International Technical Support Organization

Web Tools for IBM System i5 developers

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IBM System i5
ITSO Technical Forum 2006

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Redbooks
International Technical Support Organization

AGENDA

iSeries AD, IBM Toronto

- WebSphere Development Studio WDS V5R4
- e-business primer
  - AD Model, traditional and web
  - Web Applications
  - Mixing Java and RPG
- Introducing WebTools for IBM System i5
  - Web projects
  - Interaction wizard
  - Page designer
  - Web Service wizard
  - JCA wizard
  - JSF (JavaServer Faces)

WebSphere Development Studio

RPG | COBOL | C/C++ | PDM SEU SDA RLU

Current 5722-WDS customers with software subscription for V5R3, to upgrade to WDSc V6.0 use feature #: 2656
Available after GA

Upgrade from WDSC 6.0 to 6.0.1 using Rational Product updater

Unlimited Licenses

New WDSc Lite Technology preview

iSeries	iSeries	iSeries	iSeries	Web Facing WDHT support	iSeries Projects	+CODE +VisualAge RPG
Java™	Debug	Struts / Web	Web Service		RSE	
JSF	EGL Java generation	Trace	Profiling	DB	XML	App Server	HATS Toolkit

www.ibm.com/software/awdtools/iseries

WebSphere Development Studio Client V6.0.1 based on RWD V6

WebSphere Development Studio Client Advanced Edition 6.0.1

Workstation License order through Passport Advantage
http://www.lotus.com/services/passport.nsf/WebDocs/Passport_Advantage_Home

Upgrade from WDSC 6.0 to 6.0.1 using Rational Product updater

iSeries	iSeries	iSeries *	iSeries	Web Facing * **WDHT support**	iSeries Projects	+CODE +VisualAge RPG
Java	Debug	Struts / Web	Web Service		RSE	
JSF	EGL Java generation	Trace	Profiling	DB	XML	App Server	HATS Toolkit
	EGL * COBOL generation	EJB * / J2EE *	Test * Cases	Portal * Toolkit		

New WDSc Lite Technology preview

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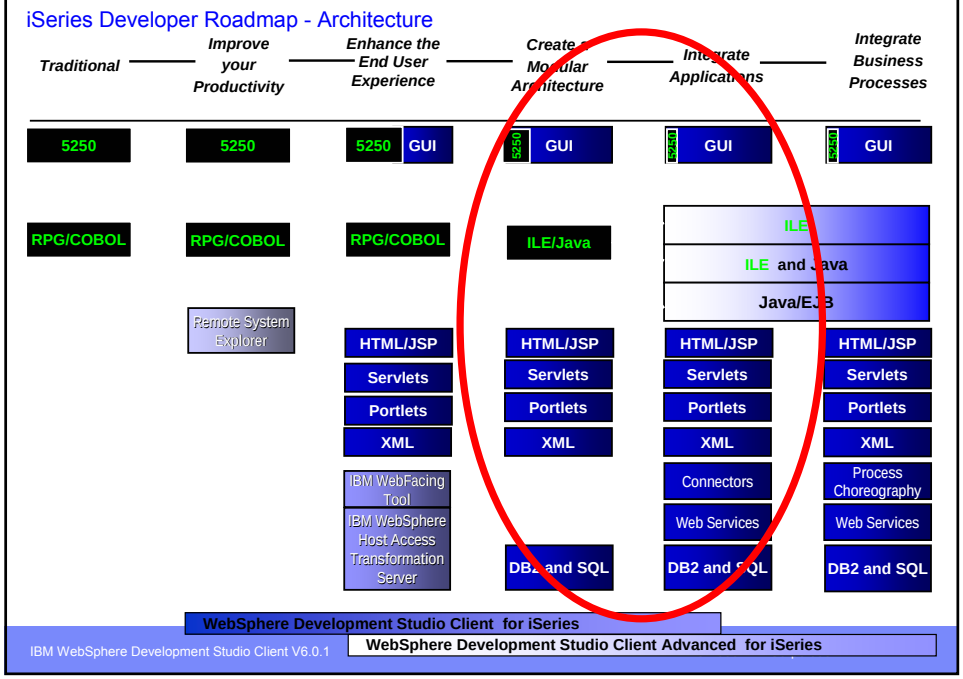
WebSphere Development Studio Client V6.0.1 based on RAD V6



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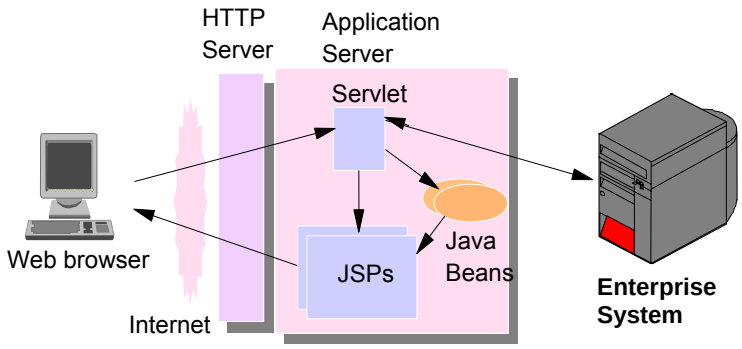
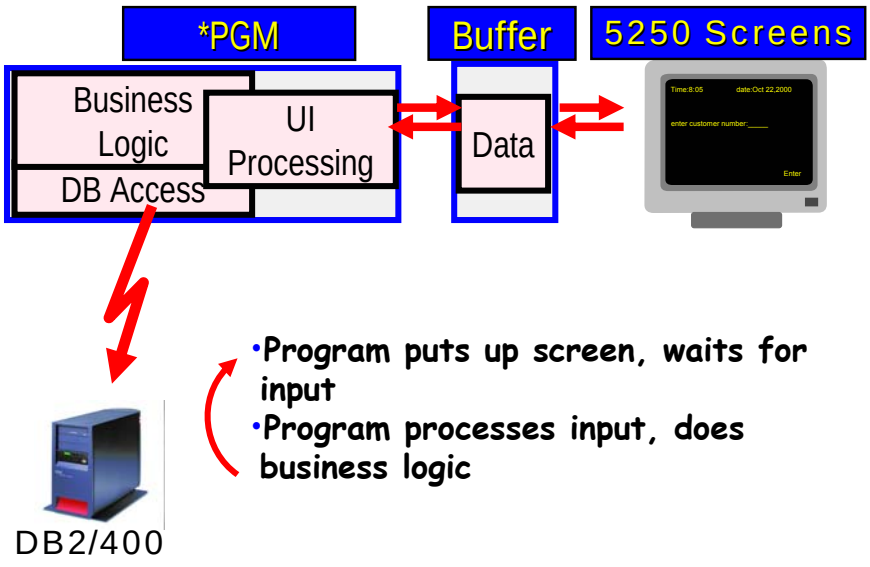
Modern App Architecture



Today's Model

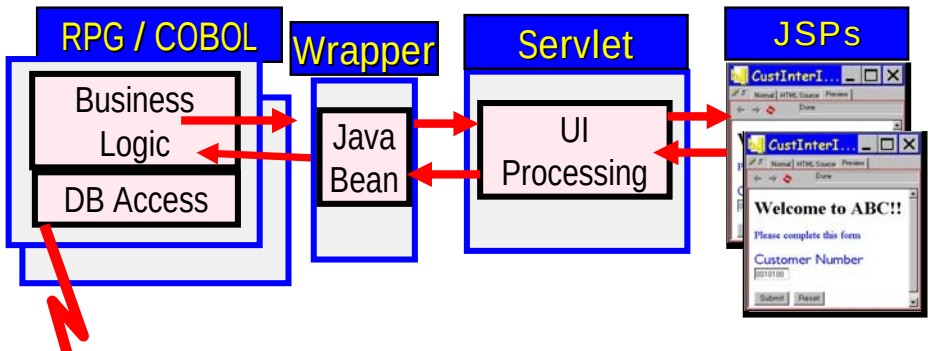
iSeries AD, IBM Toronto



- Program puts up screen, waits for input
- Program processes input, does business logic

eBusiness Application

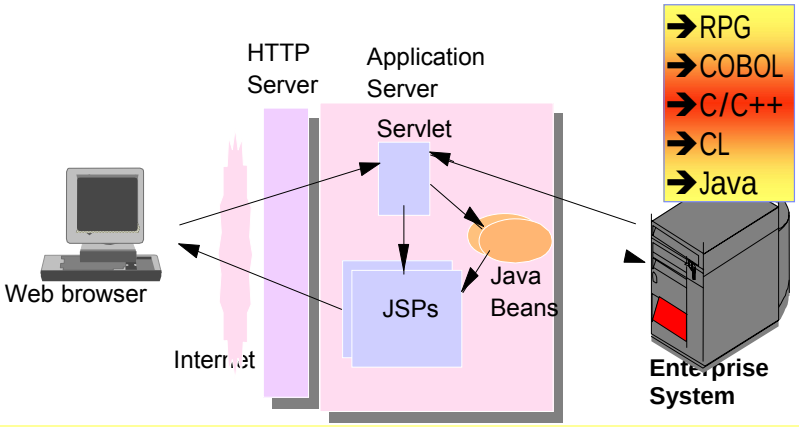
iSeries AD, IBM Toronto



DB2 UDB

- **JavaServer Pages (JSPs) for UI**
  - HTML tags for constant part
  - JSP tags for dynamically substituted data
  - HTML FORMs for user input fields
- **Servlets for UI processing**
- **Java Bean encapsulation of business logic**
- **Business Logic: *PGM or ILE procedures**

Tooling for building modern applications



WDSc

- iSeries webtooling
  - Pagedesigner
  - Interaction wizard
  - WebServices wizard
- iSeries 3 GL tooling
  - Remote system explorer
  - LPEX source editor
  - Integrated Debugger

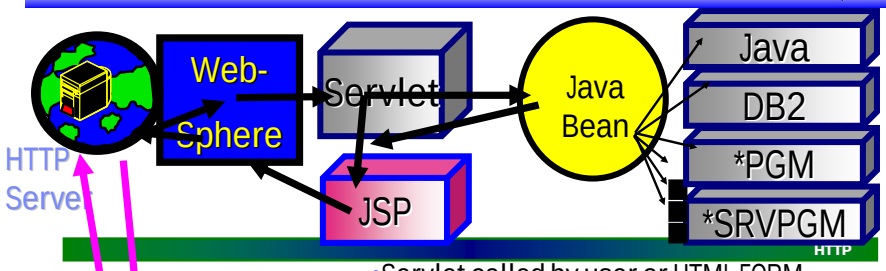
What Are Servlets?

- Servlets are . . .
  - Java classes (programs written in Java) that run . . .
    - On an application server (eg, WAS)
- Servlets are called . . .
  - By your HTTP Server software
  - From other Servlets
- The input to Servlets is . . .
  - User-entered data from a Web page
- The output of a Servlet is . . .
  - Java Bean, passed to a JavaServer Page

What Are JSPs?

