

**IBM Information**

>>> On Demand



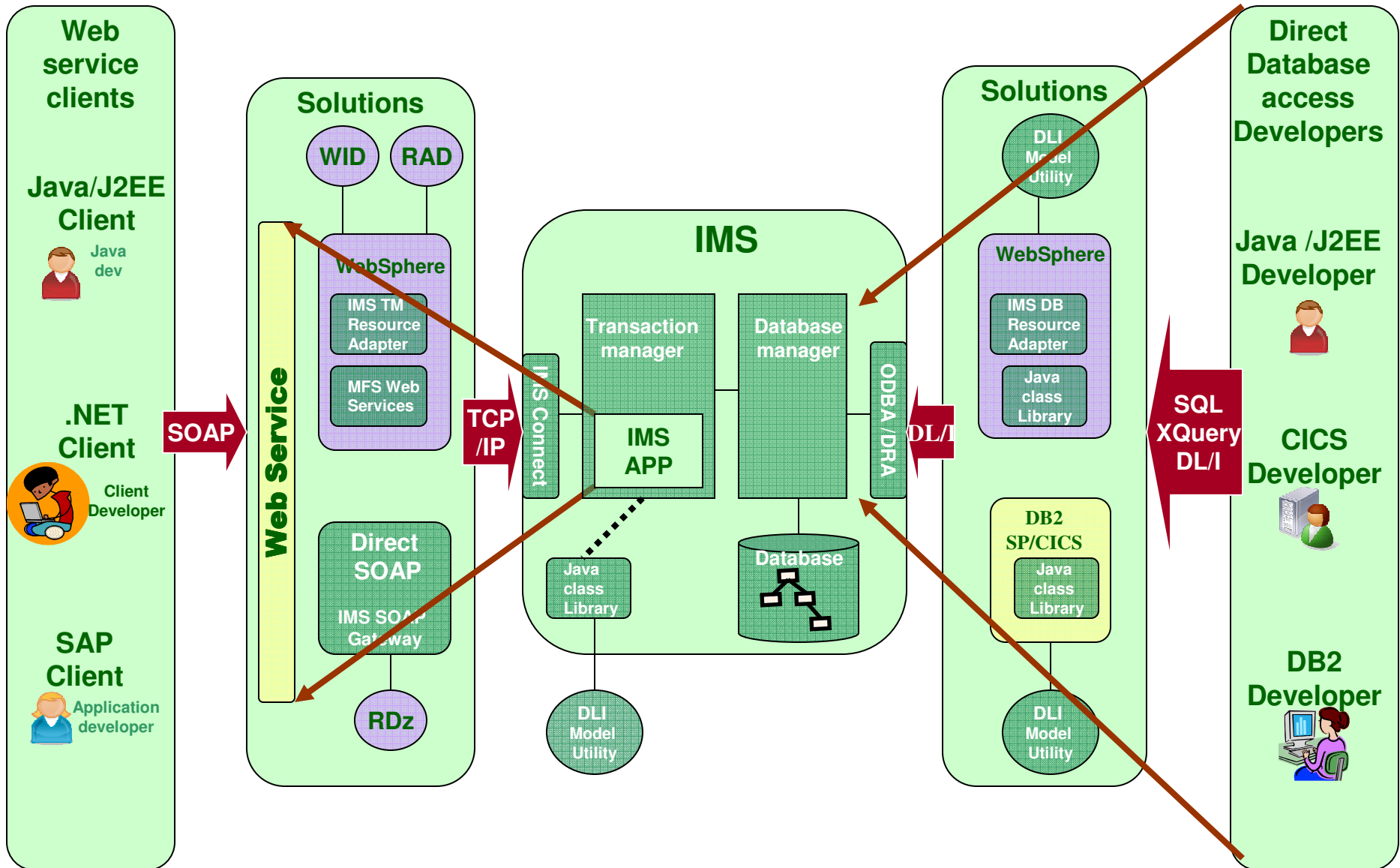
# SOA for IMS DB

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# IMS On Demand Solutions Overview



# What's SOA?

- SOA is about reuse
  - *Not* “out with the old, in with the new”
- SOA is about packaging
  - Taking what exists and structuring it differently such that future expansion is fast, easy, and cheap
- SOA is about liberating business from the constraints of technology
- SOA is about services
  - Loosely coupled black-box components



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## So...what's a service?

- A logical encapsulation of a business function
  - A program
  - A transaction

## ...loosely coupled?

- Well-defined and self-contained
  - Does not depend on the state of other services

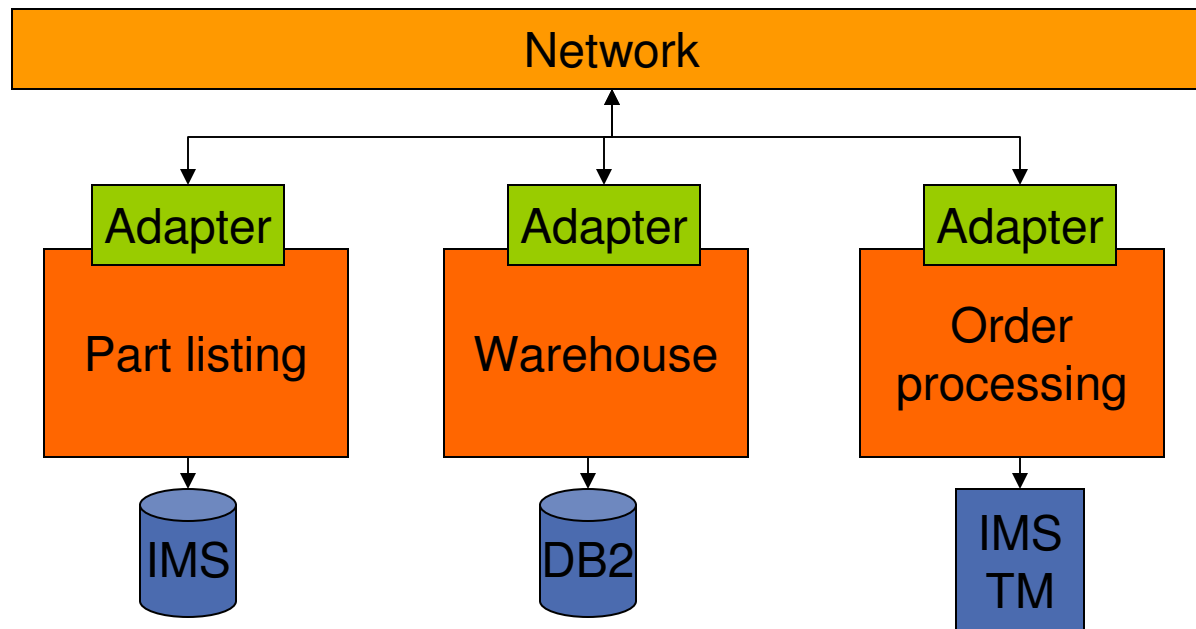
## ...black box?

