IBM Software Group

CICS Web Services Support

GSE/CICS working group
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ibm.com/software/ts/cics

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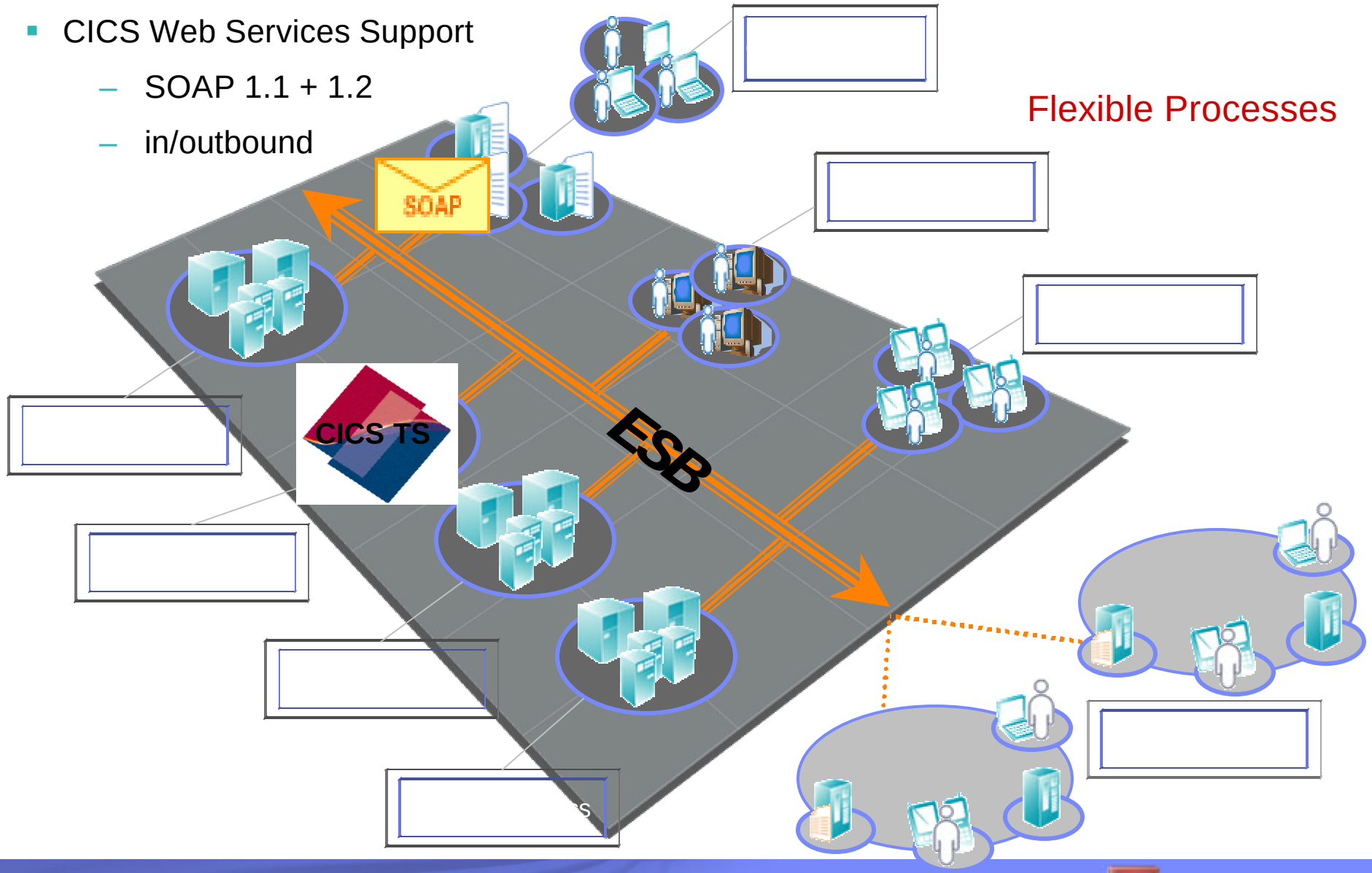
Agenda

- **Short introduction to SOA (Service Oriented Architecture)**
- **Overview of CICS WebServices Support**
- **Development approaches for CICS WebServices**
- **The sample application**
- **WS Security introduction**
- **WS Atomic Transaction (WS-AT) introduction**
- **Some hints**
- **Summary**

CICS in an On-Demand IT solution

- CICS Web Services Support
  - SOAP 1.1 + 1.2
  - in/outbound



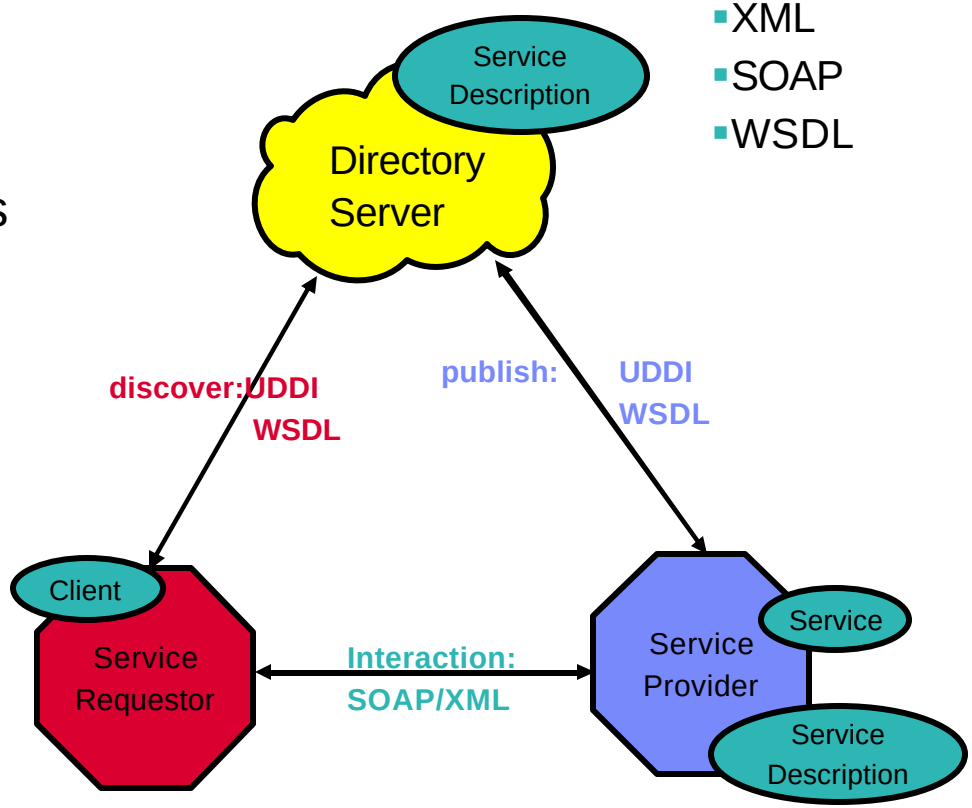
Web Services Architecture

- flexible business processes require flexible applications
  - ✓ Business orientation, not technically oriented
  - ✓ ´adhoc´ re-configurable components
  - ✓ de-coupled & platform neutral communication
- Requires application modernisation
  - ✓ cost savings by integration / reuse
- SOA is a foundation for flexible applications to support an **ON Demand Business**

prerequisite: ***Standards !***

Basic Technology

- HTTP
- MQ
- XML
- SOAP
- WSDL



UDDI - Universal Description, Discovery and Integration
WSDL-web services description language

WSDL – Web Service Description Language

Standardized XML constructs to describe a Web Service

WSDL Structure

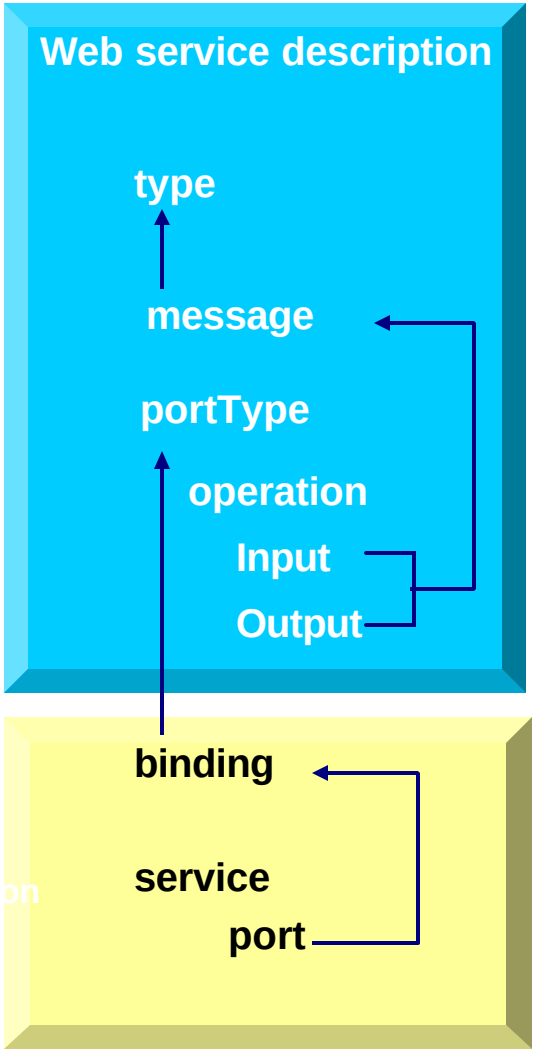
Type –data type definitions

Message –input/ output message definition

portType –supported operations

Binding –binds operations to network protocol(s)

Service –service name and location endpoint



New Components for CICS WebServices

Resource definitions

- Transport definition: -**TCPIPSERVICE** (in CICS, HTTP/HTTPS)
  -**QLOCAL** (in WebSphere MQ)
- **URIMAP**
  - maps URI to corresponding service
  - points to pipeline and webservice resource definitions
- **PIPELINE**
  - points to pipeline configuration file (XML file)
  - defines the QoS for a webservice (security, atomic trx....)
- **WEBSERVICE**
  - points to bind file and WSDL file, defines service programm
  - bind file is used for data mapping between XML doc and language structure

