Full Disclosure Report

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

Category: Single Server

Hardware:	**IBM® eserver® xSeries® 346**
Software:	**Microsoft Exchange Server 2003**
Test Profile:	**MAPI Messaging Benchmark 3**
Date Accepted:	**08/30/2005**

Revision History

08/30/2005 – original submission

Executive Summary

IBM® @server® xSeries® 346	
Test results	
MMB3 score	**8,630**
Response time	**307 milliseconds (ms)**
CPU utilization	**81**
Avg. queue	**59**
Messages submitted	**367,475 (4-hour steady state period)**
Messages delivered	**922,658 (4-hour steady state period)**
Messages sent	**367,284 (4-hour steady state period)**
Server configuration	
CPU	**Intel® Xeon™ 3.8-gigahertz (GHz)**
CPU count	**Two, with Hyper-Threading enabled**
RAM	**4 gigabytes (GB)**
L1 cache	**Instruction: 12 Kilobytes (KB) ops Data: 8 kilobytes (KB)**
L2 cache	**2 megabytes (MB)**
L3 cache	**N/A**
Operating system	**Microsoft® Windows® Server 2003 Enterprise Edition**
Storage	**1) 1 x 73GB 15K RPM U320 SCSI disk for Operating system, Active Directory, Paging file, and Exchanger Server system files 2) 255 x 36GB 15K RPM Fiber Channel disk for Exchange Information Store and Transaction log files**
Controller	**2 - QLogic Fibre Channel Adapter**
NIC	**1 – Integrated Broadcom NeXtreme 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.

IBM eServer™ xSeries 346 Server

Highlights

- The latest 64-bit Intel Xeon processors deliver rich 32-bit performance and support Intel® Extended Memory 64 Technology (Intel EM64T)
- Feature-rich, application-serving platform integrates standard, advanced functionality to lower total solution cost
- Easy deployment and management features provide enhanced flexibility and help control administrative costs

New levels of performance and reliability

The IBM eServer xSeries 346 delivers mission-critical performance and reliability for data-dense environments. New support for 64-bit extensions through Intel EM64T provides investment protection by supporting 32-bit and 64-bit applications and outstanding performance and reliability at the operating system and application levels. Performance is also enhanced through:

- Improved front-side bus speed with dual 800 MHz Intel Xeon Processors
- Support for up to 16GB DDR2 memory, improving memory speed
- Faster I/O speed with support for PCI-Express, a new standard for PCI adapters

Innovation helps lower total costs

The x346 delivers many advanced features as standard—keeping more slots free and helping to control total solution cost. New, dual Ultra320 SCSI controllers provide standard mirroring to help reduce system downtime. Integrated management and RAID-5 options maximize flexibility and expansion capability.

Easy to deploy and manage

Simplified management features help the x346 improve manageability and uptime. The standard Integrated Systems Management processor provides robust standards-based remote control at no extra cost. The optional Remote Supervisor Adapter II SlimLine helps expand systems management functionality by providing virtual control of remote servers. And the drop-down light path panel improves ease of use by letting administrators view diagnostics information from the front of the server.

IBM eServer xSeries 346 at a glance

Form factor	Rack/2U
Processor	Intel Xeon processor up to 3.80 GHz/800 MHz front-side bus supports Intel EM64T
Number of processors (std/max)	1/2
Cache (max)	Up to 2MB L2
Memory (std/max)	512MB or 1GB/16GB PC2-3200 DDR2 via 8 DIMM slots
Expansion slots	4 PCI-X or 2 PCI-X and 2 PCI-Express
Disk bays (total/hot-swap)	6/6
Maximum internal storage	1.8TB Ultra320 SCSI
Network interface	Dual integrated 10/100/1000 Ethernet
Power supply (std/max)	1/2 625W
Hot-swap components	Power supply, fans and hard disk drives
RAID support	Integrated RAID-0/-1, optional RAID-5
Systems management	Automatic Server Restart; Predictive Failure Analysis® n hard disk drives, processors, VRMs, fans and memory; light path diagnostics with drop-down panel; integrated IPMI System Management Processor; IBM Director; Remote Supervisor Adapter II SlimLine and ServerGuide™
Operating systems supported	Microsoft® Windows® Server 2003, Windows 2000®/Advanced Server, Red Hat® Linux® or SUSE Linux, Novell NetWare, VMware™ ESX Server™ 2.5
Limited warranty	3-year onsite limited warranty
Internal tape (optional)	IBM 36/72GB DDS Generation5 Internal Tape Drive

