navigation with Labels master)
	`gui/adm2/pnavlbl.r`
	(compiled code for Navigation with Labels master)
	`src/adm2/pupdsav.w`
	(source code for Update master)
	`gui/adm2/pupdsav.r`
	(compiled code for Update master)
	`src/adm2/pcommit.w`
	(source code for Commit master)
	`gui/adm2/pcommit.r`
	(compiled code for Commit master)

Primary include file	`src/adm2/panel.i`
ADM/Progress Advisor-supported SmartLinks	Commit–Source (`pcommit.w`) Navigation–Source (`pnavico.w` and `pnavlbl.w`) TableIO–Source (`pupdsav.w`)

Table 2–9: SmartPanel Files *(2 of 2)*

File Type	Filename
Instance property dialog boxes	`src/adm2/support/n-panel.w` (source code for Navigation with Icons and Navigation with Labels panels) `gui/adm2/support/n-panel.r` (compiled code for Navigation with Icons and Navigation with Labels panels) `src/adm2/support/u-panel.w` (source code for Update panel) `gui/adm2/support/u-panel.r` (compiled code for Update panel)

[1] Because SmartPanels are customized at design time, a template is not necessary

2.7.1 SmartPanel Instance Property Dialog Boxes

Navigation and Update SmartPanels have instance property dialog boxes but the Commit SmartPanel does not. This is because Commit SmartPanels do not have any instance properties.

Figure 2–7 shows the instance property dialog box for a Navigation SmartPanel.

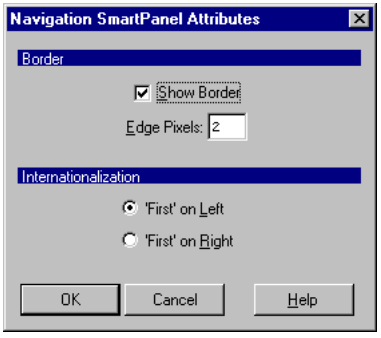


Figure 2–7: Navigation SmartPanel Properties Dialog Box

You use the instance properties in this dialog box as follows:

- **Show Border**—Specifies whether to create a decorative rectangular border around the SmartPanel.
- **Edge Pixels**—If positive, this value specifies the width of the decorative rectangular border to be created with Show Border. Setting it to zero removes the border.
- **'First' on Left, 'First' on Right**—Determine the actions associated with the navigation radio buttons. If you specify 'First' on Left (the default), the radio buttons perform Get–First, Get–Prev, Get–Next, and Get–Last actions in order from left to right. If you specify 'First' on Right, the order of these actions is reversed: the radio buttons perform Get–First, Get–Prev, Get–Next, and Get–Last actions in order from right to left.

  NOTE: The 'First' on Left and 'First' on Right properties are enabled for the Icons version of the Navigation SmartPanel master (`p-navico.w`) but not for the Labels version (`p-navlbl.w`).

Figure 2–8 shows the instance property dialog box for an Update SmartPanel.

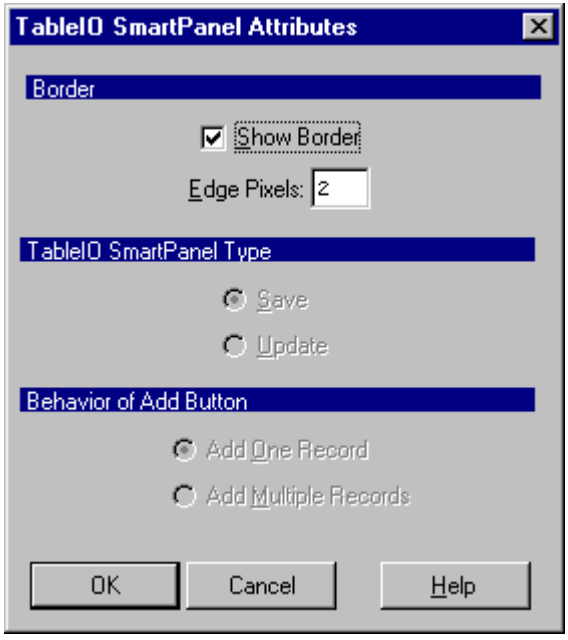


Figure 2–8: Update SmartPanel Properties Dialog Box

You use the instance properties in this dialog box as follows:

- **Show Border**—Specifies whether to create a decorative rectangular border around the SmartPanel.
- **Edge Pixels**—If positive, specifies the width of the decorative rectangular border. Setting this value to zero removes the border.
- **Save, Update**—Specifies whether the Update SmartPanel is run in Save mode or Update mode. For descriptions of these modes, see the "Update SmartPanel" section in Chapter 4, "Data Management in the ADM."
- **Add One Record, Add Multiple Records**—Specifies whether the SmartPanel's Add button prompts the application user for a single new record or multiple new records at run time.

2.7.2 SmartPanel Usage Notes

This section discusses special programming considerations for using SmartPanels.

Resizing SmartPanels at Design Time

SmartPanel instances are resizable at design time. All buttons are resized and reconfigured by the resizeObject procedure in the file `panel.p`. You can make SmartPanel buttons larger or smaller, rearrange them in rows, or make their display vertical instead of horizontal. Buttons that you add to a SmartPanel are automatically resized with the other buttons.

SmartPanels as Toolbars

In previous ADM releases, a common way to provide toolbar-type functionality in Progress applications was to use a Navigation SmartPanel and an Update SmartPanel collectively as a sort of toolbar. If the containing SmartObject is a SmartWindow, this is no longer necessary, as you can now use a SmartToolbar instead: a SmartObject that provides a toolbar and/or menu interface to application commands such as running other windows or procedures or performing navigation and transaction actions in the current object. For details, see the "SmartToolbars" section.

2.8 SmartFolders

A SmartFolder is an ADM folder-class SmartObject that provides an interface for selecting pages in a SmartContainer. You can modify a SmartFolder instance at design time by resizing it or by modifying instance properties in its instance properties dialog box.

Table 2–10 lists the SmartFolder files.

Table 2–10: SmartFolder Files

File Type	Filename
Master files[1]	`src/adm2/folder.w` (source code) `gui/adm2/folder.r` (compiled code)
Primary include file	None
ADM/Progress Advisor-supported SmartLinks	Page–Source
Instance property dialog box	`src/adm2/support/folderd.w` (source code) `gui/adm2/support/folderd.r` (compiled code)

[1] Because SmartFolders are customized at design time, a template is not necessary.

2.8.1 SmartFolder Instance Property Dialog Box

Figure 2–9 shows the instance property dialog box for a SmartFolder.

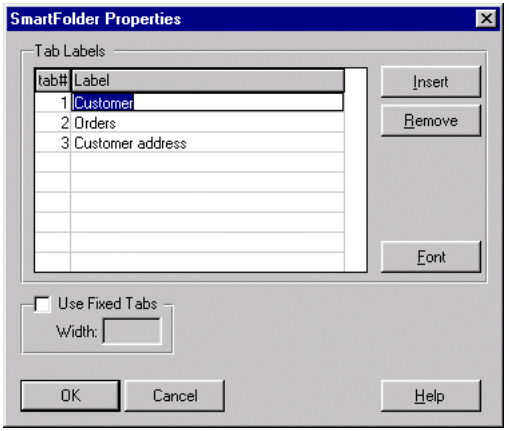


Figure 2–9: SmartFolder Instance Property Dialog Box

You use the instance properties in this dialog box as follows:

- **Tab Labels**—Specifies labels for the tabs in the SmartFolder. The Label field contains the label text; the tab numbers in the tab# field correspond directly to page numbers in the SmartContainer that contains the SmartFolder. To leave a blank space with no tab in the SmartFolder, insert a tab and leave its label blank.
- **Font**—Opens the standard font dialog box, in which you specify the font for the SmartFolder's tab labels. The default font is the "default" selection in the dialog box. The tab height is adjusted according to the font you select, and the label on the Font button changes to utilize the font that you specify.
- **Insert**—Adds a new tab after the currently selected tab.
- **Remove**—Deletes the currently selected tab and moves all of the tabs that were to its right exactly one position to the left, to fill the gap.
- **Use Fixed Tabs**—If checked, specifies that all SmartFolder tabs have the same width and enables the Width fill-in field, where you supply this value. The default is to allow dynamic sizing, which adjusts the tab widths relative to the lengths of the tab labels.
- **Width**—A fill-in field in which to specify a fixed width for the SmartFolder tabs. This field is enabled only if you check the Use Fixed Tabs check box.

2.8.2 SmartFolder Usage Notes

This section discusses special programming considerations for using SmartFolders.

Page 0 in SmartFolders

It is possible to set Page 0 in a SmartFolder. Page 0 visualizes either at design time or at run time. For example, Figure 2–10 shows a run-time SmartFolder that is open to Page 0.

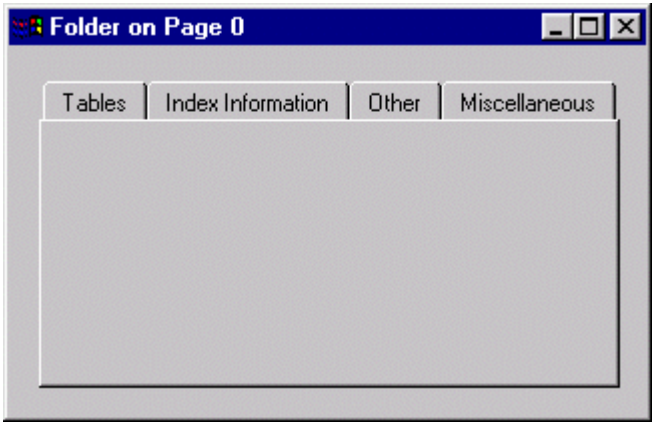


Figure 2–10: SmartFolder Page 0

2.9 SmartFilters

A SmartFilter is an ADM filter-class SmartObject that comprises a frame containing data fields that are used to gather user-specified selection criteria for filtering the data in a SmartDataObject. It follows the query-by–fields model and is implemented as a dynamic SmartObject; that is, the selection criteria (the filter) are specified at run time rather than at design time.

Because the SmartFilter is implemented as a dynamic SmartObject, it does not have a Wizard. At design time, it opens as a frame that contains only three visual objects: buttons labeled Apply, Blank, and Reset. You then use the Link Advisor specify a SmartDataObject as a data source for the SmartFilter instance. You also specify its filter fields: the data-source fields in which the application user can specify selection criteria. You do this by modifying instance properties in its instance properties dialog box.

At run time, the user specifies selection criteria in the filter fields, using the buttons as needed:

- The Apply button applies the currently specified filter to the base query.
- The Blank button removes the currently specified filter, leaving the selection fields undefined.
- The Reset button resets the selection fields to the most recently applied filter.

Table 2–11 lists the SmartDataObject files.

Table 2–11: SmartFilter Files

File Type	Filename
Master file[1]	`src/adm2/dynfilter.w`
Primary include file	`src/adm2/filter.i`
ADM/Progress Advisor-supported SmartLinks	Filter–Source
Instance property dialog box	`src/adm2/support/filterd.w` (source code) `gui/adm2/support/filterd.r` (compiled code)

[1] Because a SmartFilter's fields are defined at design time and its selection criteria are defined dynamically at run time, a template is not necessary.

2.9.1 SmartFilter Instance Property Dialog Box

The main purpose of SmartFilter instance properties is to allow you to select fields from the SmartDataObject that serves as the SmartFilter's Filter–Target and customize how application users specify filter data. Figure 2–11 shows the instance property dialog box for a SmartFilter.

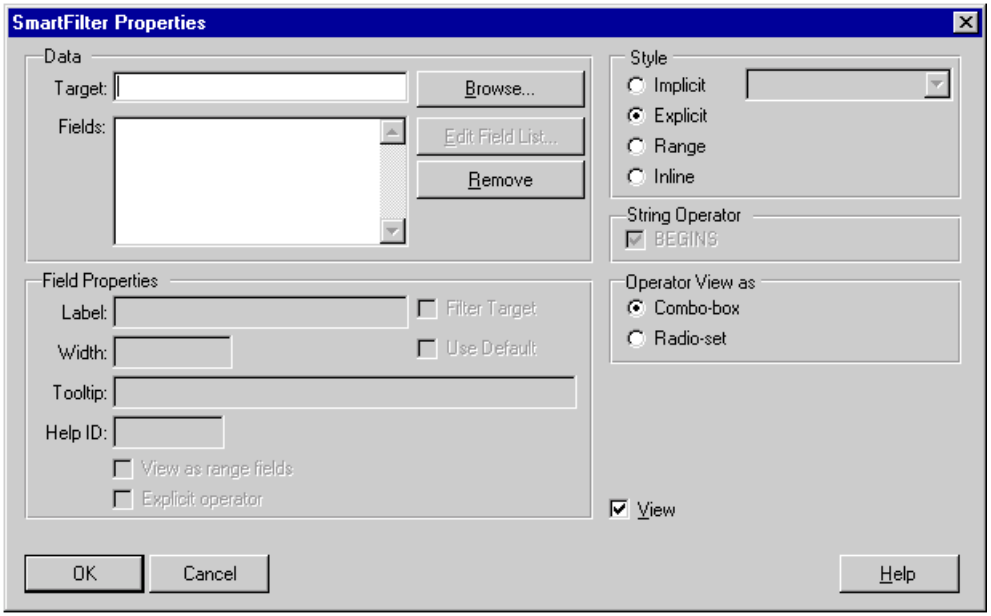


Figure 2–11: SmartFilter Properties Dialog Box

The instance properties in this dialog box are grouped into the following panes of related properties:

- Data pane
- Field Properties pane
- Style pane
- String Operators pane
- Operator View as pane
- Size & Position pane

A final instance property, View, is not in any group.

You use these instance properties as described in the following sections.

Data Pane

You use the instance properties in the Data pane to define the SmartDataObject that will serve as the SmartFilter's Filter–Target and specify the SmartDataObject fields that are available to the SmartFilter:

- **Target, Browse**—If your SmartFilter is already linked to a SmartDataObject that will serve as its Filter–Target, the Target fill-in field lists that SmartDataObject, and is disabled—you cannot specify another value.

  However, the Target field is enabled if you open the instance property dialog box without linking the SmartFilter to a Filter–Target. You might want to create a SmartFilter without a link, for example, because you have placed it in a SmartContainer and intend to link it to a Filter–Target in another SmartContainer. The Browse button opens a window in which you can browse to and select a SmartDataObject.

  NOTE: This SmartDataObject is only design-time SmartDataObject. You must ensure that it is linked at run time.

- **Fields, Edit Field List**—The Fields list box lists the filter fields that will appear in the SmartFilter, in the order that they will be shown. The Edit Field List button opens a window in which you can select, deselect, and reorder these fields.

Field Properties Pane

Because the fields that appear in the SmartFilter are generated dynamically, you cannot access most of their properties in the AppBuilder. However, the SmartFilter's instance property does provide access to a few field properties. Simply select a field in the Fields list box, and its current property values appear in the Field Properties pane.

Note that changes entered into a control in the Field Properties pane take effect as soon as you select another field in the Fields list box. Pressing OK in the dialog box saves all field property value changes, including any that are not currently displayed:

- **Label, Filter Target**—The Label fill-in field displays the label of the selected field. By default, the AppBuilder uses the label from the data source and disables this field. To enable the Label field so that you can enter your own label, uncheck the Filter Target check box.

- **Width, Default**—The Width fill-in field displays the width of the selected field. By default, the AppBuilder uses the default field width and disables this field. (The default field width is data-type dependent and is specified in the Size & Position pane. See the "Size & Position Pane" section for details.) To enable the Width field so that you can enter your own value, uncheck the Default check box.

- **Tooltip**—Enter the text of the Tooltip for this field. There is no default.
- **Help ID**—Enter the context ID for the relevant help topic. There is no default.
- **View as range fields, Explicit**—These check boxes override the default filter style (see the "Style Pane" section for details) for the field selected in the Fields fill-in field:
  - The View as range field check box gives the selected field the same visualization as the Range style gives to all fields.
  - The Explicit operator check box assigns the same operator to the selected field as the Explicit style gives to all fields.

  You can check only one of these boxes. Note that one or both of them might be disabled depending on your choice of default filter style:
  - If the default filter style is Inline, neither check box is enabled.
  - If the style is Explicit or Implicit, only the View as range fields check box is enabled.
  - If the style is Range, only the Explicit check box is enabled.

Style Pane

You use this set of radio buttons to specify the default filter style, which defines how the AppBuilder visualizes the fields in the SmartFilter and applies the application user's filter criteria to the query:

- **Implicit**—Generates a single list of fill-in fields in which the application user can specify filter data at run time. Each field is assigned the appropriate data type, thus restricting the filter data entered by the user to the correct data type. You specify in the associated combo box the implicit operator to be used with the filter data.

  In some cases, other SmartFilter properties might override the default behavior of the Implicit style:
  - If you check the BEGINS property, the AppBuilder uses the BEGINS operator for character fields regardless of your choice of operator. (This is the default.)
  - If you check the CONTAINS property, the AppBuilder uses the CONTAINS operator for filter fields that are mapped to word-indexed database fields, regardless of your choice of operator. In addition, these fields are visualized as editors rather than fill-in fields, with their height and word-wrap capabilities regulated by the Number of Lines in Editors property.

See the"String Operators Pane" section for details on the BEGINS and CONTAINS properties. For details on the Number of Lines in Editors property, see the"Size & Position Pane" section.

The Implicit style supports wild cards, but only if you do not check the BEGINS property. There is one exception: a value that starts with a wild card always generates an expression with the Progress MATCHES keyword.

- **Explicit**—Shows, after a filter field, a list of selectable operators from which the application user can select at run time. The operator is visualized as either a combo box or a radio set, depending on how you set the properties in the Operator View as pane. For details, see the "Operator View as Pane" section.

  Selecting the Explicit style disables the BEGINS property. (This is because BEGINS is in the operator list for character fields.) For details, see the "String Operators Pane" section.

- **Range**—Generates two lists of each filter field, allowing the application user to specify a range of inclusive values as filter data at run time. The left-hand set of fields support wild cards.

  Selecting the Range style disables the BEGINS property. However, the CONTAINS string operator property might override the default behavior of the Range style. If you check this property, the AppBuilder uses the CONTAINS operator for filter fields that are mapped to word-indexed database fields, instead of a range of values. In addition, these fields are visualized as editors rather than fill-in fields, with their height and word-wrap capabilities regulated by the Number of Lines in Editors property.

  See the "String Operators Pane" section for details on the BEGINS and CONTAINS properties. For details on the Number of Lines in Editors property, see the "Size & Position Pane" section.

- **Inline**—Generates a single list of fields for which the application user can enter the filter data and an operator at run time. All fields are represented as character fields to allow typing the operator names. The default operator, which the AppBuilder uses if the user does not enter an operator, is EQUALS.

  In some cases, other SmartFilter properties might override the default behavior of the Inline style:

  – If you check the BEGINS property, the AppBuilder uses the BEGINS operator as the default operator for character fields instead of EQUALS.

  – If you check the CONTAINS property, the AppBuilder uses the CONTAINS operator for filter fields that are mapped to word-indexed database fields, regardless of the user's choice of operator (or the default operator, if relevant). In addition, these fields are visualized as editors rather than fill-in fields, with their height and word-wrap capabilities regulated by the Number of Lines in Editors property.

  See the "String Operators Pane" section for details on the BEGINS and CONTAINS properties. For details on the Number of Lines in Editors property, see the "Size & Position Pane" section.

  The Inline style supports wild cards, but only if you do not check the BEGINS property. There is one exception: a value that starts with a wild card always generates an expression with the Progress MATCHES keyword.

String Operators Pane

You use these check boxes to specify certain overrides for the default filter styles, For details, see the "Style Pane" section.

- **BEGINS**—If checked, specifies the following:
  - If the default filter style is Implicit, Progress uses the BEGINS operator for character fields instead of the implicit operator that you specify.
  - If the default filter style is Inline, Progress uses BEGINS as the default operator for character fields. (The default operator is used when application users do not specify an operator.)

  The BEGINS property is disabled for the Explicit and Range filter styles.
- **CONTAINS**—If checked, and the default filter style is Implicit, Range, or Inline, specifies that the AppBuilder uses CONTAINS as the operator for filter fields that are mapped to word-wrapped database fields, regardless of the operator specified for that style. In addition, these fields are visualized as editors rather than fill-in fields, with their height and word-wrap capabilities regulated by the Number of Lines in Editors property. For details, see the "Size & Position Pane" section.

Operator View as Pane

You use this set of radio buttons to specify how the AppBuilder visualizes the operator selection provided when you select Explicit as the default filter style. For details, see the "Style Pane" section.

- **Combo–box**—Visualizes the operator selection as a combo box.
- **Radio–set**—Visualizes the operator selection as a radio set.

These radio buttons are disabled if the default filter style is Implicit or Inline. However, they are enabled if the default filter style is Range, in case you choose to override the style for a specific field to Explicit with the Explicit operator property. For details, see the "Field Properties Pane" section.

Size & Position Pane

You use the instance properties in the Size & Position pane to define various aspects of filter fields:

- **Width of Character Fields**—Specifies the default width of character fields.
- **Width of Other Fields**—Specifies the default width of noncharacter fields.
- **Column**—Specifies the column position of all fields.

  NOTE: This is the position of the actual field and not the label.

- **Number of Lines in Editors**—When you check the CONTAINS property (see the "String Operators Pane" section), the AppBuilder visualizes certain filter fields as editors rather than fill-in fields. This property specifies the number of lines to use for these editors. If you specify 1, the editor has the same height as fill-in fields and word wrapping is disabled. If you specify 2, the editor shows two lines, word wrapping is enabled, and a vertical scroll bar appears.

View Property

If checked (the default), the View check box makes the SmartFilter visible.

2.9.2 SmartFilter Usage Notes

This section discusses special programming considerations for using SmartFilters.

Filter Link as Pass-through Link

The Filter link that connects a SmartFilter and its data source can be implemented as a pass-through link. This allows you to create a SmartFilter in a separate SmartWindow and wait to link it to the Filter-target until you drop the SmartFilter's SmartWindow into the Filter-target's SmartWindow.

You can start a SmartFilter that is in a separate SmartWindow from a SmartToolbar. Follow these general steps to do this:

1. Create a SmartFilter in a separate SmartWindow, specifying all necessary instance properties, and link it temporarily as a Filter-source to THIS–PROCEDURE (the SmartWindow).

2. Drop this SmartWindow in a SmartWindow with a potential filter—a SmartDataObject that matches the SmartFilter—and answer Yes to the Link Advisor's prompt about adding the Filter link to the SmartDataObject.

3. Optionally, specify HideOnInit and DisableOnInit in the SmartWindow's instance properties dialog box and start the main SmartWindow.

4. Check the Filter check box in the SmartToolbar's Instance Property dialog box.

The SmartToolbar can now view and start the SmartFilter's SmartWindow.

2.10 SmartToolbars

A SmartToolbar is an ADM toolbar-class SmartObject that provides a toolbar and/or menu interface to application commands that perform various actions; for example, running other windows or procedures or performing navigation and transaction actions in the current object. You can contain a SmartToolbar in a SmartWindow but not in a SmartFrame or a SmartDialog, and you can put only one SmartToolbar instance in a given SmartWindow.

When a SmartToolbar instance opens, it contains a default menu and toolbar that provide access to the basic actions that application users perform. You can modify several aspects of the SmartToolbar at design time through its instance properties dialog box: whether to use both the menu and toolbar or only one of them, which actions to include, and selected presentation and behavior details. (For a note on more complex modifications, see the "SmartToolbar Usage Notes" section.)

The rules and data for the actions accessible in the SmartToolbar are defined in an action class from which the SmartToolbar inherits and are totally independent of the SmartToolbar's layout and structure. As a result, all SmartToolbar actions have the same text, image, and interface throughout the application regardless of the SmartToolbar layout.

Table 2–12 lists the SmartDataObject files.

Table 2–12: SmartToolbar Files

File Type	Filename
Master file[1]	`src/adm2/dyntoolbar.w`
Primary include file	`src/adm2/toolbar.i`
ADM/Progress Advisor-supported SmartLinks[2]	Navigation–Source Tableio–Source
Instance property dialog	`src/adm2/support/toold.w` (source code) `gui/adm2/support/toold.r` (compiled code)

[1] Because SmartToolbars are customized at design time, a template is not necessary

[2] These links are supported by default. The SmartToolbar can also support the Commit–Source SmartLink depending on how you set the Commit instance property.

2.10.1 SmartToolbar Instance Property Dialog Box

Figure 2–12 shows the instance property dialog box for a SmartToolbar.

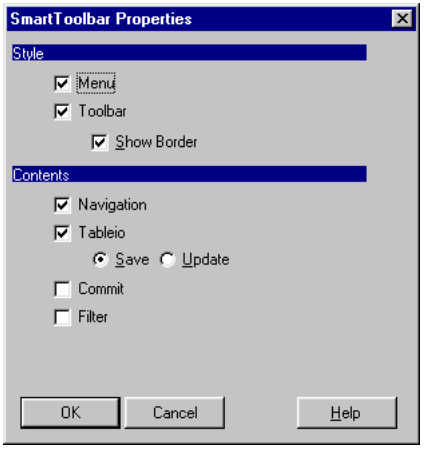


Figure 2–12: SmartToolbar Instance Properties Dialog Box

The instance properties in this dialog box are grouped into two panes containing style properties and content properties. Figure 2–12 shows the default properties; the available properties might change if you add or remove actions from the SmartToolbar or the action class (on which the SmartToolbar is based). You use these instance properties as described in the following sections.

Style Pane

You use the instance properties in the Style pane to specify how your SmartToolbar instance provides access to toolbar actions. You can specify a menu bar, a toolbar, or a menu bar and a toolbar. You cannot deselect both the menu bar and the toolbar.

- **Menu**—If checked (the default), specifies that the SmartToolbar instance provides a menu bar with the two menus (File and Navigation) shown in Figure 2–13.

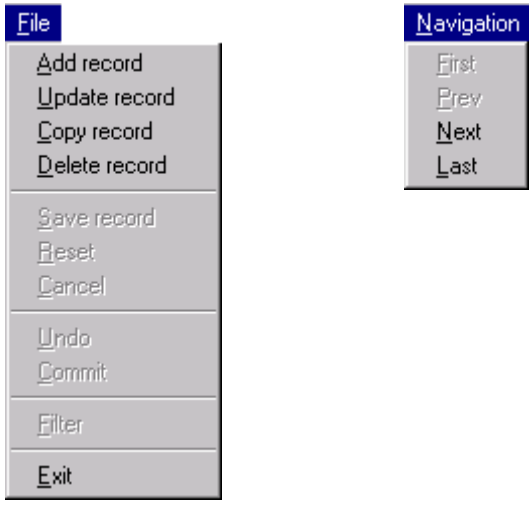


Figure 2–13: SmartToolbar Menus

Figure 2–13 shows how the menus look when all possible commands are enabled. Various commands are present or absent from the menu bar depending on how you set the instance properties in the Contents pane at design time.

- **Toolbar**—If checked (the default), specifies that the SmartToolbar instance provides a toolbar, shown in Figure 2–14.



Figure 2–14: SmartToolbar Toolbar

Figure 2–14 shows how the toolbar looks when all possible icons are displayed. Various icons are present or absent depending on how you set the instance properties in the Contents pane at design time.

- **Show Border**—If checked, adds a graphic border that surrounds the toolbar and divides the icon groups. This property is enabled only if the Toolbar property is checked.

Contents Pane

You use the instance properties in the Contents pane to specify the actions that application users can perform from the SmartToolbar. Each property represents several actions (as defined defined by the action class):

- **Navigation**—If checked (the default), enables navigation actions: first record, previous record, next record, and last record. These actions are accessible from the First, Prev, Next, and Last commands on the Navigation menu and from the third group of icons (the arrow icons) on the toolbar.

- **Tableio**—If checked (the default), enables tableio actions: add, update, copy, delete, and save records; reset; and cancel. These actions are accessible from the Add record, Update record, Copy record, Delete record, Save record, Reset, and Cancel commands on the File menu and the first group of icons on the toolbar.

  The Save and Update radio buttons associated with the Tableio check box enable slightly different sets of tableio actions:

  – Clicking the Update button includes the File menu's Update record and the corresponding icon on the toolbar.

  – Clicking the Save button omits the Update record command and icon.

- **Commit**—If checked, enables commit actions for updateable objects: undo and commit. These actions are accessible from the Undo and Commit commands on the File menu and from the second group of icons on the toolbar. The default is unchecked.

  NOTE: This property is enabled only if you link the SmartToolbar as a Commit–Source to a Commit–Target.

- **Filter**—If checked, enables calling a SmartFilter that is the SmartToolbar's Navigation–Target. This functionality is available through the Filter command on the File menu and the last icon on the toolbar. For details, see the "Filter Link as Pass-through Link" section.

2.10.2 SmartToolbar Usage Notes

This section discusses special programming considerations for using SmartToolbars.

SmartPanels as Toolbars

In previous ADM releases, a common way to provide toolbar-type functionality in Progress applications was to instance both a Navigation SmartPanel and an Update SmartPanel and use them collectively as a sort of toolbar. If the containing SmartObject is a SmartWindow, this is no longer necessary, as you can now use a SmartToolbar instead.

Complex SmartToolbar Modifications

More complex SmartToolbar modifications (for example, the order and structure of icons and menus) involve modifying the SmartToolbar object itself. You manage the layout and availability of actions in a toolbar in the functions initializeMenu( ) and initializeToolbar( ). These functions are not defined in the SmartToolbar super procedure as a default, but are called from initializeObject and must always exist in the toolbar. Using these functions to customize the SmartToolbar ensures that its structure and layout are defined at the right moment in the initializeObject( ) function.

You can override the default behavior of the SmartToolbar in either a local SmartToolbar master or a local SmartToolbar super procedure.

- **Local SmartToolbar master**—Create a local SmartToolbar master by copying the master (`adm2/dyntoolbar.w`), then customize the initializeMenu( ) and initializeToolbar( ) functions as required.

  Note that if your application requires two or more versions of a SmartToolbar, you can create local masters for each (the local masters must have different names), then update the `.cst` files accordingly.

- **Local SmartToolbar super procedure**—Create a local SmartToolbar super procedure by copying the super procedure (`adm2/custom/toolbarcustom.p`), then customizing its code as required. The code in `adm2/dyntoolbar.w`'s initializeMenu( ) and initializeToolbar( ) functions calls SUPER( ) with the no–error option. If it does not find a super procedure or returns false, the default code is executed.

  You can use this technique to implement a data-driven SmartToolbar that checks properties (for example, user and object) to retrieve the correct SmartToolbar specification data. (If no data is found, return FALSE to trigger the default behavior.)

2.11 SmartSelects

A SmartSelect is a special type of SmartDataField that performs a lookup on the associated SmartDataObject field; that is, it retrieves and displays a predefined set of values from which an application user can choose a single value. Inherited SmartDataField behavior ensures that the SmartSelect automatically displays the current field values and that modified SmartSelect values are passed back to the associated SmartDataObject field. Like the basic SmartDataField, the SmartSelect is intended for inclusion only in a SmartDataViewer.

Table 2–13 lists the SmartSelect files.

Table 2–13: SmartSelect Files

File Type	Filename
Master file[1]	`src/adm2/dynselect.w`
Primary include file	`src/adm2/select.i`
ADM/Progress Advisor-supported SmartLinks	None
Instance property dialog	`src/adm2/support/selectd.w` (source code) `gui/adm2/support/selectd.r` (compiled code)

[1] Because SmartSelects are customized at design time, a template is not necessary.

2.11.1 SmartSelect Instance Properties

Figure 2–15 shows the default instance property dialog box for a SmartSelect (different properties are enabled or disabled if you reset the View–as property).

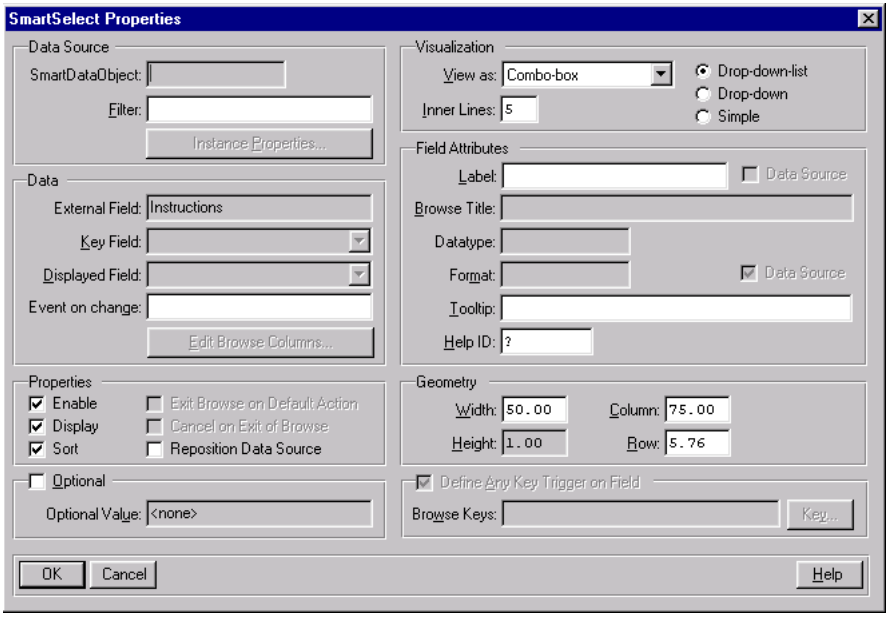


Figure 2–15: SmartSelect Instance Properties Dialog Box

The instance properties in this dialog box are grouped into the following panes of related properties:

- Data Source pane
- Data pane
- Properties pane
- Optional pane
- Visualization pane
- Field Attributes pane
- Geometry pane
- Define Any Key Trigger on Field pane

You use these instance properties as described in the following sections.

Data Source Pane

You use the instance properties in the Data Source pane to get and specify information about the SmartDataObject that is the data source for the SmartSelect:

- **SmartDataObject**—Shows the name of the SmartDataObject that serves as the SmartSelect's data source. This field is populated by dropping a SmartDataObject into the associated SmartDataViewer and linking it to the SmartSelect with a Data SmartLink.
- **Filter**—Specifies an optional filter for the SmartDataObject; for example, an expression such as the following:

```
Credit-Limit > 10000
```

  Note that you can specify the filter only as a hard-coded value; you cannot specify variables.

- **Instance Properties**—Opens the instance property dialog box for the SmartDataObject identified by the SmartDataObject property.

Data Pane

You use the instance properties in the Data pane to define the field that the SmartSelect represents.

- **External Field**—A nonupdateable field in the SmartDataViewer that displays the SmartDataObject field that the SmartSelect represents. This field is populated when you drop the SmartSelect onto a SmartDataViewer's field.
- **Key Field**—A combo box in which to specify the SmartDataObject field that maps to the SmartDataViewer field that the SmartSelect represents. When the SmartSelect's instance property dialog box first appears, this property automatically displays any SmartDataObject field whose name matches the name of the SmartDataViewer field.
- **Display Field**—A combo box in which to specify the SmartDataObject field to display. All of the SmartDataObject's fields are available in the combo box.

- **Event on change**—Enter an event to PUBLISH if the value of the displayed field changes. For more detailed information on using this property (including an example), see the "Event on Change Instance Property" section in the "SmartSelect Usage Notes" section.

- **Edit Browse Columns**—Enter the fields to display in a browse if the View–as property is set to Browser. (See the "Visualization Pane" section.) If View–as is set to Browser and you do not specify any browse columns, the browser displays the key field and the display field. This button is enabled only when the View–as property is set to Browser.

Properties Pane

You use the instance properties in the Properties pane to specify whether the SmartSelect is enabled and when and how it displays data:

- **Enable**—If checked (the default), enables the SmartSelect for use when the containing SmartDataViewer is also enabled for use.

- **Display**—If checked (the default), the SmartSelect displays data when the containing SmartDataViewer is displayed.

- **Sort**—If checked (the default), specifies that the SmartSelect data is sorted on the displayed column.

- **Exit Browser on Default Action**—This field is enabled only when View–as is set to Browser. It controls whether the SmartSelect browser exits (closes) when the application user selects a row. If unchecked (the default), the browser stays open until it is explicitly closed, otherwise it exits as soon as the application user selects a row.

- **Cancel on Exit of Browse**—This field is enabled only when View–as is set to Browser. It controls whether exiting (closing) the browser is considered a selection. If unchecked (the default), exiting behaves as a selection, otherwise it does not.

- **Reposition Data Source**—Controls whether the Data-Source linked to the SmartDataViewer that contains this SmartSelect repositions itself to the record that corresponds with the selected value whenever the value in the SmartSelect changes. If unchecked (the default), the Data-Source does not reposition itself, otherwise it does reposition itself. The default behavior is the implicit behavior for a browser, so this field is **disabled** when View–as is set to Browser.

  NOTE: Leaving this option unchecked minimizes performance overhead. (The amount of performance overhead varies depending on how much data there is and where it is.) However, in some circumstances, your application will work correctly only if you check this option; for example, if the Data-Source linked to the containing SmartDataViewer is linked to other objects that must reflect changes in the SmartSelect.

Optional Pane

You use the instance properties in the Optional pane to manage the display of no value in the SmartSelect:

- **Optional**—If checked, indicates that displaying a value in the SmartSelect is optional. This allows the SmartSelect to display no value (represented by the unknown value).

- **No Value**—Enter a value to be displayed when no value (the unknown value) is selected. This field is enabled only when Optional is checked.

Visualization Pane

You use the instance properties in the Visualization pane to manage the visualization of the SmartSelect:

- **View–as**—A combo box in which to select the type of control used to visualize the SmartSelect. The choices are Browse, Combo–box, Selection–list, and Radio–set.

  If you select Browse, the containing SmartDataViewer displays the SmartSelect as a field with a button that, when pressed by the application user, starts a separate window with a browser that displays the SmartSelect data. This browser shows the number of lines specified by the Inner Lines property and presents the application user with a search field in which to search on the field specified by the Display Field property. (See the "Data Pane" section.) The application user selects a row either by double-clicking or by pressing the **Return** key or its equivalent.

  If you select Combo–box, a radio–set appears from which you can select a combo box type: Drop–down–list, Drop–down or Simple (these are the three types of Progress combo boxes).

  If you select Radio–set, a radio set appears from which you can select an orientation: horizontal or vertical.

- **Inner Lines**—Specifies the number of lines used to display data in the SmartSelect. This option is disabled if you select Radio–set.

Field Attributes Pane

You use the instance properties in the Field Attributes pane to specify labeling and formatting information for the SmartSelect field:

- **Label, Data Source**—The Label fill-in field displays the label of the SmartSelect field. By default, the AppBuilder uses the label from the data source and disables this field. To enable the Label field so that you can enter your own label, uncheck the associated Data Source check box.
- **Browse Label**—Enter a title for the browse window if the View–as property is set to Browser. (See the "Visualization Pane" section.) This field is enabled only when the View–as property is set to Browser.
- **Data Type**—The data type of the SmartSelect key field (this field is read only).
- **Format, Data Source**—The Format fill-in field displays the format of the SmartSelect key field. By default, the AppBuilder uses the format from the data source and disables this field. To enable the Format field so that you can enter your own format, uncheck the associated Data Source check box. This is field is enabled only if you select Combo–box as the value of View–as.
- **Tooltip**—Enter the text of the Tooltip for this field. There is no default.
- **Help ID**—Enter the context ID for the relevant help topic. There is no default.

Geometry Pane

You use the instance properties in the Geometry pane to alter the SmartSelect's size and position. Note that you can also modify the SmartSelect's geometry by directly manipulating the SmartSelect in the SmartDataViewer Container:

- **Width**—The width of the SmartSelect.
- **Height**—The height of the SmartSelect. This field is disabled for object types that have a fixed height.
- **Column**—The width of the SmartSelect's field.
- **Row**—The height of the SmartSelect's field.

Define Any Key Trigger on Field Pane

- **Define Any Key Trigger on Field**—This field is enabled only when View–as is set to Browser. It controls whether a persistent trigger is defined on the ANY–KEY event of the field. If it is checked (the default), the trigger is defined.

  The main use for a persistent trigger on the ANY–KEY event is to start the SmartSelect's browser as specified in the Browse Keys instance property's fill-in field. The procedure that runs on this event is the anykey procedure; however, you can have other keys perform actions in the data–source by overriding the anykey procedure in a customized SmartSelect super procedure (`adm2/custom/selectcustom.p`). For example, you do this to implement combo-box behavior such as navigation on cursor keys.

  See the "Custom Class Files" and "Writing Super Procedures" sections in Chapter 8, "Developing ADM Extensions," for a description of custom files and information on customizing super procedures, respectively.

- **Browse Keys**—Specifies the key label or key function that starts the SmartSelect's browser from the field. You can supply a comma-separated list.

- **Key**—A button that opens the Keyboard Event dialog box, shown in Figure 2–16:

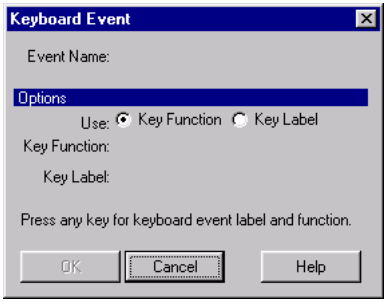


Figure 2–16: Keyboard Event Dialog Box

This dialog box traps a key function or key label and returns the value to the fill-in field for the Browse Keys instance property. You can append the selected value to the current value by inserting a comma after the existing value before you press the Key button. Note that this dialog box cannot distinguish between key functions and key labels.

2.11.2 SmartSelect Usage Notes

This section discusses special programming considerations for using SmartSelects.

Event on Change Instance Property

The Event on change property allows you to specify an event to PUBLISH if the value of a displayed SmartSelect field changes. However, doing this entails more than simply specifying an event name; you must also subscribe the SmartSelect's data source to your new event, define the event, and so forth. The following example illustrates how to do this. Note that it assumes that you have started the AppBuilder and connected to a copy of the Progress sports2000 database. Follow these steps:

1 ♦ Create the following SmartObjects:

- A SmartDataObject named `dcust.w` against the customer table.
- A SmartDataObject named `dslsrep.w` against salesrep table.
- A SmartDataViewer for the customer SmartDataObject. Include the Custnum, Name, and SalesRep fields.

2 ♦ Drop the salesrep SmartDataObject onto the SmartDataViewer.

3 ♦ Drop a SmartSelect onto the salesrep field of the SmartDataViewer.

4 ♦ Set the SmartSelect instance properties as follows:

- SmartDataObject: dslsrep.w (the salesrep SmartDataObject)
- Key Field: SalesRep
- Displayed Field: SalesRep
- Event on change: SalesRepSelected (you will define this event in a later step)
- View as: Browser
- Label: Sales Rep
- Browse Title: Sales Representatives
- Tooltip: Select Sales Rep for the Order

For all other instance properties, accept the defaults.

5 ♦ In the Section Editor, create the following:

- An override procedure for the SmartDataViewer that uses the initializeObject procedure. Note that whether this procedure runs before or after the SmartDataViewer's standard behavior depends on where you put the code, as the example code illustrates.
- A SUBSCRIBE statement for your event. (Note that h_dynselect is the SmartSelect object name.)

```
/*------------------------------------------------------------------
  Purpose:    Super Override
  Parameters:
  Notes:

------------------------------------------------------------------*/

  /* Code placed here executes PRIOR to the standard behavior. */

  RUN SUPER.

  /* Code placed here executes AFTER the standard behavior. */

  SUBSCRIBE "SalesRepSelected" IN h_dynselect.

END PROCEDURE.
```

6 ♦ Using the Section Editor, create an internal procedure that defines your event; for example:

```
/*------------------------------------------------------------------
  Purpose:
  Parameters:  <none>
  Notes:
  ------------------------------------------------------------------*/

DEFINE INPUT PARAMETER cNewValue AS CHARACTER NO-UNDO.
  MESSAGE "VALUE IS: " cNewValue VIEW-AS ALERT-BOX.
END PROCEDURE.
```

7 ♦ Save this procedure with Name = SalesRepSelected.

8 ♦ Save the SmartDataViewer object as `vcustsls.w`.

9 ♦ Create a new SmartWindow, then add the following:

- A customer SmartDataObject (`dcust.w`)
- Your modified SmartDataViewer (`vcustsls.w`)
- For navigation purposes, a SmartToolbar (accept the defaults)

10 ♦ Save this application as the object `wcustsls.w`, then run it.

11 ♦ Choose Browse icon to view a list of sales-representative names.

12 ♦ Select the name of a sales representative. A dialog box appears and displays the value that you selected. This dialog box is based on the SalesRepSelected procedure that you defined.

2.12 Simple SmartObjects

The template for the simple SmartObject is a starting point for creating new visual SmartObjects. Figure 2–17 shows how an unmodified simple SmartObject appears.

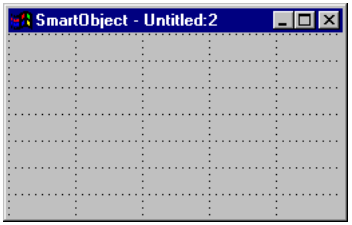


Figure 2–17: Simple SmartObject

The simple SmartObject is intended primarily as a container for basic objects (Progress 4GL widgets) and 4GL code; however, you can also build a new SmartObject from its template instead of basing it on another SmartObject template (for example, the SmartDataViewer template).

The simple SmartObject template includes a single primary include file, `src/adm2/smart.i`. This is the library that is common to all SmartObjects. It specifies no Advisor-supported SmartLinks. No instance properties are associated with the simple SmartObject template. You add include files, supported SmartLinks, and instance properties as needed when you create a new SmartObject template based on the basic SmartObject.

3

SmartLinks

SmartLinks are the mechanism, or pathway, by which SmartObjects communicate with each other. This chapter provides a detailed discussion of SmartLinks. It discusses these topics:

- SmartLink overview; including:
  - A summary of SmartLink types
  - Source and Target objects
  - Events
- Descriptions of SmartLink types
- SmartLink usage notes, including:
  - Invoking behavior in linked objects
  - Using Data SmartLinks
  - Defining custom SmartLinks in applications, but static and dynamic

3.1 SmartLink Overview

SmartLinks are an important element of the ADM architecture. A SmartLink is a bidirectional association of two SmartObjects. It establishes how one SmartObject relates to another and what sort of behavior each can expect from the other. SmartLinks are also part of the overall ADM messaging scheme (communication between SmartObjects).

A SmartObject associated with another by a SmartLink serves as either the link's Source object or its Target object. Data flows across the SmartLink primarily from the Source to the Target, but in some circumstances, from the Target to the Source.