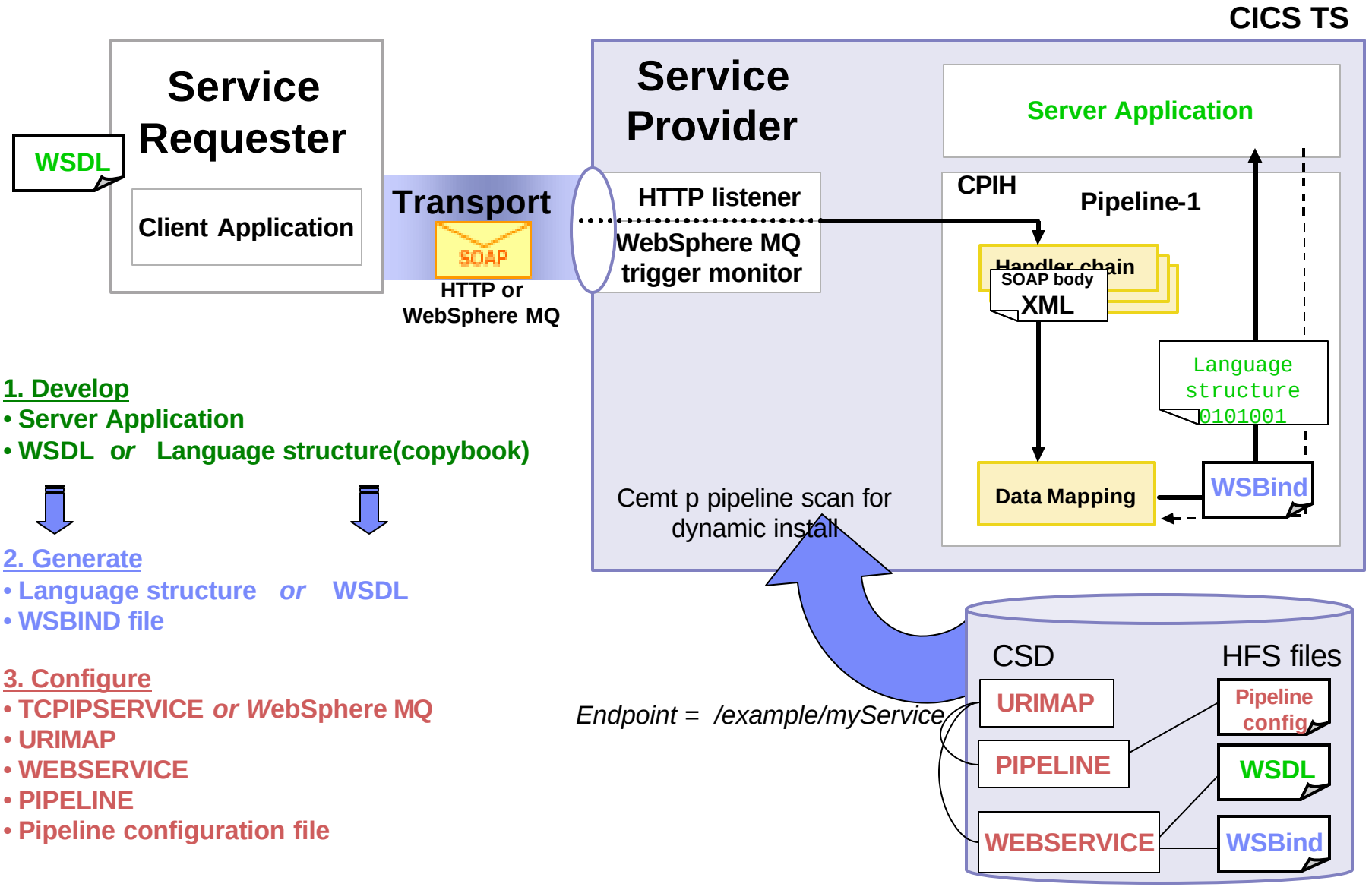
Message handlers

- implement requested SOAP protocol and QoS
  - can include private handlers
  - defined in the pipeline configuration file

Web services assistant (utility):

- generates language copybooks from a given WSDL (DFHWS2LS)
- generates WSDL from a language copybook (DFHLS2WS)
- generates the web service binding file (WSBIND)

CICS as web service provider



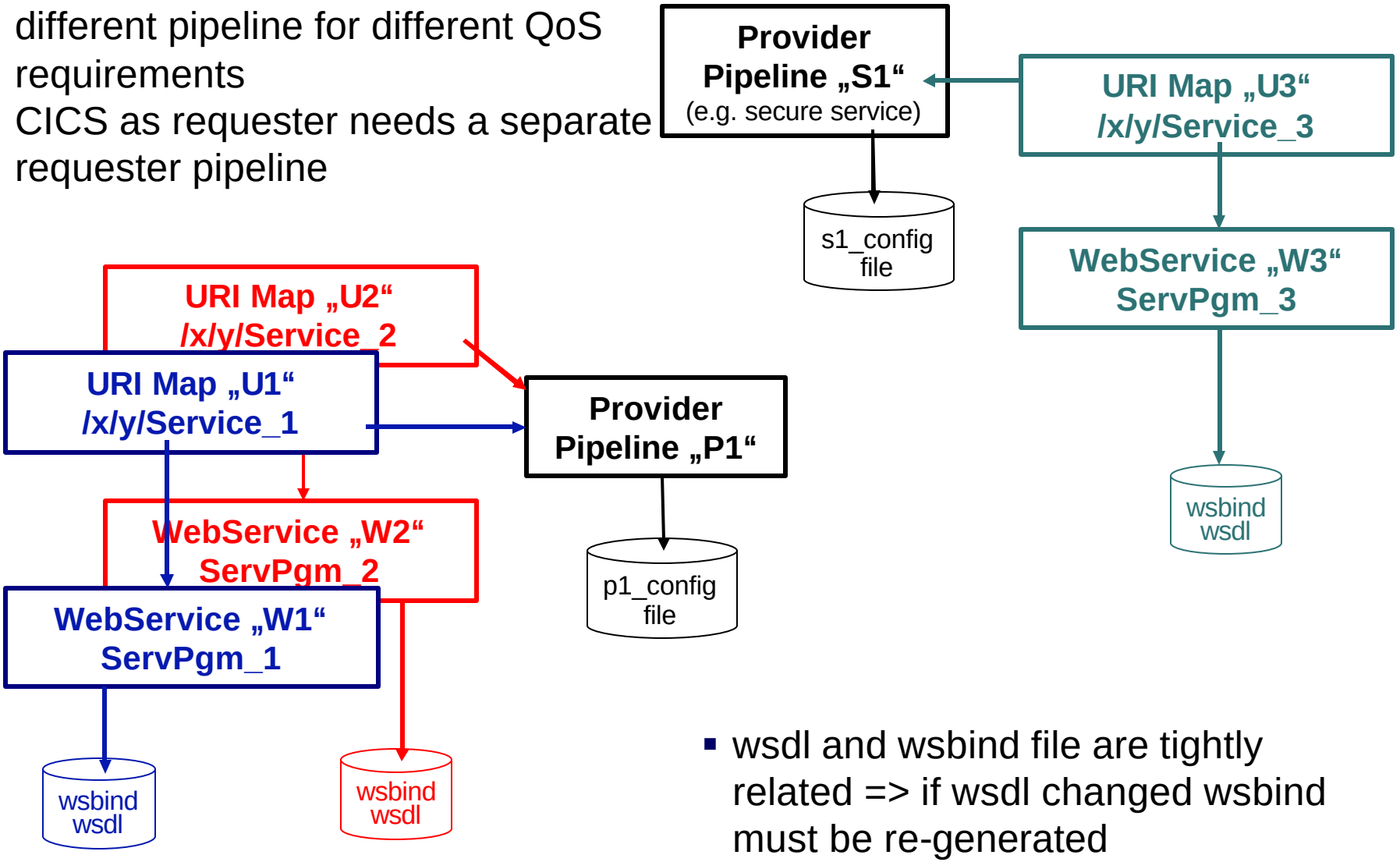
1. Develop
- **Server Application**
- **WSDL *or* Language structure(copybook)**

2. Generate
- **Language structure *or* WSDL**
- **WSBIND file**

3. Configure
- **TCPIPSERVICE *or* WebSphere MQ**
- **URIMAP**
- **WEBSERVICE**
- **PIPELINE**
- **Pipeline configuration file**

