COMPAQ

Deploying Lotus Intranet Starter Pack (LISP) on Compaq Platforms

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Chapter 1
About This TechNote

This TechNote provides information that the customer, value-added reseller, system integrator, and/or network administrator can use to fully understand, size, and implement the Compaq ProSignia 200 or ProLiant 1600 with the Lotus Intranet Starter Pack (LISP) within their organization. The information contained in this paper enables the reader to implement a complete Intranet solution for an organization. The following integration topics are included as part of this Intranet solution:

- An explanation of the components that make up LISP on Compaq Platforms
- System performance results and overall performance analysis as well as capacity planning of the Compaq ProSignia 200 and ProLiant 1600 with LISP
- Backup hardware alternatives, performance information, and recommendations
- Mobile communication (remote access) performance information
- Security considerations for connecting your intranet to the Internet

Compaq conducted all performance tests included in this paper. The information and recommendations presented in this paper are based on technical knowledge of Compaq performance engineers and the analysis of performance data relating to the Compaq ProSignia 200 and ProLiant 1600 with LISP. Performance testing was conducted running Lotus Intranet Starter Pack on the Compaq ProSignia 200 and ProLiant 1600 in a closely controlled environment.

This TechNote helps customers, value-added resellers, system integrators, and network administrators fully understand implementing LISP on Compaq Platforms. The paper assumes no knowledge of the Compaq ProSignia 200, ProLiant 1600, Lotus Domino, Lotus Intranet Starter Pack, or Windows NT. It is a supplement to the *Compaq Hardware Reference* document, *the Lotus Intranet Starter Pack* documentation, and the *Lotus Domino 4.5* documentation.

Objective

The objective of this TechNote is to provide technical information regarding implementing LISP on the Compaq ProSignia 200 or ProLiant 1600 to customers to assist them in selecting the appropriate hardware configuration for their operating environment. Provided data illustrates the performance of different hardware configurations and testing workloads. Customers can use this data to determine which configuration would best suit their business needs considering price and performance information.

Additional Resources

Consult the following resources for additional information on obtaining the best possible performance and throughput with Lotus Domino Server for Windows NT:

- Lotus Domino 4.5x documentation

  The Lotus Domino 4.5 documentation set provides a comprehensive set of documents covering installation, reference, and an administrator's guide with detailed information on Lotus Domino 4.5x.

- World Wide Web on the Internet

  http://www.compaq.com/support/techpubs/ for additional Compaq technical publications on relevant topics such as backup solutions

  http://www.compaq.com/solutions/enterprise/internet-corporate-security.html for Internet security related product information and technical publications

  http://www.compaq.com/products/servers/platforms.html for Compaq system information on Compaq server offerings

  http://www.compaq.com/internet.html for Compaq Internet and Intranet solutions

  http://www.lotus.com for Domino product information

- *Compaq Hardware Reference* documentation

  The *Compaq Hardware Reference* documentation provides information similar to that available on the Web site for all Compaq server and option offerings

- *Optimizing Windows NT volume of Microsoft Windows NT Resource Kit*

  This book can help to determine bottlenecks in networks and servers and gain an understanding of how various activities affect the performance of computer hardware. The book also discusses performance and capacity planning to help you determine your future equipment needs.

NOTE: This list of available materials is not intended to be all-inclusive, but access to these materials will be of benefit to the reader.

Chapter 2
Overview of Deploying LISP on Compaq Platforms

Deploying LISP on Compaq platforms combines a reliable certified system with the powerful Lotus Domino Server 4.51. It includes five ready-to-use applications and Internet access into one packaged solution targeted to small and medium-sized businesses. The intranet applications included with the Lotus Intranet Starter Pack provide the following features:

- **Email** – makes communication easy to anyone in your office and on the Internet
- **Electronic diaries** - allows you track your appointments electronically
- **Telephone Lists** – helps you access, update, and share phone lists electronically
- **Discussion Forums** – allows users to hold virtual meetings regardless of where and when your teammates are working
- **Document Libraries** – helps you to file and find work your quickly as well as share documents, spreadsheets, and presentations easily with team members
- **Electronic Forms** – helps you store frequently used forms such as letterheads and timesheets so everyone in your company can use them

Lotus Intranet Starter Pack delivers the functions that organizations need to allow a growing business to employ the power of the Internet to enhance communication, automate office processes, track customers and contacts and manage projects more efficiently. It includes the powerful Domino Web application server, ready-to-use and easily customizable business applications for intranets, and a choice of 5 client licenses. LISP supports popular Web browsers, POP3 mail and Lotus Notes clients. Choose Microsoft Internet Explorer or Lotus Notes clients that enable users to be productive anywhere. An extensive range of features in Notes clients helps users harness the vast pool of information available on the Web and manage day-to-day operations more efficiently with calendar and scheduling features. The combination of Lotus software and Compaq hardware is easy to set up and use, and quickly delivers custom applications without extensive programming, all built on proven software and hardware technology.

Benefits of Deploying LISP on Compaq Platforms

Deploying LISP on Compaq platforms enables your company to rollout a comprehensive business solution to your entire workforce in a matter of days. The solution is based on proven Compaq hardware and innovative software from Lotus Development Corporation.

Certification

Compaq has received a certification letter for the Compaq ProSignia 200 system from KMDS, an independent auditing agency, verifying that the performance numbers represented in this paper are accurate.

Rapid Installation

LISP on Compaq platforms is easy to install and can be configured quickly. Once the applications are configured, anyone with a Web browser can create, edit and maintain their own website and intranet content.

Easy-to-Use

Virtually self-sufficient, it's designed to reduce the time, effort, and resources you spend on your intranet, leaving you free to focus on other things. Even if it is a customer's first time online, the customer can access and manipulate the information in the LISP applications. Just point and click and fill in the blanks. For example, users with authorization can update Directory listings on the fly. No HTML knowledge is required.

Cost-Effectiveness

LISP delivers custom applications without expensive programming. You or your consultant can perform many routine administrative tasks online.

Security

LISP gives you complete control over whom can access your valuable business information. It allows you to assign access privileges, including who can create information, edit it, or simply read information. Customers can even block out users from seeing specific sets of documents. Security controls allow you to extend your intranet safely to those outside your company.

Compatibility

Users can pull in existing data such as employee listings or product pricing from Web pages or ODBC-compliant databases, including Microsoft Access, dBase, and FoxPro.

LISP on Compaq platforms provides features that enable a business to fully exploit communication capabilities both internally and externally. In the small and medium-sized business world, the price/performance ratio is an important criterion when making administrative decisions. How much money is required to purchase hardware that enables you to obtain the best profit for your business? This question can only be answered after in-depth performance management exploration and testing. Compaq has completed the performance management tasks for implementing LISP on Compaq platforms. Performance management, the key to addressing how to achieve the best performance/cost efficiency for the business, is discussed fully in the following chapter.

Chapter 3
Performance Management

Performance Management can only be successfully achieved by fully understanding the performance impact those system resources such as the processor, memory, and the disk subsystem components have on the overall operation of the entire system. By changing the configuration of these components, performance is affected in some way. The goal of this chapter is to help the you better understand the relationship between system resources and the performance of LISP on Compaq platforms so configuration decisions can be made when purchasing a new system or when upgrading.

This chapter addresses the following topics:

- What is performance?
- A description of performance analysis
- Using NotesBench as the standard performance measuring tool
- Summary of NotesBench results for the Compaq ProSignia 200 and Compaq ProLiant 1600

What is Performance?

The term performance can be viewed in either of two ways. To a network administrator, performance means effective management of system resources. A system administrator's concerns are with system throughput and utilization. To an end user, however, performance is measured by system response time. In practice, it is necessary to balance the two perspectives, understanding that a change made to improve response time may require additional system resources.

Performance Analysis

Performance analysis is an ongoing interactive process necessary for determining whether or not your server is operating as it should. Performance analysis required as a part of performance management includes:

- Understanding your user requirements
- Monitoring your server and network load patterns
- Making appropriate modifications to your configuration to achieve optimal use of resources

For the performance analysis investigation, Compaq used a standard benchmark tool called NotesBench to examine the following Lotus Domino Server system resource areas:

- System Processor (CPU) Performance
- Memory
- Disk Subsystem

Using NotesBench as the Standard Performance Benchmarking Tool

A benchmark tool provides the baseline to compare various operating environments. The same NotesBench test can be run on different hardware configuration and software settings. The hardware changes imply that the processor, total system memory, or disk subsystem configuration has been changed. The different performance results show the impact of those changes. NotesBench was used as the standard benchmarking tool to test the performance of LISP on Compaq platforms.

NotesBench is a benchmark developed by Lotus Development Corporation to provide a means for customers to make apples to apples comparisons of Domino Server running on different hardware and under various operating systems. The NotesBench License Agreement requires that vendors run the tests or workloads in the same manner.

NotesBench Workloads

The NotesBench software consists of a suite of benchmarks referred to as workloads. Two benchmark workloads were included in this performance testing:

- **Mail -** A server for mail users—a workload that models sites that rely only on mail for communication.
- **DiscDB -** A server for active users who are performing heavy shared database operations, applying to sites that heavily utilize the collaborative features of Domino.

NotesBench Performance Metrics

NotesBench generates the same throughput metric for these two workloads (the value of the metric changes from test to test). This metric is called a *NotesMark* and records units in transactions per minute (tpm). Along with a NotesMark value, each workload produces a value for the maximum users supported by the test as well as the average response time.

NotesBench Price/Performance

Price/performance measurements for NotesBench include the price/NotesMark and the price/user. The cost of the system under test includes all hardware components as well as the operating system and application software that were used to achieve the reported workload performance. NotesMark and supported users are the performance values for a NotesBench test, generated by the NOTESNUM command. The system under test price is then divided by NotesMark to provide $/transaction per minute or users to provide $/user.

Users and Threads

NotesBench executes its tests (workloads) by assigning Notes users on driver systems to threads in the NotesBench process. Each thread is the equivalent of one Notes user. Each thread executes the entire NotesBench script for its workload process. Each thread executes many iterations of the same NotesBench script. If you assign 100 users to a NotesBench driver, there are 100 threads simultaneously executing the workload script.

NotesBench Test Procedure

During NotesBench testing, Compaq performs several trial runs to determine test duration and confirmation of steady state for a given test. Both test duration and steady state are determined using real time monitor utilities from Windows NT. During the trial runs, Windows NT Performance Monitor is used for monitoring system resources and for logging during the test process. The resulting data is presented as appropriate throughout this document.

The system under test typically showed tremendous stress during the workload initialization stage. Performance Monitor ran for the duration of the tests to log performance information. Steady state was determined to be achieved during the test run by monitoring server output, the connected user threads, as well as mail routing activity when appropriate. For example, during a Mail workload test run that supported 600 users, the Domino server console displayed 600 users from the time the last client thread connected to the system, during the ramp-up phase at the beginning of the test, until the test duration was achieved. Performance Monitor log files are also used when presenting resource utilization information.

Summary of NotesBench Results for the Compaq ProSignia 200 and ProLiant 1600

The ProSignia 200 is designed for small and medium-sized businesses requiring an inexpensive, feature-rich workgroup server. Performance testing was completed for two models of the ProSignia 200 – the most recently announced model based on the Pentium II 300 MHz processor, and a prior model based on the Pentium II 233 MHz processor. Results for the Pentium II 300 MHz processor model (referred to as ProSignia 200 6/300) is presented first, followed by data from previous tests performed on the Pentium II 233 MHz model (referred to as ProSignia 200 6/233).

All NotesBench testing conducted on the Compaq ProSignia 200 6/300 model was run under Microsoft Windows NT Server 4.0 with SP3 and Lotus Intranet Starter Pack, which is based on Domino Server 4.51. The system was configured with a 4.3-GB Wide-Ultra SCSI drive. Fast Page ECC memory ranging from 128-MB to 384-MB was used for the NotesBench testing on the ProSignia 200 6/300 model.

The ProSignia 200 model, powered by an Intel Pentium II 233 MHz processor with a 512-KB second level cache, ships standard with 32-MB of EDO memory. The ProSignia 200 6/233 is expandable to 192-MB using industry standard EDO SIMMs or upgradable to 384-MB using Fast Page ECC memory.

All NotesBench testing conducted using the Compaq ProSignia 200 6/233 model was run under Microsoft Windows NT Server 4.0 with SP3 and Lotus Intranet Starter Pack which is based on Domino Server 4.51. The system was configured with a 4.3-GB Wide-Ultra SCSI drive.

The Compaq ProLiant 1600 is a high performance workgroup server for workgroup and remote-office applications with uptime features unmatched in its class. A state-of-the-art Pentium II 300 MHz processor with dual processing capability provides exceptional performance, and the hot-plug drives deliver increased uptime. Two Wide-Ultra SCSI-3 controllers offer increased performance with plenty of headroom for growing network demands.

All NotesBench testing conducted using the Compaq ProLiant 1600 Pentium II 300 MHz model was run under Microsoft Windows NT Server 4.0 with SP3 and Lotus Intranet Starter Pack which is based on Domino Server 4.51. The system tested included three 4.3-GB Wide-Ultra SCSI drives configured in a RAID 0 array. Fast Page ECC memory ranging from 128-MB to 512-MB was used in during NotesBench testing.

Note: Complete system specifications can be found in Chapter 4 – "Capacity Planning" (within the System Features section).

With the end user's perspective of good performance (good response time) in mind, Compaq set a requirement that all test runs keep the average response time result under, or as close as possible to, one second.

For performance conclusions, please see the section, "Performance Conclusions" later in this chapter. The following information provides details about the Mail and DiscDB NotesBench test results.

Mail Workload NotesBench Test Results

Meeting the one second or better average response time requirement resulted in the system memory configuration being increased as the number of simulated users increased for both ProSignia 200 models and the ProLiant 1600. Using the Mail workload, several tests were run to obtain the maximum number of simulated users that could be supported at a specific memory configuration.

ProSignia 200 tests were run using memory configurations of 128-MB, 256-MB, and 384-MB. For the NotesBench testing involving the ProSignia 200 6/300 model, all memory configurations used Fast Page ECC memory.

Table 3-1 summarizes the memory configuration, the number of users that can be supported maintaining the average response time under or very close to one second, and the NotesMark or transactions per minute supported by the test run.

Table 3-1
Mail Workload Tests for ProSignia 200 6/300

Memory Size/Type	Maximum Users Supported	Average Response Time	NotesMark (Transactions per minute)
128-MB Fast Page ECC	600	968 msec.	786
256-MB Fast Page ECC	750	1178 msec.	994
384-MB Fast Page ECC	900	703 msec.	1208

Notice that as memory is increased, additional users can be supported while still maintaining the response time requirement of less than, or very close to, one second. The 256-MB test run supporting 750 simulated users went slightly over the one-second response time requirement. The test was not rerun due to time constraints.

