IBM Audit Report

NotesBench Disclosure Report
for
Lotus Domino Server 5.0.3
on
IBM AS/400e 840-2420 on V4R5 OS/400

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NotesBench Disclosure Report

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Section 1: Executive Summary

In recently conducted measurements, using Lotus Development Corporation's NotesBench benchmark, the IBM AS/400e model 840 (feature code 2420) demonstrated industry leadership performance with Lotus Domino Server Release 5.0.3 on IBM OS/400 V4R5.

<u>**AS/400e 840-2420**</u>
- Users: 75,000
- Response Time: 276 milliseconds
- Fault Tolerance: Mirrored
- Notesbench for 5.0.3 Version: 166 - Windows/32
- 27 Domino Partitions in a single Notes Domain

The results for the IBM AS/400e 840-2420 are based on the NotesBench R5Mail workload which was run on a single configuration. The results are summarized in the following table.

75,000 Users	101,213 NotesMark
276 Millisecond Response Time	Steady State Test Time- 6 hours
The cost per Notes users is $31.78	The cost per NotesMark is $23.55

The IBM AS/400e 840-2420, configured with 24 - 500 MHz PowerPC microprocessors, 64GB of memory, and 270 x 8.589GB hard disk drives, and 27 Domino partitions supported a Notesbench R5Mail workload of 75,000 active Notesbench R5Mail users.   All partitions
shared the same Domino Directory which contained 150,000 person documents.

In addition to the IBM AS/400e 840-2420 system under test (SUT), the benchmarked configuration used 75 client (child) driver systems for Notesbench R5Mail workload, and one parent system. All systems were connected on a single 100Mbps Ethernet LAN, using the TCP/IP network protocol. Configuration details are provided in **Appendix A**: Overall Test Setup and Software Versions.

The performance measurements were completed by June 16, 2000. All aspects of the performance measurements including setup, execution, results analysis and reporting were performed by the Performance Design II team in IBM's Server Group Division in Rochester, MN.   KMDS Technical Associates, Inc., audited the results on June 26, 2000.

NotesBench provides an objective method for evaluating the performance of different platforms running Lotus Domino Server Release 5.0.3. 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.

For more information about Domino, AS/400, Domino for AS/400, and the AS/400 Workload Estimator(system sizer), visit the following Web sites:

Http://www.lotus.com
Http://www.as400.ibm.com
Http://www.as400.ibm.com/domino
Http://www.as400.ibm.com/techstudio
Http://www.softmall.ibm.com/as400/domino/index.html
Http://notes.net
Http://www.as400service.ibm.com/estimator

Section 2: Benchmarking Objectives

The benchmark objective was to provide customers with information on AS/400e leadership in performance scalability running Lotus Domino Release 5.0.3.   The Notesbench R5Mail workload was used to demonstrate the large number of R5Mail users and partitions that can be supported on an IBM AS/400e 840 system.

Section 3: Test Methodologies

Test Setup and Hardware/Software Configuration

The IBM AS/400e 840-2420 system under test (SUT) was configured with twenty-four 500MHz PowerPC microprocessors; 64GB of memory; 270 x 8.589GB DASD; and 5 10/100Mbs Ethernet I/O Adapters. The 270 8.589GB DASD were mirrored.

For these tests, a single 100Mbs Ethernet LAN was used. The SUT and the driver systems were connected to the LAN. An IBM PC 365 computer was used as the source driver (parent) system; IBM PC300PL's and IBM Intellistation computers were used as the client driver (child) systems.

The IBM AS/400e 840-2420 SUT ran OS/400 V4R5 and Domino for AS/400 Release 5.0.3. The Public Name and Address Book contained person documents for 150,000 Notesbench R5Mail recipients who were randomly selected by each active Notesbench R5Mail user.

The following NOTES.INI parameters were modified for the Domino partitions on the SUT.

NSF_BUFFER_POOL_SIZE_MB=200
SERVER_SHOW_PERFORMANCE=1
SERVER_POLL_SCALING_FACTOR=20
LOG_MAILROUTING=10
MAILLOGTOEVENTSONLY=1
UPDATE_NO_FULLTEXT=1
MAILBILLINGFLAGS=1
MailCompactDisabled=1
FaultRecovery=0
ServerTasks=Router
SERVER_MAX_CONCURRENT_TRANS=100
SERVER_POOL_TASKS=40
NSF_DBcache_MaxEntries=100
DEBUG_TCP_RESOLVER=1

The following parameter was added to the notes.ini file in order to capture the server console output:

DEBUG_OUTFILE=/dom5p1/notes/data/log.txt.

All Domino server tasks were disabled except Router on the system under test (SUT). Please refer to **Appendix C** for additional information on Operating System Parameters.

Test Procedures

During ramp-up for the Notesbench R5Mail test, all users were added over a period of 154 minutes. Each of the 75 children ran 1000 users. Children were started in 5 groups of 15 children each. The 5 groups had ThreadStagger set to 1, 1, 1, 2, and 3 seconds respectively. After the last child in each group had all of its users up, we waited 1 minute before starting the next group.

