IBM 2007 IMPACT

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CICS Web services atomic transactions

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Session 4134B

impact-venture*

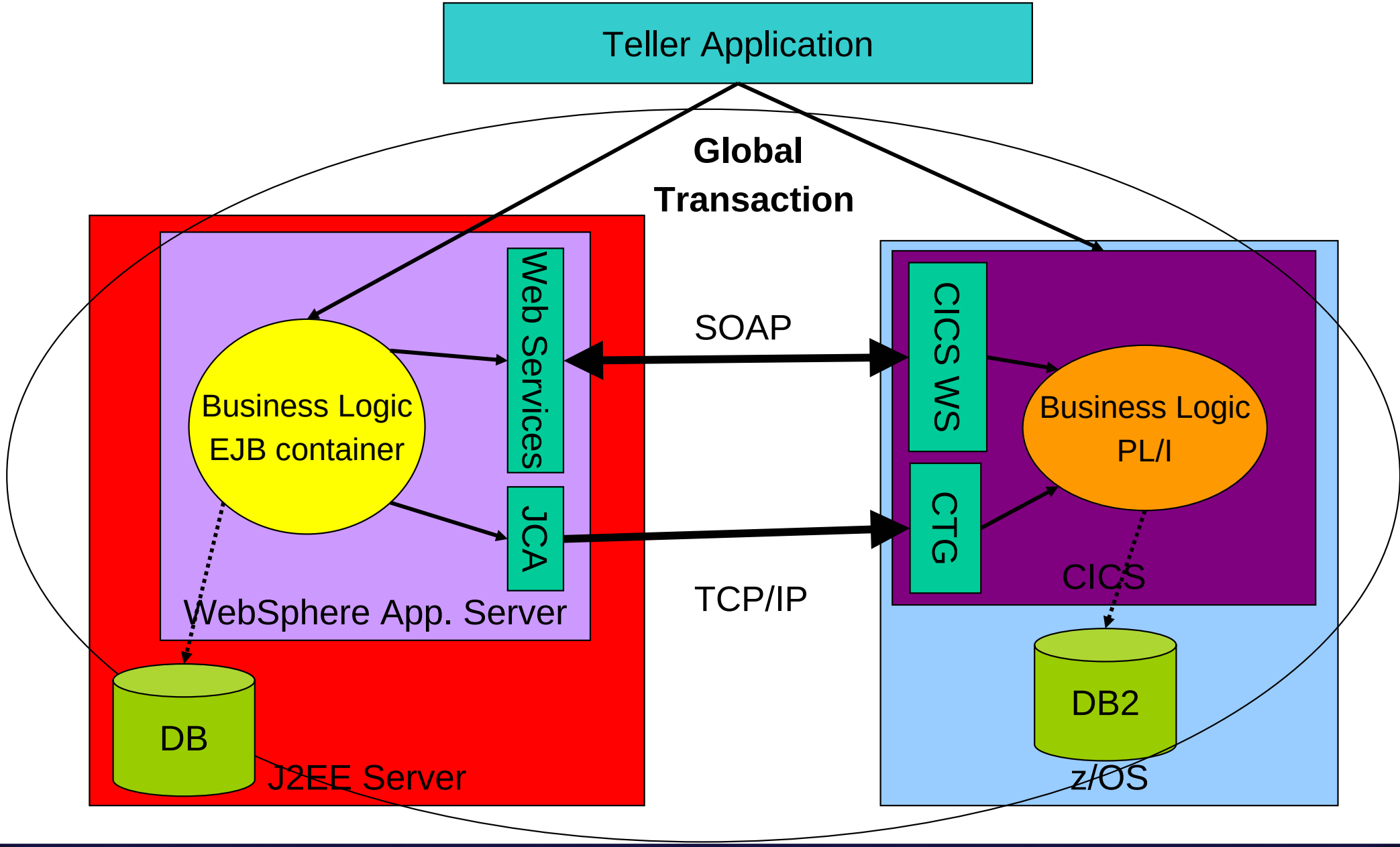
Background

- Savings Bank has existing core business applications based on PL/1 – CICS – DB2
- Plans to build new business logic in J2EE
- PL/1 and J2EE will coexist for a long time, so reliable transactions across both environments are required
- Transactions can start in CICS or in WebSphere so support for bi-directional communication with 2PC is needed (for **some** transactions)
- If no 2PC support, need to build compensation logic that increases development costs and complexity

Objectives

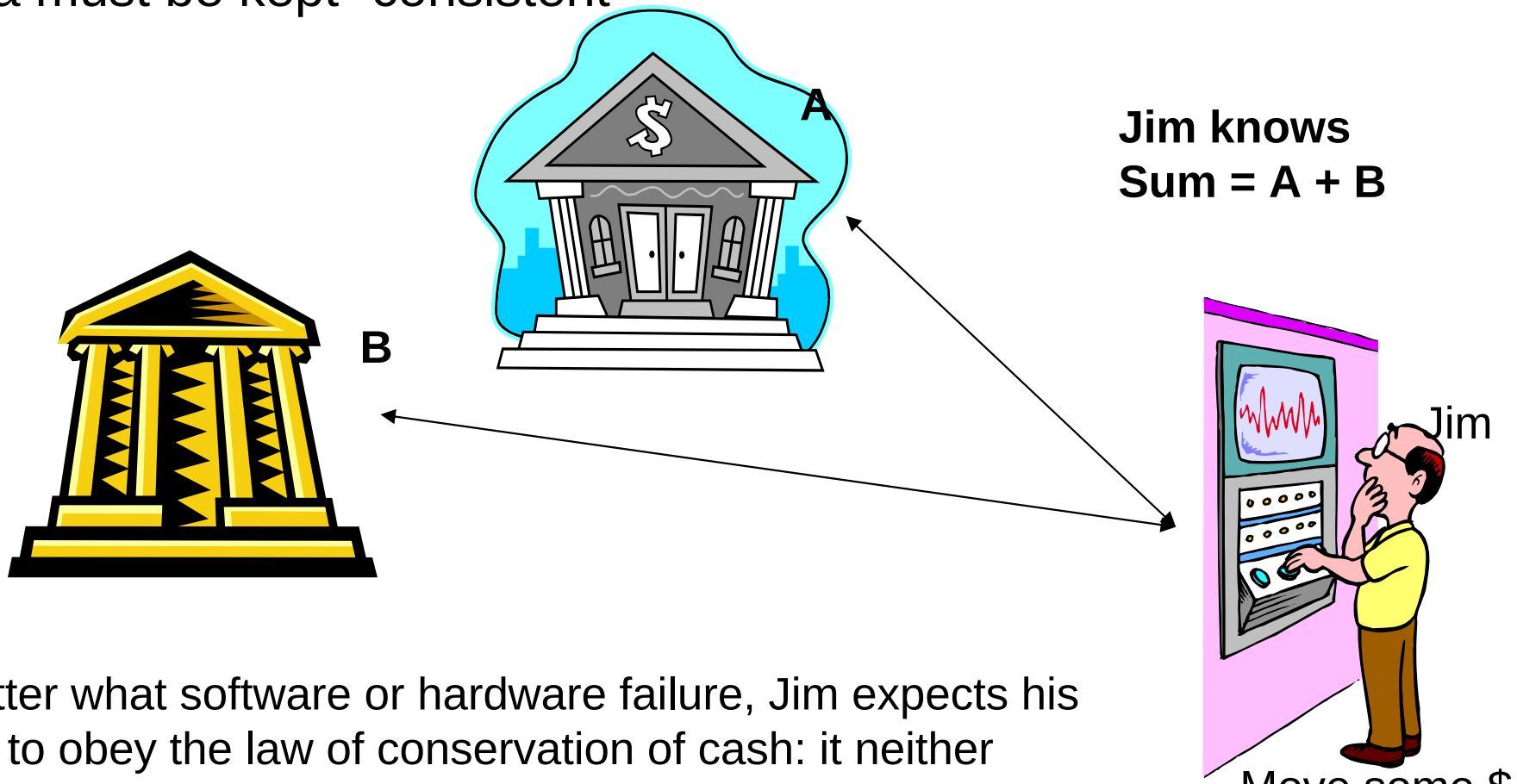
- Why distributed transactions are required at Savings Bank
- What technology options were considered for proof of concept
- Review of Web services atomic transactions
- Results of proof of concept
- Conclusions

Planned Architecture



Why 2PC ?

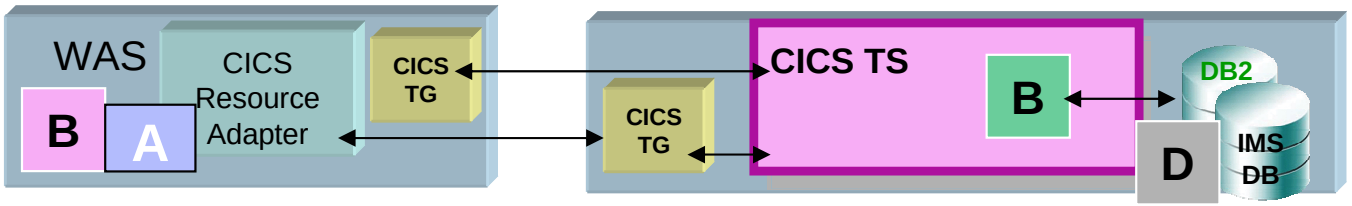
- Data must be kept “consistent”



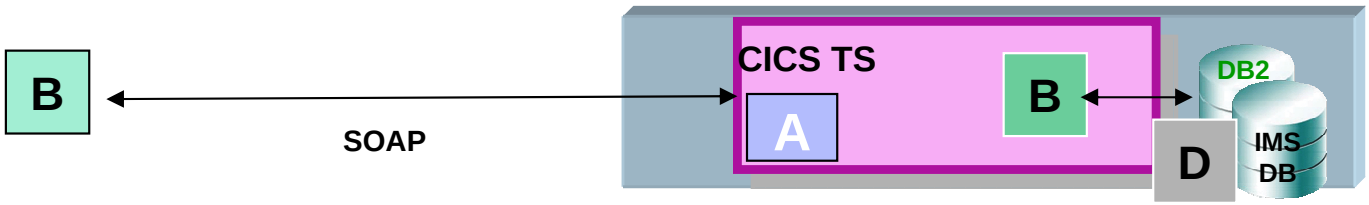
No matter what software or hardware failure, Jim expects his money to obey the law of conservation of cash: it neither evaporates nor suddenly appears from nowhere (the latter is acceptable to him, but not to the bank).

