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Configuration and Tuning of Sybase System 10 for Novell UnixWare 2.0 on Compaq Servers

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Chapter 1

Installation and Tuning Recommendations

The information presented in this document is based on Sybase System 10 for UnixWare 2.0. Because there is an abundance of information available concerning general tuning of Sybase System 10 on the UNIX platform, this TechNote focuses on specific tuning suggestions for Compaq ProLiant servers. Wherever possible, references are made to other useful tuning documentation.

The following publications provide information on tuning and related topics:

Sybase SQL Server System Administration Guide, Document ID:32500-01-1000-02

Sybase SQL Server Troubleshooting Guide, Document ID:39998-01-1000-0

Compaq TechNote, *Configuring Compaq RAID Technology for Database Servers*, Part Number 184206-001.

NOTE: See Appendix A, "Multivendor Integration from Compaq," for a listing of available TechNotes and ordering information.

This chapter deals with the following topics:

- Sybase Installation Issues
- I/O Tuning
- Memory Tuning
- UnixWare User Capacity Parameters
- System 10 Server Configuration and Tuning Parameters

Chapter 2, "Compaq Drive Array Controllers," provides a data striping comparison between the Compaq Fast SCSI-2 Controller and the Compaq SMART SCSI Array Controller.

Sybase Installation Issues

Pre-Installation with CD-ROM

If you are installing Sybase from a CD-ROM, you must mount the CD-ROM to a directory such as */mnt* to run the **sybload** program. Here is an example of the procedure:

1. Log in as **root** and enter the following command:

```
mount -F -r cdfs /dev/cdrom1 /mnt
```

2. Log out and log back in as your System Administrator and enter the following commands:

```
cd $SYBASE
```

```
/mnt/sybload -D
```

3. Go to the *\$SYBASE/install* directory and run **sybinit**.

Sybase Installation Default Parameters

Sybase SQL Server boots at the end of **sybinit**. Sybase SQL Server starts up with one data engine and the default configuration values. Table 1-1 lists a few parameters you might need to change before building your database. See the section, "System 10 Server Configuration and Tuning Parameters," for more detail on these. Also, refer to the *Sybase SQL Server System Administration Guide*.

Table 1-1
Sybase Parameters

Parameter	Description
memory	Sets the memory size, in 2-Kbyte units, that SQL Server allocates from the operating system.
devices	Sets the number of database devices the SQL Server can use. Include master and log devices in this count. The default is 10. Devices must be set before doing disk init to initialize your devices so the server can restart successfully.
user connections	Sets the maximum number of connections that can connect to the SQL Server at the same time.
max online engines	Sets the number of data server engines that start up when SQL Server boots. For a one-processor environment, this should be set to one. For SMP environments, one engine per processor is common. If there are many non-server processes being performed by the users, then the number of data engines configured should be one less than the number of system processors.

Tuning Goals

There are several factors involved in achieving the best performance from your system. These include optimization of the hardware, the Sybase SQL Server, the operating system, and the application software.

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. This TechNote focuses on the hardware, Sybase SQL Server, and the operating system.

Use the tuning process and parameters in this paper as a starting point. Tuning is an iterative process that evolves as user and work loads change on your system.

An optimally tuned Sybase System 10 on UnixWare 2.0 system should have the following characteristics:

- There is little or no waiting on I/O.
You can verify this by running **sar** or **rtpm**. These indicate that the system processors always have some work to do while there are outstanding I/Os.
 - Most of the system processor use is in user mode.
Again, you can verify this by running **sar** or **rtpm** and looking at the percentage of system processor time spent in kernel and in user time. System 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 system time that you have, the better.
 - Users should see good response times.
A system that appears to be tuned well but has poor response times could have inefficient statements in the application or excess latencies in the I/O subsystem or network. Because well-tuned database applications are system processor bound, an additional system processor could improve response times.
-

I/O Tuning

In most well-tuned Sybase systems, the I/O subsystem is not the performance bottleneck. To ensure that this is not a problem in your system, verify that the following factors are true:

- 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

Separate Sequential and Random I/O Activity

To achieve maximum performance on sequentially accessed data files, the disk(s) must be dedicated to this purpose. Of primary importance are the Sybase 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 transaction logs, such as the operating system partition and swap (unless your machine is limited by system memory).

