Full Disclosure Report

ECperf Benchmark for IBM® eServer x350 Cluster running IBM WebSphere® Application Server Advanced Edition, Version 4.0.3 and IBM eServer® x350 running IBM DB2® V7.2

February 25, 2002

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RevisionHistory:

2002/03/12-Addedtexttoclause7.4.9documentingtheuseof   CMPOptfor ejbStoreperformanceoptimizations.
.

7.2.3 Summary Statement

See 7.3 for the Summary statement.

7.2.4 Sponsors

This benchmark was sponsored and conducted by International Business Machines Corporation (IBM).

7.2.5 Diagrams of both measured and priced configurations must be provided, accompanied by a description of the differences. This includes, but is not limited to:

- *Number and type of processors.*
- *Size of allocated memory, and any specific mapping/partitioning of memory unique to the test.*
- *Number and type of disk units (and controllers, if applicable).*
- *Number of LAN (e.g., Ethernet) connections, including routers, etc., that were physically used in the test.*
- *Type and the runtime execution location of software components (e.g., EJB Server/Containers, DBMS, client processes, software load balancers, etc.). This section provides detailed information about the priced configuration. The only differences in the measured configuration are:*

The tested configuration is the priced configuration.

PRICED CONFIGURATION:
Application Server System Configuration:
WebSphere® Application Servers (two Systems):
IBM xSeries® x350 model 6RY
4 x 900 MHz Intel®Pentium III Xeon®CPUs with 2MB L2 Cache
2.5 GB RAM
Microsoft® Windows®2000 Server
J2RE 1.3.1 IBM Windows 32 build cn131w-20020128 ORB130
WebSphere Application Server, Version 4.0 3, Advanced Edition .Availability 04/30/2002

Database Server Configuration:
IBM xSeries 350 Model 6RY
2 x 900 MHz Intel Pentium III Xeon ® CPUs with 2MB L2 Cache
2.5 GB RAM
Microsoft Windows 2000 Server
DB2® V7.2 Workplace Edition

Number and type of disk units:
x350 Application Servers:
SCSI controller
SCSI chain 0
1 - 36.4 GB 10K RPM disks

X350 Database Server:
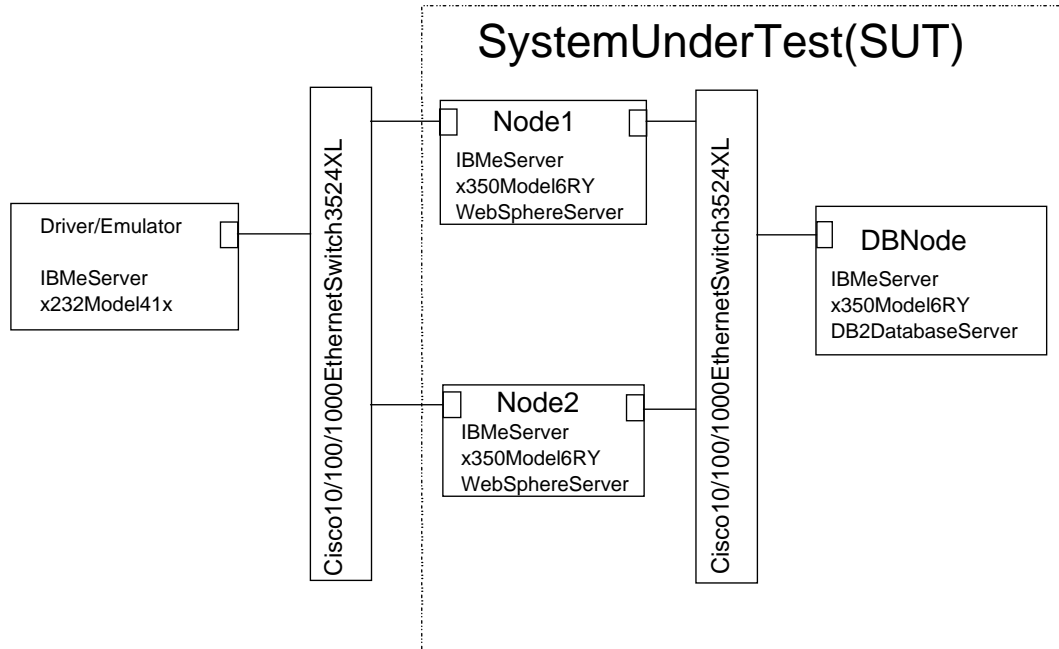SCSI RAID controller
6 - 36.4 GB, 10K RPM disks

Number of LAN connections used: One Switched LAN connecting Driver to WebSphere Application Server Nodes and one switched LAN connecting the nodes in the SUT.

Network 1: Connection of Driver/Emulator to SUT (3 Interfaces - 1 Driver, 2 WebSphere SUT Nodes)

Driver/Emulator(IBM eServer xSeries232 (2x1.266 GHz))10/100 EthernetServerAdapter 100Mbit networkinterface to WebSphereApplicationServers(x350)10/100 EthernetServerAdapter via a Cisco 100Mbitswitch .

<u>Network2: Interconnectionofall SUT Nodes</u>
One10/100Mb EthernetServerAdapter from each WebSphere SUT Nodew asconnectedviaa Cisco

100Mbitswitch .