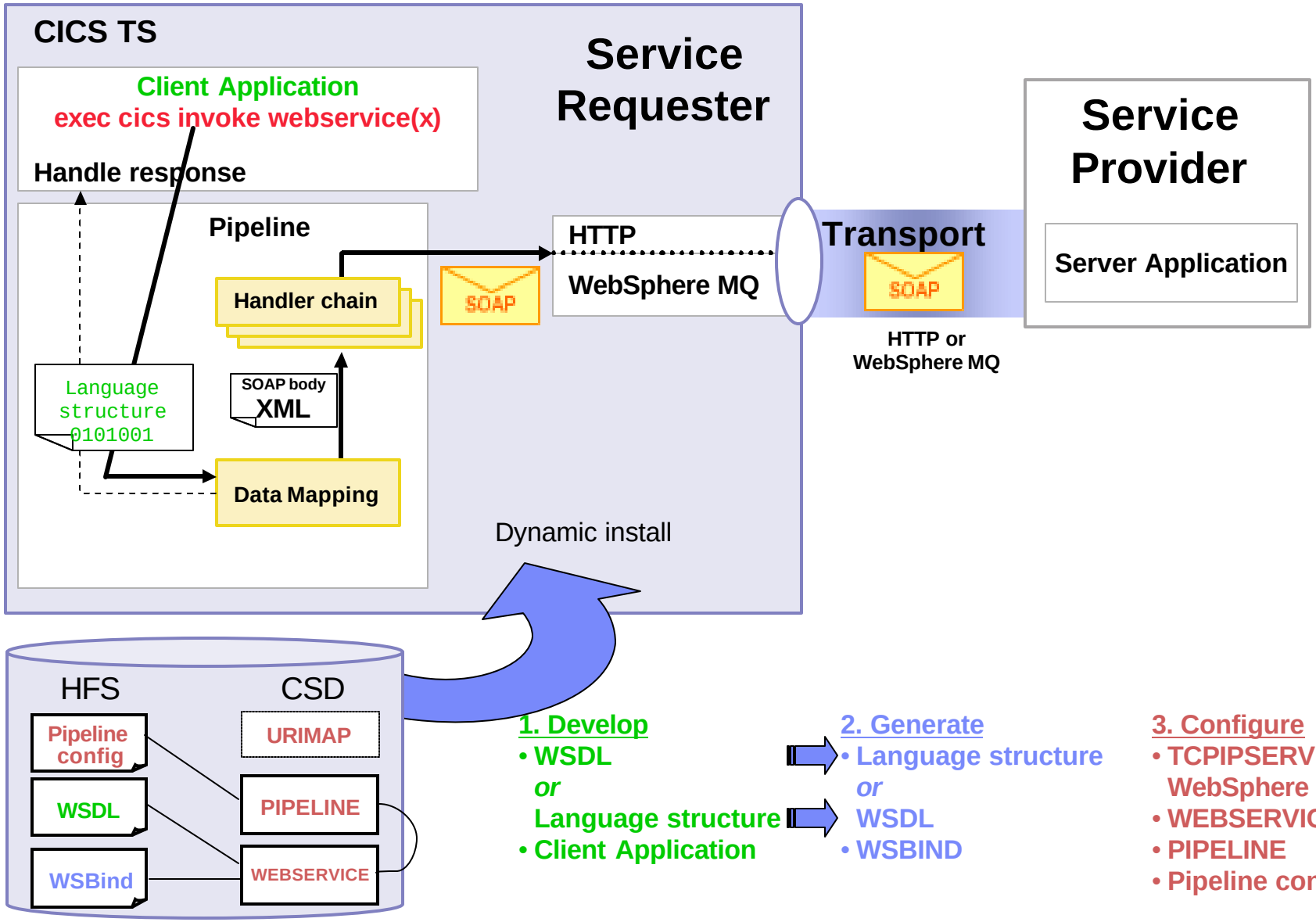
How the Resource Definitions Relate

- different pipeline for different QoS requirements
- CICS as requester needs a separate requester pipeline



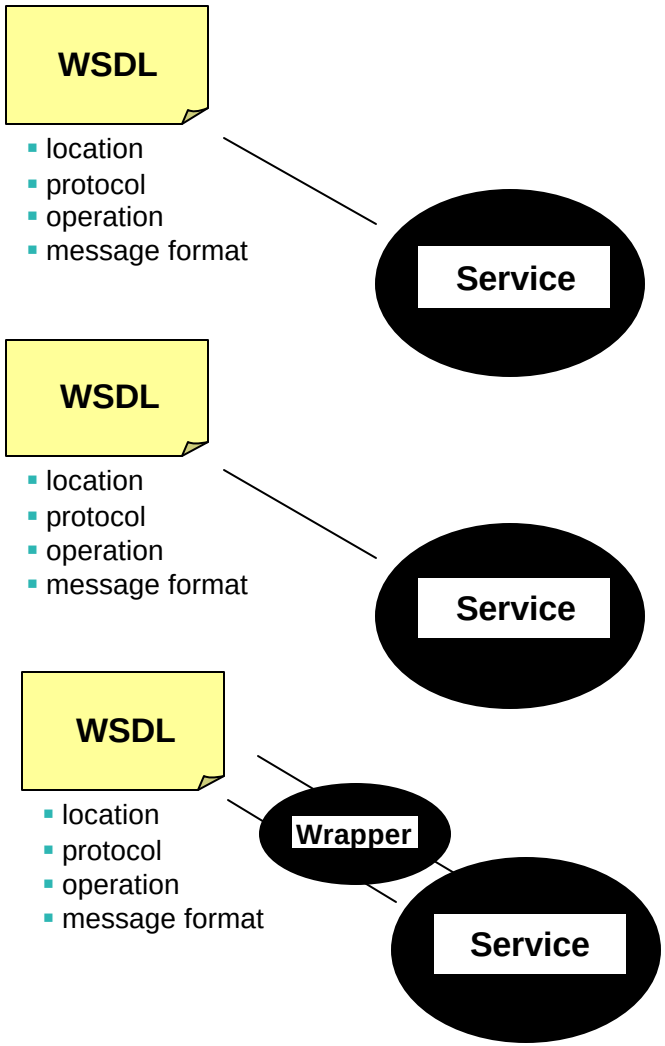
- wsdl and wsbind file are tightly related => if wsdl changed wsbind must be re-generated

CICS as web service requester



Web Service Development Approaches

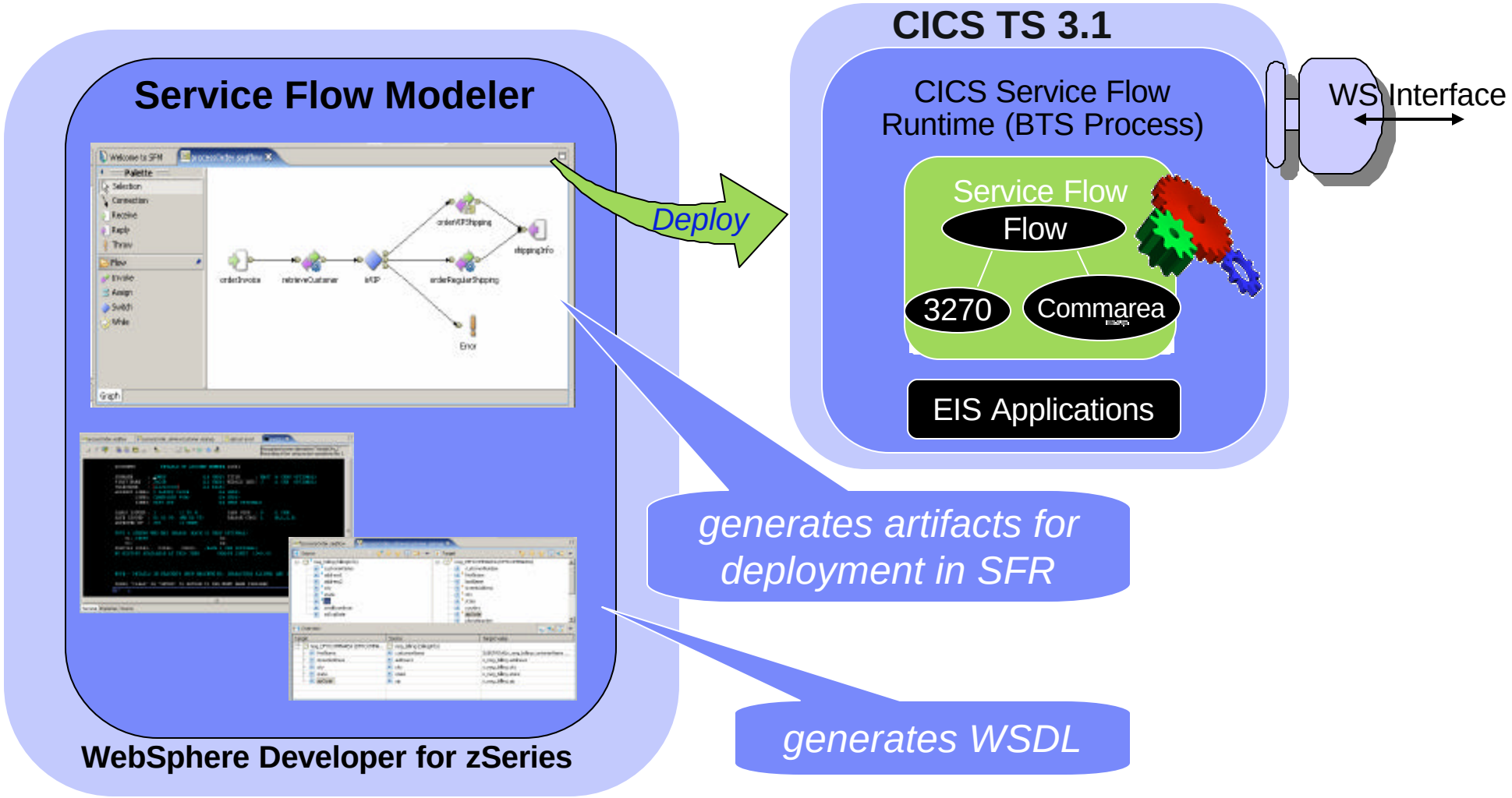
- **"Top down" approach**
  - create a (new) service program from an existing WSDL (create new CICS Web service application)
    - +better interfaces for the requester
    - -development cost
- **"Bottom up" approach**
  - create a WSDL from an existing application
  - expose the application as a Web service
    - +quicker implementation of the service
    - -more complex interface for the requester
- **"Meet in the middle" approach**
  - –You have existing WSDL and existing application
  - –create a WSDL from an existing application
  - –modify the WSDL and create a wrapper program from the modified WSDL
  - –indirectly exposes the application as a Web service
    - +more suitable interface for the requester
    - -development cost, but tools can help



