

CICS Web Services as a Provider and Requestor

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August 14th, 2013 (Wed)

3:00pm – 4:00pm

Session 13360

Agenda

- Introduction to web services in general, and in CICS
- Four methods for creating a web service provider in CICS:
 1. CICS web services assistant
 2. Rational Developer for System z (RDz) with interpretive runtime XML conversion
 3. RDz, with compiled runtime XML conversion
 4. RDz Service Flow Modeler (SFM)
- Two methods for creating a web service requester in CICS:
 1. CICS web services assistant
 2. RDz
- Diagnosing web services in CICS

Terms

Web service

- A software system designed to support interoperable machine-to-machine interaction over a network
- It has an interface described in a machine-processable format (specifically **WSDL**)
- Other systems interact with *[it ...]* using **SOAP** messages, typically conveyed using **HTTP** *[...]*

or MQ, JCA... in the examples presented here, we will use HTTP

Complete your sessions evaluation online at SHARE.org/BostonEval

WSDL

- *[Web Service Description Language is an XML vocabulary that]* describes *[...]* the messages that are exchanged between the requester and provider

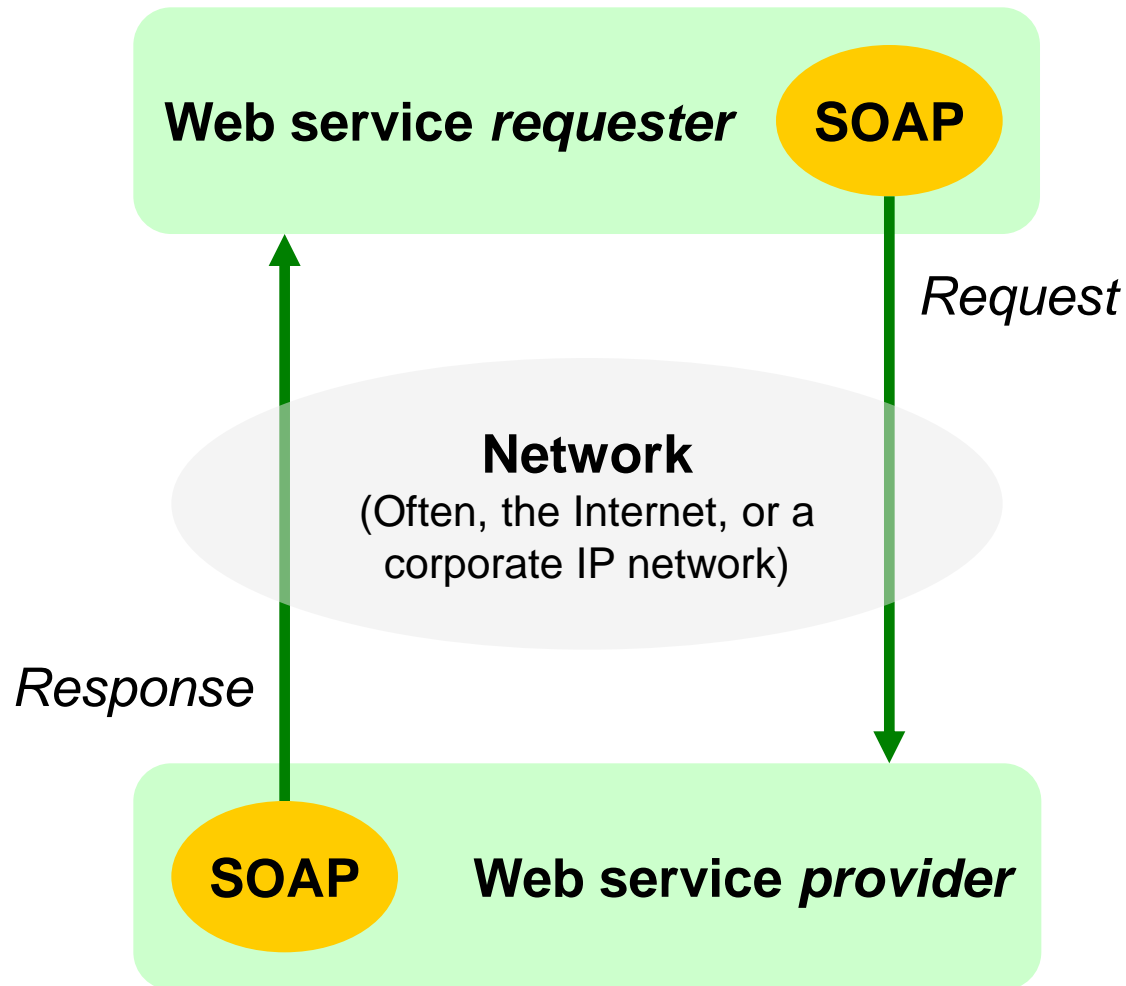
SOAP

- *[A ...]* framework for packaging and exchanging XML messages

Source: *Web Services Architecture*

<http://www.w3.org/TR/ws-arch/>

Basic concept



Example SOAP request

XML defined by the SOAP standard

```
<soapenv:Envelope
  xmlns="http://www.PAYBUS.PAYCOM1.Request.com"
  xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soapenv:Body>
    <PAYBUSOperation>
      <ws_payroll_data>
        <ws_request>DISP</ws_request>
        <ws_key>
          <ws_department>1</ws_department>
          <ws_employee_no>00001</ws_employee_no>
        </ws_key>
      </ws_payroll_data>
      ...some markup omitted for brevity...
    </PAYBUS1Operation>
  </soapenv:Body>
</soapenv:Envelope>
```

Web service-specific XML (contents of the SOAP Body) is described in a WSDL file

In plain English:

Please “display” payroll data for employee number 1 in department 1

Example SOAP response

```
<soapenv:Envelope
  xmlns="http://www.PAYBUS.PAYCOM1.Request.com"
  xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soapenv:Body>
    <PAYBUSOperationResponse>
      <ws_payroll_data>
        <ws_request>DISP</ws_request>
        <ws_key>
          <ws_department>1</ws_department>
          <ws_employee_no>00001</ws_employee_no>
        </ws_key>
        <ws_name>CIRCLE COMPUTER 1 </ws_name>
        <ws_addr1>65 WILLOWBROOK BLVD </ws_addr1>
        <ws_addr2>4TH FLOOR</ws_addr2>
        <ws_addr3>WAYNE, NJ 07470 </ws_addr3>
        <ws_phone_no>890-9331</ws_phone_no>
        <ws_timestamp/>
        <ws_salary>50000.00</ws_salary>
        <ws_start_date>12312008</ws_start_date>
        <ws_remarks>CIRCLE IS MAGIC </ws_remarks>
        ...some markup omitted for brevity...
      </PAYBUSOperationResponse>
    </soapenv:Body>
  </soapenv:Envelope>
```

Response details

Web Service Description Language (WSDL) file

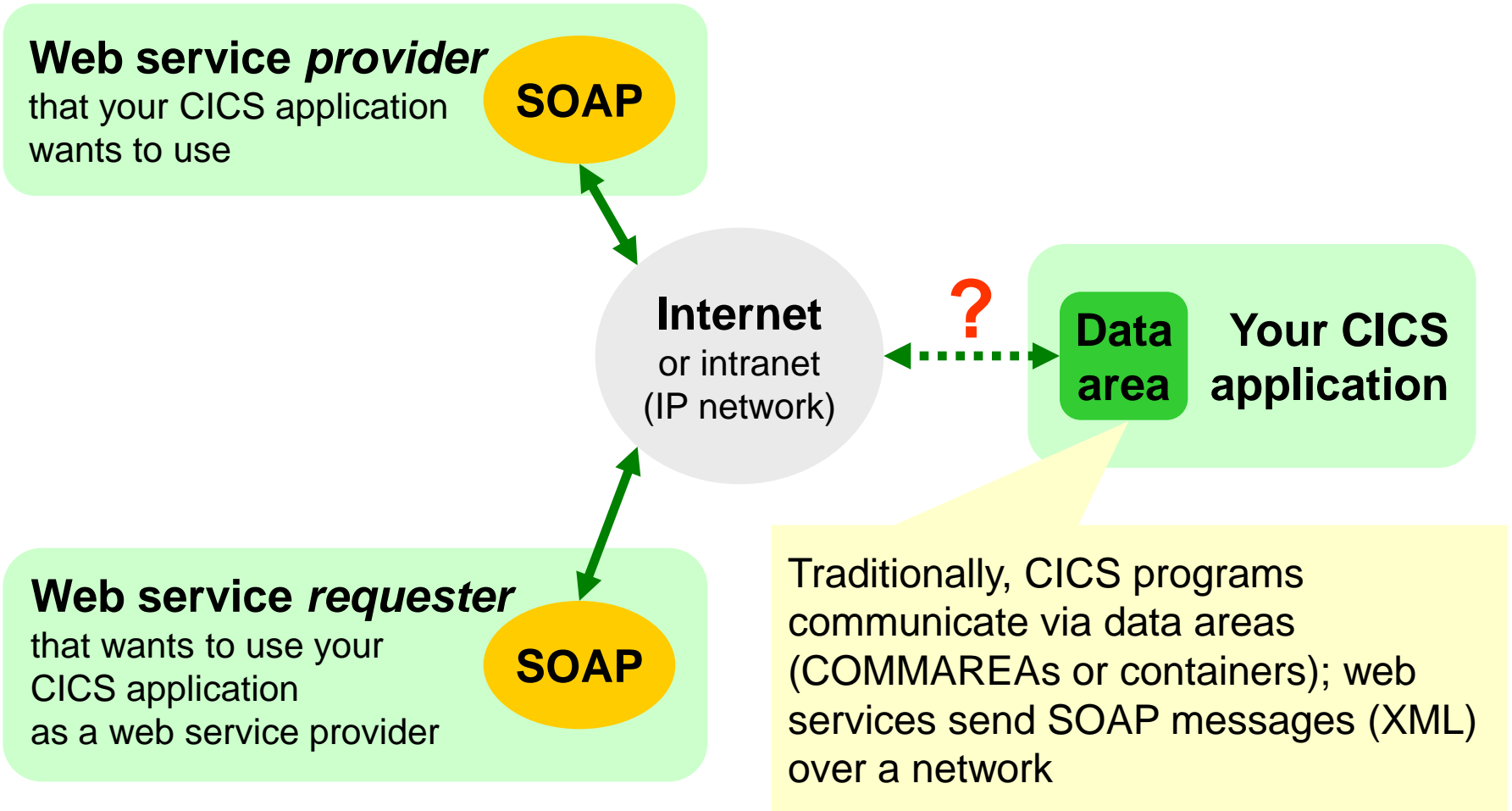
- WSDL 1.1 (see below) or 2.0: generated by CICS web services assistant or RDz (if you don't have one)
- Describes the request/response message XML (schema); groups messages into operations on an abstract port; binds the operations to a message transport; specifies the web service address

```
<definitions ... >
  <types>
    <xsd:schema ... > ... </xsd:schema>
    <xsd:schema ... > ... </xsd:schema>
  </types>
  <message name="PAYBUSOperationResponse">
    <part element="resns:PAYBUSOperationResponse" name="ResponsePart"/>
  </message>
  <message name="PAYBUSOperationRequest">
    <part element="reqns:PAYBUSOperation" name="RequestPart"/>
  </message>
```

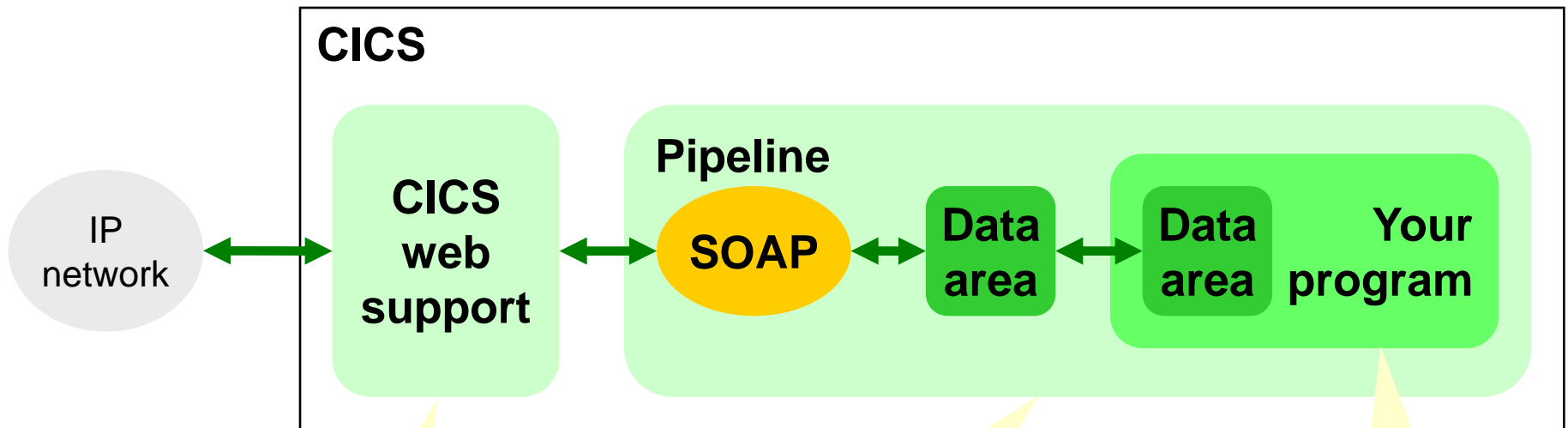
WSDL 1.1 file, continued

```
<portType name="PAYBUSPort">
  <operation name="PAYBUSOperation">
    <input message="tns:PAYBUSOperationRequest" name="PAYBUSOperationRequest"/>
    <output message="tns:PAYBUSOperationResponse" name="PAYBUSOperationResponse"/>
  </operation>
</portType>
<binding name="PAYBUSHTTPSoapBinding" type="tns:PAYBUSPort">
  <soap:binding style="document" transport="http://schemas.xmlsoap.org/soap/http"/>
  <operation name="PAYBUSOperation">
    <soap:operation soapAction="" style="document"/>
    <input name="PAYBUSOperationRequest">
      <soap:body parts="RequestPart" use="literal"/>
    </input>
    <output name="PAYBUSOperationResponse">
      <soap:body parts="ResponsePart" use="literal"/>
    </output>
  </operation>
</binding>
<service name="PAYBUSService">
  <port binding="tns:PAYBUSHTTPSoapBinding" name="PAYBUSPort">
    <soap:address location="http://my-server:my-port/paybus1"/>
  </port>
</service>
</definitions>
```


Problem



Solution

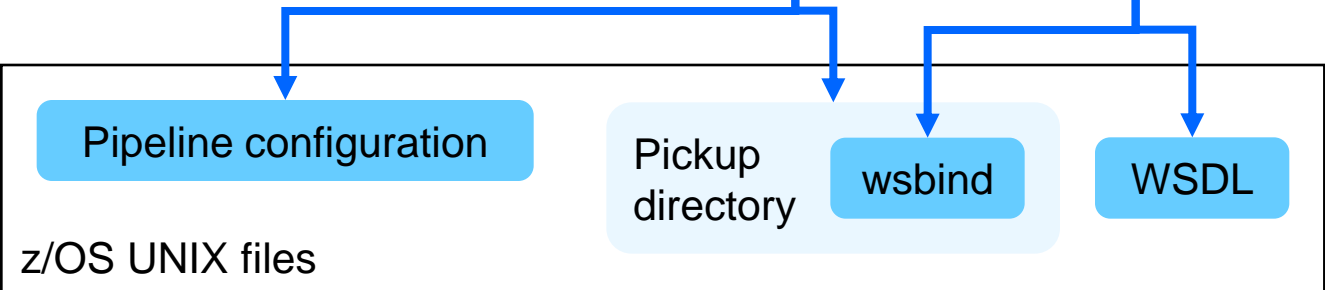
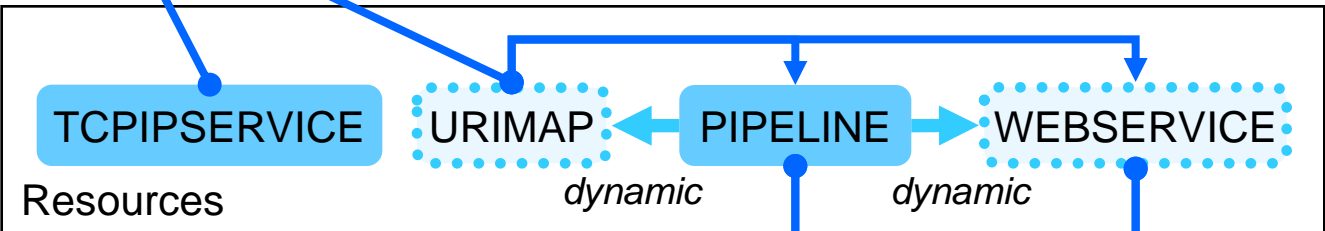
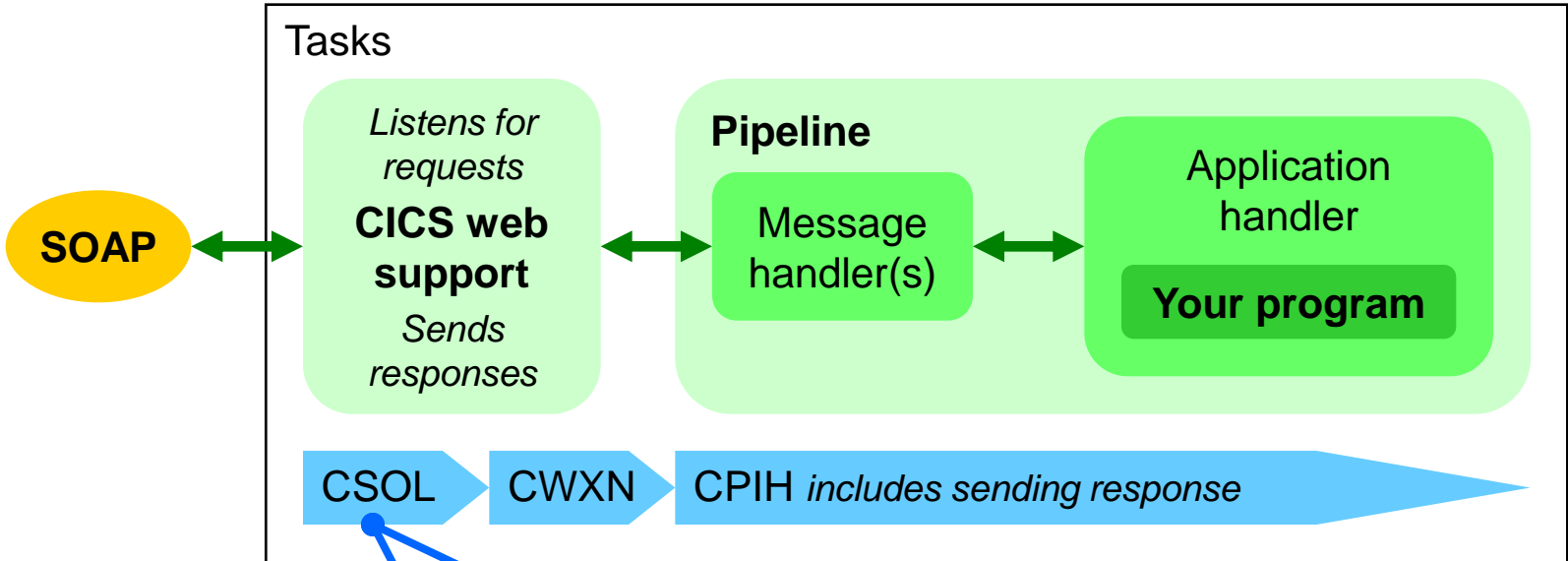