Technology options considered

JCA Connector:
CICS Transaction Gateway

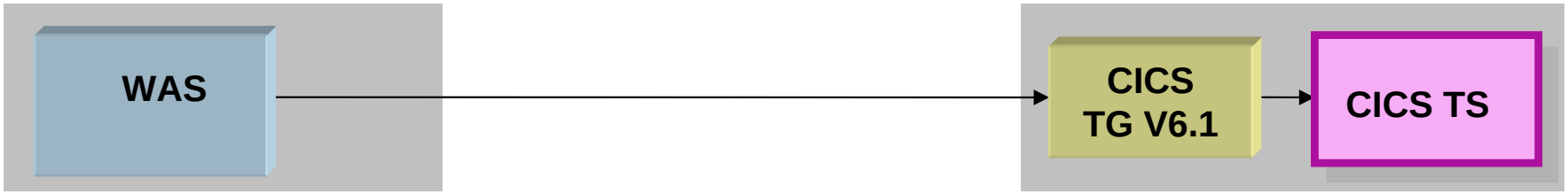


SOAP Access:
CICS Web services Support



CICS TG 2PC transaction support

Distibuted platform **z/OS**



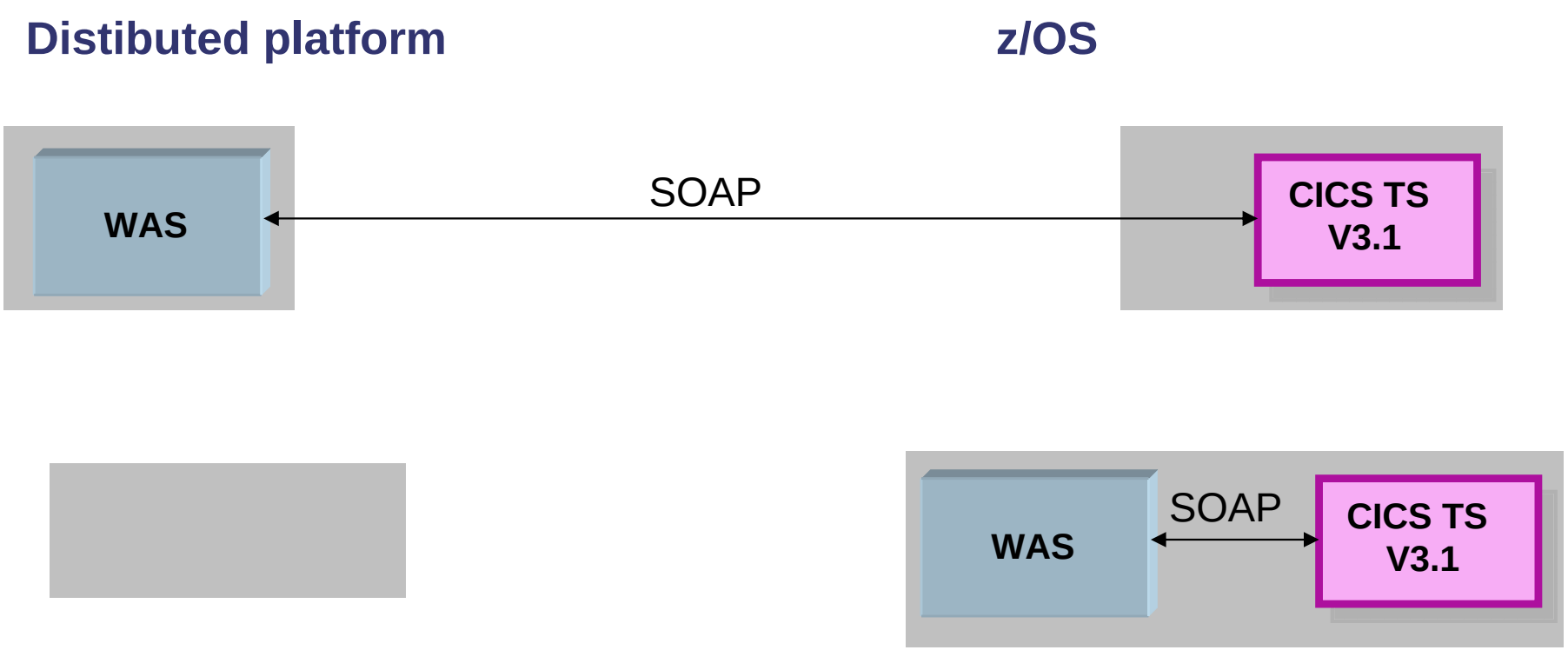
-2PC introduced with XA support in CTG V6.1

-CICS TG must run on z/OS

-2PC through RRS

- Requires CICS TG 'local' mode (not through TCP/IP)

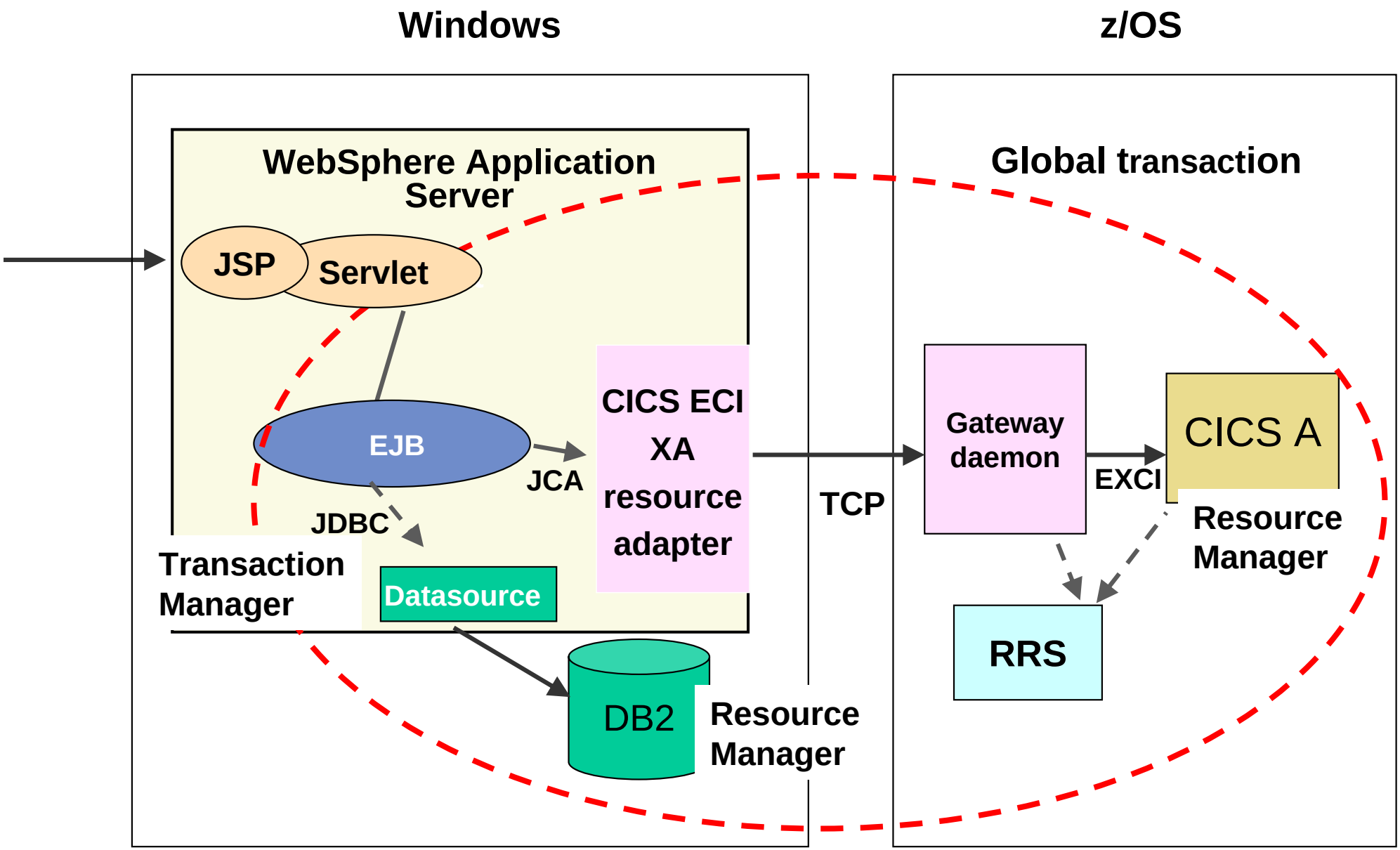
CICS Web services 2PC transaction support



-2PC through WS-AtomicTransaction support in CICS TS V3.1 (as service provider and as service requester)

- WAS V6 and later supports WS-AtomicTransaction (WS-AT)

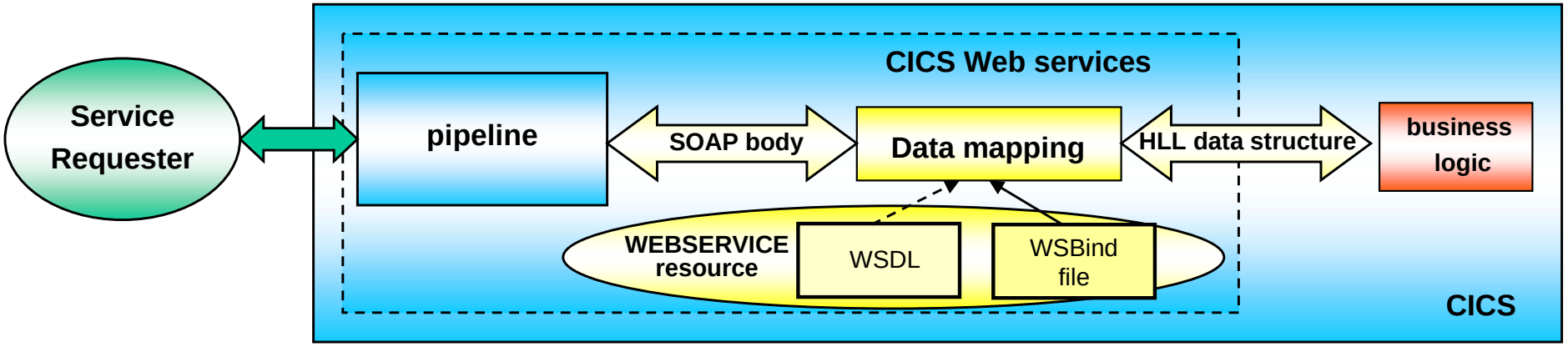
CICS TG V6.1 2PC support



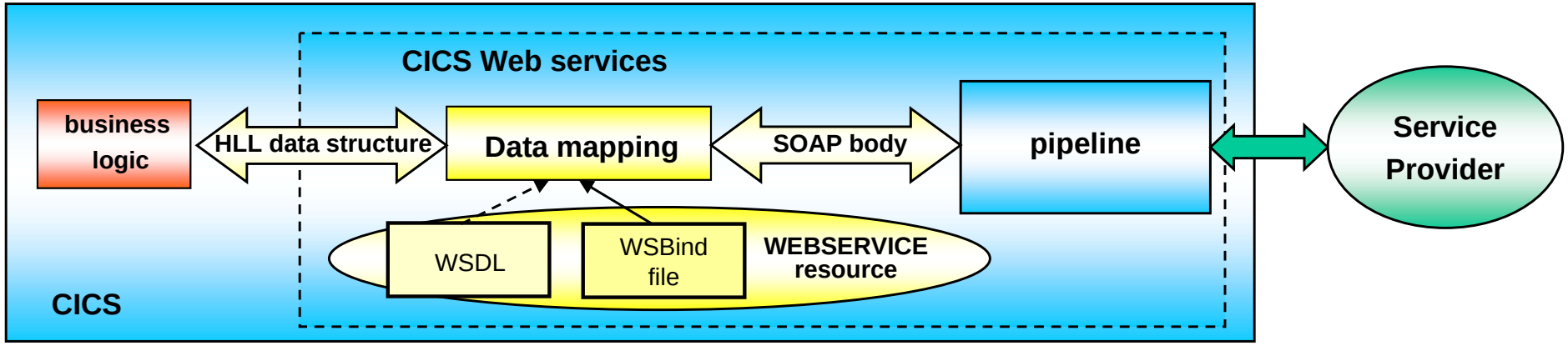
Review: Web services atomic transactions

CICS Web Services support (overview)

