

Oracle Workload Characterization

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My Background

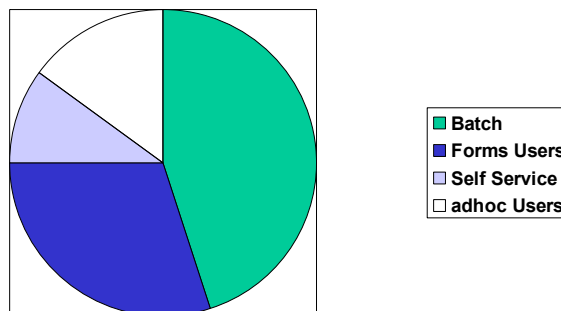
- Started as an IBM systems programmer in 1984.
- Became an Oracle DBA in 1992.
- Worked for Oracle Corporation for a couple of years.
- Founded AppsDBA Consulting in 1998.
- Full time employment at Lawrence Livermore National Laboratory.

Introduction

- This is part 2 of Oracle Workload Management.
- Part 1 was Oracle Workload Measurement.
 - See appsdba.com – Oracle Workload Measurement
 - Presented at 2005 Hotsos Symposium and the May 2005 NoCOUG meeting.

The Business Major Approach

- Not meant to offend any business majors, but all I was initially looking for was the ability to create a picture like this:



Scope Creep

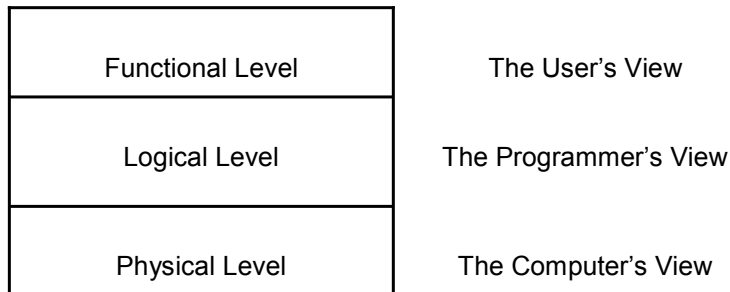
- Of course nothing is really that simple.
- So, had to create a process.
- Had to be repeatable.
- How accurate is it really?
- Ultimately had to build a tool.

Workload Characterization

Menasce and Almeida[1] define workload characterization as:

“Process of partitioning the global workload of a computer system into smaller sets or workload components composed of transactions or requests having similar characteristics, and assigning values that represent their typical resource demand and intensity.”

Levels of Workload



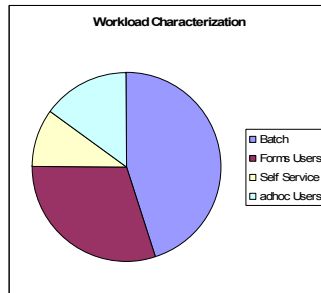
Source: An article titled "An Introduction to Workload Characterization"[2], Ron Lee credits "Dr. Domenico Ferrari, a professor in the Computer Science Division of the University of California at Berkeley" with the following concept of *levels* of workload characterization

My Definition of Workload Characterization

Workload characterization is the process of identifying classes of workload, measuring those classes and then identifying their impact to the business. The goal is to understand the impact of those classes on database workload and to enable the organization to better schedule its business processes.

The Goal

- So, if we can figure out how to measure the workload classes that we have defined, we can create this picture:



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Workload Management

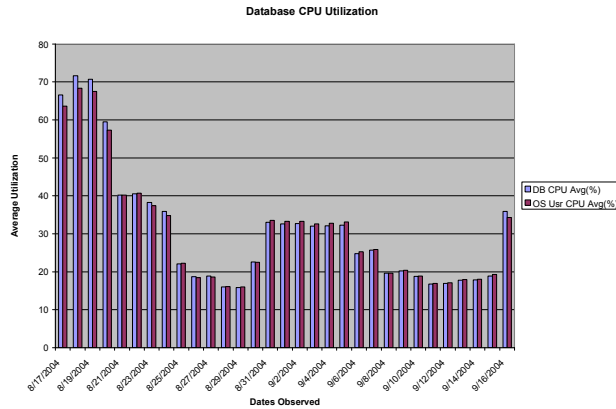
- Workload Measurement
- Workload Characterization
- Capacity Planning
- Workload Reduction

