

IMS and IBM WebSphere Application Server: SOA in Action at Delta Airlines



Khalid Ishaque

Solution Architect, Delta Air Lines Inc., Khalid.Ishaque@Delta.com

Kyle Charlet

IMS SOA technical lead , IBM Silicon Valley Lab, charletk@us.ibm.com

February 2 , 2010 Teleconference



Presentation Overview

- **Delta Air Lines Inc. / Delta TechOps**
- **Demand: Innovative Technology**
- **Why IMS?**
- **Mission: SOA enable IMS**
- **SOA Options Considered**
- **Proof of Concept: DB Resource Adaptor**
- **Lessons Learned**
- **Benefits**
- **What's next for Java → IMS?**



Delta Air Lines Inc.

- No. 1 airline in the world
- Headquartered in Atlanta
- Air carrier service to every continent except Antarctica
- Approximately 800 aircraft
- Major U.S. Airport hubs
 - Atlanta International Airport
 - Cincinnati International Airport
 - New York City (JFK)
 - Salt Lake City International Airport
 - Minneapolis-St. Paul
 - Detroit
 - Memphis



Delta TechOps

- World-class maintenance & safety engineering for Delta fleet & MRO customers
 - Airframe, Component, Engine, Line & Support Services
- MRO -- Maintenance, Repair and Overhaul
- Largest Airline MRO in North America & growing
- MRO Customers
 - EVA Airways
 - LAN
 - Canadian based airline, First Air
 - UPS
 - Hawaiian Air Lines
 - and many other





A fast paced business demands innovative technology

- The technology that powers Delta TechOps
 - Over 170 complex & integrated applications
 - Core systems include SCEPTRE & SAP, among many

- SCEPTRE
 - Comprehensive Maintenance & Engineering system
 - Developed by North Central Airlines and IBM in 1973-75
 - Was actively marketed and sold to over 10 airlines currently used by Delta, Continental, and US Airways
 - Technology: COBOL(MVS), IMS(9.0) DB/DC, DB2(8.0)
 - Integrated with front-end Web and distributed systems



Web Environment at Delta

- Java Enterprise Applications
 - IBM WAS running on UNIX AIX
 - Applications developed using IBM RAD
- LDAP security structure
- Various data sources
 - Sybase
 - Oracle
 - MS SQL Server
 - Operational support real-time DB2 data
 - Warehouse, static and archived DB2 data
 - IMS DB
 - SAP
- Java Struts, JSF, IBATIS frameworks
- Java Application → IBM MQ → IMS COBOL Transaction



IMS competitive advantage

→ Why IMS?

- Scalable, Reliable and Secure
- Industry Proven
- Performance
 - Can handle high volumes of transaction and still perform better than many relational databases
- Excellent support from IBM

→ Our mission: SOA-enable IMS

- Manage the risk of depleting/limited COBOL skills
- Need to modernize/SOA-enable environment
- Seamless, cost-effective development and support with
 - Multiple databases
 - Multiple applications implemented with different technology
 - SAP



SOA

- Service-Oriented Architecture
- “SOA separates functions into distinct units, or services, which developers make accessible over a network in order that users can combine and reuse them in the production of applications.”
- “Managed environments can also wrap COBOL legacy systems and present them as software services. This has extended the useful life of many core legacy systems indefinitely, no matter what language they originally used.”
 - Page name: Service-oriented architecture
 - Author: Wikipedia contributors
 - Publisher: *Wikipedia, The Free Encyclopedia.*
 - Date of last revision: 4 September 2009 19:22 UTC
 - Date retrieved: 4 September 2009 19:22 UTC
 - Permanent link: http://en.wikipedia.org/w/index.php?title=Service-oriented_architecture&oldid=311883911



Options considered: SOA enable IMS

- Keep using COBOL Transactions
 - Not our SOA Initiative
- One Java Approach
- Remote Database Solution (RDS)
 - Uses EJBs (Enterprise Java Beans)
 - Contains application business logic
 - Resource intensive (memory)
 - Can be very complicated
- POC used DB Resource Adapter (RA)

