Application Designer

Custom Controls

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Preface

This documentation provides information on how to develop your own custom controls. It is organized under the following headings:

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1 Overview

This documentation provides information on the Application Designer control concept. It is recommended that you first become familiar with the “normal development” of screens inside Application Designer.

When do you need custom controls? In general there are two cases:

1. You want to combine existing controls to form complex controls with a certain dedicated task. Maybe you want to define an “address area” control which consists of a certain arrangement of fields and labels that form an address. This kind of building controls is called “composing controls” in this documentation - you take what is available and group it into certain units.
2. You want to create new controls - maybe you need some special kind of icon with a certain behavior.

While case 1 does not require to deal with JavaScript and HTML, case 2 requires knowledge of JavaScript and HTML and the use of the JavaScript library functions that are available via the Application Designer framework.

Due to the usage of XML as the layout definition format and due to an open interface for integrating control definitions into the page generation process of Application Designer, the Application Designer control concept is a flexible and open framework. Actually, all Application Designer controls are following the framework - there is no “special way” or “shortcut” that is internally used.

The first concept is the definition of controls, that is, control tags with certain attributes which you can integrate via a tag library concept into layout definitions. The second concept is the binding of the control to server-side adapter properties. Following the strict Application Designer architecture - that the GUI is a reflection of a “net data”/“model data”, dynamic controls have to transfer their data at runtime to/from adapter properties. This binding concept is important:

- On the one hand, you want newly created controls to reference the adapter properties/methods.

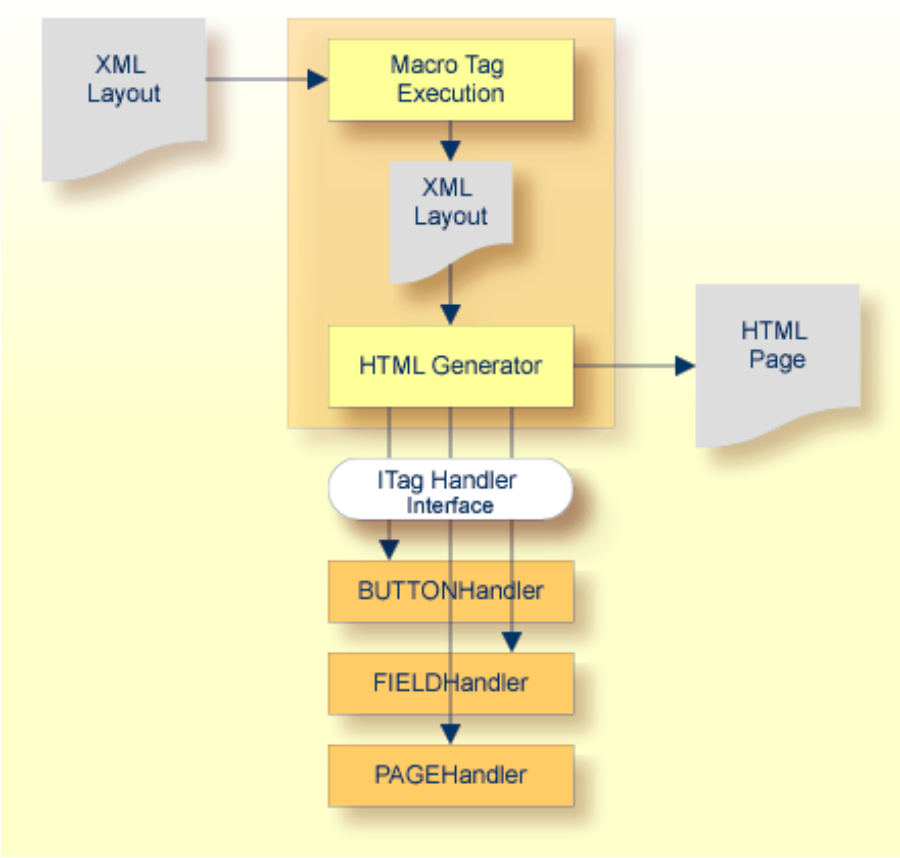
- On the other hand, you want to compose controls (for example, an address area) and want to bind them to complex objects (e.g. an address object) on the server side - already providing for a set of data and methods that fit to the control and provide some server side logic.

See *Binding between Page and Adapter* in the *Special Development Topics* for detailed information, especially about the hierarchical name binding concept (access path).

2 Control Concept

Page Generation

The page generation is the process of transferring an XML layout definition into an HTML/JavaScript page. It is automatically executed inside the Layout Painter when previewing a layout. It can also be called from outside.



A generator program (`com.softwareag.cis.gui.generate.HTMLGenerator`) is receiving a string which contains the XML layout definition. The generator program parses this string with a SAX parser and as a consequence processes the string tag by tag.

The generation of HTML pages is done in two steps:

- **Macro Execution**
  First, each tag of the XML layout is checked if it is a so-called “macro tag”. A macro tag is a tag which does not produce HTML output itself but which itself produces XML tags. Imagine a control rendering an address input: this control is using existing controls in order to create some defined output area representing an address. The HTML is not produced by the address control directly - the address control internally creates other controls (such as fields or buttons) which themselves produce corresponding HTML code.

The execution of macro tags is recursively done until no macro tag is contained in the XML layout anymore; that is, macro tags themselves can internally use macro tags.

- **HTML Generation**
  After having executed the macros, the rendering of HTML is started: for each tag, the renderer creates one object of a tag handler class, that it finds via library definitions and naming conventions.

  Each tag handler is called via a defined interface (`com.softwareag.cis.gui.generate.ITagHandler`) and is invited to take part in the generation process. It gets all the tag data including the attributes from the layout definition and it gets the HTML string “on the right” and is allowed to append own information into this HTML string.

A tag handler instance is called at three different points of time by the generator:

- when the tag is starting (for example, the generator finds "<page…>"),
- when the tag is closing (for example, the generator finds "</page>"),
- when the generator creates a defined JavaScript method which is called at runtime in the browser when the page is loaded.

It is now the task of the tag handler to create HTML/JavaScript statements at the right point of time.

Tag Handlers and Macro Tag Handlers

The following topics are covered below:

Macro Tag Handlers (IMacroTagHandler)

The interface `com.softwareag.cis.gui.generate.IMacroTagHandler` contains two methods which represent the different points of time when the generator calls the tag handler during the macro execution phase.

```
package com.softwareag.cis.gui.generate;

import org.xml.sax.AttributeList;
import com.softwareag.cis.gui.protocol.ProtocolItem;

public interface IMacroTagHandler
{
    public void generateXMLForStartTag(String tagName,
                                       AttributeList attrlist,
                                       StringBuffer sb,
                                       ProtocolItem pi);
    public void generateXMlForEndTag(String tagName,
                                     StringBuffer sb);
}
```

Detailed information about the methods can be found inside the Javadoc documentation which is part of your Application Designer installation. See also *Developing Java Extensions* in the *Ajax Developer* documentation.

