

**NotesBench Disclosure Report**  
**for**  
**IBM PC Server 704**  
**with**  
**Lotus Domino Server 4.51 for Windows NT 4.0**

**Audited July 14, 1997**

**IBM Corporation**



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# NotesBench Disclosure Report

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## Executive Summary

This report documents the results of performance measurements made using NotesBench for Lotus Domino Server Release 4.51 with the IBM PC Server 704, running Lotus Domino Server Release 4.51 on Microsoft Windows NT Server Version 4.0 with Service Pack 3. The results for the IBM PC Server 704 are based on two NotesBench workloads: Mail-only and Mail and Shared Database (MailDB), which were run on a single configuration.

Test Script	Maximum Users	NotesMark (tpm)	Ave. Response Time (sec)	\$/User	\$/NotesMark
Mail-Only	3,300	4,331	0.875	\$16.28	\$12.41
MailDB	2,300	5,242	2.008	\$23.36	\$10.25

The system measured was an IBM PC Server 704, configured with three 200MHz<sup>1</sup> Intel\*\* Pentium\*\* Pro processors, 1GB of memory, and twelve 4.51GB hard disk drives. The PC Server 704 supported a Mail-only workload of 3,300 active mail users and a workload of 2,300 active MailDB users (see price/performance results<sup>2</sup> in Table 1).

In addition to the IBM PC Server 704 system under test (SUT), the benchmarked configuration used three destination servers, 13 client driver systems for mail and 12 client driver systems for MailDB, and one controller system. All systems were connected on a single 100Mbps Ethernet LAN segment, using the TCP/IP network protocol. For detailed configuration information, see Appendix A: Overall Test Setup and Software Versions.

The PC Server Performance Laboratory in the IBM PC Company conducted the benchmark in June, and KMDS Technical Associates, Inc., audited the results in July.

NotesBench provides an objective method for evaluating the performance of different platforms running Lotus Domino Server Release 4.51. NotesBench generates a transactions-per-minute (tpm) throughput metric, called a NotesMark, for each test, along with a value for the maximum capacity (number of users) supported, and the average response time.

## Benchmarking Objectives

The benchmark objective was to provide customers with information on the number of Lotus Domino Server Release 4.51 Mail-only and MailDB users supported on the IBM PC Server 704 system with three 200MHz Pentium Pro processors. Performance measurements on IBM PC Servers using NotesBench for the Domino Server Release 4.x are ongoing.

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<sup>1</sup> MHz denotes the internal clock speed of the microprocessor; other factors also affect application speed.

<sup>2</sup> The price/performance ratio is based on IBM's Estimated Reseller prices. IBM resellers set their own prices.

## Test Methodologies

### *Test Setup and Hardware/Software Configuration*

The IBM PC Server 704 system under test used three 200MHz Pentium Pro processors (512KB of L2 write-back cache per processor); 1GB of memory; twelve 4.51GB<sup>3</sup> Wide Ultra SCSI hard disk drives configured as a RAID-0 array, using an IBM PC ServeRAID SCSI Adapter; and one IBM 100/10 Ethernet PCI Adapter. The IBM PC Server 704 system under test ran Microsoft Windows NT Server Version 4.0 with Service Pack 3 and Domino Server Release 4.51. For these tests, a single 100Mbps Ethernet LAN segment was used. The system under test, the destination servers, and the driver systems were connected to the LAN by two Bay Networks BayStack 201 100BaseT Hubs.

For the PC Server 704 (SUT), the following Power-on Setup parameters were changed from their default settings:

- IOQ Depth = 8
- Outbound Posting = Enable
- Address Bit Permitting = Enable

The RAID controller configuration value for Stripe Unit Size was set at 16KB.

The following NOTES.INI parameters were modified as recommended in the NotesBench operator's manual:

<b>Mail-Only Workload</b>	<b>MailDB Workload</b>
LOG_MAILROUTING=10	LOG_MAILROUTING=10
MAILLOGTOEVENTSONLY=1	MAILLOGTOEVENTSONLY=1
MAILUSEPROCESS=0	MAILUSEPROCESS=0
MAILUSETHREADS=1	MAILUSETHREADS=1
MAILMAXTHREADS=3	MAILMAXTHREADS=3
SERVER_SHOW_PERFORMANCE=1	SERVER_SHOW_PERFORMANCE=1

The following parameters were added to suppress database activity logging after long runs and to capture server console output:

```
NO_FORCE_ACTIVITY_LOGGING=1
DEBUG_OUTFILE=D:\SUTDATA\SUTINFO
```

All Notes server tasks were disabled except Replica, Router and Update.

