Tuning z/OS for WebSphere 4.0.1
(A View from 100,000 Feet)

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Agenda for This Presentation

• Overview
• z/OS Base Tuning
• TCP/IP Tuning
• z/OS UNIX Tuning
• Language Environment (LE) Tuning
• Workload Manager Tuning
• Hardware Upgrades
• References
• Questions?
Overview: The Big WebSphere Picture

- Base Infrastructure
  - z/OS and z/OS UNIX
  - HFS and zFS
  - Language Environment (LE)
  - TCP/IP
  - WLM
  - System Logger
  - DB2
  - RACF (SAF)
  - RRS

- System Servers
  - DAEMON
  - NAMING
  - SMS (System Management Server)
  - IR (Interface Repository)

- J2EE Servers
  - Hosting J2EE applications

- HTTP
  - IBM HTTP Server (plugin)
  - J2EE Server HTTP Transport Handler

- Backend
  - CICS
  - IMS
  - DB2
  - MQSeries (JMS)

z/OS Base Tuning

- Hints for a smooth install
  - Pull PSP for WebSphere AND related products
  - Follow installation instructions to the letter

- Keep maintenance current
  - z/OS (including z/OS UNIX)
  - WebSphere Application Server (WAS)
  - Java
  - Language Environment (LE)
  - DB2 and JDBC

- Much new function being delivered via service
z/OS Base Tuning

- WebSphere storage consumption
  - Nine+ new address spaces
  - Each needs 384 MB minimum to initialize
  - Expect even more as workload increases
  - Add 200 MB if WebSphere modules not in LPA

- Virtual storage recommendation #1
  - Code "REGION=0M" in the JCL for:
    - WebSphere tasks (both run-time and server)
    - IBM HTTP Server (IHS or IMWEBSRV)
    - TCP/IP

z/OS Base Tuning

- Virtual storage recommendation #2
  - Investigate exits and thresholds that can limit region size
    - JES2 exit EXIT06
    - JES3 exit IATUX03
    - SMF exit IEFUSI
    - UNIX thresholds in BPXPRMxx
    - UNIX thresholds in RACF OMVS segments
z/OS Base Tuning

• Virtual storage recommendation #3
  – Place WAS load modules in dynamic LPALIB
  – Use dynamic option because of PDSE libraries
  – Add libraries to PROGxx PARMLIB member:
    • LPA ADD DSNAMES(WAS40.WAS.SBBOLPA) MASK(*)
    • LPA ADD DSNAMES(WAS40.WAS.SBBOLOAD) MASK(*)
  – Use COM='SET PROG=xx' in COMMNDxx to activate
  – Check and increase ECSA size accordingly
  – Check and increase size of CSA page data set
  – Remove any unneeded STEPLIBs from JCL

z/OS Base Tuning

• Virtual storage recommendation #4
  – If storage resources are still a problem, consider:
    • Reducing JVM heap size (256 MB is the default)
    • Reducing LE heap size (80 MB is the default)
z/OS Base Tuning

• GRS considerations
  – ENQ/DEQ used for global WebSphere transactions
  – Suggest you set GRS options based on configuration:
    • For a sysplex, use GRS=STAR
    • For a monoplex, use GRS=NONE

z/OS Base Tuning

• Component tracing
  – Check this debugging option that affects performance
  – Identify components being traced
    • D TRACE,COMP=ALL
  – Disable trace if not needed
    • TRACE CT,OFF,COMP=xxxx (temporary)
    • SYS1.PARMLIB(CTnccccxx) (permanent)
**z/OS Base Tuning**

- **System Logger**
  - Common sysplex-wide logging facility
    - One logger task per image
    - Provides a single-system view of logged data
  - Supports two types of logstreams
    - DASD-only logstream
    - Coupling Facility logstream
  - Recommendations
    - Use Coupling Facility logstream
    - Else, use fast devices with DASD Fast Write (DFW)
    - Else, allocate logstreams with large CI sizes

**z/OS Base Tuning**

- **System Logger logstream sizes**
  - Small logs cause overhead during offload
  - Large logs may exhaust space in Coupling Facility
  - SMF record type 88 may be used to monitor and tune
    - Is CF size adequate?
    - What is the offload frequency?
- **Use of the RRS Archive Log**
  - Expect 1-3 records for each WebSphere transaction
  - Consider disabling log because of extra overhead
    - Create log during application development and tuning
    - Disable log when application stabilizes
TCP/IP Tuning