CICS manages IP and HTTP

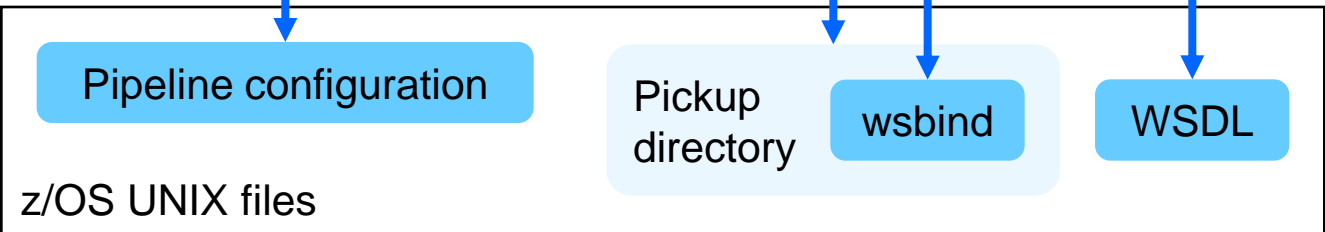
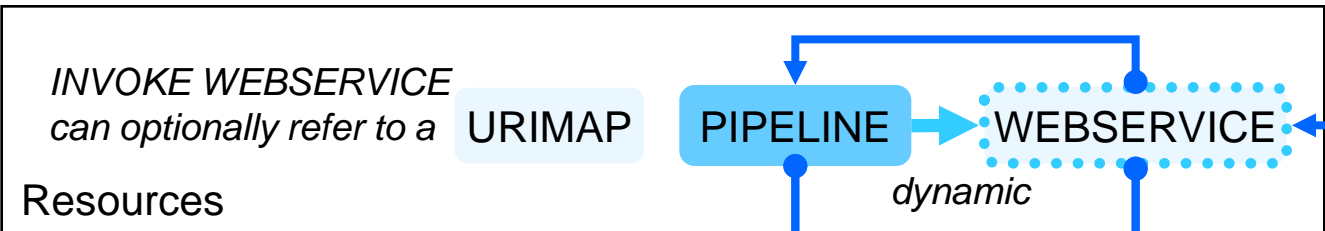
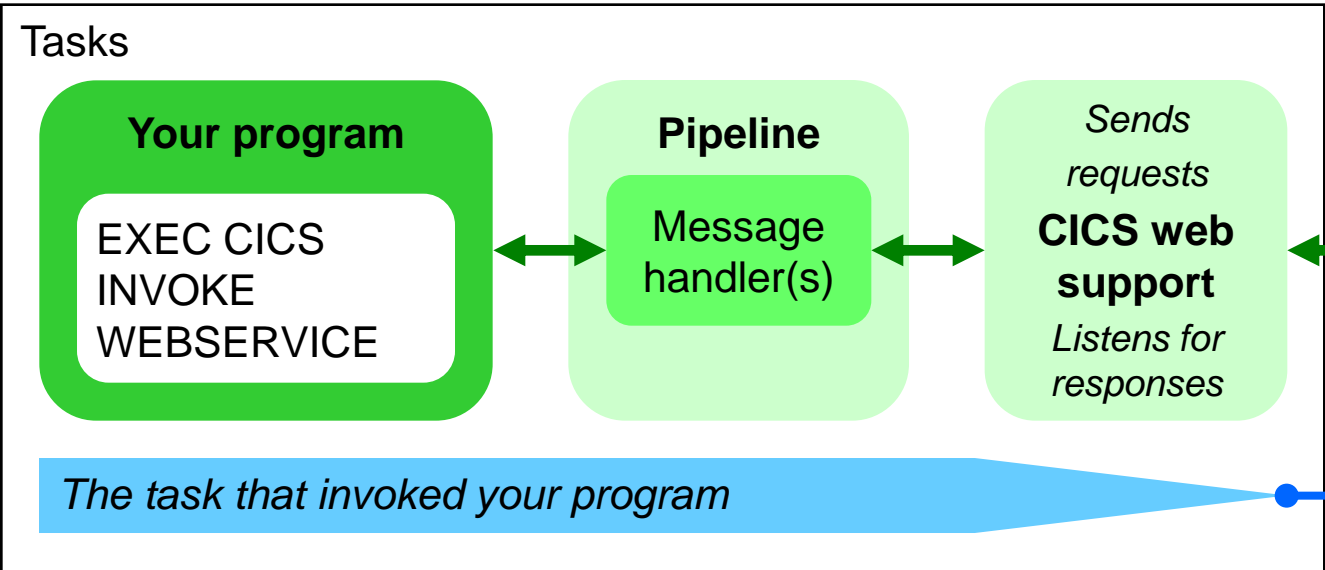
A pipeline of programs unwraps data from SOAP XML into a data area, and vice versa

Your program can continue to work with data areas

CICS as a web service provider



CICS as a web service requester



CICS resources

- You must manually create:
 - **Provider only:**
TCPIPSERVICE: Specifies which port to listen to for requests. (This assumes HTTP message transport. For WebSphere MQ, you would create an MQCONN.)
 - **PIPELINE:** Points to a pipeline configuration file, which specifies the sequence of handler programs in the pipeline.
- **CICS dynamically creates** when PIPELINE is installed (or when you run the PIPELINE SCAN command):
 - **Provider only:**
URIMAP: Specifies which pipeline and web service to use for this request. (For a requester, the INVOKE (WEB)SERVICE can optionally refer to a URIMAP for the provider address.)
 - **WEBSERVICE:** Points to a WSDL file and a wsbind file.

Pipeline configuration file

- Defines the handlers that constitute the pipeline (in these examples, the single handler wraps/unwraps the contents of the SOAP message body in the SOAP envelope)
- If you do not require special processing, you can use these IBM-supplied sample files unchanged:

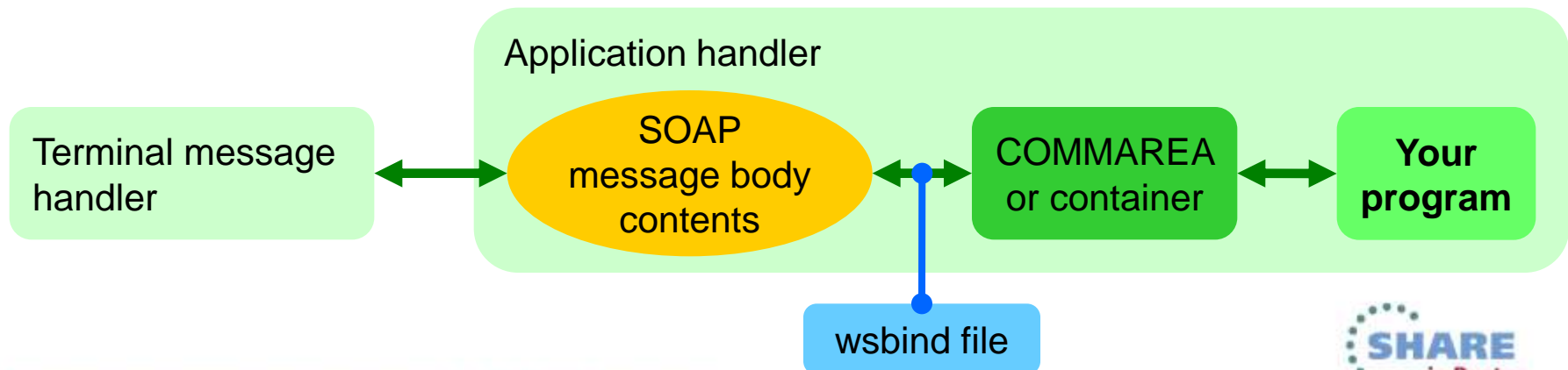
```
<provider_pipeline ... >  
  <service>  
    <terminal_handler>  
      <cics_soap_1.1_handler/>  
    </terminal_handler>  
  </service>  
  <apphandler>DFHPITP</apphandler>  
</provider_pipeline>
```

```
<requester_pipeline ... >  
  <service>  
    <service_handler_list>  
      <cics_soap_1.1_handler/>  
    </service_handler_list>  
  </service>  
</requester_pipeline>
```

Also known as a “wrapper” program. Extracts data from XML, calls your CICS application program, converts returned data back into XML.

Web service binding (wsbind) file

- Generated by CICS web services assistant or RDz
- Proprietary to CICS web services
- Contains web service-specific information, such as how to map between the fields in a COMMAREA or container and the XML in a SOAP message body
- Enables you to use the CICS-supplied application handler (DFHPITP) for different web services



wsbind file: pickup and shelf directories

- When you install the PIPELINE resource, or when you issue a PIPELINE SCAN command, CICS copies the wsbind file from the pickup directory to the shelf directory.
- At runtime, CICS refers to the copy in the shelf directory.

WSDIR attribute of the
PIPELINE resource

SHELF
attribute

Pickup
directory

wsbind file

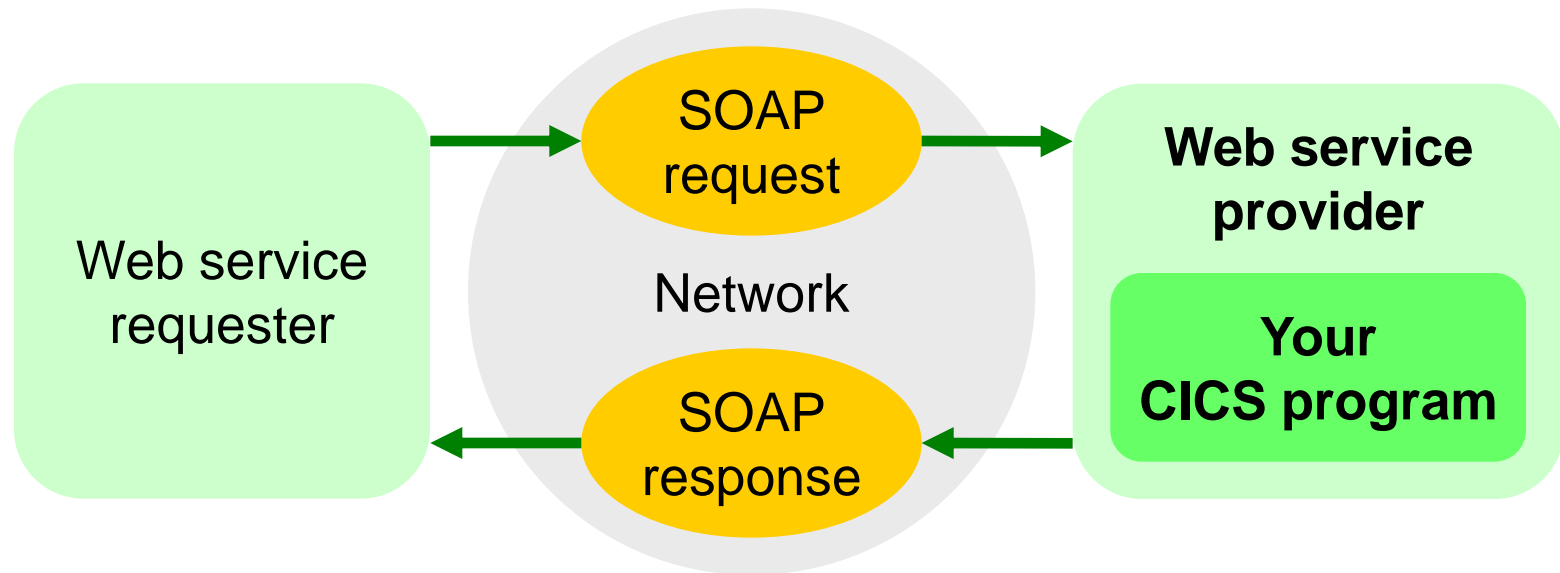
Shelf directory

Subdirectory for this region

Subdirectory for this PIPELINE

wsbind file

Creating a web service provider in CICS

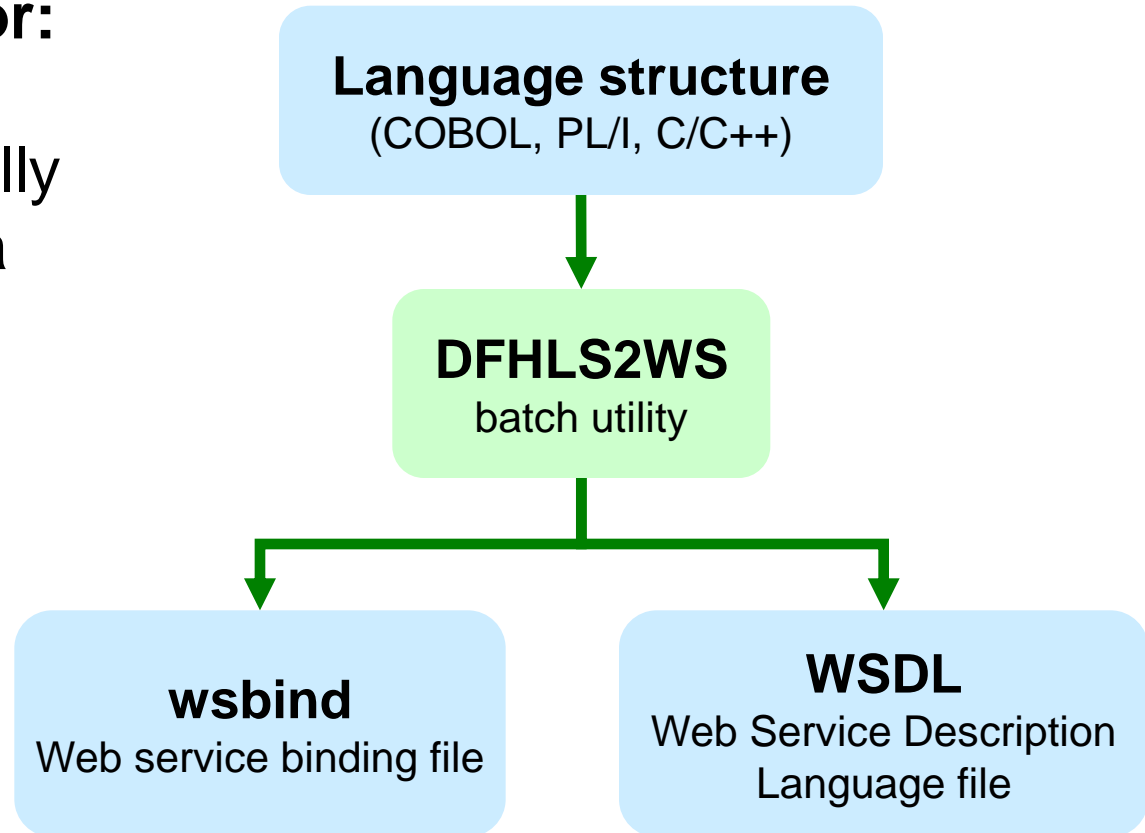


Methods for creating a web service provider in CICS

- 1. CICS web services assistant** (batch utilities supplied with CICS) from a copybook, using the DFHLS2WS batch utility (generates a WSDL file and a wsbind file)
- 2. Rational Developer for System z (RDz)** from a copybook (using a wizard), with *interpretive* runtime XML conversion (as per DFHLS2WS, above)
- 3. RDz** as above, but with *compiled* runtime XML conversion (in addition to WSDL and wsbind files, also generates a bespoke COBOL program to convert XML)
- 4. RDz Service Flow Modeler** from a recording of an interactive CICS terminal user interface (and using a wizard)

Creating a provider using the CICS web services assistant

- **Use this method for:** an existing CICS application that is fully functional and has a COMMAREA or channel interface
- **You will need:** a COBOL copybook (or PL/I, C/C++ equivalent)



Creating the CICS infrastructure for a provider



- These steps apply to any method for creating a provider.
 1. Create a **TCPIP SERVICE** resource.
 2. Create a **pipeline configuration file**.
 3. Create a **PIPELINE** resource.
 4. Unless you use autoinstalled PROGRAM definitions, create a **PROGRAM** resource for each program in the pipeline.

Creating a provider using the CICS web services assistant

1. Run the **DFHLS2WS** batch utility (for example, specifying a COBOL copybook as the input file).
2. Copy the generated **wsbind** file to the pickup directory (the z/OS UNIX path specified by the WSDIR attribute of the PIPELINE resource).
Optionally, copy the generated **WSDL** file to the same path (if you want to validate the SOAP messages).
3. Install the **PIPELINE** (dynamically creates the WEBSERVICE and URIMAP resources).

The provider is ready for testing.

JCL to run DFHLS2WS

```
//SYSEGXLS JOB (39248C,A,T),'LS2WS',  
// MSGCLASS=A,NOTIFY=&SYSUID,REGION=0M  
// SET QT=''''  
//WHERE SMA JCLLIB ORDER=CIRCLE.CICSWS.PROCLIB  
//JAVAPROG EXEC DFHLS2WS,  
// JAVADIR='Java601_64/J6.0.1_64',PATHPREF='/u',TMPDIR='/u/tmp',  
// TMPFILE=&QT.&SYSUID.&QT,USSDIR='cicsts42'  
//INPUT.SYSUT1 DD *  
PDSLIB=CIRCLE.CICSWS.COPYLIB  
REQMEM=PAYCOM1  
RESPMEM=PAYCOM1  
PGMINT=COMMAREA  
MAPPING-LEVEL=3.0  
MINIMUM-RUNTIME-LEVEL=CURRENT  
LANG=COBOL  
PGMNAME=PAYBUS  
URI=/paybus1  
WSBIND=/u/usr/lpp/cicsts/cicsts42/samples/webservices/wsbind/provider/p*  
aybus1.wsbinding  
WSDL=/u/usr/lpp/cicsts/cicsts42/samples/webservices/wsd1/paybus1.wsd1  
LOGFILE=/u/sysegx0/paybus  
/*
```

Input COBOL copybook PDS members:
one for the request, another for the
response (same in this case)

Output wsbind and
WSDL files

Your existing CICS program

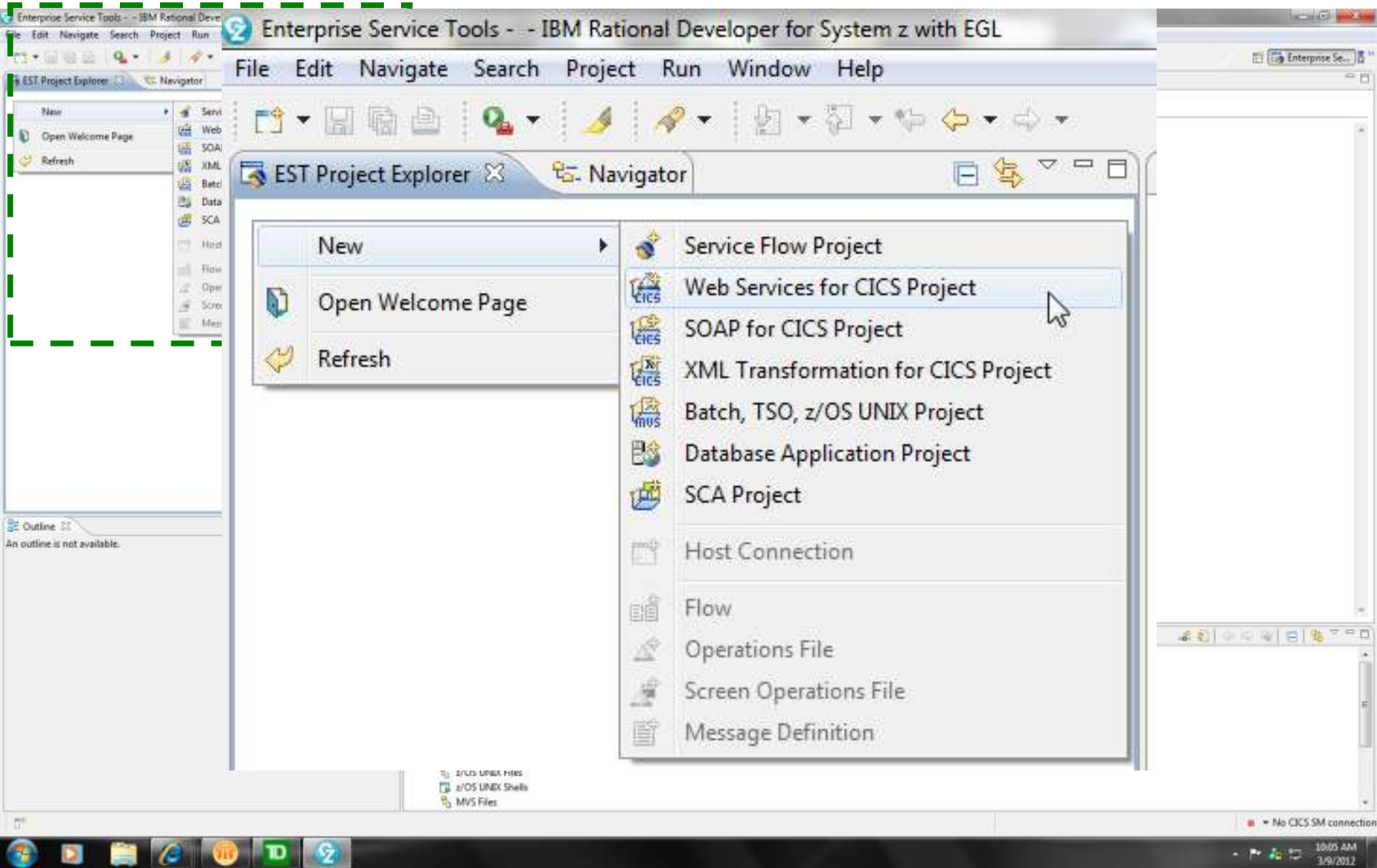
DFHLS2WS log

DFHPI9609I Parameter "LOGFILE" has value "/u/sysegx0/paybus".
...
DFHPI9609I Parameter "PDSLIB" has value "//CIRCLE.CICSWS.COPYLIB".
DFHPI9609I Parameter "PGMINT" has value "COMMAREA".
DFHPI9609I Parameter "PGMNAME" has value "PAYBUS".
DFHPI9609I Parameter "REQMEM" has value "PAYCOM1".
...
DFHPI9609I Parameter "RESPMEM" has value "PAYCOM1".
...
DFHPI9609I Parameter "URI" has value "/paybus1".
...
DFHPI9629I The minimum runtime level required for this Web service is "3.0".
DFHPI9640I This Web service should be installed into a PIPELINE that uses SOAP version "1.1".
DFHPI9587I Program "DFHLS2WS" has completed SUCCESSFULLY.

