



Using TeamQuest® Performance Software to Manage the Memory Performance of an Oracle Database

White Paper
TQ-WP8 Rev.B Release 9.1

Summary

Oracle can be a vital component to the success of your business, whether your focus is ERP, e-commerce, or other mission-critical applications. This document tells you how to maximize the performance of critical Oracle-based components using TeamQuest Performance Software.

This document focuses on how TeamQuest® Performance Software helps an Oracle database administrator (DBA) manage the memory performance of an Oracle database. It demonstrates how to configure the collection of Oracle performance parameters within TeamQuest software. It also provides examples of some performance problems within Oracle and gives some possible solutions to them.

Please refer to the final page of this document for important legal notices and information regarding how to contact TeamQuest Corporation.

Like what you see? [Subscribe](#).

Oracle Environment Overview

The Oracle database is comprised of several components that must interact efficiently to ensure acceptable performance. Those components are:

System global area (SGA)

The SGA is a portion of memory shared among the background processes, server processes, database files, and redo log files. This central communication medium is essentially comprised of the following areas: redo log buffer, database buffer cache, and shared pool.

Background processes

The background processes perform a variety of administrative tasks necessary for the operation of an Oracle instance. These tasks include making physical updates to the database and redo log files, ensuring database integrity, and performing error recovery.

Server processes

The server processes handle all database work requested by the end user. Depending on the server process model used, a user either is assigned a single dedicated server process or utilizes one from a pool when needed.

Database files

The database files contain the physical representation of the objects within the database. The server processes read this data as necessary into the SGA while one of the background processes, the database writer (DBWR), writes any changes back to the file.

Redo log files

The redo log files contain a record of every change made to the database. These are used in the event a recovery of the database is required.

Control files

The control files are essentially the “brains” of the database. These are used to ensure database integrity.

In addition to the Oracle database components listed, you must also consider the performance of the CPU, memory, network, and disk I/O of the system on which your Oracle database resides.

Brief Introduction to TeamQuest Performance Software

TeamQuest’s suite of products warrants a bit of an introduction before we delve into how it can be used in your data center. The products are specifically designed for managing the performance and capacity of IT systems. The individual members of the suite are:

- TeamQuest Alert
- TeamQuest On the Web
- TeamQuest View
- TeamQuest Model

TeamQuest Alert provides multi-system monitoring for event management with built-in performance evaluation. It can help you manage the performance of hundreds or thousands of heterogeneous servers scattered across multiple locations. It can alert you to impending performance problems and help you to make a diagnosis.

TeamQuest On the Web is a tool for providing remote, Web-based access to performance reports. It’s great for providing reports to management or to line organizations wanting to see if service levels are

Like what you see? [Subscribe](#).

Using TeamQuest Performance Software to Manage the Memory Performance of an Oracle Database

being met. You can get both real-time and historical information, and it works with a variety of servers and applications.

TeamQuest View is a comprehensive performance analysis tool that can help you to find underutilized capacity, identify trends, diagnose problems and drill down to the root cause. It can do both real-time and historical analysis. You can run TeamQuest View on a variety of platforms because it works with either Motif or Windows user interfaces.

TeamQuest Model uses analytic and simulation modeling to make predictions about system performance. It is ideal for capacity planning and server consolidation projects. TeamQuest Model can help you to find a configuration for providing high-value services to your line organization clients at minimum cost.

TeamQuest is unique in the industry because it provides a complete performance management solution, ranging from monitoring to full-fledged capacity planning with TeamQuest Model. TeamQuest solutions can:

- Detect problems early
- Determine the root cause quickly
- Predict the future

TeamQuest solutions scale well for data centers with hundreds of heterogeneous servers.

If you check Web sites for TeamQuest's competitors, you might discover that they claim to be quick and easy to install, implement, and use. If you check with *customers*, you will discover that TeamQuest's products *actually are*. TeamQuest software installs on a single server in 15 minutes and on 100 within two days. The people at TeamQuest are experts in performance management. TeamQuest employees are experts at helping IT organizations efficiently meet the needs of their clients.

Oracle Database Statistics

Oracle databases have numerous performance parameters to help in administrating the application. TeamQuest Performance Software allows you to monitor and analyze those performance parameters in greater detail. The following is a summary of the performance parameters that the TeamQuest Oracle Data Agent collects:

- Summary metrics
 - Disk usage and activity
 - Latch activity
 - Library cache usage and activity
 - Memory usage for sessions and SGA
 - Oracle networking activity
 - Rollback activity
 - Row cache usage
 - System information
 - Wait activity

Like what you see? [Subscribe](#).

