IMS Open Database Best Practices

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Open Database Components

- IMS Open DB Universal Type-4 Drivers
- Open Database Components
- SCI
- DDM TCP/IP DRDA/ DDM DLI
- IMS Open DB Universal Type-4 Drivers
- SCI
- DRDA/ DDM
- SCIDRDA/ DDM
- SCI
- SCI
- SCI
- SCI
- Operations Manager (OM)
- Structured Call Interface (SCI)
- SCI API
- SCI API
- Open DB Manager (ODM)
- SCI
- DLI
- ODBA/CCTL
- IMS
- TCP/IP
- DRDA/ DDM
- z/OS LPAR 1
- z/OS LPAR 2
- IMS Connect ODBM Client
Open Database request flow
CSL IMSPlex startup/shutdown

- Start as a z/OS started procedure or as JCL
- Start all SCIs.
- Start all OMs.
- Start CQS if using a resource structure.
- Start all RMs.
- Start all IMS control regions
- Stop all IMS control regions
- Stop all RMs.
- Stop CQS
- Stop all OMs
- Stop all SCIs.

- STOP CSLjob command
  - STOP (P) cslobname
- CSL SHUTDOWN command
  - F sci:jobname, SHUTDOWN …
- CSLZSHUT API
  - Programming interface
Reminder of BPE Address Space Setup

BPE Address Space JCL
// EXEC PGM=BPEINI00, ....
PARM= ...
BPECFG= BPEINIT=specific module
xxINIT=suffix
PARM1=initialisation overrides

BPE Configuration Member
- Shared or dedicated
- Details of traces
- Pointers to Exit Lists

Exit List Member
- by exit type and component
- Shared or dedicated

Initialization Member
CSLDIxxx
- Name of BPE Address Space
- Plex name
- Other parameters

"Configuration" Member
- Configuration parameters
- CSLDCxxx

DFSPBxxx
ODBM BPE Trace Tables

- **CSL**
  - used for routines that are common to all CSL managers
- **ERR**
  - used to trace errors that occur within the ODBM address space
- **ODBM**
  - used for general ODBM processing flow
- **PLEX**
  - used for ODBM processing for a specific IMSplex

**BPE Commands**

```
F ODBM,DISPLAY TRACETABLE NAME(*) OWNER(ODBM)
F ODBM,UPDATE TRACETABLE NAME(*) OWNER(ODBM)
   LEVEL(HIGH) EXTERNAL(YES)
```
ODBM BPE Configuration PROCLIB Member Example

TRCLEV=(*,LOW,ODBM)                  /* DEFAULT ODBM TRACES TO LOW */
TRCLEV=(CSL,HIGH,ODBM)               /* CSL TRACE ON HIGH */
TRCLEV=(ODBM,HIGH,ODBM)               /* ODBM GENERAL TRACE ON HIGH */
TRCLEV=(PLEX,HIGH,ODBM)              /* IMSPLEX TRACE ON HIGH */

#
# USER EXIT LIST PROCLIB MEMBER SPECIFICATION
#

EXITMBR=(CSLEXOB0,BPE)              /* SPECIFY PROCLIB DATASET */
    /* MEMBER CSLEXOB0 AS BPE'S */
    /* USER EXIT LIST MEMBER */
EXITMBR=(CSLEXDM0,ODBM)              /* SPECIFY PROCLIB DATASET */
    /* MEMBER CSLEXDM0 AS ODBM'S */
    /* USER EXIT LIST MEMBER */
ODBM User Exit List PROCLIB Member

- EXITMBR= specifies PROCLIB member to define ODBM user exits
- User Exit List Statement
  - EXITDEF = (TYPE=type, EXITS=(exitname1, exitname2, ...), ABLIM=limit, COMP=ODBM)
    - TYPE=type (CLNTCONN, INITTERM, INPUT, or OUTPUT)
    - EXITS=(exitname)
      - list of one or more user exit module names.
    - ABLIM=limit
      - limit for the exit type being defined.
      - decimal number from 0 to 2147483647