- A way of describing dynamic web pages
- JavaServer Pages (JSPs) are . . .
  - .jsp files
    - containing html tags plus JSP tags
- JSP tags . . .
  - Allow dynamic data to be inserted into the static HTML
- JSPs are invoked . . .
  - By a servlet
  - The input to JSPs are . . .
    - Java Beans passed from your Servlet
  - The output of a JSP is . . .
    - A full Web page, displayed to user

Web Model



- Servlet called by user or HTML FORM
- Web Server calls Servlet
  - Servlet optionally reads input fields
- Servlet calls Java Bean to get data
- Java Bean gets its data
  - From other Java code, DB2, RPG, whatever
- Servlet calls JSP
  - Passes Java Bean containing data
  - JSP merges data with HTML => new page
- HTTP Server sends new page to user

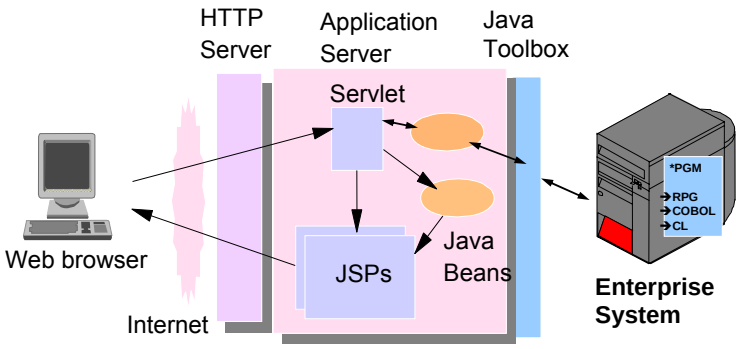
Calling native programs from Java

A brief look at:

IBM System i5 Java toolbox

- Using Program Call Markup Language (PCML)

Calling native programs from Java



Using the iSeries tool box classes to access native objects

Java Calling RPG

iSeries AD, IBM Toronto

Say we have the following RPG code . . .

```
FCUSTOML3  IF   E           K DISK
DCUSTINFO        DS
D Number                  1      7A
D Name                    8     47A
C     *ENTRY      PLIST
C                 PARM                    CUSTINFO
C     Number      SETLL     CUSTOM01
C     Number      READE     CUSTOM01                9091
C                 EVAL      Name = CUSTNA
C                 MOVE      *ON           *INLR
**************** End of data ************************
```

Pass in Customer ID and receive back customer name.

Use PCML to describe program interface

RPG/COBOL compilers create PCML

No need for you to write PCML

```
<pcml version="1.0">

 <!-- Create a Data Structure -->
 <struct name="custinfo">
   <data name="Number" type="char" length="7"
         usage="inputoutput" init="0014400"> </data>
   <data name="Name"   type="char" length="40"
         usage="inputoutput" init=" "> </data>
 </struct>

 <!-- Program getcust -->
 <program name="getcust"
          path="/QSYS.lib/FARR.lib/GETCUST.pgm">
   <data name="gotback" type="struct"
         usage="inputoutput" struct="custinfo"> </data>
 </program>

</pcml>R
```

Program Call Markup Language (PCML)

Call RPG from Java Servlet


```
public static void main(String[] argv)
{
    AS400 as400System = new AS400();
    ProgramCallDocument pcml = null;
    String msgId, msgText;
    Object value = null;
    try {
      System.out.println(
         "Creating ProgramCallDocument for GetCust pgm.");
      pcml = new ProgramCallDocument(as400System, "GETCUST");
      boolean ok = pcml.callProgram("getcust");
      System.out.println(" rc is---> " + rc);
      if (!ok)
        { /* Retrieve list of AS/400 messages & display them */ }
      else
        {
          value = pcml.getValue("getcust.gotback.Name");
          System.out.println("Customer name: " + value);
        }
    } catch (PcmlException exc) {
      System.out.println("*** Call to getcust failed. ***");
      System.exit(0);
    }
    System.exit(0);
} // end main method
```

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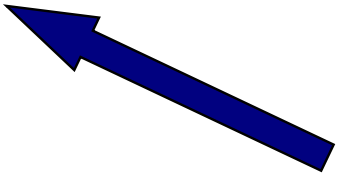


Web Application

- Standard Web App folder structure:

```
+Web application folder (root folder)
  +source
    –all non-deployed files (java)
  +WebContent
    –all Web files (html, jsp, gif, ...)
    +META-INF
      –MANIFEST.MF
    +theme
      –.css style sheets
    +WEB-INF
      –web.xml
      +classes
        –Java classes of this app (usually generated)
      +lib
        –Supporting classes and jar files
```

collectively known as "Web Resources"

maps dependent jar files in other Web apps

Web application deployment descriptor:
- identifies servlets, security, env vars, mime types, key pages, external references and session configuration info

J2EE 1.3

Terms: Web Application

- Example Web Application

```
+accounts
  +source
  +WebContent
    -index.html
    +receivable
      -page1.html
    +payable
      -page1.html
    +META-INF
      -MANIFEST.MF
    +theme
      -corporate.css
    +WEB-INF
      -web.xml
      +classes
      +lib
```

www.mydomain.com/accounts

www.mydomain.com/accounts/receivable/page1.html

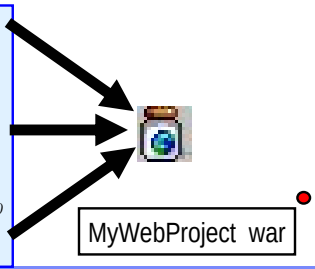
www.mydomain.com/accounts/payable/page1.html

Web Archive Files (WAR)

J2EE 1.3

- **One file containing**
  - Whole folder structure of Web application
  - Including web.xml file
  - Optionally including source
- **Used to**
  - Install and configure Web application in an application server

```
+Web application folder (root folder)
    +source
        –all non-deployed files (java)
    +WebContent
        –all Web files (html, jsp, gif, ...)
        +META-INF
            –MANIFEST.MF
        +theme
            –.css style sheets
        +WEB-INF
            –web.xml
            +classes
                –Java classes of this app (usually generated)
            +lib
                –Supporting classes and jar files
```

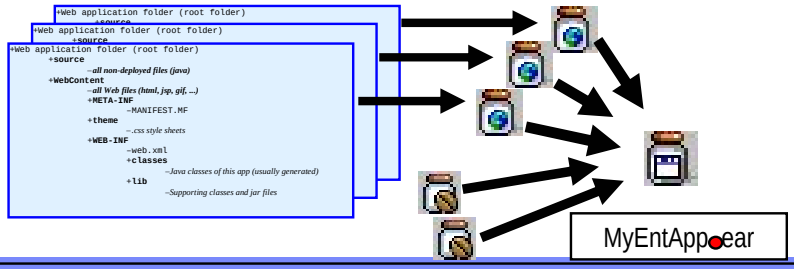


MyWebProject war

Enterprise Archive Files (EAR)

J2EE EJB Spec

- **One file containing:**
  - Zero or more Web Archive (war) files
  - Zero or more EJB jar files
  - A J2EE deployment descriptor
- **Used to install and configure:**
  - All pieces of a J2EE Enterprise Application
    - ✓Web application plus EBJs plus EJB clients
  - All Web applications for a Web site (say)

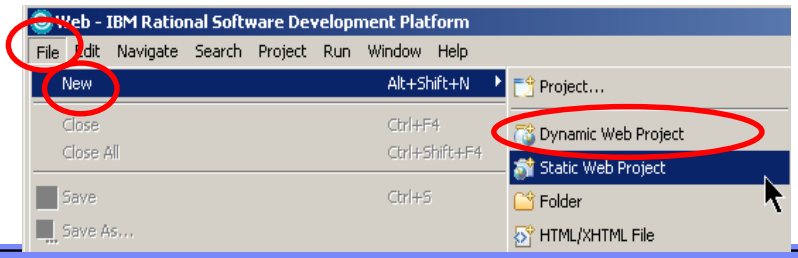


WDSc Web Tools At A Glance

- Web projects
- ✓Created with J2EE-defined folder structure for Web Applications
  - ✓Superset of Java projects (so contain all Java Tool support too)
- Automatic creation/maintainence of web.xml file
- Editor support
  - ✓JSP and HTML files
    - ✓Support for creating, validating, editing and debugging
    - ✓Including WYSIWYG PageDesigner
    - ✓Custom JSP tags (taglib) support
    - ✓based on the Sun Microsystems JSP 1.1 Specification
  - ✓Images and animation
  - ✓Cascading Style Sheets (CSS)
- Import/Export from/to a variety of sources
  - ✓HTTP/FTP/WAR
- Link viewing and management
  - ✓Converting links, flagging broken links, and fixing up links as linked resources are moved or renamed
- Wizard for servlets, Web pages from DB or JavaBean
- Integration with WebSphere Test Environment

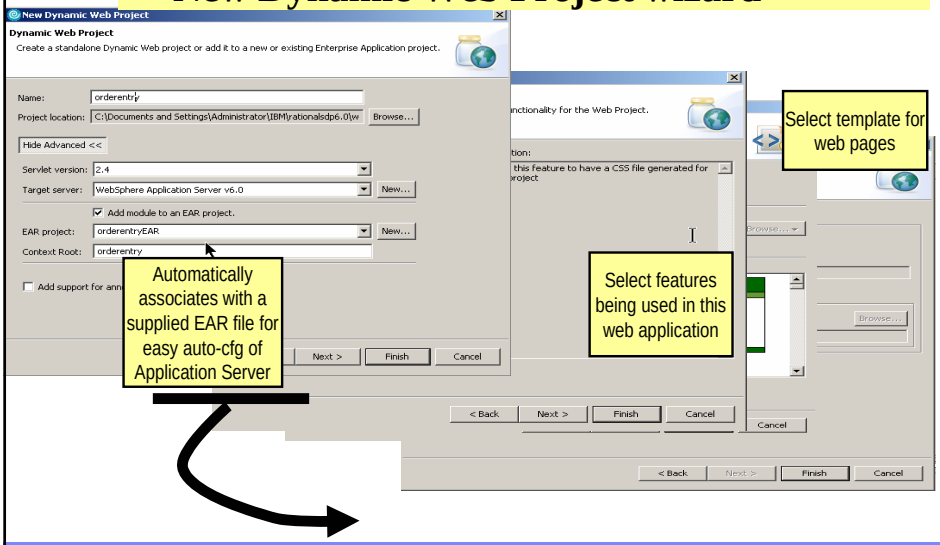
Web Projects

- One of the project types in WDSc
  - With its own perspective
  - With its own "new" wizard
  - With its own set of tools
- Created with J2EE folder layout
- Created with simple web.xml file
  - Automatically updated as resources are created
  - Has specialized web.xml editor



