COMMUNIQUÉ

CONTENTS

Performance of Domino Partition Server on the Compaq ProLiant 7000

EXECUTIVE OVERVIEW

The use of the Domino R4.5's advanced server feature, partitioned server, made available with the Domino Advanced Server license, enabled Domino running on a four processor Compaq ProLiant server, running Microsoft NT as the operating system, to fully utilize the processing power of all four processors for the first time. The Domino partitioned server is an advanced server feature that enables multiple Domino server sessions to run on a single computer. In other words, one physical computer may have two or more instances of Domino Server running simultaneously.

Using four partitions (or instances) of Domino on a single Compaq ProLiant 7000 system, a NotesBench Mail workload test supported 5,150 Mail users. This NotesBench 5,150 Mail User result is the first certified result to stand on the NotesBench Consortium web site.

The Mail workload test simulating 5,150 mail users ran a total of 10 hours and 30 minutes during which the system under test achieved 6,766 NotesMark (transactions per minute or tpm) with an average response time of 0.890 seconds. The test ran for 7 hours after all 5,150 users were running against the four Domino partitions on the ProLiant 7000. Based on these results, the price/performance ratio is $13.22/NotesMark (or $17.37/user).

This paper provides information about Domino Partition Server, describes the test setup including the system under test configuration and the NotesBench environment, and presents the performance results for the 5,150 Mail user test including system resource utilization information.

CONCLUSION

Configuring four partitions (or instances) of Domino Server on the Compaq ProLiant 7000, running Microsoft NT 4.0, enabled an unprecedented 5,150 Mail users to be supported at a sub-second response time on any Intel platform. The significant finding of the partition server testing was the major improvement in the ability to use additional processors to help scale the number of users supported. This Domino four partition configuration implementation was able to efficiently use all four Compaq ProLiant 7000 Pentium Pro processors. The multiple instances of Domino were able to utilize the processing power of all processors to scale the number of supported users up to 5,150. With the normal single instance implementation of Domino server, the good processor scalability had been limited to two processors providing a maximum return on dollars invested on the additional processor. A third processor typically provided marginal scaling in the number of users supported, and thus less of a return on the third processor investment. Enterprise customers wanting to scale the number of Domino users supported on a single box should consider a partition server implementation.

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NOTICE

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Performance of Domino Partition Server on the Compaq ProLiant 7000
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WHAT IS DOMINO PARTITIONED SERVER?

The Domino partitioned server is an advanced server feature that enables multiple Domino server sessions to run on a single computer. In other words, one physical computer may have two or more instances of Domino Server running simultaneously. Running a partitioned server requires a Lotus Domino Advanced Server license. Lotus Domino Release 4.5 supports partitioned servers on Windows NT and UNIX operating systems.

There are several advantages of partitioning a single computer into separate Domino servers. Partitioned server features provide the following capabilities:

- Full Domino security for users of partitioned servers

- Reduced number of computers to own and administer in order to support independent groups of users

- Easy migration from partitioned servers to individual servers

Partitioned servers may provide the scalability and security needed for an enterprise Notes system. The use of partitioned servers provides administrators a way to give independent groups of users their own private Notes domain on a shared computer. At the same time, the administrator can reduce the number of computers relative to the number of supported users. As the Notes system grows, users can be migrated from partitioned servers to individual servers if necessary.

Domino 4.5 documentation states support for up to six partitioned servers on a single computer. The number of partitioned servers installed depends on user requirements and on the ability of a computer to run more than one Domino server. The Lotus Domino Install Guide for Servers describes the requirements for a Domino partitioned server.

Partitioned servers on the same computer can belong to different Notes domains. If user requirements include high availability of Notes databases, a server can also be a member of a cluster. Domino server clustering is outside the scope of this paper, and will not be discussed.

Lotus recommendations concerning partitioned server include carefully planning the naming scheme you use and if possible, avoiding a server name change after you install. When you use the TCP/IP protocol and choose to assign a unique IP address to each partitioned server, Lotus recommends that you use the computer host name as the name of each partitioned server. In general, choose names that are easy to associate with specific servers, for example, names of departments or customers. Anyone performing an administrative task should be able to immediately distinguish one partitioned server from another.

When installing a partitioned server for the first time, a name must be specified for the program directory, which defaults to *Notes*, and the data directory, which defaults to *Data*. Domino partitioned servers use different Notes data directories and NOTES.INI files. The second installation of partitioned server on the same computer requires naming the data directory only. The same program directory is used by both partitions. Domino will increment the data directory name specified during the initial install. For example, if the default data directory name *Data* was accepted during the initial installation of partitioned server, the second install of partitioned server will default to *Data2*. The data directory entry can be edited and changed to another name if the default is not desired.

During Notes Setup, a unique partition number process is automatically assigned to each partitioned server. The partition number will be between 1 and 99. This partition number guarantees separate system resources for each partitioned server installed. Each partitioned server has its own administrative client that uses the same partition number used by its corresponding partitioned server, sharing its system resources and Notes data directory. For instance, *Client1* will be used for administration for *Server1*. On Windows NT systems, one administrative client can be run at a time on a single computer. The SHOW SERVER command will display a server's partition number.

*For additional configuration information, see the Lotus Domino Install Guide for Serve*rs.