The SUT ran for an extended period of 6 hours after all users were added. During the test, the tools used to determine steady state included 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. Over 90% of the mail generated
during the test period was delivered during the test period. We confirmed steady state when:

> **v**The SUT Domino consoles sustained the peak user load
> **v**Mail being sent did not become backlogged, as verified by:
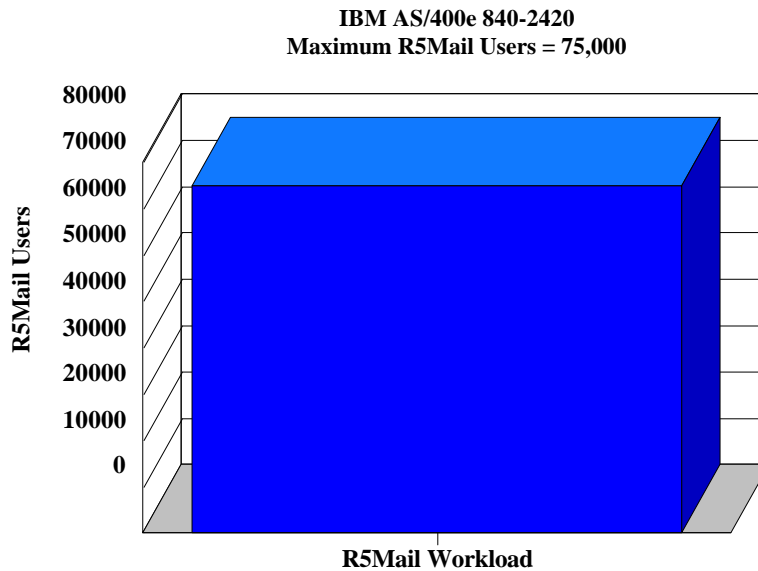>> **v**Pending mail snapshots using sh stat mail at 30 minute intervals

During the workload we monitored the SUT performance using the AS/400 performance monitor provided with the system.

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

Section 4: Data

AS/400e 840-2420 NotesMark Value for Notesbench R5Mail Workload

The Notesbench R5Mail workload ran for over 9 1/2 hours, including ramp-up and steady state. The IBM AS/400e 840-2420 system demonstrated that it can support 75,000 concurrent active users with this workload.

IBM AS/400e 840-2420
Maximum R5Mail Users = 75,000

R5Mail Users

80000
70000
60000
50000
40000
30000
20000
10000
0

R5Mail Workload

The Notesbench R5Mail workload executes Notes transactions that model a server for Mail users at sites that rely on Mail for communication. The Notesbench R5Mail test script models an active user who is reading and sending mail, scheduling an appointment, and sending a Calendar & Scheduling (C&S) invitation. 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, 3 messages comprised of 1 memo to 3 recipients, 3 lookups against the Domino Directory (when NthIteration=6), 1 C&S appointment, and 1 C&S invitation which each user sends approximately every 90 minutes.

The NotesMark throughput value was 101,213. Average response time was 276 milliseconds.

IBM AS/400e 840-2420
75,000 R5Mail Users
Notesmark = 101,213
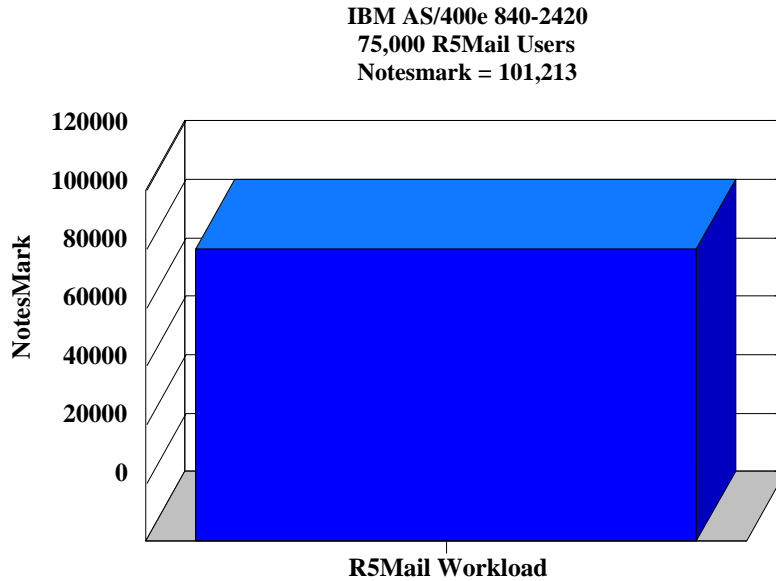
NotesNum Output for Notesbench R5Mail Workload

Min Start Time = 06/18/2000 01:08:07 PM   Max Stop Time = 06/18/2000 10:56:03 PM
[1]Total Test Errors = 8
Total Test Time = 35280 sec

Test Run: Users = 75000   NotesMark = 101213   Response Time = 276 msec (06/18/2000 03:16:00 PM
to 06/18/2000 09:18:00 PM)

The response time was well within the 5 seconds (5000 msec) NotesBench response time criteria.

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[1]   The 8 errors occurred during Ramp-up. Errors that occur during Ramp-up are not considered part of the NotesBench test
period.

