

NotesBench Disclosure Report
for
IBM Netfinity 5500 M20 (RAID-1)
with
Lotus Domino R5 for Windows NT 4.0

Certified March 24, 1999

IBM Corporation



Table of Contents

Executive Summary

Benchmarking Objectives

Test Methodologies

Data

Analysis

Conclusions

Statement by Auditor

Appendix A: Overall Test Setup and Software Versions

Appendix B: System Configurations

Appendix C: Operating System Parameters Values

Appendix D: Notes Parameters (NOTES.INI file)

Appendix E: Network Configuration File(s)

Appendix F: Guidelines for Information Usage

Appendix G: Pricing

Appendix H: Optional (vendor-defined information)

Edition Notice

Executive Summary

Performance measurements using NotesBench were conducted with the IBM Netfinity 5500 M20 (Model 8662-41Y) running Lotus Domino R5 Release 164.1 (using the R4.6 Mail template) on Microsoft Windows NT Server Version 4.0 with Service Pack 4. Results for the IBM Netfinity 5500 M20 are based on the NotesBench Mail-only workload run on a RAID-1 configuration. The results are summarized in the following table.

Test Script	Maximum Users	NotesMark (tpm)	Ave. Response Time (sec)	\$/User	\$/NotesMark
Mail-Only	8,250	10,957	0.264	\$5.51	\$4.15

The IBM Netfinity 5500 M20, configured with two 500MHz¹ Intel** Pentium** III Xeon** processors, 2GB of memory, and twenty-three 4.51GB² 10K-rpm hard disk drives (configured as a RAID-1 array), supported a Mail-only workload of 8,250 active mail users (see price/performance results³ above).

In addition to the IBM Netfinity 5500 M20 system under test (SUT), the benchmarked configuration used six destination servers, 19 client driver systems, and one controller system. All systems were connected to the SUT through two 100Mbps Ethernet LAN segments, using the TCP/IP network protocol. Configuration details are provided in Appendix A: Overall Test Setup and Software Versions.

IBM's Server Performance Laboratory in Research Triangle Park, NC, conducted the benchmark in March 1999, and KMDS Technical Associates, Inc., audited the results in March 1999.

NotesBench provides an objective method for evaluating the performance of different platforms running Lotus Domino R5. 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 R5 Mail-only (using the R4.6 Mail template) users supported on a high-end RAID-1 configuration of the IBM Netfinity 5500 M20 Model 8662-41Y. Performance measurements on IBM Netfinity servers using NotesBench for the Domino R5 are ongoing.

Test Methodologies

Test Setup and Hardware/Software Configuration

The IBM Netfinity 5500 M20 system under test used two 500MHz Pentium III Xeon processors (1MB of L2 write-back cache); 2GB of memory, and twenty-three 4.51GB 10K-rpm Wide Ultra SCSI hard disks configured with RAID-1. Four Netfinity ServeRAID-3L Ultra2 SCSI Adapters and one integrated ServeRAID II Ultra SCSI controller were used, along with one integrated 100/10Mbps Ethernet controller and one Ethernet 100/10 PCI Adapter.

The system under test, the destination servers, and the driver systems were connected to the SUT through two 100Mbps Ethernet LAN segments, using the TCP/IP network protocol. An IBM PC 300GL system was used as the source driver (parent) system; IBM PC 350 and IBM IntelliStation** M-PRO systems were used as the client drivers. Six IBM PC Server 330 systems were used as destination servers, across which the mail addresses were distributed.

The IBM Netfinity 5500 M20 system under test ran Microsoft Windows NT Server Version 4.0 and Domino R5 Release 164.1. The Name and Address Book in all the clients contained person documents for 9,000 mail recipients (R4.6 Mail template) who were randomly selected by each active Mail user. The server under test contained mail files for 9,000 Mail (R4.6 Mail template) users. The public Name and Address Book contained 9,000 mail-recipient person documents and each of the six destination servers contained mail files for 1,500 recipients.