Web projects

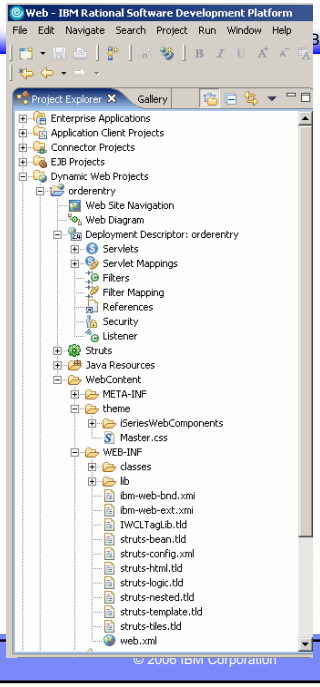
New Dynamic Web Project wizard



Web projects

To create a new web project
- **Select New Dynamic Web Project in Web perspective**

Web application structure is created from information provided in New Dynamic Web Project Wizard



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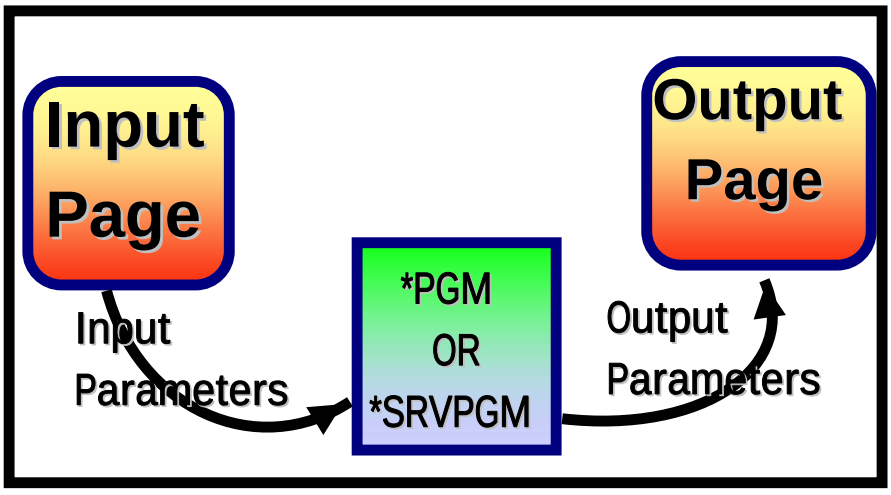
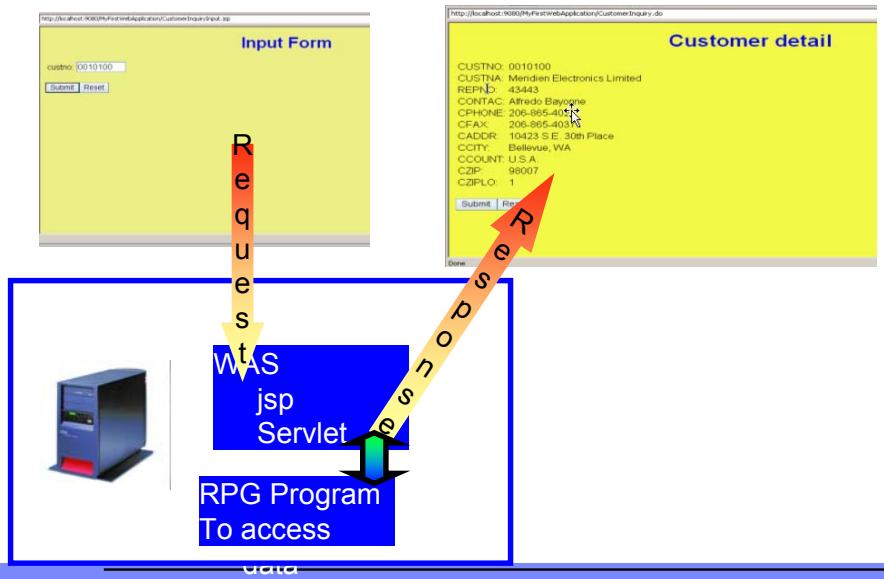
Web Tool for iSeries

- Wizards to help create iSeries RPG/COBOL web applications
  - Interaction wizard to build web application
  - WebService wizard to build an iSeries WebService
  - JCA wizard to build an iSeries Java Connector Architecture (JCA) connector

An interaction



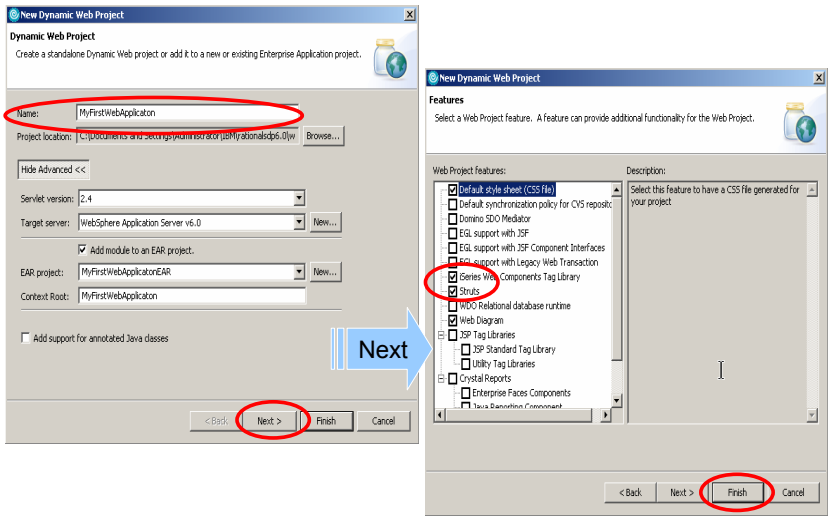
Build this simple interaction



Using the Interaction wizard

- Steps involved
  - Create a dynamic web project
  - Create Runtime configuration
    - iSeries server
    - User id/password
    - Library list setup
  - Create Interaction
    - Input screen
    - Program interface (PCML)
    - Output screen

Create a Web project



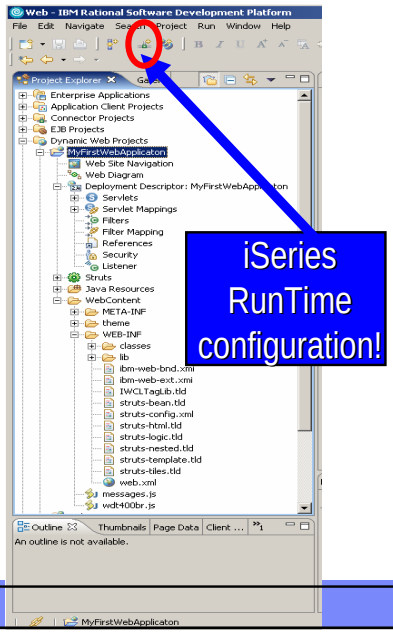
Using the Interaction wizard

- ✓ Create a Webproject
- Create Runtime configuration
  - iSeries server
  - User id/password
  - Library list setup
- Create Interaction
  - Input screen
  - Program interface
  - Output screen

Runtime configuration

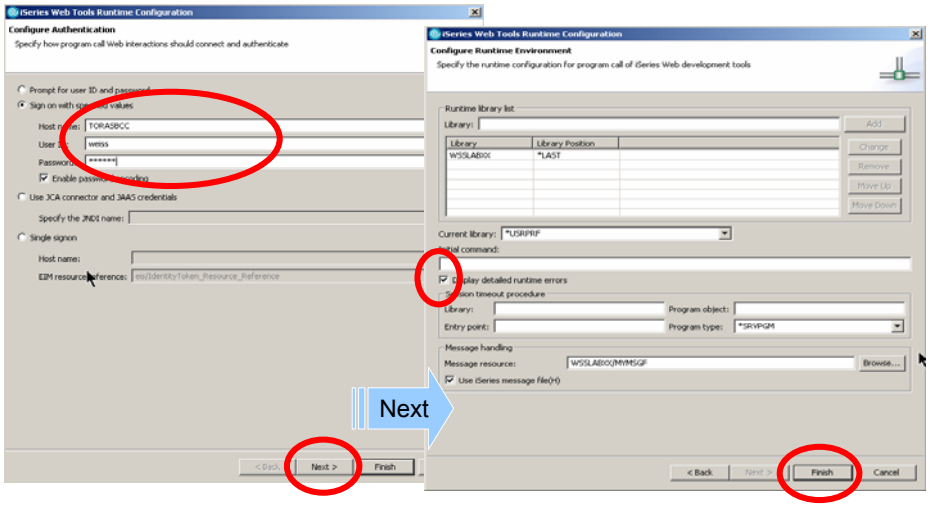
Created Dynamic Web project:
➔ MyFirstWebapplication
Now create the runtime environment

- **Information used at runtime by all generated Web servlets in this Web project**
  - ►Name of host containing *PGM or ILE Procedure
  - ►User ID and password for signing on
  - ►Library list to set for *PGM/Proc job



iSeries Web Tools

► iSeries Web Host Information Wizard

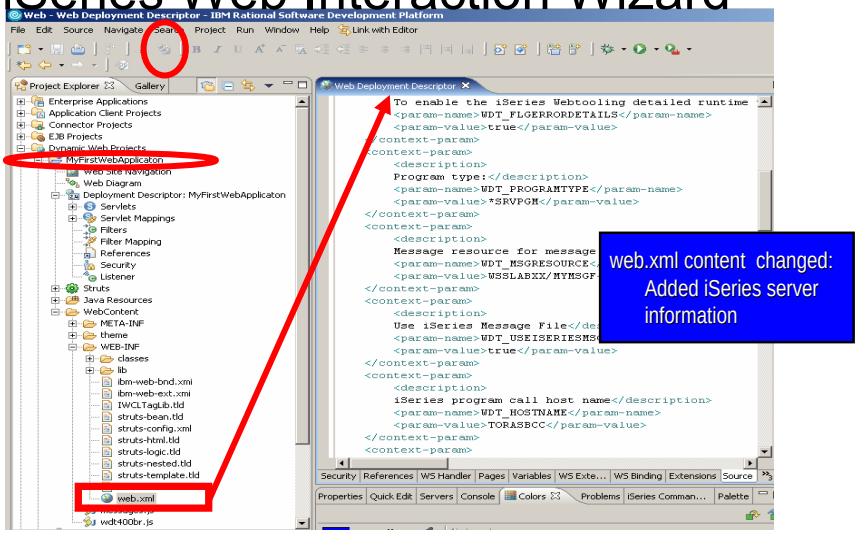


Using the Interaction wizard

- ✓ Create a Webproject
- ✓ Create Runtime configuration
  - ✓ iSeries server
  - ✓ User id/password
  - ✓ Library list setup
- Create Interaction
  - Input screen
  - Program interface
  - Output screen