IBM AS/400e 840-2420
75,000 R5Mail Users
Average Response Time = 276 milliseconds
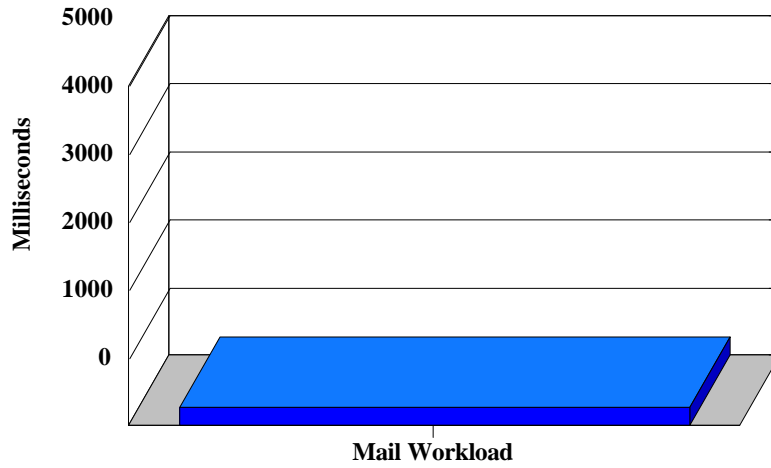
Average response time for 101,213 Notesmark over a 6 hour
period was 276 milliseconds (0.276 seconds).

Section 5: Analysis

During the non-audited measurement runs, the OS/400 performance monitor was used to collect data on the SUT. As reported by the AS/400 Performance Tools, the utilization of the CPU was approximately 92.9% This was calculated using the data collected during a 6 hour time interval with 75,000 Notesbench R5Mail users running at a steady state. (Note: AS/400 is designed to run well even at high CPU utilizations.)

During the 6 hour steady state of the audit run, the average disk utilization was 21.2% with an average disk response time of .0068 seconds. The mail files, operating system, and other data on the SUT occupied 82.3% of the disk space during the test.

75,000 NotesBench R5Mail Users

CPU %Busy (y-axis, values 0 to 100 in increments of 10)

Legend: CPU %Busy
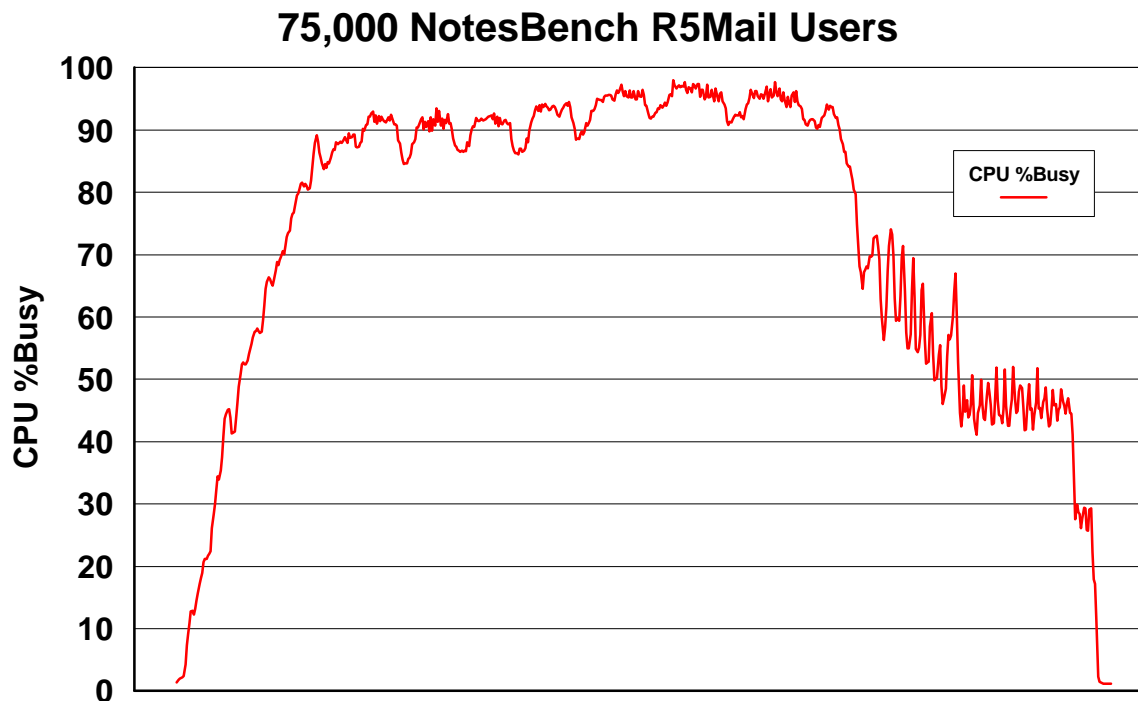
Section 6: Conclusions

The test results demonstrate that an IBM AS/400e 840-2420 configured with 27 partitions, as described within this report, can support 75,000 Notesbench R5Mail users[1] with a response time of 276 milliseconds (well within benchmark criteria).

[1]The results are based on running the IBM AS/400e 840-2420 as a Domino server. 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.

Section 7: Statement by Auditor

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

Appendix A: Overall Test Setup and Software Versions

System Under Test (SUT)