Each partitioned server instance operates completely independently of the others even though residing on the same computer. If one partitioned server on a computer shuts down or encounters a fatal error, the other partitioned server instances that run on the same computer are not affected. If one server shuts down, the others continue to run. If a partitioned server encounters a fatal error, an automatic cleanup procedure allows the server to restart without having to shutdown and restart the entire computer operating system.

Performance Test Setup

**SYSTEM UNDER TEST
PL7000**

Client
Drivers

Destination
Server

Parent Driver

Client Drivers

Destination
Server

Parent
Driver

Parent Driver

Destination Server

Client
Drivers

Parent
Driver

Destination
Server

Client Drivers
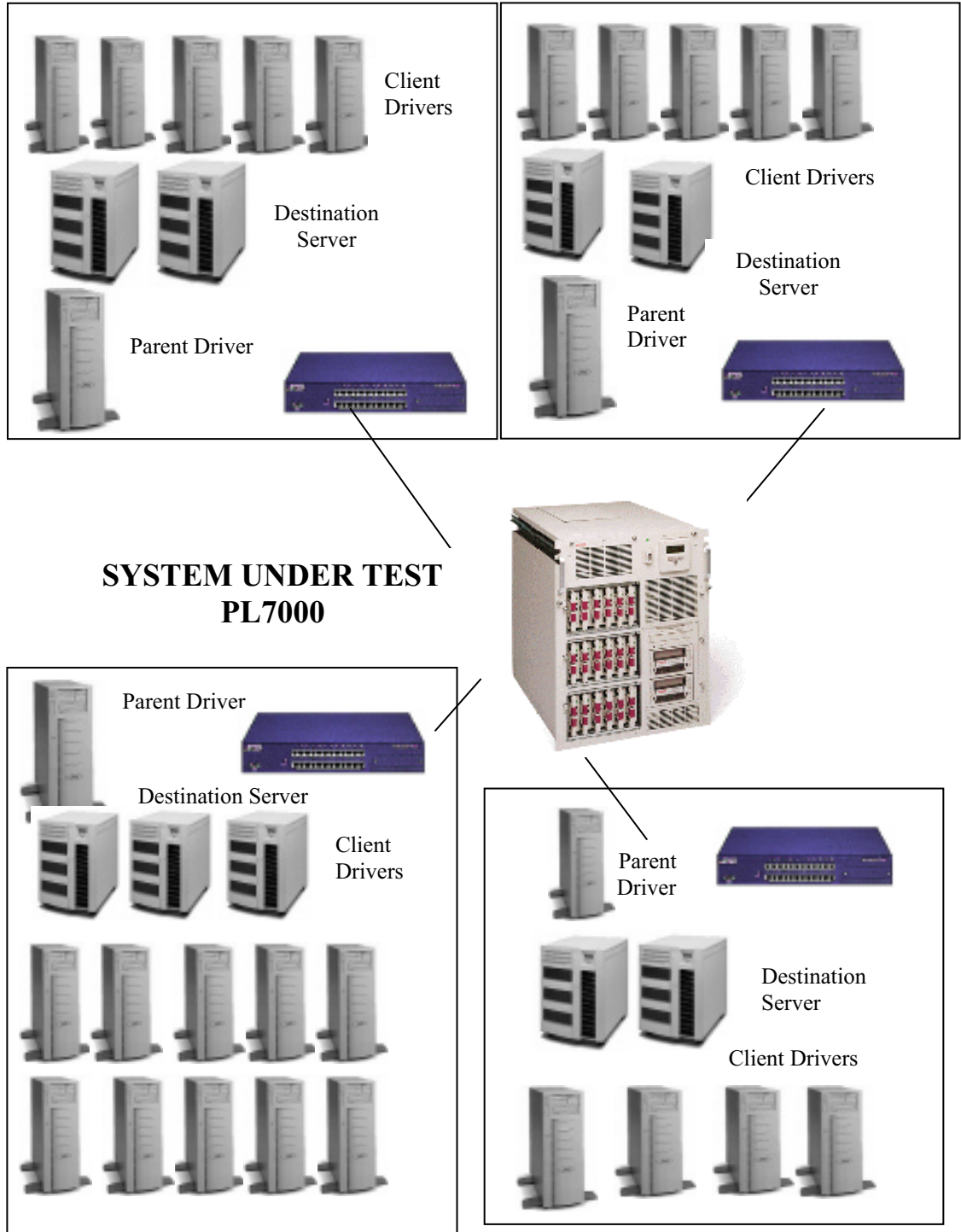
SYSTEM UNDER TEST CONFIGURATION

ProLiant 7000

4xP6/200MHz – 1-MB L2 cache

1536-MB Memory

1x2.1-GB System Volume, & paging File NTFS (C:)

7x2.1-GB Data Volume, NTFS RAID 0 (E:) [Drives in external cabinet]

6x2.1-GB Data Volume, NTFS RAID 0 (F:)

6x2.1-GB Data Volume, NTFS RAID 0 (G:)

5x2.1-GB Data Volume, NTFS RAID 0 (H:)

Four 100 Mb/s NICs

NotesBench Test Configuration

The test was set up to measure the performance of Domino Server 4.51 Partitioned Server capabilities. The ProLiant 7000 was configured with four partitions or instances of Domino Server. This implementation of Domino Partitioned Server uses a single domain model representative of a corporation with 6,300 employees in one Name and Address Book. The tests measured the performance of 5,150 employees participating in Mail-related activities simultaneously connected to the Domino Server. Running the NotesBench Mail workload against each of the four Domino partitions generated the Mail activity. This NotesBench testing required four NotesBench testbeds, which operated on four network segments. Each of the four NotesBench testbeds consisted of a parent system, child driver systems, a Domino partition on the system under test, and destination servers used to generate the Mail workload against each Domino partition.