In typical multiuser database systems, 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. Spreading out the disk requests among many disks allows a high degree of parallelism to occur on accesses. You can best achieve this by using the disk striping available with the Compaq SMART SCSI Array Controller. The SMART Controller ensures that the load is balanced equally across the disks. 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:

- Transaction log access is 100-percent sequential I/O and should be isolated, if possible. The log speed 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 Compaq TechNote, *Configuring Compaq RAID Technology for Database Servers*.
- Data file access is usually random and should be spread across as many drives as necessary. By increasing the number of physical drives, you can achieve greater I/O rates. Using a striped array ensures that the I/O activity is well distributed.

Checking Disk I/O Rate

Avoid overloading any 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.

To determine the I/O rate per driver, first determine the number of I/O's per second to each logical volume. You can determine this with **sar -d, rtpm**, or other third-party tools. Take the number of I/O's per second to each logical volume and divide by the number of physical disks in that logical volume. This provides the number of I/O's per second per disk. If this number exceeds recommended I/O's per second rating, adding more physical disks should improve average system performance.

The following **sar** command provides an example for determining the I/O (r+w/s) for each logical controller volume on a system.

```
> sar -d 25 1
10:51:47 device %busy avque r+w/s blks/s await avserv
10:52:12 sd011 26.13 218.81 156.95 712.22 362.65 1.66
          sd012 100.00 56.07 295.67 1178.64 681.90 12.38
          sd013 100.00 89.28 331.34 1319.40 1140.51 12.92
          sd014 100.00 109.97 260.40 1029.66 1605.28 14.73
```

Enabling Asynchronous I/O

Asynchronous I/O (AIO) is available on the UnixWare 2.0 operating system. You can use AIO with databases built using RAW devices or file systems to achieve the best performance. To enable AIO you must do two things:

1. Execute the following command:

```
chmod 666 /dev/async
```

This gives permissions on that file to the user (possibly the system administrator) who starts up the SQL Server.

2. Open the file `/etc/conf/node.d/async`, and change the mode number to 666.

Sybase automatically uses AIO. You do not need to set parameters in SQL Server.

Memory Tuning

Initial Memory Recommendations for Sybase

Sybase recommends a minimum of 48 Megabytes of memory to install and run SQL Server. You might need to increase these initial memory requirements, based upon the following items:

- Number of users
- Complexity of queries
- Number of disk controllers
- Amount of total disk storage
- Number of network interface controllers
- Intensity of the workload in your environment

For each user, SQL Server allocates approximately 40 Kbytes for the users' stack area and an additional 5-10 Kbytes for the users' procedure cache. To estimate the minimum memory requirements for a 512-user system, multiply 512 times 50 Kbytes for a total of 25,600 Kbytes (that is, 25 Megabytes) and add this to the Sybase minimum requirement of 48 Megabytes, for a total of 63 Megabytes.

Do not tune Sybase memory at the expense of swapping. Swapping degrades system performance more than the advantages acquired by giving more memory to Sybase. (See the following section for checking on swapping.)

UnixWare Shared Memory Parameters

The amount of shared memory allowed in UnixWare must equal or exceed the amount of shared memory required for Sybase. Several tunable parameters determine the maximum amount of shared memory allowed in a system. The operating system parameters **SVMMLIM** and **HVMMLIM** set the maximum amount of memory available to a user on the system. The parameter **SHMMAX** sets the maximum size of a single, shared-memory segment.

The maximum amount of shared memory that a single process can use is equal to the operating system parameters **SHMMAX** times **SHMSEG** (maximum shared memory segment size times maximum number of shared memory segments). Check to see that only one shared memory segment is being allocated. If more than one segment is being allocated, it is less efficient than having one large shared memory segment. You should then increase **SHMMAX**.