Figure7.2.1:Ne tworkDescription

7.3SummaryStatement

7.3.1TheSummaryStatementisahigh-levelviewoftheECperfbenchmarkconfigurationandrun results.AnexampleoftheSummaryStatementispresentedinAppendixB.TheSummary Statementmustincludealloftheinformationcontainedinthisexampleinthesameformatforthe benchmarkbeingreported.

IBMCorporation: eServer x350 Clusterwithx350DatabaseMachine
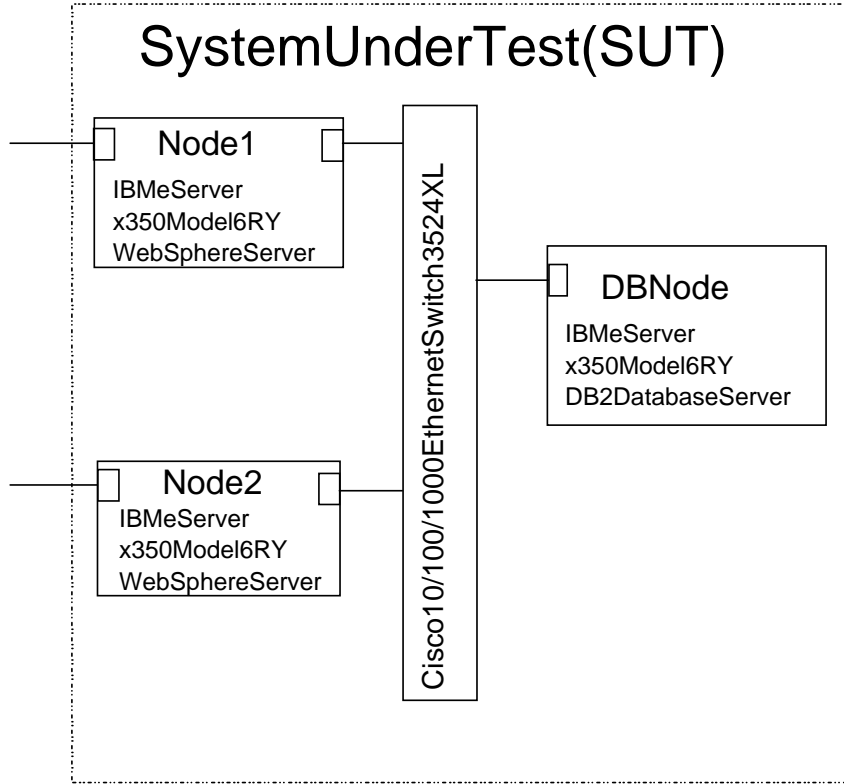   WebSphereApplicationServerAdvancedEditionVersion4.0   .3
                             DB2 WorkgroupEditionUnlimitedVersion7.2

Metrics: 16634.40 BBops/min@Std $13/BBops/min@Std
AvailabilityDate: WebSphere4.0.3willbeavailableApril   30,2002.Allothercomponentsare availableasofFebruary2 5,2002.
BeanDeploymentMode: CMPonly

Configuration:

Figure7.3.1:SystemUnderTest

System	Software	CPUs	Memory	Disk
Nodes 1 and 2 IBM eServer x350Model 6RY	WebSphereApplicationServer4.0 .3 MicrosoftWindows2000Server SP2 J2RE1.3.1IBMWindows32build cn131w-20020128 ORB130	4 x900 MHz PentiumIII Xeon 2 MBL2Cache	2.5GB	Internal: 1x36.4 GB
DBNode IBM eServer x350Model 6RY	IBM DB2V7.2 FP5 WorkGroupEdition MicrosoftWindows2000Server SP2	2 x900 MHz Pentium III Xeon 2 MBL2Cache	2.5GB	Internal: 6x36.4 GB

7.3.2 The Driver summary reports must appear as part of the Summary Statement. These include the ECperf.summary, Orders.summary and Mfg.summary files.

Contents of Ecperf.summary:

```
                    ECPerf Summary Report
                    Version : ECperf 1.0 Update 2


Run Parameters :
runOrderEntry = 1
runMfg = 1
txRate = 161
rampUp (in seconds) = 600
rampDown (in seconds) = 300
stdyState (in seconds) = 1800
triggerTime (in seconds) = 134
numOrdersAgents = 1, numMfgAgents = 1
dumpStats = 0
Benchmark Started At : Mon Feb 25 11:07:42 EST 2002


Orders Summary report is in : Orders.summary
Orders Detailed report is in : Orders.detail
Orders Transaction Rate : 9608.53 Transactions/min

Manufacturing Summary report is in : Mfg.summary
Manufacturing Detail report is in : Mfg.detail
Manufaturing Rate : 7025.87 WorkOrders/min

ECperf Metric : 16634.40 BBops/min
```