Testing the provider using RDz Web Services Tester

- The following slides demonstrate using the RDz Web Services Tester to test the provider:
 1. Create a CICS web service project in RDz
 2. Import the WSDL file
 3. Run the Web Services Tester
 4. Use the GUI to create and send a request to the provider

Testing the provider using RDz (1 of 8)



The screenshot displays the IBM Rational Developer for System z with EGL interface. The main window is titled "Enterprise Service Tools - - IBM Rational Developer for System z with EGL". The menu bar includes "File", "Edit", "Navigate", "Search", "Project", "Run", "Window", and "Help". The "EST Project Explorer" and "Navigator" panes are visible on the left. The "New" menu is open, showing a list of project types:

- New
- Open Welcome Page
- Refresh
- Service Flow Project
- Web Services for CICS Project
- SOAP for CICS Project
- XML Transformation for CICS Project
- Batch, TSO, z/OS UNIX Project
- Database Application Project
- SCA Project
- Host Connection
- Flow
- Operations File
- Screen Operations File
- Message Definition

The "Web Services for CICS Project" option is highlighted by the mouse cursor. The status bar at the bottom indicates "No CICS SM connection" and the system clock shows "10:05 AM 3/9/2012".


Testing the provider using RDz (2 of 8)

Enterprise Service Tools - IBM Rational
File Edit Navigate Search Project R
EST Project Explorer Navigator
Outline
An outline is not available.

New Web Services for CICS Project

Create a Web Services for CICS Project

You can use this project to hold Web Services for CICS application components.
You can also use this project as part of a service flow project.

 Project name: DFHLS2WSTest

Options


Development scenario: Create New Service Implementation (top-down) ▼

Application mode: Service Requestor ▼

Conversion type: Interpretive XML Conversion ▼

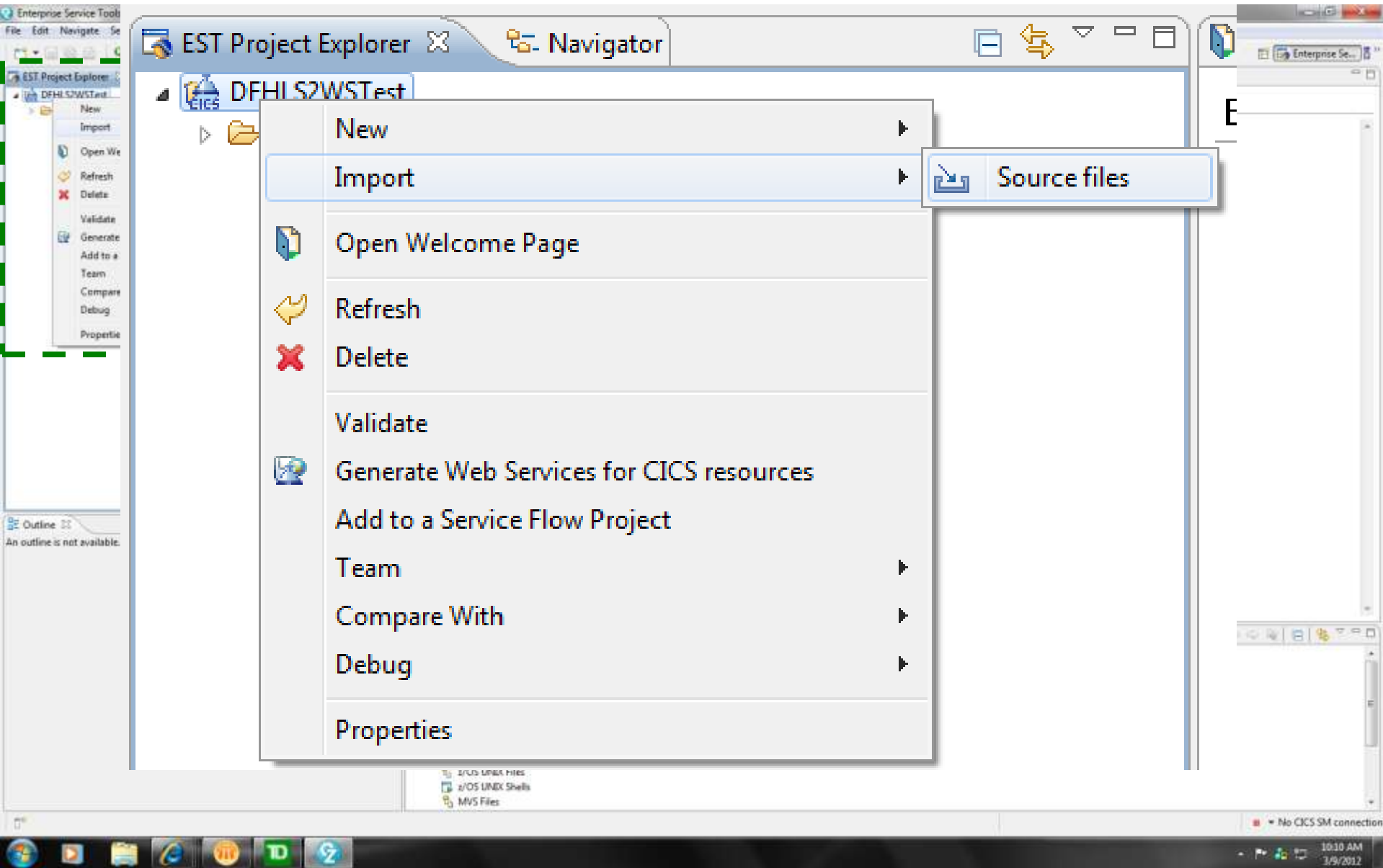
Scenario description:

Generate high level language data structures and runtime specific XML message processing from a Web service description. You can use this option to (1) Create a new service provider application program (2) Expose an existing application program as a service provider or (3) Construct a new service requester application program.

 < Back Next > Finish Cancel

Enterprise Se...
No CICS SM connection
10:09 AM
3/9/2012

Testing the provider using RDz (3 of 8)



The screenshot displays the Enterprise Service Tools (EST) interface. The main window is titled "EST Project Explorer" and "Navigator". The project being viewed is "DFHLS2WSTest". A context menu is open over a folder icon, listing various actions:

- New
- Import
- Open Welcome Page
- Refresh
- Delete
- Validate
- Generate Web Services for CICS resources
- Add to a Service Flow Project
- Team
- Compare With
- Debug
- Properties

The "Import" option is selected, and a sub-menu is visible with the option "Source files".

At the bottom of the interface, there is a status bar with the text "No CICS SM connection". The system tray at the bottom right shows the time "10:10 AM" and the date "3/9/2012".

Testing the provider using RDz (4 of 8)

Enterprise Service Tools - IBM Rational Dev

File Edit Navigate Search Project Run

EST Project Explorer Navigator

DFHLS2WSTest
Generation

Outline 22
An outline is not available.

Import Source Files Wizard

Import source files from the workspace, file system, or remote z/OS system.

Source files to import

Y:\WORK\PAYBUSWSDL.wsdl

Import from:

File system...
Workspace...
Remote...
Remove

Overwrite existing resources without warning

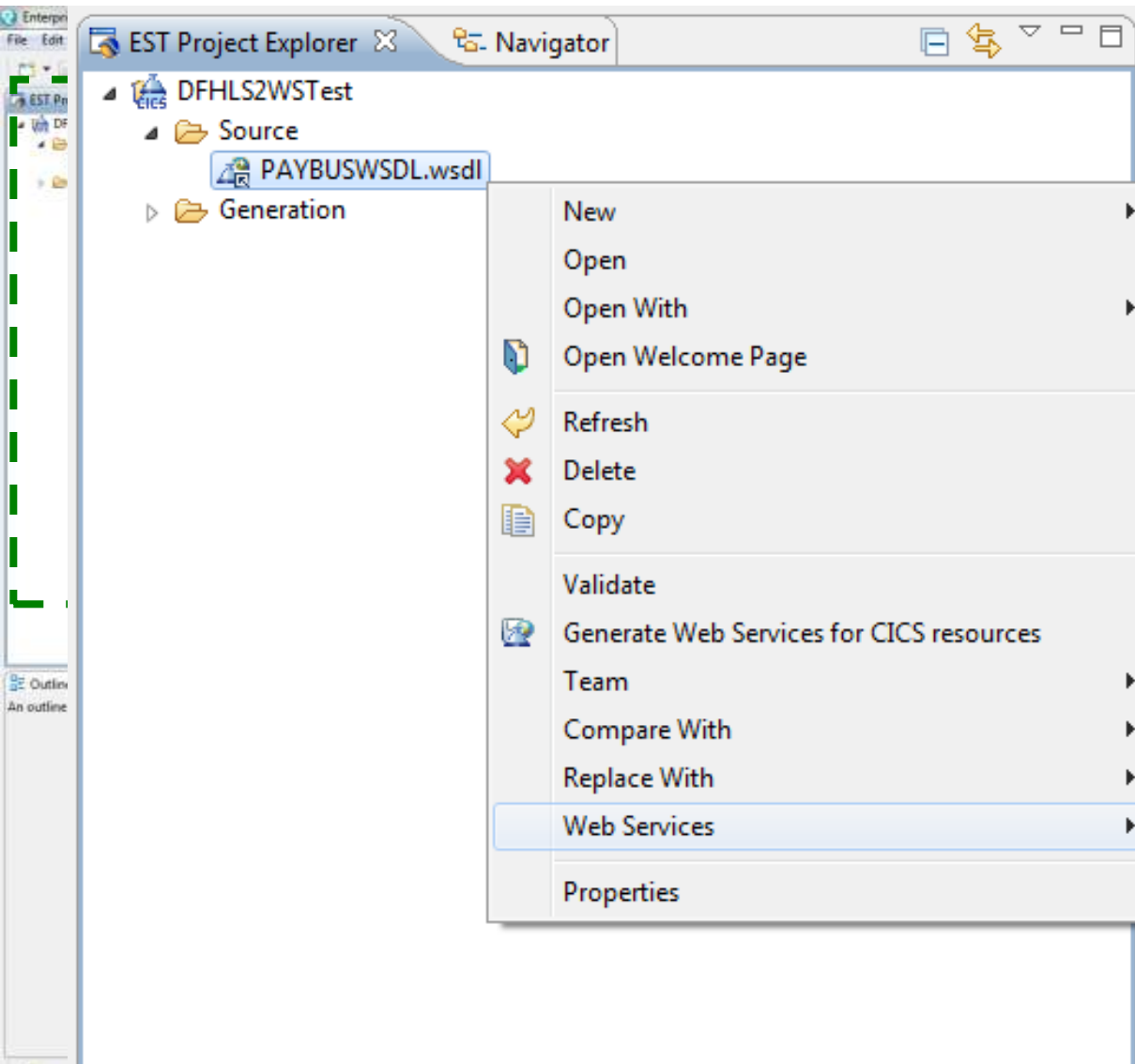
Finish Cancel

Enterprise Se...

No CICS SM connection

10:11 AM
3/9/2012

Testing the provider using RDz (5 of 8)



The screenshot shows the EST Project Explorer interface. The project 'DFHLS2WSTest' is expanded to show the 'Source' folder containing 'PAYBUSWSDL.wsdl'. A context menu is open over this file, listing various actions. The 'Web Services' option is selected, which has opened a sub-menu with the following options:

- Test with Web Services Explorer
- Publish WSDL File
- Generate Java Bean Skeleton
- Generate Client
- Generate WSIL

Other options in the main context menu include: New, Open, Open With, Open Welcome Page, Refresh, Delete, Copy, Validate, Generate Web Services for CICS resources, Team, Compare With, Replace With, and Properties.

Enterprise Service Tools (EST)

Welcome to Enterprise

The Enterprise Service Tools compo applications running on z/OS to par

The single-service projects provide services for applications written in C service components including COBC specific XML message processing an

The service flow project tools provi

Testing the provider using RDz (6 of 8)

Welcome to EST | Web Services Explorer

Web Services Explorer

Navigator

- WSDL Main
 - file:Y:/WORK/PAYBUSWSDL.wsdl
 - PAYBUSService
 - PAYBUSHTTPSoapBinding**

Actions

WSDL Binding Details

Shown below are the details for this SOAP <binding> element. Click on an operation to fill in its endpoints.

Operations

Name	Documentation
PAYBUSOperation	--

Endpoints [Add](#) [Remove](#)

Endpoints
<input type="checkbox"/>
<input type="checkbox"/> http://my-server:my-port/paybus1

Testing the provider using RDz (7 of 8)



Welcome to EST | Web Services Explorer

Web Services Explorer

Navigator

- WSDL Main
 - file:Y:/WORK/PAYBUSWSDL.wsdl
 - PAYBUSService
 - PAYBUSHTTPSoapBinding**

Actions

WSDL Binding Details

Shown below are the details for this **SOAP** <binding> element. Click on an operation to fill in its endpoints.

Operations

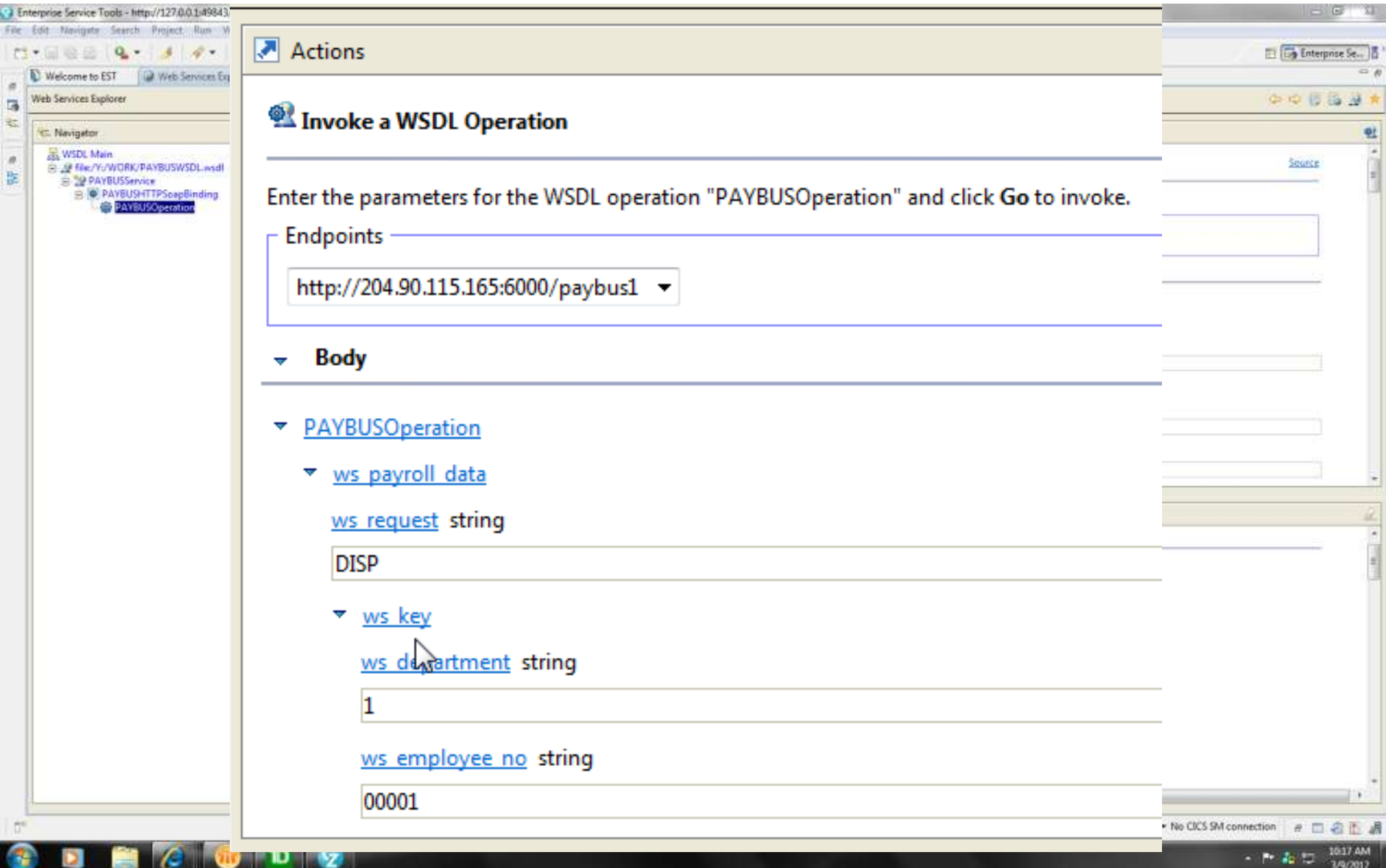
Name	Documentation
PAYBUSOperation	--

Endpoints [Add](#) [Remove](#)

<input type="checkbox"/>	Endpoints
<input type="checkbox"/>	http://my-server:my-port/paybus1
<input type="checkbox"/>	http://204.90.115.165:6000/paybus1



Testing the provider using RDz (8 of 8)



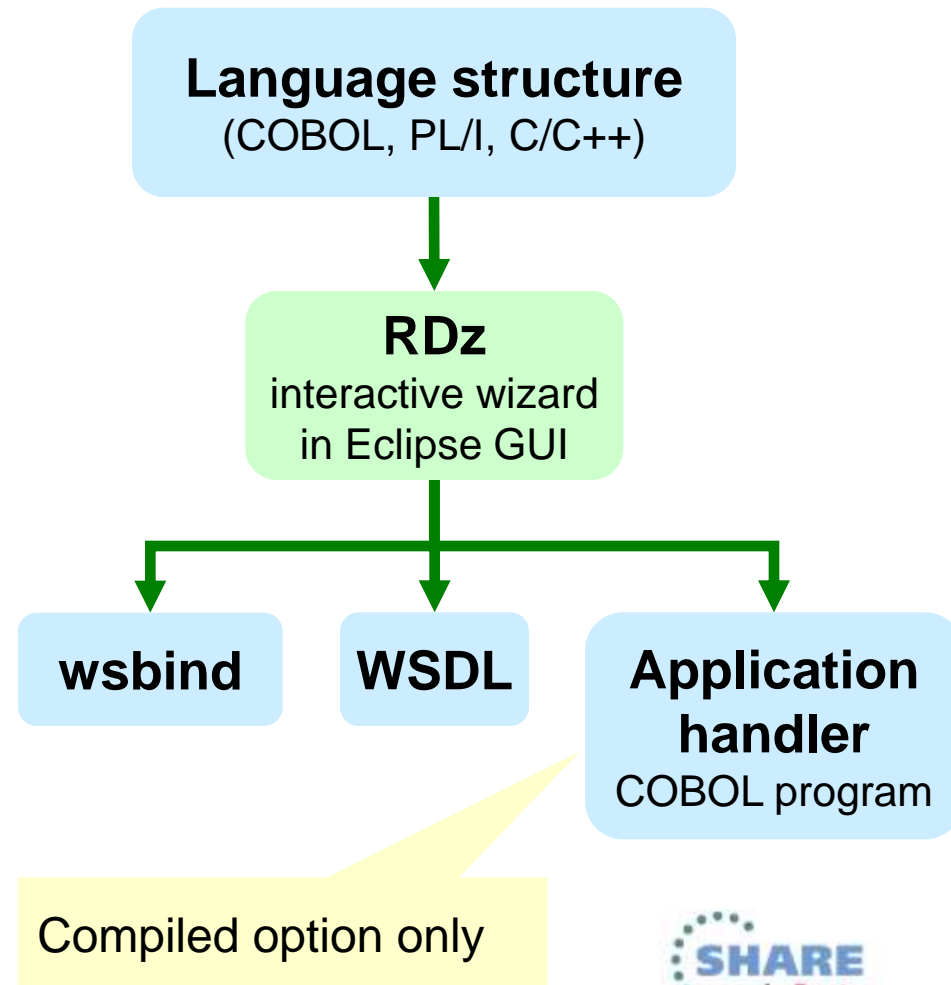
The screenshot displays the Enterprise Service Tools (EST) interface. On the left, the Web Services Explorer shows a tree view with 'PAYBUSOperation' selected. The main 'Actions' pane is titled 'Invoke a WSDL Operation' and contains the following configuration:

- Endpoints:** A dropdown menu showing 'http://204.90.115.165:6000/paybus1'.
- Body:** A section containing three parameters for the 'PAYBUSOperation':
 - ws payroll data:** A field labeled 'ws request string' containing the value 'DISP'.
 - ws key:** A field labeled 'ws department string' containing the value '1'.
 - ws employee no:** A field labeled 'string' containing the value '00001'.

