

Full Disclosure Report

Microsoft® Exchange Server 2003 MAPI Messaging Benchmark 3 (MMB3)

Category: Single Server

Hardware:	IBM® System x™ 3650
Software:	Microsoft Exchange Server 2003
Test Profile:	MAPI Messaging Benchmark 3
Date Accepted:	05/15/2006

Revision History

05/15/2006– original submission

Executive Summary

IBM® System x™ 3650	
Test results	
MMB3 score	11,600
Response time	258 milliseconds (ms)
CPU utilization	69
Avg. queue	96
Messages submitted	495,124 (4-hour steady state period)
Messages delivered	1,229,092 (4-hour steady state period)
Messages sent	495,103 (4-hour steady state period)
Server configuration	
CPU	Dual-Core Intel® Xeon™ Processor 5160 (3.0GHz, 2MB L2 cache per core, 1333 MHz front-side bus)
CPU count	Two
RAM	8 GB
L1 cache	Instruction: 12 Kilobytes (KB) ops Data: 8 kilobytes (KB)
L2 cache	4 MB Total, 2MB per Core
L3 cache	N/A
Operating system	Microsoft® Windows® Server 2003 Enterprise Edition
Storage	1) 2 x 146 GB 15K RPM SAS disk for Operating system, Active Directory, Paging file, and Exchanger Server system files 2) 4 x 146 GB 15K RPM SAS disk for Exchange Server Public Folder 3) 336 x 36GB 15K RPM Fibre Channel disk for Exchange Information Store and Transaction log files 4) 14 x 18GB 15K RPM Fibre Channel disk for Exchange Transaction log files
Controller	2 - QLogic Fibre Channel Adapter
NIC	1 – Integrated Broadcom NetXtreme Gigabit Ethernet controller

Results based on 4 hours of steady state running.

Results should be interpreted as a benchmark for messaging throughput and should not be confused with deployment recommendations. Factors such as backup/restore, topology and other issues should be considered when planning a deployment. For information on how MMB3 results differ from deployment and configuration information refer to the “Benchmark vs. Production Configuration Disclosure Note” section.

Index

EXECUTIVE SUMMARY	2
INDEX	3
1 BENCHMARK VS. PRODUCTION CONFIGURATION DISCLOSURE NOTE	4
2 TEST RESULTS	5
2.1 RESPONSE TIMES (LATENCIES)	9
2.2 MESSAGE THROUGHPUT.....	9
3 TEST CONFIGURATION	10
3.1 LOAD GENERATOR CONFIGURATION.....	11
4 ADDITIONAL CONFIGURATION AND TUNING	12

1 Benchmark vs. Production Configuration Disclosure Note

This test measures the messaging throughput of a single server, single-site topology. Its purpose is to measure the maximum throughput of a Microsoft Exchange Server on this hardware configuration. This can provide a benchmark for comparing hardware and/or software products, **but cannot be used as a deployment guide for production environments.** For deployment-specific information, contact a Microsoft or IBM representative.

The MMB3 benchmark does not account for:

- Usage profiles not matching that of the Load Simulator MMB3 profile
- Per-user storage and per-server backup requirements
- Fault-tolerance requirements
- Anti-virus processes and effects on the server
- UBE/UCE (spam) mail flow
- Workloads other than MAPI private folder access, including Public Folder, NNTP, POP3 and other e-mail interfaces
- Multiple Exchange Server deployments, where additional resources are required to forward mail intra-site
- Connectors, links and replication to remote Exchange sites
- Network topologies, bandwidth availability, latency requirement and SLA- related factors like QOS and fail-over path issues.

2 Test Results

The new MAPI Messaging Benchmark (MMB3) measures throughput in terms of a specific profile of user actions, executed over an 8-hour working day.

This benchmark is different from the “MMB2” setting that was used with Exchange 2000 in that the rate of client requests is significantly greater for the MMB3 profile.