SmartLinks are created and maintained by each SmartObject's container. Each link is a property in each SmartObject that supports that type of link. The `smart.p` super procedure has procedures and functions for link management. Each link is mapped to one or more events that use the PUBLISH and SUBSCRIBE statements. These event lists are also SmartObject properties. For more information on PUBLISH and SUBSCRIBE, see the chapter on named events in the *Progress Programming Handbook* and the PUBLISH and SUBSCRIBE entries in the *Progress Language Reference*.

3.2 SmartLink Summary

The SmartLink type determines the kind of relationship that is established between two objects. Table 3–1 describes the relationships that these SmartLinks establish and gives examples (in parentheses) of SmartObjects that support each SmartLink type.

Table 3–1: ADM-recognized SmartLink Types *(1 of 2)*

SmartLink Type	Relationship
Container	Links a containing object (SmartContainer) to an object that it contains. One SmartObject contains another if it creates the contained SmartObject, regardless of whether the containing object visually parents the contained object. The ADM automatically establishes all Container SmartLinks at run time. This is why Container SmartLinks do not appear in the AppBuilder.
Navigation	Links an object that provides a navigation interface (SmartPanel or SmartToolbar) to an object that supplies a query through which to navigate (SmartDataObject).
TableIO	Links an object that provides a record-modification interface (SmartPanel or SmartToolbar) to an object through which to enter changes (SmartDataViewer or SmartDataBrowser).

Table 3–1: ADM-recognized SmartLink Types *(2 of 2)*

SmartLink Type	Relationship
Page	Links an object that provides a page-selection interface (SmartFolder) to an object that manages the hiding and viewing of pages (SmartContainer).
PageN	Links an object that manages the hiding and viewing of a numbered set of pages (SmartContainer) to the SmartObjects on a specific page (holds the object handle and the page that it is on). **NOTE:** Application developers do not normally use this link type.
GroupAssign	Links an object that manages a record (SmartDataViewer, considered the master SmartDataViewer) to an object that manages a related record or another view of the same record (SmartDataViewer), to assure that all fields are updated in a single transaction. **NOTE:** This is an advanced task. For details, see the "Using GroupAssign SmartLinks" section in Chapter 6, "Advanced ADM Topics."
Data	Links an object that manages records (SmartDataObject) to a visualization object (SmartDataViewer or SmartDataBrowser) or to another object that manages records (SmartDataObject).
Update	Links a visualization object (SmartDataBrowser or SmartDataViewer) to a SmartDataObject for the purpose of passing updated data values from the visualization object to the SmartDataObject. Note that this is a separate link from the Data link. This is because the data source might not be a SmartDataObject, but all updates must be done through a SmartDataObject. Normally, the Update link associates the same two SmartObjects as a Data link, but in the opposite direction; however, this is not the case if the visualization object gets records from itself or from another source.
Commit	Links a Commit SmartPanel to a SmartDataObject for committing changes to sets of database records when it is necessary to perform more than one update in a single transaction.
Filter	Links a SmartFilter to a SmartDataObject.

You are not restricted to using these ADM-recognized SmartLink types. You can also define new SmartLink types and configure SmartObjects to support them.

3.3 Source and Target Objects

A SmartLink connects Source SmartObjects and Target SmartObjects. A Source object can have one or more active Target objects, but a Target object usually has only one active Source object. For example, a single SmartContainer (Container–Source) might contain a SmartDataViewer, a SmartDataBrowser, and a SmartPanel, each of which is a Container–Target.

Sometimes, a single object can be on either end of a SmartLink type. For example:

- A SmartContainer might contain other SmartContainers.
- A SmartDataObject might be the Data–Source for a SmartDataViewer and a Data–Target for another SmartDataObject.

As you design an application screen, you determine how SmartObjects link together. However, different SmartObjects have rules about which SmartLinks they allow. For details on what SmartLinks are allowed for each SmartObject, see Chapter 2, "SmartObjects."

3.4 SmartLink Events

For each SmartLink type, the Source object has specific responsibilities to the Target object, and the Target object has specific responsibilities to the Source object. These responsibilities are fulfilled by the methods contained in the SmartObject; therefore, the type of links that a particular SmartObject can support is determined by the methods that it contains.

The specific responsibilities of a pair of linked SmartObjects to each other depend only on the type of SmartLink that connects them, not on their object types. For example, in a TableIO relationship, the Target object always has the same responsibilities regardless of whether it is a SmartDataBrowser or a SmartDataViewer. Specifically:

- A Source object PUBLISHes named events to which its Target object must SUBSCRIBE and for which the Target object must implement event procedures that execute when PUBLISHED events occur.
- The Target object PUBLISHes named events to which its Source object must SUBSCRIBE and for which the Source object must implement event procedures that execute when PUBLISHED events occur.

Therefore, the Source and Target objects must SUBSCRIBE to the correct set of events or they cannot interact as expected. These events evaluate to the internal procedures in the Source and Target objects.

Subscription occurs when you add the SmartLink: the addLink procedure (in `smart.p`) SUBSCRIBEs the Target procedure to the SourceEvents for the link and SUBSCRIBEs the Source procedure to the TargetEvents, as shown in the following code fragment:

```
/* SUBSCRIBE to all the appropriate events on each side of the link.
     First SUBSCRIBE the target to all the events it says it wants
     from its source. */
  cEvents = dynamic-function("get":U + pcLink + "SourceEvents":U IN phTarget)
      NO-ERROR.
  IF cEvents NE ? THEN
  DO iEvent = 1 TO NUM-ENTRIES(cEvents):
    SUBSCRIBE PROCEDURE phTarget TO ENTRY(iEvent, cEvents) IN phSource.
  END.
  /* Then SUBSCRIBE the source to all the events (if any) that it wants
     from its target. */
  cEvents = dynamic-function("get":U + pcLink + "TargetEvents":U IN phSource)
      NO-ERROR.
  IF cEvents NE ? THEN
  DO iEvent = 1 TO NUM-ENTRIES(cEvents):
    SUBSCRIBE PROCEDURE phSource TO ENTRY(iEvent, cEvents) IN phTarget.
  END.

  RETURN.
END PROCEDURE.
```

Note that this behavior happens automatically, in the addLink procedure.

See the *Progress Programming Handbook* or the *Progress Language Reference* for more information on PUBLISH and SUBSCRIBE. For a description of dynamic–function, see the *Progress Language Reference*.

The following sections describe the responsibilities of the Source and Target SmartObjects for each ADM-recognized SmartLink type. These sections also list, for each SmartLink type, the subscribed events/internal procedures required by the Source and Target objects.

3.4.1 Container SmartLink

The Container SmartLink's Source object can create and destroy its Target objects. During creation, the Source can tell its Targets to set their positions relative to the Source (provided that the Targets have visualizations).

The Source can also tell its Targets to parent themselves to the Source. If the Source is hidden, viewed, or deleted, then all of its Targets are also hidden, viewed, or deleted (this is standard Progress behavior.)

To maintain a Container SmartLink, the ADM requires the Source and Target objects to SUBSCRIBE to and implement the events shown in Table 3–2. Specifically:

- The Container–Target SUBSCRIBEs to the source events in the Container–Source procedure handle, and must implement the corresponding internal procedure names.
- The Container–Source SUBSCRIBEs to target events in the Container–Target procedure handle, and must implement the corresponding internal procedures.

Table 3–2: Container Events

ContainerSourceEvents	ContainerTargetEvents
initializeObject hideObject viewObject destroyObject enableObject confirmExit	exitObject

A Container SmartLink typically connects the following types of SmartObjects:

- Source: SmartWindow, SmartFrame, SmartDialog
- Target: any SmartObject

3.4.2 Navigation SmartLink

The Navigation SmartLink's Source object can send navigation requests to its Target objects. The Source can also manage an interface for navigation (such as First, Next, Prev, and Last buttons).

To maintain a Navigation SmartLink, the ADM requires the Source and Target objects to SUBSCRIBE to and implement the events shown in Table 3–3. Specifically:

- The Navigation–Target SUBSCRIBEs to the source events in the Navigation–Source procedure handle, and must implement the corresponding internal procedure names.
- The Navigation–Source SUBSCRIBEs to target events in the Navigation–Target procedure handle, and must implement the corresponding internal procedures.

Table 3–3: Navigation Events

NavigationSourceEvents	NavigationTargetEvents
fetchFirst	queryPosition
fetchNext	updateState
fetchPrev	linkState
fetchLast	filterState
startFilter	

The Navigation SmartLink typically connects the following types of SmartObjects:

- Source: Navigation SmartPanel, SmartToolbar
- Target: SmartDataObject

3.4.3 Page SmartLink

The Page SmartLink's Source object can inform its Target object that a new page has been selected. The Source can also manage an interface for selecting pages (such as tab folders).

To maintain a Page SmartLink, the ADM requires the Source object to SUBSCRIBE to and implement the events shown in Table 3–4. Specifically, the Page–Source SUBSCRIBEs to target events in the Page–Target procedure handle, and must implement the corresponding internal procedures.

Table 3–4: Page Events

PageSourceEvents	PageTargetEvents
none	changeFolderPage deleteFolderPage

The Page relationship typically connects the following types of SmartObjects:

- Source: SmartFolder
- Target: SmartContainer, SmartWindow, SmartFrame, SmartDialog

3.4.4 PageN SmartLink

The PageN SmartLink's Source object can manage a set of pages. The Target object is expected to have hide and view capabilities.

The PageN SmartLink has no PageN events—neither source events nor target events.

NOTE: Application developers do not normally use the PageN link type. Instead, the ADM maintains this link type, to identify which objects are on which page of a container for the purposes of hiding and viewing objects, and so forth.

3.4.5 TableIO SmartLink

The TableIO SmartLink's Source object can tell its Target objects to perform record modifications.

To maintain a TableIO SmartLink, the ADM requires the Source and Target objects to SUBSCRIBE to and implement the events shown in Table 3–5. Specifically:

- The TableIO–Target SUBSCRIBEs to the source events in the TableIO–Source procedure handle, and must implement the corresponding internal procedure names.
- The TableIO–Source SUBSCRIBEs to target events in the TableIO–Target procedure handle, and must implement the corresponding internal procedures.

Table 3–5: TableIO Internal Procedures

TableIOSourceEvents	TableIOTargetEvents
addRecord	queryPosition
updateRecord	updateState
copyRecord	linkState
deleteRecord	
resetRecord	
cancelRecord	
updateMode	

The TableIO SmartLink typically connects the following types of SmartObjects:

- Source: Update SmartPanel, SmartToolbar
- Target: SmartDataViewer, SmartDataBrowser

3.4.6 GroupAssign SmartLink

The GroupAssign SmartLink's Source object can tell its Target objects to either commit or not commit record modifications as part of a single transaction.

To maintain a GroupAssign SmartLink, the ADM requires the Source and Target objects to SUBSCRIBE to and implement the events shown in Table 3–6. Specifically:

- The GroupAssign–Target SUBSCRIBEs to the source events in the GroupAssign–Source procedure handle, and must implement the corresponding internal procedure names.
- The GroupAssign–Source SUBSCRIBEs to target events in the GroupAssign–Target procedure handle, and must implement the corresponding internal procedures.

Table 3–6: GroupAssign Events

GroupAssignSourceEvents	GroupAssignTargetEvents
addRecord copyRecord updateRecord resetRecord cancelRecord enableFields disableFields collectChanges	updateState

The GroupAssign SmartLink typically connects the following types of SmartObjects:

- Source: SmartDataViewer
- Target: SmartDataViewer

3.4.7 Data SmartLink

The Data SmartLink's Source object can tell its Target objects that a record is waiting in the data source.

To maintain a Data SmartLink, the ADM requires the Source and Target objects to SUBSCRIBE to and implement the events shown in Table 3–7. Specifically:

- The Data–Target SUBSCRIBEs to the source events in the Data–Source procedure handle, and must implement the corresponding internal procedure names.
- The Data–Source SUBSCRIBEs to target events in the Data–Target procedure handle, and must implement the corresponding internal procedures.

Table 3–7: Data Events

DataSourceEvents	DataTargetEvents
dataAvailable queryPosition deleteComplete fetchDataSet	updateState

The Data SmartLink typically connects the following types of SmartObjects:

- Source: SmartDataObject
- Target: SmartDataObject, SmartDataViewer, SmartDataBrowser

3.4.8 Update SmartLink

The Update SmartLink's Source object can tell its Target objects which fields have changed and supply the fields' new values.

The ADM does not require the Source and Target objects to SUBSCRIBE to and implement any events. Instead, the Update relationship is maintained by the Update–Source directly running functions such as submitRow in the Update–Target.

The Update relationship typically connects the following types of SmartObjects:

- Source: SmartDataViewer, SmartDataBrowser
- Target: SmartDataObject

3.4.9 Commit SmartLink

The Commit SmartLink's Source object can tell its Target objects to commit or undo the current transaction.

To maintain a Commit SmartLink, the ADM requires the Source and Target objects to SUBSCRIBE to and implement the events shown in Table 3–8. Specifically:

- The Commit–Target SUBSCRIBEs to the source events in the Commit–Source procedure handle, and must implement the corresponding internal procedure names.
- The Commit–Source SUBSCRIBEs to target events in the Commit–Target procedure handle, and must implement the corresponding internal procedures.

Table 3–8: Commit Events

CommitSourceEvents	CommitTargetEvents
commitTransaction undoTransaction	rowObjectState

The Commit SmartLink typically connects the following types of SmartObjects:

- Source: Commit SmartPanel, SmartToolbar
- Target: SmartDataObject

3.4.10 Filter SmartLink

The Filter SmartLink's Source object passes its filter data (operators and values) to the Target object and removes filter data (for any field and operator combination that this Source potentially can apply) in the Target. When it finishes, the Source opens its query. It reads the current operators and values from its target when it starts and whenever it is reset.

The ADM does not require the Source and Target objects to SUBSCRIBE to and implement any events. Only the Source object knows about a filter relationship. The Target object has no knowledge of the Source object or why its activities are occurring.

The Filter relationship typically connects the following types of SmartObjects:

- Source: SmartFilter
- Target: SmartDataObject

3.5 Invoking Behavior in Other Linked Objects

A SmartObject can execute internal procedures or functions in any SmartObject to which it is linked. This is often necessary to access special behavior or to facilitate communication between the SmartObjects. Accessing these internal procedures or functions does not require the SmartObjects to know each others' procedure handles.

The ADM accomplishes this using the Progress PUBLISH/SUBSCRIBE syntax. Each SmartLink represents a set of named events. During the creation of a SmartLink, its Source automatically subscribes to the named events in the Target procedure, and vice versa. For example, the Navigation–Target subscribes to the named events fetchFirst, fetchNext, fetchPrev, and fetchLast in a SmartPanel Navigation–Source. When the application runs and a user presses the Next button, the SmartPanel executes the following statement, which sends a message to its Navigation–Target:

```
PUBLISH 'fetchNext'.
```

This syntax does not require the SmartPanel to keep track of which objects are its Navigation–Targets. Instead, the Progress interpreter tracks this using the SUBSCRIBE statements that the addLink procedure executes on the Navigation–Target's behalf. (The addLink procedure is executed when the SmartObjects are initialized.)

The standard ADM code contains many such PUBLISH statements. Custom application code can also use PUBLISH statements such as these to communicate between SmartObjects. For example, suppose that you use the addLink procedure as follows to add a SmartLink that is not recognized as one of the object's supported links:

```
RUN addLink(h1, 'newLink', h2)
```

The addLink procedure now executes the following statement:

```
SUBSCRIBE PROCEDURE h2 TO 'newlink' IN h1.
```

The procedure h1 can now execute the PUBLISH statement whenever it wants to invoke the named event in h2:

```
PUBLISH 'newlink'.
```

Each SmartObject includes properties for each link type. These properties, which have names composed of the link type followed by an event name, define the events to which an object is automatically subscribed by the addLink procedure. (See Table 3–2 through Table 3–7 for lists of Source and Target events.) You can modify these properties for your custom link types.

3.5.1 Pass-through Links

Applications invariably contain SmartObjects that are subordinate to SmartContainers, either because they are contained by them (a SmartFrame inside a SmartWindow or another SmartFrame) or because they are lower in the SmartContainer hierarchy (a SmartWindow that is defined as the logical child of another). In some cases, you must be able to connect a SmartObject outside of the containing or parenting SmartContainer with its subordinate SmartObject even though you have direct access only to the SmartContainer. A SmartObject inside a SmartContainer cannot link directly to a SmartObject external to the SmartContainer at design time. However, you can create a two-step link called a *pass-through link* that allows the two objects to communicate. In a pass-through link, the outer SmartObject is the Source for the containing or parenting SmartContainer and the containing or parenting SmartContainer is the virtual Source for the contained SmartObject.

Figure 3–1 illustrates the two-step pass-through link.

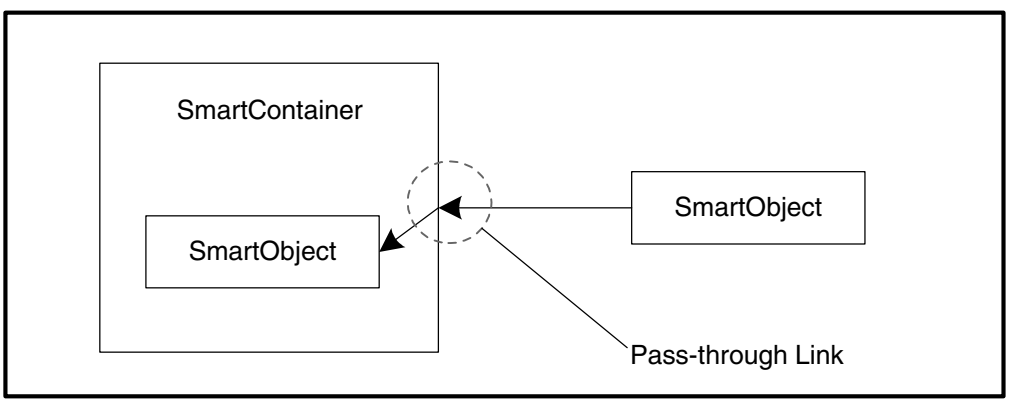


Figure 3–1: Pass-through Link

The simplest way to explain how to set up a pass-through link is to use an example. Suppose that you build a special SmartFrame, called an Order SmartFrame, that contains these SmartObjects:

- A SmartDataObject for Orders
- A SmartDataBrowser that browses this SmartDataObject's query
- A SmartDataViewer that displays field values for the current Order
- An Update SmartPanel that allows changes to the current Order record

You create the Order SmartFrame, as a package; that is, as a single reusable object. You want to use an instance of this SmartFrame to display and update Orders for a particular Customer, an operation that requires passing Customer keys (the Cust–Num fields) from a SmartObject outside the SmartFrame to the SmartDataObject that it contains. Your application will have as its basis a SmartWindow that will contain an instance of your special SmartFrame and a SmartDataObject and SmartDataBrowser for Customers. You will link the SmartObjects in the SmartWindow so that each time an application user selects a Customer, the SmartDataObject inside the Order SmartFrame receives the Cust–Num value and reopens its query for Orders of that Customer; that is, the Order SmartDataObject will be the Data–Target of the Customer SmartDataObject. Because the containing SmartFrame is between these SmartDataObjects, you cannot link them directly and must establish a pass-through link. In one part of this link, the Order SmartFrame is the virtual Data–Source for its Order SmartDataObject. In the other part of this link, the Customer SmartDataObject is the Data–Source, and the Order SmartFrame is its Data–Target.

You must build the your application in a specific order:

1. Build the inner connection, between the SmartFrame and the contained SmartDataObject.
2. Create the SmartWindow and define its contents.
3. Build the outer connection, between the outer SmartDataObject and the SmartFrame.

At run time, the ADM combines the two separate connections into a single link.

When you build your Order SmartFrame, you define the SmartFrame as the virtual Data–Source for the SmartDataObject that it contains in the Link Editor. To do this, you select THIS–PROCEDURE (which indicates the SmartFrame container that you are building) as the Data–Source and the Order SmartDataObject as the Data–Target. You then tell the Order SmartDataObject to expect a Cust–Num key from its Data–Source at run time. The Link Advisor in the AppBuilder cannot do this automatically because the objects are not in a single SmartContainer. Therefore, you must set the ForeignFields property of the Order SmartDataObject so that it expects Customer keys. To do this, define a createObjects procedure in the SmartFrame with this code:

```
RUN SUPER.
DYNAMIC-FUNCTION('setForeignFields' IN h_dorder /* Order SmartDataObject
handle */ ,"Order.Cust-num, Cust-Num").
```

The RUN SUPER statement runs the standard behavior for createObjects. This runs the AppBuilder-generated adm–create–objects procedure, which creates all of the objects in the SmartFrame and establishes the necessary links. After the standard createObjects procedure executes, the setForeignFields function tells the SmartDataObject to expect to receive the Cust–Num field from its Data–Source and to use it to match the Order.Cust–Num field in its own query.

Figure 3–2 illustrates the established inner connection.

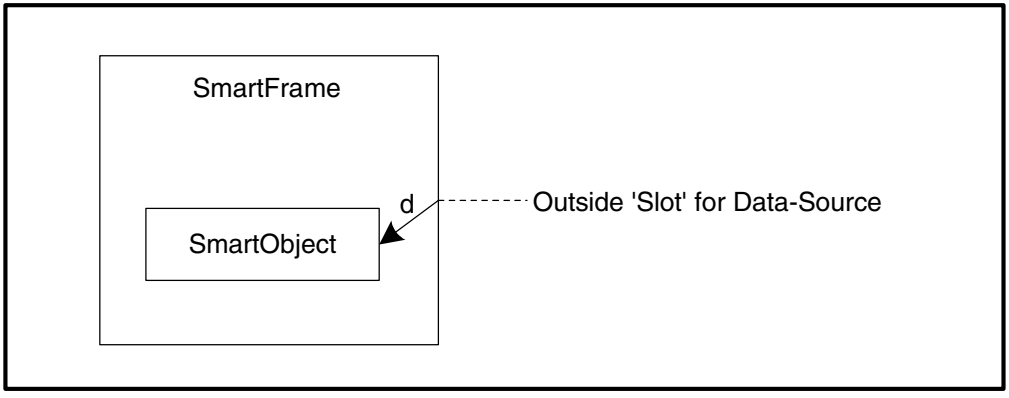


Figure 3–2: Pass-through Link: Inner Connection

You now create a SmartWindow into which you place a Customer SmartDataObject and SmartDataBrowser. Next, drop your Order SmartFrame into the SmartWindow. You want to pass Customer keys to that SmartFrame so that they get to the Order SmartDataObject inside it. You also do this in the Link Editor, by choosing the Customer SmartDataObject as the Data–Source and the SmartFrame as its Data–Target. Theoretically, when you run this SmartWindow, you will have two Data links, one from the Customer SmartDataObject to the SmartFrame, and one from the SmartFrame to the Order SmartDataObject, as shown in Figure 3–3.

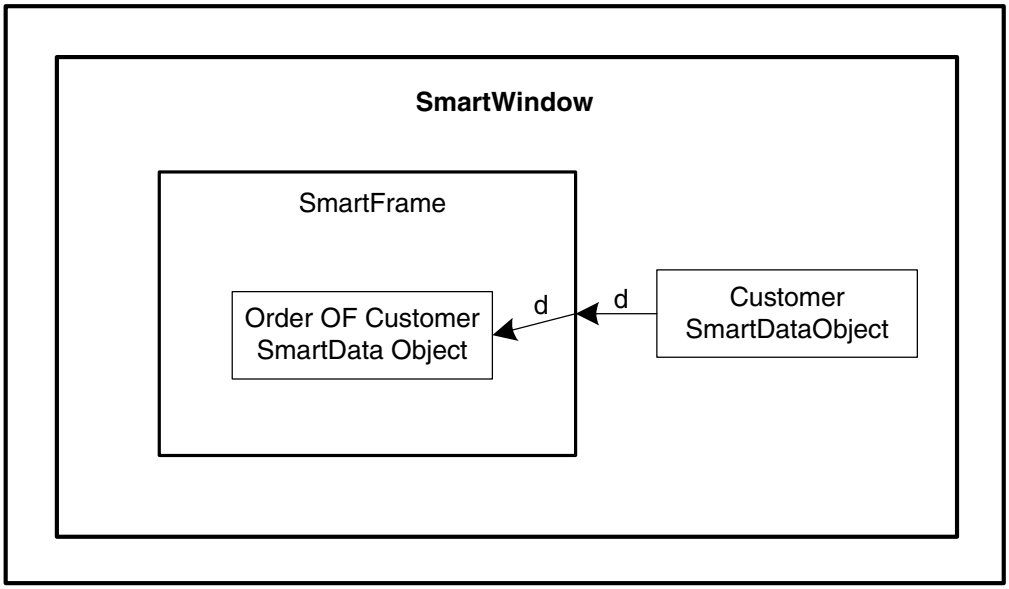


Figure 3–3: Pass-through Link: Inner and Outer Connections

However, the SmartFrame is not prepared to deal with the Customer keys: the two Data links must be combined into one so that the Customer SmartDataObject and the Order SmartDataObject can communicate directly with each other. To accomplish this, the addLink procedure, which establishes links, notes that the SmartFrame container is both a Data–Target and a Data–Source (this makes the Data link a potential pass-through link) and modifies the inner link by changing its Data–Source from the SmartFrame to the Customer SmartDataObject. There is now a link from the Customer SmartDataObject directly to the Order SmartDataObject, and the two objects can function as if they are in the same container. Note that with a pass-through link, it is the **link** rather than the data that is passed through.

Note also that the outer link, from the Customer SmartDataObject to the SmartFrame, is maintained. This enables the code in the SmartFrame to use Customer keys passed from the Customer SmartDataObject. There is no standard code in the SmartFrame object or its super procedure `containr.p` to handle the data. If you want, you can write application code to respond to events from the Customer SmartDataObject.

3.5.2 Getting Records from an Additional Source

As with most other link types, it is valid for a Data–Target SmartObject to have only one Data–Source at a time. Sometimes, however, you must be able to pass a record down a different path than the normal Data link path. For example, suppose that you have a a SmartDataViewer that receives Customer values from a SmartDataObject. When the SmartDataObject is notified of the dataAvailable event, it gets the Customer values for the current row in the Customer SmartDataObject. This sequence is repeated whenever the SmartDataObject retrieves a new Customer record. However, the SmartDataViewer might occasionally need to get a different record. For example, it might need the User record on startup in order to perform security checks. This User record might not be available through its normal Data–Source.

You can deal with this scenario in a number of ways. In addition to the default automatic execution of the colValues function in the Data–Source from dataAvailable, you can program a SmartObject to run colValues in a SmartObject other than its regular Data–Source. This approach provides an ADM–standard way to get an extra set of values from one SmartObject to another. For example, you could define an initializeUser link from the source of the User ID to the SmartDataViewer that needs it. When you create a nonstandard link, Progress performs a single SUBSCRIBE in the Target for the link name. For example, if the initializeUser procedure is defined in the SmartDataViewer, it will be executed whenever the Source PUBLISHes the initializeUser event. The User ID can be passed as an argument or queried from Target to Source.

3.6 Using Data SmartLinks

Data in the form of field values is passed from one SmartObject to another using a Data SmartLink. A SmartDataObject can be a Data–Source for another object. It can also be a Data–Target, receiving a key value from another query object to use in opening a query. Visual objects such as SmartDataBrowsers and SmartDataViewers can also be Data–Targets. A SmartDataViewer as a Data–Target receives formatted column values from a SmartDataObject for display. A SmartDataBrowser as a Data–Target browses its Data–Source's query and displays column values.

At design time, when you drop a SmartObject into an application, the AppBuilder's Link Advisor assesses each SmartObject already in the application to determine whether it is suitable for a Data link connection with the new SmartObject and, if it is, it recommends the connection. It makes its assessment by examining the properties of each object to determine what columns it defines: a query object can be a Data–Source for another object only if it can supply one or more columns that the object could use as a key to open its own query. In particular:

- A query object can be a Data–Source for a visual object such as a SmartDataViewer if all of the fields displayed by the SmartDataViewer are in the query object and all fields that are enabled in the SmartDataViewer are updateable in the Data–source.

- A SmartDataBrowser can be a Data–Target only for a SmartDataObject that has the same signature. For more information on signatures, see the "Compatibility Checking" section of Chapter 4, "Data Management in the ADM."

  NOTE: Because of the flexibility of SmartObject combinations and the dynamic nature of queries, the Link Advisor might suggest links that are not desirable for your application. Always examine the Link Advisor's recommendations before accepting them. One way to avoid problems is to drop Data–Sources onto the design window before Data–Targets. When two objects can be linked in either direction, the Link Advisor assumes that the first object dropped into the application is the Data–Source.

When you are linking two query objects, you can use the SmartDatObject's ForeignFields property at design time to designate which of its fields to use as foreign key fields in SmartDataObjects that are subordinate to it. A corresponding property called ForeignValues holds the values of those fields for the current row. For details, see the "Initializing the Foreign Key Fields" section in Chapter 4, "Data Management in the ADM."

3.7 Defining SmartLinks in Progress Applications

You are not restricted to using only the SmartLinks installed with the Progress product in your application. You can define additional SmartLinks for the ADM, either static SmartLinks, which use a standard event support structure and whose run-time behavior is predefined, or dynamic SmartLinks, whose run-time behavior varies depending on application-user choices. The following sections provide information on defining both types.

3.7.1 Defining Static SmartLinks

When you define a new, custom, static SmartLink, you must provide the following support structure for standard events:

- The template for a SmartObject that will use the new SmartLink must define a preprocessor value called ADM–SUPPORTED–LINKS. This value is a comma-separated list of links that this object supports. This list becomes the initial value of the SupportedLinks property when the object is initialized; however, you can modify the associated instance property value at run time (before the object is initialized) if an application condition changes the links that the SmartObject must support.

  NOTE: The Container and PageN links are supported implicitly and do not need to be on this list.

- The Source object for the link must define a property named *link*Target, where *link* is the base link name such as Data, and the Target object must define a property *link*Source, along with get*propname* and set*propname* functions to get and set the values for those properties. The data type of the property indicates whether the link supports multiple objects on either end:

  – A data type of HANDLE means that only one object is allowed; its procedure handle is stored in its native data type. This is the typical case for the Source for the standard ADM links, which generally support only one Source SmartObject.

  – A data type of CHARACTER indicates that multiple objects can be at that end of the link; their handles are stored in string format as a comma-separated list. This is the typical case for the Target for the standard ADM links, which generally support multiple Target SmartObjects.

  For example, a Data–Source can have multiple Data–Targets, but a Data–Target can have only one Data–Source. The addLink procedure uses these properties to store the handles of related objects, and to determine whether one object or multiple objects are permitted.

- Any events that are associated with the link must be defined in a property in the Source called *link*TargetEvents, where *link* is the base link name such as Data, and/or in the Target in a property called *link*SourceEvents. This property is a comma-separated list of events to subscribe to. For example, a SmartContainer (which can be a Container–Source) has the following:

  – A ContainerTarget property of type Character where the addLink procedure stores the handles of its Container–Target procedures at run time.

  – A ContainerTargetEvents property, which is initialized in the property include file `cntnprop.i` to `exitObject`, the one event that a Container must subscribe to in its Target.

  Likewise, all SmartObjects that can be Container–Targets have the following:

  – A ContainerSource property of type Handle (defined in `smrtprop.i`, because it applies to all SmartObjects) where addLink stores the handle of its Container–Source at run time.

  – A ContainerSourceEvents property, which is initialized in the property include file to a list of all the events to which the Container–Target must subscribe in its Container–Source and for which it must implement event procedures ("initializeObject,destroyObject,…").

  These property values can also be modified at run time, before the object is initialized, to change the list of events to which the object will subscribe in that particular instance. The addLink procedure then subscribes to each event in the list using the Source and Target handles. The get*propname* and set*propname* property functions and the event procedures are normally implemented in the super procedure for the object (`containr.p` for links defined in `cntnprop.i`, `smart.p` for links defined in `smrtprop.i`, and so forth).

Once you account for all of these requirements, the ADM takes care of all of the necessary mechanics of handling events between SmartObjects automatically.

Note that you can also define standard Supported Links programmatically by writing calls to addLink in an application. Likewise, you can remove them by running the removeLink procedure.

3.7.2 Defining Dynamic SmartLinks

Sometimes a SmartObject application requires a link that passes messages between SmartObjects more dynamically; that is, the particular message to be passed (and any resulting processing) is determined by an application user's run-time choice. This type of link is a dynamic SmartLink.

When you define a dynamic SmartLink, you do not need to provide the support structure for standard events required for static SmartLinks (see the previous section for details). If, at design time, you define between two SmartObjects a SmartLink that is not in the SupportedLinks list for either object, the addLink procedure registers the link as a subscription to an event of the same name as the links. (You can also do this programmatically, by running the addLink procedure in application code.)

The following example illustrates how to define a dynamic SmartLink. This SmartLink, called ProcessCalc, links a simple SmartObject and a SmartDataObject, passing messages that invoke processing in the SmartDataObject. The particular message sent, and the processing invoked, are determined at run time by the choice of the application user.

Follow these steps in the AppBuilder to define the ProcessCalc dynamic SmartLink:

1 ♦ Create a SmartDataObject that contains an internal procedure named ProcessCalc that has the following code:

```
DEFINE INPUT PARAMETER pcCalcType AS CHARACTER NO-UNDO.

CASE pcCalcType:
  WHEN "Totals":U THEN RUN calcTotals.
  WHEN "Discounts":U THEN RUN calcDiscounts.
END CASE.
```

2 ♦ Create the code for the calcTotals and calcDiscounts procedures.

3 ♦ Create a simple SmartObject called `sCalcPanel.w` that contains two buttons named Calculate Totals and Calculate Discounts, and add the following trigger code to these buttons:

```
ON CHOOSE OF btnCalcTotals DO:
  PUBLISH "ProcessCalc":U (INPUT "Totals":U).
END.

ON CHOOSE OF btnCalcDiscounts DO:
  PUBLISH "ProcessCalc":U (INPUT "Discounts":U).
END.
```

4 ♦ Create a SmartWindow.

5 ♦ Drop the SmartDataObject onto the SmartWindow.

6 ♦ Drop the `sCalcPanel.w` simple SmartObject onto the SmartWindow.

7 ♦ Add a SmartLink as follows:

a) Invoke the Link Advisor.

b) Choose Add. The Add a SmartLink dialog box appears.

c) From the Add a SmartLink dialog box, choose h_sCalcPanel as the Source.

d) Choose New… as the Link Type.

e) Enter ProcessCalc as the New Link Type.

f) From the Add a SmartLink dialog box, choose the SmartDataObject as the Target.

g) Click OK.

When you run this application:

- Choosing the Calculate Totals button invokes ProcessCalc in the SmartDataObject with the Totals input parameter, which runs the calcTotals procedure.
- Choosing the Calculate Discounts button invokes ProcessCalc in the SmartDataObject with the Discounts input parameter, which runs the calcDiscounts procedure.

Thus the ProcessCalc SmartLink is dynamic, in the sense that the link name is not bound to a set of event procedure names that are statically defined in the SmartObjects.

4

Data Management in the ADM

The main purpose of most Progress applications is data management: allowing application users to browse, maintain, add, and delete records in databases. Thus, most SmartObjects are related to data management:

- SmartDataObjects work with database records.
- SmartDataViewers and SmartDataBrowsers provide display and browse capabilities for data sets.
- SmartFilters allow the user-specified filtering of queries.
- SmartPanels and SmartToolbars provide screen controls for moving through and updating records managed by the other SmartObjects.

Each of these SmartObjects represents an individual aspect of data-management functions. This chapter describes how they work together to allow you to build applications that manage database records in a variety of ways. It discusses the following topics:

- Displaying and browsing data sets
- Filtering records
- Using SmartPanels and SmartToolbars
- Miscellaneous data-management concepts

4.1 Displaying and Browsing Data Sets

The SmartDataObject accesses data. SmartDataViewers and SmartDataBrowsers provide various display and browse capabilities for the data sets accessed by the SmartDataObjects to which they are linked.

- A SmartDataObject manages a database query on one or more tables that can be distributed across the AppServer; it defines and retrieves a set of database records.
- A SmartDataViewer views column values that it receives from another object, such as a SmartDataObject, that is accessing the database. The SmartDataObject and SmartDataViewer, together with a SmartPanel, can retrieve, display, navigate, and update records.
- A SmartDataBrowser allows an application user to browse column values that it receives from another object, such as a SmartDataObject, that is accessing the database. A SmartDataBrowser may also allow updates to data.

A SmartDataObject has its own database query. A SmartDataObject can pass a key value from one query object to a subordinate object so that the second object can open a query dependent on that key value; for example, Orders OF a particular Customer. For more information, see the "Initializing the Foreign Key Fields" section.

All database queries can be modified dynamically so that a given SmartDataObject can be used in various application contexts. For example, a SmartDataObject whose query definition is FOR EACH Order might be used in one application context to display and manage all Orders, but in another context, might be made into a dependent query object that receives a Cust–Num key from another Customer SmartDataObject and opens its query as FOR EACH Order WHERE Cust–Num = *key value*.

4.1.1 SmartDataObjects

The SmartDataObject accesses a database directly. It transfers rows, as defined by its database query, to a temp–table called RowObject one batch at a time. (Fields from one or more tables can be joined into a single result table.) For a discussion of the RowObject temp–table, see the "SmartDataObject Query and Update Operations" section in Chapter 7, "Developing Your Application's Business Logic."

Once the RowObject temp–table has been built, the SmartDataObject presents its rows to SmartDataViewers, SmartDataBrowsers, and other client objects. The SmartDataObject thus insulates the client objects from the database specifics.

Note that when a SmartDataObject reads a data set into a RowObject temp–table, it provides essentially a snapshot of the current state of the data set, often called a *view*. The RowObject temp–table does not necessarily reflect updates to the data set that are made by other users in another session; however, any code that executes the openQuery procedure on the data set automatically refreshes the RowObject temp–table with the latest data. Alternatively, you can use the refreshRow function on the current row to get the latest data.

You can customize various field-related properties of a SmartDataObject to meet your own application needs:

- Select which fields will be a part of the data set presented to other client objects.
- Change the field names.
- Determine which fields the SmartDataObject allows client objects to update.
- Change formats and other field attributes.
- Use calculated fields to express a calculation based on other fields in the RowObject temp–table or as a placeholder for information to be passed to or from client objects that use the SmartDataObject.

SmartDataObjects support update validation logic beyond that defined in the Data Dictionary or in database triggers. For more information, see Chapter 7, “Developing Your Application’s Business Logic.”

4.1.2 SmartDataViewers

A SmartDataViewer does not define or open a query and therefore always relies on another SmartObject for data. SmartDataViewers never FIND a database record and no record buffers are passed to it. This helps separate the UI from the data management and does not constrain SmartDataViewers to run in a session with a database connection. A SmartDataViewer never has any database records at run time; it displays data from a query defined elsewhere. As with the SmartDataBrowser, all updates must be performed through a SmartDataObject.

4.1.3 SmartDataBrowsers

You build a SmartDataBrowser against a SmartDataObject, selecting fields from that SmartDataObject. The SmartDataBrowser browses the SmartDataObject query at run time. In the same way as a SmartDataViewer, the SmartDataBrowser does not actually have any database records at run time; it is browsing a query defined elsewhere. Also, as with the SmartDataViewer, updates to a SmartDataBrowser simply cause modified values to be passed to the SmartDataObject for updating. This method of building a SmartDataBrowser maintains independence of the UI from the database, since the SmartDataBrowser browses a temp–table query maintained in another object.

Recall that there are two types of SmartDataBrowsers: dynamic and static. The dynamic SmartDataBrowser is the more versatile of the two; it can be configured to display and update the query of any SmartDataObject, unlike a static SmartDataBrowser, which is specific to a particular SmartDataObject. The dynamic SmartDataBrowser displays and updates records from a set of fields that are determined at run time (rather than at design time, as is the case for the static SmartDataBrowser) and takes its query at run time from the SmartDataObject to which it is linked.

4.1.4 Initializing the Foreign Key Fields

The ForeignFields property is a SmartDataObject property that is set at design time to designate which of its fields to map to foreign key fields in a SmartDataObject that is its parent. A corresponding property called ForeignValues holds the values of those fields for the current row. When the ForeignFields property is set for a particular SmartDataObject, performing the Add or Copy operation in that SmartDataObject assigns the values of the key fields to the corresponding fields in the newly added row.

Suppose that you have two SmartDataObjects called CUST and ORDER that are set up as follows:

- The CUST SmartDataObject parents the ORDER SmartDataObject.
- Each of these SmartDataObjects has a cust–num field.
- The ForeignFields property in the ORDER SmartDataObject is set to the cust–num field.
- The current value of cust–num (and, therefore, the ForeignValues property in the ORDERCUST SmartDataObject) is 27.

Figure 4–1 illustrates this setup.

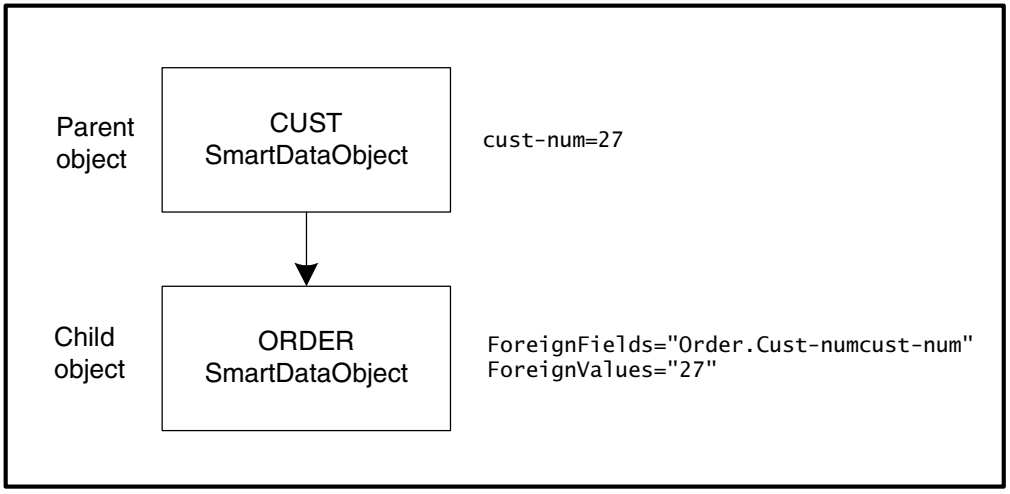


Figure 4–1: Inheriting Foreign Key Field Values

As the application user adds orders, the value of the ORDER SmartDataObject's cust–num field is automatically set to the current value of the CUST SmartDataObject's cust-num field; that is, 27. This is done in the addRow function of `data.p` to display the ForeignField value as the initial value for the new row. If the application user does not change that value (and such fields are normally not updateable), the initial value is assigned to the new row in the procedure submitForeignField, called from the function submitRow during the Save operation. See the online help for descriptions of these functions,

4.1.5 Compatibility Checking

When you instantiate a static SmartDataBrowser or a SmartDataViewer in a Progress application, the AppBuilder must be able to check whether the fields to be browsed or displayed in the SmartObject match (are compatible with) those of the SmartDataObject to which you will link it. Depending on the SmartObject type, the AppBuilder uses either signatures or field lists to perform this check. (Compatibility checking is not required for dynamic SmartDataBrowsers.)

Signature and Field-list Checking at Design Time

The AppBuilder performs a compatibility check in the following circumstances:

- When you instantiate a SmartDataBrowser or SmartDataViewer in a SmartContainer. The AppBuilder checks all SmartDataObjects in the SmartContainer to see whether their signatures and field lists match those of the new SmartDataBrowser or SmartDataViewer, respectively. If any matches occur, the Progress Advisor asks which, if any, SmartDataObjects to link to the SmartDataBrowser or SmartDataViewer. If there are no matches, the Advisor does not appear.

- When you instantiate a SmartDataObject in a SmartContainer. The AppBuilder checks all existing SmartDataBrowsers and SmartDataViewers in the SmartContainer to see whether their signatures and field lists, respectively, match those of the new SmartDataObject. If any matches occur, the Progress Advisor asks which, if any, SmartDataBrowsers or SmartDataViewers to link to the SmartDataObject. If there are no matches, the Advisor does not appear.

- When you modify a SmartDataObject. The AppBuilder checks all objects linked to that SmartDataObject for compatibility, and the Progress Advisor notes any incompatibilities.

- When you modify a SmartDataBrowser or SmartDataViewer that is linked to a SmartDataObject. The AppBuilder checks for compatibility, and the Progress Advisor notes any incompatibilities.

You can verify the validity of the signatures of linked objects by clicking on the Check Links button in the SmartLinks window. (See the *Progress AppBuilder Developer's Guide* for details.)

Checking SmartDataBrowser Compatibility

Compatibility checking is not required for dynamic SmartDataBrowsers. A dynamic SmartDataBrowser simply attaches to the query of its SmartDataObject and generates a column list at run time, thus avoiding the necessity for a compatibility check.

Compatibility checking for static SmartDataBrowsers uses signatures. As in the case of a SmartDataObject, the temp–table definition of a SmartDataBrowser gives it a unique signature that identifies the order, number, and data types of its fields. The exact use of the signature differs depending on what action is attempted and against which objects the action occurs.

In a compatibility check, the getDataSignature function for both the SmartDataObject and static SmartDataBrowser returns a character string with a representation of the object's signature. The signature of the SmartDataObject is compared to the signature of the static SmartDataBrowser to see whether they are compatible. If so, the static SmartDataBrowser can browse the SmartDataObject's query when the objects are linked at run time.

Checking SmartDataViewer Compatibility

The field-matching relationship of a SmartDataViewer with a SmartDataObject against which it is built is different from that of a SmartDataBrowser with a SmartDataObject. The AppBuilder uses the SmartDataViewer's displayed field list, rather than a signature, to determine compatibility with the SmartDataObject. This displayed field list is defined by the SmartDataViewer's displayed fields and accessed with the getDisplayedFields function. If a SmartDataViewer's displayed fields are the same as or a subset of a SmartDataObject's fields, the objects are considered to have a matching displayed field signature. A SmartDataViewer can successfully retrieve data from a SmartDataObject only if the SmartDataObject can provide all of the fields that the SmartDataViewer needs.

Similarly, a SmartDataViewer has an enabled field list that is defined by its enabled fields and accessed with the getEnabledFields function. If a SmartDataViewer's enabled fields are the same as or a subset of a SmartDataObject's updateable fields, the objects are considered to match, according to this enabled field list. A SmartDataViewer can successfully send data to a SmartDataObject only if the SmartDataObject can update all of the fields that the SmartDataViewer provides.