The system under test was a ProLiant 7000, configured with four Pentium Pro 200 MHz processors with a 1-MB L2 cache and 1536-MB of RAM. The Compaq ProLiant 7000 is a standards-based server, delivering superior performance, breakthrough high-availability, and unparalleled growth opportunities for 7x24 environments. The ProLiant 7000 offers 1 to 4 Pentium Pro® Processors with a planned upgrade to Intel's next generation processor technology and 8 processors. Combined with the latest high-availability features, including PCI Hot Plug, the ProLiant 7000 offers superior investment protection for your most demanding business-critical applications.

Testing was performed to determine the performance impact on the underlying computer resources of this advanced server feature and to verify proper operation of the partitioned server feature on Compaq hardware.

NotesBench was the tool used to help determine the performance impact of running four partitioned server instances on a single ProLiant 7000 system. The ProLiant 7000 was configured with four Pentium Pro 200 MHz 1-MB cache processors, 1536-MB RAM, 4 Smart-2DH controllers, 18 internal and 7 external drives (configured in 4 RAID 0 data arrays), and 4 network controllers. All internal drives were Wide-Ultra drives. The seven external drives used were Fast-SCSI 2 drives. One NIC connected the first Domino Server partition to segment one Parent, Child, and Destination servers. Each of the remaining NICs connected a Domino Server partition to segments two through four Parent, Child and Destination servers.

PARTITIONED SERVER PERFORMANCE RESULTS

By using the Domino Advanced Server Partitioned Server feature, Compaq engineers were able to obtain the highest number of NotesBench Mail workload users supported on a single system to date – 5,150. The Partitioned Server feature also demonstrated the most effective use of four processors in a single Compaq NT system running Domino to date. Previous processor scalability testing performed with systems running single instances of Domino showed that the customer received good scalability, ranging from 30-50 percent, when upgrading from one processor to two. Satisfactory scalability, ranging from 15-30 percent, was observed when upgrading from two processors to three. After three processors, scalability drastically flattens out, ranging from 0-10 percent when upgrading from three processors to four.

Through the use of partitioned server features, the scalability of the same exact hardware configuration can be drastically improved over the same system running a single instance of Domino. The following section provides performance results and system utilization information gathered when running the partitioned server NotesBench tests.
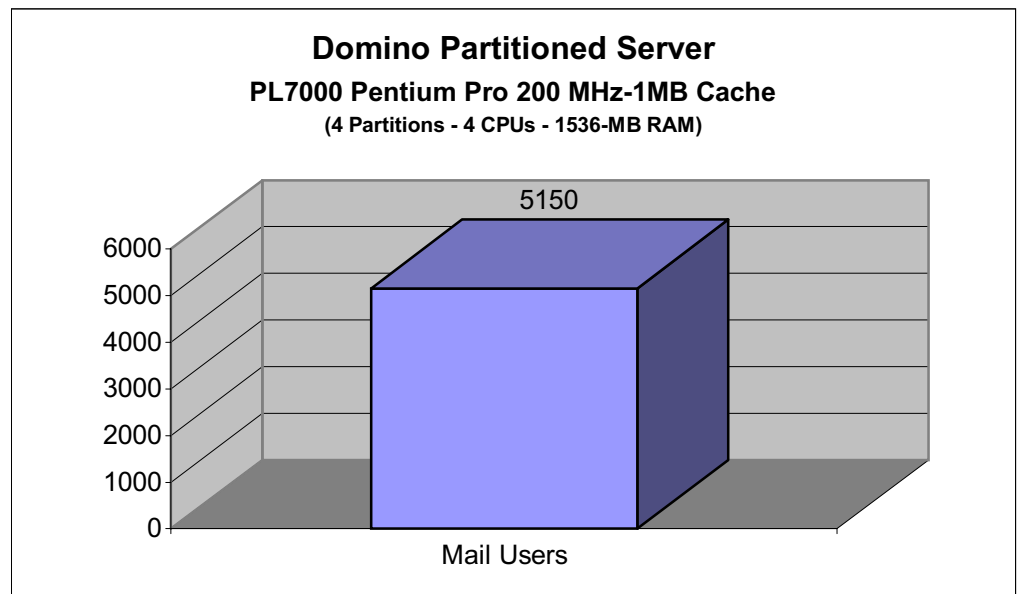

Figure 1-1. *Lotus NotesMark (transactions per minute or tpm) Values for Benchmarked Configurations*

.This partitioned server result can be attributed to several hardware changes made when running this partitioned server test. The hardware enhancements that were used for this test include the following:

- New Compaq Processor Upgrade Kit providing the Intel Pentium Pro 200 MHz processor which utilizes a 1-MB L2 cache

- New Compaq Smart-2DH Array Controller that supports Wide-Ultra SCSI data transfer rates

- New Compaq Smart-2DH Controller Array Accelerator provides 16-MB of onboard cache (as compared to 4-MB of onboard cache available with the Smart-2/P Controller Array Accelerator)

- Wide-Ultra SCSI drives for all but one drive array on the system under test.