All Domino data files were located on the E - partition, which was formatted with an Allocation Unit Size of 512 bytes. The Domino executables were placed on the C - partition.

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<sup>3</sup> When referring to hard drive capacity, GB stands for one thousand million bytes. Total user-accessible capacity may vary depending on operating environments.

## ***Test Procedures***

Several trial test runs were conducted and system resource utilization was monitored using Windows NT Performance Monitor (PERFMON). This enabled us to optimize the system configuration while maximizing balanced system resources. We let the number of processors in the system determine our memory subsystem and disk subsystem configurations. To maximize memory performance, we selected from specific memory size increments. Smaller memory sizes may support the maximum number of users achieved, albeit at lower overall system performance. Audited runs were conducted with no performance monitoring to avoid the performance penalty incurred in the use of the system performance monitor.

The number of users was distributed over 13 clients for Mail and 12 clients for MailDB. Each client added 100 to 260 users to the system under test. The first client to be started added the most users. Subsequent clients added users at the interval of 4 to 10 minutes apart, adding progressively fewer users to the system under test. All users were connected to the system under test in 77 minutes or less. The tests were run continuously for a total duration of about 8-1/2 hours.

For both the Mail and MailDB test, users were added in a manner that simulated the staggered connection schedule of a real-world environment. In both tests, the system under test ran for an extended period of about 8-1/2 hours. During the test runs, the tools used to determine steady state included the Notes Server SHOW command, the child driver RES files, and Domino Server statistics output to the server console on a minute-by-minute basis. To confirm steady state, we verified the number of users, the number of transactions per minute, and the mail-routing log at the SUT. We confirmed steady state when the:

- Number of users on the SUT Notes Server console did not drop below the number of connected users
- Pending mail did not become backlogged, as seen from the mail-routing log at the SUT.

To ensure that the test results were reproducible, all tests were repeated, and the results were compared for consistency.

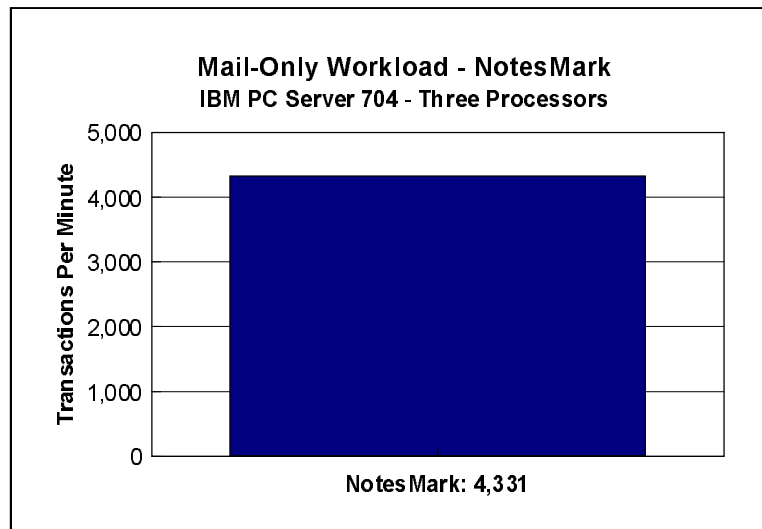
## ***Other NotesBench Tests***

Other Lotus NotesBench tests, such as WebWalker, WebBuyer and Calendar and Scheduling are planned for future disclosure reports.

## Data

### **IBM PC Server 704 NotesMark Value for Mail-Only Test**

The Mail workload was run for approximately 8-1/2 consecutive hours (including startup and shutdown activities). The IBM PC Server 704 system demonstrated that it can support 3,300 concurrent active users with this workload. The NotesMark throughput value was 4,331. Average response time was .875 seconds.



The Mail workload executes Notes transactions that model a server for mail users at sites that rely only on mail for communication. The resulting capacity metric for a mail-only server is the maximum number of users that can be supported before the average user response time becomes unacceptable.

The mail-only test script models an active user who is reading and sending mail. The script contains an average of 15 minutes of waiting; thus, the average user would execute this script a maximum of four times each hour. For each iteration of the test script, there are 5 documents read, 2 documents updated, 2 documents deleted, 1 view scrolling operation, 1 database opened and closed, 1 view opened and closed, and some miscellaneous operations. In sending messages, each user sends a mail message to NumMessageRecipients no more frequently than every 90 minutes.

