E22

Connecting to IMS using XML, SOAP and Web Services

Shyh-Mei F. Ho

IMS e-business Design and Development
SVL, San Jose, IBM
shyhmei@us.ibm.com

IMS Technical Conference

**St. Louis, MO**   **Sept. 30 - Oct. 3, 2002**

Agenda

- **IMS XML and Web Services Objectives**
- **XML and Web Services overview**
- **Common Application Metamodel (CAM) and business integration challenge**
- **Technology demonstration using CAM**
- **CAM and IBM enterprise tooling**
- **IMS XML and Web Services solutions**
- **IMS MFS XML and Web Services**
- **Summary**

IMS XML and Web Services Objectives

- **Provide Web enablement and Web services support to IMS transactions, including traditional MFS transactions**
  - ► XML is growing in acceptance as universal data format of the choice
  - ► Web services are the next evolution for e-business. A Web service can be described, published, located and invoked over network
- **Insulate business from further evolving technology and facilitate reuse of IMS transactions in the new B2B environment without changing the existing IMS applications**
  - ► Meet B2B challenge to provide a standard interface between dissimilar systems
- **Provide integrated tool solutions to enable Internet access to existing IMS transaction programs**

XML Technology Overview
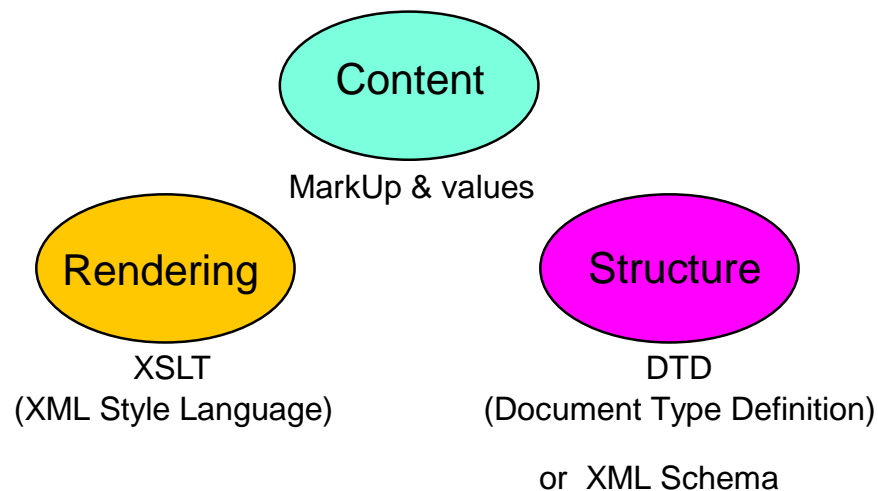
Traditional data description

Content   Structure

Document
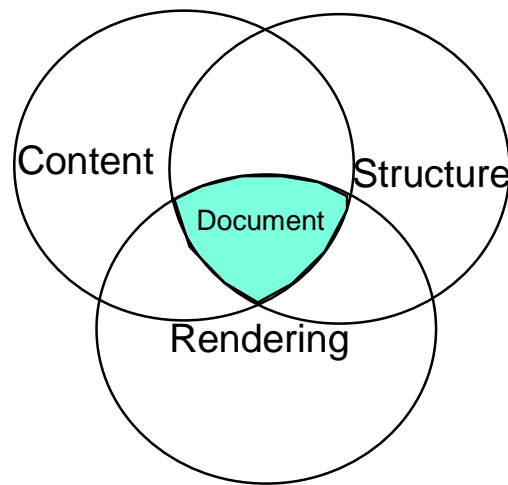
Rendering

Problem :

- message structure
- message validity
- rendering method
- content coupling

depend on implementation

} ✗ **meaning difficult to extract**

XML data description

Content

MarkUp & values

Rendering

XSLT
(XML Style Language)

Structure

DTD
(Document Type Definition)

or XML Schema

}
✓ **self describing**
✓ **validation of form**
✓ **multiple renderings**
✓ **open standard vocabularies**
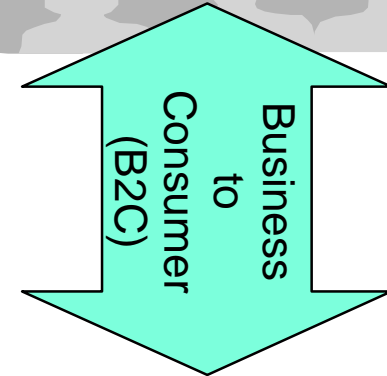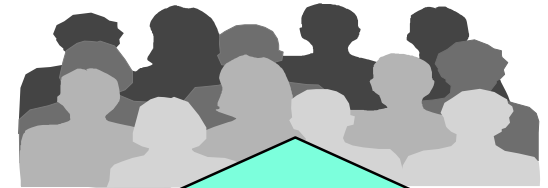✓ **Internet enabled**

IBM®

The XML Opportunity

"Business-to-business e-commerce is expected to grow rapidly, at five to ten times the rate of business-to-consumer e-commerce"
 IBM's Corporate Strategy Global Market Trends (GMT), 1998

Business to Consumer (B2C)

Business to Business (B2B)
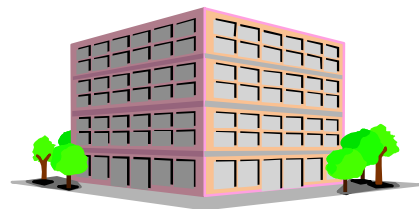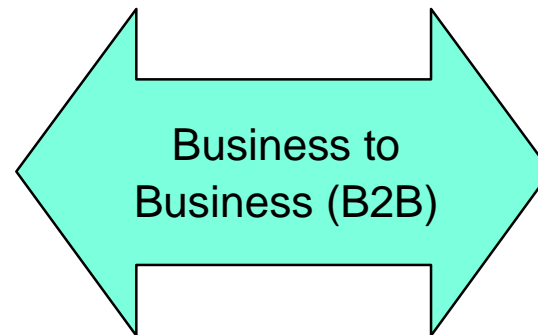
Buyer

Seller

XML B2C = request-at-a-time electronic commerce
  programmed rendering & simple seller side processing
XML B2B = fully automated electronic commerce (EDI)
  programmed buyer-side server & seller side processing

IBM®

Web Services

- **Web Services are the next step in the evolution of the WWW and allow programmable elements to be placed on web sites where other can access in distributed behaviors**
  - A provider of information or capabilities exposed on a network through a consistent set of interfaces and protocols
  - support heterogeneous environment seamlessly
- **Connect applications to applications in other businesses quickly and easily**
  - Focus on automation of development and deployment
- **Establish interaction with marketplaces more efficiently**
- **Deliver business functions to a broader set of customers and partners**
- **Pursue new business models by combining applications in new dynamic ways**

Web Services - Base Technologies

- **XML - Universal data format**
- **SOAP - Simple Object Access Protocol**
  - ► an XML protocol to invoke a method on a server to execute a requested operation and get a response in XML
  - ► request message is sent by service requestor
  - ► response message is sent by service provider
- **UDDI - Universal Description, Discovery, Integration**
  - ► UDDI servers act as a directory of available services and service providers
  - ► SOAP can be used to query UDDI for services
- **WSDL - Web Services Description Language**
  - ► an XML vocabulary to describe service interface
  - ► operational information about the service
    - – service interface
    - – implementation details
    - – access protocol
    - – contact endpoints

