Using SOA Web Services with z/VSE

Ingo Franzki, IBM

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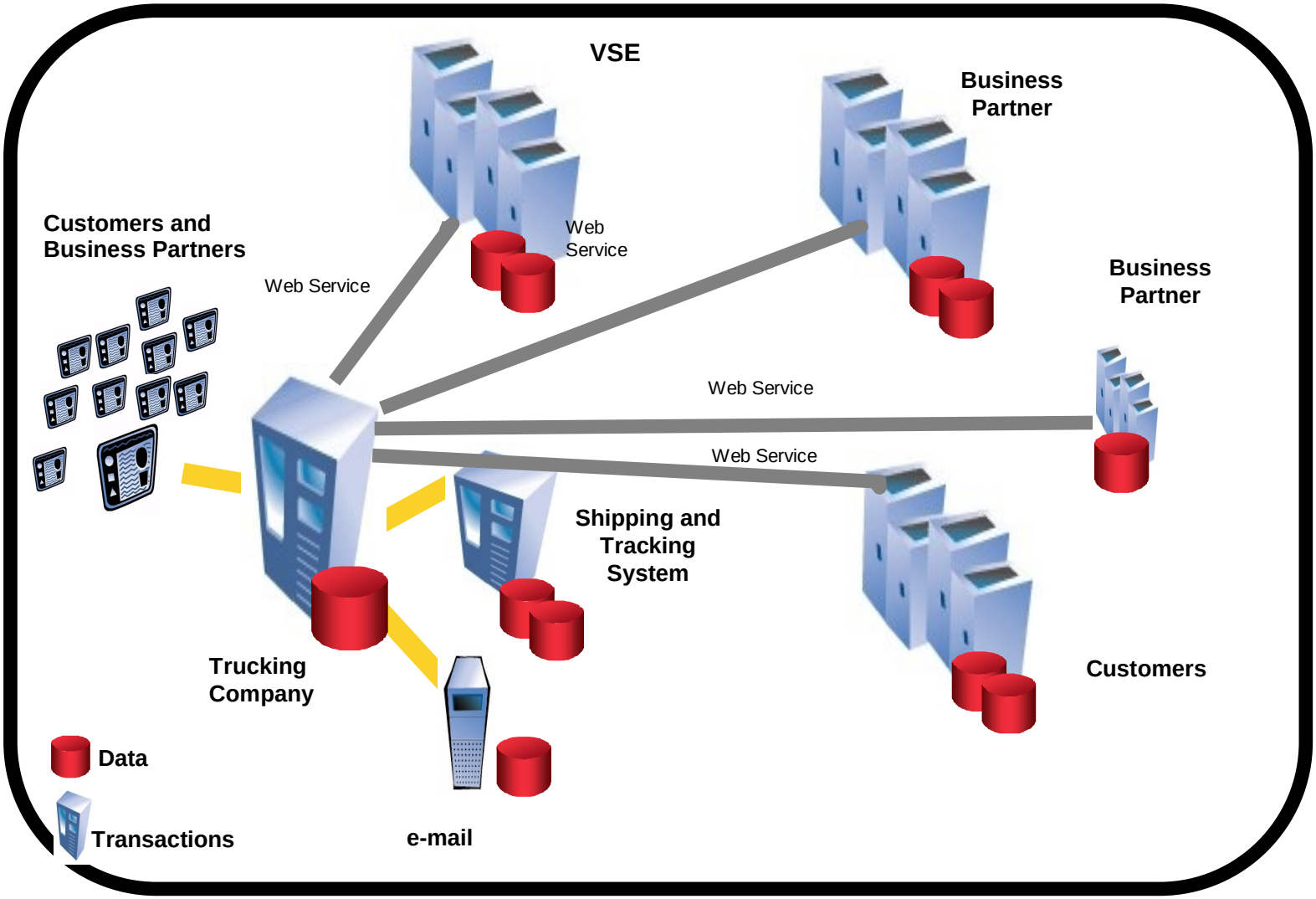
Roadmap for dynamic e-business - SOA



What is Service-Oriented Architecture (SOA)?

- **SOA is an IT architectural style**
  - supports integrating your business as linked services that can be accessed when needed over a network, enabling your business to adapt to changing conditions and requirements
  - These services are self-contained and have well-defined interfaces to let the users of those services -- called clients or consumers -- know how to interact with them
- **SOA results in "loosely coupled" application components**
  - The code is not necessarily tied to a particular database, or even a particular infrastructure.
- **It is this loose coupling that enables the combination of services into diverse applications.**
  - It also enables much greater code reuse, cutting your workload at the same time that it increases your capabilities.
- **Because a service and the client accessing that service are not tied to each other**
  - a service used to process an order could be completely replaced, and the client-services placing orders would never know.

What is Service-Oriented Architecture (SOA)?

- **From a business standpoint, a Service-Oriented Architecture is focused on**
  - developing technology that helps you accomplish your business tasks
  - rather than allowing technological constraints to dictate your activities.
- **For example, the process of selling, manufacturing, shipping, and getting paid for an item may involve dozens of steps and several different databases and computer systems.**
- **But at the heart of things, the process encompasses a handful of human activities, for example:**
  - Salesmen finds a likely customer
  - Customer orders product
  - Production department produces product
  - Production department ships product
  - Billing department bills for product
  - Customer pays for product

What is Service-Oriented Architecture (SOA)?

- **Implementing SOA can bring you a great number of benefits, including the following:**
  - Greater alignment of business and IT
  - Component-based systems
  - Loosely coupled components and systems
  - A network-based infrastructure, enabling geographically and technologically diverse resources to work together
  - On-demand, built-on-the-fly-applications
  - Greater code reuse
  - Better process standardization throughout the enterprise
  - Easier centralization of corporate control

What is Service-Oriented Architecture (SOA)?

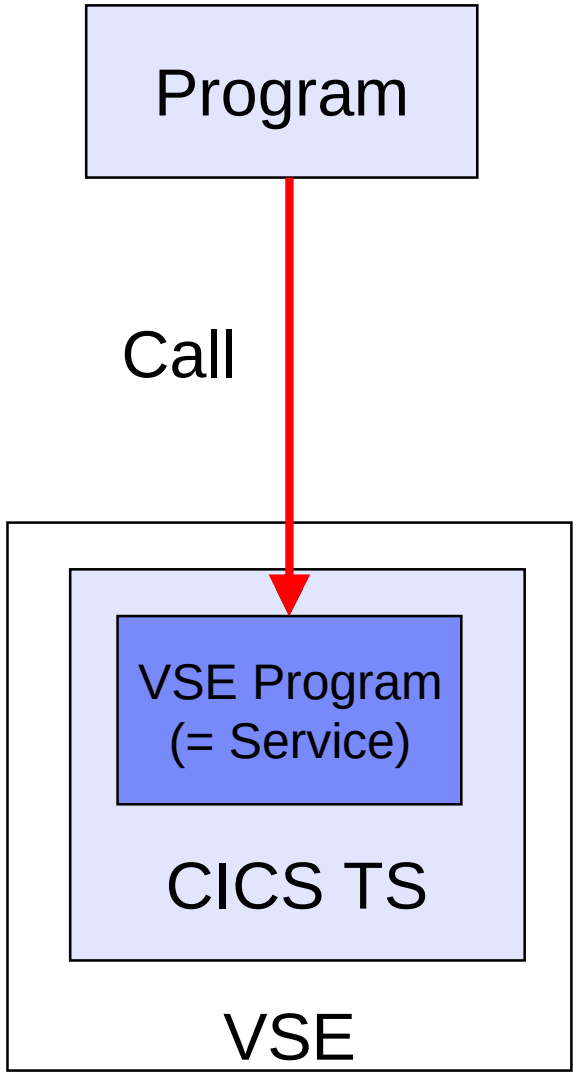
- **Web services are the most common technology standards used to implement SOA**
  - However, they are not the only technology one can use to develop the parts of an SOA
- **Many SOAs -- most, in fact -- involve the integration of legacy data**
  - contained in systems that use technology such as MQSeries and Common Object Request Broker Architecture (CORBA) or even CICS.
- **Many of these technologies have been adapted for the SOA world, and they can be used with or without a Web services wrapper.**
- **But, Web services is rapidly becoming the de facto standard used to support SOA.**

Why would a VSE customer do SOA ?

- **SOA is modern (hype) and strategic**
  - The management says: We also have to do SOA
- **Easy integration of existing VSE programs into the modern world**
  - Reducing the interface complexity
  - Reuse of existing applications as services
  - Use of standard protocols (XML, SOAP, HTTP)
- **Encapsulation of VSE programs**
  - Disconnecting business and display logic
- **Integration of VSE into a Microsoft .Net environment**
  - You do not want to use Java
  - You already have a Microsoft environment

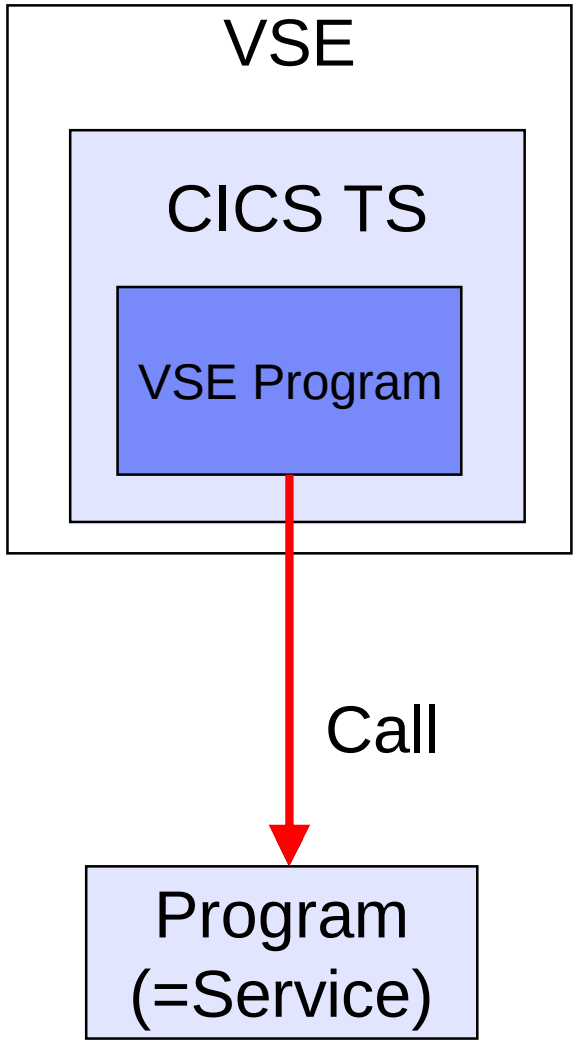
What is a Web Service?

- **Assume you have a VSE program that implements some kind of important business logic**
- **Someone else (outside VSE) wants to use this program**
  - 1. Possibility: Rewrite the same logic
    - May need access to VSE data
    - Changes/Fixes in VSE code needs to be re-done in new code also
  - 2. Possibility: Call the VSE program from remote
    - VSE program can be treated as a Web Service
    - VSE is the Web Service provider



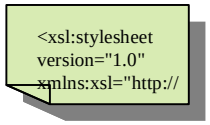
What is a Web Service?