Example: SmartDataObject and SmartDataViewer. The SmartDataObject `dcust.w` generates the following include file:

dcust.i

```
FIELD Name LIKE Customer.Name VALIDATE~
FIELD Address LIKE Customer.Address VALIDATE~
FIELD City LIKE Customer.City VALIDATE~
FIELD State LIKE Customer.State VALIDATE~
FIELD Postal-Code LIKE Customer.Postal-Code VALIDATE~
.
.
.
```

The updateable fields in this file are the Name, Address, and City fields.

Suppose that a SmartDataViewer built against `dcust.w` enables the Name and Address fields. In this case:

- The SmartDataViewer has a matching displayed field list with the SmartDataObject.
- The SmartDataViewer has a matching enabled field list with the SmartDataObject.

Now, suppose that the SmartDataViewer is built against `dcust.w` enables the Name and Postal-Code fields. In this case:

- The SmartDataViewer has a matching displayed field list with the SmartDataObject.
- The SmartDataViewer does not have a matching enabled field list with the SmartDataObject. This is because the SmartDataObject's Postal-Code field is not updateable.

Example: SmartDataObjects with Contrasting Signatures. The SmartDataObject `dcust.w` generates the following include file:

dcust.i

```
FIELD Name LIKE Customer.Name VALIDATE~
FIELD Address LIKE Customer.Address VALIDATE~
FIELD City LIKE Customer.City VALIDATE~
FIELD State LIKE Customer.State VALIDATE~
FIELD Postal-Code LIKE Customer.Postal-Code VALIDATE~
.
.
.
```

In contrast, the SmartDataObject `d-custreverse.w` generates the following include file:

dcustreverse.i

```
FIELD Postal-Code LIKE Customer.Postal-Code VALIDATE
FIELD State LIKE Customer.State VALIDATE~
FIELD City LIKE Customer.City VALIDATE~
FIELD Address LIKE Customer.Address VALIDATE~
FIELD Name LIKE Customer.Name VALIDATE~
.
.
.
```

In this example:

- A SmartDataBrowser built against the `dcust.w` SmartDataObject will not match the `d-custreverse.w` SmartDataObject. This is because the temp–table signature is used to determine compatibility and the order of the fields is different.
- A SmartDataViewer built against the `dcust.w` SmartDataObject will match the `d-custreverse.w` SmartDataObject. This is because the displayed field list is used to determine compatibility and the order of the fields does not matter, only their names and data types.

Using Data SmartLinks

Data in the form of field values is passed from one SmartObject to another using a Data SmartLink. A SmartDataObject can be a Data–Source for another object. It can also be a Data–Target, receiving a key value from another query object to use in opening a query. Visual objects such as SmartDataViewers and SmartDataBrowsers can also be Data–Targets. A SmartDataViewer as a Data–Target receives formatted column values from a SmartDataObject for display. A SmartDataBrowser as a Data–Target browses its Data–Source's query and displays column values in its browse.

At design time, when you drop a SmartObject into an application, the AppBuilder's Link Advisor assesses each SmartObject already in the application to determine whether it is suitable for a Data link connection with the new SmartObject and, if it is, it recommends the connection. It makes its assessment by examining the properties of each object to determine what columns it defines: a query object can be a Data–Source for another object only if it can supply one or more columns that the object could use as a key to open its own query.

In particular:

- A query object can be a Data–Source for a visual object such as a SmartDataViewer if all of the fields displayed by the SmartDataViewer are in the query object and all fields that are enabled in the SmartDataViewer are updateable in the Data–Source.

- A SmartDataBrowser can be a Data–Target only for a SmartDataObject that has the same signature.

NOTE: Because of the flexibility of SmartObject combinations and the dynamic nature of queries, the Link Advisor might suggest possible links that are not desirable for your application. Always examine Link Advisor recommendations before accepting them. One way to avoid problems is to drop Data–Sources onto the design window before Data–Targets. When two objects can be linked in either direction, the Link Advisor assumes that the first object dropped into the application should be the Data–Source.

4.2 Filtering Records

You use the SmartFilter to allow your application users to filter records with user-specified selection criteria rather than built-in criteria. The SmartFilter follows the query-by-form model and is implemented as a dynamic SmartObject; that is, the selection criteria are specified at run time rather than being built into the object.

Progress provides the prebuilt master `dynfilter.w` for the SmartFilter. When you build a SmartFilter, you must define a Filter link to connect the SmartFilter to the SmartDataObject that will serve as its data source, optionally defining that SmartDataObject at this time. (You can also define it later in the Instance Properties dialog box.) The Filter link can be implemented as a pass-through link. (See the "Pass-through Links" section in Chapter 3, "SmartLinks.") This allows you to create a SmartFilter in a separate SmartWindow and wait to link it to the Filter-target until you drop the SmartFilter's SmartWindow into the Filter-target's SmartWindow.

Because the SmartFilter is implemented as a dynamic SmartObject, it does not have a Wizard, and you modify it at design time through its instance properties. You can specify both the SmartDataObject that will serve as the data source for the records to be filtered and the fields that the application user can filter. (See the "Customizing SmartFilters" section.) At run time, the user specifies selection criteria in the filter fields.

Note that the SmartToolbar contains a Filter button that can start a SmartFilter. If the SmartFilter is in the same Window as the SmartToolbar, it simply uses a Filter SmartLink. For instructions on linking the SmartToolbar if the SmartFilter is in a separate SmartWindow, see the "Connecting to a SmartFilter in Another SmartWindow" section.

Customizing SmartFilters

You customize the SmartFilter object through its instance properties. The SmartFilter has an Instance Properties dialog box (source program: `src/adm2/support/filterd.w`) that you can use to specify various filter properties. Unless you linked to a data source before you opened the Instance Properties dialog box, you must, at minimum, customize your SmartFilter by providing it with a SmartDataObject that will serve as its data source. By default, all fields are selected, but you can add or delete fields and change the order in which they appear. Because SmartFilter fields are generated dynamically, you cannot access their properties in the Instance Properties dialog box. However, you can access the most important field properties for each field: its label, width, tooltip, and HelpID.

You can also specify some additional properties of the filter itself:

- Its style: Implicit, Explicit, Range, or Inline
- Whether filter data in a character field is evaluated with BEGINS
- Whether an Explicit operator is visualized using a combo box or a radio set

See Chapter 2, "SmartObjects," for descriptions of the SmartFilter instance properties.

Connecting to a SmartFilter in Another SmartWindow

Follow these steps to link the Filter button in a SmartToolbar to a SmartFilter in a separate SmartWindow:

1 ♦ Create a SmartFilter in a separate SmartWindow, specifying all necessary instance properties, and link it temporarily as a Filter-source to THIS–PROCEDURE (the SmartWindow).

2 ♦ Drop this SmartWindow in a SmartWindow with a potential filter—a SmartDataObject that matches the SmartFilter—and answer Yes to the Link Advisor's prompt about adding the Filter link to the SmartDataObject.

3 ♦ Optionally, specify HideOnInit and DisableOnInit in the SmartWindow's Instance Properties dialog box and start the main SmartWindow.

4 ♦ Check the Filter check box in the SmartToolbar's Instance Property dialog box.

The SmartToolbar can now view and start the SmartFilter's SmartWindow.

4.3 Using SmartPanels and the SmartToolbar

A SmartPanel is a group (or panel) of buttons that send messages to other SmartObjects. There are several types of SmartPanels, which you can use to manage records in various ways: navigate through them, update them, or perform transaction processing. The SmartToolbar provides a toolbar and/or menu interface for performing one or more of these operations, as well as some additional operations not discussed in this chapter.

4.3.1 Using SmartPanels

Progress provides prebuilt masters for three SmartPanel types: Navigation, Update, and Commit. You can modify these masters to create new SmartPanels with specialized functions, so the ADM does not include a SmartPanel template.

In previous ADM releases, a common use for the Navigation and Update SmartPanels was to place both a Navigation SmartPanel and an Update SmartPanel in a Progress application and use them collectively as a sort of toolbar. If the containing SmartObject is a SmartWindow, this is no longer necessary, as you can provide this combined functionality with a SmartToolbar. (See the "Using SmartToolbars" section.)

Navigation SmartPanels

Two prebuilt SmartPanels are designed to navigate through a set of records; they support the Navigation link type. These panels contain buttons that represent the functions First, Previous, Next, and Last. They differ only in how they represent these buttons:

- The master file `src/adm2/pnavlbl.w` has buttons with labels.
- The master file `src/adm2/pnavico.w` has buttons that resemble VCR icons.

Choosing these buttons publishes the following ADM events (implemented in the procedure `src/adm2/query.p`), which are received in the SmartPanel's Navigation–Target:

- First invokes fetchFirst.
- Prev invokes fetchPrev.
- Next invokes fetchNext.
- Last invokes fetchLast.

The standard SmartObject designed to be a Navigation–Target is the SmartDataObject. However, if you want your users to be able to use buttons to navigate through records, use a SmartDataBrowser as a visualization for a SmartDataObject. In this case, moving through the rows of the SmartDataBrowser navigates through the SmartDataObject query (although the SmartDataBrowser is not actually the Navigation–Target). Note that the SmartPanels know nothing about the data through which they help to navigate. A custom SmartObject with these four ADM procedures could use them to navigate through any kind of data, including pages in a report, segments of a video, and so forth.

Update SmartPanel

Another prebuilt SmartPanel contains buttons for modifying records. This SmartPanel, which uses the TableIO link type, can serve as a TableIO–Source for a SmartDataViewer, SmartDataBrowser, or other SmartObject that is a TableIO–Target.

The master file `src/adm2/pupdsav.w` is called the Standard Update SmartPanel. You should use this SmartPanel to modify database records. It has six buttons and runs in one of two modes, or styles, that you can set in the SmartPanel's Instance Properties dialog box: Save mode and Update mode:

- Save mode is the default mode. In Save mode, the updateable fields of the SmartPanel's TableIO–Target are enabled at all times. The label on the first button is Save. A user can make changes to the current record and choose the Save button to write them back to the associated SmartDataObject.

- Update mode is the nondefault mode. Initially, the label on the first button is Update, and fields in the TableIO–Target SmartDataViewer or SmartDataObject are disabled. When the user locates a record to change, choosing the Update button enables the updateable fields, and the label on this button becomes Save. Choosing the Save button sends the changes to the SmartDataObject, disables the fields again, and resets the label to Update.

Choosing the buttons of the Standard Update SmartPanel in Save mode invokes the following methods, which are found in the super procedure `src/adm2/datavis.p`, as well as in the SmartDataBrowser- and SmartDataViewer-specific super procedures `src/adm2/browser.p` and `src/adm2/viewer.p`:

- Save invokes updateRecord.
- Add invokes addRecord.
- Reset invokes resetRecord.
- Copy invokes copyRecord.
- Delete invokes deleteRecord.
- Cancel invokes cancelRecord.

In Update mode, choosing the Save, Add, Reset, Copy, Delete, and Cancel buttons invokes the same methods as in Save mode. In addition, choosing the Update button invokes enableFields.

See the online help for more information on the functions of these procedures and functions.

Note that the Standard Update SmartPanel has no direct role in managing database transactions. It merely invokes the procedures and functions named. All actual data access, locking, and transaction management are handled by the super procedures for the SmartDataObjects themselves.

Commit SmartPanel

The Commit Panel SmartObject includes two buttons: Commit and Undo. The Commit button PUBLISHes commitTransaction and the Undo button PUBLISHes undoTransaction.

The Commit SmartPanel, `pcommit.w`, defines the CommitTarget property and CommitTarget event. The panel subscribes to the RowObjectState in its Target. The RowObjectState procedure takes either NoUpdates or RowUpdated for parameters. These states disable or enable the panel buttons.

When you use a Commit Panel, the SmartDataObject is made a Commit–Target and the panel is a Commit–Source. The SmartDataObject sets the AutoCommit property to No if it has a Commit–Source.

The `data.p` super procedure includes the commitTransaction and undoTransaction event procedures. See the online help for more information on these procedures.

NOTE: You should use the Commit SmartPanel only when your application must specifically allow users to batch multiple updates to be committed at the same time; for example, to allow a set of order-line records for an order to be added or updated together. In other cases, using the Commit Panel is unnecessary and can complicate the update process.

SmartDataObjects have an AutoCommit property that indicates whether, on update (Add, Save, Copy, or Delete operations), changes should be written back to the database as each individual record is saved (or deleted). By default, the AutoCommit property is set to YES. When this is the case, the following happens each time the Save or Delete button is pressed (or an equivalent updateRecord or deleteRecord operation occurs in some other way):

1. The before and after image of the single row that is being updated is written into an additional temp–table called RowObjUpd. For a discussion of this temp–table, see the "SmartDataObject Query and Update Operations" section in Chapter 7, "Developing Your Application's Business Logic."

2. If the SmartDataObject is divided between client and AppServer, the row is passed back to the AppServer.

3. The change is made to the database.

However, if a SmartDataObject has a Commit–Source (normally the Commit SmartPanel), the AutoCommit property is automatically set to NO. In this case, each time the Save or Delete button is pressed, the relevant RowObject row is written to the RowObjUpd temp–table, but the changes are not written back to the database. To write the updates to the database, the application user presses the Commit button, which executes the commitTransaction procedure in the SmartDataObject. This procedure sends the RowObjUpd table back to the server, then opens a transaction block and makes all of the modifications to the database in a single transaction. If errors occur, the updates continue (if possible) in order to identify all errors with the update, the transaction is then undone, and the errors are then returned to the client for correction. If no errors occur, all the updates are written to the database in a single transaction block.

Pressing the Undo button, which executes the undoTransaction procedure, has the effect of reversing the current Commit operation. This procedure cancels all updates that have not been committed, empties the RowObjUpd temp–table, and returns the RowObject temp–table to its state before the first of these updates was made.

Customizing SmartPanels

You can customize the SmartPanel objects in a number of ways.

- Instance properties. The SmartPanels have an Instance Properties dialog box (source program `src/adm2/support/n-paneld.w` for Navigation panels and `src/adm2/support/u-paneld.w` for Update panels) that you can use to specify properties in a run-time instance of a SmartPanel without modifying the master object itself. For all SmartPanels, you can choose to show a decorative border rectangle around the buttons. The default border is a rectangle with two edge-pixels (giving a chiseled look in MS-Windows). You can modify the number of edge-pixels, or suppress the rectangle altogether by setting the value of the EdgePixels instance property to zero.

  For the Navigation SmartPanel with icons, you can choose to make the VCR icon on the left the First button (the default) or the button on the right (for countries where text is read from right to left). This corresponds to the instance property RightToLeft.

  For descriptions of the SmartPanel instance properties, see Chapter 2, "SmartObjects."

- Resizing the SmartPanels. You can resize a SmartPanel at design time by grabbing its resize handles and reshaping the panel. The resizeObject procedure in the super procedure `src/adm2/panel.p` (used by all SmartPanels) resizes and rearranges the buttons (in a column or in multiple rows if necessary) to fit the available space.

- Creating custom SmartPanels. You can create a custom SmartPanel by deleting one or more buttons from a SmartPanel and saving the result as a new SmartPanel. (Code in the SmartPanel master files verifies that a button is present before enabling or disabling it.) For example, you can remove any of the buttons from the Navigation SmartPanels to create a smaller custom Navigation panel. You can also remove buttons from the Update SmartPanels.

  CAUTION: Do not remove from Update SmartPanels any buttons that are needed to complete update operations. You cannot remove the Save/Update button. If Add or Copy is present, or if a panel based on the Standard Update panel is in Update mode, do not remove the Cancel button.

  You can also add buttons with user-specific functionality to a custom SmartPanel. See Chapter 6, "Advanced ADM Topics," for more information on building custom SmartObjects.

4.3.2 Using SmartToolbars

A SmartToolbar is a SmartObject that provides a toolbar and/or menu interface to application commands that perform various actions; for example, performing navigation and transaction actions in the current object. You can contain a SmartToolbar in a SmartWindow but not in a SmartFrame or a SmartDialog, and you can put only one SmartToolbar instance in a given SmartWindow.

Progress provides the prebuilt master `toolmenu.w` for the SmartToolbar. You can modify this master to create a new SmartToolbar with specialized functions, so the ADM does not include a SmartToolbar template.

By default, a SmartToolbar instance includes both a toolbar and a menu. See the "Customizing SmartToolbars" section for information on changing this.

The SmartToolbar provides the application user with the ability to perform the following groups of actions:

- Navigation operations: First, Prev, Next, Last. For information on these actions, see the "Navigation SmartPanels" section.
- Tableio operations; either:
  - Tableio Save operations: Add record, Copy record, Delete record, Save record, Reset, Cancel
  - Tableio Update operations: Add record, Update record, Copy record, Delete record, Save record, Reset, Cancel

  For information on these actions, see the "Update SmartPanel" section.
- Commit operations: Commit, Undo. For information on these actions, see the "Commit SmartPanel" section.
- Filter operation. For information on this action, see the "Filtering Records" section.

By default, only the Navigation and Tableio Save operations are enabled. You can specify that the user can perform all or a subset of these actions. (See the "Customizing SmartToolbars" section.) Which action groups you select determine whether the SmartToolbar functions as a Navigation–Source or a Tableio–Source or both. The Wizard prompts you with possible connections.

The rules and data for the actions accessible in the SmartToolbar are defined in an action class from which the SmartToolbar inherits and are totally independent of the SmartToolbar's layout and structure. As a result, all SmartToolbar actions have the same text, image, and interface throughout the application regardless of the SmartToolbar layout.

Customizing SmartToolbars

The simplest way to customize the SmartToolbar object is through its instance properties. The SmartToolbar has an Instance Properties dialog box (source program: `src/adm2/support/toold.w`) that you can use to specify properties in a run-time instance of a SmartPanel without modifying the master object itself:

- You can choose to show either a menu or a toolbar or both.
- You can choose to show a decorative border rectangle around the toolbar; the border includes dividers between icon groups.
- You can specify which actions the application user can perform from the SmartToolbar.

For descriptions of the SmartToolbar instance properties, see Chapter 2, "SmartObjects."

More complex SmartToolbar modifications (for example, the order and structure of icons and menus) involve modifying the SmartToolbar object itself. For some basic information, see the "Complex SmartToolbar Modifications" section in Chapter 2, "SmartObjects."

4.4 Transactions and Record Locking

The transaction logic built into the standard SmartObjects (in particular, the SmartDataObject and its supporting files `data.i` and the super procedure `data.p`) uses optimistic locking. No database records are locked when they are initially read and transferred into the RowObject temp–table. When an update is committed, the corresponding database records are re-read with an EXCLUSIVE–LOCK. If a lock conflict occurs, the commit is aborted and this information is reported to the user. In the case of an add or copy operation, the record CREATE for the new record is performed inside of this transaction block.

Next, by default, the SmartDataObject verifies that the database records have not been modified by another user since they were first read. If you want to skip this check, set the checkCurrentModified property in the SmartDataObject to NO in the Instance Property dialog box for the SmartDataObject when assembling an application. Alternatively, you can set it to NO in the initialization code for the SmartDataObject.

Finally, only those fields that were actually modified by the application are ASSIGNed back to the database records. Note that because the code uses the ChangedFields field in the update temp–table (RowObjUpd) to keep track of which fields were changed, it is necessary to update this field by hand if user-written application code is used; for example, if the RowObjectValidate procedure in a SmartDataObject modified fields beyond those changed in a SmartDataViewer or SmartDataBrowser.

When the update is complete, the database records are re-read to capture any field values that might have been assigned by the CREATE, WRITE, or ASSIGN triggers, and those values are passed back to the client objects for display. A transaction is never held open while data values are examined or entered.

5

SmartObject Interactions

For a given application screen to work smoothly, the SmartObjects on the screen must continually interact. In particular, they must know how to communicate, how to get and set ADM properties, and how to pass data. As a programmer, you need to know how the ADM manages these different forms of interaction.

This chapter discusses the general structure of SmartObjects and describes the standard ADM protocols for:

- Running internal procedures and functions
- Publishing and subscribing to named events
- Getting and setting ADM properties

These protocols provide a reliable and flexible way for independent encapsulated modules (SmartObjects) to communicate and pass data.

5.1 General Structure of a SmartObject

This section discusses the following topics:

- Directory and file structure
- Support include files
- Super procedures
- Property and prototype include files

5.1.1 Directory and File Structure

The ADM directory structure includes:

- Primary include files for SmartObjects and their super procedures, located in `%DLC/src/adm2`
- Templates, located in `%DLC/src/adm2/template`
- Support procedures, located in `%DLC/src/adm2/support` and compiled into `%DLC/gui/adm2/support`
- Super procedures and prebuilt objects such as the SmartPanels and SmartFolders, also located in `%DLC/src/adm2 and compiled into %DLC/gui/adm2`

Many SmartObjects are constructed from template (.w) files. These templates contain a minimum of executable code to minimize maintenance problems if general changes need to be made to a class of objects after many specific masters have already been built from a template. Some SmartObjects do not have template files; they have only master files that can be customized at design time.

5.1.2 Support Include Files

As noted in Chapter 1, "Overview," a SmartObject template generally includes a single support include file: the primary include file for the class on which the SmartObject is based. This include file has the same name as the template (but a different extension). For example, the SmartDataViewer template `viewer.w` includes the primary include file `viewer.i`. A primary include file such as `viewer.i` does not directly contain most of the code needed to support the SmartObject. It contains only those program elements required to compile a master built from that template:

- Any variable or other definitions needed by all masters of that type.
- A reference to the next support include file up the chain (for example, a SmartDataViewer is a visual object that displays data, so it includes `datavis.i`; if there is no other intermediate object above this type, it includes `smart.i`), and its own property include file, which defines those properties stored in the ADMProps temp–table for the object.
- Initialization code in the Main Block for this object type's properties and any other generic object startup code.
- Any routine that requires compile-time resolution of preprocessors or that for some other reason must be part of the master's compilation unit (`.r` file).

5.1.3 Super Procedures

All of the support code for an object type, other than the code in its primary include file, is in a separately compiled super procedure that is built as a structured `.p` file. For example, the super procedure for SmartDataViewers is `viewer.p`.

During startup, the `.p` file is run and established as a super procedure for each of its SmartObjects running in that session. Its routines use TARGET–PROCEDURE to get the procedure handle of the appropriate SmartObject and can then get property values from that procedure to get handles or other data needed to act on behalf of the SmartObject. These SmartObjects can run any internal procedure or function implemented in one of the object's super procedures as if it were implemented in the SmartObject itself. This allows these separately compiled procedure objects to do the following:

- Support standard behavior for all SmartObjects of a given type running in a Progress session
- Enable the customization or overriding of these procedures and functions in individual SmartObjects

For an overview of super procedures, see the *Progress Programming Handbook*. For descriptions of super procedures and TARGET–PROCEDURE, see the *Progress Language Reference*.

Figure 5–1 illustrates this relationship.

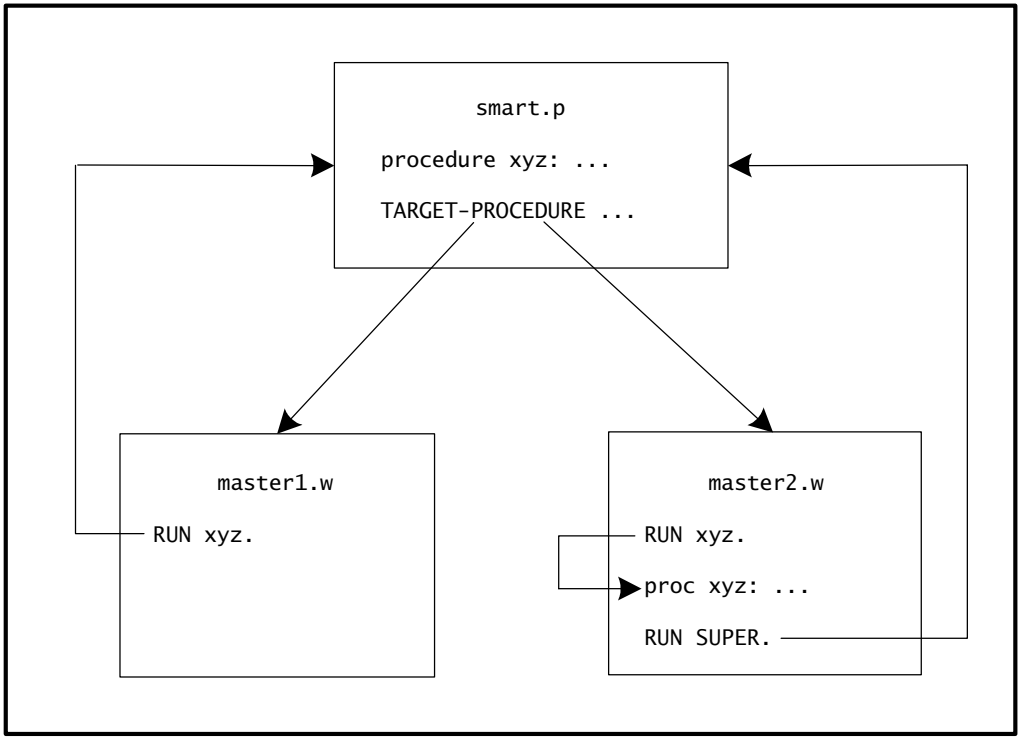


Figure 5–1: Super Procedures and Master Interactions

The `smart.p` code uses TARGET–PROCEDURE to reference the two masters. For `master1.w`, the xyz procedure in the `smart.p` super procedure is run because `master1.w` does not have its own xyz procedure. For `master2.w`, its own xyz procedure is run and then, because it executes RUN SUPER, the xyz procedure in `smart.p` is also run.

As this example illustrates, using super procedures to provide most of the support code for a SmartObject provides these advantages:

- Encapsulation of routines into a super procedure where they are accessible from all SmartObjects associated with that super procedure
- The ability to use the same procedure or function name in multiple layers when defining the behavior for a particular SmartObject

Each super procedure must define a get*propname* function for each object property that can be retrieved from objects of that type and a set*propname* function for each settable property. For more information on these properties, see the "Get and Set Functions for Object Properties" section.

Note that super procedures are not SmartObjects in themselves and are not directly seen or manipulated in the AppBuilder during application assembly. They do not have SmartLinks nor do they have properties of their own.

The super procedures for SmartObjects are designed to be shared and stateless. This means that a given super procedure such as `viewer.p` is run only once in a session. No matter how many SmartDataViewers there are, each SmartDataViewer designates the same instance of `viewer.p` as its super procedure. This means that whenever a routine is invoked in `viewer.p` as a super procedure, it queries whatever properties of its TARGET–PROCEDURE are needed for it to act. The next routine invoked in `viewer.p` is not assumed to come from the same TARGET–PROCEDURE.

5.1.4 Property and Prototype Include Files

The property include file for a SmartObject defines its basic properties, references the its prototype file, and, if necessary, starts its super procedure. It can also define instance properties and the instance property dialog box and may reference certain custom class files as needed. For more information on properties, see the "ADM Properties" section.

5.1.5 Prototype Include Files

The prototype include file for a SmartObject defines prototypes for all internal entries (functions, internal procedures) of the super procedure for the class.

5.1.6 SmartObject File Relationships

Within the overall SmartObject class hierarchy, the class files described in the "General Structure of a SmartObject" section relate to other files of the same type in certain very specific ways. These relationships establish what characteristics and properties a specific SmartObject type inherits. Figure 5–2, which is based on the SmartDataViewer, illustrates these relationships.

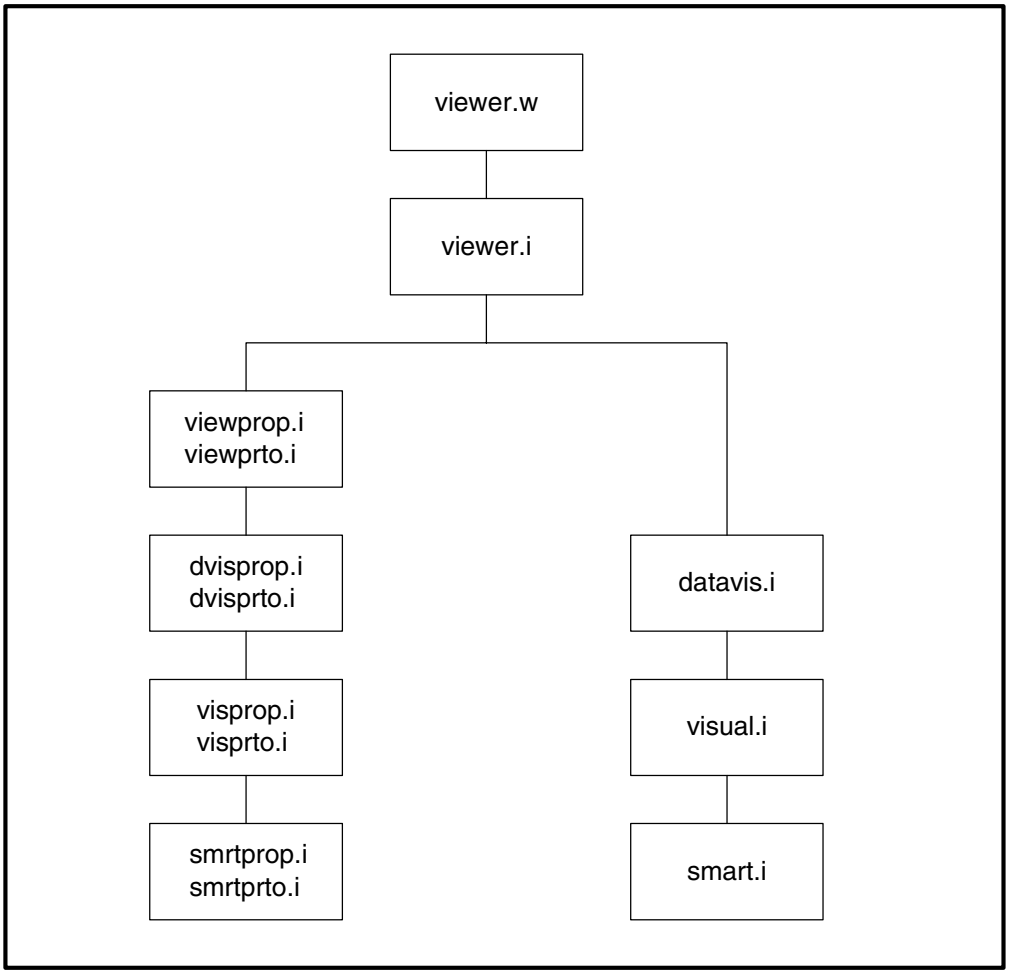


Figure 5–2: Include File Structure for SmartDataViewer

In Figure 5–2, note the following:

- The `smrtprop.i` file, at the lower left, defines an ADMProps temp–table that in turn defines the basic properties that apply to all SmartObjects. Each include file above the `smrtprop.i` file adds properties specific to the class with which it is associated. For details on the ADMProps temp–table, see the "ADMProps Temp–table and Object Properties" section.
- The `viewer.w` file includes only `viewer.i`.
- The `viewer.i` file includes `datavis.i`, because a SmartDataViewer is a data visualization object. It also includes `viewprop.i`, which includes the prototype include file `viewprto.i`.
- The `datavis.i` file includes `visual.i` because a SmartDataViewer is a visual object. It also includes `dvisprop.i`, which includes `dvisprto.i`.
- The `visual.i` file includes `smart.i`, because a visual object is a SmartObject. The `visual.i` file also includes `visprop.i`, which includes `visprto.i`.
- The `smart.i` file includes only `smrtprop.i` (which includes `smrtprto.i`).

Note that when SmartObject code is preprocessed, the preprocessors limit the full expansion of the include files to exactly one branch of the class hierarchy, to avoid duplication of the SmartObject code.

Each SmartObject type uses a different part of the class hierarchy (different branches), but the The tree for any SmartObject type always ends with `smart.i`.

Figure 5–3 expands on Figure 5–2 to illustrate how super procedures are started.

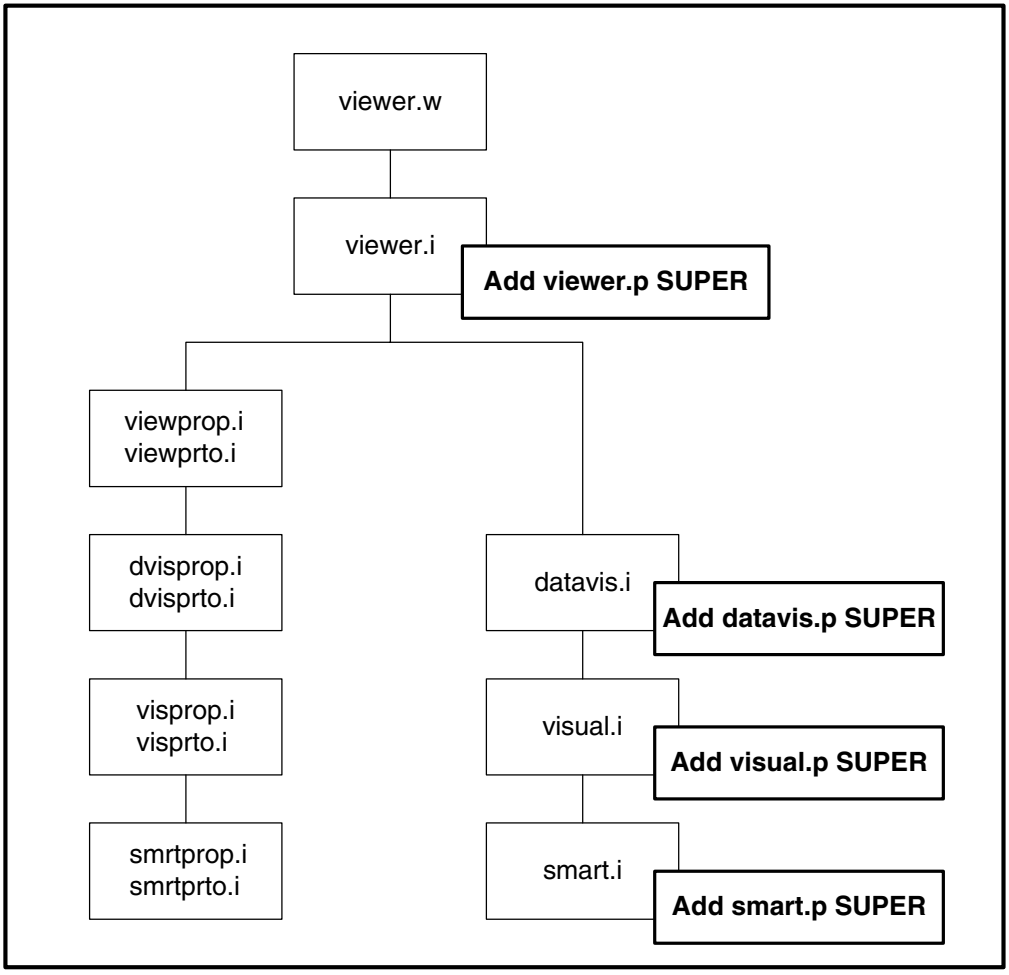


Figure 5–3: Super Procedure Schematic for SmartDataViewer

In Figure 5–3, note the following:

- The `smart.i` file starts `smart.p`, if it is not already running, and adds it as a super procedure for the SmartDataViewer. The `smart.p` file should be the top-level super procedure for all SmartObjects.
- The `visual.i` file starts `visual.p`, if it is not already running, and adds it as a super procedure for the SmartDataViewer.
- The `datavis.i` file then starts `datavis.p`, if it is not already running, and adds it as a super procedure for the SmartDataViewer.
- The `viewer.i` file starts `viewer.p`, if it is not already running, and adds it as a super procedure.

NOTE: The object's own super procedure must always be added last. This is because super procedures are searched in last-in, first-out (LIFO) order, so the interpreter searches in `viewer.p` **first** for needed routines and in `smart.p` **last**. This ensures that more general behavior is executed last and more object-specific behavior is executed first.

5.2 RUN Protocol

All SmartObjects can invoke the behavior of other SmartObjects in themselves by running internal procedures and invoking functions and by publishing events to which other objects subscribe.

5.2.1 RUN Statement

Many aspects of SmartObject behavior are invoked by running internal procedures and invoking functions. Much of this behavior is implemented in super procedures that support the SmartObjects. The behavior in super procedures can be localized and the Progress interpreter will locate and execute the correct behavior. This is possible because super procedures are initialized and added to each SmartObject as each SmartObject starts up.

For example, an application can use the addLink procedure to add a link from one SmartObject to another during execution:

```
RUN addLink ( hSourceProc, 'navigation', hTargetProc ).
```

In this code, hSourceProc is the HANDLE of the source procedure and hTargetProc is the HANDLE of the target procedure.

The RUN statement for addLink is written as if addLink were an internal procedure within the calling procedure. In fact, it is contained in the super procedure `smart.p`. The super procedure mechanism makes the contents of `smart.p` available to every SmartObject. Standard behavior of this kind includes the following procedures (any many others):

- **initializeObject**—Runs when each object is started, to initialize that object
- **destroyObject**—Runs when an object is terminated, to destroy that object
- **addMessage**—Adds an error message to a message log

Similarly, the contents of other SmartObject super procedures are available to SmartObjects that require their support. For example, all visible objects use the super procedure `visual.p` and all SmartObjects that can contain other SmartObjects use `containr.p`. (See the AppBuilder online help for a detailed list of super procedures and their contents.) Using this architecture locates the majority of SmartObject behavior in a set of independently built procedures that can serve all SmartObjects that are running in a Progress session. This helps to organize behavior into reusable classes and keeps the size of individual SmartObjects to a minimum.

Just as a SmartObject can RUN procedures that are implemented in its super procedures, a SmartObject can invoke behavior in another SmartObject simply by knowing its procedure handle and running internal procedures or functions in that SmartObject. For example, one SmartObject can destroy another by executing the following statement:

```
RUN destroyObject IN hOtherObject.
```

5.2.2 Localizing Standard SmartObject Behavior

Another advantage of using super procedures to implement classes of behavior is that you can localize each of the internal procedures and functions that compose a super procedure in any individual SmartObject by writing a procedure or function of the same name. You can do this either to replace the standard behavior or to augment the standard behavior as required by the SmartObject. The Section Editor supports this functionality by identifying the internal procedures and functions that you can override based on the type of object that you are creating.

For example, follow these steps in the AppBuilder to create a new displayFields procedure for a SmartDataViewer:

1 ♦ In the Object Palette, right-click on the SmartDataViewer button.

2 ♦ Choose New SmartDataViewer.

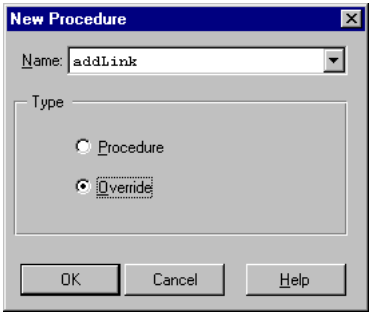
3 ♦ Complete the steps in the SmartDataViewer Wizard.

4 ♦ Choose the Edit code button on the AppBuilder toolbar.

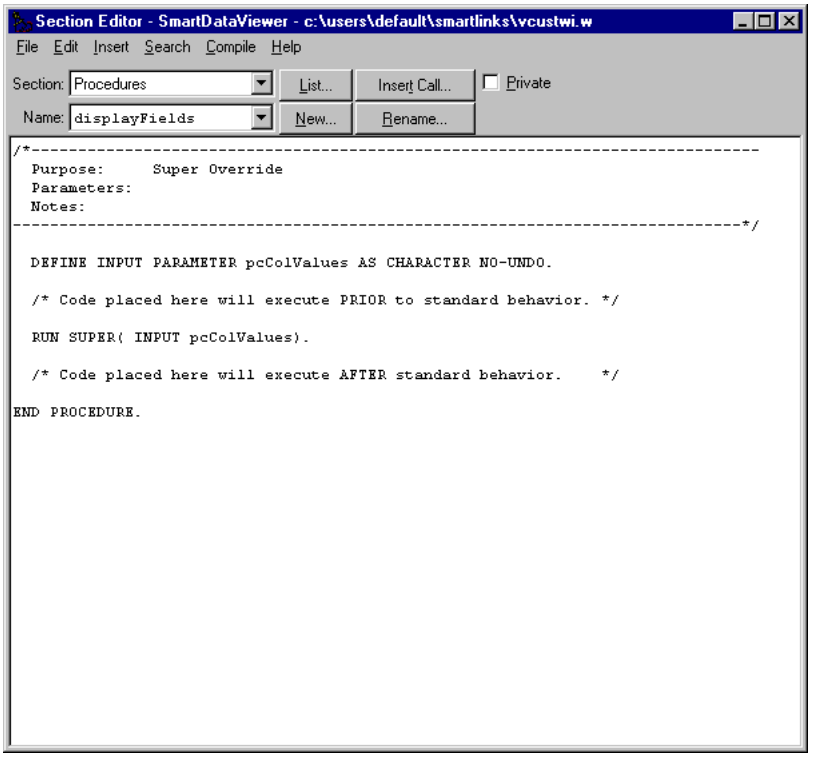
5 ♦ Change the Section to Procedures.

6 ♦ Click on the New button. The New Procedure dialog box appears.

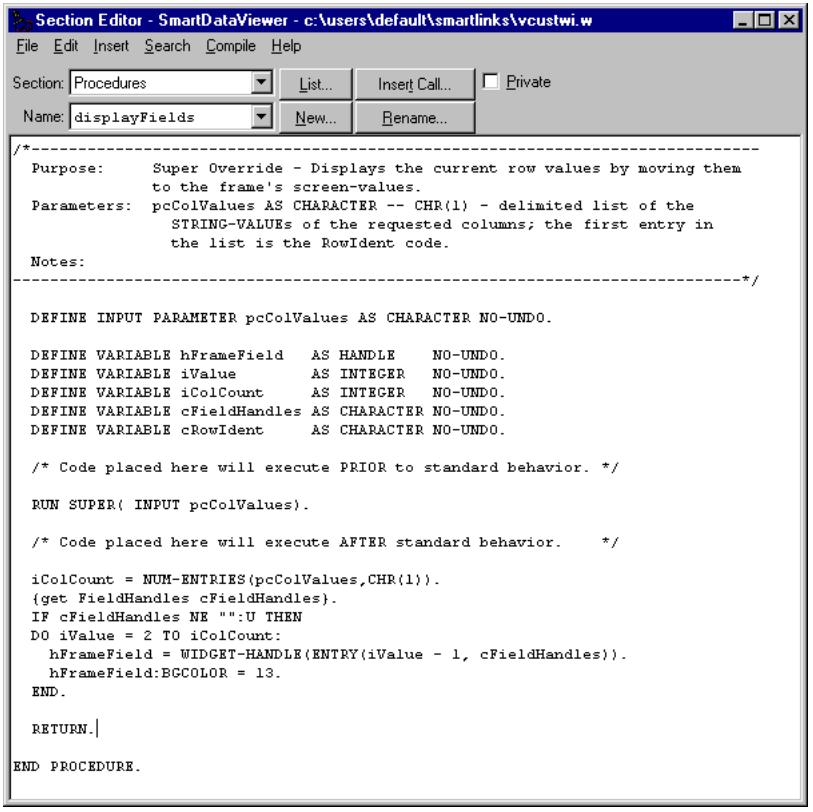
7 ♦ Choose the Override Type radio button. The Name fill-in becomes a combo box:



8 ♦ Choose the displayFields procedure and click on OK. The Section Editor generates a skeleton of the local procedure or function. This contains the necessary parameter definitions and, by default, invokes the standard behavior by executing the RUN SUPER or RUN SUPER ( ) statement:



9 ♦ You can change this code as required for your application. For example, to change the color of the fields in the SmartDataViewer, change the code as shown:



NOTE: This code augments the standard displayFields behavior and affects all instances created from this master.

5.3 ADM Properties

A basic requirement of SmartObjects is that each SmartObject can expose its properties to other objects, either Progress procedures or non-Progress application objects communicating through the Open4GL interface. Within a Progress session, it is not practical to use SHARED variables or buffers to share values between SmartObjects. SmartObjects are run as persistent procedures, which means that they run as peers of one another and have no fixed execution hierarchy. Therefore, the SHARED mechanism does not work well. Also, there is no way to use SHARED values between a client and non-Progress application components.

The ADM supports properties through these mechanisms:

- The ADMProps temp–table for object property definitions and storage
- Property-specific get and set functions
- The setUserProperty and getUserProperty functions for dynamic properties

The first two mechanisms, which establish static properties, share a common syntax and can be used interchangeably. They return property values with the native data type, so their use is recommended when you need properties in custom super procedures that will become part of an object type. Dynamic properties, in contrast, return property values as strings that might need conversion to other data types, so this mechanism is most appropriate for properties that will be used only once in your application. The rest of this chapter describes these mechanisms, as well as a number of related topics.

Note that some special property considerations apply when you are building new SmartObject classes and or extending existing classes. For details, see Chapter 8, “Developing ADM Extensions.”

5.3.1 ADMProps Temp–table and Object Properties

One mechanism that supports getting and setting many SmartObject properties is the *ADMProps temp–table*. An ADMProps temp–table is defined for each object; it defines all of the standard object properties for that object type.

Each SmartObject super procedure uses a Progress include file that defines its own set of properties, and each SmartObject type that uses that super procedure also includes the same list. For example, the super procedure `smart.p` defines functions and procedures that all SmartObjects use and is at the top of the hierarchy of super procedures. This procedure includes `smrtprop.i`, which defines the basic properties that apply to all SmartObjects. It defines a preprocessor constant for each basic property and also puts a FIELD definition for that property in the ADMProps temp–table. In addition, all SmartObjects use `smart.p` as a super procedure and include the supporting include file `smart.i`. The `smart.i` include file also includes `smrtprop.i`, as well as adding `smart.p` as a super procedure.

