Managing Oracle Workload with 
*z/OS Workload Manager*

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**Agenda**

- Brief Introduction to MVS Workload Management (WLM) Externals
- Classifying Different Oracle Workloads
  - TSO
  - Batch
  - CICS or IMS
  - Transparent Gateway for DB2
- What is an Enclave?
- Handling of Enclaves in Oracle Net
- Some Examples of Oracle Workload Classification
  - Oracle Apps Benchmark
    - Classify Oracle Net client work
- CPU Accounting considerations
  - Enclave CPU reporting
Controls Managed by WLM

In goal mode, SRM uses the following controls to manage work to help meet customer specified goals.

- Dispatching Priority
- MPL Targets
- Swap Protect Time
- Storage Targets
  - Protective Storage Targets
  - Restrictive Storage Targets
- Storage Policies
  - Estor (protected, LRU, space available)
  - Swap, VIO, Hiperspace, Stolen pages
- Etc.

Service Class and Classification

- WLM part of z/OS
- A “Work Manager” calls WLM to classify a work request
  - Ex: JES, CICS, Websphere, Oracle
- A Service Class is assigned based on information passed to Classify service
- Classification rules are in the workload definition in the WLM Policy
- Policy built with ISPF Dialog
  - EXEC ‘SYS1.SBLSCLI0(IWMARIN0)’
Goals

• The Service Class has multiple Periods
  – Based on the amount of CPU used
• The SC Period has two attributes
  – Importance
    • 1-5 and discretionary
  – Performance Goal
    • Response, or percentile response
    • Velocity

Velocity Goals

• A goal for long running, non response oriented work
• Velocity = Using samples ÷ (Using + Delay samples) × 100
  – Includes Storage Delay
    • MPL
    • Paging
  – Includes CPU Delay
    • Higher priority work
  – Optionally includes I/O delay
Response Goals

• A goal for interactive, response oriented work
• Average response time
  – Ex: Average response of transactions = .2 sec.
• Percentile
  – Ex: 95% of transactions with response less than .5 sec.

Service Class Period

• After consuming a number of Service Units, the service class migrates to another period
  – Different goal and importance
  – Allows longer work to be treated at lower importance than new work
CPU Service Unit

- Service Units per CPU second is a constant associated with the CPU model.
- Examples:
  - 9672-R56 delivers 5158 SU per CPU second
  - 2066-002 delivers 8588.3 SU per CPU second
  - 2084-301 delivers 21858 SU per CPU second
- WLM uses Service Units to make Policy independent of processor speed

Resource Group

- Define a maximum or minimum service rate
  - CPU service units
- A set of service classes
- Usually used as a “cap” on resource
- Can be very effective as a minimum rate
  - Service class with discretionary goal, but guaranteed a minimum number of service units corresponding to 5% of system capacity
Classifying TSO

- Usually classified by USER ID
- Recommend a Goal with Multiple Periods
- Oracle processing performed at priority of the TSO transaction
  - Response Time Goal for first and second period
    - Maintain high importance for short transactions
  - Velocity Goal for last period, or large response
    - Lower importance for long running transactions
- Example:
  - Period 1: Importance 1, Average response .1 second
  - Period 2: Importance 3, Average response .5 second
  - Period 3: Importance 5, Velocity 10 or
  - Period 3: Importance 5, Average response 10 seconds

Classifying Batch Jobs

- Usually classified by Job Name or Job Class
- Recommend a Goal with a Single Period
- Oracle processing performed at priority of the Batch Job
  - Velocity Goal
    - Lower importance to prevent interference with interactive work
- Example:
  - Importance 5, Velocity 10
- Note different classes of work may require different service classes, with differing goals
Classifying CICS Transactions

• Usually classified by CICS Transaction ID
• Oracle processing performed at priority of the CICS address space
  – If MRO, Classification done in TOR
  – Response Time Goal is recommended
    • Maintain high importance for short transactions
    • All transactions in same region should have similar response requirements
    • Must be single period
  – Velocity Goal for CICS address space
    • Transactions can be managed by this goal if desired
    • Similar to (obsolete) WLM Compatibility Mode
• Example:
  – Importance 2, Average response .2 second

What Is an Enclave?