- Hides the “how”
  - Allows reuse of existing applications by providing adapters to interface with them



# How do these services “interface” (communicate)?

- Standards, standards, standards
  - Put simply, the role of “adapters”

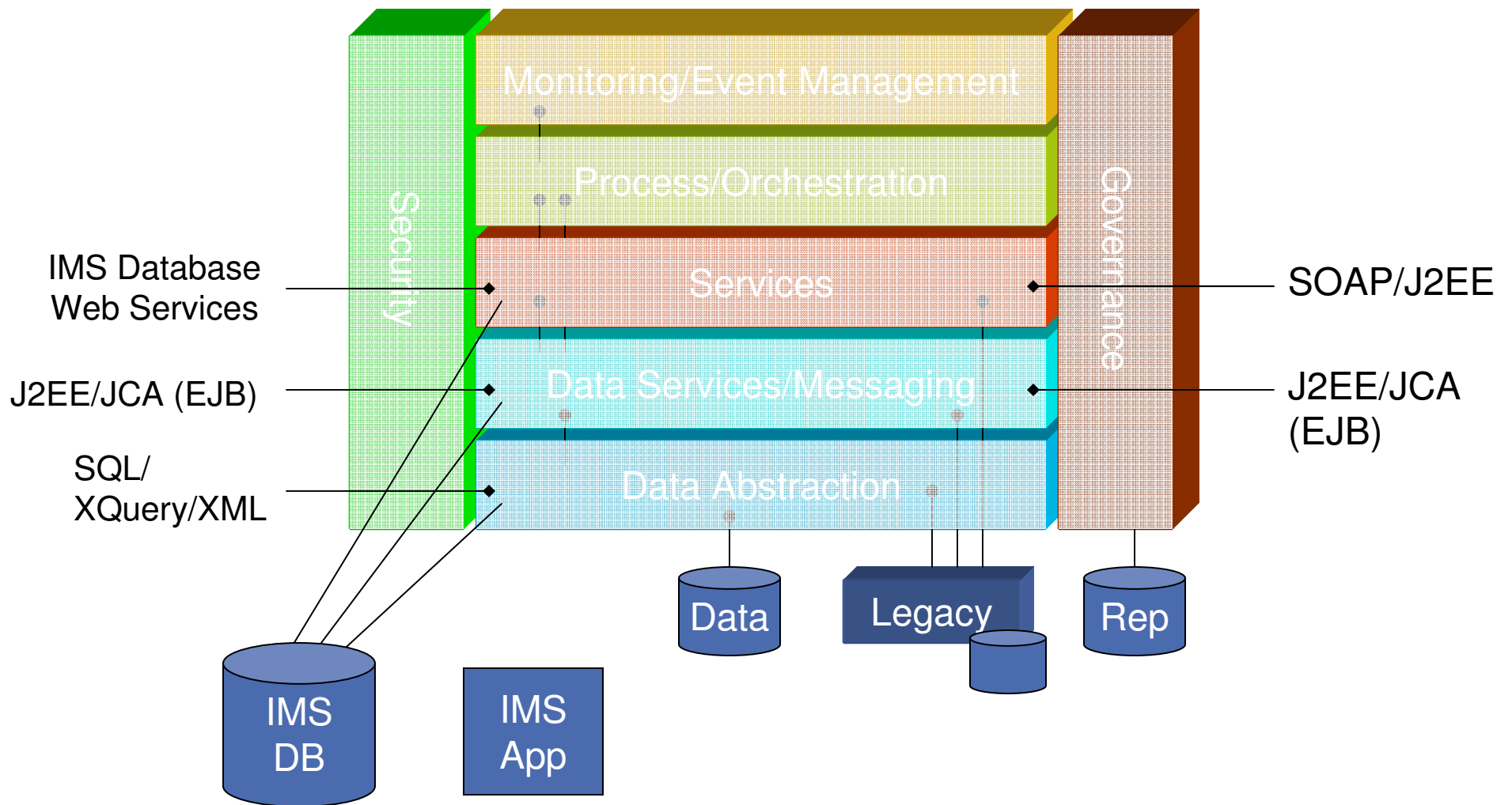


# Service Oriented Architecture

- Software architecture that defines the use of **loosely coupled software services** to support business processes
  - Resources made available as independent services
  - Services inter-operate based on a formal definition
- What are the benefits?
  - Can help businesses respond more quickly and cost-effectively to changing market conditions
  - Promotes reuse at the service level rather than the object level
  - **Simplifies connection to and usage of existing IT assets**
- Key point
  - **Independent services** with **defined interfaces** that are invoked in a **standard way**



# Service Oriented Architecture Model



Source: Linthicum Group



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# IMS SOA Initiative

*“The really big objective in my mind is helping our architects and lead developers **understand how to include the legacy business logic we have in IMS with our SOA approach.** What are the strategies, techniques, and technologies that enable us to do this?*

*I also want to see if we can **bridge the gap** between our mainframe and distributed folks. Typically the mainframe developers think that SOA and web services are just for the Java and distributed guys. I want them to get them **jazzed up** about how they can participate and **bring their legacy knowledge into the game.**”*