The smrtprop.i file defines these properties:

smrtprop.i *(1 of 2)*

```
.
.
.
 /* These preprocessors let the get and set methods know at compile time
    which property values are located in the temp-table and which must
    be accessed through the property functions.
 */
 &GLOB xpObjectVersion
 &GLOB xpObjectType
 &GLOB xpContainerType
 &GLOB xpPropertyDialog
 &GLOB xpQueryObject
 &GLOB xpContainerHandle
 &GLOB xpInstanceProperties
 &GLOB xpSupportedLinks
 &GLOB xpContainerHidden
 &GLOB xpObjectInitialized
 &GLOB xpObjectHidden
 &GLOB xpContainerSource
 &GLOB xpContainerSourceEvents
 &GLOB xpDataSource
 &GLOB xpDataSourceEvents
 &GLOB xpTranslatableProperties
 &GLOB xpObjectPage
 &GLOB xpDBAware
```

smrtprop.i *(2 of 2)*

```
 /* This temp-table defines all the property fields for an object.
    This include file contributes the DEFINE statement header and
    all basic smart object properties. Each other property class include
    file adds its own fields and then the parent object ends the statement.
    Define the fields for smart objects only, not for their super procedures.
 */
 /* Note that ObjectHidden is here because "hidden" is a logical concept. */
&IF "{&ADMSuper}":U = "":U &THEN
  CREATE TEMP-TABLE ghADMProps.
  ghADMProps:UNDO = FALSE.
  ghADMProps:ADD-NEW-FIELD('ObjectVersion':U, 'CHAR':U, 0, ?,
    '{&ADM-VERSION}':U).
  ghADMProps:ADD-NEW-FIELD('ObjectType':U, 'CHAR':U, 0, ?,
    '{&PROCEDURE-TYPE}':U).
  ghADMProps:ADD-NEW-FIELD('ContainerType':U, 'CHAR':U, 0, ?,
    '{&ADM-CONTAINER}':U).
  ghADMProps:ADD-NEW-FIELD('PropertyDialog':U, 'CHAR':U, 0, ?,
    '{&ADM-PROPERTY-DLG}':U).
  ghADMProps:ADD-NEW-FIELD('QueryObject':U, 'LOGICAL':U, 0, ?, no).
  ghADMProps:ADD-NEW-FIELD('ContainerHandle':U, 'HANDLE':U).
  ghADMProps:ADD-NEW-FIELD('InstanceProperties':U, 'CHAR':U, 0, ?,
    '{&xcInstanceProperties}':U ).
  /* NOTE: Any need to support &User-Supported-Links??*/
  ghADMProps:ADD-NEW-FIELD('ContainerHidden':U, 'LOGICAL':U, 0, ?, yes).
  ghADMProps:ADD-NEW-FIELD('ObjectInitialized':U, 'LOGICAL':U, 0, ?, no).
  ghADMProps:ADD-NEW-FIELD('ObjectHidden':U, 'LOGICAL':U, 0, ?, yes).
  ghADMProps:ADD-NEW-FIELD('UIBMode':U, 'CHAR':U, 0, ?, '':U).
  ghADMProps:ADD-NEW-FIELD('ContainerSource':U, 'HANDLE':U).
  ghADMProps:ADD-NEW-FIELD('ContainerSourceEvents':U, 'CHAR':U, 0, ?,

'initializeObject,hideObject,viewObject,destroyObject,enableObject,confirmE
xit':U).
  ghADMProps:ADD-NEW-FIELD('DataSource':U, 'HANDLE':U).
  ghADMProps:ADD-NEW-FIELD('DataSourceEvents':U, 'CHAR':U, 0, ?,
    'dataAvailable,queryPosition,deleteComplete,fetchDataSet':U).
  ghADMProps:ADD-NEW-FIELD('TranslatableProperties':U, 'CHAR':U, 0, ?,
    '{&xcTranslatableProperties}':U).
  ghADMProps:ADD-NEW-FIELD('ObjectPage':U, 'INT':U, 0, ?, 0).
  ghADMProps:ADD-NEW-FIELD('DBAware':U, 'LOGICAL':U, 0, ?,
  &IF DEFINED (DB-AWARE) NE 0 &THEN
    {&DB-AWARE}).
  &ELSE
    no).
  &ENDIF
&ENDIF.
.
.
.
```

If a preprocessor has a name of the form xp*propname*, you can access the associated property value directly from its property temp–table FIELD. The {get} and {set} pseudo-syntax uses this mechanism to optimize references to properties, primarily in super procedures. If it is necessary for either get or set to invoke the corresponding property function (because of some other action it performs), then the preprocessor constant is not defined for that property and references always go through the get and set functions. For more information on the {get} and {set} pseudo-syntax, see the "{get} and {set} Pseudo-syntax for Object Properties" section.

Now consider a SmartObject that is defined as a subclass of `smart.p`. For example, a SmartDataObject adds `smart.p` as its first super procedure, and then adds `query.p` and `data.p` as the super procedures that define behavior specific to SmartDataObjects. The `data.p` procedure includes the property include file `dataprop.i`, which appends more basic values to the list already started by `smrtprop.i` and continued by `qryprop.i`. Each property include file adds FIELD definitions to the ADMProps temp–table definition.

The dataprop.i file defines these additional basic properties:

dataprop.i *(1 of 2)*

```
.
.
.
 /* Preprocessor definitions which tell at compile time which
    properties can be retrieved directly from the property temp-table. */
 &GLOB xpEnabledTables
 &GLOB xpAutoCommit
 &GLOB xpDataHandle
 &GLOB xpCurrentRowid
 &GLOB xpAppService
 &GLOB xpASUsePrompt
 &GLOB xpASInfo
 &GLOB xpASHandle
 &GLOB xpASDivision
 &GLOB xpUpdateSource
 &GLOB xpCommitSource
 &GLOB xpCommitSourceEvents
 &GLOB xpCommitTarget
 &GLOB xpCommitTargetEvents
 &GLOB xpDataModified
 &GLOB xpRowsToBatch
 &GLOB xpCheckCurrentChanged

{src/adm2/qryprop.i}
```

dataprop.i *(2 of 2)*

```
&IF "{&ADMSuper}":U = "":U &THEN
  ghADMProps:ADD-NEW-FIELD('RowObject':U, 'HANDLE':U, 0, ?, ?).
  ghADMProps:ADD-NEW-FIELD('RowObjUpd':U, 'HANDLE':U, 0, ?, ?).
  ghADMProps:ADD-NEW-FIELD('FirstRowNum':U, 'INT':U, 0, ?, ?).
  ghADMProps:ADD-NEW-FIELD('LastRowNum':U, 'INT':U, 0, ?, ?).
  ghADMProps:ADD-NEW-FIELD('EnabledTables':U, 'CHAR':U, 0, ?, '':U).
  ghADMProps:ADD-NEW-FIELD('AutoCommit':U, 'LOGICAL':U, 0, ?, yes).
  ghADMProps:ADD-NEW-FIELD('DataHandle':U, 'HANDLE':U).
  ghADMProps:ADD-NEW-FIELD('CurrentRowid':U, 'ROWID':U).
  ghADMProps:ADD-NEW-FIELD('AppService':U, 'CHAR':U, 0, ?, '':U).
  ghADMProps:ADD-NEW-FIELD('ASUsePrompt':U, 'LOGICAL':U, 0, ?, ?).
  ghADMProps:ADD-NEW-FIELD('ASInfo':U, 'CHAR':U, 0, ?, '':U).
  ghADMProps:ADD-NEW-FIELD('ASHandle':U, 'HANDLE':U).
  ghADMProps:ADD-NEW-FIELD('ASDivision':U, 'CHAR':U, 0, ?, '':U).
  ghADMProps:ADD-NEW-FIELD('UpdateSource':U, 'HANDLE':U).
  ghADMProps:ADD-NEW-FIELD('CommitSource':U, 'HANDLE':U).
  ghADMProps:ADD-NEW-FIELD('CommitSourceEvents':U, 'CHAR':U, 0, ?,
    'commitTransaction,undoTransaction':U).
  ghADMProps:ADD-NEW-FIELD('CommitTarget':U, 'CHAR':U, 0, ?, '':U).
  ghADMProps:ADD-NEW-FIELD('CommitTargetEvents':U, 'CHAR':U, 0, ?,
'rowObjectState':U).
  ghADMProps:ADD-NEW-FIELD('DataModified':U, 'LOGICAL':U, 0, ?, no).
 ghADMProps:ADD-NEW-FIELD('RowsToBatch':U, 'INT':U, 0, ?, 200).  /* Rows per
AppServer xfer */
  ghADMProps:ADD-NEW-FIELD('CheckCurrentChanged':U, 'LOGICAL':U, 0, ?, yes).
  ghADMProps:ADD-NEW-FIELD('NextBatchRow':U, 'CHAR':U, 0, ?, ?).   /* Next
row to return in a batch */
  ghADMProps:ADD-NEW-FIELD('DataQueryBrowsed':U, 'LOGICAL':U, 0, ?, no).
  ghADMProps:ADD-NEW-FIELD('FirstResultRow':U, 'CHAR':U, 0, ?, ?).
  ghADMProps:ADD-NEW-FIELD('LastResultRow':U, 'CHAR':U, 0, ?, ?).
  ghADMProps:ADD-NEW-FIELD('RebuildOnRepos':U, 'LOGICAL':U, 0, ?, no).
  ghADMProps:ADD-NEW-FIELD('RowObjectState':U, 'CHAR':U, 0, ?,
'NoUpdates':U).
  ghADMProps:ADD-NEW-FIELD('ServerOperatingMode':U, 'CHAR':U, 0, ?, ?).
  ghADMProps:ADD-NEW-FIELD('StatelessSavedProperties':U, 'CHAR':U, 0, ?,

'CheckCurrentChanged,RowObjectState,LastResultRow,FirstResultRow,QueryRowId
ent':U).
  ghADMProps:ADD-NEW-FIELD('DestroyStateless':U, 'LOGICAL':U, 0, ?, no).
  ghADMProps:ADD-NEW-FIELD('DisconnectAppServer':U, 'LOGICAL':U, 0, ?, no).
&ENDIF
.
.
.
```

As this example shows, each SmartObject type appends more basic properties to the end of the existing list. The process of appending basic properties to the existing list can be nested to any number of levels of object definition. In this case, both the `data.p` super procedure for SmartDataObjects, and individual SmartObjects themselves, include `dataprop.i`. The `dataprop.i` include file in turn includes `qryprop.i`, which includes `smrtprop.i`. Basic properties are then initialized in each corresponding object include file (such as `smart.i` for all SmartObjects and `data.i` for SmartDataObjects). This initialization both allocates FIELDs for each basic property and, where appropriate, assigns specific initial values. Because these preprocessor values are included in both the super procedures and in master objects of the type, both have access to them. This allows a super procedure to retrieve a property value directly from the ADMProps temp–table of its TARGET–PROCEDURE, which is extremely fast, instead of using function calls.

5.3.2 Get and Set Functions for Object Properties

A second mechanism that supports retrieving and setting property values is a naming convention that defines two groups of Progress functions called *get and set functions*. These functions are available for all properties that can be read or written by other objects:

- The get functions, which have the format get*propname*, retrieve the values of properties. They take no input parameters and each returns the associated property value with the native data type. If a property is write only, no get function is available.

- The set functions, which have the format set*propname*, set property values. They take as their only INPUT parameter the value of the associated property (which can be of any Progress data type) and each returns the type LOGICAL: TRUE or FALSE depending on whether the set operation was successful. If a property is read only, no set function is available.

If no special processing is needed to get or set a property, the get and set functions simply use the special include file syntax defined in the "ADMProps Temp–table and Object Properties" section to access the appropriate field in the properties temp–table record for the SmartObject. For example:

```
FUNCTION getMyProp RETURNS CHARACTER:
  DEF VAR cProp AS CHAR.
  {get MyProp cProp}.
  RETURN cProp.
END.

FUNCTION setMyProp RETURNS LOGICAL (pcMyValue AS CHARACTER):
  {set MyProp pcMyValue}.
  RETURN TRUE.
END.
```

Note that the get and set functions are not restricted to such simple operations; they can perform whatever actions you need to in order to set and get values, such as verifying the validity of values. For example, you could use the following pair of functions to get and set the value of the BackGround Color property (BGColor) of the default Progress Frame in an object such as a SmartDataViewer:

```
FUNCTION getBGColor RETURNS INTEGER:
  RETURN {&FRAME-NAME}:BGCOLOR.
END.

FUNCTION setBGColor RETURNS LOGICAL (piBGC AS INTEGER):
  IF piBGC <= SomeMaxBGColorValue THEN DO:
   {&FRAME-NAME}:BGCOLOR = piBGC.
    RETURN TRUE.
  END.
  ELSE RETURN FALSE.
END.
```

5.3.3 {get} and {set} Pseudo-syntax for Object Properties

Progress supplies a {get} and {set} pseudo-syntax in the ADM that can be used to access property values. It is implemented using Progress include files named `get` and `set`, located in the `gui` and `tty` directories. This pseudo-syntax makes accessing property values as simple as possible, and provides transparency to whether a property can be retrieved or set directly, or must be accessed through its get and set functions. (The normal .i extension has been removed in order to make these references look as much like standard syntax as possible.)

Get Include File Logic

The get include files use the following logic:

```
{get propname target-variable [ object-handle ] }.
```

The get syntax first checks to see whether the preprocessor xp*propname* exists. If it does, the get syntax returns the value in the TARGET–PROCEDURE's ADMProps temp–table into *target-variable*. If the optional *object-handle* is specified, the get syntax searches that procedure's ADMProps temp–table instead of the TARGET–PROCEDURE.

If there is no xp*propname* preprocessor constant, the function get*propname* is executed in the TARGET–PROCEDURE (or in the *object-handle*, if specified).

This syntax is appropriate as an optimization for super procedures. In your application code, you should invoke the real functions.

Set Include File Logic

The set include files operate similarly, as follows:

```
{set propname value [ object-handle ] }.
```

If xp*propname* is defined, that entry in the TARGET–PROCEDURE's or the *object-handle*'s ADMProps temp–table is set to *value*. If xp*propname* is not defined, the function set*propname* is executed and passed the *value* (in its native data type) as an input parameter. The function returns TRUE or FALSE depending on whether the operation was successful.

The following example illustrates interpreting the {get} logic:

```
{get DataColumns cColumns}.
```

How this translates depends on whether DataColumns has an xp preprocessor defined for it. If it does, the statement translates into the actual 4GL code:

```
ASSIGN ghProp = WIDGET-HANDLE(ENTRY(1, TARGET-PROCEDURE:ADM-DATA, CHR(1)))
     ghProp = ghProp:BUFFER-FIELD('DataColumns')
      cColumns = ghProp:BUFFER-VALUE.
```

This retrieves the handle of the ADMProps temp–table buffer for the TARGET–PROCEDURE (stored in the procedure's ADM–DATA attribute) and then retrieves the field value using the dynamic BUFFER–FIELD attribute.

If the preprocessor is not defined for DataColumns, the statement translates to the following:

```
cColumns = dynamic-function("getDataColumns":U IN TARGET-PROCEDURE).
```

The variable ghProp is defined in `smart.i` for use by these include files. The buffer handle of the ADMProps property temp–table record is stored in the ADM–DATA procedure property of each SmartObject, so it can be located by these include files. These include files resolve during compilation to a single executable Progress statement, making them extremely fast.

Using the Get and Set Include Files in Other Progress Code

You can use the `get` and `set` include files from any Progress code. When you use them either from a SmartObject of a given type or one of its super procedures, the syntax locates and uses the basic properties in the ADMProps property temp–table. If you use the syntax in other Progress application code (for example, in an object of a different type that does not share that property), it will not have a value for the preprocessor index and so will always use the get and set property functions.

Note that the `get` and `set` include files are not actual 4GL syntax and represent a fairly small optimization, so you should restrict their use to super procedures and use the standard get and set function invocations in other Progress application code. Further, any non-Progress code that uses the Open 4GL interfaces will be able to access the property only by invoking the appropriate get or set functions directly. For this reason, you should always define get*propname* and set*propname* functions for each basic property that is intended to be read and written from outside the object's class. These property functions can simply access the ADMProps value directly.

Special Properties

In some cases, it is desirable to store a property value in the ADMProps temp–table to allow direct access to it from its super procedure and elsewhere, but also to have an action of some type take place when the value is set. For example, the QueryPosition property holds information about the cursor position of a query (FirstRecord, LastRecord, and so forth). Whenever its value is set, a message must be also PUBLISHed so that other objects can react. In cases of this type, you should not define an xp*propertyname* preprocessor constant, so that the get and set functions that have the additional behavior will run instead of getting and setting the value directly in the ADMProps temp–table.

5.3.4 Instance Properties

Each object type has certain properties that are appropriate to set as part of the object's initialization and that can be assigned values when SmartWindows and other containers using that object are being assembled. For example, the properties HideOnInit, DisableOnInit, and ObjectLayout can be set for any visual object to indicate whether this particular instance of the object should be hidden when it is first realized or disabled when it is first realized, or which of multiple visual layout names should be used for the object. These properties are referred to as Instance Properties. These can be differentiated from properties such as ObjectInitialized, ObjectHidden, QueryPosition, and many others that are set during the course of application execution but have no meaningful initial value that would specialize how that object is used in a particular case.

For each object include file, there is defined a list of instance properties using the xcInstanceProperties preprocessor value. These properties can be passed down to subclasses of a class. For example, all visual objects (including SmartDataViewers, SmartPanels, etc.) have the three Instance Properties defined in `visual.i`, and can append more to that list.

These properties are supported by Instance Property Dialog procedures for each object type. Any class can define an Instance Property Dialog procedure by defining the preprocessor ADM–PROPERTY–DIALOG to be the name of the procedure file that contains the Instance Property dialog box. This initializes the PropertyDialog property at object startup time. When the object is dropped into a container at application assembly time, selecting the Instance Properties choice from the object's pop-up menu runs this Dialog Box procedure and sets these property values in that instance of the object. The values are also specified in AppBuilder-generated code in adm–create–objects, in calls to the constructObject procedure.

5.3.5 Translatable Properties

In the ADM, Progress maintains a list of properties that are translatable; that is, those properties whose literal values should not be tagged with ":U" when specified in adm–create–objects code generated by the AppBuilder. Most properties are not translatable, but a few should be; for example, the FolderLabels property for a Folder. The list of these properties is stored in the TranslatableProperties property.

5.3.6 Functions for Accessing Properties

The following property functions are useful for accessing SmartObject properties from application code:

- The assignLinkProperty function sets a property value in one or more objects at the other end of the specified link. It is defined as follows:

```
assignLinkProperty RETURNS LOGICAL
  (pcLink AS CHARACTER, pcPropName AS CHARACTER,
   pcPropValue AS CHARACTER):
```

  For example, the following code in a SmartDataObject uses assignLinkProperty to set the DataModified property to yes in all of its Data Targets:

```
DYNAMIC-FUNCTION('assignLinkProperty':U,
  INPUT "DATA-TARGET":U,
  INPUT "DataModified":U,
  INPUT "yes":U).
```

- The linkProperty function returns the value of the specified property in the single object at the other end of the specified link. It is defined as follows:

```
linkProperty RETURNS CHARACTER
  (pcLink AS CHARACTER, pcPropName AS CHARACTER):
```

  For example, the following code in a visual object (a SmartDataViewer or a SmartDataBrowser) uses linkProperty to get the current page of the object's container:

```
iCurrentPage = DYNAMIC-FUNCTION('linkProperty':U,
  INPUT "CONTAINER-SOURCE":U,
  INPUT "CurrentPage":U).
```

- The propertyType function returns the data type of the specified property. It is defined as follows:

```
propertyType RETURNS CHARACTER
  (pcPropName AS CHARACTER):
```

For example, the following code in a SmartDataObject gets the data type of its DataQueryBrowsed property:

```
cDataType = DYNAMIC-FUNCTION('propertyType':U IN h_dcustomer,
  INPUT "DataQueryBrowsed":U).
```

Note that this function returns data types only for properties for which a set*propname* function is defined.

5.3.7 Dynamic Properties

Dynamic properties are object properties that are defined on an as-needed basis. Two functions, setUserProperty and getUserProperty, support dynamic properties in SmartObjects. They allow you to define dynamic properties without using either the set and get functions or a temp–table FIELD.

The setUserProperty function sets a named property. It is defined in an application as follows:

```
setUserProperty RETURNS LOGICAL
  ( pc<i>PropName</i> AS CHARACTER, pc<i>PropValue</i> AS CHARACTER ) :
```

The getUserProperty function returns the value of a specified property that was previously set using the setUserProperty function. The getUserProperty function is defined as follows:

```
getUserProperty RETURNS CHARACTER
  ( pcPropName AS CHARACTER ) :
```

Note that because the property values managed by getUserProperty and setUserProperty are stored as part of the ADM–DATA procedure attribute for the SmartObject, they are always stored and returned as CHARACTER strings.

This example illustrates how to set up a dynamic property called NewLimit. It assumes that you have a SmartDataViewer, and a SmartWindow that contains a button that sets a NewLimit attribute in the SmartDataViewer. To set up the NewLimit dynamic property, follow these steps:

1 ♦ Add the following to the SmartWindow button trigger code, to set the property:

```
DYNAMIC-FUNCTION('setUserProperty':U IN h_v-customer,
  INPUT "NewLimit",
  INPUT dNewLimit:SCREEN-VALUE).
```

2 ♦ Add the following code to the SmartDataViewer, to get the property:

```
DECIMAL(DYNAMIC-FUNCTION('getUserProperty':U,
  INPUT "NewLimit")).
```

6

Advanced ADM Topics

This chapter discusses several advanced ADM topics:

- Parameterizing SmartObject instances as variables
- Writing local event procedures and functions
- Monitoring SmartObjects applications
- AppBuilder requirements for SmartObjects
- Using GroupAssign SmartLinks

6.1 Parameterizing SmartObject Instances as Variables

When you insert a SmartObject instance into a SmartContainer, you can specify a variable name for it by accessing its property sheet and activating the Parameterize As Variable toggle box. When you do this, you are prompted for a variable name to associate with the SmartObject. You can supply either a local CHARACTER variable or parameter that you define in the SmartContainer that you are building; this variable or parameter must be assigned the filename of the SmartObject procedure file to be run in place of the SmartObject. The SmartContainer uses the specified variable name at run time to get the name of the master procedure file. The SmartContainer uses this filename to instantiate the SmartObject instance; by programmatically changing the value of the variable, you can have it specify different SmartObject master filenames. When the SmartContainer instantiates the SmartObject, it uses the setting of the variable to choose a particular master procedure file.

With this technique, you can use the same SmartContainer to create many different application screens. Keep in mind that inside the SmartContainer you must define the variable and set it appropriately.

The following examples illustrate how to use Parameterize As Variable. Each example uses *placeholder* SmartObjects: SmartObjects that you place in a SmartWindow to allow linking them at design time in the AppBuilder. Specifically, each example uses a placeholder SmartDataObject and SmartDataViewer for the customer table, which you can replace at run time with any SmartDataObject and SmartDataViewer that can be linked with Data and Update SmartLinks. To do this, you set the variables to the object names for the replacement SmartDataObject and SmartDataViewer.

Using Parameterize As Variable with a Variable. To use Parameterize As Variable with a variable defined in a SmartContainer, follow these steps:

1 ♦ Create a SmartWindow.

2 ♦ Drop a placeholder SmartDataObject and a placeholder SmartDataViewer into the SmartWindow and link them with Data and Update SmartLinks.

3 ♦ Select the SmartDataObject and open its property sheet (Tool→ Property Sheet), then check the Parameterize As Variable option and enter cSDOName in the Variable fill-in field that appears.

4 ♦ Select the SmartDataViewer and open its property sheet (Tool→ Property Sheet), then check the Parameterize As Variable option and enter cSDVName in the Variable fill-in field that appears.

5 ♦ Save the SmartWindow to a filename of your choice.

6 ♦ In the Definitions section of the saved SmartWindow file, define variables for the SmartDataObject and SmartDataViewer that the SmartWindow will contain:

```
DEFINE VARIABLE cSDOName AS CHARACTER NO-UNDO.
DEFINE VARIABLE cSDVName AS CHARACTER NO-UNDO.
```

7 ♦ In the SmartWindow's main block, assign to these variables values that specify which SmartDataObject and SmartDataViewer are displayed in this SmartWindow at run time:

```
ASSIGN cSDOName = "dorder.w"
       cSDVName = "vorder.w".
```

You must assign values to these variables in the main block so that they are set before the AppBuilder runs adm–create–objects to construct the SmartObjects that they specify.

Using Parameterize As Variable with Input Parameters. To use Parameterize As Variable with input parameters defined in a SmartContainer, follow these steps:

1 ♦ Create a SmartWindow.

2 ♦ Drop a placeholder SmartDataObject and a placeholder SmartDataViewer into the SmartWindow and link them with Data and Update SmartLinks.

3 ♦ Select the SmartDataObject and open its property sheet (Tool→ Property Sheet), then check the Parameterize As Variable option and enter pcSDOName in the Variable fill-in field that appears.

4 ♦ Select the SmartDataViewer and open its property sheet (Tool→ Property Sheet), then check the Parameterize As Variable option and enter pcSDVName in the Variable fill-in field that appears.

5 ♦ Save the SmartWindow to a filename of your choice.

6 ♦ In the Definitions section of the saved SmartWindow file, define variables for the SmartDataObject and SmartDataViewer that the SmartWindow will contain:

```
DEFINE INPUT PARAMETER pcSDOName AS CHARACTER.
DEFINE INPUT PARAMETER pcSDVName AS CHARACTER.
```

7 ♦ When the SmartWindow is run, pass the SmartDataObject and SmartDataViewer names to the SmartWindow as parameters:

```
RUN wparamasvar.w (INPUT "dorder.w", INPUT "vorder.w").
```

6.2 Writing Local Event Procedures and Functions

An event procedure is a procedure that executes when a particular event occurs. This is sometimes accomplished through the PUBLISH/SUBSCRIBE functionality, as follows:

1. SmartObjects that need to know about an event SUBSCRIBE to the event. (The addLink procedure does this at startup.)
2. When an event occurs, a SmartObject PUBLISHes the event.
3. This action notifies all subscribing SmartObjects that the event occurred.

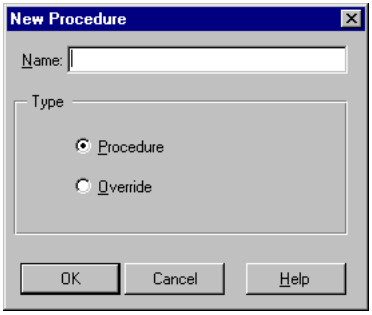
Sometimes, however, this happens simply when a SmartObject RUNs an internal procedure or invokes a user-defined function. In either case, the procedure or function being executed is normally implemented in a separate super procedure. (See the "Super Procedures" section in Chapter 5, "SmartObject Interactions.")

The super procedure functionality allows you to write a local version of an ADM internal procedure or function in a SmartObject master procedure file that augments or overrides default ADM events. When the ADM runs an internal procedure or function, Progress 4GL looks at the SmartObject and its super procedures, starting with a local version if there is one, and runs the first one it finds. If this super procedure performs a RUN SUPER or SUPER( ), the 4GL looks further up the super procedure chain to find the next version to run. A local version of an ADM procedure can execute code before, after, or instead of the more standard behavior of the internal procedures and functions in ADM super procedures.

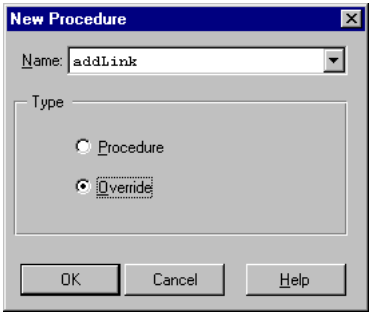
6.2.1 Writing a Local Event Procedure

Follow these steps in the AppBuilder to write a local event procedure:

1 ♦ Invoke the Code Section Editor, go to the Procedures code section, and choose the New button. The New Procedure dialog box appears:



2 ♦ Activate the Override radio button. The AppBuilder populates the Name combo box list with the ADM event procedures available in the super procedures for the SmartObjects:



3 ♦ Select the ADM event procedure for which you want to write a local version, then choose OK. The AppBuilder returns you to the Code Section Editor and creates a procedure with the same name. If this procedure already exists, the AppBuilder displays the existing code section.

The default code for a local event procedure always executes the standard version of the procedure, located in one of the SmartObject's super procedures. For example, for addLink, the following line appears in the local version:

```
RUN SUPER ( INPUT phSource, INPUT pcLink, INPUT phTarget).
```

This allows you to put code before or after the standard event procedure call or not run the code at all (by commenting it out).

NOTE: Do not suppress the standard event procedure by removing the RUN SUPER statement unless you are sure that you understand what it does and that you replace it correctly.

6.2.2 Writing a Local Event Function

With one exception, you write a local event function in the same way that you write a local event procedure, as described in the "Writing a Local Event Procedure" section. The exception is that in Step 1, you go to the list of functions in the Section editor instead of the Procedures code section.

6.3 Monitoring SmartObject Applications

ADM provides several Progress PRO*Tools for monitoring SmartObject applications: the Procedure Object Viewer, the Progress Debugger, and PRO*Spy for Version 9.

6.3.1 Procedure Object Viewer

The Procedure Object Viewer keeps track of all procedures that you run in your Progress session and displays information about procedure objects. You can use the information and options that this tool provides to manage procedures when you work with SmartObject applications. You can also make use of its information when you are using the Progress Debugger.

Starting the Procedure Object Viewer

The Procedure Object Viewer is accessible from the AppBuilder's PRO*Tools palette. To open the PRO*Tools palette, choose Tools→ PRO*Tools from the AppBuilder main window. Figure 6–1 shows the PRO*Tools palette and identifies the Procedures Object Viewer icon.



Figure 6–1: Procedure Object Viewer Icon on PRO*Tools Palette

Clicking this icon opens the Procedure Object Viewer, shown in Figure 6–2.

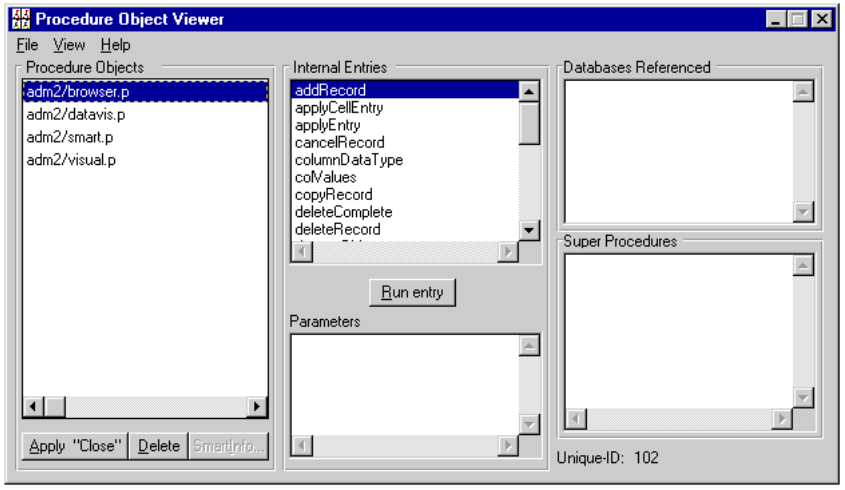


Figure 6–2: Procedure Object Viewer

Viewing Procedure Objects

The Procedure Object Viewer lets you see immediately what internal procedures are available for a SmartObject and what their parameters are. As shown in Figure 6–3, its Procedure Objects selection list displays a list of all of the procedures that you run in your Progress session. When you select a procedure from this selection list, the Internal Entries selection list displays all of the internal procedures available in the external procedure. Similarly, when you select an entry from the Internal Entries selection list, the Parameters selection list displays a list of the entry's parameters.

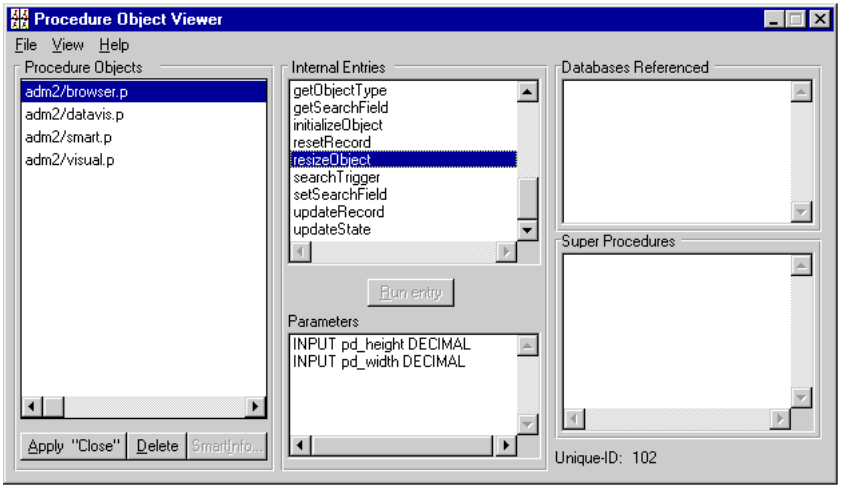


Figure 6–3: Selecting Procedure Objects and Internal Entries

The Procedure Object Viewer application does not merely display information. It also lets you do the following:

- Run an internal procedure inside of a procedure object to see its effect, provided that the procedure does not take parameters
- Look at a SmartObject's SmartInfo dialog box and view the SmartObject's properties

By default, the Procedure Object Viewer views all procedures running persistently in a Progress session except for those used by the Progress tools and those SmartObjects that are in design mode. If you want to see SmartObjects that are in design mode, choose View→ Hide UIB–Mode Objects.

6.3.2 The Progress Debugger

The Progress Debugger enables you to move automatically from object to super procedure, and from event publisher to subscriber. You can use this tool to follow the flow of control among the persistent procedures that make up an application.

Here is an effective way to begin a debugging session for a SmartObject application:

1 ♦ Choose a starting point for a debugging session by picking the event procedure where you want to start tracking the program flow. You can find this procedure in the Procedure Object Viewer.

2 ♦ Create a local version of that event procedure or function in the SmartObject where you want to begin tracing behavior.

3 ♦ In that procedure or function, insert the following statements before the RUN SUPER statement:

```
DEBUGGER:INITIATE( ).

DEBUGGER:SET-BREAK( ).
```

4 ♦ Save this object and run the SmartWindow that contains it. The Debugger starts up the first time that procedure or function executes.

5 ♦ When the Debugger starts up, use the STEP command, which causes the Debugger to step into the super procedure version of that same procedure. This effectively puts a breakpoint at the start of an internal procedure or function in a super procedure without the necessity of editing the super procedure itself.

Alternatively, if you run your Progress session with the -debugalert startup option, you can simply code a message statement in Step 3, instead of explicitly invoking the Debugger; for example:

```
MESSAGE "proc-name".
```

Then, when you run your application and the message alert box appears, press the HELP button to see a stack trace of the Progress 4GL code and determine where you are in the application. If you now press the Debug button on the stack trace window and the OK button on the original message alert box, Progress invokes the Debugger to allow you to move through the application from that point. (If you do not want to enter the Debugger, do not press the Debug button.)

Debugger Tips

Here are some useful notes for using the Debugger:

- When the Debugger is at a RUN SUPER statement, a STEP command steps into the code in the next super procedure up the chain.
- When the Debugger is at a PUBLISH statement, a STEP command steps into the event procedure in the first subscriber for that event. Continuing to STEP or NEXT through the code walks through all subscribers to that event.
- To display what procedure is executing, use the THIS–PROCEDURE:FILE–NAME expression.
- To display the name of the SmartObject on whose behalf a super procedure routine is executing, use the TARGET–PROCEDURE:FILE–NAME expression.
- To display the name of the calling procedure, use the SOURCE–PROCEDURE:FILE–NAME expression.
- To ensure that the Debugger has access to all procedures you want to walk through, be sure to add the `%DLC/src` directory to the PROPATH after the `gui` directory.

6.3.3 PRO*Spy for Version 9

PRO*Spy for Version 9 is a Progress PRO*Tool whose primary function is to serve as a training and debugging aid for use when developing SmartObject applications. Specifically, this tool logs execution flow information for the application and provides it to the developer. This section provides a brief overview of PRO*Spy for Version 9. For complete details on its use, see the online help.

PRO*Spy for Version 9 is accessible from the AppBuilder's PRO*Tools palette. To open the PRO*Tools palette, choose Tools→ PRO*Tools from the AppBuilder main window. Figure 6–4 shows the PRO*Tools palette and identifies the PRO*Spy for Version 9 icon.



Figure 6–4: PRO*Spy for Version 9 Icon on PRO*Tools Palette

Clicking this icon opens the PRO*Spy for Version 9 window, shown in Figure 6–5.

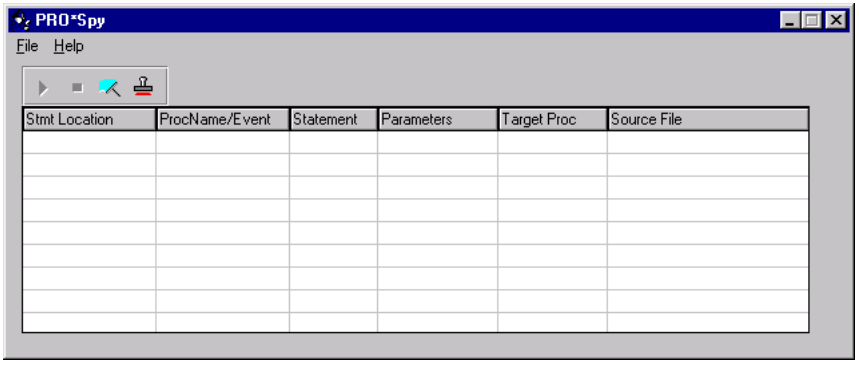


Figure 6–5: PRO*Spy for Version 9 Window

This window contains a menubar, a toolbar, and the PRO*Spy Browse. In the menubar, you select a file to run (this is the application that you want to monitor). Using buttons on the toolbar, you turn the logging of execution flow information on and off while running the application.

- When you enable logging, PRO*Spy for Version 9 opens an operating-system file and logs execution flow information about the selected application to that file.
- When you disable logging, PRO*Spy for Version 9 closes the operating-system file, reads and parses its contents, and writes it to the PRO*Spy Browse.

Other buttons on the toolbar allow you to set marks and to clear and save the PRO*Spy Browse. In the menubar for this window, you select a file to run (this is the file that you want to monitor). Using buttons on the toolbar, you turn the logging of application flow information on and off while running the application.

6.4 AppBuilder Requirements for SmartObjects

If you want to design your own SmartObject procedure file, make sure that the `src/adm2/smart.i` class include file is included, directly or indirectly. However, you must be aware of the following points about how the AppBuilder interacts with SmartObject procedure files:

- A master procedure file must be runnable by itself:
  - It must use no shared variables.
  - It must receive no parameters (from other external procedures).
  - It must compile successfully.
- If the procedure file is designed to have instance properties, the AppBuilder must be able to execute the editInstanceProperties event procedure for the procedure file. If the AppBuilder cannot locate this event procedure, then the AppBuilder disables the Instance Properties option on the Instance menu.
- The AppBuilder determines which SmartLinks it will allow for the procedure file by checking the SupportedLinks property (using the getSupportedLinks function). The AppBuilder also checks the SupportedLinks property to see if the procedure file can be a Page–Target. If so, the AppBuilder enables the Pages button on the Procedure Settings dialog box and the Page number area in the status bar on the AppBuilder main window.

  The initial value of the SupportedLinks property is the ADM–SUPPORTED–LINKS preprocessor name, which is usually defined in the object template.
- The procedure file must contain the following ADM event procedures:
  - initializeObject
  - destroyObject

  NOTE: The AppBuilder also dispatches the hideObject and viewObject event procedures, if they are available.

- If the procedure file is for a SmartObject that is meant to be visualized, it must return a value for the getContainerHandle function. If the RETURN value is not the handle of a frame, the AppBuilder does not initialize the SmartObject. Instead, the AppBuilder creates a visualization using the SmartObject icon. For example, the SmartDataObject has no visualization, so the AppBuilder visualizes it using the SmartDataObject icon.

- If the procedure file is for a SmartObject that is designed to be visualized with a frame, the AppBuilder runs the repositionObject and resizeObject procedures, if they are available. These procedures determine whether the visualization is movable and/or resizable, respectively, at application assembly time. Note that in order for the AppBuilder to visualize a procedure file with a frame, it must be able to set the parent of the frame by invoking the setObjectParent function.

6.5 Using GroupAssign SmartLinks

GroupAssign SmartLinks are intended for grouping updates in multiple SmartDataViewers into one transaction. To do this, you link a master SmartDataViewer to the SmartDataObject with an Update SmartLink, then use GroupAssigns to link this SmartDataViewer to the other SmartDataViewers that will be grouped with it. When the updateRecord procedure executes the collectChanges procedure runs for the master SmartDataViewer in order to collect changed field values from all of its GroupAssign–Targets. The collected changes serve as the input to the submitRow procedure in the data source that updates the database.

Figure 6–6 illustrates this process (the arrows indicate SmartLinks).

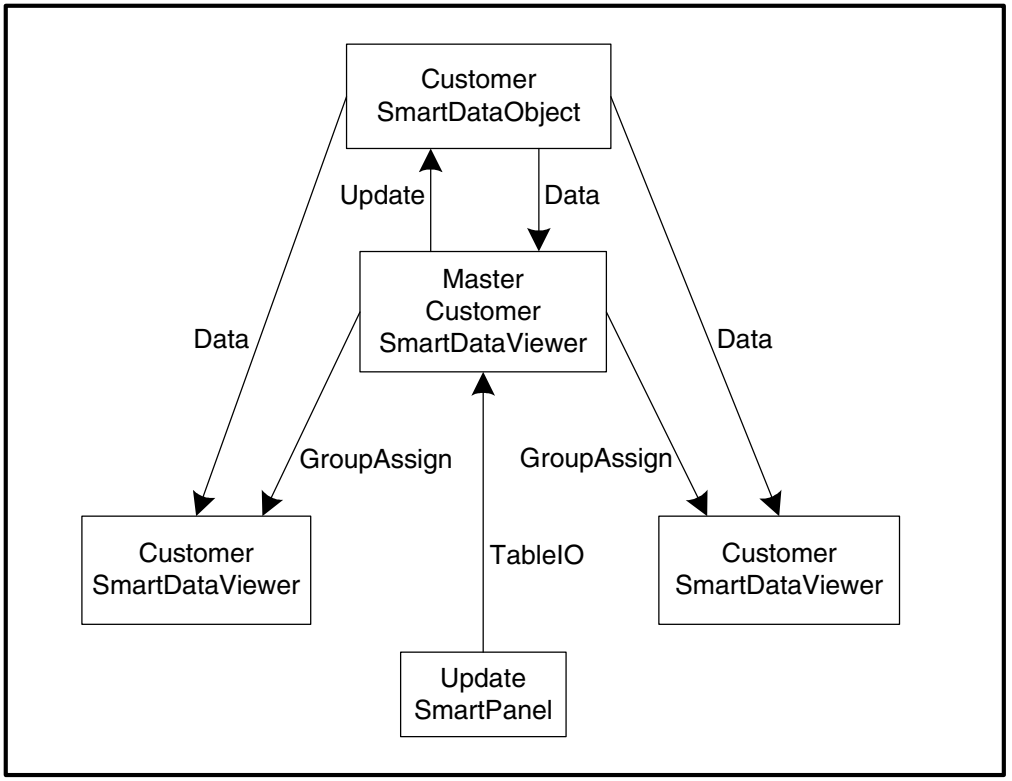


Figure 6–6: Grouping Updates with GroupAssign SmartLinks

Note the SmartLinks in Figure 6–6:

- The Customer SmartDataObject is linked to each Customer SmartDataViewer with a Data SmartLink.
- The master SmartDataViewer is linked to the SmartDataObject with an Update link.
- The master SmartDataViewer is linked to each of the other SmartDataViewers, in a star pattern, with a GroupAssign SmartLink.
- The Update SmartPanel is linked to the master SmartDataViewer with a TableIO SmartLink.

The following example, which uses the Customer table in the Progress sample database, links various SmartDataViewers with GroupAssign SmartLinks so that the application can update a single customer record across multiple SmartDataViewers. Follow these steps:

1 ♦ Create a SmartDataObject for the Customer table.

2 ♦ Create a SmartDataViewer for the Customer table that contains the following fields:

- CustNum
- Name
- Contact
- Phone
- Fax
- EmailAddress

Name this SmartDataViewer `vcustcontact.w`. This is the master SmartDataViewer.

3 ♦ Create a second SmartDataViewer for Customer table that contains the following fields:

- Address
- Address2
- City
- State
- PostalCode
- Country

Name this SmartDataViewer `vcustaddress.w`.

4 ♦ Create a SmartWindow and on it create a SmartFolder with two tabs, labeled Contact and Address.

5 ♦ Drop the SmartDataObject onto the window.

6 ♦ Drop the `vcustcontact.w` SmartDataViewer (the master SmartDataViewer) onto page 1 of the SmartWindow and link it to the SmartDataObject with Data and Update links.

7 ♦ Drop the `vcustaddress.w` SmartDataViewer onto page 2 of the SmartWindow and add SmartLinks as follows:

- A Data link from the SmartDataObject to this SmartDataViewer
- A GroupAssign link from the `vcustcontact.w` (master) SmartDataViewer to this SmartDataViewer.

8 ♦ Drop an Update SmartPanel onto page 0 of the window and link it to the `vcustcontact.w` (master) SmartDataViewer.

When this application is run, it can make updates to a single record through both SmartDataViewers. These updates are saved together, updating the database with all changes to a single customer record in one transaction.

7

Developing Your Application's Business Logic

The AppBuilder supports the development and deployment of applications in heterogeneous environments (single or combined client/server, n-tier, or Web-enabled environments). The business logic for your application determines how you implement it. Developing and deploying a distributed SmartObject application requires a more detailed understanding of how a SmartDataObject operates, which this chapter provides.

This chapter discusses the following topics:

- SmartDataObject features and operating characteristics
- SmartDataObject query and update operations
- ADM event procedures and functions in the SmartDataObject
- SmartDataObjects and SmartLinks
- SmartDataObject validation procedures
- Running SmartDataObjects in a distributed environment
- Managing SmartDataObjects in distributed mode
- Running SmartDataObjects from non-Progress clients
- AppServer-related SmartDataObject properties
- Java applications and SmartDataObjects

7.1 SmartDataObject Features and Operating Characteristics

Progress applications require an object that can manage a database query and the associated data update logic. The SmartDataObject serves this purpose. It is designed to meet several key ADM goals:

- **UI-independence**—SmartObjects that manage the user interface do not manage data and, conversely, SmartDataObjects that manage data do not manage the user interface.
- **Open interface**—SmartDataObjects can function in an Open4GL environment with non-Progress objects and applications.
- **Distributed**—SmartDataObjects can function appropriately and efficiently "close to the UI" or "close to the data"; that is, they can function competently at any location within a distributed application.

The SmartDataObject provides the following features:

- A basic database query definition that can be refined at run time
- Query management logic such as open query, repositions, key finds, and sending rows or batches of rows between client and server
- Formatting and other logic in support of one visualization or many separately defined visualizations
- Validation and other data-checking code and business rules
- Database update logic

Note that you can associate business rules or any other required logic with the SmartDataObject.

The operating characteristics of the SmartDataObject make it suitable for heterogeneous environments:

- The SmartDataObject is the only SmartObject that connects directly to the database.
- The SmartDataObject takes a database query and turns it into a temp–table representation that is used by all other SmartObjects.
- The SmartDataObject can be transparently and efficiently distributed using the AppServer.
- The SmartDataObject handles batching rows, performing updates, and reporting errors.