- CICS as a service provider

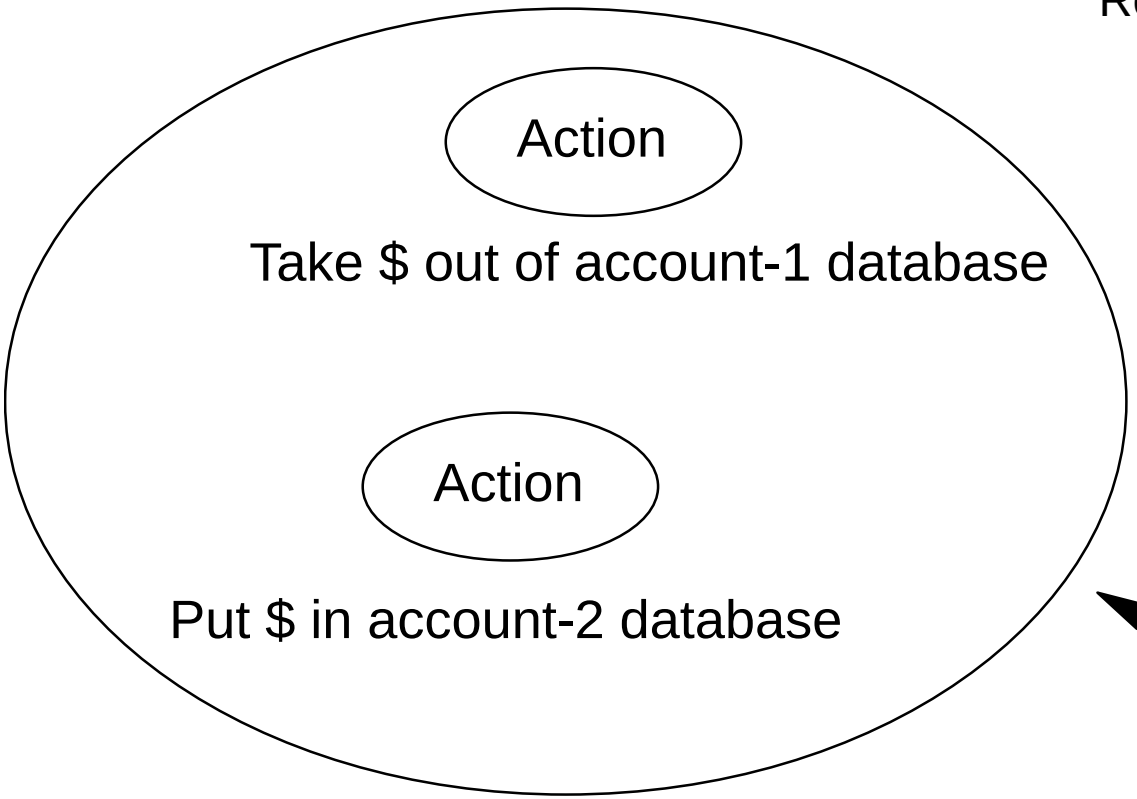


- CICS as a service requester



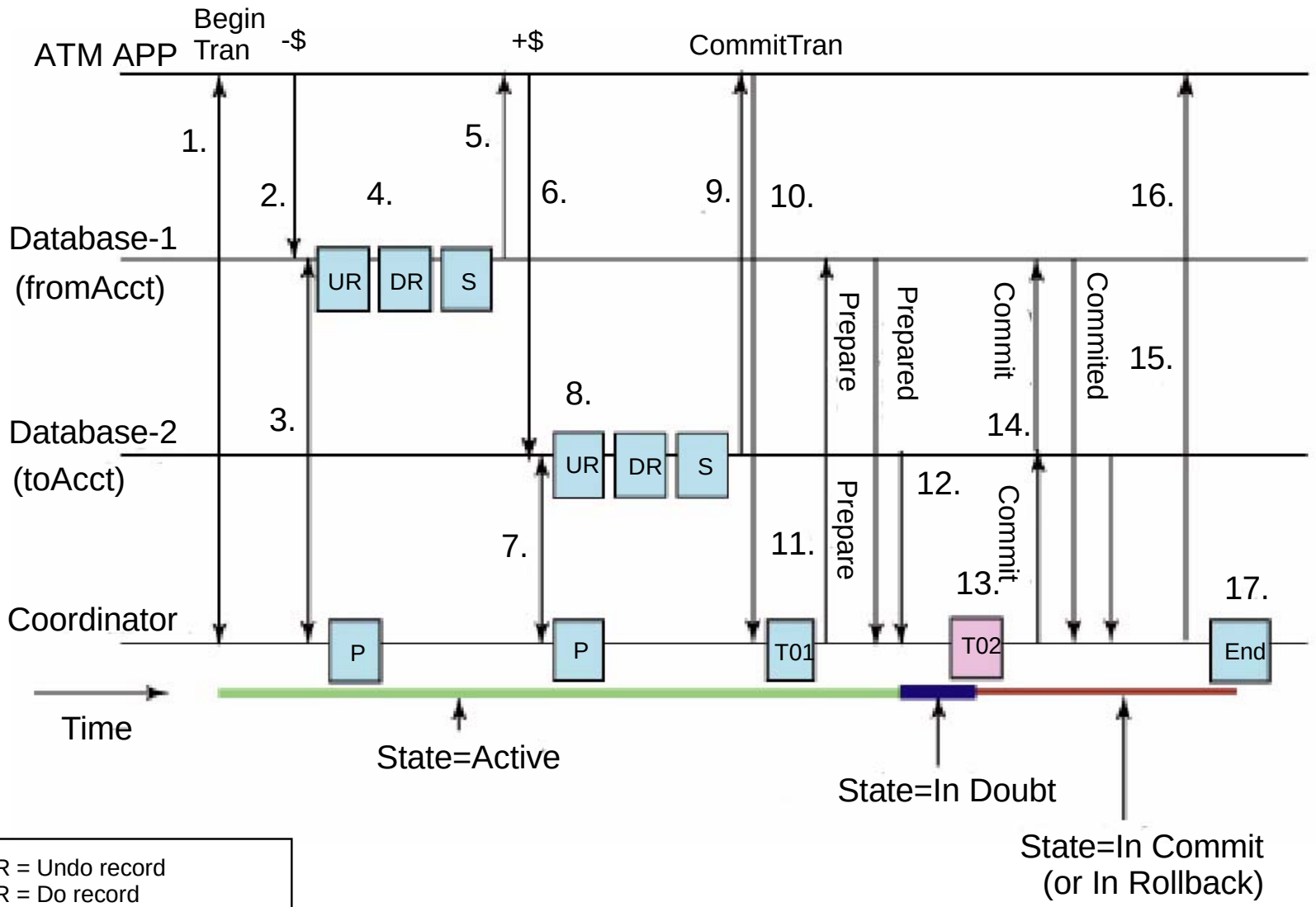
Simple to code a transaction

```
TransferCash(fromAcct, toAcct, amount)
    BeginTransaction
        fromAcct = fromAcct - amount
        toAcct = toAcct + amount
    CommitTransaction
Return
```



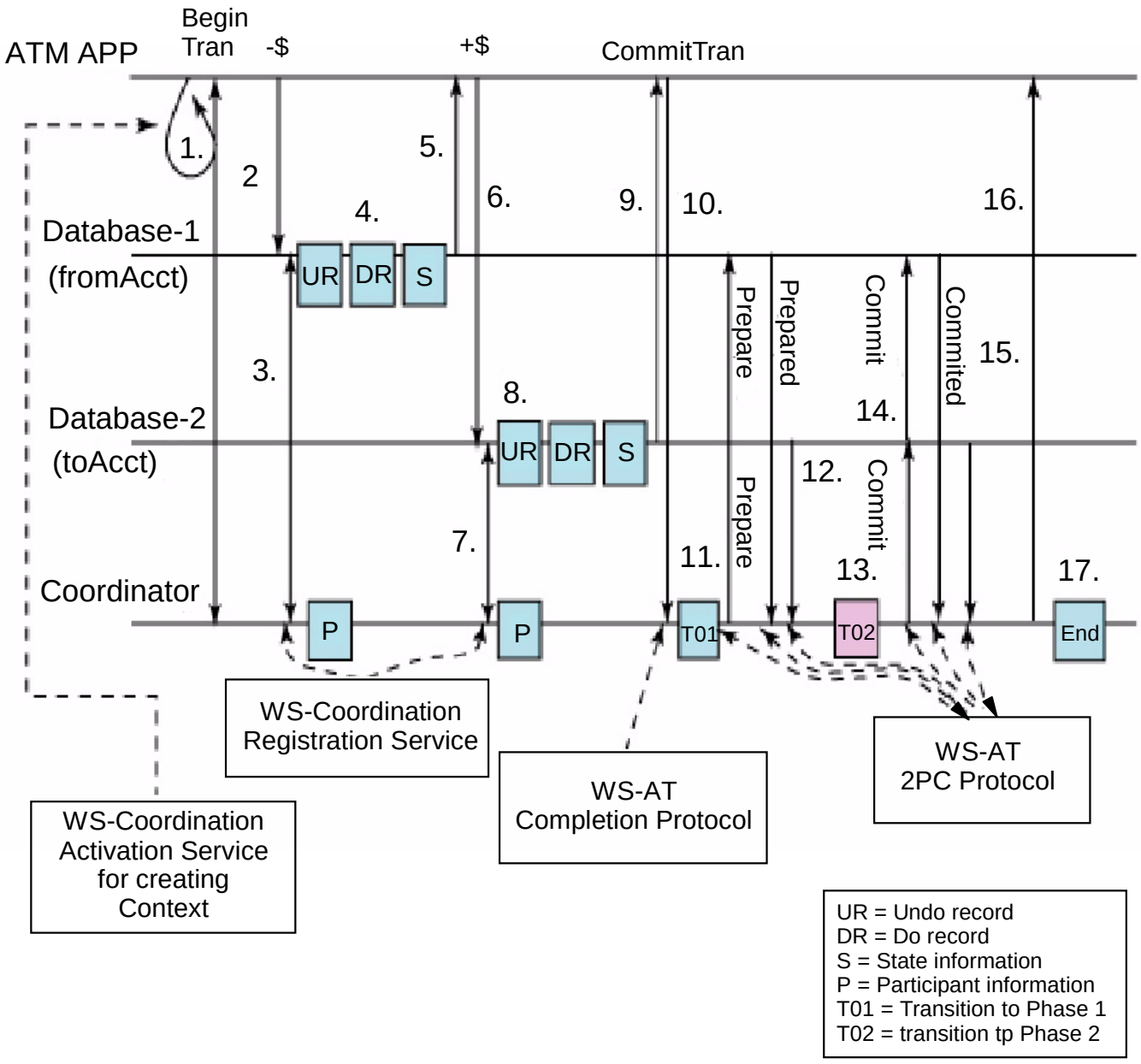
All or none outcome

Classic transaction



UR = Undo record
DR = Do record
S = State information
P = Participant information
T01 = Transition to Phase 1
T02 = transition tp Phase 2

WS-Atomic transaction



WS-Atomic transaction (cont…)

- Web services can be configured to take part in an extended or global unit of work, known as an ***Atomic Transaction***
  - Recoverable updates are not committed or backed out until the Web service is instructed to do so
  - Provision is made to allow updates to be completed manually or automatically if they cannot be successfully coordinated in a reasonable timeframe