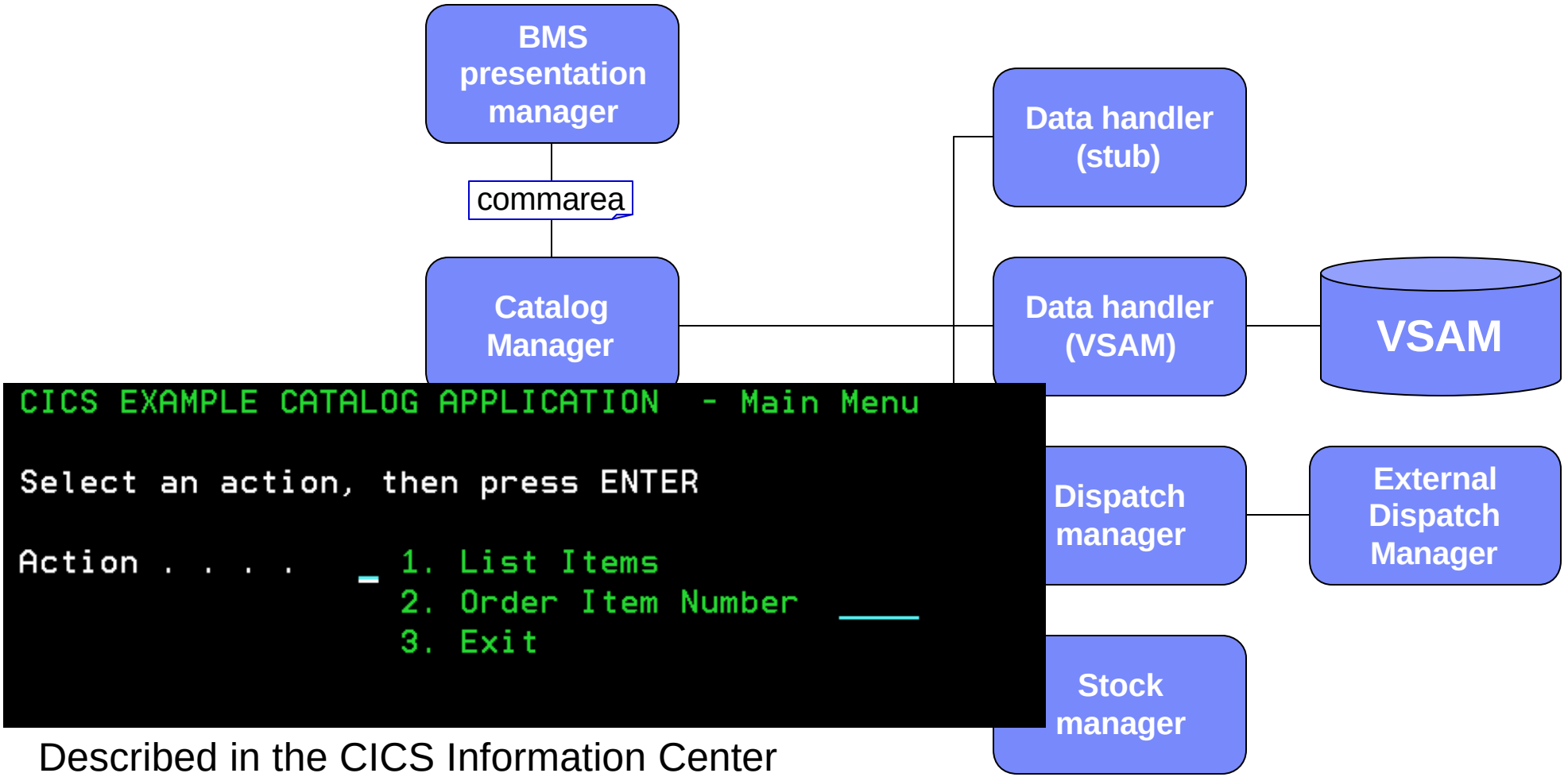
Tools to assist development

- **Web Service Assistant (WSA) Batch Tool** (DFHLS2WS + WS2LS)
  - generates WSDL or language structure and WSBIND
    - supports Cobol, PLI, C, C++
  - good for proof of technology
  - redefines not supported
  - generated WSDL may need modifications (e.g. nillable data elements)
- **Websphere Developer for zSeries (WDz)**
  - XML Services for the Enterprise (XSE)
    - generates WSDL and WSBIND files
    - provides better granularity, userfriendly element names etc…
  - can generate sceleton pgm for “meet in the middle” approach
  - can generate a test client for immediate tests
  - best suited for real projects
  - Service Flow Modeler (SFM)
    - provides flow modeling and mapping
      - flow can include all types of CICS backends (DPL-Pgm, 3270 Trx…)
      - backends “packaged” as one web service
    - generates all artifacts for deployment in SF runtime (CICS or HATS)

