Full Disclosure Report

Exchange MAPI Messaging Benchmark 3 (MMB3)

Category: Single Server

Hardware: **IBM® eServer™ xSeries® 346**
Software: **Exchange Server 2003**
Test Profile: **MAPI Messaging Benchmark 3**
Date Accepted: **8/30/2004**

Revision History

8/30/2004– original submission

Executive Summary

IBM eServer xSeries 346 – Single Server	
Test results	
MMB3 score	**7,000**
Response time	**361** milliseconds (ms)
CPU utilization	**74%**
Avg. queue	**71**
Messages submitted	**242,394** (4-hour steady state period)
Messages delivered	**623,480** (4-hour steady state period)
Messages sent	**242,322** (4-hour steady state period)
Server configuration	
CPU	**3.6-gigahertz (GHz) Xeon**
CPU count	**Two, with Hyper-Threading enabled**
RAM	**8 gigabytes (GB)**
L1 cache	**Instruction: 12 Kilobytes (KB) μops** **Data: 8 kilobytes (KB)**
L2 cache	**1 megabytes (MB)**
L3 cache	**N/A**
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) 140 x 36GB disk for Exchange Information Store and transaction log files**
Controller	**1) 1 - Integrated IBM ServeRAID® 7K 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 346 Server

The IBM @server® xSeries 346 delivers outstanding performance, availability and capacity – all in a space-saving 2U rack design. Ideal for storage hungry applications and data for your networked environment or space constrained data center. The x346 supports the latest Intel Xeon processors technology to help provide customers with the computing power they need to match their business needs and growth. The new IBM Extended Design Architecture initiative is evident inside its 2U rack design, the x346 offers impressive scalability, including dual processor support, up to 16GB of memory and six high-performance, hot swap hard disk bays and the ability to support an internal tape backup. If you need a balance of high-performance 2-way processing, large internal storage and superior manageability in a rack-dense environment, the x346 is the ideal system.

Features

Two-way Intel® Xeon™ processors (1MB L2 cache)	• Improves productivity through higher processing performance • 800MHz front side bus speeds information access within the system • Intel's EM64T enables 64-bit extensions, allowing applications to address more memory without using a PCI slot
Optimized for EM64T	• 8 memory slots allow you to access more memory when you take advantage of EM64T enabled operating systems and applications. • High availability subsystems help increase server uptime, allowing you to trust your most important applications to the x346
Fast 400MHz PC2-3200 DDR2 memory	• Match the high performance speed of the Intel Xeon processors with fast DDR2 memory. • Online spare and memory mirroring provide customers with two ways to increase system and application reliability by allowing the system to continue operating even if a memory DIMM fails • Interleaved memory to improve application performance
Supports up to 6 Ultra320 H/S HDDs	• Up to 880GB of internal storage
Four available PCI I/O slots (two 64-bit 133MHz PCI-X slots and two low profile 64-bit 100 MHz PCI-X slots)	• Provides expandability choices and the capability to increase I/O bandwidth for performance and productivity • Enables customers to continue to utilize their PCI-X adapters while they plan their transition to the PCI-Express standard
Support for an internal tape drive option	• Protect valuable data throughput backup and arrive with an internal DDS5 tape drive- leaving four available hot-swap drive bays

Upgradeable I/O with support for PCI-Express	• Customers can upgrade their I/O with up to 2x4 PCI-Express adapters • Allows customers to achieve faster interconnect speeds than PCI-X 133MHz
Integrated SCSI RAID-0 and RAID-1	• Enhances system availability and data protection by supporting SCSI hard disk drive RAID without using a PCI slot
Optional Ultra320 SCSI RAID-5 via ServeRAID 7k Daughter Card	• Take high availability to your hard drives efficiently with out sacrificing performance with RAID 5 protection • New ServeRAID 7k does not require the use of an I/O slot-leaving more room for system availability
Integrated dual 10/100/1000 Ethernet	• Provides increased network throughput and redundancy with efficient slot-saving integration
Integrated DVD-ROM drive standard	• Ease of system installation and software deployment
Hot swap/redundant power and cooling	• Reduces unplanned down time by maintaining system performance if a fan/power supply fails • Reduces planned down time by allowing failed fans/power supplies to be replaced without taking the server down
Drop-down LightPath® diagnostics panel	• Gives information about a failing component without interrupting system operation • Expedites hardware repairs to dramatically reduce service time • Provides a lighted path to failing component inside the system
Remote Deployment with Wake on LAN and Preboot eXecution (PXE®)	• WOL saves you time and money by providing the capability to remotely manage servers • PXE provides remote control of server initialization process, saving IT staff travel and dollars; Designed to work with IBM's Remote Deployment Manager
Integrated System Management Processor	• Provides around-the-clock remote management capabilities • Increases server availability by continuously monitoring your system and notifying you of potential system failures or changes
Support for optional IBM Remote Supervisor Adapter II Slim Line card	• Works in concert with integrated system management processor to provide even greater system control • Decreases downtime by allowing you to remotely perform systems management functions whether your server is operational or not • Activates dedicated system management Ethernet port
IBM Director	• Comprehensive systems management tools • Help increase uptime, reduce costs and improve productivity via advanced server management capabilities
ServerGuide™ software	• Assist with the installation of operating systems and drivers • Gets your server up and running faster • Simplifies installation and configuration of your xSeries servers
Three-year onsite limited warranty for parts and labor	• Provides peace of mind for an extended period of 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	**7,000** 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	242,394
Total Message Recipients Delivered	623,480
Total Messages Sent	242,322
Message Recipients Delivered / Messages Submitted	2.49
Total Messages Submitted	242,394
Transaction Load (per hour)	
Messages Submitted / hour	76,108
Message Recipients Delivered / hour	189,425
Messages Sent / hour	76,036
Transaction Load (per Second)	
Message Opens / sec	83
Folder Opens / sec	28
RPC Read Bytes / sec	233,058
RPC Write Bytes / sec	4,300,369
Transaction Queues	
MSExchangeIS Send Queue Average Length	71
MSExchangeIS Receive Queue Average Length	0