Using TeamQuest Performance Software to Manage the Memory Performance of an Oracle Database

- Detailed data
 - Disk capacity per data file
 - I/O per data file
 - Performance data per session
 - Performance data per rollback segment
 - Performance data per library cache namespace
 - Performance data per row cache
 - Performance data per latch
 - Additional block contention wait data
 - Session wait event data
 - System wait event data
 - Top SQL statements
 - Instance configuration information

The TeamQuest Oracle Alarm Agent also detects a number of conditions within the Oracle instance and generates alarms on those conditions. Some of the conditions monitored include:

- Instance up/down
- Listener up/down
- Oracle Names Server up/down
- Specific error code detected in alert.log
- Next extent for segment too large
- Segment near max extents
- Locks held for long time

For more information on the specific Oracle performance parameters that TeamQuest agents collect, refer to the TeamQuest Performance Software Statistics Reference Manual for Microsoft Windows Systems or UNIX Systems.

Configuring Collection of Oracle Performance Data

The TeamQuest data collectors used to monitor an Oracle instance are the TeamQuest Oracle Data Agent (tqorap) and the TeamQuest Oracle Alarm Agent (tqoraalm). The Oracle Data Agent collects performance data on local or remote Oracle instances. The Oracle Alarm Agent monitors conditions on local or remote Oracle instances, Oracle Listeners, and Oracle Names servers, and generates an alarm when appropriate. These agents can monitor more than one Oracle instance on a given system.

You must supply information about each Oracle instance before the Oracle Agents can start collecting data. You supply this site-specific configuration information through the TeamQuest Manager browser-based interface. The following settings are used to configure each instance:

Instance Name

This is the name of the Oracle instance that will be monitored. Normally, this value will be the same as the ORACLE_SID environment variable for the Oracle instance if you are logging into the instance using sqlplus.

User name

A user name within Oracle that is used to connect to an Oracle instance. The user-specified name must have read permissions on the V\$ dynamic performance views and DBA data dictionary views. This can be typically be achieved by granting the user the select_catalog_role role. To connect to the Oracle instance, the user will minimally need the “create session” privilege.

Like what you see? [Subscribe](#).

Using TeamQuest Performance Software to Manage the Memory Performance of an Oracle Database

Password

The password is the password for the specified user name. It is stored in encrypted format for user security purposes.

Oracle Network Alias

This is the Oracle network alias that is used by the Oracle Agents when connecting to the instance. If this is omitted, the Oracle Agents will connect locally by setting the ORACLE_SID environment variable to the value specified by the Instance Name.

Oracle Home

The full path name of the directory where the Oracle products are installed.

After you have finished configuring the Oracle Agents, you will need to start them to begin gathering performance data. For instructions on how to configure the Oracle Agents and start data collection, refer to the TeamQuest Performance Software Administration User Guide for Microsoft Windows Systems.

Common Oracle Database Memory Problems and Solutions

Tuning the memory of your Oracle systems helps reduce user complaints and ensure that your Oracle instance is using memory as efficiently as it can. Once you have the TeamQuest Oracle Agents up and running, you will want to find and resolve any performance problems with your Oracle instance. TeamQuest View can be used to analyze the Oracle data collected by the TeamQuest Oracle Agents. A set of predefined TeamQuest Oracle reports is included with TeamQuest View.

As a general rule, memory access is faster than disk access. The more information that can be retrieved from memory, rather than from disk, the better the response time and the overall system performance will be. We are going to discuss the following components related to memory that an Oracle DBA or a system administrator needs to know about to optimize their Oracle memory effectively:

- Buffer cache
- Redo log buffer
- Shared buffer pool
- Sort area

Buffer Cache

Buffer cache is an area of memory within the SGA that stores copies of database blocks for tables, indexes, rollback segments, clusters, and sort data¹. The buffer cache significantly reduces disk I/O and improves performance.

One performance parameter that you need to look at when you measure the performance of the buffer cache is the buffer cache hit ratio. It is computed as (logical reads – physical reads) / (logical reads). The TeamQuest performance parameter, Oracle:Ratio::CacheHitRatio, can be used to monitor the buffer cache hit ratio. The closer this hit ratio is to 1.00, the better your system will perform. Typically, if the ratio consistently remains below 80% during your normal production hours, it may indicate that an undesired amount of disk I/O is occurring and further investigation is necessary.