The IBM AS/400e 840-2420 was running OS/400 V4R5. Lotus Domino for AS/400 5.0.3 was configured with 27 partitions. Twenty-five of these were mail servers and 2 of these were acting as mail routing hubs. The Domino servers were configured in one Notes Domain. Each user was capable of sending mail to any other user. Each Domino for AS/400 server ran in a separate partition and in a dedicated OS/400 subsystem, which isolates each Domino server from performance impacts or problems associated with other servers or workloads on the system. There were five 10/100 Ethernet I/O Adapter cards connecting the AS/400e to a single LAN segment running at Full-Duplex.
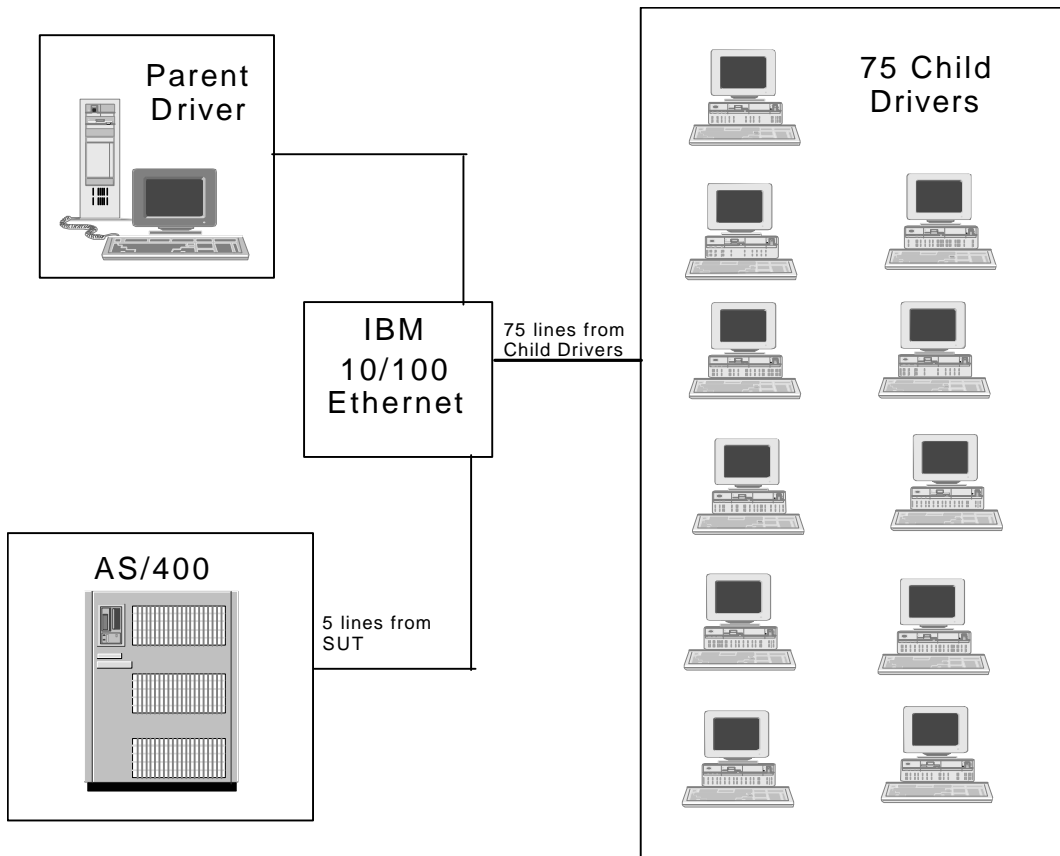
Number of Client Systems

For the Notesbench R5Mail workload, 76 driver systems were used. Seventy-five of those systems were configured as child drivers (child 1 through child 75). One system was configured as the parent (source driver). The parent was running Windows NT Server 4.0 with service pack 4. The NT server was set up in stand-alone mode, not as a domain controller.

The child systems were IBM Intellistations and IBM PC300PL computers, each configured with 320MB of memory and one Pentium Pro processor (200MHz - 450MHz). Each Child driver had one IBM 10/100 Ethernet Adapter or equivalent. The disk configuration used for the child systems is as follows:

[1] C: Partition (0.61 - 4.5GB - NTFS)	Windows NT 4.0 Workstation with Service Pack 4.
D: Partition (0.97GB - 9.0GB - NTFS)	Notes 5.0.3 executable and Notes data

Number of Server Platforms

One server platform, the IBM AS/400e 840-2420 with 64GB of memory, was benchmarked.

The disk configuration used for the system under test was configured as 1 ASP with 18 RAID Controllers, 6 PCI IOPs and the following disk mirroring options:

Controller Level: Mirrored Pair 1	2 x 8.589GB DASD
Bus Level: Mirrored Pairs 2-135	268 x 8.589GB DASD

Network

A single 100Mbps Ethernet LAN was used. Five IBM Ethernet type 8226 switches were used to connect the servers and clients to the LAN.

Software Versions

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

- w OS/400 V4R5
- w Domino for AS/400 Release 5.0.3

Software versions used on the child drivers were as follows:

- w Microsoft Windows NT Workstation Version 4.0 and Service Pack 4
- w Lotus Notes Client for Windows NT Release 5.0.3
- w NotesBench for Version 166 - Windows/32

¹ On some of our Child systems, all data is on the C drive.

Appendix B: System Configurations

System under Test (SUT)	
System	IBM AS/400e 840-2420
Processors	24- 500MHz PowerPC microprocessor
Memory	64GB
Disk	270 - Model 6717 8.589GB. Mirrored using 18 controllers.
Network Interface Adapter	5 - Model 4838 10/100Mbs Ethernet I/O Adapter
Operating System	OS/400 V4R5
Notes	Domino for AS/400 Release 5.0.3

Parent	
System	IBM PC 365
Processor	200 MHz Pentium
Memory	146MB
Disk	C: 1.51 GB (NTFS) D: 4.18 GB (NTFS)
SCSI	IBM PCI FAST/Wide Ultra SCSI Adapter
Network Interface Adapter	IBM 10/100 Ethernet Adapter
Operating System	Microsoft Windows NT Server 4.0 with Service Pack 4
Notes	Notes Client and Server for Windows NT Release 5.0
Notesbench	NotesBench for Version 166 - Windows/32