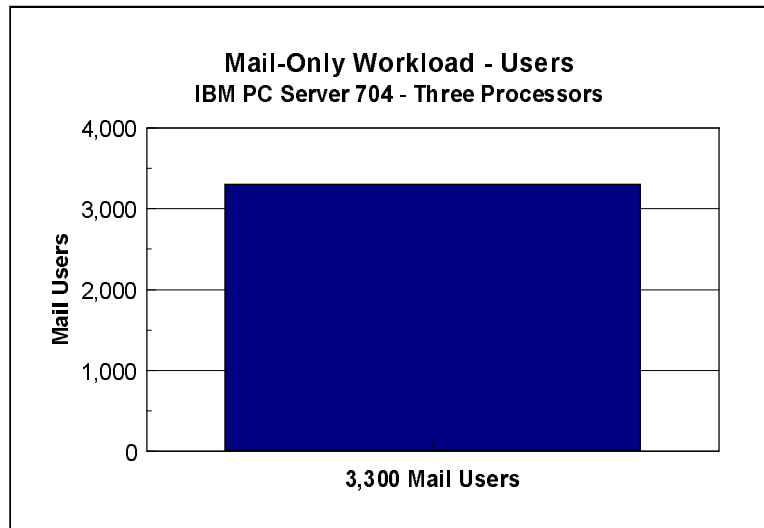
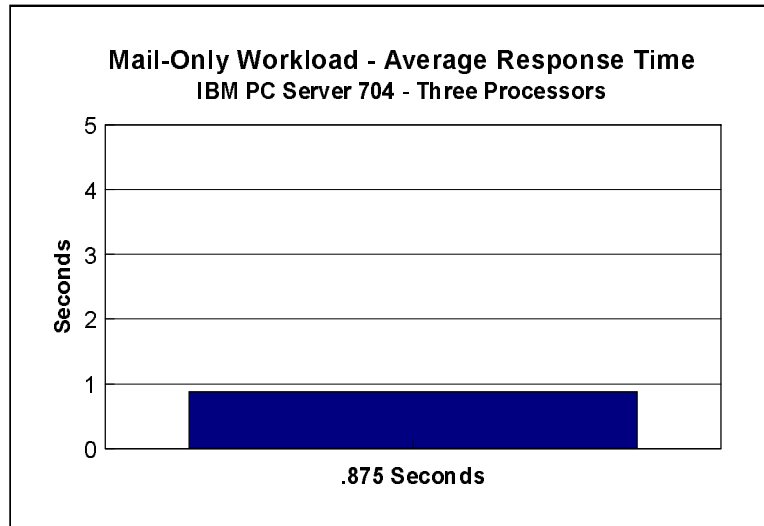
## NotesNum Output

Min Start Time = 06/20/97 09:11:45 AM Max Stop Time = 06/20/97 06:23:01 PM

Total Test Errors = 0

Total Test Time = 33120 sec

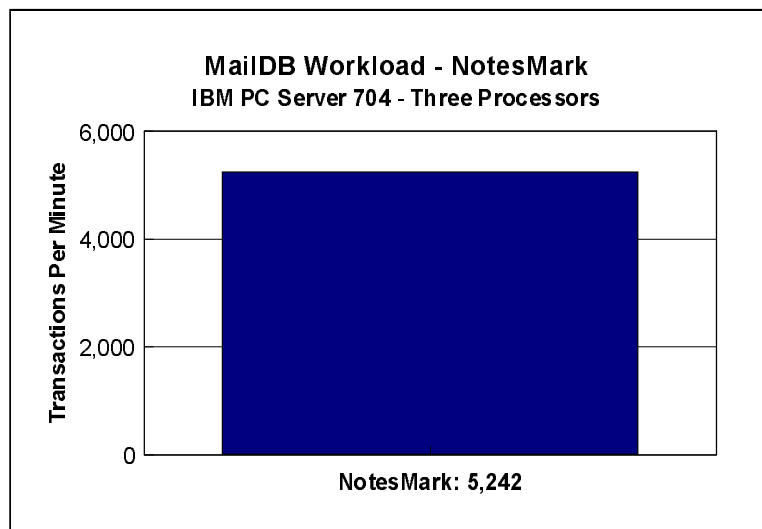
Test Run: Users = 3300 NotesMark = 4331 Response Time = 875 msec (06/20/97 10:26:00 AM to 06/20/97 06:06:00 PM)



## **IBM PC Server 704 - NotesMark Value for MailDB Test**

The MailDB workload was run for approximately 8-1/2 consecutive hours (including startup and shutdown activities). The IBM PC Server 704 system demonstrated that it can support 2,300 concurrent active users with this workload. The NotesMark throughput value was 5,242. Average response time was 2.008 seconds.