Contentsof Orders.summary:

```
                      Orders Summary Report
                      Version : ECperf 1.0 Update 2

Orders Transaction Rate : 9608.53 Transactions/min

TRANSACTION MIX

Total number of transactions = 288256
TYPE          TX. COUNT    MIX        REQD. MIX.(5% Deviation Allowed)
----          ---------    ---        ----------
NewOrder:     144036       49.97%     50%    PASSED
ChangeOrder:  58021        20.13%     20%    PASSED
OrderStatus:  57129        19.82%     20%    PASSED
CustStatus:   29070        10.08%     10%    PASSED
ECPerf Requirement PASSED

RESPONSE TIMES            AVG.        MAX.          90TH%  REQD. 90TH%

NewOrder          0.710        5.844        1.900        2
ChgOrder          0.404        2.110        0.900        2
OrderStatus       0.188        1.250        0.600        2
CustStatus        0.235        1.406        0.600        2
ECPerf Requirement for 90% Response Time PASSED
ECPerf Requirement for Avg. Response Time PASSED


CYCLE TIMES   TARGETED AVG. ACTUAL AVG.  MIN.   MAX.

NewOrder      4.962        5.057        0.000        25.000        PASSED
ChgOrder      4.956        4.990        0.000        25.000        PASSED
OrderStatus   4.960        4.968        0.000        25.000        PASSED
CustStatus    4.992        5.003        0.000        25.000        PASSED

MISC. STATISTICS

Average items per order                28.279
Widget Ordering Rate              135770.800/min      PASSED
Percent orders that are Large Orders  9.85   PASSED
Average items per Large order         149.908      PASSED
Largeorder Widget Ordering Rate       70881.267/min PASSED
Average items per Regular order       14.992 PASSED
Regular Widget Ordering Rate          64889.533/min PASSED
Percent orders submitted from Cart    49.89  PASSED
Percent ChgOrders that were delete    10.08  PASSED


LITTLE'S LAW VERIFICATION


Number of users = 805
Sum of Avg. RT * TPS for all Tx. Types = 803.971008
```

Contentsof Mfg.summary:

```
                Mfg Summary Report
                Version : ECperf 1.0 Update 2

Total Number of WorkOrders Processed : 210776
Number of WorkOrders as a result of LargeOrders : 37194
Total WorkOrders Production Rate : 7025.87 WorkOrders/min
LargeOrders Production Rate : 1239.80 LargeOrders/min

Total Widget Manufacturing Rate : 127582.80 widgets/min
LargeOrderLine Widget Rate : 62488.60 widgets/min     PASSED
PlannedLines Widget Rate : 65094.20 widgets/min PASSED

RESPONSE TIMES          AVG.       MAX.        90TH% REQD. 90TH%

                1.792       8.141       2.750        5
ECPerf Requirement for 90% Response Time PASSED
ECPerf Requirement for Avg. Response Time PASSED
```

7.3.3The Audit.reportfilegeneratedbytheDriverforrunvalidationmustappearaspartofthe SummaryStatement.

Contentsof Audit.report:

```
                      ECperf Audit Report
                      Version : ECperf 1.0 Update 2

Study State Started at : Mon Feb 25 11:17:42 EST 2002
Study State Ended at : Mon Feb 25 11:47:42 EST 2002
Orders Domain Transactions

New Order Transaction validation
Condition : New Order TxCount <= New Order DB Count
New Order Tx Count 121570
New Order DB Count 123291
Orders Transaction validation PASSED

Corp Domain Transactions

Corp Customer Transaction validation
Condition : Final Corp Customer Count >= Initial Count
Initial Corp Customer  Count = 12816
Final Corp Customer  Count  = 66358
Corp Customer Transaction validation PASSED

Mfg Domain Transactions

Work Order Transaction validation
Condition : New Work Order TxCount <= New Work Order DB Count
Work Order Tx Count 210776
Work Order DB Count 211022
Work Order Transaction validation PASSED

Suppier Domain Transactions

Purchase Order (PO) Transaction validation
Condition : PO DB Count <= Emulator TxCount
Emulator Tx Count  = 6195
PO DB Count  = 6195
PO Transaction validation PASSED

Purchase Order Line (POLine) Transaction validation
Condition : New POLine DB Count >= Delivery Servlet Tx Count
Delivery Servlet Tx Count  = 6297
New POLine DB Count  = 6315
POLine Transaction validation PASSED
```

7.4 Clause 4 Scaling and Run Rules Related Items

7.4.1 All commercially available software products used must be identified. Settings must be
provided for all customer-tunable parameters and options which have been changed from the
defaults found in actual products, including but not limited to:

• Operating system options.

• Web Container options used for the Supplier Domain and the Emulator.

> The following options were changed from their defa ult values for the Web c ontainer for both the
> Supplier and Emulator. (All changes were accomplished using the Administrative Console)
> **Emulator**
> JVM Settings Panel
> -Specify Java min and maxheapsize as 1024m
> WebContainer Panel
> -Change KeepAlives to 0
>
> **Supplier** (same JVM as EJB container on Node1)
> JVM Settings Panel
> -Specify Java min and maxheapsize as 768m
> WebContainer Panel
> -Change KeepAlives to 0

• J2EE Server and EJB Container options.

> The following options were changed from their default values for the EJB container. (All changes
> were accomplished using the Administrative Console).
> JVM Settings Panel
> -Specify Java min and maxheapsize as 768m
> -Add -Dcom.ibm.ws.Orb.ThreadPoolGrowable=false
> -Add -Djavax.rmi.CORBA.UtilClass=com.ibm.CORBA.iiop.Util
> ORBServices Panel
> Specify MaxThreads of 25
> EJBContainer (a single EJB container was run on each WebSphere Node)
> Specify cache size of 8191
> DataSourceOptions
> ECperfDataSource- Min/MaxConnections 28, StatementCacheSize 2100
> UtilDataSource- Min/Max 28 Connections, StatementCacheSize 2100 (Used only for the util.jar-
> SequenceEntbean)

•Database options.
Refer to schema/db2/db2tune.bat in the Full Disclosure Archive for a script that shows the database
parameters that were changed.