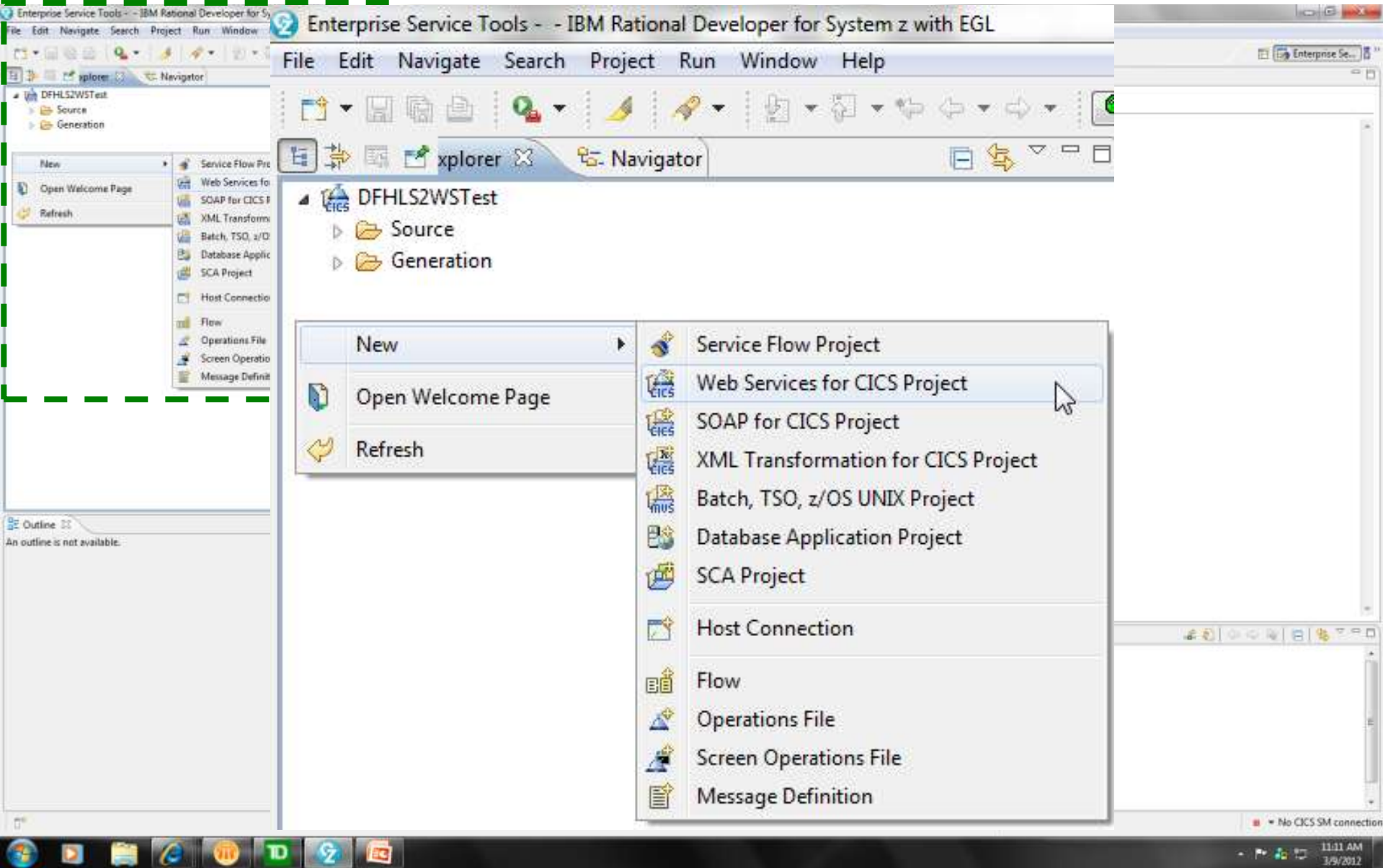
The bottom status bar indicates 'No CICS SMI connection' and shows the system time as 10:17 AM on 3/9/2012.

Creating a provider using Rational Developer for System z (RDz)

- Step-by-step wizard, with two options for runtime XML conversion:
- **Interpretive** uses a standard wrapper program, as per the CICS assistant
- **Compiled** generates a bespoke COBOL application handler (wrapper program)



Creating a provider using RDz: interpretive (1 of 9)



The screenshot displays the IBM Rational Developer for System z with EGL interface. The main window shows a project named 'DFHLS2WSTest' with subfolders 'Source' and 'Generation'. A context menu is open over the project, listing various project types. The 'Web Services for CICS Project' option is highlighted by the mouse cursor.

Enterprise Service Tools - - IBM Rational Developer for System z with EGL

File Edit Navigate Search Project Run Window Help

DFHLS2WSTest

- Source
- Generation

New

- Service Flow Project
- Web Services for CICS Project
- SOAP for CICS Project
- XML Transformation for CICS Project
- Batch, TSO, z/OS UNIX Project
- Database Application Project
- SCA Project
- Host Connection
- Flow
- Operations File
- Screen Operations File
- Message Definition

Outline 22
An outline is not available.

11:11 AM
3/9/2012

Creating a provider using RDz: interpretive (2 of 9)

Enterprise Service Tools -- IBM Rational Developer

File Edit Navigate Search Project Run

Explorer Navigator


- DFHLS2WSTest
 - Source
 - Generation

Outline 22
An outline is not available.

New Web Services for CICS Project

Create a Web Services for CICS Project

You can use this project to hold Web Services for CICS application components.
You can also use this project as part of a service flow project.

 Project name:

Options


Development scenario:

Application mode:

Conversion type:

Scenario description:

Generate a Web service description and runtime specific XML message processing from a high level language data structure. You can use this option when you expose an application program as a service provider.

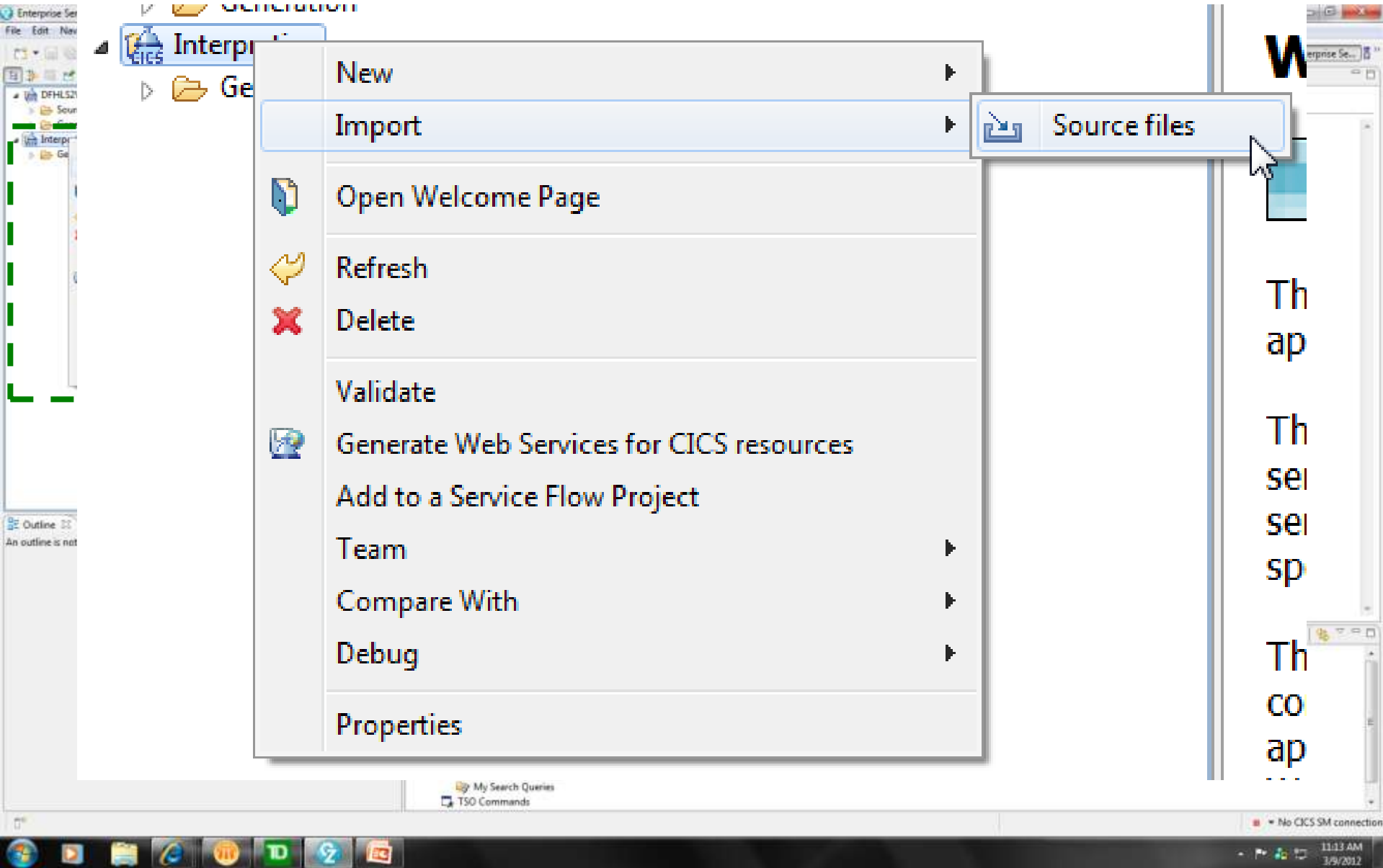


Enterprise Se...

No CICS SM connection

11:12 AM
3/9/2012

Creating a provider using RDz: interpretive (3 of 9)



The screenshot shows the IBM Enterprise Service Architect interface. A context menu is open over a resource named 'Interpretive'. The menu items are:

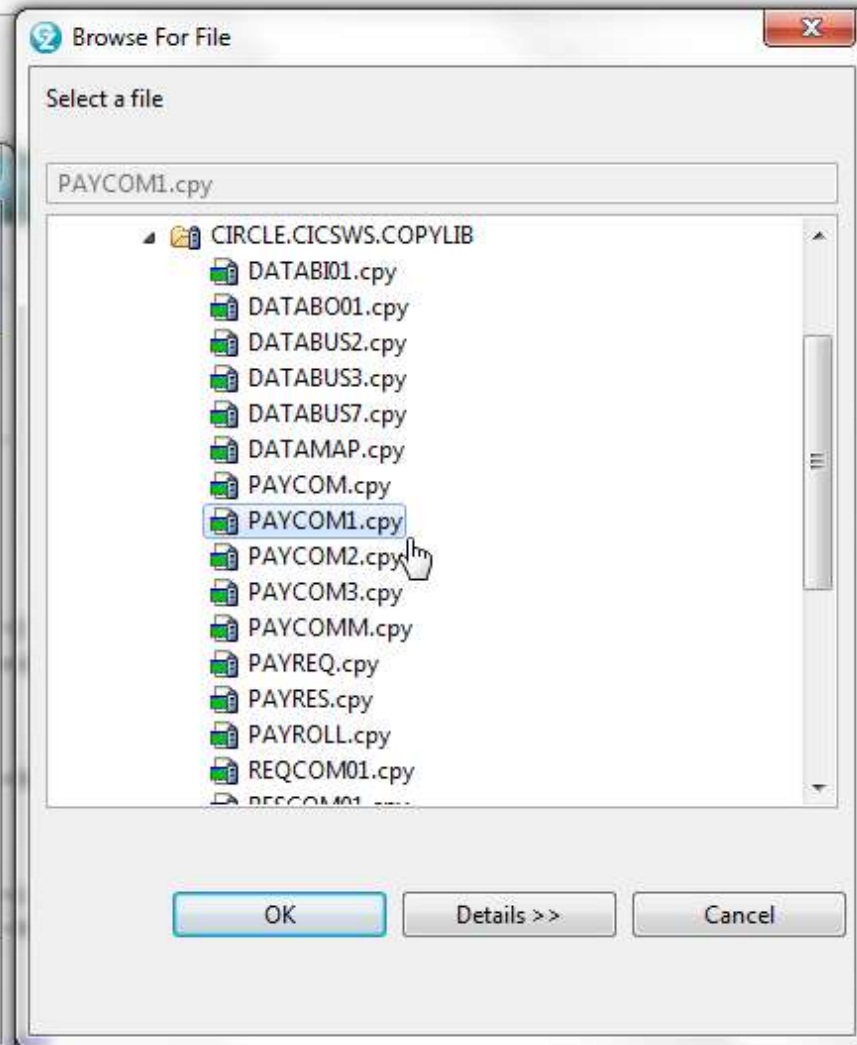
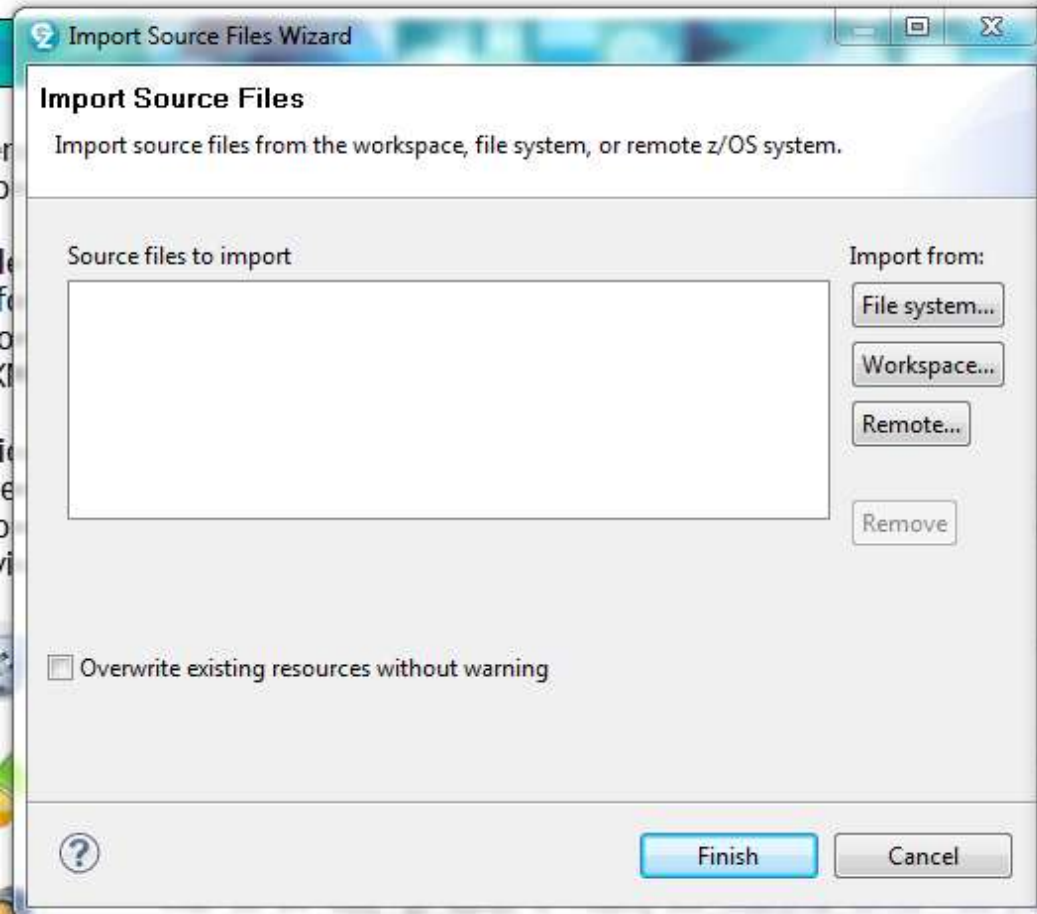
- New
- Import
- Open Welcome Page
- Refresh
- Delete
- Validate
- Generate Web Services for CICS resources
- Add to a Service Flow Project
- Team
- Compare With
- Debug
- Properties

The 'Import' option is selected, and a sub-menu is open showing 'Source files'. The background shows a project tree with folders like 'Generation' and 'Interp'. The bottom status bar indicates 'No CICS SM connection'.

