. . . .

NOTICE

The information in this publication is subject to change without notice.

COMPAQ COMPUTER CORPORATION SHALL NOT BE LIABLE FOR TECHNICAL OR EDITORIAL ERRORS OR OMISSIONS CONTAINED HEREIN, NOR FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM THE FURNISHING, PERFORMANCE, OR USE OF THIS MATERIAL.

This publication contains information protected by copyright. No part of this publication may be photocopied or reproduced in any form without prior written consent from Compaq Computer Corporation.

The software described in this guide is furnished under a license agreement or non disclosure agreement. The software may be used or copied only in accordance with the terms of the agreement.

This publication does not constitute an endorsement of the product or products that were tested. The configuration or configurations tested or described may or may not be the only available solution. This test is not a determination of product quality or correctness, nor does it ensure compliance with any federal, state, or local requirements. Compaq does not warrant products other than its own strictly as stated in Compaq product warranties.

Product names mentioned herein may be trademarks and/or registered trademarks of their respective companies.

Configuration and Tuning of Oracle7 Server for Windows NT on Compaq Servers

Contents

Tuning Goals *continued*

Appendix A
Multivendor Integration from Compaq

Figures

Tables

Chapter 1
Introduction

The information in this TechNote deals with Oracle7 Server version 7.1.3.3.6 for Windows NT version 3.5. Because there is an abundance of information available concerning generic tuning of Oracle7 Server, this TechNote focuses on specific tuning suggestions for Compaq servers and Windows NT. Wherever possible, there are references other useful tuning documentation.

Oracle7 Server Architecture

Oracle7 Server for Windows NT is a 32-bit Windows NT application. Oracle7 Server is implemented on Windows NT as a single process, multi-threaded architecture. Each Oracle7 Server instance consists of a single process with multiple threads.

The number of threads associated with the Oracle7 Server process varies depending upon options selected (background threads) and user connections (shadow threads). The maximum number of shadow threads, and thus the maximum number of user connections, is 500. The Windows NT Performance Monitor displays the process (ORACLE71) and threads (0,1 represent the Oracle service threads; 2,3,4,5,6 represent the background threads [PMON, DBWR, LGWR, SMON and RECO respectively]) as shown in Figure 1-1 on the following page.
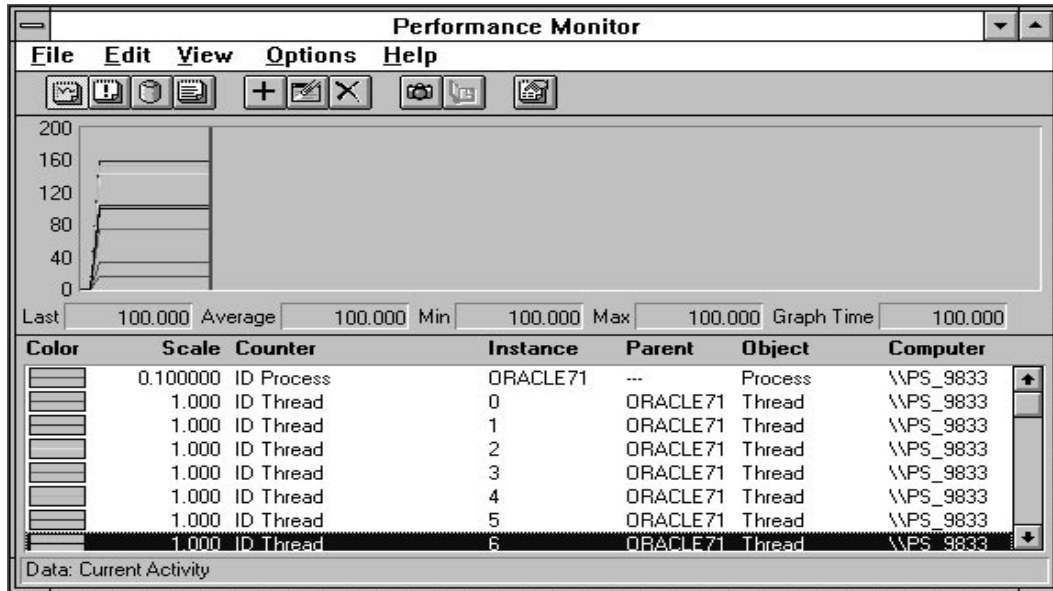
Figure 1-1.   Performance Monitor - Oracle7 Server Process and Threads

The Oracle7 Server process is represented under Windows NT as a service (OracleServiceSSSS [SSSS= System ID]) associated with the executable ORACLE71.EXE. The Oracle Service consists of two threads, 0 and 1. Thread 0 is the Oracle process main thread acting as a service dispatcher and creating thread 1 to handle the service.

Each Oracle instance is associated with a specific Windows NT service and consists of a single process and multiple threads. Use the Windows NT Control Panel/Services to display the Oracle Services (OracleServiceORCL represents the Oracle Instance ORCL [seed database], OracleServiceIONE represents the Oracle instance IONE and OracleServiceITWO represents the Oracle Instance ITWO) as shown in Figure 1-2.
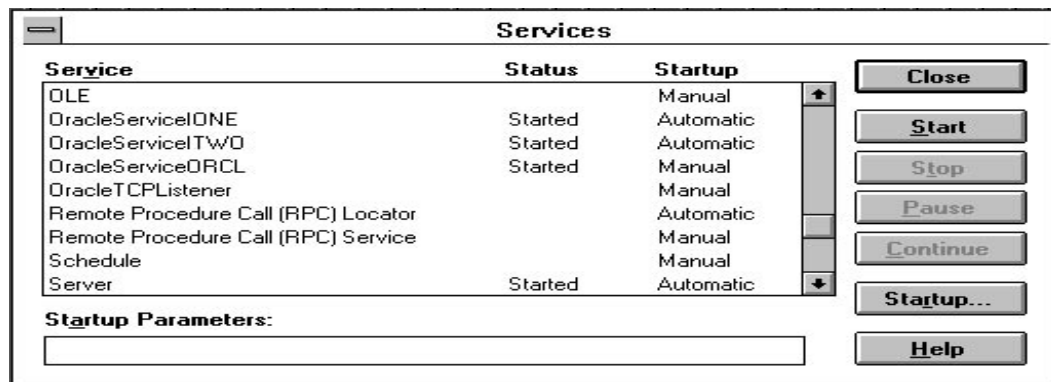
Figure 1-2. Control Panel/Services - Oracle7 Server Instances

NOTE: Performance Monitor does not separate the instances on the chart, log, or report. Therefore, it is impossible to monitor multiple instances using Performance Monitor.

