Full Disclosure Report

Microsoft Exchange Server 2003
MAPI Messaging Benchmark 3 (MMB3)

Category: Single Server

Hardware: **IBM®**e**server® xSeries® 365**
Software: **Microsoft Exchange Server 2003**
Test Profile: **MAPI Messaging Benchmark 3**
Date Accepted: **11/6/2004**

Revision History

11/6/2004– original submission

Executive Summary

IBM eServer xSeries 365 – Single Server	
Test results	
MMB3 score	**9,200**
Response time	**481** milliseconds (ms)
CPU utilization	**81%**
Avg. queue	**196**
Messages submitted	**389,932** (4-hour steady state period)
Messages delivered	**964,293** (4-hour steady state period)
Messages sent	**389,821** (4-hour steady state period)
Server configuration	
CPU	**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) 256 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 – 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 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.

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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. 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	**9,200** MMB3s
Benchmark Profile	MAPI Messaging Benchmark 3 (MMB3)
Protocol	Exchange MAPI
Length of Steady State	4 Hours
Length of Test	8 Hours
Unless otherwise noted, values listed below are averages over entire 4 hour steady state period.	
Transactions in Total	
Total Messages Submitted	389,932
Total Message Recipients Delivered	964,293
Total Messages Sent	389,821
Message Recipients Delivered / Messages Submitted	2.47
Total Messages Submitted	389,932
Transaction Load (per hour)	
Messages Submitted / hour	96,326
Message Recipients Delivered / hour	238,211
Messages Sent / hour	96,298
Transaction Load (per Second)	
Message Opens / sec	105
Folder Opens / sec	36
RPC Read Bytes / sec	304,942
RPC Write Bytes / sec	5,559,519
Transaction Queues	
MSExchangeIS Send Queue Average Length	196
MSExchangeIS Receive Queue Average Length	0

SMTP Local Queue	213
SMTP Categorizer Queue	1
Processor Utilization	
System Processor Utilization (%)	81
System Processor Interrupts/sec (Total)	7,592
System Processor Queue Length	7
System Context Switches/Sec	29,059
Process % CPU Time - Store	566
Process % CPU Time - Inetinfo	18
Exchange server is also domain controller? (yes/no)	Yes
Process % CPU Time – LSASS (on domain controller)	13
Memory Utilization	
Available Bytes	1,560,832,737
Pages / sec	2
Process Private Bytes - Store	1,549,956,772
Process Working Set Bytes - Store	1,643,008,553
Process Virtual Bytes - Store	2,187,199,160
MSExchangeIS VM Largest Block Size	862,650,040
MSExchangeIS VM Total 16MB Free Blocks	1
MSExchangeIS VM Total Free Blocks	288
MSExchangeIS VM Large Free Block Bytes	862,650,040
Disk Utilization (Aggregate for Database Logical Disks)	
Logical Drive Utilization (%)	7,677
Database Disk Reads/Sec	7,666
Database Disk Read Bytes/Sec	36,061,179
Database Disk Writes/Sec	2,146
Database Disk Write Bytes/Sec	14,677,834
Database Disk Avg. Disk sec / Read	0.03
Database Disk Avg. Disk sec / Write	0.003
Database Average Disk Queue Length	96

Disk Utilization (Aggregate for Transaction Log Logical Disks)	
Logical Drive Utilization (%)	56
Log Disk Reads/Sec	27
Log Disk Read Bytes/Sec	111,331
Log Disk Writes/Sec	617
Log Disk Write Bytes/Sec	7,069,148
Log Disk Avg. Disk sec / Read	0.069
Log Disk Avg. Disk sec / Write	0.004
Log Average Disk Queue Length	0
Network Utilization	
Packets Sent/sec	2,759
Packets Received/sec	2,078
Bytes Sent/sec	2,435,099
Bytes Received/sec	590,992

2.1 Response Times (Latencies)

Client Actions	95th Percentile Response Time (in milliseconds)
Send	1,062
Read	329
Reply	203
Reply All	219
Forward	235
Move	453
Delete	297
Permanently Delete	312
S+ Free/Busy	313
Browse Calendar	391
Make Appointment	1,156
Request Meeting	1,984
Create Smart Folder	515
Delete Smart Folder	1,094
Create Rule	406
Delete Rule	484
Apply View/Sort	5,672
Weighted Total	481

2.2 Message Throughput

Summary of the MMB3 profile for an 8 hour day:

	Expected	Measured
Messages Submitted/MMB3/Day	85	83.8
Messages Delivered/MMB3/Day	210	207.1
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) 256x 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 – 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	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?		
Interrupt Coalescing?		

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	9,200
Simulated Users/Process	1 control client with 50 users 15 clients with 600 users each 1 client with 150 users
Model	IBM eServer xSeries 330
Processor	Intel 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 Standard 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