- **Assume someone has a program that implements some kind of important business logic**
- **You want to use this program inside a VSE application**
  - 1. Possibility: Rewrite the same logic
    - May need access to the remote data
    - Changes/Fixes in code needs to be re-done in VSE code also
  - 2. Possibility: Call the external program from VSE
    - External program can be treated as a Web Service
    - VSE is the Web Service Requestor



Web Services - Summary

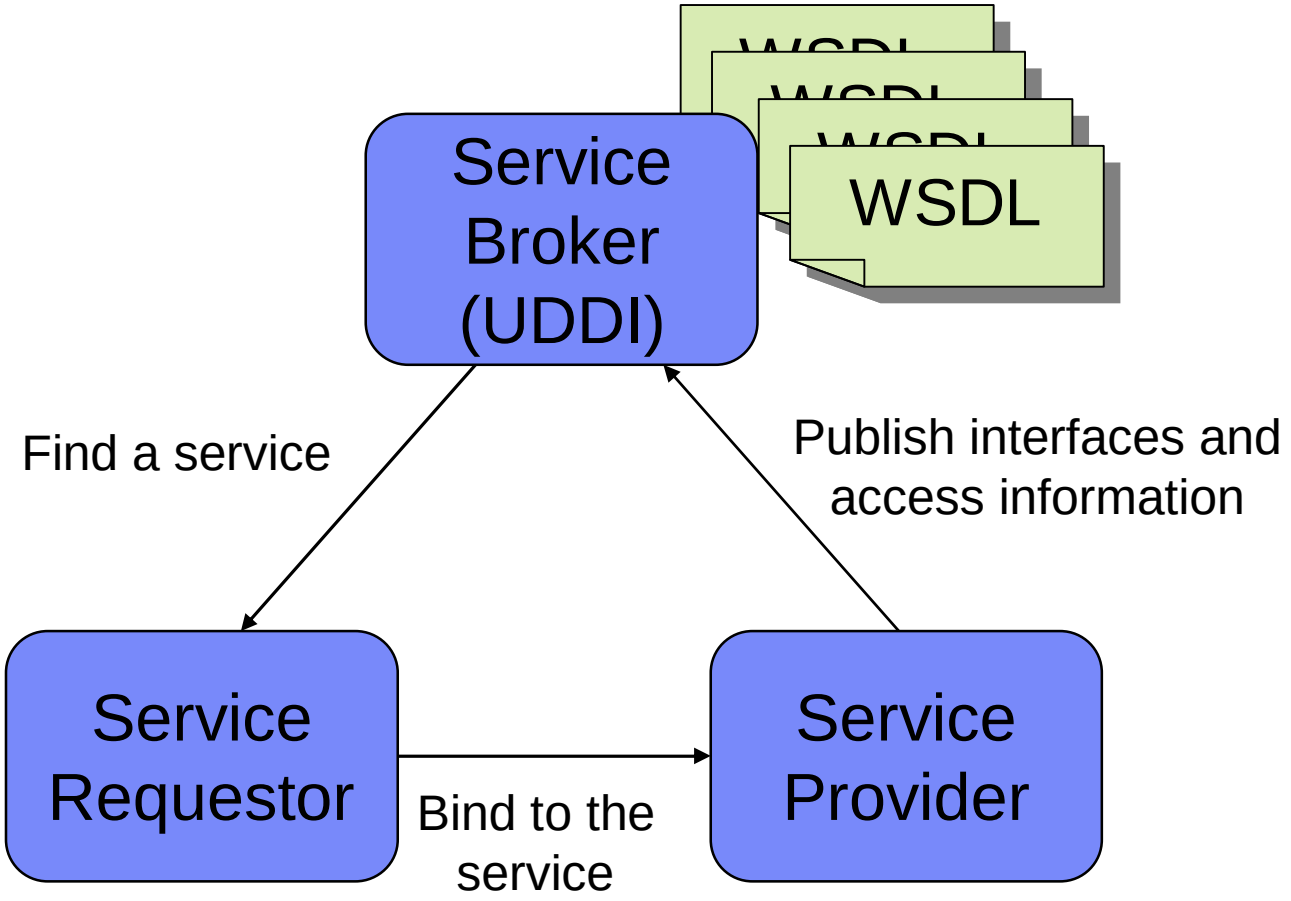
XML



SOAP -

HTTP - Transport Service

TCP/IP - Street



News with z/VSE V4.2

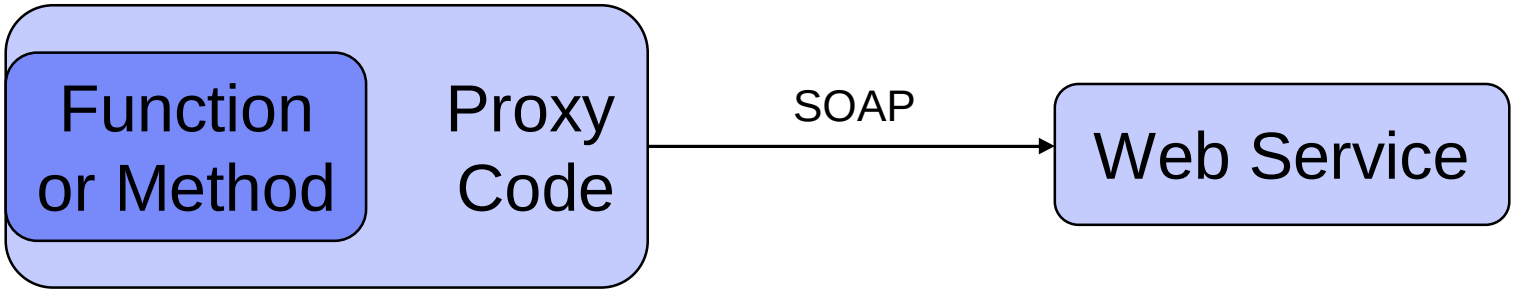
- **Web Service Security**
  - Message Encryption
    - Transport-layer authentication using:
      - HTTPS/SSL
  - Authentication:
    - Transport-layer authentication using:
      - HTTP authentication (Basic and Digest Access Authorization).
      - SSL Client Authentication with HTTPS.
    - Message-layer authentication using:
      - a UsernameToken (plaintext password or password digest).
      - an X.509 Certificate (BinarySecurityToken).

- **Long-name to short-name mapping**
  - To support parameter names longer than 16 characters
  - A mapping table can be used to translate long (external) names to short (internal) names

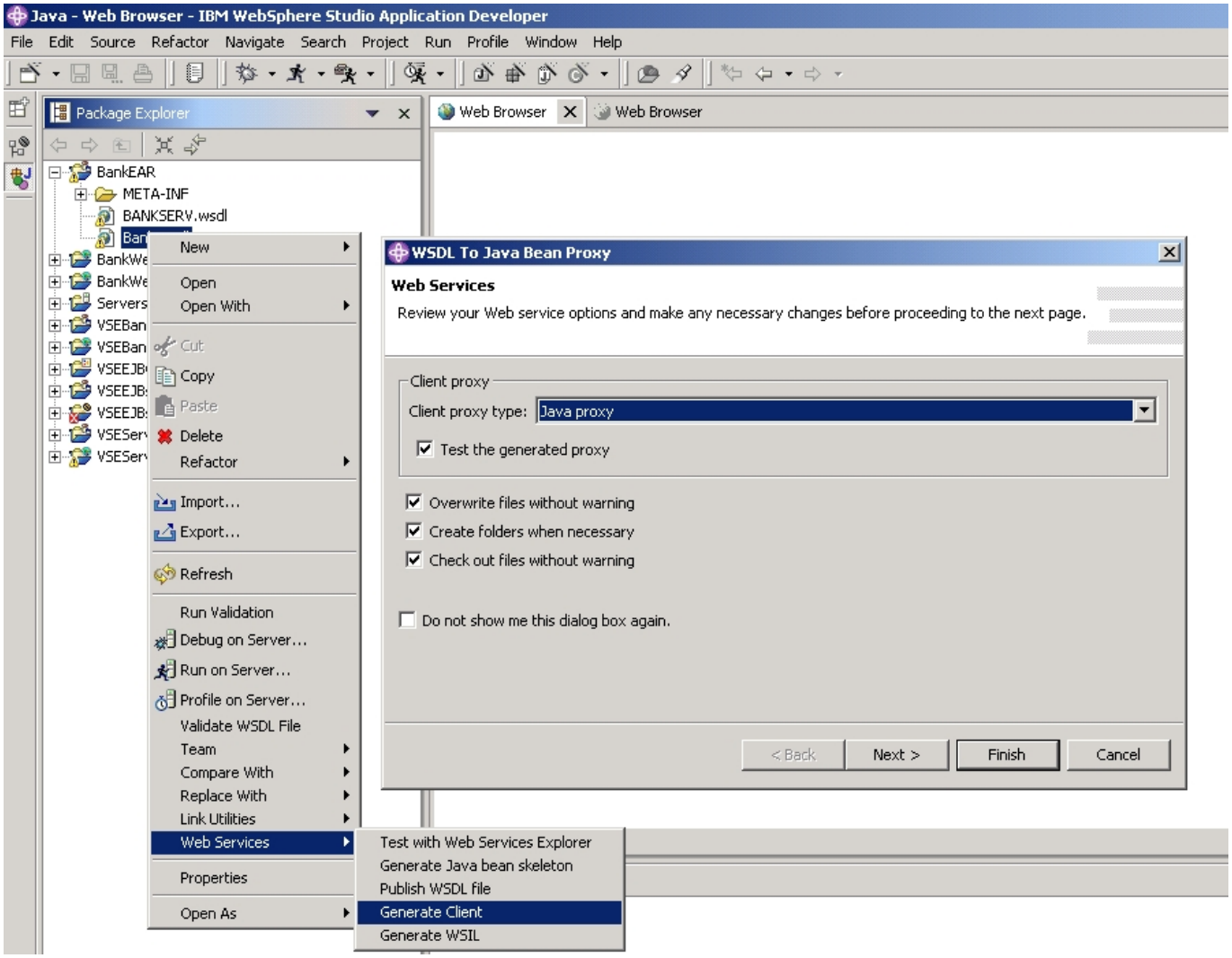
- **New Redbook-style document: “How to use Web Servcies with z/VSE“**
  - http://www.ibm.com/servers/eserver/zseries/zvse/documentation/ebusiness.html#soap

Using Web Services with Java or MS .Net

- **Use/Call an existing Web Service**
  - You know that a specific Web Service exists
  - Locate the Web Service Description (WSDL)
  - Use a tool like Rational Application Developer (RAD/WSAD) or Microsoft Visual Studio and import the WSDL
    - Generate “proxy code” that implements all things needed to invoke the Web Service
    - Applications will call a function or method of the proxy code as it would implement the service locally