DB2 JDBC Type 2 (CLI) driver was used to connect to the Database Server.

Comment 1: This requirement can be satisfied by providing a full list of all parameters and options.

**7.4.2 For a new version of a J2EE Compatible Product, the date by which it is expected to have
passed the J2EE Compatibility Test Suite (CTS) should be indicated.**
WebSphere Application Server 4.0 has passed CTS testing in July 2001
.

7.4.3 The Orders Injection Rate used to load the database(s) must be disclosed.
The databases were loaded with an Orders Injection Rate of 1 61.

7.4.4 The Full Disclosure Archive must include all table definition statements and all other statements used to set-up the database.
These can be found in the schema sub-directory in the Full Disclosure Archive. Note, two additional indexes were added to the M_LargeOrder table. See the schema_M.sql file in the archive for specific information. These indexes were added to decrease table locks and improve performance.

Also, script db2tune was executed after the database tables were re-populated with the load utility. This file can be found in the FDA schema/db2.

7.4.5 If the Load Programs in the ECperf kit were modified (see Clause 4.4.4), all such modifications must be disclosed and the modified programs must be included in the Full Disclosure Archive.
The load programs were not modified.

7.4.6 All scripts/programs used to create any logical volumes for the database devices must be included as part of the Full Disclosure Archive. The distribution of tables and logs across all media must be explicitly depicted.
The commands used to create the database environment can be found in schema/db2/ in the Full Disclosure Archive.

The database was laid out on a total of 5 disks, 4 of these were used for the log and 1 for the tables. The tables were placed on a single disk image. The log files were striped across two pairs of mirrored disks in a RAID10 configuration using the hardware RAID card.

7.4.7 The type of persistence, whether CMP, BMP or mixed mode used by the EJB Containers must be disclosed. If mixed mode is used, the list of beans deployed using CMP and BMP must be enumerated.
Only CMP persistence was used.

All beans were deployed at an isolation level of READ_COMMITTED except SequenceEnt which was deployed at REPEATABLE_READ.

7.4.8 If the ECperf Reference Beans were modified (see Clause 4.1.3), a statement describing the modifications must appear in the Full Disclosure Report and the modified code must be included in the Full Disclosure Archive.
No modifications were made.

7.4.9 All Deployment Descriptors used must be included in the Full Disclosure Archive.
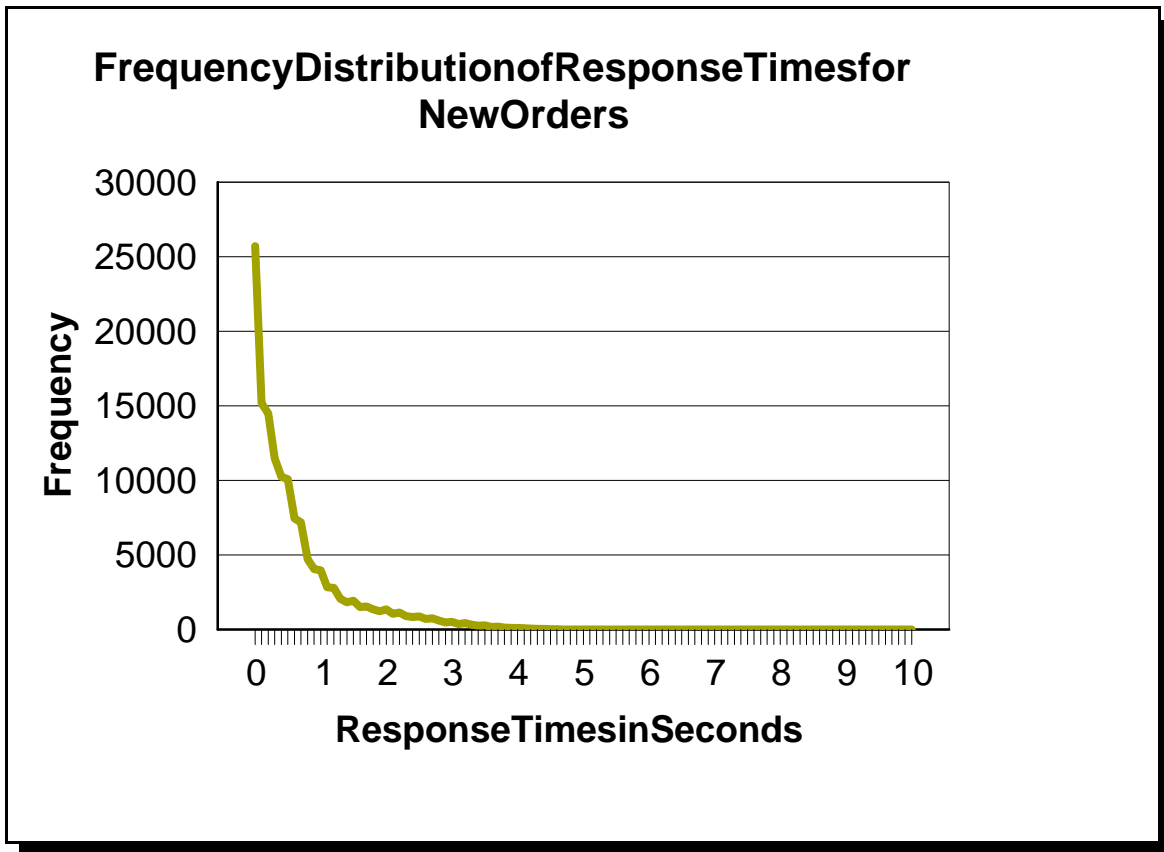The Full Disclosure Archive contains the deployment descriptors used in the   deploy/WebSphere directory .