An Oracle instance consists of the System Global Area (SGA), the Oracle service/background/shadow threads, the control and configuration files, the database files, and the redo log files.

The SGA is a memory construct that contains the following:

■ Database Buffers
Contains the most recently used database blocks

■ Shared Pool
Contains shared SQL areas and data dictionary cache

■ Redo Log Buffers
Logs changes made to the database

■ Cursors
Handles for memory associated with specific statements

The Oracle7 Server background threads consist of the following:

Table 1-1
Oracle7 Server Background Threads

Thread	Abbreviation	Description
Process Monitor	PMON	Responsible for the management of the Oracle7 Server process and associated threads (Thread 2).
Database Writer	DBWR	Writes database blocks to disk (Thread 3).
Log Writer	LGWR	Writes the redo log entries to disk (Thread 4).
System Monitor	SMON	Performs instance recovery and cleanup (Thread 5).
Recovery Process	RECO	Resolves failures with the distributed option (Thread 6).
Archival Process	ARCH	Copies full online redo log files to the archive device (if in ARCHIVELOG mode).
Dedicated Checkpoint Process	CKPT	Signals DBWR to perform updates on all data and control files of the database. If not present, LGWR does this.

A shadow thread is a separate dedicated server thread which acts on behalf of a particular user. One thread is created for each user who connects to the database. Any requests that a user has for the database is performed through the shadow thread for that user.

When a shadow thread must read from the database, it checks to see if the data exists in the SGA. If the data exists in the SGA, the shadow thread reads it from the memory. If the data is not found in memory, the shadow thread goes directly to the datafiles and reads the data into the SGA. When a shadow thread must write to the database, it writes into the SGA only. At a later time the DBWR writes this "dirty" data out to disk.

The redo log contains a history of all transactions for the database to perform an instance recovery. A minimum of two redo logs is required and more may be used. When a redo log fills, a log switch occurs. At log switch time all new redo information goes to the next redo log file in line. If the system is running in ARCHIVELOG mode, which is recommended, the previous log file is copied out to an archive log file.

With a recent backup, the redo log files, and the redo log archive files, the database can be recovered if needed. The control and configuration files are used to store information of the state layout of the database as well as system tunables. A more in-depth discussion of the Oracle7 Server architecture can be found in the *Oracle7 Server Concepts Manual.*

New Features in Oracle7 Version 7.1

Although Oracle7 version 7.1 is primarily a maintenance release, there are several
new features, briefly outlined below. For more details on these new features, refer to
the *Oracle7 Server Documentation Addendum Release 7.1*.

Table 1-2
New Features in Oracle7 Server, Version 7.1

New Feature	Description
Server Manager	This is an administration tool that runs locally as a 16-bit Windows application in the Windows NT subsystem, Windows on Win32, or remotely from DOS clients running Microsoft Windows. Server Manager provides all of the features previously available in SQLDBA plus additional configuration and performance monitoring information.
Procedural Option	Features previously limited to users of PL/SQL, such as stored procedures and triggers, are now available to all users. Multiple triggers of the same type are also allowed on a single table.
Symmetric Replication	This feature allows multiple, updateable copies of data at different sites in a distributed environment. Oracle's symmetric replication facility will be available on a different schedule from version 7.1. More information will be provided as it becomes available on the topic of Replicated Servers.
Consistent Snapshot Refresh	This feature allows multiple, related snapshots to be kept consistent to any point in time.
Enhancements to SQL and PL/SQL	Oracle7 version 7.1 conforms to entry-level ANSI SQL92 standard requirements. SQL was enhanced to allow PL/SQL user-defined functions to be called from within SQL.

continued

New Features in Oracle7 Server Version 7.1 *Continued*

Read-Only Tablespaces	Read-only tablespaces reduce backup and recovery efforts because these tablespaces do not require backup. They also allow read-only media, such as CD-ROM and WORM drives, to store data.
Parallel Recovery	This feature is not available with Oracle7 Server for Windows NT v7.1.3.3.6.
Improved Security when connecting to a remote database	Passwords are now encrypted when they are sent over the network.
Parallel Query	This feature is not available with Oracle7 Server for Windows NT v7.1.3.3.6.
SQL*Net Oracle Names	This feature allows you to perform a database link without providing a connect string to the database. SQL*Net Oracle Names uses the Oracle Network Manager to provide connection information to all the machines on the network.

Chapter 2
Tuning Goals

There are several factors involved in achieving the best performance from your system. These include the optimization of the hardware, the Oracle7 Server, the operating system and the application software. This TechNote focuses on the hardware, Oracle7 Server, and the operating system.

Although it is important to tune the application software to take advantage of the system resources, tuning application software is beyond the scope of this TechNote. For more information on the tuning of applications, refer to the *Oracle7 Server Application Developer's Guide.*

An optimally tuned Oracle7 Server for Windows NT system has the following characteristics:

■   There is little or no waiting on I/O. This indicates that the system processors always have some work to do while there are outstanding I/Os. This is verified by running the Performance Monitor and observing the processor activity (Processor:% Processor Time), the disk activity (LogicalDisk/PhysicalDisk:Disk Transfers/sec), the length of the processor queue (System:Processor Queue Length) and threads performing I/O operations (Thread:% Processor Time).

   NOTE: To observe disk activity using the Performance Monitor, run the *diskperf* utility to activate disk performance measurement by the system (**diskperf -Y**), then shutdown and restart the system.