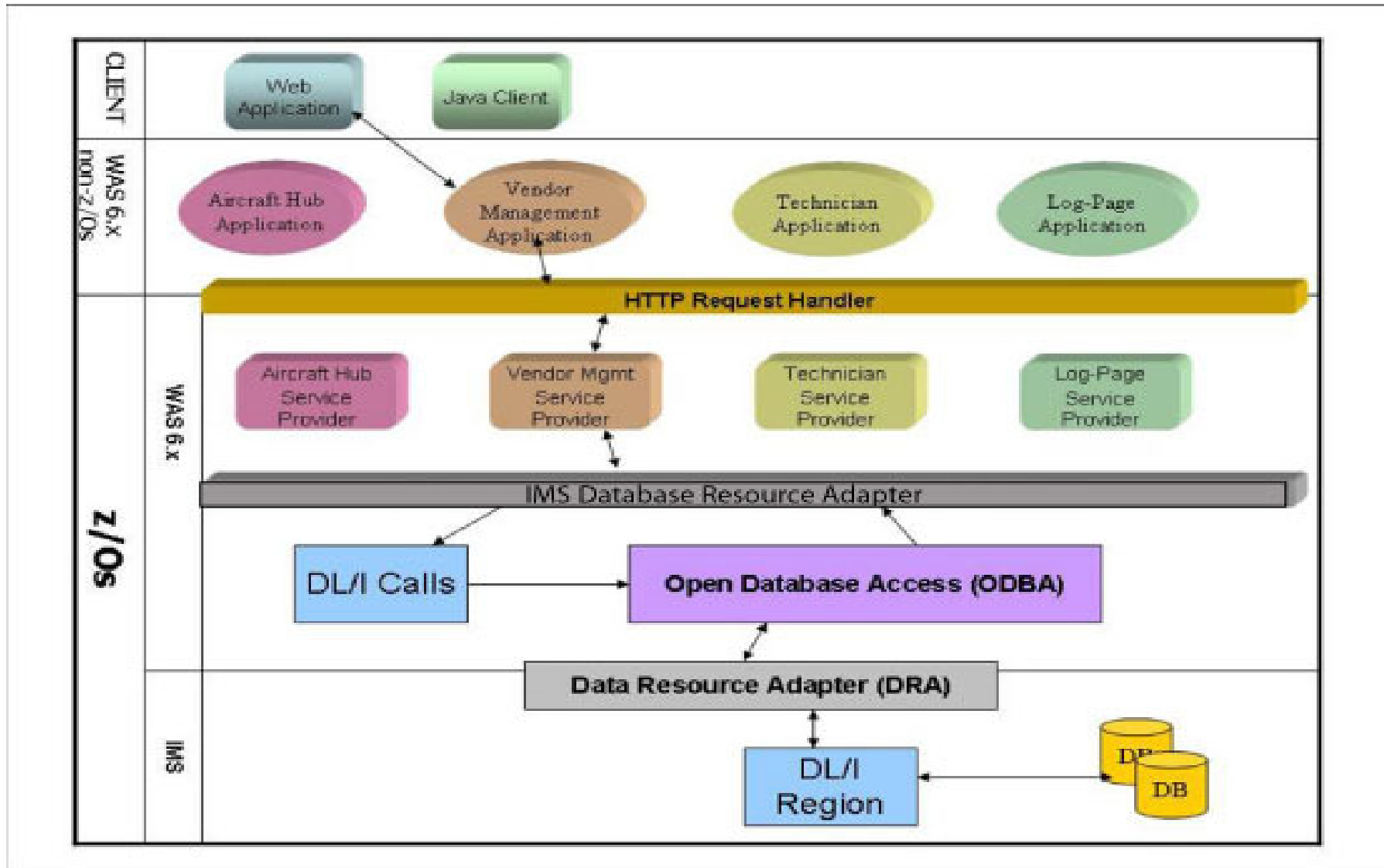


Why IMS DB Resource Adapter?