Tag Handlers (ITagHandler)

The interface `com.softwareag.cis.gui.generate-ITagHandler` contains three methods that represent the different points of time when the generator calls a tag handler during the HTML generation phase.

```
package com.softwareag.cis.gui.generate;

import org.xml.sax.AttributeList;
import com.softwareag.cis.gui.protocol.*;

public interface ITagHandler
{
    public void generateHTMLForStartTag(int id,
                                        String tagName,
                                        AttributeList attrlist,
                                        ITagHandler[] handlersAbove,
                                        StringBuffer sb,
                                        ProtocolItem protocolItem);

    public void generateHTMLForEndTag(String tagName,
                                      StringBuffer sb);

    public void generateJavaScriptForInit(int id,
                                          String tagName,
                                          StringBuffer sb);
}
```

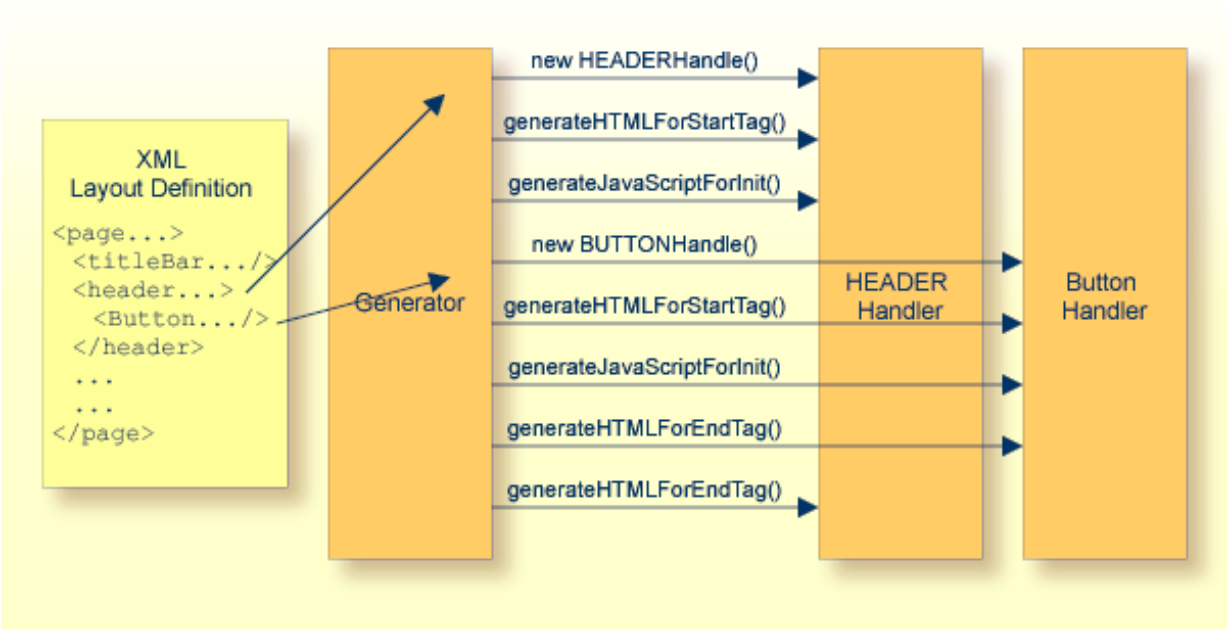
Detailed information about the methods can be found inside the Javadoc documentation which is part of your Application Designer installation. See also *Developing Java Extensions* in the *Ajax Developer* documentation.

Call Sequence (IMacroTagHandler and ITagHandler)

A tag is processed by the generator in a certain way that is now described for the HTML generation phase. (The macro execution phase is processed in a similar way.)

- The generator finds the tag, reads its properties and assigns an ID. The ID is unique inside one page.
- The generator creates a new instance of the tag handler which is responsible for processing the tag.
- The generator calls the `generateHTMLForStartTag` method. It passes the list of properties, the string buffer which represents the HTML/JavaScript string and a protocol item in which the tag handler can store further information.
- The generator calls the `generateJavaScriptForInit` method. It passes as main parameter a string representing the method body of the `initialisation` method. You can append JavaScript statements to this string.
- (If the generator finds tags below the current tag, these tags are processed in the same way now.)
- The generator finds the end tag and calls the `generateHTMLForEndTag` method.

The following image illustrates the call sequence for tag handlers:



Be aware of the following:

- There is one instance of a corresponding tag handler per tag. If there are three button definitions inside a layout definition, then during generation there are three instances of the `BUTTONHandler` class.

- There is one instance of a protocol item which is passed as parameter per tag. Each tag has its own protocol item. All the protocol items are collected at generation point of time to form one generation protocol.

Extensions of IMacroTagHandler and ITagHandler

There are certain interfaces which extend the framework for specific situations:

- `com.softwareag.cis.gui.generate.IMacroHandlerWithSubTags` - this is an extension of `IMacroHandler` and provides the possibility to also receive subtags of a tag.
- `com.softwareag.cis.gui.generate.ITagWithSubTagsHandler` - this is an extension of the `ITagHandler` interface and provides the possibility to also receive the subtags of a tag.
- `com.softwareag.cis.gui.generate.IRepeatCountProvider` and `com.softwareag.cis.gui.generate.IRepeatBehaviour` - these interfaces are responsible for controlling a special management for the REPEAT processing, which you use, for example, inside grids (ROWTABLEAREA2).

You do not need to know anything about these extensions to create your first controls. Documentation is provided inside the Javadoc documentation. See also *Developing Java Extensions* in the *Ajax Developer* documentation.

Library Concept

The library concept is responsible for defining the way how the generator finds a tag handler class for a certain tag. There are two situations:

1. The generator finds a tag without a ":" character. This indicates that this is a native Application Designer tag - the according tag handler is found inside the package `com.softwareag.cis.gui.generate`, the class name is created by converting the tag name to upper case and appending "Handler".

   For example, if the generator finds the tag "header", it tries to use a tag handler class `com.softwareag.cis.gui.generate.HEADERHandler`.

2. The generator finds a tag with a ":" character, for example, `demo:address`. This indicates that an external control library is used. The generator looks into a certain configuration file (*<installdir>/config/controllibraries.xml*) and finds out the package name which deals with the "demo:" library. After having found the package name, the class name is built in the same way as with standard Application Designer controls.

   For example, if the generator finds the tag `demo:address` and in the configuration file the demo prefix is assigned to the package *com.softwareag.cis.demolibrary*, then the full class name of the tag handler is `com.softwareag.cis.demolibrary.ADDRESSHandler`.

What happens if the generator does not find a valid class for a certain tag? In this case, it just copies the tag of the layout definition inside the generated HTML/JavaScript string. Via this mechanism, it is possible to define, for example, HTML tags inside the layout definition which are just copied into the HTML/JavaScript generation result.

Control Libraries

A control library is a Java library containing `ItagHandler`/`IMacroTagHandler` implementations. The corresponding *.jar* file has to be part of the Application Designer application libraries in order to be found inside the Layout Painter and Layout Manager; i.e. it can be copied, for example, into the *<webappdir>/<projectdir>/appclasses/lib* directory.

The central control file for configuring control libraries in your installation is the file *<webappdir>/cis/config/controllibraries.xml*. An example of the file looks as follows:

```
<controllibraries>
 <library package="com.softwareag.cis.demolibrary"
          prefix="demo">
 </library>
</controllibraries>
```

Each library is listed with its tag prefix and with the package name in which the generator looks for tag handler classes.