*IT Manager*





# IMS SOA Initiative

- Objectives
  - Reach out to IT architects, application architects/developers, database administrators
    - Host IMS SOA seminars worldwide
  - Establish IMS as a key player in the SOA community
    - Provide as much education as needed – including targeted on-site visits
  - Identify IMS SOA opportunities
  - Support implementation of IMS SOA projects
    - On-site visits to help facilitate proof of concept/proof of technology projects
- Information on upcoming seminars
  - [ibm.com/software/systems/seminars/adims](http://ibm.com/software/systems/seminars/adims)



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# Access to IMS data

*SOA solutions for IMS DB*



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# Java support in IMS: Features

- Language interoperability
  - Ability for Java and OO COBOL to invoke one another within the same transaction
- DB2 interoperability
  - Access an IMS and DB2 database in the same transaction
    - Use either the DB2 JDBC or SQLJ drivers to access DB2
    - IMS and DB2 activity in the same unit of work
- Java TM API
  - Offers transaction processing support
- Java DB API
  - Offers database access support
- JDBC driver for IMS
  - Implements Industry standards JDBC 2.0 API
  - Offers SQL and XQuery support for IMS DB



# Java API for IMS TM

- Java library provides an API for use in Java dependent regions
  - Perform traditional transaction processing
    - Message queue processing (reading and writing)
    - Transaction demarcation
    - Program switching capabilities
      - Easy integration of Java with existing assets



# Customer example

- Who?
  - German bank
    - Mainly PL/I based with conversational transactions
- Situation
  - Purchased 3<sup>rd</sup> party credit checking technology as part of a Java package
    - Replaced existing PL/I-based transaction
  - Wanted to deploy this in a Java Dependent Region and integrate with existing PL/I applications
    - Just another service...
- Solution
  - Leverage the deferred program switching support already in IMS (and supported within the Java class libraries) to switch conversation iterations from MPP to JMP regions and back
  - In production within a month with this solution



# Java API for IMS DB

- Java library provides a Database access API
  - Connects to an IMS database
    - Allocates the PSB (APSB) if not under IMS control
  - Complete DLI support:
    - GHU, GU, GHN, GN, GNP, ISRT, REPL, DLET
  - Segment Search Arguments (SSA) Support
  - Command Code Support
  - Database read and write support
    - Full Function, FP and HALDB
  - Datatype conversion
- But these are IMS standards, what about industry standards?



# JDBC (Java Database Connectivity)

- Defines a standard Java API for accessing databases
- Provides an API for sending SQL statements to a relational database and processing the tabular data returned
  - Wait a minute...IMS is hierarchic
  - More on this later
- JDBC application model
  - Establish and open connection to database
  - Execute query and obtain results
  - Process results
  - Commit the results
  - Close connection
- Provides application interoperability



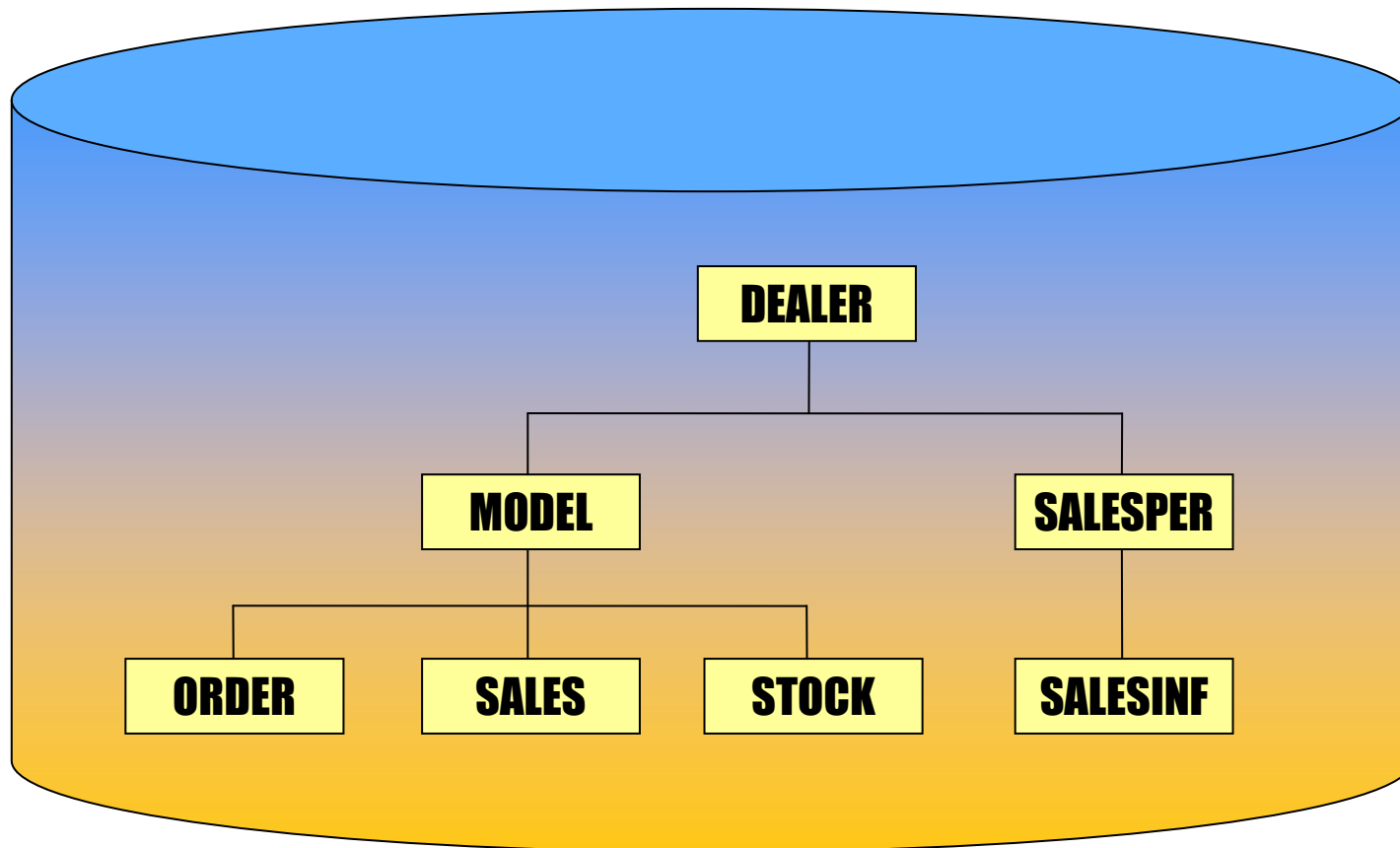
# SQL and IMS

- SQL is an extremely powerful query language
  - Designed to be usable for all database types
  - Multiple ways to write queries that return the same results
    - Can prove costly with inefficient queries
  - IMS JDBC supports subset of SQL syntax
    - Limit function to what IMS DBMS can do natively
- Projects IMS database assets into the SOA 'Data Abstraction' layer





