NotesBench Disclosure Report

for

IBM Netfinity 5000 (RAID-1)

with

Lotus Domino 4.62a for Windows NT 4.0

Certified January 6, 1999

IBM Corporation

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Executive Summary

Performance measurements using NotesBench were conducted with the IBM Netfinity 5000 (Model 8659-31Y) running Lotus Domino Server Release 4.62a on Microsoft Windows NT Server Version 4.0 with Service Pack 4. Results for the IBM Netfinity 5000 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	3,350	5,042	1.016	$5.93	$3.94

The IBM Netfinity 5000, configured with two 450MHz[1] Intel** Pentium** II processors, 1GB of memory, and ten 4.51GB[2] 10K-rpm hard disk drives (configured as a RAID-1 array), supported a Mail-only workload of 3,350 active mail users (see price/performance results[3] above).

In addition to the IBM Netfinity 5000 system under test (SUT), the benchmarked configuration used three destination servers, 14 client driver systems, and one controller system. All systems were connected to the SUT through a single 100Mbps Ethernet LAN segment, 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 December 1998 and January 1999, and KMDS Technical Associates, Inc., audited the results in January 1999.

NotesBench provides an objective method for evaluating the performance of different platforms running Lotus Domino Server Release 4.6x. 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 4.62a Mail-only users supported on a high-end RAID-1 configuration of the IBM Netfinity 5000 Model 8659-31Y, which ships with one 450MHz Pentium II processor. Performance measurements on IBM Netfinity servers using NotesBench for the Domino Server Release 4.6x are ongoing.

Test Methodologies

Test Setup and Hardware/Software Configuration

The IBM Netfinity 5000 system under test used two 450MHz Pentium II processors (512KB of L2 write-back cache); 1GB of memory, and ten 4.51GB 10K-rpm Wide Ultra SCSI hard disks. The Netfinity ServeRAID-3L Ultra2 SCSI Adapter was used for this test; the integrated 100/10Mbps Ethernet controller was used for this test.

The system under test, the destination servers, and the client driver systems were connected to the SUT through a single 100Mbps Ethernet LAN segment, using the TCP/IP network protocol. An IBM PC Server 320 system was used as the source driver (parent) system; IBM PC 750 systems were used as the client drivers. Three IBM PC Server 330 systems were used as destination servers. Destination mail addresses were distributed across these three destination servers.

The IBM Netfinity 5000 system under test ran Microsoft Windows NT Server Version 4.0 and Domino Server Release 4.62a. The Name and Address Book in all the clients contained person documents for 3,450 mail recipients who were randomly selected by each active Mail user. The server under test contained mail files for 3,450 Mail users for the RAID-1 configuration. The public Name and Address Book contained 3,450 mail-recipient person documents and each of the three destination servers contained mail files for 1,150 recipients.

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

Mail-Only Workload - RAID-1
LOG_MAILROUTING=10
MAILLOGTOEVENTSONLY=1
MAILUSEPROCESS=0
MAILUSETHREADS=1
MAILMAXTHREADS=4
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 data files were located on the E - partition. The Domino executables were placed on the C - partition

.

Test Procedures

For the run using RAID-1, 14 child drivers were used. The number of users simulated in child drivers 1 through 14 were, respectively: 275, 250, 250, 250, 250, 250, 250, 250, 250, 250, 250, 250, 250, and 75. 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, 1, 1, 2, 2, 2, 3, 3, 3, 4, 4, 4, 5, 5, and 5 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 5000 NotesMark Value for Mail-Only Test

The Netfinity 5000 server ran error-free during a steady-state period of 8 hours and demonstrated that it can support 3,350 concurrent active Mail users. The NotesMark throughput value was 5,042. Average response time was 1.016 seconds.