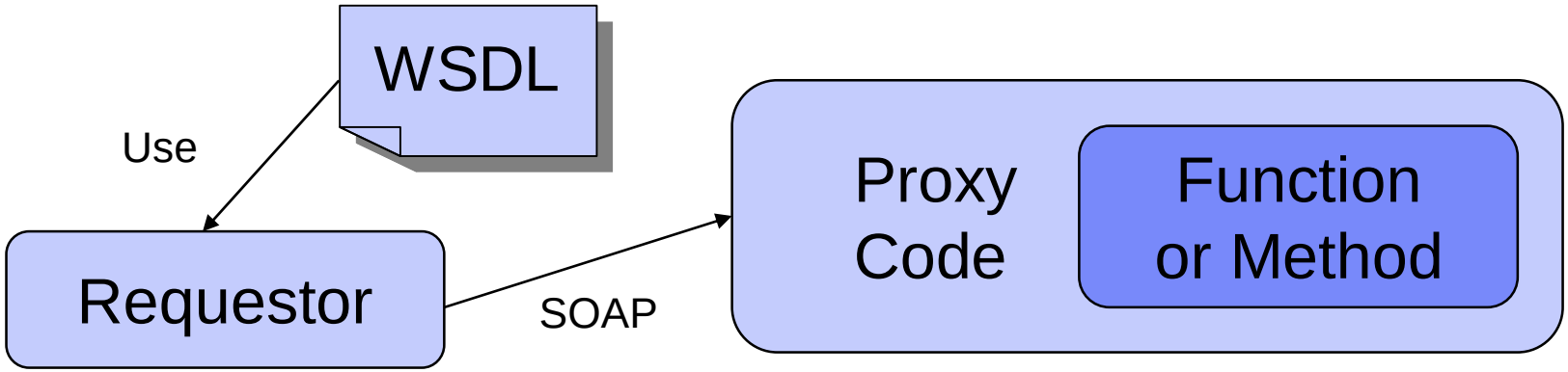


Using Web Services with Java or MS .Net



Using Web Services with Java or MS .Net

- **Create/provide a new Web Service**
  - You have a function or method that implements some kind of service that you want to provide
  - Use a tool like Rational Application Developer (RAD/WSAD) or Microsoft Visual Studio to model a Web Service
    - Generate a Web Service Description (WSDL) and publish it
    - Generate “proxy code” that makes the function or method callable from outside as a Web Service via SOAP
    - Deploy it in an application server



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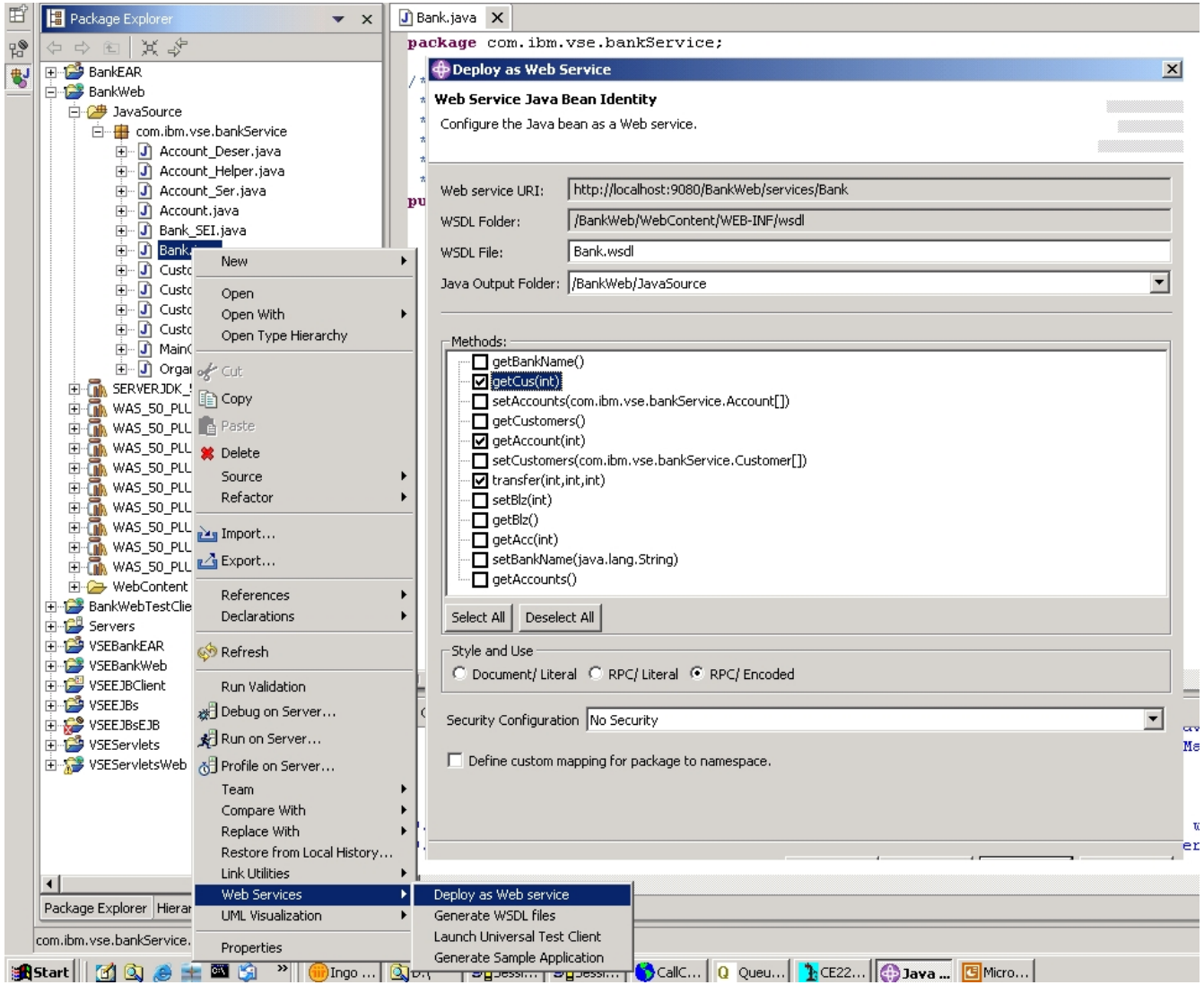
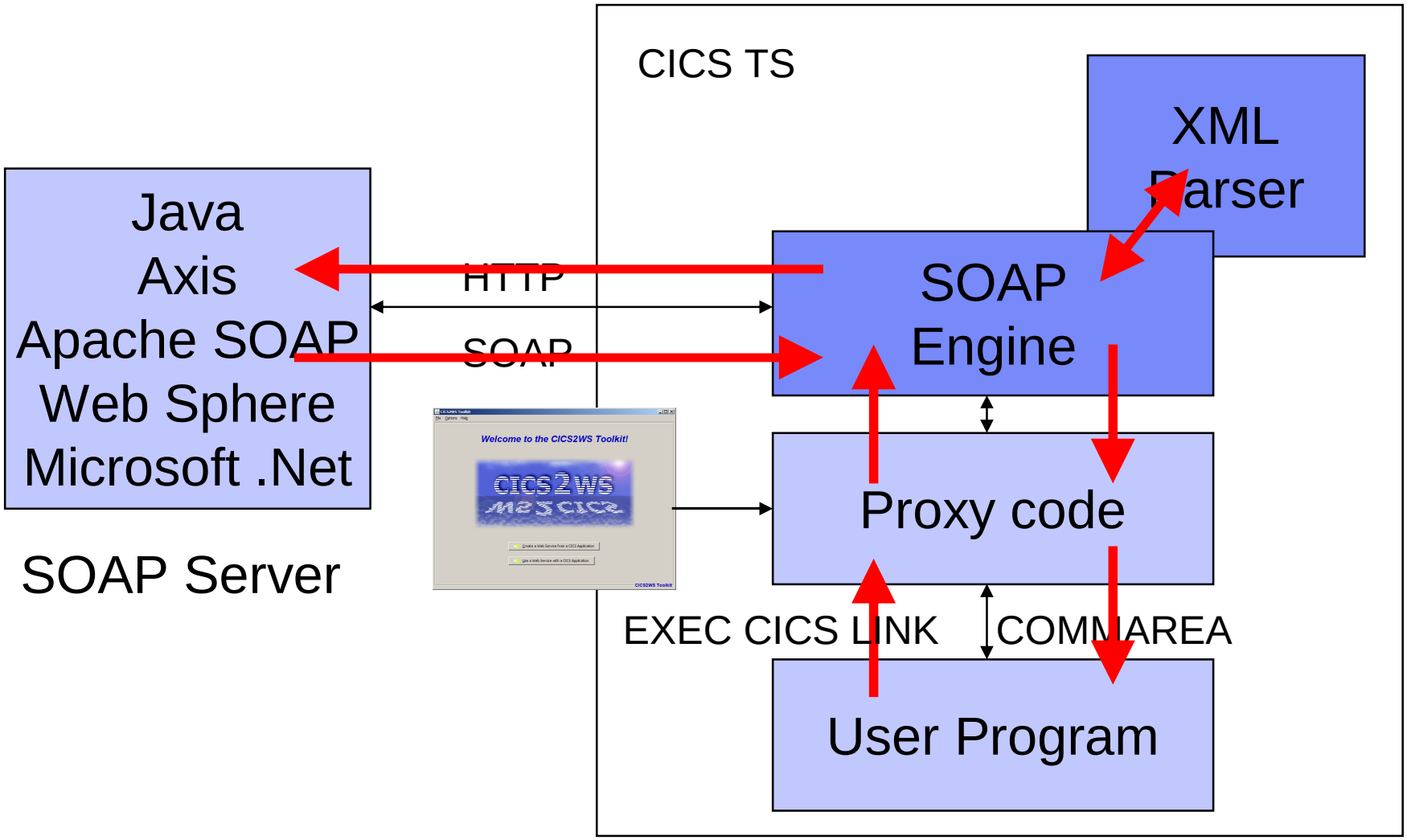
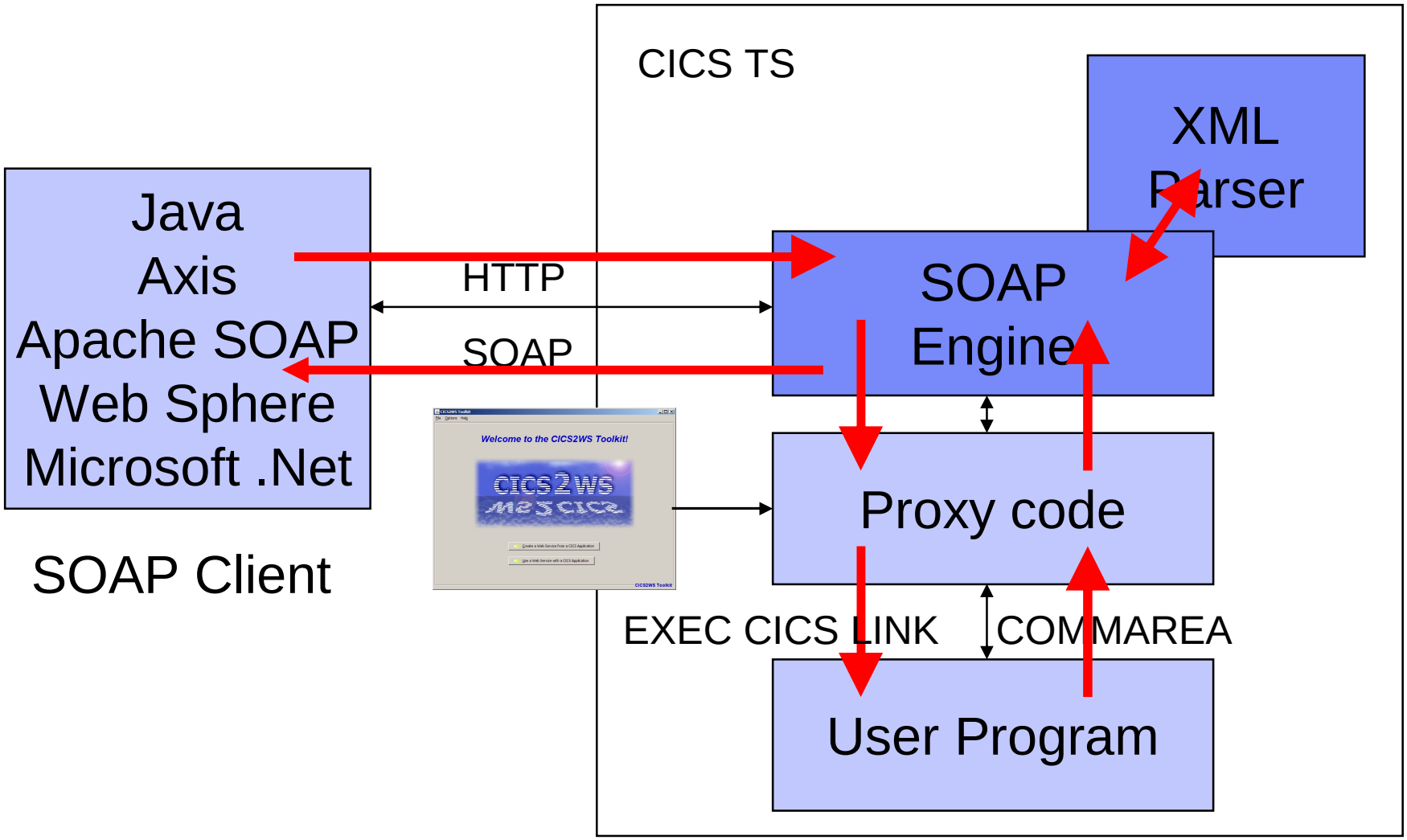