The partitioned server NotesBench performance test result supported the 5,150 Mail users with a favorable response time of .89 seconds. This can be attributed to the optimal combination of performance tuned hardware components and the Domino Partitioned Server software. The

combined performance impact is evident by this performance test result. Additional NotesBench performance testing is planned for the ProLiant 7000. Future NotesBench testing will also help determine the individual performance contribution of each of the hardware enhancements previously listed.
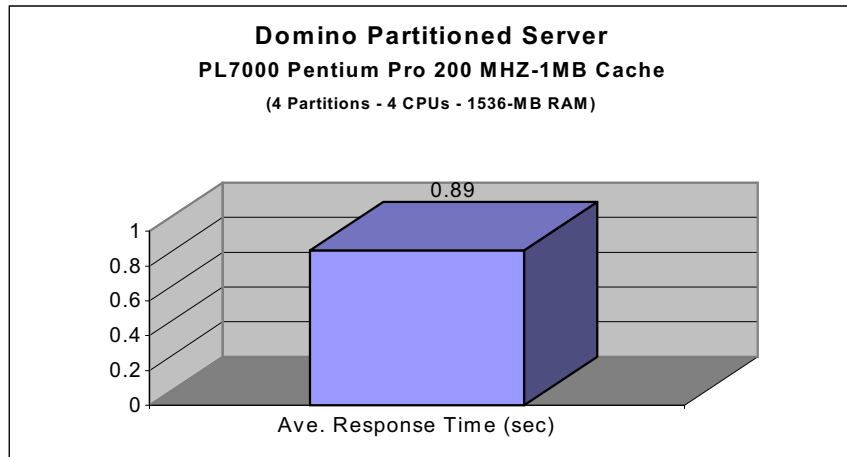
Domino Partitioned Server
PL7000 Pentium Pro 200 MHZ-1MB Cache
(4 Partitions - 4 CPUs - 1536-MB RAM)

0.89

Ave. Response Time (sec)

Figure 1-2. *Lotus Average Response Time Value for 5,150 Mail Users*

Domino Partitioned Server
PL7000 Pentium Pro 200 MHz-1MB
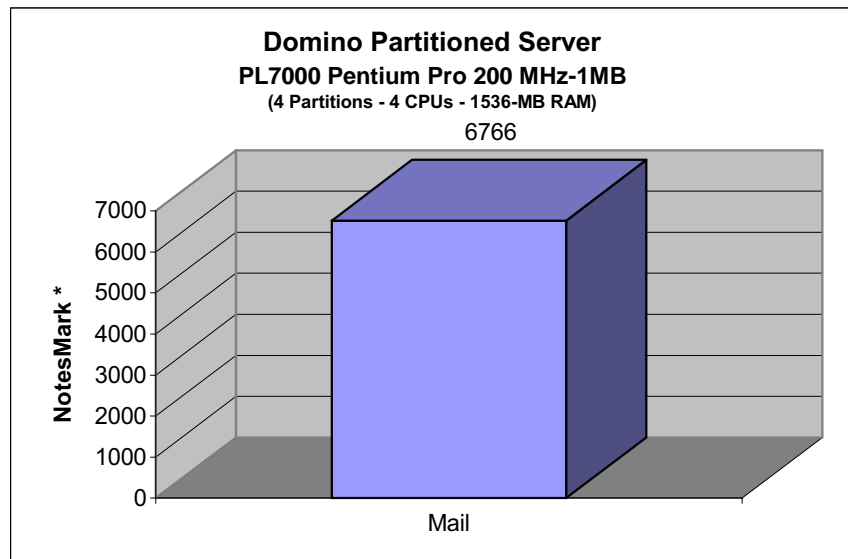**(4 Partitions - 4 CPUs - 1536-MB RAM)**

6766

NotesMark *

Mail

Figure 1-3. *Lotus NotesMark (tpm) Values for Benchmarked Configurations*

The price performance ratio information for the ProLiant 7000 supporting 5,150 users is found below:

Mail Workload	6,766 NotesMark (tpm)	Price/Performance for System Throughput:	$13.22/NotesMark
	5,150 Users	Price/Performance for System Capacity:	$17.37/user

Processor (CPU) Utilization

As previously mentioned, prior testing performed with multi-processor systems demonstrated that the customer should expect to realize a nice return on the investment of a second processor from a price/performance perspective. In other words, the Domino and Notes user loads could be increased by roughly 30-50% depending on the type of activity being placed on the server. When upgrading from two processors to three, the user loads could be increased by 15-30%. Previous NotesBench testing showed that configuring a system with four processors to support Domino/Notes running under NT provided results illustrating that the scalability flattened out to a range between 0 and 10%. Domino/Notes running under Microsoft NT 4.0 did not efficiently utilize the fourth processor in a single instance configuration. However, when running the partitioned server tests, the four processors were very efficiently utilized as is illustrated by the following Performance Monitor statistics.