# Sample Database for SQL Example



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# SQL Parsing

## SQL

```
SELECT Dealer.Name, Dealer.Phone, Order.LastName  
FROM SomePCB.Order  
WHERE Model.MSRP > '50000'  
      AND Order.Date >= '5/1/2003'  
      AND Order.Date <= '5/31/2003'
```

## SSA List



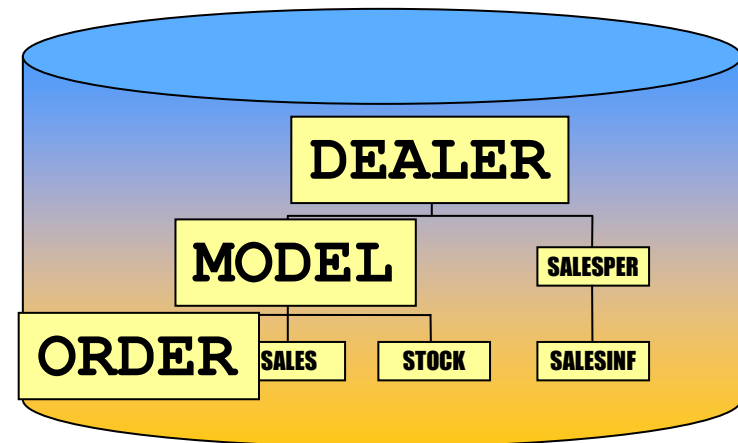
# SQL Parsing

## SQL

```
SELECT Dealer.Name, Dealer.Phone, Order.LastName  
FROM SomePCB.Order  
WHERE Model.MSRP > '50000'  
      AND Order.Date >= '5/1/2003'  
      AND Order.Date <= '5/31/2003'
```

## SSA List

DEALER  
MODEL  
ORDER



# SQL Parsing

## SQL

```
SELECT Dealer.Name, Dealer.Phone, Order.LastName  
FROM SomePCB.Order  
WHERE Model.MSRP > '50000'  
      AND Order.Date >= '5/1/2003'  
      AND Order.Date <= '5/31/2003'
```

## SSA List

**DEALER**

**MODEL (MSRP GT50000)**

**ORDER (DATE GE20030501 &**

**DATE LE20030531**



# SQL Parsing

## SQL

```
SELECT Dealer.Name, Dealer.Phone, Order.LastName  
FROM SomePCB.Order  
WHERE Model.MSRP > '50000'  
      AND Order.Date >= '5/1/2003'  
      AND Order.Date <= '5/31/2003'
```

## SSA List

```
DEALER *D  
MODEL (MSRP GT50000)  
ORDER (DATE GE20030501 &  
      DATE LE20030531)
```



# SQL Parsing

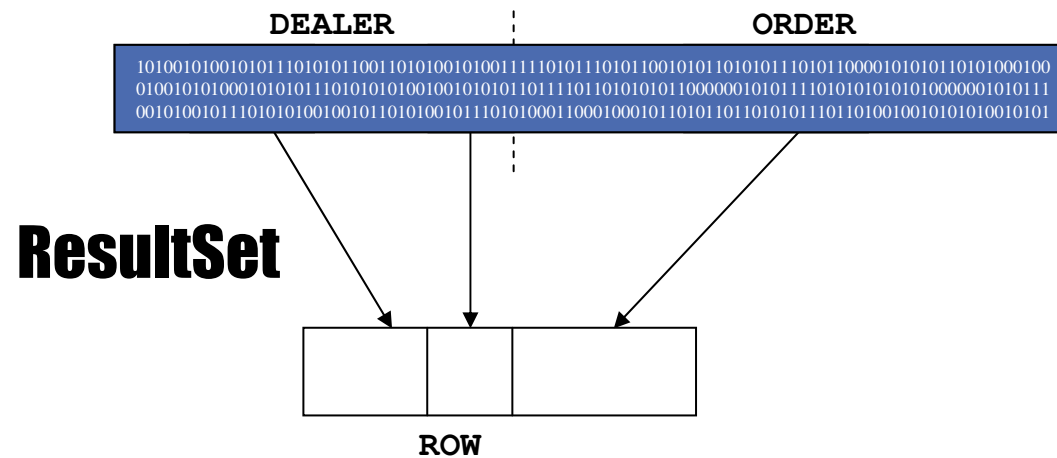
## SQL

SELECT Dealer.Name, Dealer.Phone, Order.LastName

## SSA List

```
DEALER *D
MODEL (MSRP GT50000)
ORDER (DATE GE20030501&
      DATE LE20030531)
```

## IOArea



# Sample JDBC application for IMS

```
public class JDBCSelect {  
  
    public static void main (String[] args) {  
  
        String query = "SELECT FirstName, LastName, Extension"+  
            " FROM Person"+  
            " WHERE Person.Lastname = 'LAST1'";  
  
        try {  
            Class.forName("com.ibm.ims.db.DLIDriver");  
  
            Connection conn = DriverManager.getConnection("jdbc:dli:samples.jdbc.DFSIVP67DatabaseView");  
  
            Statement stmt = conn.createStatement();  
  
            ResultSet rs = stmt.executeQuery(query);  
  
            while (rs.next()) {  
                System.out.println("First Name: " + rs.getString("FirstName"));  
                System.out.println("Last Name: " + rs.getString("LastName"));  
                System.out.println("Extension: " + rs.getString("Extension"));  
            }  
  
            stmt.close();  
            conn.close();  
            IMSTransaction.getTransaction().commit();  
        } catch (Exception e) {  
            System.out.println("Exception = " + e.toString());  
        }  
    }  
}
```