The following NOTES.INI parameters were modified as recommended in the NotesBench operator's manual and by addenda from the NotesBench Consortium Web site:

Mail-Only Workload - RAID-1
Mail_Number_of_MailBoxes=2
Max_Users=10000
NSF_DBcACHE_MaxEntries=10000
DBMaxEntries=10000
Server_Pool_Tasks=100
Server_Max_Concurrent_Trans=1000
MailMaxThreads=2
Log_Sessions=0
Log_Mailrouting=10
SetMailLog_to_Events_Only=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=_\nbfstb2\lastrun\SUTINFO.log
```

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

All Domino executable and data files were located on the C: partition except for the Domino log.nsf. However, the actual mail files (located on partitions E:, F:, G:, and H) were accessed via mail links located in the Domino R5 Data directory..

Test Procedures

The number of users simulated in child drivers 1 through 19 were, respectively: 1000, 300, 1000, 300, 300, 300, 300, 300, 300, 300, 300, 200, 200, 200, 200, 1000, 1000, 500 and 250. The number of child drivers used and the number of users simulated by each child driver are defined by the “NumClientsN” parameters in the parent’s NOTES.INI file. For each child driver, users’ start times were staggered. Numerically by child driver they were, respectively, 1, 3, 1.5, 1.7, 1.8, 4, 3, 2, 2, 3, 3, 2, 4, 3, 3, 3, 3, 3 and 3 seconds, as defined in the “ThreadStagger” parameter for each child driver. The start time of each child driver was staggered to allow sufficient time for all users simulated by each child driver to be connected at the SUT and to allow the SUT to settle for at least 5 minutes before releasing the users from the next child drivers.

Our experience shows that ramp-up time increases non-linearly as a function of the number of users simulated by a child driver. This effect becomes even more pronounced as we approach the capacity of the server. Since the NotesBench audit rules do not put any restriction on ramp-up time, and we had a limited number of child drivers, the attempt to minimize ramp-up time was only carried far enough to ensure adequate benchmarking productivity. During the test runs, the tools used to determine steady state included Windows NT’s PERFMON, the Notes Server SHOW command, and the child driver RES files. To confirm steady state, we monitored the number of users, the number of transactions per minute, and pending mail at the SUT. We confirmed steady state when:

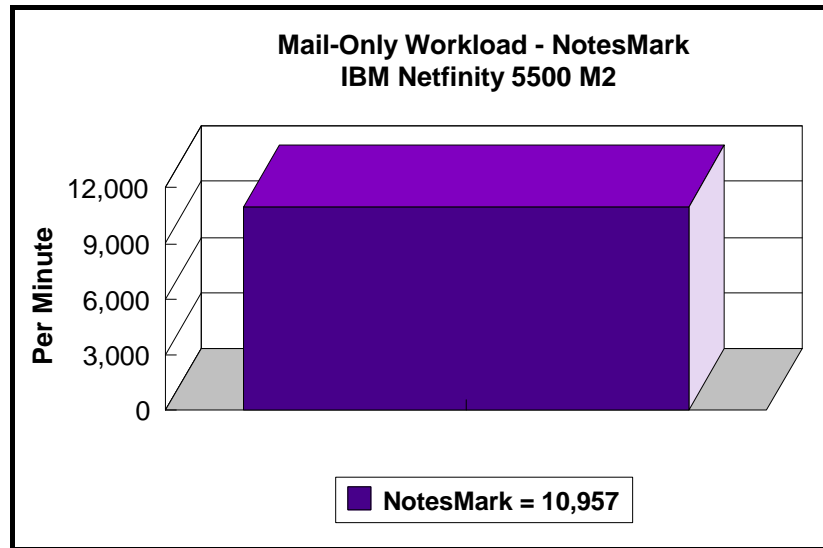
- The SUT Domino Server console sustained the peak user load
- Pending mail did not become backlogged, as verified by:
 - Inspection of the mail-routing log at the SUT after the test run ended