- Keep the data access implementation as close to the data source as possible to reduce complexity and network traffic.
- SOA enable existing data
- Web access to IMS data
- Standards based technology
 - JDBC, Java EE, Web Services, etc
- Easy off-platform access
- WebSphere solution
 - Java EE = ease of application development & deployment
- Integration with modern application development tooling
 - Rational Application Developer (RAD)
 - Rational Application Developer for Z (RDz)



POC Project





Goals/Benefits

- Web Application Development/Enhancement
 - Provide a faster interface development to IMS data
 - Streamline development
 - Direct access to IMS data
 - SOA web service approach
- Benefits
 - Provide Web Services for TechOps Applications
 - No new COBOL transactions needed
 - Web Services easily extendable
 - Fast access to data
 - Fast response to changing business needs

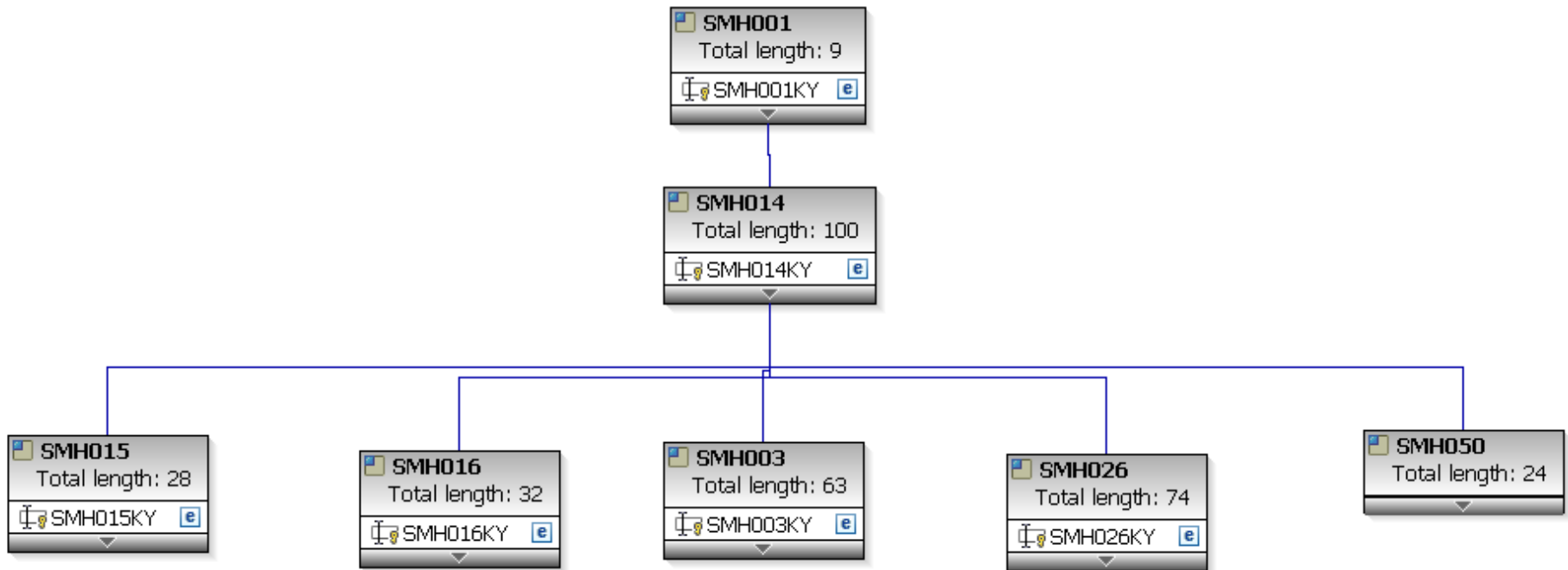


Hierarchical Database

- IMS DB Hierarchical Database
- Segments
 - Equivalent to relational database Tables
 - Names (Delta's)
 - SMH001
 - SMH014
 - Root Names (Delta's)
 - SMH001, SDC001, GNB001
 - Child/Parents Names (Delta's)
 - SMH014 SMH016 SMH015
- Fields
 - Equivalent to relational database Columns