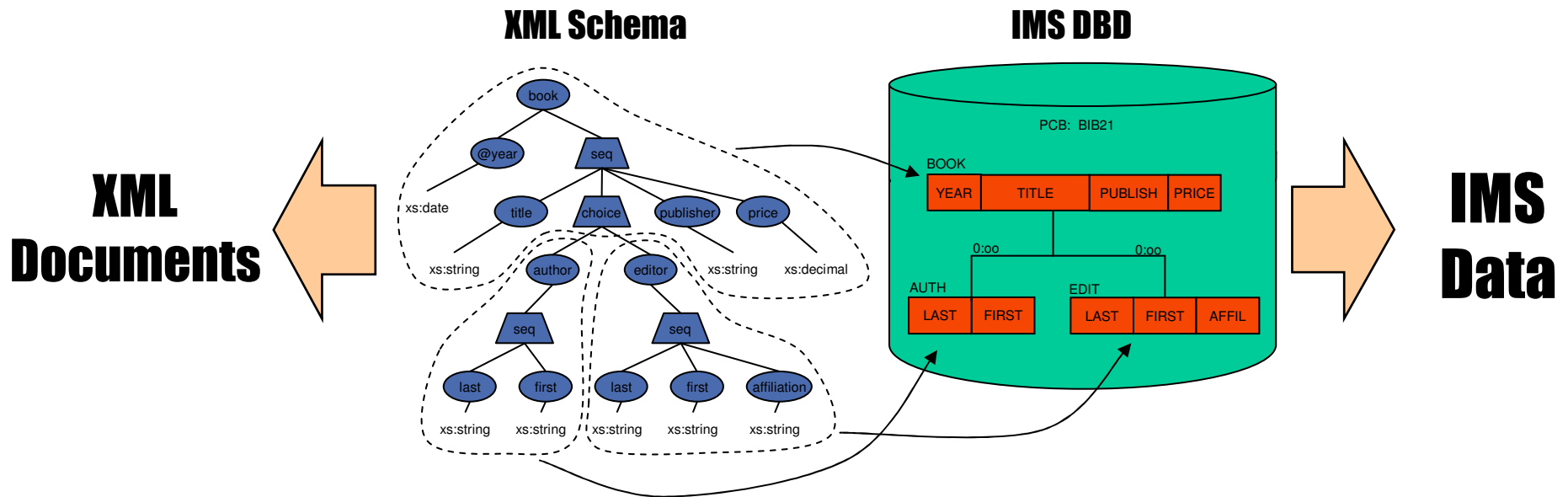


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# IMS XML Database

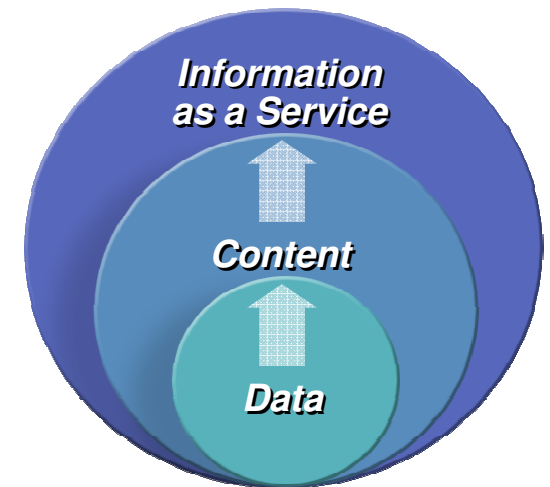
- Introduces a way to view/map *native* IMS hierarchical data to XML documents
- Aligns IMS Database (DBD) with XML Schema
- Allows the retrieval and storage of IMS Records as XML documents with ***no change*** to existing IMS databases
- Enables query of IMS data using XQuery





# XQuery support in IMS V10

- Further aligns IMS with industry direction
  - XML, SOA, Web Services, etc.
- More natural fit for hierarchical data querying
- Enables customers to leverage emerging standard skill set
- Enhanced product and tooling integration
- Immediately usable with no migration of existing IMS data



```
<bib> {  
  for $b in /bib/book  
  let $title := $b/title  
  where $b/publisher = "Addison-Wesley"  
  order by $b/@year  
  return  
    <book year="{ $b/@year }">  
      { $title }  
    </book>  
}</bib>
```



```
<bib>  
  <book year="1992">  
    <title>Advanced Programming in the Unix</title>  
  </book>  
  <book year="1994">  
    <title>TCP/IP Illustrated</title>  
  </book>  
</bib>
```



# IMS DB Resource Adapter

- IMS provides a JCA resource adapter for deployment in a WebSphere Application Server runtime
  - There is also an IMS TM resource adapter that provides J2EE platform access to existing IMS transactions
- JCA interaction ultimately provides the application with a JDBC Connection to an IMS DB
  - A direct connection to an IMS database
  - Applications can directly query and manipulate IMS database information using JDBC with both SQL and XQuery
- Projects IMS database assets into the SOA 'Data Services/Messaging' layer



# Features

- Supports J2EE Connector Architecture (JCA) 1.0
- Connection Management
  - Connection pooling
- Supports various types of interactions and programming models
  - JDBC
    - SQL and XQuery support
  - Java for DLI
- Security Management
  - RACF for authentication
  - ODBA does additional check for PSB (database) authorization
- Transaction Management
  - Global z/OS RRS transaction support
- Multi-platform support
  - Runs in WebSphere family of 31 and 64 bit application servers