Mail-Only Workload - NotesMark
IBM Netfinity 5000

Per Minute

6,000
5,000
4,000
3,000
2,000
1,000
0

NotesMark = 5,042
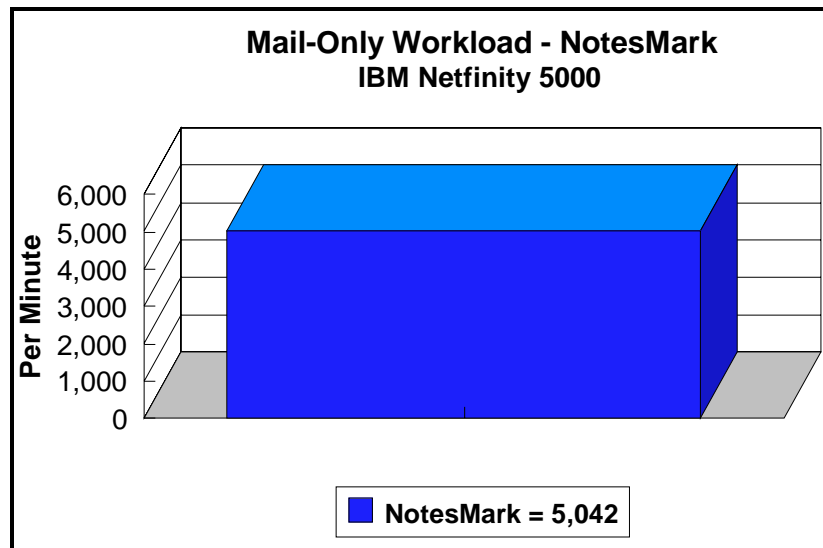
The Mail workload executes Notes transactions that model a server for mail users at sites that rely only on mail for communication. The resulting capacity metric for a mail-only server is the maximum number of users that can be supported before the average user response time becomes unacceptable.

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 = 01/04/99 05:03:42 PM   Max Stop Time = 01/05/99 04:20:13 AM
Total Test Errors = 0
Total Test Time = 40620 sec
Test Run: Users = 3350   NotesMark = 5042   Response Time = 1016 msec (01/04/99
07:46:00 PM to 01/05/99 04:02:00 AM)

Mail-Only Workload - Average Response Time
IBM Netfinity 5000

Seconds

5
4
3
2
1
0

Average Response Time = 1.016

Mail-Only Workload - Users
IBM Netfinity 5000

Mail Users

4,000
3,000
2,000
1,000
0
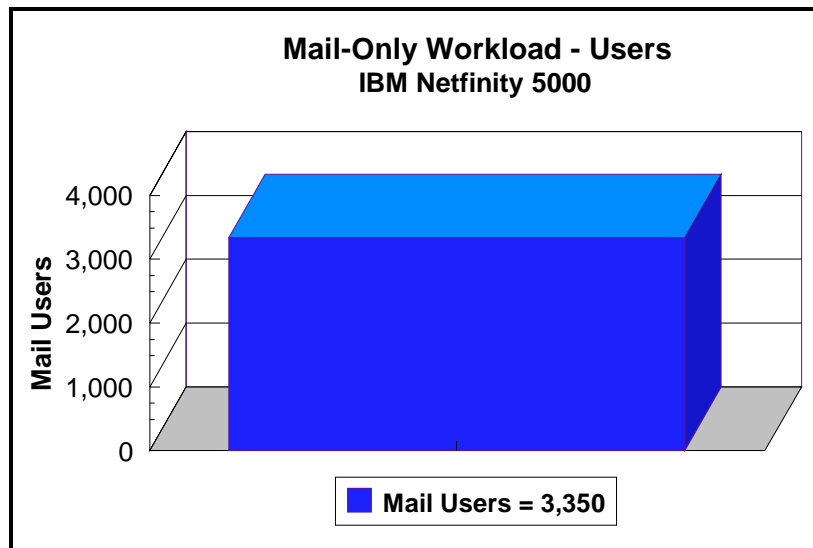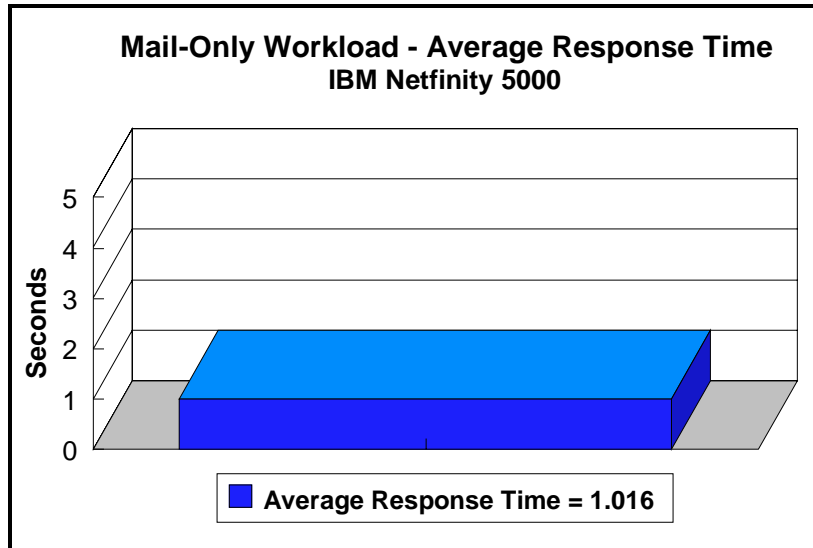
Mail Users = 3,350