 - Server Mail statistics collected every thirty minutes throughout the test run.

To ensure that the test results were reproducible, the tests were repeated, and the results were compared and found to be consistent.

Data

IBM Netfinity 5500 M20 NotesMark Value for Mail-Only Test

The Mail workload was run for 14 hours, including ramp-up and steady state. The IBM Netfinity 5500 M20 system configured with RAID-1 demonstrated that it can support 8,250 concurrent active Mail users. The NotesMark throughput value was 10,957. Average response time was .264 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.

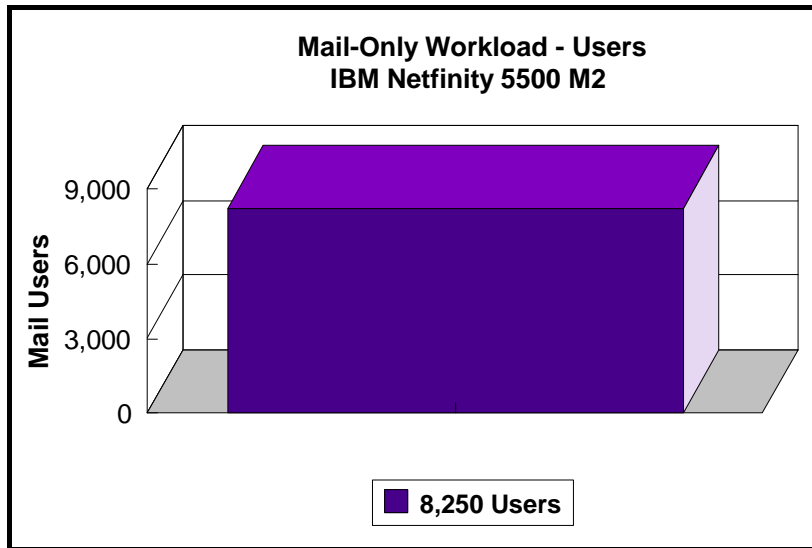
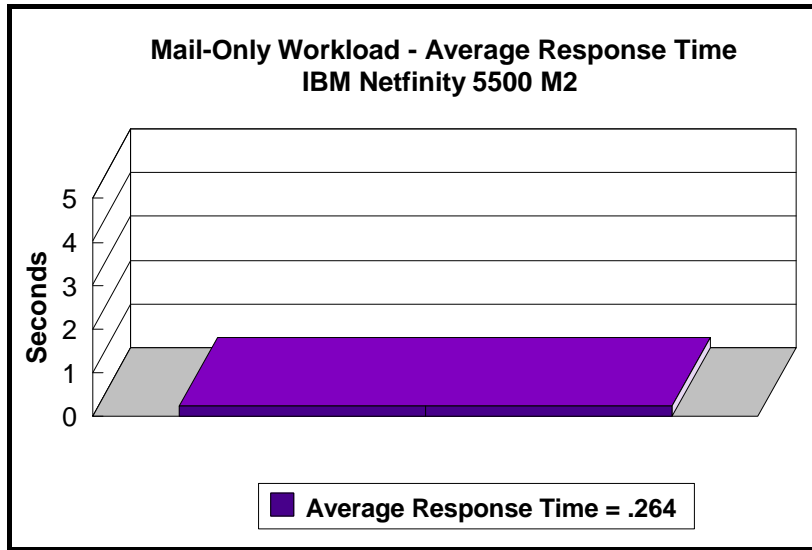
NotesNum Output for Mail-Only Test

Min Start Time = 03/17/99 01:39:29 PM Max Stop Time = 03/18/99 03:45:01 AM

Total Test Errors = 0

Total Test Time = 50760 sec

Test Run: Users = 8250 NotesMark = 10957 Response Time = 264 msec (03/17/99
05:21:00 PM to 03/18/99 03:20:00 AM)

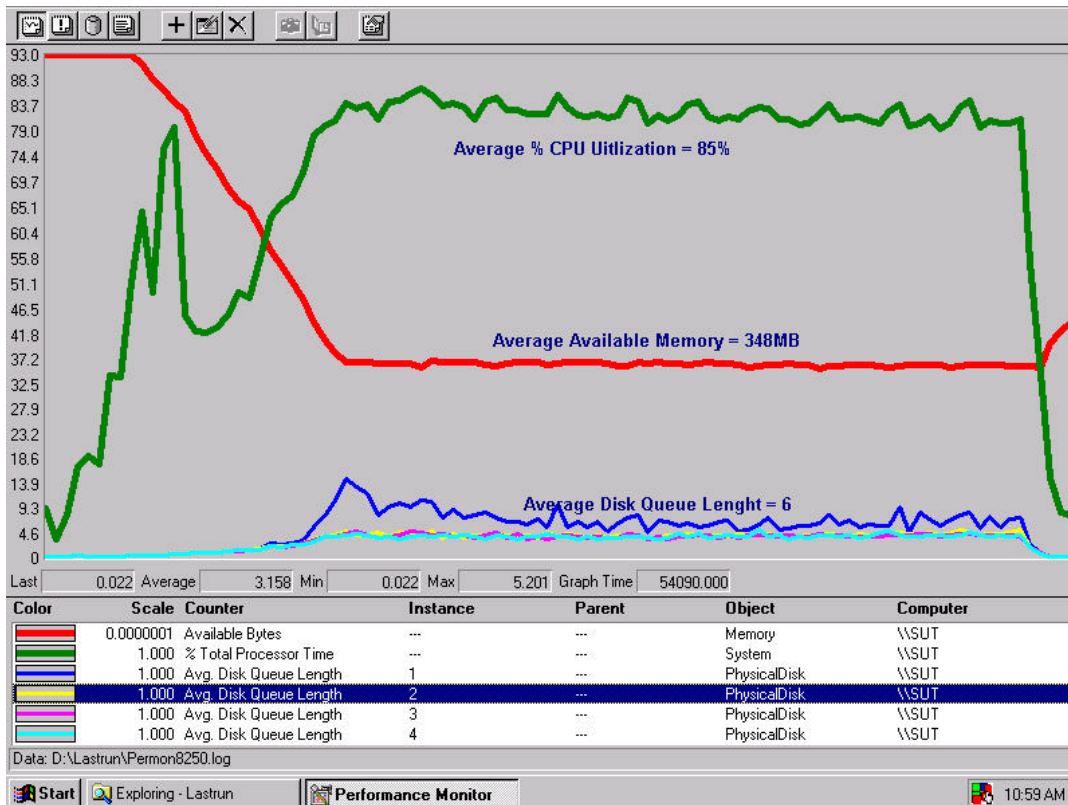


Analysis

PERFMON data was collected for a shorter run when the system was ramped up for about four hours. Ramp-up through shutdown is shown in the screen capture below. Steady-state statistics are shown in the table below.

Steady State Values	Domino Data
Maximum Concurrent Mail Users	8,250
Average CPU Utilization	85%
Average Memory Used *	1.7GB
Average Memory Available	348MB
Average Pagefile Usage	0.7%
Average Physical Disk Q Length	6

*Average Memory Used is computed by subtracting the Average Available Bytes of Memory measured by PERFMON from the installed memory of 2GB. The available memory bytes are used as disk cache, helping to provide acceptable user response time. Because of the significant system overhead required, PERFMON was not enabled or used for the audit run. For the audited run, all users ran error-free for 10 hours before the controller client performed an orderly stop of the run.



Conclusions

These NotesBench results demonstrate that the IBM Netfinity 5500 M20 (Model 8662-41Y) can support 8,250 Mail-only users. The results obtained are based on running the IBM Netfinity 5500 M20 as a dedicated Domino server; the addition of other application workloads will affect the number of users supported as well as the response time. To support additional applications and users, two additional processors, as well as more memory and drives, could be added. 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.

Statement by Auditor

The original “Lotus NotesBench Test Results Report Certification Letter” was signed by Daryl K. Thompson, NotesBench Auditor for KMDS Technical Associates, Inc., and is on file at IBM.