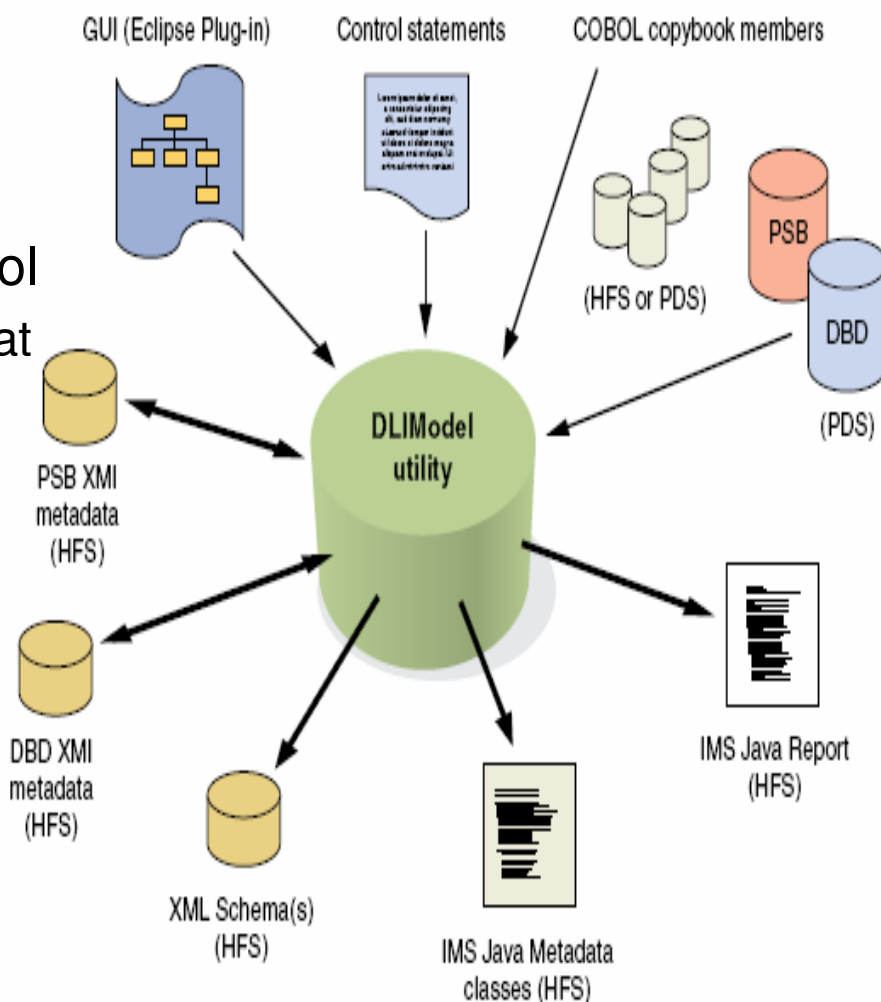
# Customer example – IMS DB RA

- Who?
  - One of the world's largest public corporations by revenue
- Situation
  - Wanted to move to a web-based J2EE model in order to manage internal inventory across their 4 regions in the United States
- Solution
  - Leveraged the IMS DB resource adapter in order to develop Enterprise JavaBeans that could access the target IMS databases directly
  - WebSphere Application Server for z/OS V5