At deployment time the utility   CMPOpt was executed against each of the ECperf jars: corp, mfg, orders,
supplier and util to optimize ejbStore operations based on Application access patterns. The following
commands were used for each jar (this is done   in ce prior to application installation):

cmpopt .\corp.jar-report-update   -ignoreopenfields -ignorenativemethods
cmpopt .\mfg.jar-report-update   -ignoreopenfields -ignorenativemethods
cmpopt .\orders.jar-report-update   -ignoreopenfields -ignorenativemethods
cmpopt .\supplier.jar-report-update   -ignoreopenfields -ignorenativemethods
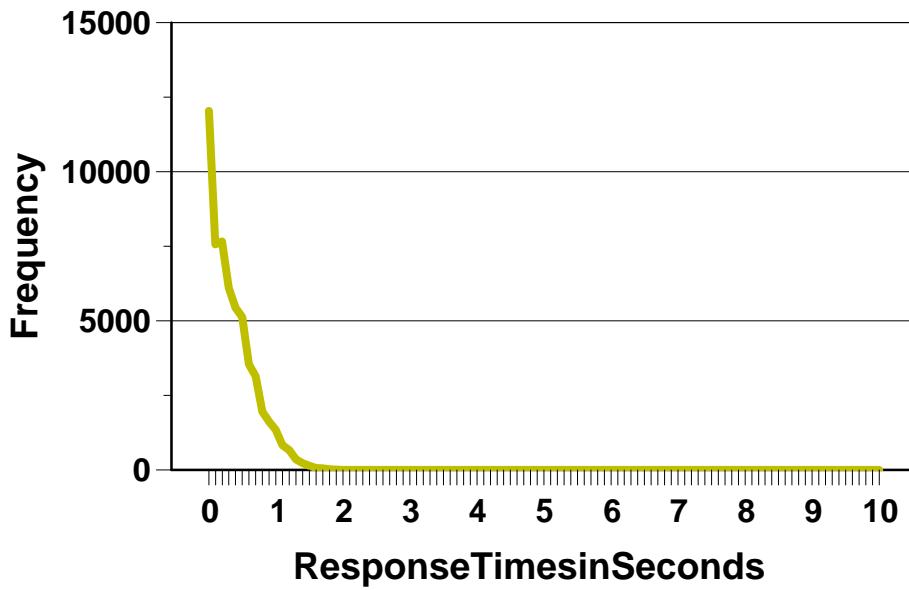cmpopt .\util.jar-report-update   -ignoreopenfields -ignorenativemethods

**7.4.10 The BBops/min from the reproducibility run must be disclosed (see Clause 4.9.2). The
entire output directory from the reproducibility run must be included in the Full Disclosure Archive
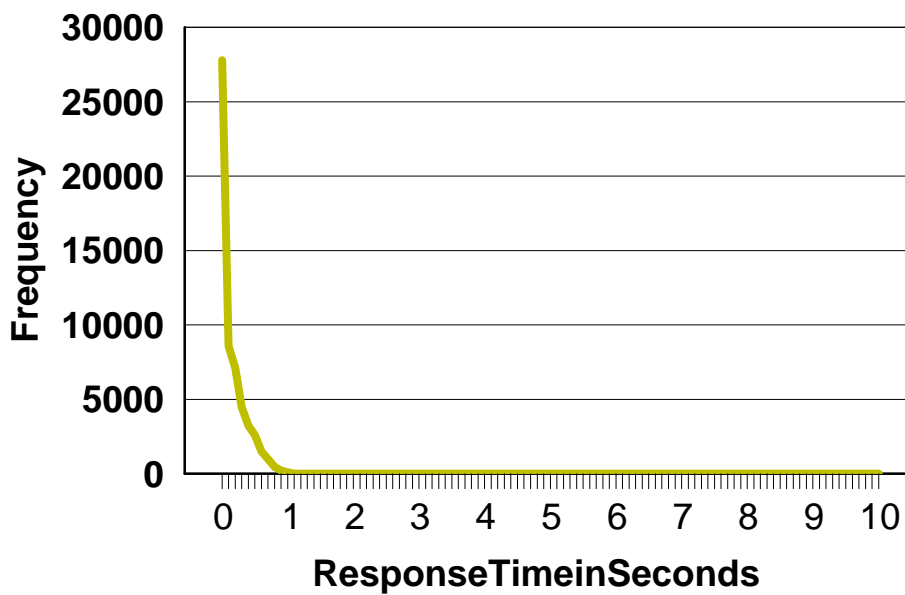in a directory named   RepeatRun.**
16745.73 Bbops/minute.