Segments





Fields



SMH001
Total length: 9
SMH001KY e

SMH001
Total length: 9

SMH001KY	e
SMH001-KEY	e
NCA_PART_NUMBER	e
NCA_SERIAL_NUMBER	e



POC Project

- Identify desired data
- For the POC Delta's part maintenance history was chosen
 - Root segment identified
 - Child segments identified
 - Specific fields identified
- Gather
 - DBD
 - Database Description for each segment
 - COBOL Copy Books
- Create Java PSB
 - Program Specification Block
 - Control access to data
 - Distributed vs COBOL programs to isolate access



POC Project Tools used

→ IMS Database Resource Adapter

- Offers J2EE development
- use servlet technology with jdbc or DLI calls
- allows for a services layer

→ RAD/z

- IMS project

→ DLI Modeling utility

- The DLIModel tool allows you to transform your IMS database information (program specification blocks, database descriptions, and COBOL copybooks) into application independent metadata.
- Generate XML schemas of IMS databases, which are used to retrieve XML data from or store XML data in IMS databases
- Incorporate additional field information from COBOL copybooks (requires Rational® Developer for System z™)
- Incorporate additional PCB, segment, and field information, or override existing information
- Generate a DLIModel report, which is designed to assist Java application programmers in developing applications based on existing IMS database structures

→ Apache XML-RPC

- Apache XML-RPC is a Java implementation of [XML-RPC](#), a popular protocol that uses XML over HTTP to implement remote procedure calls.



POC PSB



```
****                                00000200
**** TEST VERSION FOR JAVA PROOF OF CONCEPT 00000300
****                                00000400
****                                00000600
****                                00000700
PMH001  PCB      TYPE=DB,NAME=PMH,PROCOPT=AP,KEYLEN=090,POS=S 00040000
        SENSEG  NAME=SMH001,PARENT=0 00040100
        SENSEG  NAME=SMH014,PARENT=SMH001 00040200
        SENSEG  NAME=SMH015,PARENT=SMH014 00040300
        SENSEG  NAME=SMH016,PARENT=SMH014 00040300
        SENSEG  NAME=SMH003,PARENT=SMH014 00040400
        SENSEG  NAME=SMH026,PARENT=SMH014 00040500
        SENSEG  NAME=SMH050,PARENT=SMH014 00040510
        PSBGEN  LANG=JAVA,CMPAT=YES,PSBNAME=IMSJAVA 00065200
        END 00065300
```