Binding Concept

The normal binding concept between a page and a corresponding class is:

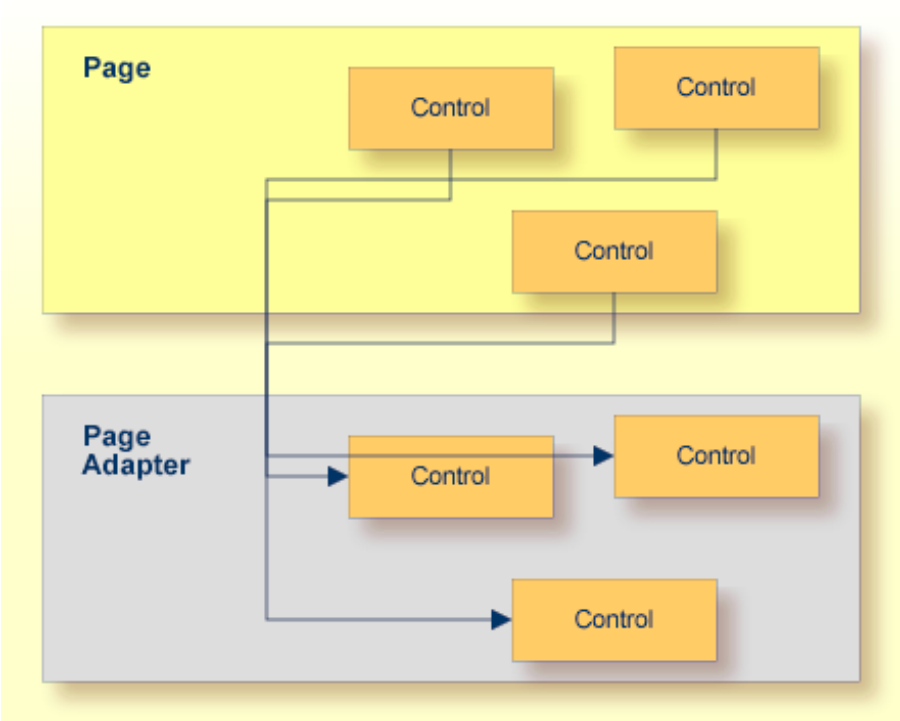
- Controls refer to properties and methods.
- Properties and methods are directly implemented as `set`/`get` methods or as straight methods inside the adapter class.

  As you might already have read in the part *Binding between Page and Adapter* of the *Special Development Topics*, the binding is much more flexible. You can define hierarchical access paths for both methods and properties.

For example, you can define a FIELD control which binds to the property `address.street`. As a consequence, the adapter is first asked for an object via a `getAddress()` method. Then the result of this method is asked for `getStreet()`. The same is true for methods: in a BUTTON control, you can define the method `address.clear` - as a consequence, the adapter again is first asked for `getAddress()`, then the method `clear()` is called in the result object.

Why is this important with controls? Well, it is especially important for composing controls: you might want complex controls, e.g. an address control which internally is composed out of 10 FIELD

controls, to be represented on the server side by a corresponding server class which matches the property and method requirements of the control. Even more: if you add an additional FIELD control to the address control, then you might not want to update all adapter classes, but just want to update the corresponding server class.



In analogy to the "Adapter", which is the representation of a whole page, the server side classes, which deal with certain controls, are called "Control Adapter" classes.

This all sounds a bit abstract - wait for the **control adapter code** example. Then you will see how powerful and simple this binding concept is.

Integrating Controls into the Layout Painter

Once having created new controls, you want to use them inside the Layout Painter. The Layout Painter is configured by a set of XML files, all of them located inside *<webappdir>/cis/config/*:

- *editor.xml*
- *editor_*.xml*

Have a look at the *editor.xml* file: all controls that come with Application Designer are listed inside this file. Each control defines the attributes that can be maintained and defines how it fits into other controls. Data type definitions to provide value help for the attributes is defined as well inside this file.

In short: *editor.xml* controls the way in which controls are presented inside the Layout Painter.

When creating new controls, you want to integrate your controls into the Layout Painter, that is, you want to register them inside *editor.xml* as well. Instead of letting you directly manipulate *editor.xml*, there is an extension concept - in order to keep your definitions untouched by release upgrades. There are some *editor_*.xml* files, each of the files containing the definitions of *editor.xml* for a certain control library.

Have a look at the *editor_demo.xml* file:

```
<!-- DEMO:ADDRESSROWAREA2 -->
  <tag name="demo:addressrowarea2">
    <attribute name="addressprop" mandatory="true"/>
    <protocolitem>
    </protocolitem>
  </tag>
  <tagsubnodeextension control="pagebody" newsubnode="demo:addressrowarea2"/>
```

In this example, a new control `demo:addressrowarea2` is defined:

- It provides one property `addressprop`.
- It can be placed into the existing Application Designer control `pagebody`.

Or have a look at the following section:

```
<!-- DEMO:ADDRESSROWAREA3 -->
  <tag name="demo:addressrowarea3">
    <attribute name="addressprop" mandatory="true"/>
    <taginstance>
      <rowarea name="Address">
          <itr>
              <label name="First Name" width="100">
              </label>
              <field valueprop="$addressprop$.firstName" width="150">
              </field>
          </itr>
          <itr>
              <label name="Last Name" width="100">
              </label>
              <field valueprop="$addressprop$.lastName" width="150">
              </field>
          </itr>
          <vdist height="10">
          </vdist>
          <itr>
              <label name="Street" width="100">
              </label>
              <field valueprop="$addressprop$.street" width="300">
              </field>
          </itr>
```

```
        <itr>
            <label name="Town" width="100">
            </label>
            <field valueprop="$addressprop$.zipCode" width="50">
            </field>
            <hdist width="5">
            </hdist>
            <field valueprop="$addressprop$.town" width="245">
            </field>
        </itr>
        <vdist height="10">
        </vdist>
        <itr>
            <hdist width="100">
            </hdist>
            <button name="Clear" method="$addressprop$.clearAddress">
            </button>
        </itr>
    </rowarea>
  </taginstance>
  <protocolitem>
      <addproperty name="$addressprop$" datatype="ADDRESSInfo" ↩
useincodegenerator="true"/>
  </protocolitem>
</tag>
<tagsubnodeextension control="pagebody" newsubnode="demo:addressrowarea3"/>
```

The control `demo:addressarea3` has the following features:

- It provides one property `addressprop`.
- It contains the macro XML (between `<taginstance>` and `</taginstance>`) for building the control out of existing controls.
- It binds to an address property of type `ADDRESSInfo` (between `<protocolitem>` and `</protocolitem>`).
- It can be positioned below the `pagebody` control.

The *editor_*.xml* files should not be maintained by yourself directly. Instead, use the Control Editor to define the file in a comfortable way.

Summary

When defining new controls, there are the following resources:

- *<webapp>/cis/config/controllibraries.xml* - to define control library prefixes and their binding to a certain Java package holding control implementations.
- *<webapp>/cis/config/editor_*.xml* - to define the controls and how they fit into existing controls.
- `IMacroTagHandler` - implementations that transfer XML control definitions into other XML control definitions.
- `ITagHandler` - implementations that transfer XML control definitions into HTML/JavaScript.

The next section contains examples for building macro controls and new controls.

3 Composing New Controls Out of Existing Controls

Concept

The concept is quite simple: you provide a macro control that tells how a given XML tag is transferred into an XML string representing the internally used Application Designer controls.