**7.4.11 The frequency distribution of response times for all the transactions must be graphed (see
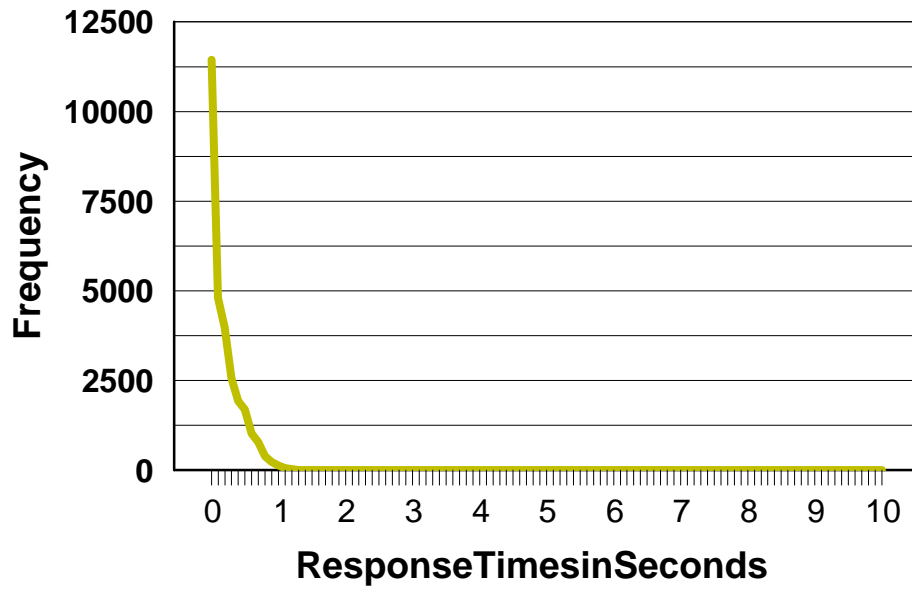Clause 4.10.1).**

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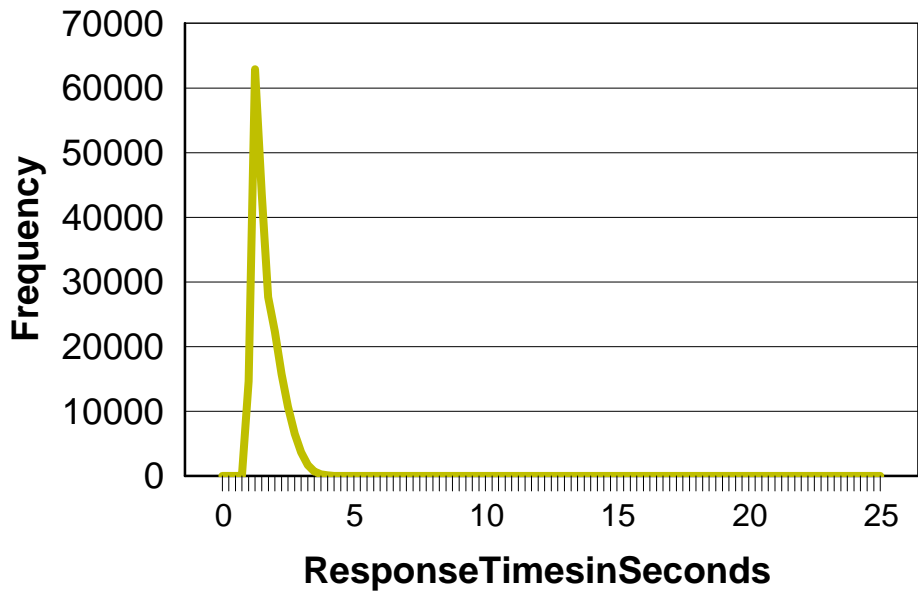
FrequencyDistributionofResponseTimesfor ChangeOrders
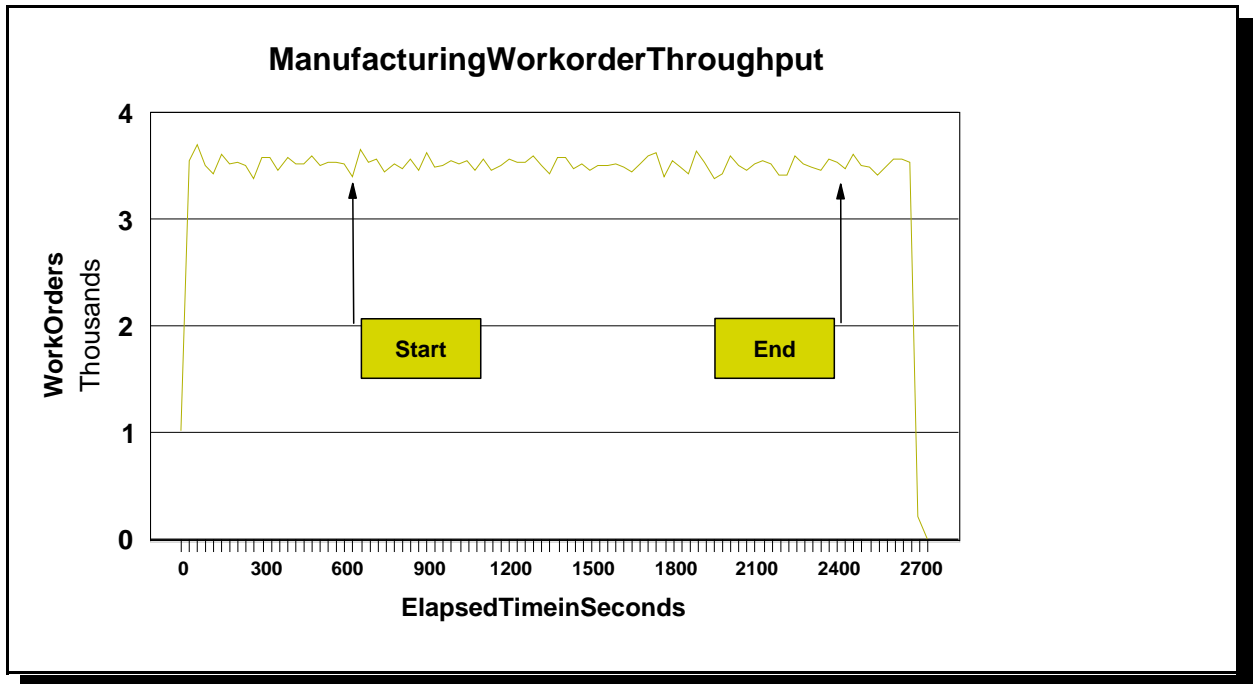