- Most of the system processor activity is allocated to the shadow threads and not the background threads. Use the Performance Monitor to verify the system processor activity at the Oracle thread level (Thread:% Processor Time). Make sure that the user's shadow threads are getting the majority of the system processor.

- Most of the system processor activity is in user mode. Verify the system processor activity by running Performance Monitor and looking at the percentage of processor time spent in privileged and in user time for the Oracle process (Process:% User Time/% Privileged Time). Privileged time can be thought of as operating system overhead such as time spent in the I/O subsystem or in system calls. The higher the percentage of user to privileged time that you have, the better.

- Users see good response times. A system that appears to be tuned well but has poor response times could have an inefficient statement in the application or excess latencies in the network or I/O subsystems. Because well-tuned database applications are system processor bound, a more powerful processor can improve response times.

Basic Tuning

Tuning is an iterative process that changes as user and work loads change on your system. Here are some suggestions that might help you in this process.

Flashable ROM

Apply the latest Compaq System ROMPaq and Option ROMPaq to the Compaq ProLiant Server.

Compaq System Configuration

During configuration of the Compaq ProLiant Server, use the latest Compaq System Configuration utility and the following recommended settings:

Table 2-1
Recommended System Configuration Settings

Item	Setting	Description
System	Primary Operating System = Windows NT	Specifies the Primary Operating System for initial configuration options.
Compaq Memory	Base Memory = 640 Kbytes, Linear	Contiguously maps all memory so Compaq Built-In Memory is not available at FA0000, but is instead added into extended memory. The previously reserved memory area at FE0000 is now available for use.
Compaq SMART SCSI Array Controller	Controller Characteristics- Operating System = Windows NT - Windows NT 3.5	Sets the drive geometry for the controller to be 32 sectors per track versus 63 sectors per track when set at Windows NT 3.5 - Maximum Boot Size.
	Array Accelerator Status - Logical Drive # = Enabled	Increases performance of the controller by writing data to RAM on the controller instead of directly to disk. The RAM on the controller is mirrored and backed up by batteries for increased reliability.

Windows NT Configuration Changes

Prior to or immediately after you install Oracle7 Server for Windows NT, make these recommended changes to the Windows NT configuration.

Compaq Software Support for Microsoft Windows NT 3.5

Install the latest version of the Compaq Software Support Diskette to apply the latest drivers specific for Windows NT on Compaq hardware. The available drivers are listed below.

- NetFlex/NetFlex-2/Integrated NetFlex-L ENET/PCI network adapter family

- NetFlex 10-Plus network adapter family

- IDA/IDA-2 disk controller

- SMART Controller

- 32-bit SCSI-2/Integrated PCI SCSI-2 adapters

- ProLiant Storage System

- SCSI Compression adapter

- System Management/Health driver

- Power Management for the Elite family

- Volume Control Service for Presario 500 family

- UPS support

- Compaq HAL support (ISA, Uniprocessor, and Multiprocessor)

Microsoft Windows NT 3.5 Workstation and Server Service Pack

Install the latest version of the Service Pack to apply the latest fixes from Microsoft.

Server Configuration

Use Control Panel/Network to choose *Server* from the Installed Network Software list and Configure. Change the relationship of memory allocated to the network connections and memory allocated to applications running on the server by choosing *Maximize Throughput for Network Applications* (the default is *Maximize Throughput for File Sharing*). This optimizes the server memory for Oracle7 Server because it performs its own memory management for caching file and network I/O. See Figure 2-1.
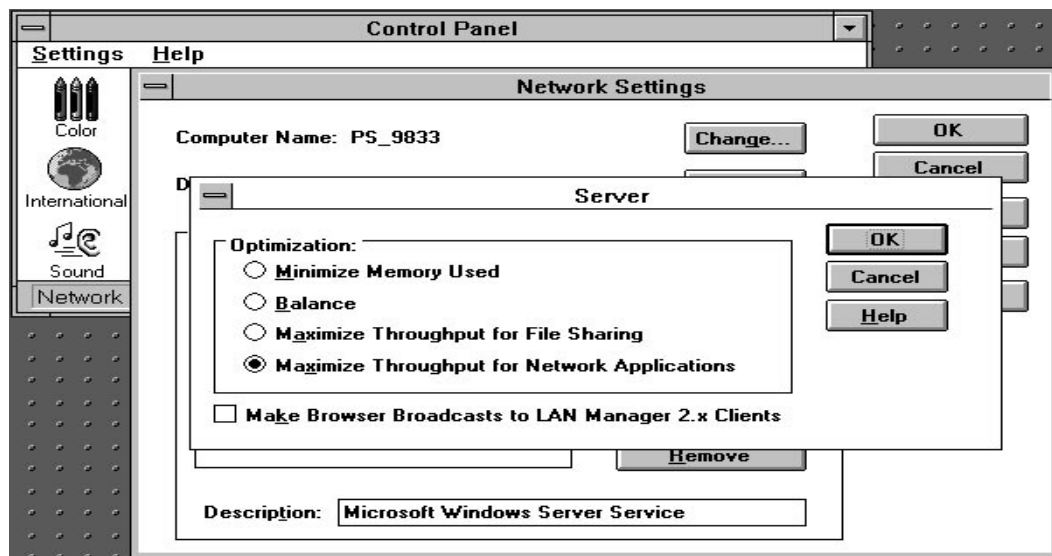
Figure 2-1.   Control Panel/Network/Server - Memory Configuration