F ODBM,DISPLAY USEREXIT ...
F ODBM,REFRESH USEREXIT ...
**ODBM Interfaces: ODBA and DRA**

- ODBM can be started with either **RRS=Y** or **RRS=N**
- **RRS=Y** for coordinated update
- **RRS=N** for inquiry only and use PCB with PROCOPT=G or use for Local transaction
THREADS and PSTs

IMSpex

- CCTL
- ODBM
- ODBA

Thread(PST)

DRA

CTL Services RRS=Y|N

DB Services

TM Services

IMS DB

BMP/JBP

MPP/JMP/IFP Application Program

PSTs
IMS Open Database and Distributed Sync Point

- Use of RRS with ODBM is optional
  - RRS=Y|N parm for ODBM start-up
  - RRS=Y is needed to supported Distributed Two-Phase Commit
    - RRS=Y in IMS Connect and ODBM and IMS Control Region

Note: An individual ODBM has either RRS=Y or RRS=N, but can not support both concurrently.
ODBM Availability

IMSPLEX(NAME=PLEX1)

IMS Connect 01 -> ODBM 02 -> IMS1
IMS Connect 02 -> ODBM 02
IMS Connect 02 -> ODBM 01 -> IMS2
IMS 02
IMS 01
z/OS LPAR 1
ODBM Availability

IMSPLEX(NAME=PLEX1)

IMS Connect 01

ODBM 02

IMS1

z/OS LPAR 1

Data Sharing

ODBM cannot cross

LPARS

IMS Connect 02

ODBM 01

IMS2

z/OS LPAR 2

Data Sharing
IMS 11 Connect and ODBM DRDA Server

IMS Universal Driver
DRDA Application Requestor
TCP/IP Client

DRDA
TCP/IP

IMS Connect
TCP/IP
DRDA PORT

DDM
SCI
z/OS

ODBM

DLI calls
DRA CCTL ODBA

OM
SCI

IMS Application Server

IMS
IMS Connect Startup Proc

HWSCFG00
*****************************************************
* IMS Connect example for IMS Universal drivers
  and DRDA client support
*****************************************************
HWS (ID=IMSCON01,PSWDMC=R,RRS=Y,RACF=Y,XIBAREA=20)
TCPIP (HOSTNAME=ZOSTCPIP,MAXSOC=2000,
ECB=Y,IPV6=Y,NODELAY=Y, RACFID=RACFID)
ODACCESS (DRDAPORT=(ID=1111,KEEPAV=5),
DRDAPORT=(ID=2222,KEEPAV=10,PORTTMOT=500)),
IMSPLEX=(MEMBER=IMSPLEX1,TMEMBER=PLEX1),
ODBMAUTOCONN=Y,ODBMTMOT=50000
IMS Connect HWSCFGxx Example …

- **OTMA**
  - HWS1
  - XCFGRP1
  - DRDA PORT 1111
  - 9999 9998

- **ODBM**
  - ICONOD2
  - PLEX2

- **OM**
  - ICONCC1
  - PLEX1

IMS CONNECT (belongs to both plexes)

For Transaction Processing

For ODBM Usage

For IMS Control Center Usage

For Transaction Processing

For ODBM Usage

For IMS Control Center Usage
Configure TCP for z/OS …

- PROFILE.TCPIP
  - PORT - Reserves a PORT for a specified Jobname

**PORT 1111 TCP IMSCON01 NODELAYACKS**

PORT portnum  TCP imsconnectname NODELAYACKS|DELAYACKS

In general, use NODELAYACKS
- Eliminates delay in sending ACK response back to client
- “Essential” if an input message is sent with multiple WRITEs
Global default can be set on TCPCONFIG statement
Customizing UNIX System Services