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Workload Measurement CPU Utilization Trend

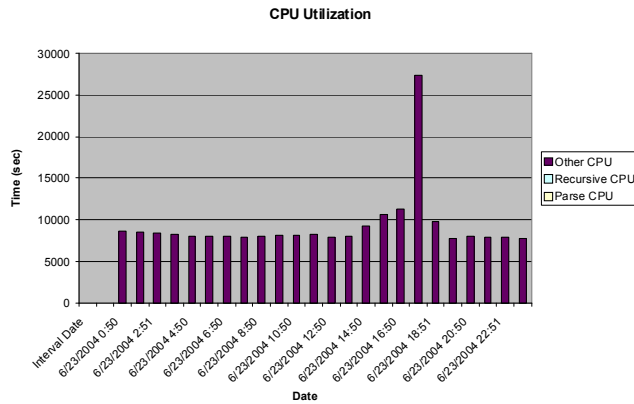


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Workload Measurement CPU Utilization



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Workload Classes

- Classifying workload at the functional level let's us easily understand the impact those classes have on database workload.
- Typically it's pretty easy to classify workload. We do it all the time.
- For example, in an Oracle Applications database we know we will have batch, forms users, self service web users and probably adhoc users as well.

Instrumentation

- Oracle has helped us by creating the framework to classify workload:
 - Services
 - Auditing and triggers
 - Client Identification (dbms_session.set_identifier)
 - dbms_application_info
 - Client Info (set_client_info)
 - Module Info (set_module)
 - Action Info (set_action)

Services Are The Future

- Services are built into the database
 - OEM/Grid Control
 - RAC
 - Resource Manager
 - dbms_service
 - Oracle Networking
- They're easy to implement.
- They are really easy to implement.

10g Really Adds Services Support

- In Oracle 10g the Service Name column is added to the view v\$session
- OEM Grid Control is close to tracking workload information based on services
- RAC incorporates services

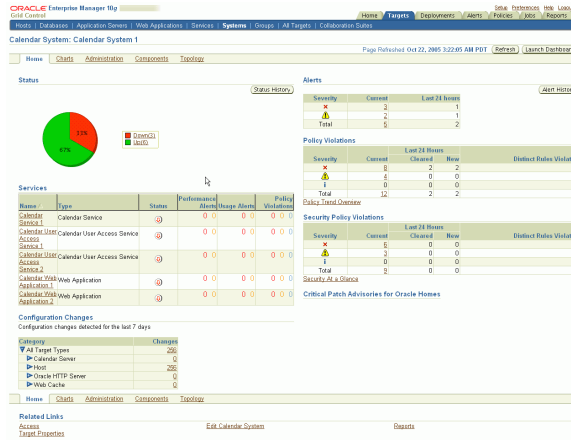
Services In v\$session

User Name	Oracle SID	Serial#	Client Identifier	Client Machine	Client Info	Module	Action	Service Name
AUTHNSVR_MGR	172	10628		nspws-2				SYS\$USERS
COLLAB_MGR	173	7518		nspws-1				SYS\$USERS
COLLAB_MGR	175	343		nspws-2				SYS\$USERS
SYSTEM	177	5050		nspdb-1		SQL*Plus		SYS\$USERS
AUTHNSVR_MGR	180	9876		nspws-1				SYS\$USERS
COLLAB_MGR	182	612		nspws-1				SYS\$USERS
AUTHNSVR_MGR	183	228		nspws-1				SYS\$USERS
COLLAB_MGR	187	7044		nspws-2				SYS\$USERS
COLLAB_MGR	188	669		nspws-1				SYS\$USERS
USER1	189	11281		USER-PC				SYS\$USERS
COLLAB_MGR	191	5491		nspws-2				SYS\$USERS
COLLAB_MGR	193	6561		nspws-2				SYS\$USERS

Grid Control – 10g R2

- Straight from the Oracle Enterprise Manager Concepts, 10gR2 Guide:
 - A "service" is defined as an entity that provides a useful function to its users.
 - A "system" is a logical grouping of targets that collectively hosts one or more services.
 - Services are measured in terms of availability and performance.