Appendix A: Overall Test Setup and Software Versions

Number of Client Systems

Twenty driver systems were used. Nineteen of those systems were configured as child drivers (child 1 through child 19). One system was configured as the parent (source driver).

Child drivers 2 and 4 through 15 were IBM PC 350 systems, each configured with one 150MHz Pentium processor, 80MB of memory, one 1.2GB hard disk, and one Intel EtherExpress 100/10 PCI TX Adapter.

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

D: Partition (1207MB - NTFS) - Windows NT Workstation 4.0 and Notes R5 Client Release 164.1 for Windows NT

Child drivers 1, 3 and 16 through 19 were IBM IntelliStation M-PRO systems, each configured with one 400MHz Pentium II processor, 256MB of memory, one 9.1GB hard disk, and one integrated Intel EtherExpress 100/10 PCI TX controller.

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

C: Partition (2GB - NTFS) - Windows NT Workstation 4.0 and Notes R5 Client Release 164.1 for Windows NT
D: Partition (7GB - NTFS) - Notes R5 Client Data directory

Number of Server Platforms

One server platform, the IBM Netfinity 5500 M20 with two 500MHz/1MB L2 cache Pentium III Xeon processors and 2GB of memory, was benchmarked.

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

- C: Partition (4GB - NTFS) - Windows NT Server Version 4.0 (boot partition), pagefiles and Domino R5 executables and Domino Data directory
- D: Partition (2GB - NTFS) - Domino Log.NSF database
- E: Partition (11GB - NTFS) - Mail files (R4.6 Mail template)
- F: Partition (11GB - NTFS) - Mail files (R4.6 Mail template)
- G: Partition (11GB - NTFS) - Mail files (R4.6 Mail template)
- H: Partition (11GB - NTFS) - Mail files (R4.6 Mail template)

The disk configuration used for destination servers 1 through 6 is as follows:

- C: Partition (2GB - NTFS) - Windows NT Server Version 4.0 and Notes executables with Service Pack 4
- D: Partition (10GB - NTFS) - Domino data

Network

Two 100Mbps Ethernet LAN segments were used.

Software Versions

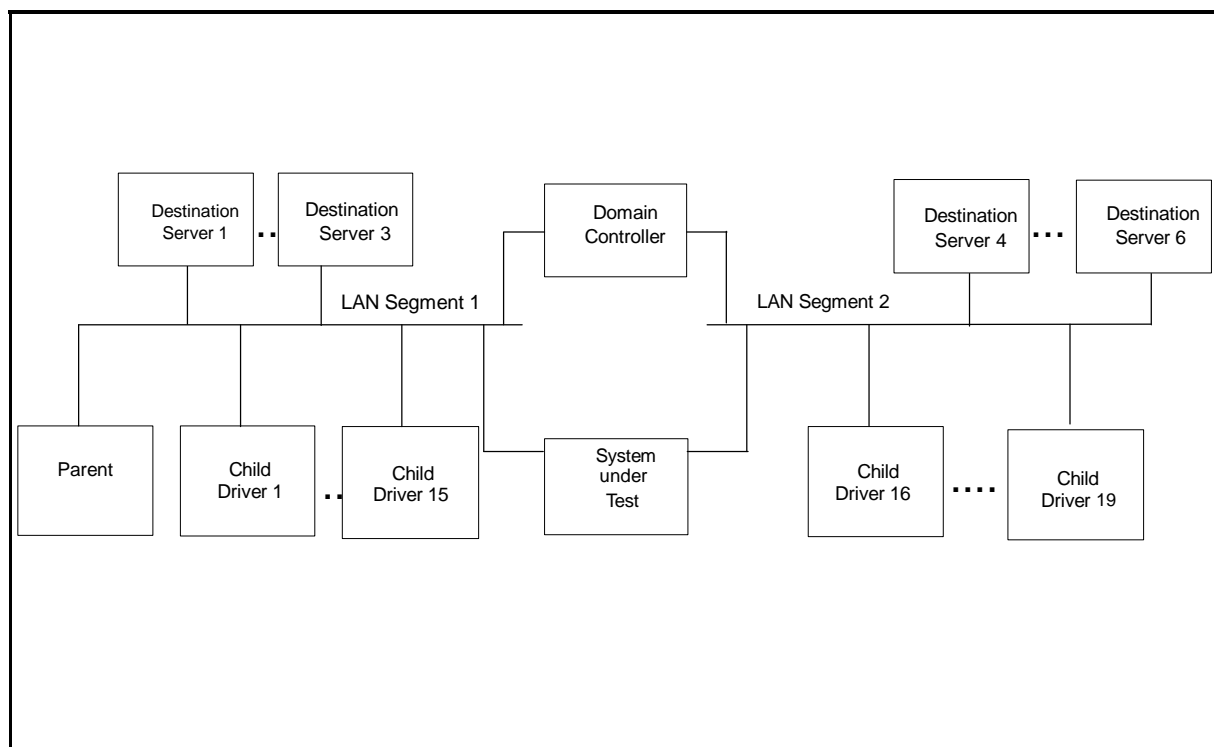
Software versions used on the system under test were as follows:

- Microsoft Windows NT Server Version 4.0 and Service Pack 4
- Lotus Domino R5 Release 164.1 for Windows NT
- NotesBench for R5 Version 164 - Windows/32

Software versions used on the child drivers were as follows:

- Microsoft Windows NT Workstation Version 4.0 and Service Pack 4
- Lotus Notes R5 Client Release 164.1 for Windows NT
- NotesBench for R5 Version 164 - Windows/32

High-Level Test Setup Diagram



Details of Configuration

System Under Test	Destination Servers 1-6	Child Drivers 2 and 4-15	Child Drivers 1, 3 and 16-19	Parent Source Driver