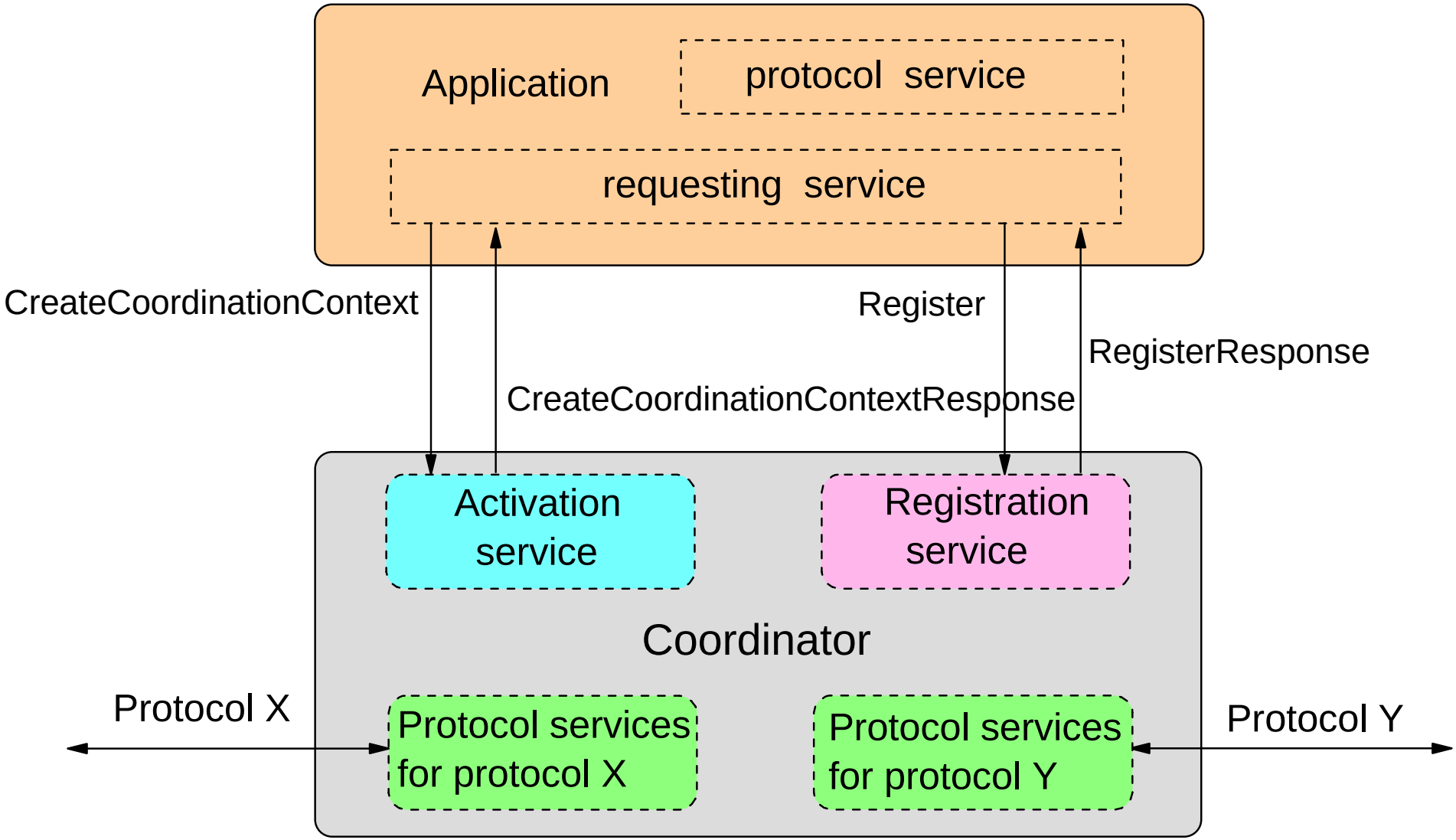
Specifications

- **Web Services Addressing (WS-A)**
  - How to provide information about the destination, where to reply to, and where faults should be sent
- **Web Services Coordination (WS-C)**
  - Define protocols for Web services interoperability
    - Coordination Context
    - Registration Services
- **Web Services Atomic Transactions (WS-AT)**
  - The WS-AT specification builds on WS-C by providing the definition of the atomic transaction coordination type

See Redbook 'Implementing CICS Web Services'

http://www.redbooks.ibm.com/abstracts/sg247206.html?Open

Coordinator services



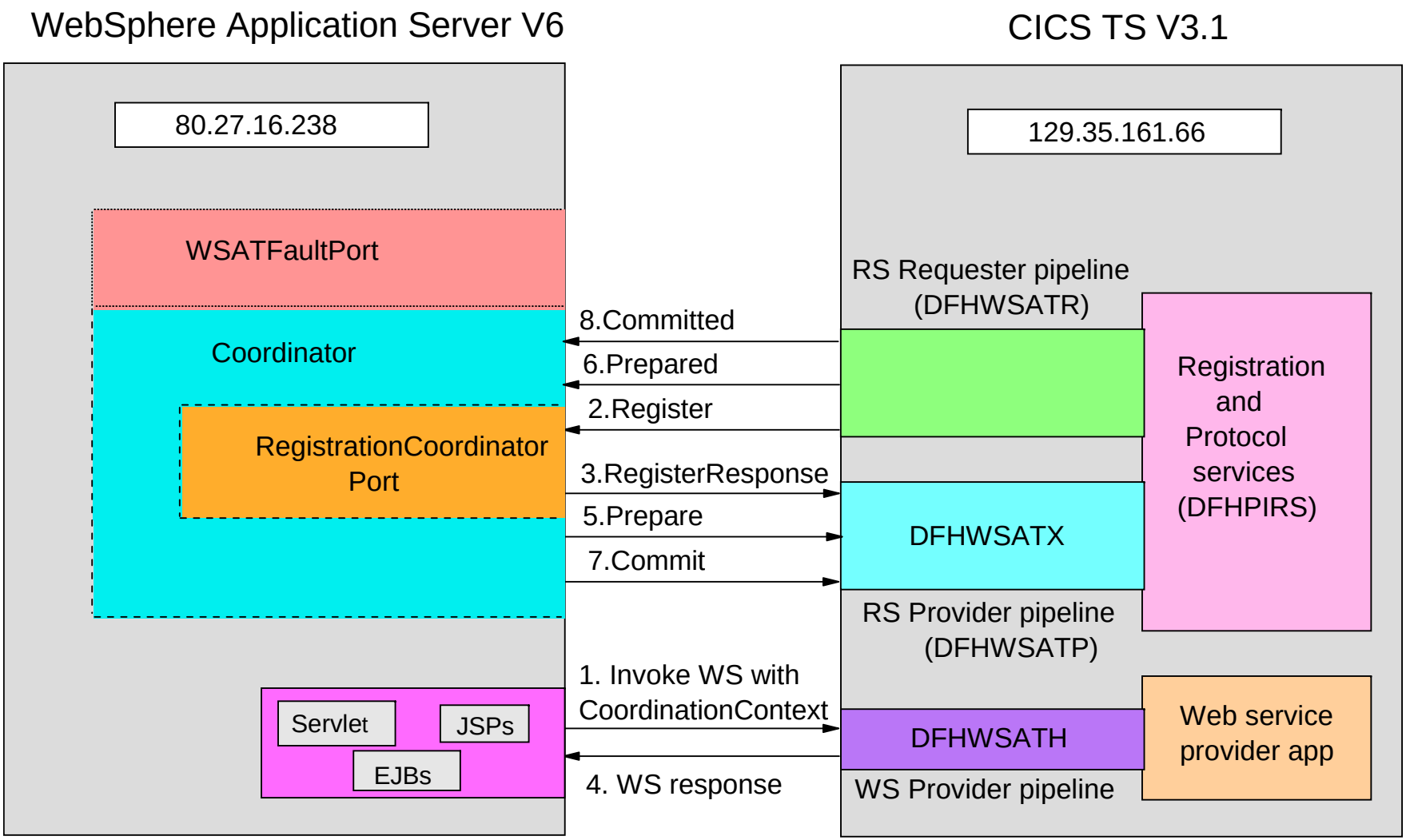
Sample CoordinationContext created by CICS

```
<wscoor:CoordinationContext>
<wscoor:Expires>00004080000</wscoor:Expires>
<wscoor:Identifier>PIAT-CCON-CICSACB2-
        0335969539286 5C</wscoor:Identifier>
<wscoor:CoordinationType>http://schemas.xmlsoap.org/ws/2004/10/wsat
</wscoor:CoordinationType>
<wscoor:RegistrationService>
        <wsa:Address>http://129.35.161.66:13301/cicswsat/Registration
        Service</wsa:Address>
        <wsa:ReferenceProperties>
                <cicswsat:Netname>CICSACB2</cicswsat:Netname>
                <cicswsat:Token>F0F0F0F0</cicswsat:Token>
                <cicswsat:UOWID>BEFA00A71EAACD0E
                </cicswsat:UOWID>
        </wsa:ReferenceProperties>
</wscoor:RegistrationService>
</wscoor:CoordinationContext>
```

Atomic Transaction Services

- **Activation Service**
  - When the application sends a *CreateCoordinationContext* element, the Activation service creates a new activity and returns its coordination context
- **Registration Service**
  - The Registration service defines a **Register** operation that allows a Web service to register to participate in a coordination protocol
- **Protocol Services**
  - A set of coordination Protocol services for each supported coordination type (e.g WS-AT)
  - Control of recoverable updates during task termination
  - Receive and respond to messages requesting that specific actions are carried out before termination
  - Provide support for resync processing