7.2 SmartDataObject Query and Update Operations

SmartDataViewers and SmartDataBrowsers provide the display and browse capabilities that make the data retrieved by a database query accessible to an application user. However, these SmartObjects never directly access a database. The query and update operations that do access the database are performed, instead, by a SmartDataObject to which the SmartDataViewer or SmartDataBrowser is linked. The SmartDataObject manages query and update operations using two automatically created Progress temp–tables called RowObject and RowObjUpd, which serve as data repositories within the application. Figure 7–1 illustrates data flow among a database, a SmartDataObject and its temp–tables, and a client object of the SmartDataObject, in this case a SmartDataViewer.

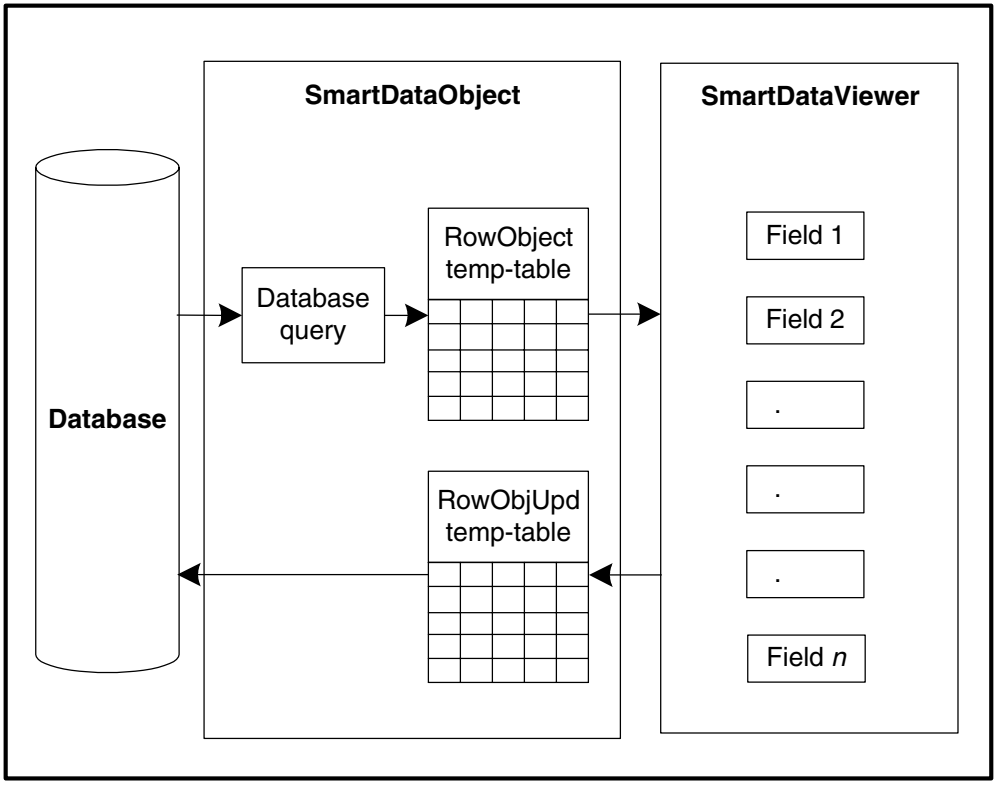


Figure 7–1: The SmartDataObject and Its Temp–tables

The following sections discuss how the SmartDataObject uses the RowObject and RowObjUpd temp–tables in query and update operations. A subsequent section describes some special fields in the RowObject and RowObjUpd temp–tables.

7.2.1 Query Operations and the RowObject Temp–table

The SmartDataObject accesses a database using its own database query. Progress transfers the result set retrieved through the query into the SmartDataObject's RowObject temp–table, which contains the columns defined for the SmartDataObject. The data in the temp–table is the access mechanism for all visualizations or other objects that use the SmartDataObject. Client objects see only the columns in RowObject, receive column values only from RowObject, and return updated values and new rows only to RowObject.

Note that the SmartDataObject uses the RowObject temp–table to manage data in both non-distributed and distributed mode. In distributed mode, the use of this temp–table allows the SmartDataObject to operate in any of these configurations:

- Run in a Progress client session with a direct connection to the database
- Run split between a client object and a server object running on an AppServer
- Run entirely on an AppServer

A SmartDataObject that operates as part of a client-side SmartDataObject application is a Navigation–Target, so it responds to repositioning commands such as fetchNext. It can also be a Data–Source, passing values from its RowObject temp–table to other objects for display and update. In addition, it can be a Data–Target, so that it can receive key field values from other SmartDataObjects and use them in defining its own query.

7.2.2 Update Operations and the RowObjUpd Temp–table

SmartDataObject update operations require an additional Progress temp–table called RowObjUpd. This temp–table, a copy of the RowObject temp–table, is used for handling all types of changes to data rows: updating existing rows, adding rows, and deleting rows:

- When an existing row is updated, Progress creates in RowObjUpd a *before image* of the row; that is, the row with its original row values, as it appeared before the update. When the update is committed, the updated version of the row is also written to the RowObjUpd table. The server-side code uses the before image to verify that the row's data has not been changed by another user since it was read, then uses the new values to make the updates to the database.
- When a row is added and the add is committed, the new row is written to the RowObjUpd table.
- When a row is deleted, the deleted row is removed from the RowObject table and written to the RowObjUpd table to be passed to the server.

The SmartDataObject transfers updated and newly added rows back to the database when it receives a Commit request. Depending on how the SmartDataObject's AutoCommit property is set, the commit can be performed either automatically when an update is received (the default behavior) or when a specific Commit request is received after a set of updates have been made. The default behavior is the typical usage; however, to change to the nondefault behavior, set the SmartDataObject's AutoCommit property to NO. (For details, see the "Commit SmartPanel" section in Chapter 4, "Data Management in the ADM.")

When a change is committed, the RowObjUpd temp–table is passed back to the server (if the SmartDataObject is divided between client and AppServer), and the code in serverCommit reads the table and makes the appropriate changes to the database. (See the field description of RowMod in the "Nondata Fields in the RowObject and RowObjUpd Temp–tables" section for details.)

7.2.3 Nondata Fields in the RowObject and RowObjUpd Temp–tables

A RowObject temp–table contains more than just fields selected from database tables. It also contains the following information:

- A temp–table definition (the first line of the table)
- Field definitions for the temp–table data (corresponds to the database data)
- Field definitions for the temp–table itself
- Index definitions

For example:

```
DEFINE TEMP-TABLE RowObject RCODE-INFORMATION

  FIELD Cust-Num LIKE Customer.Cust-Num VALIDATE ~
  FIELD Name LIKE Customer.Name VALIDATE ~
  FIELD Address LIKE Customer.Address VALIDATE ~
  FIELD City LIKE Customer.City VALIDATE ~
  FIELD State LIKE Customer.State VALIDATE ~
  FIELD Postal-Code LIKE Customer.Postal-Code VALIDATE ~

  FIELD RowNum   AS INTEGER
  FIELD RowIdent AS CHARACTER
  FIELD RowMod   AS CHARACTER

  INDEX RowNum   IS PRIMARY RowNum
  INDEX RowMod   RowMod
  INDEX RowIdent RowIdent.
```

Note that the RowObject temp–table contains three special fields named RowNum, RowIdent, and RowMod. These fields. which are maintained by the SmartDataObject support code, are used to manage queries and updates as follows:

- **RowNum**—An integer value that represents the sequence number of the row within the query's result set. A unique value is assigned to each row as it is added to the table; it is used basically to keep the rows in a consistent sort order. The values begin arbitrarily with 900,000, which generally assures that the values of this field remain positive whether the temp–table is built forward or backward.

- **RowIdent**—A character field that contains a comma-separated list of the ROWIDs of the database records from which the RowObject row is derived. The database ROWIDs are used to re-retrieve the records from the database when performing an update. Note that if the records in the RowObject temp–table result from a join, the ROWIDs in this field are a combination of the ROWIDs for the joined tables.

- **RowMod**—A character field that contains a one-character code that indicates the kind of update operation performed on a row:

  – For a newly added row, RowMod is set to "A" if the row results from an Add operation or "C" if it is results from a Copy operation.

  – For a row that is to be deleted, RowMod is set to "D".

  – An Update operation returns two rows: a copy of the row as it was received, for which RowMod is set to "", and the row with its changes, for which RowMod is set to "U". The copy of the row as received is used to verify that the corresponding database records have not been changed since the user accessed the row, and the row with changes is used to update the database.

The RowObjUpd temp–table contains the same fields as the RowObject temp–table plus the ChangedFields field, which is used only for updates:

- **ChangedFields** (RowObjUpd temp–table only)—A character field that contains a comma-separated list of the names of all SmartDataObject columns in the current row that have been modified. This list is used to ensure that only those fields that have not previously been changed are written back to the database, in order to minimize interference between different users of an application who might be changing different fields in the same record. This field is maintained automatically by the SmartDataObject support code regardless of how each field's value may have been changed.

7.3 ADM Event Procedures and Functions in the SmartDataObject

This section documents the internal procedures and functions of the SmartDataObject. For comprehensive details about these procedures and functions, see the *Progress ADM 2 Reference* and the online help.

The SmartDataObject is supported by two super procedures in addition to `smart.p`: the `query.p` procedure contains all logic relative to managing the database query and the `data.p` procedure (with its include file `data.i`) provides the remaining support.

7.3.1 Opening a Database Query

The openQuery( ) function opens a database query. It is typically called when the SmartObject is initialized, however, you can override this by setting the OpenOnInit property to FALSE. (The default is TRUE.)

7.3.2 Dynamic Query Manipulation

The ADM provides a set of functions that allow you to modify a SmartDataObject's database query dynamically. These functions modify the query's WHERE clause in various ways:

- assignQuerySelection( ) and addQueryWhere( ) append new criteria to existing criteria.
- removeQuerySelection( ) and columnQuerySelection( ) work with field expressions that you add with assignQuerySelection( ).
- setQuerySort( ) changes the sort criteria.
- setQueryWhere( ) sets the WHERE clause criteria.

The manipulated query is stored in a property and the actual QUERY–PREPARE and QUERY–OPEN do not take place until openQuery( ) is called.

Note that you can also write code to obtain the QueryHandle property and perform your own QUERY–PREPARE. If the SmartDataObject is divided between client and AppServer, such code must be executed on the AppServer for the QueryHandle property to be valid.

The remainder of this section provides more detailed information on the ADM query-manipulation functions. For more information about the WHERE, QUERY–PREPARE, and QUERY–OPEN keywords, see the *Progress Language Reference*.

The assignQuerySelection( ) function adds field comparison expressions to the query. It supports the majority of standard database queries. With this function:

- The criteria are added to the existing WHERE clause.
- Fields, values, and operators have separate input parameters.
- Each field expression is distributed to the correct table's WHERE clause.
- A field can be referenced several times, while a field and operator is considered unique. Thus, a field/operator value pair overwrites the value previously added to the WHERE clause with this method.
- An implicit AND is used to add new expressions to existing expressions. (This function does not support OR.)
- An implicit AND is used between field expressions. (This function does not support OR.)

The addQueryWhere( ) function allows you to add more complex criteria to a query. This function:

- Adds criteria to the existing WHERE clause.
- Adds the criteria to ONE of the tables in the queries. (It defaults to the first table reference in the expression.) If you must add criteria to more than one table, simply use the function once for each table.
- Accepts an optional parameter to specify which table.
- Accepts an optional parameter to specify to specify OR.

The removeQuerySelection( ) function works with field expressions that are added with assignQuerySelection. Specifically, it allows you to remove criteria from the WHERE clause. Fields and operators have separate input parameters.

The columnQuerySelection( ) function also works with field expressions that are added with assignQueryselection. Specifically, it allows you to inspect all of the current criteria for a field, and returns all values added for a particular field as a CHR(1)-separated list of operators and values.

The setQuerySort( ) function changes the SORT phrase.

The setQueryWhere( ) function sets the criteria. It can also be used to add one expression to the query. With this function:

- You can pass a complete query prepare string (beginning with the FOR keyword).
- A blank input parameter resets the query to the design expression.
- The criteria is added to ONE of the tables in the queries. (It defaults to the first table reference in the expression.)

  CAUTION: The setQuerySort( ) function wipes out any other dynamically added criteria from the WHERE clause, including ForeignFields.

Data Transfer in Queries

Rows are transferred from a database query to a SmartDataObject temp–table, called RowObject, when the first fetch operation takes place. Additional rows are transferred as needed when either of the following operations is performed:

- A fetchNext operation that moves beyond the end of the list of rows currently in the RowObject table
- A fetchLast operation

The transfer of rows is performed through the sendRows procedure, which has both a client and a server component in order to support transparently a SmartDataObject that is divided between client and AppServer. The number of rows transferred at a time is determined by the RowsToBatch SmartDataObject property. (The initial value is 200.)

By default, the RowObject data set is built up contiguously starting at the beginning, thus the fetchLast operation causes the retrieval of successive batches of rows until it reaches the end of the data set. For a large data set, this can be a very slow process. Progress Software Corporation recommends that for potentially large data sets, you modify this default behavior by changing the Rebuild On Reposition toggle box in the SmartDataObject instance property dialog box to YES. (This sets the Rebuild On Reposition SmartDataObject property.) The data set is now rebuilt whenever the query is repositioned to a row outside of the current client-side data set.

You use the fetchFirst, fetchNext, fetchPrev, and fetchLast procedures to position within the RowObject table. Once you are positioned on a row, you use the colValues( ) function to return a list of formatted values for the current row. (See the Progress ADM 2 Reference or the online help for details on the format of the values returned.) Whenever the cursor position in the RowObject query changes, the dataAvailable event occurs. (Objects such as SmartDataViewers subscribe to this event.) Additional procedures and functions allow many useful operations, including but not limited to the following:

- Repositioning to a particular database ROWID (fetchRowIdent)
- Identifying the database ROWID of a record that satisfies a where–clause expression (rowidWhere)
- Obtaining the latest database values for the current row (refreshRow)

The following example illustrates how to reposition to a particular record in a SmartDataObject's query. In this application, the application user can search a database for a customer name. If the application finds the name, it displays the customer information in the SmartDataViewer.

The SmartWindow in this example contains the following SmartObjects:

- A SmartDataObject for the customer table
- A SmartDataViewer whose data source is the SmartDataObject
- A name-search field and a button to start the search

The application user enters a customer name into the name-search field, then presses the search button. The search button contains the following trigger code:

```
ON CHOOSE OF BtnSearch DO:
  DEFINE VARIABLE cRowIdent AS CHARACTER NO-UNDO.
  DEFINE VARIABLE cSearch   AS CHARACTER NO-UNDO.
  CSearch = "Name BEGINS '" + NameSrch:SCREEN-VALUE + "'".
  CRowIdent = DYNAMIC-FUNCTION('rowidWhere':U IN h_dcustomers, cSearch).
  IF cRowIdent NE ? THEN
  DYNAMIC-FUNCTION('fetchRowIdent':U IN h_dcustomers,
  cRowIdent, '':U).
END.
```

The rowidWhere function in this code returns the ROWID of the first database query row that satisfies the where clause specified in cSearch. The fetchRowIdent function accepts a comma-separated list of database record ROWIDs for a SmartDataObject row that corresponds to the RowObject's RowIdent field. If the row is currently in the SmartDataObject's temp–table, the SmartDataObject repositions to that record, otherwise the database query repositions to that row and rebuilds the temp–table.

After the application repositions the SmartDataObject's query to the specified customer, it refreshes the SmartDataViewer, displaying the customer data in the SmartDataViewer.

Error Handling

Errors that occur during the transfer of data rows between the database and a visualization object can be detected either on the client side or the server side. If they are detected on the client side, error messages can go directly back to the visualization object. However, errors that are detected on the server side must go back to the visualization object through the SmartDataObject handling the row transfer. For more information on error reporting, see the "Validation Procedures" section.

Initiating Update Operations

The event procedures in visual objects (SmartDataViewers and SmartDataBrowsers) that initiate update operations are as follows:

- updateRecord
- addRecord
- copyRecord
- deleteRecord
- cancelRecord
- resetRecord

These procedures are typically invoked from the buttons of an Update SmartPanel or a SmartToolbar. They perform only the parts of their operations that are relevant to the visualization, such as enabling Frame fields or displaying initial values. The actual data update side of the operation occurs in the SmartDataObject, using the following functions:

- submitRow( )
- addRow( )
- copyRow( )
- deleteRow( )
- cancelRow( )

These functions cause changes to the RowObject table. If the SmartDataObject's AutoCommit property is set to Yes (the default if no Commit Panel is attached), each row's changes are automatically written to the database through the Commit( ) function, otherwise they remain in the RowObject table until an explicit Commit is performed.

Getting and Setting Properties

In addition to the standard set and get functions for properties, `data.p` has a number of support functions to set and get properties of individual columns in the RowObject; for example, Format and DataType. To differentiate these functions from the normal get/set functions for object properties, they are named assignColumn*property* (*column*, *value*) to assign a value (for those properties that are writable) and column*property* (*column*) to retrieve the value.

Signaling Data Availability

The SmartDataObject indicates that data is available by PUBLISHing dataAvailable, and the Data–Target that has SUBSCRIBEd to this event responds appropriately. This happens when the SmartDataObject opens its query and when the cursor position in the query changes. This behavior makes sense for a configuration in which the SmartDataObject and its visualization are part of the same Progress client.

However, if the UI either is not Progress or is in a different process than the SmartDataObject, the Data SmartLink is not present and the dataAvailable event is not sent; you must design your UI objects to deal with this. For example, a visualization could execute the openQuery function in the SmartDataObject by knowing its handle rather than by using an ADM link, and then immediately start requesting data using other functions. If no other outside source is controlling the SmartDataObject, its visualization does not need the Data link or the dataAvailable event; that is, ADM links and event procedures are supported by SmartDataObjects but are not required by other new objects with which they communicate.

Generally, signaling data availability without the Data SmartLink and the dataAvailable event is of interest when you are using SmartDataObjects from a non-Progress environment. Within a 4GL SmartObject application, the ADM manages communication between objects using the link and event, and the code in the ADM super procedures handles this automatically.

Special considerations apply when you access a SmartDataObject from a Java application. For details, see the "Java Applications and SmartDataObjects" section.

7.4 SmartDataObjects and SmartLinks

The ADM provides separately defined Data and Update SmartLinks in order to allow maximum flexibility in how you build and assemble SmartDataObjects:

- The Data link passes values from one object to another for display.
- The Update link passes changed values back to a SmartDataObject to be validated and saved in the database.

A SmartDataObject that is the Data–Source for a particular SmartObject can be the Update–Target for the same SmartObject. For example, a SmartDataObject that is the Data–Source for (and passes value to) a SmartDataViewer can be the Update–Target for that SmartDataViewer. Similarly, if a SmartDataBrowser allows updates, it must pass the updates to a SmartDataObject, because that is where the update logic resides. In this case, the SmartDataObject is the Update–Target for the SmartDataBrowser.

The SmartDataObject is designed to participate in a peer-to-peer SmartObject client relationship. However, it is also designed to operate as a server object that receives requests from other client objects, satisfies them strictly through OUTPUT parameters to those requests, and does not need links or callbacks in order to function.

7.5 Validation Procedures

The SmartDataObject supports the definition of validation procedures for the following:

- RowObject temp–table fields
- The RowObject temp–table record as a whole
- Update transaction on the server side

This allows you to define several distinct levels of data validation, as discussed in this section.

7.5.1 Data Dictionary Validation

As you might expect, Data Dictionary validation is simply the validation expression (and accompanying validation message) defined in the Data Dictionary. The temp–table columns inherit this validation for each column that maps to a single database field. Client objects can query it using the columnValExp and columnValMsg functions; for example, you might do this at design time to include Data Dictionary validation in the generated code for a non-Progress visualization.

Note that SmartDataBrowsers and SmartDataViewers include the same field definition list as the SmartDataObject. In this way, these objects automatically inherit the format, validation expression, and other field attributes of each field in the RowObject, as defined in the SmartDataObject. This field validation can be performed in the visualization even without a database connection available at run time (in the event that the application is distributed using AppServer), as long as the field validation does not require database lookups (CAN–FIND, and so forth). Because of this restriction, the column definition dialog box (which appears when you build a SmartDataObject) includes a toggle box that you can turn off to prevent the RowObject field from inheriting the field validation for the database field from which that column is derived. You should normally turn off this toggle box if the Data Dictionary validation requires a database lookup and the client might be run without a database connection of its own to satisfy that lookup.

The Data Dictionary validation is not automatically executed in the SmartDataObject itself. It normally occurs in the SmartDataViewer or SmartDataBrowser when saving changes to an entire row.

7.5.2 Field-level Validation Procedures

You can define field validation procedures (also called column validation procedures) in the SmartDataObject for each updateable field in the temp–table. To do this, you define an internal procedure named *column*Validate that takes the column value as an input parameter. Each time the SmartDataObject receives an updated field from a client object, the submitRow function in the super procedure `data.p` runs the field validation procedure (if any). The procedure receives the field's value as an INPUT parameter. If the validation fails, the procedure can signal an error and log a message by RETURNing the message text. This message is displayed to the user as the error text, and in the visualization, focus is applied to the invalid field.

The field-level validation procedure allows more extensive value checking than the logical ValExp (schema validation expression) permits. Note that because the schema validation expression might not always be executed in the client visualization, it is a good idea to duplicate any important checks in the SmartDataObject field validation procedures. Note also that the field validation procedures are executed only if a field value changes.

NOTE: To work around the restriction that field-level validation executes only when a field value changes, use record-level validation instead of field-level validation. This works because the record-level validation procedure can access any field in the row object by name. For details, see the "Record-level Validation Procedures" section.

The following example, which utilizes the Progress sample database, describes a SmartObject application that implements a field-level validation procedure in a SmartDataObject. Specifically, it creates field-level validation that ensures that application users enter OrderLine quantities that are greater than zero.

Follow these steps in the AppBuilder to implement this example:

1 ♦ Create a SmartWindow.

2 ♦ Create a SmartDataObject for the OrderLine table in the sports2000 sample database.

3 ♦ Create a SmartDataViewer for the OrderLine table, using the SmartDataObject created in Step 2 as its Data Source.

4 ♦ Drop the SmartDataObject and SmartDataViewer onto the SmartWindow and link them with Data and Update links.

5 ♦ Drop a Navigation SmartPanel onto the SmartWindow and link it to the SmartDataObject with a Navigation link.

6 ♦ Drop an Update SmartPanel onto the SmartWindow and link it to the SmartDataViewer with a TableIO link.

7 ♦ Create in the SmartDataObject an internal procedure called QtyValidate that has the following code:

```
DEFINE INPUT PARAMETER valqty AS CHARACTER NO-UNDO.

IF INTEGER(valqty) = 0 THEN RETURN
"Order Line quantity must be greater than zero".

END PROCEDURE.
```

With this field-level validation procedure in place, an application user who enters zero for the Order Line quantity receives the specified error message, and focus is applied to that field in the SmartDataViewer. Note, however, that if the initial value of the Order Line quantity is zero and the application user does not modify the field in the visualization, the validation does not run. This is because field validation procedures are executed only if a field value changes.

7.5.3 Record-level Validation Procedures

You can define a validation procedure called RowObjectValidate in the SmartDataObject for the temp–table record as a whole. This record-level validation procedure (also called a row validation procedure) can perform cross-field validation and other kinds of checks for a set of updates to a single record. The submitRow function in the super procedure `data.p` executes the record-level validation procedure (if defined) whenever one or more field values in a record are updated, after the field validation procedures run. The procedure can access any field in the RowObject row by name and, like the field-level validation procedure, it signals error by RETURNing an error message text to the caller.

NOTE: Because the RowObjectValidate procedure can access any field in the row object by name, you can use record-level validation instead of field-level validation to work around the restriction that field-level validation executes only when a field value changes.

The fact that RowObjectValidate procedures in a SmartDataObject run whenever one or more field values in a record are updated has a side effect that you must be aware of. If your RowObjectValidate procedure validates a field that is not included in a visualization that updates the table and the procedure returns an error, the application user cannot access the field or fix the error.

CAUTION: RowObjectValidate procedures run for every visualization that can add or update the table. If you add a RowObjectValidate procedure to a SmartDataObject, make sure that any visualization that might fire the procedure includes the appropriate fields so that application users can add or correct data as necessary to pass the validation check.

Suppose, for example, that a customer SmartDataObject includes a RowObjectValidate procedure that ensures that at least one of the following fields—phone, fax, email address—is populated for a customer record. If the application that uses this SmartDataObject includes a SmartDataViewer that can add customer records but does not include any of these fields, the validation procedure will not allow the application user to add a record and will return an error noting that the user must enter either a phone, fax, or e-mail address. However, the user cannot access these fields and will not be able to enter any of these values.

The following example, which utilizes the Progress sample database, describes a SmartObject application that implements a record-level validation procedure in a SmartDataObject. Specifically, it creates record-level validation that ensures that application users enter credit limits that are greater than zero.

Follow these steps to implement this example:

1 ♦ Create a SmartWindow.

2 ♦ Create a SmartDataObject for the customer's table that includes the name and credit–limit fields.

3 ♦ Create a SmartDataViewer for the SmartDataObject in Step 2, with its fields in it.

4 ♦ Drop the SmartDataObject and SmartDataViewer onto the SmartWindow and link them with Data and Update links.

5 ♦ Drop a Commit SmartPanel on the SmartWindow and link it to the SmartDataObject with a Commit link.

6 ♦ Drop a Save SmartPanel onto the SmartWindow and link it to the SmartDataViewer with a TableIO link.

7 ♦ Create in the SmartDataObject an internal procedure called RowObjectValidate that has the following code:

```
If rowobject.credit-limit <= 0 THEN RETURN
"Credit limit must be greater than zero".

END PROCEDURE.
```

With this record-level validation procedure in place, an application user who enters zero for the credit limit receives the specified error message.

As another example, the following code, when placed in the RowObjectValidate internal procedure, cancels any data change (add or update) where the value of SalesRep is SLS (this is a new sales rep) and the Balance or CreditLimit fields are out of a specified range:

```
IF RowObject.SalesRep = "SLS": THEN
  IF RowObject.Balance > 0 OR RowObject.CreditLimit > 5000 THEN
    RETURN "SalesRep Not Authorized For This Change".
```

7.5.4 Transaction-level Validation Procedures

As updates are made, the ADM creates a version of the RowObject temp–table, called RowObjUpd, that contains only the rows that are being updated (that is, modified, added, or deleted). It passes the RowObjUpd temp–table to the server side of the Commit process, which finds the corresponding database records (using the RowIdent field) and moves the update rows into those records. ADM allows you to implement transaction-level validation at various points in the process.

The SmartDataObject contains four entry points for transaction-level validation procedures: preTransactionValidate, beginTransactionValidate, endTransactionValidate, and postTransactionValidate. These entry points are simply procedure names that execute NO–ERROR. If you want your SmartDataObject to perform custom validation at a particular point in a transaction, you simply write an internal procedure of the corresponding name in the SmartDataObject. These procedures are executed where the database connection is. If the SmartDataObject is divided between client and AppServer, they are executed on the AppServer.

The four entry points operate as follows:

- **preTransactionValidate**—This procedure is executed immediately before a transaction block begins. At this point, all of the rows in the RowObjUpd temp–table are available, can be read, and, if necessary, can be modified. This is the appropriate place to put checks that would result in canceling a transaction before it begins; for example, checks that verify the validity or consistency of rows being added, updated, or deleted. It is also the place to put code that changes or sets any values in those records that have not been set before; for example, totals.

- **beginTransactionValidate**—This procedure is executed immediately after the beginning of a transaction block. This is the appropriate place for business logic that:

  – Updates related database records that should be updated as part of the same transaction.

  – Is not dependent on SmartDataObject updates having been made to the database already.

- **endTransactionValidate**—This procedure is executed immediately before the end of a transaction block. This is the appropriate place for:

  – Business logic that updates related database records that should be updated as part of the same transaction.

  – Performing other checks that are dependent on SmartDataObject updates having been made to the database already.

  For example, if the logic for an Order SmartDataObject must total all orders to compare them with a credit limit, then it must be able to read not only updated order records but also any records already in the database. This logic is easier to implement if it is executed after the updated rows are written back to the database.

  As another example, suppose that you add to a SmartDataObject a row for which the following are true:

  – It is a one-to-one join of two database tables.

  – Its key field, which is the join field for the tables, is assigned from a numeric sequence in the database.

  In this case, it is impossible to assign the key field value for the second table any sooner than at the end of the transaction. An endTransactionValidate procedure can read the primary table record from the database, retrieve the key value, and assign it to the secondary table record.

- **postTransactionValidate**—This procedure is executed immediately after the end of the transaction block. This is the appropriate place to put business logic that performs other checks that should not be part of the basic transaction; for example, sending status messages or other work that should be performed in a separate transaction or in no transaction at all.

Each of these procedures has access to the RowObjUpd table and to any connected database tables. The procedures signal error by RETURNing an error message; if any of these procedures does return an error message, processing stops. Thus:

- When preTransactionValidate returns an error, it cancels the update before the transaction begins.
- When beginTransactionValidate or endTransactionValidate returns an error, it undoes the transaction.
- When postTransactionValidate returns an error, there is no effect on the transaction: it does not undo the transaction because at that point, the transaction has already been completed.

NOTE: The version of ADM 2 available in Progress V9.0 provided a single entry point called TransactionValidate for transaction-level validation. The preTransactionValidate procedure effectively replaces TransactionValidate, but TransactionValidate is still supported for compatibility with the previous release. As is the case with preTransactionValidate, TransactionValidate executes NO–ERROR so that it runs only if it has been defined for the SmartDataObject.

7.5.5 Database Trigger Procedures

Database trigger procedures are not part of the SmartDataObject model, and Progress Software Corporation recommends that you limit them to performing essential data integrity checks. There are two reasons for this recommendation:

- They are relatively more difficult to maintain and examine than code that is part of the business logic of an application.
- The checks are not performed until the actual database update is attempted.

By moving as much as possible of the application's business logic as far from the database transaction as possible, you ensure that most data errors are reported earlier and more efficiently. If a database trigger fails during a SmartDataObject update, the transaction is aborted and the error message, if any, is reported back to the client object, where either the data must be modified or the update canceled.

The ADM provides a standard error reporting mechanism that database triggers can use. This mechanism, the addMessage procedure, allows the SmartDataObject to log one or more error messages and return them in a standard format to a visualization or other client object, which can then present them to the user as appropriate, including repositioning the cursor to the field where the error occurred. The addMessage procedure takes as arguments the message text, the field name, if applicable, and the table name, if applicable. If database trigger procedures run addMessage, these messages are returned to the client visualization for display, even across an AppServer connection. Note that MESSAGE statements are not transmitted across an AppServer connection and are not, therefore, an appropriate way to log error messages in any database that might be used in distributed applications.

7.6 Running SmartDataObjects in a Distributed Environment

The SmartDataObject supports distributed computing. You can run a SmartDataObject in a distributed environment using either the traditional client/server model or the AppServer model:

- In the client-server model, the SmartDataObject runs entirely on one machine as a single `.r` file and is connected to the necessary databases.
- In the AppServer model, the SmartDataObject is split across the network using AppServer technology, as follows:
  - A SmartDataObject *proxy*, also called a client proxy, resides on the client machine. It interfaces with other client-based procedures and with the complete SmartDataObject on the AppServer machine.
  - A complete SmartDataObject resides with the database on the AppServer machine. It interacts with the database and with the SmartDataObject proxy on the client machine.

  The complete SmartDataObject and its proxy interface with each other using AppServer technology.

  Note that in this model, it is possible to use a complete SmartDataObject rather than a client proxy on the client machine. This configuration occurs when the partition is configured to run remotely and the client is connected to the database at run time. It happens because the decision on whether to use complete SmartDataObject or a client proxy is based on whether the proper databases are connected, a decision that is independent from the decision on whether to run remotely or locally. Since the partition is an instance property of the SmartDataObject, it is possible to determine which partition is to be used and whether or not it is to be executed locally or remotely only after starting up the SmartDataObject or its proxy. The SmartDataObject runs the same way regardless of whether you run the complete version or its proxy, but the complete version includes code that is not executed by the client in a remote configuration.

Regardless of how you will deploy your SmartDataObject, you need to build it only once and maintain a single set of source code. This is because when you build a SmartDataObject, you use conditional preprocessor statements that identify code sections requiring database access and enable compiling the SmartDataObject into two versions:

- A database-aware version that contains all of the SmartDataObject code. This version can be used either in the traditional client/server model, or in the AppServer model as the AppServer-resident procedure that accesses the required databases.
- A nondatabase-aware version that is compiled with all database-access sections compiled out of the r–code. This version is suitable only as the client proxy on the client machine in the AppServer model.

NOTE: You need to compile conditionally into database-aware and nondatabase-aware versions only if your SmartDataObject will run in a distributed environment using the AppServer model. This is because it is the only configuration in which the SmartDataObject is split into database-aware and nondatabase-aware versions.

The following sections describe how to set up the master (`.w` file) for your SmartDataObject so that it will compile conditionally into database-aware and non-database-aware versions, how the AppBuilder modifies the master, and what happens when the SmartDataObject is initialized in an application.

7.6.1 Setting Up the SmartDataObject Master for Conditional Compilation

You use the following tools to set up a SmartDataObject master so that it will compile into database-aware and a nondatabase-aware versions:

- The DB–AWARE procedure setting in the SmartDataObject template. This is already set to YES in the `data.w` template.
- A toggle box labeled DB–REQUIRED in the Section Editor for code sections. When you edit an internal procedure or function in the Section Editor, the AppBuilder adds a toggle box labeled DB–REQUIRED to the Section Editor for any section that might contain database references. By default, this toggle box is checked (selected). If you know that a section has no references to a database, you can uncheck the toggle box.

7.6.2 AppBuilder Modifications to the SmartDataObject Master

When you generate the master (.w file) for the SmartDataObject that has been set up for conditional compilation into database-aware and nondatabase-aware versions, the AppBuilder modifies the master as follows:

1. It checks each code-block section to see whether its DB–REQUIRED toggle box is checked. If it is, the AppBuilder brackets the code in that section with the following preprocessor names:

```
{&DB-REQUIRED-START}
.
.
.
{&DB-REQUIRED-END}
```

These preprocessor names resolve to the following code:

```
&IF {&DB-REQUIRED} &THEN
.
.
.
&ENDIF
```

This code excludes the section from the r-code during the compilation of the client proxy.

If the section's DB Required toggle box is unchecked, the AppBuilder does not bracket its code with the {&DB–REQUIRED–START} and {&DB–REQUIRED–END} preprocessor names, and the section is included in the r-code during the compilation.

2. If the preprocessor names for a section are present, the AppBuilder generates the following code to define them before it produces any code block that might require them:

```
/* DB-Required Preprocessor definitions */
&IF DEFINED (DB-REQUIRED) = 0 &THEN
  &GLOBAL-DEFINE DB-REQUIRED TRUE
&ENDIF
&GLOBAL-DEFINE DB-REQUIRED-START &IF {&DB-REQUIRED} &THEN
&GLOBAL-DEFINE DB-REQUIRED-END   &ENDIF
```

If DB–REQUIRED is not defined when the compiler processes this block of code, all code blocks are included in the compiled r-code. However, if DB–REQUIRED is defined as false, code blocks bracketed with {&DB–REQUIRED–START} and {&DB–REQUIRED–END} are not included in the compiled r-code. This is the case when generating a client proxy (a SmartDataObject proxy to be used on a client machine); it means that the proxy is not required to be connected to any database when executed.

You can choose to compile out just a part of an internal procedure or function. To do this, uncheck the DBRequired toggle box and program the following statements around the section of code to be executed only when a database connection is available:

```
&IF {&DB-REQUIRED} &THEN
  .
  .
  .
&ENDIF
```

This technique allows you to execute different versions of the same procedure on the client and the AppServer. You might even code the client version to invoke the AppServer version; for an example, see the installed file `%DLC%/src/adcm2/cltorsrver.i`.

3. When it generates the .w file for the SmartDataObject, the AppBuilder also produces a client proxy .w file. The proxy has the same name of the form *sdoname*_cl.w, where *sdoname* is the name of the SmartDataObject. For example, a SmartDataObject named dcust.w automatically has a proxy named dcust_cl.w. The proxy contains the following code:

```
/* dcust_cl.w - non-db proxy for dcust.w */
&GLOBAL-DEFINE DB-REQUIRED FALSE
{dcust.w}
```

   This code, when compiled, first sets {&DB–REQUIRED} to false, then creates an r-code proxy named dcust_cl.r that is identical to its sibling SmartDataObject named dcust.r except that all sections marked DB–Required are removed.

4. The AppBuilder turns on the SmartDataObject's DBAware attribute. It uses this attribute later, when it generates a SmartContainer that contains the SmartDataObject.

7.6.3 Initializing the SmartDataObject

When the AppBuilder generates a SmartContainer, it produces calls to the constructObject method for each contained SmartObject. This method launches the contained SmartObject by running it persistently. If a contained SmartObject is a database-aware SmartDataObject, the AppBuilder appends the DB–AWARE keyword to the SmartDataObject's name, separated by a CHR(3) character. This serves as a flag to the constructObject method in the containing SmartObject to check the connected databases at run time and determine whether to run the complete SmartDataObject or its proxy.

The constructObject method determines whether to run the complete SmartDataObject or its proxy based on whether all necessary databases are currently connected when the SmartDataObject is about to be executed. If they are, constructObject launches the complete SmartDataObject. If any of the required databases are not connected, constructObject runs the client proxy instead. The proxy then makes the proper AppServer connection to the complete SmartDataObject that is its sibling, based on the partition indicated in its instance attributes setting.

7.7 Managing SmartDataObjects in Distributed Mode

This section describes how to manage Progress SmartDataObjects in a distributed mode, using AppServer.

As described in the "Running SmartDataObjects in a Distributed Environment" section, you can compile a SmartDataObject into database-aware and non-database-aware versions, with sections that contain database references compiled in or out depending on whether the SmartDataObject version will be run client/server, on a client that talks to an AppServer, or on an AppServer.

A SmartDataObject client proxy contains the code needed to connect to an AppServer Broker, to run the complete SmartDataObject on that AppServer, and to send requests through that connection to retrieve and update database records from the database through the AppServer. To enable a SmartDataObject for this use, follow these steps, either before saving the master for a new SmartDataObject from the AppBuilder or when editing the master for an existing SmartDataObject:

1 ♦ Select the Procedure settings button from the AppBuilder toolbar. The Procedure Settings dialog box appears.

2 ♦ In the Procedure Settings dialog box:

a) Check the AppServer Aware toggle box.

b) Enter the Application Service name that this SmartDataObject is to be associated with into the Partition fill-in field. Note that the Partition field appears in the Procedure Settings dialog box only if you are working with a SmartDataObject master.

Note that this runs all instances of that SmartDataObject on the AppServer. To change this for a single instance, use the SmartDataObject's Partition instance property. For example, you might do either of the following:

- Set the procedure properties in the SmartDataObject so that all instances except one run on the AppServer, and then set the instance property for that instance to none (that is, it runs locally).
- Leave the procedure property unset in the SmartDataObject so that all instances except one run locally, and set the instance property for that instance to run on the AppServer.

Note that if the AppServer is not known earlier or is variable, you can use the Partition instance property to set it when you assemble the application.

7.7.1 SmartDataObject Deployment Files

The ADM support files are shipped only with the Windows versions of the product. This is because you normally develop SmartObjects only with the AppBuilder, which generates a great deal of code for SmartObjects. Because the include files and super procedures that form the ADM become in effect a part of the final application, it is essential that you use the same version of those files to build and run your application on all platforms. As a result, you must port needed super procedures to each deployment platform along with the application code. In order to test SmartDataObjects on an AppServer on which the Progress software is not installed, you must put these files into an `adm2` directory on that machine relative to its PROPATH.

You need the following super procedures to run standard SmartDataObjects on an AppServer, either from a Progress client, from WebSpeed, or from a non-Progress client such as Java:

- `smart.r`
- `query.r`
- `data.r`

To facilitate testing distributed applications on a single NT workstation (where you can run both a Progress client and a Progress AppServer session), these three super procedures reside in both the `tty` directory and the `gui` directory.

You must move all SmartDataObjects to be run on an AppServer to that machine. You usually do not need to recompile the super procedures or SmartDataObjects on the target machine, unless it is a platform to which Progress .r code is not portable. However, if it is necessary or desirable to recompile the SmartObject super procedures or the application's SmartObjects on the target machine, you must also move the following source files, as well as the `custom` subdirectory and its contents, to that machine, in a `src\adm2` directory relative to the PROPATH:

- `smart.i`
- `query.i`
- `data.i`
- `smrtprop.i`
- `qryprop.i`
- `dataprop.i`
- `smrtprto.i`
- `qryprto.i`
- `dataprto.i`

- `smart.p`
- `query.p`
- `data.p`

When you run a SmartDataObject on an AppServer, the supporting super procedures `smart.r`, `query.r`, and `data.r` are started automatically, just as on the client, and are left running in support of any SmartDataObjects that are run for the duration of that AppServer session. All the super procedures run stateless, without maintaining any data specific to an individual client, thus the same AppServer process can service a number of clients in succession, even when each client expects to have exclusive use of that AppServer for the duration of its connection. As a result, your application incurs the overhead of starting super procedures once per AppServer session. (You can even run these procedures persistently as part of the session startup.)

7.7.2 Service Choices and SmartDataObject Execution

A SmartDataObject that is part of a client-side application runs on the client if either of the following is true:

- No Application Service is defined for the SmartDataObject.
- The SmartDataObject is AppServer-aware but its Configuration option is set to Local in the PRO*Tools Application Partition Deployment utility.

A SmartDataObject that runs only on the client has its own database connection and accesses the database through that connection.

However, if the SmartDataObject is AppServer-aware and the Application Service on an AppServer host machine is set to an actual service, the client SmartDataObject's initializeObject procedure establishes a connection to that AppServer, then runs a copy of itself (that is, a file with the same filename) on the AppServer. (Note that if the client is running the client-only SmartDataObject, with the "_cl" suffix, that suffix is ignored when locating the matching SmartDataObject on the AppServer.) The SmartDataObject on the AppServer opens its database query as part of its own initialization. For more information, see the *Progress Open Client Developer's Guide*.

When the client-side SmartDataObject runs its openQuery function, the sendRows procedure executes. How this procedure executes depends on whether the application is running in client/server mode or AppServer mode. In client/server mode, when the client uses its own database connection, sendRows retrieves rows from the database and populates the RowObject temp–table, which is then accessed by other objects on the client.

In AppServer mode, however, the sendRows procedure runs clientSendRows. This in turn runs serverSendRows in the AppServer SmartDataObject, which returns the RowObject temp–table to the client. The client-side SmartDataObject uses the temp–table until it is finished with it. It can then either simply exit or execute the closeQuery function, which disconnects it from the AppServer. The same procedures are used to update one or more rows in the table or to add or delete rows as in client/server mode. When the Commit function is run on the client side, it in turn runs serverCommit in the AppServer SmartDataObject, passing a temp–table containing all modified, deleted, or added rows. The serverCommit procedure writes the records back to the database as described in the SmartDataObject description or, if the update fails, returns any errors to the client.

When a 4GL client running a client-side SmartDataObject connects to the same object on an AppServer, the support code for those procedures contains all of the code needed to get updates back to the server. (The support code is located in `data.i`, which is compiled into each SmartDataObject, and the super procedure `data.p`.) You can use the same calls from a non-Progress client (for example, a Java client using a proxy built by ProxyGen). However, in this case, if the client process performs any update operations, it is its responsibility to return to the AppServer SmartDataObject an update temp–table that contains those changes. The update temp–table (called RowObjUpd in the 4GL code) must be of the same form as the RowObject temp–table that is passed to the client with the original rows. See the "SmartDataObject Query and Update Operations" section for specifications of this temp–table.

Special considerations apply when you access a SmartDataObject from a Java application. For details, see the "Java Applications and SmartDataObjects" section.

7.7.3 AppServer Session Operating Modes and SmartDataObjects

In a distributed application, a SmartDataObject inherits its operating mode—state-aware, stateless, or state-reset—from the AppServer that it uses to access its database. (This is the default behavior; you need not configure the SmartDataObject specially for this to happen.) These three modes operate as follows:

- In state-aware mode, a SmartDataObject connects to an AppServer session and binds it for the entire length of the SmartDataObject's client connection. At the end of the connection, the context (state) of the AppServer session remains and can be used by the next connection to that session. In this mode, it is unnecessary for a new connection to the AppServer session to re-establish context; however, it might be difficult to design a system in which each user can benefit from the context left by the previous user.

- In stateless mode, a SmartDataObject connects to an AppServer session but binds it only briefly to do the following:

  – Re-establish the context of the AppServer session at the end of its last request

  – Make a request

  – Save the context for the next request

  Between requests, nothing is bound. In this mode, each individual AppServer request might take slightly longer, but many clients can share fewer AppServer sessions with minimal performance degradation.

- In state-reset mode, the AppServer session's state is reset to the initial state after each connection. This mode is particularly useful for applications that do not use SmartDataObjects.

In some cases, you might want a SmartDataObject to run in a state-aware mode even though the AppServer is running in stateless mode. For example, a SmartDataObject might have a query that is so complex that the overhead of re-establishing it at every use degrades performance. To request state-aware mode explicitly, you set the Force to Stateful Operating Mode instance property in the SmartDataObject's Instance Property dialog box. This property causes the SmartDataObject to run in state-aware mode even though AppServer session is running in stateless mode. (For an illustration of the SmartDataObject Instance Property dialog box, see Chapter 2, "SmartObjects.")

NOTE: A SmartDataObject executes exactly the same regardless of its operating mode.

7.8 AppServer-related SmartDataObject Properties

Two parameters to the AppBuilder-supported appServerConnect function are defined as SmartDataObject properties. The following properties set these parameters:

- **ASUsePrompt**—Determines whether the connect process prompts for username/password. It is false by default.
- **ASInfo**—A user-defined character string that can be passed to the CONNECT method as its third parameter, if needed. It is blank by default.

There are also two other AppServer-related SmartDataObject properties:

- **ASHandle property**—Holds the procedure handle of the AppServer connection, if there is one. This is set by the Connect process.
- **ASDivision property**—Is set automatically when the SmartDataObject determines whether it is running as a divided object on both Client and AppServer. It is set to "Client" if it's the client-side object, "Server" if it's the AppServer-side object, and is left blank otherwise. User code should not set this property but can examine it if needed.