You can verify this with the command **ipcs**. The following example shows this.

```
> ipcs -b
IPC status from /dev/kmem as of Sun Jan 29 10:33:19 1995
T  ID  KEY      MODE   OWNER   GROUP  QBYTES
Message Queues:
T  ID  KEY      MODE   OWNER   GROUP  SEGSZ
Shared Memory:
m  900 0x10043232 --rw-r----- sybasedba    50745344
T  ID  KEY      MODE   OWNER   GROUP  NSEMS
Semaphores:
```

In this example, only one shared memory segment was allocated with a size of 50745344.

.....

1-10 Installation and Tuning Recommendations

By increasing the amount of shared memory allocated, you reduce the amount of memory available to non-server user processes. Avoid reducing this memory to a point where swapping occurs. You can detect swapping by noting the available space on the swap file with the UNIX command `/etc/swap -l` or by noting swapping activity with `sar -r`, `sar -w`, or `rtpm`.

The following example shows the system response from one of these commands:

```
sar -r 5 5
10:09:54   freemem   freeswp
10:09:59   28640       196608
10:10:04   28627       196608
10:10:09   28637       196608
10:10:15   28637       196608
10:10:20   28637       196608
Average    28636       196608
```

These values are given in number of 4-Kbyte pages. There is sufficient free memory. If the amount of `freemem` dips below 100 and `freeswp` decreases, then swapping is occurring.

Here is another example:

```
> sar -w
```

10:09:28	swpin/s	bswin/s	swpot/s	bswot/s	pswch/s
10:09:33	0.00	0.0	0.00	0.0	20
10:09:38	0.00	0.0	0.00	0.0	23
10:09:43	0.00	0.0	0.00	0.0	24
10:09:48	0.00	0.0	0.00	0.0	22
10:09:54	0.00	0.0	0.00	0.0	23
Average	0.00	0.0	0.00	0.0	22

NOTE: The blocks swapped in and out per second (bswin/s & bswot/s) are given in 512-byte blocks. The number of swap ins and swap outs per second is zero. This indicates that no swapping is occurring.

If you see that swapping is occurring, reduce the memory size given to SQL Server by running the **sp_configure memory** command in isql. Check for swapping again. Continue reducing the memory size given to SQL Server until swapping ceases.

UnixWare PSE Pages

To make the most efficient use of system memory on a system using an Intel Pentium processor, take advantage of PSE memory. PSE memory allocates contiguous memory with a 4-Megabyte page size that can be used for shared memory. The larger page size allows more efficient page lookup on Intel Pentium processors.

You can configure PSE pages with the kernel parameter **PSE_PHYSMEM**. **PSE_PHYSMEM** is specified in bytes but is rounded up to the nearest 4 Megabytes. To allow Sybase to use this shared memory area, you must tune both **PSE_PHYSMEM** and **SHMMAX** to a size equal to or greater than the memory size given to SQL Server.

UnixWare User Capacity Parameters

There are several areas of necessary tuning based on the number of users that you want to connect. In this section we describe the two operating system parameters that deal with user connections, **MAXUP** and **NPROC**. For information on tuning the Sybase parameter, **user connections**, see the following section, “System 10 Server Configuration and Tuning Parameters.”

The parameter **MAXUP** specifies the maximum number of processes allowed on the system on a per user basis. The parameter **NPROC** specifies the maximum number of processes allowed on the system. **NPROC** must be at least 50 greater than **MAXUP** to allow for other operating system and user processes to run. Both **MAXUP** and **NPROC** are tuned automatically based on the amount of memory in your system. To check on the current value, use the operating system command **sysdef**.

For descriptions of these and more of the operating system parameters, refer to the System Tuner program on your UnixWare desktop or to the UnixWare on-line documentation.

System 10 Server Configuration and Tuning Parameters

sp_configure

The default settings for the **sp_configure** parameters are usually sufficient for running SQL Server. If you need to alter these parameters, do so with care. Some of the **sp_configure** values take effect dynamically as you change them and others require you to stop and restart SQL Server to take effect. If SQL Server has determined that you are setting a value outside of its pre-determined normal guidelines, you might have to issue a *reconfigure with override* followed by a *checkpoint* for the new value to be set. In all cases, check via `isql` to ensure that the **sp_configure** `run_value` and `config_value` of the items you have changed match before you let additional users onto the system.