Grid Control System View

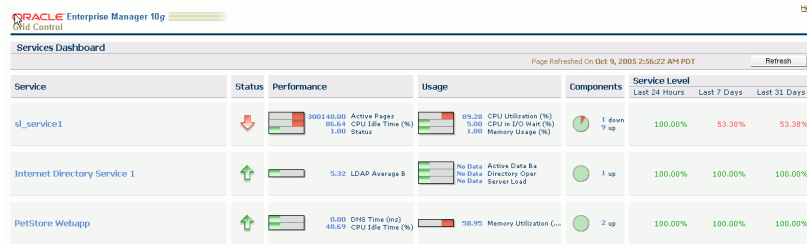


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Grid Control Service Dashboard



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Grid Control – I think it's almost there

- I believe the infrastructure is there
- The ability to create tests, use custom scripts, and define your own services and systems are all available.
- Oracle just has to add the ability to track service level resource usage for a system
- It would be nice to also allow an aggregation by system

Auditing and Triggers

- The “audit sessions” feature has been around since Oracle7.
- Logoff triggers
- Interval based snapshots
- Application level auditing

Client Identification

- `dbms_session.set_identifier`
- It is meant to allow individual application user identification when using shared connections.
- It is exposed in the field “client identifier” in the `v$session` view.

Application Information

- The `dbms_application_info` package
 - `set_client_info`
 - `set_module`
 - `set_action`

v\$session Fields

```
v$session view:
User      Oracle      Client      Client      Client
Name      SID Serial#  Identifier  Machine     Info
-----
PERFSTAT  164  15069  Rivenes1   appsdba     DBAMON
                                module     step2
```

Tool Support

- SQL*Plus provides the ability to set the module field with the “set appinfo” command
- JDBC End-To-End Metrics and Dynamic Monitoring Services (DMS) provide “free” access to instrumentation calls.

SQL*Plus appinfo

```
SQL> show appinfo
appinfo is OFF and set to "SQL*Plus"
SQL> set appinfo on
SQL> show appinfo
appinfo is ON and set to "SQL*Plus"
SQL> set appinfo 'AppsDBA Example'
SQL> variable mod varchar2(30)
SQL> variable act varchar2(30)
SQL> execute dbms_application_info.read_module(:mod,:act);
PL/SQL procedure successfully completed.
SQL> print mod
MOD
-----
AppsDBA Example
SQL> print act
ACT
-----
SQL> show appinfo
appinfo is ON and set to "AppsDBA Example"
SQL> set appinfo off
```

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JDBC End-To-End Metrics

```
// Register application
metrics = new
String[OracleConnection.END_TO_END_STATE_INDEX_MAX];
metrics[OracleConnection.END_TO_END_MODULE_INDEX] = "AppInfo10g";
metrics[OracleConnection.END_TO_END_ACTION_INDEX] = "Main";
conn.setEndToEndMetrics(metrics, (short) 0);

String[] etem = conn.getEndToEndMetrics();
System.out.println("Module:
"+etem[OracleConnection.END_TO_END_MODULE_INDEX]);
System.out.println("Action:
"+etem[OracleConnection.END_TO_END_ACTION_INDEX]);
```

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Collection

- Collecting workload information is highly dependent on the type of application.
- It is important to realize that we're only after aggregates of our classes. We don't need perfection.
- Usually several methods of collection are required.

Collection Guidelines

- Connections that span collection intervals should use interval snapshots
- Connections that last less than a collection interval should use some form of logoff based trigger.

Classifying Workload

- Identify the workload classes
- Classify the workload (i.e. how to capture)
- Measure the workload
- Interpret the results

Identify Workload Classes

- Identify workload classes for the system being diagnosed.
- In general all systems will be different.
- However, there are some classes that will be common to similar types of applications.
- The script *usercat.sql* will produce output that can be used to help identify workload classes.