The following Performance Monitor charts shows the resource utilization of the system under test during ramp-up and after achieving a steady state supporting a NotesBench workload of 5,150 Mail Users. The system was configured with 1536-MB memory and 4xP6/200MHz CPU with 1-MB L2 Cache.
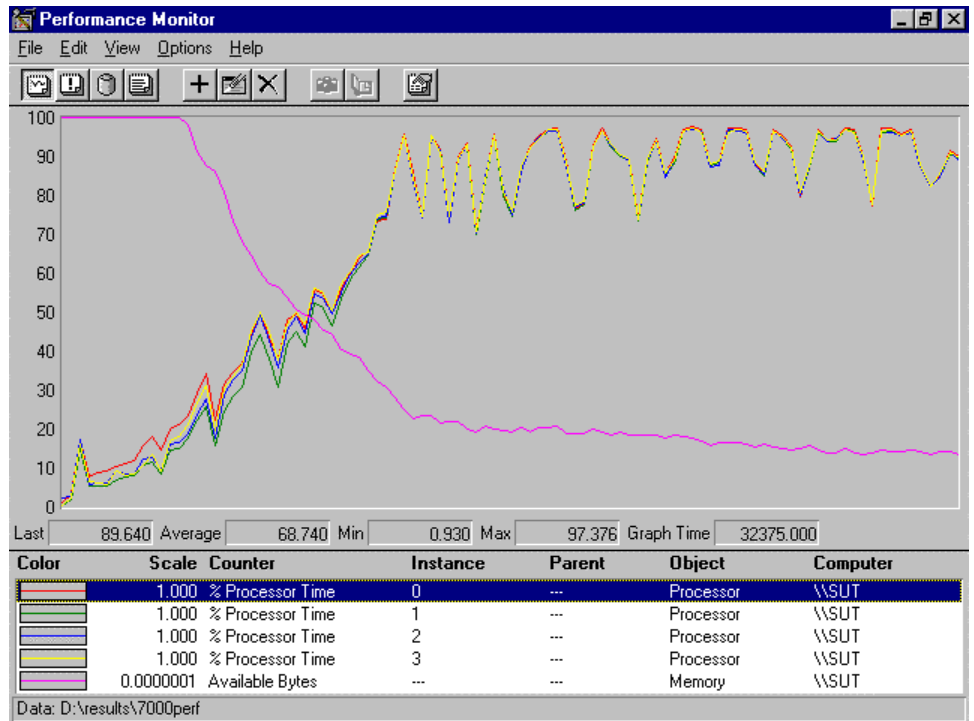

Figure 1-4. *Performance Monitor – First Processor Utilization rate results of Partitioned Server 5,150 Mail Users*

Notice that Microsoft NT uses the four processors almost identically as is expected. Processor 0 had the highest average CPU utilization rate at 68.7% with the lowest average utilization rate on Processor 1 at 66.8%. The overall system average processor utilization rate for the test was 67.8% during the ramp-up period when all simulated users were connecting to the system under test and during the steady-state time after all 5,150 user connections were established.
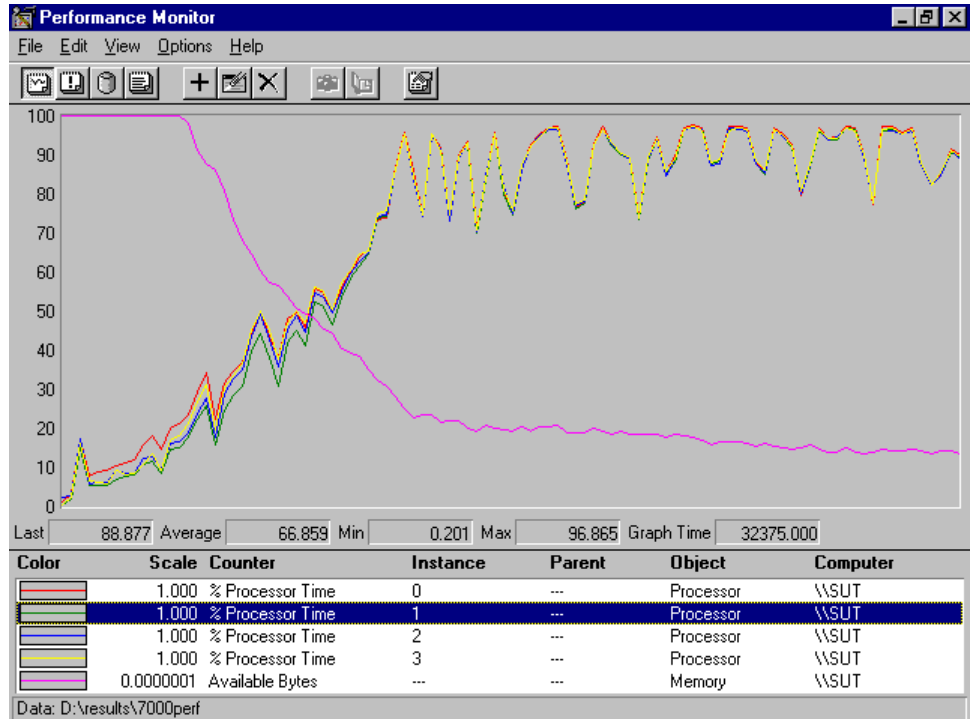

Figure 1-5. *Performance Monitor – Second Processor Utilization rate results of Partitioned   Server 5,150 Mail Users*