• A "business transaction" without address space boundaries
• Independent enclave used by Oracle
  – True SRM transaction
  – Separately classified and managed in service class or performance group
• LE uses the word Enclave for something completely different
  – the set of resources and processing associated with a single logical LE application
  – Defines the scope of the application. Owns storage, files, etc.
  – Not discussed here
How Do MVS Enclaves Behave?

• Created by an address space (the "owner")
• One address space can own many enclaves
• One enclave can include multiple dispatchable units (SRBs/tasks) executing concurrently in multiple address spaces (the "participants")
  – Enclave SRBs are preemptible, like tasks
  – All its dispatchable units are managed as a group
• Many enclaves can have dispatchable units running in one participant address space concurrently

NET Structure and CPU Recording
Classifying NET Transactions

- All independent enclaves are classified using the active MVS WLM policy.
- Classified using attributes associated with each subsystem.
- Defaults if you do not classify in WLM policy:
  - Enclaves default to the SYSOTHER service class which has a discretionary goal.
- Note that goal mode is required on all currently supported MVS releases.

WLM Support in Oracle Net

- Support in Oracle OSDI 8.1.7 or subsequent
- Inbound client work gets WLM classification
  - Client IP/LU, target service, userID.
- Client requests run under a preemptable enclave SRB.
- Each enclave classified into a service class
  - Resource consumption and transaction rates in RMF workload report.
  - Separately managed by WLM
    - Dispatching priority, storage, I/O priority.
Transparent Gateway for DB2 (TG4DB2)

- TG4DB2 in 8i was based on MPM
  - All work in TG4DB2 ran at priority of TG4DB2
- TG4DB2 in 9i is based on OSDI
  - Work from network comes through Oracle NET
    - Runs in an enclave until it gets to TG4DB2 A/S
    - TCB per session, uses Call Attach Facility (CAF)
  - You must classify this enclave
    - Velocity goal with high importance is appropriate

TG4DB2 …

- With latest OSDI patches the work in TG4DB2 TCB is joined to the enclave
  - Some of DB2 code runs in the enclave
  - Background DB2 processes charged to DB2
  - Response time goals possible
- In 10g, CAF removed, RRSAF used to connect to DB2
  - All DB2 work runs in the enclave
  - Response time goals are recommended
Code for Database Available in MetaLink

• Ensure you are at current Oracle OSDI maintenance level
  – 8.1.7.4.50, 9.2.0.5.21, or 10.1.0.3.0 plus the latest OSDI cumulative patches
  – Check with Oracle support
    • Notes 237007.1, and 290738.1 in Metalink
    • Critical patch update scheduled for April 12, 2005
• Must migrate from MPM

WLM Support in Oracle Net…

• Define Net Service

```
DEFINE SERVICE ORANETW TYPE(NET) 
  PROC(ORANET) -
  DESC(’Oracle Network Supporting WLM Transactions’) SID(NETW) -
  PARM(’HPNS PORT(1521) ENCLAVE(CALL)’)
```

• ENCLAVE(CALL)
  – dynamic enclaves, many WLM transactions
• ENCLAVE(SESS)
  – static enclaves (default), one WLM transaction per session
WLM Support in Oracle Net…

• Enclave(Sess)
  – Classification done once at Logon
  – Enclave deleted at Logoff
  – Entire session is a single WLM transaction
  – Only Velocity Goals are appropriate

• Enclave(Call)
  – Classification done every time a request arrives from client
  – Enclave deleted when NET has to wait for next request
  – Each client request is a separate WLM transaction
  – Response Time or Percentile Goals should be used

NET Behaviour with Enclave(sess)

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NET Behaviour with Enclave(call)

Client request 1
---
Enclave Active
Enclave exists until NET has no more data
Enclave transaction
Managed by SRM
Response time reported by RMF

Client request 2
---
New Enclave Active
State can be running, waiting for I/O, …
Enclave transaction
Managed by SRM

New Management Capabilities

- Recommend ENCLAVE(CALL)
- Establish Response Goal at high importance for first period
- Migrate to less importance for second period
- Third Period for very low importance
  - This allows you to maintain high response for trivial work
  - Treat heavier, less sociable work at an appropriate priority
  - Especially if running in capped Logical Partition or capped resource group
Both Modes Can Co-exist

- Separate Net can be used for greater flexibility
- Segregate users based upon workload and performance needs
- Distinguish by IP address or Port number