FrequencyDistributionofResponseTimesfor OrderStatus

FrequencyDistributionofResponseTimesfor CustomerStatus

FrequencyDistributionofResponseTimesfor ManufacturingWorkOrders

ManufacturingWorkorderThroughput

7.4.12Agraphofthe   workorderthroughputversuselapsedtimemustbereported(seeClause 4.10.2).

7.4.13 The scripts/programs used to run the ACID tests and their outputs must be included in the Full Disclosure Archive.

The results of the Atomicity tests can be found in the sub-directory called **AtomicityTest** in the Full Disclosure Archive.

7.5 Clause 5   SUT and Driver Related Items

7.5.1 If any software/hardware is used to influence the flow of network traffic beyond basic IP routing and switching, the additional software/hardware and settings must be disclosed. See Clause 5.1.1.

No software/hardware is used to influence the flow of network traffic beyond basic IP routing and switching.

7.5.2 The input parameters to the Driver must be disclosed by including the config/run.properties file and bin/driver.sh script used to run the benchmark in the Full Disclosure Archive. If the Launcher package was modified, its source must be included in the Full Disclosure Archive.

The config\run.properties is included in the Full Disclosure Archive. The bin\driver.bat script was Modified to point to the correct jars for WebSphere as well as miscellaneous updates for hostnames and port numbers.

In addition, the emulator.err and delivery.err had to be manually retrieved as the driver failed to retrieve this information. A browser was used and the output pasted into a flat file.

7.5.3 The bandwidth of the network(s) used in the tested/priced configuration must be disclosed.

The Emulator/Driver and J2EE server used a switched 100Mbit Ethernet network. All connections in the SUT were switched 100Mb Fast Ethernet Full/Duplex connections.

7.5.4 The protocol used by the Driver to communicate with the SUT (e.g RMI/IIOP) must be disclosed.

The protocol used was RMI-over-IIOP
.

7.5.5 If the Driver system(s) perform any load-balancing functions as defined in Clause 4.12.5, the details of these functions must be disclosed.

The WebSphere Application Server ORB on the driver system balanced requests among Node s1 and 2 . The methodology was Round-Robin, PreferLocal(default).

7.5.6 The number and types of client system used, along with the number and types of processors, memory and network configuration must be disclosed.

The following single client system was used:
IBM x232 model 41X
2x1.266 GHz Pentium III CPUs with 512K BL2 Cache
2.0GB RAM
1 36.4GB Disk
1 100Mbit Ethernet interface

7.6 Clause 6 Pricing Related Items

7.6.1 A detailed list of hardware and software used in the priced system must be reported. Each separately orderable item must have vendor part number, description, and release/revision level, and either general availability status or committed delivery date. If package-pricing is used, vendor part number of the package and a description uniquely identifying each of the components of the package must be disclosed. Pricing source(s) and effective date(s) of price(s) must also be reported.

Pricing detail for the hardware components is in **Appendix A.**

Hardware **(includes at least 1 year 24x7 support)**

System	AcquisitionPrice
EthernetSwitch	3,421
Two WebSphereApplicationServerNode s	63,492
DatabaseNode	23,337
	$90,250

Note: Hardware pricing is independent of software configured or used.

Software

Description	Price	Qty	ExtendedPrice
WebSphereApplicationServerAE	$10,081/processor	8	$80,648
IBM DB2 WorkgroupUnlimited	$14,012/processor	2	28,024
MicrosoftWindows2000Server	$999	3	2,997
IBMSupportLinefor2-5servers	$12,206.38/year	1	12,207
SoftwareTotal			$123,876

Note:SoftwarepricingbasedonPassportAdvantageAgreement.Thisisastandard,free,offeringfrom IBMandincludes24x7softwaresupportforIBM   WebSphereApplicationServerand   DB2. Microsoft Windows2000Server supportiscovered   bytheIBMSupportLine   itemabove.Pricingisbasedonthe purchaseofthethreenodeclusterasusedinthetest.Thisisastandardpackageoffering.

HardwareAcquisitionand1-yearcostofownership		90,250
SoftwareAcquisitionand1-yearcostofownership		123,876
1-YearHardware/SoftwareAcquisitionandMaintenance Costofownership	$	214,126
BBOPS@Std		16634.4
$/BBOPS@Std		13

Pricingsources:
IBM: www.ibm.com
Microsoft: www.microsoft.com
Cisco:1-800-326-1941
Effectivedatesofpricing: 02/21/2002

7.6.2Thetotalpriceoftheentireconfigurationmustbereported,including:hardware,software, andmaintenancecharges.Separatecomponentpricingisrecommended.

