IBM IMS Connect for Enterprise Workloads

Fundi Software
Overview

• Introduction: IMS Connect, why it increasingly matters
• Evolution of typical IMS Connect architectures
• Impact and challenges of growing workloads
• Strategies for addressing these challenges
• Conclusions
IMS Connect History

• 1997 – ITOC Get’s a User’s Guide
• 1998 – Visual Age for Java – Connecting to IMS using Java (“e-business”)
• 2004 – IMS V9 – “IMS Connect” becomes an integrated component
• WebSphere TM Resource Adapter (from distributed) Support
• 2009 – IMS V11 – IMS Open Database
• 2011 – IMS Management Console
• Now z/OS Connect
IMS Connect: state of the union
IMS Connect characteristics

• Lightweight
• Own address space
• Extensible: messages processed via user exits
• Simple to configure and set up
• Propriety IRM protocol (except for open database)
IMS Connect Extensions

• Companion tool for IMS Connect
• Available since just before IMS V9
• Originally developed for routing and exit management
• Used for event collection
• Recent years show a strong shift towards routing and exit management
• Why?
Profile of an IMS Connect customer

- Gradual migration
- Incremental growth in use
- Experiences growth pains

Greenfield development
Application modernization
Network modernization
IMS Connect use
P.O.C
IMS Connect
Growing pains

- Cost of down time
- Performance limits
- Workload type changing
- Increasing customization needs
- Consolidation versus redundancy
- Operations and maintenance challenges
- Clients coded to an inflexible topology
With pain comes requirements

• Greater scalability
• Higher availability
• Improved security
• Cost containment: consistency, fewer customizations, greater flexibility
• Requirements must be met while minimizing the disruption to existing client code and existing client instances
Meeting the challenges

• Use routing to improve parallelism, add redundancy, and provide abstraction (insulation) to clients
• Consider additional security
• Centralize the management of client option
• Centralize operational management
• Use IMS Connect instrumentation to tag the various workloads
Customizing exits

• Can provide a short-term fix for some requirements
• Open database offers simple round-robin routing
• Maintenance over time
• Can only refresh BPE Exits, not message exits
User Story: Manage workload by attributes

- OTMA routing includes the ability to qualify by transaction code as well as datastore
- Open Database routing support can qualify by the alias name or PSB
- Generic destinations.
- Parallelism
- Optional fallback (flood or down)

Try at SHARE
User Story: Manage message distributions

- Capacity weights allow you to dynamically favour certain destinations
- Switch from one plan to another with z/OS Explorer plug-in.
- Or batch automation….

Try at SHARE
User Story: do not interrupt in-flight work

1. Active IMS system used by three IMS Connects

- ICON 2 Datastore for IMSA
- ICON 3 Datastore for IMSA

2. Drain initiated stopping new transactions to IMS system. Workload is routed to other IMS systems

- ICON 2 Datastore for IMSA
- ICON 3 Datastore for IMSA

3. When all activity has completed the IMS system can be bought down safely

- ICON 2 Datastore for IMSA
- ICON 3 Datastore for IMSA

4. When the IMS system is restarted, IMS Connect Extensions automatically resumes routing workload to it.

- Drain in-flight work before IMS shut down.
- Coordinate manually using z/OS Explorer Plugin
- Use commands and batch automation.

Try at SHARE
Security

What does IMS Connect provide?

- Password, Passtablet and Password Phrase verification
- ACEE caching
- Automatically monitors RACF Event Notification Facility (ENF) events for changes.

What additional security could you need?

- Access control by system name, client IP address and port
- Consistent implementation for both traditional OTMA clients and Open Database clients
User Story: limit IP address access

- Manage access to IMS Connect systems based on the IMS Connect system a client is connecting through and the IP address they are connecting from.
- Security rules (RACF or other) can be used to produce whitelists.
- Rules can be formed to produce blacklists that reject access from certain IP addresses or address ranges.
- Access can be restricted further based on the IMS Connect port being used by the client.

Governance, not just security
When an IMS Connect system is restarted after maintenance, established persistent socket sessions on other IMS Connect systems remain in place. The newly started IMS Connect is underutilized and the sysplex workload appears out of balance.

You can also drain persistent sessions.
Centralized management of client options

- Transaction options (expiration, IRM Timer values, client ID cancellation)
- Duration of persistent sessions
- Message translation between any code pages (such as EBCDIC <=> ASCII)
- Extended RSM feedback

- Fine tuning options by transaction
- Removes the need to customize exits
- Restrict client session life
- Changes are immediate
Key features: Centralized monitoring and control

Growing workloads mean more IMS Connect instances

Eclipse or ISPF

File Option Help
- Stop IMS 1 link
- View TOKYO sessions
- Stop NY sessions
F1 - Help F2 - Scroll

And REXX for Automation

/* REXX */
address LINK "CERXENV INIT"
address CEX
"CONNECT HOST=FTSD,||, "PORT=13883,HWSID=HWS1, "SWITCH TYPE=JOURNAL"
address LINK "CERXENV TERM"
Beyond VIEWHWS

VIEWHWS

- Output in system-specific joblogs.
- Output is cluttered and fills spool.
- Difficult to filter, search, sort, summarize and export.
- Displays don’t provide leads to command actions.