IBM Netfinity 5500 M20	IBM PC Server 330	IBM PC 350	IBM IntelliStation M-PRO	IBM PC 300GL
2 x 500MHz Pentium III Xeon	1 x 200MHz Pentium Pro	1 x 150MHz Pentium	1 x 400MHz Pentium II	1 x 233MHz Pentium II
2GB Memory	256MB Memory	80MB Memory	256MB Memory	96MB Memory
23 x 4.51GB Drives	6 x 2.25GB Drives (RAID-0)	1 x 1.2GB Drive	1 x 9.1GB Drive	1 x 4.51GB Drive
4 x ServeRAID-3L Ultra2 SCSI Adapters 1 x Integrated ServeRAID II Ultra SCSI Controller	IBM SCSI-2 Fast/Wide Streaming RAID Adapter			
1 x Integrated 100Mbps Ethernet Controller 1 x Ethernet 100/10 PCI Adapter	IBM 100/10 Ethernet PCI Adapter	Intel EtherExpress 100/10 PCI TX Adapter	Integrated Intel PRO 100/10 PCI Controller	IBM 100/10 Ethernet PCI Adapter
Windows NT 4.0 and Service Pack 4	Windows NT 4.0 and Service Pack 4	Windows NT 4.0 and Service Pack 4	Windows NT 4.0 and Service Pack 4	Windows NT 4.0 and Service Pack 4

Two 100Mbps Ethernet LAN segments were used. One IBM PC Server 325 was configured as a router and used to connect the servers and clients to the LAN segment.

Appendix B: System Configurations

Server under Test	
System	IBM Netfinity 5500 M20
Processor	2 x 500MHz Pentium III Xeon Processor
Memory	2GB
Cache	1MB L2 Write-Back Cache
Disk Controller	Integrated ServeRAID II Ultra SCSI Controller and 4 x ServeRAID-3L Ultra2 SCSI Adapter
Disk Drive	23 x 4.51GB
Network Interface Adapter	1 x Integrated 100/10 Ethernet PCI Controller and 1 x Ethernet 100/10 PCI Adapter
I/O	PCI Bus
Operating System	Microsoft Windows NT Server 4.0 with Service Pack 4
Notes	Domino R5 Release 164.1 for Windows NT

Clients 2 and 4-15	
System	IBM PC 350
Processor	1 x 150MHz Pentium Processor
Memory	80MB
Disk Drive	1 x 1.2GB
Network Interface Adapter	Intel EtherExpress 100/10 PCI Adapter
I/O	PCI Bus
Operating System	Microsoft Windows NT Workstation 4.0 with Service Pack 4
Notes	Notes R5 Client Release 164.1 for Windows NT

Clients 1,3 and 16-19	
System	IBM IntelliStation M-PRO
Processor	1 x 400MHz Pentium II Processor
Memory	256MB
Disk Drive	1 x 9.1GB
Network Interface Adapter	Integrated Intel PRO 100/10 PCI Controller
I/O	PCI Bus
Operating System	Microsoft Windows NT Workstation 4.0 with Service Pack 4
Notes	Notes R5 Client Release 164.1 for Windows NT

Appendix C: Operating System Parameters

The following registry variables were changed from their default values as shown:

HKEY_LOCAL_MACHINE/System/CurrentControlSet/Control/PriorityControl\Win32PrioritySeparation:
REG_DWORD:0

HKEY_LOCAL_MACHINE/System/CurrentControlSet/Control/SessionManager/MemoryManager/
LargeSystemCache: REG_DWORD:0

Appendix D: NOTES.INI Settings

NOTES.INI Files for the System under Test

[Notes]