Server Consolidation

- Work can be assigned different Service Classes
  - Multiple Oracle instances handled based on goals for service classes assigned by NET, TSO, JES, …
  - Single copy of Oracle Subsystem
  - Single copy of NET possible
  - Can safely consolidate multiple independent Oracle instances onto a single MVS image
Classification of Oracle NET Enclaves

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SI</td>
<td>OSDI subsystem name</td>
</tr>
<tr>
<td>UI</td>
<td>User ID from the client. For Oracle Applications this is the UID of the user running the application server on the middle-tier processor</td>
</tr>
<tr>
<td>NET</td>
<td>if SNA: client Network Name from VTAM if TCP: First eight characters of dotted IP address. (ex.100.024.)</td>
</tr>
<tr>
<td>LU</td>
<td>if SNA: The client LU name. if TCP: Last eight characters of dotted IP address. Note that the IP address requires leading zeros to be specified.</td>
</tr>
<tr>
<td>CT</td>
<td>Protocol from connect, TCP or LU6.2</td>
</tr>
<tr>
<td>SPM</td>
<td>Position 1 to 8. Oracle Service Name for this connection. The service name is defined in the parameters used to initialize the Oracle ODSI subsystem.</td>
</tr>
<tr>
<td>SPM</td>
<td>Position 9 to 89. TCP/IP hostname (left justified)</td>
</tr>
</tbody>
</table>

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An Example: Oracle Applications Benchmark

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## Classification Rules for ORANET

<table>
<thead>
<tr>
<th>Subsystem Type</th>
<th>Xref</th>
<th>Notes</th>
<th>Options</th>
<th>Help</th>
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<td>Row 1 to 5 of 5</td>
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<td>Command ====&gt;</td>
<td>SCROLL ====&gt; PAGE</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Subsystem Type . : OSIDI</td>
<td>Fold qualifier names? Y (Y or N)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Description . . . ORACLE Subsystem</td>
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<td></td>
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<td>Action codes:</td>
<td>A=After</td>
<td>C=Copy</td>
<td>M=Move</td>
<td>I=Insert rule</td>
</tr>
<tr>
<td></td>
<td>B=Before</td>
<td>D=Delete row</td>
<td>R=Repeat</td>
<td>IS=Insert Sub-rule</td>
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<td>More ===&gt;</td>
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<td>________</td>
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<td>________</td>
<td>________</td>
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<td>ORAMT1</td>
<td>________</td>
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<td>ORAMT2</td>
<td>________</td>
</tr>
<tr>
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<td>LU</td>
<td>003.081____</td>
<td>ORAMT3</td>
<td>________</td>
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<td>****************************** BOTTOM OF DATA ************************</td>
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## Service Class Goal for Important Work

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<th>Service-Class</th>
<th>Xref</th>
<th>Notes</th>
<th>Options</th>
<th>Help</th>
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<tr>
<td>Description . . . . . . Oracle Mid Tier #1</td>
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<tr>
<td>Workload Name . . . . . . . . ORACLE (name or ?)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base Resource Group . . . . . . . . . . ORACLE (name or ?)</td>
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<td></td>
<td></td>
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<td>Specify BASE GOAL information. Action Codes: I=Insert new period, E=Edit period, D=Delete period.</td>
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<td>---Period--- -----------Goal-------------</td>
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<tr>
<td>Action</td>
<td>#</td>
<td>Duration</td>
<td>Imp.</td>
<td>Description</td>
</tr>
<tr>
<td>---</td>
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<td>---</td>
<td>---</td>
</tr>
<tr>
<td>1</td>
<td>50</td>
<td>1</td>
<td>Average response time of 00:00:00.015</td>
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</tr>
<tr>
<td>2</td>
<td>1000</td>
<td>3</td>
<td>Average response time of 00:00:00.500</td>
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<tr>
<td>3</td>
<td>5</td>
<td>Execution velocity of 10</td>
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| ************************************************** Bottom of data **************************************************
### Goal for Concurrent Manager Work

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<table>
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<td>Description</td>
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<td>Workload Name</td>
<td>ORACLE (name or ?)</td>
</tr>
<tr>
<td>Base Resource Group</td>
<td>(name or ?)</td>
</tr>
</tbody>
</table>

Specify BASE GOAL information. Action Codes: I=Insert new period, E=Edit period, D=Delete period.

