# Full Disclosure Report


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


# Category: Single Server


| | |
|---|---|
| **Hardware:** | **IBM®** $e$ **server® xSeries® 206m** |
| **Software:** | **Microsoft Exchange Server 2003** |
| **Test Profile:** | **MAPI Messaging Benchmark 3** |
| **Date Accepted:** | **09/06/2005** |


**Revision History**

**09/06/2005** – original submission

# Executive Summary

| IBM®@server® xSeries® 206m | |
|---|---|
| **Test results** | |
| MMB3 score | **5,000** |
| Response time | **352** milliseconds (ms) |
| CPU utilization | **87** |
| Avg. queue | **38** |
| Messages submitted | **222,219** (4-hour steady state period) |
| Messages delivered | **550,634** (4-hour steady state period) |
| Messages sent | **221,955** (4-hour steady state period) |
| **Server configuration** | |
| CPU | **Intel® Pentium D™ 3.0-gigahertz (GHz)** |
| CPU count | **One, with Dual Core** |
| RAM | **4 gigabytes (GB)** |
| L1 cache | **Instruction: 12 Kilobytes (KB)    ops**<br>**Data: 8 kilobytes (KB)** |
| L2 cache | **1 megabytes (MB) per core** |
| L3 cache | **N/A** |
| Operating system | **Microsoft® Windows® Server 2003 Enterprise Edition** |
| Storage | **1) 1 x 73GB 15K RPM SAS disk for Operating system, Active Directory, Paging file, and Exchanger Server system files**<br>**2) 132 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 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 <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.

# IBM eServer™ xSeries 206m Server

The new IBM eServer xSeries 206m server brings new features to entry-level servers that help lower overall IT costs and better accommodate growth.

**Highlights**

- Manage your business with a server that offers many configurations and room to grow
- New technologies such as dual-core processors help protect your investment
- New high-availability features help keep systems running

**Available to run your business**

The x206m is highly expandable and provides unprecedented system availability. On select models, upgrade hard disk drives (HDDs) from low-cost, fixed serial ATA (SATA) to Serial Attached SCSI (SAS), a new HDD technology that adds more performance and features. And even if an HDD or power supply fails, the x206m can stay up and running with features such as hot-swap SATA and SAS HDDs and redundant power supplies.

**Protect your investment and your data**

New features such as DDR II memory and PCI-Express help extend the life of your system. Dual-core processor models provide higher performance for systems running multiple applications. Protect your data with IBM ServeRAID™-8e, which provides RAID-0 or RAID-1 delivering more features than standard server operating system-based RAID. For more robust RAID-5 or RAID-6 data protection, IBM offers optional upgrades that are part of the IBM ServerProven® program.

## IBM eServer xSeries 206m at a glance

| | |
|---|---|
| **Form factor/height** | Tower/5U |
| **Processor** (L2 cache/CPU GHz/ front-side bus MHz max) | Intel Pentium D (dual-core) (2x1MB/up to 3.0/800) or Intel Pentium 4 (1MB or 2MB/up to 3.4//800), both support Intel Extended Memory 64 Technology |
| **Number of processors** (std/max) | 1/1 |
| **Memory** (std/max) | Up to 8GB PC2-4200 DDR II |
| **Expansion slots** | 2 PCI, 2 PCI-X (model-dependent) and 2 PCI-Express |
| **Disk bays** (total/hot-swap) | 4 fixed simple swap or hot-swap Serial ATA HDDs or 4 hot-swap Serial Attached SCSI HDDs |
| **Maximum internal storage** | Up to 1.2TB hot-swap SAS HDDs, or up to 1TB hot-swap, simple-swap or fixed SATA HDDs |
| **Network interface** | Integrated 10/100/1000 Ethernet |
| **Power supply** (std/max) | 400W 1/1 or 430W hot-swap redundant 2/2 (model-dependent) |
| **Hot-swap components** | Hard disk drives, power supplies (model-dependent) |

| | |
|---|---|
| **RAID support** | Integrated ServeRAID-8e (RAID-0, RAID-1), optional upgrade to RAID-5 and RAID-6 |
| **Systems management** | IPMI 1.5-compliant, mini-BMC, IBM Director, Alert Standard Format 2.0, ServerGuide™, optional Remote Supervisor Adapter II and optional Remote Deployment Manager |
| **Operating systems supported** | Microsoft® Windows® Server 2003 Standard/Enterprise Edition, Windows Small Business Server 2003, Red Hat® Enterprise Linux®, SUSE Linux Enterprise Server, Novell NetWare 6.5, OS 4690 |
| **Limited warranty** | 1-year or 3-year onsite limited warranty (model-dependent) |