IMS Connect Extensions

- Consolidated output from multiple systems.
- Output is tabulated.
- Built-in filtering and sorting.
- Instant export to spreadsheet applications.
- Context actions: perform commands directly against objects in table.
The Status Monitor view provides you with:

- Tabbed views of each resource type.
- Context actions against resource instances like drain, stop, and start.
- Sortable, searchable, and filterable sysplex view of resources.
- Summarise, save, and export the session list as a CSV file.
- Auto-update highlighting any criteria.
- Many more session attributes.
The sessions view provides you with:
- Context actions to cancel sessions and get network status.
- Sortable, searchable, and filterable Sysplex view of sessions.
- Ability to summarize, save, and export the session list as a CSV file.
- Auto-update highlighting any criteria.
- Many more session attributes.
## Restart the datastore

- Click to stop the datastore
- Perform maintenance
- Click to start the datastore

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<table>
<thead>
<tr>
<th>IMS Connects</th>
<th>Ports</th>
<th>Exits</th>
<th>Datastores</th>
<th>Datastore Groups</th>
<th>ODBMs</th>
<th>Aliases</th>
<th>MSCs</th>
<th>Remote Connects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status</td>
<td>System</td>
<td>Name</td>
<td>TMember</td>
<td>Super Member</td>
<td>Connect Status</td>
<td>IMS Status</td>
<td>Routing Status</td>
<td>Waiting Reply</td>
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<tr>
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<td></td>
<td>HWS0PGS1</td>
<td>IMSA</td>
<td>XCFMICDA</td>
<td>MEM1</td>
<td>Active</td>
<td>Normal</td>
<td>Normal</td>
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<td>IMSB</td>
<td>XCFMICDA</td>
<td>MEM1</td>
<td>Active</td>
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<td>MEMA</td>
<td>Active</td>
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<td>Normal</td>
<td>0</td>
</tr>
</tbody>
</table>

- **No sessions waiting – datastore drained**

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**Route Drain**
- Route Drain with AUTORESUME
- Route Resume

**Start**
- Update Capacity Weight...
Datastore Drain

- Recall: Take datastores offline without disrupting active sessions
- Mark the datastore as requiring a drain
- Status changed to suspended
Update Commands: IMS Connect

- OTMA/ODBM Routing Plans
- Event Collection Level
- Message Limits
- Single or multiple systems

New in V2.4

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Update capacity weight

New in V2.4
Update CWR:
- GUI or Batch
- Zero CWR
Use case: But now I want to automate it…

Master your operations with automation

The CEX host command environment for REXX enables IMS Connect Extensions commands to be embedded in REXX programs, which allows more flexible automation of IMS Connect operations.

- Programs can connect to multiple IMS Connects.
- Use REXX features such as variables and conditional logic.
- Integrate with other host command environments (MVS, CONSOLE, TSO).
- Submit programs interactively as well as in batch.

Use the flexibility of REXX
Single REXX to control multiple systems
Integrate with other host command environments
Automate routine operational activities
working REXX samples
User story: Management reporting

• Why now?
  – Nature of the workload

• Historical summary

• Why focus on IMS Connect (as opposed to IMS or further upstream)?
  – All web facing activity

• Long term trends more important
User story: unmasking abstractions

• How do I quickly understand where a problem lies in complex multi-tiered environment?
The problem is somewhere in here: a reporting "black hole" between the two product support teams.

Response times over 2 seconds!

"Application waits 2 seconds for a response from IMS. Contact IMS support."

"IMS responds in a millisecond."

Event journal

IMS Connect Extensions

IMS Connect

ODBM

IMS

IMS log

Distributed Application

Application Support staff

IMS support staff

Tracks DRDA flow

IMS Problem Investigator

IMS Performance Analyzer

Reports separate response times for IMS Connect and IMS
Database requests via TCP/IP

IMS Connect receives Open

IMS Connect calls security and routing exits

IMS Connect forwards requests to ODBM

IMS Processes Open Database request

Response returns to client via ODBM & IMS Connect

IMS Connect receives next request from client

DRDA conversation continues until PSB deallocated and socket closes

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IMS Connect Extensions Journal
IMS Log
IMS Monitor
Omegamon for IMS ATF

Other: DB2, SMF, MVS, CQS...