Web Service Components

■ **Service Provider**

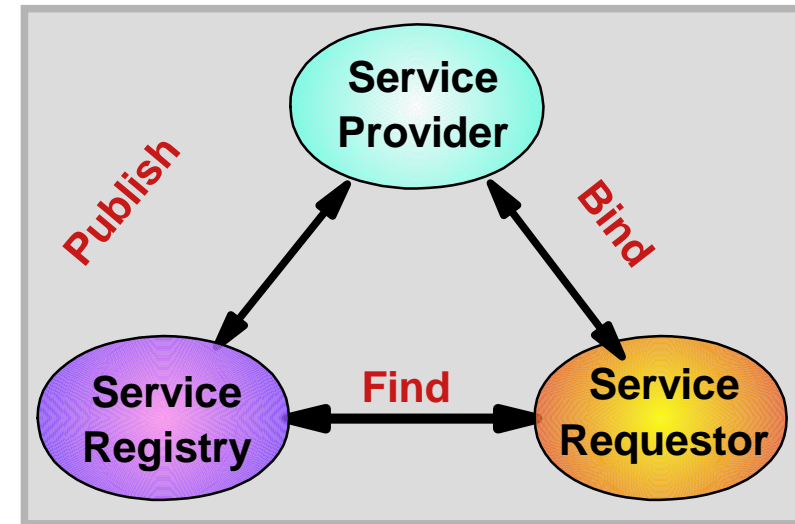 ► provides e-business services

  ► uses WSDL to describe a service

  ► **PUBLISHES** availability of these services through a UDDI registry

■ **Service Registry**

  ► provides support for publishing and locating services

  ► like telephone yellow pages

■ **Service Requestor**

  ► **FINDS** required services via the Service Registry

  ► **BINDS** (invokes) to services via Service Provider

Business Integration Challenge

- **The Challenge**
  - Simplify access to existing backend systems
  - Seamlessly integrate distinct enterprises
- **IBM's Innovative Solution**
  - Common Application Metamodel (CAM) defines a metadata interchange for accessing enterprise applications
    - CAM allows to develop tools that analyze existing enterprise applications and describe applications as metadata in a format that can be exchanged among tools
  - CAM simplifies business integration for invoking and translating application information
    - facilitates data translations from one language and platform domain into another
  - CM enables Web services (WSDL) for enterprise applications
  - CAM is OMG (Object Mangement Group) markeplace standards for EAI (Enterprise Application Integration)

CAM: A Collection of Metamodels
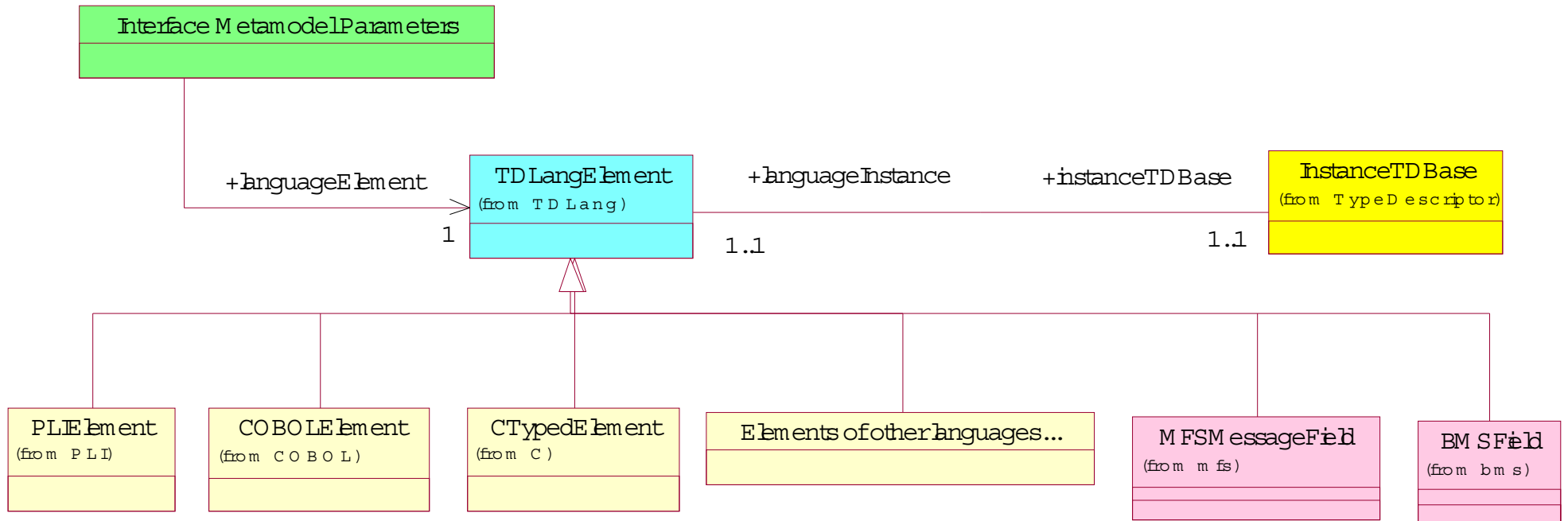
- **Language metamodels:** C, C++, Java, COBOL, PL/I, and HL Assembler models
- **Physical representation metamodels:** TDLang and Type Descriptor models
- **Enterprise application metamodels:** IMS transaction messages, 3270 formats (i.e. IMS MFS and CICS BMS models)

CAM and Tools Development

Copybooks (e.g. COBOL source files)

IMS Applications
CICS Applications
...

Importers: COBOL, C, PL/I, and MFS, etc.

Importer Framework

CAM Models

generate

XMI Instance File

Adapter

WSDLs

HTML forms

JSPs
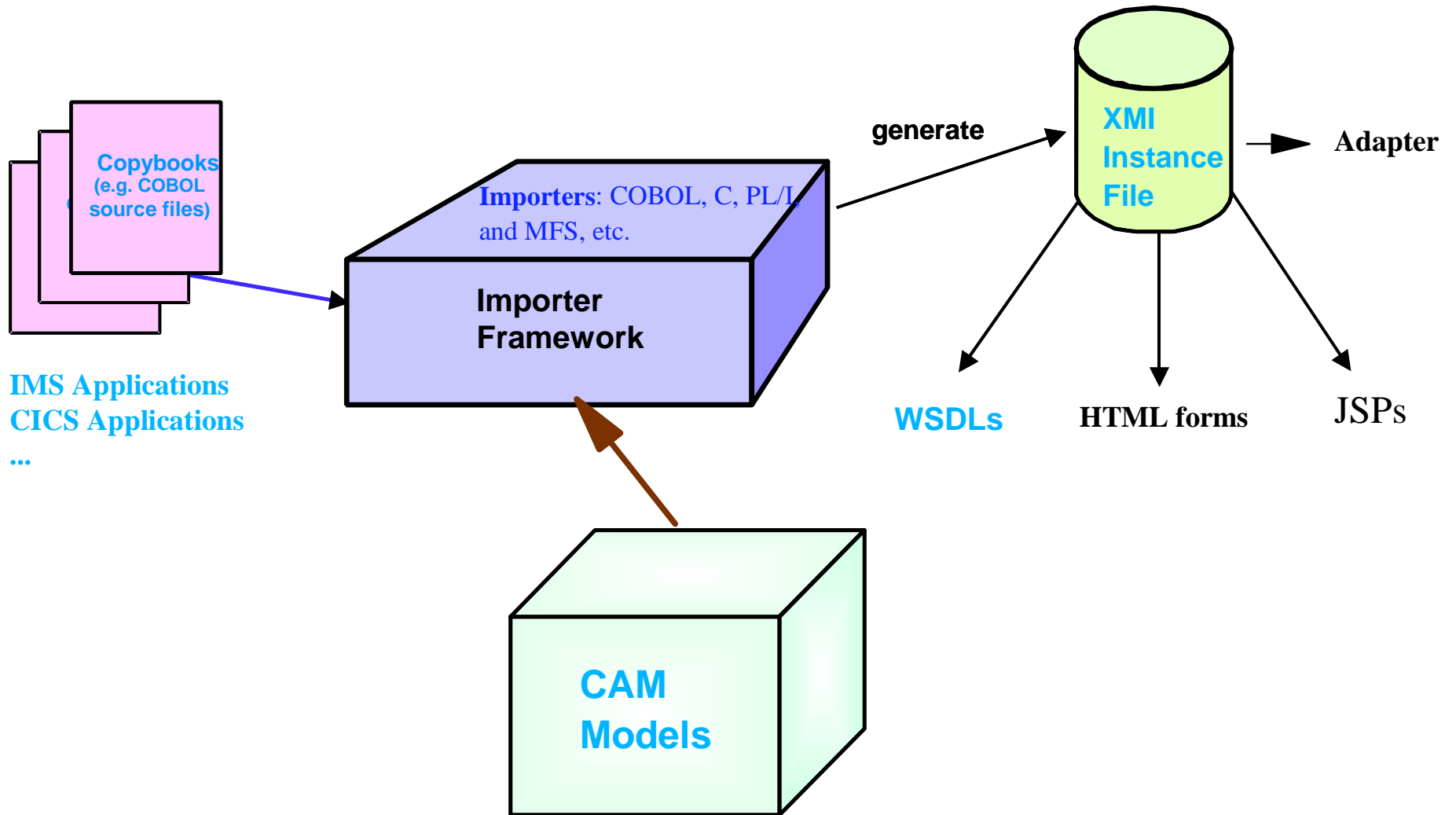
Technology Demonstration Using CAM

IMS MFS XML and Web Services Demo

CAM and IBM Enterprise Tooling

- **CAM is a standards based technology that has already been adopted in the parts of IBM WebSphere Studio Tools to enable enterprise connectivity and Web services**
  - ► Underpinning for connectors and adapter tools that perform transformations and connections
  - ► Based on CAM, IBM is building the next generation WebSphere Studio tool suite for B2B applications
    - – WebSphere Studio Application Developer Integration Edition (WSAD-IE)
    - – WebSphere Studio Enterprise Developer (WSED)
    - – etc. (more to come...)
  - ► IMS Java tool (DLIModel Utility) is also based on CAM