Network Protocols

Use Control Panel/Network to choose any protocol not required for the activities on the server from the Installed Network Software List and Remove. See Figure 2-2.
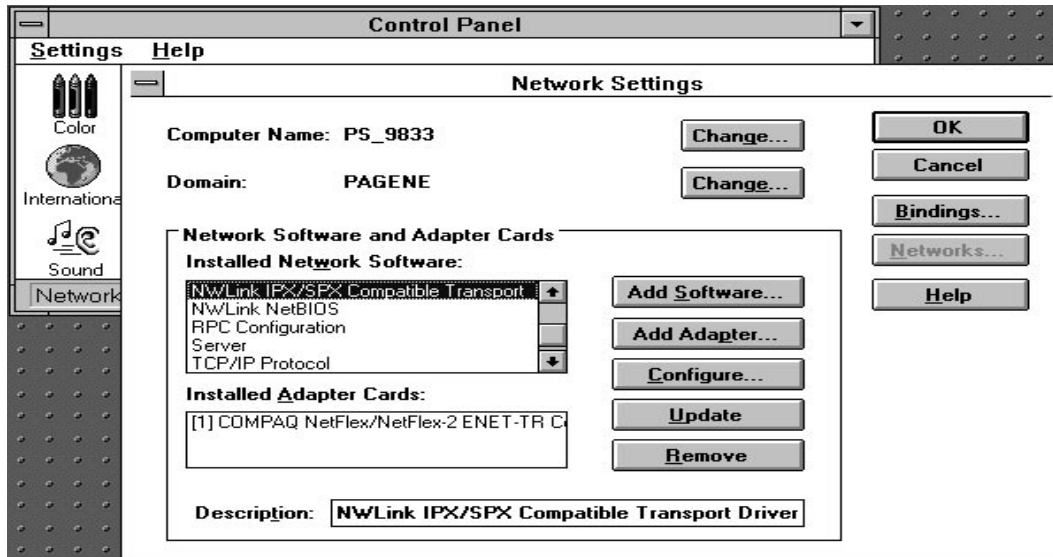
Figure 2-2.   Control Panel/Network - Network Protocols

Server and Workstation Network Bindings

Use Control Panel/Network to choose *Bindings* to configure the Server and Workstation network bindings path. Move the protocol of primary use to the top followed by the protocol of second highest usage and so forth on both the Server and Workstation. This reduces the average connection time. See Figure 2-3.
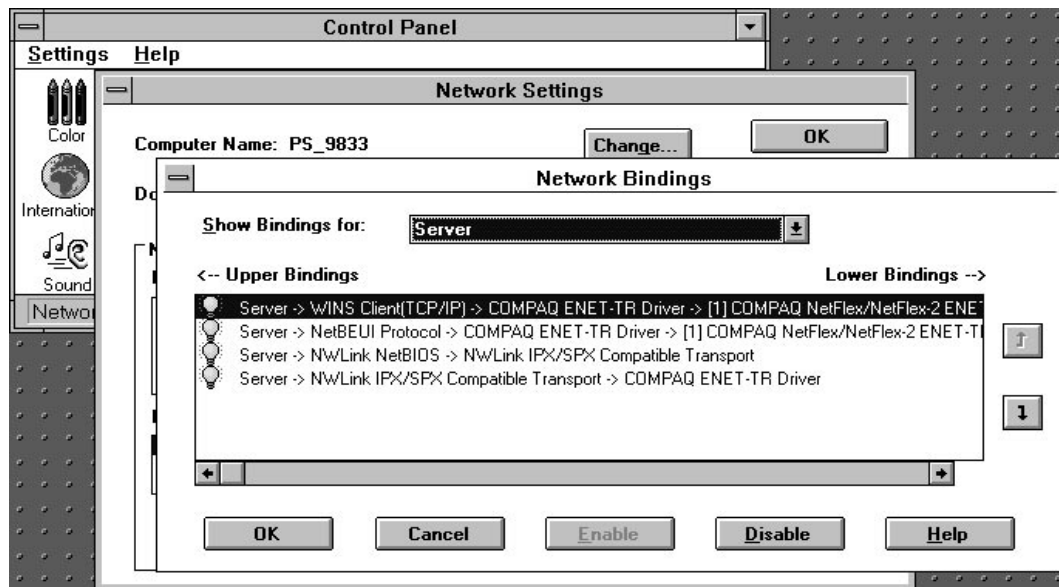
Figure 2-3.   Control Panel/Network/Bindings - Protocol Binding Order

Services

If the Oracle7 Server is dedicated to being a database server only, various services may be stopped to reduce overhead on the processor(s). The minimum services needed are (Server and OracleServiceSSSS), but Compaq also recommends EventLog and Workstation. One or more services, depending upon the versions of SQL*Net and protocols supported, will be required to support user connections through SQL*Net (example, OracleTCPListener). Turn off services using the Control Panel/Services, and change the service's Startup option to Manual. See Figure 2-4.
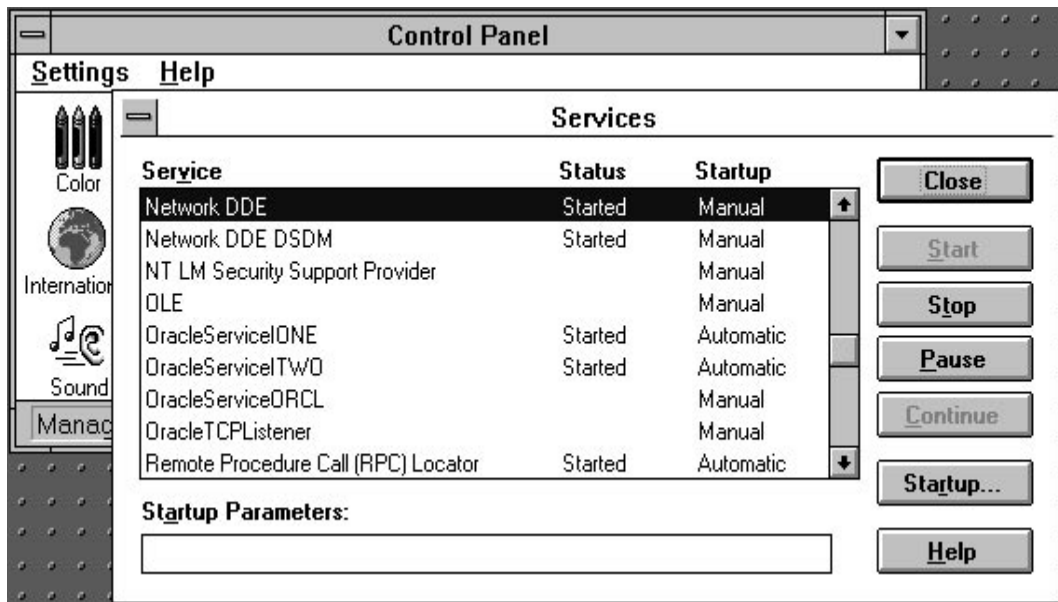
Figure 2-4. Control Panel/Services

Windows NT File System

Compaq testing indicated a minimal performance difference when using FAT, NTFS, or RAW file partitions in Windows NT. Compaq recommends using FAT for the initial boot partition. This allows emergency booting from a DOS diskette. Windows NT and Oracle executables are placed on the FAT partition as well. The system, log and data files are normally placed on NTFS file partitions.