Due to the large number of users added per driver system with no staggering of connections between users, there were five errors of the type “Network operation did not complete in a reasonable amount of time; please retry.” As shown in the Notesnum output, the server under test recovered and ran error-free for 8 hours and 7 minutes.



The MailDB workload models a server for active users who are performing only mail and simple shared database operations. The test includes mail-only activity plus view operations in a shared database and navigation of unread documents in a shared database. The test applies especially to sites that rely primarily on mail for communication or that have Notes users who do not yet use all the Notes features. The throughput for this test is a capacity metric. It indicates the maximum number of active users that can be supported before the average user response time becomes unacceptable.

The MailDB script models an active user who is reading mail, sending mail and reading a shared database. It contains an average of 15 minutes of waiting; thus, an average user will execute this script no more frequently than four times per hour. For each iteration of the script, there are 8 documents read, 2 documents updated, 2 documents deleted, 4 view scrolling operations, 2 databases opened and closed, 2 views opened and closed, and some miscellaneous operations. In sending messages, each user sends one mail message to NumMessageRecipients approximately once every 90 minutes.



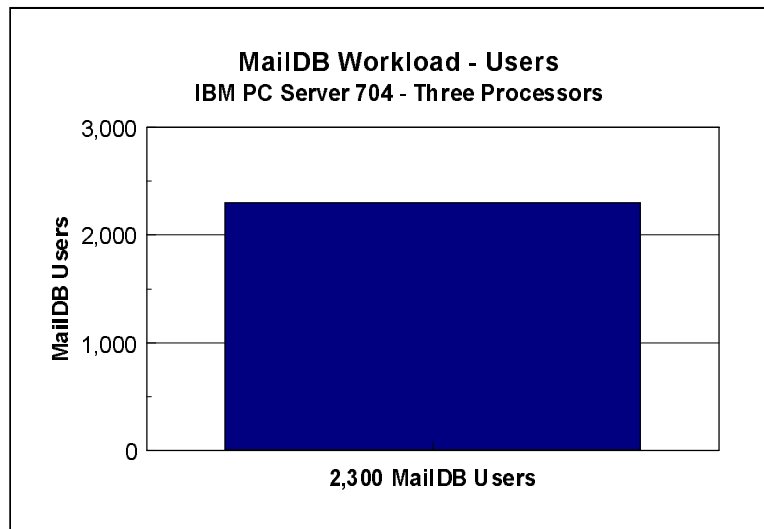
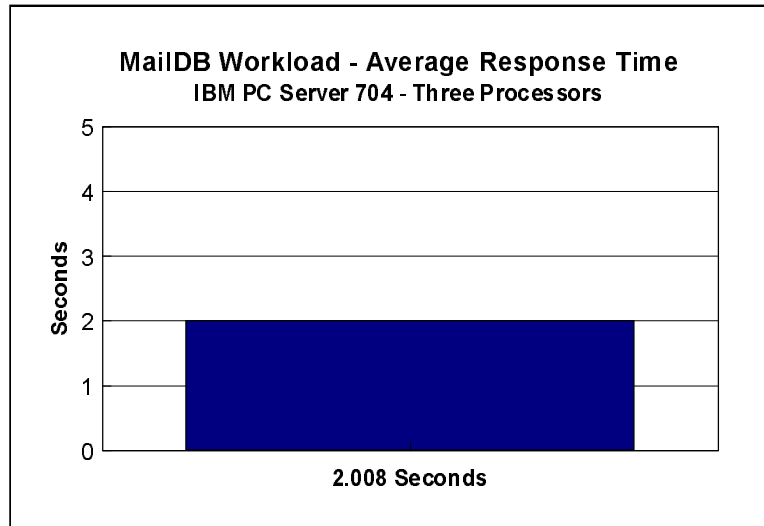
## NotesNum Output