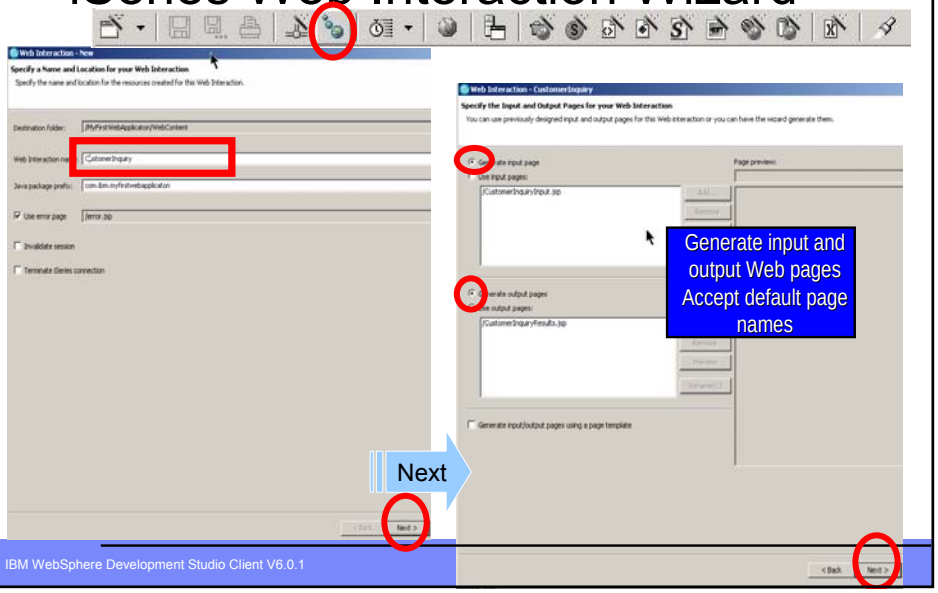
WDSc: iSeries Web Tools

iSeries Web Interaction Wizard



WDSc: iSeries Web Tools

- iSeries Web Interaction Wizard

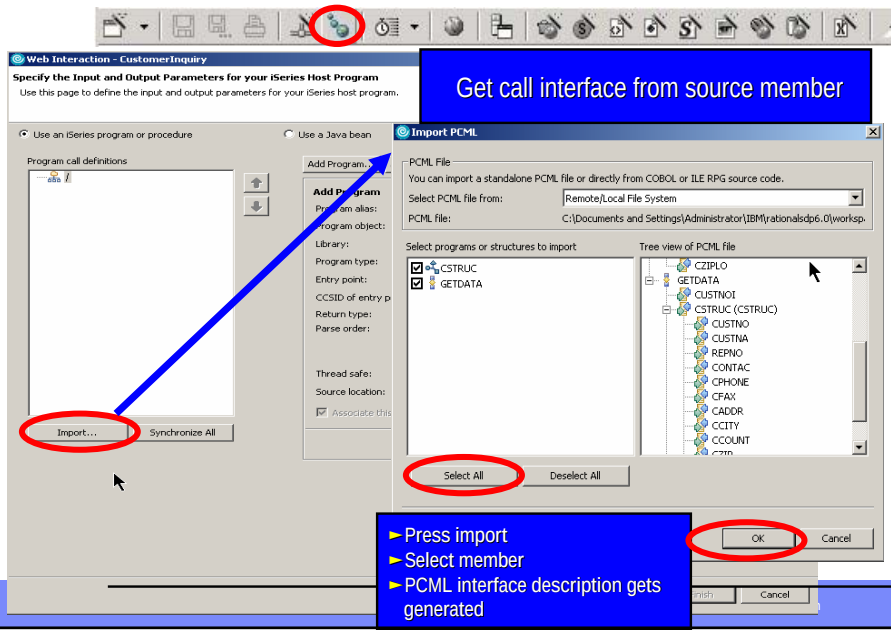


Web Interaction Wizard

- Two modes to interaction wizard:
  - **Generate input/output Web pages**
    - **Given the parameter description of the API to call** **(In this sample we are using this mode)**
  - **Generate mappings**
    - **Given the input/output pages**
    - **Given the parameter description of the API to call**
    - **Given the mappings**
      - ✓between input parms & input fields
      - ✓between ouput parms & output fields

iSeries Web Interaction Wiz

iSeries AD, IBM Toronto



RPG IV Program GETDATA

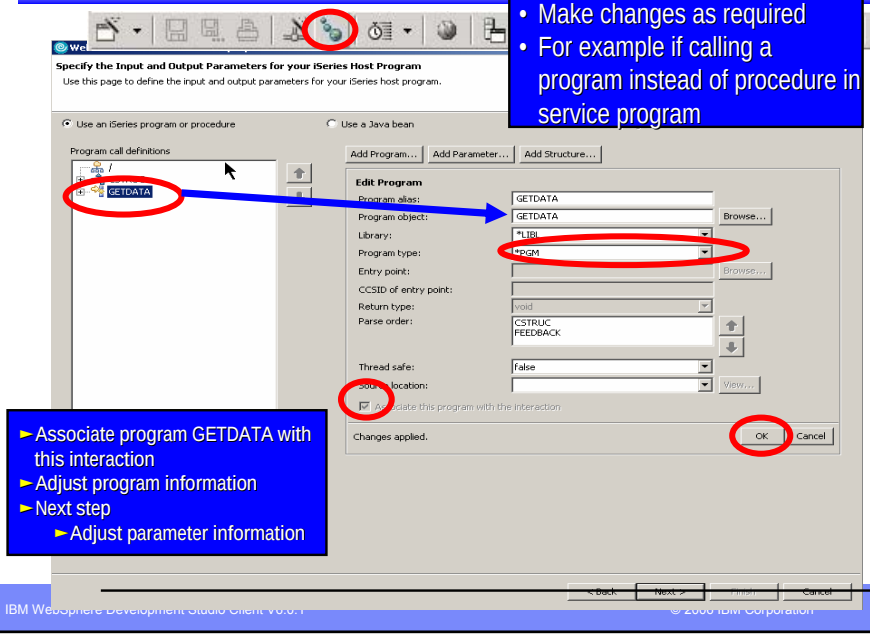
iSeries AD, IBM Toronto

NOTE: Parameters to be passed

```
FCUSTOML3  IF   E           K Disk
DCustnoi         s                  like(CUSTNO)
D*
D CSTRUC         E DS               extname(customl3:custom01)
d field2                      10
D return         s                  20
D*-------------  ------------------------------  ---------------
c     *entry     plist
c                parm               custnoi
c                parm               cstruc
c                parm               return
c                eval               return=*blank
c     custnoi    chain     customl3                          5050
c                if        *in50
c                eval      return='CUS0001 ' + CUSTNOI
c                else
c                eval      return='0'
c                endif
c                return
```

iSeries Web Interaction Wiz

iSeries AD, IBM Toronto

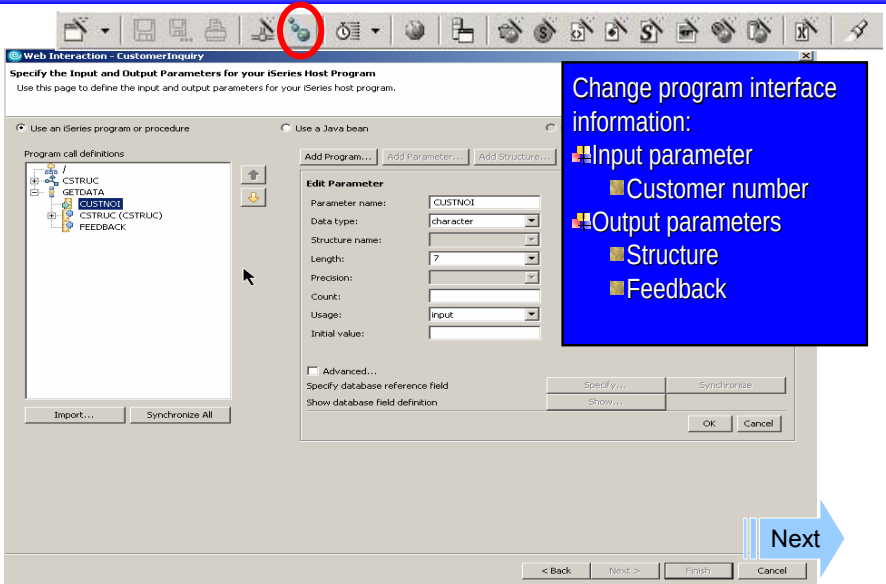


- Make changes as required
- For example if calling a program instead of procedure in service program

- Associate program GETDATA with this interaction
- Adjust program information
- Next step
  - Adjust parameter information

iSeries Web Interaction Wiz

iSeries AD, IBM Toronto

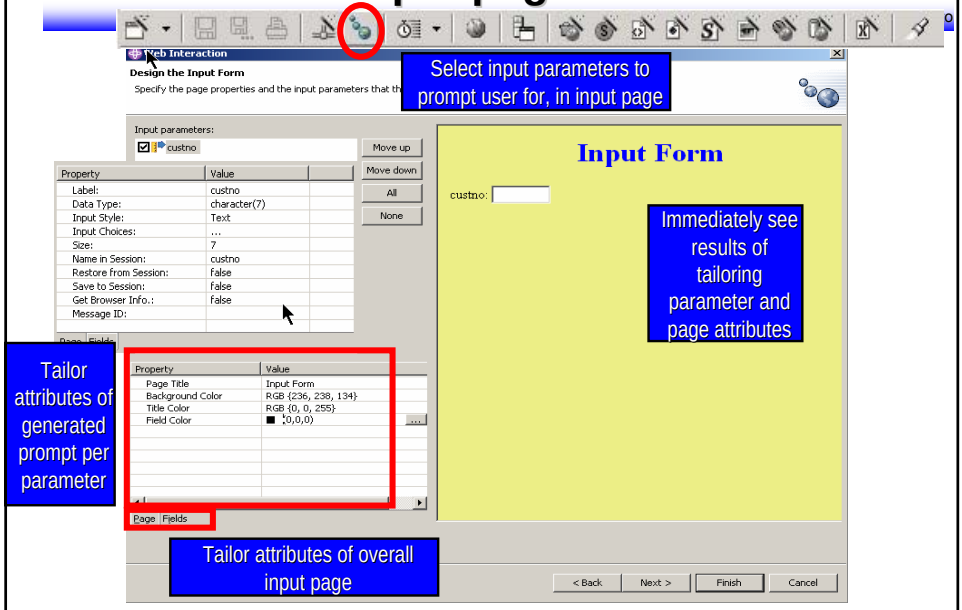


Change program interface information:

- Input parameter
  - Customer number
- Output parameters
  - Structure
  - Feedback

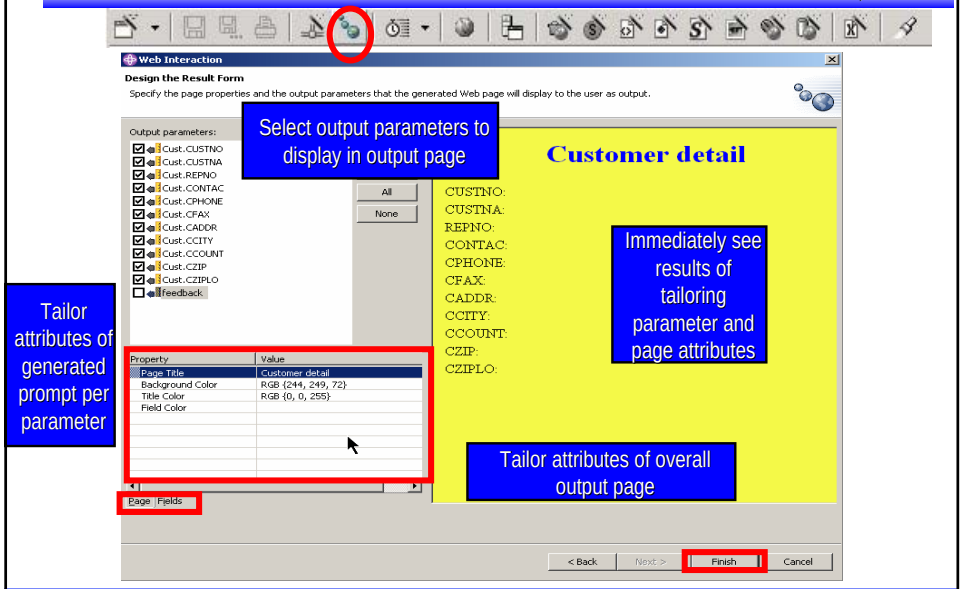
Next

Input page



Output page

iSeries AD, IBM Toronto



You are done! What's Next?