If you are I/O bound with your system, you may switch the log and data files to RAW partitions to gain I/O performance. The consequence of this choice is that it restricts the configuration options. Each RAW partition equates to a single file and is represented by a single drive letter (for example, \\.\E:).

Oracle7 Server

Use the Windows NT Registry Editor to make any necessary changes to the Oracle configuration parameters (ORACLE_SID, LOCAL, ORACLE_HOME, and so on). Do not change the parameter ORACLE_PRIORITY. The correct setting for maximum performance and stability is CLASS:normal;DEF:normal. See Figure 2-5.

Figure 2-5. Registry Editor

I/O Tuning

In most well-tuned Oracle systems, the I/O subsystem is not the performance bottleneck. To assure that you are not I/O bound, verify that the following factors are true.
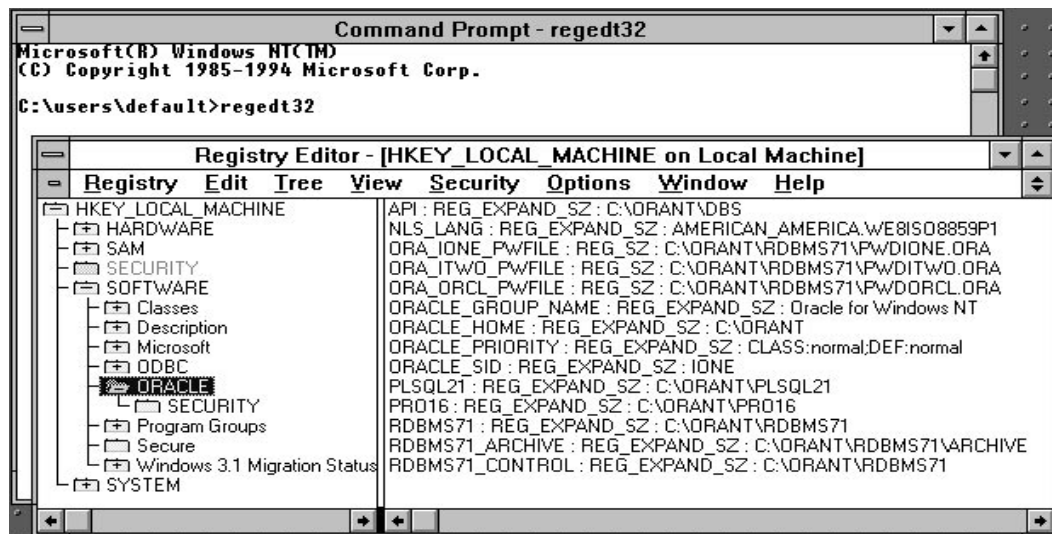
■   Asynchronous I/O capabilities are available

■   Sequential I/O activity is isolated to its own controller volume

■   Random I/O activity is balanced across all drives allocated to data and indexes

■   Physical disk I/O rate capacities are not exceeded

Asynchronous I/O Capabilities

Oracle7 Server for Windows NT uses the asynchronous I/O capabilities of Windows NT. Asynchronous I/O allows the DBWR and/or the LGWR thread to avoid blocking on I/O. By using the asynchronous I/O capabilities of the operating system and Oracle, only one DBWR thread is necessary in the system. This cuts down on system idle time that might occur when the DBWR is blocked on I/O.

Separate Sequential and Random I/O Activity

To achieve maximum performance on data files being accessed sequentially, the disk(s) must be dedicated to this purpose. Of primary importance are the Oracle transaction log files, which are accessed in a sequential, write-only fashion. Other partitions with little I/O activity can share the disk(s) with the redo logs, such as the operating system partition.

In a typical multiuser database system, file access is random. Spread out these files over as many physical disks as necessary to achieve random I/O rates which do not exceed recommendations. You can best achieve this by using the disk striping available with the Compaq SMART Controller. The SMART Controller ensures that the load is balanced equally across disks in a volume and allows a high degree of parallelism to occur on accesses. For more information on optimizing array configurations refer to the Compaq TechNote, *Configuring Compaq RAID Technology for Database Servers*.

Layout of Tables and Files

To improve performance where disk I/O is a problem, keep in mind the following items:

■ Redo Log access is 100-percent sequential I/O and should be isolated, if possible. Speed of the redo log is essential to the performance of the system. If possible, these drives should also be fault tolerant. Hardware fault tolerance provides the maximum performance and reliability. See the TechNote, *Configuring Compaq RAID Technology for Database Servers.*

■ Redo log archive files also are 100-percent sequential I/O. Isolate them for maximum performance.

■ Data file access is usually random and should be spread across many drives as necessary. By increasing the number of physical drives, you can achieve greater I/O rates. By using a striped array, you can ensure that the I/O activity is well distributed.

Do Not Exceed I/O Limits

Avoid overloading an individual disk with random I/O activity. Compaq recommends that random I/O activity not exceed 50 I/O's per second per drive for 2-Gigabyte drives and not exceed 40 I/O's per second per drive for 1-Gigabyte and 500-Megabyte drives.

