Full Disclosure Report

Microsoft Exchange Server 2003
MAPI Messaging Benchmark 3 (MMB3)

Category: Single Server

Hardware:	**IBM® @server® xSeries® 365**
Software:	**Microsoft Exchange Server 2003**
Test Profile:	**MAPI Messaging Benchmark 3**
Date Accepted:	**12/20/2004**

Revision History

12/20/2004– original submission

Executive Summary

IBM eServer xSeries 365 – Single Server	
Test results	
MMB3 score	**9,300**
Response time	**366** milliseconds (ms)
CPU utilization	**71%**
Avg. queue	**88**
Messages submitted	**400,858**(4-hour steady state period)
Messages delivered	**991,338**(4-hour steady state period)
Messages sent	**400,633**(4-hour steady state period)
Server configuration	
CPU	**Intel 3.0-gigahertz (GHz) Xeon™**
CPU count	**Four, with Hyper-Threading enabled**
RAM	**4 gigabytes (GB)**
L1 cache	**Instruction: 12 Kilobytes (KB) μops Data: 8 kilobytes (KB)**
L2 cache	**512 kilobytes (KB)**
L3 cache	**4 megabytes (MB)**
Operating system	**Microsoft® Windows® Server 2003 Enterprise Edition**
Storage	**1) 6 x 36GB disk for operating system, Active Directory, page file, and Exchanger Server system files 2) 264 x 36GB disk for Exchange Information Store and transaction log files**
Controller	**1) 1 - IBM ServeRAID® 6i U320 SCSI controller (operating system, Active Directory, page file, and Exchanger Server system files) 2) 1- QLogic Fibre Channel Adapter**
NIC	**1 – Intel PRO 1000XT Server Adapter**

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, see Section 1, "Benchmark vs. Production Configuration Disclosure Note."

IBM eServer xSeries 365 Server

With the x365, IBM introduces a rack-optimized, high-performance 4-way server that combines exceptional price and performance with the datacenter readiness of Enterprise X-Architecture™ and IBM Director, creating a powerful new solution for mission-critical enterprise applications.

- Second-generation Enterprise X-Architecture technology with the latest Intel® Xeon™ Processor MP
- Exclusive "pay as you grow," remote I/O scalability using the RXE-100 I/O expansion chassis
- Flexibility to be used for high performance, value performance or I/O-intensive server applications
- Powerful 4-way SMP in space-efficient, slender 3U form factor
- Maximum internal storage (up to 876GB) while supporting large capacity Storage Area Networks
- Native IXA-adapter support for interoperability with iSeries servers

Features

Exclusive rack-dense 3U design	• Optimizes space-constrained environments
Second generation Enterprise X-Architecture chipset (IBM XA-32) with remote I/O capability	• Provides platform for extreme application performance while enabling cost effective PCI and PCI-X expansion • Enables enterprise class, partitionable, high-availability SANs and clusters with slots for full redundancy
4-way processor with Intel Xeon Processors MP with 2MB or 4MB L3 cache	• Provides power and scalability to drive resource-hungry, mission-critical applications • Improves productivity through higher processor performance
1GB memory expandable to 32GB per system	• Meets or exceeds memory requirements of resource-intensive applications • Utilizes industry-standard PC2100 DDR SDRAM Chipkill™ memory, which can locate and correct multiple memory errors • Memory ProteXion and memory mirroring provide

	increased availability and improved data integrity
Five Active™ PCI-X slots standard — 6 available	• Allows hot-add and hot-swap of PCI or PCI-X adapter on demand • Allows slot configuration or reconfiguration without sacrificing availability • Allows you to increase I/O performance and bandwidth on demand as application needs change
Up to six internal hot-swap SCSI hard disk drives support SAN-optimized network storage	• 876GB of current storage in addition to SAN support, meeting today's storage needs and tomorrow's growth requirements • Hot-swap hard drives simplify and expedite hard file installation and replacement, maximizing availability
Toolless chassis	• Easy access to all server subsystems for fast installation, upgrade and service
Hot-swap, redundant power	• Fully redundant power for higher availability in the event of power supply outage
Hot-swap, redundant fans	• Provides redundant cooling, reducing server outage in the event a fan failure
Light Path Diagnostics	• Lights the way to failing components for rapid problem diagnosis and repair, reducing down time and service time.