Children	
System	24 IBM Intellistations M Pro (333 MHz Pentium Pro Processor) 11 IBM Intellistations Z Pro (200 MHz Pentium Pro Processor) 40 IBM PC300PL (450 MHz Pentium Processor)
Memory	320MB
Disk	C: 0.6 - 4.5GB (NTFS) D: 0.9 - 9.0GB (NTFS)
Network Interface Adapter	IBM 10/100 Ethernet Adapter

Operating System	Microsoft Windows NT Workstation 4.0 with Service Pack 4
Notes	Notes Client for Windows NT Release 5.03
Notesbench	NotesBench for Version 166 - Windows/32

Appendix C: Operating System Parameters (SUT)

Changed System Values			
Name	**Current Value**	**Shipped Value**	**Description**
QACTJOB	1,000	20	Initial number of active jobs
QADLACTJ	1,000	10	Additional number of active jobs
QADLTOTJ	1,000	10	Additional number of total jobs
QBASACTLVL	30,000	6	Base storage pool activity level
QCMNRCYLMT	5 1	0 0	Communications recovery limits
QCTLSBSD	QSYS/QCTL	QSYS/QBASE	Controlling subsystem
QHSTLOGSIZ	32,767	5,000	Maximum history log records
QJOBMSGQFL	*PRTWRAP	*NOWRAP	Job message queue full action
QJOBMSGMX	64	16	Maximum size of job message queue
QJOBMSGQSZ	16,384	16	Job message queue initial size
QJOBMSGQTL	16,384	24	Job message queue maximum initial size
QMCHPOOL	4,803,428	4,287,478	Machine storage pool size
QPFRADJ	0	2	Performance adjustment
QSECURITY	20	40	System security level
QSTRUPPGM	SECURITY/ QSTRUPPGM	QSYS/ QSTRUP	Startup Program
QTOTJOB	1,000	30	Initial total number of jobs

Both the HTTP server and the print spooler are part of the base OS/400 product and run by default. The HTTP Server and the QSPL (print spooler) subsystem were ended.

Added/Changed AS/400 Environment Variables	
Notes_AS400_CONSOLE_ENTRIES	10,000

The SUT was configured to use two memory pools, System Pool 1 and 2. System Pool 1 (*MACHINE) was allocated 4.6GB. By default, System Pool 2 (*BASE) receives the rest of the system's memory - in our case about 59.4GB.

System pool 2 (*BASE) had the *CALC option specified. This option has the effect of forcing memory pages to be written to disk more frequently, thus improving the overall performance of disk I/Os. The *CALC option was changed using the Change Shared Storage Pools(CHGSHRPOOL) command (PAGING parameter).

Appendix D: NOTES.INI Settings

NOTES.INI File for the System under Test

(Partition #1)
[Notes]
Directory=/DOM5P1/NOTES/DATA
KitType=2
NPN=1
UNICODE_DISPLAY=1
CleanupScriptPath=CALL QNOTES/NSD
Passthru_LogLevel=0
Console_LogLevel=2
VIEWIMP1=Lotus 1-2-3 Worksheet,0,_IWKSV,,.WKS,.WK1,.WR1,.WRK,.WK3,.WK4,,4,
VIEWIMP2=Structured Text,0,_ISTR,,.LTR,.CGN,.STR,,1,
VIEWIMP3=Tabular Text,0,_ITAB,,.PRN,.RPT,.TXT,.TAB,,1,
VIEWEXP1=Lotus 1-2-3 Worksheet,0,_XWKS,,.WKS,.WK1,.WR1,.WRK,,4,
VIEWEXP2=Structured Text,0,_XSTR,,.LTR,.CGN,.STR,,1,
VIEWEXP3=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=CGM Image,0,_IFL,,.GMF,.CGM,,8,
EDITIMP5=TIFF 5.0 Image,0,_ITIFF,,.TIF,,18,
EDITIMP6=Ami Pro,0,_IW4W,W4W33F/V0,.SAM,,2,
EDITIMP7=HTML File,0,_IHTML,,.HTM,.HTML,,1,
EDITIMP11=WordPerfect 5.x,0,_IW4W,W4W07F/V1,.DOC,.WPD,,2,
EDITIMP12=PCX Image,0,_IPCX,,.PCX,,18,
EDITIMP13=FrameMaker 3.0,0,_IW4W,W4W42F/V0,.MIF,,2,
EDITIMP19=Binary with Text,0,_ISTRNGS,,.*,,1,
EDITIMP20=Interleaf ASCII,0,_IW4W,W4W46F/V0,.TPS,,2,
EDITIMP21=WordPerfect 6.0/6.1,0,_IW4W,W4W48F/V0,.WPD,.WPT,.DOC,,2,
EDITIMP22=Excel spreadsheet,0,_IW4W,W4W21F/V4C,.XLS,,4,
EDITIMP23=Word for Windows,0,_IW4W,W4W49F/V0,.DOC,,2,
EDITIMP24=GIF Image,0,_IGIF,,.GIF,,18,
EDITIMP25=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,
EDITEXP9=WordPerfect 5.1,2,_XW4W,W4W07T/V1,.DOC,,2,
EDITEXP10=FrameMaker 3.0,0,_XW4W,W4W42T/V0,.MIF,,2,
EDITEXP11=Interleaf ASCII,0,_XW4W,W4W46T/V0,.TPS,,2,
EDITEXP14=WordPerfect 6.0,2,_XW4W,W4W48T/V0,.DOC,,2,
EDITEXP15=WordPerfect 6.1,2,_XW4W,W4W48T/V1,.WPD,.WPT,.DOC,,2,
EDITEXP16=Word for Windows 6.0,2,_XW4W,W4W49T/V0,.DOC,,2,
NAMEDSTYLE0=020042617369630000000000000000000000000000000000000000000000000000000000
0001010100000A000000000000100A0050000A00500000000000000000000000000000000000000000000
00000000000000000000000000000000000000000000000000000000000