Analysis

PERFMON data was collected for a shorter run when the system was ramped up for about three hours. Ramp-up through shutdown is shown in the screen capture below.

Steady State Values	Domino Data in RAID-1
Maximum Concurrent Mail Users	3,350
Average CPU Utilization	88%
Average Memory Used *	998MB
Average Pagefile Usage	1.440
Average Physical Disk Q Length	12

Average Memory Used is computed by subtracting the Average Available Bytes of Memory measured by PERFMON from the installed memory of 1GB. In both cases, the available memory bytes would be used as disk cache, helping to provide acceptable user response time at the respective concurrent-users level. All users ran error-free for more than 8 hours before the controller client performed an orderly stop of the run.
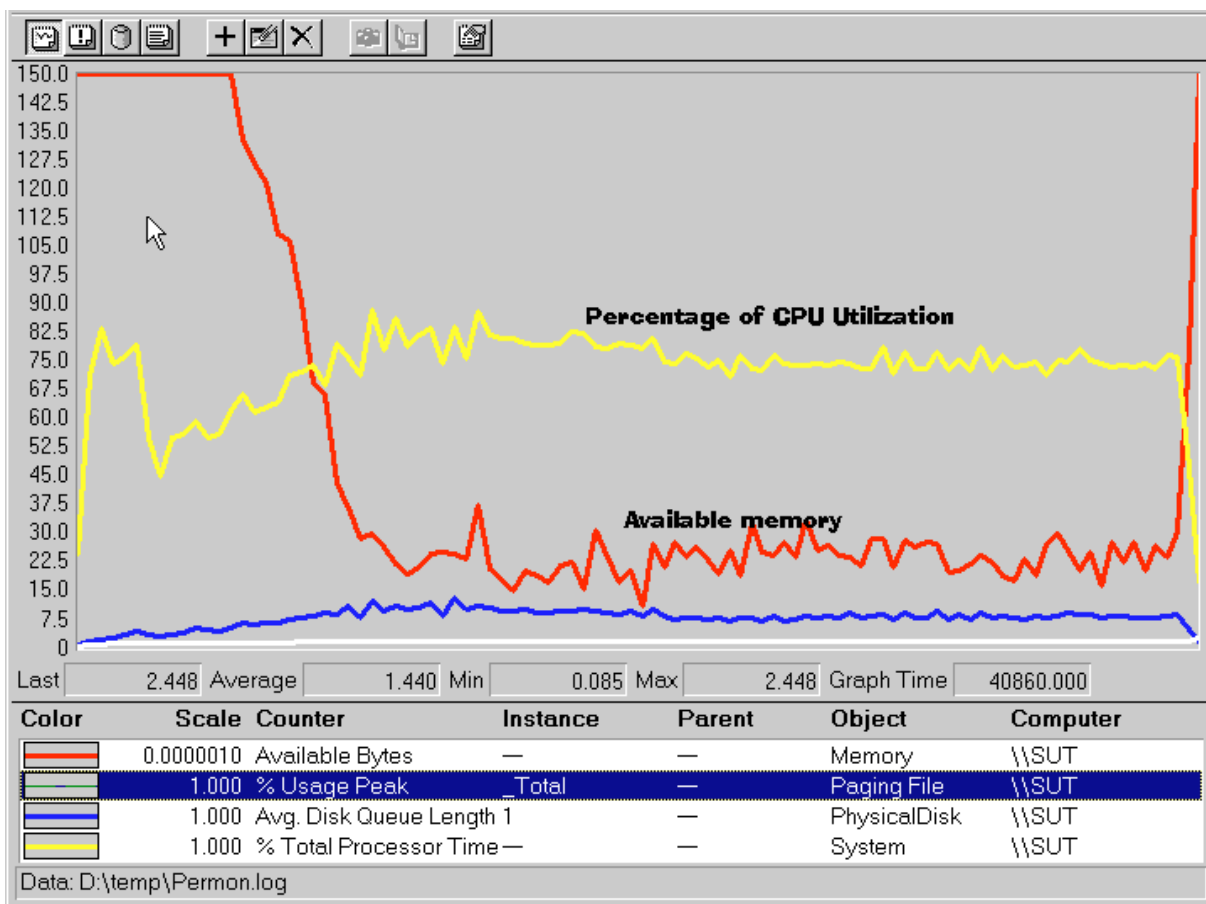
Conclusions