It is possible to configure these parameters so you cannot start SQL Server. If this does happen, you can reset ALL of the **sp_configure** parameters to their default values via the **buildmaster** routine found in the Sybase *bin* directory. The **-d** option is followed by the full path name of your master device. For example:

```
buildmaster -d /dev/master -r
```

You might not be able to start your database if the number of devices your database requires exceeds the default number of 10 devices. If this is the case, use the command line switch `-ycnvdisk=nn`, where `nn` is the number of database devices you need. For example, if your database uses 25 devices the reset command line looks like:

```
buildmaster -d /dev/master -ycnvdisk=25
```

To get a listing of all the **buildmaster** parameters and their current values, enter the following command line:

```
buildmaster -d /dev/master -yall
```

sp_configure Recovery Interval

Leave this setting at its default value unless you are willing to take the risk of setting it to a higher value. If the recovery interval is set too long, the user response times deteriorate and become intolerable when a checkpoint occurs. Setting the recovery interval too short wastes valuable system processor cycles and generates excessive disk I/O.

During a checkpoint, the SQL Servers data cache area is forcibly written to disk, during which time all other database activity is suspended. Immediately after a checkpoint, user response times are slightly faster than normal until the data cache area becomes filled. Once this area is filled, user response times slow down to “normal” levels due to necessary disk access and memory management.

sp_configure User Connections

This setting should be set at the smallest value that permits system operation. Setting this parameter too high wastes memory and increases the size of the table that Sybase needs to scan when looking for new user logins or existing users logging out.

NOTE: For each user connection SQL Server allocates approximately 40 Kbytes for the users' stack area and an additional 5-10 KBytes for the users' procedure cache. You might have to readjust the **sp_configure memory** value, depending upon the number of user connections your environment requires.

sp_configure Memory

Leave this setting at its default value as a start. If you have a large number of active user connections or if users cannot connect to the database, you must increase this value.

The value expressed by **sp_configure** is in 2-Kbyte pages. This memory area is used to store the data and procedure caches. Refer to the previous sections, “Initial Memory Recommendations for Sybase” and “sp_configure User Connections” for more details on determining the proper value for this parameter.

You can perform further tuning by adjusting this value up or down for best user response times. In general, more memory allocated to Sybase gives better performance, up to the point where swapping occurs.

One method to improve performance is to set **sp_configure memory** large enough for heavily used tables and indexes to fit into the data cache area. However, this value higher than necessary might cause a performance *loss*, not a gain. SQL Server might spend too much time trying to manage the data cache memory area instead of using it.

If you set the value for memory higher than the amount of memory available to the server, you cannot start SQL Server. If this occurs, use the **buildmaster** routine with the **-r** option as described in the previous section, “sp_configure,” to reset the value and restart SQL Server.

sp_configure Procedure Cache

This setting is a percentage of the memory allocated to SQL Server that is reserved for caching of stored procedures. The initial default setting of 20 percent should be sufficient for most database environments. You can experiment running with a lower percentage for procedure cache to leave more memory for data cache.

On the other hand, if you run many different procedures or ad hoc queries, you might want to increase this value. The procedure cache is used for creating and storing the compiled stored procedures and for compiling queries.

Network Characteristics of an SQL Server Environment

Typically, a client workstation assembles a group of SQL commands and submits them for execution by the database server. The server processes the commands and returns the resultant data. Rather than having the client workstation send a huge grouping of SQL commands, profile the queries. Determine if any of the queries are candidates for conversion to stored procedures.

A stored procedure is a grouping of “standardized” SQL query commands that are pre-compiled and placed into the procedure area of the database by the System Administrator. The stored procedure can then be referenced by name for execution. Using stored procedures for most of the standard DBMS activities reduces the amount of network traffic and uses less server system processor resources to process the query.