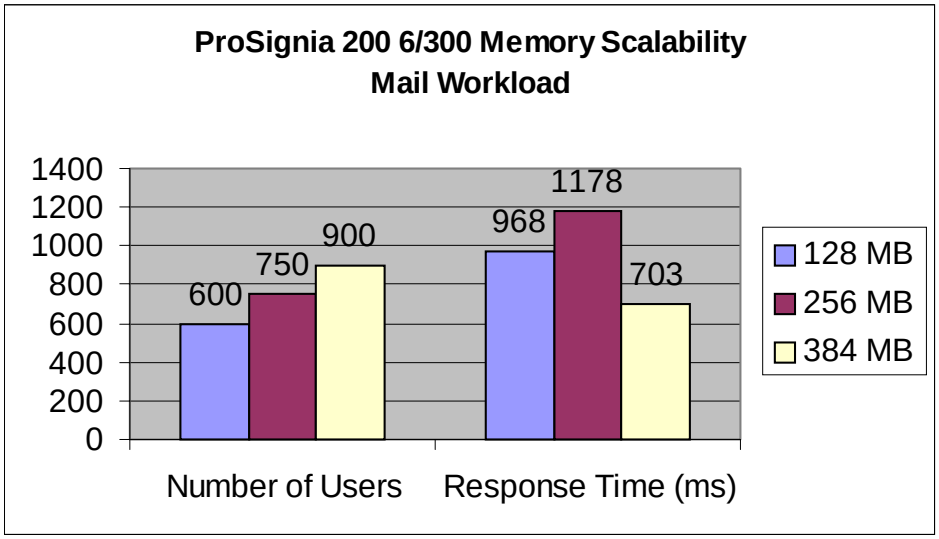

Figure 3-1. ProSignia 200 6/300 Memory Scalability - Mail Workload

While the NotesBench tests reveal that up to 900 simulated Mail users are supported on the ProSignia 200 configured with its maximum memory of 384-MB, Compaq recommends taking the NotesBench numbers and running them through a formula to determine the appropriate number of real world users that can be supported by the system. Please refer to Chapter 4 - “Capacity Planning” for further information.

Testing performed using the ProSignia 200 6/233 compared the performance of EDO SIMMs and Fast Page ECC memory in a 128-MB configuration. Thus results for ProSignia 200 6/233 configured with 128-MB include both EDO SIMMs and Fast Page ECC tests. The 256-MB and 384-MB tests were performed using only Fast Page ECC memory. The Mail workload test results which follow were all generated on the Compaq ProSignia 200 6/233 system running Windows NT Server 4.0 with SP3 and Lotus Intranet Starter Pack, which is based on Domino Server 4.51. The system was configured with one 4.3-GB Wide-Ultra SCSI drive.

Table 3-2 summarizes the memory configuration, the number of users that can be supported maintaining the average response time under or very close to one second, and the NotesMark or transactions per minute supported by the test run.

Table 3-2
Mail Workload Tests for ProSignia 200 6/233

Memory Size/Type	Maximum Users Supported	Average Response Time	NotesMark (Transactions per minute)
128-MB EDO	600	1112 msec.	790
128-MB Fast Page ECC	600	1096 msec.	786
256-MB Fast Page ECC	750	714 msec.	980
384-MB Fast Page ECC	900	1117 msec.	1174

The table includes one test run to determine the performance impact contributed by type of memory, comparing extended data output memory (EDO) to fast page (FP ECC) memory in the ProSignia 200 6/233.

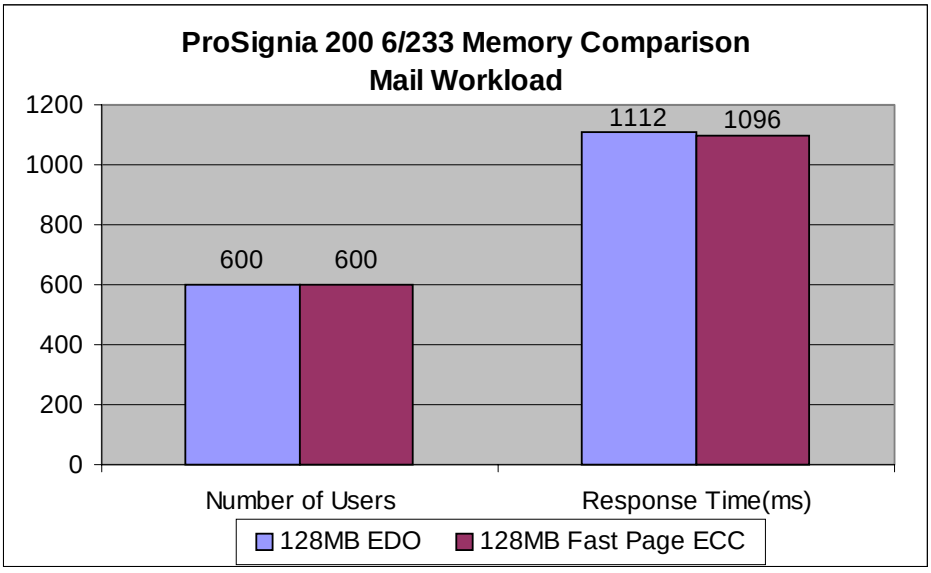

Figure 3-2. ProSignia 200 6/233 128-MB Memory Comparison - Mail Workload

The results in Table 3-2 are graphically displayed in the previous chart, demonstrating that no significant performance difference was observed when comparing test results from a configuration using 128-MB EDO to results from a system using 128-MB of Fast Page ECC memory.

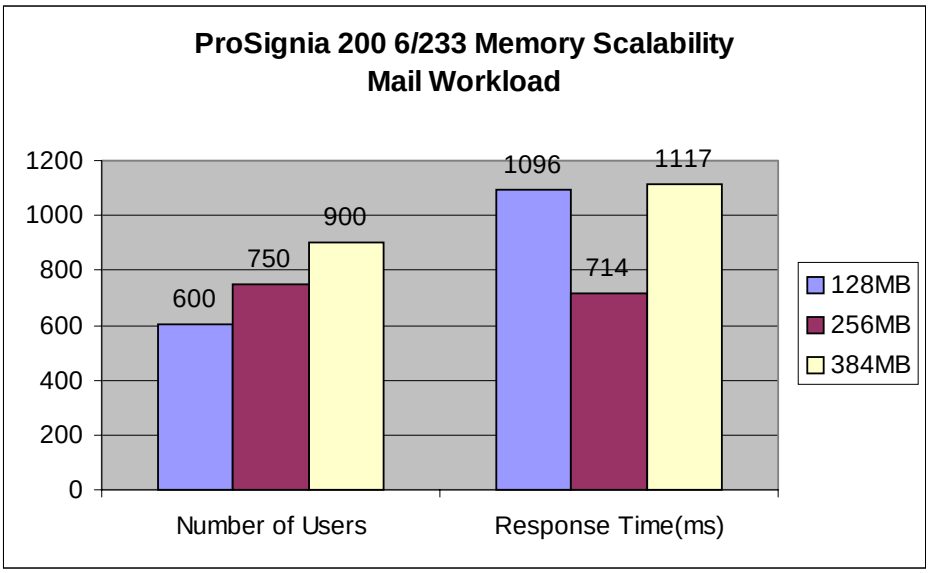

Figure 3-3. ProSignia 200 6/233 Memory Scalability - Mail Workload

While the NotesBench tests reveal that up to 900 simulated Mail users are supported on the ProSignia 200 configured with its maximum memory of 384-MB, Compaq recommends taking the NotesBench numbers and running them through a formula to determine the appropriate number of real world users that can be supported by the system. Please refer to Chapter 4 - “Capacity Planning” for further information.

ProLiant 1600 tests were run using memory configurations of 128-MB, 256-MB, 384-MB, and 512-MB. For the NotesBench testing involving the ProLiant 1600 model, all memory configurations used EDO ECC DIMM memory.

Table 3-3 summarizes the ProLiant 1600 memory configuration, the number of users that can be supported maintaining the average response time under or very close to one second, and the NotesMark or transactions per minute supported by the test run.

Table 3-3
Mail Workload Tests for ProLiant 1600 6/300

Memory Size/Type	Maximum Users Supported	Average Response Time	NotesMark (Transactions per minute)
128-MB EDO ECC	600	74 msec.	804
256-MB EDO ECC	1200	230 msec.	1587
384-MB EDO ECC	1500	353 msec.	2006
512-MB EDO ECC	1700	289 msec.	2261

Notice that as memory is increased, additional users can be supported while still maintaining the response time requirement of less than one second. All ProLiant 1600 mail workload tests results demonstrated excellent response time.

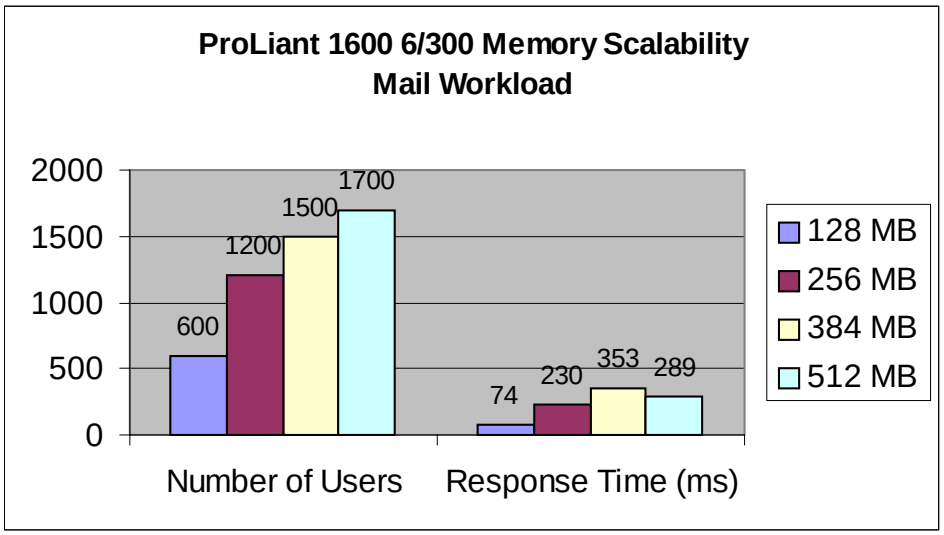

Figure 3-4. ProLiant 1600 6/300 Memory Scalability - Mail Workload

The ProLiant 1600 performance results show scaling up to 1700 users for the 512-MB single processor system. Based on the monitoring of available system resources during the 128-MB test, the number of users could be increased somewhat greater than 600 and still achieve adequate response time.

NotesBench tests reveal that up to 1700 simulated Mail users are supported on the ProLiant 1600 configured with its maximum memory of 512-MB. Compaq engineers recommend taking these NotesBench numbers and running them through a formula to determine the appropriate number of real world users that can be supported by the system. Please refer to Chapter 4 - “Capacity Planning” for further information.

Shared Discussion Database (DiscDB) Workload NotesBench Test Results

Meeting the close to one second average response time requirement for the DiscDB workload resulted in a set of tests being run supporting a varying number of users. The performance of the ProSignia 6/300 configured with 128-MB to 384-MB of Fast Page ECC memory running Windows NT 4.0 with SP3 and LISP was measured supporting a number of users ranging from 600 to 800. The performance of the ProSignia 200 Pentium II 233 MHz system configured with 128-MB to 384-MB of Fast Page ECC memory running Windows NT Server 4.0 with SP3 and LISP was measured supporting a number of users varying from 260 to 750. The system was configured with a 4.3-GB Wide-Ultra drive. The ProLiant 1600 6/300 supported between 600 and 900 users during the DiscDB workload tests run with memory configurations ranging from 128-MB to 512-MB.

Table 3-4 summarizes the memory configuration, the number of users that can be supported maintaining an average response time close to one second, and the NotesMark or transactions per minute supported by the test run for the ProSignia 200 6/300.

Table 3-4
DiscDB Workload for the ProSignia 200 6/300

Memory Size	Number of Users	Average Response Time	NotesMark (Transactions per minute)
128-MB	600	250 msec.	1055
256-MB	650	323 msec.	1150
384-MB	800	1423 msec.	1378

Figure 3-5 summarizes the memory configuration, the number of users that can be supported maintaining the average response time close to one second, and the NotesMark or transactions per minute supported by the test run. Each DiscDB workload result listed in Table 3-4 was run between four and nine hours.

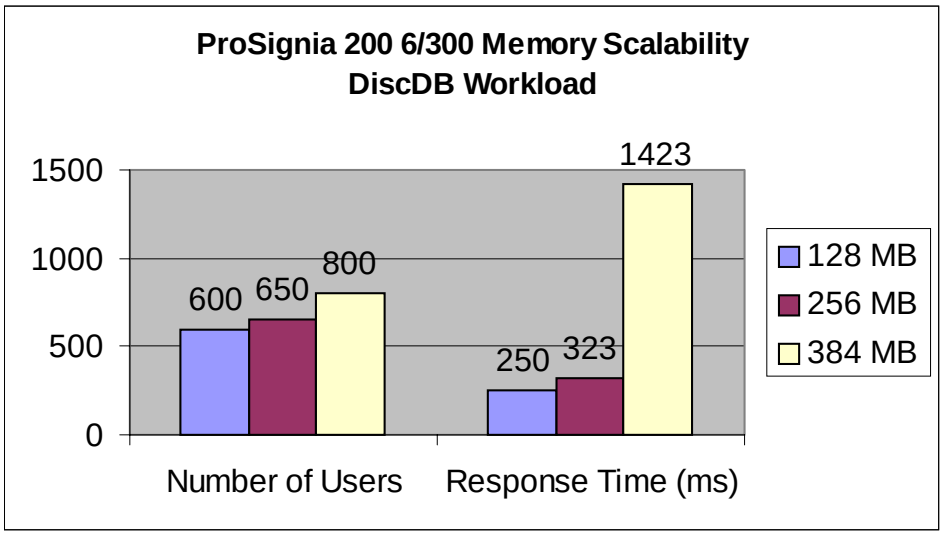

Figure 3-5. ProSignia 200 6/300 Memory Scalability - DiscDB Workload

Figure 3-6 illustrates the additional transaction per minute or NotesMark achieved during each test run. Notice that the NotesMark value increases as the number of users increase.

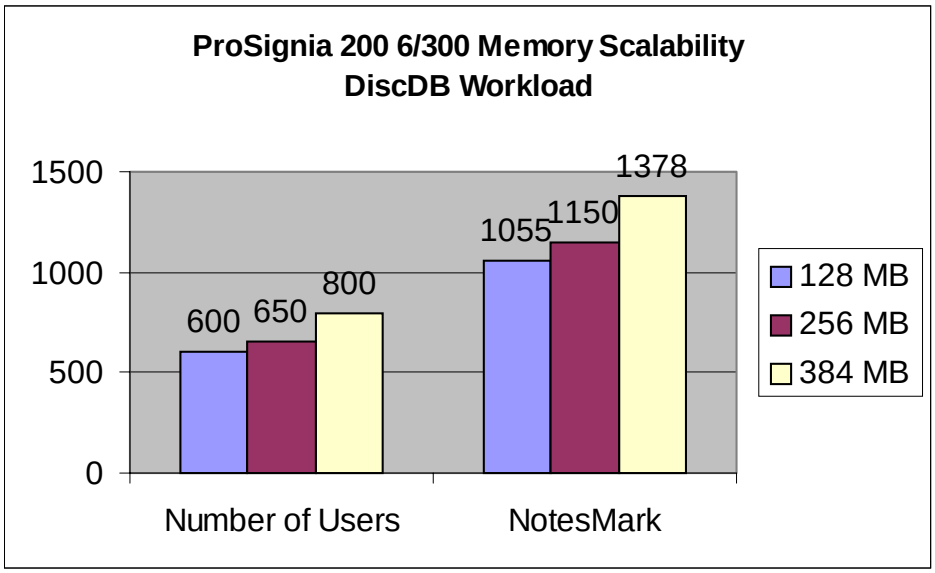

Figure 3-6. ProSignia 200 6/300 Memory Scalability - DiscDB Workload

Table 3-5
DiscDB Workload for the ProSignia 200 6/233

Memory Size	Number of Users	Average Response Time	NotesMark (Transactions per minute)
128-MB	260	156 msec.	458
256-MB	700	1097 msec.	1211
384-MB	750	1511 msec.	1294

Figure 3-7 summarizes the memory configuration, the number of users that can be supported maintaining the average response time close to one second, and the NotesMark or transactions per minute supported by the test run. Each DiscDB workload result listed in Table 3-5 was run for nine hours.