POC DLI Meta Data Class

```
public class IMSJAVADatabaseView extends DLIDatabaseView {

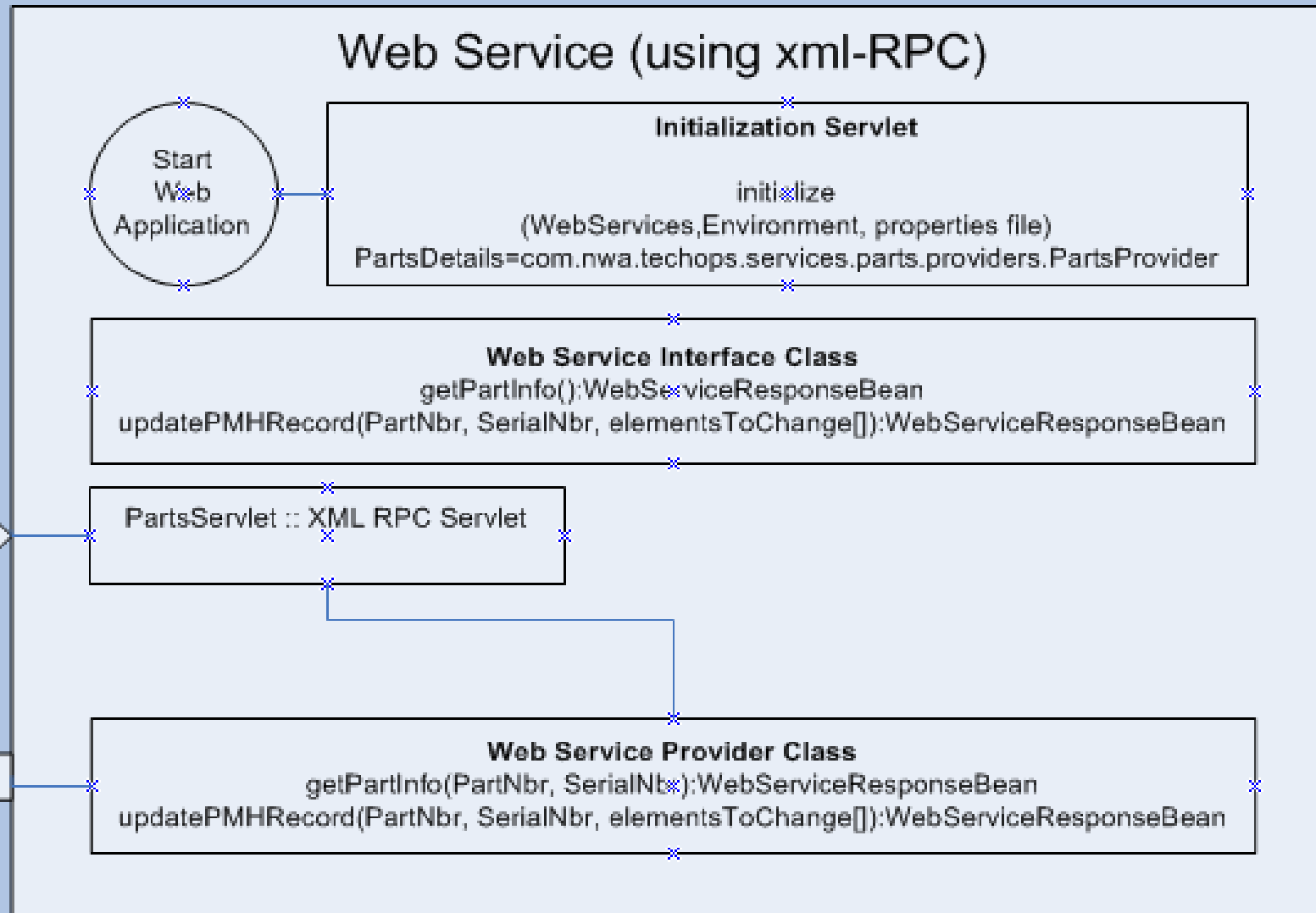
    // This class describes the data view of PSB: IMSJAVA
    // PSB IMSJAVA has database PCBs with 8-char PCBNAME or label:
    //     PMH001
    //
    // The following describes Segment: SMH001 ("SMH001") in PCB: PMH001 ("PMH001")
    static DLTypeInfo[] PMH001SMH001Array= {
        new DLTypeInfo("SMH001KY", DLTypeInfo.CHAR, 1, 9, "SMH001KY", DLTypeInfo.UNIQUE_KEY),
        new DLTypeInfo("SMH001-KEY", DLTypeInfo.CHAR, 1, 9),
        new DLTypeInfo("NCA_PART_NUMBER", "9(11)", DLTypeInfo.PACKEDDECIMAL, 1, 6),
        new DLTypeInfo("NCA_SERIAL_NUMBER", "9(5)", DLTypeInfo.PACKEDDECIMAL, 7, 3)
    };
}
```