The overall maximum processor utilization rate (% Total Processor Time) during ramp-up was 96% as illustrated by the following Performance Monitor chart. The overall average processor utilization rate was 67.8% during this nine-hour period of the ramp-up and steady-state time of the test run.
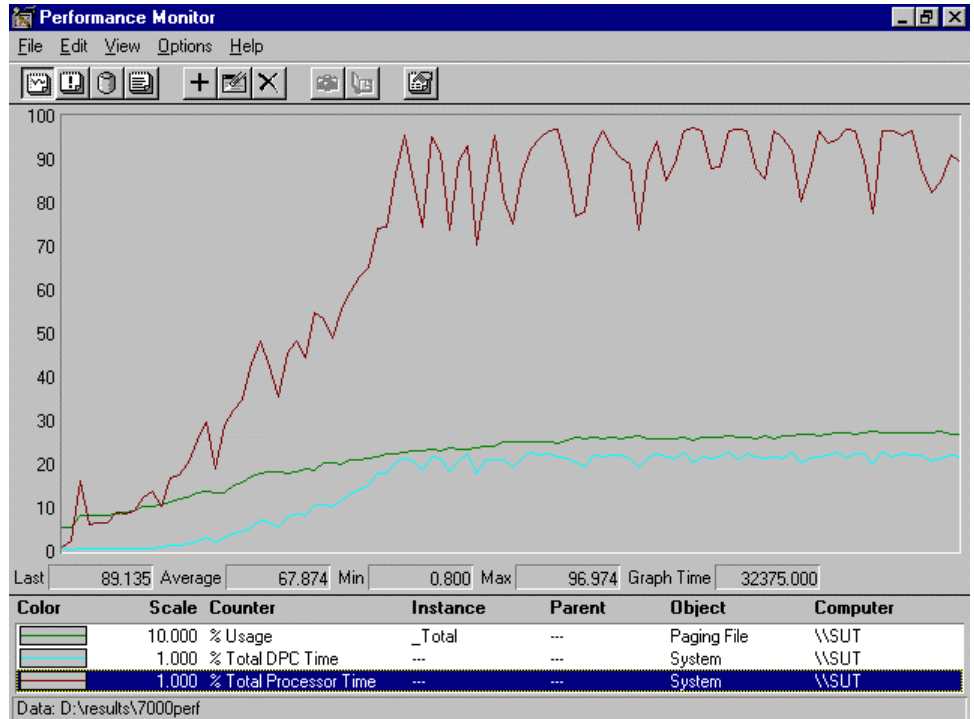

Figure 1-6. *Performance Monitor – Overall System Processor Utilization rate results of Partitioned Server 5,150 Mail Users*

During the ramp-up time, as illustrated previously, the system's processor utilization went as high as 96% and continued to be stressed until all the users were connected to the server. The CPU utilization is shown climbing to 96% as all simulated user connections are established. The CPU subsystem utilization then dropped off and settled into a lower, steady rate of utilization averaging 89% during the remainder of the test. The previously mentioned overall average utilization rate of 67.8% includes the ramp-up time period while the steady state average utilization rate of 89% includes only the time period after all simulated users are connected to the system under test.

Memory Utilization

The available memory Performance Monitor statistic was observed as well as the processor utilization rate. The memory configuration for this 5,150 Mail user partitioned server test was 1536-MB.
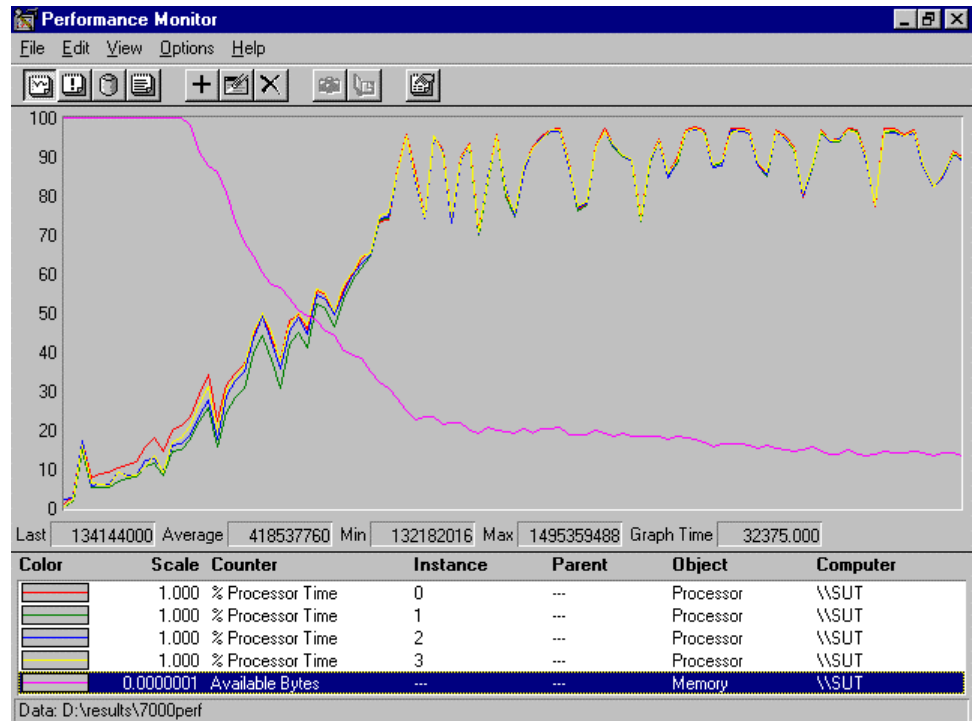

Figure 1-7. *Performance Monitor available memory results of Partitioned Server 5,150 Mail Users during ramp-up and steady state*

The available memory Performance Monitor statistic was observed as well as the processor utilization rate. The minimum available memory during the ramp-up and steady-state period of the test run was approximately 126-MB of RAM. While this implies that less memory could have been used to support this number of users, attempts to run this workload with 1024-MB of RAM resulted in unsuccessful test runs resulting in errors. When configured with 1024-MB of RAM, the errors were due to the simulated client requests not being handled in a reasonable amount of time. NotesBench will report errors if this client response time exceeds five seconds. Memory was increased to 1536-MB to eliminate this response time problem.