```
Directory=C:\Domino\Data
KitType=2
SetupDB=Setup.nsf
UserName=Jackal
CompanyName=Wacko
NotesProgram=C:\Domino
InstallType=5
;=====NotesBench Parameter=====
Mail_Number_Of_MailBoxes=2
Max_Users=10000
NSF_DBcache_MaxEntries=10000
DBMaxEntries=10000
Server_Pool_Tasks=100
Server_Max_Concurrent_Trans=1000
MailMaxThreads=2
;MailUseThreads=1
LOG_SESSIONS=0
LOG_MAILROUTING=10
SetMailLogToEventsOnly=1
SERVER_SHOW_PERFORMANCE=1
No_Forced_Activity_Logging=1
ServerTasks=Router,Replica,Update
DEBUG_OUTFILE=\\NBtest1\Lastrun\sutinfo.txt
;=====
;           end performance parameters
;=====
CONSOLE_Lotus_Domino_Server=80 60 113 50 -4 718 579
WinNTIconPath=C:\Domino\Data\W32
TRANSLLOG_USE_CONFIG=1
$$HasLANPort=1
WWWDSPP_SYNC_BROWSERCACHE=0
WWWDSPP_PREFETCH_OBJECT=0
EnablePlugins=1
Preferences=-2147480463
Region=en-US
COUNTRY_LANGUAGE=en
AltNameLanguage=en
ContentLanguage=en-US
WeekStart=1
ViewWeekStart=2
NavWeekStart=2
XLATE_CSID=52
SPELL_LANG=1033
Passthru_LogLevel=0
Console_LogLevel=2
VIEWIMP1=Lotus 1-2-3 Worksheet,0,_IWKSV,,WKS,.WK1,.WR1,.WRK,.WK3,.WK4,,4,
VIEWIMP3=Structured Text,0,_ISTR,,LTR,.CGN,.STR,,1,
VIEWIMP4=Tabular Text,0,_ITAB,,PRN,.RPT,.TXT,.TAB,,1,
VIEWEXP1=Lotus 1-2-3 Worksheet,0,_XWKS,,WKS,.WK1,.WR1,.WRK,,4,
VIEWEXP3=Structured Text,0,_XSTR,,LTR,.CGN,.STR,,1,
VIEWEXP4=Tabular Text,1,_XTAB,,LTR,.RPT,.CGN,.TAB,,1,
EDITIMP1=ASCII Text,0,_ITEXT,,TXT,.PRN,.C,.H,.RIP,,1,
EDITIMP2=Microsoft Word RTF,0,_IRTF,,DOC,.RTF,,2,
EDITIMP3=Lotus 1-2-3 Worksheet,0,_IWKSE,,WKS,.WK1,.WR1,.WRK,.WK3,.WK4,,4,
EDITIMP4=Lotus PIC,0,_IPIC,,PIC,,8,
EDITIMP5=CGM Image,0,_IFL,,GMF,.CGM,,8,
EDITIMP6=TIFF 5.0 Image,0,_ITIFF,,TIF,,18,
EDITIMP7=BMP Image,0,_IBMP,,BMP,,18,
EDITIMP8=Ami Pro,0,_IW4W,W4W33F/V0,.SAM,,2,
EDITIMP9=HTML File,0,_IHTML,,HTM,.HTML,,1,
EDITIMP17=WordPerfect 5.x,0,_IW4W,W4W07F/V1,.DOC,.WPD,,2,
```



