IMS Connect: Proving It’s Worth for Web Services

Ellis Holman, IBM System z Client Architect
Nancy Stein, IBM Consulting IT Specialist

August 8, 2011
Session Number 9405
Disclaimer

© Copyright IBM Corporation 2011. 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. 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, z/OS, IMS, DB2, WebSphere, WMQ, Rational, RAD, RADz, and zLINUX 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.
Purpose and Agenda

• Proof of Concept Purpose
  • Determine if a combination of IMS 11 and IMS Connect can replace the existing WMQ interface to IMS applications, simplify the environment and continue to meet business SLAs

• Agenda
  • Introduction
  • IMS Connect PoC
  • Findings
  • Potential Benefits
  • References
  • Appendix
Introduction – Background

• In the beginning … an onsite System z Infrastructure Architecture Workshop (zIAW) was executed with customer and IBM SMEs

• Developed and outlined an IMS Connect PoC
  • Subject Applications
    • Online Inquiry System portal integration with mainframe application
    • Online Update System portal integration with mainframe application
    • Outbound Pricing Service

• Established IMS Connect PoC sandbox environment for learning and discovery of IMS SOA capabilities
Introduction – Key Participants

• Customer
  • Enterprise Architects
  • Application Developers
  • System Programmers & DBAs
  • Performance & Tuning / Capacity Planning
  • Application Developers
  • Management

• Ellis Holman, IBM System z Client Architect
• Nancy Stein, IBM Consulting IT Specialist
• Haley Fung, IBM IMS Connect Lead Developer
Introduction – Additional Team Members

• Linda Warfield, IBM Project Manager
• Subra Narayanaswamy, IBM Global Services
• Thomas Garrett, IBM Global Services
• Gerald Waterman, IBM
IMS Connect POC – Customer’s Goals

Create a simple sandbox environment to exercise IMS Connect for:

1) inbound calls to an existing IMS application
2) outbound calls from IMS applications to existing web services

This environment is going to be used for discovery and learning relative to the IMS Connect product. We hope to learn how we can leverage IMS Connect in the environment.

• Inbound Transaction Use Case Evaluation
  • Port an existing client application to the mainframe running under a z/Linux LPAR
  • Existing WMQ calls will be modified to utilize the IMS TM Resource Adapter running in Websphere on z and IMS Connect to call existing IMS transactions
  • The modified application will eliminate the need for WMQ

• Outbound Transaction Use Case Evaluation
  • Use an existing CLAIM application to leverage the new IMS DLI call, ICAL, to invoke an existing web service via the IMS SOAP Gateway
IMS Connect POC – What Was Done?

- On-Site IBM System z Infrastructure Architecture Workshop
  - September 2009
  - Studied two selected Business Use Cases
- Setup Sandbox Environment for PoC
- Application Portals Modifications
  - Migrated from mid-tier AIX platform to Linux on System z platform
  - Replaced WMQ calls with IMS TM Resource Adapter / IMS Connect API
- Inbound Transaction Use Case Evaluation
  - IMS TM Resource Adapter (J2C 1.5 Architecture)
  - IMS Connect API
  - IMS DB Resource Adapter
  - IMS JDBC Universal Drivers
- Outbound Transaction Use Case Evaluation
  - IMS Transactions as web service consumers
  - IMS SOAP Gateway
A project plan was drawn up and teams assembled to provide support for the effort.
IMS Connect POC – Sandbox Environment

- **Hardware:**
  - 1 new LPAR
    - 1 IFL
    - 10 Gb Memory

- **Software:**
  - z/OS LPAR
  - z/VM LPAR
  - IMS 11 Control Region and IMS Connect
  - IMS SOA Integration Suite
  - Rational Application Developer Version 7.5.5
  - Rational Application Developer for System z Version 7.6
  - Websphere Application Server – ND Version 7
  - Redhat Enterprise Linux for z/OS Version 5
IMS Connect POC– Architecture

“Inside the box” virtual networking

Service Machines
(similar to daemons)