How CICS supports atomic transactions

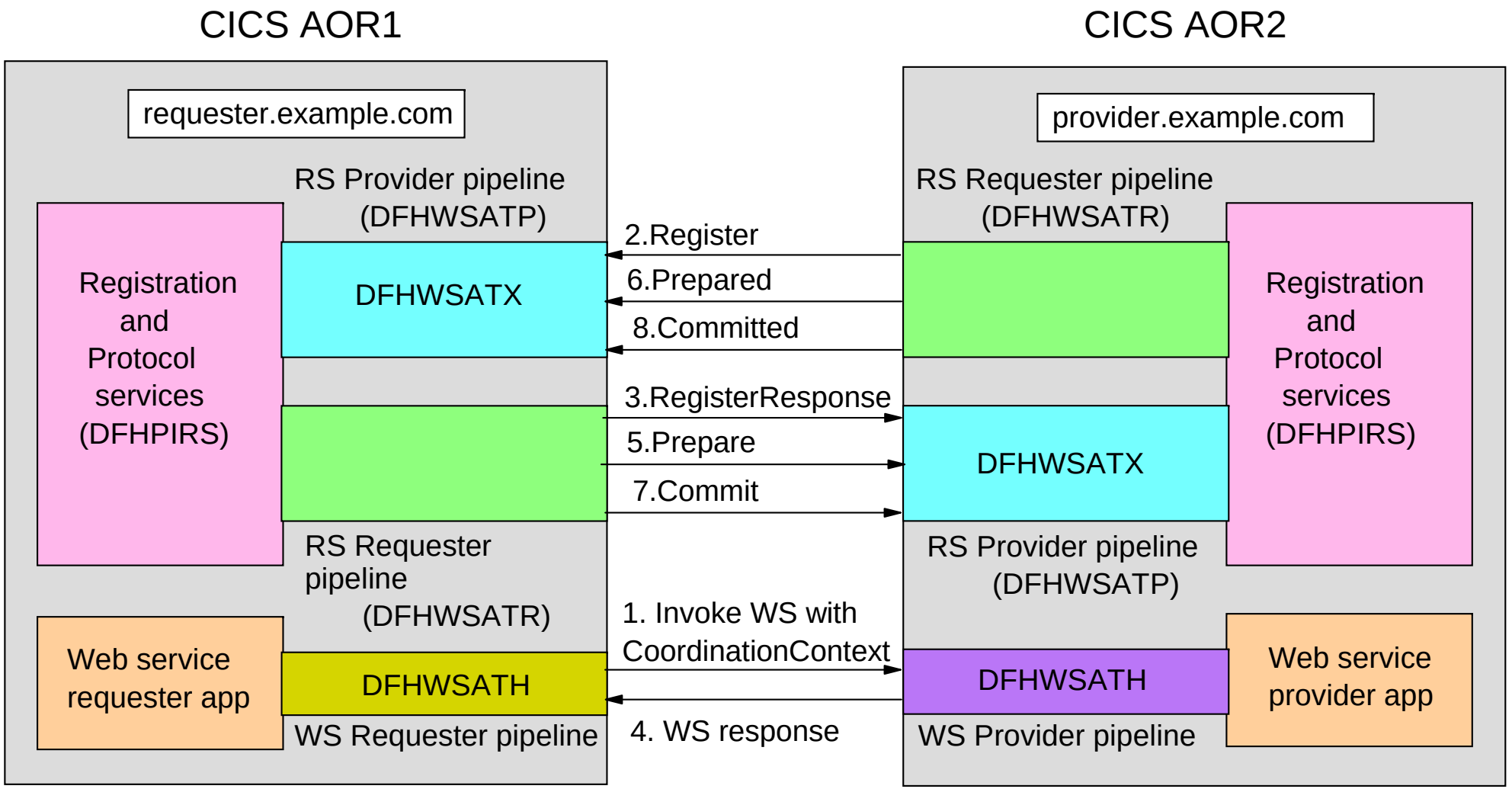


1. Invoke
2. Register

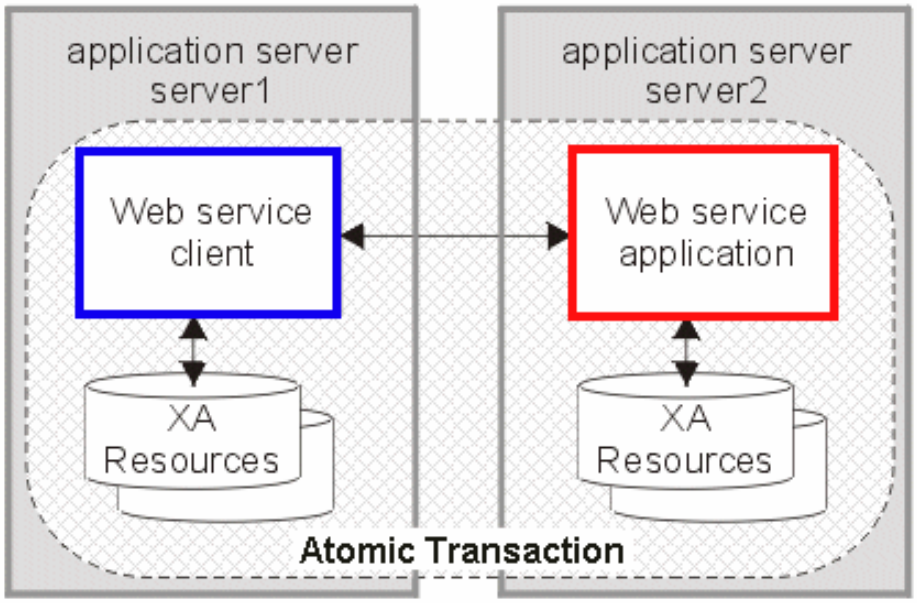
CICS WS-AT pipelines

- Pipeline DFHWSATP
  - Provider pipeline for registration and protocol processing
  - Invokes the CICS-supplied message handler DFHWSATX as the last message handler in the pipeline
- Pipeline DFHWSATR
  - Requester pipeline for registration and protocol processing

CICS as a requester and provider



WAS support for WS-C and WS-AT



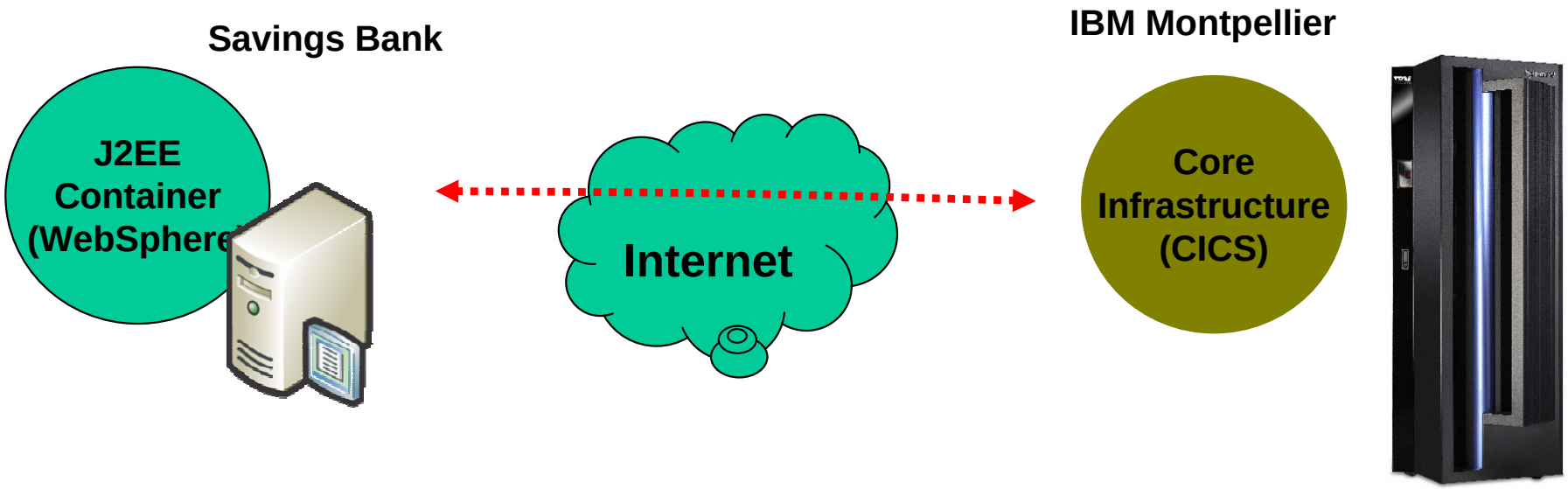
- WAS runtime takes responsibility for the registration of WS-AT participants in the same way as the registration of XA resources
- At transaction completion time all XA resources and WS-AT participants are atomically coordinated by the WAS transaction service
- Configure using application deployment descriptors

Proof of concept

Testing environment

- Due to no availability of CICS 3.1 at customer site the testing has been done with a System z machine provided by IBM Montpellier

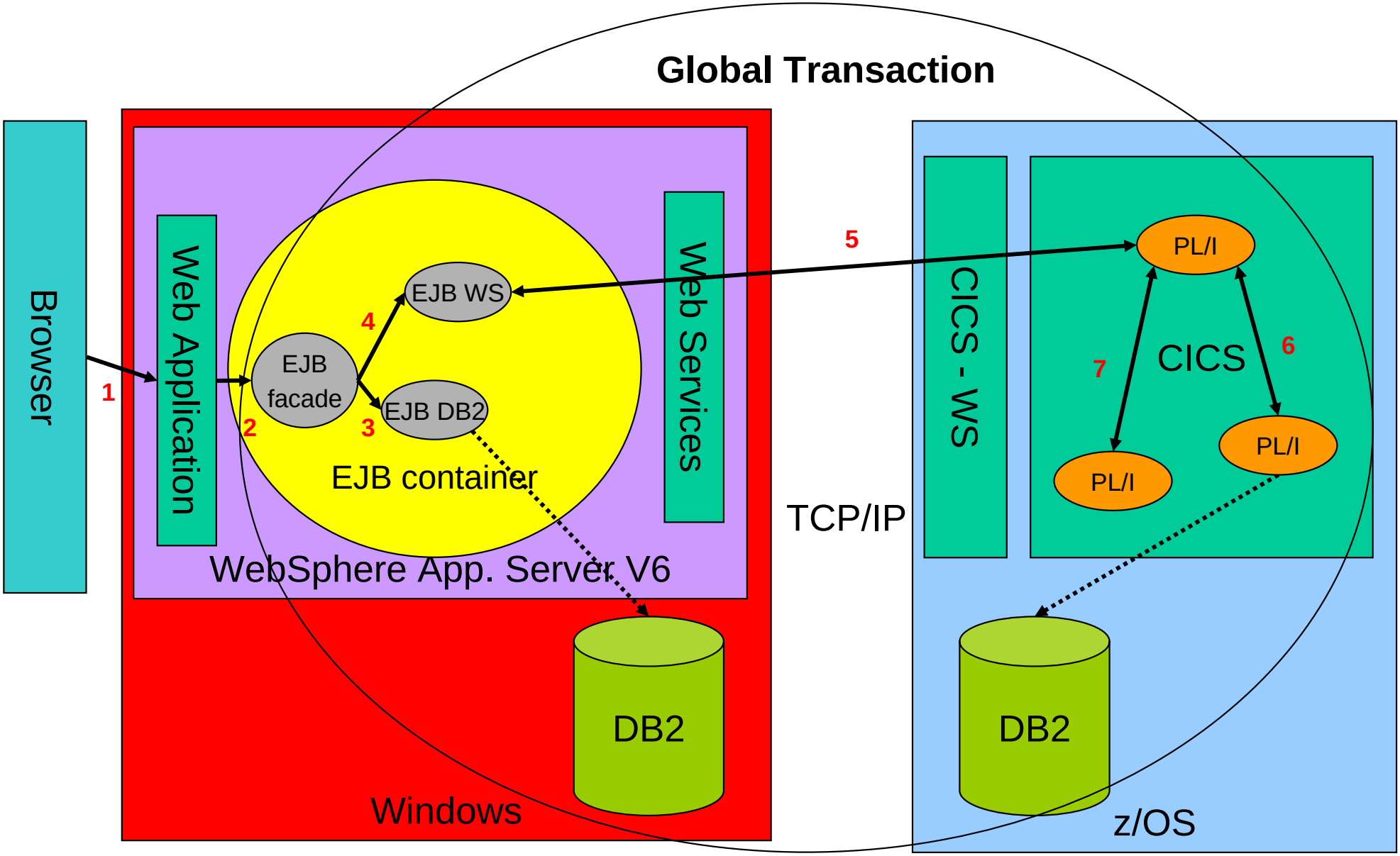
- WAS Windows server runs at customer site



PoC Support

- IBM Montpellier has facilities to do all kinds of testing providing us a complete z/OS stack available from internet
- IBM Design Center have skills to help with PoC

PoC Development - Scenarios



PoC Development

- WebSphere Application Server
  - Session EJBs acting as Web Services requester and provider
  - Session EJBs writing data in DB2
  - Web Application to invoke tests
- CICS – PL/I – DB2
  - PL/I programs acting as Web Services provider (and requester)
  - PL/I transactions write data in DB2 zSeries
- Action in each environment (CICS and WAS) to insert record in DB2 table
  - Errors caused (division by zero) to see how the atomic transaction is rolled back

CICS Web Services tooling

- Used tools DFHLS2WS and DFHWS2LS to generate the necessary files to convert XML data (described in the WSDL) to language structures (PL/I) and vice-versa
  - DFHLS2WS: generate WSDL and WSBind from language structure
  - DFHWS2LS: generate LS and WSBind from WSDL

- To invoke a Web Service from CICS:
  - EXEC CICS INVOKE WEBSERVICE ( ) CHANNEL ( ) URI ( ) OPERATION ( )

Software Maintenance

- Required CICS TS V3.1 maintenance :
  - PTF UK12958/APAR PK20166
  - PTF UK11916/APAR PK19530

    INVREQ on EXEC CICS INVOKE WEB SERVICE
  - PTF UK13664/APAR PK22600

    CICS transaction abend if service provider updates DB2

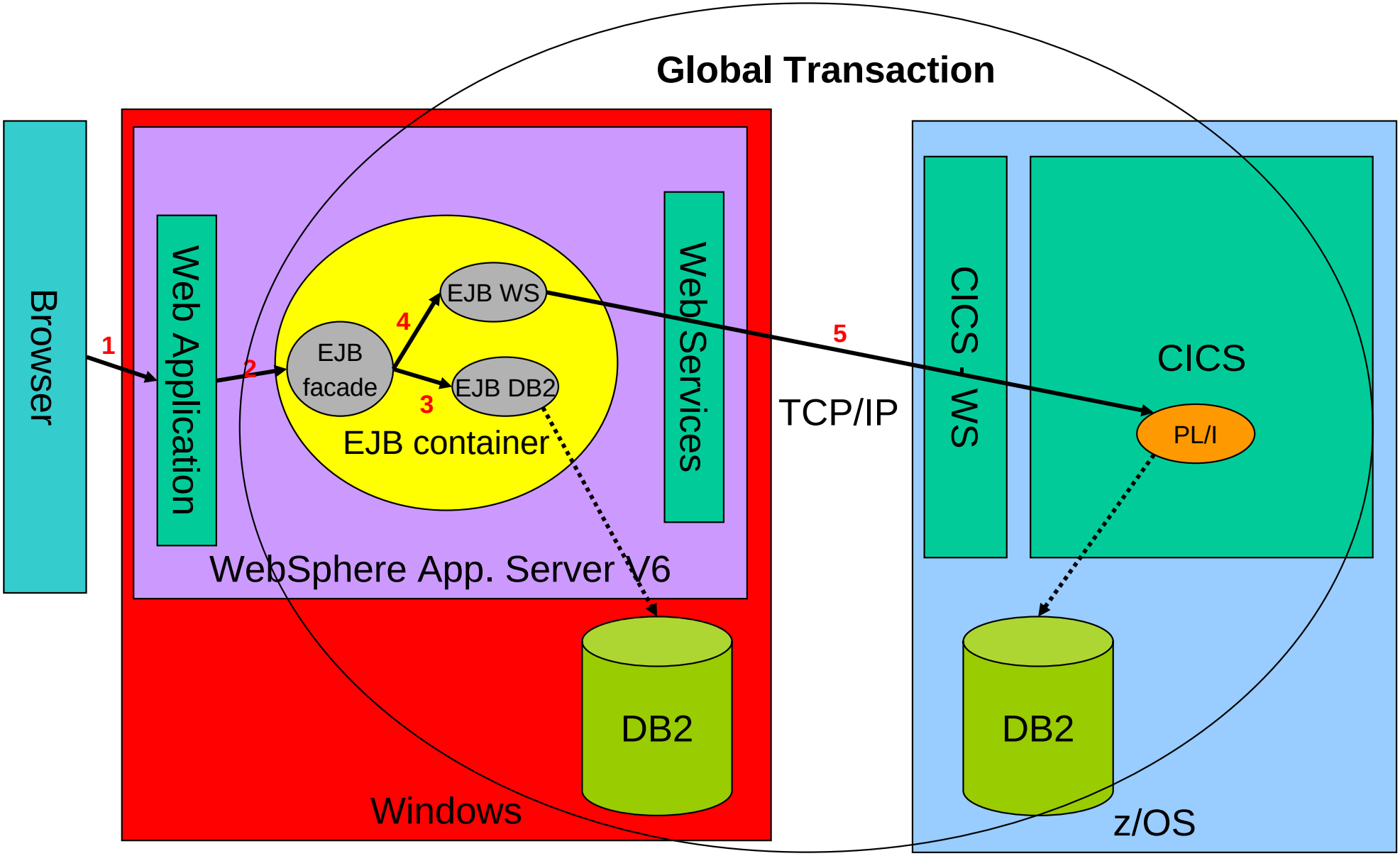
- WAS maintenance level, require version over 6.0.2.7 (we used 6.0.2.9)
  - Includes fix for APAR PK16509