- **TCPIP.PROFILE changes**
  - Increase send/receive buffer sizes from 16K default
    ```
    TCPCONFIG TCPSENDBFRSIZE 65535
    TCPRCVBUFRSIZE 65535
    ```
  - Add 'NODELAYACKS' to PORT statement(s)
    - Shortens delay in sending ACK response back to client
    - Should improve throughput for trivial transactions
    - Adds slightly more overhead for complex transactions
  - Specify 'SHAREPORT OFF' (default)
    - A value of 'ON' allows sharing of the same port number
    - Avoid 'ON' if possible due to excessive overhead

TCP/IP Tuning

- **TCP/IP and VTAM**
  - If mixing web-based and legacy applications...
  - ...Same dispatching priority for TCP/IP and VTAM
- **HiperSockets for IP traffic in a Sysplex**
  - Faster and less overhead than using XCF
- **Advanced TCP/IP network options**
  - Multiple TCP/IP stacks (availability)
  - Connection Optimization (WLM and DNS)
  - WebSphere Edge Server
z/OS UNIX Tuning

• Changing UNIX threshold values
  – Update BPXPRMxx for a permanent change
  – Use SETOMVS command for a temporary change
  – Check values when configuration changes
    • HTTP Server operational mode (Standalone/Scalable)
    • HTTP Server versus HTTP Transport Handler
    • Transaction load
  – Consider RACF overrides for some changes
  – Monitor regularly to prevent problems

z/OS UNIX Tuning

• MAXFILEPROC
  – Defines maximum files open for any one process
  – Use 10000 for up to 150 concurrent users
  – Or ... 120 X number of web requests per second
  – Consider RACF override for this threshold

• MAXTHREADTASKS
  – Defines maximum active threads for any one process
  – Use 1000-5000 based on transaction load
**z/OS UNIX Tuning**

- **MAXTHREADS**
  - Defines maximum total threads for any one process
  - Use 2 X value of MAXTHREADTASKS

- **MAXSOCKETS**
  - Defines maximum sockets in AF_INET socket family
  - Use (2 X value of MAXFILEPROC) + 500

- **IPCSHMMPAGES**
  - Defines maximum pages for shared memory segments
  - Use 256 (for IHS running in Scalable mode)

**z/OS UNIX Tuning**

- **zSeries File System (zFS)**
  - More efficient alternative to HFS
  - An enhancement to the DCE Episode file system
  - Supported starting with z/OS V1R2
  - Available to z/OS V1R1 and OS/390 V2R10 via service
  - Two types of file systems supported
    - Compatibility Mode aggregate
    - Multi-File System aggregate
z/OS UNIX Tuning

- zSeries File System (zFS) considerations
  - Transparent to applications (no changes needed)
  - Performs much better for random access
  - May perform better for sequential access
  - Other enhancements
    - File system cloning
    - Space Quotas and Access Lists
    - Better error recovery after system outages
- But...
  - More difficult to administer
  - Cannot replace HFS in some cases

Language Environment (LE) Tuning

- General tuning hints
  - Put reentrant LE routines in common storage
    - Update SYS1.PARMLIB(LPALSTxx)
    - Add library name CEE.SCEELPA
  - Place non-reentrant LE routines in the link list
    - Update SYS1.PARMLIB(LNKLISTxx)
    - Add library name CEE.SCEERUN
  - But … when running multiple LE versions
    - Do not add modules to LPALIB/link list
    - Use Run-Time Library Services (RTLS) instead
Language Environment (LE) Tuning

• Application tuning hints
  – Update JCL for the server regions
    • Set PARM='RPTOPTS(ON),RPTSTG(ON)'
    • This will display LE options and storage statistics
  – Results will appear in joblog after a clean shutdown
    • VARY WLM,APPLENV=xxxx,QUIESCE
    • P server_name
  – Evaluate results and change options as needed
  – Remove options from JCL when finished