Contents

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. This includes Public Folder, NNTP, POP3 and other email 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	**9,300** 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	400,858		
Total Message Recipients Delivered	991,338		
Total Messages Sent	400,633		
Message Recipients Delivered / Messages Submitted	2.47		
Total Messages Submitted	400,858		
Transaction Load (per hour)			
Messages Submitted / hour	98,828		
Message Recipients Delivered / hour	244,406		
Messages Sent / hour	98,773		
Transaction Load (per Second)			
RPC Read Bytes / sec	304,318		
RPC Write Bytes / sec	5,565,350		
Processor	**Average**	**Max**	**Min**
% Processor Time	68	100	1
Database	**Average**	**Max**	**Min**
Database cache size	1,191,935,279	1,207,959,552	172,748,800
Table opens/sec	1,385	1,879	2

Memory Utilization	**Average**	**Max**	**Min**
Available Bytes	1,298	3,216	1,094
Cache Faults/sec	1,045	1,998	9
Free System Page Table Entries	34,565	35,707	33,747
Pages / sec	4	650	1
Pool Nonpaged Bytes (Bytes)	59,828,621	60,719,104	55,234,560
Pool Paged Bytes (Bytes)	35,617,180	36,896,768	21,569,536
System Cache Resident Bytes	46,158,985	71,778,304	29,011,968
Transition Faults/sec	13	659	2
MSExchangeIS Mailbox	**Average**	**Max**	**Min**
Folder Opens / sec	36.4	76.9	0.7
Message Opens / sec	94.6	134.1	0.0
MSExchangeIS Send Queue Average Length	0	0	0
MSExchangeIS Receive Queue Average Length	93	322	0
MSExchangeIS	**Average**	**Max**	**Min**
Active User Count	574	1,166	0
RPC Avarage Latency (ms)	18	37	0
RPC Num. of Slow Packets	1	9	0
RPC Packets/sec	1,196	1,522	0
RPC Read bytes/sec	282,415	426,666	0
RPC Requests	22	50	0
RPC Operations/sec	2,023	2,603	0
RPC Write bytes/sec	5,177,152	7,821,921	0
TempTable Current	12	42	0
MSExchangeIS VM Largest Block Size	652,467,954	1,031,417,856	596,049,920
MSExchangeIS VM Total 16MB Free Blocks	2	10	1
MSExchangeIS VM Total Free Blocks	267	296	176
MSExchangeIS VM Large Free Block Bytes	786,679,521	2,084,777,984	596,049,920