    WebSphere sends SOAP actor role in CoordinationContext which is rejected by CICS

Test scenarios

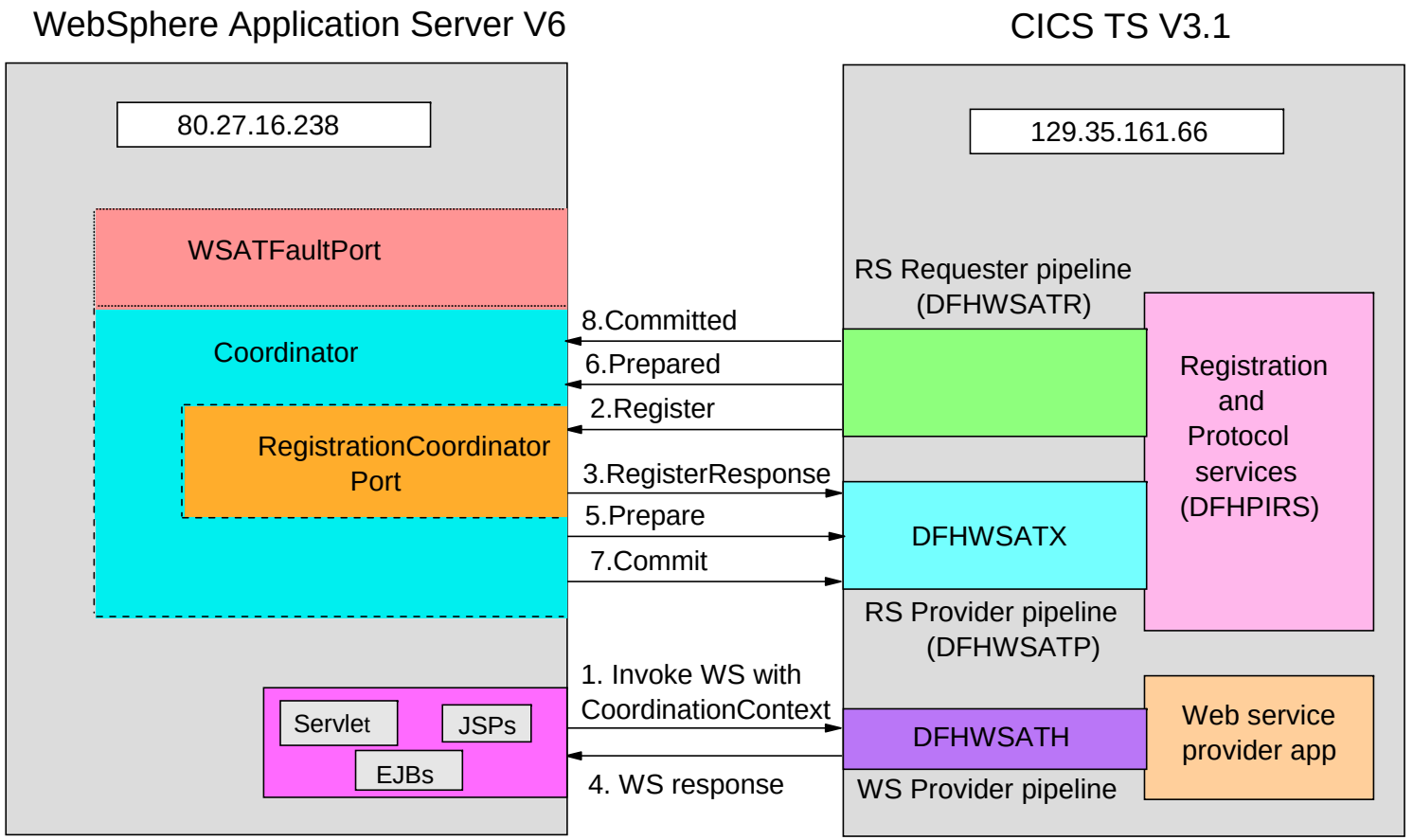
- Scenario 1: WAS -> CICS
- Scenario 2: WAS -> CICS -> WAS
- Scenario 3: CICS -> WAS
- Scenario 4: CICS -> WAS -> CICS

Scenario 1: WAS - CICS



WS-AT protocol between servers: Commit

1. Invoke
2. Register
3. RegisterResponse
4. Response
5. Prepare
6. Prepared
7. Commit
8. Commited



Configuring CICS for WS-AT

- Install group **DFHWSAT** which contains the CICS resource definitions needed
  Note: this group is not part of DFHLIST.

- The HFS locations for the pipeline files for the **DFHWSATR** and **DFHWSATP** pipelines may need to be changed if they have not been installed in the default locations
  - Copy the contents of group DFHWSAT to another group
  - Change the CONFIGFILE attribute in the PIPELINE resources

- Update service provider pipeline for (optional) invocation of **DFHWSATH** header processing program whenever the SOAP message contains a CoordinationContext header

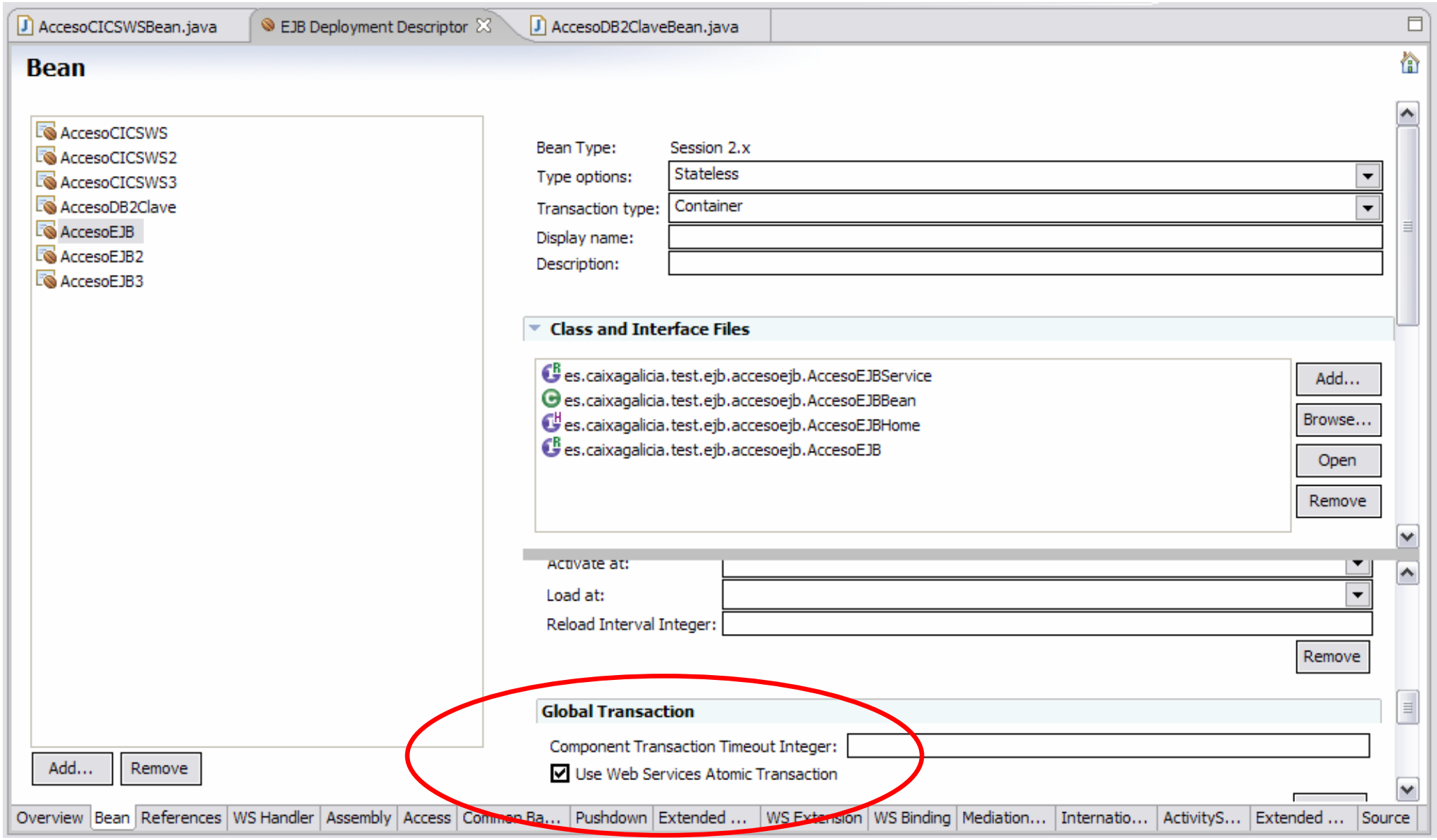
Service provider pipeline config file

```
<service>
  <terminal_handler>
    <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>
  </terminal_handler>
</service>
<apphandler>DFHPITP</apphandler>
<service_parameter_list>
  <registration_service_endpoint>
  http://129.35.161.66:13301/cicswsat/RegistrationService
  </registration_service_endpoint>
</service_parameter_list>
```