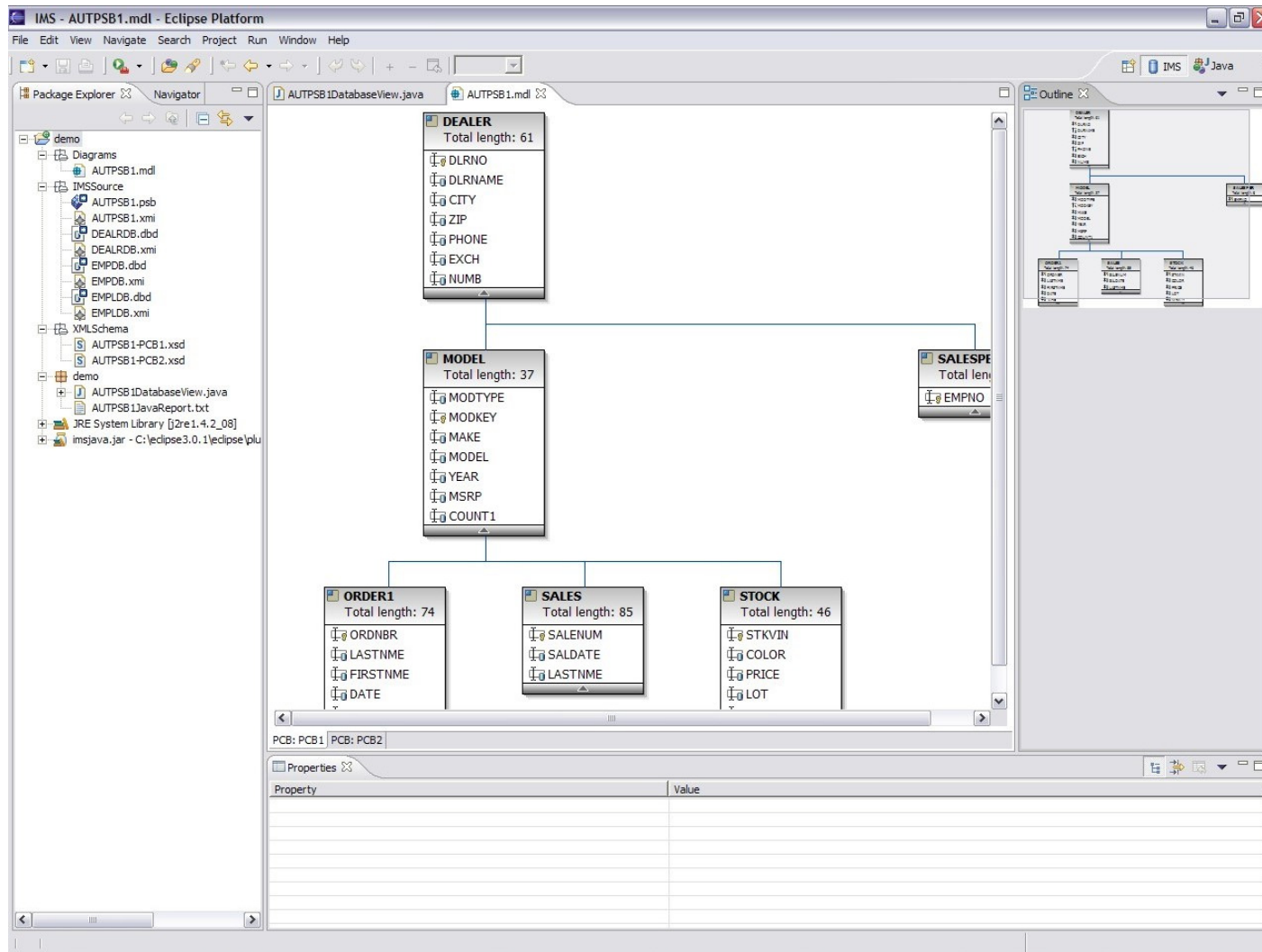


# DLIModel Utility

- IMS database visualization tool
  - Visualize an entire IMS PSB
  - Can view each PCB individually
    - Hierarchy, segments, fields, types, etc
- IMS database metadata generation tool
  - Generates the necessary metadata that is consumed at runtime by IMS DB Resource Adapter, XML-DB support
    - Database metadata
    - XML schema
- Bottom up tooling approach
  - Parses PSB and DBD source
  - Optionally COBOL copybook definitions of segments
- An Eclipse 3.x plug-in



# Database Visualization (UML View of the Database Metadata)



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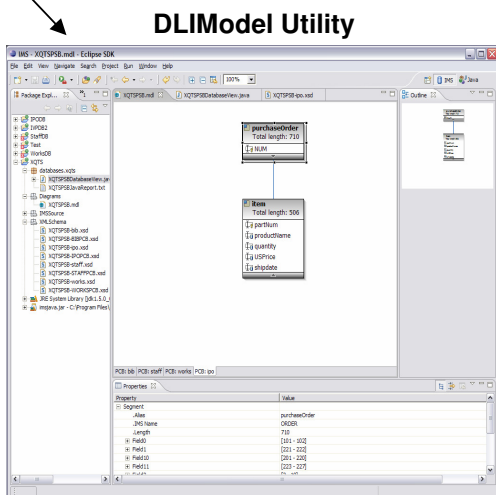
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# Upcoming V10 item – IMS DB web services

- Provide ability to expose a database query as a callable web service
  - Tooling support generates

- Deployable ear file
- WSDL

**Config**



**EAR**

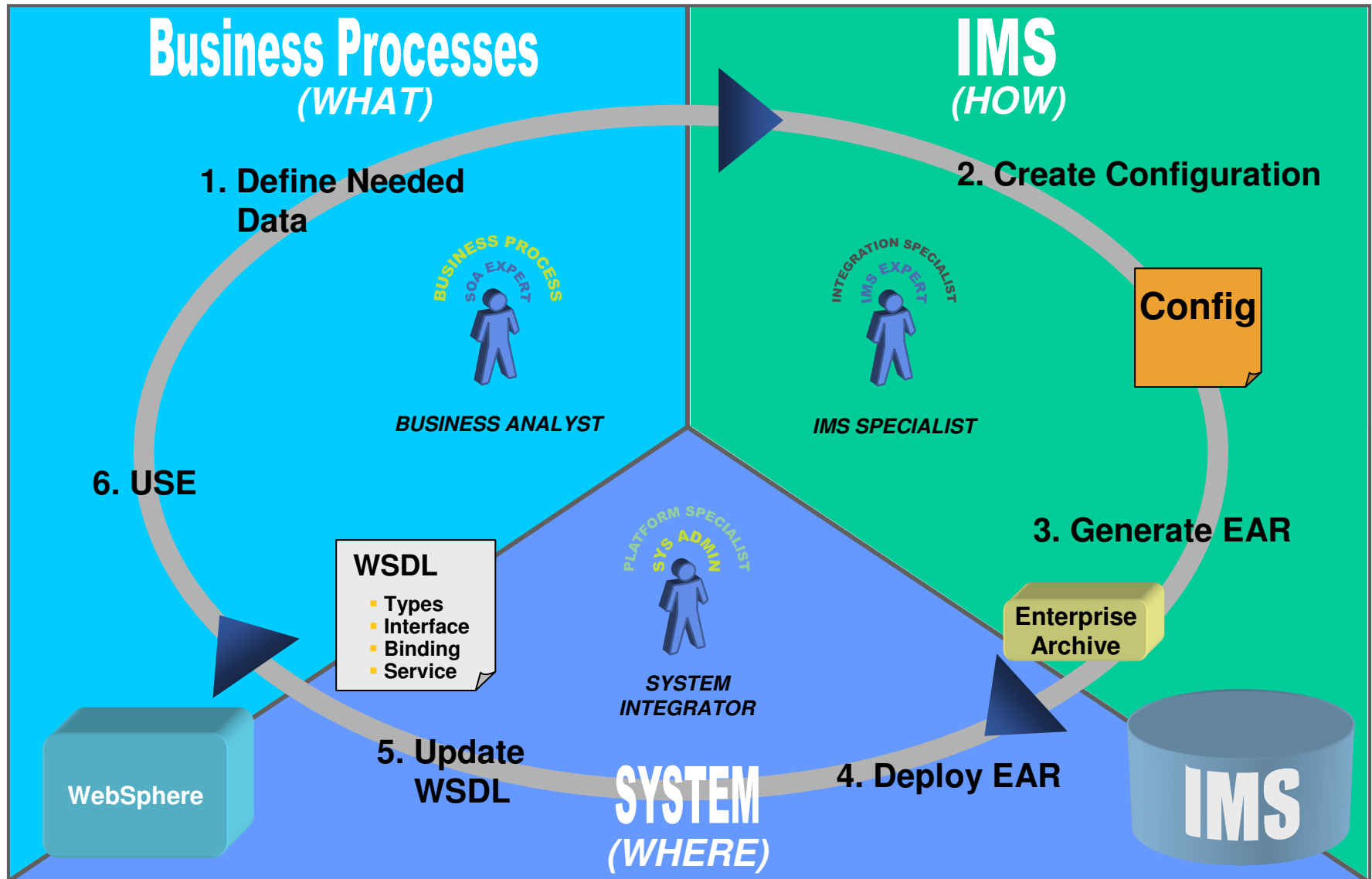
**WebSphere z/OS**

**WSDL**

- Types
- Interface
- Binding
- Service



# IMS Database Web Services Development Lifecycle





# Requirement – IMS Open Database

- Leverage and expose IMS data in a distributed topology
  - Enable creation of services that expose IMS data to distributed platforms
    - PSB authorization still applies!
- Distribution of database assets comes in two flavors
  - Distribution within an IMS plex
    - Applications on one LPAR can access an IMS database on another LPAR
  - Distribution to non-zSeries platforms
    - Applications on a non-zSeries platform can have direct IMS DB access without needing an IMS transaction to proxy the data