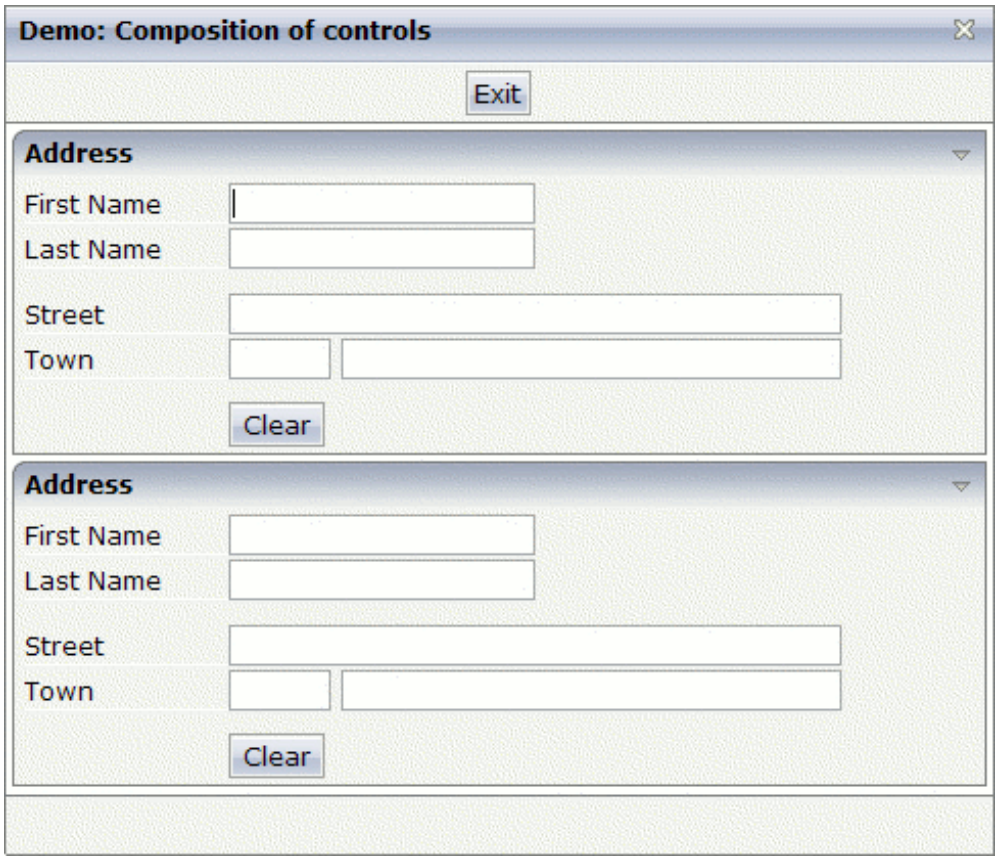
There are two ways to provide a macro control:

- Either you program a control on your own,
- or you configure the control using an XML definition.

The first way is the most flexible way - you create a piece of code translating the macro XML tag into other controls' XML tags. The second way is the easier way by which you can use a certain XML definition to define macro controls without having to code at all.

Programmed Macro Control - Example

Let us have a look at the following page:



This page contains two address areas. Now let us look at the corresponding XML layout definition:

```
<page model="com.softwareag.cis.test14.ControlLibraryControlCompositionAdapter">
    <titlebar name="Demo: Composition of controls">
    </titlebar>
    <header withdistance="false">
        <button name="Exit" method="endProcess">
        </button>
    </header>
    <pagebody>
        <demo:addressrowarea2 addressprop="address">
        </demo:addressrowarea2>
        <demo:addressrowarea2 addressprop="addressWife">
        </demo:addressrowarea2>
    </pagebody>
    <statusbar withdistance="false">
    </statusbar>
</page>
```

You see that there is a control `demo:addressrowarea2` which is used two times - once per address area. The control is responsible for arranging all its inner controls. Each tag has an `addressprop` property - we will see later how this property is treated.

Control Handler Code

Let us have a look at the corresponding control handler code:

```
package com.softwareag.cis.demolibrary;

import org.xml.sax.AttributeList;

import com.softwareag.cis.gui.generate.IMacroTagHandler;
import com.softwareag.cis.gui.protocol.Message;
import com.softwareag.cis.gui.protocol.ProtocolItem;

public class ADDRESSROWAREA2Handler
    implements IMacroTagHandler
{
    // ---------------------------------------------------------------------------
    // members
    // ---------------------------------------------------------------------------

    String m_addressprop;

    // ---------------------------------------------------------------------------
    // public usage
    // ---------------------------------------------------------------------------

    /** */
    public void generateXMLForStartTag(String tagName,
```

```
                                        AttributeList attrlist,
                                        StringBuffer sb,
                                        ProtocolItem pi)
    {
        readAttributes(attrlist);
        fillProtocol(pi);
        // build XML that consists out of contained controls
        sb.append("<rowarea name='Address'>");
        sb.append(  "<itr>");
        sb.append(    "<label name='First Name' width='100'/>");
       sb.append(   "<field valueprop='"+m_addressprop+".firstName' width='150'/>");
        sb.append(  "</itr>");
        sb.append(  "<itr>");
        sb.append(    "<label name='Last Name' width='100'/>");
       sb.append(   "<field valueprop='"+m_addressprop+".lastName' width='150'/>");
        sb.append(  "</itr>");
        sb.append(  "<vdist height='10'/>");
        sb.append(  "<itr>");
        sb.append(    "<label name='Street' width='100'/>");
       sb.append(   "<field valueprop='"+m_addressprop+".street' width='300'/>");
        sb.append(  "</itr>");
        sb.append(  "<itr>");
        sb.append(    "<label name='Town' width='100'/>");
       sb.append(   "<field valueprop='"+m_addressprop+".zipCode' width='50'/>");
        sb.append(    "<hdist width='5'/>");
        sb.append(    "<field valueprop='"+m_addressprop+".town' width='245'/>");
        sb.append(  "</itr>");
        sb.append(  "<vdist height='10'/>");
        sb.append(  "<itr>");
        sb.append(    "<hdist width='100'/>");
        sb.append(    "<button name='Clear' ↩
method='"+m_addressprop+".clearAddress'/>");
        sb.append(  "</itr>");
        sb.append("</rowarea>");
    }

    /** */
    public void generateXMlForEndTag(String tagName,
                                     StringBuffer sb)
    {
    }

    // ---------------------------------------------------------------------
    // private usage
    // ---------------------------------------------------------------------

    /** */
    private void readAttributes(AttributeList attrlist)
    {
        for (int i=0; i<attrlist.getLength(); i++)
        {
            if (attrlist.getName(i).equals("addressprop"))
```

```
                m_addressprop = attrlist.getValue(i);
        }
    }

    /** */
    private void fillProtocol(ProtocolItem pi)
    {
        // check
        if (m_addressprop == null)
          pi.addMessage(new Message(Message.TYPE_ERROR,"Attribute ADDRESSPROP is ↩
not set"));
        // properties
        pi.addProperty(m_addressprop,"ADDRESSInfo");
        // no further properties to be proposed in code assistant
        pi.suppressFurtherCodegenEntries();
    }

}
```

Let us have a look at the building blocks of the code:

- The class has a member `m_addressprop`. This member is filled directly at the beginning of the `generateHTMLForStartTag` method - inside the `readAttributes()` method. The attribute list is walked through and checked for the attribute `addressprop`.
- As the next step, the protocol item is filled. On the one hand, you can put there any information with a certain `severity` attribute - in the example, an error message is written to protocol if no attribute `addressprop` is defined. On the other hand, you have to tell the protocol item which properties you are accessing from your control.

  Pay attention that the properties which are accessed inside the access control are a composition out of the `m_address` value and some fix names which are defined by the control.
- In the processing of the method `generateXMLForStartTag()`, all the XML is created that per control instance creates the container representing an address area.

Control Adapter Code

The control adapter is not required to be written for a control - it is just an option which is extremely useful for structuring you server side code.