Output – *usercat.sql*

User Name	Client OS User	Client Machine	Program	Module	Action	Logical Reads	Physical Reads
APPS	appsrvr	app2		FNDSMSGN	US PO Inq uiry	3,101	26
APPS	appsrvr	app2	httpd@db- app2 (TNS V1-V3)	httpd@db- app2 (TNS V1-V3)		18,134	673
APPS	appsrvr	app2	JDBC Thin Client	ap.oie.se rver.Home PageAM:R	22999	34,343	1,919
EXTAPP	winapp	DOM\APP-PRD	Mvbars32.exe	Mvbars32. exe		1,298,339	119,857
APPS	appsrvr	app3		OEXOEORD	FRM:US OM Inquiry	1,068,797	26,821

Classify

Class Description	Class Type	Column Name	Column Value
Background processes	INTERVAL	TYPE	BACKGROUND
APP User	INTERVAL	USERNAME	APP_DATA
Interval Totals	INTERVAL	USERNAME	
LOADING META_DATA User	INTERVAL	USERNAME	LOADING_META_DATA
SQL*Plus Connections	INTERVAL	PROGRAM	SQLPLUS
STATS User	INTERVAL	USERNAME	STATS

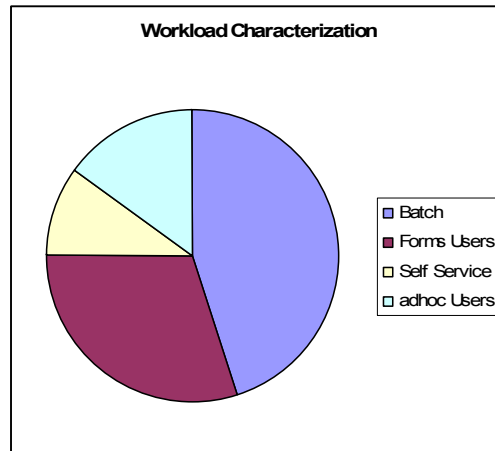
Workload Class Measurements

Run Date	Intvl	Description	Count Total	Logical Reads	Physical Reads	CPU Time (min.)
01/26/2006	00:10	Interval Totals	512	80,887,158	2,350,458	19.20
		OA Forms Users	61	34,425,797	113,017	5.63
		Ext App	41	1,195,564	153,933	1.77
		Custom Users	11	236,176	186,101	0.69
		Background processes	11	30,366	24,955	0.00
		Interface App	24	13,198	3,321	0.05
		OA Self Service	9	22	0	0.00
		Concurrent manager jobs	11	0	1,898,109	0.08

Interpretation

- Interpretation leads to understanding the overall impact of each workload class on the total workload.
- Based on the information available a pie chart or some other visual tool can be created.
- Decisions can then be made about work shift allocations or redistribution, and about possibly re-scheduling work to non-critical time periods.

This Could Be Your End Result

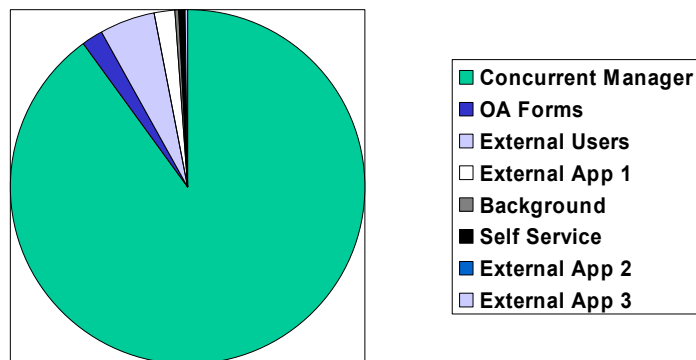


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A Real Example (Run Time)



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Workmon Utility

- Available at appsdba.com
- May help you get started
- A set of UNIX and SQL scripts to track workload in an Oracle database.
- May provide the “custom” scripts needed to feed a future version of Grid Control.

Conclusion

- Workload Characterization
 - Identify
 - Classify
 - Measure
 - Analyze
- Use as another tool when managing workload

Questions?

References

- [1] D. A. Menascé, V. A. F. Almeida, "Scaling for E-Business, Technologies, Models, Performance, and Capacity Planning", Prentice Hall, Upper Saddle River, New Jersey, 2000.
- [2] R. Lee, "An Introduction to Workload Characterization", Novell, <http://support.novell.com/techcenter/articles/na19910503.html>, 1991.
- Oracle Enterprise Manager Concepts, 10gR2 Guide

Thank You

This presentation and more
information is available at
www.appsdba.com