- SYS1.PARMLIB(BPXPRMxx)
  - MAXSOCKETS sets total number active sockets per stack
  - MAXFILEPROC sets total number socket descriptors per process

```bash
FILESYSTYPE TYPE(INET)
NETWORK DOMAINNAME(AF_INET)
DOMAINNUMBER(2)
MAXSOCKETS(4000)
TYPE(INET)

MAXFILEPROC(2000)
```

HWS (ID=IMSCON01,)
TCPIP (HOSTNAME=ZOSTCP, MAXSOC=2000 ...)
MAXSOCKETS/MAXFILEPROC Example

Remote Hosts

Connect to port 1111 at 64.235.160.98 IMS

Connect to port 2222 at 64.235.160.99 IMS

TCP/IP

Host 10.125.286.45
MAXSOCKETS(5000)
MAXFILEPROC(3000)

IMS Connect
DRDAPORT 1111
MAXSOC=2000

IMS Connect
DRDAPORT 2222
MAXSOC=3000

ODBM ALIAS IMSA

IMS

IMS A

z/OS Host
Configure TCP for z/OS ...

- **PROFILE.TCPIP**
  - SOMAXCONN statement to specify the maximum number of connection requests queued for a listening socket.
  - Where queue-size indicates the number of connection requests that can be queued by the system while the IMS Connect has not yet issued the Accept() call

  **SOMAXCONN 100**

  SOMAXCONN queue depth –
  - Default is 10,
  - Maximum value is 2,147,483,647

- Should be large enough to support the max concurrent requests
SOMAXCONN Example

Connect to port 1111
Client 1
IMS

Remote Hosts

Connect to port 1111
Client n+1
IMS

z/OS Host

TCP/IP

Host
10.125.286.45
IMSCON01
DRDAPORT1111
LISTEN
ACCEPT n

OBM
ALIAS
IMSA

IMSA

timeout while "Contacting host".
Configure TCP for z/OS ...

- **PROFILE.TCPIP**
  - TCPCONFIG statement configures various settings of the TCP layer
  - In particular, use INTERVAL timeout specification if remote client will specify long timeout values on input to IMS Connect (INTERVAL should be greater than IMS Connect timeout)

**TCPCONFIG INTERVAL 1440**

**INTERVAL** –
- Specifies “keepalive” value in minutes. On an open socket, if there is no activity for more than this period, then a “keepalive” message will be sent to the remote client. If the remote client does not respond, the socket is terminated.
  - Default is 120 minutes, maximum is 35791 minutes
  - The keepalive option is enabled by the remote client using setsockopt call

**IMS Connect** ODACCESS (DRDAPORT=(ID=1111,KEEPAV=5) this overrides TCPIPCONF INTERVAL
Sysplex Distributor – Distributed DVIPA

- Sysplex function providing a single “Cluster IP address” for a group of Hosts
  - Sysplex-wide VIPA - Workload balancing across multiple servers (WLM or round-robin)
  - Performs a Network Dispatcher type function on the z-Series environment
  - High availability - enhanced Dynamic VIPA and Automatic Takeover
Timeouts

- **PORTTTMOT=** Defines the amount of time that IMS Connect waits:
  - An subsequent input messages from TCP/IP client application
Timeouts

- **ODBMTIME** = Defines the amount of time that IMS Connect waits:
  - A response message on connections with ODBM
  - An initial input message from TCP/IP client application
**ODBM Security**

- ODBM does not perform any user authentication or authorization
  - Assumes the end Client Userid associated with an Allocate PSB request has been authenticated
  - IMS Connect does the authentication
  - IMS does the authorization
    - Checks that the User is authorized to use the PSB when the PSB is allocated
- There are 3 parameters which determine which security, if any, will be used
  - ODBM RRS=Y/N
  - ODBASE=Y/N
  - ISIS=N/R/C/A
- There is an additional parameter to determine which Userid is used
  - IMS Connect RACF=Y/N
SAF APSB Security