Summary			
Supported Benchmark Load	11,600 MMB3s		
Benchmark Profile	MAPI Messaging Benchmark 3 (MMB3)		
Protocol	Exchange MAPI		
Length of Steady State	4 Hours		
Length of Test	8 Hours		
Transactions in Total			
Total Messages Submitted	495,124		
Total Message Recipients Delivered	1,229,092		
Total Messages Sent	495,103		
Message Recipients Delivered / Messages Submitted	2.48		
Total Messages Submitted	495,124		
Transaction Load (per hour)			
Messages Submitted / hour	122,077		
Message Recipients Delivered / hour	303,043		
Messages Sent / hour	122,072		
Transaction Load (per Second)			
RPC Read Bytes / sec	364,262		
RPC Write Bytes / sec	6.724,810		
Processor	Average	Max	Min
% Processor Time	69	82	0
Database	Average	Max	Min
Database cache size	1,241,513,984	1,241,513,984	1,000,000,000
Table opens/sec	1,821	2,236	0

Memory Utilization	Average	Max	Min
Available Mbytes	5,552	5,912	5,429
Cache Faults/sec	1,362	2,256	0
Free System Page Table Entries	18,956	19,720	18,760
Pages / sec	2	16	0
Pool Nonpaged Bytes (Bytes)	33,146,100	34,004,992	30,285,824
Pool Paged Bytes (Bytes)	37,545,202	38,322,176	33,525,760
System Cache Resident Bytes	50,156,393	78,487,552	33,648,640
Transition Faults/sec	12	459	0
MSExchangeIS Mailbox	Average	Max	Min
Folder Opens / sec	43.6	164.1	0
Message Opens / sec	119.4	158.4	0.0
MSExchangeIS Receive Queue Average Length	0	0	0
MSExchangeIS Send Queue Average Length	96	242	13
MSExchangeIS	Average	Max	Min
Active User Count	999	1,798	0
RPC Average Latency (ms)	16	39	7
RPC Num. of Slow Packets	1	9	0
RPC Packets/sec	1,525	1,781	0
Read bytes RPC Clients/sec	364,262	517,296	0
RPC Requests	25	41	3
RPC Operations/sec	2,586	3,083	0
Write bytes RPC Clients/sec	6,724,810	8,800,230	0
TempTable Current	13	32	1
MSExchangeIS VM Largest Block Size	577,496,269	1,029,259,264	528,941,056
MSExchangeIS VM Total 16MB Free Blocks	3	14	2
MSExchangeIS VM Total Free Blocks	269	284	177
MSExchangeIS VM Large Free Blocks Bytes	703,292,047	2,083,954,688	557,228,032

Paging File	Average	Max	Min
% Usage (_Total)	1	1	1
Processor Utilization	Average	Max	Min
System Processor Utilization (%)	69	82	0
System Processor Interrupts/sec (Total)	18,173	21,267	0
Process % CPU Time - Store	233	277	0
Process % CPU Time - Inetinfo	7	9	0
Exchange server is also domain controller? (yes/no)	Yes		
Process % CPU Time – LSASS (on domain controller)	6	10	0
Handle Count (STORE)	18,217	19,353	8,233
Private Bytes (STORE)	1,904,082,266	1,981,861,888	1,000,000,000
Virtual Bytes (STORE)	2,470,329,811	2,482,835,456	1,000,000,000
Working Set (STORE)	2,021,796,696	2,102,439,936	1,000,000,000
Handle Count (Inetinfo)	4,141	4,013	3,636
Private Bytes (Inetinfo)	39,759,491	42,663,936	33,759232
Virtual Bytes (Inetinfo)	478,845,096	481,636,352	472,608,768
Working Set (Inetinfo)	161,775,694	169,074,688	138,178560
SMTP Server	Average	Max	Min
Cat: Address lookups completions/sec	113	147	0
Cat: LDAP searches/sec	9	12	0
SMTP Categorizer Queue	0	3	0
DNS Queries/sec	0	0	0
SMTP Local Queue	106	260	16
Messages Currently Undeliverable	0	0	0
Messages Delivered/sec	34	43	0
Messages Received/sec	0	0	0
Messages Sent/sec	0	0	0
NDRs Generated	0	0	0
Remote Queue Length	0	0	0
System	Average	Max	Min

System Processor Queue Length	5	30	0
System Context Switches/Sec	34,604	44,729	0
Disk Utilization (Aggregate for Database Logical Disks)	Average	Max	Min
Logical Drive Utilization (%)	5,676	8248	0
Disk Reads/Sec	10,767	13,820	0
Disk Read Bytes/Sec	50,066,023	64,496,374	0
Disk Writes/Sec	2,959	3,751	0
Disk Write Bytes/Sec	19,390,309	24,958,925	0
Avg. Disk sec / Read	0.018	0.02	0
Avg. Disk sec / Write	0.011	0.027	0
Average Disk Queue Length	56	83	0
Disk Utilization (Aggregate for Transaction Log Logical Disks)	Average	Max	Min
Logical Drive Utilization (%)	40	113	0
Disk Reads/Sec	0	0.034	0
Disk Read Bytes/Sec	0.274	137	0
Disk Writes/Sec	1040	1301	0
Disk Write Bytes/Sec	8,983,643	12,340,625	0
Avg. Disk sec / Read	0	0.009	0
Avg. Disk sec / Write	0	0.009	0
Average Disk Queue Length	0.403	1.137	0
Network Utilization	Average	Max	Min
Packets Sent/sec	2,072	2,477	0
Packets Received/sec	2,574	3,109	0
Bytes Sent/sec	2,847,331	3,924,313	0
Bytes Received/sec	682,571	875,744	0