Min Start Time = 06/21/97 08:51:57 AM Max Stop Time = 06/21/97 06:02:19 PM

Total Test Errors = 5

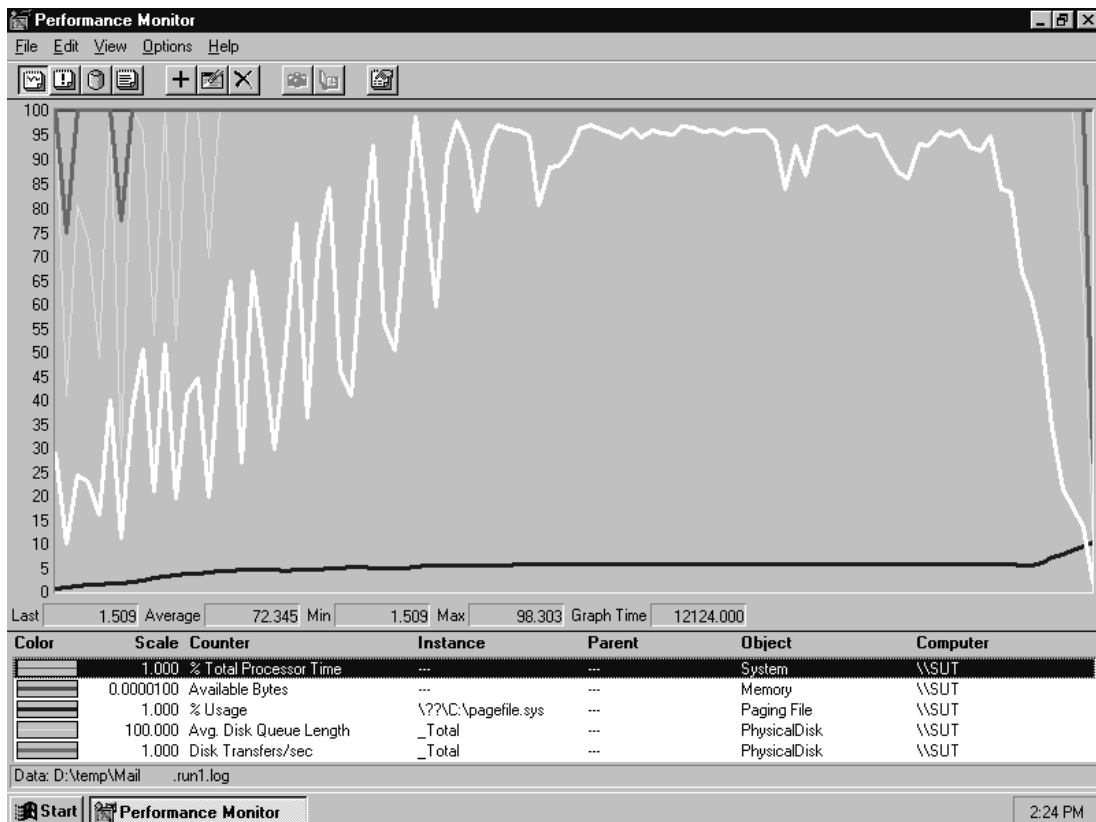
Total Test Time = 33060 sec

Test Run: Users = 2300 NotesMark = 5242 Response Time = 2008 msec (06/21/97 09:40:00 AM to 06/21/97 05:47:00 PM)



## Analysis

When configured optimally as described in this disclosure, the PC Server 704 with the PC ServeRAID SCSI Adapter has demonstrated that it can manage the intense resource usage during ramp-up to as many as 3,300 concurrent Mail-only users with minimal recoverable errors at the clients. This was achieved without applying excess processor resource, which is left idle after ramp-up. As can be seen in the following PERFMON chart captured in a trial run for the Mail-only test, average processor utilization during ramp-up did not significantly rise above average processor utilization after ramp-up.



## Conclusions

The test results demonstrate that an IBM PC Server 704 configured as described within this report can support 3,300 Mail-only users and 2,300 MailDB users with a response time well below what the test criteria permit. These results are based on running the IBM PC Server 704 as a dedicated Domino server; the addition of other application workloads will affect the number of users supported as well as the response time. Achieving optimum performance in a customer environment is highly dependent upon selecting adequate processor power, memory and disk storage as well as balancing the configuration of that hardware and appropriately tuning the operating system and Domino software.

These results demonstrate that the IBM PC Server 704 system provides leadership performance as a hardware platform for the Domino Server environment.

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## **Statement by Auditor**

See the attached “Lotus NotesBench Tests Results Report Certification” letter.

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## **Appendix A: Overall Test Setup and Software Versions**

### ***Number of Client Systems***

Fourteen driver systems were used. Thirteen of those systems were configured as child drivers (child 1 through child 13) for the Mail measurements, 12 for the MailDB measurements. One system was configured as the parent (source driver).

The child systems were IBM PC 350 computers, each configured with one 150MHz Pentium processor, 80MB of memory, one 1.12GB hard disk, and one Intel EtherExpress 10/100 PCI TX Adapter.