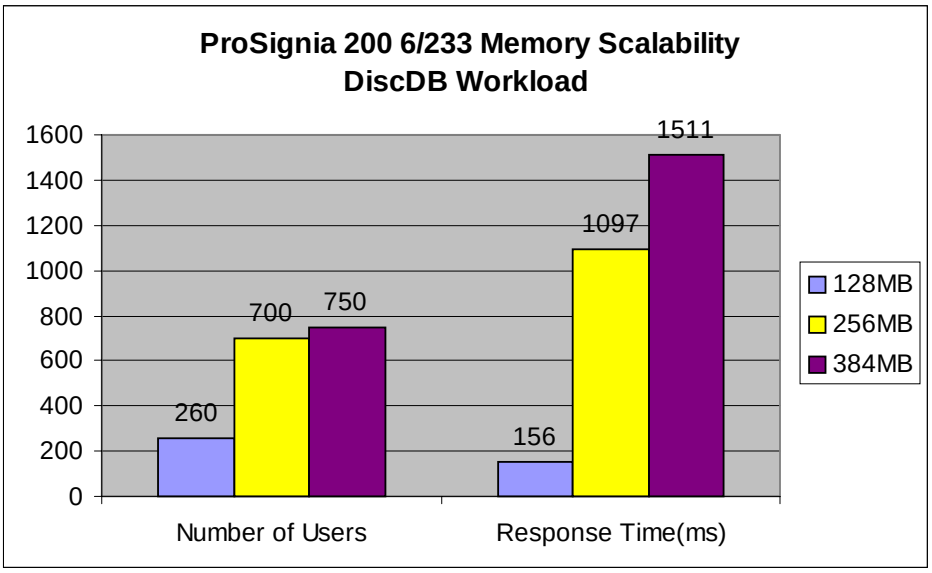

Figure 3-7. ProSignia 200 6/233 Memory Scalability - DiscDB Workload

Figure 3-7 reveals that the ProSignia 200 configured with 384-MB of Fast Page ECC memory can support up to 750 simulated DiscDB users. However, Compaq engineers recommend taking the NotesBench numbers and running them through a formula to determine the appropriate number of real world users that can be supported by the system. Refer to Chapter 4 - "Capacity Planning" for further information regarding the number of real world users this system should support.

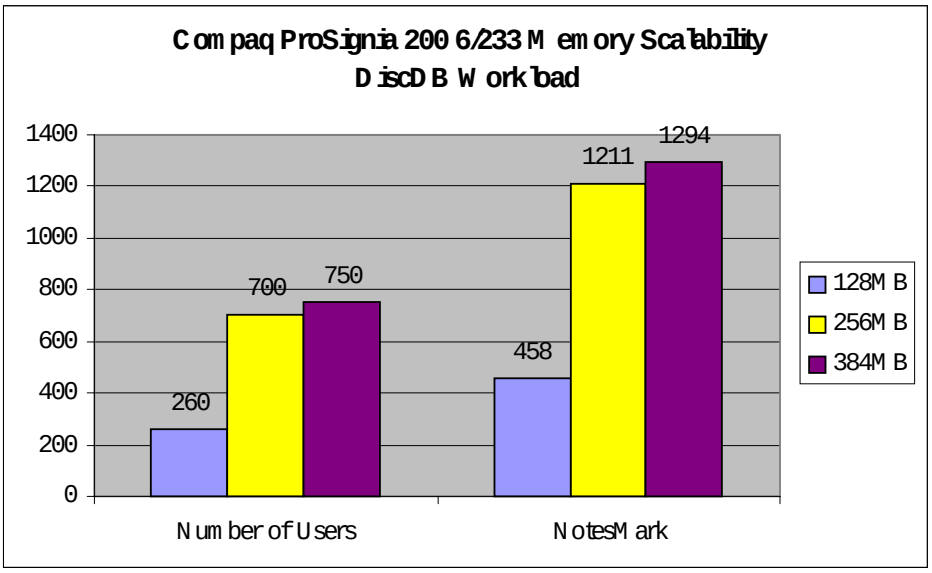

Figure 3-8. Compaq ProSignia 200 6/233 Memory Scalability (NotesMark) DiscDB Workload

Figure 3-8 illustrates the transactions per minute or NotesMark value increasing as the number of users is increased. Notice that the relative increase in number of users has a fairly linear relationship to the corresponding increase in the NotesMark value.

Table 3-6
DiscDB Workload for the ProLiant 1600 6/300

Memory Size	Number of Users	Average Response Time	NotesMark (Transactions per minute)
128-MB	600	175 msec.	1055
256-MB	700	256 msec.	1243
384-MB	900	2016 msec.	1544
512-MB	850	988 msec.	1483

Each DiscDB workload result listed in Table 3-6 was run between four and nine hours.

Figure 3-9 summarizes the memory configuration, the number of users that can be supported maintaining the average response time close to one second, and the NotesMark or transactions per minute supported by the test run.

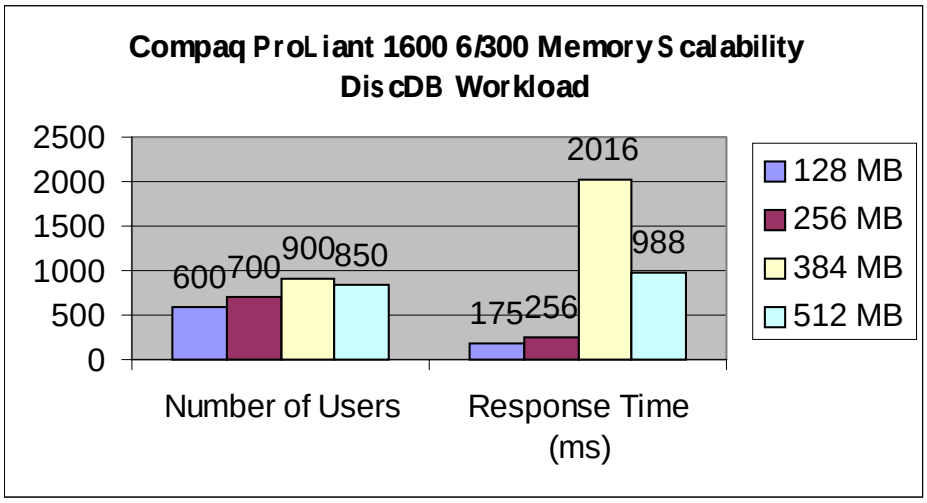

Figure 3-9. Compaq ProLiant 1600 6/300 Memory Scalability

The jump in user count from 700 to 900 when changing the memory configuration from 256-MB to 384-MB was too large as is evident by the slow response time. However, due to project time constraints, this test was not rerun. The more appropriate number of users would be closer to 800 to ensure that an acceptable response time is still achievable.

Summary of Performance Monitor Log Information from NotesBench Mail and DiscDB Test Runs

NT Performance Monitor is one of the tools that Compaq uses to monitor the utilization of the system under test. During a typical NotesBench test run, the CPU utilization increases as the number of simulated users are connecting to the system under test. Usually during this ramp up time, the peak CPU utilization is reached. After all users have connected to the system under test (and mail is being routed in the Mail workload tests), a stable steady state is reached. The CPU utilization usually settles to a fairly consistent level during this steady state time.

Available memory is normally high at the beginning of the test. As users are connecting to the system under test, the available memory steadily decreases until a stable level is reached once all users have connected to the system under test. The Available memory metric usually settles to a fairly consistent level during this steady state time.

Every NotesBench test for this paper was run for four to nine hours. The NT Performance Monitor Tool averages out the utilization during this total run time. The Performance Monitor results provide the Average, Minimum and Maximum values for CPU utilization and the Bytes Available of system memory.

Mail Workload System Utilization

The NotesBench Mail workload CPU Utilization and Available Memory results are provided in Table 3-7 for the Compaq ProSignia 200 6/300.

Table 3-7
NT Performance Monitor Mail Results
For the Compaq ProSignia 200 6/300

Workload/ Utilization	Mail 600 Users 128-MB	Mail 750 Users 256-MB	Mail 900 Users 384-MB
CPU Util.: Ave.	16.8	21.5	22.4
Max	25.9	31.39	39.2
Avail RAM: Ave.	4.3	4.6	122.45
Min	3.6	2.9	67.4

As evident by the Performance Monitor data gathered for these three tests run on the ProSignia 200 6/300, memory was almost totally consumed for the 128-MB and 256-MB configurations. Thus very little memory was available to handle other tasks that could be taking place in a production environment. The 384-MB configuration had sufficient available memory remaining during the workload run supporting 900 users. The processing power of the Pentium II 300 MHz processor appears to more than adequate with the processor rate maximums ranging from 25.9, to 31.39, and finally 39.2% for the 900 user workload run.

The NotesBench Mail workload CPU Utilization and Available Memory results are provided in Table 3-8 for the Compaq ProSignia 200 6/233.

Table 3-8
NT Performance Monitor Mail Results
For the Compaq ProSignia 200 6/233

Workload/ Utilization	Mail 750 Users 256-MB	Mail 900 Users 384-MB
CPU Util.: Ave.	24.837	30.892
Min	0.691	8.147
Max	30.084	36.457
Avail RAM: Ave.	117.80096	96.720128
Min	31.78496	69.533696
Max	176.988160	317.878272

According to the Performance Monitor utilization rate chart, the heavier the Mail workload, the higher the Memory requirement and the higher the CPU utilization reached during the test. A heavier workload is defined as more users being supported during the NotesBench tests. By setting the requirement for response times to be as close to or less than one second, the number of users that can be supported by the system is kept to a reasonable level.

As the table illustrates, the CPU utilization rate for the entire spectrum of Mail workload tests is really quite low. The highest utilization is 37% for the Mail workload with 900 users configured with 384-MB of memory. These results indicated that the Pentium II 233 MHz processor is undoubtedly sufficient for supporting these NotesBench Mail workload users. This low CPU utilization implies that the CPU can handle additional activities such as backup operations or supporting agents that provide services such as anti-virus scanning.

According to the previous table, the higher the mail users the greater the CPU utilization. The CPU utilization average between 24 and 30% is fairly low for the 750 and 900 user tests. The CPU is definitely not a bottleneck at this workload level. During the 900 Mail users 384-MB Fast Page memory workload, the average CPU utilization is 30% which means 70% of the CPU is idle. This implies that more Mail workload users could be added to the test to more fully utilize the processor. However, the response time for the 900 user test is already 1117 msec, implying that the processor is not a bottleneck. Keep in mind that while there is sufficient processing power to push the number of users higher, other system resources such as available memory should be considered as well.

The Performance Monitor's Available Bytes results can also be seen in Table 3-8. The Memory Utilization is measured by Bytes Available, which reveals the amount of system memory available for other operations.

Available memory should be examined similar to the CPU utilization previously investigated. For instance during the 900 Mail users 384-MB Fast Page memory test, the average memory available is 97-MB, which is approximately 25% of the total 384-MB. Past experience with the Mail workload tells us that if we increase the number of users without also increasing the amount of memory, the user response time can be expected to suffer. While the average available memory implies that there seems to be some room for increasing the number of users in the 900 user test, remember the desired response time is close to or less than one second. The response time of this workload is already 1.117 seconds! Thus if more users are added, the response time will increase beyond a desirable level. Therefore 900 simulated users is clearly the maximum number of simulated Mail users that can be supported on the ProSignia 200 233 MHz Pentium II system. The bottleneck is disk access or I/O related. The performance results imply that the 384-MB of Fast Page Memory could be decreased by 32 - 64-MB without impacting response time.

Table 3-9 provides performance results for the Compaq ProLiant 1600 6/300 for 600, 1200, 1500, and 1700 mail users. The memory varied from 128-MB, 256-MB, 384-MB, to 512-MB. The results illustrate that additional memory helped support a higher number of users while maintaining an acceptable response time.

Table 3-9
NT Performance Monitor Mail Results
For the Compaq ProLiant 1600 6/300

Workload/ Utilization	Mail 600 Users 128-MB	Mail 1200Users 256-MB	Mail 1500 Users 384-MB	Mail 1700 Users 512-MB
CPU Util.: Ave.	11.65	29	36.7	54
Max	28.1	46	66.8	67
Avail RAM: Ave.	81	186	46	36
Min	3	1	3.6	5

As is evident by the Performance Monitor results, the Mail workload requires an increasing amount of memory and processing power as the number of mail users is increased. The 1700 user mail test required most of the 512-MB of memory configured for the system. In addition, the processor utilization climbed to an average of 54% when supporting the 1700 mail users.

DiscDB Workload System Utilization

Running the DiscDB Workload, Compaq found a pattern in the CPU utilization similar to that seen in the Mail workload tests. The memory utilization trend differed slightly, however, as users were pushed to the limit. Following are three charts illustrating CPU utilization of the ProSignia 200 6/300, ProSignia 200 6/233, and the ProLiant 1600 6/300 DiscDB NotesBench test runs. Table 3-10 provides utilization rates for the ProSignia 200 6/300 various DiscDB workloads.

Table 3-10
NT Performance Monitor DiscDB Results
For the Compaq ProSignia 200 6/300

Workload/ Utilization	DiscDB 600 Users 128-MB	DiscDB 650 Users 256-MB	DiscDB 800 Users 384-MB
CPU Util.: Ave.	37.6	48	76
Max	57.7	63	84
Avail RAM: Ave.	31.2	155	251
Min	24.2	148	224

As is evident by the Performance Monitor results, the DiscDB workload is more processor intensive than the Mail workload as additional users are added. The stress added to the processor is illustrated in processor utilization rates that climb from 37.6% when supporting 600 users to 76% when supporting 800 users. By increasing the number of users supported by one-third, the processing utilization rate doubled.

Table 3-11
NT Performance Monitor DiscDB Results
For the Compaq ProSignia 200 6/233

Workload/ Utilization	DiscDB 260 Users 128-MB	DiscDB 700 Users 256-MB	DiscDB 750 Users 384-MB
CPU Util.: Ave.	7.026	73.070	75.731
Min	0.162	13.388	8.332
Max	21.735	83.091	88.068
Avail RAM: Ave.	48.715588	84.38001251	239.213226
Min	4.386816	67.68359375	222.613281
Max	99.704832	185.7265625	329.343750

According to Table 3-11, as the number of DiscDB users increases so does the CPU utilization rate. The average CPU utilization increased from 7% for 260 DiscDB users to 76% for 750 DiscDB users.