WebSphere Stuido Tooling Patform

WebSphere Studio Enterprise Developer (WSED)

Application Developer Integration Edition (WSAD-IE)

Application Developer (WSAD)

Site Developer

- Web Developer
  - Create Web Content
  - HTML/JSP/Graphics
  - Servlets
  - Web Services

- Basic J2EE Developer
  - Create Web Content
  - EJBs

- Advanced J2EE Developer
  - Integrate existing EIS applications into J2EE Applications
  - CICS, IMS, HOD, J2C, etc

- Enterprise Developer
  - IDE for zOS appl
  - Create new EIS applications
  - XML Converter
  - etc.

WebSphere Stuido Platform
* IBM's commercially supported version of Eclipse Workbench

Eclipse Workbench

WSAD-IE: Converge of Tools and Technology

- **The marriage of J2EE Connectors & Web Services**
- **Services-Oriented Architecture for accessing Enterprise Information Systems (EIS), including IMS**
- **Deliverables**
  - WSAD-IE 4.1: GA (03/02)
  - WSAD-IE 5.0

Enterprise Access Builder
- VisualAge for Java

WSAD IE

J2EE, Web Services, JCA, XML, WSDL, etc.

WebSphere Studio
Application Developer
(WSAD)
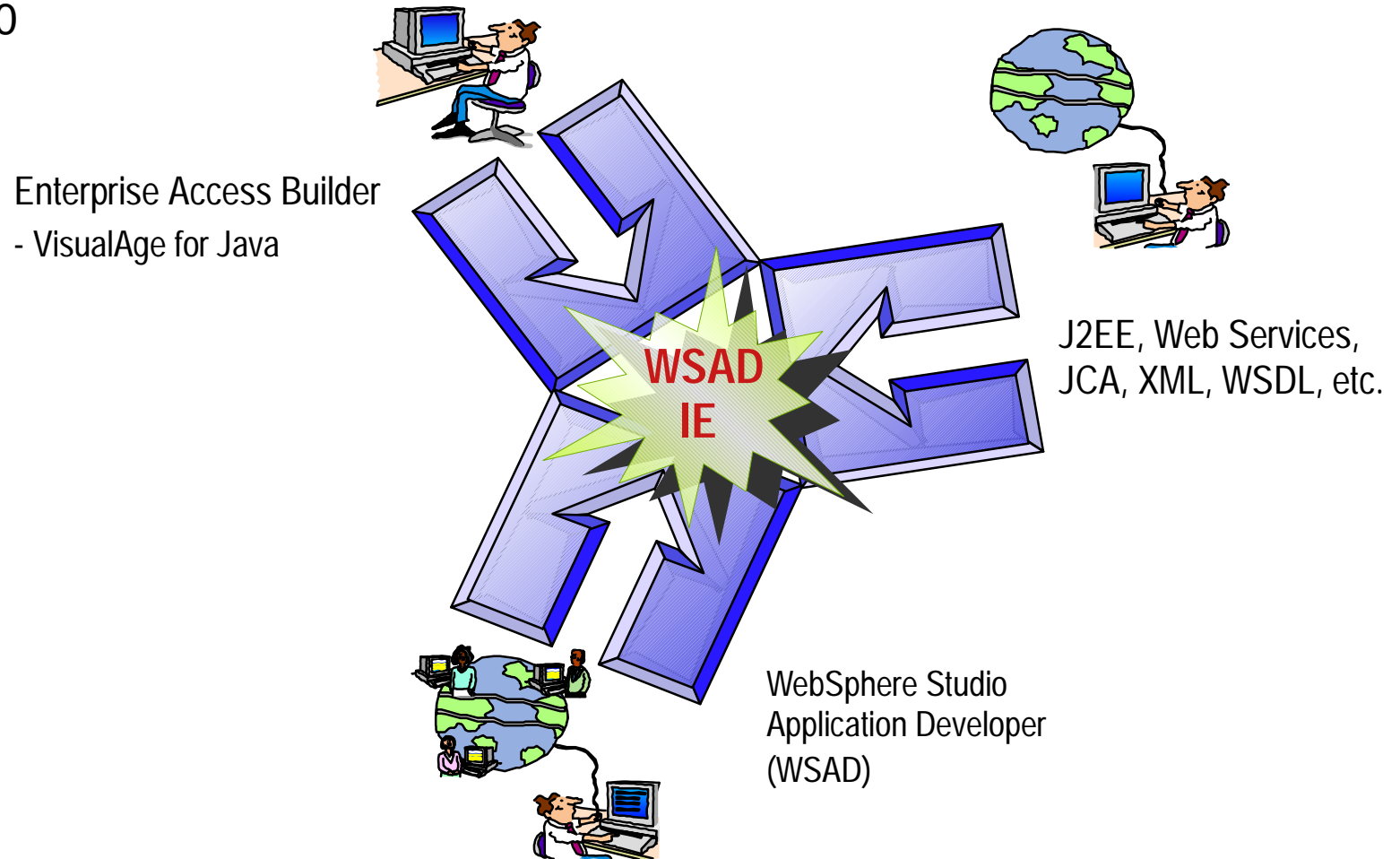
WSAD-IE: Key Features

- **Enterprise Services - more than just Web Services**
  - ▶ Create services from application artifacts such as adapters, Enterprise JavaBeans™ components, Flows or JavaBeans™ components
  - ▶ Importers - read and parse copybooks to generate WSDLs
  - ▶ Adapters (i.e. format handlers) - data transformation
- **JCA (J2EE Connector Architecture) Tool Plugin**
  - ▶ Connector architecture extension to make resource adapters plugable into tool environments
  - ▶ IMS Resource Adapter (i.e. IMS Connector for Java) is one of the JCA implementations
- **Service Flow Editor**
  - ▶ Visual composition tool that allows you to compose a Flow service out of one or more other services
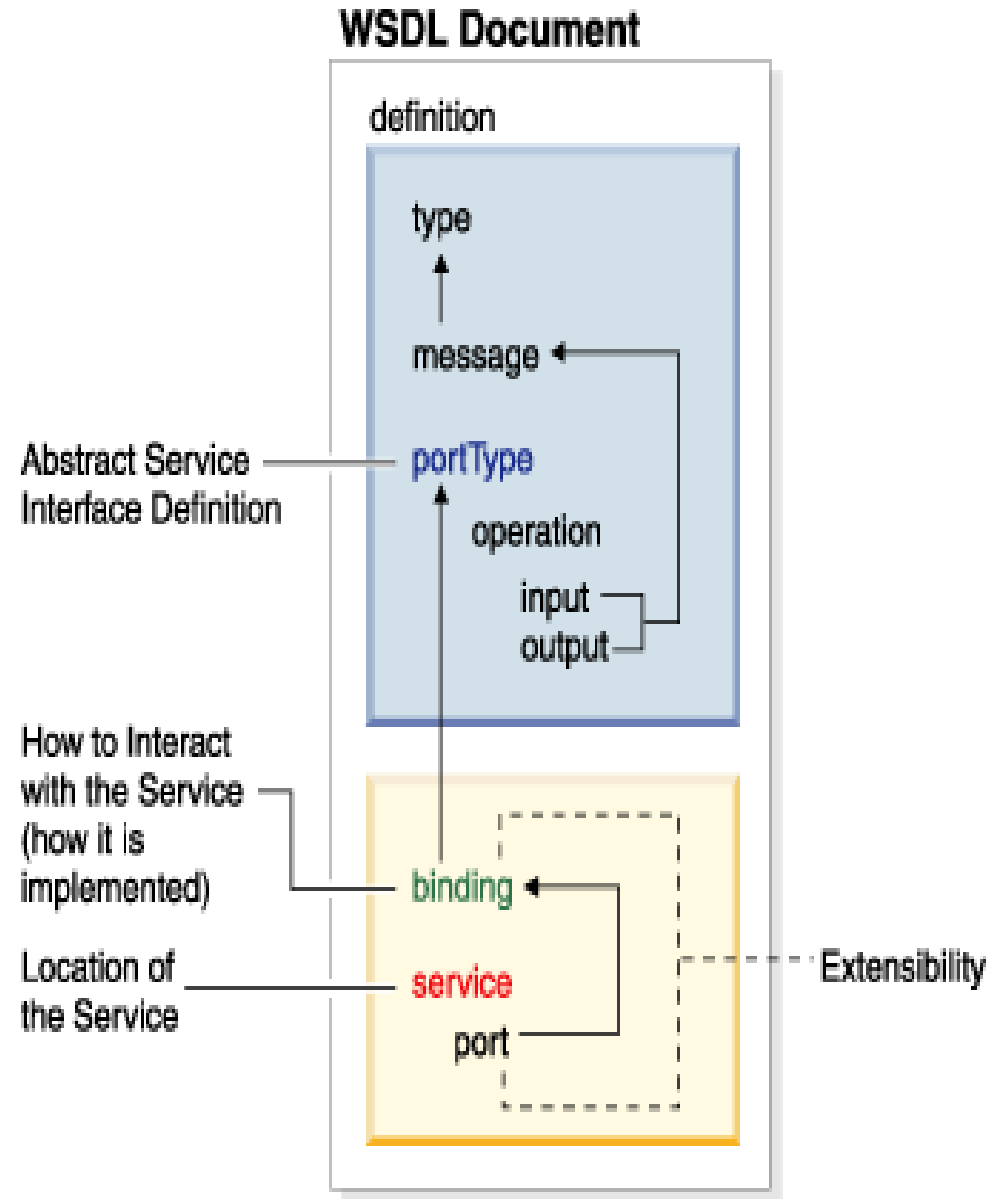
WSAD-IE and WSDL