Using Web Services with VSE – SOAP client



Providing Web Services with VSE – SOAP server



VSE SOAP Engine

- **Input/Output parameters**
  - Each parameter is represented by a TS-Queue entry
    - Parameter name (e.g. “StockPrice”)
    - Parameter type (e.g. “String”)
    - Parameter value (e.g. “34.5”)
    - Length of the parameter data
  - Input parameters are put onto the Input-Queue
  - Output parameters are read from the Output Queue

```
01 SOAP-PARAM-HDR.
   05  NAME                    PIC X(16).
   05  TYPENAME                PIC X(16).
   05  LENGTH                  PIC 9(8)  COMP.
   05  TYPECODE                PIC 9(8)  COMP.
   05  VALUE                   PIC X(20).

EXEC CICS WRITEQ TS QUEUE(OUTQUEUE)
                 FROM(SOAP-PARAM-HDR)
                 LENGTH(TS-QUEUE-LENGTH-OUT)
                 RESP(COMMAND-RESPONSE)
                 END-EXEC.
```

Why use a proxy program?

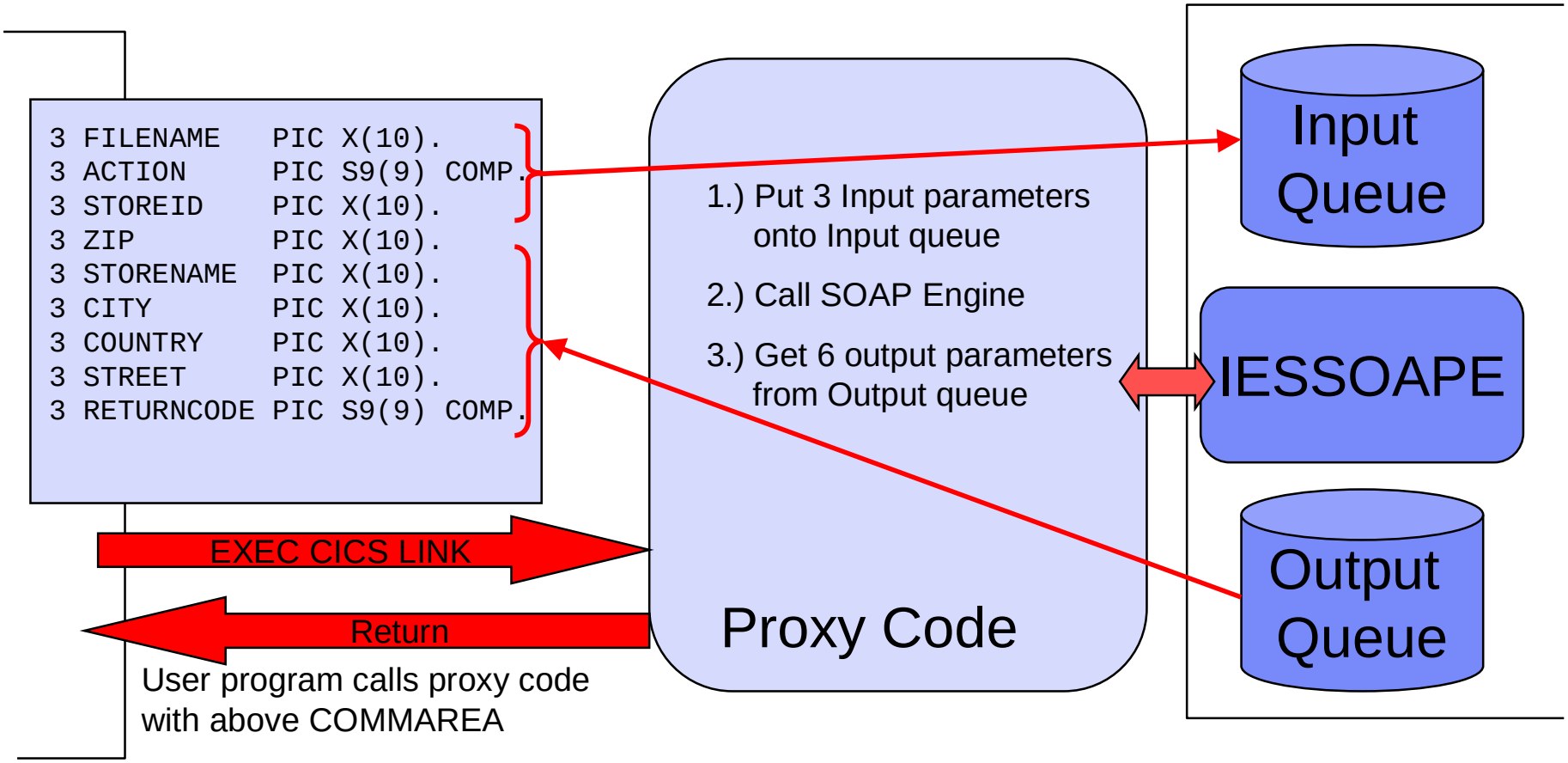
- **Although the SOAP Engine interface uses standard CICS methods, special coding is needed to interface with the VSE SOPA Engine.**
- **Proxy code 'maps' between standard COMMAREA interface and SOAP Engine**
  - All SOAP specific handling is done in proxy code
  - User applications calls the proxy code or gets called by the proxy code like a local program call (EXEC CICS LINK) using a COMMAREA
  - User COMMAREA format can be freely defined by user
  - Proxy code copies fields from COMMAREA into TS queue entries and vice versa

Why use a proxy program?

- **All SOAP implementations use some kind of “proxy code”**
  - Java (RAD/WSAD)
  - Microsoft .Net
  - …
- **The proxy code maps the implementation specifics of the SOAP engine to a common interface**
- **The proxy code is generated using the information from the WSDL**
- **The proxy code is usually not modified directly by user**
- **VSE uses the same technique as other SOAP implementations**

What does the proxy code do?

§To call an external Web Service

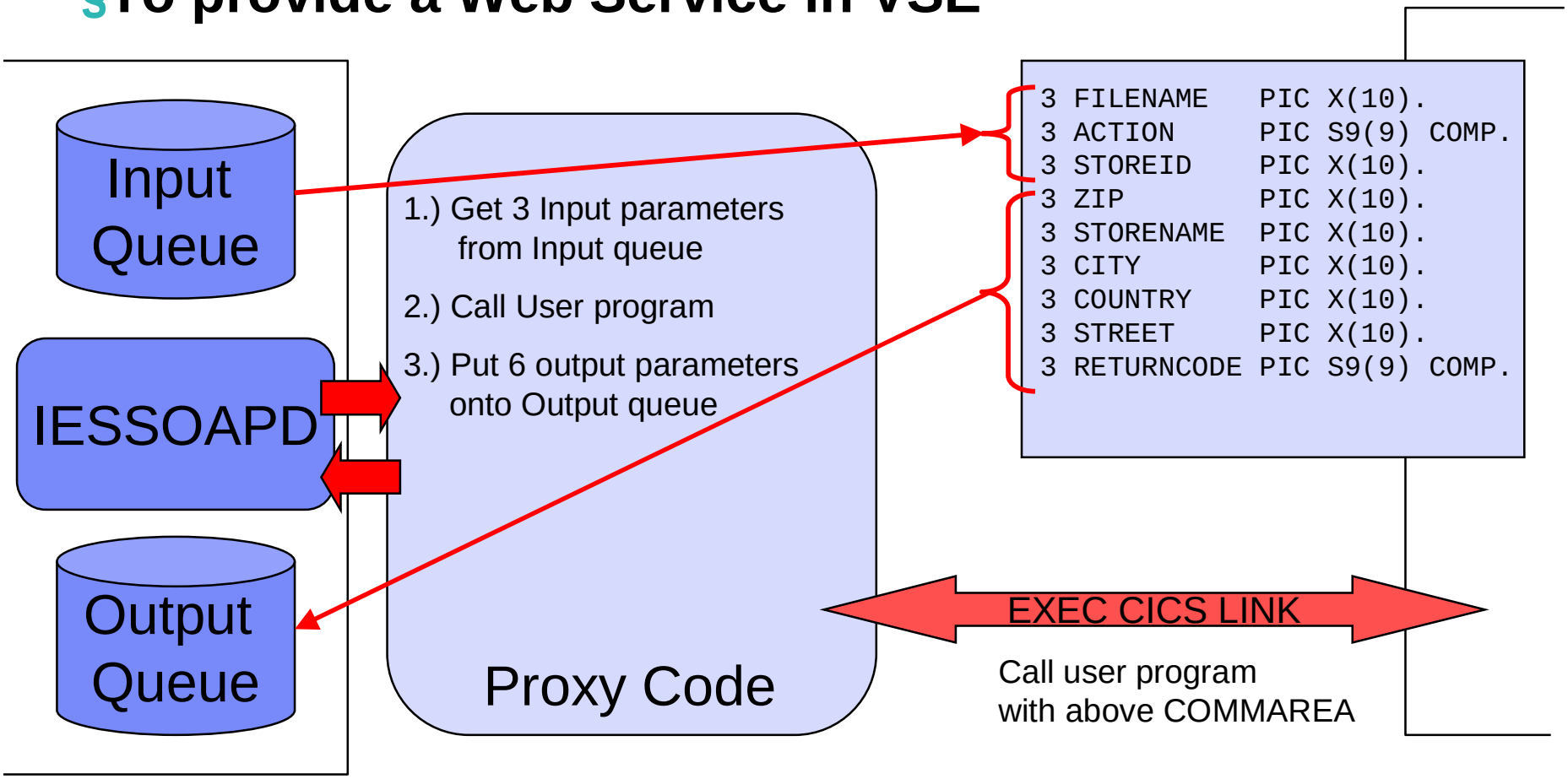


What does the proxy code do?