Sudden jumps in elapsed or relative times may indicate problems
## DRDA requests and responses

DDM (distributed data management) commands. ‘Code points’ show flow of DRDA requests and responses.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Date</th>
<th>Time (LOCAL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>005B</td>
<td>DRDA 1041-EXCSAT-Exchange Server Attributes</td>
<td>2015-04-30 Thursday</td>
<td>09.23.59.653612</td>
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<tr>
<td>005B</td>
<td>DRDA 106D-ACCSEC-Access Security</td>
<td></td>
<td>09.23.59.653639</td>
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<tr>
<td>005C</td>
<td>DRDA 1443-EXCSATRD-Server Attributes Reply Data</td>
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<td>09.23.59.653656</td>
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<tr>
<td>005C</td>
<td>DRDA 14AC-ACCECRD-Access Security Reply Data</td>
<td></td>
<td>09.23.59.653663</td>
</tr>
<tr>
<td>005B</td>
<td>DRDA 106E-SECHK-Security Check</td>
<td></td>
<td>09.23.59.690552</td>
</tr>
<tr>
<td>005C</td>
<td>DRDA 1219-SECCKRM-Security Check Reply Message</td>
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<td>09.23.59.691545</td>
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<tr>
<td>005B</td>
<td>DRDA 1055-SYNCTLR-Sync Point Control Request</td>
<td></td>
<td>09.23.59.717168</td>
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<tr>
<td>005C</td>
<td>DRDA 1248-SYNCCRD-Sync Point Control Reply</td>
<td></td>
<td>09.23.59.717859</td>
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<tr>
<td>005B</td>
<td>DRDA 2001-ACCRDB-Access RDB</td>
<td></td>
<td>09.23.59.887593</td>
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<tr>
<td>005C</td>
<td>DRDA 2201-ACCRDDBM-Access RDB Reply Message</td>
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<td>09.23.59.995587</td>
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<tr>
<td>005B</td>
<td>DRDA 200C-OPNQRY-Open Query</td>
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<td>09.24.00.223312</td>
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<tr>
<td>005B</td>
<td>DRDA CC01-INAIB-AIB data</td>
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<td>09.24.00.223384</td>
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<tr>
<td>005B</td>
<td>DRDA CC04-RTRVFLD-Field client wants to retrieve data</td>
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<tr>
<td>005B</td>
<td>DRDA CC06-SSALIST-List of segment search argument</td>
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<td>09.24.00.223432</td>
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<tr>
<td>005C</td>
<td>DRDA 2205-OPNQRYRM-Open Query Complete</td>
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<tr>
<td>005B</td>
<td>DRDA 2006-CNTQRY-Continue Query</td>
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<td>09.24.00.230294</td>
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<tr>
<td>005C</td>
<td>DRDA 2418-QRYDTA-Query Answer Set Data</td>
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<tr>
<td>005B</td>
<td>DRDA 2006-CNTQRY-Continue Query</td>
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<td>09.24.00.237237</td>
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<tr>
<td>005C</td>
<td>DRDA 2418-QRYDTA-Query Answer Set Data</td>
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</tr>
<tr>
<td>005B</td>
<td>DRDA 2006-CNTQRY-Continue Query</td>
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<td>09.24.00.240196</td>
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<tr>
<td>005C</td>
<td>DRDA 2208-ENQRYRM-End of Query</td>
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<tr>
<td>005B</td>
<td>DRDA C802-RLS-Release database locks</td>
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<td>09.24.00.441456</td>
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<tr>
<td>005C</td>
<td>DRDA CA03-RLSERM-RLSE command has completed normally</td>
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<tr>
<td>005B</td>
<td>DRDA 1055-SYNCTLR-Sync Point Control Request</td>
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<tr>
<td>005C</td>
<td>DRDA 1248-SYNCCRD-Sync Point Control Reply</td>
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<tr>
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<td>DRDA 1248-SYNCCRD-Sync Point Control Reply</td>
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<td>09.24.00.541405</td>
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<tr>
<td>005B</td>
<td>DRDA C801-DEALLOCDB-Deallocate PSB</td>
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<td>09.24.00.567558</td>
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<tr>
<td>005C</td>
<td>DRDA CA01-DEALLOCDBRM-Name of deallocated PSB</td>
<td></td>
<td>09.24.00.568680</td>
</tr>
</tbody>
</table>

These code points include:
- DRDA V5 Code points as defined by the Open Group
- IMS-specific code points
Virtual IMS User Group

Command: Navigate < 00.00.01.000000 >

Date/Time: 2016-02-16 09.44.02.176316

Tuesday 2016-02-16 Time (Relative) 09.48.19.182300

0049 READ Socket
00A4 Event Collection IRM Trace
003D Message Exit called for READ
00A3 Event Collection OTMA Trace
003E Message Exit returned from READ TranCode=IVTNO
00A3 Event Collection OTMA Trace
0041 Message sent to OTMA Type=Transaction
01 Input Message TranCode=IVTNO Source=Connect
35 Input Message Enqueue TranCode=IVTNO
31 DLI GU TranCode=IVTNO Region=0002
5050 Database ISRT Database=IVPDB1I Region=0002
5610 Syncpoint Start of Phase 1 Region=0002
00A3 Event Collection OTMA Trace
0042 Message received from OTMA Type=Data
00A3 Event Collection OTMA Trace
0042 Message received from OTMA Type=Commit confirm
00A3 Event Collection OTMA Trace
003D Message Exit called for XMIT

z/OS Connect
Conclusions

• Starting with IMS Connect is easy but it can be a poisoned chalice
  – Can be a victim of its own success
• Have a plan for how you will grow your workloads
• Understand that growth is not just more workload but greater variety of workload
• Understand what changes impact clients that you cannot control
• Understand the big picture
Thank You