```

EDITIMP21=WordPro 96/97,0,_IW4W,W4W12F/V0,.LWP,,2,
EDITIMP22=PCX Image,0,_IPCX,..PCX,,18,
EDITIMP28=Binary with Text,0,_ISTRNGS,..*,1,
EDITIMP29=WordPerfect 6.0/6.1,0,_IW4W,W4W48F/V0,.WPD,.WPT,.DOC,,2,
EDITIMP30=Excel spreadsheet,0,_IW4W,W4W21F/V4C,.XLS,,4,
EDITIMP31=Word for Windows,0,_IW4W,W4W49F/V0,.DOC,,2,
EDITIMP32=GIF Image,0,_IGIF,..GIF,,18,
EDITIMP33=JPEG Image,0,_JPEG,..JPG,,18,
EDITEXP1=ASCII Text,2,_XTEXT,..TXT,.PRN,.C,.H,.RIP,,1,
EDITEXP2=MicrosoftWord RTF,2,_XRTF,..DOC,.RTF,,4,
EDITEXP3=CGM Image,2,_XCGM,..CGM,.GMF,,8,
EDITEXP4=TIFF 5.0 Image,2,_XTIFF,..TIF,,18,
EDITEXP5=Ami Pro,2,_XW4W,W4W33T/V0,.SAM,,2,
EDITEXP14=WordPerfect 5.1,2,_XW4W,W4W07T/V1,.DOC,,2,
EDITEXP21=WordPerfect 6.0,2,_XW4W,W4W48T/V0,.DOC,,2,
EDITEXP22=WordPerfect 6.1,2,_XW4W,W4W48T/V1,.WPD,.WPT,.DOC,,2,
EDITEXP23=Word for Windows 6.0,2,_XW4W,W4W49T/V0,.DOC,,2,
DDETimeOut=10
NAMEDSTYLE0=0300426173696300000000000000000000000000000000000000000000000000000101010000A00000000000
00100A0050A0000006400A0050A000000000000000000000000000000000000000000000000000000000000000000000000
00009404000000000000
NAMEDSTYLE0_FACE=Default Sans Serif
NAMEDSTYLE1=030042756C6C6574000000000000000000000000000000000000000000000000000101010000A00000000000
00000008070A00000064008070A00000000000000000000000000000000000000000000000000000000000000000000000000000000
0000494040000000000000
NAMEDSTYLE1_FACE=Default Sans Serif
NAMEDSTYLE2=0300486561646C696E6500000000000000000000000000000000000000000000000000010101010B0C0000000000
000100A0050A0000006400A0050A0000000000000000000000000000000000000000000000000000000000000000000000000000000
0000094040000000000000
NAMEDSTYLE2_FACE=Default Sans Serif
$$$OpenSpecial=NotesNIC
$$$NotesNIC=CN=Home/OU=Notes/O=NET, welcome.nsf, Notes NIC Welcome, Notes Network Information Center on the Internet
DefaultMailTemplate=mail50.ntf

;=====
;ServerTasks=Router,Replica,Update,Amgr,AdminP,RunJava ISpy.maps
;ServerTasksAt1=Catalog,Design
;ServerTasksAt2=UpdAll,Object Collect mailobj.nsf
;ServerTasksAt3=Object Info -Full
;ServerTasksAt5=Statlog