- **To call an external Web Service**
  - Proxy code gets invoked via EXEC CICS LINK by user program
  - Put input parameters onto input queue
  - Setup parameter area for Web Service call
    - Endpoint URL
    - Name of method to call
    - Names of Input and Output queues
  - Call SOAP Engine
    - EXEC CICS LINK to IESSOAPE
  - On return
    - Check for errors
    - Get output parameters from output queue
    - Return to user program

What does the proxy code do?

- **To provide a Web Service in VSE**



What does the proxy code do?

- **To provide a Web Service in VSE**
  - Proxy code gets called by SOAP Engine
  - Get input parameters from input queue
  - Prepare user COMMAREA
  - Call user program
    - EXEC CICS LINK service provider program (user program)
  - On return
    - Check for errors
    - Put output parameters onto output queue
    - Return to SOAP engine

Which programs can be used with Web Services?

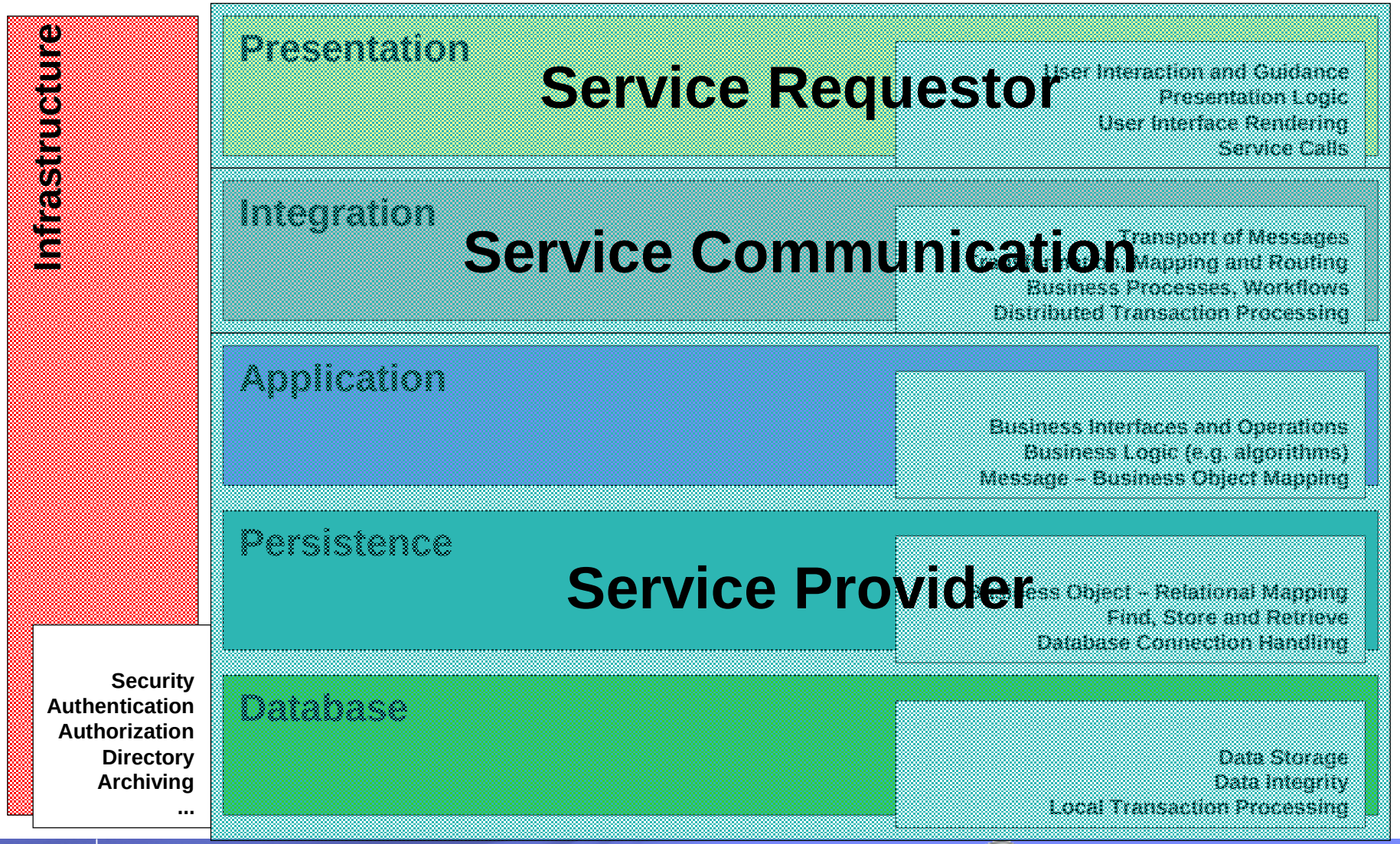
- **Which VSE programs can be used as an Web Service?**
  - All CICS TS programs that implement the “service” you want to provide
    - In any programming language (COBOL, PL/1, C, Assembler)
  - You should separate business logic from user interface
    - 3270 screens or BMS maps can not be used
  - The proxy code calls your program with EXEC CICS LINK and an user defined COMMAREA
- **Which VSE programs can call an external Web Service?**
  - All CICS TS programs that can call another program with a COMMAREA
    - In any programming language (COBOL, PL/1, C, Assembler)
  - Your program calls the proxy code with EXEC CICS LINK and an user defined COMMAREA
- **VSE SOAP Engine requires CICS TS**
  - But you can use MRO or remote program definitions to use programs running in CICS/VSE 2.3

Requirements for web services to be used with z/VSE

- **You need to have an WSDL that describes:**
  - where the web service is located (URL)
  - what methods/operations it provides
  - what input and output parameters it expects

- **The web service must follow these requirements:**
  - It must use the SOAP 1.1 protocol
  - It must use SOAP encoding (use=”encoded”), literal style is not supported by CICS2WS
  - It must use RPC style. Document style is not supported
  - Parameter names must not be larger than 16 characters
    - unless you use long-name to short-name mapping

Layered Software Architecture



How to write the proxy code

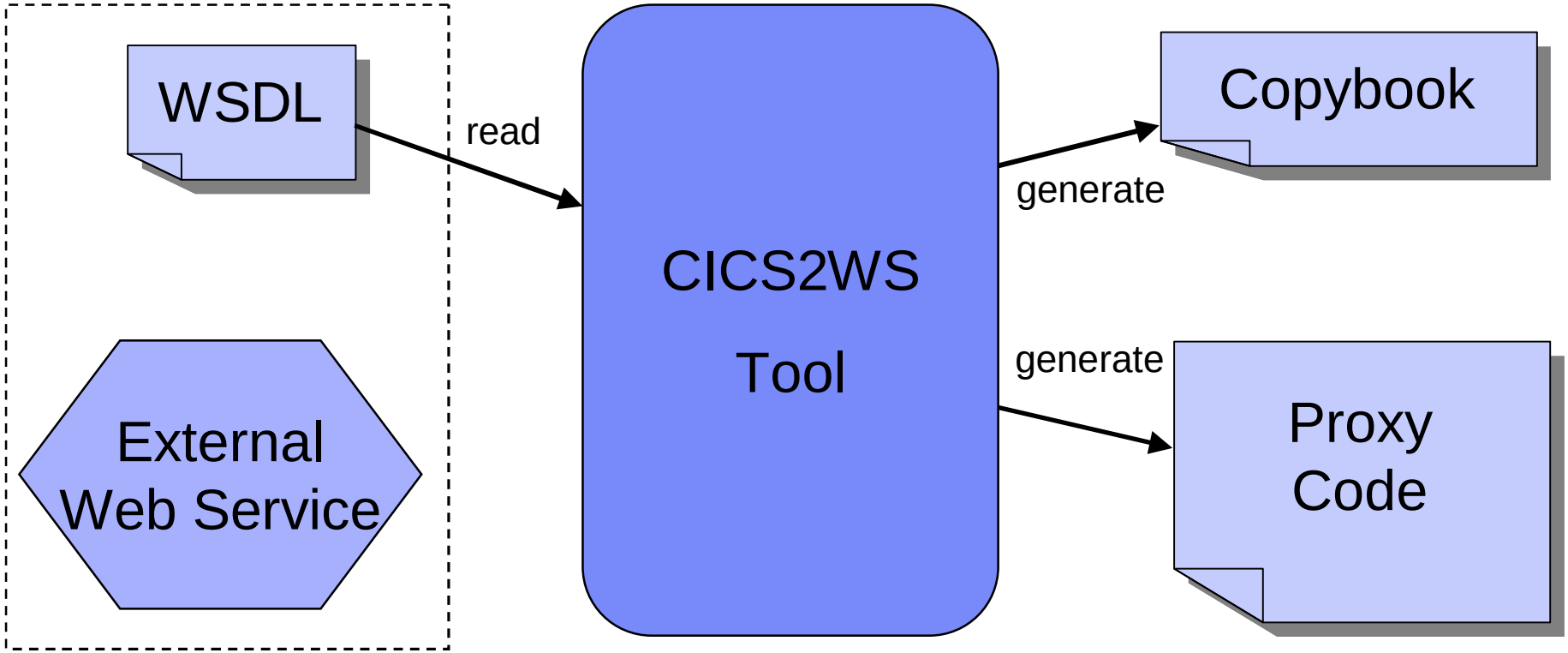
- **You can write the proxy code “by hand”**
  - Not very difficult, use samples as skeleton
  - COBOL Example (from Rich Smrcina):
    - ftp://ftp.software.ibm.com/eserver/zseries/zos/vse/download/xmps/soap_cobol_rsmrcina.zip
- **Use the new CICS2WS tool**
  - Generates proxy code and WSDL files
  - Proxy code is in assembler language
    - No extra charged compiler needed (e.g. COBOL or PL/I)
    - Code is very simple, straight forward
    - Usually no manual changes needed in proxy code