In principle, the control definition says that it refers to an address property (`ADDRESSPROP` value). The inner controls take their information out of sub-properties of this control. For example, if the `ADDRESSPROP` value is defined to be "wifeAddress", then the fields and buttons are bound to:

- `wifeAddress.firstName`
- `wifeAddress.lastName`
- `wifeAddress.street`

- `wifeAddress.zipCode`
- `wifeAddress.town`
- `wifeAddress.clearAddress` (method)

You now can provide for a server side control adapter class which provides for all this data. For example, the implementation is:

```
package com.softwareag.cis.demolibrary;

import com.softwareag.cis.server.*;

/**
 * This is the logic-class behind the control ADDRESSROWAREA.
 */
public class ADDRESSInfo
{
    // ---------------------------------------------------------------------
    // members
    // ---------------------------------------------------------------------

    String m_firstName;
    String m_lastName;
    String m_street;
    String m_zipCode;
    String m_town;

    // ---------------------------------------------------------------------
    // public access
    // ---------------------------------------------------------------------

 public String getFirstName() { return m_firstName; }
 public String getLastName() { return m_lastName; }

 public String getStreet() { return m_street; }
 public String getTown() { return m_town; }

 public String getZipCode() { return m_zipCode; }
 public void setFirstName(String firstName) { m_firstName = firstName; }

 public void setLastName(String lastName) { m_lastName = lastName; }
 public void setStreet(String street) { m_street = street; }

 public void setTown(String town) { m_town = town; }
 public void setZipCode(String zipCode) { m_zipCode = zipCode; }

     public void clearAddress()
       {
        m_firstName = null;
        m_lastName = null;
        m_street = null;
```

```
        m_zipCode = null;
        m_town = null;
    }
}
```

A page adapter class can now use this control adapter class and can automatically take over all its contained properties and methods. For example, the page adapter of the page of this example might look like:

```
package com.softwareag.cis.test14;

import com.softwareag.cis.demolibrary.*;
import com.softwareag.cis.server.Model;

public class ControlLibraryControlCompositionAdapter
    extends Model
{
    // ------------------------------------------------------------------------
    // members
    // ------------------------------------------------------------------------

    ADDRESSInfo m_address = new ADDRESSInfo();
    ADDRESSInfo m_addressWife = new ADDRESSInfo();

    // ------------------------------------------------------------------------
    // public access
    // ------------------------------------------------------------------------

    public ADDRESSInfo getAddress() { return m_address; }
    public ADDRESSInfo getAddressWife() { return m_addressWife; }
}
```

The page adapter just creates two instances of the control adapter `ADDRESSInfo` and publishes them as property `address` and property `wifeAddress`.

Be aware that you can use all Java possibilities on the server side to let the control adapter interact with your page adapter. Maybe you would like to be informed inside the page adapter every time the `clear()` method is invoked? Then just build some eventing functions into the control adapter - and the page adapter can register as event listener to its contained control adapter.

Configured Macro Control - Example

In the previous example, an explicit control handler class was written in order to transfer a short XML statement into a long one. For simple control arrangements without any sophisticated logic, you can do the same by just configuring the control - instead of programming it.

Let us now do the same as done with code in the previous section - this time without coding.

The configuration is done using an editor extension file (e.g. *editor_demo.xml* in the *cis/config* directory). When generating HTML pages, Application Designer looks into its configuration directory and searches for all *.xml* files starting with "editor_". Each of the files contains configuration information about controls and their usage.

Have a look at the *editor_demo.xml* file and you will see the following section:

```
<!-- DEMO:ADDRESSROWAREA3 -->
  <tag name="demo:addressrowarea3">
    <attribute name="addressprop" mandatory="true"/>
    <taginstance>
         <rowarea name="Address">
           <itr>
             <label name="First Name" width="100"/>
             <field valueprop="$addressprop$.firstName" width="150"/>
           </itr>
           <itr>
             <label name="Last Name" width="100"/>
             <field valueprop="$addressprop$.lastName" width="150"/>
           </itr>
           <vdist height="10"/>
           <itr>
             <label name="Street" width="100"/>
             <field valueprop="$addressprop$.street" width="300"/>
           </itr>
           <itr>
             <label name="Town" width="100"/>
             <field valueprop="$addressprop$.zipCode" width="50"/>
             <hdist width="5"/>
             <field valueprop="$addressprop$.town" width="245"/>
           </itr>
           <vdist height="10"/>
           <itr>
             <hdist width="100"/>
             <button name="Clear" method="$addressprop$.clearAddress"/>
            </itr>
          </rowarea>
    </taginstance>
    <protocolitem>
        <addproperty name="$addressprop$" datatype="ADDRESSInfo" ↩
```

```
useincodegenerator="true"/>
    </protocolitem>
  </tag>
  <tagsubnodeextension control="pagebody" newsubnode="demo:addressrowarea3"/>
```

The following is defined in this section:

- The new tag ADDRESSROWAREA3 is defined.
- A property `addressprop` is defined to exist.
- The XML macro is contained that is used for transferring the control into XML. Inside the XML you see that the value of `addressprop` is referred to by using "$addressprop$".
- The new tag is defined to be reachable below the PAGEBODY tag.

The result at the end is the same as produced with the ADDRESSROWAREA2 control of the previous section.

The XML configuration can be either done manually within the XML file or by using the Control Editor.

editor_* File Concept

In the example above, the macro XML definition was part of a file *editor_demo.xml*. If you have a look at the */cis/config* directory of your web application, then you will see some files:

- *editor.xml*
- *editor_demo.xml*

  editor_report.xml

  editor_pivot.xml

  and other *editor_** files
- *editorextensions_template.xml*

Each file contains information about controls. When gathering the available controls, Application Designer reads all *editor_*.xml* files and builds one “big internal” control model.

editor_*.xml files are also mentioned later. Since they hold information on how to arrange controls, they are also used as control files for Application Designer's Layout Painter. For more details, see the section ***Bringing Controls into the Layout Painter***.

Note: If you are using an old servlet engine of version 2.2 (e.g. Tomcat 3, Websphere 4), there is one additional file to be maintained: *editorextensions.xml*. For detailed information, see the *editorextensions_template.xml* file.

4 Creating New Controls

Concept

In the previous section, you learned how to compose complex controls out of existing controls. You will now learn how to build completely new controls which are not yet part of the Application Designer control set.

The concept of building your own controls is to insert corresponding HTML and JavaScript instructions into the HTML page which is the result of the generation process.

A JavaScript function library is available which can be directly accessed inside the HTML code which is generated. This library contains useful methods for accessing properties and executing methods of the "model" (“net data”) behind the page.

Example 1

The first example is a quite simple one: a tag with the name "democontrol" is introduced, which does nothing else than writing a text which is passed via a tag attribute into the generated HTML page:

The corresponding XML layout definition looks as follows:

```
<rowarea name="Demo Control">
    <itr>
        <demo:democontrol text="ABCDEFG">
        </demo:democontrol>
    </itr>
</rowarea>
```

You see that the text which is passed inside the `text` attribute of the `demo:democontrol` tag is displayed inside the control in bold letters.