For more information
World Wide Web
U.S. **ibm.com**/eserver/xseries
Canada **ibm.com**/ca/eserver/xseries

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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	**8,630** 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	367,475		
Total Message Recipients Delivered	922,658		
Total Messages Sent	367,284		
Message Recipients Delivered / Messages Submitted	2.51		
Total Messages Submitted	367,475		
Transaction Load (per hour)			
Messages Submitted / hour	90,959		
Message Recipients Delivered / hour	228,381		
Messages Sent / hour	90,912		
Transaction Load (per Second)			
RPC Read Bytes / sec	271,815		
RPC Write Bytes / sec	4,981,650		
Processor	**Average**	**Max**	**Min**
% Processor Time	81	100	11
Database	**Average**	**Max**	**Min**
Database cache size	1,232,069,435	1,241,513,984	326,672,384

Table opens/sec	**1,331**	**1,724**	**77**
Memory Utilization	**Average**	**Max**	**Min**
Available Mbytes	1,010	2,874	860
Cache Faults/sec	1,042	2,265	32
Free System Page Table Entries	18,862	19,882	18,642
Pages / sec	3	33	1
Pool Nonpaged Bytes (Bytes)	33,802,275	34,611,200	27,848,704
Pool Paged Bytes (Bytes)	31,452,127	32,239,616	17,793,024
System Cache Resident Bytes	41,558,134	60,739,584	27,541,504
Transition Faults/sec	12	866	1
MSExchangeIS Mailbox	**Average**	**Max**	**Min**
Folder Opens / sec	35.0	310.0	16.0
Message Opens / sec	90.0	124.0	0.0
MSExchangeIS Receive Queue Average Length	0	0	0
MSExchangeIS Send Queue Average Length	59	318	0
MSExchangeIS	**Average**	**Max**	**Min**
Active User Count	857	1,420	0
RPC Average Latency (ms)	11	37	0
RPC Num. of Slow Packets	1	11	0
RPC Packets/sec	1,147	1,369	511
Read bytes RPC Clients/sec	271,815	466,712	21,145
RPC Requests	13	45	0
RPC Operations/sec	1,937	2,391	600
Write bytes RPC Clients/sec	4,981,650	7,115,924	420,138
TempTable Current	8	39	0
MSExchangeIS VM Largest Block Size	556,552,880	1,031,356,416	519,962,624
MSExchangeIS VM Total 16MB Free Blocks	4	14	2
MSExchangeIS VM Total Free Blocks	288	312	177
MSExchangeIS VM Large Free Blocks Bytes	666,160,751	2,086,051,840	548,249,600