- **Services are described by means of WSDL documents**

1. **Interface definition file**
   - portTypes consist of one or mor operations with input and output
   - input and output are described by messages
   - service messages are typed using XML Schema

2. **Implementation file**
   - binding is the implementation of the service
     - imports the service interface file
     - uses CAM to describe physical memory layout
   - service consists of port for service location

WSDL Document

definition

type

message

Abstract Service Interface Definition — portType

operation

input
output

How to Interact with the Service (how it is implemented) — binding
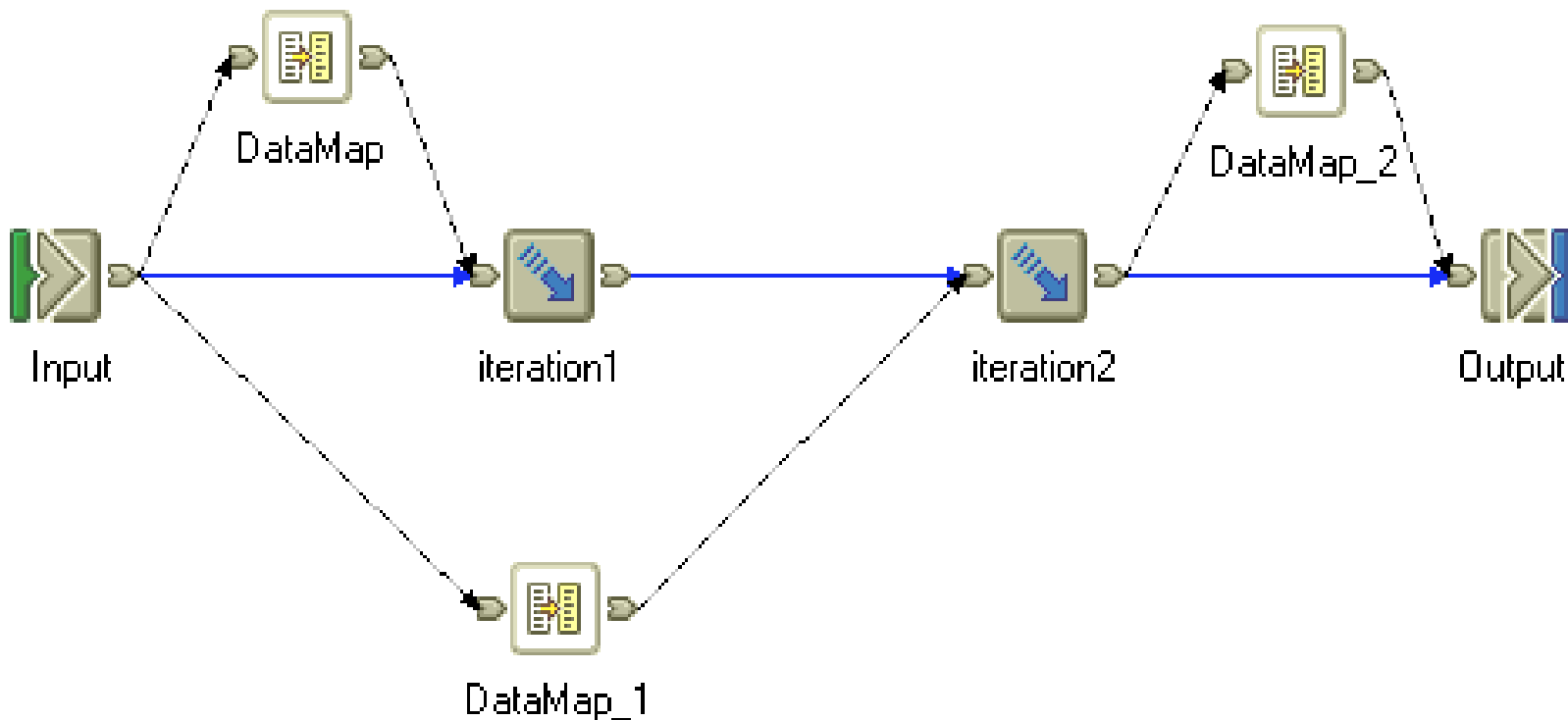
Location of the Service — service

port

Extensibility

What is a Service Flow?

- Flows are a specific form of service implementation
- A Service flow is a service composed of multiple services
- *Flow models* - dictate the flow of information and control between and within services
- *Microflows* - short-lived operations composed of business operations that occur within a business service
  - ▶ non-interruptible flows
  - ▶ predefine all inputs for "simple" conversations
- *Macroflows* - long-running process flows that are composed of business services
  - ▶ dynamically input data at all iterations of the conversation
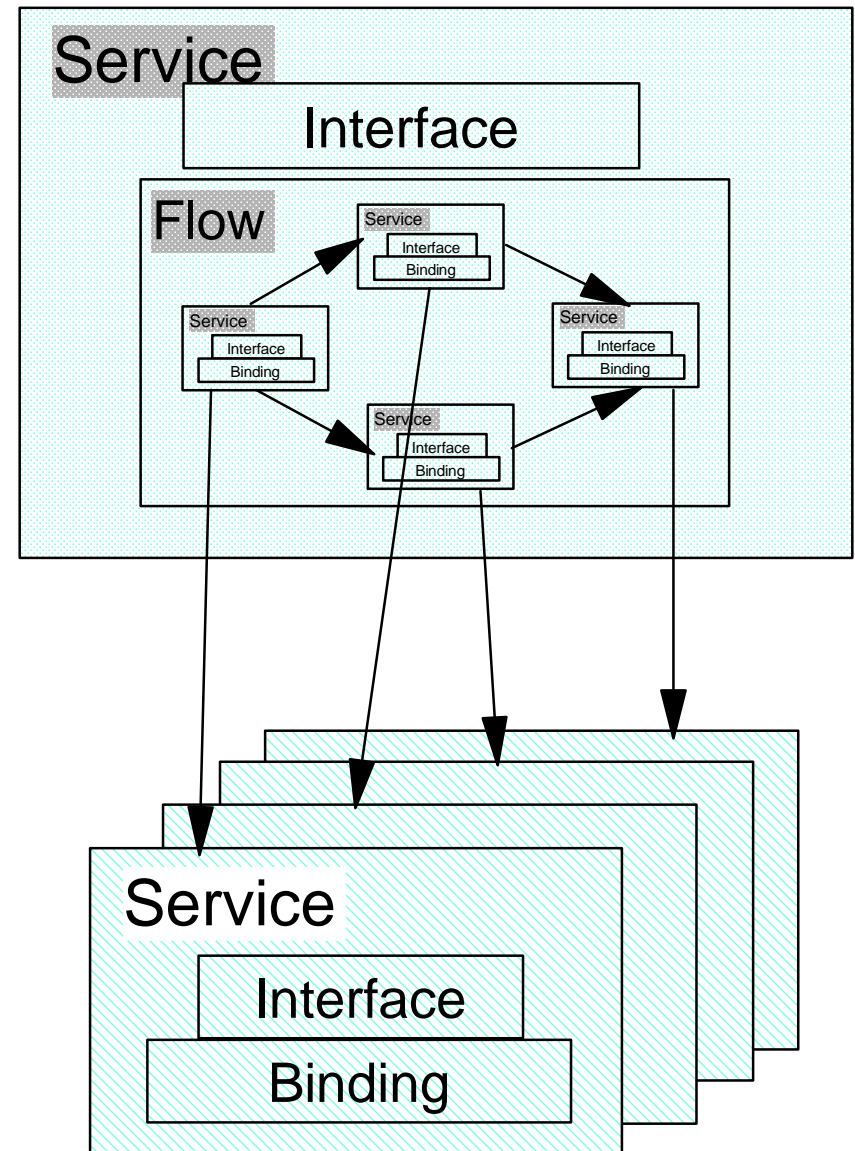
WSAD-IE 4.1 and Microflows