CICS2WS Tool

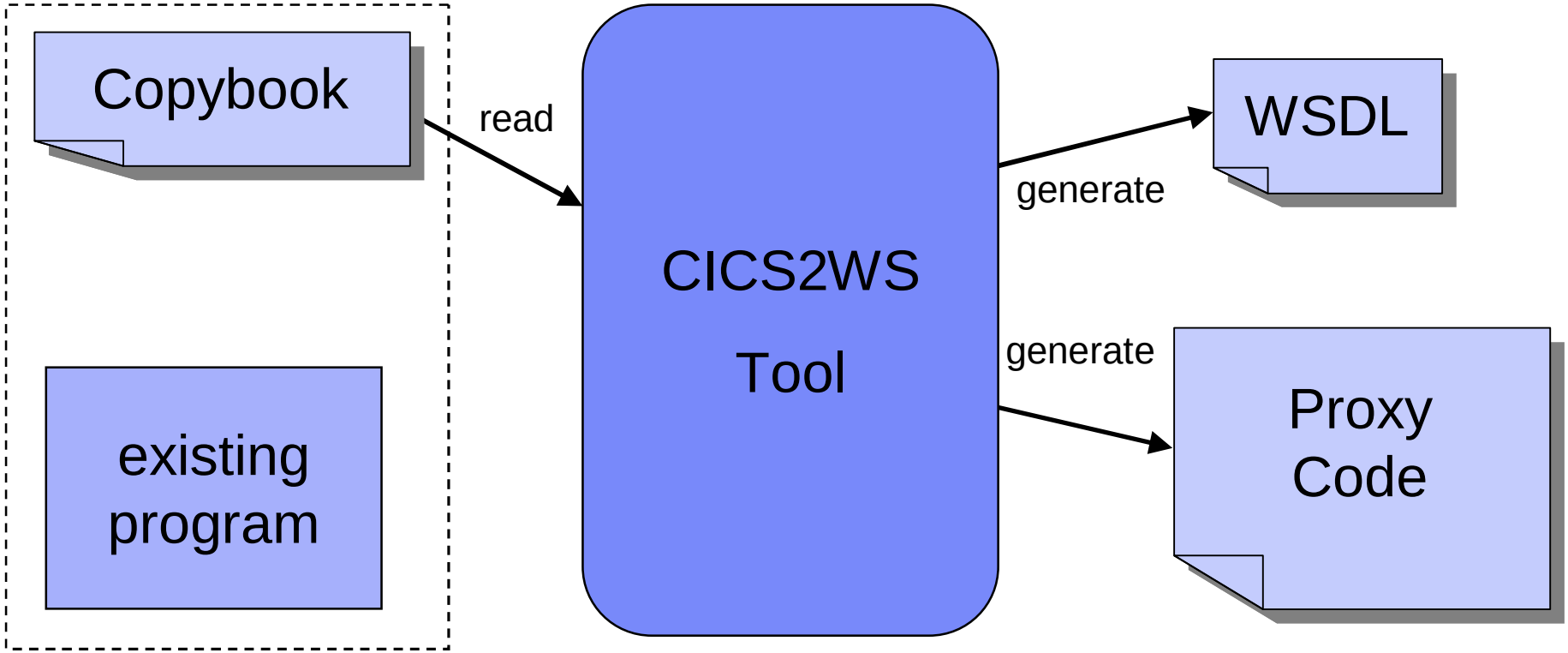
- **The tool runs on your PC or workstation**
- **Implemented in Java**
- **VSE as a SOAP client (service requestor)**
  - Reads the WSDL file
  - Generates the proxy code (Assembler)
  - Generates a COMMAREA mapping (copybook)
    - in COBOL, PL/I or Assembler

- **VSE as a SOAP server (service provider)**
  - Reads a given COMMAREA mapping (copybook)
    - in COBOL, PL/I or Assembler
  - Generates the proxy code (Assembler)
  - Generates the WSDL file

VSE as a SOAP client (service requestor)



VSE as a SOAP server (service provider)

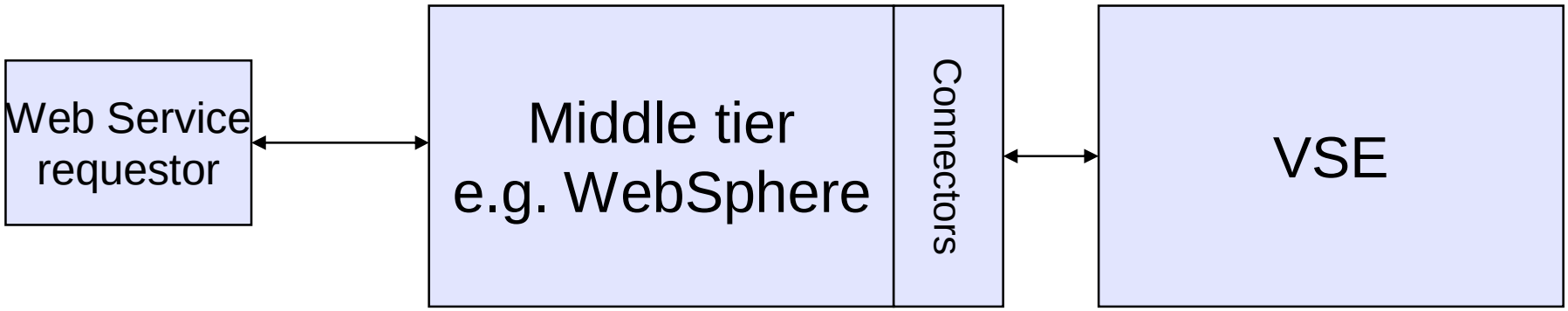


Disadvantages of Web services

- **When should you not use Web Services?**
  - When you have very high performance requirements
    - Communication using SOAP/XML is very time consuming
  - When you transport large amounts of data
    - XML data can get really huge
  - If you require transaction security
    - No 2 phase commit
  - When you want to access the data directly
    - SOAP is program to program communication
- **Similar functions provide**
  - CICS Transaction Gateway
  - MQ Series

Other possibilities to participate into SOA solutions

- **2 Tier Solutions**
  - The Web Service requestor or provider runs on VSE itself
- **3 Tier Solutions**
  - The Web Service is implemented on a middle tier system, but accesses VSE data or programs

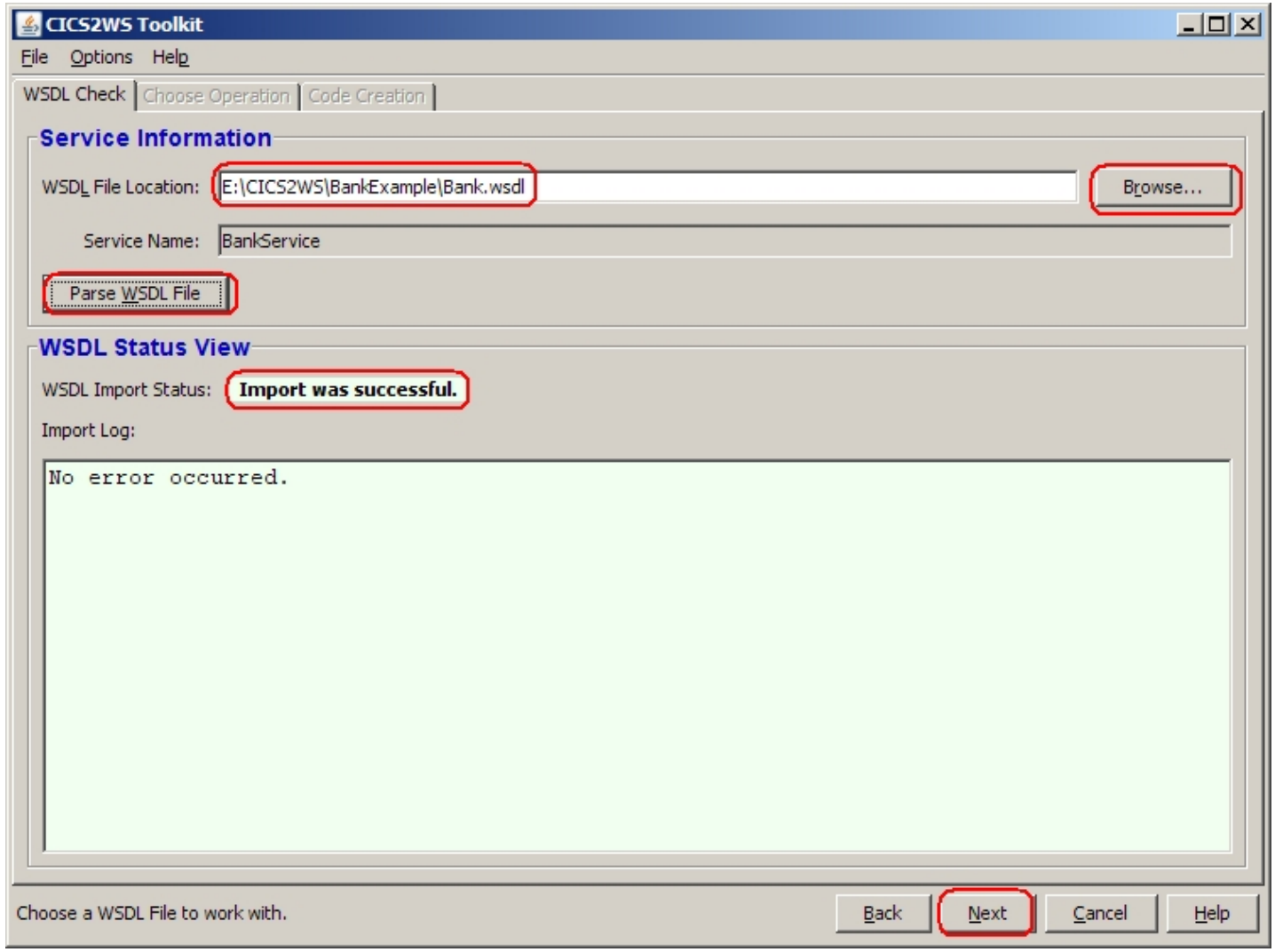


3 tier SOA solutions

- **Access to VSE using connectors**
  - CICS Transaction Gateway (CICS programs)
  - DB2 Connect (DB2 data)
  - VSE Java-based Connectors (VSAM, DL/I, Jobs, …)
  - MQ Series
- **Middle tier**
  - Using modern technology and products
  - E.g.. WebSphere SOA Products (Enterprise Service Bus, WebSphere Process Server)
  - Can also run on Linux on System z