According to the chart, the higher the DiscDB users the greater the CPU utilization. The CPU utilization average of 8% is very low for the 260 user test. The CPU is definitely not a bottleneck at this workload level. During the 700 and 750 DiscDB users workloads, the average CPU utilization ranged from 73% to 76% which means that the CPU demands of the DiscDB workload as the number of users increase is much greater than the CPU demands of the Mail workload. Recall that the CPU average utilization for 900 Mail users was relatively low at 37%. Other than the incremental difference of 50 users, the difference between the 700 and 750 user DiscDB tests was the memory configuration. The 700 user test was configured with 256-MB of memory while the 750 user test was configured with 384-MB of memory.

The average utilization rate for these workloads falls in an acceptable range, although higher, than the average utilization for the Mail workloads. Recall the response times were 1097 and 1449 msec for the 700 and 750 user workloads, respectively, indicating that no additional DiscDB workload users could be added to the test without the response time becoming undesirable. Keep in mind that while there is sufficient processing power to push the number of users higher, other system resources such as available memory should be considered as well.

The Performance Monitor Available Bytes results can be seen in Table 3-11. The Memory Utilization is measured by Bytes Available, which reveals the amount of system memory available for other operations. According to the table, as the users increased in the DiscDB workload, memory was added to support the additional users. The 260 user workload was configured with 128-MB of memory. This test showed available memory dipping to 43.9-MB of the 128-MB of total memory available during the test. The average available memory was 48.7-MB. This memory would be available to support other system operations that may be required in addition to supporting the DiscDB users.

As the users increased in the DiscDB workload for 700, the amount of memory was increased to 256-MB total. Of that 256-MB, the available memory dipped to 67.7-MB at some point during the test. The average available memory was 84.4-MB. This memory would be available to support other system operations that may be required in addition to supporting the DiscDB users. As users were increased to 750, the memory was increased to 384-MB. Of that 384-MB, the available memory dipped to 215-MB at some point during the test. The average available memory was 238-MB. This available memory indicates that the 384-MB memory configuration of the 750 user workload exceeded the required memory. While 700 users were supported with 256-MB of memory, the additional 128-MB of memory did not allow the users to be increased as much as you might expect. This indicates that other system bottlenecks were encountered placing a limit on the optimal number of NotesBench DiscDB users around 700. The performance return for the additional 128-MB memory investment would be difficult to justify based on the results of the 750 DiscDB user test.

Table 3-12
NT Performance Monitor DiscDB Results
For the Compaq ProLiant 1600 6/300

Workload/ Utilization	DiscDB 600 Users 128-MB	DiscDB 700 Users 256-MB	DiscDB 900 Users 384-MB	DiscDB 850 Users 512-MB
CPU Util.: Ave.	37.4	54	89.9	74.5
Max	57.2	85.75	99.1	95
Avail RAM: Ave.	17.8	129	225	347
Min	7.8	124	221	316

The processor and memory utilization trend demonstrated by the ProSignia 200 results continues with the Performance Monitor results of the ProLiant 1600 6/300 configured with 128-MB, 256-MB, 384-MB, and 512-MB of memory. The results in Table 3-12 illustrate that memory is not a bottleneck with this system running the DiscDB workload as additional users are added. The bottleneck is tied to the processor. Note that the CPU average and maximum utilization rates increased dramatically as the number of users was incremented very gradually. The 900 users run on the 384-MB configuration stressed the system more than desired, resulting in a response time of 2.016 as mentioned previously. Time permitting, this test would have been run again using 800 users to achieve a more desirable response time.

Performance Conclusions

Based on the performance tests and data analysis performed by Compaq for the tests run on the Compaq ProSignia 200 and ProLiant 1600, the conclusions and recommendations for performance management are as follows:

System Processor

Past research clearly shows that the processor was found to be the most important server subsystem to affect overall system performance of the Lotus Domino Server. The conclusion continues to be that the faster the processor, the better the performance gains for the system. Therefore Compaq recommends the fastest processor that can be purchased within budgetary limitations to meet your needs.

If the system choice for your LISP implementation is the Compaq ProSignia 200, the model configured with a Pentium II 300 MHz processor is highly recommended. This is the fastest CPU available in the entry-level ProSignia 200 server platform. The Compaq ProSignia 200 6/233 was also tested. Compaq Engineers do not recommend models slower than the 300 and 233 MHz system to support LISP. The ProSignia 200 233 MHz Pentium II Processor chip is upgradable to future Intel OverDrive processors. This means that the ProSignia 200 system that you purchase today can be upgraded in the future to an even faster processor if necessary. Thus the investment that you make today will be protected in the future as well.

The Pentium II 300 MHz processor is also recommended for the ProLiant 1600 if this is the system selected for implementing LISP within your organization. All ProLiant 1600 performance testing was completed using the 300 MHz model.

Memory

Memory was found to be a resource that depended upon the type of Domino Server activity that was taking place. The optimal memory configuration recommendation varies for the same number of users as the workload itself varies. As Compaq worked with the Mail workload of the ProSignia 200 6/233, the best performance was 750 Users and 256-MB of memory. When the memory was upgraded to 384-MB, the overall system performance did not improve significantly. When increasing the memory by 50%, only 150 additional users were supported. Remember that the processor, memory, and disk subsystem combination impact the overall system performance. Thus the amount of memory needs to be properly balanced with the system's need for the resource. Too much or too little memory can have a negative impact on performance, depending upon the specific server activity involved.

The memory usage trends observed by Compaq engineers during the NotesBench testing were used to derive the memory recommendations in the table located below. There is a noticeable difference in the amount of memory needed to support 600 Mail workload users and 600 real world users. The conversion between NotesBench users and real world users is covered in the next chapter, which discusses capacity planning.

The memory recommendation table that follows is based on many NotesBench Mail workload tests that were run. Compaq engineers used the available and minimum memory Performance Monitor results for these test runs to derive the recommended memory configurations for mail. The optimal memory findings are listed, as minimal memory required for varying number of real world users. The recommended memory configuration amount includes 64-MB added for other background tasks.

Using the 750 Mail user test run with 256-MB of memory as an example, the average and minimum available memory were examined to determine the optimal memory configuration for the 750 simulated users. Minimal memory was only 31-MB; however, average available memory was 117-MB. Because the average available memory was fairly high and the response time was excellent at 714 msec, the optimal memory configuration was derived to be around 192-MB or 64-MB less than the actual configuration of the test run. These 750 simulated users can be related to approximately 375 real world users. (This relationship between simulated and real world users is discussed in detail in Chapter 4, "Capacity Planning".)

Table 3-13 provides the administrator a guideline for determining the initial system memory requirement. Notice that the chart relates memory recommendations to real world users, not the simulated NotesBench user numbers generated by the test. Using this chart as a guideline, the administrator can use a tool such as NT Performance Monitor to follow the memory resource utilization during operation to determine whether a memory upgrade is necessary after implementation.

Table 3-13
ProSignia 200 Pentium II Processor System Memory Recommendation

Number of Real World Users	Minimum Memory Required (MB)	Recommend Memory Configuration (MB)
100 or less	48	64
200	64	80
250	80	96
300	96	128
350	128	192
400	192	256
450	256	320
500	320	384

This memory recommendation chart can be used for shared discussion database (DiscDB) user memory recommendations as well as mail users. In the NotesBench DiscDB workload, the users are updating and reading a shared discussion database. The users would therefore be categorized as active participants. Using the 700 DiscDB user test run with 256-MB of memory as an example, the average and minimum available memory were examined to determine the optimal memory configuration for the 700 simulated users. Minimal memory was 67-MB while average available memory was 84-MB. Because the average available memory was slightly high and the response time was good at 1097 msec, the optimal memory configuration was derived to be around 192-MB or 64-MB less than the actual configuration of the test run. The 700 DiscDB users can be related to approximately 375 real world shared discussion database users whose shared database activity includes updating as well as reading. (This relationship between simulated and real world users is discussed in detail in Chapter 4 – “Capacity Planning”.)

Table 3-14
ProLiant 1600 6/300 System
Memory Recommendation

Number of Real World Users	Minimum Memory Required (MB)	Recommend Memory Configuration (MB)
100 or less	48	64
200	64	80
250	80	96
300	96	128
400	128	192
500	192	256
600	256	320
700	320	384
800	384	448
900	448	512

This memory recommendation chart can be used for shared discussion database (DiscDB) user memory recommendations as well as mail users. In the NotesBench DiscDB workload, the users are updating and reading a shared discussion database. The users would therefore be categorized as active participants. Using the 900 DiscDB user test run with 384-MB of memory as an example, the average and minimum available memory were examined to determine the optimal memory configuration for the 900 simulated users. Minimal memory was 211-MB while average available memory was 225-MB. Because the average available memory was slightly high and the response time was good at 256 msec, the optimal memory configuration was derived to be between 192-MB and 256-MB rather than the 384-MB the system was configured with during the test. This means that 128-MB to 192-MB of memory available on the system was never used during the test run. The 900 DiscDB users can be related to approximately 450 real world shared discussion database users whose shared database activity includes updating as well as reading. (This relationship between simulated and real world users is discussed in detail in Chapter 4 – "Capacity Planning".)

Disk Subsystem

Previous performance testing demonstrated the superior performance of the Wide-Ultra SCSI drives over the performance of IDE drives. The Wide-Ultra drive is supported by the Wide-Ultra SCSI-3 Controller in a PCI slot. The IDE drive support is available in a model that is configured with an Integrated Enhanced IDE support on the PCI local bus. Compaq recommends the ProSignia SCSI model over the EIDE model as the system to use with the Lotus Intranet Starter Pack. For any system that will be supporting Domino, the SCSI drive solution is more desirable than an IDE drive solution.

System Tuning

Domino Server NSF Buffer Size

A Domino Server tunable parameter that impacts the system performance is the NSF Buffer Size which is the amount of memory allocated to the Domino Server NSF buffer specified in bytes.

Compaq recommends that the NSF buffer size be allowed to take its default value of 25 percent of available memory.

NT Server Tuning

When running under NT Server, consider changing the following operating system parameter values:

- Foreground and Background Applications set to “Equally Responsive” - this is set under Control Panel/System/Tasking
- NT Registry - Hkey_Local_Machine/System/CurrentControlSet/Control/PriorityControl/Win32PrioritySeparation:REG_DWORD:0x0
- NT Registry - Hkey_Local_Machine/System/CurrentControlSet/Control/SessionManager/MemoryManager/LargeCacheSystemCache:REG_DWORD:0x0

Chapter 4
Capacity Planning

Definition of Capacity Planning

Capacity planning is a method of determining the balance between your Lotus Domino Server workload and its configuration at minimum cost, while meeting necessary user response time objectives. The goal of capacity planning is to find the best server and equipment that will cost-effectively meet network workload demands and performance requirements. Capacity planning allows you to balance demand and supply—the demand for present and anticipated workload and the supply of present and future computer resources. A basic objective is consistent and acceptable user response times.

Capacity planning may be one of many responsibilities of the Lotus Domino administrator or integrator. Capacity planning is closely tied to performance management. Domino Server performance depends on the number of users on the system, the operating environment of the server and workstations, and the bandwidth and speed that are available to the physical network. The type of server, NICs, and cabling systems play an important role in how the network operates under heavy traffic conditions.

In capacity planning, the planner must balance complex, vague, and sometimes confusing data about workload, user needs, and computer resources, devise a coherent plan, and make these needs known to others. Although capacity planning requires the use of statistical data and mathematical techniques, it also requires a planner with practical experience and expert-level knowledge of the computer industry. It is not an exact science.

This Compaq TechNote offers data from testing in Compaq integration labs to help you in these efforts.

Compaq Capacity Planning Methodology

The capacity planning methodology recommended by Compaq involves a step by step process beginning with determining the application mix or user profile requirements. Customers are walked through the task of relating the real world user to a discounted NotesBench simulated user, understanding the features of the ProSignia 200 system, and determining the memory and disk subsystem configurations. This section guides you through the following five steps:

1. Determine the Application Mix or User Profile
2. Convert Real World Users to NotesBench Workload Users
3. Examine System Features
4. Determine the Memory Configuration
5. Determine the Disk Subsystem Configuration

Determine the Application Mix or User Profile

The first step in the capacity planning methodology is to determine the user requirements. Determining the user requirements begins with classifying the type of application activity that will take place on your server such as mail and shared discussion database usage. Secondly, a user count should be associated with each application activity category to create a complete user profile. Then the user profile requirements can be correlated to the closest NotesBench workload that has similar activity.

For example, if Domino were used for mail alone, then all users would be categorized as Mail users. When determining that users are mail users it is also important to classify their mail usage as light, medium, or heavy depending on the number of messages that are sent with attachments as well as the size of these messages. Light mail users are defined here as sending and receiving mail messages averaging between 1 and 10-KB. Medium mail users are defined here as average mail messages between 10 and 20-KB. Heavy mail users are defined here as average messages from 20 to 30-KB.

For Shared Discussion Database users, determine the level of discussion database activity appropriate for the participating users. For example if the activity is related more to information retrieval (read activity) with very little update (or write) activity, consider users to be shared discussion database readers. Classify the shared discussion database user as an active participant if the user activity includes main topic and response creation, involving write file activity, as well as some read activity.

These classifications of Mail and Shared Discussion Database users are put to use during the second step of the capacity planning process when converting real world users to NotesBench simulated users.

Convert Real World Users to NotesBench Workload Users

Step two explains the model used to convert real world users into an appropriate number of NotesBench users. To use this capacity planning model, a formula must be created that relates the required number of real world users to NotesBench workload user results. During NotesBench performance testing on the ProSignia 200, it was demonstrated that given a Pentium II 233 MHz single-processor system, the maximum number of supported NotesBench mail workload users is 900. Compaq engineers would like to see the maximum production system resource utilization less than 70%. Thus for capacity planning purposes, taking an additional 20% is recommended resulting in a system running at 50% utilization. Applying this 50% utilization discount, the ProSignia 200 Pentium II 233 MHz system should be able to support 450 real world users, providing very good performance while allowing some resources for other activities. Therefore the following model which discounts the maximum NotesBench mail users by at least 50% to relate the NotesBench mail workload users to planned real world mail users can be used for capacity planning purposes:

# of real world mail users = Max NotesBench mail users x 50%

or

# of planned real world mail users x 2 = Maximum NotesBench mail users

Thus if we know how many users need to be supported, available NotesBench mail results can be used to help select the appropriate ProSignia 200 system configuration. If we need to support 400 real world mail users for example, a ProSignia 200 system that had a NotesBench result of 800 mail users or greater should be selected. This would be the correct relationship for mail users classified as light mail users as discussed in the previous section.