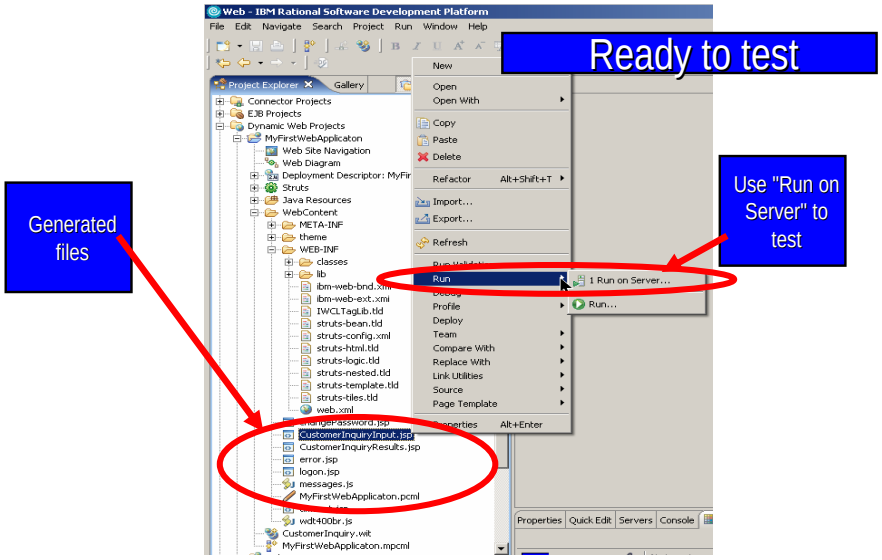
- **What did you do so far?**
  - √Created your Files on the iSeries
  - √Created your RPG Program
  - √Created an 'iSeries Web Interaction' to link your program parameters to the input page and output page
    - √The input page was generated for you
    - √The output page was generated for you
- **Next?**
  - ►Run locally to test your application Or
  - ►Publish all your files to the iSeries server

WDSc: Run On Server

- ►Run On Server
  - **Now this is VERY COOL!**
- ►When ready to test your Web app
  - **Right click on initial html or jsp file**
  - **Select "Run... --> Run on Server"**
  - **Wait for the magic...**
- ►Your Web application will run!
  - **Opens Server perspective**
    - ►Publishes it to built-in copy of WAS
    - ►Starts built-in copy of WAS
    - ►Brings up a Web Browser
    - ►**Runs your application!!**

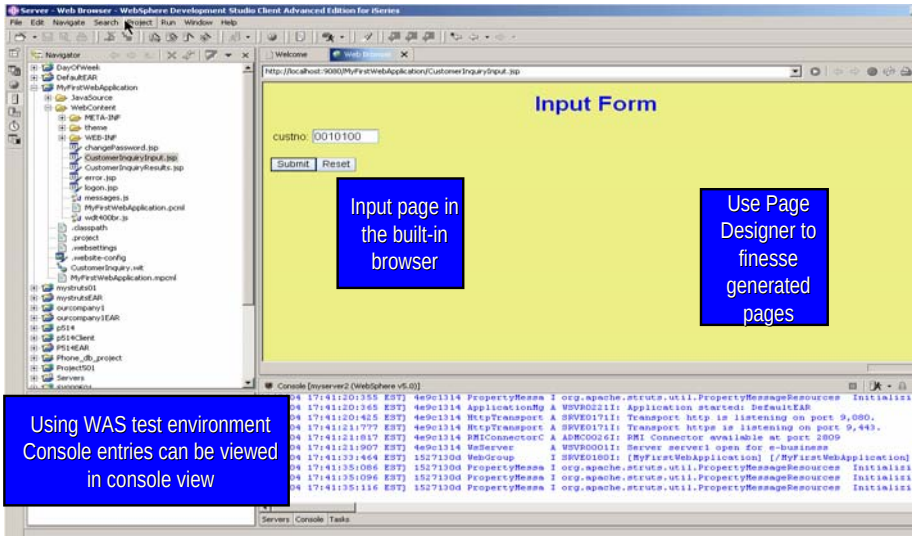
iSeries Web Interaction Wiz

iSeries AD, IBM Toronto

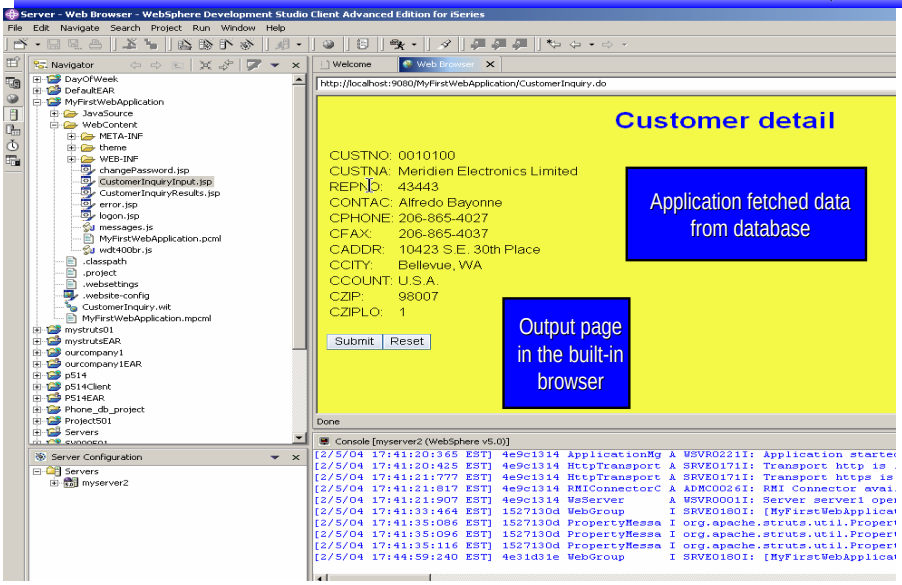


Testing the Interaction

iSeries AD, IBM Toronto



Testing the Interaction



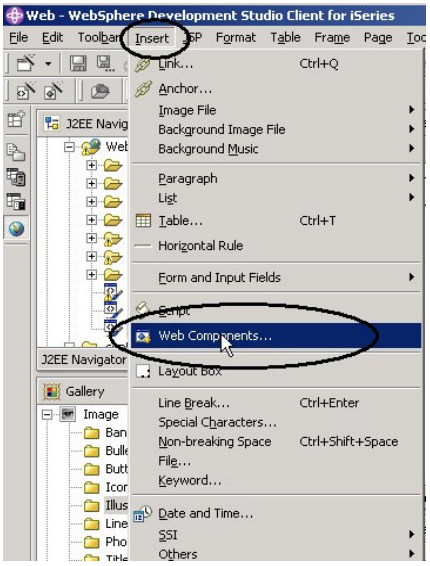
WebSphere Test Environment

A full copy of WAS 6.0 is embedded in the IDE

- Integrated with Server Tools to enable instant and dead-easy testing of Web projects within WDSc.
  - ✓Standalone all-in-one testing
  - ✓No dependency on WAS installation or availability
  - ✓No dependency on an external database
- Provides the ability to debug live server-side code
- Supports configuring multiple Web applications
- Supports multiple servers that can be configured and run at the same time
- Provides access to the profiling feature that is available in the workbench
- Provides the ability to version Server Tools server configurations
- Provides access to the WAS Administration Client

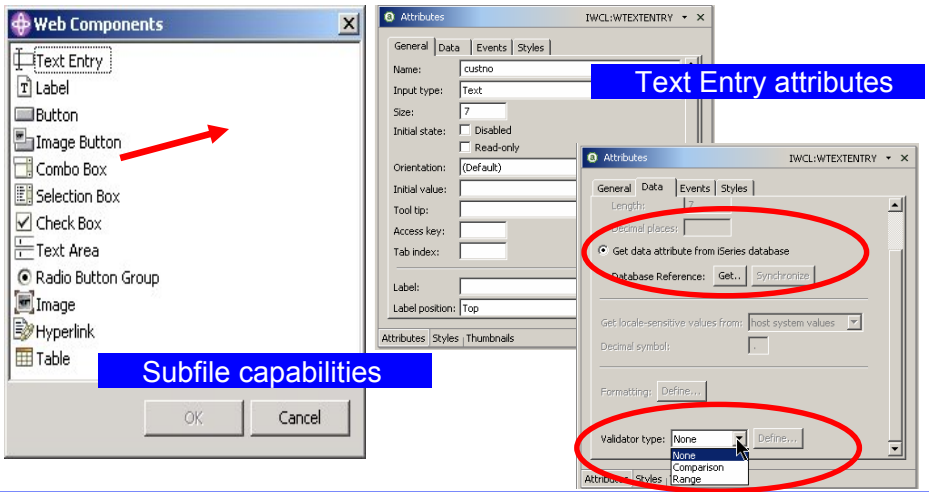
Web UI with Web components

- Web components: Visual Control Tags (VCT)
- Tag library defined by:
  - www.sun.com
- Extendable



Web components ...