Disk Subsystem

The Performance Monitor counter, current disk queue length, was used to observe the impact of the disk subsystem on the performance of the overall test. The system was configured with 4 Smart-2DH controllers, 18 internal and 7 external drives (configured in 4 RAID 0 data arrays). All internal drives were Wide-Ultra drives. The seven external drives used were Fast-SCSI 2 drives.
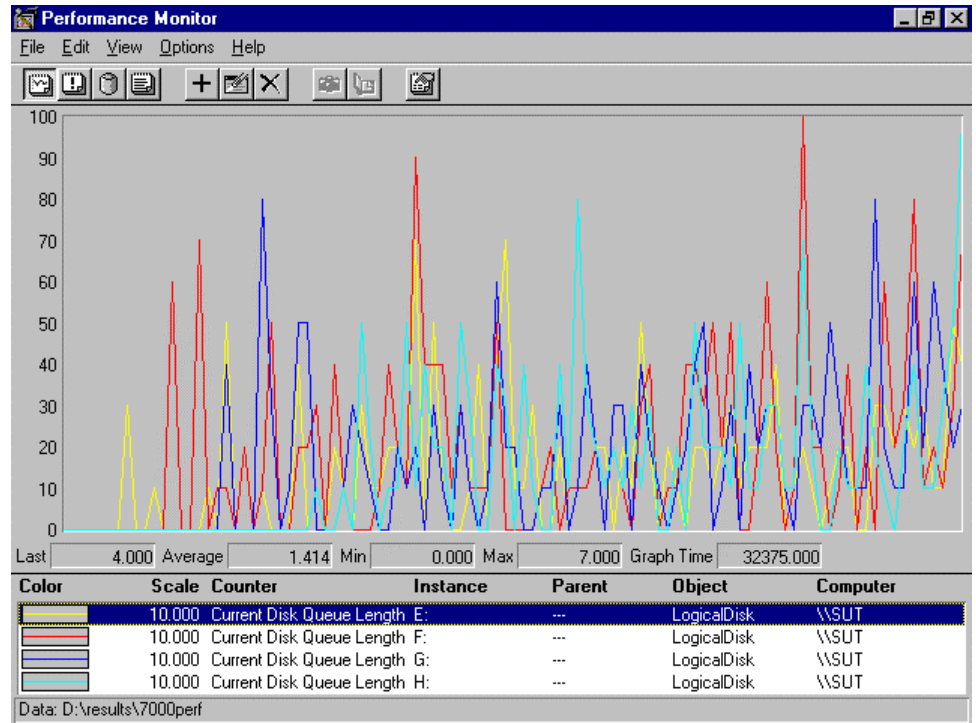
Figure 1-8. *Performance Monitor disk utilization results of Partitioned Server 5,150 Mail Users*

As the counter name, Current Disk Queue Length, implies, the length of the queue waiting to be handled by the disk subsystem is monitored. Logically, a low disk queue length is desired since a shorter disk queue can be interpreted as the system's ability to most efficiently handle the disk operations. The disk queue length for all drive arrays is very similar with the external drive array utilizing Fast SCSI-2 drives lagging the internal drives slightly from a performance perspective. Wide-Ultra drives are recommended over the Fast SCSI-2 drives.

Overall System Utilization

The two following Performance Monitor charts show the resource usage of the system under test during ramp-up and after achieving a steady state supporting a NotesBench workload of 5,150 Mail Users. The system was configured with 1536-MB memory and 4xP6/200MHz CPU with 1-MB L2 Cache.