- **ODBASE=Y**
  - **ACEE - Authenticated USERID**
  - **The IMS application group resource class (AIMS or Axxxxxxx)**

ODBM uses RACO to create ACEE for ODBM Thread TCB
Userid will represent the end client

IMS Connect RACF=N a RACO is not provided IMS uses ODBM Job Card UserID
ACEE for ODBM ASCB
- ISIS=R or A

- ODBM extracts and passes RACO Userid in PAPL
- The IMS application group resource class (IIMS or Ixxxxxxx)

ODBM extracts the UserID from the RACO and passes it in PAPL.
Userid will represent the end client IMS Connect RACF=N if a RACO is not provided, IMS uses ODBM JOB Card UserID.

IMS Connect RACF=N a RACO is not provided IMS uses ODBM JOB Card UserID.
IMS Connect in a Multi-IMS IMSplex

- LPAR 1:
  - OM
  - SCI
  - IMS Connect
  - ODBM
  - IMS1

- LPAR 2:
  - SCI
  - OM
  - ODBM
  - IMS2

- LPAR 3:
  - OM
  - SCI
  - IMS3
  - ODBM
  - IMS Connect

- LPAR 4:
  - IMS4
  - ODBM
  - SCI
  - IMS Connect
IMS Connect in a Multi-IMSplexs

LPAR 1
- OM
- SCI1
- IMS Connect
- SCI1
- SCI2
- IMS1
- ODBM

LPAR 2
- SCI3
- OM
- ODBM
- IMS2
- SCI2

LPAR 3
- OM
- SCI2
- IMS3
- ODBM
- IMS Connect

LPAR 4
- SCI4
- IMS4
- ODBM
- IMS Connect
- SCI1
- SCI3

XCF
IMS Connect Routing to ODBM

- ODBM Alias Name Routing
  - Alias name is used by IMS Connect DRDA Client application programs
    - Remote applications do not need to know IMSID
      - *But one Alias can be same as IMS ID*

- Remote application can leave alias name blank
  - IMS Connect uses round robin routing across all ODBMs

- Specified Alias can be non-unique
  - Same alias defined for multiple IMS systems
  - IMS Connect uses round robin routing across ODBMs with the alias defined
IMS Connect Routing to ODBM

- ALIAS IO1A only routes to IMS1
- ALIAS IO2A only routes to IMS2
- ALIAS IO3A only routes to IMS3
- IMS4 has no alias, applications can use the DATASTORE name IMS4

- ALIAS IM1A is routed to ODBMB1 for either IMS1 or IMS2

IMS Connect A

IMS Connect B

ODBM (NAME=ODBMB1)
DATASTORE (NAME=IMS1, ALIAS (NAME=IM1A, IO1A))
DATASTORE (NAME=IMS2, ALIAS (NAME=IM1A, IO2A))

ODBM (NAME=ODBMB2)
DATASTORE (NAME=IMS3, ALIAS (NAME=IO3A, IMS3))
DATASTORE (NAME=IMS4)

ACCESS DB using ALIAS IM1A
And using IMS Connect Hostname port

TCP/IP

LPARA

LPARB

DB

DB

DB

DB
Connections

- ODBM Alias Name Routing
  - Alias name is used by IMS Connect DRDA Client application programs
    - Remote applications do not need to know IMSID
      - *But one Alias can be same as IMS ID*
  - Remote application can leave alias name blank
    - IMS Connect uses round robin routing across all ODBMs
  - Specified Alias can be non-unique
    - Same alias defined for multiple IMS systems
    - IMS Connect uses round robin routing across ODBMs with the alias defined
IMS Connect Routing and Security Exits for ODBM

- BPE managed and refreshable User Exits
  - **Routing user exit – HWSROUT0**
    - Override the IMS Connect selection of an ODBM and/or ALIAS
  - **Security user exit – HWSAUTH0**
    - Authenticate the input user ID and password or passticket
    - Provide the RACF group ID to be authenticated

```
EXITDEF(TYPE=ODBMROUT,EXITS=(HWSROUT0),ABLIM=8,COMP=HWS)
EXITDEF(TYPE=ODBMAUTH,EXITS=(HWSAUTH0),ABLIM=8,COMP=HWS)
```
IMS Connect Extensions