The Java code of the tag handler of the `demo:democontrol` tag looks as follows:

```
package com.softwareag.cis.demolibrary;

import org.xml.sax.AttributeList;

import com.softwareag.cis.gui.generate.*;
import com.softwareag.cis.gui.protocol.*;

public class DEMOCONTROLHandler implements ITagHandler
{
    // ---------------------------------------------------------------------------
    // members
    // ---------------------------------------------------------------------------

    String m_text;

    // ---------------------------------------------------------------------------
    // public methods
    // ---------------------------------------------------------------------------

    /**
     */
    public void generateHTMLForStartTag(
        int id,
        String tagName,
        AttributeList attrlist,
        ITagHandler[] handlersAbove,
        StringBuffer sb,
        ProtocolItem protocolItem)
    {
        readAttributes(attrlist);
        fillProtocolItem(protocolItem);
        sb.append("\n<!-- DEMOCONTROL begin -->\n");
        sb.append("<td>The text is: <b>"+m_text+"</b></td>\n");
    }

    /**
     */
    public void generateHTMLForEndTag(String tagName, StringBuffer sb)
    {
        sb.append("\n<!-- DEMOCONTROL end -->\n");
    }

    /**
     */
    public void generateJavaScriptForInit(
        int id,
        String tagName,
        StringBuffer sb)
    {
    }

    // ---------------------------------------------------------------------------
```

```
    // private methods
    // ---------------------------------------------------------------------

    /**
     */
    public void readAttributes(AttributeList attrlist)
    {
        for (int i=0; i<attrlist.getLength(); i++)
        {
            if (attrlist.getName(i).equals("text"))
                m_text = attrlist.getValue(i);
        }
    }

    /**
     */
    public void fillProtocolItem(ProtocolItem pi)
    {
        if (m_text == null)
            pi.addMessage(new Message(Message.TYPE_ERROR,
                                      "Attribute TEXT is not defined"));
    }

}
```

In the tag handler, the following steps are processed:

- In the `generateHTMLForStartTag()` method, the attributes which are defined with the tag are read first and the protocol is filled.
- Then, plain HTML information is appended to the HTML string which is passed as a parameter (StringBuffer `sb`). Inside the HTML information, the value of the `text` attribute is dynamically inserted.

This control does not provide for any interactivity; it just writes out a certain value which is defined inside its tag definition.

JavaScript Functions

For more interactive controls - for example, which use certain data coming from the server-side adapter - you need to access certain JavaScript functions which are available inside the client. The generated HTML page contains an object named "csciframe". This object provides a certain set of functions for usage from within custom controls.

It is not possible in JavaScript to arrange a set of published functions in some kind of interface in order to only allow users a dedicated access. Therefore, the functions which are allowed to access are listed in this section. You must not use any other functions - even if you may see additional functions in the JavaScript sources.

Function	Description

setPropertyValue(pn,pv)	Sets a property value inside the adapter. The value is not directly sent to the server but is buffered first in the client. If there is a synchronization event, then the buffer is transferred.
	
	pn = name of property
	
	pb = value
	
	Examples:
	
	`csciframe.setPropertyValue(companyName,"Software AG");`
	
	`csciframe.setPropertyValue(address.firstName,"John");`
	
	`csciframe.setPropertyValue(addresses[2].firstName,"Maria");`

getPropertyValue(pn)	Reads a property value from the adapter (better: the client representation of the adapter).
	
	pn = name of property
	
	result = string of property value
	
	Examples:
	
	`var vResult1 = csciframe.getPropertyValue("company");`
	
	`var vResult2 = csciframe.getPropertyValue("addresses[2].firstName");`
	
	Pay attention: the adapter value is always passed back as a string.
	
	A boolean value, as a consequence, is returned as "true" string and not as "true" boolean value.
	
	Null values of the adapter, that is, where the Java adapter class on the server side passes back "null", are returned as an empty string ("").
	
	A JavaScript null value is passed back if the property for which you ask does not exist.

registerListener(me)	Passes a method pointer (me value). The method is called every time when a response of a client request is processed. In other words: every time new data comes from the server or if the model is updated in another way (for example, by flush signals of other controls), then the corresponding methods are called. In the method, you can place a corresponding reaction of your control on new data. The method which you pass must have a parameter `model` - which is not used anymore, but which has to be defined. Example:

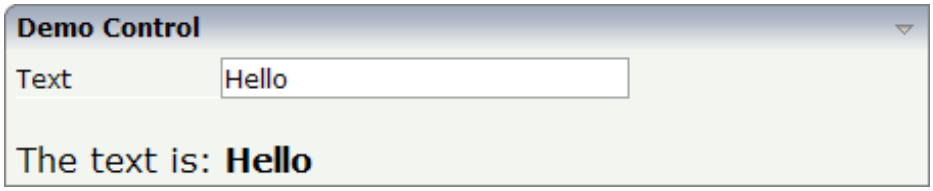
Function	Description

	``
	...
	...
	function reactOnNewData(model)
	{
	  var vResult = csciframe.getPropertyValue("firstName");
	  alert(vResult);
	}
	...
	...
	csciframe.registerListener(reactOnNewData);
	...
	...
	``

invokeMethodInModel(mn)	Invokes the calling of a method inside the adapter. As a consequence, the data changes which may have been buffered inside the client are flushed to the server and the method is called. mn = name of adapter method Example: `csciframe.invokeMethodInModel("onSave");`
submitModel(n)	Synchronizes the client with the server. Analogous to the `invokeMethodInModel()` method from the synchronization point of view - but now without calling an explicit method in the adapter. n = name, must be `submit` Example: `csciframe.submitModel("submit");`

Example 2

The following example is an extension of the previous example. Whereas in *Example 1* the text which is output by the control was defined as an attribute of the tag definition, the text is now dynamically derived from an adapter property.



The XML layout definition is:

```
<rowarea name="Demo Control">
    <itr>
        <label name="Text" width="100">
        </label>
        <field valueprop="text" width="200" flush="screen">
        </field>
    </itr>
    <vdist height="20">
    </vdist>
    <itr>
        <demo:democontroldyn textprop="text">
        </demo:democontroldyn>
    </itr>
</rowarea>
```

You see that the DEMOCONTROLDYN control references the same adapter property `text` as the FIELD control.

Let us have a look at the tag handler class for the DEMOCONTROLDYN control:

```
package com.softwareag.cis.demolibrary;

import org.xml.sax.AttributeList;

import com.softwareag.cis.gui.generate.*;
import com.softwareag.cis.gui.protocol.*;

public class DEMOCONTROLDYNHandler implements ITagHandler
{
    // ---------------------------------------------------------------------------
    // members
    // ---------------------------------------------------------------------------

    String m_textprop;

    // ---------------------------------------------------------------------------
    // public methods
    // ---------------------------------------------------------------------------

    /**
     */
    public void generateHTMLForStartTag(
        int id,
        String tagName,
        AttributeList attrlist,
        ITagHandler[] handlersAbove,
        StringBuffer sb,
        ProtocolItem protocolItem)
    {
        readAttributes(attrlist);
        fillProtocolItem(protocolItem);
```

```
        sb.append("\n<!-- DEMOCONTROL begin -->\n");
        sb.append("<td>The text is: <b>");
        sb.append("<span id='DEMOSPAN"+id+"'></span>");
        sb.append("</b></td>\n");
        sb.append("<script>\n");
        sb.append("function reactOnModelUpdate"+id+"(model)\n");
        sb.append("{\n");
       sb.append("  var vText = csciframe.getPropertyValue('"+m_textprop+"');\n");
        sb.append("  var vSpan = document.getElementById('DEMOSPAN"+id+"');\n");
        sb.append("  vSpan.innerHTML = vText;\n");
        sb.append("}\n");
        sb.append("</script>\n");
    }

    /**
     */
    public void generateHTMLForEndTag(String tagName, StringBuffer sb)
    {
        sb.append("\n<!-- DEMOCONTROL end -->\n");
    }

    /**
     */
    public void generateJavaScriptForInit(
        int id,
        String tagName,
        StringBuffer sb)
    {
        sb.append("csciframe.registerListener(reactOnModelUpdate"+id+");\n");
    }

    // ---------------------------------------------------------------------------
    // private methods
    // ---------------------------------------------------------------------------

    /**
     */
    public void readAttributes(AttributeList attrlist)
    {
        for (int i=0; i<attrlist.getLength(); i++)
        {
            if (attrlist.getName(i).equals("textprop"))
                m_textprop = attrlist.getValue(i);
        }
    }

    /**
     */
    public void fillProtocolItem(ProtocolItem pi)
    {
        // Messages
        if (m_textprop == null)
```

```
            pi.addMessage(new Message(Message.TYPE_ERROR,
                                      "Attribute TEXTPROP is not defined"));
        // Property Usage
        pi.addProperty(m_textprop,"String");
    }

}
```