These NotesBench results demonstrate that the IBM Netfinity 5000 (Model 8659-31Y) can support 3,350 Mail-only users. The results obtained are based on running the IBM Netfinity 5000 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.

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

Fifteen driver systems were used used. Fourteen of those systems were configured as client drivers (child 1 through child 14). One system was configured as the parent (source driver).

The client drivers were IBM PC 750 systems, each configured with one 133MHz Pentium Pro processor. Each client driver was configured with 64MB of memory, one 1.6GB hard disk, and one IBM 100/10 Ethernet PCI Adapter.

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

> C: Partition (1.6GB - NTFS) - Windows NT Workstation 4.0 and Notes 4.62a

Number of Server Platforms

One server platform, the IBM Netfinity 5000 with two 450MHz Pentium II processors and 1GB of memory, was benchmarked.

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

- C: Partition (3GB - NTFS) - Windows NT Server Version 4.0 (boot partition) and Domino 4.62a executables
- E: Partition (17GB - NTFS) - Domino data

The disk configuration used for destination servers 1 through 3 is as follows:

- C: Partition (2GB - NTFS) - Windows NT Server Version 4.0 and Notes executables
- E: Partition (10GB - NTFS) - Domino data

Network

A single 100Mbps Ethernet LAN segment was used to connect all systems.

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 Server Release 4.62a
- NotesBench Version 4.62 - 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 Client for Windows NT Release 4.62a
- NotesBench Version 4.62 - Windows/32