- A flow consists of the following nodes
  - ► service node - represents the invocation of a service operation
  - ► data map node - maps the actual data between activities
  - ► input and output nodes
- Control link - defines the sequence of execution and under which condition execution takes place
- Data link - defines the data flow between activities

WSAD-IE Macroflows (Direction)

- **No need to predefine inputs, to get user input into a flow:**
  - ► pass data on the initial invocation of the flow, or
  - ► send the flow events, or
  - ► call services which end up asking the user some information, or
  - ► define staff node on the flow
- **A flow consists of the following nodes**
  - ► input and output nodes
  - ► service node
  - ► staff node and event node
  - ► Java snippets
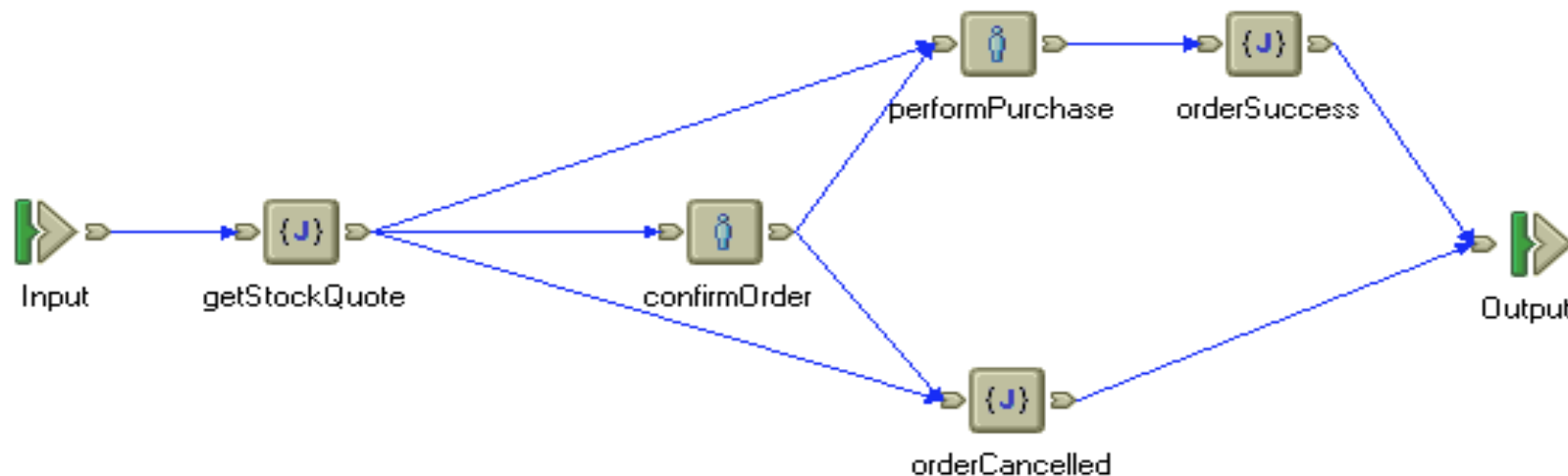
WSED and XML Converters

- **WSED is WSAD-IE plus**
  - ► IDE for zOS traditional applications
  - ► XML converter tools based on CAM models for supporting COBOL and PL/I XML
  - ► V5.0: Generated XML Converter for COBOL
    - – Inbound XML Converter
      - use XML Parse verb of the new Enterprise COBOL V3.1 compiler to parse incoming XML messages
      - convert parsed messages to COBOL byte streams
    - – Outbound XML Converter
      - convert output COBOL byte streams to XML messages
  - ► Future: XML Converter for PL/I

WSED - XML Converter

XML inbound

XML outbound

**Generated Converter
COBOL with
high-speed parser
(inbound & outbound XML)**

**Existing COBOL
application
logic**
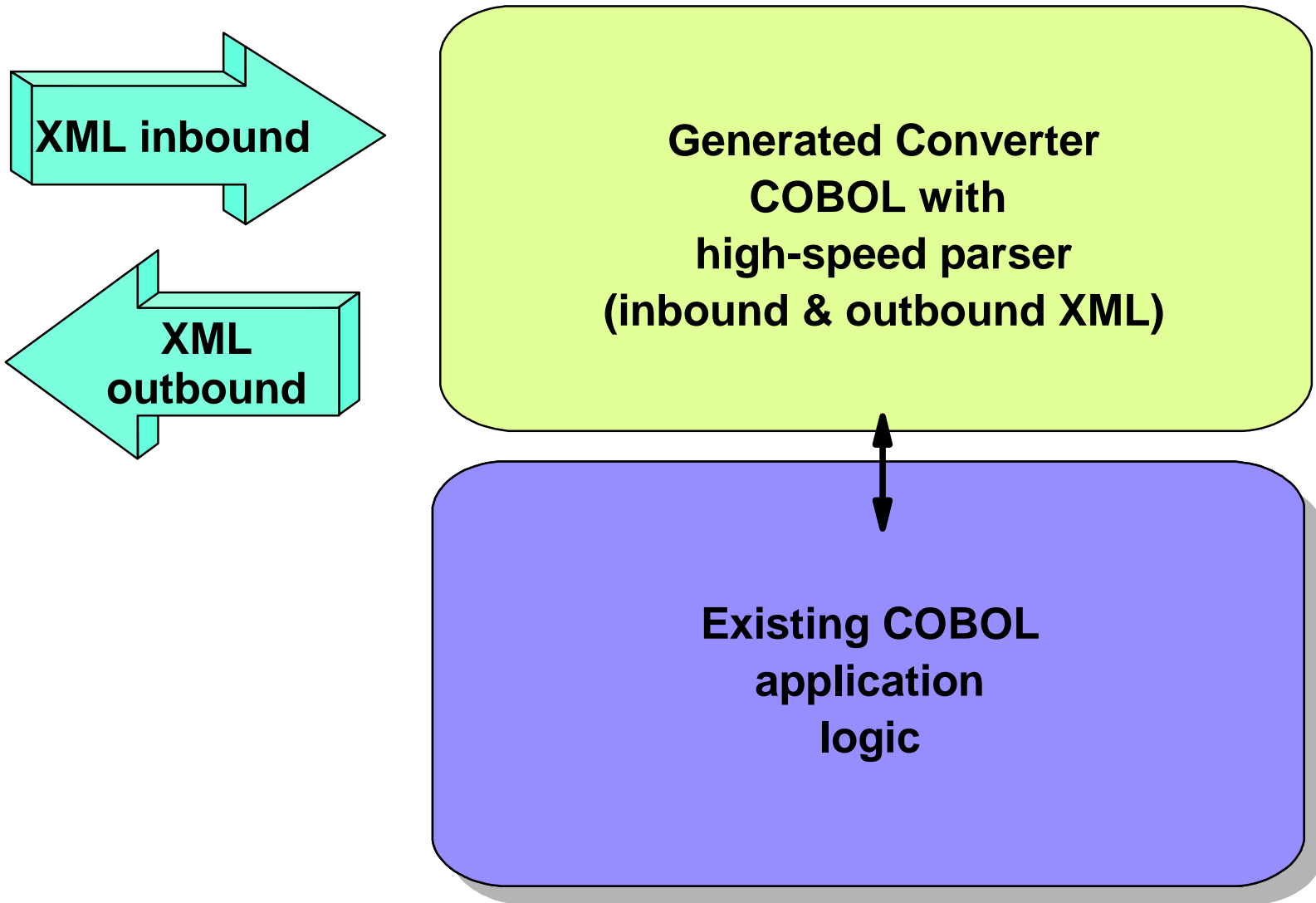
IMS XML and Web Services Solutions

IMS Resource Adapter:
IMS Connector for Java

Helping IMS Users make the transition
to e-business easier

Java Applications

Java Servlets

EJB (Enterprise JavaBeans)