Paging File	**Average**	**Max**	**Min**
% Usage (_Total)	1	9	1
Processor Utilization	**Average**	**Max**	**Min**
System Processor Utilization (%)	81	100	1
System Processor Interrupts/sec (Total)	8,122	10,365	1,177
Process % CPU Time - Store	278	351	24
Process % CPU Time - Inetinfo	10	13	0
Exchange server is also domain controller? (yes/no)	Yes		
Process % CPU Time – LSASS (on domain controller)	9	20	4
Handle Count (STORE)	14,774	15,831	2,180
Private Bytes (STORE)	1,742,697,468	1,833,660,416	590,274,560
Virtual Bytes (STORE)	2,427,370,664	2,473,164,800	1,000,000,000
Working Set (STORE)	1,825,624,336	1,924,268,032	23,011,328
Handle Count (Inetinfo)	3,484	3,651	1,110
Private Bytes (Inetinfo)	40,397,177	43,732,992	28,499,968
Virtual Bytes (Inetinfo)	479,497,007	484,282,368	448,970,752
Working Set (Inetinfo)	128,899,561	138,784,768	23,064,576
SMTP Server	**Average**	**Max**	**Min**
Cat: Address lookups completions/sec	85	109	0
Cat: LDAP searches/sec	7	9	0
SMTP Categorizer Queue	0	3	0
DNS Queries/sec	0	0	0
SMTP Local Queue	66	350	0
Messages Currently Undeliverable	0	0	0
Messages Delivered/sec	26	34	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	7	30	0
System Context Switches/Sec	18,029	29,317	7,677
Disk Utilization (Aggregate for Database Logical Disks)	**Average**	**Max**	**Min**
Logical Drive Utilization (%)	2,576	9,162	57
Disk Reads/Sec	4,501	6,803	129
Disk Read Bytes/Sec	21,926,612	33,771,392	623,450
Disk Writes/Sec	1,629	2,663	0
Disk Write Bytes/Sec	12,390,702	18,191,987	1,689
Avg. Disk sec / Read	0.02	0.189	0
Avg. Disk sec / Write	0.008	0.188	0
Average Disk Queue Length	25	92	0
Disk Utilization (Aggregate for Transaction Log Logical Disks)	**Average**	**Max**	**Min**
Logical Drive Utilization (%)	19	25	0
Disk Reads/Sec	0	0	0
Disk Read Bytes/Sec	2	274	0
Disk Writes/Sec	672	886	6
Disk Write Bytes/Sec	5,985,154	9,389,282	28,217
Avg. Disk sec / Read	0	0.017	0
Avg. Disk sec / Write	0	0	0
Average Disk Queue Length	0	0	0
Network Utilization	**Average**	**Max**	**Min**
Packets Sent/sec	1,545	2,120	378
Packets Received/sec	1,865	2,376	414
Bytes Sent/sec	2,103,807	3,328,754	98,119
Bytes Received/sec	532,028	747,924	97,989

2.1 Response Times (Latencies)

Client Actions	95th Percentile Response Time (in milliseconds)
Send	**937**
Read	**172**
Reply	**94**
Reply All	**109**
Forward	**125**
Move	**218**
Delete	**141**
Permanently Delete	**157**
S+ Free/Busy	**156**
Browse Calendar	**172**
Make Appointment	**750**
Request Meeting	**1,453**
Create Smart Folder	**359**
Delete Smart Folder	**640**
Create Rule	**172**
Delete Rule	**203**
Apply View/Sort	**5,563**
Weighted Total	**307**

2.2 Message Throughput

Summary of the MMB3 profile for an 8 hour day:

	Expected	Measured
Messages Submitted/MMB3/Day	**85**	**84.3**
Messages Delivered/MMB3/Day	**210**	**211.7**
Average Recipients per Message	**2.47**	**2.51**

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	x346	
Processor	Intel Xeon 3.8GHz	
# of Processors (Physical)	2	
# of Processors (Logical)	4	
Hyper-Threading enabled?	Yes	
Primary Cache	Instruction: 12KB □ops Data: 8KB	
Secondary Cache	2MB	
Other Cache	N/A	
Memory	4GB	
Disk Subsystem	1) 1 x 73GB 15K RPM U320 SCSI disk for operating system, Active Directory, Paging file, and Exchange Server system files 2) 255 x 36GB 15K RPM Fibre Channel disk for Exchange Information Store and Transaction log files	
Disk Controllers	2- QLogic Fibre Channel Adapter	
Other Hardware	1 – Integrated Broadcom NeXtreme 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)	14
Total # of LG processes	8,630
Simulated Users/Process	1 control client with 99 users 9 clients with 660 users each 1 client with 661 users 3 client with 650 users 1 client with 630 users
Model	IBM eServer xSeries 330
Processor	Intel Pentium™ III 933MHz
# of Processors (Physical)	1
# of Processors (Logical)	0
Hyper-Threading enabled?	N/A
Memory	1GB
Network Controller	Integrated IBM 10/100 Ethernet Adapter
Network Bandwidth	100 Mbit
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