Live Demo – Use a Web Service

Live Demo – Use a Web Service



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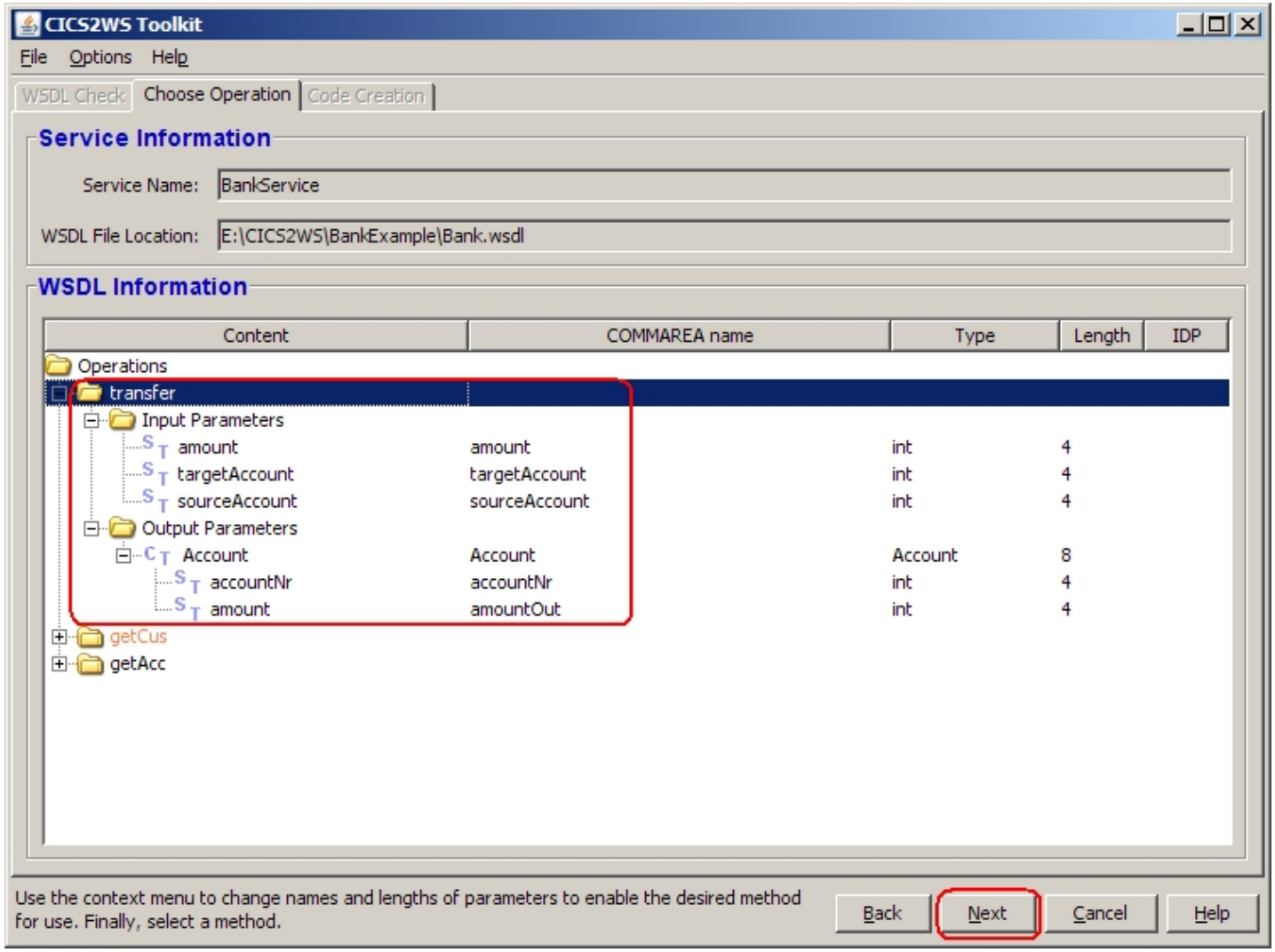

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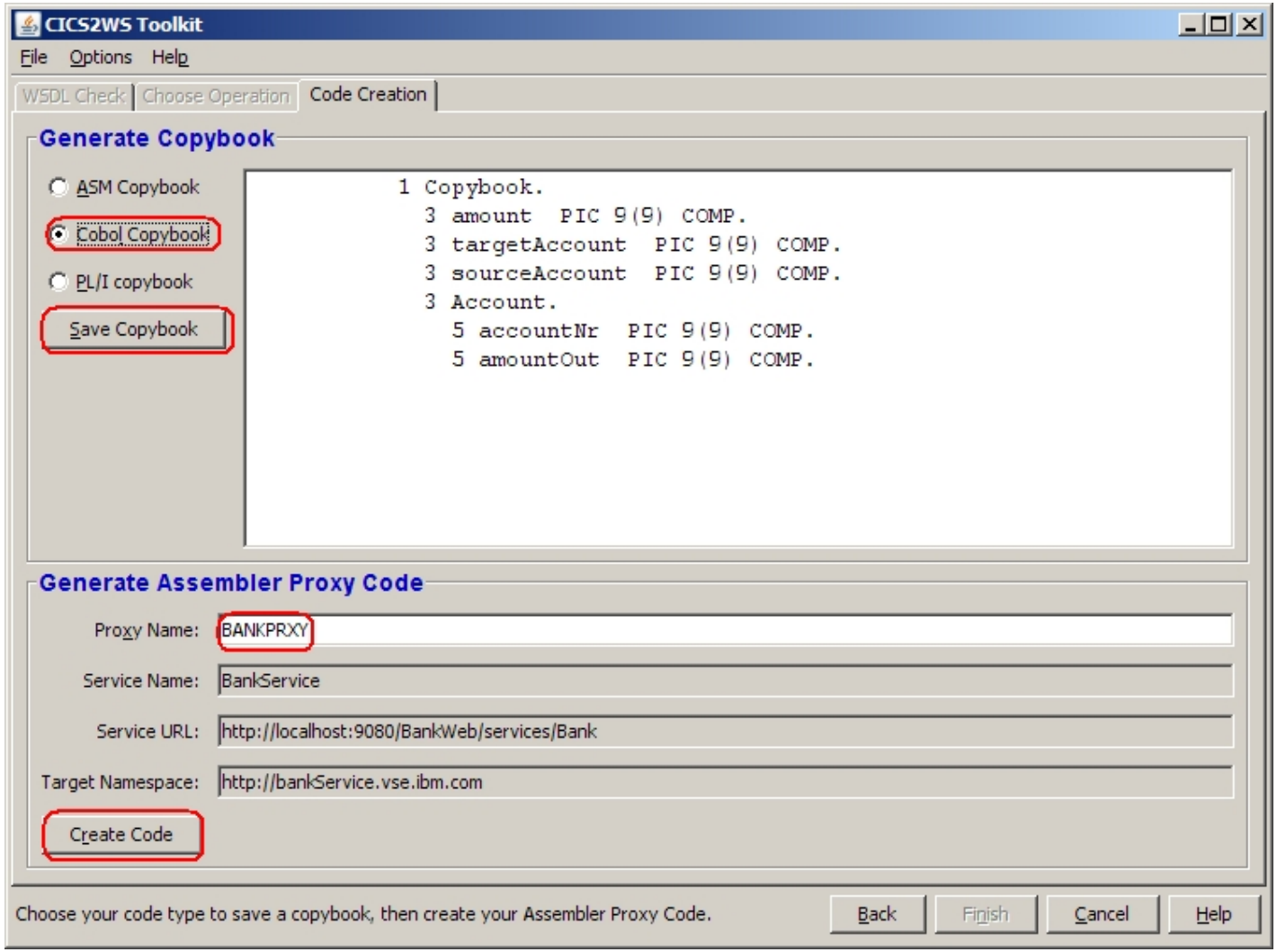


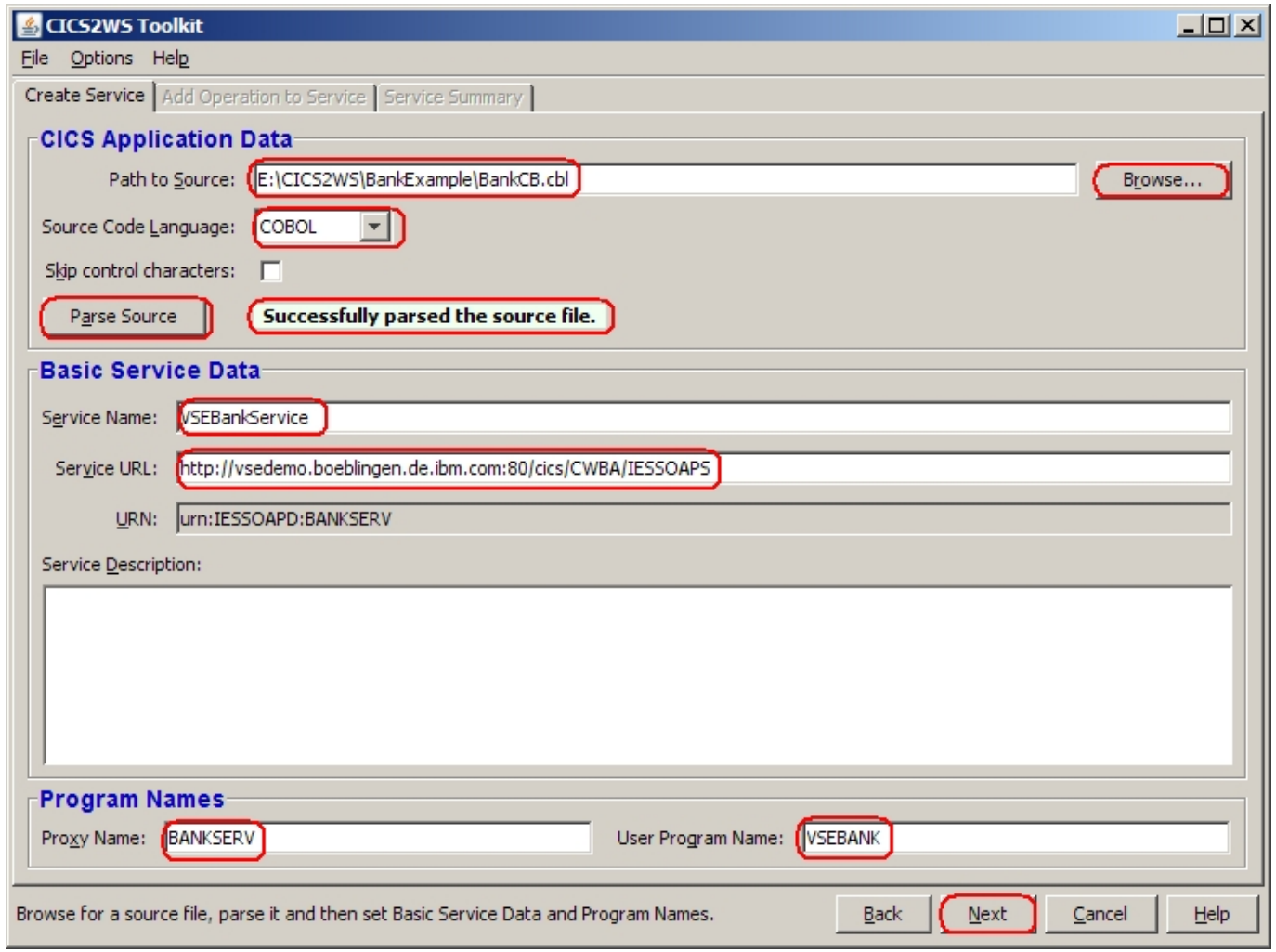
Live Demo – Use a Web Service

```
1 Copybook.
    3 amount  PIC 9(9) COMP.
    3 targetAccount  PIC 9(9) COMP.
    3 sourceAccount  PIC 9(9) COMP.
    3 Account.
      5 accountNr  PIC 9(9) COMP.
      5 amountOut  PIC 9(9) COMP.
```