• Heap size tuning hints
  – Default of 80MB may be too large
  – Add 'RPTOPTS(ON),RPTSTG(ON)' to JCL as shown earlier
  – Evaluate output and reduce defaults if appropriate
    • HEAP(iiM,ssM)
    • ii = Initial heap allocation size in MB
    • ss = Secondary heap allocation size in MB
  – Test results and adjust values as needed
  – As before, remove diagnostic options when finished
Workload Manager (WLM) Tuning

- Control Region Service Classes
  - Assigned with the STC subsystem classification rules
  - Assign a high-velocity Service Class (or SYSSTC)
  - Consider a separate Reporting Class
  - Assign Service Class to the following tasks:
    - Daemon Server Control Region
    - System Management Server (SMS) Control Region
    - Naming Server Control Region
    - Interface Repository Control Region
    - Application Server Control Regions (J2EE and MOFW)

- Application Environments
  - A feature of Workload Manager used by:
    - WebSphere Server Regions
    - DB2 Stored Procedures
    - MQSeries Workflow
    - SOM
  - Implemented using Enclaves
  - Composed of a Queuing Manager and Server Regions
Workload Manager (WLM) Tuning

• Application Environments
  – Queuing Manager
    • Usually only one
    • Receives work and passes it to WLM
    • WLM passes work on to a Server Region
  – Server Regions
    • Usually multiple; running in separate address spaces
    • Accepts work from Queuing Manager and WLM
    • WLM will start the first one when work arrives (optional)
    • WLM will start/stop others to meet Service Class goals
    • Server Regions may run across a Sysplex

Workload Manager (WLM) Tuning

• Defining WebSphere Application Environments
  – Required for run-time and application server regions
    • System Management Server (SMS) Server Region
    • Naming Server Server Region
    • Interface Repository Server Region
    • Application Server Server Regions (J2EE and MOFW)
  – Define with subsystem type CB
  – Specify the PROC name to be started by WLM
  – Set number of servers to 'No limit'
    • Consider using '1' just during new application testing
    • Directives MIN_SRS and MAX_SRS also control this
Workload Manager (WLM) Tuning

- Server Region Service Classes
  - Started with the STC subsystem classification rules
    - Assign a high-velocity Service Class (or SYSSTC)
  - Arriving transactions put into new Service Classes
    - Service Class assignment is driven by Control Region
    - Transaction is then passed to WLM
    - WLM assigns to appropriate Server Region
  - Only one active Service Class per Address Space
    - WLM starts MIN_SRS=x Regions for each Service Class
    - MAX_SRS=x limits upper bound and may cause waiting
    - Set MAX_SRS = (MIN_SRS * maximum Service Classes)

Workload Manager (WLM) Tuning

- WebSphere transactions and WLM subsystems

<table>
<thead>
<tr>
<th>Transaction Source</th>
<th>Subsystem</th>
</tr>
</thead>
<tbody>
<tr>
<td>HTTP Server (Standalone mode)</td>
<td>CB</td>
</tr>
<tr>
<td>HTTP Server (Scalable mode)</td>
<td>IWEB</td>
</tr>
<tr>
<td>HTTP Server (Enclave mode)</td>
<td>IWEB</td>
</tr>
<tr>
<td>HTTP Transport Handler</td>
<td>CB</td>
</tr>
<tr>
<td>IIOP Client</td>
<td>CB</td>
</tr>
</tbody>
</table>
Workload Manager (WLM) Tuning

- Transaction Service Class guidelines
  - Suggest using a response-time based goal
  - Set priorities based on business goals
  - Use default CB/IWEB Service Class with high priority
    - Allows you to detect classification errors without penalty
    - Otherwise, default is SYSOTHER (low priority)
- Subsystem CB classification can be based upon
  - Collection Name (CN); Logical server name
  - Subsystem Instance (SI); Logical server instance
  - Userid (UI)
  - Transaction Class (TC)

Hardware Upgrades

- Processor upgrade
  - Model G5+ provides native IEEE floating point support
  - Java workloads are floating-point intensive
- Memory upgrade
  - Expect to use 512 MB for a lightly-loaded system
  - Expect to use up to 2 GB for heavy workloads
- Other upgrades
  - Hardware encryption for SSL-heavy workloads
  - Network bandwidth
  - Sysplex configuration
References

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  – Questions?