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<th>---Period---</th>
<th>Goal------------</th>
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<tr>
<td>Action</td>
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<tr>
<td></td>
<td>1</td>
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</tbody>
</table>

******************************************************************************* Bottom of data ***********

### Effect of Implementing Enclave(call)

- RMF III Enclave report only shows “active” enclaves
  - Many fewer in display
  - Use the RMFPP reports for the service class data
- RMF now has transaction rate, and related stats
  - “Transaction” is a network interaction with new code
  - Better definitions will come in later releases of Oracle
    - This code available today
- Slight increase in NET TCB time

---

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### RMF Monitor III Enclave Report

**RMF Monitor III Enclave Report**

**RMF 2.10.0 Enclave Report**
Command ===>  Scroll ===> CSR

Samples: 100  System: MVS4  Date: 02/20/02  Time: 17.18.20  Range: 100   Sec
Current options:  Subsystem Type: ALL  -- CPU Util --
Enclave Owner:    Appl%  EAppl%  Class/Group:
Enclave   Attribute  CLS/GRP  P Goal    % D X   EAppl%  TCPU    USG  DLY  IDL

*SUMMARY  28.78
ENC00001  ORAMT1   3  28.78  71.79  49  41 0.0

---

### RMF Monitor III Sysplex Summary

**RMF Monitor III Sysplex Summary**

**RMF 2.10.0 Sysplex Summary - R26PLEX**
Command ===>  Scroll ===> PAGE

WLM Samples: 400  Systems: 1  Date: 06/10/02 Time: 13.25.00 Range: 100   Sec

Service Definition: PBCORAC  Installed at: 06/07/02, 10.16.52
Active Policy: ORAPOL  Activated at: 06/07/02, 10.17.00

<table>
<thead>
<tr>
<th>Name</th>
<th>T</th>
<th>I</th>
<th>Goal Act</th>
<th>Goal %</th>
<th>Actual %</th>
<th>Index Rate</th>
<th>Time</th>
<th>Time</th>
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<td>W</td>
<td>46</td>
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<td>237.1 0.000 0.031 0.031</td>
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<td>3.403 3.403 3.403 3.403</td>
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</table>

---
CPU Accounting for Oracle Work

- CPU time for user work through Oracle Net now accumulated separately
  - May require changes to customer accounting and capacity planning methodologies
    - CPU now charged to NET not DB Server or Gateway
  - Operations staff may need education
    - SDSF shows almost no CPU in Server or Gateway A/S
    - Lots in ORANET
- Overhead of Enclave(Call) in NET TCB time

---

Example SDSF display

<table>
<thead>
<tr>
<th>NP</th>
<th>JOBNAME</th>
<th>STEPNAM</th>
<th>SRVCLASS</th>
<th>DP</th>
<th>CPU%</th>
<th>ECPU%</th>
<th>CPU-TIME</th>
<th>ECPU-TIME</th>
<th>REAL-TIME</th>
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<tr>
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<td>SYSSTC</td>
<td>FE</td>
<td>0.00</td>
<td>0.00</td>
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<td>45261.24</td>
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IBM @server. For the next generation of e-business.
Comments and Recommendations

- Goal Mode required since z/OS 1.3
  - Enclave(call) with velocity goals will not hurt
    - Velocity still appropriate, but not optimal
  - Enclave(sess) with response time goals not appropriate
    - Enclave goes to last period shortly after Logon
- Must have subsystem OSDI defined, with a default service class specified
  - If no service class assigned by policy then SYSOTHER is used
  - SYSOTHER has a discretionary goal. *Very Bad*
- Recommend ENCLAVE(CALL) in Oracle Net Service
  - Establish a short 1st period importance 1 to maintain response for trivial requests
  - Lower importance for 2nd period
  - Importance 5 or discretionary 3rd period
- Consider setting PARALLEL_MAX_SERVERS = 1
  - Parallel query processing still in DB service address space

Summary

- OSDI WLM support exploits z/OS function not available to other Oracle versions
- Consolidation of multiple smaller Oracle instances on single S/390 now possible
  - Either multiple or single instance of Oracle on MVS
- Transparent Gateway product allows coexistence with DB2, with new support for response time goals
- Each client's transactions can be separately managed
  - The most important work gets the resources
  - Unsociable work can be segregated
- Resource group can be used to guarantee minimum (or maximum) service
- New response time and transaction rate recording in RMF
Thank you – Any Questions?

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