If the users had average message sizes ranging from 10 KB to 20-KB, then they would be classified as *medium* mail users. The following formula uses a discount of 33% to take into account the additional work placed on the server by these more active users and can be used for capacity planning purposes:

# of real world mail users = Max NotesBench mail users x 33%

or

# of planned real world mail users x 3 = Maximum NotesBench mail users

If the users had average message sizes ranging from 20-KB to 30-KB, then they would be classified as *heavy* mail users. The following formula uses a discount of 25% to take into account the additional work placed on the server by these most active users and can be used for capacity planning purposes:

# of real world mail users = Max NotesBench mail users x 25%

or

# of planned real world mail users x 4 = Maximum NotesBench mail users

Based on the previous explanation, the number of required users that participate in shared discussion database (DiscDB) activity will also be discounted at 50-75%. This supports relating NotesBench DiscDB workload users to the number of planned real world shared database users that would stay within the comfort zone of the CPU utilization range. If the users will mainly utilize the shared database for information retrieval purposes, then these users would be classified as *readers* and the following formula would apply:

# of real world DiscDB users = Max. NotesBench DiscDB users x 75%

or

# of planned real world DiscDB users x 1.333 = Maximum NotesBench DiscDB users

If the users will utilize the shared database for information retrieval purposes and will create main topics and submit responses to existing topics, then these users would be classified as *active participants* and the following formula would apply:

# of real world DiscDB users = Max. NotesBench DiscDB users x 50%

or

# of planned real world DiscDB users x 2 = Maximum NotesBench DiscDB users

In summary, the following formulas will be used to relate real world (planned) users to our Capacity Planning (CP) NotesBench Users for these workloads:

Table 4-1
Capacity Planning for Mail and DiscDB Workloads

	Mail Workload
Classification	*Formula*
Light	*# of planned Mail users = NotesBench Mail Users/2*
Medium	*# of planned Mail users = NotesBench Mail Users/3*
Heavy	*# of planned Mail users = NotesBench Mail Users/4*
	DiscDB Workload
Classification	*Formula*
Reader	*# of planned DiscDB users = NotesBench DiscDB Users/1.333*
Active Participant	*# of planned DiscDB users = NotesBench DiscDB Users/2*

Examine System Features

The features of the Compaq ProSignia 200 and the ProLiant 1600 systems are examined in step three. The Compaq ProSignia 200 delivers high performance and true server functionality at a desktop price. This server was designed for small and medium-sized businesses requiring an inexpensive, feature-rich workgroup server. The detailed specifications of the Compaq ProSignia 200 follow.

Specifications of ProSignia 200 *w/ 233 MHz/300 MHz Pentium II*

- **Form Factor**: Mini-tower
- **Processor**: Pentium II 233-MHz/300 MHz
- **Memory**: 6/233: 32-MB of EDO memory, expandable to 192-MB with industry-standard SIMMs installed in pairs. Optional ECC memory is expandable to 384-MB; 6/300: ECC memory standard expandable to 384-MB
- **Cache Memory**: 512-KByte Level 2

- **System Architecture**: PCI System Architecture
- **Internal Expansion Slots**: 3 PCI slots, 1 ISA slot, and 1 shared ISA/PCI slot
- **Drive Controller**: Wide-Ultra SCSI in PCI slot
- **Network Controller**: Integrated Netelligent 10/100 T/2 PCI UTP/Coax Network Interface Controller
- **Drive Bays** (5 total bays):
  - 1.44-MB floppy
  - 16X IDE CD-ROM
  - 1" hard drive bay
  - Available 5.25" hard drive bays
- **Interfaces**: Network (RJ-45 and BNC), parallel, two serial, graphics, keyboard, and pointing device (mouse)
- **Security**: Power-on Password; Keyboard Password; QuickLock with QuickBlank; Network Server Mode; Diskette Boot Control; Diskette Drive Control; Hard Drive Control; Serial Interface Control; Parallel Interface Control; Diskette Write Control; System Configuration Lock; Administrator Password; Safety Interlock; Security
- **Management** (Full-Spectrum Fault Management):
  - Fault Prevention - Compaq Insight Manager, Disk System Tracking
  - Fault Tolerance - Smart SCSI drives, Optional ECC memory
  - Fault Recovery - Automatic Server Recovery (ASR-2), Pre-Failure Warranty
- **Power Supply**: 280 Watt - CE Mark Compliant
- **Service and Support**: CompaqCare provides a wide range of service offerings including a three-year warranty as well as a Pre-Failure Warranty. The Pre-Failure Warranty extends the advantage of Compaq's industry-leading, three-year On-Site Warranty by applying it to critical server components before they actually fail. Compaq Service and Support Programs are available on a worldwide basis.

- **Software**: SmartStart and Compaq Insight Manager are standard with all Compaq servers. Also shipped with the ProSignia 200 with Pentium II 233MHz, are encrypted versions of NetWare 3.12, IntranetWare, and Computer Associates products. Other SmartStart enabled operating systems and applications are available from Compaq. The Compaq ProSignia 200 with Pentium II 233MHz is also certified to support IntranetWare for Small Business.

Specifications of the ProLiant 1600 *w/ 300 MHz Pentium II*

The Compaq ProLiant 1600 is a new workgroup server available in tower and rack models, that includes a 300 MHz Pentium II processor with 512-KB cache. Incorporating the latest dual Pentium II processor technology with Compaq standards-based Highly Parallel System Architecture, this new ProLiant 1600 server model delivers the highest performance available for demanding file/print and small database applications. It delivers high performance and true server functionality at a desktop price. This server was designed for small and medium-sized businesses requiring an inexpensive, feature-rich workgroup server. The detailed specifications of the Compaq ProLiant 1600 6/300 follow.

- **Form Factor**: Tower or 5U Rack
- **Processor**: Pentium II 300 MHz
- **Memory**: 64-MB ECC memory expandable to 512-MB (using industry-standard 60ns buffered EDO DIMMS
- **Cache Memory**: 512-KByte Level 2
- **Internal Expansion Slots**: 2 PCI slots and 4 Shared PCI/EISA slots
- **Drive Controller**: Integrated Dual Wide Ultra SCSI-3 controller
- **Network Controller**: Compaq Netelligent 10/100 TX Embedded UTP Controller
- **Removable Media Bays**: Four 5.25" removable media bays - 2 open + (1) diskette and (1) 16X IDE CD-ROM
- **Drive Bays**: Up to three 1.6" or three 1" Hot Pluggable Drive Bays
- **Optional Drive Cages:** 5 x 1" Hot Pluggable Drive Cage; Duplex Drive Cage

- **Interfaces**: External Wide-Ultra SCSI controller, network (AUI and RJ-45), parallel, two serial, graphics, keyboard, and pointing device (mouse)
- **Security**: MultiLock security features; power-on password; keyboard password; diskette drive control; diskette boot control; network server mode; security provision; parallel and serial interface control; administrator's password; disk configuration lock; QuickLock
- **Management** (Full-Spectrum Fault Management):
  - Fault Prevention - Compaq Insight Manager, Integrated Remote Console, Server Environment Tracking, Disk System Tracking, Pre-Failure Warranty, Integrated Management Display (optional), Remote Insight (optional)
  - Fault Tolerance - On-Line Spare, UPS (optional), ECC memory, SMART Array Controller Family (optional), Hot Plug Redundant Power Supply (optional)
  - Fault Recovery - On-Line Recovery Server (optional), Standby Recovery Server (optional), Automatic Server Recovery-2 (ASR-2), Server Health Logs
- **Power Supply**: 325 Watts, or Optional Hot Plug Redundant Power Supply
- **Service and Support**: CompaqCare provides a wide range of service offerings including three-year, limited warranty, Pre-Failure Warranty. Compaq Service and Support Programs available on a worldwide basis.
- **Software**: Compaq SmartStart, Compaq Insight Manager, Systems Reference Library

Determining the Memory Configuration

The appropriate memory configuration relates to the number of real world users determined during step two, which explained the method for converting NotesBench workload users into real world users. The memory recommendation charts in Table 4-2 and Table 4-3 were included previously in Chapter 3, “Performance Management.” An explanation of how entries in the chart were derived is also included in Chapter 3.

Step four of the capacity planning process is to determine the system memory requirements based on the number of real world users that need to be supported. The following table is provided to assist customers and serve as a guideline for determining the initial system requirements when configuring a ProSignia 6/300 or 6/233 for LISP.

Table 4-2
ProSignia 200 6/233 and 6/300 System Memory Recommendation

Number of Real World Users	Minimum Memory Required (MB)	Recommend Memory Configuration (MB)
100 or less	48	64
200	64	80
250	80	96
300	96	128
350	128	192
400	192	256
450	256	320
500	320	384

Frequently the users may require multiple activities relating to more than one workload. For instance, assume the system needs to support 300 mail users, 100 of those users also need shared discussion database activity support. Handle the profiles that relate two workloads separately. Treat the 100 discussion database users independently of the 300 mail users. In other words, using Table 4-2, you can determine that 64-MB is required to support the 100 real world discussion database users. According to Table 4-2, 128-MB is recommended to support 300 real world mail users. Adding these two numbers reveals that 320-MB of memory is recommended to support these users collectively on a single system.

The following table is provided to assist customers and serve as a guideline for determining the initial memory requirements when configuring a ProLiant 1600 6/300 for LISP.

Table 4-3
ProLiant 1600 6/300 System
Memory Recommendation

Number of Real World Users	Minimum Memory Required (MB)	Recommend Memory Configuration (MB)
100 or less	48	64
200	64	80
250	80	96
300	96	128
400	128	192
500	192	256
600	256	320
700	320	384
800	384	448
900	448	512

Table 4-4 can be used for both the ProSignia 200 and the ProLiant 1600 6/300 memory requirements when configuring either system for use with LISP. This table should be used as a guideline for memory requirements when implementation plans include utilizing the product in a way that results in user activity closely matching the activity that occurs during the NotesBench groupware workload.

Table 4-4
Memory Recommendation – GroupWare

Number of Real-World Users	Minimum Memory Required (MB)	Recommend Memory Configuration (MB)
100 or less	96	128
150	128	192
200	192	256
250	256	320
300	320	384
350	384	448
400	448	512

As mentioned in the previous performance management chapter, these memory recommendations are to serve as guidelines for customers. If the user activity involves a mixture of profiles, then a memory configuration will need to be derived. These charts are provided to assist customers with memory configurations for the Compaq ProSignia 200 6/300 and 6/233 as well as the ProLiant 1600 6/300 systems running LISP.

For example, if a customer needed to support 300 GroupWare real world users, then a memory configuration from 320 to 384-MB should provide adequate memory resources. Memory recommendations are guidelines that provide a good starting point for customers. Memory utilization should be monitored once the system is running to determine if adequate memory resources are available to the system. Response time experienced by users is in part affected by the server's memory resource. Adding more memory often results in better response time for mail and shared discussion database users as discussed in the Chapter 3, "Performance Management".

Determining the Disk Subsystem Configuration

In step five, the disk subsystem is determined. LISP on Compaq platforms can be set up with one or two drives and volumes:

- **System Volume:** The system volume should be a single Wide-Ultra drive attached to the SCSI bus, formatted as NTFS. The following should be included on this volume:
  - Windows NT Server
  - Lotus Intranet Starter Pack software
  - Domino log file (Log.nsf)
- **Data Volume:** For systems that support a large number of users, the data volume should be an array of drives controlled by a Smart-2 Array Controller. Hardware fault tolerance is recommended for all Domino Server systems. This drive array should be configured with a fault tolerance level of RAID 5 using hardware striping for non-critical data and RAID 1, mirroring, for mission critical data servers.

  However, for the typical small-sized business, the data will probably reside on the same drive as the system volume due to budget limitations. This is the configuration of the disk subsystem on the system used to produce the NotesBench test results included in Chapter 3 - Performance Management. For some medium-sized businesses, the data volume may reside on a separate drive that is connected to the same embedded SCSI controller from which the system drive operates. The maximum internal storage is 22.5-GB SCSI. If the CD-ROM is removed, the maximum internal storage is 31.6-GB. External storage capacity is limited to 254.8-GB.

  Regardless if a separate drive is used or not, the following should be included on the data volume:
  - Lotus Intranet Starter Pack data
  - NT Paging File (size dependent upon memory configuration)

When determining the disk subsystem configuration of a Lotus Domino server system, use Wide-Ultra drives connected to controllers that support the Wide-Ultra transfer rates when possible. Disk access is often a major bottleneck in Domino server performance. Using the fastest available SCSI drives combined with disk controllers that support Wide-Ultra transfer rates, the system will be configured to keep this impact minimized as much as possible.

The size of the data volume allocated for Lotus Domino data is dependent on the applications that will be used from the Lotus Intranet Starter Pack. If mail is required for your implementation of LISP, at least 50-MB per mail user should be planned for storage of mail messages. If you have 100 mail users that need to be supported on your server, then the server should have at least 5-GB (100 users x 50-MB per user = 5000-MB for mail data) plus another 71-MB for the NT paging file of the system. The rule of thumb for this calculation is Amount of Memory + 10%. For our example, we determined the memory configuration for 100 mail users was 64-MB, therefore the NT Paging File size is calculated as 64-MB+6.4-MB=70.4-MB. For capacity planning purpose the 70.4-MB Paging File was rounded to 71-MB.

Depending on the applications that will be used by the business, additional storage should be planned for the Lotus Intranet Starter Pack Domino databases. For example, the rule of thumb used to calculate the storage requirements for the discussion databases allows at least 500-MB for each database; 3 databases × 500-MB/database = 1500-MB. An additional 1.5-GB of space should be allowed for the three discussion databases.

Once the total storage requirements are determined, the exact disk configuration can be decided. If your storage requirements exceed the capacity of the largest single drive supported by your system, there is no choice except to configure the server with two drives. If your immediate storage requirements do not exceed the capacity of a single drive, there is a choice to configure the system with one large drive that satisfies storage requirements. A second drive could always be added if storage requirements outgrow your existing storage.

You could optionally choose to configure the system with two drives that satisfy the current requirements plus provide some room for future storage needs. This alternative assumes that your budget limitations will permit buying extra storage that will not be needed immediately.

Chapter 5
Backup Solutions for LISP on Compaq Platforms

Overview

Data backup and recovery is one of the most important aspects of business-critical application servers such as the Compaq ProSignia 200 or ProLiant 1600 server. This document presents and analyzes various backup and recovery solutions available for a Windows NT and Lotus Server, from both the hardware and software perspective, and provide choices based on performance, cost, capacity and functionality. Based on the information presented, the customer will be able to make an informed decision about the protection of data.

Why are Backups for Lotus Data Essential?

The backup process copies important information (in many companies, this is vitally important information) onto magnetic tape or other disks. This enables the restoration of anything from one file to the entire system, should the need arise. Backups have helped companies recover from data losses caused by power surges and outages, static electricity, lightning strikes, simple accidents (such as a spilled cup of coffee), sabotage, equipment malfunctions, viruses, and so on. Data recovery tools and services exist, but they are limited and can be expensive. While users might be able to recreate some lost data, retrieving all of the lost information is unlikely. Complex application and network configurations, customized setups, even passwords and IDs will be difficult and expensive - perhaps even impossible to recreate.

The sudden loss of a mission-critical server that stores and maintains corporate records and data (one of a company's most valuable assets) can be financially disastrous. In most companies, just the downtime before recovery can be much too costly. A well-designed backup system safeguards crucial information, providing the most efficient and cost-effective insurance against a potentially disastrous loss of data, time, and money.