- Improves the manageability of IMS Connect
- IMS Connect Extensions enhancements for Open Database include:
  - Event collection for ODBM events
  - Routing of ODBM Allocate PSB requests
  - Monitoring of ODBM throughput in GUI or ISPF
  - Determination of ODBM resource availability
IMS Open Database Universal Drivers

- Different API layers are provided to leverage the DRDA protocol
  - **IMS Universal DB Resource Adapter** - to use JDBC SQL access to IMS data in a JEE environment such as WebSphere Application Server (WAS) on any platform
  - **IMS Universal JDBC driver** - to use JDBC SQL access to IMS data in a Non-JEE environment such as stand-alone java, DB2 SP, IMS TM, CICS
  - **IMS Universal DL/I driver** - to issue calls that are similar to DL/I directly to IMS from a Non-JEE Java environment
  - **RYO** - Use a programming language of your choice to issue DRDA commands directly to IMS Connect

- *Makes Application development and Connectivity much simpler!*
IMS Solutions for Java Development

- IMS 11 Open Database APIs JDBC 3.0
- IBM SDK V5 z/OS
  - CICS, DB2, WebSphere
- IBM SDK V6 z/OS
  - IMS TM
- IMS 9, 10 Java Drivers JDBC 2.1
- IBM SDK V1.3.1 IMS 9
- IBM SDK V1.4.2 IMS 9
- IBM SDK V5 z/OS IMS 10
setFetchSize and Network Efficiency

• An application can set the expected or desired number of rows to be returned – default is 1
• Especially relevant for a distributed client to maximize network efficiency
  • The driver will build a request for this number of rows to be returned
  • Send it to ODBM (via IMS Connect) to interact with IMS to retrieve this number of rows (if available)
• One network interaction will retrieve multiple rows
  • If the remote client application continues to ask for more rows, the driver will submit a request for another set of rows to be returned
• This facility is available in all the drivers
  • Universal DB Resource Adapter – for JDBC, and for CCI SQL or DL/1 access
  • Universal JDBC Driver
  • Universal DL/1 Driver
ODBM Client API

- ODBM Client request flow
  - CSLSCREG – Register to SCI
  - CSLDMREG – Register to ODBM
  - CSLSCRDY – Enable the ODBM client for SCI processing
  - CSLDMI FUNC= – API function calls
  - CSLSCBFR – Release output buffer
  - CSLDMDRG – Deregister from ODBM
  - CSLSCDRG – Deregister from SCI

CSL macros are documented in “IMS Version 11 System Programming APIs”
DRDA RYO Client API

- IMS DRDA Client flow
  - Establish TCP/IP connection to IMS Connect (open socket connection)
    - Host IP Address
    - DRDA Port number
    - IMS Alias
  - Allocate PSB (Open Database connection)
    - `ACCRDB` command `RDBNAM=PSB`
  - Access IMS DB using AIB, PCBNAME, SSALIST.
    - `OPNQRY` command `DLIFUNC=GU`
    - `EXCSQLIMM` command `DLIFUNC=ISRT,REPL,DLET`
    - `RDBCMM` command to commit changes
  - Deallocate PSB (Close Database connection)
    - `DEALLOCDB` command `RDBNAM=PSB`
IMS Enterprise Suite DLIModel Utility Plug-in or IMS Enterprise Suite Explorer

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

• Open Database Capabilities
  • Supports open-standards for connectivity to online IMS databases
    • Across z/OS LPARs
    • Across networks
    • Direct access from distributed platforms
  • Provides an environment that manages access to online IMS databases
  • Provides Open Database APIs
    • Ease application development access to IMS databases

IMS 11 Open Database