7.9 Running SmartDataObjects from a Non-Progress Client

The SmartDataObject has an extensive API. You can access many of its internal procedures and functions from a non-Progress client application such as one written in Java. You can use the Progress ProxyGen tool to generate a proxy that supports this interface. Note that because the code generated by ProxyGen is based on the INTERNAL–ENTRIES of the Progress procedure, you can control the list of exactly which internal procedures and functions are exposed to ProxyGen by editing the contents of the prototype include files. For more information on prototype include files, see Chapter 6, "Advanced ADM Topics." Because there is no specific client-side support for SmartDataObjects in Java or Visual Basic, you must write code that uses the SmartDataObject API to control and communicate with the SmartDataObject as required by the application.

The following descriptions provide an overview of which procedures and functions you use to perform various operations. Generally, you can retrieve data from a SmartDataObject and return updates either in batch mode or a row at a time.

7.9.1 Batch-mode Operations

In batch mode, you batch data in a Progress temp–table from a SmartDataObject and, when needed, back to the SmartDataObject. When a SmartDataObject is initialized and its database query opened, the object transfers rows from the query into the RowObject temp–table defined in the SmartDataObject. (By default, 200 rows are transferred at a time, but you can reset this with the setRowsToBatch function.) A non-Progress client application should run serverSendRows to receive this table; this function returns the RowObject temp–table, which can be browsed from the client as an SQL dataset. If you make updates, you must construct a RowObjUpd dataset with the RowNum, RowIdent, RowMod, and ChangedFields fields set for each modified row. To return this dataset to the SmartDataObject, run serverCommit, which accepts the temp–table and returns the same table with any additional fields that might have been set by database triggers (key values and so forth), along with OUTPUT parameters that contain any error messages and the RowIdent fields of any records that were not updated because of errors. The calling sequence for the fetchMessages function is described in the format of the error message string.

7.9.2 Single-row Operations

If you want to receive and return data a row at a time, use the colValues function to obtain desired column values for the current row in the data set, then use the fetchFirst, fetchNext, fetchPrev, fetchLast, and fetchRowIdent procedures to reposition the SmartDataObject's query. Additional batches of rows are moved from the database query into the RowObject temp–table query automatically as necessary. To perform updates to individual rows, use the submitRow function to return updated values for a single row to the SmartDataObject. You can use the deleteRow procedure to delete the current row. You also use the addRow and copyRow procedures to create new rows starting with the initial values for the table or with the values from the previous current row. After these initial values have been returned to the caller, use the submitRow function to send the final field values back to the SmartDataObject to be written to the database.

Special considerations apply when you access a SmartDataObject from a Java application. For details, see the "Java Applications and SmartDataObjects" section.

7.10 Java Applications and SmartDataObjects

A Java application running on a client machine can access a remote SmartDataObject on an AppServer. It does this through a Java AppObject, using an interface based on the Java Database Connectivity (JDBC) 2 ResultSet. The supported interface includes many of the standard ResultSet methods and adds a number of extensions.

Figure 7–2 shows how a Java Open Client accesses a Progress SmartDataObject running on an AppServer.

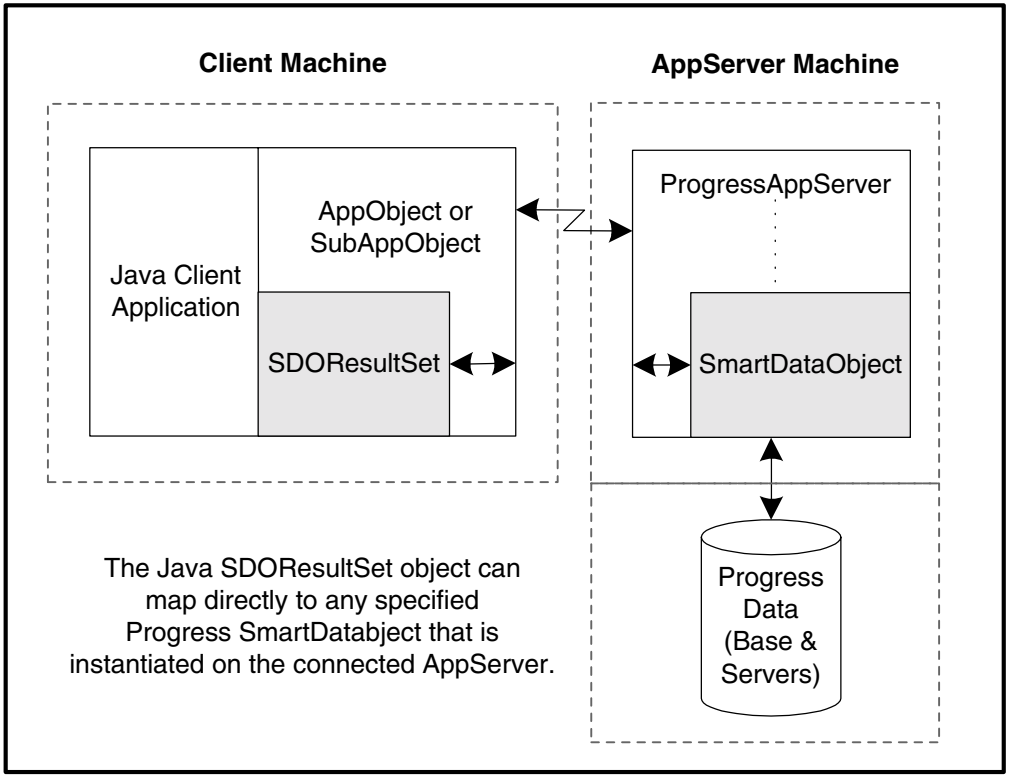


Figure 7–2: Java Open Client Access to a Remote SmartDataObject

To enable a Java client to access a remote Progress SmartDataObject as a JDBC 2 ResultSet, you must:

- Have at least one remote SmartDataObject deployed on the connected AppServer.
- Call the AppObject or SubAppObject class factory method, `_createSDOResultSet()`, to create an SDOResultSet object that maps to and can access the specified SmartDataObject.

The SDOResultSet object implements the SDOResultSet interface, which is an extended implementation of the JDBC 1 ResultSet interface. Thus, using standard JDBC 2 ResultSet methods on this SDOResultSet object, you can access Progress data provided by the specified SmartDataObject in the same way as a standard JDBC 2 ResultSet. The SDOResultSet interface also provides extensions to JDBC 2 that allow you to access the unique capabilities of SmartDataObjects.

Complete support for access to remote SmartDataObjects includes a small set of classes and interfaces that, together with SDOResultSet, come installed as part of the Open Client Runtime. For reference information on each class and interface, see the Javadoc installed in *Progress-Install-Directory*`\java\doc\*.html`. For information on accessing and using this interface, see the SmartDataObject chapter in the *Progress Open Client Developer's Guide*.

NOTE: The SDOResultSet interface allows you to access only the default SmartDataObject API generated by the Progress AppBuilder. If you need to access custom programmer extensions to this API, you must access the SmartDataObject API directly. For more information, see the relevant appendix in the *Progress Open Client Developer's Guide*.

8

Developing ADM Extensions

Developing extensions to the ADM means extending the ADM class hierarchy with new or customized classes. This chapter describes how to do this, using either the AppBuilder's New ADM Class tool or the custom files for an existing class as appropriate.

This chapter discusses these topics:

- Extending the ADM class hierarchy
- Creating a new class at the bottom of the ADM class hierarchy
- Customizing an existing ADM class
- Adding application logic to your new or customized class, including descriptions of the custom class files, design rules for modifying class files, and notes on adding properties
- Examples of creating a new class and of customizing an existing class

8.1 Introduction

In some circumstances when developing Progress 4GL applications that use SmartObjects, it is necessary or useful to create a new ADM class. Suppose, for example, that you have a number of SmartDataBrowser master files that share some set of properties and/or behaviors beyond what is supported in the SmartDataBrowser as shipped, but that have other properties and/or behaviors that are unique to each master. You can create a new SmartDataBrowser template that includes the common functionality as standard behavior, and then build master files from this new template. Your custom SmartDataBrowser constitutes an extension of the ADM—a new ADM class.

Before you begin to develop a new ADM class, be sure that you understand the basic ADM architecture as described in Chapter 1, "Overview," and are familiar with the material in the other chapters of this manual.

NOTE: The current ADM file structure is different from that in earlier ADM versions, and takes advantage of core features that did not exist in those versions. If you implemented your own customizations to the standard ADM classes, please note that the current ADM version does not support backward compatibility. Progress Software Corporation recommends that you convert your applications to use the ADM custom files, as described in this chapter.

There are three ways to extend the ADM class hierarchy:

- **Create a new class at the bottom of the ADM hierarchy**—Creating a new class at the bottom of the ADM class hierarchy (also called subclassing) allows you to create new SmartObject templates without affecting existing SmartObjects: it affects only new SmartObjects that reference your new class.

Figure 8–1 shows the ADM class hierarchy for SmartFrames, to help illustrate bottom-level extensions.

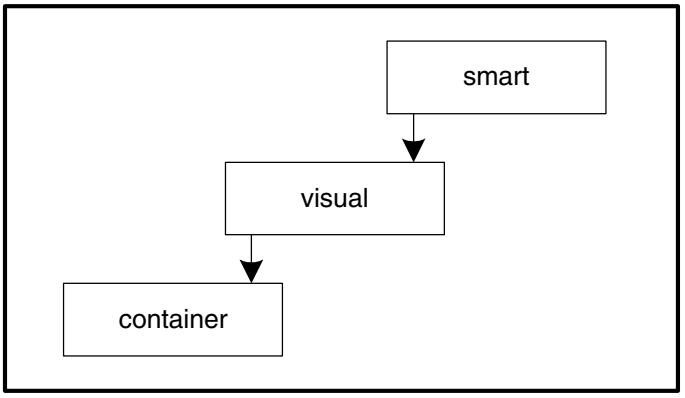


Figure 8–1: ADM Hierarchical Class Structure for SmartFrames

The top (root) of the hierarchy is the smart class, which contains the essential behavior shared by all SmartObjects. (Recall that the smart class is the root object for all SmartObjects.) As you work down the tree, you encounter successively more specific classes of behavior; in this case, the visual class and then the container class. The standard SmartObject templates are all based on bottom-level (leaf-level) ADM classes.

You use the New ADM Class tool to create the new ADM class files, then modify the standard class files by adding Progress 4GL code as required to provide behavior specific to your class. For details, see the "Creating a New Class at the Bottom of the ADM Class Hierarchy" section.

- **Customize an existing class**—Customizing an existing ADM class allows you to extend or modify its behavior by modifying the custom files that are built into it. You do not create any new class files when you customize an existing class: you simply change the behavior of a class by adding Progress 4GL code to one or more of its custom class files. For details, see the "Customizing an Existing ADM Class" section.

- **Create a new class in the middle of the ADM hierarchy**—You create a new class at the middle of the ADM class hierarchy by inserting a new class between two existing classes. This approach allows you to change or extend the standard behavior of existing SmartObjects. However, you should be able to handle most extension needs either by creating a new class at the bottom of the hierarchy or by customizing an existing class.

  NOTE: Progress Software Corporation strongly recommends that you do not create a new class in the middle of the ADM class hierarchy. It requires extensive knowledge of the ADM and entails significant risk of damaging your Progress installation.

8.2 Creating a New Class at the Bottom of the ADM Class Hierarchy

You use the AppBuilder's New ADM Class tool to create a new ADM class. There are three steps in creating a new class:

- Considering and resolving planning issues for your new class
- Using the New ADM Class tool to create the class files
- Adding application logic to the class files as required to provide the custom behavior for your new class

This section describes planning issues and explains how to use the New ADM Class tool to create the class files. For instructions on adding application logic, see the "Adding Application Logic to Your New or Customized ADM Class" section. For an example of creating a new class, see the "Creating the myviewer Class" section.

8.2.1 Planning Issues

Before you use the New ADM Class tool, you must consider some planning issues for questions that will arise during its use. Be sure to resolve these issues before you use this tool to create your new class:

- Decide where to put your new class files at design time. Since an ADM class is a collection of files, most of which are include files, and other files will reference the location of these include files, you might want to have a standard location in which to put all of the new class files. The New ADM Class tool (described later in this chapter) will prompt you to enter the name of the directory where you want your new class files to be written. Progress Software Corporation recommends that you follow the convention of the standard ADM class files and create an `src\adm2` directory for your source files and an `adm2` directory for your `.r` files in your working directory.
- Think about how to name your class files. The New ADM Class tool will automatically generate the filenames based on the naming convention used for the standard ADM class files that are shipped with Progress. Progress Software Corporation recommends that you use the same convention with your new class files.

- The New ADM Class tool will automatically create a `custom` subdirectory under the source directory that you specify. This subdirectory will hold all of the custom files or hooks that the standard ADM class files reference to allow the end user to customize the class. These files are a necessary part of the class structure, even if you do not plan to use them.

Remember that you cannot change the filenames and relative paths of a class once the AppBuilder generates the files. You must be careful to create a development environment that is consistent with the environment and file structure in which you plan to deploy your applications.

8.2.2 Creating the New Class Files

You create the new class files with the New ADM Class tool, located on the AppBuilder menu bar. To start the New ADM Class tool, choose Tools→ New ADM Class... from the menu bar, shown in Figure 8–2:

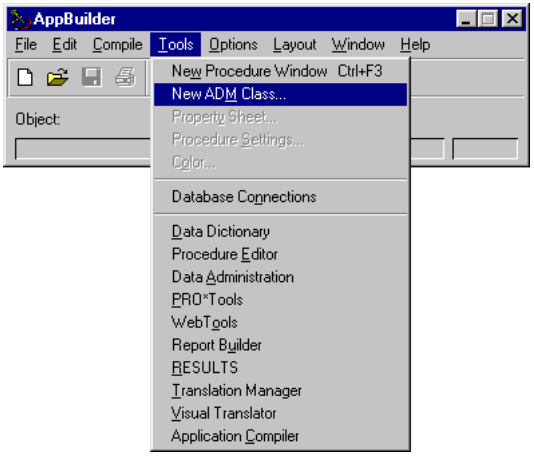


Figure 8–2: New ADM Class Menu Option

Invoking this command opens the New ADM Class dialog box, shown in Figure 8–3:

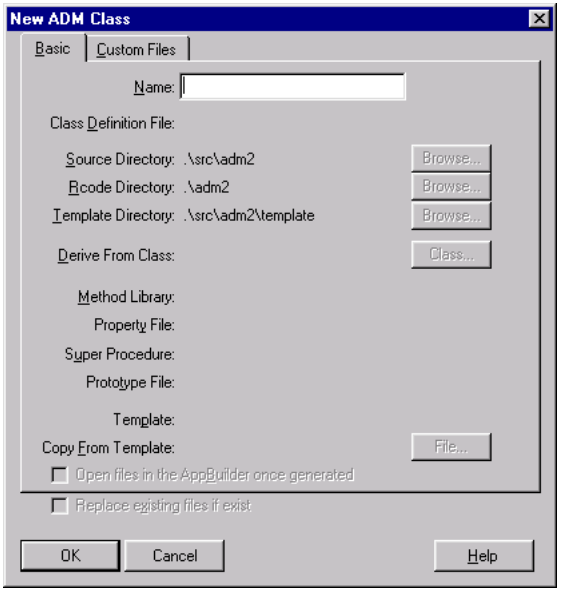


Figure 8–3: New ADM Class (Initial)

Note that this dialog box contains two tabs: a Basic tab, in which you name the class and supply various file and directory names and locations, and a Custom Files tab that provides information about the new custom files for this class. The following sections describe how to use these tabs.

The Basic Tab

The Basic tab initially contains only a single fill-in field: the Name field, in which you enter the name of your new class. After you specify a class name, fill-in fields open for the other labels on this tab. These fields contain automatically generated default names based on the class name that you supply. For example, specifying the class name as `mybrowser` and the class from which to derive as `...browser.cld` produces the result shown in Figure 8–4:

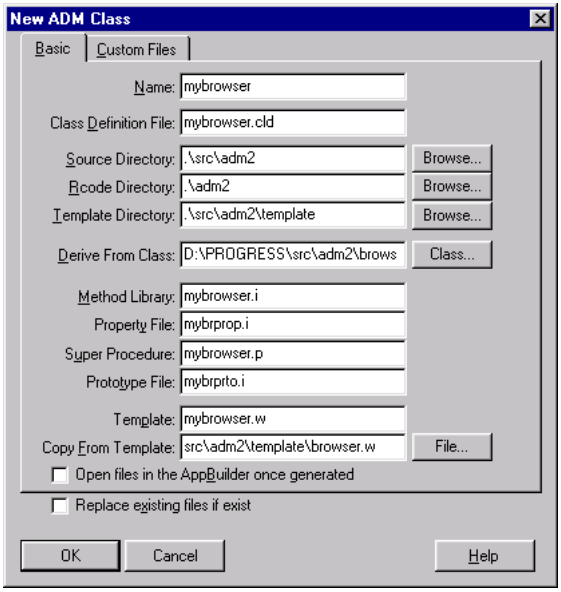


Figure 8–4: Basic Tab with Fill-in Fields

Note that the default names follow the standard Progress naming convention. Progress Software Corporation recommends that you use these names, but does not require that you do so. Recall that once you save your new class, you cannot change the file and directory names for your new class.

Table 8–1 lists and describes the fill-in fields in this tab.

Table 8–1: Basic Tab Fill-in Fields *(1 of 2)*

Field Name	Description	Mandatory?
Name	The name of the class. This name serves as a base name for the names of all of the files for the class.	Yes
Class Definition File	A file that references the components of a class. The extension must be .cld.	Yes
Source Directory	The pathname of the directory where the source files will be generated. You can browse for this directory.	Yes
Rcode Directory	The pathname of the directory for the r-code for the super procedure. You can browse for this directory.	Yes
Template Directory	The pathname of the directory for the template file. You can browse for this directory.	Mandatory if there is a value in the Template field
Derive From Class	The class definition file (`.cld`) to subclass.	No
Method Library	A file that defines the class name, references a property file, and starts the super procedure. The extension must be .i. This file is also called the primary include file.	Yes
Property File	A file that defines properties for the class. The extension must be .i.	Yes
Super Procedure	Defines the get and set functions for readable/writable properties and new behavior for the class. The extension must be .p.	Yes
Prototype File	A file that references the functions and internal procedures of a super procedure. The extension must be .i. **NOTE:** You can create the contents of this file by using the ProtoGen tool from the AppBuilder's Pro*Tools palette.	Yes

Table 8–1: Basic Tab Fill-in Fields *(2 of 2)*

Field Name	Description	Mandatory?
Template	The name of the template file. It references the primary include file of the class.	No
Copy From Template	A template file to copy from. You can select the file on disk by clicking the file button.	No

Check the Replace existing files if exist option at the bottom of the Basic tab if you want to open these files in the AppBuilder once they have been created.

The Custom Files Tab

The Custom Files tab displays all of the custom files (hooks) that will be generated when the new class is created. Like the file and directory names in the Basic tab's fill-in fields, these filenames are automatically generated based on the class name that you supply, and thus are not filled until after you specify a class name. For example, specifying the class name mybrowser in the Basic tab produces the result in the Custom Files tab shown in Figure 8–5:

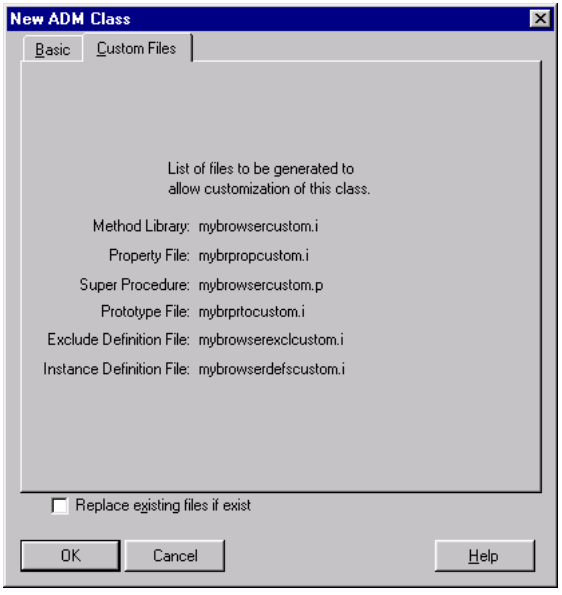


Figure 8–5: Custom Files Tab

The custom files allow you to modify and/or extend a class after it has been deployed, without altering the basic class itself. They are described in more detail in the "Custom Class Files" section.

Creating the Class Files

Once you supply all of the information required in the Basic tab, including specifying whether to open the files in the AppBuilder, you are almost ready to create the files.

Before you create them, however, you must decide whether the AppBuilder should replace files that already exist when it creates the class files. To specify this, either check or uncheck the Replace existing files if exist option at the bottom of the New ADM Class dialog box, as appropriate. You can now create the class by clicking OK. (To cancel the operation, click Cancel.)

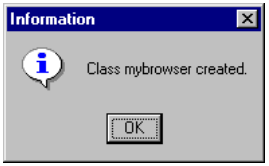
When the AppBuilder creates a new class, it generates these files:

- Class definition file: *class-name*.cld
- Primary include file: *prim-incl-file*.i
- Property file: *prop-file*.i
- Prototype file: *proto-file*.i
- Super procedure: *super-proc*.p
- Template: *template-file*.w (if specified in the Basic tab of the New ADM Class dialog box)
- Custom primary include file: *prim-incl-file*custom.i
- Custom property file: *prop-file*custom.i
- Custom prototype file: *proto-file*custom.i
- Custom super procedure: *super-proc*custom.p
- Custom exclude definition file: *class-name*exclcustom.i
- Custom instance definition file: *class-name*defscustom.i
- The r-code for the super procedures in the r-code directory.

You should already be familiar with the standard class files. For descriptions of the custom class files, see the "Adding Application Logic to Your New or Customized ADM Class" section.

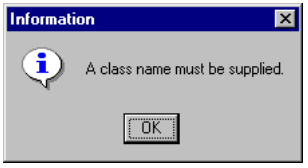
Warnings and Error Messages

When the AppBuilder attempts to create a new class, it uses validation controls to check whether pathnames and filenames are correct and whether files already exist. If it is successful in creating the class, the AppBuilder advises you of this as follows:

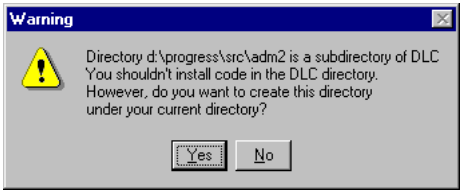


If the validation process fails, the AppBuilder displays a warning message and does not generate code. The rest of this section describes warnings and error messages that the AppBuilder might display.

Saving the Class Without a Class Name. If you attempt to save the class without providing a class name, the AppBuilder displays the following error message:

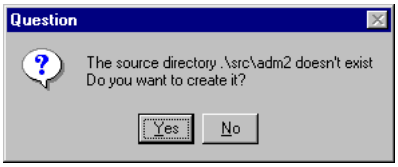


Generating Your Files Directly in the `%DLC%` Directory. Progress Software Corporation recommends that you do not install user-defined code in the `%DLC%` directory. If you try to do this, the AppBuilder displays the following warning message:



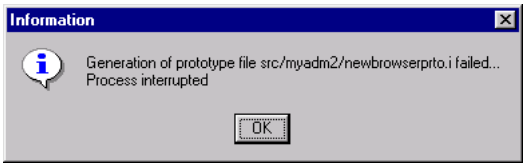
Note that the warning gives you the option of creating a similar directory structure in your working directory (that is, `\src\adm2`).

If you choose to do this, and any of the directories specified do not yet exist, you will be prompted to create them:



If you choose not to create the directory, the AppBuilder stops processing and does not generate files. You must provide a valid directory name and then try again.

File Generation Error. If an error occurs while the AppBuilder is generating class files, it displays a message and stops processing. For example:



Note that if the AppBuilder stops processing during file generation, it does not delete files that it has finished generating.

8.2.3 Modifying the New Class Files

After you create the class files for your new class, you modify the standard class files as required to provide behavior specific to your new class. You should already be familiar with the standard class files, which are described in detail in Chapter 1, "Overview."

You modify the standard class files by adding Progress 4GL code that supplies the application logic for the class' custom behavior. For details, see the "Adding Application Logic to Your New or Customized ADM Class" section. For an example of creating a new class, see the "Creating the myviewer Class" section.

8.3 Customizing an Existing ADM Class

The custom class files that are built into a particular ADM class provide a way for you to add modifications and/or extensions without altering its standard class files. Most of the custom class files share essentially the same structure as the corresponding standard class files. The custom files allow you to alter an existing ADM class by:

- Adding new properties
- Adding a new super procedure
- Adding new behaviors
- Replacing or removing existing behaviors
- Adding new prototype definitions
- Adding new instance properties

All of the standard class files located in the `%DLC%` directory under the `adm2` and `web2` subdirectories include custom hooks that allow their customization. Similarly, any new class that you create (or that is given to you) has these custom hooks built in.

For descriptions of the custom class files, as well as design rules and special notes on adding properties, see the "Adding Application Logic to Your New or Customized ADM Class" section. For an example of customizing an existing class, see the "Customizing the Visual Class" section.

8.4 Adding Application Logic to Your New or Customized ADM Class

Regardless of whether you are creating a new class or customizing an existing class, you must modify class files to provide the application logic for the new or customized class:

- If you are creating a new class, you modify the standard class files.
- If you are customizing an existing class, you modify the custom class files.

Although you are working on different sets of files, the process is very similar: you modify the standard class files with the same sorts of changes that you apply to the custom class files. This section describes the custom class files, then provides design rules and some special information on adding properties and writing super procedures. Note that you should read the custom class files section even if you are modifying standard files, since you modify them similarly.

For examples of both processes, see the "Examples" section.

8.4.1 Custom Class Files

The custom class files for a given ADM class are built into the class. These files contain a structure for the required application logic, as well as instructions for adding this code. The following list describes the custom class files, including for each file the filename format, the file type, and a discussion of the types of changes you can make with the file:

- Custom primary include file (filename: *prim-incl-file*custom.i). This include file is referenced in the standard primary include file. It contains the code to start the custom super procedure. This code is initially commented out; you must uncomment it manually once you have developed your custom super procedure. You can also use this file to initialize properties.

- Custom property file (filename:*prop-file*custom.i). This include file is referenced in the standard property include file. It allows you to extend the behavior of the class by defining new properties.

- Custom super procedure (filename: *super-proc*custom.p). This structured procedure file is referenced (instantiated) in the custom primary include file. It allows you to define internal functions and procedures to support new properties in the custom property file (that is, to define new behavior), and generally to extend or override the standard behavior of the class it belongs to:

  – To extend the standard behavior of a class, create a local version of a standard function that contains the statement SUPER( ) or procedure that contains the statement RUN SUPER, then add code lines before and/or after the RUN SUPER statement that provide additional behavior before and/or after the standard behavior.

  – To override a particular behavior, remove the standard behavior by defining an EXCLUDE–{*proc-or-func-name*} preprocessor value in the custom exclude definitions file for this class. This causes the removal of the corresponding procedure or function from the standard super procedure file. You then define in the custom super procedure a procedure or function of your own that has the same name as the procedure or function that you are overriding. (The custom exclude definitions file is described later in this section.) Be sure to include the RUN SUPER or SUPER( ) statement if the procedure or function that you are placing has it.

- Custom prototype file (filename: *proto-file*custom.i). This include file is referenced in the custom property include file. It allows you to define the function and procedure prototypes to match the internal entries of the custom super procedure. These prototypes allow an Open4GL client (for example, a Java client) to identify the entry points of the corresponding SmartObject.

- Custom exclude definition file (filename: *class-name*exclcustom.i). This include file is referenced in the standard super procedure file. It allows you to exclude procedures and/or functions by defining an EXCLUDE–{*proc-or-func-name*} preprocessor value. Each internal entry in a super procedure file is enclosed by special preprocessor code that checks for the existence of a corresponding EXCLUDE–{*proc-or-func-name*} preprocessor value and removes the procedure or function from the compilation. You typically exclude a procedure or function so that you can rewrite it in the custom super procedure. Note that the EXCLUDE mechanism is available not only for super procedures but also for any standard structured procedure created in the AppBuilder.

  Note that the standard class files do not contain a file corresponding to the custom exclude definition file.

- Custom instance definition file (filename:*class-name*defscustom.i). This include file is referenced in the standard property include file. It allows you to modify the list of instance properties for the class, usually by adding properties. You can also use it to change the Instance Property dialog itself, by specifying the filename of a different Instance Properties dialog box.

  Note that the standard class files do not contain a file corresponding to the custom instance definition file.

8.4.2 Design Rules

This section summarizes the design rules for constructing a new SmartObject that inherits from the new class that you created. These rules are fairly simple; follow them to assure the right application structure.

The design rules are:

- Each SmartObject type (template) includes a primary include file that, by convention, has the same name as the template but with a .i extension. For example, `viewer.w` includes `$DLC\src\adm2\viewer.i`.

- Each primary include file such as `viewer.i` includes its parent's support include file, plus its own property include file. For example, `viewer.i` includes `datavis.i`, because a SmartDataViewer is a visual object that displays data, and also `viewprop.i`, where the properties specific to SmartDataViewers are defined. It also starts the associated super procedure.

- Each super procedure file includes its own property include file. These nest in such a way as to define all of the object properties in the proper order.

  In addition, the presence of super procedures means that it is possible to run many internal procedures and user-defined functions in SmartObjects that are not actually present in those objects, but only in their super procedures.

- Each prototype file should include a prototype definition for each internal procedure and function that is implemented in a SmartObject's super procedures. The contents of the prototype file are implementation dependent, so it is initially empty. Use the AppBuilder's Pro*Tool ProtoGen to generate the prototype file based on your super procedure. For more information on the ProtoGen utility, see the online help.

Follow these rules when building a new SmartObject type, to ensure that all the relationships are established.

8.4.3 Adding Properties

When you extend the ADM, whether by creating a new class or by customizing an existing class, you define properties that support the special behavior of your class. If you are creating a new class, you define standard properties in the standard property file; if you are customizing an existing class, you define custom properties in the custom property file.

Within the relevant file, you define properties in the same way. The property definition section of these files appears near the end of the Main Block section of the file. It has the following format:

```
&IF "{&ADMSuper}":U = "":U &THEN
  ghADMProps:ADD-NEW-FIELD(prop-specs)
  ghADMProps:ADD-NEW-FIELD(prop-specs)
  ghADMProps:ADD-NEW-FIELD(prop-specs)
  .
  .
  .
&ENDIF
```

When adding properties to the property file for a new or customized class, consider defining any properties that will be accessed frequently and for which the best possible performance is important as direct access properties. Properties are stored in the ADMProps temp–table; *direct access properties* are accessed directly from the temp–table rather than using get/set functions. The lack of function-call overhead can significantly improve performance.

You specify that a property is a direct access property by defining a preprocessor constant of the form xp*propname* for it. The preprocessor constant definition section is in the Main Block of the property file, just before the property definition section. The definitions have this format:

```
&GLOBAL-DEFINE xppropname
```

Sometimes you might want to read or write a direct access property from outside its own class. However, the ADMProps temp–table can be accessed directly only from objects of its own class and super procedure. To work around this problem, you must define get and/or set functions (as needed) that can be called from outside the class but that internally access the required property directly. This special-purpose get function has the following format:

```
FUNCTION getpropname RETURNS LOGICAL
  ( ):
  DEFINE VARIABLE lpropname AS LOGICAL NO-UNDO.
   {get propname lpropname}.
   RETURN lpropname.
END FUNCTION.
```

Its companion set function has the following format:

```
FUNCTION setpropname RETURNS LOGICAL
 (pxvariable AS data-type):
  {set propname pxvariable}.
  RETURN TRUE.
END FUNCTION.
```

8.4.4 Writing Super Procedures

Another task that you perform when you extend the ADM, whether by creating a new class or by customizing an existing class, is writing super procedures; that is, adding to the super procedure file custom functions and/or internal procedures that support the special behavior of your class. If you are creating a new class, you do this for the standard super procedure file; if you are customizing an existing class, you do it for the custom super procedure file.

Two important points to keep in mind when writing any functions or internal procedures that go into an ADM super procedure are:

- The functions and internal procedures in an ADM super procedure must always refer to the procedure on whose behalf they run.
- An ADM super procedure is designed to be shared among all running instances of the SmartObjects that use that super procedure.

References in Super Procedures to Other Procedures

When you write the functions or internal procedures that go into an ADM super procedure, keep in mind that there is nothing about a super procedure that identifies it as a super procedure. It is simply a Progress procedure file that is run as a persistent procedure and then added as a super procedure to some other running procedure. The source code or compiled r-code for a super procedure contains nothing special that identifies it as a super procedure.

What is special about a super procedure is the style of the code within its functions and internal procedures, which must account for the fact that these entry points are run on behalf of some other procedure. ADM super procedures must therefore always refer to the procedure on whose behalf they run. The basic mechanism is the TARGET–PROCEDURE built-in function, which evaluates to the procedure handle of the procedure from which the entry point was originally invoked. The {get} and {set} include files, which provide a pseudo-syntax for getting and setting ADM properties, support this mechanism by always referring back to the TARGET–PROCEDURE, so you should always use {get} and {set} when writing property references in super procedures. In addition, these include files identify whether a given property can be accessed directly out of the ADMProps temp–table record in the TARGET–PROCEDURE or instead requires the execution of the actual get*propname* or set*propname* function. For detailed information on these property mechanisms, see the "{get} and {set} Pseudo-syntax for Object Properties" and "Get and Set Functions for Object Properties" sections in Chapter 5, "SmartObject Interactions."

For example, an internal procedure that operates on the RowObject buffer handle of its TARGET begins by retrieving that property value:

```
DEFINE VARIABLE hRowObject AS HANDLE NO-UNDO.
...
{get Rowobject hRowObject}.
```

Note that if you want to retrieve the value of a property from an object other than the TARGET–PROCEDURE, you can specify an optional final argument for the {get} and {set} include files that is the object's procedure handle. For example, the following code gets the value of the EnabledTables property from the Data–Source of the TARGET–PROCEDURE:

```
{get DataSource hSource}.
{get EnabledTables cTables hSource}.
```

You can also use the include file {fn} as a convenient way to invoke a function in TARGET–PROCEDURE; for example:

```
{fn openQuery}  /* invoke the openQuery function in my TARGET-PROCEDURE */
```

Similarly, the variant {fnarg} invokes a function that takes a single argument; for example:

```
{fnarg colValues pcViewColList}.  /* invoke the colValues function in my
                                     TARGET-PROCEDURE, and pass
                                  pcViewColList as the one input parameter. */
```

Shared Super Procedures

ADM super procedures are designed to be shared among all running instances of the SmartObjects that use that procedure.

NOTE: It is possible to create a super procedure that is intended to serve exactly one running procedure at a time, but this is not the correct design for super procedures that are part of the ADM class hierarchy and that are started in the standard way (that is, by running start–super–proc in the ADM include files).

Because ADM super procedures are shared, you must ensure that their code never assumes continuity between calls. If a particular operation involves executing two entry points in a super procedure, the code should not share property values between calls (whether by using local variables defined in the Definitions section or by using some other technique); instead, it should retrieve any property values that are needed at the top of each entry point. Although this might seem slightly inefficient, using {get} to retrieve a property value from the property temp–table compiles into a single in-line Progress 4GL ASSIGN statement and is quite fast. Using this technique assures that your super procedures can be shared among all running instances of your new class.

Likewise, because super procedures operate on behalf of other procedures, you must always PUBLISH events FROM TARGET–PROCEDURE. If you do not do this, your event will normally not have any effect, because the SmartObjects will not have subscribed to that event in the super procedure itself.

Also, when you invoke one entry point in a super procedure from another, you must preserve the value of TARGET–PROCEDURE in the called entry point. For example, suppose that your super procedure contains two procedures named ProcA and ProcB, and you want to run ProcB from ProcA in that super procedure. You have basically two choices, depending on whether ProcB is a PRIVATE internal procedure or function that should never be run from any other procedure, or an entry point that you might want to run or to override from its TARGET–PROCEDURE or some other procedure:

- If ProcB is a PRIVATE internal procedure or function, one that should never be run from any other procedure, ProcA can run ProcB directly. In this case, if ProcB must refer to the target procedure (to get a property value, for example):

  – TARGET–PROCEDURE must be passed as an input parameter to ProcB.

  – ProcB must not use {get} or {set} to access the property.

  This is because the value of TARGET–PROCEDURE inside ProcB will not be TARGET–PROCEDURE—it will be the super procedure's procedure handle, since it was executed directly from the super procedure. In such a case, it is normally better to pass any property values to ProcB from ProcA. The following examples, which illustrate code in ProcA, show two ways to do this:

  Example 1

```
…
RUN procB (INPUT TARGET-PROCEDURE).
…

procB:
DEFINE INPUT PARAMETER hTarget AS HANDLE NO-UNDO.
DEFINE VARIABLE cDisplayedFields AS CHARACTER NO-UNDO.
…
cDisplayedFields = dynamic-function('getDisplayedFields' in hTarget).
```

  Example 2

```
DEFINE VARIABLE cDisplayedFields AS CHARACTER NO-UNDO.
{get DisplayedFields cDisplayedFields}.
…
RUN procB (INPUT cDisplayedFields).
```

- If ProcB is an entry point that you might want to run or override from its TARGET–PROCEDURE or from some other procedure, ProcA should invoke ProcB IN TARGET–PROCEDURE even though they are located in the same super procedure. In this way, references to TARGET–PROCEDURE inside ProcB correctly evaluate to the handle of the SmartObject that caused ProcA to be invoked. (This also makes it possible to override ProcB in a SmartObject, if this is necessary and appropriate.) The following example, which illustrates code in ProcA, shows how to do this:

```
…
RUN procB IN TARGET-PROCEDURE.
…

procB:
DEFINE VARIABLE cDisplayedFields AS CHARACTER NO-UNDO.
{get DisplayedFields cDisplayedFields}.   /* This works because procB was
invoked in TARGET-PROCEDURE. */
```

8.5 Examples

This section provides two examples. The first illustrates creating a new class with the New ADM Class tool; the second illustrates customizing an existing class.

8.5.1 Creating the myviewer Class

The example in this section illustrates creating a new class based on the viewer class. The new class, called myviewer, will contain custom functionality that displays a warning message to an application user who wants to delete a record and allows the user to choose how to proceed. This functionality will be built into all SmartObjects based on this class.

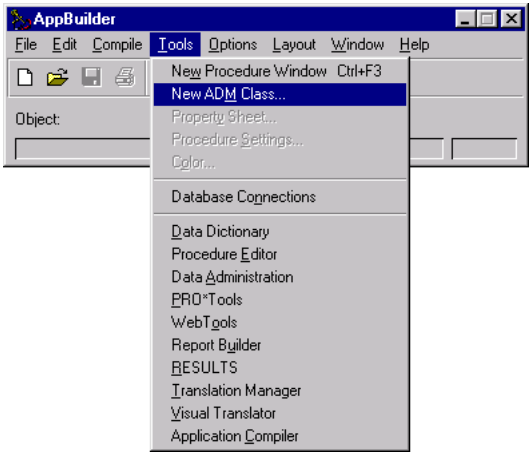
The following sections describe how to create the new myviewer class files, then modify them to create the new functionality.

NOTE: The example assumes that you installed Progress in the `D:\PROGRESS` directory.

Creating the myviewer Class Files

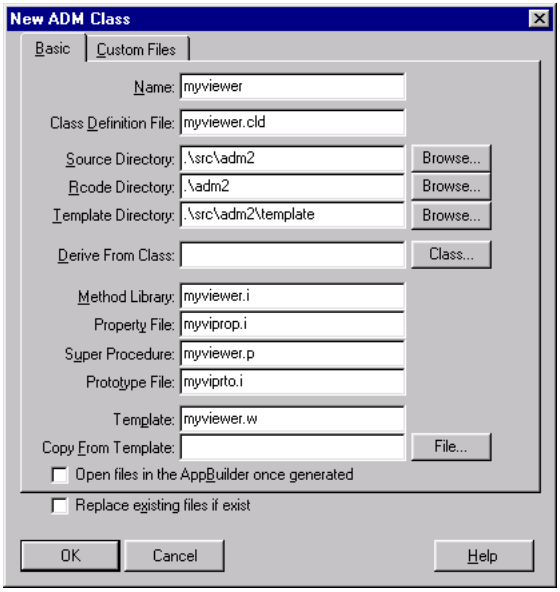
Follow these steps to create the myviewer class files:

1 ♦ From the AppBuilder main menu, choose the Tools→ New ADM Class... command:



The New ADM Class dialog box opens, with the Basic tab in front.

2 ♦ Type **myviewer**, the new class name, in the Name field:



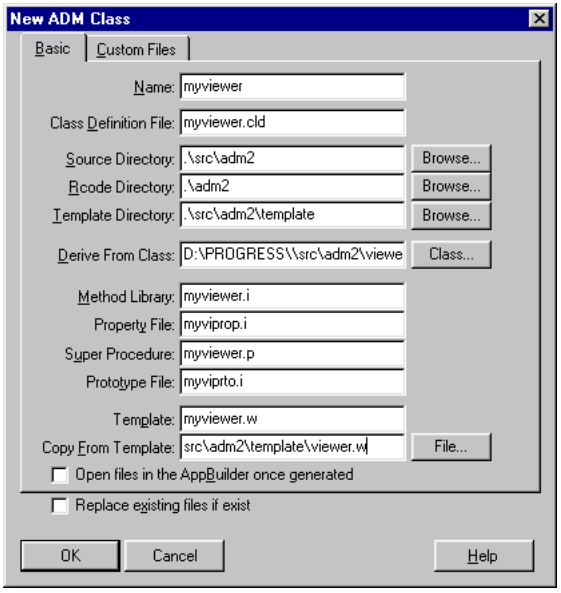
Note that when you type **myviewer**, the AppBuilder enters default directories in the directory fill-in fields and names based on **myviewer** in many of the filename fill-in fields; for example, `myviprop.i` for the property filename.

3 ♦ Select the class from which to derive the myviewer class:

a) Click on the Class button next to the Derive From Class field. In the Choose Class Definition dialog box that appears, you are placed by default in the `%DLC%\src\adm2` directory.

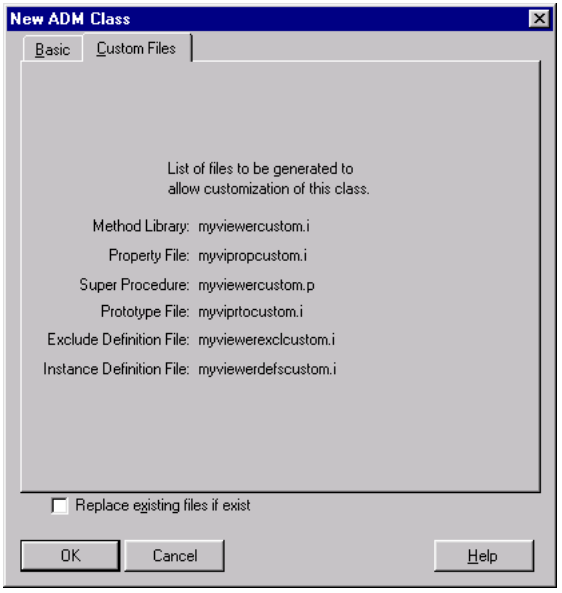
b) Select the `viewer.cld` class definition file in that directory, then choose Open.

The AppBuilder adds information to the New ADM Class dialog box:

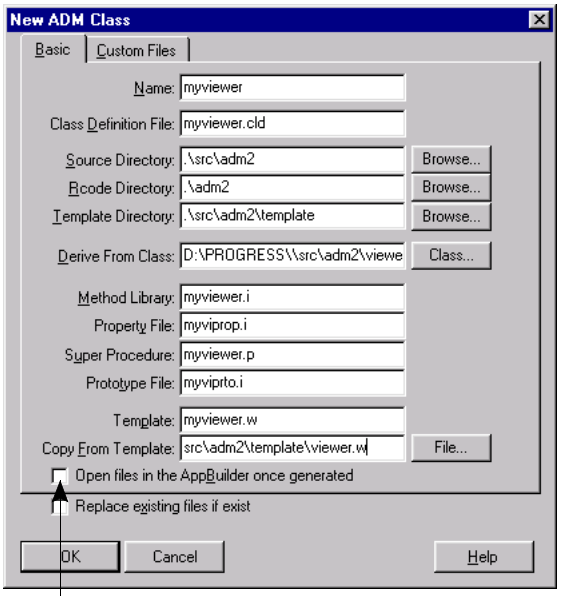


Note that the Derive From Class field now contains the `viewer.cld` class definition file. Note also that the Copy From Template field is automatically filled with the filename of the viewer template. This happens only because the class definition file contains a definition of this template; if it did not, this field would stay empty.

4 ♦ Click the Custom Files tab to note the custom class files that will be generated for the myviewer class:



5 ♦ Click the Basic tab, then click to check the Open files in the AppBuilder once generated check box at the bottom of this tab. This instructs the AppBuilder to open the primary include file, the property file, the super procedure file, and the prototype file after creating the class files:



Open files in the AppBuilder once generated check box

6 ♦ Press OK to create the files.

7 ♦ After the AppBuilder finishes creating the myviewer class files, close the primary include file (`myviewer.i`) and the prototype file (`myviprto.i`); these files do not need modification in this example.

Modifying the myviewer Standard Class Files

You use the following new code to implement the custom myviewer functionality: a DeleteMessage property, a setDeleteMessage function, and an override procedure for the standard ADM deleteRecord method. Adding this functionality requires changes only to the `myviprop.i` property file and the `myviewer.p` super procedure file, both of which should still be open in the AppBuilder.

Follow these steps in the AppBuilder to add the new functionality:

1 ♦ Define the new DeleteMessage property in the `myviprop.i` property file. To do this, go to the file's main block and add the code shown in bold typeface:

```
/* Include the file that defines prototypes for all of the super
     procedure's entry points.
    And skip including the prototypes if we are *any* super procedure. */
&IF "{&ADMSuper}":U EQ "":U &THEN
  {src/adm2/myviprto.i}
&ENDIF

  /* Put your xp{&Property} preprocessor definition here.
     Use the following format, e.g.,
     &GLOBAL-DEFINE xpMyProperty
     These preprocessors tell at compile time which properties can
     be retrieved directly from the temp-table */

     &GLOBAL-DEFINE xpDeleteMessage

  {src/adm2/viewprop.i}

&IF "{&ADMSuper}":U = "":U &THEN
  /* Put your property field definition here.
     Use the following syntax, e.g.,
     ghADMProps:ADD-NEW-FIELD('MyProperty':U, 'CHAR':U, ,'x(20)':U,
'Hi':U). */

     ghADMProps:ADD-NEW-FIELD('DeleteMessage':U, 'CHAR':U, 0, ?,
                         'Are you sure you want to delete this record?':U).
&ENDIF

  {src/adm2/custom/myvipropcustom.i}
```

When you finish making these changes, click on the Save button (the diskette icon) on the AppBuilder main window to save your changes, then close the property file window.