Organizations depend highly on the messaging and workflow automation provided by LISP on Compaq platforms. Many organizations store gigabytes of email messages, document databases and mission-critical applications on a server or even across multiple servers. Data loss can be catastrophic in most environments, resulting in the loss of days or weeks of productivity. For these reasons, backup management as well as anti-virus protection is vital to a successful implementation. Backup management will be thoroughly discussed in this chapter while anti-virus protection is addressed in Chapter 7 – "Security Considerations". A well thought-out backup strategy can reduce lost productivity due to hardware or software failure. A proven restore strategy is also important to ensure successful restores when required. Also discussed in this chapter are backup software and hardware solution alternatives.

Backup Basics

Backups are classified by the status of the network server or servers (off-line or on-line) when the backup takes place, and by the amount of information that is backed up (complete or partial backups).

Off-line and On-line

For an off-line backup, the system administrator's first step is to take the server off-line, making it unavailable to users for the duration of the backup operation. The typical off-line backup takes place when user activity is at its lowest.

An on-line backup takes place with the server on-line and available to users. Depending on the network architecture, users may see network performance degradation while an on-line backup is taking place. In addition, there can be a danger to data integrity caused by file contention. Selecting the appropriate backup software can minimize this data integrity danger.

Complete and Partial Backups

Complete and partial are terms used to describe the amount of information that is copied during a backup. A complete backup is a full backup of the entire server or PC client hard drive. For a server, this includes all volumes, directories, and files. For a PC client, this includes all drives, directories, and files. A partial backup can be one of the types listed below. All backups, whether complete or partial, can be done on-line or off-line.

There are many partial backup alternatives that differ in which files are included in the backup. Partial backup alternatives include:

- **Differential -** All files that were changed since the last complete backup are copied. Differential backups are useful when it is important to have the latest version of each file. If the same tapes are used for consecutive differential backups, the newer versions of backed up files are often allowed to overwrite older versions of the same file on the tape. Typically, backup programs do not reset the file's archive bit after a differential backup; the archive bit remains turned on until the next complete backup.
- **Incremental -** All files that were changed since the last backup are copied, regardless of what kind of backup took place. This type of backup is used when each revision of a file must be maintained. If the same tapes are used for consecutive incremental backups, the newer versions of backed up files are not allowed to overwrite earlier versions. Rather, the newer files are usually appended to the backup medium. Typically, backup programs reset the archive bit following each incremental backup.
- **User-defined -** A user-defined set of files are copied during the backup. Often this is a special backup requested by a group of employees on a mission-critical project.

When choosing exactly which files will be included in the backup, there are several options. The information that is backed up can be:

- **All Applications -** This type of backup saves all files in the area defined by the user, including settings, customizations, passwords, etc. Application backups are particularly useful after a major change or upgrade in software.
- **Applications and Data -** This type of backup creates a standalone copy of the user's information base. Application and data backups allow easy restoration of the user organization's records. These backups can also be used to migrate information to another server.
- **Data Only –** This type of backup includes only data, which may be segregated by project or department, or which may include all information created within a certain timeframe, or both.

Clearly, the amount of backed-up information varies with the type of backup selected. This, in turn, directly affects the overall strategy in terms of capacity and transfer rate.

Backup Strategy

Backing up your Lotus Intranet Starter Pack data as well as other important data on your system should become part of a daily routine. When determining the precise backup strategy, you should consider the following questions.

How Long is the Backup Window?

Administrators typically perform backups when user demands on the server are at the lowest. Ideally, this time period, the backup window, is when user access can be restricted or the server shut down. As more and more companies move to 24-hours-per-day, 7-days-per-week operation, backup windows are shrinking. For many companies with worldwide operations accessing their servers, no clear backup window exists. The system administrator must determine how to get the backup done without impacting the productivity of users or seriously degrading network performance.

How Often Should Backups Take Place?

Backups must be performed regularly. The actual frequency of backups will be determined by considerations such as:

- the acceptable amount of work that could be lost, if any, in the event of a catastrophic failure
- the allowable down-time for recovery from this failure
- the volume of update transactions that normally take place

Where Should Backup Tapes be Stored?

The storage location of backup tapes is an important consideration. Backups are intended to help recover from catastrophes such as fires as well as minor problems such as data loss due to a single corrupt file. For this reason, tapes should not be stored near the server. Try to store the tapes in a fire proof safe or closet located as far away from the server as feasible, preferably off-site. The most recent backup should be kept relatively accessible in case data needs to be restored.

Backup Strategy Example

An effective backup strategy should also incorporate redundancy. An example is included to provide some practicality to the main points of the previous backup discussion.

Suppose a mid-size company of about 150 employees implements a backup strategy that includes backing up Lotus data. A decision was made to implement different backup schedules set according to the priorities of various application databases.

Business Critical Databases

It was determined that the human resource policy database, project discussion database, status report database needed an incremental backup daily, followed up with a full backup monthly.

Mail Databases

Aware that email databases are critical to each of the employees within your company, the backup strategy was well thought-out and implemented. The size of the mail databases as well as the necessity to be able to restore data quickly when necessary was considered in this backup strategy.

An incremental backup daily, followed by a full backup weekly was determined to be the backup strategy for email databases. Assuming an average mail database size of 50-MB x 150 employees, the total mail data was calculated as 7500-MB or 7.5-GB.

Operational Critical Databases

Realizing those operational critical applications and databases such as the Name and Address Book for the system, the system log database, and system tracking database are vital to the operation of the system, the most conservative backup strategy was selected. A full backup daily was required to prevent the possibility of a problem such as a corrupt Name and Address book from placing the entire LISP system in jeopardy.

Restore Strategy

A sound restore strategy is as important as a good backup strategy. The restore strategy should include the period testing of tapes to ensure that a successful restore is possible. There are often multiple methods of restoring files, depending on the backup and restore software selection. The restore methods typically include an option that controls whether the restored file replaces an existing file with the same name in the backup source directory or whether the restore file may be placed in a specified directory different than the source.

Careful consideration should be made before implementing one of the available restore methods of your software. In a Lotus Intranet Starter Pack environment, there are databases that are critical to the operation of the intranet applications. In addition there may also be other critical databases designed by third party developers.

Perhaps the most critical database of all from an administration standpoint is the Public Name and Address book, also known as NAMES.NSF. Some software packages support restoring an important file such as the Public Name and Address book to a pre-determined directory other than the original directory. Of course, this software would also support restoring the file to its original location. The restore method selected would depend entirely on the situation at hand.

For example, suppose the Notes administrator inadvertently deletes a view from the Public name and Address Book that gets replicated throughout the entire domain before the damage is discovered. If this view is not preventing users from authenticating with the server and accessing databases or mail files, then the best option would be to restore the Public Name and Address book to an alternative directory. This will save time on the restore process. All that is required then is to copy the restored NAMES.NSF to its original data directory at a later time, replicate it across the domain, and restore the file to its previous state.

Backup Solution Software

One software product available today, from Computer Associates (CA), backs up your LISP data files and other data whenever possible and enters an error in the log to notify the administrator that the file's protection is suspect. The administrator can then take the appropriate action, which may be to restore an earlier, non-suspect version of the file. Although often referred to as backup software, the same application supports restore operations as well.

Other products that protect open files during backup include ARCserve database agents, which are available from Compaq. The ARCserve Backup Agent communicates with Lotus Domino and ARCserve to back up the open Lotus Domino databases on a local or remote server.

ARCserve 6.5 Features

ARCserve 6.5 Enterprise is a powerful storage management product that offers a rich set of features, especially when combined with its option software. The following is a brief look at some of the capabilities of the ARCserve products:

- **Automation** - The ARCserve Job Engine makes it possible to schedule backup / restore jobs based on customized repeat methods (time interval, days of the week, etc.). In addition, a Tape Rotation scheme can be configured for the backup jobs.
- **Database Agent** - The Backup Agent for Lotus is available as an option. Otherwise, ARCserve must perform off-line backups of the database device files. The agent functions as a Windows NT service, and allows backup at the database level.
- **Information Repository** - The ARCserve Database Engine maintains complete historical information on such things as jobs that have been completed, a record of which files/directories/drives/machines that have been backed up, and the media that was used.
- **Tape Spanning** - ARCserve 6.5 allows the creation of 'groups' of media, should multiple tape drives be available. A single backup job can continue uninterrupted across all the tape drives in that group. ARCserve supports up to 8 tape drives per server.
- **Parallel Streaming** - If tape drives are separated into different 'groups', then multiple backup jobs can be run (one to each group) simultaneously.

- **Fault Tolerance / Striping** - This option provides a Tape RAID (or 'RAIT') system so that multiple tape drives can be placed in a group and be written to as one 'tape array' by a single backup job. Fault tolerance can be provided to the array through RAID-1 (mirroring) or RAID-5 (striping with parity), so that backup operation can continue if a tape drive fails, or so that a backup set can be recreated if a tape is lost. The array can also utilize RAID-0 striping, for a purely high-performance backup without fault tolerance.
- **Centralized, Remote Management** - The Enterprise version allows the management of multiple servers from a single machine, using a 'tree' view display. All storage management tasks for these servers, including submission of backup and restore jobs, can be performed from a single location.

Backup Solution Hardware

Compaq offers a line of tape drives that include the Compaq DLT (Digital Linear Technology) family of tape drives, DAT (Digital Audio Tape) drives, SLR (single-channel linear recording) drives, and supports other older tape technologies such as the QIC (Quarter Inch Cartridge).

Note: Compaq backup solution information is available online at the Compaq Web site - http://www.compaq.com/products/servers/storage/.

The decision for selecting the appropriate hardware should be carefully thought out. After determining the company's backup needs, the system administrator determines the specifications for an appropriate, cost-effective backup solution that will best meet those needs in terms of:

- Performance and Capacity
- Hardware and Media Cost
- Hardware Reliability
- Compaq Small Business Tape Drive Alternatives

Performance and Capacity

Performance is measured by dividing the amount of information (in gigabytes) that must be backed up by the length of the backup window (in hours). This simple calculation yields the required performance as an overall transfer rate expressed in gigabytes per hour (GB/HR).

The following table provides a listing of the transfer rates of the Compaq small business backup alternatives, providing performance information that can be used in making the backup solution decision.

Table 5-1
Transfer Rates of Compaq Small Business Tape Backup Alternatives

Tape Drive	2/4-GB DAT	4/8-GB SLR
Native Maximum	650-MB/HR	1.36-GB/HR
Native Typical	300-MB/HR	1.0-GB/HR
2:1 Compressed Ratio Maximum	1.4-GB/HR	2.7-GB/HR
2:1 Compressed Ratio Typical	1.0-GB/HR	2.0-GB/HR

The following chart provides capacity information for the Compaq 2/4-GB DAT and 4/8-GB SLR drives that should be considered as an appropriate solution for Implementing LISP on Compaq platforms.

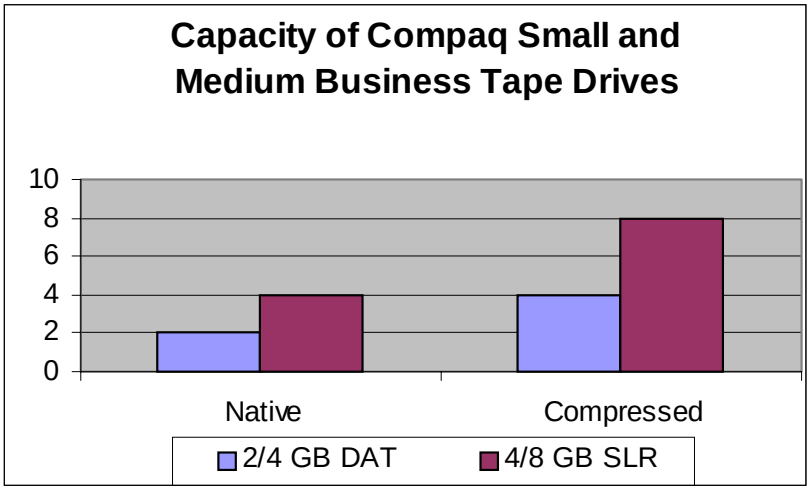

Figure 5-1. Capacity of Compaq Small and Medium Business Tape Drives

By comparing the results of the required-performance calculation with the typical backup performance rates listed in Table 5-1, the administrator can determine if the required backup performance is achievable. Capacity information is presented in the chart above. If one of the drives will provide the level of performance and meets capacity requirements, then local, off-line backups using that device is an appropriate choice.

Hardware and Media Costs

The needed drive performance and drive capacity must be evaluated in view of current drive and media costs and your company's budget. A realistic budget for the purchase of the appropriate drives and media is important. If too little is budgeted for drives, the company will probably incur increased labor costs.

An all-too-common example of a poor backup solution decision involves a system administrator who must work overtime every evening changing tapes on a drive without an autoloader. Another example of a poor solution decision involves a company that ends up with a drive that is simply too slow to complete the backup operation during the backup window. This could result in degradation of server performance outside the backup window. The unit will be in use more than its intended design, resulting in prematurely wearing out the tape drive.

On the opposite end of the price/performance spectrum, a drive with ten times the required capacity may have the advantage of low cost per gigabyte, but the initial purchase price would be difficult to justify. The Compaq DAT and SLR tape drives mentioned previously fall within the typical backup solution price/performance requirements for customers using the Compaq ProSignia 200.

Hardware Reliability

The reliability of any backup device is directly related to its duty cycle (the number of hours per day that the device is in use). The hardware device which will back up the Compaq ProSignia 200 server should be selected so that the reliability or duty cycle rating satisfies the expected and, more importantly, actual level of backup activity. For example, if a tape drive designed for 1-GB backups is being used to back up a 10-GB server, the impact on that drive will probably include the following:

- A need for accelerated preventive maintenance - especially head cleaning
- Premature aging
- Reliability problems

The best method for building hardware reliability into a backup strategy is to ensure that the backup hardware is matched to the server(s). If the company needs special, partial backups in addition to the routine backups, it might be appropriate to select the next larger drive size.

If a 2/4-GB DAT drive appears to be the appropriate choice for a given system, the projected duty cycle of the drive becomes an important consideration. Consider the example of an organization that plans to do an unattended, 4-GB complete backup every night, using one 2/4-GB DAT drive. The 4-GB of data are well within the capacity of the drive. However, at a backup rate around 1 GB/hour, that tape drive will be in operation for 4-8 hours every night. With this amount of usage, the tape drive's read/write heads should be cleaned every other night. Assuming that a person can be found to do this, these backups could hardly be called "unattended." If the drive heads are not cleaned when they need cleaning, soft errors will increase (as will overall backup time) to the point at which something will fail. For this particular customer, even though a 2/4-GB DAT drive would seem to be the appropriate choice, a SLR 4/8-GB or perhaps even a DLT drive would be a better choice.

Compaq Tape Drive Alternatives

As previously mentioned, Compaq offers a line of tape drives that include DAT (Digital Audio Tape) drives, SLR (single-channel linear recording) drives, the Compaq DLT (Digital Linear Technology) family of tape drives, and provides support for other older tape technologies such as the QIC (Quarter Inch Cartridge).

The most appropriate drives for the LISP on Compaq platforms implementation are the DAT and SLR drives. These drives are most likely to provide the performance, capacity, and reliability needed at a tape drive and media cost that is appropriate for the small or medium sized business.