NAMEDSTYLE1=020042756C6C65740000000000000000000000000000000000000000000000000000000
00001010100000A0000000000000000080700000807000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000040000000000000000
NAMEDSTYLE2=0200486561646C696E65000000000000000000000000000000000000000000000000000
000010101010B0C00000000000000100A0050000A0050000000000000000000000000000000000000000000
00000000000000000000000000000000000000000000000000000000000000
$$$OpenSpecial=NotesNIC
$$$NotesNIC=CN=Home/OU=Notes/O=NET, welcome.nsf, Notes NIC Welcome, Notes Network Information
Center on the Internet
Preferences=2147617905
ServerTasks=Router
KillProcess=1
ServerName=DOM5P1/IBM
TCPIP=TCP, 0, 15, 0
TCPIP_TcpIpAddress=0,1.1.1.1:1352
TRANSLOG_USE_CONFIG=1
$$HasLANPort=1
Ports=TCPIP
SPX=SPX, 0, 15, 0
Serial1=XPC,1,15,0,
Serial2=XPC,2,15,0,
DisabledPorts=SPX,Serial1,Serial2
LOG_REPLICATION=1
LOG_SESSIONS=0
ExistingServerName=PARENT
KeyFilename=DOM5P1.ID
Timezone=6
DST=1
ZONE_SET=1
MailServer=CN=DOM5P1/O=IBM
ServerKeyFileName=DOM5P1.ID
Domain=IBM
Admin=CN=Admin/O=IBM
TemplateSetup=62
ServerSetup=50
Setup=60
CleanSetup=1
PhoneLog=2
Log=log.nsf, 1, 0, 7, 40000
SCHEDULE_VERSION=3
;
; NOTES BENCH STUFF
;
SERVER_SHOW_PERFORMANCE=1
SERVER_POLL_SCALING_FACTOR=20
EmptyTrash=0
SDI_WINDOW=0
NewMailInterval=15
log_mailrouting=10
maillogtoeventsonly=1
Update_No_Fulltext=1
PhoneLog=2
Log=log.nsf,1,0,7,40000
DEBUG_OUTFILE=/DOM5P1/notes/data/log.txt

```
MailBillingFlags=1
MailCompactDisabled=1
FaultRecovery=0
;
; End of NotesBench stuff
; NOTES BENCH STUFF
DDETimeout=10
DefaultMailTemplate=mail50.ntf
BillingClass=Agent,Database,Document,Mail,Replication,Session
BillingAddinOutput=1
MailClusterFailover=1
DDETimeout=10
SCHEDULE_VERSION=3
MTEnabled=0
DEBUG_GASN_BREAK=1
Previous_TRANSLOG_Path=/DOM5P1/NOTES/DATA/tranlog1/
Previous_TRANSLOG_Style=0
SetMailLogToEventsOnly=1
No_Forced_Activity_Logging=1
IMAP_Session_Timeout=15
DEBUG_SHRED=0
Disable_IOCP=0
debug_threadid=0
server_clock=0
TRANSLOG_AutoFixup=1
TRANSLOG_UseAll=0
TRANSLOG_Style=0
TRANSLOG_Performance=2
TRANSLOG_Status=0
NAMES=names.nsf
NSF_Buffer_Pool_Size_MB=200
Server_Pool_Tasks=40
Server_Max_Concurrent_Trans=100
;Server_MaxSessions=4000
;Server_Session_Timeout=10
NSF_DBcache_MaxEntries=100
DEBUG_TCP_RESOLVER=1
DISABLE_TYPEAHEAD=0
```

NOTES.INI Differences for Additional Partitions

System Under Test Notes.ini for Partition #2 - 25

```
[notes]
Directory=/dom5pX/notes/data
ServerName=dom5pX
TCPIP_TcpIpAddress=0,1.1.1.X:1352
KeyFilename=/dom5pX/notes/data/dom5pX.id
MailServer=CN=DOM5PX/O=IBM
ServerKeyFileName=dom5pX.id
FileDlgDirectory=/dom5pX/notes/data
DEBUG_OUTFILE=/dom5pX/notes/data/log.txt
```

Where *X* equals the partition number.

System Under Test Notes.ini for Partition #26 - 27 (HUBS)

```
Directory=/hubX/notes/data
ServerName=hubX
TCPIP_TcpIpAddress=0,1.1.1.X:1352
KeyFilename=/hubX/notes/data/hubX.id
MailServer=CN=HUBX/O=IBM
ServerKeyFileName=hubX.id
FileDlgDirectory=/hubX/notes/data
DEBUG_OUTFILE=/hubX/notes/data/log.txt
NSF_Buffer_Pool_MB=750
Server_Pool_Tasks=20
NSF_DBCache_MaxEntries=10
```

Where *X* equals blank or 2. (for 'hub' and 'hub2')

Appendix E: Network Configuration

The network for the test environment was a single isolated Ethernet LAN.

The Ethernet was set to a line speed of 100Mbs, running Full Duplex, and the Maximum Transfer Unit was set to 1492.