To help solve the problem, you can accordingly increase the initialization parameter, DB_BLOCK_BUFFERS. Once this is done, it is important to re-examine the buffer cache hit ratio until it is acceptable and user complaints are at a minimum. This value may be different depending on your environment. You should increase it only after you have effectively tuned the size of the shared pool. As a rule of thumb, always make sure you have at least 5% free physical memory¹.

Like what you see? [Subscribe](#).

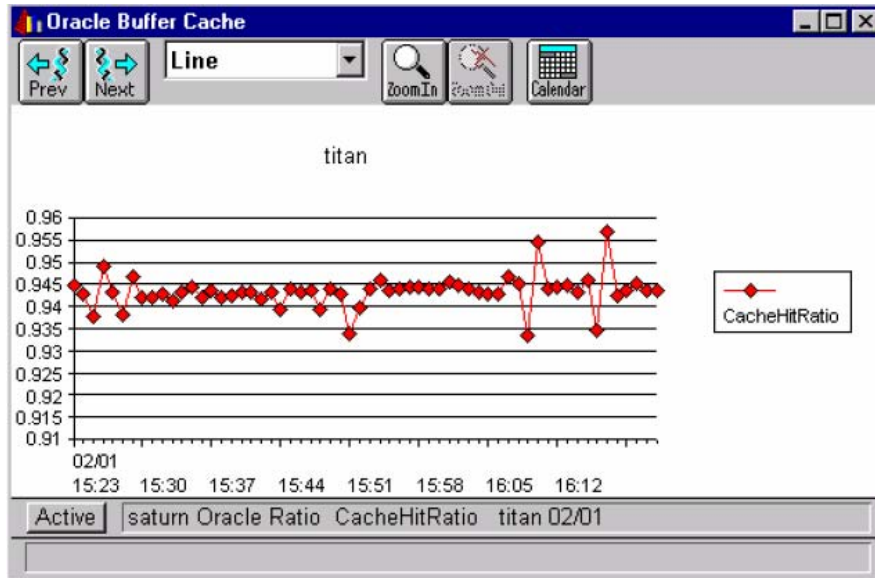


Figure 1
TeamQuest View Oracle Buffer Cache Report

You also need to consider how effectively the database writer (DBWR process) is writing to your database. When a server process reads data into the buffer cache, it has to find free buffers to place the data in. If the buffers are dirty, it has to wait for the DBWR process to write the dirty buffers to disk before the user data can be loaded in. This also can significantly increase the response time¹.

Redo Log Buffer

Another component of the SGA is the redo log buffer. The redo log is used to protect your database if it should ever have any kind of failure.

The Oracle instance writes heavily to the redo logs. Whenever a database buffer block is modified, the redo information is also written to the log buffer. Redo log buffer writes to disk take place when a commit occurs, when the log buffer reaches one-third full, when there has been no activity, or when the database writer writes to the datafiles. Only the modified data is written by the log writer (LGWR) to the redo log, not the entire database block, unless you are performing hot backups¹.

If the redo log buffer is too small, LGWR will have to write to disk too frequently and cause an I/O bottleneck to the devices on which the redo logs reside. This also has the potential of causing user processes to wait to place changes into the redo log buffer. If many processes are accessing the log buffer, they will be forced to wait for the write to complete, which causes redo log buffer contention.

Redo log buffer contention can be computed by the following ratio: (redo log space requests / number of redo log entries). The TeamQuest performance parameter, Oracle:Ratio::RedoLogSpaceWaitRatio, can be used to monitor redo log buffer contention. If this value is greater than 0.0002, it is an indication of contention.

To help solve this problem you can increase the value of the LOG_BUFFER initialization parameter to at least 64 kilobytes on a busy OLTP database. This increase will cause fewer but larger writes to the redo logs. This will also reduce the redo log buffer contention. On average, a redo log size of 5 megabytes is sufficient for most environments¹.

Like what you see? [Subscribe](#).

Shared Buffer Pool

The SGA also contains the shared buffer pool. The shared buffer pool is comprised of the library cache (shared SQL statements), the dictionary cache (data dictionary information), and session information (when using a multi-threaded server). All three of these areas must co-exist within the space allocated to the shared pool.

Library Cache

The library cache contains shared SQL statements, PL/SQL procedures and packages, and control structures². Response time is greatly improved when a process can utilize an object that already exists within the library cache. Otherwise, it must be retrieved from disk and possibly be processed before it can be used.

The performance of the library cache can be computed using the following ratio: (pins – reloads) / pins. The TeamQuest performance parameters, Oracle:Library::CachePins and Oracle:Library::Reloads, can be used to monitor the library cache hit ratio. Typically, if this value is above 0.9, the cache is being adequately used. Otherwise, you must examine the amount of free memory in the shared pool to determine a course of action.