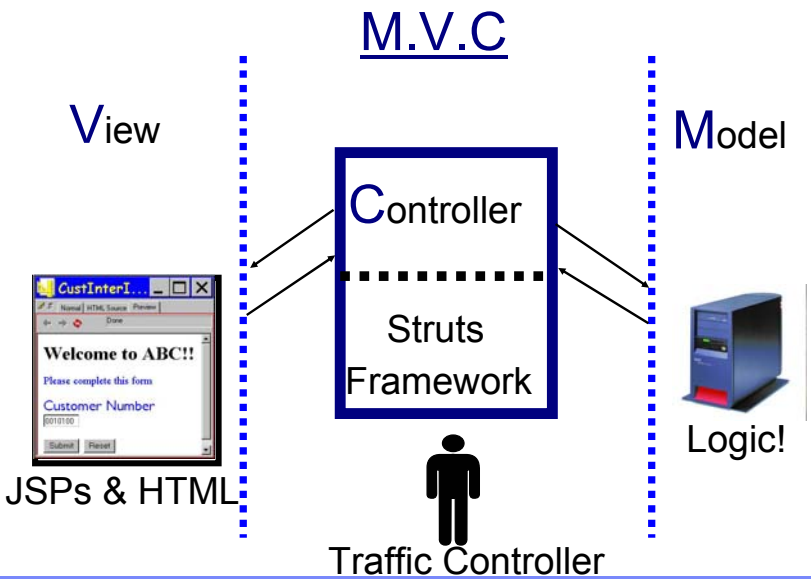
- With iSeries built in capabilities!



Struts

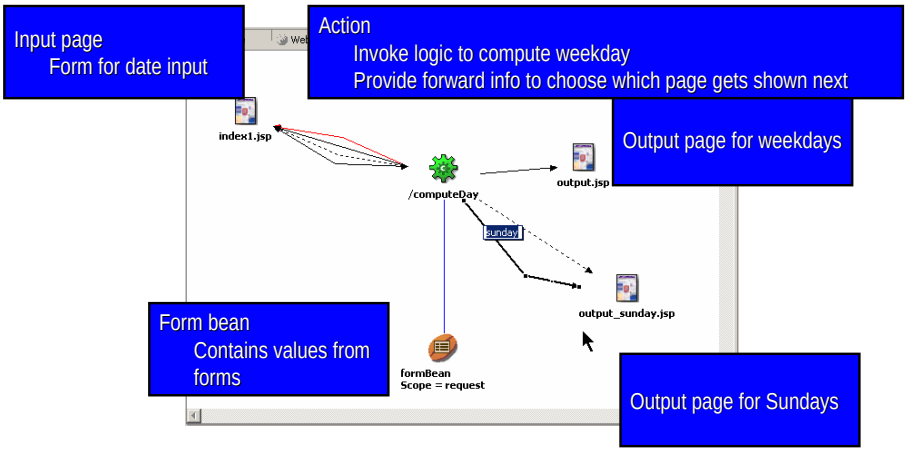
- Web Interations are Struts based!
  - Struts environment
  - Simple Struts application
  - iSeries Interaction and Struts

Web Wizard Struts based ...



Simple Struts application

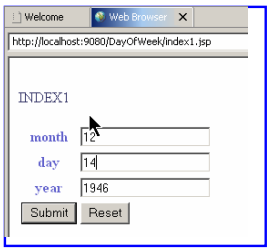
Web diagram of a simple Struts application

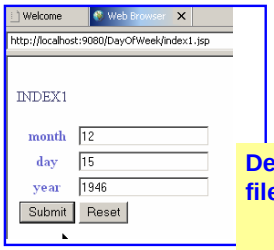


Input is date, output is day of week for that date
or if the day of week is a **Sunday,** output is a special Sunday page

Simple Struts web application

➔Determine weekday from date

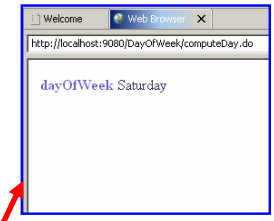




➔One input page
➔Two different
Output pages

Struts-config file

```
<action-mappings>
<action name="formBean" path="/computeDay"
    scope="request"
    type="com.ibm.dayofweek.actions.ComputeDayAction"
    input="index1.jsp">
<forward name="success" path="/output.jsp">
</forward>
<forward name="failure" path="/index1.jsp">
</forward>
<forward name="sunday" path="/output_sunday.jsp">
</forward>
</action>
```



Define in the Struts config file
Which page to show
The action just returns different

It Is A Sunday Wonderful

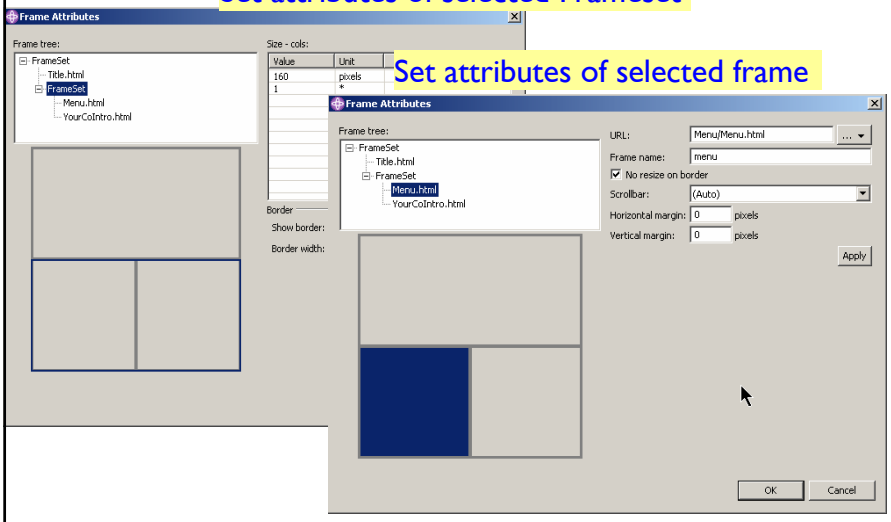
Page designer tool

- **Page Designer for JSPs & HTML**
  - **Frame wizard**
  - **WebArt designer**
  - **AnimatedGIF designer**
  - **Spell Checker**
  - **HTML validator**
  - **HTML to XHTML converter**
  - **Attribute dialog**
- **Link utilities**
  - **fix broken links**
  - **Convert links**

PageDesigner

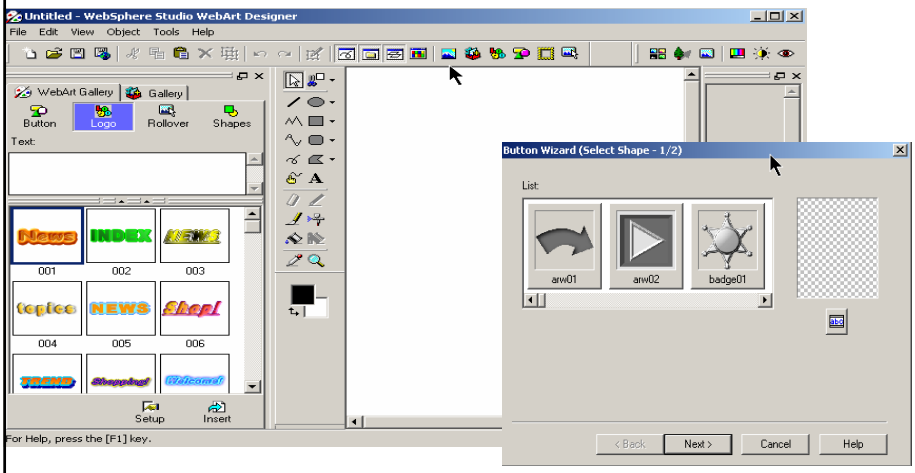
Frame tools

Set attributes of selected Frameset

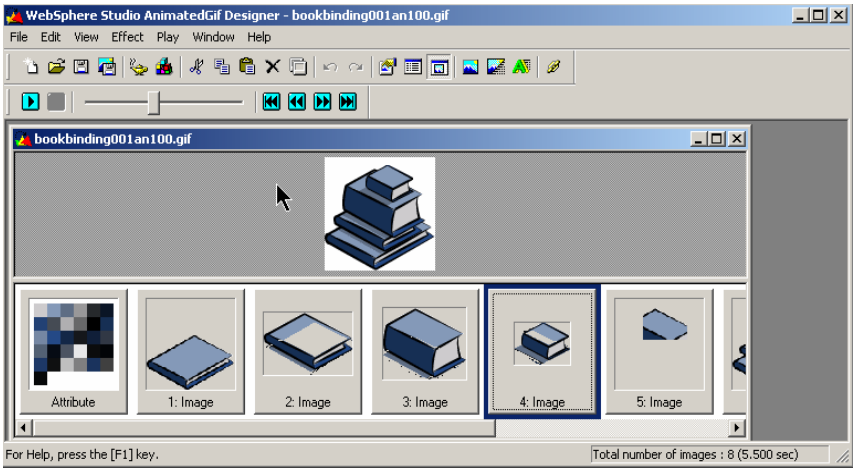


WebArt Designer

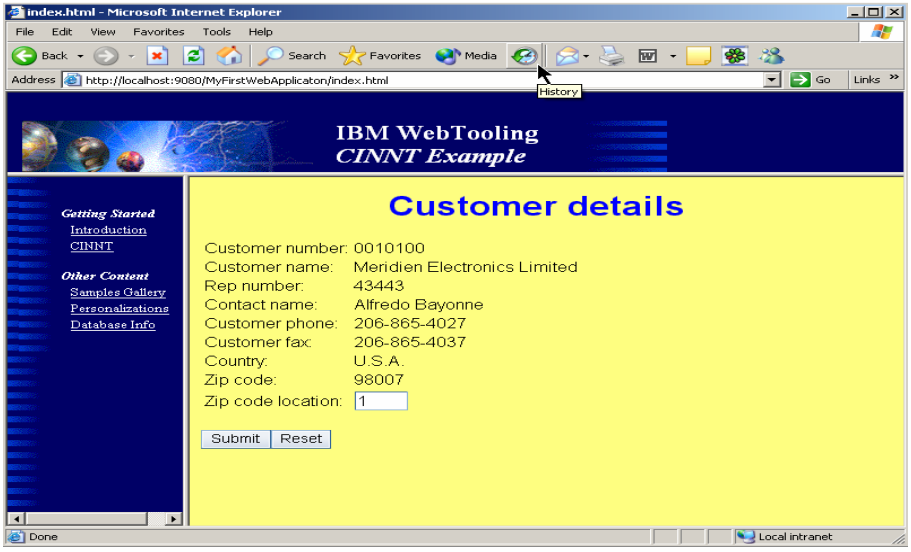
Wizards for Logo/Button/PhotoFrame/Rollover



Animation GIF designer



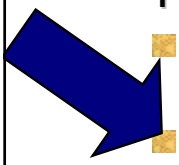
Running the improved application



AGENDA

- WebSphere Development Studio WDS V5R4
- e-business primer
  - AD Model, traditional and web
  - Web Applications
  - Mixing Java and RPG
- Introducing WebTools for IBM System i5
  - Web projects
  - Interaction wizard
  - Page designer
  - Web Service wizard
  - JCA wizard

