Full Disclosure Report

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

Category: Single Server

Hardware:	**IBM® System x™ 3200**
Software:	**Microsoft Exchange Server 2003**
Test Profile:	**MAPI Messaging Benchmark 3**
Date Accepted:	**09/12/2006**

Revision History

09/12/2006– original submission

Executive Summary

IBM® System x™ 3200	
Test results	
MMB3 score	**8,780**
Response time	**207 milliseconds (ms)**
CPU utilization	**84**
Avg. queue	**67**
Messages submitted	**316,070 (4-hour steady state period)**
Messages delivered	**815,693 (4-hour steady state period)**
Messages sent	**316,000 (4-hour steady state period)**
Server configuration	
CPU	**Dual-Core Intel® Xeon® Processor 3060 (2.4GHz, 2MB L2 cache per core, 1066 MHz front-side bus)**
CPU count	**One**
RAM	**4 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) 1 x 74 GB 15K RPM SAS disk for Operating system, Active Directory, Paging file, and Exchanger Server system files** **2) 3 x 36 GB 15K RPM SAS disk for Exchange Server Public Folder** **3) 362 x 36GB 15K RPM Fibre Channel disk for Exchange Information Store and 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 <u>not</u> 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

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	**8,780** 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	370,841		
Total Message Recipients Delivered	926,580		
Total Messages Sent	370,787		
Message Recipients Delivered / Messages Submitted	2.50		
Total Messages Submitted	370,841		
Transaction Load (per hour)			
Messages Submitted / hour	91,792		
Message Recipients Delivered / hour	229,351		
Messages Sent / hour	91,779		
Transaction Load (per Second)			
RPC Read Bytes / sec	275,714		
RPC Write Bytes / sec	5,104,368		
Processor	**Average**	**Max**	**Min**
% Processor Time	84	97	0
Database	**Average**	**Max**	**Min**
Database cache size	1,233,664,246	1,241,513,984	4,096,000
Table opens/sec	1,468	1,850	**0**

Memory Utilization	Average	Max	Min
Available Mbytes	1,770	3,686	1,622
Cache Faults/sec	1,029	1,939	0
Free System Page Table Entries	22,083	23,092	21,732
Pages / sec	2	45	0
Pool Nonpaged Bytes (Bytes)	40,525,828	41,267,200	35,381,248
Pool Paged Bytes (Bytes)	32,684,761	33,468,416	18,706,432
System Cache Resident Bytes	46,910,360	65,286,144	31,526,912
Transition Faults/sec	9	339	0
MSExchangeIS Mailbox	**Average**	**Max**	**Min**
Folder Opens / sec	35.3	438.2	0
Message Opens / sec	90.9	123.7	0
MSExchangeIS Receive Queue Average Length	0	0	0
MSExchangeIS Send Queue Average Length	67	477	0
MSExchangeIS	**Average**	**Max**	**Min**
Active User Count	535	987	0
RPC Average Latency (ms)	10	35	0
RPC Num. of Slow Packets	1	11	0
RPC Packets/sec	1,158	1,607	0
Read bytes RPC Clients/sec	275,714	417,190	0
RPC Requests	11	33	0
RPC Operations/sec	1,961	2,512	0
Write bytes RPC Clients/sec	5,104,368	8,282,794	0
TempTable Current	9	103	0
MSExchangeIS VM Largest Block Size	592,551,444	1,029,259,264	531,890,176
MSExchangeIS VM Total 16MB Free Blocks	4	14	2
MSExchangeIS VM Total Free Blocks	262	282	177
MSExchangeIS VM Large Free Blocks Bytes	758,971,816	2,084,429,824	561,225,728

Paging File	Average	Max	Min
% Usage (_Total)	1	1	1
Processor Utilization	**Average**	**Max**	**Min**
System Processor Utilization (%)	84	97	0
System Processor Interrupts/sec (Total)	9,351	11,355	8,410
Process % CPU Time - Store	143	167	0
Process % CPU Time - Inetinfo	5	7	0
Exchange server is also domain controller? (yes/no)	Yes		
Process % CPU Time – LSASS (on domain controller)	5	6	4
Handle Count (STORE)	15,434	16,898	1,927
Private Bytes (STORE)	1,744,227,043	1,827,106,816	589,561,856
Virtual Bytes (STORE)	2,427,714,286	2,462,810,112	1,000,000,000
Working Set (STORE)	1,833,403,091	1,924,452,352	9,912,320
Handle Count (Inetinfo)	3,499	3,623	1,118
Private Bytes (Inetinfo)	38,442,187	44,703,744	29,335,552
Virtual Bytes (Inetinfo)	439,853,408	448,790,528	430,800,896
Working Set (Inetinfo)	133,246,188	145,846,272	24,182,784
SMTP Server	**Average**	**Max**	**Min**
Cat: Address lookups completions/sec	86	113	0
Cat: LDAP searches/sec	7	10	0
SMTP Categorizer Queue	0	2	0
DNS Queries/sec	0	0	0
SMTP Local Queue	74	546	0
Messages Currently Undeliverable	0	0	0
Messages Delivered/sec	26	35	0
Messages Received/sec	0	0	0
Messages Sent/sec	0	0	0
NDRs Generated	0	0	0