SOAP XML Web Services
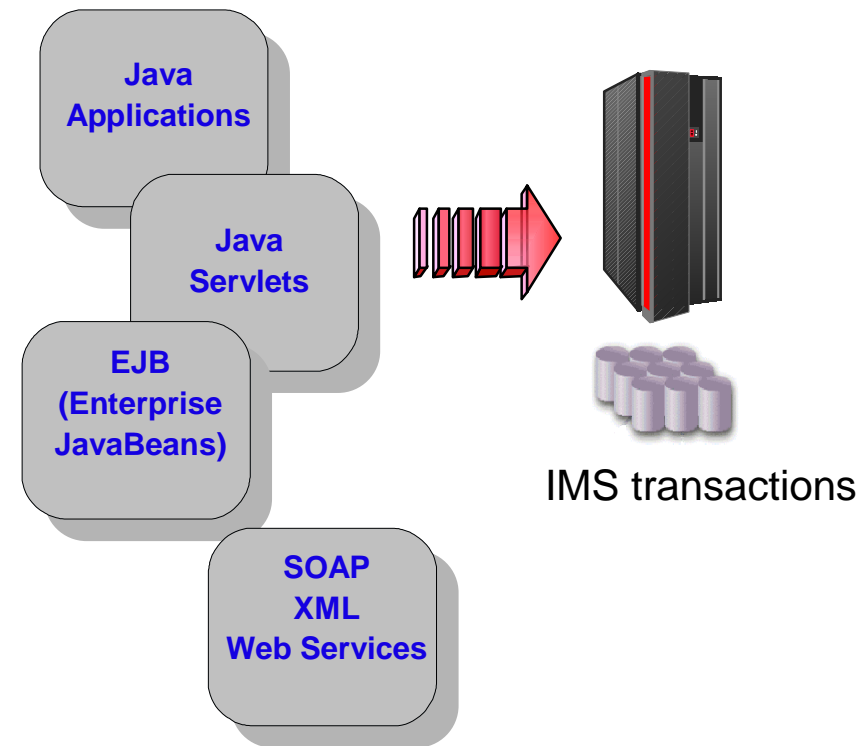
IMS transactions

- One of the IBM e-business Connectors (also called <u>WebSphere Resource Adapters</u>)
- Consists of Java components and class libraries which allows Java applications (Java servlets, Enterprise JavaBeans), or SOAP clients to submit IMS transactions via IMS Connect
- Implements J2EE Connector Architecture and IBM Common Connector Framework (CCF)

IMS Connect

- **Capability**
  - ▶ Provides High Performance **TCP/IP** or **local** access to IMS applications
  - ▶ Provides e-business access to IMS applications
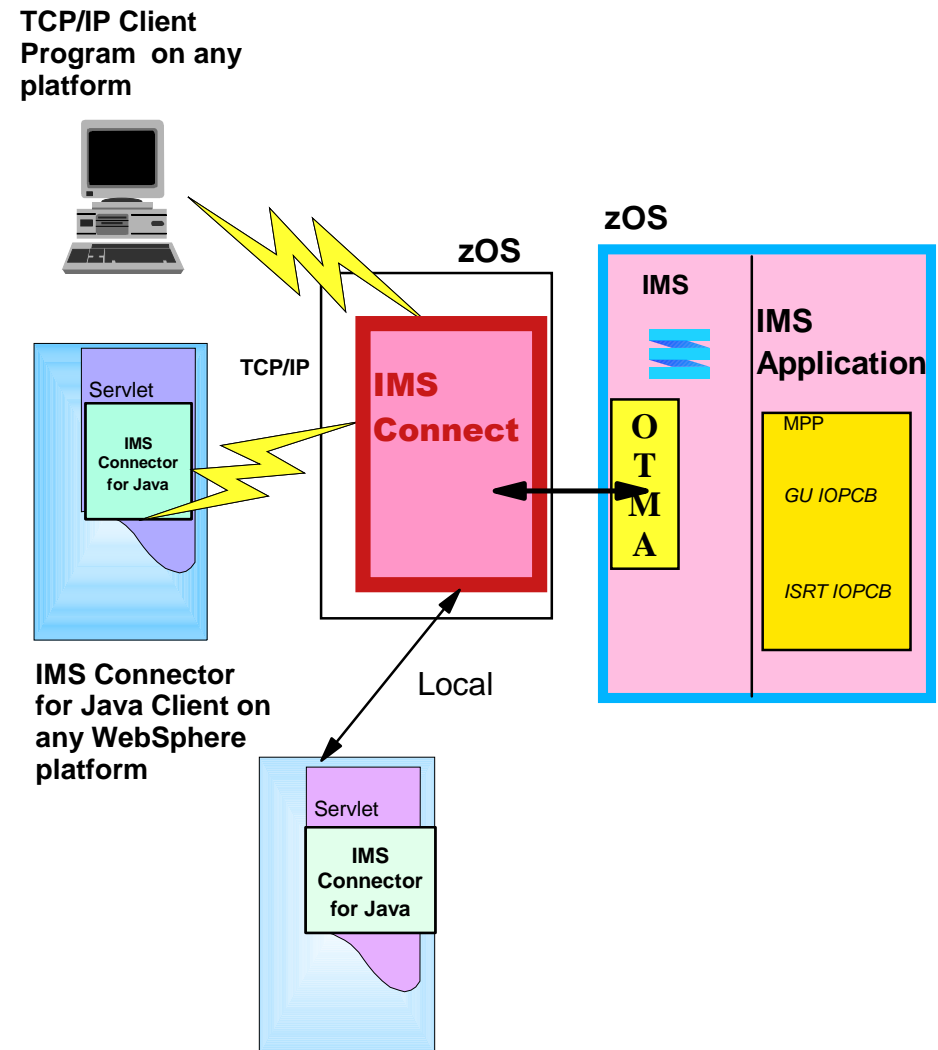 - ▶ Provides flexible communications and workload balancing
    - – through OTMA (Open Transaction Manager Access) and exits
  - ▶ Separately managed address space with command interface
- **Benefits and Value**
  - ▶ Supports TCP/IP sockets access to IMS transactions and commands
  - ▶ No requirement to modify existing IMS transactions
  - ▶ Provides a general purpose and structured interface
    - – For the IMS Connector for Java clients
    - – For user-written clients

TCP/IP Client Program on any platform

IMS Connector for Java Client on any WebSphere platform

zOS

zOS

TCP/IP

IMS Connect

IMS

Servlet

IMS Connector for Java

TCP/IP

Local

OTMA

IMS Application

MPP

GU IOPCB

ISRT IOPCB

Servlet

IMS Connector for Java

IMS Transaction and Web Services

- **Transform existing IMS applications as Web services**
- **Use WebSphere Studio Application Developer Integration Edition (WSAD-IE) to create service definitions for IMS transaction applications**
- **Deploy service definitions to WebSphere Application Server (WAS)**
- **Make IMS services available as EJB services or SOAP services**
- **IMS applications**
  - ► IMS COBOL and C applications (WSAD-IE 4.1/WASEE 4.1)
  - ► IMS MFS-based applications (direction)
  - ► IMS PL/I applications (direction)

IMS XML Enablement using WSAD-IE

UDDI

UDDI may be consulted to dsicover the service at application build or runtime.

WSDL file describing this service is registered in UDDI prior to discovering and invoking the Service.