TCP/IP

TSM

VMR

ACCOUNTING

AUTLOG1

MAINT

LPAR

LPAR

z/VM Control Program

System z Hardware

IMS

IMS Connect

z/OS

IMS DB

WAS Linux Guests

WAS

WAS

WAS

CP1

CP2

CP3

IFL4

LPAR

LPAR

z/OS

IMS Connect

z/OS

IMS DB

WAS Linux Guests

WAS

WAS

WAS

CP1

CP2

CP3

IFL4

LPAR

LPAR

z/VM Control Program

System z Hardware

IMS

IMS Connect

z/OS

IMS DB

WAS Linux Guests

WAS

WAS

WAS

CP1

CP2

CP3

IFL4

LPAR

LPAR

z/VM Control Program

System z Hardware

IMS

IMS Connect

z/OS

IMS DB

WAS Linux Guests

WAS

WAS

WAS

CP1

CP2

CP3

IFL4

LPAR

LPAR

z/VM Control Program

System z Hardware

IMS

IMS Connect

z/OS

IMS DB

WAS Linux Guests

WAS

WAS

WAS

CP1

CP2

CP3

IFL4

LPAR

LPAR

z/VM Control Program

System z Hardware

IMS

IMS Connect

z/OS

IMS DB

WAS Linux Guests

WAS

WAS

WAS

CP1

CP2

CP3

IFL4

LPAR

LPAR

z/VM Control Program

System z Hardware
IMS Inbound Service Requests
IMS Connect – IMS’s TCP/IP Gateway

IMS Control Center
DataPower Appliance
WebSphere IMS TMRA
IMS SOAP Gateway
IMS Univ DB Adapters
IMS Connect API Clients
ISV Solutions
Roll Your Own Solution

z/OS
IMS
OTMA
TM
DEP RGN Application
DB MGR
DRA
ODBA

IMS Connect
IMS Connect Extensions
EXIT
EXIT
EXIT

XCF
SCI
SCI

Operations Manager
IMS PA & IMS PI Tooling

IMS DBs

TCP/IP

Roll Your Own Solution
IMS Connect PoC
Use Case #1: Inbound Call to IMS

1. User issues inquiry or update request from Web Browser via HTTP(S)
2. Business Service EJB receives and processes request
3. Business Service EJB invokes IMS TM Resource Adapter
4. IMS TM Resource Adapter sends request to IMS Connect via TCP/IP (uses Hipersocket connection)
5. IMS Connect passes I/P message to OTMA via XCF; OTMA places transaction on IMS Message Queue
6. IMS schedules and processes transaction in dependent region,
7. O/P response message is returned to Business Services EJB
Findings – Inbound Applications

• Positives …
  • Improved performance of inbound IMS transaction
    • application response time reduced by 25%
  • Improved performance of Portals under Linux on System z
    • average 30% improvement in the overall performance
  • Standard and flexible IMS interfaces vs. proprietary WMQ calls
    • JEE, TMRA, JCA 1.5, JDBC and direct API calls
  • Standard, supported IMS SOA vs. proprietary black box solutions of EIS and BSI application frameworks
  • Flexibility of switching backend IMS subsystems via WAS Admin Console
    • no coding changes required when using WAS and IMS TMRA
  • Paradigm shift to a two-tier architecture model
    • resulted in code that is cleaner and easier to maintain
  • IMS 11 supports inbound services calls after enabling IMS Connect
  • Narrowed the knowledge gap between M/F and Distributed personnel
Findings – Inbound Transactions

• Things to be aware of …

• Not a full JDBC 3.0 implementation
  • No impact on this PoC, but does not support JDBC Batch accessing databases directly in DLI mode

• Little Endian and Big Endian conversion between platforms
  • When the client application was migrated to Linux on System z, the order in which bytes were stored in memory required specific parsing of the IMS message returned

• Need to handle mainframe transaction ABENDs properly
Stress Test Observations

View of performance results for use cases accessing IMS transactions to fetch data
### Stress Test Observations