Chapter 2

Compaq Drive Array Controllers

The Compaq SMART Array Controller has a great advantage over the Compaq Fast SCSI-2 Controller. The SMART Controller can do hardware striping of data in 16-KByte blocks on your drives. The best way to illustrate this advantage is with an example. Let's assume you have a system with five 2-Gigabyte drives. The first two drives are mirrored and hold the operating system and log files only. The other three drives hold data only and are configured for "No Fault Tolerance".

Fast SCSI-2 Controller Example

The SCSI-2 Controller requires that each of the drives be configured as a separate EISA logical volume. For the example, that means you have a total of five logical volumes. To stripe data on the three data drives, you must use software striping. This is done during the Sybase **create database** command. You must first use the Sybase **disk init** command to initialize a device for each of the three logical data volumes. Then use those devices in **create database** to stripe the data by using fragments. Figure 2-1 illustrates an example:

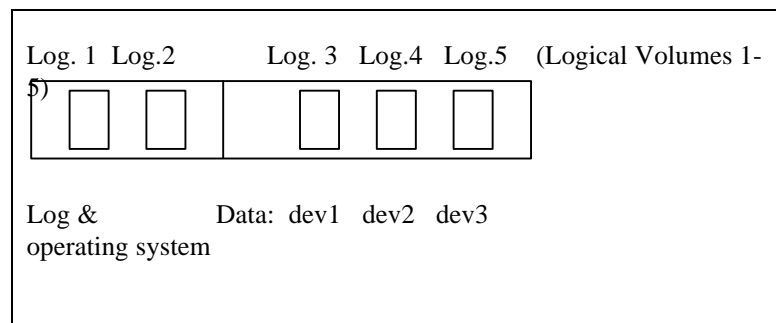


Figure 2-1. Fast SCSI-2 Controller drive configuration

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2-2 Compaq Drive Array Controllers

Initialize the three devices you have made partitions for through UnixWare utilities.

```
ISQL
1> disk init name = "dev1",
2>physname = "/dev/syblink/dev1",
3>vdevno = 5,
4>size = 921600
5> go
```

One million 2-Kbyte pages is the maximum size for disk init; that is 1953.125 Megabytes which is less than 2 Gigabytes.

```
1> disk init name = "dev2",
2>physname = "/dev/syblink/dev2",
3>vdevno = 6,
4>size = 921600
5> go

1> disk init name = "dev3",
2>physname = "/dev/syblink/dev3",
3>vdevno = 7,
4>size = 921600
5> go
```

Create the database with fragments, striping across the three devices.

```
1> create database mydb on
2>dev1 = 180, dev2 = 180, dev3 = 180,
3>dev1 = 180, dev2 = 180, dev3 = 180,
4>dev1 = 180, dev2 = 180, dev3 = 180,
5>dev1 = 180, dev2 = 180, dev3 = 180,
6>dev1 = 180, dev2 = 180, dev3 = 180,
7>dev1 = 180, dev2 = 180, dev3 = 180,
8>dev1 = 180, dev2 = 180, dev3 = 180,
9>dev1 = 180, dev2 = 180, dev3 = 180,
10>dev1 = 180, dev2 = 180, dev3 = 180,
11>dev1 = 180, dev2 = 180, dev3 = 180
...
> go
```

Create one segment spanning all three devices in order to load table data onto that segment. That way the data spans across all three devices.

```
1> exec sp_addsegment Seg1, dev1
2> go
1> exec sp_extendsegment Seg1, dev2
2> go
1> exec sp_extendsegment Seg1, dev3
2> go
```

This method works, but is more tedious and complicated than the next example with the SMART Controller.

SMART Controller Example

The SMART Controller allows you to create a logical volume that spans up to 14 drives. The UnixWare size limit for a raw device partition is two Gigabytes. That means you would need to have 14 raw partitions defined if you want to use all the drive capacity of 14 2-Gigabyte drive system. Another way to do this is to create two logical volumes of seven drives each, and then create seven partitions on each logical volume.

In our example with three data drives, we can make one logical volume. Now we can use the data striping capability of the SMART Controller to do the work.