Paging File	**Average**	**Max**	**Min**
% Usage (_Total)	1	5	1
Processor Utilization	**Average**	**Max**	**Min**
System Processor Utilization (%)	68	100	1
System Processor Interrupts/sec (Total)	7,647	8,403	973
Process % CPU Time - Store	469	688	0
Process % CPU Time - Inetinfo	16	23	0
Exchange server is also domain controller? (yes/no)	yes		
Process % CPU Time – LSASS (on domain controller)	12	17	0
Handle Count (STORE)	15,483	17,166	1,962
Private Bytes (STORE)	1,725,485,949	1,846,370,304	591,486,976
Virtual Bytes (STORE)	2,411,863,583	2,460,835,840	1,000,000,000
Working Set (STORE)	1,806,595,101	1,939,107,840	7,786,496
Handle Count (Inetinfo)	3,560	3,940	1,157
Private Bytes (Inetinfo)	40,444,623	50,798,592	29,409,280
Virtual Bytes (Inetinfo)	535,651,607	554,348,544	524,058,624
Working Set (Inetinfo)	131,574,884	152,663,712	24,928,256
SMTP Server	**Average**	**Max**	**Min**
Cat: Address lookups completions/sec	89	118	**0**
Cat: LDAP searches/sec	8	10	**0**
SMTP Categorizer Queue	0	4	**0**
DNS Queries/sec	0	0	**0**
SMTP Local Queue	101	342	0
Messages Currently Undeliverable	0	0	0
Messages Delivered/sec	27	36	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	4	35	0
System Context Switches/Sec	24,702	37,988	2,096
Disk Utilization (Aggregate for Database Logical Disks)	**Average**	**Max**	**Min**
Logical Drive Utilization (%)	4,338	8,270	0
Disk Reads/Sec	5,934	9,764	0
Disk Read Bytes/Sec	28,316,024	46,873,244	0
Disk Writes/Sec	1,869	3,061	0.025
Disk Write Bytes/Sec	13,393,872	19,715,761	102
Disk Avg. Disk sec / Read	0.026	0.031	0
Disk Avg. Disk sec / Write	0.012	0.028	0
Average Disk Queue Length	43.389	82.76	0
Disk Utilization (Aggregate for Transaction Log Logical Disks)	**Average**	**Max**	**Min**
Logical Drive Utilization (%)	34	46	0
Disk Reads/Sec	0	0.05	0
Disk Read Bytes/Sec	3	205	0
Disk Writes/Sec	697	904	0.038
Disk Write Bytes/Sec	6,300,835	9,677,563	19
Disk Avg. Disk sec / Read	0	0.018	0
Disk Avg. Disk sec / Write	0.002	0.009	0
Average Disk Queue Length	0.343	0.454	0
Network Utilization	**Average**	**Max**	**Min**
Packets Sent/sec	1,637	2,166	1
Packets Received/sec	1,951	2,555	1
Bytes Sent/sec	2,192,225	3,549,977	166
Bytes Received/sec	554,140	732,601	298

2.1 Response Times (Latencies)

Client Actions	95th Percentile Response Time (in milliseconds)
Send	**844**
Read	**235**
Reply	**125**
Reply All	**125**
Forward	**141**
Move	**328**
Delete	**203**
Permanently Delete	**219**
S+ Free/Busy	**172**
Browse Calendar	**343**
Make Appointment	**859**
Request Meeting	**1,515**
Create Smart Folder	**344**
Delete Smart Folder	**766**
Create Rule	**297**
Delete Rule	**359**
Apply View/Sort	**5,516**
Weighted Total	**366**

2.2 Message Throughput

Summary of the MMB3 profile for an 8 hour day:

	Expected	Measured
Messages Submitted/MMB3/Day	**85**	**85**
Messages Delivered/MMB3/Day	**210**	**210.2**
Average Recipients per Message	**2.47**	**2.47**

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	xSeries 365	
Processor	Intel Xeon 3.0GHz	
# of Processors (Physical)	4	
# of Processors (Logical)	8	
Hyper-Threading enabled?	Yes	
Primary Cache	Instruction: 12KB μops Data: 8KB	
Secondary Cache	512KB	
Other Cache	4MB	
Memory	4GB	
Disk Subsystem	1) 6 x 36GB disk for operating system, Active Directory, page file, and Exchange Server system files 2) 264x 36GB disk for Exchange Information Store and transaction log files	
Disk Controllers	1) 1 - IBM ServeRAID 6i U320 SCSI controller (operating system, Active Directory, page file, and Exchanger Server system files) 2) 1- QLogic Fibre Channel Adapter	
Other Hardware	1 – Intel PRO_1000XT Server Adapter	
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	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)	17	
Total # of LG processes	9,300	
Simulated Users/Process	1 control client with 50 users 15 clients with 600 users each 1 client with 250 users	
Model	IBM eServer xSeries 330	
Processor	Intel 933 Pentium™ III	
# of Processors (Physical)	1	
# of Processors (Logical)	0	
Hyper-Threading enabled?	N/A	
Memory	1GB	
Network Controller	Integrated IBM Netfinity® 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