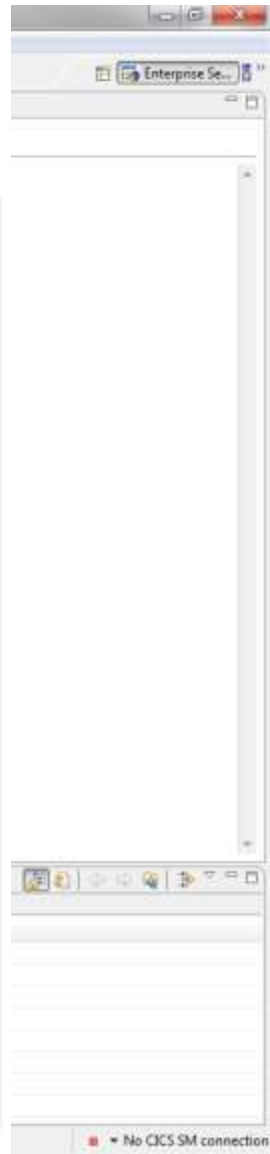
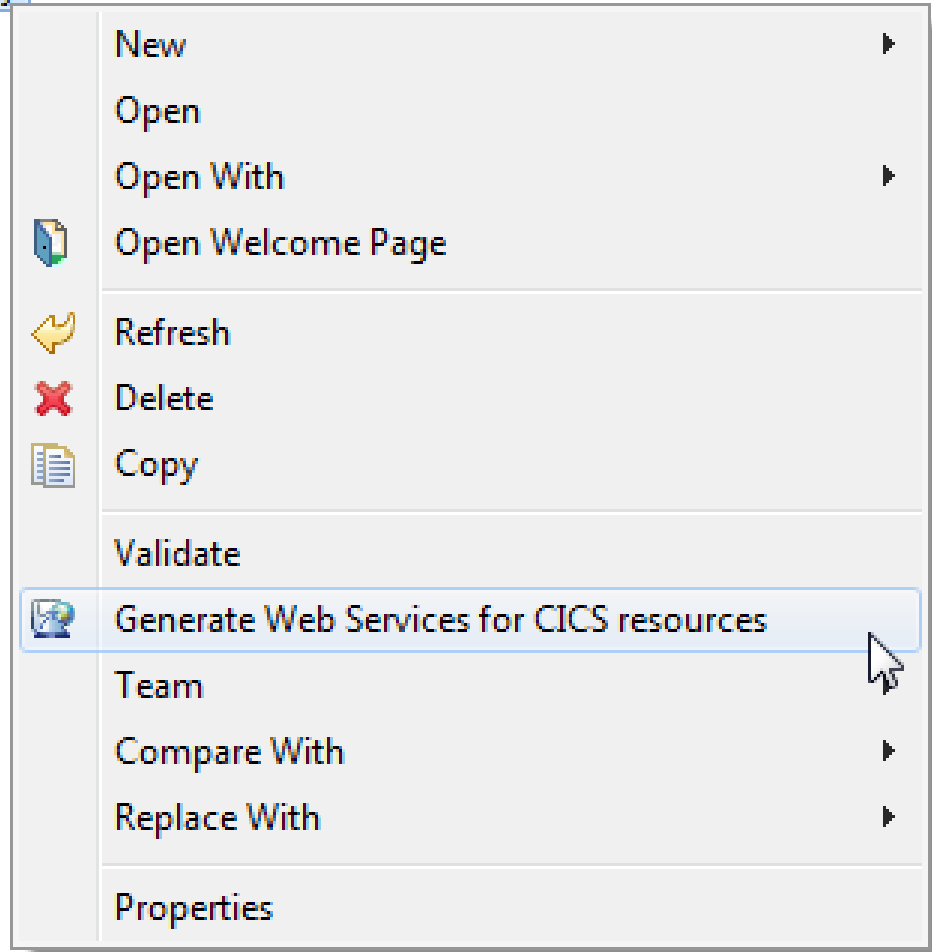
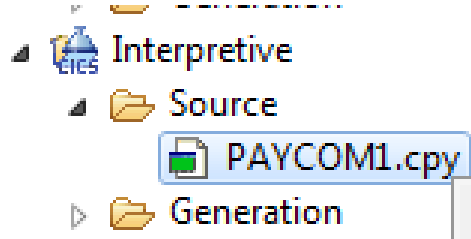
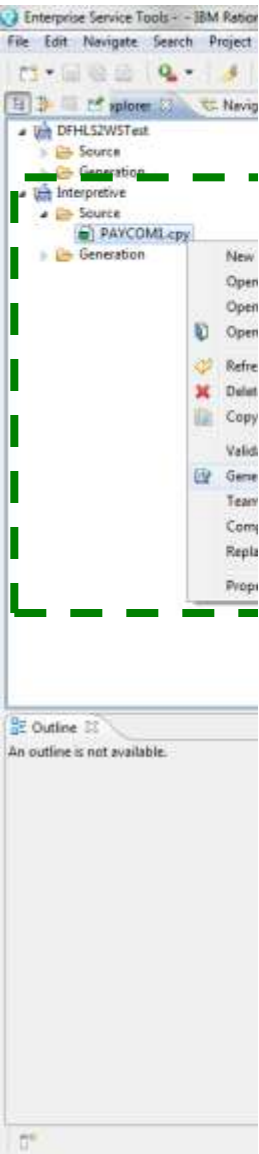
Creating a provider using RDz: interpretive (4 of 9)

Enterprise Service Tools (EST)

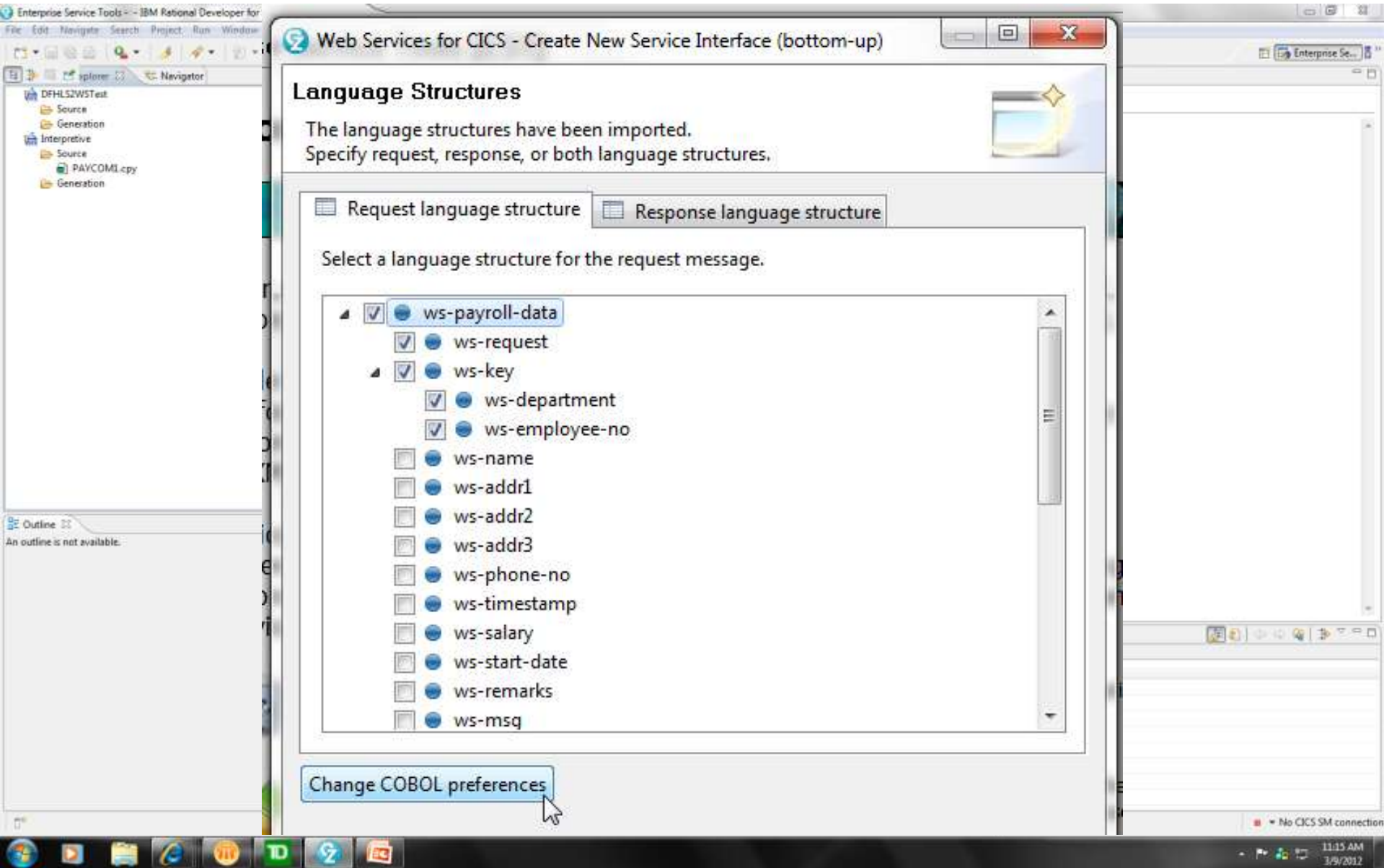
Welcome to Enterprise Service Tools



Creating a provider using RDz: interpretive (5 of 9)



Creating a provider using RDz: interpretive (6 of 9)



Enterprise Service Tools - IBM Rational Developer for System z

Web Services for CICS - Create New Service Interface (bottom-up)

Language Structures

The language structures have been imported.
Specify request, response, or both language structures.

Request language structure Response language structure

Select a language structure for the request message.

- ws-payroll-data
 - ws-request
 - ws-key
 - ws-department
 - ws-employee-no
 - ws-name
 - ws-addr1
 - ws-addr2
 - ws-addr3
 - ws-phone-no
 - ws-timestamp
 - ws-salary
 - ws-start-date
 - ws-remarks
 - ws-msq

[Change COBOL preferences](#)

Enterprise Service Tools - IBM Rational Developer for System z

DFHLS2WSTest

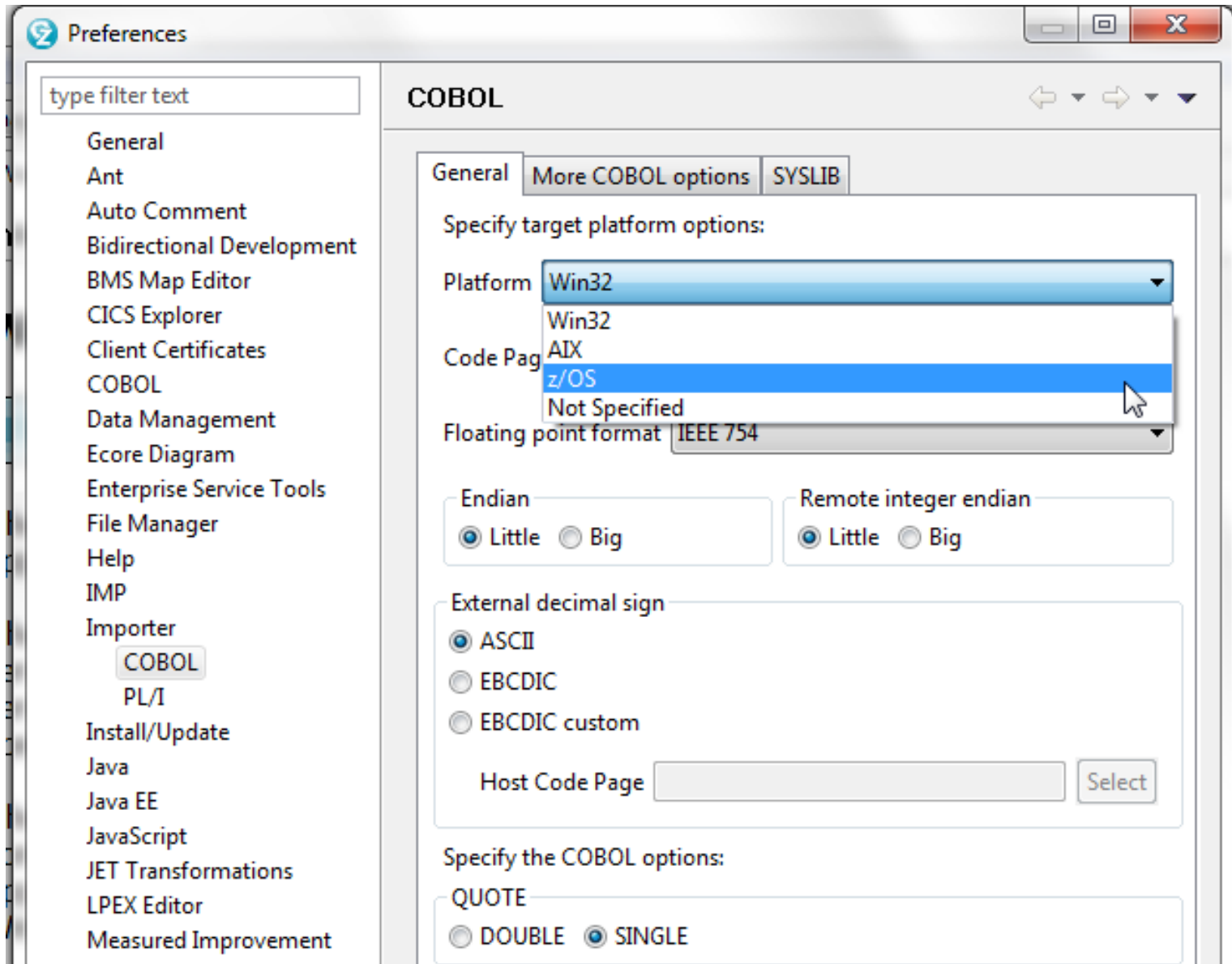
- Source
- Generation
- Interpretive
- Source
- PAYCOM1.cpy
- Generation

Outline 22
An outline is not available.

No CICS SM connection

11:15 AM
3/9/2012

Creating a provider using RDz: interpretive (7 of 9)



Preferences

type filter text

- General
- Ant
- Auto Comment
- Bidirectional Development
- BMS Map Editor
- CICS Explorer
- Client Certificates
- COBOL
- Data Management
- Ecore Diagram
- Enterprise Service Tools
- File Manager
- Help
- IMP
- Importer
 - COBOL
 - PL/I
- Install/Update
- Java
- Java EE
- JavaScript
- JET Transformations
- LPEX Editor
- Measured Improvement

COBOL

General | More COBOL options | SYSLIB

Specify target platform options:

Platform Win32

Code Page AIX

Floating point format IEEE 754

Endian Little Big

Remote integer endian Little Big

External decimal sign ASCII EBCDIC EBCDIC custom

Host Code Page Select

Specify the COBOL options:

QUOTE DOUBLE SINGLE

Creating a provider using RDz: interpretive (8 of 9)

Enterprise Service Tools - IBM Rational Dev

File Edit Navigate Search Project Run

explorer Navigator

- DFHLS2WSTest
 - Source
 - Generation
 - Interpretive
 - Source
 - PAYCOM1.cpy
 - Generation

Outline 22

An outline is not available.

Web Services for CICS - Create New Service Interface (bottom-up)

Language Structures

The language structures have been imported.
Specify request, response, or both language structures.

Request language structure Response language structure

Select a language structure for the response message.

- ws-payroll-data
 - ws-request
 - ws-key
 - ws-department
 - ws-employee-no
 - ws-name
 - ws-addr1
 - ws-addr2
 - ws-addr3
 - ws-phone-no
 - ws-timestamp
 - ws-salary
 - ws-start-date
 - ws-remarks
 - ws-msq

Enterprise Se...

No CICS SM connection

11:16 AM
3/9/2012

Creating a provider using RDz: interpretive (9 of 9)



Welcome to EST PAYCOM1.wsbind X

CICS Web Service Binding File (WSBind) Viewer

▼ Maintenance Information

Timestamp: 201203091117

Product: Interpretive XML Conversion

▼ Service Interface and Pipeline Properties

Service mode: Service Provider

Provider URI: /cics/services/PAYCOM1

Requester URI:

WSDL binding name: PAYCOM1HTTPSsoapBinding

Operations: PAYCOM1Operation

Transaction ID:

User ID:

Syncpoint: false

▼ Required Runtime and Mapping Levels

Mapping level: 3.0

Runtime level: 3.0

▼ Target Program Interface and Properties

Program name: PAYCOM1

Program interface: COMMAREA

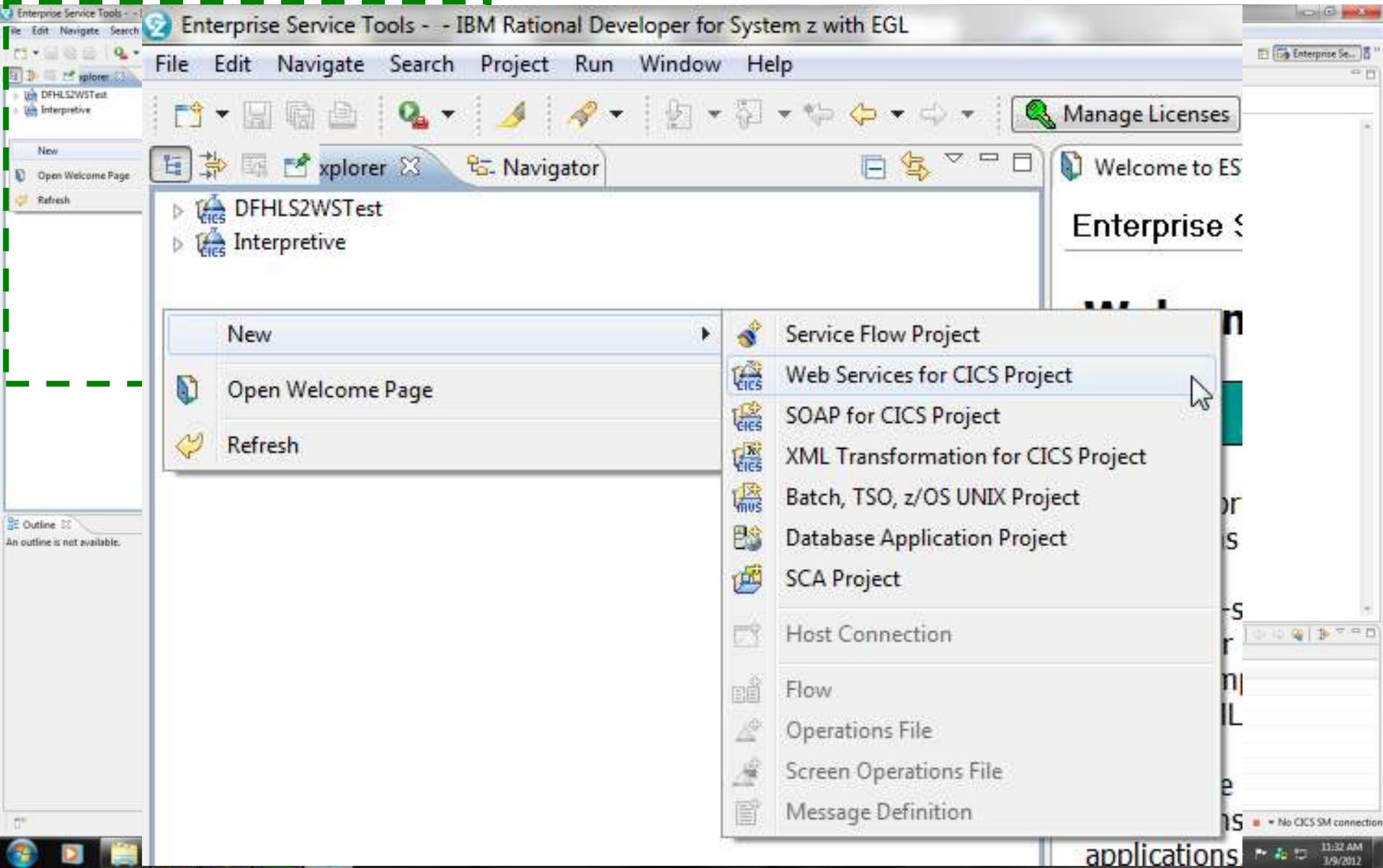
Container name:

Request Channel:

Response Channel:

Vendor Converter name:

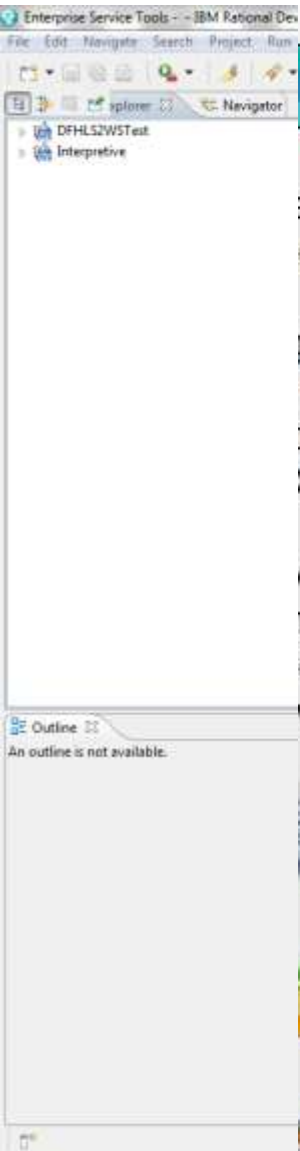
Creating a provider using RDz: compiled (1 of 6)



The screenshot shows the IBM Rational Developer for System z with EGL interface. The 'New' menu is open, and the 'Web Services for CICS Project' option is selected. The interface includes a menu bar (File, Edit, Navigate, Search, Project, Run, Window, Help), a toolbar, and a project explorer on the left showing 'DFHLS2WSTest' and 'Interpretive'. A 'Manage Licenses' button is visible in the top right. The system tray at the bottom right shows the time as 11:32 AM on 3/9/2012.