The amount of free memory in the shared pool can be tracked with the TeamQuest performance parameter, Oracle:Memory::SgaFreeMemory. If there is insufficient free memory in the shared pool, the size should be increased to improve the hit ratio. The size of the shared pool is specified with the SHARED_POOL_SIZE initialization parameter. After increasing this value, you should check the hit ratio to see if it is now acceptable. Looking at the pins and reloads columns from the TeamQuest Oracle:LibraryCache table can also indicate specific problem areas within the library cache.

Row	Instance	namespace	gets	get_hits	get_hit_ratio	pins	pin_hits	pin_hit_ratio	reloads	invalidations
1	titan	CLUSTER	0	0	<N/A>	0	0	<N/A>	0	0
2	titan	INDEX	0	0	<N/A>	0	0	<N/A>	0	0
3	titan	OBJECT	0	0	<N/A>	0	0	<N/A>	0	0
4	titan	PIPE	0	0	<N/A>	0	0	<N/A>	0	0
5	titan	TRIGGER	0	0	<N/A>	0	0	<N/A>	0	0
6	titan	BODY	3	3	1.00	3	3	1.00	0	0
7	titan	SQL AREA	289	289	1.00	615	615	1.00	0	0
8	titan	TABLE/PROCEDURE	6	6	1.00	18	18	1.00	0	0

Figure 2
TeamQuest View Oracle Library Cache Table Report

Data Dictionary Cache

The data dictionary is a set of database tables and views containing reference information on the objects within the Oracle database². As needed, this reference information is read into the data dictionary cache. Because this information is accessed frequently, performance improves when the information can be found in the cache rather than having to be accessed from disk.

The performance of the dictionary cache can be computed using the following ratio: (rowgets – rowgetmisses) / rowgets. The TeamQuest performance parameters, Oracle:Row::RowGets and Oracle:Row::RowGetMisses, can be used to monitor the dictionary cache hit ratio. Typically, if this value is above 0.9, the cache is being effectively used.

Like what you see? [Subscribe](#).

Using TeamQuest Performance Software to Manage the Memory Performance of an Oracle Database

If there is insufficient free memory in the shared pool, the size should be increased to improve the hit ratio. The size of the shared pool is specified with the SHARED_POOL_SIZE initialization parameter. After increasing this value, you should check the hit ratio to see if it is now acceptable. Looking at the get_miss_ratio column from the TeamQuest Oracle:RowCache table can also indicate specific problem areas within the data dictionary cache.

Session Information

Increasing the shared buffer pool may also be necessary if there is not enough room to accommodate session data access when using the multi-threaded server (MTS). The uga_mem column from the TeamQuest Oracle:Session table report can be monitored to track session memory usage within the shared pool.

Sort Area

The last memory component that we will talk about is the sort area. A sort area is used by a user session to sort data in memory. If the data sorting cannot completely occur within the sort area, the data is broken up into smaller pieces to sort. These intermediate sorts are written to temporary segments on disk. After these individual pieces have been sorted, the data is then merged back together.

Performing sorts to disk are less efficient than those that can be completed entirely in memory. By comparing the ratio of disk sorts to memory sorts, you can get an indication of the percentage of disk sorts occurring.

The TeamQuest performance parameter, Oracle:Ratio::SortOverflowRatio, can be used to monitor this ratio. Typically, a value less than 0.2 indicates that most sorts are occurring in memory. If the sort overflow ratio is unacceptable, you should consider increasing the size of the sort area allocated to each user session. This is accomplished by increasing the value of the SORT_AREA_SIZE initialization parameter. However, you must take care not to increase the value so high that it will saturate the memory on your system.