All nodes were part of the same Notes Domain and Network

The TCP/IP protocol was used.

Appendix F: Guidelines for Information Usage

This report is intended for IBM Business Partner, 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 the end user for the U.S. only. Information on the following IBM/Lotus Partners/Resellers can be found in **Appendix H**.

> Corning Data Services, Inc.
> Essex Technology Group
> REAL Solutions
> Sirius Computer Solutions

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.

Item Description	Qty	Price	Vendor
Hardware:			
2420 Model 840 24-way Processor	1	$550,000.00	
9406-840 System Unit	1	$640,000.00	
9079 BASE I/O Tower	1	NC	
9943 BASE PCI IOP	6	NC	
9691 BASE Bus Adapter	5	NC	
9771 BASE PCI Two-line WAN w/Modem	1	NC	
9737 BASE HSL Ports - 16 Copper	1	NC	
9748 BASE PCI Disk Unit Ctrl	1	NC	
0042 MIRRORED SYSTEM IOP LEVEL	1	NC	
9907 Base 4.19 GB Disk Unit	1	NC	
2843 PCI IOP	6	$11,550.00	
2924 ENGLISH	1	NC	
3195 4096MB Main Store	16	$1,179,648.00	
4317 8.58GB 10K RPM DISK UNIT	270	$540,000.00	
4425 CD-ROM	1	$415.00	
4482 4GB ¼ INCH CARTRIDGE TAP	1	$1,300.00	
4746 PCI Twinaxial Workstn IOA	1	$750.00	
4748 PCI RAID Disk Unit Controller	17	$102,000.00	
4838 PCI 100/10Mbps Ethernet IOA	5	$4,500.00	
5000 SW PRELOAD REQUIRED	1	NC	
5027 Software Version V4R5	1	NC	

5074 PCI Expansion Tower	5	$89,500.00	
5101 30-DISK EXPANSION FEATURE	6	$54,000.00	
5506 ALT IPL SPECIFY FOR QIC-40	1	NC	
5540 ATTACH TWNAXAL WRKSTA CTRL	1	NC	
1426 200V 14-Foot Line Cord	1	NC	
1454 250V 14- Foot Locking Line Cord	6	NC	
1461 6m HSL Cable	12	$6,600.00	
1464 6m SPCN Cable	6	NC	
0348 V.24/EIA232 20-FT Cable	1	$125.00	
#3488 V1Z Twinax Base Unit	1	$715.00	
#6548 0AZ Display Unit	1	$259.00	
Software:			
5027 V4R5	1	NC	
2924 English	1	NC	
Lotus Domino Server Release 5.0.3 for AS/400e	1	$20,054.00	
Total System Price:		$3,201,416	$2,383,805.97

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(2) The total system price of $2,383,805.97 reflects a 25.7% discount on all hardware and software except for "Lotus DominoServer Release 5.0.3 for AS/400e", which was not discounted.

Appendix H: Optional (Vendor-Defined Information)

Innovations in hardware and software technology allow AS/400 to once again achieve record- breaking Lotus Domino performance. This trend began with the January 1998 audit of 10,400 Notesbench Mail users on the largest AS/400 system to date. The audit was done approximately one month before the Domino for AS/400 product launch. An even more impressive audit in October 1998 featured the high end member of the AS/400e processor family based on the Northstar processor. AS/400 scalability had more than doubled to 27,030 Notesbench Mail users within one year.

Today, the 24-way AS/400e model 840 IStar server is among the industry's first servers to use silicon on insulator (SOI) and copper interconnect in its processor chips. These technology advancements contribute to a potential performance boost of approximately 300% over the previous generation high end AS/400 servers. Taking advantage of the software scalability and performance enhancements of Lotus Domino Release 5, this audit highlights AS/400 as an "extreme machine" for Domino. The outstanding result is 75,000 Domino for AS/400 R5 Mail and Calendar users on a single AS/400 server footprint.

AS/400 truly shines, particularly when you look beyond acquisition cost and evaluate the true cost of owning and managing your Domino environment. The value, ease of administration, and demonstrated low cost of ownership of AS/400 stem from its robustness, its integration, and its ability to safely run many applications at the same time. The following paragraphs summarize the AS/400 value proposition for Domino -- why IBM, Lotus, our Business Partners, and our customers continue to invest in it.

This benchmark result is a testament to AS/400 **scalability**. The audited high end configuration, with 64 GB of memory and 1.159 terabytes of disk, supports 75,000 users at 93% CPU utilization and 276 millisecond response time. Top-to-bottom scalability for Domino workloads within the new AS/400e model 8xx server family represents a growth of more than 30 times with the same operating system. In addition, Domino for AS/400 makes efficient use of all the processors in an SMP configuration.

Scalability is not dictated solely by the number of users claimed in a controlled benchmark. The true measure is how many users a server can realistically support with mission-critical availability in real life. With its history of robust **reliability**, AS/400e delivers. Furthermore, AS/400 architecture provides a high **availability** environment in which Domino partitions are isolated from the effects of one another. This promotes uninterrupted performance for other applications, making a system reboot an uncommon occurrence for most AS/400 customers. As an added benefit, clustering of Domino servers with a single AS/400 system is a very feasible configuration.

Because AS/400 subsystem architecture works so beautifully with Domino partitioning, you can easily and safely run a **mixed workload** on the same physical server. This may consist purely of multiple instances of Domino (for example, the audited configuration consisted of 27 Domino for AS/400 partitions), or the workload may include a combination of Domino and other AS/400 software, such as ERP applications. Customers trust AS/400 to manage their computing resources equitably and ensure integrity and availability for their applications.