2.1 Response Times (Latencies)

Client Actions	95 th Percentile Response Time (in milliseconds)
Send	281
Read	156
Reply	62
Reply All	63
Forward	63
Move	235
Delete	156
Permanently Delete	156
S+ Free/Busy	63
Browse Calendar	234
Make Appointment	531
Request Meeting	813
Create Smart Folder	188
Delete Smart Folder	531
Create Rule	235
Delete Rule	312
Apply View/Sort	5,046
Weighted Total	258

2.2 Message Throughput

Summary of the MMB3 profile for an 8-hour day:

	Expected	Measured
Messages Submitted/MMB3/Day	85	84.2
Messages Delivered/MMB3/Day	210	209.0
Average Recipients per Message	2.47	2.48

3 Test Configuration

Describe below the configuration of the Exchange Server machines (physical) used for this test. If more than one, they should have an identical configuration.

Hardware	Exchange Server	Domain Controller (if remote)
Vendor	IBM	
Model	x3650	
Processor	Dual Core Intel Xeon Processor 5160 (3.0GHz, 2MB L2 cache per core, 1333 MHz front-side bus)	
# of Processors (Physical)	2	
# of Cores (Total)	4	
Hyper-Threading enabled?	N/A	
Primary Cache	Instruction: 12KB ops Data: 8KB	
Secondary Cache	4MB Shared, 2MB per Core	
Other Cache	N/A	
Memory	8GB	
Disk Subsystem	1) 2 x 146 GB 15K RPM SAS disk for Operating system, Active Directory, Paging file, and Exchanger Server system files 2) 4 x 146 GB 15K RPM SAS disk for Exchange Server Public Folder 3) 336 x 36GB 15K RPM Fiber Channel disk for Exchange Information Store and Transaction log files 4) 14 x 18GB 15K RPM Fibre Channel disk for Exchange Transaction log files	
Disk Controllers	2- QLogic Fibre Channel Adapter	
Other Hardware	1 – Integrated Broadcom NetXtreme Gigabit Ethernet controller	
Mail Software	Exchange Server	Domain Controller (if remote)
Vendor	Microsoft Corporation	n/a
Mail Server	Exchange Server	n/a

Release Version	2003	n/a
Operating System	Exchange Server	Domain Controller (if remote)
OS Version	Microsoft Windows Server 2003 Enterprise Edition	
Service Pack	Windows Server 2003 SP1 and Exchange Server SP1	
OS Hot-fixes/patches		
File System Type	NTFS	
Network	Exchange Server	Domain Controller (if remote)
Type of Network	Ethernet	
Network Speed	1 Gbit	
TCP/IP Offload/Checksum	Yes	
PCI Flow Control?	N/A	
Interrupt Coalescing?	N/A	

3.1 Load Generator Configuration

This section holds all the configuration parameters of the load generator machines used in the test.

# of Load Generators (LG)	21
Total # of LG processes	11,600
Simulated Users/Process	1 control client with 99 users 1 client with 501 users 4 clients with 500 users each 15 clients with 600 users each
Model	IBM eServer xSeries 335
Processor	Intel Xeon 2.8GHz
# of Processors (Physical)	2
# of Processors (Logical)	4
Hyper-Threading enabled?	Yes
Memory	2GB
Network Controller	Integrated Gigabit Ethernet Adapter
Network Bandwidth	1 Gbit
Operating System	Microsoft Windows Server 2003 Enterprise Edition

4 Additional Configuration and Tuning

Describe below in items any modifications done to the Exchange Server(s) and the server/client operating systems. These modifications include but are not restricted to performance tuning changes like registry keys and boot.ini settings. All modifications must be approved by Microsoft prior to the testing and submission of the MMB3 result.

Boot.ini Modifications:

/3GB
/userva=3030

Registry Changes:

HeadDeCommitFreeBlockThreshold=0x00040000

Exchange Server Cache Size Setting:

msExchESEParamCacheSizeMax=303104

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