Service Flow Modeler and WS Deployment to SFR



The Sample Application

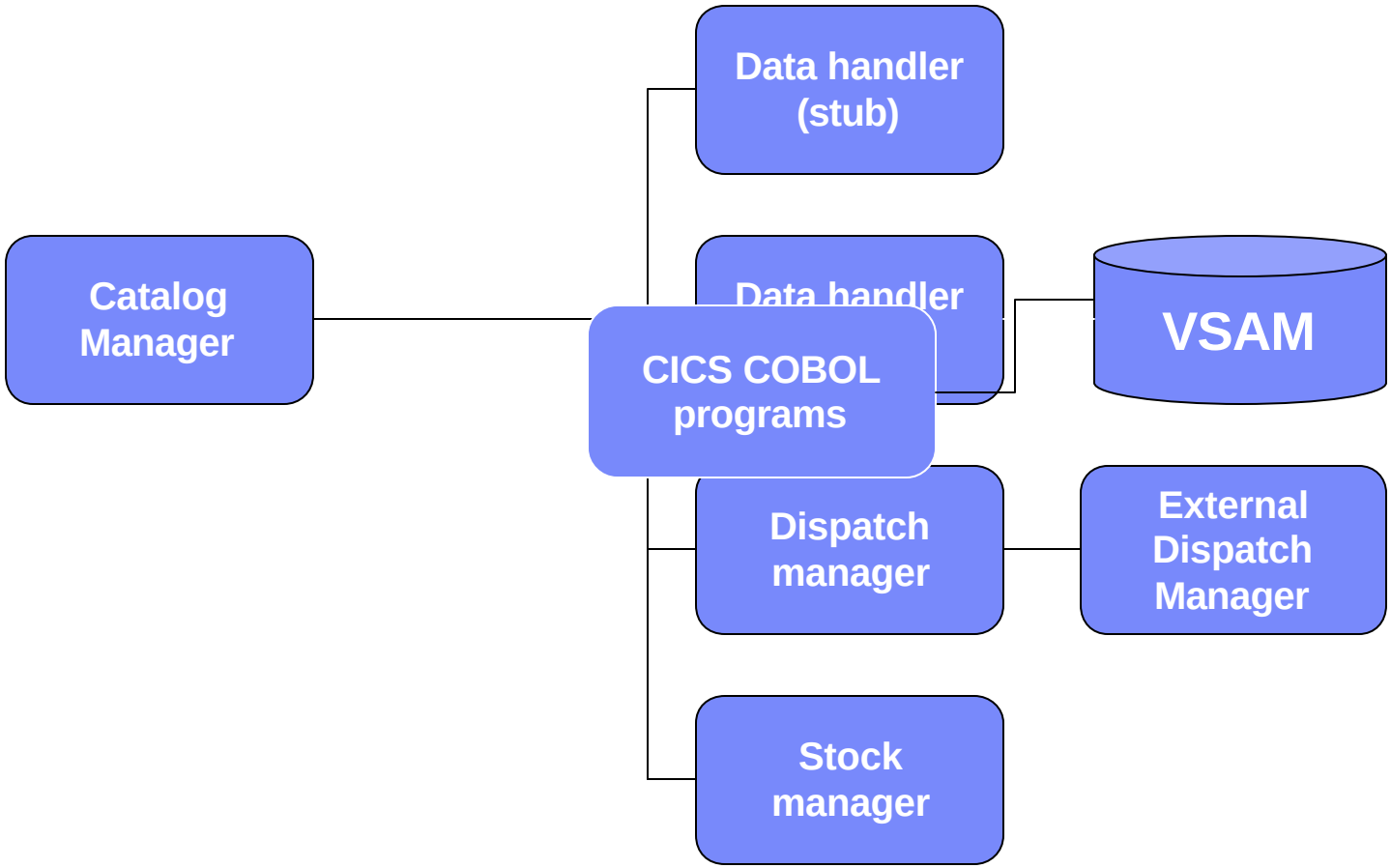


Described in the CICS Information Center

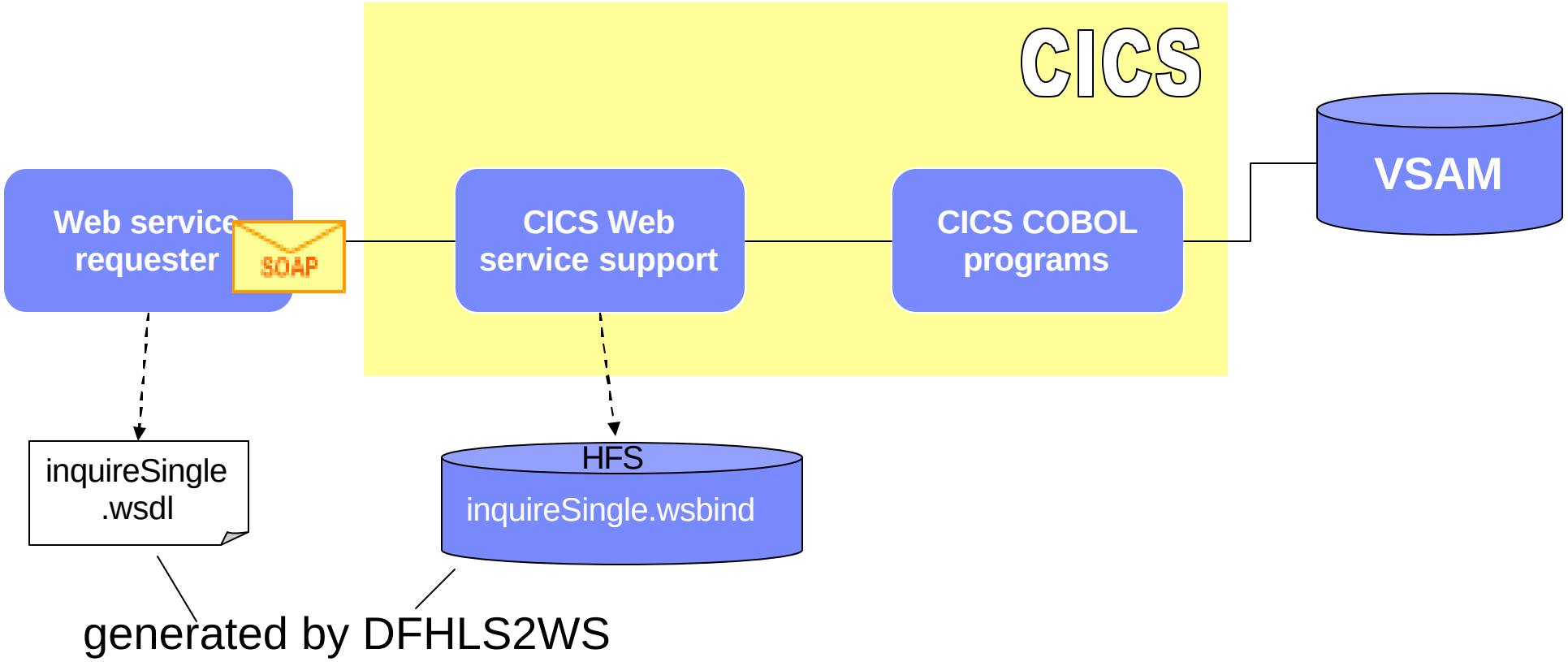
http://publib.boulder.ibm.com/infocenter/cicsts/v3r1/index.jsp

CICS functions → Web Services → The CICS catalog manager example applicaiton

The Base Application



CICS Comarea Pgm exposed as Web service



Generate Web Service Components with WSA

DFHLS2WS Batch Utility

```
//INPUT.SYSUT1 DD *
LOGFILE=/u/exampleapp/wsbind/inquireSingle.log
PDSLIB=CICSHLQ.SDFHSAMP
REQMEM=DFH0XCP4
RESPMEM=DFH0XCP4
LANG=COBOL
PGMNAME=DFH0XCMN
PGMINT=COMMAREA
URI=exampleApp/inquireSingle
WSBIND=/u/exampleapp/wsbind/inquireSingle.wsbind
WSDL=/u/exampleapp/wsdl/inquireSingle.wsdl
*/
```

Input:

-Log file (HFS)
-Library containing copybooks
-(CA) copybook for request from client
-(CA) copybook for reponse to client
-language
-CICS Server Pgm name
-Interface type (commarea or container)
-universal request identifier
-location and name of WSBIND file (HFS)
-location and name of WSDL file (HFS)

Generated WSBIND and WSDL files

inquireSingle.wsbind

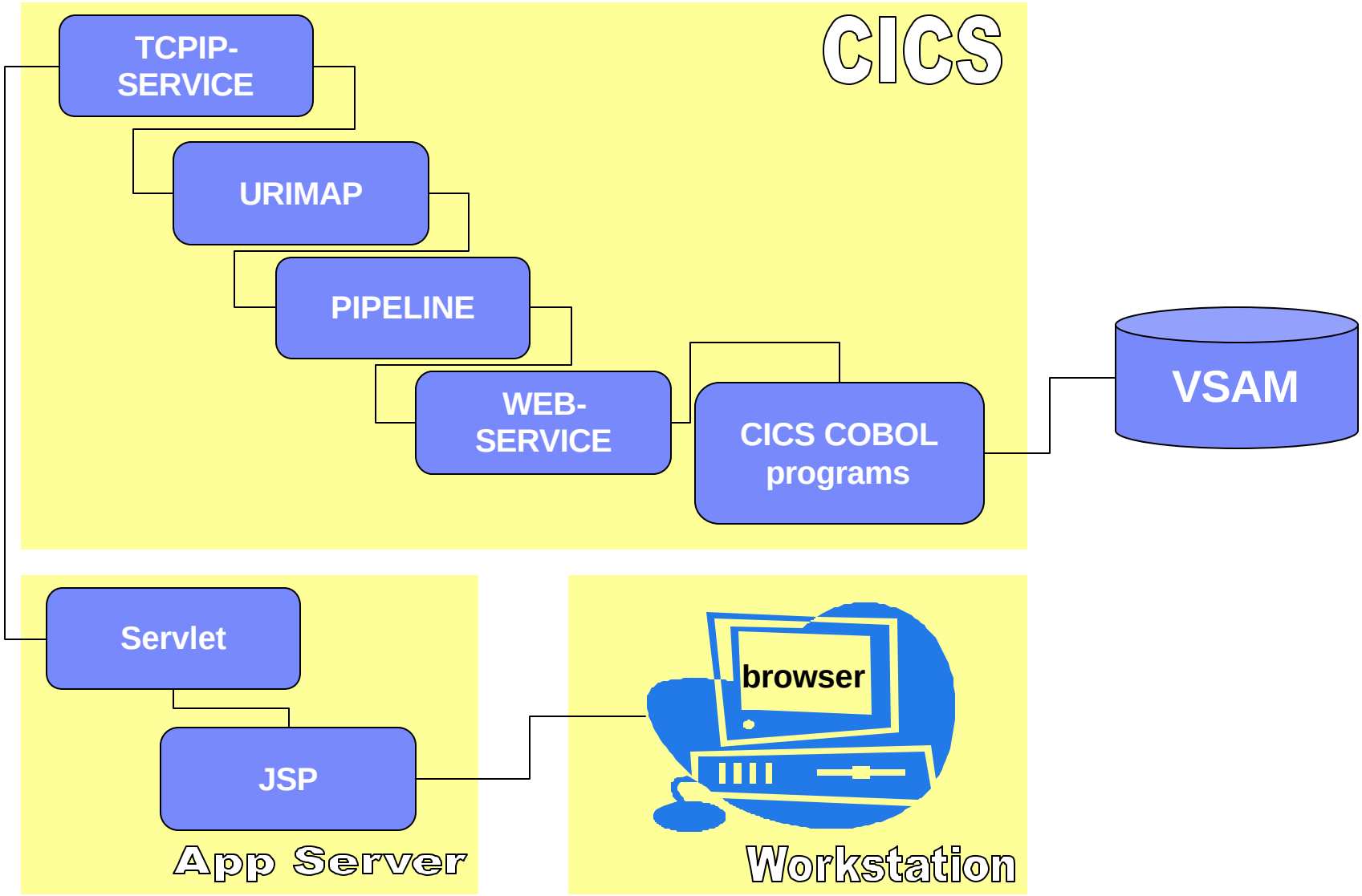
```
/u/exampleapp/wsbind/inquireSingle.wsbind
WSDL=/u/exampleapp/wsdl/inquireSingle.wsdl DFH0XCMN
.......
<Wrapper>
    <CA-REQUEST-ID>&CA-REQUEST-ID;</CA-RI
    <CA-RETURN-CODE>&CA-RETURN-CODE;</
    <CA-RESPONSE-MESSAGE>&CA-RESPONSE
    &CA-INQUIRE-SINGLE;
</Wrapper>
<DFH0XCMN xmlns="http://www.DFH0XCMN.DFH
    &Wrapper;
</DFH0XCMN>
<SOAP-ENV:Body>&DFH0XCMN;</SOAP-ENV:Bo


......
```

DFHLS2WS Batch Utility

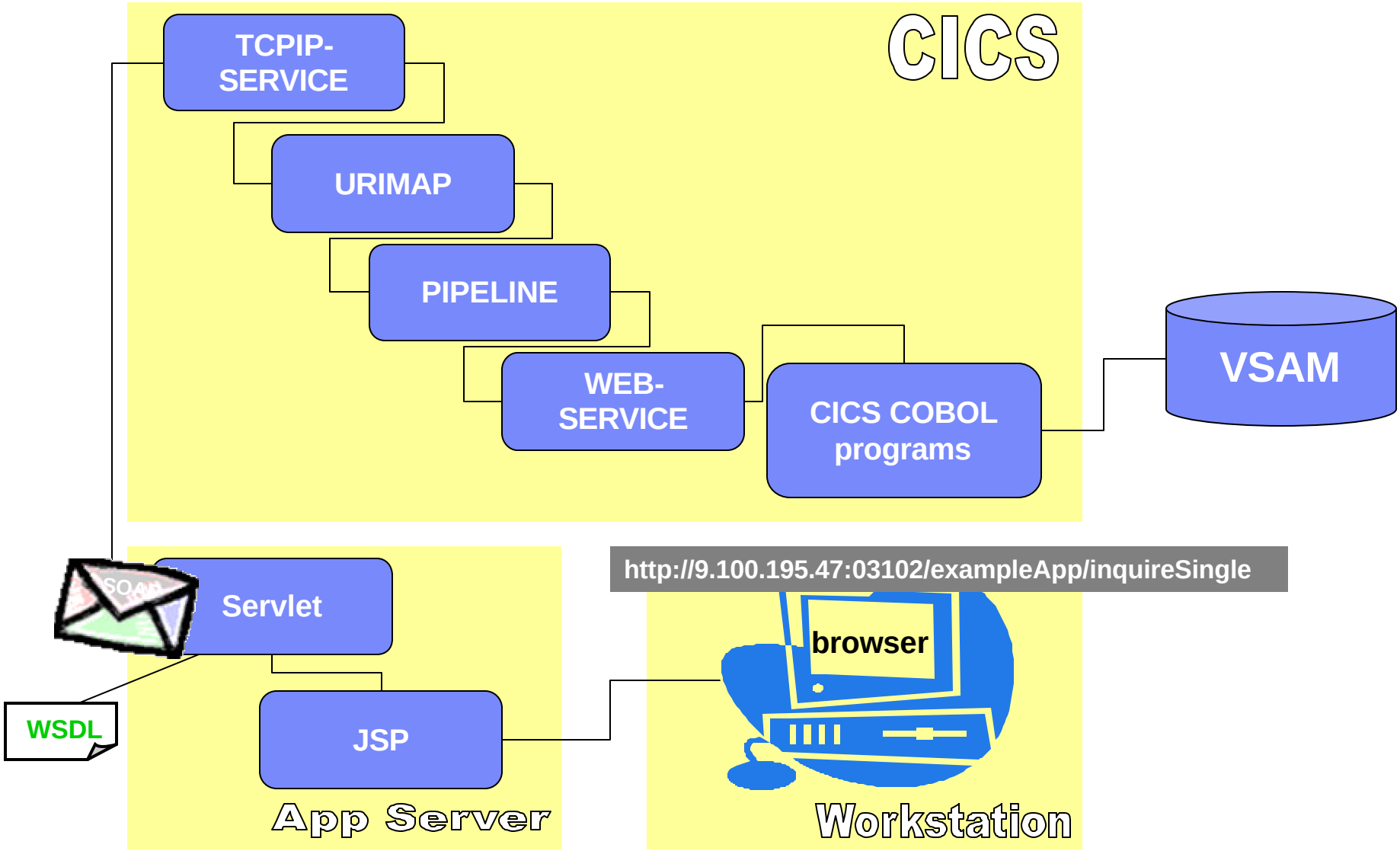
inquireSingle.wsdl

```
<?xml version="1.0" ?>
...
<xsd:schema attributeFormDefault="qualified"
elementFormDefault="qualified"
        targetNamespace="http://www.DFH0XCMN.DFH0XCP4.Request.com"
        xmlns:tns="http://www.DFH0XCMN.DFH0XCP4.Request.com"
        xmlns:xsd="http://www.w3.org/2001/XMLSchema">
        <xsd:complexType name="ProgramInterface">
          <xsd:sequence>
            <xsd:element name="CA-REQUEST-ID" nillable="false">
              <xsd:simpleType>
                <xsd:restriction base="xsd:string">
                  <xsd:length value="6"/>
                  <xsd:whiteSpace value="preserve"/>
                </xsd:restriction>
              </xsd:simpleType>
            </xsd:element>
              ....more ....
```