While the system is under load, determine the number of I/O's per second to each logical volume using the Performance Monitor. See Figure 2-6. Then, using the formulas in the Compaq TechNote *Configuring Compaq RAID Technology for Database Servers*, you can calculate the number of I/O's per physical disk based on the fault tolerance level of that particular logical volume.

In the example displayed in the following figure, there is no fault tolerance on logical NTFS volume G: and it consists of seven 2-Gigabyte drives. The average I/O rate is 478.262 I/Os per second. Thus, the I/O rate per second per drive is 478.262 / 7 = 68.32 I/O's per second per drive. The test flooded the logical drive with I/O's, giving a scenario above the recommended 50 I/O's per second per disk and requiring the possibility of adding more disk drivers or rearranging files.
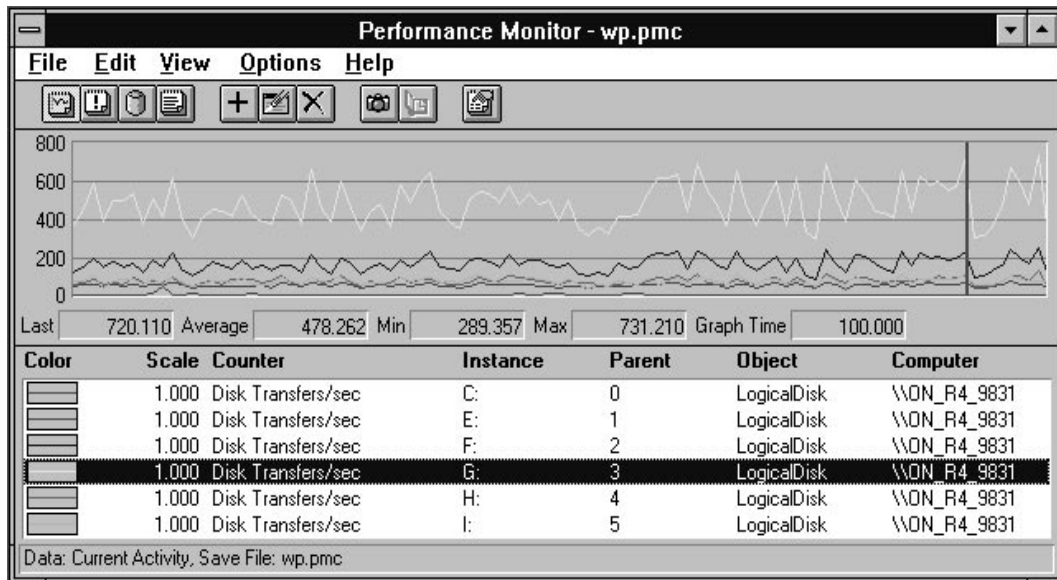
Figure 2-6. Performance Monitor - Disk I/O

System Processor Scalability

Oracle7 Server for Windows NT provides good system processor scalability. By adding additional system processors, you can dramatically improve performance if your system is processor bound. While no operating system or hardware provides 100-percent scalability, Windows NT and Oracle7 provide an above-average level of scalability.

Because most well-tuned Oracle instances are processor bound, most applications see significant improvement from the addition of more powerful processors, more processors, and additional cache on the processors. If the system is I/O bound, adding system processors does not offer a significant improvement. The following graph represents system processor scalability on the Compaq ProLiant 4000 using tests that are both disk and memory intensive.
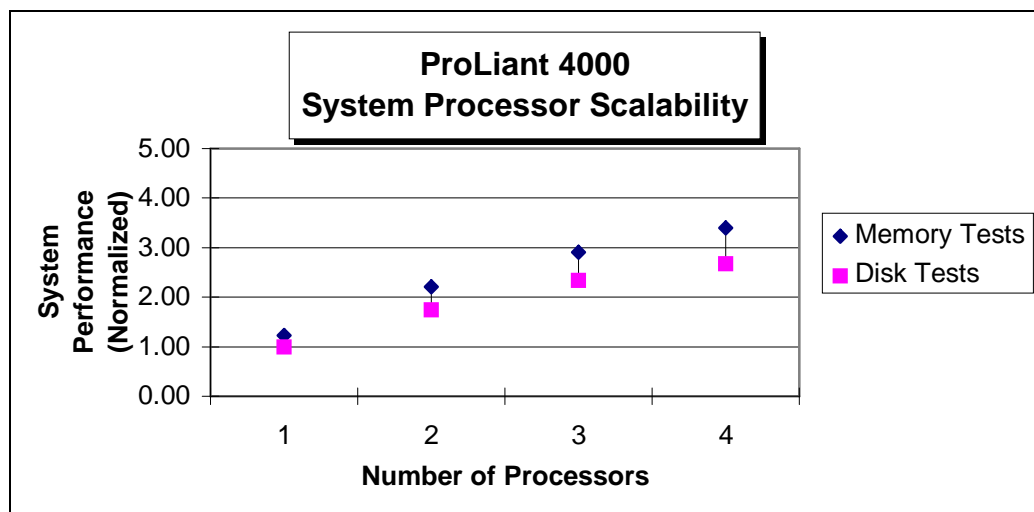
Figure 2-7.   System Processor Scalability

Memory Tuning

To improve server performance, Compaq recommends adjusting the following:

■   Oracle DB block buffers

■   Oracle DB block size

■   System Global Area (SGA) size

Oracle DB Block Buffers

To reduce excess I/O, tune the Oracle7 Server data cache to provide maximum use of resources available. You can tune the Oracle7 Server buffers with the parameter **DB_BLOCK_BUFFERS**. Because Oracle7 Server is a single process, multithreaded application all the threads share the memory from the single process. To determine how much memory is available for buffers, use the Performance Monitor (Memory:Available Bytes) and observe the amount available memory left in the system. See Figure 2-8. Do not use all the available memory for buffers or swapping might occur. Swapping degrades system performance more than the advantages acquired by tuning up the Oracle7 Server buffers.