2 ♦ Create a new setDeleteMessage function in the `myviewer.p` super procedure file. This function allows you to set the new DeleteMessage property. To create the new function, add the code shown in **bold typeface:**

```
RETURNS LOGICAL
  ( INPUT pcDeleteMessage AS CHARACTER ) :
/*------------------------------------------------------------------
  Purpose:
    Notes:
  ------------------------------------------------------------------*/
  {set DeleteMessage pcDeleteMessage}.

  RETURN TRUE.   /* Function return value. */
END FUNCTION.
```

3 ♦ Create a new override procedure for the deleteRecord method in the `myviewer.p` super procedure file. This procedure displays an alert box when the deleteRecord method is invoked; this alert box prompts the user with a message that corresponds to the value of the new DeleteMessage property: if the user chooses Yes, the ADM deleteRecord executes, otherwise it returns without executing. To create the new override procedure, add the code shown in bold typeface:

```
/*------------------------------------------------------------------
  Purpose:
  Parameters:  <none>
  Notes:
--------------------------------------------------------------------*/
  DEFINE VARIABLE cDeleteMessage AS CHARACTER   NO-UNDO.

  {get DeleteMessage cDeleteMessage}.
  MESSAGE cDeleteMessage
    VIEW-AS ALERT-BOX QUESTION
    BUTTONS YES-NO
    UPDATE lAnswer AS LOGICAL.

  IF lAnswer THEN
    RUN SUPER.

END PROCEDURE.
```

When you finish making the changes in Steps 2 and 3, click on the Save button (the diskette icon) on the AppBuilder main window to save your changes, then close the super procedure file window. The AppBuilder now creates a `.r` version of the super procedure in the `src\adm2` directory under your working directory.

4 ♦ Enable the new super procedure file by moving the `.r` file from the `src\adm2` directory under your working directory into the `adm2` directory under your working directory.

NOTE: If you do not move the `.r` file into the `adm2` directory under your working directory, you will not be able to use the new super procedure.

5 ♦ Make the template for the myviewer class available on the New dialog box that appears when you choose File→ New from the AppBuilder menu. To do this:

a) Create a new `.cst` file and add to it the following code lines:

```
*NEW-SMARTOBJECT  SmartDataViewer Demo
NEW-TEMPLATE    src/adm2/template/myviewer.w
```

b) Put the .cst file into the `src\adm2\template` directory under your working directory.

c) Load the new .cst file by choosing Menu→ Use Custom… from the AppBuilder Palette window and adding the name of the new file to the list.

The new class, with its custom behavior, is now ready for use. Before you work with it, you should restart the AppBuilder to re-establish the super procedure stack.

8.5.2 Customizing the Visual Class

The example in this section illustrates customizing the visual class. The customization defines a special property that you can set to specify the background color for SmartObjects that inherit from this class (that is, all visual SmartObjects), thus standardizing the look of your Progress 4GL applications.

The following sections note which custom class files you need to provide, and describe how to modify them to create the new functionality.

Copying the Visual Custom Class Files

You customize an existing class by modifying the custom class files built into that class. For this example, you will modify a selected set of the visual custom class files. Note that you work on a copy of the required files in your working directory rather than in their installed location.

To prepare for customization, follow this step;

1 ♦ Copy the following files from the `%DLC%\src\adm2\custom` directory into the `src\adm2\custom` directory under your working directory:

- `vispropcustom.i`
- `visualcustom.p`
- `visualdefscustom.i`

Modifying the Visual Custom Class Files

You use the following new code to customize the visual class with the new functionality: a BgColor property, setBgColor and getBgColor functions, and an override procedure for the standard ADM initializeObject method. Adding this functionality requires changes to the `visualcustom.i` primary include file, the `vispropcustom.i` property file, the `visualcustom.p` super procedure file, and the `visualdefscustom.i` custom instance definition file, which you will copy and open as required.

Follow these steps in the AppBuilder to add the new functionality:

1 ♦ Define the BgColor property in the `vispropcustom.i` custom property file in your working directory) To do this, open the file, go to its main block, and add the code shown in bold typeface:

```
/* Include the file that defines prototypes for all of the super
     procedure's entry points.
    And skip including the prototypes if we are *any* super procedure. */
&IF "{&ADMSuper}":U EQ "":U &THEN
  {src/adm2/custom/visprtocustom.i}
&ENDIF

  &GLOB xpBgColor

&IF "{&ADMSuper}":U = "":U &THEN
  ghADMProps:ADD-NEW-FIELD('BgColor':U, 'INTEGER':U, 0, ?, 7).
&ENDIF

/* _UIB-CODE-BLOCK-END */
&ANALYZE-RESUME
```

When you finish making these changes, click on the Save button (the diskette icon) on the AppBuilder main window to save your changes, then close the property file window.

2 ♦ Create new setBgColor and getBgColor functions in the `visualcustom.p` super procedure file. These functions allows you to set and get the new Bgcolor property publicly. To create the new function, open the file, then add the code shown in bold typeface:

```
FUNCTION getBgColor RETURNS INTEGER
  ( /* parameter-definitions */ ) :
/*------------------------------------------------------------------
  Purpose:
  Notes:
------------------------------------------------------------------*/
  DEFINE VARIABLE iBgColor  AS INTEGER  NO-UNDO.

  {get BgColor iBgColor}.

  RETURN iBgColor.   /* Function return value. */

END FUNCTION.


FUNCTION setBgColor RETURNS LOGICAL
  ( INPUT piBgColor AS INTEGER ) :
/*------------------------------------------------------------------
  Purpose:
  Notes:
------------------------------------------------------------------*/
  {set BgColor piBgColor}.

  RETURN TRUE.   /* Function return value. */

END FUNCTION.
```

3 ♦ Create an override procedure for the initializeObject method in the `visualcustom.p` custom super procedure file in your working directory. This procedure gets the current value of the new BgColor property and sets the background color of container frame accordingly. To create the new override procedure, add the code shown in bold typeface:

```
PROCEDURE initializeObject :
/*------------------------------------------------------------------------
---------
  Purpose:
  Parameters:  <none>
  Notes:

------------------------------------------------------------------------
-----*/
  DEFINE VARIABLE hFrame    AS HANDLE   NO-UNDO.
  DEFINE VARIABLE iBgColor  AS INTEGER  NO-UNDO.

  {get ContainerHandle hFrame}.
  {get BgColor iBgColor}.

  RUN SUPER.
  /* Don't do anything in design mode */
  IF DYNAMIC-FUNCTION ('getUIBMode':U IN TARGET-PROCEDURE) NE "":U THEN
RETURN.

  IF hFrame:TYPE = "FRAME":U THEN
    hFrame:BGCOLOR = iBgColor.
  ELSE IF hFrame:TYPE = "WINDOW":U THEN
    ASSIGN
      hFrame = hFrame:FIRST-CHILD
      hFrame:BGCOLOR = iBgColor.

END PROCEDURE.
```

When you finish making the changes in Steps 2 and 3, click on the Save button (the diskette icon) on the AppBuilder main window to save your changes, then close the super procedure file window. The AppBuilder now creates a .r version of the super procedure in the `src\adm2` directory under your working directory.

4 ♦ Edit the `visualcustom.i` primary include file and uncomment the line that starts the custom super procedure. When you finish making this change, click on the Save button (the diskette icon) on the AppBuilder main window to save your change, then close the primary include file window.

5 ♦ Add the BgColor property to the list of instance properties and specify a filename for the instance property dialog in the `visualdefscustom.i` custom instance definition file in your working directory. To add the property and filename, open the file, then add the code shown in bold typeface:

```
/*------------------------------------------------------------------------
-----
  File        : visualdefscustom.i
  Purpose     : Entry point to define:
                   New definitions
                   {&xcInstanceProperties}
                   {&ADM-PROPERTY-DLG}
  Syntax      : {src/adm2/custom/visualdefscustom.i}
  Modified    : 06/03/1999

  Notes       : Referenced in {src/adm2/visprop.i}

------------------------------------------------------------------------
-*/
 &IF "{&xcInstanceProperties}":U NE "":U &THEN
   &GLOB xcInstanceProperties {&xcInstanceProperties},
 &ENDIF
  &GLOB xcInstanceProperties {&xcInstanceProperties} BgColor

 &GLOBAL-DEFINE ADM-PROPERTY-DLG adm2/support/myvisuald.w
```

Note that you have specified `adm2/support/visuald.w`—that is, the file `visuald.w` in the `adm2\support` directory under your working directory—as the instance property dialog box file. (Progress code is not sensitive to whether you use forward or reverse slashes in pathnames.) You will add support for this dialog box in the next step.

When you finish making these changes, click on the Save button (the diskette icon) on the AppBuilder main window to save your changes, then close the property file window.

6 ♦ Provide support for your new property in the instance property dialog box. In this example, the simplest approach is to copy the instance property dialog box for the visual class, `visuald.w`, from the `%DLC%\src\adm2\support` directory to the `src\adm2\support` directory under your working directory, then modify the copy as needed.

Alternatively, you can either modify the original `visuald.w` instance property dialog box in the `%DLC%\src\adm2\support` directory or create a completely new instance property dialog box that includes support for the new property (as well as for all other properties required by the class).

Regardless of which technique you use, you must be sure that the instance property dialog box filename matches the name that you specified in the custom instance definition file in your working directory. (See Step 5 .)

7 ♦ Enable the new super procedure file by moving the .r file from the `src\adm2` directory under your working directory into the `adm2` directory under your working directory.

NOTE: If you do not move the .r file into the `adm2` directory under your working directory, you will not be able to use the new super procedure.

The customized class, with its new property, is now ready for use. Before you work with it, you should restart the AppBuilder to re-establish the super procedure stack.

A

ADM Standard and Custom Class Files

All class files of a particular type have the same basic structure regardless of which class they support. For example, the standard property file for the viewer class has the same basic structure as the browser property file, though the specifics-for example, which properties are defined-are different.

This appendix shows the contents of the container class files, as a way of illustrating the basic structures of all class files. For specifics on other classes, see their class files in the following directories:

- Standard class files: `%DLC%\src\adm2`
- Template files: `%DLC%\src\adm2\template`
- Custom class files: `%DLC%\src\adm2\custom`

A.1 Container Class Files

The container class consists of a set of standard class files, three template files, and a set of custom class files. All ADM classes contain a parallel set of standard and custom class files; however, not all classes contain template files.

The following sections show the contents of the container class files, as well as one of its templates.

A.1.1 Standard Class Files

The container class has the following standard class files, located in the directory `%DLC%\src\adm2`:

- `containr.i`: primary include file
- `cntnprop.i`: property file
- `containr.p`: super procedure file
- `cntnprto.i`: prototype file

Following is the `containr.i` primary include file:

containr.i *(1 of 3)*

```
&ANALYZE-SUSPEND _VERSION-NUMBER AB_v9r12
&ANALYZE-RESUME
&ANALYZE-SUSPEND _UIB-CODE-BLOCK _CUSTOM _DEFINITIONS Method-Library
/*------------------------------------------------------------------------
    Library     : containr.i
    Purpose     : Default V9 Main Block code and Method Procedures
                  for ADM Container procedures.

    Syntax      : {src/adm2/containr.i}

    Modified    : May 19, 1999 Version 9.1A
----------------------------------------------------------------------*/
```

containr.i *(2 of 3)*

```
/***********************  DEFINITIONS  *********************************/

&IF "{&ADMClass}":U = "":U &THEN
  &GLOB ADMClass containr
&ENDIF

&IF "{&ADMClass}":U = "containr":U &THEN
  {src/adm2/cntnprop.i}
&ENDIF

/* _UIB-CODE-BLOCK-END */
&ANALYZE-RESUME

&ANALYZE-SUSPEND _UIB-PREPROCESSOR-BLOCK

/* ********************  Preprocessor Definitions  ******************** */

/* _UIB-PREPROCESSOR-BLOCK-END */
&ANALYZE-RESUME

/* ************************ Procedure Settings ************************ */

&ANALYZE-SUSPEND _PROCEDURE-SETTINGS
/* Settings for THIS-PROCEDURE
   Type: Method-Library
   Allow:
   Frames: 0
   Add Fields to: Neither
   Other Settings: INCLUDE-ONLY
 */
&ANALYZE-RESUME _END-PROCEDURE-SETTINGS

/* ***************************  Create Window  *************************** */

&ANALYZE-SUSPEND _CREATE-WINDOW
/* DESIGN Window definition (used by the UIB)
  CREATE WINDOW Method-Library ASSIGN
         HEIGHT             = 8
         WIDTH              = 60.
/* END WINDOW DEFINITION */

*/
```

containr.i *(3 of 3)*

```
&ANALYZE-RESUME

&ANALYZE-SUSPEND _UIB-CODE-BLOCK _CUSTOM _INCLUDED-LIB Method-Library

/* ************************ Included-Libraries ************************ */

{src/adm2/visual.i}

/* _UIB-CODE-BLOCK-END */
&ANALYZE-RESUME

&ANALYZE-SUSPEND _UIB-CODE-BLOCK _CUSTOM _MAIN-BLOCK Method-Library

/* ***************************  Main Block  *************************** */

  RUN start-super-proc("adm2/containr.p":U).

/* Best default for GUI applications - this will apply to the whole session: */
PAUSE 0 BEFORE-HIDE.

  /* _ADM-CODE-BLOCK-START _CUSTOM _INCLUDED-LIB-CUSTOM CUSTOM */
  {src/adm2/custom/containrcustom.i}
  /* _ADM-CODE-BLOCK-END */

/* _UIB-CODE-BLOCK-END */
&ANALYZE-RESUME
```

Following is the cntnprop.i property file:

cntnprop.i *(1 of 3)*

```
&ANALYZE-SUSPEND _VERSION-NUMBER UIB_v8r12
&ANALYZE-RESUME
&ANALYZE-SUSPEND _UIB-CODE-BLOCK _CUSTOM _DEFINITIONS Include
/*------------------------------------------------------------------------
    File        : cntnprop.i
    Purpose     : Starts containr.p super procedure and defines general
                  SmartContainer properties and other values.
    Syntax      : {src/adm2/cntnprop.i}

    Description :

    Modified    : May 19, 1999 Version 9.1A
  ----------------------------------------------------------------------*/
```

cntnprop.i *(2 of 3)*

```
/*          This .W file was created with the Progress UIB.             */
/*----------------------------------------------------------------------*/

/* ***************************  Definitions  ************************** */

  {src/adm2/custom/containrdefscustom.i}

/* _UIB-CODE-BLOCK-END */
&ANALYZE-RESUME

&ANALYZE-SUSPEND _UIB-PREPROCESSOR-BLOCK

/* ********************  Preprocessor Definitions  ******************** */

/* _UIB-PREPROCESSOR-BLOCK-END */
&ANALYZE-RESUME

/* ************************ Procedure Settings ************************ */

&ANALYZE-SUSPEND _PROCEDURE-SETTINGS
/* Settings for THIS-PROCEDURE
   Type: Include
   Allow:
   Frames: 0
   Add Fields to: Neither
   Other Settings: INCLUDE-ONLY
 */
&ANALYZE-RESUME _END-PROCEDURE-SETTINGS

/* ***************************  Create Window  ************************** */

&ANALYZE-SUSPEND _CREATE-WINDOW
/* DESIGN Window definition (used by the UIB)
  CREATE WINDOW Include ASSIGN
         HEIGHT             = 8
         WIDTH              = 60.
/* END WINDOW DEFINITION */

*/
&ANALYZE-RESUME

&ANALYZE-SUSPEND _UIB-CODE-BLOCK _CUSTOM _MAIN-BLOCK Include
```

cntnprop.i *(3 of 3)*

```
/* ***************************  Main Block  *************************** */

  /* Include the file which defines prototypes for all of the super
     procedure's entry points. Also, start or attach to the super procedure.
     Skip start-super-proc if we *are* the super procedure.
     And skip including the prototypes if we are *any* super procedure. */
&IF "{&ADMSuper}":U EQ "":U &THEN
  {src/adm2/cntnprto.i}
&ENDIF

  /* Preprocs to identify to compiler which properties are in the temp-table.*/
  &GLOB xpCurrentPage
  &GLOB xpContainerTarget
  &GLOB xpContainerTargetEvents
  &GLOB xpPageNTarget
  &GLOB xpPageSource
  &GLOB xpFilterSource
  &GLOB xpDataTarget
  &GLOB xpUpdateSource
  &GLOB xpUpdateTarget
  &GLOB xpStartPage
  &GLOB xpRunMultiple

  /* Now include the next-level-up property include file. This builds up
     the property temp-table definition,
     which we will then add our field definitions to. */
    {src/adm2/visprop.i}

&IF "{&ADMSuper}":U = "":U &THEN
  ghADMProps:ADD-NEW-FIELD('CurrentPage':U, 'INT':U, 0, ?, 0).
  ghADMProps:ADD-NEW-FIELD('ContainerTarget':U, 'CHAR':U, 0, ?, '':U).
  ghADMProps:ADD-NEW-FIELD('ContainerTargetEvents':U, 'CHAR':U, 0, ?,
    'exitObject':U).
  ghADMProps:ADD-NEW-FIELD('PageNTarget':U, 'CHAR':U, 0, ?, '':U).
  ghADMProps:ADD-NEW-FIELD('PageSource':U, 'HANDLE':U).
  ghADMProps:ADD-NEW-FIELD('FilterSource':U, 'HANDLE':U).
  ghADMProps:ADD-NEW-FIELD('DataTarget':U, 'CHAR':U, 0, ?, '':U).
  ghADMProps:ADD-NEW-FIELD('UpdateSource':U, 'HANDLE':U).
  ghADMProps:ADD-NEW-FIELD('UpdateTarget':U, 'CHAR':U, 0, ?, '':U).
  ghADMProps:ADD-NEW-FIELD('StartPage':U, 'INT':U, 0, ?, ?).
  ghADMProps:ADD-NEW-FIELD('RunMultiple':U, 'LOGICAL':U, 0, ?, NO).
&ENDIF

  {src/adm2/custom/cntnpropcustom.i}
/* _UIB-CODE-BLOCK-END */
&ANALYZE-RESUME
```

Following is an abridged version of the containr.p super procedure file (the complete file is quite long). The bold-typeface text in the figure indicates the material that has been removed:

containr.p *(1 of 5)*

```
&ANALYZE-SUSPEND _VERSION-NUMBER AB_v9r12
&ANALYZE-RESUME
&ANALYZE-SUSPEND _UIB-CODE-BLOCK _CUSTOM _DEFINITIONS Procedure
/*------------------------------------------------------------------------
    File        : containr.p
    Purpose     : Code common to all containers, including WIndows and Frames

    Syntax      : adm2/containr.p

    Modified    : July 22, 1999 Version 9.1A
  ----------------------------------------------------------------------*/
/*          This .W file was created with the Progress UIB.             */
/*----------------------------------------------------------------------*/

/* ***************************  Definitions  ************************** */

/* Tell cntnattr.i that this is the Super Procedure */
&SCOP ADMSuper containr.p

  {src/adm2/custom/containrexclcustom.i}

DEFINE VARIABLE giPrevPage AS INTEGER NO-UNDO.

/* _UIB-CODE-BLOCK-END */
&ANALYZE-RESUME

&ANALYZE-SUSPEND _UIB-PREPROCESSOR-BLOCK

/* ********************  Preprocessor Definitions  ******************** */

&Scoped-define PROCEDURE-TYPE Procedure
&Scoped-define DB-AWARE no

/* _UIB-PREPROCESSOR-BLOCK-END */
&ANALYZE-RESUME
```

containr.p *(2 of 5)*

```
/* ************************  Function Prototypes ********************** */

&IF DEFINED(EXCLUDE-getContainerTarget) = 0 &THEN

&ANALYZE-SUSPEND _UIB-CODE-BLOCK _FUNCTION-FORWARD getContainerTarget
Procedure
FUNCTION getContainerTarget RETURNS CHARACTER
  (  )  FORWARD.

/* _UIB-CODE-BLOCK-END */
&ANALYZE-RESUME

&ENDIF

.
.
.
[Similar prototypes for the following functions:
    getContainerTargetEvents    pageNTargets
    getCurrentPage              setContainerTarget
    getDataTarget               setDataTarget
    getFilterSource             setFilterSource
    getPageNTarget              setPageNTarget
    getPageSource               setPageSource
    getRunMultiple              setRunMultiple
    getUpdateSource             setUpdateSource
    getUpdateTarget             setUpdateTarget]
.
.
.

/* *********************** Procedure Settings ************************ */

&ANALYZE-SUSPEND _PROCEDURE-SETTINGS
/* Settings for THIS-PROCEDURE
   Type: Procedure
   Allow:
   Frames: 0
   Add Fields to: Neither
   Other Settings: CODE-ONLY COMPILE
 */
&ANALYZE-RESUME _END-PROCEDURE-SETTINGS
```

containr.p *(3 of 5)*

```
/* ************************  Create Window  ************************** */

&ANALYZE-SUSPEND _CREATE-WINDOW
/* DESIGN Window definition (used by the UIB)
  CREATE WINDOW Procedure ASSIGN
         HEIGHT             = 15
         WIDTH              = 60.
/* END WINDOW DEFINITION */
                                                                        */
&ANALYZE-RESUME

&ANALYZE-SUSPEND _UIB-CODE-BLOCK _CUSTOM _INCLUDED-LIB Procedure

/* ************************* Included-Libraries *********************** */

{src/adm2/cntnprop.i}

/* _UIB-CODE-BLOCK-END */
&ANALYZE-RESUME

&ANALYZE-SUSPEND _UIB-CODE-BLOCK _CUSTOM _MAIN-BLOCK Procedure

/* ***************************  Main Block  *************************** */

/* _UIB-CODE-BLOCK-END */
&ANALYZE-RESUME

/* ***********************  Internal Procedures  *********************** */

&IF DEFINED(EXCLUDE-assignPageProperty) = 0 &THEN

&ANALYZE-SUSPEND _UIB-CODE-BLOCK _PROCEDURE assignPageProperty Procedure
PROCEDURE assignPageProperty :
/*------------------------------------------------------------------------
  Purpose:  Sets the specified property in all objects on the CurrentPage of
            calling SmartContainer.
   Params:  INPUT pcProp AS CHARACTER -- property to set.
            INPUT pcValue AS CHARACTER -- value to assign to that property.
                This is specified in CHARACTER form but can be used to
                assign values to non-character properties.
    Notes:  This variation on assignLinkProperty is necessary because
            the notion of paging does not fit well with PUBLISH/SUBSCRIBE.
          All objects in a Container will subscribe to initializeObject, etc.,
             but the paging performs the operation on subsets of those objects
```

containr.p *(4 of 5)*

```
 at a time. That is, the container will not publish 'iniializeObject'
            to objects on a page other than zero until that page is first
            viewed.  So properties such as HideOnInit which are set as part
            of initialization must be set page-by-page.

------------------------------------------------------------------------------/

  DEFINE INPUT PARAMETER pcProp  AS CHARACTER NO-UNDO.
  DEFINE INPUT PARAMETER pcValue AS CHARACTER NO-UNDO.

  DEFINE VARIABLE iVar     AS INTEGER   NO-UNDO.
  DEFINE VARIABLE cObjects AS CHARACTER NO-UNDO.

  {get CurrentPage iVar}.
  cObjects = pageNTargets(TARGET-PROCEDURE, iVar).

  DO iVar = 1 TO NUM-ENTRIES(cObjects):
   dynamic-function("set":U + pcProp IN WIDGET-HANDLE(ENTRY(iVar, cObjects)),
      pcValue) NO-ERROR.
  END.

  RETURN.
END PROCEDURE.

/* _UIB-CODE-BLOCK-END */
&ANALYZE-RESUME

&ENDIF

.
.
.
[Similar code for the following procedures:
    changePage          initPages
    confirmExit         notifyPage
    constructObject     passThrough
    createObjects       removePageNTarget
    deletePage          selectPage
    initializeObject    viewObject
                        viewPage]
```

containr.p *(5 of 5)*

```
/* ************************  Function Implementations ***************** */

&IF DEFINED(EXCLUDE-getContainerTarget) = 0 &THEN

&ANALYZE-SUSPEND _UIB-CODE-BLOCK _FUNCTION getContainerTarget Procedure
FUNCTION getContainerTarget RETURNS CHARACTER
  (  ) :
/*------------------------------------------------------------------------------
  Purpose:  Returns a list of the handles of the object's contained objects.
   Params:  <none>
------------------------------------------------------------------------------/

  DEFINE VARIABLE cTarget AS CHARACTER NO-UNDO.
  {get ContainerTarget cTarget}.
  RETURN cTarget.

END FUNCTION.

/* _UIB-CODE-BLOCK-END */
&ANALYZE-RESUME

&ENDIF

[Similar code for the following functions:
    getContainerTargetEvents    pageNTargets
    getCurrentPage              setContainerTarget
    getDataTarget               setDataTarget
    getFilterSource             setFilterSource
    getPageNTarget              setPageNTarget
    getPageSource               setPageSource
    getRunMultiple              setRunMultiple
    getUpdateSource             setUpdateSource
    getUpdateTarget             setUpdateTarget]
```

Following is the cntnprto.i prototype file:

cntnprto.i *(1 of 3)*

```
/*
 * Prototype include file: C:\adm90\src\adm2\cntnprto.i
 * Created from procedure: C:\adm90\src\adm2\containr.p at 09:47 on 10/27/98
 * by the PROGRESS PRO*Tools Prototype Include File Generator
 */

/***** Start excluded prototypes

PROCEDURE viewPage IN SUPER:
  DEFINE INPUT PARAMETER piPageNum AS INTEGER.
END PROCEDURE.

PROCEDURE selectPage IN SUPER:
  DEFINE INPUT PARAMETER piPageNum AS INTEGER.
END PROCEDURE.

PROCEDURE removePageNTarget IN SUPER:
  DEFINE INPUT PARAMETER phTarget AS HANDLE.
  DEFINE INPUT PARAMETER piPage AS INTEGER.
END PROCEDURE.

PROCEDURE notifyPage IN SUPER:
  DEFINE INPUT PARAMETER pcProc AS CHARACTER.
END PROCEDURE.

PROCEDURE initPages IN SUPER:
  DEFINE INPUT PARAMETER pcPageList AS CHARACTER.
END PROCEDURE.

PROCEDURE initializeObject IN SUPER:
END PROCEDURE.

PROCEDURE deletePage IN SUPER:
  DEFINE INPUT PARAMETER piPageNum AS INTEGER.
END PROCEDURE.
```

cntnprto.i *(2 of 3)*

```
PROCEDURE createObjects IN SUPER:
END PROCEDURE.

PROCEDURE constructObject IN SUPER:
  DEFINE INPUT PARAMETER pcProcName AS CHARACTER.
  DEFINE INPUT PARAMETER phParent AS HANDLE.
  DEFINE INPUT PARAMETER pcPropList AS CHARACTER.
  DEFINE OUTPUT PARAMETER phObject AS HANDLE.
END PROCEDURE.

PROCEDURE confirmExit IN SUPER:
  DEFINE INPUT-OUTPUT PARAMETER plCancel AS LOGICAL.
END PROCEDURE.

PROCEDURE changePage IN SUPER:
END PROCEDURE.

PROCEDURE assignPageProperty IN SUPER:
  DEFINE INPUT PARAMETER pcProp AS CHARACTER.
  DEFINE INPUT PARAMETER pcValue AS CHARACTER.
END PROCEDURE.

PROCEDURE start-super-proc IN SUPER:
  DEFINE INPUT PARAMETER pcProcName AS CHARACTER.
END PROCEDURE.

FUNCTION getContainerTarget RETURNS CHARACTER IN SUPER.

FUNCTION getContainerTargetEvents RETURNS CHARACTER IN SUPER.

FUNCTION getDataTarget RETURNS CHARACTER IN SUPER.

FUNCTION getPageNTarget RETURNS CHARACTER IN SUPER.

FUNCTION getPageSource RETURNS HANDLE IN SUPER.

FUNCTION pageNTargets RETURNS CHARACTER
  (INPUT phTarget AS HANDLE,
   INPUT piPageNum AS INTEGER) IN SUPER.
```

cntnprto.i *(3 of 3)*

```
FUNCTION setContainerTarget RETURNS LOGICAL
  (INPUT pcObject AS CHARACTER) IN SUPER.

FUNCTION setDataTarget RETURNS LOGICAL
  (INPUT pcTarget AS CHARACTER) IN SUPER.

FUNCTION setPageNTarget RETURNS LOGICAL
  (INPUT pcObject AS CHARACTER) IN SUPER.

FUNCTION setPageSource RETURNS LOGICAL
  (INPUT phObject AS HANDLE) IN SUPER.

END excluded prototypes ********/

FUNCTION getCurrentPage RETURNS INTEGER IN SUPER.
```

A.1.2 Templates

The container class has the following templates, located in the directory `%DLC%\src\adm2\template`:

- `cntnrdlg.w`: dialog box template
- `cntnrfrm.w`: frame template
- `cntnrwin.w`: window template

Following is the cntnrfrm.w frame template (the other templates are similar):

Frame Template

cntnrfrm.w *(1 of 7)*

```
&ANALYZE-SUSPEND _VERSION-NUMBER AB_v9r12 GUI ADM2
/* Procedure Description
"ADM2 SmartFrame Object Template

Use this template to create a new frame which supports SmartObjects. Draw
your SmartObjects on this container and establish the appropriate SmartLinks
to connect them."
*/
&ANALYZE-RESUME
&Scoped-define WINDOW-NAME CURRENT-WINDOW
&ANALYZE-SUSPEND _UIB-CODE-BLOCK _CUSTOM _DEFINITIONS fFrameWin
/*------------------------------------------------------------------------

  File:

  Description: from cntnrfrm.w - ADM2 SmartFrame Template

  Input Parameters:
      <none>

  Output Parameters:
      <none>

------------------------------------------------------------------------*/
/*          This .W file was created with the Progress AppBuilder.      */
/*------------------------------------------------------------------------*/
```

cntnrfrm.w *(2 of 7)*

```
/* Create an unnamed pool to store all the widgets created
     by this procedure. This is a good default which assures
     that this procedure's triggers and internal procedures
     will execute in this procedure's storage, and that proper
     cleanup will occur on deletion of the procedure. */

CREATE WIDGET-POOL.

/* ***************************  Definitions  ************************** */

/* Parameters Definitions ---                                           */

/* Local Variable Definitions ---                                       */

/* _UIB-CODE-BLOCK-END */
&ANALYZE-RESUME

&ANALYZE-SUSPEND _UIB-PREPROCESSOR-BLOCK

/* ********************  Preprocessor Definitions  ******************** */

&Scoped-define PROCEDURE-TYPE SmartFrame
&Scoped-define DB-AWARE no

&Scoped-define ADM-CONTAINER FRAME

&Scoped-define ADM-SUPPORTED-LINKS
Data-Target,Data-Source,Page-Target,Update-Source,Update-Target

/* Name of first Frame and/or Browse and/or first Query                 */
&Scoped-define FRAME-NAME fMain

/* Custom List Definitions                                              */
/* List-1,List-2,List-3,List-4,List-5,List-6                            */

/* _UIB-PREPROCESSOR-BLOCK-END */
&ANALYZE-RESUME

/* ************************  Control Definitions  ********************** */
```

cntnrfrm.w *(3 of 7)*

```
/* ************************  Frame Definitions  *********************** */

DEFINE FRAME fMain
    WITH 1 DOWN NO-BOX KEEP-TAB-ORDER OVERLAY
         SIDE-LABELS NO-UNDERLINE THREE-D
         AT COL 1 ROW 1
         SIZE 79.86 BY 11.92.

/* *********************** Procedure Settings ************************ */

&ANALYZE-SUSPEND _PROCEDURE-SETTINGS
/* Settings for THIS-PROCEDURE
   Type: SmartFrame Template
   Allow: Basic,Browse,DB-Fields,Query,Smart
   Container Links:
Data-Target,Data-Source,Page-Target,Update-Source,Update-Target
   Other Settings: PERSISTENT-ONLY
 */

/* This procedure should always be RUN PERSISTENT.  Report the error,  */
/* then cleanup and return.                                            */
IF NOT THIS-PROCEDURE:PERSISTENT THEN DO:
  MESSAGE "{&FILE-NAME} should only be RUN PERSISTENT."
          VIEW-AS ALERT-BOX ERROR BUTTONS OK.
  RETURN.
END.

&ANALYZE-RESUME _END-PROCEDURE-SETTINGS

/* ***************************  Create Window  *************************** */

&ANALYZE-SUSPEND _CREATE-WINDOW
/* DESIGN Window definition (used by the UIB)
  CREATE WINDOW fFrameWin ASSIGN
         HEIGHT             = 11.91
         WIDTH              = 79.8.
/* END WINDOW DEFINITION */

*/
```

cntnrfrm.w *(4 of 7)*

```
&ANALYZE-RESUME
&ANALYZE-SUSPEND _UIB-CODE-BLOCK _XFTR "SmartFrameCues" fFrameWin _INLINE
/* Actions: adecomm/_so-cue.w ? adecomm/_so-cued.p ? adecomm/_so-cuew.p */
/* SmartFrame,ab,49268
A SmartFrame is a SmartContainer--a procedure object that serves as a
container for SmartObject instances.

A SmartFrame instantiates and initializes the SmartObject instances it
contains. At initialization, the SmartFrame sets the position of the
instances and links them together.

USING A SMARTFRAME

Step 1
Build your desired SmartObject masters, save, and close them.

Step 2
Draw instances of the SmartObject masters into the SmartFrame.

Step 3
Add all necessary SmartLinks between SmartObject instances.

Note: During assembly, the PROGRESS Advisor suggests links and creates
them for you. However, you can also add and remove SmartLinks with the
SmartLinks dialog box. To access this dialog, choose the Procedure button
from the UIB main window. Then choose the SmartLinks button from the
Procedure Settings dialog box.
*/
/* _UIB-CODE-BLOCK-END */
&ANALYZE-RESUME

&ANALYZE-SUSPEND _UIB-CODE-BLOCK _CUSTOM _INCLUDED-LIB fFrameWin

/* ************************ Included-Libraries ********************** */

{src/adm2/containr.i}

/* _UIB-CODE-BLOCK-END */
&ANALYZE-RESUME
```

cntnrfrm.w *(5 of 7)*

```
/* ***********  Runtime Attributes and AppBuilder Settings  *********** */

&ANALYZE-SUSPEND _RUN-TIME-ATTRIBUTES
/* SETTINGS FOR WINDOW fFrameWin
  VISIBLE,,RUN-PERSISTENT                                               */
/* SETTINGS FOR FRAME fMain
   NOT-VISIBLE                                                          */
ASSIGN
       FRAME fMain:HIDDEN           = TRUE.

/* _RUN-TIME-ATTRIBUTES-END */
&ANALYZE-RESUME

/* Setting information for Queries and Browse Widgets fields            */

&ANALYZE-SUSPEND _QUERY-BLOCK FRAME fMain
/* Query rebuild information for FRAME fMain
     _Options          = ""
     _Query            is NOT OPENED
*/  /* FRAME fMain */
&ANALYZE-RESUME

&ANALYZE-SUSPEND _UIB-CODE-BLOCK _CUSTOM _MAIN-BLOCK fFrameWin

/* ***************************  Main Block  *************************** */

&IF DEFINED(UIB_IS_RUNNING) <> 0 &THEN
   /* Now enable the interface  if in test mode - otherwise this happens when
      the object is explicitly initialized from its container. */
   RUN initializeObject.
&ENDIF

/* _UIB-CODE-BLOCK-END */
&ANALYZE-RESUME
```

cntnrfrm.w *(6 of 7)*

```
/* ***********************  Internal Procedures  *********************** */

&ANALYZE-SUSPEND _UIB-CODE-BLOCK _PROCEDURE adm-create-objects fFrameWin
_ADM-CREATE-OBJECTS
PROCEDURE adm-create-objects :
/*------------------------------------------------------------------------------
  Purpose:     Create handles for all SmartObjects used in this procedure.
               After SmartObjects are initialized, then SmartLinks are added.
  Parameters:  <none>
------------------------------------------------------------------------------*/

END PROCEDURE.

/* _UIB-CODE-BLOCK-END */
&ANALYZE-RESUME

&ANALYZE-SUSPEND _UIB-CODE-BLOCK _PROCEDURE disable_UI fFrameWin
_DEFAULT-DISABLE
PROCEDURE disable_UI :
/*------------------------------------------------------------------------------
  Purpose:     DISABLE the User Interface
  Parameters:  <none>
  Notes:       Here we clean-up the user-interface by deleting
               dynamic widgets we have created and/or hide
               frames.  This procedure is usually called when
               we are ready to "clean-up" after running.
------------------------------------------------------------------------------*/
  /* Hide all frames. */
  HIDE FRAME fMain.
  IF THIS-PROCEDURE:PERSISTENT THEN DELETE PROCEDURE THIS-PROCEDURE.
END PROCEDURE.

/* _UIB-CODE-BLOCK-END */
&ANALYZE-RESUME
```

cntnrfrm.w *(7 of 7)*

```
&ANALYZE-SUSPEND _UIB-CODE-BLOCK _PROCEDURE enable_UI fFrameWin
_DEFAULT-ENABLE
PROCEDURE enable_UI :
/*------------------------------------------------------------------------------
  Purpose:     ENABLE the User Interface
  Parameters:  <none>
  Notes:       Here we display/view/enable the widgets in the
               user-interface.  In addition, OPEN all queries
               associated with each FRAME and BROWSE.
               These statements here are based on the "Other
               Settings" section of the widget Property Sheets.
------------------------------------------------------------------------------*/
  {&OPEN-BROWSERS-IN-QUERY-fMain}
END PROCEDURE.

/* _UIB-CODE-BLOCK-END */
&ANALYZE-RESUME
```

A.1.3 Custom Class Files

The container class has the following custom class files, located in the directory `%DLC%\src\adm2\custom`:

- `containrcustom.i`: custom primary include file
- `cntnpropcustom.i`: custom property file
- `containrcustom.p`: custom super procedure file
- `cntnprtocustom.i`: custom prototype file
- `containrexclcustom.i`: custom exclude definition file
- `containrexclcustom.i`: custom instance definition file

Following is the containrcustom.i custom primary include file:

containrcustom.i *(1 of 2)*

```
&ANALYZE-SUSPEND _VERSION-NUMBER UIB_v9r12
&ANALYZE-RESUME
&ANALYZE-SUSPEND _UIB-CODE-BLOCK _CUSTOM _DEFINITIONS Include
/*------------------------------------------------------------------------
    File        : containrcustom.i
    Purpose     : References the start of the custom super procedure.
                  Allows properties initialization.

    Syntax      : {src/adm2/custom/containrcustom.i}

    Description :

    Created     : 06/03/1999
    Notes       : Referenced in {src/adm2/containr.i}
  ----------------------------------------------------------------------*/
/*          This .W file was created with the Progress AppBuilder.      */
/*----------------------------------------------------------------------*/

/* ***************************  Definitions  ************************** */

/* _UIB-CODE-BLOCK-END */
&ANALYZE-RESUME

&ANALYZE-SUSPEND _UIB-PREPROCESSOR-BLOCK
```

containrcustom.i *(2 of 2)*

```
/* ********************  Preprocessor Definitions  ******************** */

/* _UIB-PREPROCESSOR-BLOCK-END */
&ANALYZE-RESUME

/* ************************ Procedure Settings ************************ */

&ANALYZE-SUSPEND _PROCEDURE-SETTINGS
/* Settings for THIS-PROCEDURE
   Type: Include
   Allow:
   Frames: 0
   Add Fields to: Neither
   Other Settings: INCLUDE-ONLY
 */&ANALYZE-RESUME _END-PROCEDURE-SETTINGS

/* **************************  Create Window  ************************** */

&ANALYZE-SUSPEND _CREATE-WINDOW
/* DESIGN Window definition (used by the UIB)
  CREATE WINDOW Include ASSIGN
         HEIGHT             = 15
         WIDTH              = 60.
/* END WINDOW DEFINITION */

*/
&ANALYZE-RESUME

&ANALYZE-SUSPEND _UIB-CODE-BLOCK _CUSTOM _MAIN-BLOCK Include

/* ***************************  Main Block  *************************** */
/* Starts here the custom super procedure
   Uncomment to run it */

/*RUN start-super-proc ("adm2/custom/containrcustom.p":U).*/

/* _UIB-CODE-BLOCK-END */
&ANALYZE-RESUME
```

Following is the cntnpropcustom.i custom property file:

cntnpropcustom.i *(1 of 2)*

```
&ANALYZE-SUSPEND _VERSION-NUMBER UIB_v8r12
&ANALYZE-RESUME
&ANALYZE-SUSPEND _UIB-CODE-BLOCK _CUSTOM _DEFINITIONS Include
/*------------------------------------------------------------------------
    File        : cntnpropcustom.i
    Purpose     : Defines basic properties.
    Syntax      : {src/adm2/custom/cntnpropcustom.i}

    Description :

    Modified    : 06/03/1999
    Notes       : Referenced in {src/adm2/cntnprop.i}
  ----------------------------------------------------------------------*/
/*          This .W file was created with the Progress UIB.             */
/*----------------------------------------------------------------------*/

/* ***************************  Definitions  ************************** */

/* _UIB-CODE-BLOCK-END */
&ANALYZE-RESUME

&ANALYZE-SUSPEND _UIB-PREPROCESSOR-BLOCK

/* ********************  Preprocessor Definitions  ******************** */

/* _UIB-PREPROCESSOR-BLOCK-END */
&ANALYZE-RESUME

/* ************************ Procedure Settings ************************ */

&ANALYZE-SUSPEND _PROCEDURE-SETTINGS
/* Settings for THIS-PROCEDURE
   Type: Include
   Allow:
   Frames: 0
   Add Fields to: Neither
   Other Settings: INCLUDE-ONLY
 */
&ANALYZE-RESUME _END-PROCEDURE-SETTINGS
```

cntnpropcustom.i *(2 of 2)*

```
/* ********************  Preprocessor Definitions  ******************** */

/* _UIB-PREPROCESSOR-BLOCK-END */
&ANALYZE-RESUME

/* ************************ Procedure Settings ************************ */

&ANALYZE-SUSPEND _PROCEDURE-SETTINGS
/* Settings for THIS-PROCEDURE
   Type: Include
   Allow:
   Frames: 0
   Add Fields to: Neither
   Other Settings: INCLUDE-ONLY
 */&ANALYZE-RESUME _END-PROCEDURE-SETTINGS

/* ***************************  Create Window  *************************** */

&ANALYZE-SUSPEND _CREATE-WINDOW
/* DESIGN Window definition (used by the UIB)
  CREATE WINDOW Include ASSIGN
         HEIGHT             = 15
         WIDTH              = 60.
/* END WINDOW DEFINITION */

*/
&ANALYZE-RESUME

&ANALYZE-SUSPEND _UIB-CODE-BLOCK _CUSTOM _MAIN-BLOCK Include

/* ***************************  Main Block  *************************** */
/* Starts here the custom super procedure
   Uncomment to run it */

/*RUN start-super-proc ("adm2/custom/containrcustom.p":U).*/

/* _UIB-CODE-BLOCK-END */
&ANALYZE-RESUME
```

Following is the containrcustom.p custom super procedure file:

containrcustom.p *(1 of 2)*

```
&ANALYZE-SUSPEND _VERSION-NUMBER AB_v9r12
&ANALYZE-RESUME
&ANALYZE-SUSPEND _UIB-CODE-BLOCK _CUSTOM _DEFINITIONS Procedure
/*------------------------------------------------------------------------
    File        : containrcustom.p
    Purpose     : Super procedure to extend containr class.

    Syntax      : containrcustom.p

    Modified    : 06/03/1999
  ----------------------------------------------------------------------*/
/*          This .W file was created with the Progress UIB.             */
/*----------------------------------------------------------------------*/

/* ***************************  Definitions  ************************** */

&SCOPED-DEFINE ADMSuper containrcustom.p

/* _UIB-CODE-BLOCK-END */
&ANALYZE-RESUME

&ANALYZE-SUSPEND _UIB-PREPROCESSOR-BLOCK

/* ********************  Preprocessor Definitions  ******************** */

&Scoped-define PROCEDURE-TYPE Procedure
&Scoped-define DB-AWARE no

/* _UIB-PREPROCESSOR-BLOCK-END */
&ANALYZE-RESUME

/* ************************ Procedure Settings ************************ */

&ANALYZE-SUSPEND _PROCEDURE-SETTINGS
/* Settings for THIS-PROCEDURE
   Type: Procedure
   Allow:
   Frames: 0
   Add Fields to: Neither
```

containrcustom.p *(2 of 2)*

```
 Other Settings: CODE-ONLY COMPILE
 */
&ANALYZE-RESUME _END-PROCEDURE-SETTINGS

/* ************************  Create Window  ************************** */

&ANALYZE-SUSPEND _CREATE-WINDOW
/* DESIGN Window definition (used by the UIB)
  CREATE WINDOW Procedure ASSIGN
         HEIGHT             = 15
         WIDTH              = 60.
/* END WINDOW DEFINITION */

*/
&ANALYZE-RESUME

&ANALYZE-SUSPEND _UIB-CODE-BLOCK _CUSTOM _INCLUDED-LIB Procedure
/* ************************* Included-Libraries *********************** */

{src/adm2/cntnprop.i}

/* _UIB-CODE-BLOCK-END */
&ANALYZE-RESUME

&ANALYZE-SUSPEND _UIB-CODE-BLOCK _CUSTOM _MAIN-BLOCK Procedure

/* ***************************  Main Block  *************************** */

/* _UIB-CODE-BLOCK-END */
&ANALYZE-RESUME
```

Following is the cntnprtocustom.i custom prototype file:

cntnprtocustom.i

```
/*
 * Prototype include file: src/adm2/custom/cntnprtocustom.i
 * Created from procedure: src/adm2/custom/containrcustom.p at 20:11:24 on
06/03/1999
 * by the PROGRESS PRO*Tools Prototype Include File Generator
 */
```

Following is the containrexclcustom.i custom exclude definition file:

containrexclcustom.i

```
/*------------------------------------------------------------------------
    File        : containrexclcustom.i
    Purpose     : Defines EXCLUDE-xxx preprocessor variables to exclude
                  functions or internal procedures in the super procedure
                  where it is referenced.
    Syntax      : {src/adm2/custom/containrexclcustom.i}

    Modified    : 06/03/1999

    Notes       : Referenced in src/adm2/containr.p
  ----------------------------------------------------------------------*/
```

Following is the containrdefscustom.i custom instance definition file:

containrdefscustom.i

```
/*------------------------------------------------------------------------
    File        : containrdefscustom.i
    Purpose     : Entry point to define:
                    New definitions
                    {&xcInstanceProperties}
                    {&ADM-PROPERTY-DLG}
    Syntax      : {src/adm2/custom/containrdefscustom.i}

    Modified    : 06/03/1999

    Notes       : Referenced in {src/adm2/cntnprop.i}
  ----------------------------------------------------------------------*/
```

B

Version 8 to Version 9 Conversion Utility

The Conversion Utility converts Version 8.1 (and later) SmartObjects to Version 9 SmartObjects. This appendix describes how to use this utility.