Testing the WebService enabled Application



Testing the WebService enabled Application

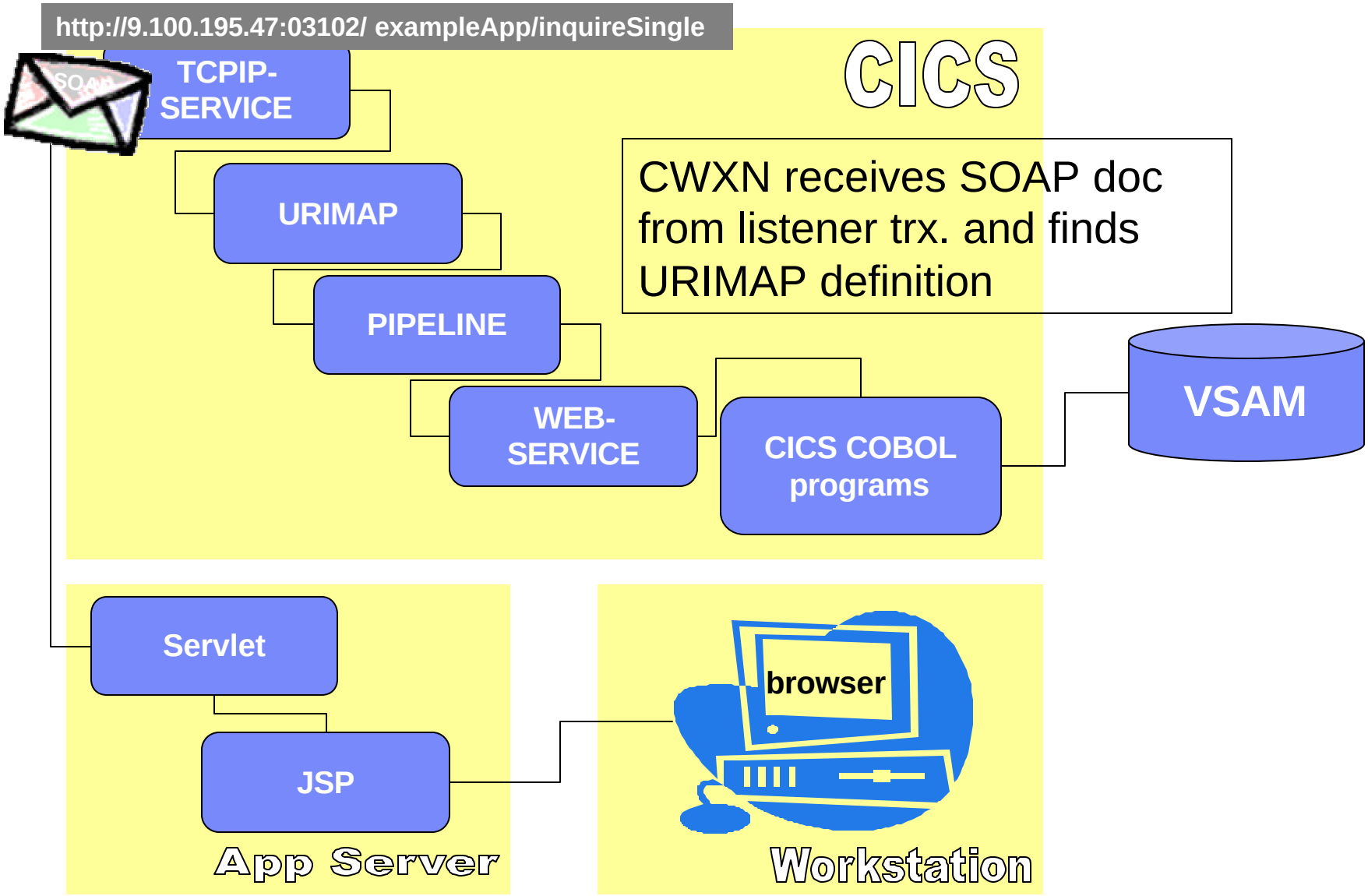


TCPIPSERVICE Definition

- **for HTTP transport**
- **listens on port (03102) for incoming Web Service requests**
- **default web alias transaction is CWXN**

```
I TCPIPSERVICE (SOAPTCP)
RESULT - OVERTYPE TO MODIFY
  Tcpipservice(SOAPTCP)
  Openstatus( Open )
  Port(03102)
  Protocol(Http)
  Ssltype(Nossl)
  Transid(CWXN)
  Authenticate(Noauthentic)
  Connections(00000)
  Backlog( 00005 )
  Maxdatalen( 000032 )
  Urm( NONE     )
  Privacy(Notsupported)
  Ciphers()
  Ipaddress(9.100.195.47)
  Socketclose(Wait)
  Closetimeout(000000)
  Dnsgroup()
  Dnsstatus(                )
```