Figure 2-8.   Performance Monitor - Available Memory

Oracle DB Block Size

The default **DB_BLOCK_SIZE** is 2048. The value you set for this parameter depends upon the type of transaction load you have when performance is the most critical. If performance is most crucial during applications that primarily access the database in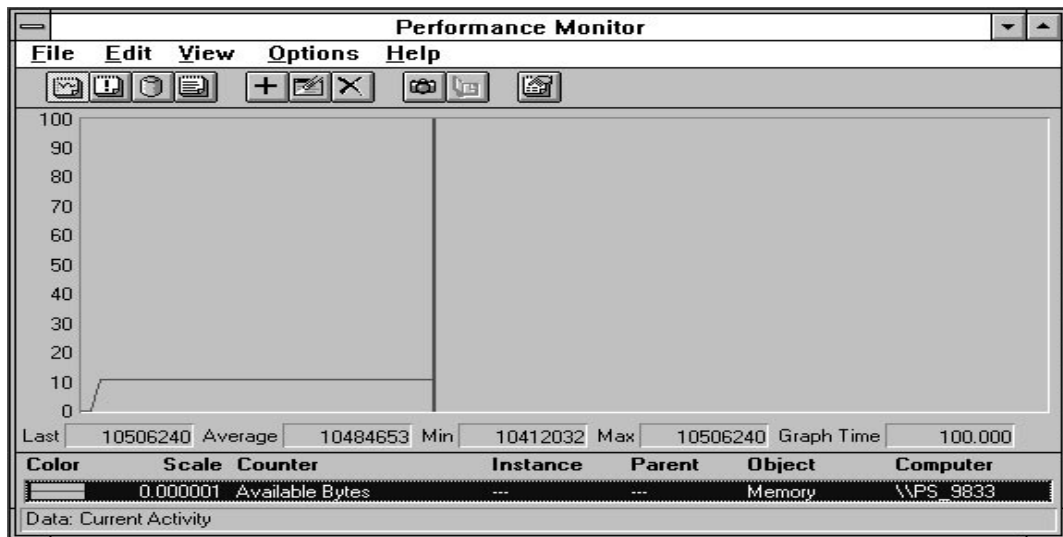 a random fashion (small reads or updates scattered throughout the database), then use a block size of 2048. On the other extreme, if most of the applications are sequentially accessing the database when performance is most crucial, use a block size of 8192. If you are uncertain of the transaction load or have an even split of random and sequential access during this critical time, use a block size of 4096.

System Global Area Size

Because the Oracle7 Server SGA resides in server memory, this is allocated at the startup of the instance. The SGA is made up of the following components:

■   Fixed Size + Variable Size + DB Block Buffers + Redo Buffers = Size of SGA

■   Fixed Size (determined by the Oracle products that you have installed)

■   Variable Size (determined by parameters in the *init.ora* file)

■   DB Block Buffers (determined by the **DB_BLOCK_BUFFERS*****DB_BUFFER_SIZE** parameters)

NOTE: If you are using asynchronous I/O and Oracle can lock down memory for asynchronous I/O, the DB Block Buffers will not be swappable.

The parameter **LOG_BUFFERS** determines the Redo Buffer size. **LOG_BUFFERS** is specified in bytes.

User Capacity

There are necessary tuning areas based on the number of users that you want to connect. In addition to tuning the Oracle parameters which allow a specified number of connections into the database engine, there are areas of operating system tuning required based on your configuration.

Program Global Area Size

The Program Global Area (PGA) is allocated by Oracle when a user thread connects and a session is created. The PGA is a region of memory that contains data and control information for a single connection. This memory must be available at the connect time for a particular user, therefore the amount of free server memory is a limitation to the number of concurrent connections. Each user's PGA could allocate anywhere from 400KB to 2MB of server memory, depending upon the application. The following parameters affect the PGA size:

OPEN_LINKS

DB_FILES

LOG_FILES

Processes

You must also adjust the *init.ora* parameter **PROCESSES**. This parameter specifies the number of threads that Oracle can create. The number you choose must also include the Oracle service and background threads. The number of Oracle service threads is two and the number of background threads is typically six. Therefore, your number must be at least the maximum concurrent connections (concurrent connections cannot exceed 500) plus two service threads and six background threads. The background threads include any or all of the threads listed in the Oracle7 Server Architecture section in chapter one of this TechNote.

Network Tuning

SQL*Net 1.1

Oracle7 Server for Windows NT supports connections using Named Pipes and TCP/IP protocols.

SQL*Net 2.1

Oracle7 Server for Windows NT supports connections using Named Pipes, SPX/IPX and TCP/IP protocols.

Management Considerations

Management of the operating system, the database, and the hardware is a great concern. If the system is used in a mission-critical role, it is especially important to notify the administrator of any fault in the system and to take corrective action quickly. In the past few months several new products have been introduced to help with this task. As more new products are introduced and evaluated, this document will be revised to provide current information.

Oracle Server Manager

Oracle Server Manager is not available with Oracle7 Server for Windows NT v7.1.3.3.6.

DB General

DB General from Bradmark provides a Microsoft Windows-based tool that uses SQL*Net to monitor various parameters in the Oracle7 database. The console runs on Windows but can connect to Oracle7 databases on any operating system.

Compaq Insight Manager

Insight Manager is a Windows-based utility that uses SNMP in conjunction with operating system and Driver Agents on the server to report hardware failures and system degradation due to a hardware problem. You can configure Insight Manager to page the system administrator if a component is failing.

Using Insight Manager pre-failure warranty allows a hardware component to be replaced under warranty before it fails. Insight Manager monitors system hardware and a few operating system components. You can locate Insight Manager on the Compaq SmartStart product.

Conclusion

The information in this TechNote is not a complete tuning guide but is a supplement to other tuning information provided by Oracle and Microsoft. To achieve an optimal configuration, there are several factors to consider. Tuning the application, tuning the hardware, tuning the operating system, and tuning the network are all areas that must be carefully planned and tuned.

The tuning process is iterative and must be performed several times to achieve the most optimal performance possible. Although all the suggestions given here have been tested extensively, do not assume that tuning a specific parameter always gives the desired result.