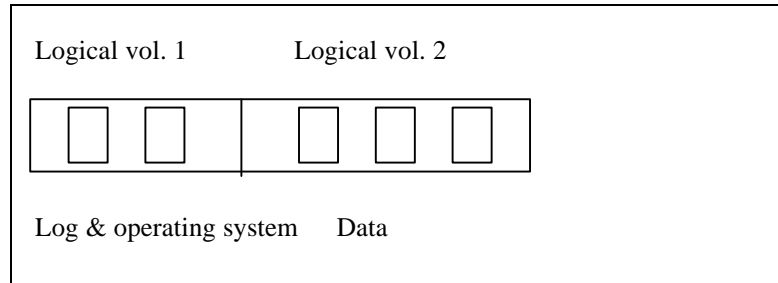


Figure 2-2. Smart Controller drive configuration

Initialize three devices you have made partitions for through UnixWare utilities.

If your data size is less than 2 Gigabytes, you only need one 2-Gigabyte partition and one device.

```
ISQL
```

```
1> disk init name = "dev1",
```

```
2>physname = "/dev/syblink/dev1",
```

```
3>vdevno = 5,
```

```
4>size = 921600
```

```
5> go
```

```
1> disk init name = "dev2",
```

```
2>physname = "/dev/syblink/dev2",
```

```
3>vdevno = 6,
```

```
4>size = 921600
```

```
5> go
```

```
1> disk init name = "dev3",
```

```
2>physname = "/dev/syblink/dev3",
```

```
3>vdevno = 7,
```

```
4>size = 921600
```

```
5> go
```

2-6 Compaq Drive Array Controllers

Now the create database command is simple. The SMART Controller stripes your data across the devices in 16-Kbyte fragments. This is much better than the previous example.

```
1> create database mydb on
2> dev1 = 1800, dev2 = 1800, dev3 = 1800
...
> go
```

Now create one segment spanning all three devices to load table data onto that segment. That way the data spans across all three devices.

```
1> exec sp_addsegment Seg1, dev1
2> go
1> exec sp_extendsegment Seg1, dev2
2> go
1> exec sp_extendsegment Seg1, dev3
2> go
```

Using the SMART Controller's hardware striping capabilities increases performance and makes it easier for the System Administrator to maintain the database.

If you have more than one logical volume and you need to spread a table across volumes to get faster I/O performance, you must use Sybase software striping, through the **create database** command, as shown above. Then you must create and extend a segment to span a device on each of the logical volumes on which you want to spread the data. That way the table data is loaded sequentially across volumes, according to your fragment sizes.

The SMART Controller still uses its hardware striping capabilities within each logical volume during creation of the database and loading of the table data. Each drive in a logical volume gets 16-Kbytes of data alternately and sequentially, until the total fragment size that you defined in **create database** is reached, or during data load, until the all data for the table is loaded. Therefore, by using a combination of SMART Controller hardware striping and Sybase software striping, the data is striped evenly across drives in a volume, as well as across volumes.

Conclusion

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

The tuning process is iterative and must be done several times to achieve the optimal performance. The information given is based on experience in tuning Sybase on UnixWare 2.0, however, each configuration is unique. Although all of the suggestions given here have been tested extensively, do not assume that tuning a specific parameter always gives the desired result.

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

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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
<i>Compaq Insight Manager</i>		
Integrating Compaq Insight Manager with Enterprise Management Platforms (7/95)		145806-003
Integrating Compaq Insight Manager with Microsoft Systems Management Server (7/95)		184720-001
Integrating Compaq Insight Manager with ManageWise (7/95)		182074-001
<i>NetWare</i>		
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
<i>NetWare (continued)</i>		
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)	√	
<i>Microsoft</i>		
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
<i>UNIX</i>		
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

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TechNote Name	Available on SmartStart	Part Number
<i>UNIX (continued)</i>		
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
<i>IBM</i>		
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
<i>Technology Overview</i>		
Configuring Compaq RAID Technology for Database Servers (7/94)	√	184206-001