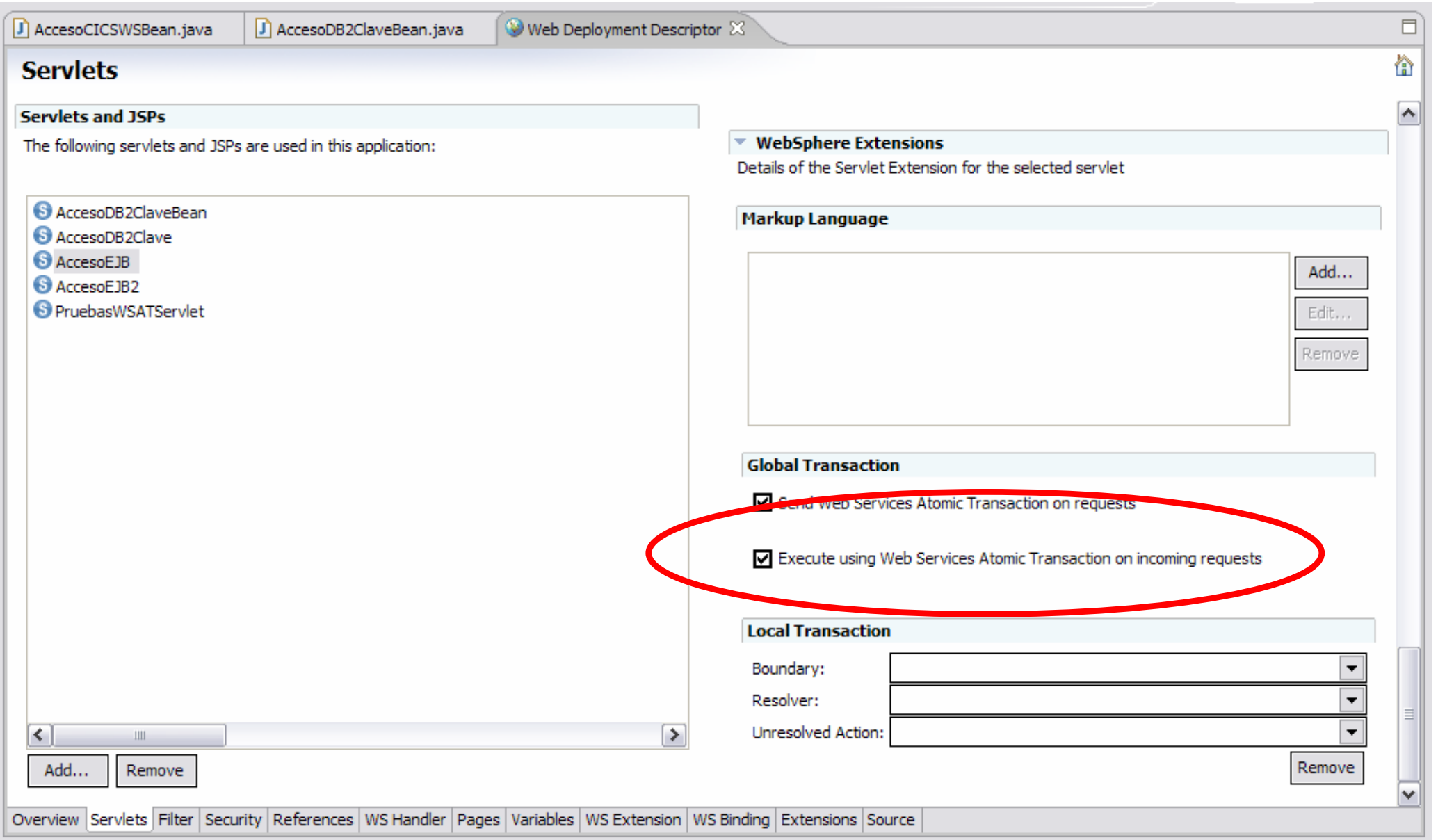
Configuring WAS for WS-AT

- In a Web module that invokes a Web service, specify ***Send Web Services Atomic Transaction Context*** *on outbound requests*
- In a Web module that implements a Web service, specify ***Execute using Web Services Atomic Transaction*** *on incoming requests*
- In an EJB module that invokes a Web service, specify ***Use Web Services Atomic Transaction*** to propagate the EJB transaction to the target Web service
- In an EJB module, bean methods must be specified with transaction type **Required**, which is the default, to participate in a global atomic transaction