Thetotalpriceofthetestedconfigurationis:$ 214,126(quotedinUSdollars)

7.6.3Thecommitteddeliverydateforgeneralavailability(availabilitydate)ofproductsusedinthe pricecalculationsmustbereported.Whenthepricedsystemincludesproductswithdifferent availabilitydates,thereportedavailabilitydateforthepricedsystemmustbethedateatwhichall componentsarecommittedtobeavailable.

WebSphere4.0.3willbeavailableApril   30,2002. All other productsusedinthisbenchmarkareavailable asof February2 5,2002 .

AppendixA-ListPricesfor SUTHardware(currentasof2002-02- 25)

	P/N	xSeries350-WebSphereSystem	ListPrice	NetPrice
1	86826RY	xSeries350900MHz/2MBPentiumIIIXeon,512MBECC,OPEN,48X,PCI(Rack4U)(P/N86826RY)	$8,199.00	$8,199.00
1		(Std)270WHot-SwapPowerSupply		
1		(Std)48X-20XCD-ROMDrive		
1		(Std)5.25to3.5DASDBayConversionKit		
1		(Std)900MHz/2MBPentiumIIIXeonProcessor		
1		(Std)IBM1.44MB3.5-inchDisketteDrive		
1		(Std)Integrated10/100EthernetController		
1		(Std)IntegratedDual-ChannelUltra160SCSIController		
1		(Std)IntegratedVideoController-8MB		
4		(Std)Netfinity128MB100MHzECCSDRAMRDIMM		
1		(Std)SystemsManagementProcessor		
3	19K4633	900MHz/2MBPentiumIIIXeonProcessor(P/N19K4633)	$6,189.00	$18,567.00
4	33L3117	Netfinity512MB100MHzECCSDRAMRDIMM(P/N33L3117)	$499.00	$1,996.00
1	37L7206	36.4GB10K-4Ultra160SCSIHot-SwapSLHDD(P/N37L7206)	$549.00	$549.00
2	06P3601	10/100EthernetServerAdapter(P/N06P3601)	$94.05	$189.00
2	37L6880	270WHot-SwapRedundantPowerSupply(P/N37L6880)	$224.00	$448.00
1	28L3621	IBMPreferredKeyboard(StealthBlack)(P/N28L3621)	$49.00	$49.00
1	28L3673	Sleek2-ButtonMouse(StealthBlack)(P/N28L3673)	$25.00	$25.00
1	66274AN	G7817inch(16inchViewable)Monitor-StealthBlack(P/N66274AN)	$229.00	$229.00
1	30L9186	3YROnsiterepair24x74-Hourwarrantyserviceupgrade(P/N30L9186)	$1,495.00	$1,495.00
		Subtotalforx350WebSphereSystem		**$31,746.00**

	P/N	xSeries350DatabaseSystem	ListPrice	NetPrice
1	86826RY	xSeries350900MHz/2MBPentiumIIIXeon,512MBECC,OPEN,48X,PCI(Rack4U)(P/N86826RY)	$8,199.00	$8,199.00
1		(Std)270WHot-SwapPowerSupply		
1		(Std)48X-20XCD-ROMDrive		
1		(Std)5.25to3.5DASDBayConversionKit		
1		(Std)900MHz/2MBPentiumIIIXeonProcessor		
1		(Std)IBM1.44MB3.5-inchDisketteDrive		
1		(Std)Integrated10/100EthernetController		
1		(Std)IntegratedDual-ChannelUltra160SCSIController		
1		(Std)IntegratedVideoController-8MB		
4		(Std)Netfinity128MB100MHzECCSDRAMRDIMM		
1		(Std)SystemsManagementProcessor		
1	19K4633	900MHz/2MBPentiumIIIXeonProcessor(P/N19K4633)	$6,189.00	$6,189.00
4	33L3117	Netfinity512MB100MHzECCSDRAMRDIMM(P/N33L3117)	$499.00	$1,996.00
1	33L5050	Netfinity3-PackUltra160Hot-SwapExpansionKit	$319.00	$319.00
1	06P5736	ServeRAID-4MxUltra160SCSIController(P/N06P5736)	$999.00	$999.00
6	37L7206	36.4GB10K-4Ultra160SCSIHot-SwapSLHDD(P/N37L7206)	$549.00	$3,294.00
1	06P3601	10/100EthernetServerAdapter(P/N06P3601)	$94.05	$95.00
2	37L6880	270WHot-SwapRedundantPowerSupply(P/N37L6880)	$224.00	$448.00
1	28L3621	IBMPreferredKeyboard(StealthBlack)(P/N28L3621)	$49.00	$49.00
1	28L3673	Sleek2-ButtonMouse(StealthBlack)(P/N28L3673)	$25.00	$25.00
1	66274AN	G7817inch(16inchViewable)Monitor-StealthBlack(P/N66274AN)	$229.00	$229.00
1	30L9186	3YROnsiterepair24x74-Hourwarrantyserviceupgrade(P/N30L9186)	$1,495.00	$1,495.00
		Subtotalforx350DatabaseSystem		**$23,337.00**

			ListPrice	NetPrice
1		CiscoSwitch-WS-C3524-XL-EN	$2,995.00	$2,995.00
1		SMARTnet1year24x74hourwarrantyService-CON-SNTP-WS-C3524	$426.00	$426.00
		SubtotalforCiscoSwitch		**$3,421.00**