POC Web Service



WAS on Z/os

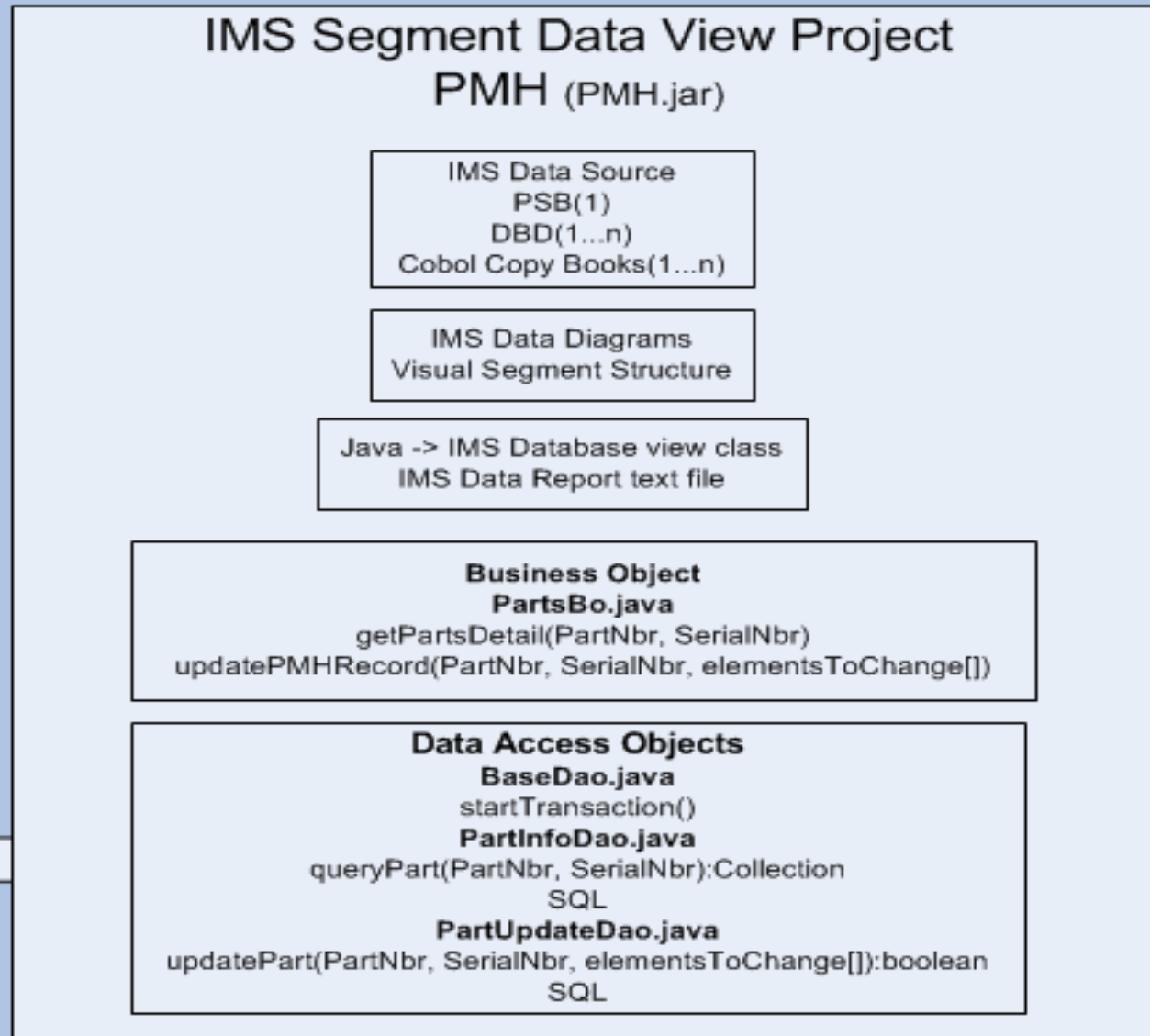




POC Web Service Queries



**WAS on
Z/os**





Lessons Learned – POC ups and downs

- Correctly defining Global transactions
- Hyphens in Delta's COBOL copy books
- WAS application server needing to be restarted following a bad transaction (solved by IBM service APAR)
- Calling rollback in the Web service code caused a hung transactions (solved by IBM service APAR)
- System.out not producing output in WAS logs
- Parallel and non-parallel PSB configuration
- AIB and APSB return codes from IMS
- Only being able to test SQL by deploying the web service
- Understanding transaction boundaries
- IMS virtual UNIX environment
- Hierarchical SQL statement limitations



Lessons Learned

- IBM's Help
- Installation and configuration of WAS/z
- Hosting a learning session on remote data access IBM IOD
- RAD for z
- DLI modeling utility
- Performance testing done with virtual clients ran very well