The disk configuration used for the child systems is as follows:

- C: Partition (12MB - FAT) - DOS 6.3 and Network Client for DOS and Windows 3.0
- D: Partition (1207MB - NTFS) - Windows NT 3.51 Workstation, Domino Workstation executables and data

### ***Number of Server Platforms***

One server platform, the IBM PC Server 704 with three 200MHz Pentium Pro processors and 1GB of memory was benchmarked.

The disk configuration used for the system under test is as follows:

- C: Partition (4.5GB - NTFS) - Windows NT Server Version 4.0 (Boot Partition) Domino executables
- D: Partition: Unused
- E: Partition (49.5GB - NTFS) - Domino data

The disk configuration used for destination servers 1, 2 and 3 is as follows:

- C: Partition (500MB - NTFS) - Windows NT Server Version 4.0 (Boot Partition)
- D: Partition (1650MB - NTFS) - Domino executables
- E: Partition (8600MB - NTFS) - Domino data

### ***Network***

A single 100Mbps Ethernet LAN segment was used. Two 12-port Bay Networks BayStack 201 100BaseT Hubs were used to connect the servers and clients to the LAN segment.

## ***Software Versions***

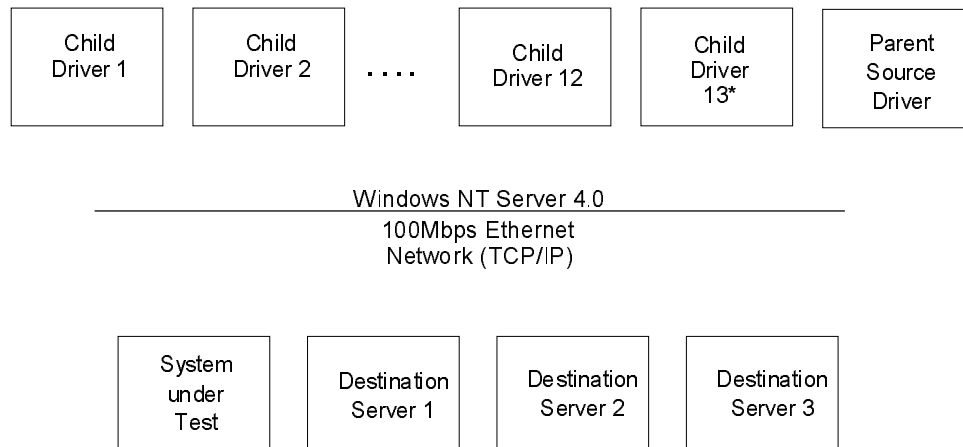
Software versions used on the system under test were as follows:

- Microsoft Windows NT Server Version 4.0 and Service Pack 3
- Lotus Domino Server Release 4.51
- NotesBench Version 138 - Windows/32

Software versions used on the child drivers were as follows:

- Microsoft Windows NT Workstation Version 4.0 and Service Pack 2
- Lotus Domino Client for Windows NT Release 4.51
- NotesBench Version 138 - Windows/32

## High-Level Test Setup Diagram for Mail-Only and MailDB



\* Child Driver 13 was not used for the MailDB measurements.

### Details of Configuration

System Under Test	Destination Servers 1-3	Child Drivers 1-14	Parent Source Driver
IBM PC Server 704	IBM PC Server 720	IBM PC 350	IBM PC 350
3 - 200MHz Pentium Pro Processors	2 - 100MHz Pentium Processors	1 - 150MHz Pentium Processor	1 - 150MHz Pentium Processor
1GB Memory	256MB Memory	80MB Memory	128MB Memory
12 - 4.51GB Drives (RAID-0)	1 - 2.25GB Drive 4 - 2.25GB Drives (RAID-0)	1 - 1.12GB Drive	1 - 1.12GB Drive
IBM PC ServeRAID SCSI Adapter	IBM SCSI-2 Fast/Wide Streaming RAID Adapter		
IBM 100/10 Ethernet PCI Adapter	Intel EtherExpress 10/100 PCI TX Adapter	Intel EtherExpress 10/100 PCI TX Adapter	Intel EtherExpress 10/100 PCI TX Adapter
Windows NT Server V4.0 and Service Pack 3	Windows NT V3.51 and Service Pack 5	Windows NT V4.0 and Service Pack 2	Windows NT V3.51 and Service Pack 5

The IBM PC ServeRAID SCSI Adapter and the IBM 100/10 Ethernet PCI Adapter used in the SUT were installed on the Primary PCI bus.

A single 100Mbps Ethernet LAN segment was used. Two 12-port Bay Networks BayStack 201 100BaseT Hubs were used to connect the servers and clients to the LAN segment.