- **DAT (Digital AudioTape)** drives are usually the appropriate choice for servers with 2 to 4-GB capacity. Standard DDS1 DAT tape drives (2/4-GB DAT) can store approximately 2-GB without compression. An Autoloader for use with DAT tapes is available from Compaq. Autoloaders reduce administrative costs by using a robotic mechanism to load and unload tapes.

- **Compaq SLR (single-channel linear recording) Tape Drive** features backward compatibility to older tapes and growth to future products ranging from 125-MB to 32-GB, making the Compaq 4/8-GB SLR Tape Drive a best growth choice.
- **DLT (Digital Linear Tape)** drives use simultaneous, multi-channel/multi-head read/write technology to achieve capacities up to 35-GB without compression. A DLT drive is the appropriate high-end backup solution for systems with 35 to 70-GB of storage.
- **QIC (Quarter Inch Cartridge)** drives meet the half-height form factor of desktop computers. QIC tapes are virtually industry-standard for standalone machines. However, with capacities limited to 1.2-GB, they are not generally suitable for backing up servers with 2-GB or more storage capacity.

Compaq Tape Drive Lotus Backup and Restore Performance

Performance testing involved on-line backup and restore using ARCserve 6.5 for Windows NT on a Compaq ProSignia 200 with 128-MB of memory. The system included Domino R4.5 and the Lotus Notes Backup Agent 2.0. Also included were InocuLAN 4 for Windows NT and AntiVirus Agent V2.0 for Lotus Notes. The system was running Windows NT Server 4.0. The testing involved local on-line backup and restore operations.

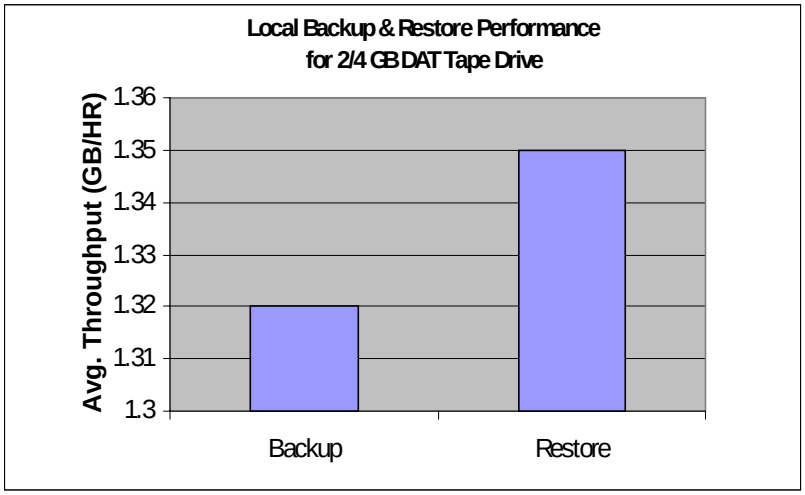

Figure 5-2. 2/4-GB DAT Backup and Restore Performance

The 2/4-GB DAT Tape Drive's backup performance is 1.32-GB/HR. The same tape drive's restore performance is 1.36-GB/HR. The backup performance of the 4/8-GB SLR drive exceeds the performance of the 2/4-GB DAT drive. The 4/8-GB SLR represents a low-cost, reliable higher capacity alternative to the 2/4-GB DAT. The 4/8 SLR supports 4-GB of native data capacity and 8-GB of 2:1 compressed data.

Backup Conclusion

Companies continue to entrust their mission-critical data to their computer systems, networks, and enterprises. As long as the possibility of a catastrophic failure exists, a well-thought out backup strategy is crucial. Developing the optimum backup strategy for a particular corporate situation requires an understanding of the performance, capacity, life, and costs of the various backup solutions available today and in the near future. A sound restore strategy is also important.

In general, the system administrator must weigh performance, capacity, projected duty cycles, and cost factors against the volume of backup information when choosing an appropriate and cost-effective backup technology.

The Compaq 2/4-GB DAT drive and Compaq 4/8-GB SLR Tape Drive are the appropriate tape drives for a small company. These tape drives will meet the capacity and performance requirements of most small business systems. The prices of these tape drives are less than $1,000, placing both drives within the budgetary limitations of most small businesses. These tape drives can backup more than 1-GB/HR using the ARCserve backup technology.

Chapter 6
Mobile User Support

A dial-up modem connection can be used to connect clients and servers to your remote LISP server to exchange information. LISP on Compaq platforms is designed specifically to provide Internet/intranet business applications. Therefore, supporting remote access of the mobile and traveling user may be a requirement when implementing the Lotus Intranet Starter Pack for your business.

In this chapter, remote access capabilities and benefits are discussed. The hardware requirements for supporting dial-up modem connections is explained. Lastly, performance information is provided for a client replicating files of various sizes via a dial-up modem connection. Replication allows users to keep local replicas of databases on their workstations, work on these local databases without a dial-up connection, and then connect to the remote server to exchange new and updated documents with the remote server's database.

Who Benefits from Remote Access Capabilities?

Sales, marketing, engineering, accounting employees and executives on the road will be able to dial-up the server and choose to replicate databases. These databases can be those included in LISP as well as other custom databases such as price lists, product lists, customer information, sale points, and product support lists that have been added to your system. The remote user can also dial-up the server to replicate email and necessary discussion databases.

The time required for replication of databases is dependent upon the remote access performance of the Compaq platforms running LISP. The speed of modem and the communication line are the critical factors for the remote access performance. Most of the mobile users will be connecting via a standard telephone line by using a hotel room phone's data port or perhaps via a mobile phone. While obtaining the best replication transfer time feasible is important, remember that even an older laptop that is equipped with a fairly slow modem can be a tolerable replication client. Replication can be started and left to process unattended so the user could be doing other tasks rather than sitting at the laptop waiting for replication to complete.

Employees will be able to keep up with email and keep track of information on databases that are critical to their job even while on the road. No more wading through hundreds of messages when returning to the office after being away on a week long business trip. If a salesperson who has traveled out of town realizes the company's updated product presentation he planned to use in the first meeting with a key new account has not been transferred to his laptop, the file may be requested via an email message or phone call. The updated presentation may be sent as an attachment to a message, enabling the presentation to be given using the most recent company information and at the originally scheduled time.

Perhaps this same person forgot his daily planner where the customer name, address and phone number information was recorded. Assuming that he had entered this information in the Lotus Intranet Starter Pack's Telephone List application, he could simply dial-up the server and replicate the database to his laptop. The information would be available on-line in a matter of minutes.

What is Required to Provide Remote Access to Mobile Users?

Compaq platforms running LISP require at least one modem on the server to provide remote access capabilities to users. If there are many remote users who may be simultaneously trying to access the server remotely, additional modems may be required. The expense of purchasing more modems can be justified by increased server accessibility.

Modem accessibility can have a direct impact on the productivity of the remote users. If users must attempt to access the server many times until a connection can be successfully established, the full benefit of having remote access capabilities will very likely be overshadowed by the frustration of numerous connection attempts. Additionally, the time being spent unsuccessfully trying to establish a connection could have been used more productively for the good of the business. Thus a balance needs to be reached between the simultaneous remote user demand for connectivity to the server and the supply of modems available to fulfill that demand.

The number of modems required to support the remote users in your business is also dependent upon how efficiently users utilize the remote connection to the server. Encouraging employees to use replication instead of working interactively helps to reduce the amount of time any single user is connected to the server. By shortening the connection time of each user, the likelihood of being denied a connection to the server is slightly lessened.

In addition to modem(s) on the server, the remote user's client desktop, laptop, or workstation must also have a modem to establish a dial-up connection to the server. The speed of the client's modems impacts the performance of the replication process. Once the remote client system establishes a connection with the server, the replication process can be started and the user can perform other tasks until the process completes. However, keep in mind that the longer this remote user is connected to the server, the greater the likelihood that other users will simultaneously attempt to establish a dial-up connection and will be denied dial-up access since the modem is in use.

Performance Testing of Replication via a Dial-up Connection

Remote access performance tests were run to provide some base performance information to customers who will use remote access capabilities to replicate the LISP data, email, and other Lotus databases via a dial-up connection to the server. Compaq ran remote access tests using telephone lines and a single 56K modem connected to the server to simulate a remote user accessing a Compaq ProSignia 200 server.

System Configuration

Lotus Intranet Starter Pack based on Domino Server 4.51 was installed on a Compaq ProSignia 200. The remote client system was loaded with the Lotus Notes 4.51 client. The two systems were configured with a single external US Robotics Sportster 54K Fax/Modem. Compaq made the following changes during setup as recommended by the US Robotics technical support group:

- Compaq used the Courier Everything External provided by NT 4.0. This change was made according to the suggestion of USR technical support group since the driver supplied with the USR 56K External modem did not work with NT4.0.
- LISP and Domino Server did not provide the modem driver for 54K USR Fax/Modem. Therefore Compaq downloaded the driver form Lotus web site at www.lotus.com. Although the driver supported a faster connection speed, the remote access tests were run at 19200 bits per second since this is a fairly common modem transfer rate.

Test Procedure

Compaq tried to simulate the activity of real business remote connections. The test was designed to reveal replication performance information for files of varying sizes. Compaq created files of varying sizes on the server so that they could be replicated to a client. The purpose of replicating files of different sizes was to determine if file size had an unexpected impact on performance. The server was accessed by the client system using the 56K USR External Fax/Modem. Once the two systems were connected via modem, the replication process began. The performance information including the size of the file and the time it took to create the new replica is listed below:

Table 6-1
Test Procedure Performance Information

File Size	Replication Time	KB/Sec
320-KB	1.7 Minutes	3.137
1120-KB	15.4 Minutes	1.212
3584-KB	60.3 Minutes	0.995
32-MB	308.4 Minutes	1.771

To get an idea of how this replication rate and time compares to network performance for replicating the same sized files, the test was run a second time using a network connection on both systems configured with NICs operating at 100 Mbps rather than a dial-up modem connection. The network replication performance information is listed below:

Table 6-2
Network Replication Performance Information

File Size	Time needed	KB/Sec
320-KB	0.1 Minutes	82.667
1120-KB	0.1 Minutes	186.667
3584-KB	0.3 Minutes	199.111
32-MB	1.0 Minutes	546.133

Mobile User Conclusion

According to the results below, Compaq concluded that the replication process via dial-up connection with modems operating at 19200 is a rather slow process. Not too surprising, the smallest files replicated with the fastest transfer rate. The 1120-KB files replication transfer rate dropped fairly proportionately with the relative change in file size. The 1120-KB file size was slightly more than three times the size of the 320-KB file, while the transfer rate was roughly one third the rate of the small file replication process. The 3584-KB and 32-MB file size replication performance results are the most difficult to explain. The 3584-KB file size increased three times over the 1120-KB file size, while the transfer rate dropped by only 20-25%. The 32-MB file replication transfer rate is also difficult to explain. File size increased dramatically over the 3584-KB file, yet the transfer rate actually improved by about 70%.

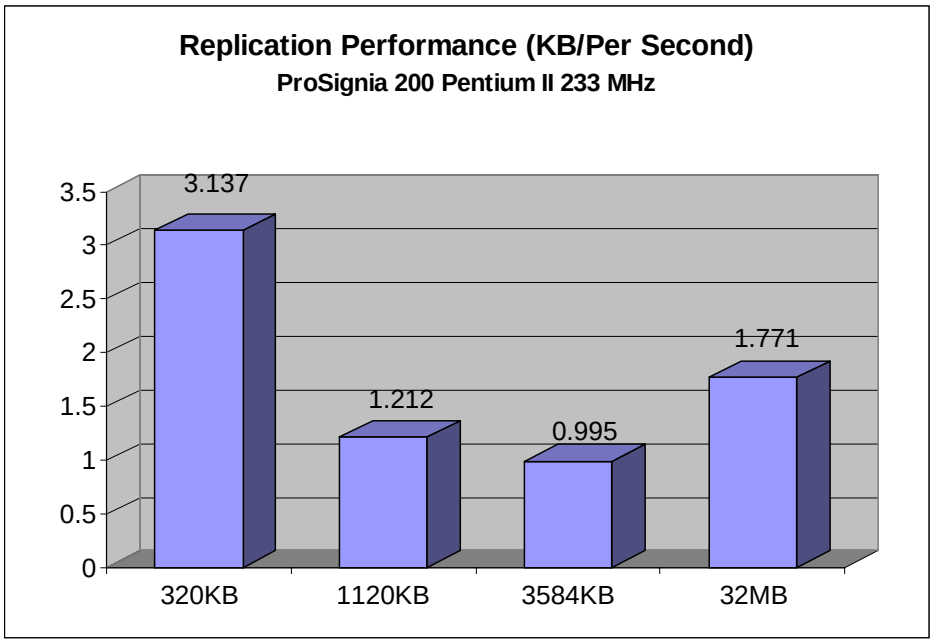

Figure 6-1. Replication Performance (KB/Per Second)

The replication performance test conclusions are that if the mobile user is replicating with the server multiple times throughout the workday, then the fastest modem and access speed that the budget will allow is recommended. On the other hand, for the mobile user who replicates once a day, a slower modem may be acceptable. This once a day replication could be planned to take place at the end of the day or first thing in the morning. This prevents the user from wasting time waiting on the replication process.

The company needs to determine what modem speed is acceptable by weighing the purchase price of a faster modem against the loss of productivity of a valuable employee. Slow modems mean longer connection times with the remote server, and therefore increase the likelihood that another user is trying to dial-up at the exact same time. The second user will be denied access if the server has only one modem. Logs on the server can be monitored to determine the frequency that the server modem is being accessed. A decision to add additional modems can be made once the log demonstrates that an upgrade is required.

Chapter 7
Security Considerations

When implementing Lotus Intranet Starter Pack solution on a Compaq platform, there are security considerations to keep in mind. These security considerations may have minimal direct impact on the end user, but can provide great advantages to protection against intruders jeopardizing systems that contain sensitive information. Protecting the system from security risks by implementing security safeguards should be a top priority.

One of the biggest security risks results from a company either not having a company security policy, or not enforcing an existing security policy. Security risks could come in a variety of forms. Examples of common security risks follow:

- Leaving the system easily accessible to employees and visitors in the office
- Leaving the office or work area while still logged in to the system
- Connecting your system to the Internet without taking necessary precautions against attacks from Internet hackers
- Neglecting to educate employees on the proper use of virus scan utilities

Every company should establish a security policy to help eliminate security risks. This chapter discusses four aspects of security that should be addressed in the company security policy:

- **Physical Security** – control over who has access to the servers
- **Access Security** – control over user accounts and passwords used to access network resources
- **Internet Security** – control over entry to the company network from the Internet and users who access the Internet from the company network
- **Virus Protection Security** – control over detecting and curing computer viruses on the desktops and servers

Physical Security

While physical security may seem to be unnecessary since your business is small and all the employees feel more like a family than co-workers, at least consider taking some physical security measures to prevent potential painful problems from occurring.

Consider the possibility of something happening at your place of business similar to the following scenario:

> Fred, an employee who works out of his home and travels a great deal, stops by the office for a meeting and remembers that he needs to use a computer to check of the status of a sale to an important account. Fred sees a new system sitting on a table behind the receptionist area not currently in use. The receptionist is away from her desk, so Fred helps himself to the system. Seeing an unusual screen on the system which is labeled as a ProSignia 200, Fred decides to use his infinite computer knowledge and uses the most popular end user cure-all for solving a computer problem – reboot or shutdown the system and restart. However, this time the system was running the new intranet applications for the entire business!