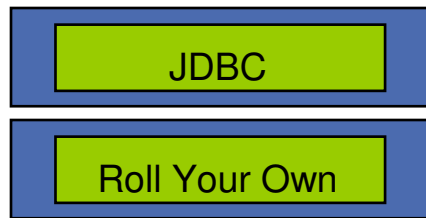
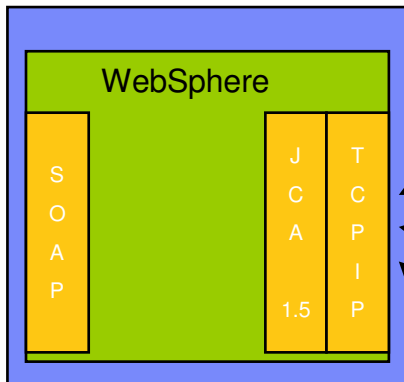
*IMS Connect will be the gateway to IMS DB as well as TM*



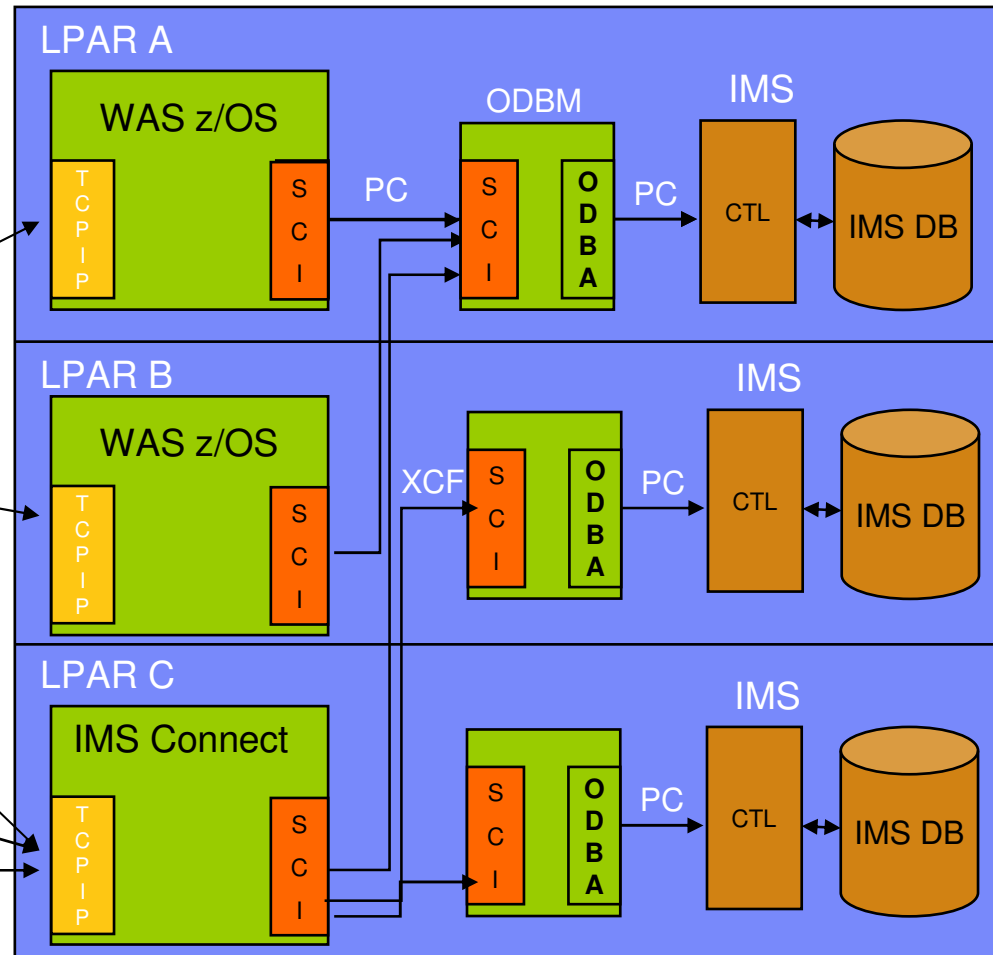
# Open Database Environment

Final ODB Solution

Distributed



z/OS



# Final Thoughts

- Service Oriented Architecture is revolutionizing the way businesses are being designed and run. For it to make sense:
  - All assets must be easily accessible in a standard way
  - All data must be represented and manipulated in a standard way
- Enable our customers to continue to leverage IMS as an integral part of their enterprise in the evolving business world through the addition of support for complimentary standards surrounding IMS connectivity, data representation, and application development
- Allow IBM customers to realize the promises of building an SOA
  - Simply the business environment
  - Respond to market changes more quickly and cheaply



# How Do I Get It?

- **IMS SOA Integration Suites**

- <http://www.ibm.com/software/data/ims/toolkit/>

- IMS DB resource adapter and JDBC driver (information)
- IMS XML DB (information)
- IMS DLIModel utility

- **IMS**

- FMID for DB resource adapter, JDBC driver, and XML-DB support

- IMS V8 (JMK8806)
- IMS V9 (JMK9906), also includes XML-DB support
- IMS V10 (JMK1016), also includes XQuery support



# How Do I Get It? ...

- Rational Application Developer  
<http://www.ibm.com/software/awdtools/developer/application/index.html>
- WebSphere Integration Developer  
<http://www.ibm.com/software/integration/wid/about>
- Rational Developer for System z  
<http://www.ibm.com/software/awdtools/rdz>



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