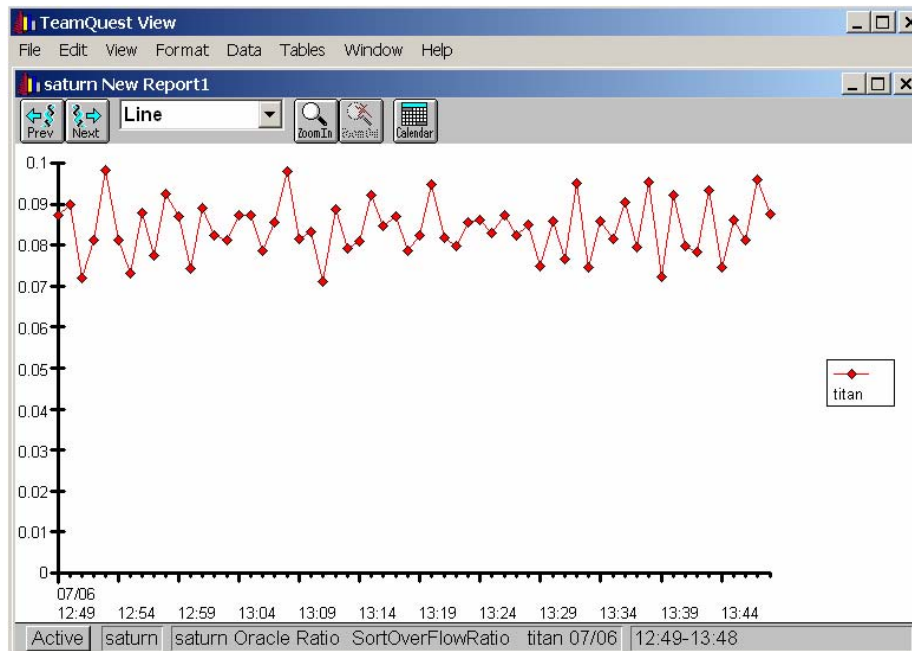


Figure 3
TeamQuest View Oracle Sort Over Flow Ratio Report

Like what you see? [Subscribe](#).

Memory Isn't Everything

This document explained how TeamQuest Performance Software can assist you in monitoring the memory performance within your Oracle database environment. We focused on metrics obtained from the Oracle instance by the TeamQuest Oracle Agents. While most Oracle performance problems can be detected strictly with metrics from the Oracle database, you also need data from the operating system to get a complete picture. Ensuring that all of these components interact efficiently is essential to obtain acceptable performance in your environment.

Bibliography

1. Mark Gurry and Peter Corrigan, *Oracle Performance Tuning, Second Edition*, O'Reilly & Associates, Inc., 1996.
2. Lefty Leverenze, Dianna Rehfield, and Cathy, Baird, *Oracle 8i Concepts*, Release 2 (8.1.6), Oracle Corporation, 1999.
3. *TeamQuest Performance Software Statistics Reference Manual for Microsoft Windows Systems* (TQ-16023). TeamQuest Corporation, 2004.
4. *TeamQuest Performance Software Statistics Reference Manual for UNIX Systems* (TQ10023.4) TeamQuest Corporation, 2004.
5. *TeamQuest Performance Software Administration Guide for Microsoft Windows Systems*. (TQ-16020). TeamQuest Corporation, 2004.

Like what you see? [Subscribe](#).

TeamQuest Corporation

Americas

One TeamQuest Way
Clear Lake, Iowa 50428
USA
+1 641 357-2700
+1 800 551-8326
info@teamquest.com

Europe, Middle East and Africa

Box 1125
405 23 Göteborg
Sweden
+46 (0)31 80 95 00

United Kingdom
38 The Old Woodyard
Hagley Hall
Hagley
Worcestershire DY9 9LQ
+44 (0)1562 881889
emea@teamquest.com

Asia Pacific

Level 6, 170 Queen Street
Melbourne, VIC 3000
Australia
+61 3 9641 2288
asiapacific@teamquest.com

Legal Notices

TeamQuest and the TeamQuest logo are registered trademarks in the US, EU, and elsewhere. Oracle is a trademark of Oracle Corporation. All other trademarks and service marks are the property of their respective owners. No use of a third-party mark is to be construed to mean such mark's owner endorses TeamQuest products or services.

The names, places and/or events used in this publication are purely fictitious and are not intended to correspond to any real individual, group, company or event. Any similarity or likeness to any real individual, company or event is purely coincidental and unintentional.

NO WARRANTIES OF ANY NATURE ARE EXTENDED BY THE DOCUMENT. Any product and related material disclosed herein are only furnished pursuant and subject to the terms and conditions of a license agreement. The only warranties made, remedies given, and liability accepted by TeamQuest, if any, with respect to the products described in this document are set forth in such license agreement. TeamQuest cannot accept any financial or other responsibility that may be the result of your use of the information in this document or software material, including direct, indirect, special, or consequential damages.

You should be very careful to ensure that the use of this information and/or software material complies with the laws, rules, and regulations of the jurisdictions with respect to which it is used.

The information contained herein is subject to change without notice. Revisions may be issued to advise of such changes and/or additions.

U.S. Government Rights. All documents, product and related material provided to the U.S. Government are provided and delivered subject to the commercial license rights and restrictions described in the governing license agreement. All rights not expressly granted therein are reserved.

Like what you see? [Subscribe](#).