WAS app deploy descriptor for service requester

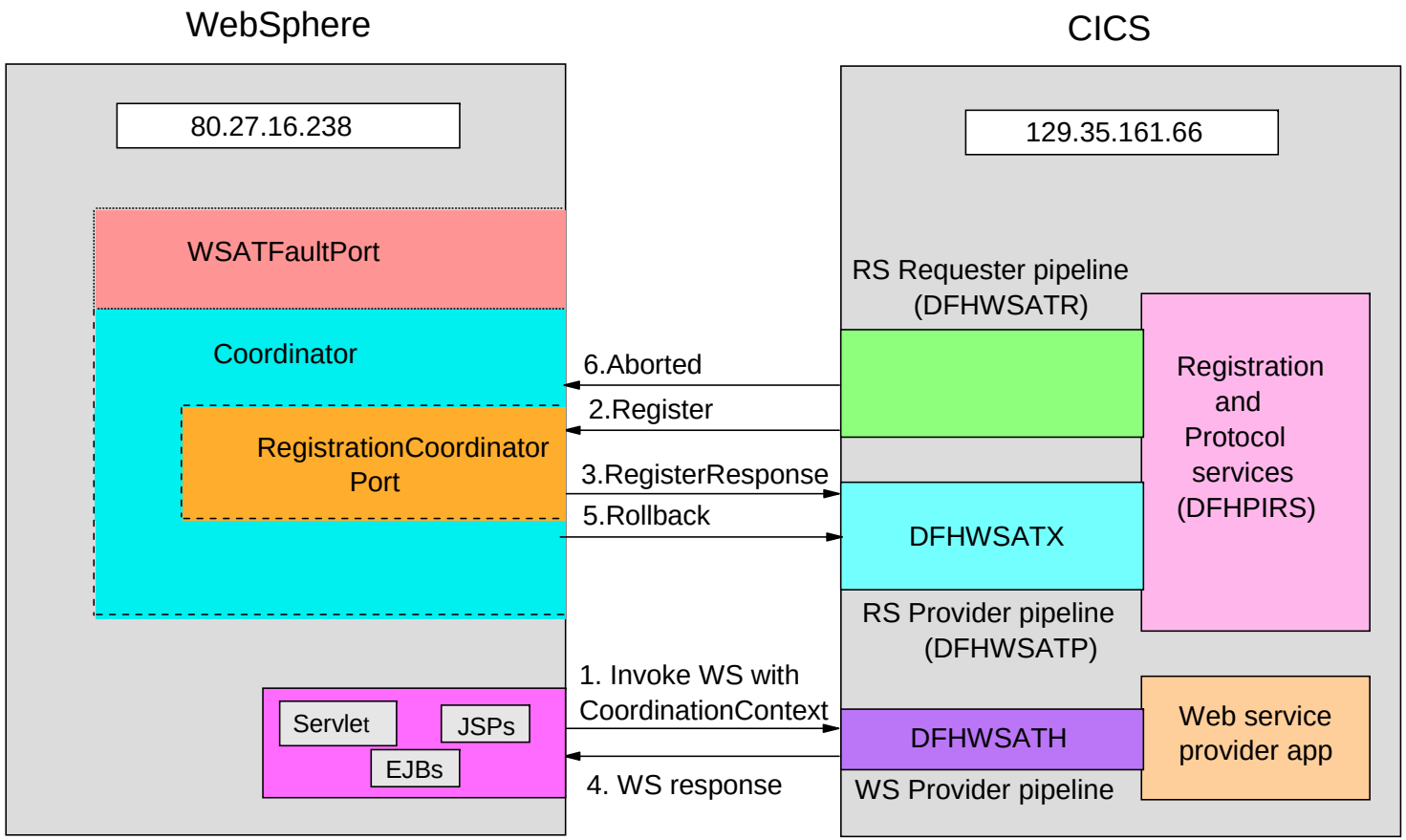


WAS app deploy descriptor for service provider

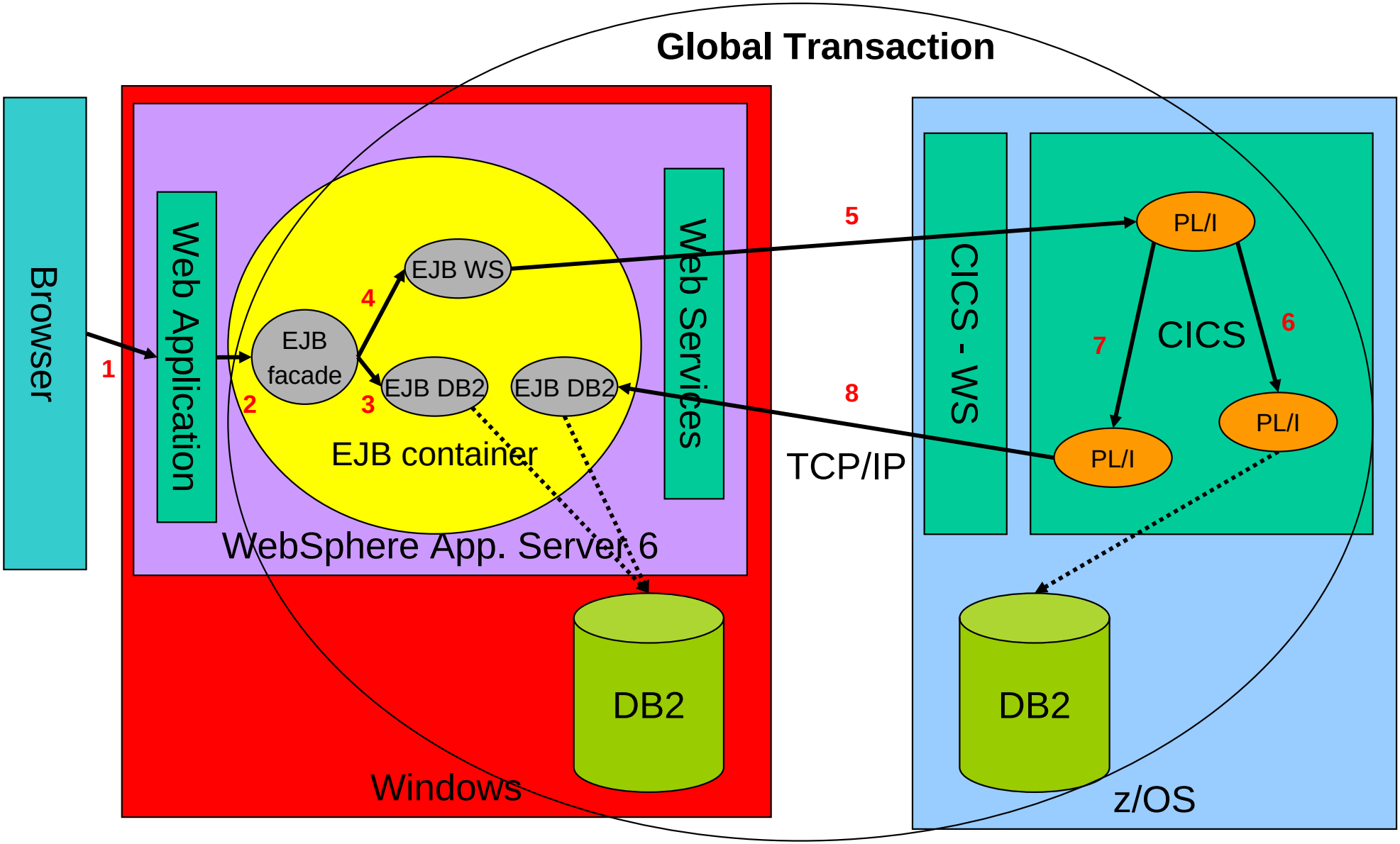


WS-AT protocol between servers: Rollback

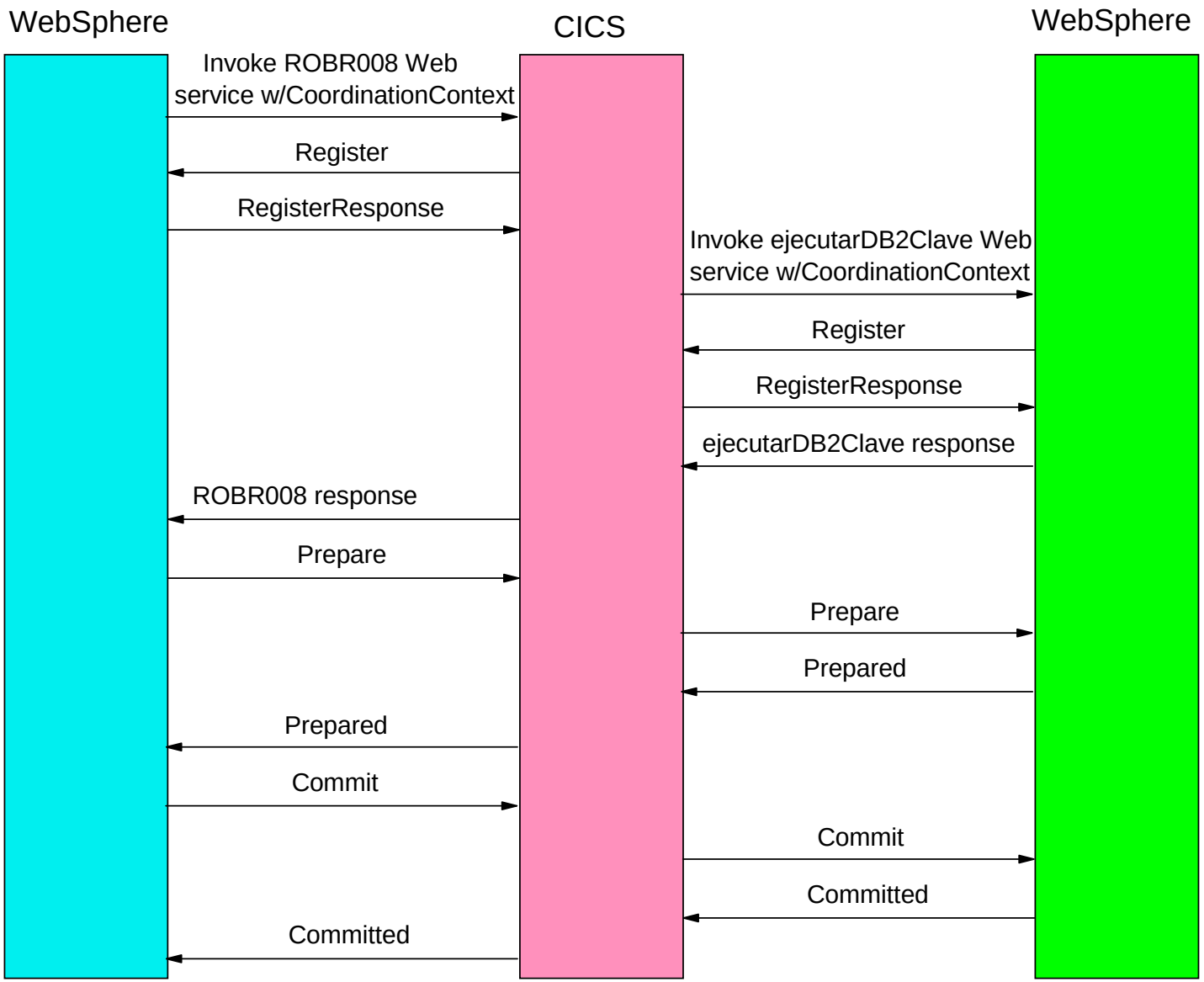
1. Invoke
2. Register
3. RegisterResponse
4. Response
5. Rollback
6. Aborted



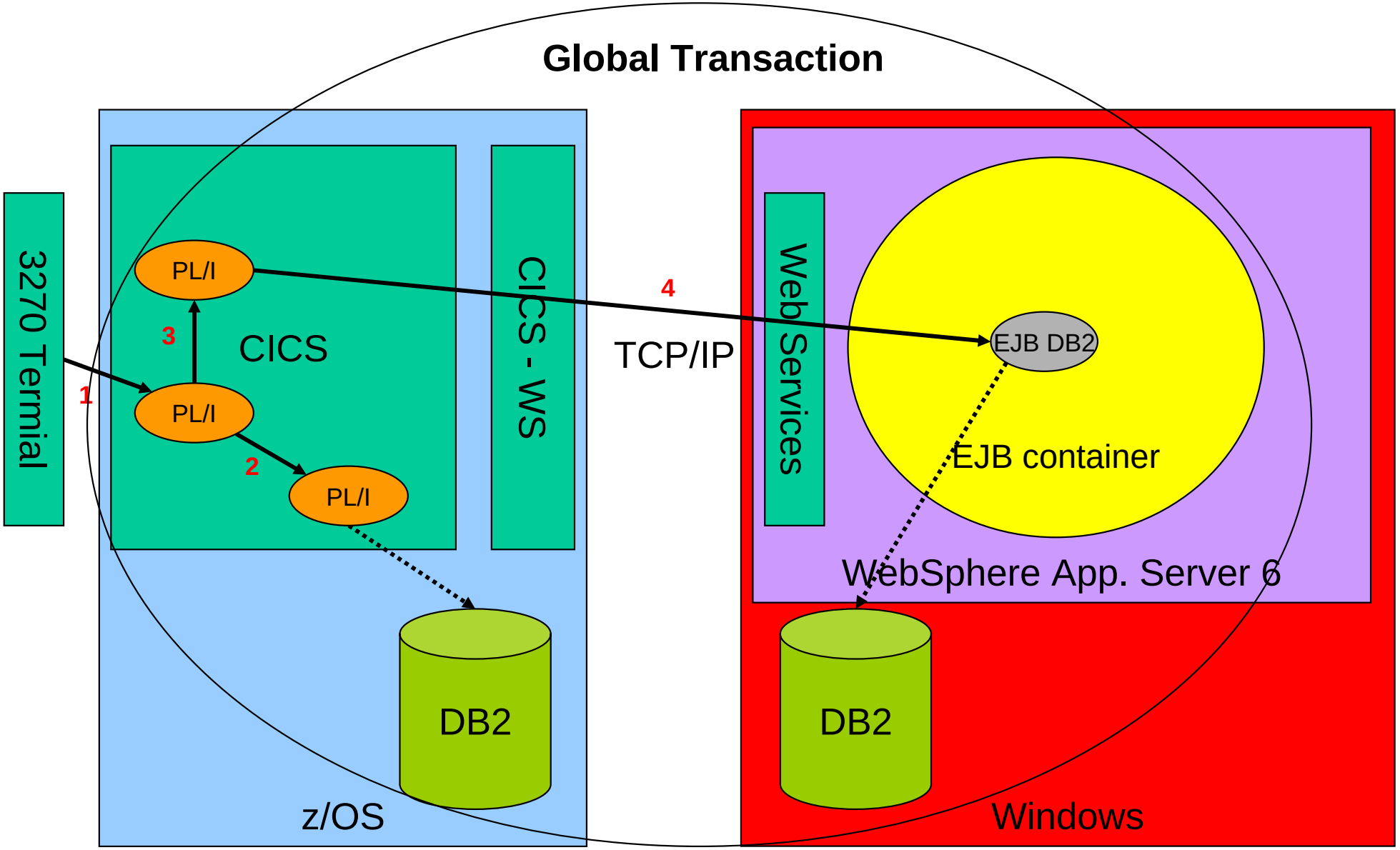
Scenario 2: WAS - CICS - WAS



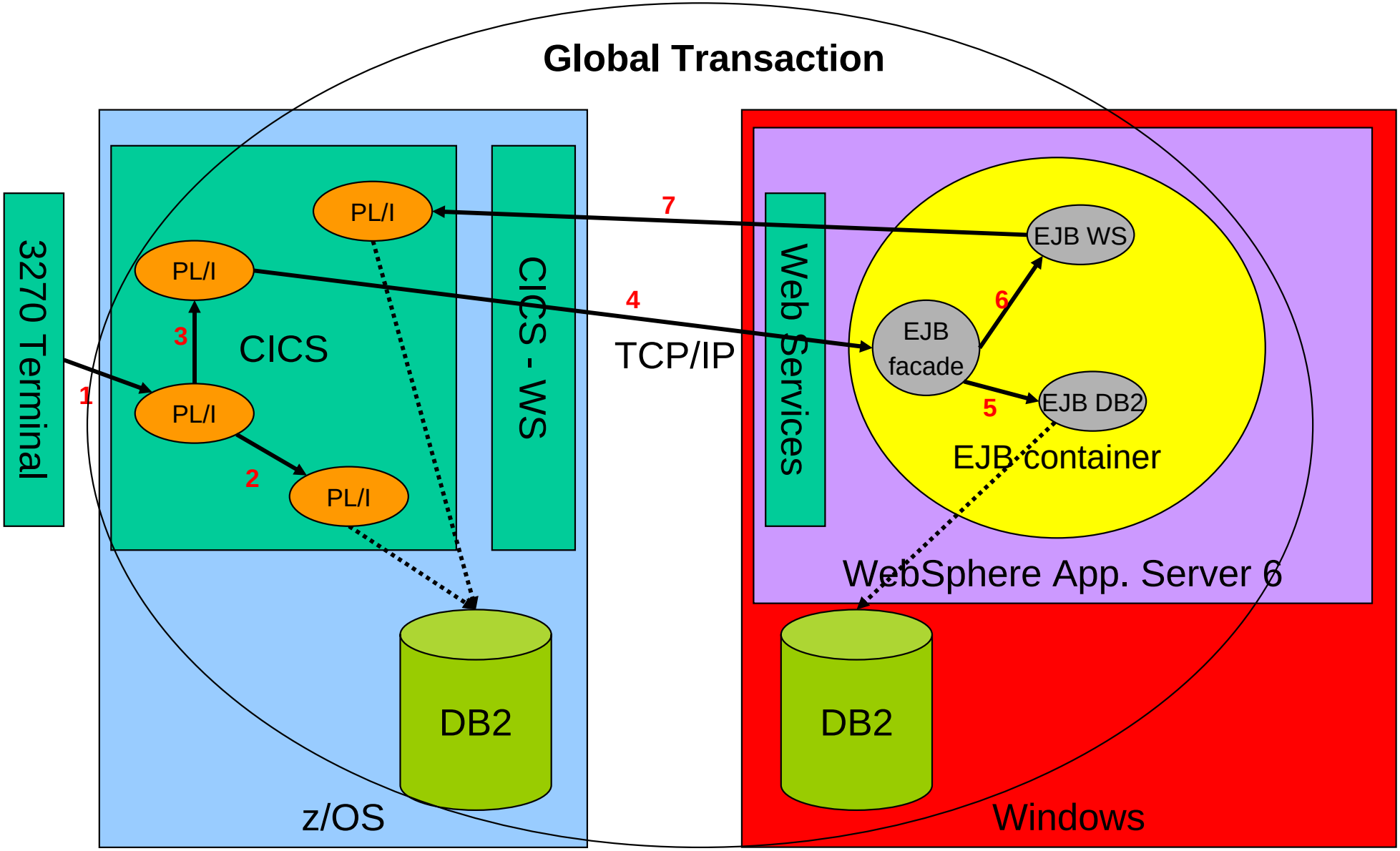
Scenario 2 flows



Scenario 3: CICS - WAS



Scenario 4: CICS - WAS - CICS



Lessons learnt

- Useful detailed scenarios in Redbook ‘Implementing CICS Web Services’
  http://www.redbooks.ibm.com/abstracts/sg247206.html?Open
- Recommend to use latest maintenance levels of CICS and WAS
- In WAS V6.1 improved support for WS-AT (e.g you can define the coordinator endpoint, in WAS V6 system IP of WAS is used)
- Use of a network sniffer (e.g TCP/IP monitor) to monitor the SOAP messages
- Web services support in CICS TS 3.1 easier to use than expected
- WS-AT is supported in IBM GA products, not betas

Conclusions

- WS-AT is a two-phase-commit protocol for short life transactions
- WS-AT should only be considered for transactions inside the company
- Inter-enterprise transactions typically require a looser semantic than 2PC
- PoC results confirm that 2PC is possible between WAS and CICS bi-directionally
- If single direction only is required first consideration should be CICS TG (V6.1 and V7)

Further Information

ITSO Redbooks

- “Implementing CICS Web Services” (SG24-7206-**2**)
- “Web Services Handbook for WebSphere Application Server 6.1” (SG247257)

Information Centers

- CICS

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

- WebSphere

http://publib.boulder.ibm.com/infocenter/wasinfo/v6r1/index.jsp

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and
Answers

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