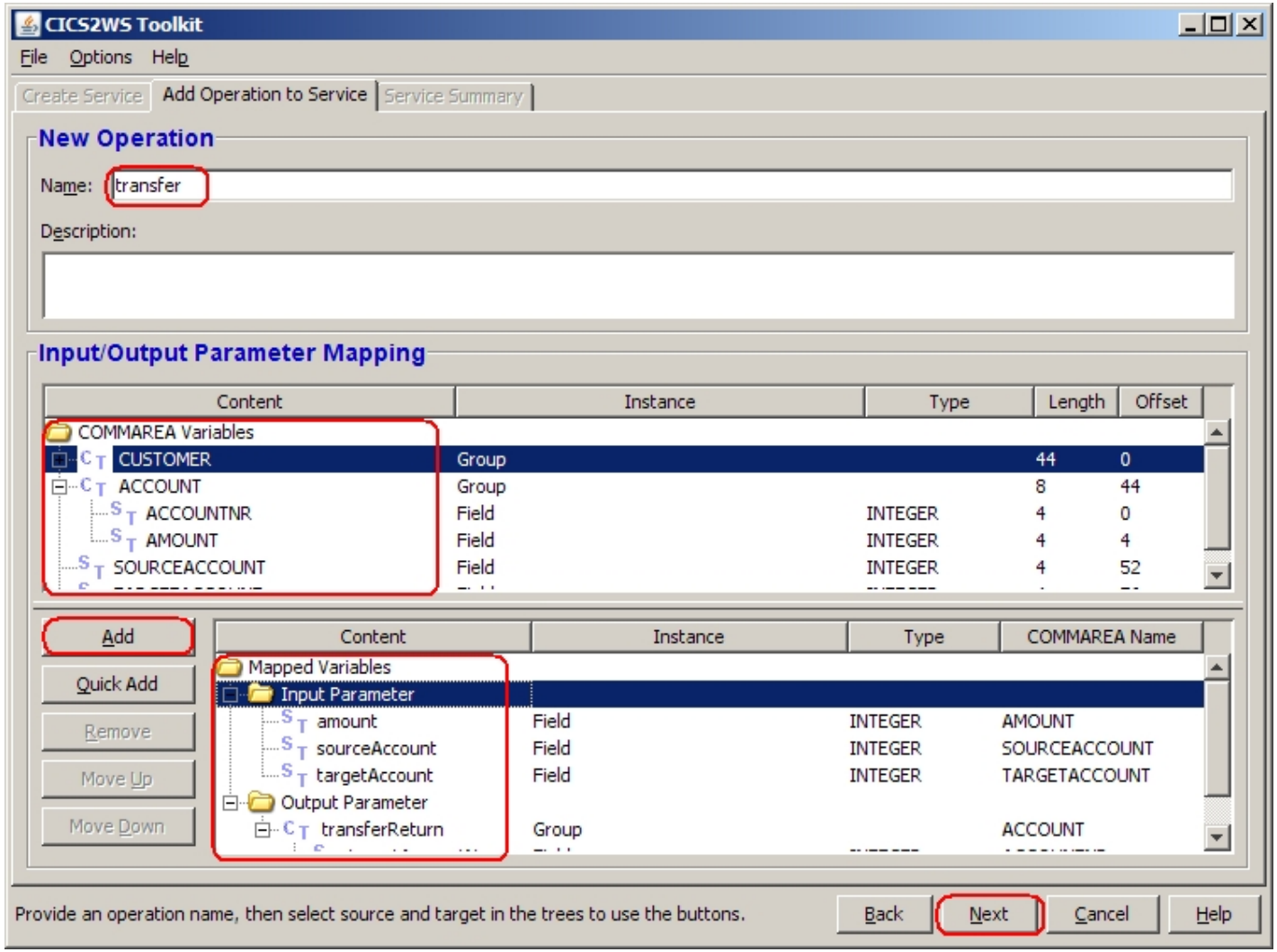
```
*****************************************
 SECTION
*****************************************

OF PARAMETER BLOCK
H OF BLOCK
NSE CODE
NSE CODE 2
) COMMAREA FOR SOAP CALL
UFFER FOR OUTPARAMS
IP19_LEN    DS    F     LENGTH OF PARAM 19
IP19_PTR    DS    A     PTR OF PARAM 19
* ********************************************************************
* END OF DYNAMIC STORAGE SECTION
* ********************************************************************
BANKCLNT AMODE 31
BANKCLNT RMODE ANY
BANKCLNT CSECT
* ********************************************************************
* START OF PROGRAM SECTION
* ********************************************************************
         DFHEIENT CODEREG=(R3),    Base registers for program code     X
               DATAREG=(R13),      Base register for data              X
               EIBREG=(R11)        Base register for CICS EIB
*
         USING BANKCLNT+4096,R4
         LA    R4,4095(R3)
...
```

Live Demo – Create a Web Service

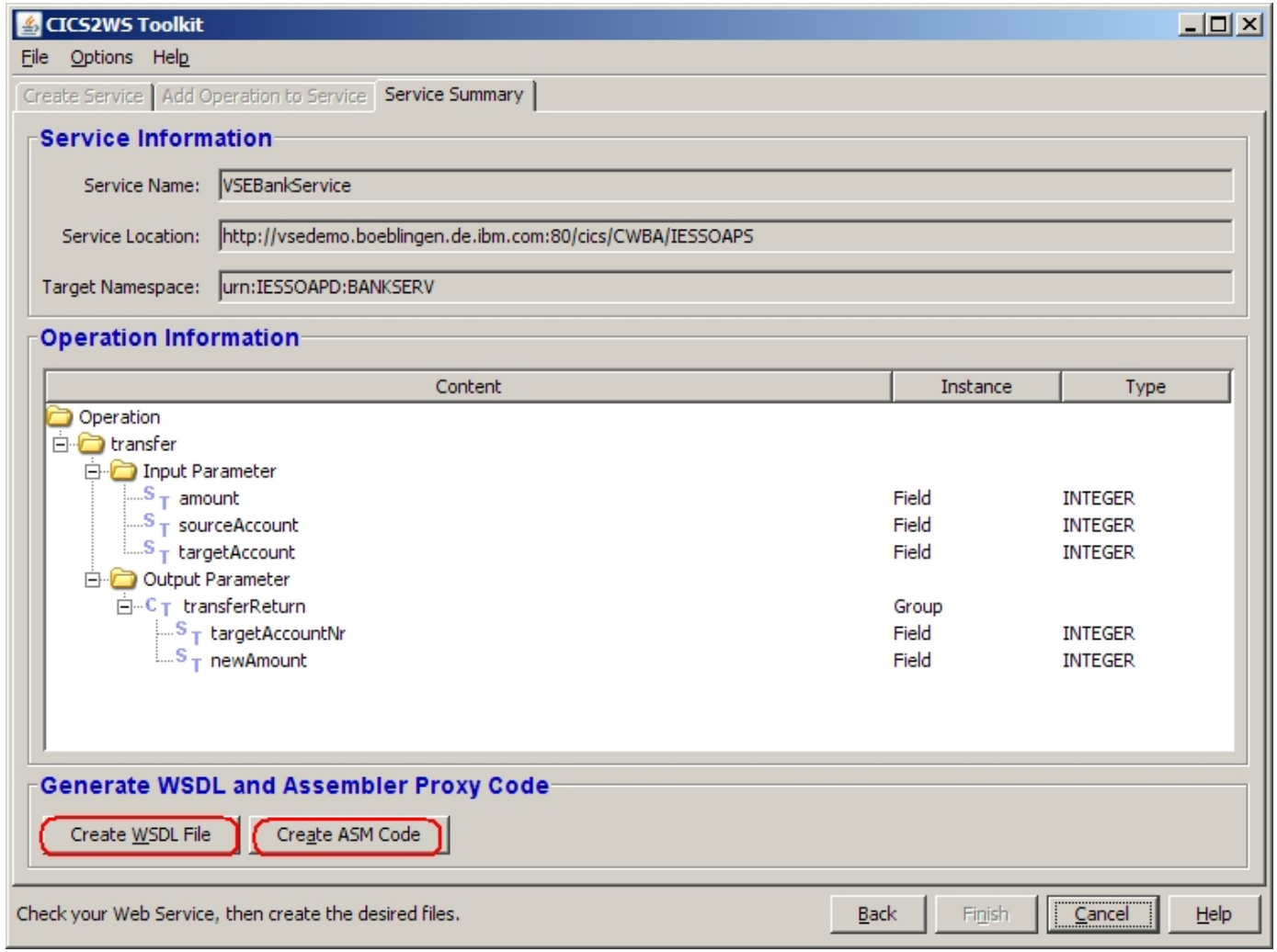
Live Demo – Create a Web Service



Live Demo – Create a Web Service



Live Demo – Create a Web Service



Live Demo – Create a Web Service

```
<?xml version="1.0" encoding="UTF-8" ?>
- <wsdl:definitions targetNamespace="urn:IESSOAPD:BANKSERV" xmlns:impl="urn:IESSOAPD:BANKSERV"
    xmlns:intf="urn:IESSOAPD:BANKSERV" xmlns:soapenc="http://schemas.xmlsoap.org/soap/encoding/"
    xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/" xmlns:wsdlsoap="http://schemas.xmlsoap.org/wsdl/soap/"
    xmlns:xsd="http://www.w3.org/2001/XMLSchema">
  - <wsdl:types>
    - <schema elementFormDefault="qualified" targetNamespace="urn:IESSOAPD:BANKSERV"
        xmlns:impl="urn:IESSOAPD:BANKSERV" xmlns:intf="urn:IESSOAPD:BANKSERV"
        xmlns="http://www.w3.org/2001/XMLSchema" xmlns:soapenc="http://schemas.xmlsoap.org/soap/encoding/"
        xmlns:xsd="http://www.w3.org/2001/XMLSchema" xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/">
        <import namespace="http://schemas.xmlsoap.org/soap/encoding/" />
        <element name="AMOUNT" type="xsd:int" />
        <element name="SOURCEACCOUNT" type="xsd:int" />
        <element name="TARGETACCOUNT" type="xsd:int" />
        <element name="TRANSFER-RETURN" type="impl:TRANSFER-RETURN" />
      - <complexType name="TRANSFER-RETURN">
        - <sequence>
            <element name="ACCOUNTNR" type="xsd:int" />
            <element name="AMOUNT" type="xsd:int" />
          </sequence>
        </complexType>
```

```
*****************************************************
AGE SECTION
*****************************************************

OR OF PARAMETER BLOCK
NGTH OF BLOCK
SPONSE CODE
SPONSE CODE 2
FFER FOR OUTPARAMS


TART OF USER PROGRAM COMMAREA
*BankCB.cbl     DSECT
CCUSTOMERNR     DS  A
CFIRSTNAME      DS  CL20
CLASTNAME       DS  CL20
CACCOUNTNR      DS  A
CAMOUNT         DS  A
CSOURCEACCOUNT  DS  A
CTARGETACCOUNT  DS  A
*               END OF DSECT
CARLEN    EQU   *-COMMAREA LENGTH OF COMMAREA
* ********************************************************************
* END OF DYNAMIC STORAGE SECTION
* ********************************************************************
BANKSERV AMODE 31
BANKSERV RMODE ANY
BANKSERV CSECT
...
```

Documentation

- **How to use Web Services with z/VSE**
  - http://www.ibm.com/servers/eserver/zseries/zvse/documentation/ebusiness.html#soap
- **Web Services in z/VSE (from Rich Smrcina)**
  - http://www.zjournal.com/index.cfm?section=article&aid=281
  - http://www.zjournal.com/index.cfm?section=article&aid=320
  - Includes COBOL sample code
- **Web Services**
  - http://www.ibm.com/servers/eserver/zseries/zvse/documentation/ebusiness.html#soap
- **What is SOA?**
  - http://www.ibm.com/developerworks/webservices/newto/
  - http://webservices.xml.com/pub/a/ws/2003/09/30/soa.html
- ***z/VSE e-business Connectors, User's Guide (SC33-8231)***

Questions ?