URIMAP maps Request to the WebService in CICS

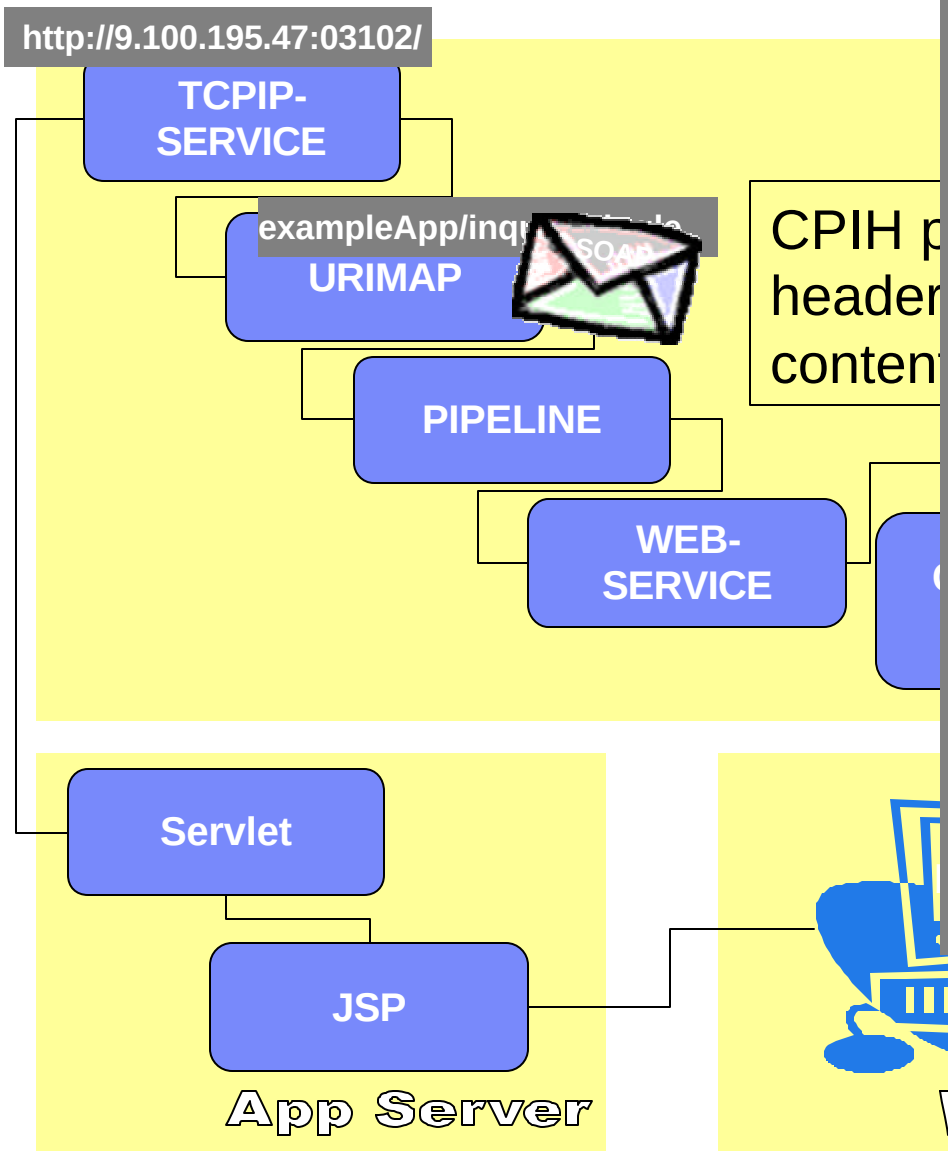


URIMAP

- **maps URI (/exampleAPP/inquireSingle) to desired processing Pipeline (SOAPIPE1) and Webservice (inquireSingle) resource definitions**
- **default pipeline trx is CPIH**
  - now invoked to process pipeline
- **URIMAP can be generated automatically and installed via pipeline scan comnd**

```
I URIMAP
RESULT - OVERTYPE TO MODIFY
   Urimap($923470)
   Usage(Pipe)
   Enablestatus( Enabled )
   Analyzerstat(Noanalyzer)
   Scheme(Http)
   Redirecttype( None )
   Tcpipservice()
   Host(*)
   Path(/exampleApp/inquireSingle)
   Transaction(CPIH)
   Converter()
   Program()
   Pipeline(SOAPIPE1)
   Webservice(inquireSingle)
   Userid()
   Certificate()
   Ciphers()
+  Templatename()
```

CPIH processes pipeline



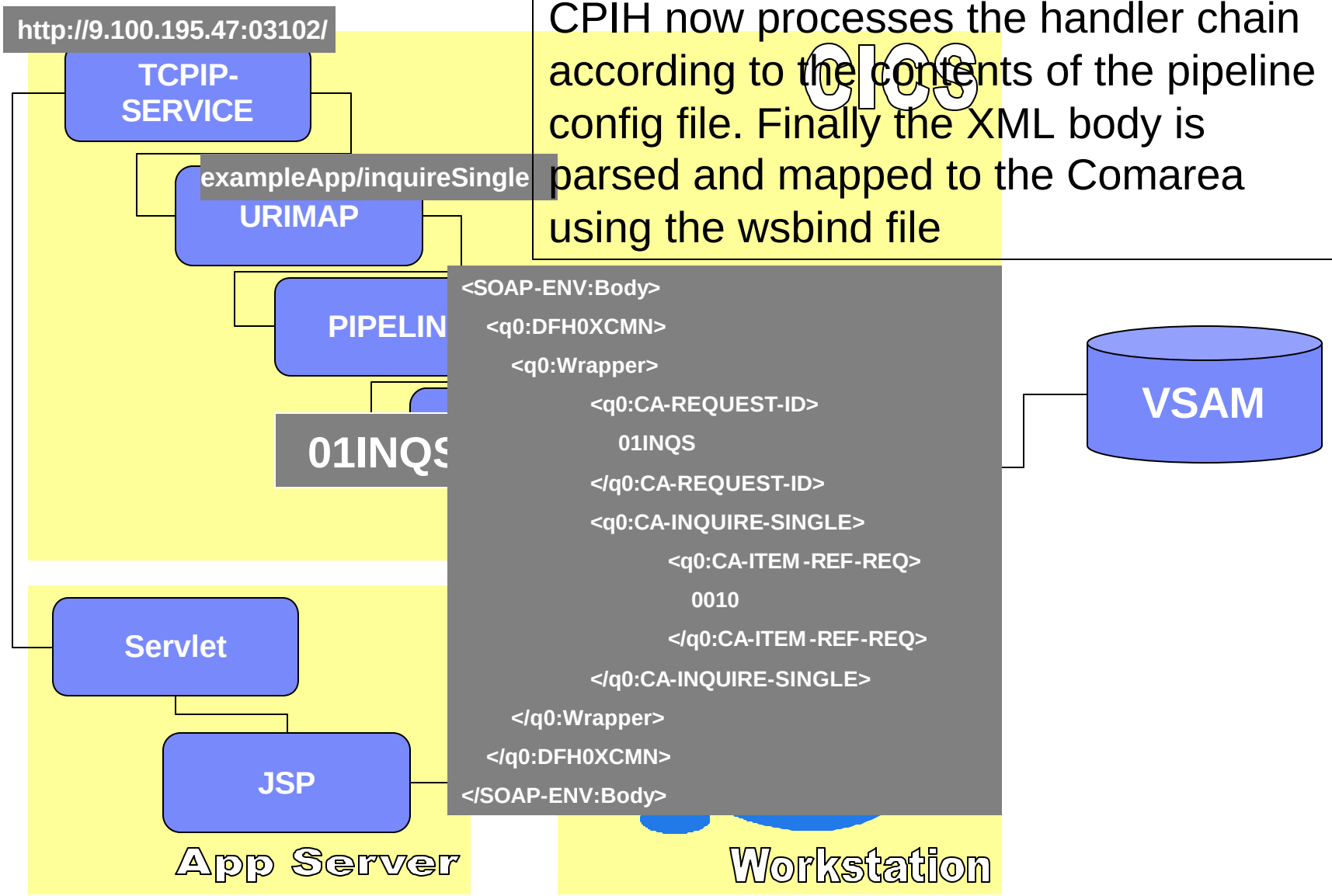

```
<?xml version="1.0" encoding="UTF-8" ?>
<SOAP-ENV:Envelope xmlns:SOAP-
ENV="http://schemas.xmlsoap.org/soap/envelope/"
xmlns:q0="http://www.DFH0XCMN.DFH0XCP4.Request.
com" xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance">
</SOAP-ENV:Envelope>
```

The Pipeline definition

```
I PIPELINE _
RESULT - OVERTYPE TO MODIFY
  Pipeline(SOAPIPE1)
  Enablestatus( Enabled )
  Configfile(/u/eric/exampleapp/pipelines/configurations/basicsoap11provid)
  Configfile(er.xml)
  Shelf(/u/eric/exampleapp/pipelines/shelf/)
  Wsdir(/u/eric/exampleapp/pipelines/wsdir/)
```

- ***pipeline configuration file*** **specifies the pipeline attributes**
  - defines Qualities of Service (WS-Security ect.)
  - specifies msg handler chain to process Web Service Request
- **Wsdir: pickup directory for wsbind files**
- **Shelf: runtime copies from wsdir**

The message handler chain



CPIH now processes the handler chain according to the contents of the pipeline config file. Finally the XML body is parsed and mapped to the Comarea using the wsbind file

The WEBSERVICE definition

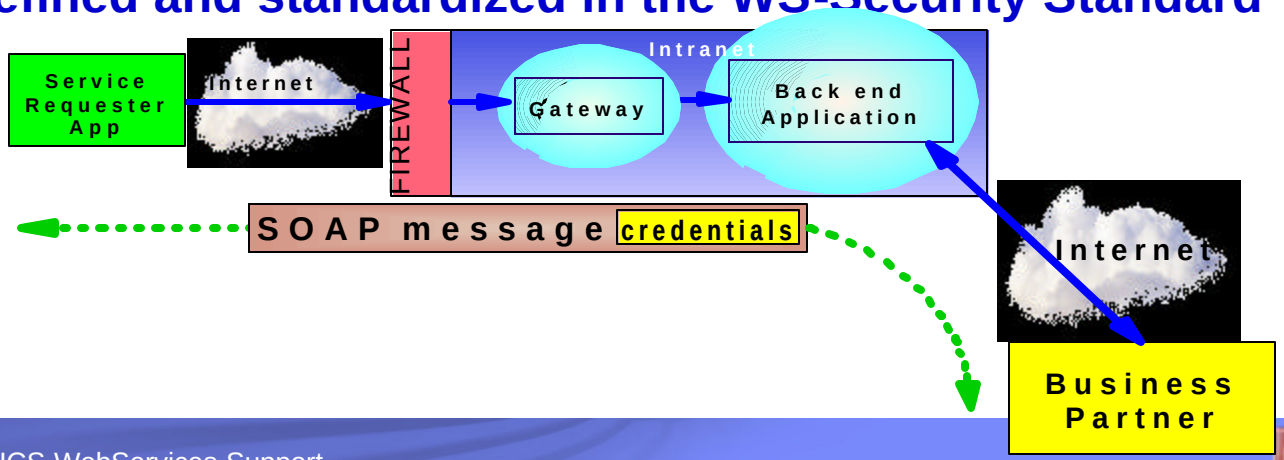
```
I WEBSERVICES
RESULT - OVERTYPE TO MODIFY
  Webservice(inquireSingle)
  Pipeline(SOAPIPE1)
  Validationst( Novalidation )
  State(Inservice)
  Urimap($923470)
  Program(DFH0XCMN)
  Pgminterface(Commarea)
  Container()
  Datestamp(20041207)
  Timestamp(09:23:47)
  Wsdlfile()
  Wsbind(/u/eric/exampleapp/pipelines/wsdir/inquireSingle.wsbind)
  Endpoint()
  Binding(DFH0XCMNHTTPSoapBinding)
```

- **defines the target CICS program (DFH0XCMN)**
- **defines the interface to the target program (Comarea or Container)**
- **defines location and name of wsbind file (....wsdir/inquireSingle.wsbind)**
- **can be generated automatically and installed via pipeline scan cmnd**

Security considerations with SOAP messaging

- https is not always sufficient for secure webservices processing
  - encryption on transport level, “all or nothing”, point-to-point
- **demand for security on the message level**
- how to include security credentials in the message?
- how to implement element-wise encryption, i.e. expose some parts for routing, hide critical data from unauthorized parties
- how to use digital signatures
- security must persist from originator to processing end-point, for the life of the transaction
- security must survive calls to external business partner
- use with, or instead of, protocol-level security