NOTE: You cannot convert Version 8.0 SmartObjects directly to Version 9.0 SmartObjects. Instead, you must first convert them to Version 8.1/8.2 SmartObjects using the Version 8.0 to Version 8.1/8.2 SmartObject Conversion Utility. (You can elect to add the icon for this utility to the PRO*Tools palette.) You can then convert them to Version 9.0 SmartObjects as described in this appendix.

B.1 Conversion Support for Version 8.1/8.2 SmartObjects in Version 9

In Version 9, Progress provides a SmartObject Conversion Utility that aids in converting Version 8.1/8.2 objects to Version 9 objects. Because conversion is an optional activity (recompiled Version 8 SmartObjects will work in Version 9) rather than a required activity, you should carefully consider whether you have specific development or application needs that require you to convert objects. If you determine that you need to convert, make sure to devise a conversion strategy to accomplish your tasks, before beginning the conversion. At minimum, your conversion strategy should address how you will use the Conversion Utility and how you will test your final conversion results. Both aspects are critical to the conversion process.

CAUTION: If you have customized any part of the Version 8 ADM method libraries, added local procedures to SmartObjects, added code to a SmartObject instance, or made other customizations, Progress Software Corporation does not guarantee that converted code will work as it did in Version 8. In fact, the Conversion Utility cannot completely convert most SmartObjects due to the lack of necessary information: a fully functional Version 8 SmartViewer does not contain the information necessary to build a fully functional Version 9 SmartDataViewer, and the same is true for other SmartObjects.

Progress Software Corporation recommends that you use the Conversion Utility only as an aid, with the understanding that you will need to make manual adjustments to your customized SmartObject applications well beyond what the Conversion Utility provides. Note, in addition, that Progress Software Technical Support provides only general, high-level assistance for the conversion of SmartObject applications and does not provide code fixes. For detailed assistance with converting SmartObjects, contact Progress Software Consulting Services.

You can employ many different strategies to attempt your conversion activities. However, Progress Software Corporation recommends that as a first step, you consider converting one window and all its components. Controlling the conversion process in this way helps to identify any difficulties that you might encounter with your conversion attempts on a limited scale. This approach also helps to assess your approach to any subsequent conversions.

Testing is also a critical component of the conversion strategy. Progress Software Corporation recommends that you define a full complement of test routines to ensure that your conversion results meet your expectations.

Keep in mind that the Conversion Utility always requires supplemental human intervention to complete the conversion tasks. The utility does not support a one-for-one conversion of files, nor can it be completely effective in converting files; consequently, you must examine the results of your conversion attempts closely and, as described later in this section, take appropriate steps to facilitate the completion of the conversion process manually.

When you create an application, be aware that Version 8 and Version 9 objects cannot coexist in the same design window; at the window level, all objects must be of the same type. Therefore, if you previously created objects in Version 8 and now want to use them in Version 9 with Version 9 objects, you should consider attempting to convert your Version 8 objects and perform the necessary manual conversion-related tasks.

B.1.1 Code Changes to SmartObject Container Type Objects

All SmartObjects have include files that are built into their templates; for example `{src/adm2/containr.i}`. In Version 9, the ADM has similar include files, but they have different content and different names.

B.1.2 Additional Miscellaneous Points

The following points refer to SmartObject code in Smart Container files:

- Version 8 Smart Containers have procedures named row-available and send-records. These procedures do not appear in a Version 9 SmartObject because Version 9 SmartObjects pass values instead of records.
- The Version 8 procedure state–changed is not present in the Version 9 SmartObjects because of the new PUBLISH/SUBSCRIBE event model.
- Local–exit is replaced by exitObject.

B.2 Version 8 to Version 9 Conversion Utility

This section describes the Conversion Utility and explains how to use it to help convert Version 8 SmartObjects to Version 9 technology. Keep the following points in mind as you review this section:

- How you employ the Conversion Utility depends on your conversion strategy; for example, whether you attempt to convert all files at a single time, or choose to attempt only one directory and its related subdirectories at a time.
- Converting a file means that the file is processed by the Conversion Utility and an attempt is made to convert the file to the Version 9 format. However, the utility cannot convert all files successfully. You will need to examine your conversion attempts and results, and manually perform additional changes to complete the conversion process. How little or how much manual clean-up work is required for a given conversion attempt can vary; to determine this adequately, you must examine the results and perform test routines. For information about manual conversions, see the "Errors and the Conversion Utility Log File" and the "Customizing the Conversion Utility" sections.

This section discusses the following topics:

- Accessing the Conversion Utility
- Defining conversion options
- Building the list of files to process, including refining file selections
- Performing the conversion, including the conversion process and errors and the Conversion Utility log file
- Reviewing conversion results
- Additional file conversion changes
- Customizing the Conversion Utility

NOTE: Progress Software Corporation strongly advises you to back up all files before you perform any of the procedures described in this section.

B.2.1 Accessing the Conversion Utility

You access the Conversion Utility from the PRO*Tools Palette, by clicking on the SmartObject Upgrade Utility icon, as shown in Figure B–1:



Figure B–1: Version 8 to Version 9 Conversion Utility Icon

This opens the Version 8 to Version 9 SmartObject Conversion Utility window, as shown in Figure B–2:

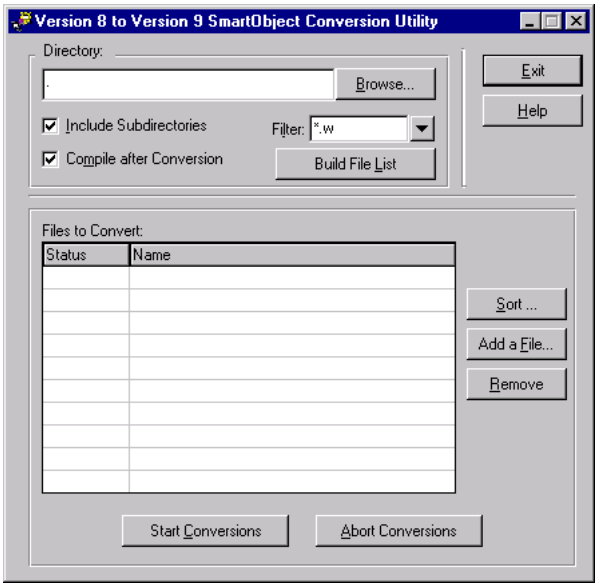


Figure B–2: Version 8 to Version 9 Conversion Utility Window

This window consists of two main sections: an upper portion that defines directory and conversion options and a lower portion that displays specific file information relative to the conversion process.

B.2.2 Defining Conversion Options

In the upper portion of the Conversion Utility window, you specify file directory information, file filter specifications, and conversion options:

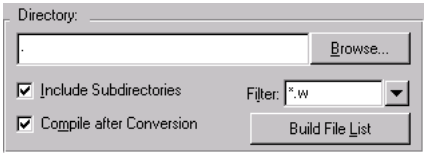


Table B–1 lists and describes the objects that you use to set conversion options, their default values, and the user-definable options for overriding the default values.

Table B–1: Setting Up File Conversion Options

Object[1]	Default Value	User-definable Options
Directory fill-in field	Current working directory	Any directory to which the user has read/write access.
Filter combo box	.w files	Any filter used to limit the files used. Other choices include *.w, *.*, or type in a set of filters.
Include Subdirectories check box	All files in all subdirectories (recursively) of the selected directory	Remove the checkmark to turn off this feature and enable only the files from the selected directory.
Compile after Conversion check box	Recompile all files after each conversion	Remove the checkmark to turn off this feature.

[1] The upper portion of this dialog box also contains a Build File List button. However, this button is not used to set conversion options and is therefore discussed in the "Building the List of Files to Process" section instead.

Follow these steps to set your conversion options:

1 ♦ In the Directory fill-in field, specify the directory of the application to be converted. The directory you choose to specify depends on your conversion strategy. For example, you might decide to convert an entire application, and therefore specify the root directory of the application. Alternatively, your strategy might be to specify only one directory at a time to convert.

NOTE: Any directory that you intend to convert should be either part of the PROPATH or a subdirectory of a PROPATH directory.

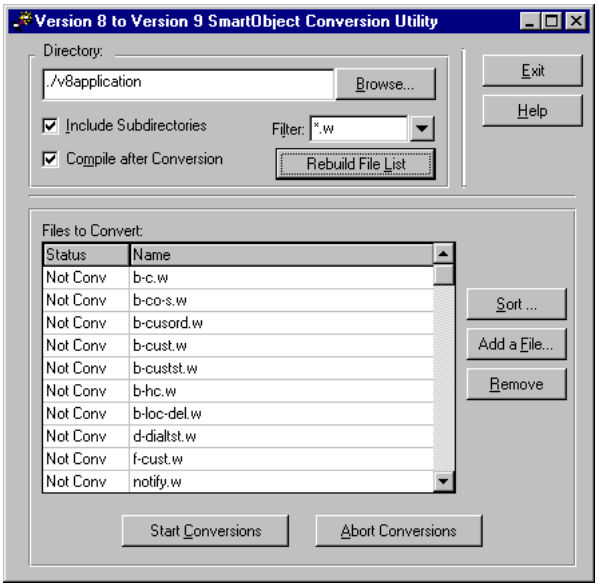
2 ♦ Using the Include Subdirectories check box, indicate whether to convert files in the subdirectories (or any subdirectories at any lower levels) of the directory identified in Step 1.

3 ♦ Using the Compile after Conversion check box, indicate whether to compile each file after the conversion attempt.

4 ♦ In the Filter combo box, specify the types of files to process. Typically, you convert only .w files. This is because you are converting Version 8 SmartObjects, which normally have the .w extension.

B.2.3 Building the List of Files to Process

In addition to the objects noted in the previous section, the upper portion of the Version 8 to Version 9 SmartObject Conversion Utility dialog box contains the Press the Build File List button. This button populates the browser located in the lower portion of the window according to the directory, filter, and conversion specifications you set, as described in the previous section. For example:



After you press this button, be sure to review the files that display before you begin the actual conversion. Note that the Files to Convert browser contains two display-only fields: Status and Name. The Status field identifies the current status of a file. (The status labels are described later in this section.) The Name field identifies the name of the file to be converted.

NOTE: The status Not Conv means that the file has not been processed since it was entered into the list.

The amount of time required for the build process varies according to the number of files being prepared. If the build process takes several minutes (a likely situation when loading thousands of files), the browse query is opened to display the first screen full of files, and an overlay frame appears to identify the current directory that is being loaded and the current number of files being loaded.

Table B–2 summarizes the various activities that you can perform based on the file information in the Files to Convert browser.

Table B–2: Files in the Browser

Current Status	Course of Action
No further file changes are required.	Continue with the information in this section and bypass the information in the "Refining the File Selections" section.
You need to modify (add or delete) files in the browser.	Go to the "Refining the File Selections" section and return to this section when the changes are complete.
You do not want to continue building the list of files to process for the options currently defined.	Modify the conversion options in the upper portion of the window and press the Rebuild File List button. This action implements the new options, discarding the browser's current file contents and repopulating it according to the new options.
You do not want to continue with the current list.	Press the Exit button.

NOTE: Once you press the Build File button, its text label changes from Build File List to Rebuild File List.

Refining the File Selections

Prior to converting, you can refine your file selection using any of the three additional options that are available by using the three buttons to the right of the browser. Table B–3 identifies these options and the functionality that they support.

Table B–3: Refining File Selection Actions

Button	Description
Sort...	Changes the displayed sort order of the files in the browser from the Sort Options dialog box. The Sort options are Status, Name, and Extension. The sort order also determines the order in which the files are processed.
Add a File...	Adds individual files, one at a time, to the browser from the System File dialog box. (This is the only way to add files once the list of files to process has been built.)
Remove	Removes one or more files from the browser. You select the files and then press the Remove button.

B.2.4 Performing the Conversion

Progress Software Corporation strongly recommends that before you attempt a conversion as described in this section, you make a backup copy of all source files. This backup copy should be separate from and in addition to the original source files that are saved into the V8–ADM directory structure as described in Step , later in this section.

Press the Start Conversions button to initiate file conversion according to the sort sequence that you have established. You can convert only files whose status is shown as Not Conv.

NOTE: The Conversion Utility does not require the AppBuilder to be running because the utility converts by parsing the code; the files are not loaded into the AppBuilder. However, the application databases should be connected.

The Conversion Process

The Conversion Utility executes by performing the following steps:

1. The utility moves the files from their current directory structure to a similar structure with a root name V8–ADM. V8–ADM is a subdirectory of the root directory originally defined in the Directory fill-in field in the upper portion of the utility window. Note that this structure will always be created. If it already exists, it will be overwritten.

   NOTE: As previously noted, it is essential that you make a backup copy of all source files before you attempt a conversion.

2. As each file is converted, the utility changes its status from Not Conv to ..., and concludes with *xxx*–changes.

3. If an error occurs during the conversion process, the utility displays an error alert box that identifies the problem and prompts you to either stop the process (that is, do not attempt to perform any more file conversions) or continue with more files. Regardless of your choice, the utility attempts to convert the file that caused the error and marks its code with an &MESSAGE statement. The statement indicates that a problem occurred during the conversion of the file and notes that the file must be adjusted manually. (Most files require some manual intervention after conversion.) This message displays each time you compile the file, flagging it as untrustworthy until you correct the problem manually.

4. Once the conversion is complete, the utility replaces each original file that was copied to the V8–ADM directory structure with the corresponding converted file.

NOTE: To abort conversion processing, press the Abort Conversions button. The Conversion Utility finishes processing only the current file, stopping before the next scheduled file.

The following figure shows how the Conversion Utility window might look once the conversion process is complete:

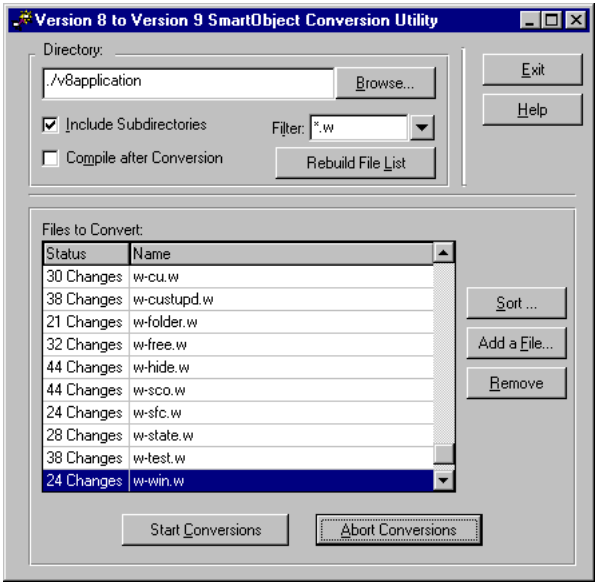


Table B–4 identifies and describes possible status labels in this window.

Table B–4: Conversion Status Labels Displayed in the Browser

Status	Description
No-change	The file has been converted, but no changes were made.
...	The conversion process is currently taking place.
xxx-changes	The file has been converted and some number of changes were made. (The *xxx* represents a numeric value that identifies how many conversion-related changes were made to a given file.)
Comp.Err.	After the conversion attempt, the compiler found some errors.
Version 9	The Conversion Utility determined that the file was either previously converted, or was built as a Version 9 file and therefore no conversion attempt was made.

Errors and the Conversion Utility Log File

The Conversion Utility cannot handle all coding styles and possible code constructs. These situations require manual intervention. To facilitate this, the utility generates a log file named `V89conv.log` in your working directory. This log identifies what procedures were converted, approximately how many changes were made to the file, whether the file was compiled, and if the compiler encountered errors. Also, if the Conversion Utility determines that it had difficulty converting a procedure, this log attempts to capture that information and report where the problem occurred. For information on modifying the Conversion Utility, see the "Customizing the Conversion Utility" section.

B.2.5 Reviewing Conversion Results

This section describes the specific changes that occur when converting Version 8 SmartObjects to Version 9 SmartObjects. The changes that it describes include Version 8 to Version 9 SmartObject conversions, specific ADM file-conversion changes, and additional conversion changes.

Table B–5 lists the Version 8 to Version 9 SmartObject file conversions that the Conversion Utility attempts to perform.

Table B–5: Version 8 to Version 9 SmartObject Conversions

Version 8 SmartObject	Corresponding Version 9 SmartObject
Version 8 SmartWindow	Version 9 SmartWindow
Version 8 SmartDialog	Version 9 SmartDialog
Version 8 SmartFrame	Version 9 SmartFrame
Version 8 SmartBrowser	Version 9 SmartDataBrowser
Version 8 SmartQuery	Version 9 SmartDataObject
Version 8 SmartViewer	Version 9 SmartDataViewer

Table B–6 identifies specific Version 8 to Version 9 file conversion changes.

Table B–6: Specific File Conversion Changes

For this element...	All...	Are...

RUN DISPATCH	`RUN dispatch [ IN hdl ]`
	`( [ INPUT ] 'proc' ).`
		Converted to:
		`RUN proc [ IN hdl ]`
		Or, if it is a local copy of itself:
		`RUN SUPER`

RUN NOTIFY	`RUN notify [ IN hdl ]`
	`( [ INPUT ] 'proc' ).`
		Converted to:
		`PUBLISH 'proc'`
		`[ FROM hdl ]`

GET–ATTRIBUTE	`RUN get-attribute`
	`[ IN hdl ]`
	`( [ INPUT ] )`
	`'attr').`
	`var=RETURN-VALUE.`
		Converted to:
		`var=[hdl:]getpropname ( ).`

SET–ATTRIBUTE–LIST	`RUN set-attribute-list`
	`( [ INPUT ]`
	`'attr1=val1,`
	`attr2=val2, ... ' ).`
		Replaced by:
		`{setpropname1 val1}`
		`{setpropname2 val2}`

NOTES: A variable that contains a list is not converted. You must write your own get and set property functions for any customized attributes.

Some common Version 8 ADM attribute names are automatically converted to the corresponding Version 9 ADM property names (for example, Current–Page to Current Page), based on entries in the file `protools/v89names.dat`. You can extend this list as described in the "Customizing the Conversion Utility" section.

This list identifies operations that the Conversion Utility performs for all converted files:

- Removes the following prefixes from procedures and procedure dispatches:
  - adm–
  - local–
  - broker–
  - Any custom prefix defined in the `protools/convt89.p` variable cCustomPrefix
- Replaces all strings found in the "++ Old Name" column of `protools/v89names.dat` file with the corresponding string in the "++ New Name" column.
- Removes all procedures and attribute references found in the `protools/v89names.dat` file "++ Remove List."
- Replaces local–exit procedures with exitObject procedures.
- Edits the ADM–SUPPORTED–LINKS preprocessor to reflect the Version 9 link types.
- When TABLES–IN–QUERY–... and ENABLED–TABLE–IN–QUERY... have more than one table, generates SECOND–TABLE–IN–QUERY–..., SECOND–ENABLED–TABLE–IN–QUERY ... preprocessors up to the TENTH–TABLE... .
- When converting a SmartViewer or SmartBrowser, generates an include file with a reasonably appropriate set of field definitions for the Version 9 SmartDataObject RowObject temp–table and flagged with an &MESSAGE statement to indicate that it should be replaced with an include file from an appropriate SmartDataObject.
- Removes external table definitions.
- If a procedure is dispatched inside of an instance of itself (for example, dispatching abc inside local–abc), converts this to RUN SUPER syntax.
- Converts Init–Object procedures to constructObject procedures. This includes the conversions of variable attributes to their new Version 9 names. For example, Layout becomes ObjectLayout, Edge–Pixels becomes EdgePixels, SmartPanelType becomes PanelType, Right–to–Left becomes RightToLeft, and so forth.
- Converts the procedure settings to the new Version 9 format. These new formats are required by the AppBuilder to re-establish the correct state when reading the `.w` file.

- Creates appropriate field definitions in the Runtime Attribute Settings when converting a Version 8 SmartQuery to a Version 9 SmartDataObject.
- Converts states based on the values of the cStateVals and cStateProps variables in the `_convt89.p` procedure.
- Removes the entire Method Library section and replaces it with the appropriate Version 9 include files based on the type of object to which it is being converted. The utility determines this by reading the Version 8 template type found in the Definitions section, as shown:

```
Description:  from VIEWER.W - Template for SmartViewer Objects
```

If the utility does not find this line, the SmartObject cannot be properly converted. Be sure to restore the line in the Definitions section before attempting the conversion.

If a SmartObject has Version 8 custom method libraries that you need to retain, you will need to re-insert them after the conversion. Generally, you will have to convert these custom method libraries, as they might not work in Version 9.

B.2.6 Customizing the Conversion Utility

This section identifies the Conversion Utility source code and describes why you might want to access it to make modifications.

The source code for the Conversion Utility is shipped with the tool. This code was written in the AppBuilder and should be maintained in the AppBuilder. The procedure `protools/convt89.p` performs the majority of the conversion tasks; it has no user interface. This procedure is called by the `protools/v89conv.w` dialog, which contains most of the Conversion Utility user interface. Much of the conversion process is table driven from the `protools/v89names.dat` file.

CAUTION: Carefully review the contents of the `protools/v89names.dat` file to ensure that you know how the Conversion Utility will change your code. You can edit this file to ensure that your customized code is not removed. For example, if you customized the state–changed internal procedure and do not want this procedure to be removed during the conversion, make the appropriate edit in the `protools/v89names.dat` file.

Generally, the Conversion Utility can fulfill most of the user's conversion needs. However, if you need to perform a few one-for-one substitutions, you can do this by creating more entries in the "++ Old Name ++New Name" section of the `protools/v89names.dat` file.

NOTE: Use caution when performing these one-for-one substitutions. The Conversion Utility checks each line of code in each of the files to be converted for each of these entries. Consequently, if you convert 1000 files and each file contains an average of 600 lines of code, each entry in this section causes 600,000 lookups.

The "++ Remove List" section of the `protools/v89names.dat` file lists several attributes and procedures that are used in Version 8 but are obsolete in Version 9. You can add to this list to remove occurrences of attributes and procedures that must be removed from the source files.

If you want to add or modify features in the Conversion Utility, you should study the code in `protools/convt89.p` and perform the changes. An easy change to make is to use custom prefixes (that is, prefixes other than adm- and local-) for your ADM1.1 methods. You should edit `protools/convt89.p` and initialize the variable cCustomPrefix with your own prefix. For example, if your prefix is ajax-, then you must give cCustomPrefix the initial value of ajax- (including the hyphen).

The "++ Method List" section contains four columns:

1. The first column contains the Version 8 method name.

2. The second column contains the name of the Version 9 equivalent.

3. The third column starts with a "P" if the method remains a procedure or an "FL" if it is converted to a function that returns a logical data type.

4. The fourth column contains parameter information for the method. It is a quoted string containing comma-delimited triplets, each of which includes the following components:

   a. The first component is the parameter name.

   b. The second component is the data type.

   c. The third component, which identifies the parameter type, is either "I" for INPUT, "O" for OUTPUT, or "I–O" for INPUT–OUTPUT.

   The triplets themselves are delimited by the vertical bar (|) character.

Index

A

Accessing
  properties 5–24
  SmartDataObjects from Java AppObjects 7–35
  SmartObjects 2–3

Add Multiple Records instance property 2–32

Add One Record instance property 2–32

Adding
  properties to ADM extensions 8–16
  SmartDataFields to SmartDataViewers 2–25, 2–28
  SmartObjects to SmartDataViewers 2–25

addMessage procedure 5–10

addQueryWhere( ) function 7–8

ADM 1–2
  advanced topics 6–1
  architecture 1–2
  business logic for applications 7–1
  class files 1–6
  classes 1–4, 8–2
  custom class files 1–8
  data management 4–1
  developing extensions 8–1
  directory and file structures 5–2
  properties 5–14
  standard class files 1–6
  templates 1–6, 1–8

ADM 2. *See* ADM

adm2 directory 5–2

ADMProps temp–table 5–15

Advanced ADM topics 6–1

AppBuilder
  interactions with 6–12
  modifying SmartDataObject masters 7–25

Application Development Model. *See* ADM

Application logic
  adding to new or customized ADM class 8–13

Applications
  business logic 7–1
  debugging 6–9
  monitoring 6–6
  SmartObject benefits 1–3

AppObjects. *See* Java AppObjects

Architecture, ADM 1–2

ASDivision property 7–33

ASHandle property 7–33

ASInfo property 7–33

assignQuerySelection( ) function 7–8

ASUsePrompt property 7–33

Audience xiii

B

Basic tab 8–7
  fill-in fields 8–8

Batch-mode operations 7–34

BEGINS instance property 2–42

Bold typeface
  as typographical convention xv

Browse instance property 2–38

Browse Keys instance property 2–57

Browse Label instance property 2–56

Browsing
  data 4–2, 4–4
  records 2–14

Business logic for applications 7–1

Buttons
  on SmartPanels 2–28

C

Calculate Width instance property 2–17

Cancel on Exit of Browse instance property 2–54

Check Current Changed instance property 2–9

Checking compatibility 4–5

Class files 1–6
  container class A–1
  creating 8–10
  custom 1–9, 8–14, A–21
  relationships among 5–6
  standard 1–7
  templates 1–8, A–14

Classes 1–2, 1–4, 8–2
  class files 1–6
  custom class files 1–8
  existing, customizing 8–3, 8–13
  hierarchical structure 1–5
  new, creating 8–3, 8–4
  standard class files 1–6
  templates 1–6, 1–8

Column instance property 2–43, 2–56

Column-level validation. *See* Field-level validation

columnQuerySelection( ) function 7–8

Columns
  getting and setting properties 7–12

Combo–box instance property 2–42

Commit instance property 2–48

Commit SmartLinks 3–3, 3–12
  events 3–12

Commit SmartPanels 2–29, 4–14

Committing multiple record updates 2–29

Compatibility checking 4–5
  signatures and field lists 4–6
  SmartDataBrowsers 4–6
  SmartDataViewers 4–7

Compiling SmartDataObjects conditionally 7–24

Connecting to SmartFilters in other Windows 4–11

Container class
  class files A–1
  custom class files A–21
  standard class files A–2
  templates A–14

Container SmartLinks 3–2, 3–5
  events 3–6

Container SmartObjects 2–5

CONTAINS instance property 2–42

Conversion Utility B–1

Creating
  class files 8–10
  new ADM classes 8–3, 8–4
    adding application logic 8–13
    example 8–22
    modifying class files 8–12
    New ADM Class tool 8–5
    planning issues 8–4
  SmartDataFields 2–27

CTRL–END trigger 2–20

CTRL–HOME trigger 2–20

Custom class files 1–8, 8–14, A–21

Custom exclude definition files 1–9, A–28

Custom Files tab 8–9

Custom instance definition files 1–9, A–28

Custom primary include files 1–9, A–22

Custom property files 1–9, A–24

Custom prototype files 1–9, A–27

Custom super procedures 1–9, A–26

Customizing
  application logic for ADM extensions 8–13
  existing ADM classes 8–3, 8–13
  SmartFilters 4–10
  SmartPanels 4–16
  SmartToolbars 4–18

D

Data
  browsing 4–2, 4–4
  committing multiple record updates 2–29
  displaying 4–2, 4–3
  filtering 2–35
  managing 4–1
  modifying records 2–28
  navigating records 2–28
  retrieving records 2–8
  signaling availability in queries 7–12
  transferring in queries 7–9
  updating records 2–28
  validation 7–14

Data Dictionary validation 2–25, 7–14

Data SmartLinks 3–3, 3–11, 7–13
  events 3–11
  retrieving records from multiple data sources 3–18
  using 3–19, 4–9

Data Source instance property 2–56

Data sources
  retrieving records 2–8
  triggers 7–22

Data Type instance property 2–56

Database records. *See* Records

Debugger
  Progress 6–9

Default instance property 2–38

Define Any Key Trigger on Field instance property 2–57

Defining SmartLinks 3–20
  dynamic 3–22
  static 3–20

Destroy on each stateless Web Request instance property 2–10

destroyObject procedure 5–10

Dialog boxes 2–7
  instance property
    dynamic SmartDataBrowser 2–16
    Navigation SmartPanel 2–30
    Simple SmartObject 2–60
    SmartDataField 2–27
    SmartDataObject 2–9
    SmartDataViewer 2–24
    SmartFilter 2–37
    SmartFolder 2–34
    SmartSelect 2–51
    SmartToolbar 2–46
    Update SmartPanel 2–31
  New ADM Class 8–6

Direct access properties 8–17

Directories
  ADM 5–2
  adm2 5–2
  support 5–2
  template 5–2

Disconnect AppServer on each Web Request instance property 2–10

Display Field instance property 2–52

Display instance property 2–53

Displaying
  data 4–2, 4–3
  fields 2–25, 2–35
  records 2–14, 2–23

Distributed environments
  managing SmartDataObjects 7–28
  running SmartDataObjects 7–23

Down instance property 2–17

Dynamic properties 5–25

Dynamic SmartDataBrowsers 2–19
  compared to static SmartDataBrowsers 2–18
  instance properties 2–16
  instance property dialog box 2–16
  setting field properties 2–22

E

Edge Pixels instance property 2–31, 2–32

Edit Browse Columns instance property 2–53

Edit displayed field list instance property 2–16

Edit enabled field list instance property 2–16

Edit Field List instance property 2–38

Enable instance property 2–17, 2–18, 2–24, 2–53

Encapsulation 1–10

END trigger 2–20

Error handling 7–11

Error messages
  displaying descriptions xxiii
  New ADM Class tool 8–11

Event on change instance property 2–53, 2–58

Events
  Commit SmartLink 3–12
  Container SmartLink 3–6
  Data SmartLink 3–11
  GroupAssign SmartLink 3–10
  Navigation SmartLink 3–7
  Page SmartLink 3–8
  procedures and functions 7–7
  TableIO SmartLink 3–9
  writing local functions 6–6
  writing local procedures 6–5

Example procedures xx

Exclude definition files
  custom 1–9, 8–15

Exit Browser on Default Action instance property 2–53

Explicit instance property 2–39, 2–40

Extensions, ADM
  adding properties 8–16
  design rules 8–15
  developing 8–1
  writing super procedures 8–18

External Field instance property 2–52

External procedures 1–16

F

Field lists 4–6

Field-level validation 7–15

Fields
  displaying 2–25, 2–35

Fields instance property 2–38

Files
  class 1–6
  container class A–1
  custom class 1–8, 8–14
  get include 5–21
  primary include 5–2
  property 5–5
  prototype 5–5
  set include 5–21
  SmartDataObject deployment 7–29
  standard class 1–6
  super procedure 5–3
  templates 1–8

Filter instance property 2–48, 2–52

Filter SmartLinks 2–44, 3–3, 3–12

Filter Target instance property 2–38

Filtering
  data 2–35
  records 4–10

'First' on Left instance property 2–31

'First' on Right instance property 2–31

Font instance property 2–34

Force to Stateful Operating Mode
instance property 2–9

Foreign key fields
initializing 4–4

Format instance property 2–56

Frame SmartObjects 2–7

Functions 1–16
event 6–6, 7–7
running 5–9

G

Get functions 5–19

Get include files
logic 5–21
using in Progress code 5–22

{get} pseudo-syntax 5–20

Getting column properties 7–12

GroupAssign SmartLinks 3–3, 3–10
events 3–10
using 6–14

H

Height instance property 2–56

Help
Progress messages xxiii

Help ID instance property 2–39, 2–56

HOME trigger 2–20

I

Implicit instance property 2–39

Include files 1–8
See also Files

initializeObject procedure 5–10

Initializing
foreign-key fields 4–4
SmartDataObjects 7–27

Initiating update operations 7–11

Inline instance property 2–41

Inner Lines instance property 2–55

Insert instance property 2–34

Instance definition files
custom 1–9, 8–15

Instance properties 2–4, 5–23
Add Multiple Records 2–32
Add One Record 2–32
BEGINS 2–42
Browse 2–38
Browse Keys 2–57
Browse Label 2–56
Calculate Width 2–17
Cancel on Exit of Browse 2–54
Check Current Changed 2–9
Column 2–43, 2–56
Combo–box 2–42
Commit 2–48
CONTAINS 2–42
Data Source 2–56
Data Type 2–56
Default 2–38
Define Any Key Trigger on Field 2–57
Destroy on each stateless Web Request 2–10

Disconnect AppServer on each Web Request 2–10
Display 2–53
Display Field 2–52
Down 2–17
Edge Pixels 2–31, 2–32
Edit Browse Columns 2–53
Edit displayed field list 2–16
Edit enabled field list 2–16
Edit Field List 2–38
Enable 2–17, 2–18, 2–24, 2–53
Event on change 2–53, 2–58
Exit Browser on Default Action 2–53
Explicit 2–39, 2–40
External Field 2–52
Fields 2–38
Filter 2–48, 2–52
Filter Target 2–38
'First' on Left 2–31
'First' on Right 2–31
Font 2–34
Force to Stateful Operating Mode 2–9
Format 2–56
Height 2–56
Help ID 2–39, 2–56
Implicit 2–39
Inline 2–41
Inner Lines 2–55
Insert 2–34
Instance Properties 2–52
Key 2–57
Key Field 2–52
Label 2–38, 2–56
Layout 2–17, 2–18, 2–24
Max Width 2–17
Menu 2–47
Navigation 2–48
No Value 2–54
Number of Lines in Editors 2–43
Optional 2–54
Partition 2–9
Radio–set 2–42
Range 2–40
Rebuild Dataset on Reposition 2–9
Remove 2–34
Reposition Data Source 2–54
Row 2–56
Rows To Batch 2–9
Save 2–32
Search Field 2–16
Show Border 2–31, 2–32, 2–47
SmartDataObject 2–52
Sort 2–53
Tab Labels 2–34
Tableio 2–48
Target 2–38
Toolbar 2–47
Tooltip 2–39, 2–56
Update 2–32
Use Fixed Tabs 2–34
View 2–17, 2–18, 2–24, 2–43
View as range fields 2–39
View–as 2–55
Width 2–34, 2–38, 2–56
Width of Character Fields 2–43
Width of Other Fields 2–43

Instance Properties instance property 2–52

Instance property dialog boxes
dynamic SmartDataBrowser 2–16
Navigation SmartPanel 2–30
simple SmartObject 2–60
SmartDataField 2–27
SmartDataObject 2–9
SmartDataViewer 2–24
SmartFilter 2–37
SmartFolder 2–34
SmartSelect 2–51
SmartToolbar 2–46
Update SmartPanel 2–31

Instantiating SmartObjects 1–14

Interactions among SmartObjects 5–1

Internal procedures 1–16
running 5–9

Italic typeface
as typographical convention xv

J

Java AppObjects 7–35

K

Key Field instance property 2–52

Key instance property 2–57

Keys
  foreign 4–4

Keystrokes xv

L

Label instance property 2–38, 2–56

Layout instance property 2–17, 2–18, 2–24

Links. *See* Pass-through links, SmartLinks

Localizing SmartObject behavior 5–11

Locking records 4–19

M

Managing data 4–1

Manipulating database queries dynamically 7–7

Manual
  syntax notation xvi

Manual, organization of xiii

Masters 1–11, 1–13
  interactions with super procedures 5–4
  SmartDataObject
    AppBuilder modifications 7–25
    compiling conditionally 7–24

Max Width instance property 2–17

Menu instance property 2–47

Messages
  displaying descriptions xxiii

Methods 1–16
  See also Functions, Internal procedures

Modifying
  class files 8–12
  records 2–28

Modifying SmartToolbars 2–49

Monitoring SmartObject applications 6–6

Monospaced typeface
  as typographical convention xv

N

Navigating database records 2–28

Navigation instance property 2–48

Navigation SmartLinks 3–2, 3–7
  events 3–7

Navigation SmartPanels 2–28, 4–12
  instance property dialog box 2–30

New ADM Class tool 8–5
creating class files 8–10
dialog box
Basic tab 8–7
Custom Files tab 8–9
warnings and error messages 8–11

No Value instance property 2–54

NO–ASSIGN property 2–20

Number of Lines in Editors instance property 2–43

O

Object classes
See Classes

OFF–END
event, scrolling a query's result set 2–21
trigger 2–20

OFF–HOME
event, scrolling a query's result set 2–21
trigger 2–20

Opening database queries 7–7

Operating modes for SmartDataObjects 7–32

Optional instance property 2–54

P

Page 0 in SmartFolders 2–35

Page SmartLinks 3–3, 3–8
events 3–8

PageN SmartLinks 3–3, 3–8

Pages
selecting in a SmartContainer 2–33

Paging 2–6

Parameterizing SmartObject instances 6–2

Partition instance properties 2–9

Pass-through links 2–6, 2–44, 3–14, 3–15, 3–17
diagram 3–14
inner and outer connections 3–17
setting up 3–15

Primary include files 5–2
container class A–2
custom 1–9, 8–14
standard 1–7

PRO*Spy for Version 9 6–10

PRO*Tools
PRO*Spy for Version 9 6–10
Procedure Object Viewer 6–6

Procedure Object Viewer 6–6
starting 6–7
viewing objects 6–8

Procedures
See also Super procedures
event 7–7
event, writing local 6–5
examples of xx
external 1–16
internal 1–16
maintained by AppBuilder 2–4
monitoring 6–6
top-level 1–14
tracking 6–6
viewing procedure objects 6–8

Properties 1–2, 1–16, 5–14
See also Instance properties
accessing 5–24
adding to ADM extensions 8–16
ADMProps temp-table 5–15
ASDivision 7–33
ASHandle 7–33
ASInfo 7–33
ASUsePrompt 7–33
columns, getting and setting 7–12
direct access 8–17
dynamic 5–25
field, setting for dynamic SmartDataBrowsers 2–22
get and set functions 5–19
{get} and {set} pseudo-syntax 5–20
instance 5–23
NO-–ASSIGN 2–20
SearchField 2–22
special 5–22
translatable 5–23
USE-DICT-EXPS 2–25

Property files 5–5
container class A–4
custom 1–9, 8–14
standard 1–7

Prototype files 5–5
container class A–12
custom 1–9, 8–14
standard 1–7

PUBLISH statement 3–4, 3–13

Q

Queries 7–3
manipulating dynamically 7–7
opening 7–7
signaling data availability 7–12
transferring data 7–9

R

Radio–set instance property 2–42

Range instance property control 2–40

Rebuild Dataset on Reposition instance property 2–9

Record-level validation 7–16

Records
browsing 2–14
committing multiple updates 2–29
displaying 2–14, 2–23
filtering 4–10
locking 4–19
modifying 2–28
navigating 2–28
retrieving 2–8, 3–18
updating 2–14, 2–23, 2–28, 7–3

Remove instance property 2–34

removeQuerySelection( ) function 7–8

Reposition Data Source instance property 2–54

Resizing SmartPanels 2–32

Retrieving records
from databases 2–8
from multiple data sources 3–18

Row instance property 2–56

ROW–ENTRY trigger 2–20

ROW–LEAVE trigger 2–20

RowObject temp-table 4–2

Rows To Batch instance properties 2–9

RUN statement 5–9

Running
  internal procedures and functions 5–9
  SmartDataObjects 7–33
    batch-mode 7–34
    single-row 7–34

S

Save instance property 2–32

Scrolling a query's result set 2–21

SCROLL–NOTIFY trigger 2–20

Search Field instance property 2–16

SearchField property 2–22

Selecting pages in a SmartContainer 2–33

Set functions 5–19

Set include files
  logic 5–21
  using in Progress code 5–22

{set} pseudo-syntax 5–20

setQuerySort( ) function 7–8

setQueryWhere( ) function 7–9

Setting properties
  column 7–12
  field, dynamic
    SmartDataBrowsers 2–22

Setting up pass-through links 3–15

Show Border instance property 2–31, 2–32, 2–47

Signaling data availability in queries 7–12

Signatures 4–6

Simple SmartObjects 1–12, 2–60
  instance property dialog box 2–60

Single-row operations 7–34

SmartContainers 1–11, 2–4
  See also SmartDataViewers, SmartDialogs, SmartFrames, SmartWindows
  contained objects 2–5
  paging 2–6
  pass-through links 2–6
  selecting pages 2–33

SmartDataBrowsers 1–11, 2–14
  browsing data 4–4
  compatibility checking 4–6
  dynamic 2–19
  dynamic and static compared 2–18
  files 2–14
  instance property dialog box 2–16
  multiple selection 2–22
  static 2–19
  triggers 2–20
  usage notes 2–20

SmartDataFields 1–11, 2–25
  adding to SmartDataViewers 2–25, 2–28
  creating 2–27
  files 2–26
  instance property dialog box 2–27
  usage notes 2–27

SmartDataObject instance property 2–52

SmartDataObjects 1–11, 2–8, 2–25
  accessing data 4–2
  accessing from Java AppObjects 7–35
  AppBuilder modifications to masters 7–25
  AppServer-related properties 7–33
  conditional compilation 7–24

deployment files 7–29
features 7–2
files 2–8
in distributed environments 7–23
initializing 7–27
instance properties 2–9
instance property dialog box 2–9
managing in distributed mode 7–28
operating modes 7–32
running from a non-Progress client 7–33
service choices 7–30

SmartDataViewers 1–11, 2–23
adding SmartDataFields 2–25, 2–28
adding SmartObjects 2–25
compatibility checking 4–7
displaying data 4–3
files 2–23
instance properties 2–24
instance property dialog box 2–24

SmartDialogs 1–11, 2–7
files 2–7

SmartFilters 1–11, 2–35, 4–10
connecting to in other SmartWindows 4–11
customizing 4–10
files 2–36
instance properties 2–37
instance property dialog box 2–37
usage notes 2–44

SmartFolders 1–12, 2–33
files 2–33
instance properties 2–34
instance property dialog box 2–34
Page 0 2–35
usage notes 2–35

SmartFrames 1–11, 2–7
files 2–7

SmartLinks 1–2, 1–15, 3–1
See also Pass-through links
Commit 3–12
Container 3–5
Data 3–11
defining 3–20
dynamic, defining 3–22
Filter 2–44, 3–12
GroupAssign 3–10, 6–14
invoking behavior in linked 3–13
Navigation 3–7
overview 3–2
Page 3–8
PageN 3–8
source and target objects 3–4
static, defining 3–20
TableIO 3–9
types 3–2
Update 3–11

SmartObjects
accessing 2–3
adding to SmartDataViewers 2–25
AppBuilder requirements 6–12
application benefits 1–2
class file relationships 5–6
contained 2–4
Data SmartLinks 7–13
design rules 8–15
include files 1–11
instance properties 2–4
instantiating 1–14
interactions 5–1
life cycle 1–12
localizing standard behavior 5–11
masters 1–11, 1–13
monitoring applications 6–6
parameterizing instances 6–2
properties 1–16
simple 2–60
structure 5–2
summary 2–2
super procedures 1–11
templates 1–11, 1–13
top-level procedure 1–14
types 1–11, 2–2
Update SmartLinks 7–13

SmartPanels 1–12, 2–28
as toolbars 2–32, 2–49
Commit 2–29
customizing 4–16
files 2–29
instance properties 2–31, 2–32
instance property dialog box 2–30, 2–31
Navigation 2–28
resizing 2–32
Update 2–28
usage notes 2–32
using 4–12

SmartSelects 1–12, 2–50
files 2–50
instance properties 2–51
instance property dialog box 2–51
usage notes 2–58

SmartToolbars 1–12, 2–45
customizing 4–18
files 2–45
instance property controls 2–46
instance property dialog box 2–46
modifying 2–49
usage notes 2–49
using 4–17

SmartWindows 1–11, 2–6
files 2–6

Sort instance property 2–53

Source objects 3–4

SOURCE–PROCEDURE function 1–19

Standard class files 1–6
container class A–2

Starting super procedures 5–8

Starting the Procedure Object Viewer 6–7

State-aware operating mode 7–32

Stateless operating mode 7–32

State-reset operating mode 7–32

Static SmartDataBrowsers 2–19
compared to dynamic SmartDataBrowsers 2–18
instance properties 2–18

SUBSCRIBE statement 3–4, 3–13

Super procedures 1–2, 1–18, 5–3
container class A–7
custom 1–9, 8–14
interactions with masters 5–4
localizing standard behavior 5–11
standard 1–7
starting 5–8
writing for ADM extensions 8–18

support directory 5–2

Support include files
See primary include files

Syntax notation xvi

T

Tab Labels instance property 2–34

Tableio instance property 2–48

TableIO SmartLinks 3–2, 3–9
events 3–9

Target instance property 2–38

Target objects 3–4

TARGET–PROCEDURE function 1–19

template directory 5–2

Templates 1–6, 1–8, 1–11, 1–13
container class A–14
frame A–15

Temp–tables
ADMProps 5–15
RowObject 4–2

Toolbar instance property 2–47

Toolbars 2–45
SmartPanels 2–32, 2–49

Tooltip instance property 2–39, 2–56

Top-level procedures 1–14

Transaction-level validation 7–19

Transactions 4–19

Transfering data in database queries 7–9

Translatable properties 5–23

Triggers
database 7–22
SmartDataBrowser 2–20

Typographical conventions xv

U

Update instance property 2–32

Update SmartLinks 3–3, 3–11, 7–13

Update SmartPanels 2–28, 4–13
instance property dialog box 2–31

Updating records 2–14, 2–23, 2–28, 7–3
initiating 7–11

Use Fixed Tabs instance property 2–34

USE-DICT-EXPS property 2–25

Using
Data SmartLinks 3–19, 4–9
GroupAssign SmartLinks 6–14
SmartPanels 4–12
SmartToolbars 4–17

V

Validating data 7–14
Data Dictionary 2–25, 7–14
fields 7–15
records 7–16
transactions 7–19

VALUE–CHANGED trigger 2–20

View as range fields instance property 2–39

View instance property 2–17, 2–18, 2–24, 2–43

View–as instance property 2–55

Viewing procedure objects 6–8

W

Warnings
New ADM Class tool 8–11

Width instance property 2–34, 2–38, 2–56

Width of Character Fields instance property 2–43

Width of Other Fields instance property 2–43

Window SmartObjects 2–6

Writing
local event functions 6–6
local event procedures 6–5
super procedures for ADM extensions 8–18