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## Appendix B: System Configurations

<b>Server under Test</b>	
<b>System</b>	IBM PC Server 704
<b>Processor</b>	Three 200MHz Pentium processors
<b>Memory</b>	1GB
<b>Cache</b>	512KB L2 write-back cache per processor
<b>RAID Controller</b>	IBM PC ServeRAID SCSI Adapter
<b>Disk</b>	12 - 4.51GB hard disks configured as a RAID-0 array
<b>Network Interface Adapter</b>	IBM 100/10 Ethernet PCI Adapter
<b>I/O</b>	PCI bus
<b>Operating System</b>	Microsoft Windows NT Server 4.0 with Service Pack 3
<b>Notes</b>	Lotus Domino Server for Windows NT Release 4.51

<b>Clients</b>	
<b>System</b>	IBM PC 350
<b>Processor</b>	One 150MHz Pentium processor upgrade
<b>Memory</b>	80MB
<b>Disk</b>	One 1.12GB
<b>Network Interface Adapter</b>	Intel EtherExpress 10/100 PCI TX Adapter
<b>I/O</b>	PCI/ISA bus (I/O bus used was PCI)
<b>Operating System</b>	Microsoft Windows NT Workstation 4.0 with Service Pack 2
<b>Notes</b>	Domino Client for Windows NT Release 4.51



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## Appendix C: Operating System Parameters

In the system under test, the following registry variables were changed from their default values of 2 to 0:

HKEY\_LOCAL\_MACHINE/System/CurrentControlSet/Control/PriorityControl/Win32PrioritySeparation:  
REG\_DWORD:0

HKEY\_LOCAL\_MACHINE/System/CurrentControlSet/Control/SessionManager/MemoryManager/  
LargeSystemCache: REG\_DWORD:0

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## Appendix D: NOTES.INI Settings

### NOTES.INI File for the System under Test

[Notes]

```
KitType=2
Directory=e:\notes\data
WinNTIconPath=e:\notes\data\W32
$$HasLANPort=1
EnableJavaApplets=1
EnablePlugins=1
Preferences=2148011121
Passthru_LogLevel=0
Console_LogLevel=2
VIEWIMP1=Lotus 1-2-3 Worksheet,0,_IWKSV,,WKS,.WK1,.WR1,.WRK,.WK3,.WK4,
VIEWIMP3=Structured Text,0,_ISTR,,LTR,.CGN,.STR,
VIEWIMP4=Tabular Text,0,_ITAB,,PRN,.RPT,.TXT,.TAB,
VIEWEXP1=Lotus 1-2-3 Worksheet,0,_XWKS,,WKS,.WK1,.WR1,.WRK,
VIEWEXP3=Structured Text,0,_XSTR,,LTR,.CGN,.STR,
VIEWEXP4=Tabular Text,1,_XTAB,,LTR,.RPT,.CGN,.TAB,
EDITIMP1=ASCII Text,0,_ITEXT,,TXT,.PRN,.C,.H,.RIP,
EDITIMP2=MicrosoftWord RTF,0,_IRTF,,DOC,.RTF,
EDITIMP3=Lotus 1-2-3 Worksheet,0,_IWKSE,,WKS,.WK1,.WR1,.WRK,.WK3,.WK4,
EDITIMP4=Lotus PIC,0,_IPIC,,PIC,
EDITIMP5=CGM Image,0,_IFL,,GMF,.CGM,
EDITIMP6=TIFF 5.0 Image,0,_ITIFF,,TIF,
EDITIMP7=BMP Image,0,_IBMP,,BMP,
EDITIMP8=Ami Pro,0,_IW4W,W4W33F/V0,.SAM,
EDITIMP17=WordPerfect 5.x,0,_IW4W,W4W07F/V1,.DOC,
EDITIMP22=PCX Image,0,_IPCX,,PCX,
EDITIMP28=Binary with Text,0,_ISTRNGS,,*,
EDITIMP29=WordPerfect 6.0/6.1,0,_IW4W,W4W48F/V0,.WPD,.WPT,.DOC,
EDITIMP30=Excel 4.0/5.0,0,_IW4W,W4W21F/V4C,.XLS,
EDITIMP31=Word for Windows 6.0,0,_IW4W,W4W49F/V0,.DOC,
EDITIMP32=GIF Image,0,_IGIF,,GIF,
EDITIMP33=JPEG Image,0,_IJPEG,,JPG,
EDITEXP1=ASCII Text,2,_XTEXT,,TXT,.PRN,.C,.H,.RIP,
EDITEXP2=MicrosoftWord RTF,2,_XRTF,,DOC,.RTF,
EDITEXP3=CGM Image,2,_XCGM,,CGM,.GMF,
EDITEXP4=TIFF 5.0 Image,2,_XTIFF,,TIF,
```