SMTP Local Queue	79
SMTP Categorizer Queue	0
Processor Utilization	
System Processor Utilization (%)	74
System Processor Interrupts/sec (Total)	6,118
System Processor Queue Length	6
System Context Switches/Sec	15,469
Process % CPU Time - Store	260
Process % CPU Time - Inetinfo	9
Exchange server is also domain controller? (yes/no)	Yes
Process % CPU Time – LSASS (on domain controller)	8
Memory Utilization	
Available Bytes	1,288,139,223
Pages / sec	2
Process Private Bytes - Store	1,410,377,646
Process Working Set Bytes - Store	2,113,280,430
Process Virtual Bytes - Store	1,479,646,597
MSExchangeIS VM Largest Block Size	871,766,753
MSExchangeIS VM Total 16MB Free Blocks	3
MSExchangeIS VM Total Free Blocks	275
MSExchangeIS VM Large Free Block Bytes	916,200,161
Disk Utilization (Aggregate for Database Logical Disks)	
Logical Drive Utilization (%)	5,351
Database Disk Reads/Sec	3,930
Database Disk Read Bytes/Sec	19,173,204
Database Disk Writes/Sec	1,422
Database Disk Write Bytes/Sec	10,405,344
Database Disk Avg. Disk sec / Read	0.024
Database Disk Avg. Disk sec / Write	0.084
Database Average Disk Queue Length	-

Disk Utilization (Aggregate for Transaction Log Logical Disks)	
Logical Drive Utilization (%)	48
Log Disk Reads/Sec	14
Log Disk Read Bytes/Sec	57,905
Log Disk Writes/Sec	535
Log Disk Write Bytes/Sec	5,036,267
Log Disk Avg. Disk sec / Read	0.004
Log Disk Avg. Disk sec / Write	0.009
Log Average Disk Queue Length	0.486
Network Utilization	
Packets Sent/sec	2,116
Packets Received/sec	1,605
Bytes Sent/sec	1,891,059
Bytes Received/sec	453,823

2.1 Response Times (Latencies)

Client Actions	95th Percentile Response Time (in milliseconds)
Send	766
Read	203
Reply	218
Reply All	219
Forward	235
Move	297
Delete	187
Permanently Delete	219
S+ Free/Busy	438
Browse Calendar	235
Make Appointment	734
Request Meeting	1,375
Create Smart Folder	469
Delete Smart Folder	938
Create Rule	297
Delete Rule	344
Apply View/Sort	5,297
Weighted Total	361

2.2 Message Throughput

Summary of the MMB3 profile for an 8 hour day:

	Expected	Measured
Messages Submitted/MMB3/Day	85	87
Messages Delivered/MMB3/Day	210	216.5
Average Recipients per Message	2.47	2.49

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 346	
Processor	Intel Xeon 3.6GHz	
# of Processors (Physical)	2	
# of Processors (Logical)	4	
Hyper-Threading enabled?	Yes	
Primary Cache	Instruction: 12KB μops Data: 8KB	
Secondary Cache	1MB	
Other Cache	N/A	
Memory	8GB	
Disk Subsystem	1) 6 x 36GB disk for operating system, Active Directory, page file, and Exchange Server system files 2) 140 x 36GB disk for Exchange Information Store and transaction log files	
Disk Controllers	1) 1 - Integrated IBM ServeRAID 7K 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)	15
Total # of LG processes	7,000
Simulated Users/Process	1 control client with 50 users 13 clients with 500 users each 1 client with 450 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