Snap shot of stress test results for use cases - WMQ, IMS Connect API & IMS TMRA

#### Comparison of use cases

<table>
<thead>
<tr>
<th>Name</th>
<th>MeasureType</th>
<th>Unit</th>
<th>Count</th>
<th>Total</th>
<th>Min</th>
<th>Avg</th>
<th>Max</th>
<th>StDev</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WebSphere MQ</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1A_Subscriber_Search</td>
<td>Response time[s]</td>
<td>Seconds</td>
<td>720</td>
<td>1,297.95</td>
<td>0.570</td>
<td>1.803</td>
<td>10.672</td>
<td>1.306</td>
</tr>
<tr>
<td>1C_Select_Category_and_click_lookup</td>
<td>Response time[s]</td>
<td>Seconds</td>
<td>360</td>
<td>708.334</td>
<td>0.625</td>
<td>1.968</td>
<td>9.844</td>
<td>1.468</td>
</tr>
<tr>
<td>1F_Benefit_Keyword_Search</td>
<td>Response time[s]</td>
<td>Seconds</td>
<td>180</td>
<td>314.68</td>
<td>0.578</td>
<td>1.749</td>
<td>10.437</td>
<td>1.32</td>
</tr>
<tr>
<td>2A_Group_SubGrp_Search</td>
<td>Response time[s]</td>
<td>Seconds</td>
<td>720</td>
<td>1,132.43</td>
<td>0.235</td>
<td>1.573</td>
<td>21.97</td>
<td>1.881</td>
</tr>
<tr>
<td>2C_Select_Category.Lookup_for_Group</td>
<td>Response time[s]</td>
<td>Seconds</td>
<td>360</td>
<td>522.939</td>
<td>0.407</td>
<td>1.453</td>
<td>7.187</td>
<td>1.318</td>
</tr>
<tr>
<td>2F_Benefit_Keyword.Search_for_Group</td>
<td>Response time[s]</td>
<td>Seconds</td>
<td>180</td>
<td>299.365</td>
<td>0.344</td>
<td>1.663</td>
<td>19.453</td>
<td>1.941</td>
</tr>
<tr>
<td><strong>IMS Connect API</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average E9 transaction time: 793 ms (12/18/2009)</td>
<td>Response time[s]</td>
<td>Seconds</td>
<td>720</td>
<td>909.542</td>
<td>0.329</td>
<td>1.263</td>
<td>14.204</td>
<td>0.871</td>
</tr>
<tr>
<td>1A_Subscriber_Search</td>
<td>Response time[s]</td>
<td>Seconds</td>
<td>360</td>
<td>504.113</td>
<td>0.484</td>
<td>1.4</td>
<td>8.563</td>
<td>0.925</td>
</tr>
<tr>
<td>1C_Select_Category_and_click_lookup</td>
<td>Response time[s]</td>
<td>Seconds</td>
<td>180</td>
<td>219.625</td>
<td>0.422</td>
<td>1.22</td>
<td>5.969</td>
<td>0.779</td>
</tr>
<tr>
<td>2A_Group_SubGrp_Search</td>
<td>Response time[s]</td>
<td>Seconds</td>
<td>720</td>
<td>494.817</td>
<td>0.078</td>
<td>0.687</td>
<td>8.766</td>
<td>0.464</td>
</tr>
<tr>
<td>2C_Select_Category.Lookup_for_Group</td>
<td>Response time[s]</td>
<td>Seconds</td>
<td>360</td>
<td>236.378</td>
<td>0.156</td>
<td>0.657</td>
<td>3.235</td>
<td>0.339</td>
</tr>
<tr>
<td>2F_Benefit_Keyword.Search_for_Group</td>
<td>Response time[s]</td>
<td>Seconds</td>
<td>180</td>
<td>120.54</td>
<td>0.141</td>
<td>0.67</td>
<td>2.906</td>
<td>0.337</td>
</tr>
<tr>
<td><strong>IMS TM RA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average E9 transaction time: 681 ms (12/21/2009)</td>
<td>Response time[s]</td>
<td>Seconds</td>
<td>720</td>
<td>728.017</td>
<td>0.281</td>
<td>1.011</td>
<td>7.75</td>
<td>0.686</td>
</tr>
<tr>
<td>1A_Subscriber_Search</td>
<td>Response time[s]</td>
<td>Seconds</td>
<td>360</td>
<td>378.439</td>
<td>0.484</td>
<td>1.051</td>
<td>4.61</td>
<td>0.614</td>
</tr>
<tr>
<td>1C_Select_Category_and_click_lookup</td>
<td>Response time[s]</td>
<td>Seconds</td>
<td>180</td>
<td>172.319</td>
<td>0.468</td>
<td>0.957</td>
<td>4.75</td>
<td>0.574</td>
</tr>
<tr>
<td>2A_Group_SubGrp_Search</td>
<td>Response time[s]</td>
<td>Seconds</td>
<td>720</td>
<td>456.587</td>
<td>0.11</td>
<td>0.634</td>
<td>8.547</td>
<td>0.506</td>
</tr>
<tr>
<td>2C_Select_Category.Lookup_for_Group</td>
<td>Response time[s]</td>
<td>Seconds</td>
<td>360</td>
<td>222.155</td>
<td>0.187</td>
<td>0.617</td>
<td>2.328</td>
<td>0.313</td>
</tr>
<tr>
<td>2F_Benefit_Keyword.Search_for_Group</td>
<td>Response time[s]</td>
<td>Seconds</td>
<td>180</td>
<td>102.066</td>
<td>0.109</td>
<td>0.567</td>
<td>1.937</td>
<td>0.247</td>
</tr>
</tbody>
</table>