MailServer=CN=SUT/O=NB3  
Domain=NB3  
Admin=CN=admin/O=NB3  
TemplateSetup=2  
Setup=49  
ServerSetup=7  
ZONE\_SET=1  
Timezone=5  
DST=1  
ECLSetup=3  
DESKWINDOWSIZE=16 23 420 288  
WINDOWSIZEWIN=33 5 574 470  
MAXIMIZED=0  
WinNTIconCommonConfig=Universal  
WinNTIconSize=2  
WinNTIconPos=2  
WinNTIconHidden=0  
WinNTIconRect=-1 -1 567 25  
FileDlgDirectory=E:\notes\data  
;  
;  
; NotesBench parm changes  
;  
SERVER\_SHOW\_PERFORMANCE=1  
MAILUSEPROCESSES=0  
MAILUSETHEADS=1  
MAILMAXTHREADS=3  
MAILLOGTOEVENTSONLY=1  
LOG\_MAILROUTING=10  
No\_Force\_Activity\_Logging=1  
DEBUG\_OUTFILE=c:\svrdata\sutinfo.log  
;  
;  
PhoneLog=2  
Log=log.nsf, 1, 0, 7, 40000  
CONSOLE\_Lotus\_Domino\_Server=80 25 7 0 44 652 375

---

## Appendix E: Network Configuration

The standard TCP/IP stack provided by Microsoft Windows NT Server 4.0 was used.

In the system under test, the network adapter speed for the IBM 100/10 Ethernet PCI Adapter was changed from the default 'Auto' to 100Mbps. This forced the Duplex Mode to 'Half'.

In addition, under 'Advanced' configuration options for the Ethernet adapter, the following three parameters were changed from their default values at the destination servers:

- Coalesce Buffers = 16
- Receive Buffers = 32
- Transmit Control Block = 32

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## **Appendix F: Guidelines for Information Usage**

This report is intended for IBM Business Partners, customers, and IBM marketing and technical support personnel. The report may be distributed in accordance with the requirements stated in the Edition notice on page 25.

## Appendix G: Pricing

The prices for the IBM products listed in the following table are suggested retail prices for the U.S. only and are provided for information only. Dealer prices may vary, and prices may also vary by country. Prices are subject to change without notice. For additional information and current prices, contact your local IBM representative.

Price/performance results reported in this document are based on the IBM Estimated Reseller Price.

### Price/Performance Results for System Capacity and System Throughput

Test Script	Maximum Users	NotesMark (tpm)	System Price	\$/User	\$/NotesMark
Mail-Only	3,300	4,331	\$53,731	\$16.28	\$12.41
MailDB	2,300	5,242	\$53,731	\$23.36	\$10.25

Item Description	Order Number	Qty	IBM Estimated Reseller Price	Total
<b>IBM PC Server 704</b>	8650-5M0	1	\$16,675	\$16,675
1 - 200MHz Pentium Pro Processor / 512KB cache				
256MB ECC Memory (4 x 64MB)				
8X-Speed CD-ROM Drive				
1 - 1.44MB Diskette Drive				
Keyboard and Mouse				
IBM PC ServeRAID SCSI Adapter	70G8489	1	1,950	1,950
PC Server 704 SMP 200MHz Upgrade	94G6678	2	2,750	5,500
PC Server 704 64MB Memory Option	94G5879	12	953	11,436
4.51GB SCSI-2 Wide Ultra SCSI Hot-Swap Drives	94G7098	12	1,264	15,168
IBM 100/10 PCI Ethernet Adapter	25H4374	1	109	109
14-Inch SVGA Color Display	6542103	1	299	299
<b>Software</b>				
Windows NT Server 4.0 (Service Pack 3 free on Internet)	22700028	1	725	725
Lotus Domino Server Release 4.51 for SMP <sup>1</sup>	G16118	1	1,869	1,869
<b>Total System Price</b>				<b>\$53,731</b>

<sup>1</sup> A single-processor copy of Domino Server 4.50 is included at no charge with all IBM PC Servers. Domino Server 4.51 for SMP is quoted here as an upgrade to Domino 4.50. All software pricing was provided by an IBM reseller.

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## **Appendix H: Optional (Vendor-Defined Information)**

None.



## **First Edition - July 1997**

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