Benefits

- The ability to create Web service provider objects
- Respond quickly to new business needs
- Simplify a complex environment
- Extend the functions of a legacy system
- No COBOL code is needed
- MQ is not required
- Directly accessing IMS data can be:
 - Queried
 - Updated
 - Created
- Independent Web services that are easily shared across applications
- Web services that are created independently of business logic
- Create and develop the web service in a RAD tool
- SOA



What's Next for Java → IMS

- Create stable WAS/z environment
- Implement web services on WAS/z
- Use web services for the new Delta
- Integrate IMS data with the various systems at Delta, which includes SAP (hub and spoke model)
- Support and help shortcut the integration of the two large airlines into one



Questions or Answers



Data Management Communities for IMS

- Data Management Community – share and interact with peers around the world
 - www.ibm.com/software/data/management/community.html

- IMS Regional User Groups
 - www.ibm.com/software/data/ims/usergroups.html

- Information Champions – recognizes individuals who have made the most outstanding contributions to the Information Management community
 - www.ibm.com/software/data/champion

- Rational Cafes – for host application programming languages
 - www.ibm.com/software/rational/cafe/index.jspa

- COBOL Cafe – IMS Hub for application programmers
 - www.ibm.com/software/rational/cafe/community/cobol/ims?view=overview



Important Disclaimer

© Copyright IBM Corporation 2010. All rights reserved.

U.S. Government Users Restricted Rights - Use, duplication or disclosure restricted by GSA ADP Schedule Contract with IBM Corp.

THE INFORMATION CONTAINED IN THIS PRESENTATION IS PROVIDED FOR INFORMATIONAL PURPOSES ONLY. WHILE EFFORTS WERE MADE TO VERIFY THE COMPLETENESS AND ACCURACY OF THE INFORMATION CONTAINED IN THIS PRESENTATION, IT IS PROVIDED “AS IS” WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED. IN ADDITION, THIS INFORMATION IS BASED ON IBM’S CURRENT PRODUCT PLANS AND STRATEGY, WHICH ARE SUBJECT TO CHANGE BY IBM WITHOUT NOTICE. THE INFORMATION ON NEW PRODUCTS IS FOR INFORMATIONAL PURPOSES ONLY AND MAY NOT BE INCORPORATED INTO ANY CONTRACT. THE INFORMATION ON ANY NEW PRODUCTS IS NOT A COMMITMENT, PROMISE, OR LEGAL OBLIGATION TO DELIVER ANY MATERIAL, CODE OR FUNCTIONALITY. THE DEVELOPMENT, RELEASE, AND TIMING OF ANY FEATURES OR FUNCTIONALITY DESCRIBED FOR OUR PRODUCTS REMAINS AT THE SOLE DISCRETION OF IBM. IBM SHALL NOT BE RESPONSIBLE FOR ANY DAMAGES ARISING OUT OF THE USE OF, OR OTHERWISE RELATED TO, THIS PRESENTATION OR ANY OTHER DOCUMENTATION. NOTHING CONTAINED IN THIS PRESENTATION IS INTENDED TO, NOR SHALL HAVE THE EFFECT OF, CREATING ANY WARRANTIES OR REPRESENTATIONS FROM IBM (OR ITS SUPPLIERS OR LICENSORS), OR ALTERING THE TERMS AND CONDITIONS OF ANY AGREEMENT OR LICENSE GOVERNING THE USE OF IBM PRODUCTS AND/OR SOFTWARE.

IBM, the IBM logo, ibm.com, Information Management, IMS, CICS, DB2, WebSphere and z/OS are trademarks or registered trademarks of International Business Machines Corporation in the United States, other countries, or both. If these and other IBM trademarked terms are marked on their first occurrence in this information with a trademark symbol (® or ™), these symbols indicate U.S. registered or common law trademarks owned by IBM at the time this information was published. Such trademarks may also be registered or common law trademarks in other countries. A current list of IBM trademarks is available on the Web at “Copyright and trademark information” at www.ibm.com/legal/copytrade.shtml

Other company, product, or service names may be trademarks or service marks of others.