**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 | **5,000** 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 | 222,219 | | |
| Total Message Recipients Delivered | 550,634 | | |
| Total Messages Sent | 221,955 | | |
| Message Recipients Delivered / Messages Submitted | 2.48 | | |
| Total Messages Submitted | 222,219 | | |
| **Transaction Load (per hour)** | | | |
| Messages Submitted / hour | 54,895 | | |
| Message Recipients Delivered / hour | 136,024 | | |
| Messages Sent / hour | 54,830 | | |
| **Transaction Load (per Second)** | | | |
| RPC Read Bytes / sec | 160,818 | | |
| RPC Write Bytes / sec | 2,906,273 | | |
| **Processor** | **Average** | **Max** | **Min** |
| % Processor Time | 85 | 100 | 21 |
| **Database** | **Average** | **Max** | **Min** |
| Database cache size | 1,230,028,890 | 1,241,513,984 | 189,710,336 |
| Table opens/sec | 785 | 1,064 | 72 |

| Memory Utilization | Average | Max | Min |
|---|---|---|---|
| Available Mbytes | 2,039 | 3,646 | 1,933 |
| Cache Faults/sec | 583 | 1,333 | 29 |
| Free System Page Table Entries | 21,870 | 22,880 | 21,560 |
| Pages / sec | 2 | 25 | 1 |
| Pool Nonpaged Bytes (Bytes) | 25,186,720 | 25,899,008 | 21,114,880 |
| Pool Paged Bytes (Bytes) | 30,078,835 | 30,683,116 | 22,048,768 |
| System Cache Resident Bytes | 37,326,053 | 54,259,712 | 26,947,584 |
| Transition Faults/sec | 9 | 494 | 1 |
| **MSExchangeIS Mailbox** | **Average** | **Max** | **Min** |
| Folder Opens / sec | 21.0 | 245.0 | 10.0 |
| Message Opens / sec | 54.0 | 75.0 | 0.0 |
| MSExchangeIS Receive Queue Average Length | 0 | 0 | 0 |
| MSExchangeIS Send Queue Average Length | 38 | 281 | 0 |
| **MSExchangeIS** | **Average** | **Max** | **Min** |
| Active User Count | 0 | 751 | 0 |
| RPC Average Latency (ms) | 0 | 63 | 0 |
| RPC Num. of Slow Packets | 0 | 10 | 0 |
| RPC Packets/sec | 461 | 828 | 461 |
| Read bytes RPC Clients/sec | 19,627 | 249,741 | 19,627 |
| RPC Requests | 0 | 27 | 0 |
| RPC Operations/sec | 541 | 1,443 | 541 |
| Write bytes RPC Clients/sec | 381,081 | 4,498,884 | 381,081 |
| TempTable Current | 0 | 348 | 0 |
| MSExchangeIS VM Largest Block Size | 529,858,560 | 1,029,259,264 | 529,858,560 |
| MSExchangeIS VM Total 16MB Free Blocks | 5 | 14 | 5 |
| MSExchangeIS VM Total Free Blocks | 177 | 287 | 177 |
| MSExchangeIS VM Large Free Blocks Bytes | 623,312,896 | 2,084,610,048 | 623,312,896 |