By implementing simple physical security measures, the above problem could have been avoided. Place the Compaq platform running LISP in the most secure location possible. Depending upon the business and the office arrangements, this may simply mean locating the system in an empty office that is used for storage or possibly locating it in an oversized storage closet or room (airflow modifications may be required to properly ventilate and cool the closet). Consider the alternatives and place the system in the most secure place.

Circumstances may require that the system be located on a table behind the receptionist area. If this is the case, take other security measures to make the best of the situation. Educate your employees to make them aware that the system is considered hands off except for the person who will be responsible for being the administrator. Consider locking the keyboard and mouse in a drawer if necessary to prevent anyone who has not been informed or a visitor from being tempted to use the system. Lastly, consider labeling the system's monitor so it is clearly marked "DO NOT USE".

Access Security

Someone has explained to the employees that the new Compaq platform running LISP is a friendly system that has built-in security because applications run on top of the Lotus Domino Server software. Domino behind the scenes can actually control the information that employees have access to based on the ID that is used when logging in to the system. The consultant who set the system up was able to set security for the IDs based on the employee job description information provided by the company.

Although the correct steps were taken when setting the system up, system security measures were implemented by the consultant, and explained to the administrator, employees must be educated so that they have a clear understanding of the privileges and responsibilities which are associated with their user ID.

Consider the possibility of something happening at your place of business similar to the following scenario:

> Sam has been selected as the employee responsible for computer operations since he is the most computer literate employee. Sam therefore serves as the Notes Administrator for the new Compaq platform running LISP applications that have recently been implemented. Sam's *real* job is director of the entire European sales organization. Sam sits in an office that is accessible to anyone in route to one of three conference rooms located down the hallway adjacent to his office. Sam, late for a director's staff meeting with the Vice President, hurriedly leaves his desk to attend the weekly morning meeting, but does not log out. Sally is heading for a new employee orientation meeting and realizes that she has forgotten to make an overhead of all of the employees in the sales force as she starts to pass Sam's office. Her meeting is scheduled to start in exactly one minute.

> One of the new intranet applications that have been implemented provides an option for printing employee's reports. Seeing Sam's workstation logged on and actually using the very application she used to print the employee lists for the other departments, Sally hurries over to Sam's computer and quickly goes through the print procedure to produce the sales employees report. She needs an overhead so she dashes to the copier, adds the created overhead to the existing stack of overheads she created for the other departments, and calmly walks into the meeting. Fifteen minutes into her presentation, Sally flips the overhead onto the machine, and begins describing the structure of the sales organization. Sally does not even need to look at the information being projected because she is very familiar with the twenty-eight names listed on report. Perplexed because of the expression on the faces of the new employees, particularly the new-hire to work in sales, Sally glances at the information projected. To her horror, the report has two columns that have never printed when she prints the report from her desk – salary and bonus percentage!
>
> Sally suddenly realizes that this probably happened because she printed from Sam's desk. (Remember that Sam is the director of sales.) No one told her this could happen! However, the damage is done. This highly confidential information was projected before the eyes of six new employees!

The chance of this ugly scene occurring could have been decreased if the employees had been properly educated about the power, privilege, and responsibility that is associated with the user ID for the new intranet applications. Users should secure their workstations in some way when leaving their desk. Depending upon the operating system being used by the employees, access can be controlled in a number of ways. The best and most complete security approach would be to log off when leaving your system. However, this may not always be a reasonable or feasible solution.

Examples of other alternatives follow for Windows 95 and Windows NT users. Windows 95 clients can set a password for the screen save so that after a certain length of time with no activity, the screen save kicks in and prevents unauthorized use of the system. The screen saver password must be supplied to begin to use the system. Windows NT workstation clients should also use the screen saver password to safeguard the desktop when the user walks away.

The power associated with knowing someone else's password should also be discussed with the employees. The computer simply validates the user ID and password association. Employees should therefore not share their user ID and password with one another. The password is the only thing that keeps others from logging into the system as another employee.

For this same reason, employees should select a password that is but can be remembered without writing it down. Examples of good passwords that are easy to remember but somewhat complex include a mixture of alphabetical and numerical characters with a minimum length of at least 8 uppercase and lowercase characters. This type of character combination and minimum length is a requirement that should be considered when creating your company security policy.

Most businesses contract out the nightly or weekly cleaning services. Whose to say that a computer literate cleaning crew manager may not decide to check out your company's intranet when all the employees are at home in bed. If your password is clearly labeled on the computer monitor or easy to crack, this improper and illegal access activity could be logged with your user ID and password!

Internet Security

As the popularity of the World Wide Web continues to rise, more and more business are going to get connected to the Internet. Before connecting your intranet to the Internet, consider implementing a well-managed firewall and make sure that a reasonable network security system is in place. A reasonable network security system is often the result of a good security policy. Implementing a firewall to protect your investment provides protection for attacks from the outside only. Studies show that 60–70% of security compromising attacks come from within the corporate network. Therefore it is important to make sure that other security precautions be taken to protect your data within the company intranet such as the common sense security precautions previously discussed as well as using Domino built-in security features properly.

This discussion will focus on alternatives for protecting the investment you made in your Compaq platform running LISP from outside attacks when connected to the Internet. An overview of basic firewall/proxy concepts and how they can be used with the Lotus Intranet Starter Pack network application is provided. A complete security solution can be quite complex and is beyond the scope of this chapter. This information is intended to help you better understand some of the firewall/proxy alternatives.

What is a Firewall?

A firewall is a standalone process or set of processes that run on a router or server to control the flow of network application traffic passing through. Firewalls are therefore usually placed on the entry point to the public network – in this case the Internet. The firewall functions as a monitor ensuring that all communication between a company's network and the Internet follow the company security policies defined as a set of access rules. These systems are primarily TCP/IP based and can enforce roadblocks as well as provide information to administrators, depending on how the firewall is implemented.

Typically usage and logistical logs generated by the firewall software provides the network administrator information that can help answers some or all of the following questions:

- Who's been accessing the company network?
- What did they access on the company network?
- What did they attempt to access but failed?
- What time of day did the access occur?
- Who was denied access to the company network?

Three Firewall Implementations

Simplifying the firewall topic, there are three types of firewall implementations. The three firewall implementations are:

- **Packet Filtering** – Does not understand the application, cannot proxy at all, can restrict at the network level
- **Application Proxies** – Does understand the application, proxies at the application level
- **Circuit-Level or Generic-Application Proxies** – Does not understand the application, proxies at the network level

Often large companies connecting to the Internet use a combination of the above firewall implementation methods. The intent of combining firewall implementations is to make the overall environment more secure. Packet filtering for instance is very often achieved in the router itself. Application proxies usually run on standalone servers.

Packet Filtering

Packet filtering treats your network data as a package that needs to be delivered to a specific destination. This data package could be part of an email message or a file being transferred. The packet filter leaves control of delivering the package to you with two stipulations. The data must be of a certain type, and you must be going to an allowable destination. While the packet filter looks at where you are going and what you are taking with you similar to a traffic cop, the packet filter does not interpret the data package contents.

Commercial routers usually have some kind of packet filtering capability built-in. Keep in mind though that some routers controlled by Internet Service Providers (ISPs) may not provide the administrators the ability to control the configuration of the router. If this is the case, administrators may choose to use a standalone packet filter behind the router.

With packet filtering, administrators may choose to allow only certain types of traffic to pass through the router. Since all Internet traffic is based on IP (Internet Protocol), each application or package can be identified through a specific TCP (Transmission Control Protocol) or UDP (User Datagram Protocol) port. For example, the default registered TCP port for Lotus Notes is 1352. When a Notes client or server requests a connection to a destination server over IP, the server name, IP address, and the TCP port of 1352 is included.

If a packet filtering device is placed between the two Notes nodes that are trying to communicate, the filter has to allow port 1352 to be passed in the direction of the request. This ease of administration is one of the advantages of using packet filtering with a Notes implementation. No special configuration is required on the server or client.

The disadvantages of using packet filtering for Notes are limited logging and alarming capabilities as well as no single proxy representing all of the Notes nodes. Also packet filtering does not provide protection against TCP or UDP protocols that are inherently insecure.

Application Proxy

The application proxy operates somewhat similar to the packet filtering scenario previously discussed. The application proxy also takes a look at the network package, this time looking inside the packet to confirm the contents. Application proxies do not allow you to deliver the data package yourself. Instead, the application proxy delivers the package if the agent has permission to deliver the contents of the package for you. Thus the name proxy – the agent acts on your behalf to deliver the data package.

Most commercial routers do not have proxy capabilities today. Instead, you must rely on a standalone system that can support application-level proxy services. Since the application proxy must communicate on behalf of the sender, it must understand the specific language or protocols associated with that application. For example, your company could set up an HTTP (HyperText Transfer Protocol) proxy to allow access to the Web from a central server. This single machine understands HTTP conversations and can speak on behalf of the requesting client. This is an example of application-level proxying.

Most application-level firewall packages support simple applications such as FTP, TELNET, HTTP, etc. but may not understand the native Notes network conversation. Native Notes is referring to the proprietary RPCs (Remote Procedure Calls) used by Lotus specifically for the Notes program which are the core of the original Notes functionality. Lotus' new Domino technology allows the server to become an Internet application server by using standard HTTP so any browser can read data published from a Notes server. The data is dynamically converted to HTML format upon request and served to the requesting client.

Domino supports native HTTP, so it can be used with any HTTP proxy server. Domino is a pure Internet server, having the default access port as the well known port 80. Earlier we mentioned ports for the native Notes application being 1352. The Domino interface is accessible via the standard HTTP port 80. When Domino is loaded onto a native Notes server, the native Notes application is available on an existing TCP/IP port defined 1352 while the Domino HTTP access is available by default on port 80. This system would have one IP address, but two port numbers that are related to Domino and Notes.

Thus, if your company already has an HTTP proxy server on the network to host browser clients, a new feature in Notes 4.5 called Notes RPC Proxy allows Notes to negotiate a session through an existing HTTP Proxy server while retaining native Notes communications. The advantage is obviously centralized control over Internet access of native Notes R4.5 clients and servers. Once the session is established from HTTP, a transparent communications channel is opened up on the proxy to allow the nodes to communicate. The proxy needs support for port 1352 as well since the conversation eventually switches to native Notes. This implementation begins at the application level and returns to the packet level once the connection is established.

Circuit-Level or Generic-Application Proxy

The circuit-level proxy is similar to the application-level proxy in that you must rely on someone to deliver the data package for you. The circuit-level proxy differs from an application-level proxy in that if the circuit-level proxy has access to deliver the data package to the requested destination it will. Circuit-level proxies do not need to know what is inside the data package.

Circuit-level proxies, specifically SOCKS, work outside of the application layers of the protocol. These servers allow the client to pass through this centralized service and connect to whatever TCP port the client specifies. SOCKS servers have the ability to authenticate the source address of connection requests and can block unauthorized clients from connecting out onto the Internet. Most TCP-based applications can be made to support SOCKS. SOCKS servers are usually used to provide a generic proxy service for many applications that may not be supported by application-level gateways.

In Notes 4.5, Lotus directly supports the SOCKS 4 standard from within the application. This feature is available for the native Notes client, server and Web Navigator. When implementing a solution that takes advantage of SOCKS support, the following two choices are available:

- The SOCKS Server can function as a Generic-Application Proxy. The Notes client or server can initiate an outbound request directly through the SOCKS server and then through a packet filter onto the Internet.
- Using a Notes Passthru Server with SOCKS is another alternative. The Notes client or server can initiate an outbound request through a Notes Passthru server (that supports SOCKS), through a SOCKS server, and then finally through a packet filter onto the Internet.

The Notes Passthru Server can understand native Notes conversations, maintain all levels of Notes security, and allow nodes of dissimilar protocols to communicate via a single Notes server and access point. Two advantages of the second implementation that uses Passthru are utilizing existing SOCKS proxy servers and centralizing control.

Firewall Conclusion

No single firewall configuration meets the diverse network security requirements of all companies. Thus, Compaq is not recommending any one implementation over another. Rather, some basic firewall implementation information is provided to assist your company system administrator to effectively communicate the company's security needs to a consultant. A sound and secure firewall design can then be created through the joint efforts and cooperation of your company administrator and the security consultant.

Virus Protection Security

As applications on computer systems become major contributors to the daily productivity of employees, maintaining the safety and usability of the data on those systems becomes increasingly critical. An earlier chapter discussed the importance of backing up data to permit restoration of the data if it somehow became lost or corrupted. This chapter focuses on the detection and protection against viruses on your system. Viruses can occur on the client's workstations or on the server. Both servers and workstations should have some type of anti-virus protection software. Many of the major firewall vendors support anti-virus scanners; however, it is extremely important to implement some type of anti-virus protection on the server if the company has not implemented a firewall solution because the corporate network is not yet connected to the Internet. The company should provide a recommendation regarding the implementation of virus scanning utilities for the server as well as for employee desktops as part of the overall company security policy.

Many virus-scanning products are available for the workstation or desktop. The selection of a standard utility for your company systems is highly recommended. A virus that has infected one workstation can be spread throughout the entire company as fast as a raging fire across a field of dry grass.

Organizations demand robust and full feature backup and virus protection tools that are easy to use and manage, without impacting user activities. Many client/server anti-virus solutions can protect users from viruses when documents are detached from messages. However, only the CA anti-virus messaging option completely scans and cures server-based messaging systems such as Lotus Notes.

Additionally, the integration of InocuLAN and ARCserve provides a solution for virus-free backups.'s AntiVirus Agent v. 2.0 for Lotus Notes integrates with CA's InocuLAN to scan and detect viruses in documents attached to email messages and Lotus Notes databases. Infected Lotus Notes attachments can be automatically cured. The users are notified through the host messaging system or through InocuLAN's Alert system.

AntiVirus Agent V2.0 for Lotus Notes

In addition to the existing full and incremental scanning, scheduled scanning and extensive cure and alerting options, the AntiVirus Agent for Lotus Notes now offers the following features:

- **Real-time Scanning and Cure:** Email attachments are automatically scanned at the point of entry into the messaging system. Upon virus detection the file can be cured in real-time, or other actions such as deletion or copy can be configured. The sender, recipient and/or administrator will be notified so that corrective actions can be taken to prevent future transmissions of infected mail.
- **Scanning of shared mail:** Transparently scans messages sent to multiple recipients in a single operation (rather that scanning when each user accesses the message).
- **Scanning of encrypted databases on the Notes Server:** Detects and cures viruses in encrypted databases, including mail databases on the Notes Server.
- **Support for Lotus Notes 4.5:** Supports the latest 4.x release of Lotus Notes/Domino Server.

AntiVirus Agent for Lotus Notes tested on a Compaq ProSignia 200 server noted an insignificant impact on system resources when comparing a system running the AntiVirus Agent for Lotus Notes to the same system not running the agent. The recommendation is clearly to implement a virus protection program for your servers and client workstations. AntiVirus Agent for Lotus Notes provides a full range of features along with sound protection from all known viruses.

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