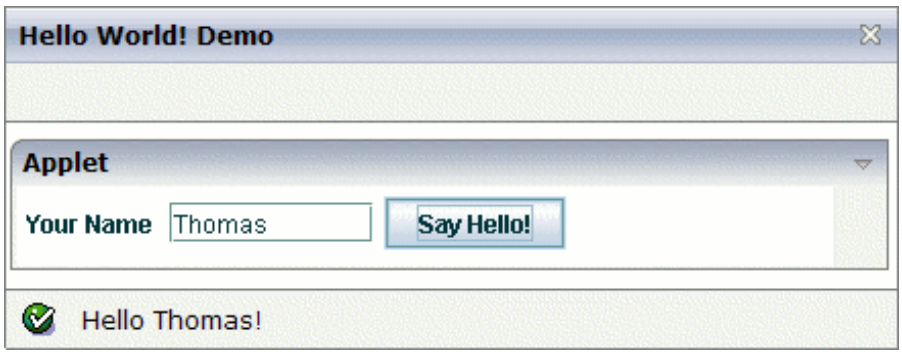
You see:

- Inside the `generateJavaScript()` method, a JavaScript function is added as a listener to adapter model changes. The function is generated inside the `generateHTMLForStartTag()` method.
- The name of the property is read via the attribute list into the member `m_textprop` - and is dynamically used when calling the JavaScript function `getPropertyValue()`.
- All JavaScript names (e.g. method names, IDs of controls) which are "global" inside the HTML page are suffixes with the control ID which is passed via the `ITagHandler` methods. The reason: if one control is defined multiple times inside a page, then the different methods and IDs are separated by this ID.
- The protocol item is filled with the information about the property which is required by the control. This is necessary at runtime because the Application Designer runtime environment needs to find out which data of an adapter property to send back to the client (see *Binding between Page and Adapter* in the *Special Development Topics*).

Example 3 (Applet)

This example shows how to embed Java applets. Unlike ***Example 1*** and ***Example 2***, the generated HTML/JavaScript here just makes the applet aware of the normal data communication between screen and page adapter. The rendering is done in Java.

This example uses a very basic "Say Hello!" applet. It shows one field input and a button. On button click, a message is displayed on the STATUSBAR control.



The XML layout definition is:

```
<page model="SayHelloAdapter">
    <titlebar name="Say Hello! Demo">
    </titlebar>
    <header>
    </header>
    <pagebody>
        <rowarea name="Applet">
            <tr>
                <demo:applet code="SayHelloApplet.class"
                             width="400"
                             height="40"
                             valueprop="yourName"
                             method="onSayHello">
                </demo:applet>
            </tr>
        </rowarea>
    </pagebody>
    <statusbar>
    </statusbar>
</page>
```

The `demo:applet` tag shows the usual applet attributes: `code`, `width` and `height`. With the attribute `valueprop`, the applet's field input is bound to the adapter property `yourName`. The attribute `method` binds the button to adapter method `onSayHello`.

This is the page adapter for this example:

```
import com.softwareag.cis.server.Adapter;

public class SayHelloAdapter extends Adapter
{
    // property >yourName<
    String m_yourName;
    public String getYourName() { return m_yourName; }
    public void setYourName(String value) { m_yourName = value; }

    /** called on button click */
    public void onSayHello()
    {
      outputMessage(MT_SUCCESS, "Hello "+m_yourName+"!");
    }
}
```

The adapter only provides for the property `yourName` and the method `onSayHello`.

The most important thing is the tag handler class. Let us have a look at `APPLETHandler`:

```
package com.softwareag.cis.demolibrary;

import org.xml.sax.*;

import com.softwareag.cis.file.CSVManager;
import com.softwareag.cis.gui.protocol.*;
import com.softwareag.cis.gui.util.*;

public class APPLETHandler implements ITagHandler
{
    // ---------------------------------------------------------------------------
    // members
    // ---------------------------------------------------------------------------

    String m_code;
    String m_codebase = ".";
    String m_width = "100";
    String m_height = "100";
    String m_valueprop;
    String m_method;

    // ---------------------------------------------------------------------------
    // public usage
    // ---------------------------------------------------------------------------

    public void generateHTMLForStartTag(int id,
                                        String tagName,
                                        AttributeList attrlist,
                                        ITagHandler[] handlersAbove,
                                        StringBuffer sb,
                                        ProtocolItem protocolItem)
    {
        readAttributes(attrlist);
        fillProtocol(protocolItem);

        sb.append("\n");
        sb.append("<!-- APPLET begin -->\n");
        sb.append("<td>\n");
        sb.append("<applet name=\"APPLET"+id+"\" " +
                                "codebase=\".\" " +
                                "code=\""+m_code+"\" " +
                                "width=\""+m_width+"\" " +
                                "height=\""+m_height+"\" " +
                                "MAYSCRIPT>\n");
        sb.append("   <param name=\"scriptable\" value=\"true\">\n");
        sb.append("   <param name=\"id\" value=\""+id+"\">\n");
        sb.append("   <param name=\"valueprop\" value=\""+m_valueprop+"\">\n");
        sb.append("   <param name=\"method\" value=\""+m_method+"\">\n");
        sb.append("</applet>\n");

        sb.append("<script>\n");
        sb.append("function romu"+id+"(model) {");
```

```
        sb.append(    "try { document.APPLET"+id+".reactOnNewData(); } \n");
       sb.append(    "catch (exc) { alert('Error occurred when talking to applet!' ↩
+ exc); }\n");
        sb.append("} \n");
        sb.append("function getProperyValue"+id+"(propertyName) { return ↩
C.getPropertyValue(propertyName); } \n");
        sb.append("function setPropertyValue"+id+"(propertyName, value) { ↩
C.setPropertyValue(propertyName, value); } \n");
        sb.append("function invokeMethodInModel"+id+"(methodName) { ↩
C.invokeMethodInModel(methodName); } \n");
        sb.append("</script>\n");
    }

    public void generateHTMLForEndTag(String tagName,
                                      StringBuffer sb)
    {
        sb.append("<!-- APPLET end -->\n");
        sb.append("</td>\n");
    }

    public void generateJavaScriptForInit(int id,
                                          String tagName,
                                          StringBuffer sb)
    {
        sb.append("C.registerListener(romu"+id+");\n");
    }

    // ---------------------------------------------------------------------
    // private usage
    // ---------------------------------------------------------------------

    /** */
    private void readAttributes(AttributeList attrlist)
    {
        for (int i=0; i<attrlist.getLength(); i++)
        {
            if (attrlist.getName(i).equals("code")) m_code = attrlist.getValue(i);
            if (attrlist.getName(i).equals("codebase")) m_codebase = ↩
attrlist.getValue(i);
           if (attrlist.getName(i).equals("width")) m_width = attrlist.getValue(i);
           if (attrlist.getName(i).equals("height")) m_height = attrlist.getValue(i);
            if (attrlist.getName(i).equals("valueprop")) m_valueprop = ↩
attrlist.getValue(i);
           if (attrlist.getName(i).equals("method")) m_method = attrlist.getValue(i);
        }
    }

    /** */
    private void fillProtocol(ProtocolItem pi)
    {
        // check
       if (m_code == null) pi.addMessage(new Message(Message.TYPE_ERROR, "CODE not ↩
```

```
set"));
        if (m_valueprop == null) pi.addMessage(new Message(Message.TYPE_ERROR, ↩
"VALUEPROP not set"));
       if (m_method == null) pi.addMessage(new Message(Message.TYPE_ERROR, "METHOD ↩
not set"));
    }

}
```

You see:

- `readAttributes()` reads all attributes from the XML. Their values are saved in member variables.
- `fillProtocol()` checks whether mandatory attributes are set. If not, an error message is shown within the generation protocol.
- `generateHTMLForStartTag()` generates HTML code containing the applet/parameter tags. Some JavaScript functions are added that are available inside the applet coding (`getPropertyValue`/`setPropertyValue`/`invokeMethodInModel`).
- `generateJavaScriptForInit()` registers function `romu()` as a listener to model changes. On change, the applet is called by `reactOnNewData`.