- New
- Open Welcome Page
- Refresh
- Service Flow Project
- Web Services for CICS Project
- SOAP for CICS Project
- XML Transformation for CICS Project
- Batch, TSO, z/OS UNIX Project
- Database Application Project
- SCA Project
- Host Connection
- Flow
- Operations File
- Screen Operations File
- Message Definition

Creating a provider using RDz: compiled (2 of 6)



New Web Services for CICS Project

Create a Web Services for CICS Project

You can use this project to hold Web Services for CICS application components. You can also use this project as part of a service flow project.

Project name: Compiled

Options

Development scenario: Create New Service Interface (bottom-up)

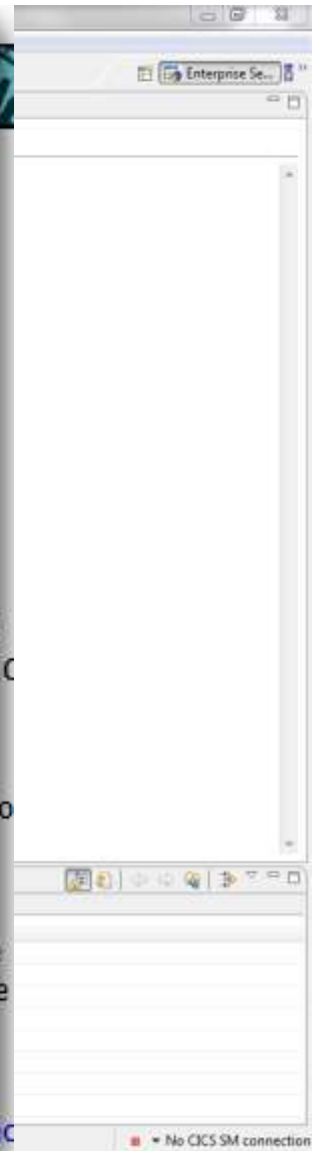
Application mode: Service Provider

Conversion type: Interpretive XML Conversion

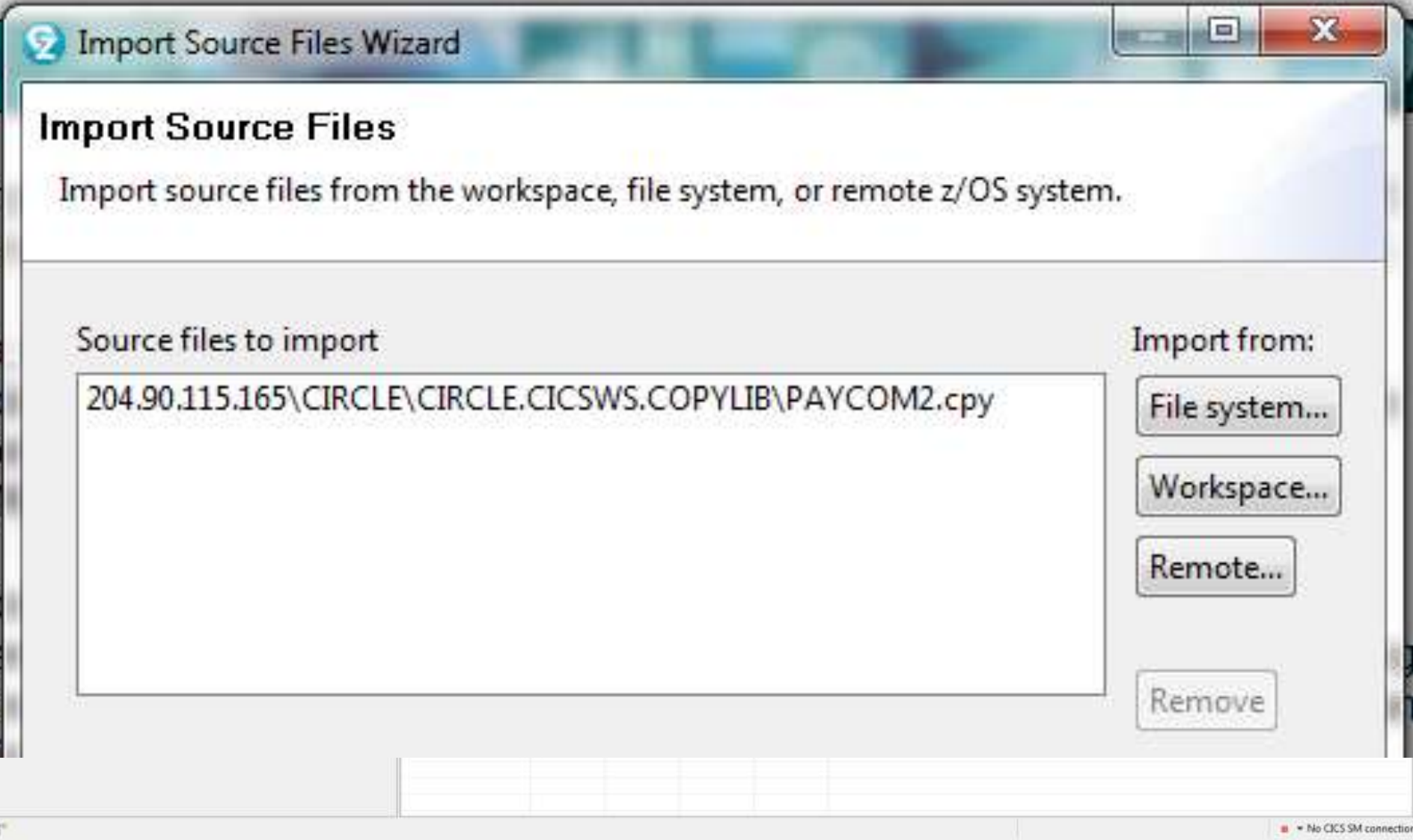
Scenario description: Interpretive XML Conversion
Compiled XML Conversion

Generate a Web service description and runtime specific XML message processing from a high level language data structure. You can use this option when you expose an application program as a service provider.

Navigation: ? < Back Next > Finish Cancel



Creating a provider using RDz: compiled (3 of 6)



Import Source Files Wizard

Import Source Files

Import source files from the workspace, file system, or remote z/OS system.

Source files to import

- 204.90.115.165\CIRCLE\CIRCLE.CICSWS.COPYLIB\PAYCOM2.cpy







Import from:

- File system...
- Workspace...
- Remote...
- Remove

No CICS SM connection

Creating a provider using RDz: compiled (4 of 6)

- Compiled
 - Source
 - PAYCOM2.cpy**
 - Generation
 - DFHLS2WSTest
 - Interpretive

	New	▶
	Open	
	Open With	▶
	Open Welcome Page	
	Refresh	
	Delete	
	Copy	
	Validate	
	Generate Web Services for CICS resources	
	Team	

Creating a provider using RDz: compiled (5 of 6)

Web Services for CICS - Create New Service Interface (bottom-up)

Language Structures

The language structures have been imported.
Specify request, response, or both language structures.

Request language structure

Response language structure

Select a language structure for the request message.

- ws-payroll-data
 - ws-request
 - ws-key
 - ws-department
 - ws-employee-no
 - ws-name
 - ws-addr1
 - ws-addr2
 - ws-addr3

Creating a provider using RDz: compiled (6 of 6)



Welcome to EST

PAYCOM2D.cbl

Line 1	Column 1	Insert
		<pre>-----*A-1-B-----2-----3-----4-----5-----6-----7-- PROCESS NODYNAM, CODEPAGE (1140), NSYMBOL (NATIONAL) PROCESS ARITH (EXTEND), NOOPT, CICS ***** * PRODUCT: IBM Rational Developer for System z * COMPONENT: Enterprise Service Tools * PROGRAM: Web Services for CICS TS Converter Driver * RUNTIME: Web Services for CICS * REQUIRED COMPILER: IBM Enterprise COBOL 4.2 * XMLPARSE OPTION: COMPAT * XML2LS XML CCSID: 1140 * LANGUAGE STRUCTURE CCSID: 1140 * LS2XML XML CCSID: 1140 ***** IDENTIFICATION DIVISION. PROGRAM-ID. 'PAYCOM2D'. AUTHOR. RD4Z. INSTALLATION. 9.4.200.V20110819_0735. DATE-WRITTEN. 3/9/12 11:37 AM. DATA DIVISION. WORKING-STORAGE SECTION. 1 CONVERTER-ERROR-7-G. 2 PIC N(12) USAGE NATIONAL VALUE NX'004C0061006E0067007500610067006500200045006E0076'. 2 PIC N(12) USAGE NATIONAL</pre>

System z LPEX1

No CICS SM connection

11:38 AM 3/9/2012

Creating a provider using RDz: after running the RDz wizard

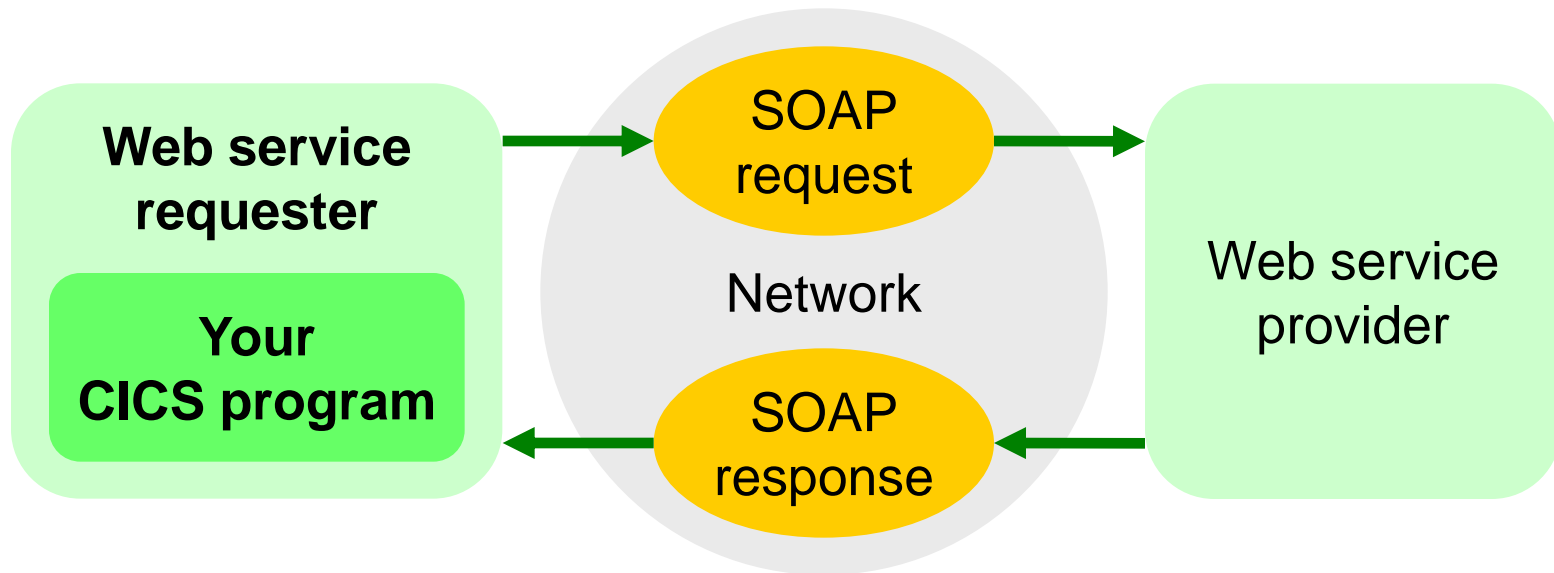
1. Transfer the wsbind file to the z/OS UNIX pickup directory. Optionally, transfer the WSDL file to the same directory.
2. Compiled option only (generated wrapper program):
 - Compile and link the COBOL source program
 - Create a PROGRAM resource
3. Issue a PIPELINE SCAN command.

Creating a provider using RDz Service Flow Modeler



1. In RDz, create a Service Flow Project. This starts a wizard that directs you to:
2. Define a host connection (to the z/OS system mainframe that hosts your CICS application).
3. Navigate to the “start” screen (signon to CICS, start the transaction, clear the screen).
4. Start recording the “flow” (your input, and the transaction output).
5. For each input field (request data), specify a variable name.
6. For each output field (response data), highlight the item on the screen, and specify a variable name.
7. Stop recording. This generates a .seqflow file.
8. Right-click the .seqflow file, and select New Generation Properties File to generate a WSDL file.
9. Click Generate Runtime code. (This wizard can submit the compile JCL on z/OS for you.)
10. The generated code includes a web service provider COBOL program that drives your original CICS application.

Creating a web service requester in CICS

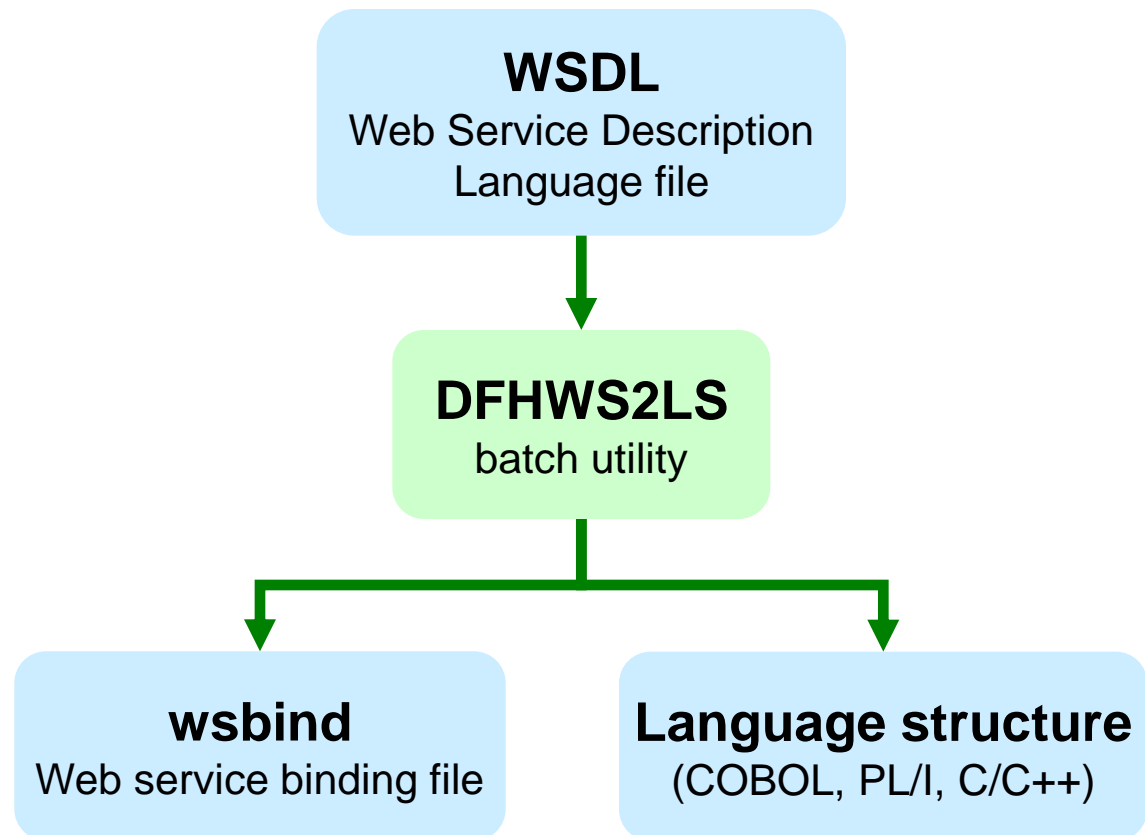


Methods for creating a web service requester in CICS

- 1. CICS web services assistant** from a WSDL, using the DFHWS2LS batch utility
 - 2. RDz** from a WSDL (using a wizard), with interpretive runtime XML conversion, as per DFHWS2LS, above (no compiled option for a requester)
- Both methods generate copybooks and a wsbind file. However, the RDz also generates COBOL source for a requester program, demonstrating how to use the EXEC CICS INVOKE WEBSERVICE command.

Creating a requester using the CICS web services assistant

- **You will need:** the WSDL for the web service that you want to use



Creating the CICS infrastructure for a requester

- Identical to the steps for a provider, except that a requester does not require a TCPIP SERVICE or a URIMAP resource
 1. Create a **pipeline configuration file**.
 2. Create a **PIPELINE** resource.
 3. Unless you use autoinstalled PROGRAM definitions, create a **PROGRAM** resource for each program in the pipeline.

Creating a requester using the CICS web services assistant

1. Run the **DFHWS2LS** batch utility (for example, specifying a COBOL copybook as the input file).
2. Copy the generated **wsbind** file to the pickup directory (the z/OS UNIX path specified by the WSDIR attribute of the PIPELINE resource).
Optionally, copy the generated **WSDL** file to the same path.
3. Install the **PIPELINE** (dynamically creates the WEBSERVICE resource).
4. Add an **EXEC CICS INVOKE WEBSERVICE** command to your COBOL program to send the request, and additional code to process the response.

The requester is ready for testing.