;=====
DESKWINDOWSIZE=-4 -4 808 580
MAXIMIZED=1
TCPIP=TCP, 0, 15, 0
Ports=WAN1,WAN2,TCPIP
LOG_REPLICATION=1
LOG_SESSIONS=1
KeyFilename=SUT.id
CertificateExpChecked=SUT.id 03/16/99
CertifierIDFile=C:\Domino\Data\cert.id
MailServer=CN=SUT/O=CERT
ServerKeyFileName=SUT.id
Domain=NotesBench
Admin=CN=Admin/O=CERT
TemplateSetup=51
Setup=58
ServerSetup=10
CleanSetup=1
PhoneLog=2
Log=d:\log.nsf, 1, 0, 7, 40000
TRANSLOG_AutoFixup=1
TRANSLOG_UseAll=0
TRANSLOG_Style=0
TRANSLOG_Performance=2
TRANSLOG_Status=0
NAMES=names.nsf
$MIMESaveFormat=136
$headlineDisableHeadlines=0
EmptyTrash=0
EnableJavaApplets=0
EnableActiveXInBrowser=1
EnableJavaScript=1

```

EnableLiveConnect=1
ShowAccelerators=1
DisableImageDithering=1
WAN1=TCP,0,15,0,,12288,
WAN2=TCP,0,15,0,,12288,
Timezone=5
DST=1
ECLSetup=3
DontShowAdminHelp=1
NewUserServer=CN=\$UT/O=CERT
SERVERS_FRAME_PERCENT=20
MONITOR_SCALE=1
WinNTIconCommonConfig=Universal
WinNTIconSize=2
WinNTIconPos=2
WinNTIconHidden=1
WinNTIconRect=0 0 0 24
FileDlgDirectory=C:\TEMP
TASKS_FRAME_PERCENT=30
MONITOR_VIEW_TYPE=0
MONITOR_DATA_STORAGE_HOURS=168
Win32InfoboxPos=2 110
WAN1_TcpConnectTimeout=0,5
BCASEWINDOWSIZE=-4 -4 808 580

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 was changed from the default 'Auto' to 100Mbps. This forced the Duplex Mode to 'Half'.

Under the 'Advanced' configuration option, the following three parameters were changed from their default values to double the default value:

- Coalesce Buffers
- Receive Buffers
- Transmit Control Block

At the destination servers, under 'Advanced' configuration options for the Ethernet adapter, the following three parameters were changed from their default values to double their default values:

- Coalesce Buffers
- Receive Buffers
- Transmit Control Block

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.

Appendix G: Pricing

The table provides the IBM Estimated Reseller Price to end users for the U.S. only. Actual Reseller 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. The price/performance reported in this disclosure is based on pricing from CDW Computer Center, Inc.

Planned availability for the IBM Netfinity 5500 M20 is April 30, 1999.

Item Description	Order Number	Qty	Reseller Unit Price	Extended Reseller Price	IBM Estimated Reseller Unit Price	Extended IBM Estimated Reseller Price
IBM Netfinity 5500 M20	8662-41Y	1	\$10,800	\$10,800	\$10,419	\$10,419
1 x 500MHz/1MB L2 Cache Pentium III Xeon Processor						
1 x 256MB ECC DIMM						
Integrated ServeRAID II Ultra SCSI Controller						
Integrated 100/10Mbps Ethernet PCI Controller						
IBM 256MB SDRAM ECC DIMM	01K8043	7	1,016	7,112	1,089	7,623
500MHz/1MB Pentium III Xeon Processor Upgrade	33L5054	1	4,200	4,200	4,329	4,329
Netfinity ServeRAID-3L Ultra2 SCSI Adapter	01K7364	4	746	2,984	799	3,196
IBM Netfinity 4.51GB 10K Wide Ultra SCSI Hard Disk	01K8009	3	558	1,674	599	1,797
IBM Netfinity EXP10 4.51GB 10K Wide Ultra SCSI Hard Disk	01K7960	20	623	12,460	599	11,980
IBM Netfinity EXP15 Rack Storage Expansion Enclosure	35202RU	2	2,605	5,210	2,799	5,598
Ethernet 100/10 PCI Adapter	34L0901	1	122	122	149	149
IBM G42 14" (13.2" Viewable) Color Monitor	654000N	1	219	219	219	219
Software						
Windows NT Server 4.0	227-01188	1	687	687	687	687
Lotus Domino R5 included with IBM Netfinity 5500 M20 at no charge		1	0	0	0	0
Total System Price				\$45,468		\$45,997

Appendix H: Optional (Vendor-Defined Information)

None.

First Edition - March 1999

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Notes

¹ MHz only measures microprocessor internal clock speed, not application performance. Many factors affect application performance.

² When referring to hard disk capacity, GB equals one billion bytes. Total user-accessible capacity depends on operating environment.

³ The price/performance results are based on pricing provided by CDW Computer Centers, Inc. IBM resellers set their own prices, and actual prices may vary.