Test Setup Diagram
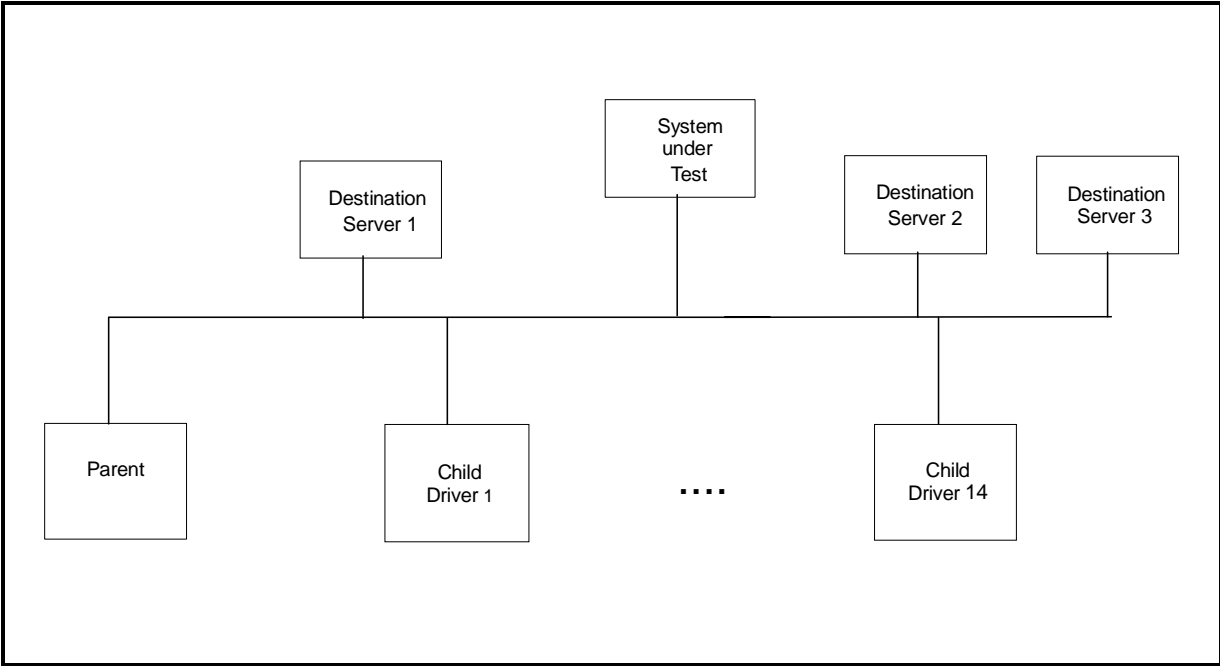
Details of Configuration

System Under Test	Destination Servers 1-3	Child Drivers 1-14	Parent Source Driver
IBM Netfinity 5000	IBM PC Server 330	IBM PC 750	IBM PC Server 320
2 x 450MHz Pentium II	1 x 200MHz Pentium Pro	1 x 133MHz Pentium Pro	1 x 100MHz Pentium Pro
1GB Memory	256MB Memory	64MB Memory	128MB Memory
10 x 4.51GB Drives	6 x 2.25GB Drives (RAID-0)	1 x 2GB Drive	1 x 4.51GB Drive
1 x ServeRAID-3L Ultra2 SCSI Adapter	IBM SCSI-2 Fast/Wide Streaming RAID Adapter		
Integrated Ethernet 100/10 PCI Controller	IBM 100/10 Ethernet PCI Adapter	IBM 100/10 Ethernet PCI Adapter	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

Appendix B: System Configurations

Server under Test	
System	IBM Netfinity 5000
Processor	2 x 450MHz Pentium II Processor
Memory	1GB
Cache	512KB L2 Write-Back Cache
Disk Controller	Netfinity ServeRAID-3L Ultra2 SCSI Adapter
Disk Drive	10 x 4.51GB
Network Interface Adapter	1 x Integrated Ethernet 100/10 PCI Controller
I/O	PCI Bus
Operating System	Microsoft Windows NT Server 4.0 with Service Pack 4
Notes	Domino Server for Windows NT Release 4.62a

Clients	
System	IBM PC 750
Processor	1 x 133MHz Pentium Pro Processor
Memory	64MB
Disk Drive	1 x 2GB
Network Interface Adapter	100/10 Ethernet PCI Adapter
I/O	PCI Bus
Operating System	Microsoft Windows NT Workstation 4.0
Notes	Notes Client for Windows NT Release 4.62a

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]