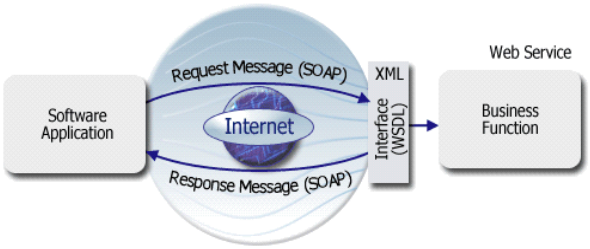
Web Tool for iSeries



- Wizards to help create iSeries RPG/COBOL web applications
  - Interaction wizard to build an RPG web application
  - WebService wizard to build an iSeries WebService
  - JCA wizard to build an iSeries Java Connector Architecture (JCA) connector

Webservice overview

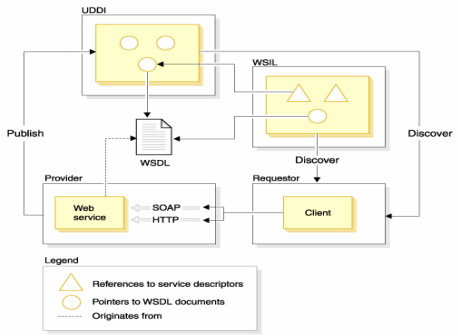
➔Industry standard
➔A way to interchange data in a non-proprietary way
➔ Self-contained software components, with a well-defined interface
➔ The interface describes a set of operations accessible over the internet
➔ UDDI Universal Description, Discovery and Integration
➔ WSIL Web Services Inspection Language
➔ WSDL Web Services Description Language
➔ SOAP Simple Object Access Protocol



Web Service and IBM System i5

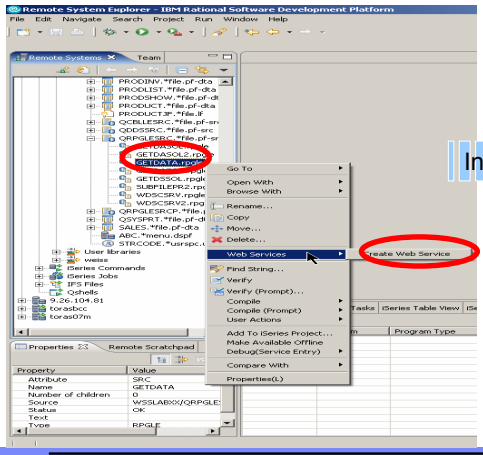
➔Describe the Program interface that provides the Service

➔ New in 6.0.1
➔ Web Service Wizard in WDSc generates
➔ for a given program source member on IBM System i5:
➔WSDL to describe the service interface
➔Test client to test the Web Service

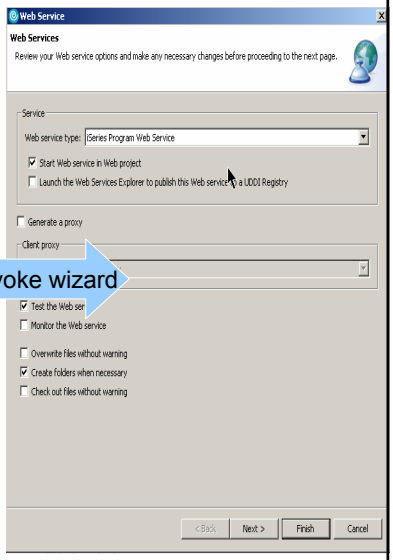


Create Web Service for RPG program

➔In RSE:
- ➔ select member
- ➔ choose Web Service wizard



Invoke wizard



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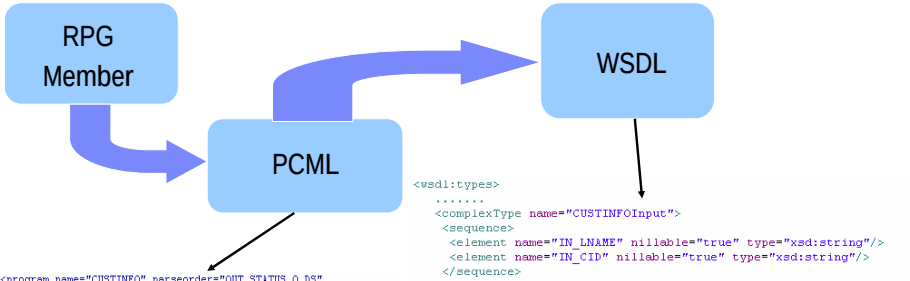
Create Web Service for RPG program

iSeries AD, IBM Toronto




```
<program name="CUSTINFO" parseorder="OUT_STATUS O_DS"
            path="/QSYS.LIB/%LIBL%.LIB/CUSTINFO.PGM">
  <data length="15" name="IN_LNAME" type="char" usage="input"/>
  <data length="4" name="IN_CID" type="char" usage="input"/>
  <data length="7" name="OUT_STATUS" type="char" usage="output"/>
  <data name="O_DS" struct="OUT_DS" type="struct" usage="output"/>
</program>
```

```
<wsdl:types>
  .......
  <complexType name="CUSTINFOInput">
   <sequence>
    <element name="IN_LNAME" nillable="true" type="xsd:string"/>
    <element name="IN_CID" nillable="true" type="xsd:string"/>
   </sequence>
  </complexType>
  <complexType name="OUT_DS">
   <sequence>
    <element name="OUT_CID" nillable="true" type="xsd:string"/>
    <element name="OUT_FNAME" nillable="true" type="xsd:string"/>
    <element name="OUT_LNAME" nillable="true" type="xsd:string"/>
    <element name="OUT_ADDRESS" nillable="true" type="xsd:string"/>
    <element name="OUT_CITY" nillable="true" type="xsd:string"/>
     ......
   </sequence>
  </complexType>
  ........
 </schema>
</wsdl:types>
```

IBM WebSphere Development Studio Client V6.0.1
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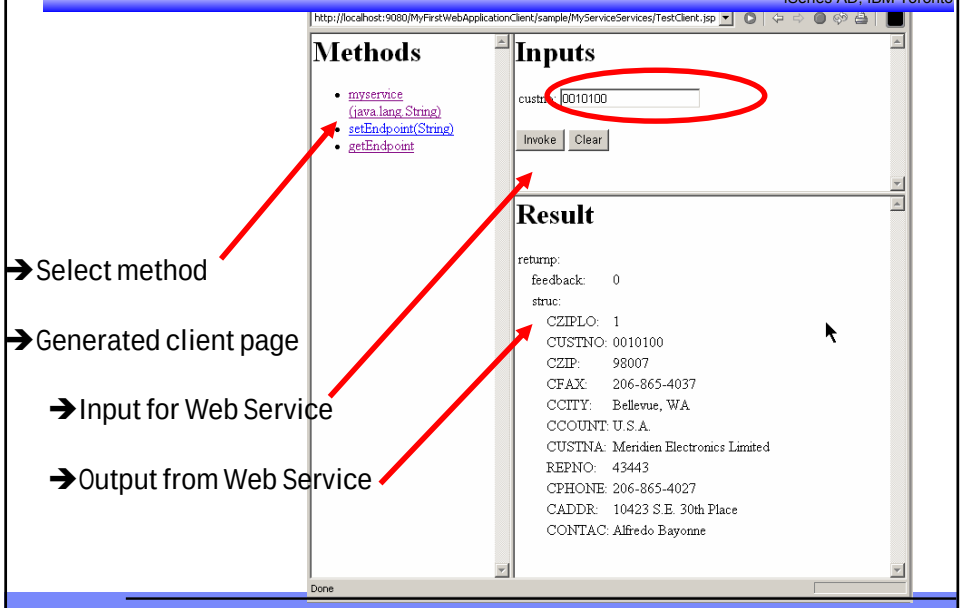
JSP Test client for Web Service



➔Select method

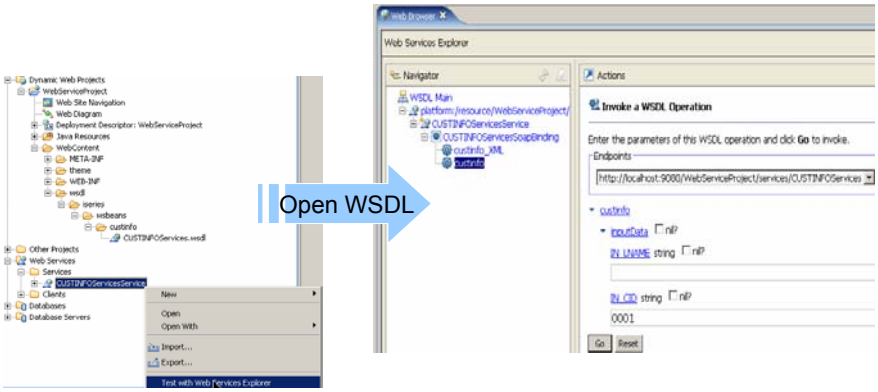
➔Generated client page

➔Input for Web Service

➔Output from Web Service

Test the Web service - Web Service Explorer

- Right-click on the WSDL document.
- Web Services explorer opens WSDL document.
- Select an operation from the Web Service (custinfo), enter program input, Go!

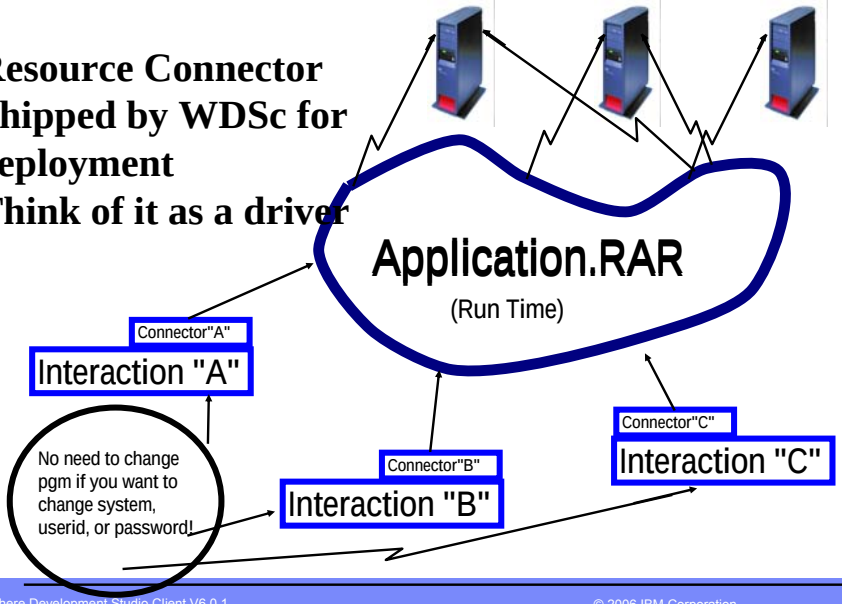


Web Tool for iSeries

- Wizards to help create iSeries RPG/COBOL web applications
  - Interaction wizard to build an RPG web application
  - WebService wizard to build an iSeries WebService
  - JCA wizard to build an iSeries Java Connector Architecture (JCA) connector

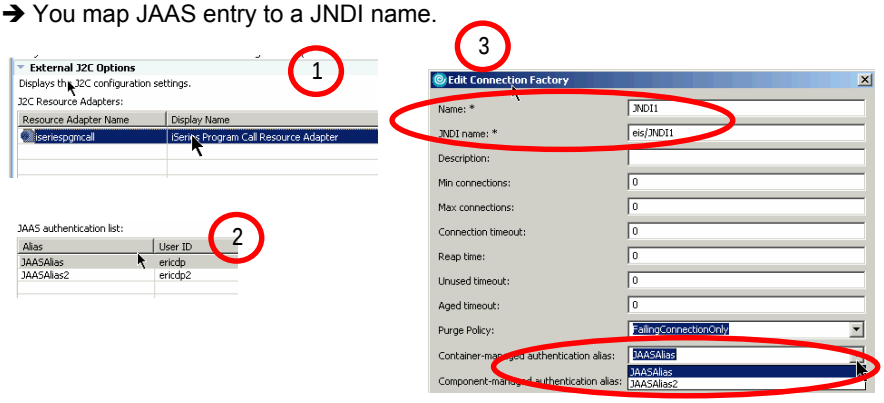
What is JCA Connectors?