AS/400's **integration** enables ease of use, speed of deployment, and ease of management. Domino for AS/400 is designed to integrate with many services that are built in (at no additional cost) to the OS/400 operating system. These include the unique subsystem architecture described earlier, as well as security, backup and recovery, directory, systems management, Operations Navigator graphical administration tool, Java™ Virtual Machine, mail server framework, integrated relational database, and much more.

Often, components such as these must be purchased separately on other servers. A typical example is the relational database. DB2 Univeral Database (UDB) for AS/400 is available for use by all attached clients at no charge. Important factors such as this must be factored into any Notesbench cost per user platform comparison that includes AS/400.

Manageability, another important benefit of AS/400 "built for business" design and integration, means less money spent on people managing servers. An authorized administrator can access a Domino for AS/400 server console from any connected workstation, local or remote. In addition, AS/400 often recovers automatically if a Domino server should fail. This happens without impact to other Domino server partitions or any other workload on the same AS/400 system. Thus, the unattended operations that are commonplace for AS/400 installations extend to Domino servers.

Data integration and centralized management are two of the primary benefits of deploying Domino on the AS/400 platform. This makes AS/400 an excellent choice for **server consolidation**. Servers are all "under one roof", so administration costs are a fraction of what is required for server farms. And only a single license of Domino is needed, regardless of the number of Domino partitions or whether logical partitioning of the hardware is implemented.

Added together, these components of the AS/400 value proposition deliver **low total cost of ownership** (TCO) for Domino. A consultant report on Lotus Domino Server published by IDC in January, 2000 summarizes the results of multiple studies demonstrating an AS/400 total cost of ownership advantage compared to PC LAN implementations. The primary contributing factors include significant differences in the number of users per server and in unscheduled downtime and operations costs. The cost advantage is reported to be as high as 43% to 51% over three years with the AS/400e Dedicated Server for Domino. For more details, read the text of the report at http://www.ibm.com/as400/conslt/dsd_tco.htm .

In interpreting the benchmark data, it is helpful to understand the positioning of the AS/400e Dedicated Server for Domino. In addition to the AS/400e traditional workload server such as the audited configuration, IBM offers a specialized server called the AS/400e Dedicated Server for Domino (DSD). DSD offers the capability to provide excellent price/performance and significantly lower cost per user for Domino-only configurations that require less capacity and fewer of the "extras" that are so important when traditional interactive workload runs on the same system.

The IBM/Lotus Reseller Business Partner channel is one vehicle to fulfill orders for AS/400 Domino servers. For larger system sales such as the audited configuration, it is not unlikely for discounts to

average 20 to 30%. The following are just four of the many companies, listed in alphabetical order, who offer these systems. The AS/400e traditional workload server includes the most popular business application relational database (DB2 UDB for AS/400) with unlimited users, unsurpassed security, HTTP server, 64-bit hardware technology and much more at no additional charge. No other system offers this total cost of ownership advantage.

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Corning Data Services, Inc. (CDS) is an IBM® Premier Business Partner, a Lotus Premier Partner, and a J.D. Edwards® Channel Partner based in upstate New York with 7 office locations in the Northeast.

Since 1980, CDS has offered customers complete business solutions providing software, hardware and services. With certified specialists on staff, CDS focuses on delivering AS/400-based and Netfinity-based solutions. As a Lotus Premier Partner, CDS can help your company to effectively implement web-enabled technologies including:

· Domino messaging implementation and integration
· Web integration to existing enterprise data
· Customer resource management
· Sales and contact management
· Interactive customer self service applications
· Workflow enablement of existing business processes

CDS has recently released a Domino-based business-to-business portal product, SevicePort/400, to help you extend an "information center" to your customers, sales staff, and support staff via the Internet. The CDS Web site is http://www.corningdata.com .

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REAL Solutions was established in early 1988 as REAL Applications, Ltd. -- the IBM computer systems subsidiary of El Camino Resources, Ltd., one of the world's leading information technology providers. Today, REAL Solutions is a dominant force in the IBM reseller marketplace, the leading provider of IBM high end data storage solutions and a major presence in the AS/400, RS/6000 and S/390 markets. REAL Solutions is both a Premier Lotus and Premier IBM Business Partner with Certified Lotus Professionals throughout the United States and UK. REAL Solutions has Domino for AS/400 messaging, workflow and web application development reference sites across the United States and UK.

REAL Solutions is significantly more. As its name implies, it is committed to providing cost effective solutions in e-business development, networking, a complete range of information systems services and

platform development. The company is based in Woodland Hills, Calif., with offices nationally. The REAL Web site is http://www.realapps.com .

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Sirius Computer Solutions received the IBM Leadership Award for 1998 and 1999 for maintaining the highest quality customer satisfaction. In addition to Notes integration, Sirius provides technology and solutions for enterprise resource planning with JD Edwards, high availability with Lakeview Technology, customer relationship management with Siebel, and
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In summary, in the short time since its Domino launch, AS/400 has positioned itself to be one of the most popular of the seven Domino server platforms. This repeated success is due to the AS/400 value proposition of non-disruptive growth, mission-critical reliability and availability for mixed workloads, simplicity through integration, manageability for effective server consolidation, and low total cost of ownership. In addition, AS/400's technology leadership has translated into scalability leadership by breaking Notesbench records three times in this short period of time. AS/400 is truly an "extreme Domino machine".

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