WSDL

Web Service Request

WebApp Server

IMS Resource Adapter

Schema conforming XML

ServiceProxy

Schema conforming XML

XML Inbound

E.g. SOAP via HTTP

XML Outbound

"XML/SOAP" pass-thru Servlet

TCP/IP

IMS Connect

zOS

IMS

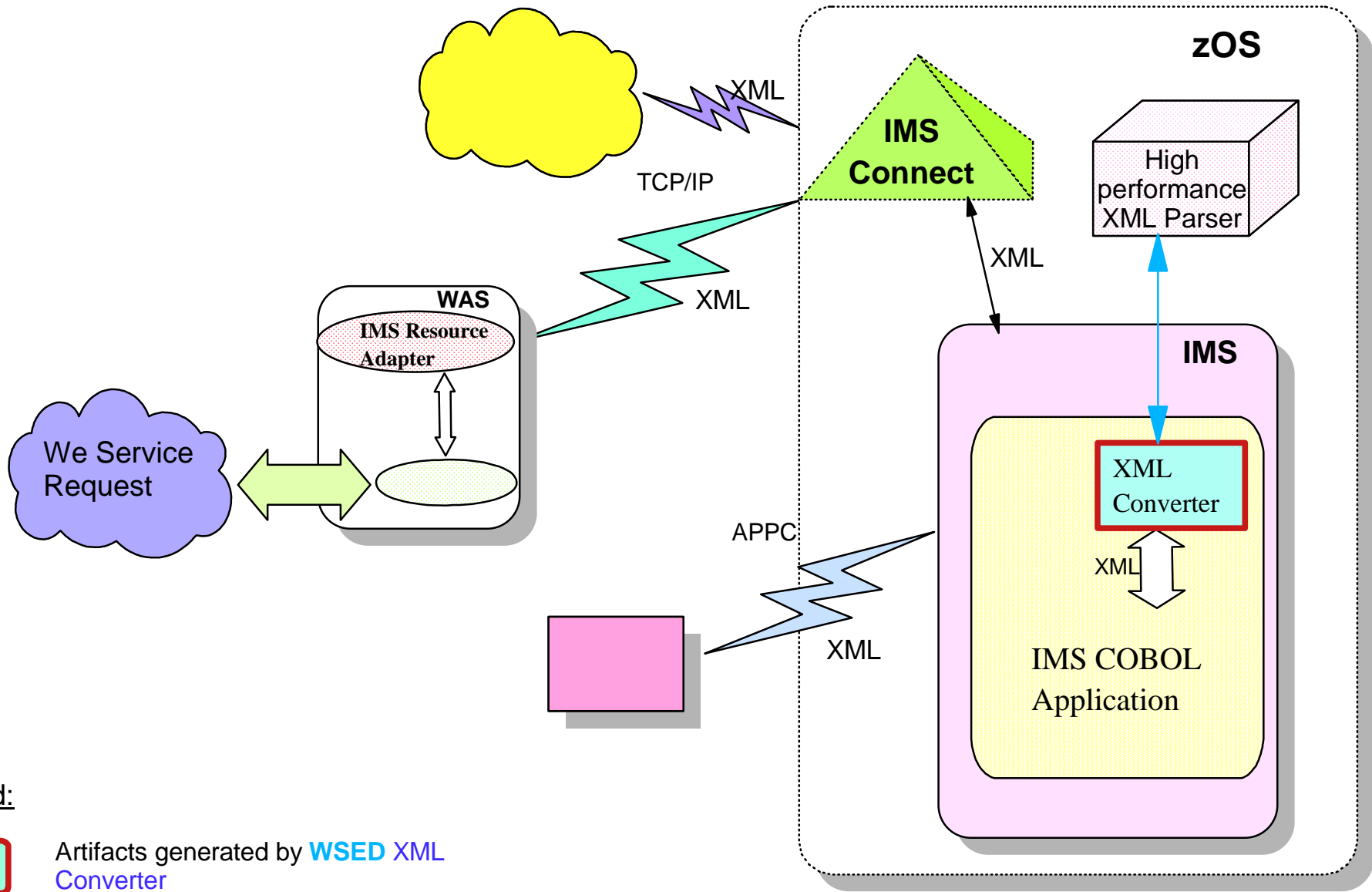IMS Trans. Application

Legend:

Artifacts generated/provided by WSAD-IE

IMS Transaction and XML

- **Send and receive XML documents to and from IMS transaction applications - Processing XML documents inside IMS applications**
  - ► Transaction code must be EBCDIC
  - ► New IMS Java applications
    - – use XML Toolkit for OS/390
  - ► New or modified IMS COBOL and PL/I applications
    - – use XML parsers for COBOL and PL/I
    - – parse incoming XML documents
    - – XML generation for both input and output messages
      - • XML Converter for COBOL (WSED 5.0)
      - • XML Converter for PL/I (direction)
- **Bridge XML and existing IMS applications**
  - ► Use MQSeries Integrator or WMQI V2.2
    - – existing IMS COBOL and C applications
  - ► Use WebSphere Application Server
    - – existing IMS COBOL and C applications (WSAD-IE/WASEE 4.1)
    - – existing MFS-based IMS applications (direction)
    - – existing IMS PL/I applications (direction)

IMS XML Enablement using WSED

zOS

XML

TCP/IP

IMS Connect

XML

High performance XML Parser

WAS

IMS Resource Adapter

XML

XML

IMS

We Service Request

XML Converter

XML

APPC

XML

IMS COBOL Application

Legend:

Artifacts generated by **WSED** XML Converter
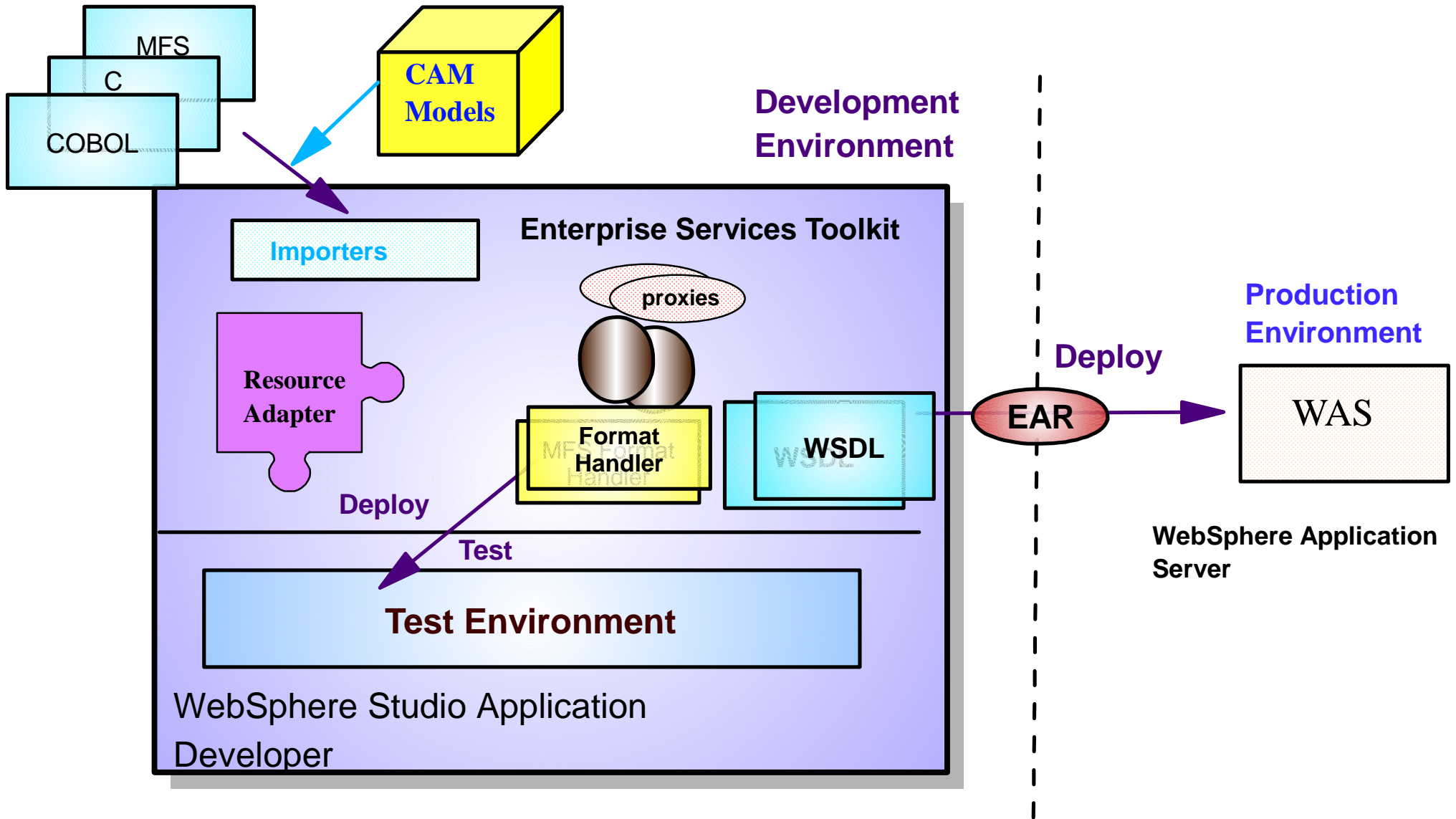
IMS Technical Conference