JCL to run DFHWS2LS

```
//SYSEGXLS JOB (39248C,A,T),'LS2WS',  
// MSGCLASS=A,NOTIFY=&SYSUID,REGION=0M  
// SET QT=''''  
//WHERE SMA JCLLIB ORDER=CIRCLE.CICSWS.PROCLIB  
//JAVAPROG EXEC DFHWS2LS,  
// JAVADIR='Java601_64/J6.0.1_64',PATHPREF='/u',TMPDIR='/u/tmp',  
// TMPFILE=&QT.&SYSUID.&QT,USSDIR='cicsts42'  
//INPUT.SYSUT1 DD *  
PDSLIB=CIRCLE.CICSWS.COPYLIB  
REQMEM=REQCOM  
RESPMEM=RESCOM  
MAPPING-LEVEL=3.0  
MINIMUM-RUNTIME-LEVEL=CURRENT  
LANG=COBOL  
WSBIND=/u/usr/lpp/cicsts/cicsts42/samples/webservices/wsbind/requester/*  
paybus6.wsbind  
WSDL=/u/usr/lpp/cicsts/cicsts42/samples/webservices/wsd1/paybus.wsdl  
LOGFILE=/u/sysegx0/paybus6  
/*
```

Output COBOL copybook PDS members:
one for the request, another for the
response

Output wsbind file

Input WSDL file

COBOL copybook generated by DFHWS2LS

```
03 PAYBUS0peration.  
06 wsXpayrollXdata.  
09 wsXrequest      PIC X(4).  
09 wsXkey.  
    12 wsXdepartment  PIC X(1).  
    12 wsXemployeeXno PIC X(5).  
09 wsXname         PIC X(20).  
09 wsXaddr1        PIC X(20).  
09 wsXaddr2        PIC X(20).  
09 wsXaddr3        PIC X(20).  
09 wsXphoneXno     PIC X(8).  
09 wsXtimestamp    PIC X(8).  
09 wsXsalary        PIC X(8).  
09 wsXstartXdate   PIC X(8).  
09 wsXremarks       PIC X(32).  
09 wsXmsg           PIC X(60).  
...
```

Corresponding XML snippet

```
<wsXpayrollXdata>  
  <wsXrequest>DISP</wsXrequest>  
  <wsXkey>  
    <wsXdepartment>1</wsXdepartment>  
    <wsXemployeeXno>00001</wsXemployeeXno>  
  </wsXkey>  
  <wsXname>CIRCLE COMPUTER 1 </wsXname>  
  ...
```

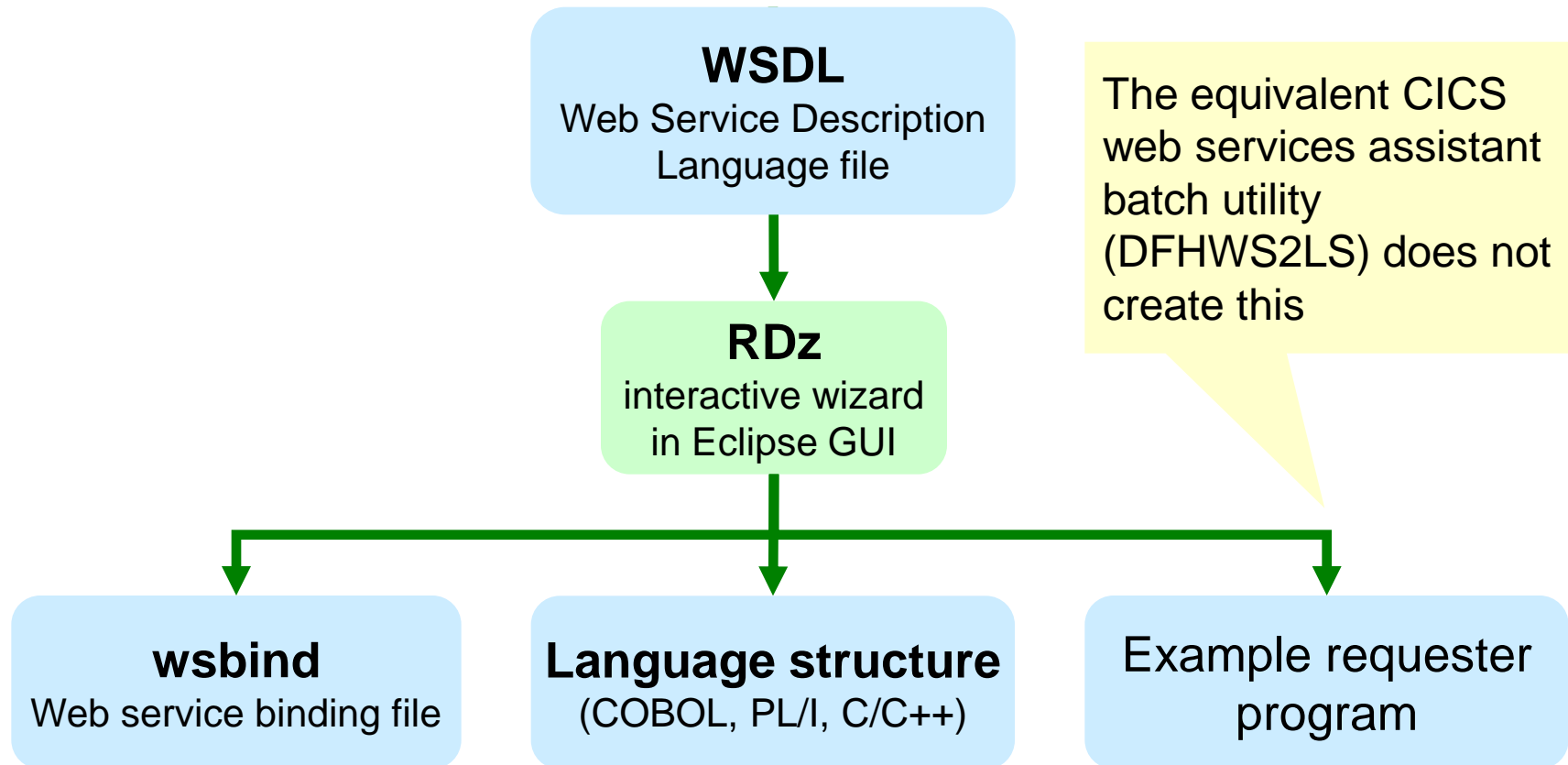
XML allows hyphens in element names, but some applications and programming languages interpret such hyphens as minus signs (mathematical operators), with undesirable results

Sending a request to a web service from a CICS COBOL program

```
EXEC CICS INVOKE  
  WEBSERVICE(CV-WEBSERVICE)  
  CHANNEL(CV-CHANNEL-NAME)  
  OPERATION(CV-OPERATION)  
  URI(CV-URI)  
  RESP(WS-EIB-RESP)  
END-EXEC.
```

The RDz wizard generates a sample CICS COBOL program that does this

Creating a requester using RDz



Creating a requester using RDz (1 of 8)



Enterprise Service Tools - - IBM Rational Developer for System z with EGL

File Edit Navigate Search Project Run Window Help

Manage Licenses

Explorer Navigator

- Compiled
- DFHLS2WSTest
- Interpretive

New

- Open Welcome Page
- Refresh

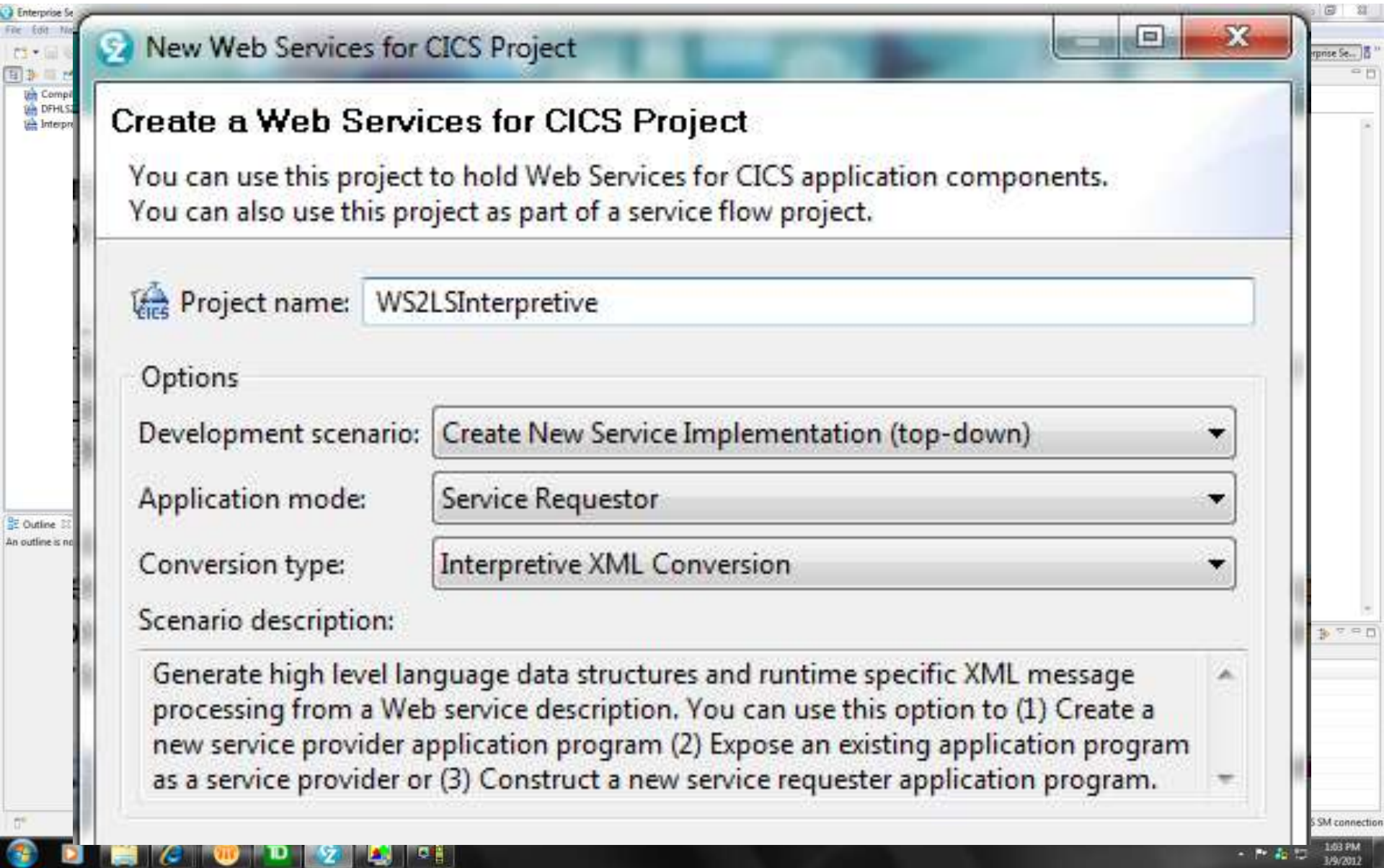
- Service Flow Project
- Web Services for CICS Project
- SOAP for CICS Project
- XML Transformation for CICS Project
- Batch, TSO, z/OS UNIX Project
- Database Application Project
- SCA Project

Welcome to EST
Enterprise S
Welcom

No CICS SM connection

1:02 PM
3/9/2012


Creating a requester using RDz (2 of 8)



New Web Services for CICS Project

Create a Web Services for CICS Project

You can use this project to hold Web Services for CICS application components.
You can also use this project as part of a service flow project.

 Project name:

Options

Development scenario:

Application mode:

Conversion type:

Scenario description:

Generate high level language data structures and runtime specific XML message processing from a Web service description. You can use this option to (1) Create a new service provider application program (2) Expose an existing application program as a service provider or (3) Construct a new service requester application program.

Creating a requester using RDz (3 of 8)

New Web Services for CICS Project

Import Source Files

Import source files from the workspace, file system, or remote z/OS system.

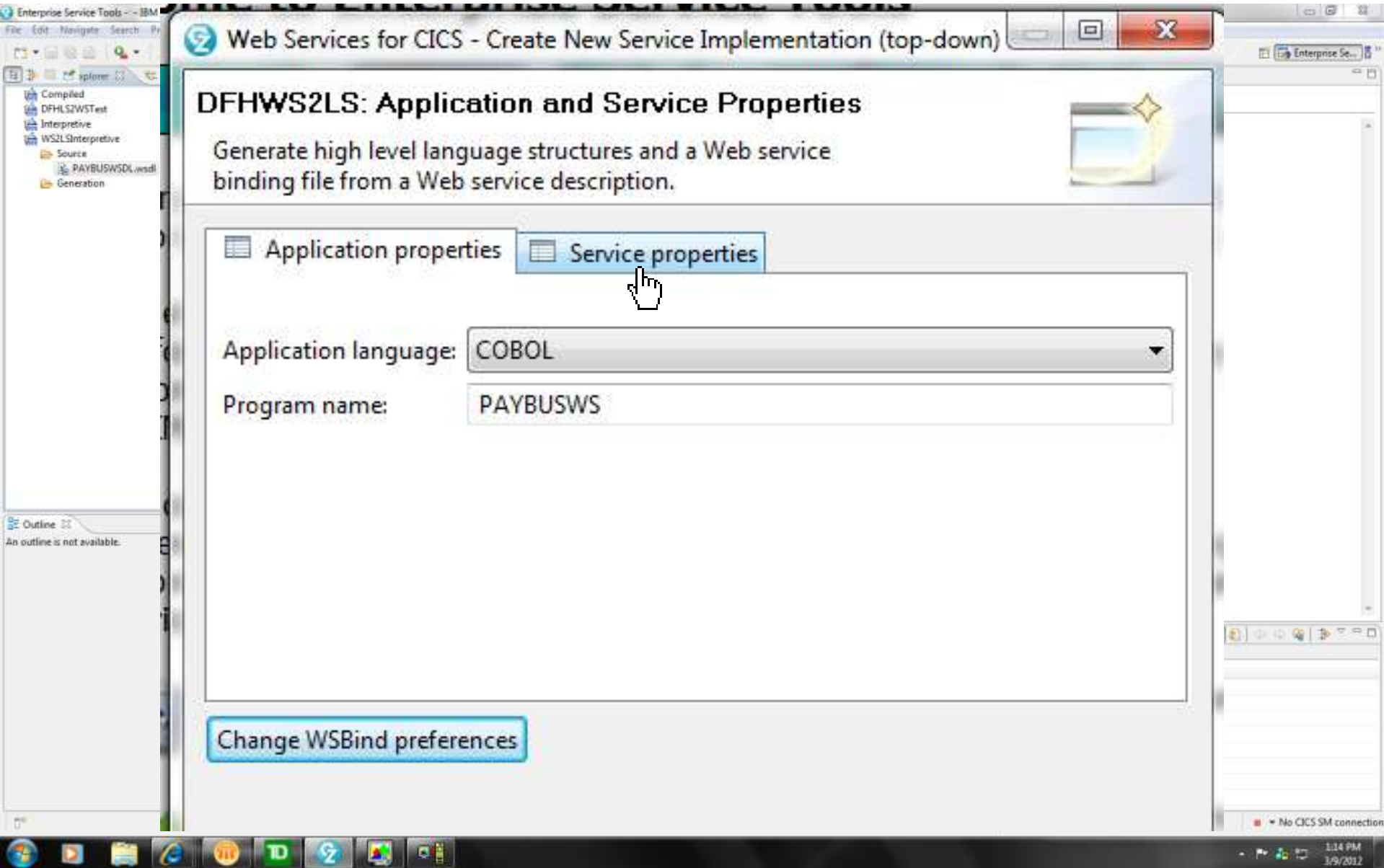
Source files to import

Y:\WORK\PAYBUSWSDL.wsdl

Import from:

- File system...
- Workspace...
- Remote...
- Remove

Creating a requester using RDz (4 of 8)



Enterprise Service Tools -- IBM
File Edit Navigate Search Pr

Web Services for CICS - Create New Service Implementation (top-down)

DFHWS2LS: Application and Service Properties

Generate high level language structures and a Web service binding file from a Web service description.

Application properties **Service properties**

Application language: COBOL

Program name: PAYBUSWS

Change WSBind preferences

Enterprise Se...

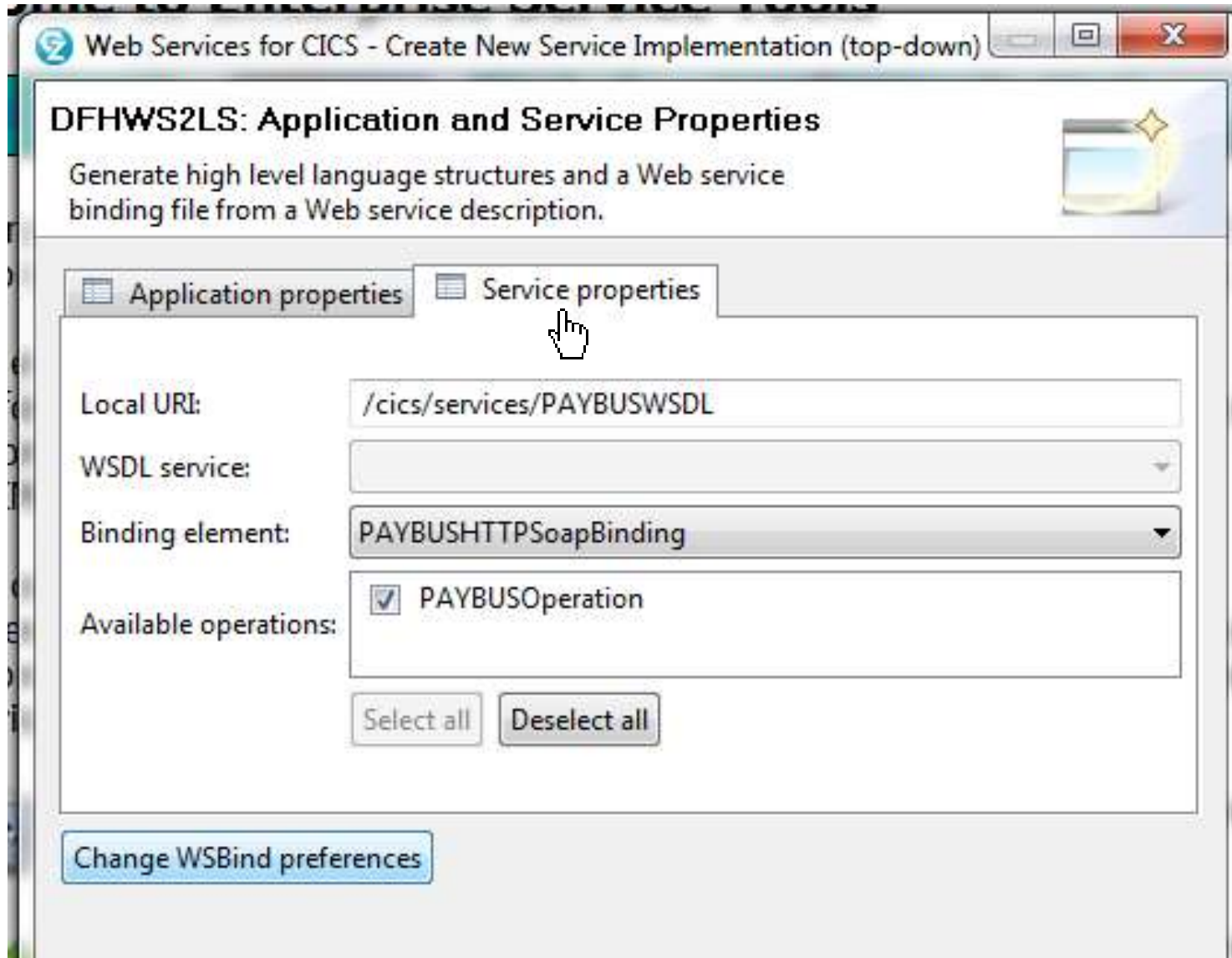
Enterprise Se...

Outline 22
An outline is not available.

No CICS SM connection

1:14 PM
3/9/2012

Creating a requester using RDz (5 of 8)



Web Services for CICS - Create New Service Implementation (top-down)

DFHWS2LS: Application and Service Properties

Generate high level language structures and a Web service binding file from a Web service description.

Application properties | **Service properties**

Local URI: /cics/services/PAYBUSWSDL

WSDL service: [Empty dropdown]

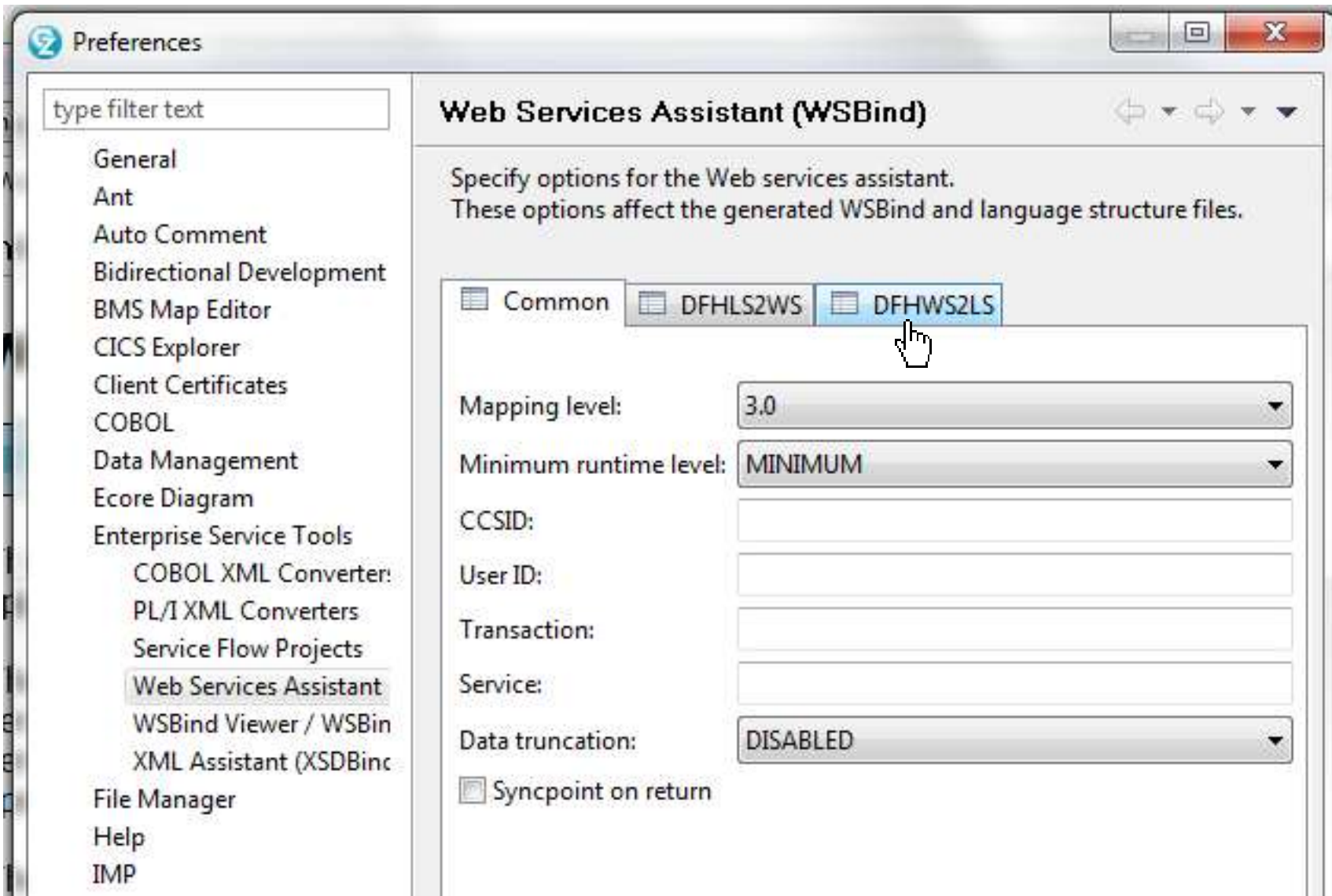
Binding element: PAYBUSHTTPSoapBinding

Available operations: PAYBUSOperation

Select all | Deselect all

Change WSBind preferences

Creating a requester using RDz (6 of 8)



Preferences

type filter text

- General
- Ant
- Auto Comment
- Bidirectional Development
- BMS Map Editor
- CICS Explorer
- Client Certificates
- COBOL
- Data Management
- Ecore Diagram
- Enterprise Service Tools
 - COBOL XML Converter:
 - PL/I XML Converters
 - Service Flow Projects
 - Web Services Assistant**
 - WSBind Viewer / WSBin
 - XML Assistant (XSDBinc)
- File Manager
- Help
- IMP

Web Services Assistant (WSBind)

Specify options for the Web services assistant.
These options affect the generated WSBind and language structure files.