Average 30% improvement using IMS Connect vs WMQ
IMS Outbound Service Requests
IMS Connect PoC
Use Case #2: IMS Outbound to Web Service

1. IMS application transaction issues an “ICAL” request with a SENDRECV to an OTMA Descriptor
2. OTMA passes the request message directly to IMS Connect bypassing the IMS Message Queue
3. IMS Connect converts message into XML and sends it to SOAP Gateway via TCP/IP (uses Hipersocket)
4. SOAP Gateway wraps SOAP envelope around the XML and sends request to the Web Service via HTTP(S)
5. Web Service receives and processes the request from IMS application transaction
6. Web Service sends response back to waiting IMS application transaction via a reverse path
Findings – Outbound Pricing Service

• Simple http enabled service was successful
  • The following configuration issues were resolved
    • Tpipe connectivity issue
      • Analysis to determine why the tpipe which connects IMS Soap Gateway and IMS Connect to OTMA is not processing IMS call to request the simple http enabled service
      • Resolved by putting adhoc security in place and applying an APAR
    • RAD/z was needed to create the WSDL used by IMS Connect
      • Issues uncovered working with RAD/z:
        • The mapping code generated is rejecting the request
        • Looking at the Cobol versioning level
      • Worked with IBM Labs in Germany and in SVL
Findings – Outbound Pricing Service

- Call failed in the timeframe of the PoC
  - Artifact creation issues within the IBM® Rational® Developer for System z® caused a change in direction to create a simple http enabled service to continue with the PoC
    - WSDL RPC support
      - Not all standard WSDL levels were supported
      - IBM confirmed that in the next release this issue would be addressed
  - Three enhancement requests were opened to make the tool useful in a production deployment environment
    - ODC
    - multiple mapping
    - embedded logic
  - Connection issues to the mainframe demon listeners using IBM® Rational® Developer for System z® (RAD/z)
    - Fixed with security
Findings - Non-Technical

• From the Customer
  • IBM as a Technical Partner
    • “IBM supported business associates and addressed the issues quickly and listened to our findings and proposed solutions or integrated our findings into future releases of the software.”
  • “Infrastructure support is strongly exploring skipping IMS 10 and migrating directly to IMS 11 and IMS Enterprise Suite Version 11, then deploying the IMS Connect and IMS SOAP Gateway address spaces.”
  • “An additional PoC is being proposed by Enterprise Architecture staff to use the IMS 11 sandbox to determine if the technology can be applied to current BSI Frameworks”
Findings – PoC Success

- **Proof of Concept Purpose**
  - Determine if a combination of IMS 11 and IMS Connect can replace the existing WMQ interface to IMS applications, simplify the environment and continue to meet business SLAs

- **IMS V11 and IMS Connect …**
  - Can replace the WMQ interface to IMS applications
  - Simplifies the integration environment significantly
  - Able to achieve better results than the business SLAs
Potential Benefits

• **IMS Connect and IMS SOA Integration Suite**
  • Performance, reliability and scalability improvements
  • Reduced configuration and maintenance vs. WMQ setup and maintenance – simplification of interface
  • Assumed significant reduction in production MIPs
    • It was determined that an average Claim took 60 - 100 ms of overhead when going through the WMQ calls
  • Eliminates 32kb payload restriction using “ICAL” / IMS Connect / IMS SOAP Gateway
    • Allowed for request and response payloads of 16mb
  • Eliminates the multiple points of failure inherent in WMQ hops
  • Allows a point to point connection to all web enabled/SOAP/html services from within IMS
  • Brings the IMS environment inline with SOA standards
Potential Benefits