KitType=2
Directory=e:\notes\data
SETUPDB=SETUP.NSF
USERNAME=Jackals
COMPANYNAME=Wacko
MTATEMP=C:\TEMP
;***
; NotesBench parm changes
;***
SERVER_SHOW_PERFORMANCE=1
MAILUSEPROCESSES=0
MAILUSETHREADS=1
MAILMAXTHREADS=3
MAILLOGTOEVENTSONLY=1
LOG_MAILROUTING=10
No_Force_Activity_Logging=1
DEBUG_OUTFILE=\\nbfstb2\lastrun\sutinfo.log
;***
WinNTIconPath=e:\notes\data\W32
$$HasLANPort=1
WWWDSP_SYNC_BROWSERCACHE=0
WWWDSP_PREFETCH_OBJECT=0
EnableJavaApplets=1
EnablePlugins=1
Preferences=-2146956175
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=MicrosoftWord 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,
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 4.0/5.0,0,_IW4W,W4W21F/V4C,.XLS,,4,
EDITIMP31=Word for Windows 6.0,0,_IW4W,W4W49F/V0,.DOC,,2,
EDITIMP32=GIF Image,0,_IGIF,,.GIF,,18,
EDITIMP33=JPEG Image,0,_IJPEG,,.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=02004261736963000000000000000000000000000000000000000000000000000000000001010100000A000000000000
0100A0050000A0050000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000
NAMEDSTYLE1=020042756C6C65740000000000000000000000000000000000000000000000000000001010100000A000000000000
0000080700000807000000000000000000000000000000000000000000000000000000000000000000000000000040000000000000
000
NAMEDSTYLE2=0200486561646C696E65000000000000000000000000000000000000000000000000000000010101010B0C000000000000
0100A0050000A0050000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000
$$$OpenSpecial=NotesNIC
$$$NotesNIC=CN=Home/OU=Notes/O=NET, welcome.nsf, Notes NIC Welcome, Notes Network Information Center on the Internet
ServerTasks=Replica,Router,Update
;ServerTasks=Router,Replica,Update,Stats,Amgr,Sched,CalConn,AdminP,Report,Event
;ServerTasksAt1=Catalog,Design
;ServerTasksAt2=UpdAll,Object Collect mailobj.nsf
;ServerTasksAt5=Statlog
TCPIP=TCP, 0, 15, 0
Ports=TCPIP,WAN2
LOG_REPLICATION=0
LOG_SESSIONS=0
ExistingServerName=CN=S1/O=TestBed2
KeyFilename=sut.id
CertificateExpChecked=e:\notes\data\sut.id 12/10/98
PhoneLog=2
Log=log.nsf, 1, 0, 7, 40000
MailServer=CN=SUT/O=TESTBED2
Domain=TESTBED2
Admin=CN=Admin/O=TESTBED2
TemplateSetup=16
Setup=53
ServerSetup=8
NAMES=names.nsf
EmptyTrash=0
WeekStart=1
WAN2=TCP,0,15,0,,12288,
SDI_WINDOW=0
DESKWINDOWSIZE=16 23 420 288
MAXIMIZED=1
WinNTIconCommonConfig=Universal
WinNTIconSize=2
WinNTIconPos=2
WinNTIconHidden=0
WinNTIconRect=-1 -1 641 25
FileDlgDirectory=E:\notes\data
ZONE_SET=1
Timezone=5
DST=1
ECLSetup=3
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 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. Also, provided are prices obtained from CDW Computer Centers, Inc. The price/performance results in this document are based on third-party pricing. For additional information and current prices, contact your local IBM representative.

Item Description	Order Number	Qty	IBM Estimated Reseller Unit Price	Extended IBM Estimated Reseller Price	Reseller Unit Price	Extended Reseller Price
IBM Netfinity 5000	8659-31Y	1	$2,885	$2,885	$2,585	$2,585
1 x 450MHz / 512KB L2 Cache Pentium II Processor						
1 x 64MB ECC DIMM						
Integrated 100/10Mbps Ethernet PCI Controller						
450MHz Pentium II Processor Upgrade	10L5900	1	1,379	1,379	1,235	1,235
Netfinity ServeRAID-3L Ultra2 SCSI Adapter	01K7364	1	799	799	739	739
256MB SDRAM ECC DIMM	01K8043	4	1,555	6,220	1,411	5,644
Netfinity EXP10 4.51GB 10K Wide Ultra SCSI Hard Disk	01K7960	10	685	6,850	621	6,210
Netfinity EXP15 Rack Storage Expansion Enclosure	35202RU	1	2,799	2,799	2,596	2,596
IBM G42 14" (13.2" Viewable) Color Monitor	654000N	1	219	219	207	207
Software						
Windows NT Server 4.0	227-01025	1	665	665	665	665
Lotus Domino Server Release 4.62 included on ServerGuide* with IBM Netfinity 5000 at no charge		1	0	0	0	0
Total System Price				$21,816		$19,881

Appendix H: Optional (Vendor-Defined Information)

None.

First Edition - January 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.