| Paging File | Average | Max | Min |
|---|---|---|---|
| % Usage (_Total) | 1 | 6 | 1 |
| **Processor Utilization** | **Average** | **Max** | **Min** |
| System Processor Utilization (%) | 85 | 100 | 21 |
| System Processor Interrupts/sec (Total) | 4,693 | 5,518 | 835 |
| Process % CPU Time - Store | 149 | 180 | 26 |
| Process % CPU Time - Inetinfo | 5 | 7 | 0 |
| Exchange server is also domain controller? (yes/no) | Yes | | |
| Process % CPU Time – LSASS (on domain controller) | 5 | 13 | 2 |
| Handle Count (STORE) | 10,312 | 11,333 | 2,180 |
| Private Bytes (STORE) | 1,566,636,184 | 1,620,312,064 | 590,721,024 |
| Virtual Bytes (STORE) | 2,385,142,149 | 2,411,143,168 | 1,000,000,000 |
| Working Set (STORE) | 1,610,876,510 | 1,667,551,232 | 17,395,712 |
| Handle Count (Inetinfo) | 2,834 | 2,955 | 1,096 |
| Private Bytes (Inetinfo) | 41,625,704 | 46,247,936 | 28,700,672 |
| Virtual Bytes (Inetinfo) | 442,462,298 | 447,426,560 | 410,173,440 |
| Working Set (Inetinfo) | 92,862,773 | 103,047,168 | 23,609,344 |
| **SMTP Server** | **Average** | **Max** | **Min** |
| Cat: Address lookups completions/sec | 51 | 67 | 0 |
| Cat: LDAP searches/sec | 4 | 6 | 0 |
| SMTP Categorizer Queue | 0 | 2 | 0 |
| DNS Queries/sec | 0 | 0 | 0 |
| SMTP Local Queue | 44 | 613 | 0 |
| Messages Currently Undeliverable | 0 | 0 | 0 |
| Messages Delivered/sec | 15 | 22 | 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 | 9 | 33 | 0 |
|---|---|---|---|
| System Context Switches/Sec | 9,183 | 15,997 | 6,010 |
| **Disk Utilization (Aggregate for Database Logical Disks)** | **Average** | **Max** | **Min** |
| Logical Drive Utilization (%) | 1,659 | 2,694 | 42 |
| Disk Reads/Sec | 2,211 | 3,111 | 109 |
| Disk Read Bytes/Sec | 11,012,772 | 15,663,319 | 485,236 |
| Disk Writes/Sec | 896 | 1,526 | 0 |
| Disk Write Bytes/Sec | 7,006,092 | 11,172,102 | 2,355 |
| Avg. Disk sec / Read | 0.02 | 0.026 | 0 |
| Avg. Disk sec / Write | 0.026 | 0.023 | 0 |
| Average Disk Queue Length | 16 | 28 | 0 |
| **Disk Utilization (Aggregate for Transaction Log Logical Disks)** | **Average** | **Max** | **Min** |
| Logical Drive Utilization (%) | 12 | 16 | 0 |
| Disk Reads/Sec | 0 | 0 | 0 |
| Disk Read Bytes/Sec | 2 | 136 | 0 |
| Disk Writes/Sec | 407 | 556 | 4 |
| Disk Write Bytes/Sec | 3,458,238 | 5,764,451 | 19,783 |
| Avg. Disk sec / Read | 0 | 0.02 | 0 |
| Avg. Disk sec / Write | 0 | 0.001 | 0 |
| Average Disk Queue Length | 0 | 0 | 0 |
| **Network Utilization** | **Average** | **Max** | **Min** |
| Packets Sent/sec | 911 | 1,476 | 294 |
| Packets Received/sec | 1,103 | 1,624 | 321 |
| Bytes Sent/sec | 1,223,003 | 2,089,968 | 77,743 |
| Bytes Received/sec | 314,491 | 427,253 | 75,900 |

## 2.1 Response Times (Latencies)

| Client Actions | 95th Percentile Response Time (in milliseconds) |
|---|---|
| Send | 1,109 |
| Read | 218 |
| Reply | 125 |
| Reply All | 141 |
| Forward | 157 |
| Move | 250 |
| Delete | 157 |
| Permanently Delete | 188 |
| S+ Free/Busy | 203 |
| Browse Calendar | 203 |
| Make Appointment | 828 |
| Request Meeting | 1,657 |
| Create Smart Folder | 515 |
| Delete Smart Folder | 672 |
| Create Rule | 187 |
| Delete Rule | 203 |
| Apply View/Sort | 5,656 |
| **Weighted Total** | 352 |

## 2.2 Message Throughput

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

| | Expected | Measured |
|---|---|---|
| Messages Submitted/MMB3/Day | 85 | 87.8 |
| Messages Delivered/MMB3/Day | 210 | 217.6 |
| Average Recipients per Message | 2.47 | 2.48 |

# 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 | x206m | |
| Processor | Intel Pentium D 3.0GHz | |
| # of Processors (Physical) | 1 | |
| # of Processors (Logical) | 2 | |
| Hyper-Threading enabled? | No | |
| Primary Cache | Instruction: 12KB    ops<br>Data: 8KB | |
| Secondary Cache | 1MB per core | |
| Other Cache | N/A | |
| Memory | 4GB | |
| Disk Subsystem | 1) 1 x 73GB 15K RPM SAS disk for operating system, Active Directory, Paging file, and Exchange Server system files<br>2) 132 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) | 8 |
|---|---|
| Total # of LG processes | 5,000 |
| Simulated Users/Process | 1 control client with 99 users<br>1 clients with 701 users each<br>6 client with 700 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

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