- **Server Virtualization Using Linux on System z**
  - Dynamic computing resource allocations
  - Decreased complexity to improve manageability of systems
  - Automate routine tasks
  - Reduces overall management costs through efficiency
  - Possible Software License cost saving
  - Improves return on infrastructure investment through better utilization of resources
  - Savings on energy and floor space
Potential Benefits

• **Lean Development Process**
  • On demand computing environment and model to test, assemble, retest & deploy applications and maximize hardware utilization
  • Automatically configure OS & software stacks
  • Provides developer self service capabilities
  • Simplifies ongoing operations and reduces technical support burden
  • 11 Servers will be sunset during solution implementation
Post-PoC Steps

- **Total Cost Ownership (TCO) Analysis by IBM**
  - Hardware cost saving model through Linux on System z virtualization
  - License cost saving
  - Maintenance and administration labor cost saving
  - Process efficiency analysis

- **Production Implementation (based on TCO analysis)**
  - IMS 11 and IMS Connect, IMS SOA Integration Suite and z/Linux
  - Application Portal z/Linux Migration
    - consolidate 11 physical boxes
    - software license and administration cost saving
  - DB2 Gateway migration
    - consolidate 2 boxes
Post-PoC Steps

• **Identify Additional Applications Within Scope**
  - Begin reengineering of another IMS application
  - Frameworks integration using DataPower
  - PoC completed in 2010

• **Phase II PoC**
  - Centralize Benefit Services running on Websphere 7 / z/OS
  - DataPower integration
References for PoC

• IMS SOA Integration Suite

• IMS Enterprise Suite

• IBM Websphere Application Server
  IBM - WebSphere Application Server - Software

• Programming with the IMS Universal JDBC drivers
References for PoC

• Bringing IMS and SOA Together With IMS Connect
  
  Bringing IMS and SOA Together With IMS Connect | Mainframe | IBM Systems Magazine

• IBM IMS TM Resource Adapter
  

• IBM Enterprise Modernization Sandbox - Demos
  
Information and Analytics Communities

• On-line communities, User Groups, Technical Forums, Blogs, Social networks, and more
  • Find a community that interests you …
    • [ibm.com/software/data/community](http://ibm.com/software/data/community)

• Information Champions
  • Recognizing individuals who have made the most outstanding contributions to Information Management communities
    • [ibm.com/software/data/champion](http://ibm.com/software/data/champion)
IMS Information and Education

- “An Introduction to IMS” book
  - Update coming for IMS 11
- IMS Redbook
  - IMS Version 11 Technical Overview
- IMS Family Website: [www.ibm.com/ims](http://www.ibm.com/ims)
  - Presentations, papers, newsletters, fact sheets, announce letters, Redbooks
  - Schedule of seminars, webcasts and conferences
  - IMS education schedule
- Information Center - enables search across IMS, DB2 and Tools documentation
- Migration, skills transfer, customized offerings at [ibmdds@us.ibm.com](mailto:ibmdds@us.ibm.com)
IMS 11 Information

• **IMS 11 Announcement Letter 208-258**
  www.ibm.com/common/ssi/index.wss

• **IMS 11 Fact Sheet - GC19-2451**

• **IMS 11 Release Planning - GC19-2442**

• **IMS 11 Publications**
  - All of the IMS 11 publications are available from the Information Management Software for z/OS® Solutions Information Center

• **IMS Version 11 Technical Overview – Redbook SG24-7807-00**

• **IMS 11 Open Database – Redbook SG24-7856-00**
Data Management Communities for IMS

- **Data Management Community** – share and interact on all Data Management topics with peers around the world

- **IMS Community** – share and interact with IMS peers around the world

- **IMS Regional User Groups** – find a meeting near you

- **IMS Application Development Forum**

- **Information Champions** – recognized individuals who have made the most outstanding contributions to the Information Management community
  - [www.ibm.com/software/data/champion](http://www.ibm.com/software/data/champion)

- **Rational Cafes** – for host application programming languages

- **COBOL Cafe** – IMS Hub for application programmers
Thank You!
Your Feedback is Important to Us

Ellis Holman, IBM System z Client Architect – eaholma@us.ibm.com
Nancy Stein, IBM ATS Specialist / IMS – ngstein@us.ibm.com