➡ **defined and standardized in the WS-Security Standard**



CICS Support for WS-Security

- CICS WS-Security Message handler, DFHWSSE1
  - shipped via APAR 22736
- Signature validation of inbound message signatures
  - RSA-SHA1 & DSA-SHA1
- Signature generation for the SOAP body on outbound messages
  - RSA-SHA1
- Decryption of encrypted data in inbound messages
  - AES 128,192, 256 or tripledes, with key wrap RSA 1_5 and AES 128,192, 256 or tripledes.
- Encryption of the SOAP body content with the above algorithms
- various mechanisms to derive a User ID from an inbound message
- **see redbook SG24-7206**

Configuring CICS to Support WS-Security

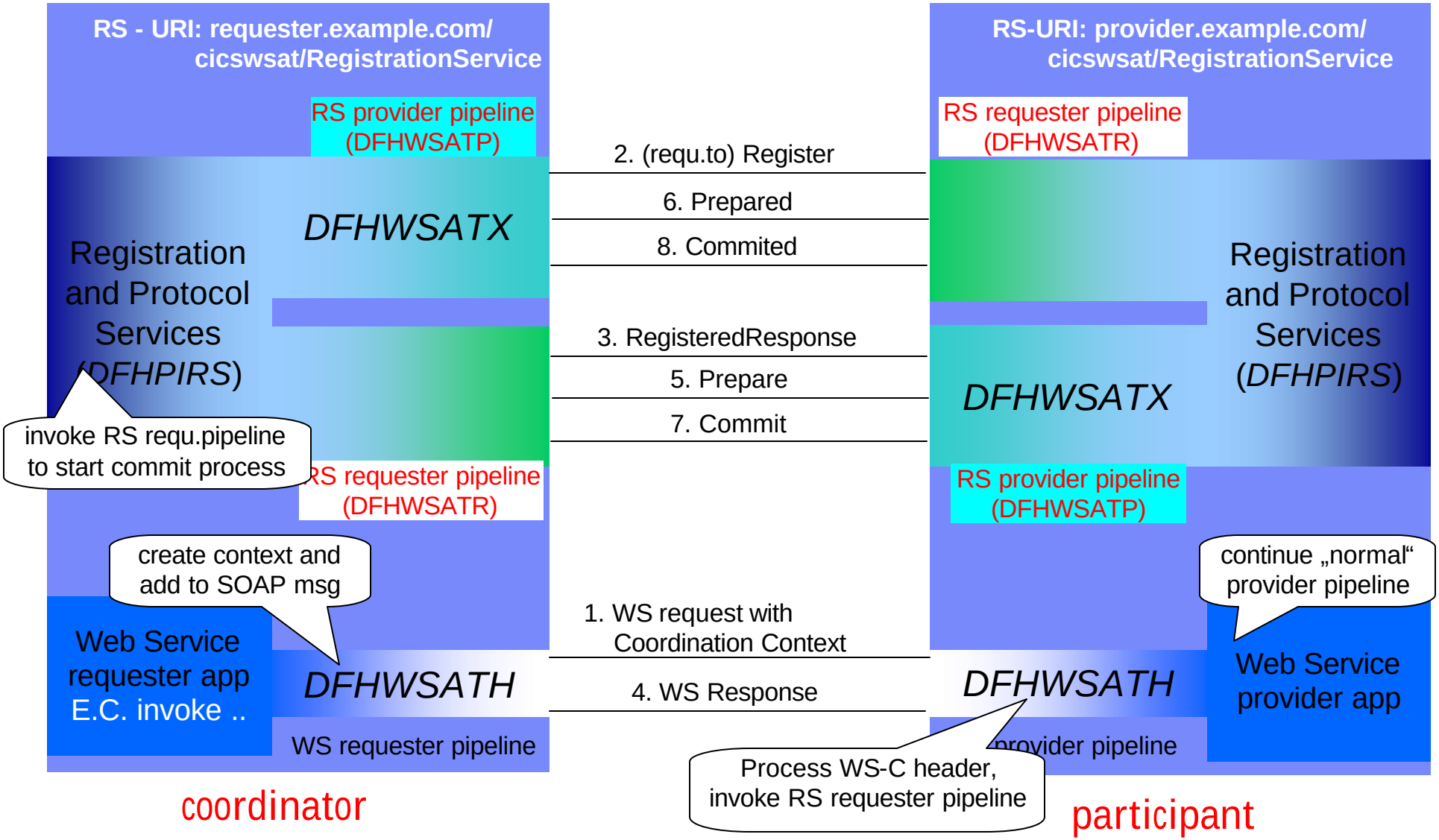
In the pipeline configuration file add a security handler to the service handler list

```
<service>
   <service_handler_list>
     <cics_wsse_handler>
       ……..……
     </cics wsse_handler>
   </service_handler_list>
   <terminal_handler>
     <cics_soap_1.1_handler/>
   </terminal_handler>
</service>
```

Transactional Support for Web Services

- **Web Services Standard focusses on 3 topics**
  - **WS-Coordination – WS-C**
    - how to establish a coordinator that creates and submits a trx.context
    - WS-C defines a *framework* for deploying coordination protocol sets
      - Activation Service – begin / end of transaction
      - Registration Service – register „participation“ in a transaction
      - Coordination Context – create and maintain a trx. context
  - **WS-AtomicTransaction – WS-AT**
    - the well known trx. model based on **A**tomicity, **C**onsistency, **I**solation, **D**urability / 2PC
    - short lived trx. where results are not made visible until commit or rollback
  - **WS-BusinessActivity – WS-BA**
    - long lived business trx. where results of operations **are** made visible before completion of entire unit of work
    - needs compensation logic rather than roll back to undo undesired work
- **more info available at**
  - IBM: Developer Works – Web Services: Technical Library/Standards
    http://www.ibm.com/developerworks/webservices
  - MSoft: Web Services Development Center
    http://msdn.microsoft.com/webservices
  - BEA: Dev2Dev – WebServices
    http://dev2dev.bea.com/technologies/webservices/index.jsp

CICS Support for WS-AT – how it works



CICS Support for WS-AT - Resources

Resources in new group DFHWSAT

- Pipeline ***DFHWSATP - registration service provider pipeline***
  - provider pipeline that enables CICS to act as a WS-C coordinator and as a WS-AT 2PC protocol handler
- Pipeline ***DFHWSATR - registration service requester pipeline***
  - requester pipeline that allows CICS to communicate with external coordinators and WS-AT 2PC protocol handlers
- URIMAP ***DFHRSURI*** (registration service URI)
  - associates inbound WS-C requests with provider pipeline *DFHWSATP*
- Program ***DFHWSATH*** (atomic trx. handler)
  - defined in pipeline config. file of WS-requester and WS-Provider
    - must be included to enable WS-Atomic trx.
  - if CICS is the WS-Coordinator (in the role of WS requester)
    - creates coordination context and adds it to SOAP request message
  - if CICS is the WS-Provider
    - receives coordination context and invokes its local RS-requester pipeline to request registration with the coordinator
- Program ***DFHPIRS*** (pipeline registration service)
- Program ***DFHWSATX*** (2PC handler)
- Program ***DFHWSATR*** (registration service requester pgm)

Updates to the pipeline config – WS Requester

```
...
<cics_soap_1.1_handler>
   <headerprogram>
     <program_name>DFHWSATH</program_name>
     <namespace>
           http://schemas.xmlsoap.org/ws/2004/10/wscoor
     </namespace>
     <localname>CoordinationContext</localname>
     <mandatory>true</mandatory>
   </headerprogram>
</cics_soap_1.1_handler>
...
<service_parameter_list>
   <registration_service_endpoint>
           http://provider.example.com:3207/cicswsat/RegistrationService
   </registration_service_endpoint>
</service_parameter_list>
```

causes CoordinationContext to be created and added to the SOAP message before it is sent

Address of the Registration service endpoint for the RS provider of this Region. Participants send Register requests to this address.

Updates to the pipeline config. – WS Provider

```
<cics_soap_1.1_handler>
   <headerprogram>
         <program_name>DFHWSATH</program_name>
         <namespace>
               http://schemas.xmlsoap.org/ws/2004/10/wscoor
         </namespace>
         <localname>CoordinationContext</localname>
         <mandatory>false</mandatory>
   </headerprogram>
</cics_soap_1.1_handler>

<service_parameter_list>
   <registration_service_endpoint>
         address:port/cicswsat/RegistrationService
   </registration_service_endpoint>
</service_parameter_list>
```

extracts data from the CoordinationContext header and invokes registration request

address of the registration service endpoint for RS provider of this region. Coordinator sends prepare and commit (or Abort) requests to this address

Some hints …

- **WSA utilities have limitations**
  - see WSA documentation in web services guide
  - wrapper pgm (“meet in the middle”) most likely needed in real world projects
  - for FSUM error messages from WSA see z/OS 1.x UNIX System Services Messages & Codes
    → number is a reference to the line in script
  - provide correct Java paths settings
- **Establish appropriate USS Authorizations**
- **Invest time in webServices design**
  - compound services vs. very granular services
  - complex vs. simple interface for web service requesters
  - consider network traffic and XML parsing overhead
    - avoid deep XML nesting levels
- **Literature**
  - CICS TS 3.1 Web Services Guide SC34-6458
  - Implementing Web Services in CICS SG24-7206 (redbook)
  - Application Development for CICS Web Services SG24-7126 (redbook)
- **CICS Web Services Class in Montpellier**

Summary

Web Services Support opens new opportunities to integrate CICS applications in an SOA and to interoperate with application components on different plattforms

-"loose coupling", plattform and language neutral

-flexible composition of services to support flexible business processes

CICS TS supports the key web services standards

-standard conformance is key to gain flexibility and it influences the speed for building an On Demand IT environment

HTTP or MQ transport

-transparent for the application

-MQ benefits may be for example "assured delivery" and usage of WBI

WebServices Support is an integrated CICS component

-simple configuration and system management

-monitoring, statistics and trace support

Thanks for Your attention