References

Configuring Compaq RAID Technology for Database Servers, Compaq TechNote, Part Number 184206-001 (See Appendix A for more information.)

Oracle7 Server Administrator's Guide, Part Number 6694-70-1292

Oracle7 Server Application Developer's Guide, Publication Number 6695-70-1292

ORACLE Performance Tuning 1993, O'Reilly & Associates, Inc., Peter Corrigan and Mark Gurry. This book offers tuning techniques and tips, focused on application tuning. There are chapters on tuning the database and the operating system, but the examples all use UNIX for operating system tuning.

Installation and Configuration Guide for Oracle7 on Windows NT, Oracle, Part No. A10159-2. This book gives all the details about Oracle7 Server for Windows NT including Oracle defaults and installation issues.

DB General, Bradmark Technologies Inc. (800) 275-2723

Appendix A
Multivendor Integration
from Compaq

To help you successfully integrate and optimize your network or multivendor system, Compaq has developed a library of systems integration TechNotes for the NetWare, Microsoft Windows NT, SCO UNIX, and OS/2 operating system environments. TechNotes provide you with important information on topics such as network performance management, server management, and operating system interconnectivity.

Pricing

Compaq TechNotes   U.S. $15   (CND $20)*

                          *Plus shipping & handling

How to Order

To order by PHONE (credit card orders only), call:

■   1-800-952-7689 (In U.S.: 7 a.m. - 7 p.m. C.S.T.)

■   1-800-263-5868 (In Canada: 24 hours)

■   1-317-364-7281 (From outside U.S. & Canada:
     7 a.m. - 7 p.m. C.S.T.)

To order by MAIL or FAX, send complete order information to:

Worldwide: Compaq Fulfillment Center
(except Canada &   P.O. Box 4100
France)   Crawfordsville, Indiana 47933

                         FAX: 1-317-364-0787

Canada: Compaq TechNotes
                         Compaq Canada, Inc.
                         111 Granton Drive, Suite 101
                         Richmond Hill, ON L4B 1L5

                         FAX: 1-800-668-1835

France: Compaq TechNotes
                         Compaq Computer S.A.R.L.
                         5, Avenue de Norvege
                         91959 LES ULIS Cedex
                         France

                         FAX: 1-331-64-46-51-81

Current TechNotes

The current TechNotes available are listed in the following tables.

Table A-1
Compaq TechNotes

TechNote Name	Available on SmartStart	Part Number
Compaq Insight Management		
Integrating Compaq Insight Management with Enterprise Management Platforms (6/95)	√	145806-003
Integrating Compaq Insight Management with Microsoft Systems Management Server (6/95)	√	184720-001
Integrating Compaq Insight Management with ManageWise (6/95)	√	182074-001
NetWare		
Performance Management in a NetWare v3.1x Environment (4/93)		133399-002
NetWare Tape Backup Management Using ARCserve from Compaq (4/93)	√	137535-001
NetWare 4 Performance Management (7/94)	√	137989-001
ORACLE Server Planning in a NetWare v3.11 Environment (5/93)		145143-001
NetWare Server Management (9/92)		145231-001
Compaq IDA-2 Configuration for NetWare (12/92)		145536-001
Compaq ProSignia Configuration Guidelines for NetWare v3.x (12/92)		145537-001
Compaq Answers to Technical Support Questions for NetWare Environments (2/95)		145710-002
NetWare SFT III v3.11 Installation (9/93)		145905-001
NetWare Migration from 2.x to 3.12 (6/94)	√	181069-001
NetWare Migration from 3.12 to 4 (3/95)	√	181152-001

Compaq TechNotes   Continued

TechNote Name	Available on SmartStart	Part Number
NetWare (continued)		
SYBASE SQL Server 4.2.2 for NetWare: Tuning and Performance (2/95)	√	184429-001
Performance of Lotus Notes 3.1 on Compaq ProLiant Servers with NetWare 3.1x (2/95)		184430-001
Configuration and Tuning of Oracle7 for NetWare on Compaq Servers (11/94)	√	
Microsoft		
Implementing Lotus Notes on Compaq Servers with Microsoft LAN Manager (9/92)		145201-001
Microsoft SQL Server and Novell NetWare Requester for OS/2 (9/92)		145376-001
Drive Subsystem Performance with Microsoft LAN Manager 2.1 (11/92)		145517-001
Configuration and Tuning of Microsoft SQL Server for Windows NT on Compaq Servers (4/95)		184207-002
Migrating from Microsoft Windows NT Advanced Server 3.1 to Microsoft Windows NT Server 3.5 (2/95)		184669-001
Compaq Backup and Recovery for Microsoft SQL Server (3/95)		184489-001
UNIX		
SCO UNIX in an SNA Environment Using CLEO DataTalker U/X (5/92)		145081-001
SCO UNIX in an SNA Environment Using Computone LYNX (7/92)		145116-001
SCO UNIX Database Servers in Novell Networks (10/92)		145402-001
Printing in SCO UNIX and NetWare Integrated Environments (3/93)		145538-001

Compaq TechNotes Continued

TechNote Name	Available on SmartStart	Part Number
UNIX (continued)		
SCO UNIX Connectivity to SNA Environments Over X.25 Networks (1/93)		145583-001
Disk Mirroring with VERITAS VxMirror (12/93)		145656-001
SCO UNIX IP Routing Over X.25 Networks (4/93)		145711-001
Performance Tuning for SCO UNIX on Compaq Systems (5/93)		145730-001
Configuration and Tuning of Oracle7 for SCO UNIX on Compaq Servers (11/94)	√	184329-001
The Compaq, SCO UNIX, and ORACLE7 Database Server (9/93)		195818-001
IBM		
Compaq Answers to Technical Support Questions for OS/2 Environments (11/94)	√	
Performance of Lotus Notes 3.1.5 on Compaq ProLiant Servers with OS/2 2.11 (3/95)		184655-001
Technology Overview		
Configuring Compaq RAID Technology for Database Servers (7/94)	√	184206-001