The first Performance Monitor chart that follows is illustrating the system utilization during the ramp-up period of the test run. During the ramp-up time, as previously mentioned, the system's processor utilization went as high as 96% and continued to be stressed until all the users were connected to the server. The processor utilization rate (% Total Processor Time) is represented by the solid line in the following Performance Monitor chart. The available memory (Available Bytes) is represented by the line made up of long dashes. Available memory is shown to be decreasing steadily as the system ramps up. The short dash line illustrates total disk queue length.
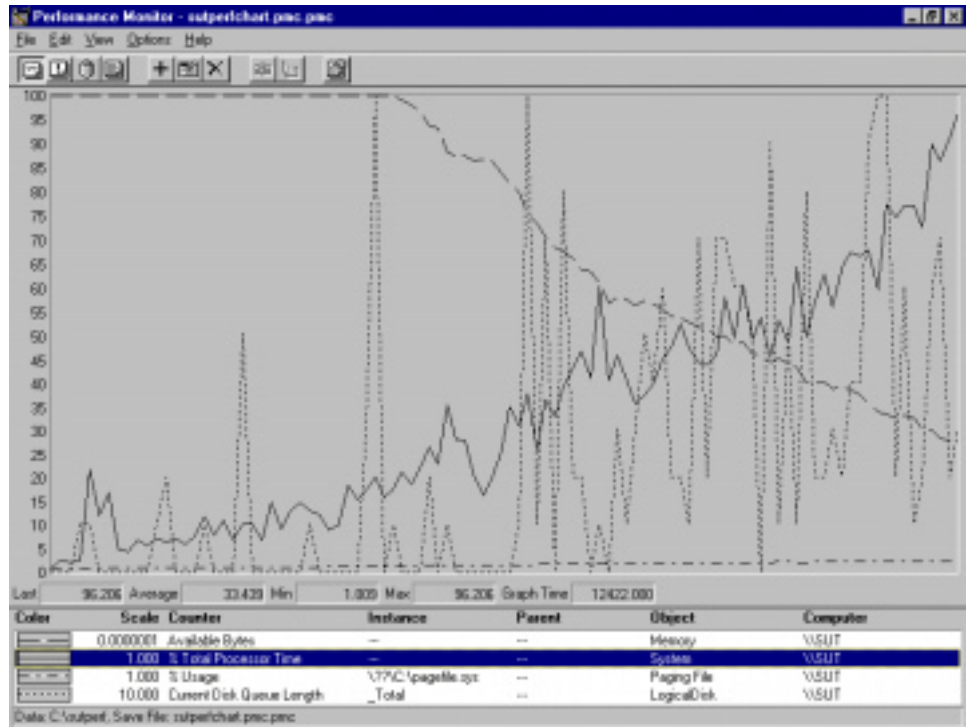
Figure 1-9. *Performance Monitor results of Partitioned Server 5,150 Mail Users during ramp-up*

This second Performance Monitor chart is illustrating the system utilization during the steady-state period of the test run after all simulated users were connected to the system under test.

The CPU utilization rate (% Total Processor Time) is again represented by the solid line at the top of the Performance Monitor chart. Processor utilization climbed to a high of 96% as all simulated user connections were established. The processor subsystem utilization then dropped off and settled into a lower, steady rate of utilization averaging 89% during the remainder of the test.

The available memory (Available Bytes) is again represented by the line made up of long dashes. Available memory is shown to have leveled off to a satisfactory level during the steady-state period of the test run. The short dash line illustrates total disk queue length.
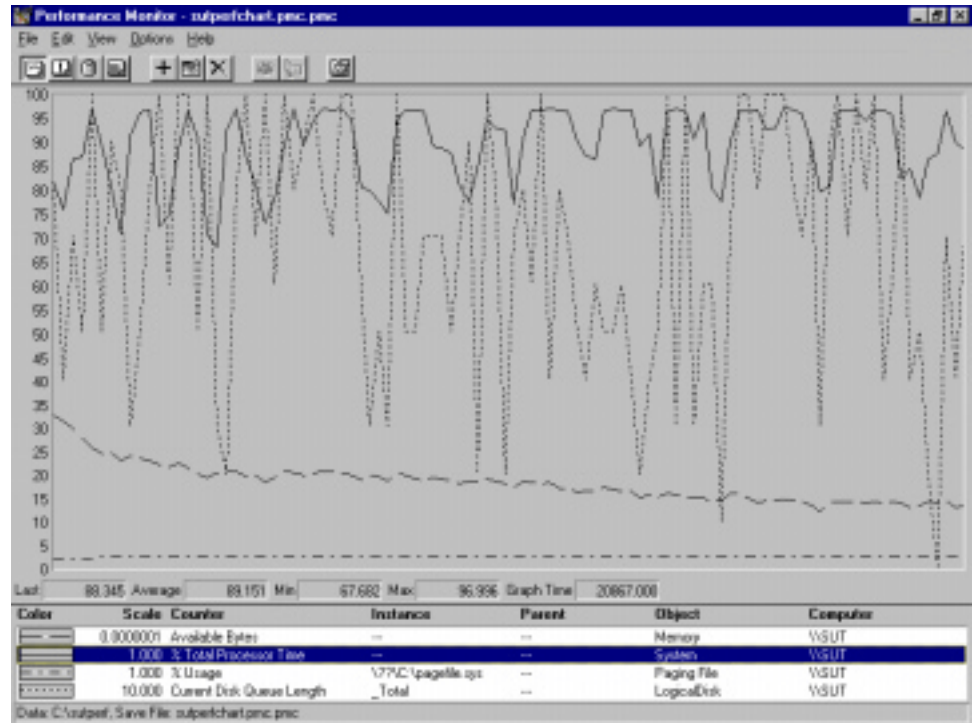
Figure 1-10*. Performance Monitor results of Partitioned Server 5,150 Mail Users*

S<small>UMMARY</small>

The use of the Domino R4.5's advanced server feature, partitioned server, made available with the Domino Advanced Server license, enabled a four processor Compaq ProLiant server running Microsoft NT as the operating system to fully utilize the processing power of all four processors for the first time.   Using four partitions (or instances) of Domino on a single Compaq ProLiant 7000 system, a NotesBench Mail workload test supported 5,150 Mail users. This NotesBench 5,150 Mail User result is the first certified result to stand on the NotesBench Consortium web site. This is also the highest published NotesBench Mail result ever for the Intel processor platform.

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