Common DFHLS2WS **DFHWS2LS**

Mapping level: 3.0

Minimum runtime level: MINIMUM

CCSID:

User ID:

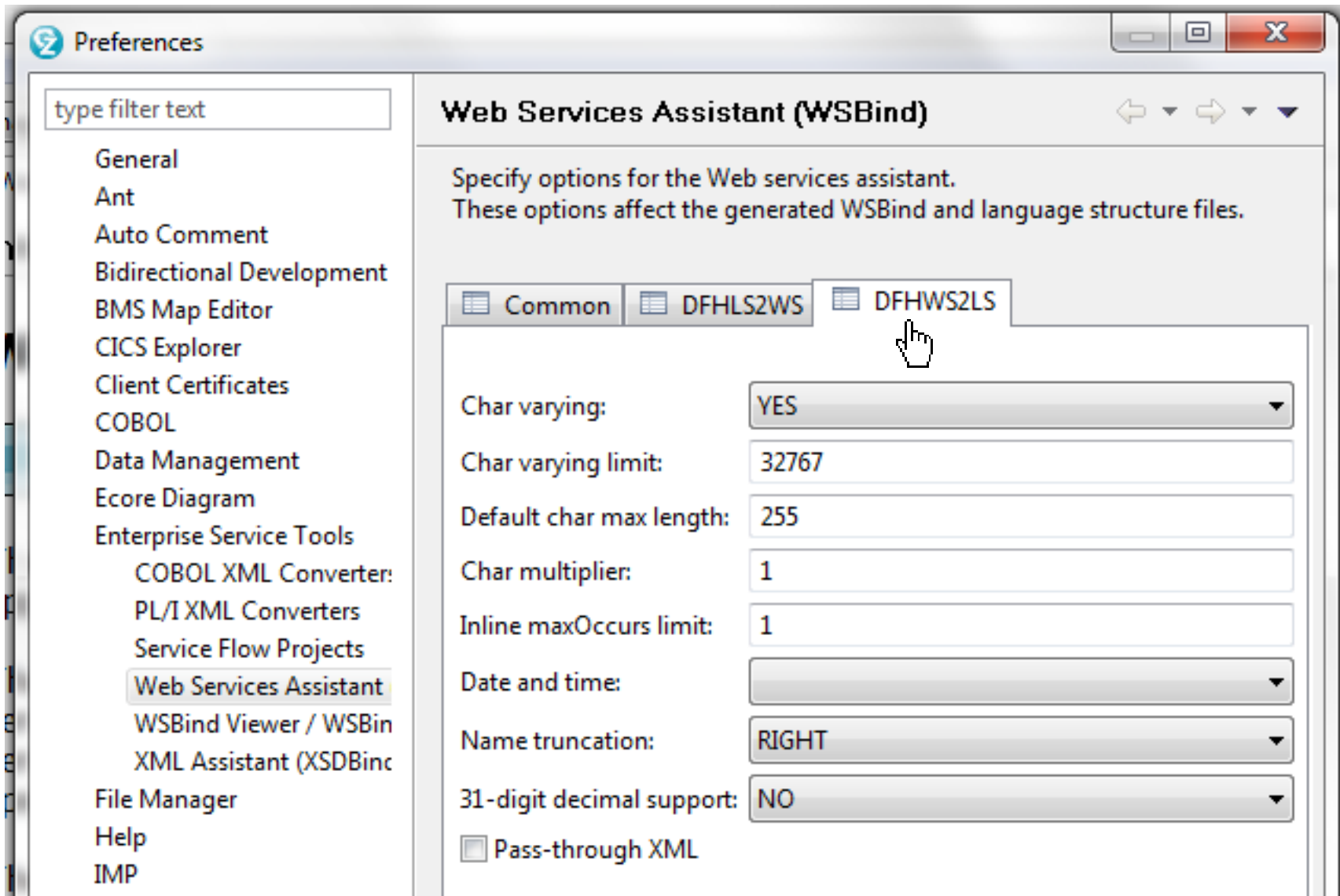
Transaction:

Service:

Data truncation: DISABLED

Syncpoint on return

Creating a requester using RDz (7 of 8)



The screenshot shows the 'Web Services Assistant (WSBind)' preferences dialog box. The left sidebar contains a list of categories, with 'Web Services Assistant' selected. The main area is titled 'Web Services Assistant (WSBind)' and contains a description: 'Specify options for the Web services assistant. These options affect the generated WSBind and language structure files.' Below this, there are three tabs: 'Common', 'DFHLS2WS', and 'DFHWS2LS'. The 'DFHWS2LS' tab is active, and a mouse cursor is pointing at it. The settings for the 'DFHWS2LS' tab are as follows:

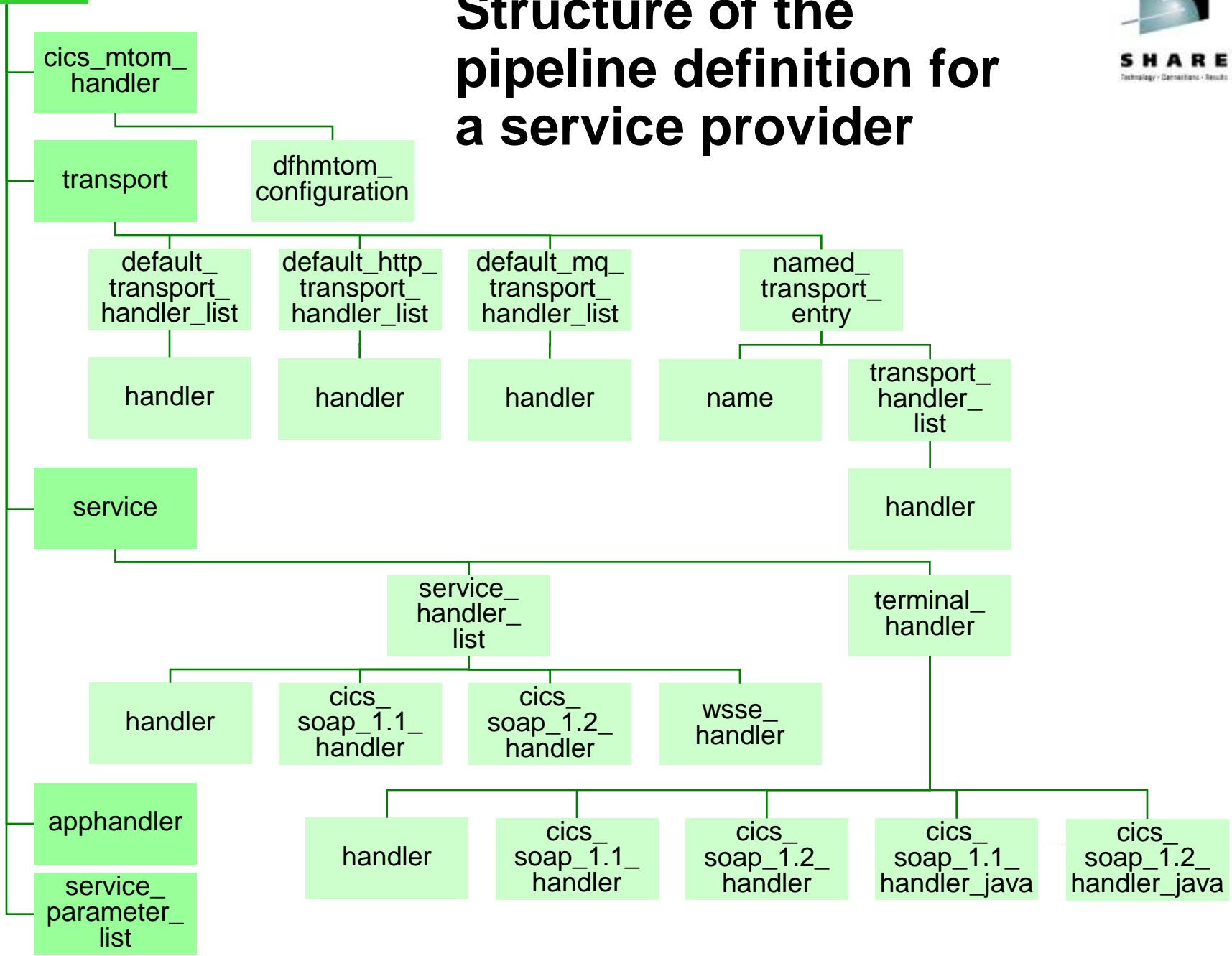
Setting	Value
Char varying:	YES
Char varying limit:	32767
Default char max length:	255
Char multiplier:	1
Inline maxOccurs limit:	1
Date and time:	
Name truncation:	RIGHT
31-digit decimal support:	NO
<input type="checkbox"/> Pass-through XML	

Creating a requester using RDz (8 of 8)



```
Enterprise Ser
File Edit New
Welcome to EST PAYBUSWS.cbl X
Line 1      Column 3      Insert
--+---*A-1-B---+---2---+---3---+---4---+---5---+---6---+---7---|
PROCESS CICS,NODYNAM,NSYMBOL(NATIONAL),TRUNC(STD)
* ++++++
* New CICS TS Web Service Requester
* ++++++
IDENTIFICATION DIVISION.
* Begin Identification Division
PROGRAM-ID. 'PAYBUSWS'.
AUTHOR. RDZ.
INSTALLATION. 9.4.200.V20110819_0735.
DATE-WRITTEN. 3/9/12 1:15 PM.
* End Identification Division
DATA DIVISION.
* Begin Data Division
WORKING-STORAGE SECTION.
* Begin Working-Storage Section
* *****
* Operations Available on the Remote Web Service
* *****
1 OPERATION-NAME-1.
2 PIC X(15) USAGE DISPLAY
   VALUE 'PAYBUSOperation'.
```

Structure of the pipeline definition for a service provider



Diagnosing web services in CICS: sniffing containers in the pipeline

- The IBM Redbook *Implementing CICS Web Services*, SG24-7206, presents a simple “sniffer” program that displays (in tdqueue CESE) the contents of the containers available in the pipeline.
- To use the sniffer, you add it to the pipeline (configuration file) as a message handler.
- For example, in a provider pipeline:

```
<provider_pipeline>  
<service>  
  <service_handler_list>  
    <handler>  
      <program>SNIFFER</program>  
      <handler_parameter_list/>  
    </handler>  
  </service_handler_list>  
  <terminal_handler>  
    <cics_soap_1.1_handler/>  
  </terminal_handler>  
</service>  
<apphandler>DFHPITP</apphandler>  
</provider_pipeline>
```

Sniffer output (1 of 5)

```

CPIH 20120314113934 SNIFFER : *** Start ***
CPIH 20120314113934 SNIFFER : >=====<
CPIH 20120314113934 SNIFFER : Container Name      : DFHFUNCTION
CPIH 20120314113934 SNIFFER : Content length    : 00000016
CPIH 20120314113934 SNIFFER : Container content: RECEIVE-REQUEST
CPIH 20120314113934 SNIFFER : Containers on channel: List starts.
CPIH 20120314113934 SNIFFER : >=====<

```

```

...
CPIH 20120314113934 SNIFFER : Container Name      : DFHFUNCTION
CPIH 20120314113934 SNIFFER : Content length    : 00000016
CPIH 20120314113934 SNIFFER : Container content: RECEIVE-REQUEST
CPIH 20120314113934 SNIFFER : >=====<

```

```

...
CPIH 20120314113934 SNIFFER : Container Name      : DFHWS-URI
CPIH 20120314113934 SNIFFER : Content length    : 00000008
CPIH 20120314113934 SNIFFER : Container content: /paybus1
CPIH 20120314113934 SNIFFER : >=====<
CPIH 20120314113934 SNIFFER : Container Name      : DFHREQUEST
CPIH 20120314113934 SNIFFER : Content length    : 00002928
CPIH 20120314113934 SNIFFER : Container content:

```

```

<SOAP-ENV:Envelope ... >
  <SOAP-ENV:Body ... >
    <PAYBUSOperationRequest>
      <ws_payroll_data>
        <ws_request>DISP</ws_request>
        <ws_key>
          <ws_department>1</ws_department>
          <ws_employee_no>00001</ws_employee_no>
        </ws_key>

```

```

...
  </SOAP-ENV:Body>
</SOAP-ENV:Envelope>

```

Sniffer output (2 of 5)



```
CPIH 20120314113934 SNIFFER : >=====<
CPIH 20120314113934 SNIFFER : Container Name      : DFHWS-PIPELINE
CPIH 20120314113934 SNIFFER : Content length    : 00000008
CPIH 20120314113934 SNIFFER : Container content: CICSWS
CPIH 20120314113934 SNIFFER : >=====<
CPIH 20120314113934 SNIFFER : Container Name      : DFHWS-USERID
CPIH 20120314113934 SNIFFER : Content length    : 00000008
CPIH 20120314113934 SNIFFER : Container content: CICSTS41
CPIH 20120314113934 SNIFFER : >=====<
CPIH 20120314113934 SNIFFER : Container Name      : DFHWS-TRANID
CPIH 20120314113934 SNIFFER : Content length    : 00000004
CPIH 20120314113934 SNIFFER : Container content: CPIH
CPIH 20120314113934 SNIFFER : >=====<
CPIH 20120314113934 SNIFFER : Container Name      : DFHWS-WEBSERVICE
CPIH 20120314113934 SNIFFER : Content length    : 00000032
CPIH 20120314113934 SNIFFER : Container content: paybus1
CPIH 20120314113934 SNIFFER : >=====<
CPIH 20120314113934 SNIFFER : Container Name      : DFHWS-APPHANDLER
CPIH 20120314113934 SNIFFER : Content length    : 00000008
CPIH 20120314113934 SNIFFER : Container content: DFHPITP
CPIH 20120314113934 SNIFFER : Containers on channel: List ends
CPIH 20120314113934 SNIFFER : DFHRESPONSE      container deleted
CPIH 20120314113934 SNIFFER : **** End ****
```



Sniffer output (3 of 5)



```
CPIH 20120314113934 SNIFFER : *** Start ***
CPIH 20120314113934 SNIFFER : >=====<
CPIH 20120314113934 SNIFFER : Container Name      : DFHFUNTION
CPIH 20120314113934 SNIFFER : Content length    : 00000016
CPIH 20120314113934 SNIFFER : Container content: SEND-RESPONSE
CPIH 20120314113934 SNIFFER : Containers on channel: List starts.
CPIH 20120314113934 SNIFFER : >=====<
CPIH 20120314113934 SNIFFER : Container Name      : DFHWS-OUTACTION
CPIH 20120314113934 SNIFFER : Content length     : 00000067
CPIH 20120314113934 SNIFFER : Container content:
C"http://www.PAYBUS.PAYCOM1.com/PAYBUSPort/PAYBUSOperationResponse"
CPIH 20120314113934 SNIFFER : >=====<
...
CPIH 20120314113934 SNIFFER : Container Name      : DFHWS-WSDL-CTX
CPIH 20120314113934 SNIFFER : Content length     : 00000116
CPIH 20120314113934 SNIFFER : Container content:
http://www.PAYBUS.PAYCOM1.com PAYBUSOperation
http://www.PAYBUS.PAYCOM1.com
http://www.PAYBUS.PAYCOM1.com PAYBUSPort
CPIH 20120314113934 SNIFFER : >=====<
CPIH 20120314113934 SNIFFER : Container Name      : DFHWS-OPERATION
CPIH 20120314113934 SNIFFER : Content length     : 00000015
CPIH 20120314113934 SNIFFER : Container content: PAYBUSOperation
```



Sniffer output (4 of 5)



```
CPIH 20120314113934 SNIFFER : >=====<
CPIH 20120314113934 SNIFFER : Container Name      : DFHRESPONSE
CPIH 20120314113934 SNIFFER : Content length   : 00002446
CPIH 20120314113934 SNIFFER : Container content:
```

```
<SOAP-ENV:Envelope ... >
  <SOAP-ENV:Body>
    <PAYBUSOperationResponse ... >
      <ws_payroll_data>
        <ws_request>DISP</ws_request>
        <ws_key>
          <ws_department>1</ws_department>
          <ws_employee_no>00001</ws_employee_no>
        </ws_key>
        <ws_name>SHARE</ws_name>
        <ws_addr1>QUEENSBURY HSE</ws_addr1>
        <ws_addr2>BRIGHTON</ws_addr2>
        <ws_addr3>SUSSEX</ws_addr3>
        <ws_phone_no>75529900</ws_phone_no>
        <ws_timestamp></ws_timestamp>
        <ws_salary>1234.56</ws_salary>
        <ws_start_date>28101984</ws_start_date>
        <ws_remarks>CIRCLE IS MAGIC</ws_remarks>
        <ws_msg></ws_msg>
        <ws_upd_inds>
          <ws_upd_name></ws_upd_name>
```

...



Sniffer output (5 of 5)



```
CPIH 20120314113934 SNIFFER : >=====<
CPIH 20120314113934 SNIFFER : Container Name      : DFHFUNCTION
CPIH 20120314113934 SNIFFER : Content length    : 00000016
CPIH 20120314113934 SNIFFER : Container content: SEND-RESPONSE
```

....

```
CPIH 20120314113934 SNIFFER : >=====<
CPIH 20120314113934 SNIFFER : Container Name      : DFHWS-WEBSERVICE
CPIH 20120314113934 SNIFFER : Content length     : 00000032
CPIH 20120314113934 SNIFFER : Container content: paybus1
CPIH 20120314113934 SNIFFER : >=====<
CPIH 20120314113934 SNIFFER : Container Name      : DFHWS-APPHANDLER
CPIH 20120314113934 SNIFFER : Content length     : 00000008
CPIH 20120314113934 SNIFFER : Container content: DFHPITP
CPIH 20120314113934 SNIFFER : Containers on channel: List ends
CPIH 20120314113934 SNIFFER : *** End ***
```



Summary



- To create a service provider or requester in CICS:
 - Create a PIPELINE resource and pipeline configuration file.
 - *Provider only:* create a TCPIP SERVICE resource.
 - Use CICS web service assistant or RDz to create wsbind (and WSDL) files. You will need a COBOL copybook (or other language structure) or a WSDL file.
 - Install the PIPELINE (or issue a PIPELINE SCAN command if already installed).
- Consider Service Flow Modeler for applications that do not have separate presentation and business logic structures.
- Add a sniffer program to the pipeline to diagnose problems.