The Java applet looks as follows:

```
import netscape.javascript.JSObject;

public class SayHelloApplet extends Applet
{
      private String m_id;
      private String m_valueprop;
      private String m_method;
      private JLabel m_label;
      private JTextField m_fieldJ;
      private JButton m_buttonJ;
      private JSObject m_windowJ = null;

    // ---------------------------------------------------------------------------
    // Data binding
    // ---------------------------------------------------------------------------

      /**
       * Callback method for model change events
       */
      public void reactOnNewData()
      {
            Object[] args = new String[] { m_valueprop };
            Object v = m_windowJ.call("getProperyValue"+m_id, args);
            if (v == null)
                  v = "";
            m_fieldJ.setText((String)v);
      }
```

```
      /**
       * button action handler
       */
      private void buttonAction()
      {
            // pass field's value into property
            Object[] args = new String[] { m_valueprop , m_fieldJ.getText() };
            m_windowJ.call("setPropertyValue"+m_id, args);

            // call adapter method
            args = new String[] { m_method };
            m_windowJ.call("invokeMethodInModel"+m_id, args);
      }

      /**
   * Is called on load
   */
      public void init()
      {
            m_windowJ = JSObject.getWindow(this);
            m_id = getParameter("id");
            m_valueprop = getParameter("valueprop");
            m_method = getParameter("method");

            createGUI();
      }

    // ---------------------------------------------------------------------
    // applet specific methods
    // ---------------------------------------------------------------------

      private void createGUI(){..}

      public void destroy(){..}

      private void cleanUp(){..}
}
```

You see:

- JavaScript methods are called using `JSObject`. It is part of *plugin.jar* of Sun's Java Virtual machine.
- The method `reactOnNewData()` accesses the fresh property value.
- The method `buttonAction()` first sets the user input and then calls the adapter method.

Summary

Writing new controls requires a profound knowledge of HTML and JavaScript. In principle, everything is simple, but there are a couple of pieces which have to be put together in order to form a control properly:

- You have to render the control via HTML.
- You have to manipulate the control via JavaScript - in case you have a dynamic control.
- You have to bind the control to adapter properties/methods.
- You have to pay attention to the fact that all controls are living in the same page - and there must not be any confusion with naming of IDs and method names.
- You have to use the JavaScript initialization for registering your control inside the internal eventing when new page content arrives inside the client.
- You have to properly fill the protocol item.

Some topics have been mentioned here, but have not been fully explained. For more information, see ***Special Issues***.

5 Special Issues

Protocol Item

Inside a tag handler, a protocol item is passed in the called methods. There are some mandatory tasks that you have to do with a protocol item:

- You must tell the protocol item every property you are referencing from your control.

  This information is required because only these properties are transferred from the server to the client at runtime which are referenced inside the page.
- You must tell the protocol item every text ID you are referencing from your control.

  Again this information is used to send the right text IDs to the client processing.

In case of using macro controls, one macro control is rendered into many normal controls. Each normal control is treated in the way that it generates corresponding HTML/JavaScript and in the way that it itself tells to which properties it binds; that is, each normal control adds its properties/text IDs itself: when your macro control contains some FIELD controls, then each FIELD control will tell during generation the adapter properties to which it binds - there is no necessity for you to re-tell on macro control level.

But: you might tell on macro control level that all the contained adapter properties are not provided via one-by-one implementation but by implementing a server-side class already providing all sub-properties. In this case, you can use the protocol item in the following way:

- Call `addProperty('nameOfProperty','serverSideClass')`. For example:

  ```
  addProperty(m_addressprop,'ADDRESSInfo')
  ```
- Tell that all property definitions made by internally contained controls are not relevant for implementation by calling the method `suppressFurtherCodeGenEntries()`.

Bringing Controls into the Layout Painter

The Layout Painter is configured via a file *editor.xml* inside the *<installdir>/cis/config/* directory. This file contains information about all controls which are available inside the editor. For each control, the list of attributes and the list of possible subnodes is listed.

Have a look at the file - the structure is self-explaining.

With early versions, you had to bring own controls into the *editor.xml* file by editing it accordingly. The disadvantage was that every time Application Designer changed the *editor.xml* file, you had to reapply your changes. Application Designer now offers a dynamic way of adding own controls into the logical structure of the *editor.xml*.

Write an *editor_xyz.xml* file and place it into the same directory as *editor.xml*. "xyz" should be the same name as the one you chose as the prefix for your control library. Each *editor_xyz.xml* file holds information about the controls of the *xyz* control library:

- data types of a tag
- name of control tags
- attributes of tags
- subnodes a tag may have
- subnode extensions for existing Application Designer tags - this means, you define below which Application Designer controls your new tags should be positioned

The following definition shows the usage of the *editor_xyz.xml* file:

```
<!--
Dynamic extension of editor.xml file.
-->

<controllibrary>
 <editor>

  <!-- datatype TEXT -->
  <datatype name="demo:count">
   <value id="1st" name="First"/>
   <value id="2nd" name="Second"/>
   <value id="3rd" name="Third"/>
  </datatype>

  <!-- control DEMOCONTROL -->
  <tag name="demo:democontrol">
      <attribute name="text" datatype="demo:count"/>
  </tag>
  <tagsubnodeextension control="itr" newsubnode="demo:democontrol"/>
  <tagsubnodeextension control="tr" newsubnode="demo:democontrol"/>

  <!-- control DEMOCONTROLDYN -->
    <tag name="demo:democontroldyn">
      <attribute name="textprop"/>
    </tag>
  <tagsubnodeextension control="itr" newsubnode="demo:democontroldyn"/>
  <tagsubnodeextension control="tr" newsubnode="demo:democontroldyn"/>

  <!-- control ADDRESSROWAREA -->
  <tag name="demo:addressrowsarea">
      <attribute name="addressprop"/>
  </tag>
  <tagsubnodeextension control="pagebody" newsubnode="demo:addressrowarea"/>
```

```
 </editor>
</controllibrary>
```

Note that the structure of the file directly corresponds to the structure of the original *editor.xml* file. The data is an add-on that is logically added to the information from the *editor.xml* file.

Note also that both new data types and new control tags are named together with their prefix - in order not to mix up with standard Application Designer controls or with controls of other control library providers.

Text ID/Multi Language Controls

Please contact Software AG in case you create new controls with language-dependent information - and if you want to use the same translation methods as Application Designer does for these controls.

6 Control Library

You have written nice sets of controls? Why not pass these controls to others who might be interested?

Application Designer will build up a library of control libraries inside the web. If desired, we will check the control library for being conform to the Application Designer framework - and then publish it within our pages. There will be no publishing without your explicit agreement. Licensing conditions - between you and the users of your control - will be defined by yourself and must be clearly defined before publishing.

Please contact the Application Designer team at Software AG.