- **Resource Connector**
- **Shipped by WDSc for deployment**
- **Think of it as a driver**



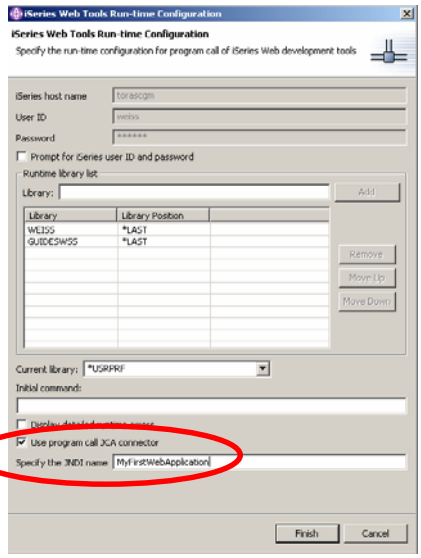
Configuring a JCA connector

- First you add the connector to the server configuration (all JCA info can be defined either through admin console)
- The userid(s) you want to use for program calls using JCA are defined via a JAAS authentication entry
- You map JAAS entry to a JNDI name.



Using JCA connector

- Use runtime configuration dialog
- Check JCA checkbox
- Specify JNDI name



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iSeries AD, IBM Toronto

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  - Web Applications
  - Mixing Java and RPG
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  - Interaction wizard
  - Page designer
  - Web Service wizard
  - JCA wizard
  - JSF – JavaServer Faces

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Java Server Faces Overview

What JSF?

- Defines the Programming Model
- Reusable Components
- Builds HTML from Components
- Validation & Conversion
- Component Tree

Why JSF?

- Ease/Simplify Development
- Support from/by tools
- Events easily tied to server side code
- Ease of extension
- Manage UI state

IBM WebSphere Development Studio Client V6.0.1
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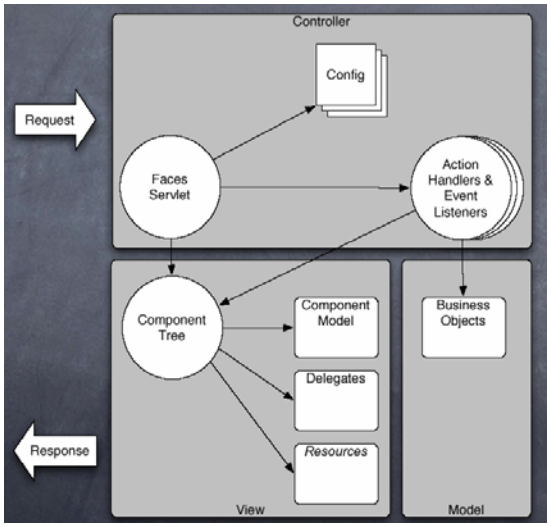
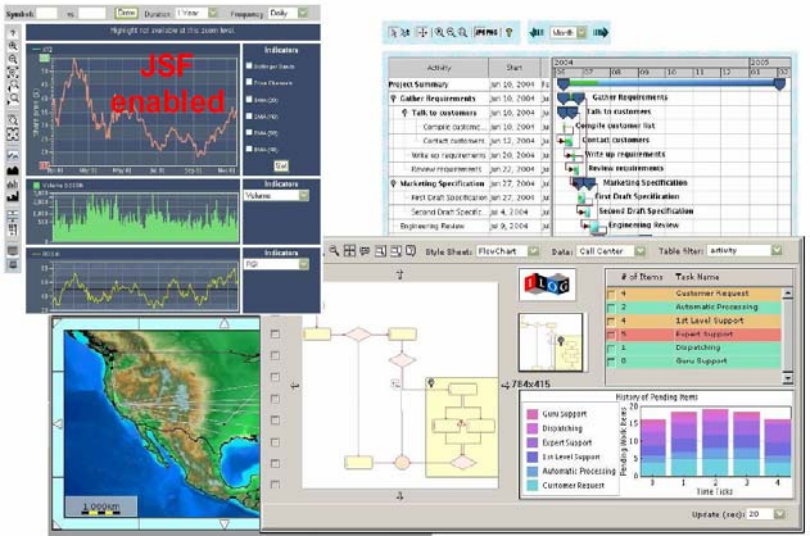
Java Server Faces MVC on the Web

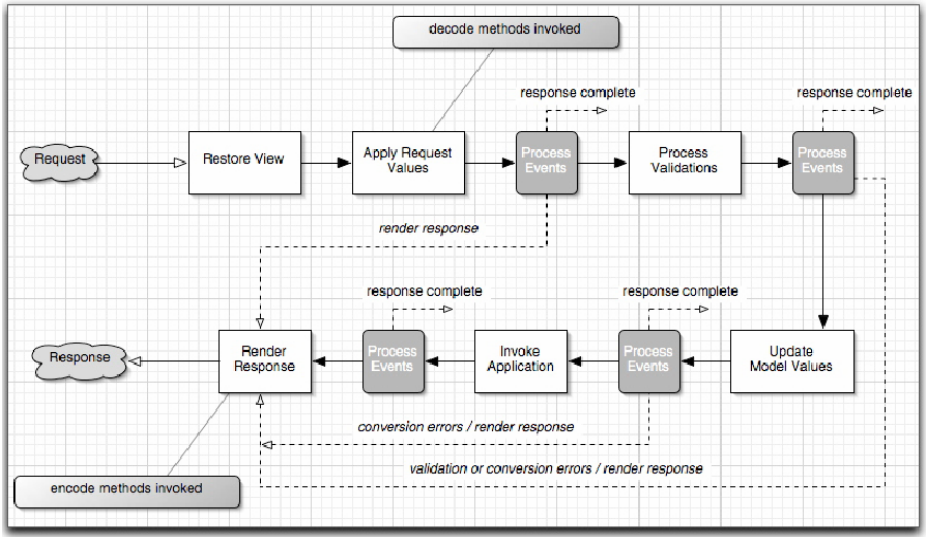


- Controller
  - FacesServlet
  - LifeCycle
  - Application
  - NavaigationHandler
  - ActionListener
  - Conversion and Validation
- View
  - RenderKit
  - Renderers
- Model
  - JavaBeans
  - EJB's
- Extension Points
  - View & Controller are extensible

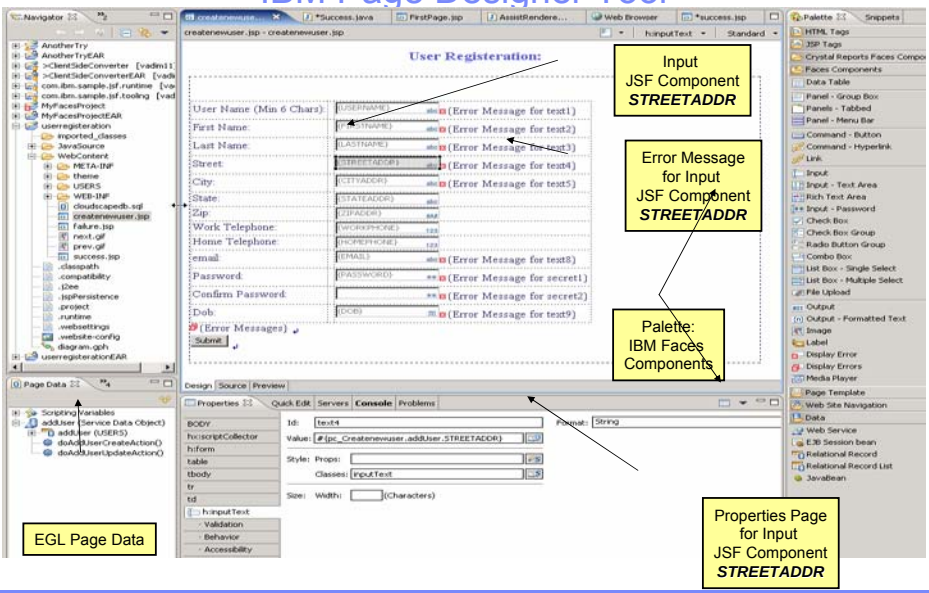
Java Server Faces Custom Component Examples



Java Server Faces Life Cycle



IBM Page Designer Tool



SUMMARY

- System i5 web tools, at a glance
  - **Tools optimized for System i5 developers!**
    - **Web Interaction wizard**
      - ✓You define the parameters to a *PGM/*SRVPGM, wizard generates input JSP prompting for input parm, output JSP showing output parms, and all the glue in-betwee
      - ✓Or you pre-create the input and/or output pages, and map the input/output fields on the pages to the input/output parameters in the *PGM/*SRVPGM, and it generates the glue to bind them
      - ✓STRUTS based application
    - **New and enhanced Web Service wizard**
      - ✓Make your system i5 programs available as a Web Service
    - **JCA wizard**
      - ✓Create connectors for you system i5 programs

More Information?

- Information Sources
  - **www.ibm.com/software/awdtools/iSeries**
    - For iSeries Applicaton Development
  - **www.eclipse.org**
    - Eclipse and information about eclipse
  - **www.ignite400.org**
    - Introduction to eclipse article
  - **www.ibm.com/software/info1/websphere/partners/iseries.jsp**
    - WebSphere on iSeries home page for BPs
  - **eServer iSeries magazine, July 2002 issue**
    - 3 articles on WDSc
  - **www.ibm.com/websphere/developer**
    - WebSphere Developer Domain
    - Many articles and tutorials on technology and tools, including eclipse and WSWB and WebSphere Studio configurations

Disclaimer

Acknowledgement:

- This presentation is a collaborative effort of the IBM Toronto AS/400 Application Development presentation team, including work done by:
  - *Phil Coulthard, George Farr, Claus Weiss, Don Yantzi*

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