System	Average	Max	Min
System Processor Queue Length	11	38	0
System Context Switches/Sec	17,007	22,848	0
Disk Utilization (Aggregate for Database Logical Disks)	**Average**	**Max**	**Min**
Logical Drive Utilization (%)	2,785	3,959	2,097
Disk Reads/Sec	4,545	6,284	3,564
Disk Read Bytes/Sec	22,300,958	31,133,058	17,110,503
Disk Writes/Sec	1,713	2,269	1,272
Disk Write Bytes/Sec	12,823,162	17,491,993	9,478,696
Avg. Disk sec / Read	0.02	0.02	0.017
Avg. Disk sec / Write	0.016	0.02	0.014
Average Disk Queue Length	27.844	39.586	20.972
Disk Utilization (Aggregate for Transaction Log Logical Disks)	**Average**	**Max**	**Min**
Logical Drive Utilization (%)	30	38	24
Disk Reads/Sec	0	0	0
Disk Read Bytes/Sec	0	0	0
Disk Writes/Sec	672	783	519
Disk Write Bytes/Sec	6,143,796	8,783,100	4,063,154
Avg. Disk sec / Read	0	0	0
Avg. Disk sec / Write	0	0.002	0
Average Disk Queue Length	0.302	0.386	0.242
Network Utilization	**Average**	**Max**	**Min**
Packets Sent/sec	1,609	1,876	1,415
Packets Received/sec	2,048	2,411	1,769
Bytes Sent/sec	2,310,596	3,032,258	1,778,364
Bytes Received/sec	538,001	689,476	422,021

2.1 Response Times (Latencies)

Client Actions	95th Percentile Response Time (in milliseconds)
Send	406
Read	94
Reply	62
Reply All	62
Forward	63
Move	156
Delete	94
Permanently Delete	109
S+ Free/Busy	94
Browse Calendar	110
Make Appointment	344
Request Meeting	734
Create Smart Folder	188
Delete Smart Folder	359
Create Rule	125
Delete Rule	172
Apply View/Sort	5141
Weighted Total	207

2.2 Message Throughput

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

	Expected	Measured
Messages Submitted/MMB3/Day	85	83.9
Messages Delivered/MMB3/Day	210	209.0
Average Recipients per Message	2.47	2.50

3   Test Configuration

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

Hardware	Exchange Server	Domain Controller (if remote)
Vendor	IBM	
Model	System x3200	
Processor	Dual Core Intel Xeon Processor 3060 (2.4GHz, 2MB L2 cache per core, 1066 MHz front-side bus)	
# of Processors (Physical)	1	
# of Cores (Total)	2	
Hyper-Threading enabled?	N/A	
Primary Cache	Instruction: 12KB ops Data: 8KB	
Secondary Cache	4MB Shared, 2MB per Core	
Other Cache	N/A	
Memory	4GB	
Disk Subsystem	1) 1 x 74 GB 15K RPM SAS disk for Operating system, Active Directory, Paging file, and Exchanger Server system files 2) 3 x 36 GB 15K RPM SAS disk for Exchange Server Public Folder 3) 362 x 36GB 15K RPM Fiber Channel disk for Exchange Information Store and 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)	13
Total # of LG processes	8,780
Simulated Users/Process	1 control client with 99 users 1 client with 651 users 4 clients with 695 users each 7 clients with 750 users each
Model	IBM eServer xSeries 335
Processor	Intel Xeon 2.8GHz
# of Processors (Physical)	2
# of Processors (Logical)	2
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

Trademarks
IBM, System x, eServer, xSeries, ServeRAID, LightPath, and the IBM logo are trademarks or registered trademarks of International Business Machines Corporation.
Intel, Xeon and Pentium are trademarks or registered trademarks of Intel Corporation.
Microsoft and Windows are registered trademarks of Microsoft Corporation in the United States and other countries.
Other company, product, or service names, may be trademarks or service marks of others.