IMS MFS and XML

- **Web-enable MFS-based IMS applications by sending and receiving XML documents**
- **Retarget MFS-based applications for Web services and B2B interchanges**
  - ► MFS metamodel
    - – part of the OMG EAI/CAM standards to ensurenon-proprietary access
    - – capture all MFS source information for messages and device formats
    - – does not describe 3270 data streams
  - ► MFS Importer
    - – read and parse MFS sources files for a particular application and generates XMI instance files
    - – both the MFS metamodel and Importer use MFS source as input
    - – valid MFS source can always be recreated by using the IMS Message Format Services Reversal Utility
  - ► MFS Adapter
    - – replace the MFS online processing
    - – to be executed in WAS
    - – to be executed in IMS Connect (future direction)
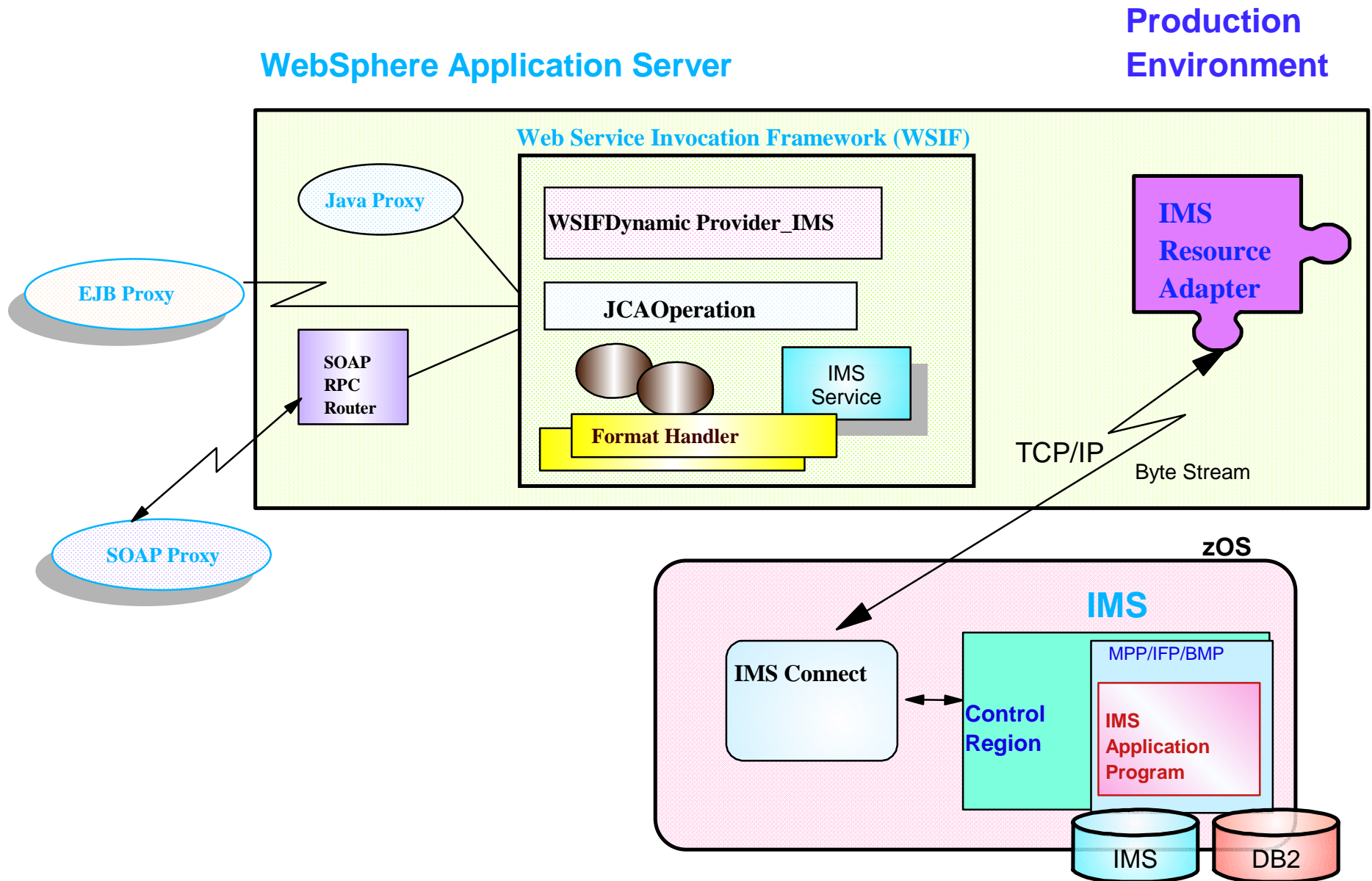
IMS MFS and Web Services

- **Enable users to create a service definition from MFS sources, publish the service, and then deploy it to WAS, and make it available as an EJB or SOAP service**
- **Enable IMS customers to publish existing MFS-based IMS applications on the Internet as Web services**
- **MFS Importer and Web services wizards**
  - ► to be integrated with WSAD-IE 5.0 Enterprise Services Toolkit
  - ► generate EAR (Enterprise Application Resource)
    - – XMI files
    - – service definition files (i.e. WSDLs)
    - – input and output beans
    - – Java, EJB and SOAP proxies
- **MFS Adapter & Generator**
  - ► generate format handlers to be included as part of EAR for data marshalling

IMS & CAM & WSAD-IE

MFS
C
COBOL

CAM Models

Development Environment

Enterprise Services Toolkit

Importers

proxies

Resource Adapter

Format Handler

MFS Format Handler

WSDL

Deploy

Test

Deploy

EAR

Production Environment

Deploy

WAS

WebSphere Application Server

Test Environment

WebSphere Studio Application Developer

WebSphere Studio Application Developer Integration Edition (WSAD-IE)

IMS Web Services & WAS

WebSphere Application Server

Production Environment

Web Service Invocation Framework (WSIF)

Java Proxy

EJB Proxy

SOAP RPC Router

SOAP Proxy

WSIFDynamic Provider_IMS

JCAOperation

IMS Service

Format Handler

IMS Resource Adapter

TCP/IP

Byte Stream

zOS

IMS

IMS Connect

Control Region

MPP/IFP/BMP

IMS Application Program

IMS

DB2

Related Sessions

- **Hands-on lab**
  - H03: Creating and deploying an IMS Conversational Transaction as an EJB or SOAP Service Flow
    - This is a double session hands-on lab starting on Tues. 8:30 - 9:45 AM and finishing on Wed. 8:30 - 9:45 AM
- **Demo Expo**
  1. Prize Drawing
  2. IMS XML and Web Services demo

Summary

- **Enable internet access to existing IMS transaction programs with integrated tool solutions**
  - ► WebSphere Studio Tooling (e.g. WSAD-IE, WSED)
- **Insulate business from further evolving technology and facilitate reuse of IMS transactions in the new B2B environment without changing existing IMS applications**
  - ► Meet B2B challenge to provide a standard interface between dissimilar systmes
    - − CAM, including MFS metamodel, is marketplace standards
- **Add a capability of sending and receiving XML documents to and from IMS transaction applications**
  - ► enable IMS in B2B environment as the high performance XML server
- **Help modernize customers' 3270 applications and support the execution of MFS-based IMS applications from leading edge software using industry standards**
- **Enable IMS customers to publish IMS applications on the Internet as Web services**