IBM

Configuration Guide for IBM xSeries with Oracle9*i* RAC
Version 1.1
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Introduction

The purpose of this guide is to assist those who are configuring and implementing Oracle9*i* Real Application Clusters (RAC) solutions with IBM xSeries servers and IBM TotalStorage subsystems.

This guide is comprised of:
- An brief description of the Oracle certification program for Intel processor-based servers
- An overview of Oracle9*i* RAC solutions
- A detailed list of Oracle certified solution components and supported variances

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RAC Certification Program for Intel processor-based servers

On 8/28, Oracle announced changes to the RAC certification program for Intel processor-based servers. These changes are:
- Oracle will no longer publish lists of specific hardware configurations except for factory pre-installed cluster configurations
- Oracle will certify to operating systems and publish these certifications on Oracle Technology Network and MetaLink.[1]
- Oracle will publish a list of compatible technology (e.g. Fibre Channel, standards, etc.).
- Solution partners will determine the specific hardware and software offered, based on the compatible technology list and the operating system version supported.
- The solution partners will be responsible for publishing their solutions
- Oracle will provide a link to the hardware vendor's web site for detailed configuration information and the operating system versions supported

The following include program changes implemented as of October 2002:
- The Oracle Certified RAC Configurations web page has been replaced.
- The Oracle Technology Network (OTN) lists compatible technologies:
  - Compatible technology list for Linux
  - Compatible technology list for Windows
- The Oracle MetaLink web support service lists RAC products certified by operating systems, compatible technology, and also provides example configurations.
- Access to Oracle certification matrices no longer requires userid and password.

Solution Overview

An Oracle9*i* RAC configuration must include:
- Two or more servers
- A high-speed server interconnect
- A shared storage subsystem

Each server runs an instance of Oracle9*i*, operating against a shared database located on the shared storage subsystem. The Oracle instances communicate with each other over the high-speed server interconnect, exchanging information to maintain database cache coherency and manage access to the shared database. This inter-instance communication is key to Oracle's Cache Fusion, first introduced in Oracle8*i* Parallel Server (OPS), and now fully implemented in Oracle9*i*. Cache Fusion in Oracle9*i* RAC eliminates forced disk writes and re-reads, resulting in much improved scalability over OPS.

Figure 1 shows a typical configuration of Oracle9*i* RAC running on two x360 servers. The server interconnect is a private Gigabit Ethernet LAN. The shared storage subsystem consists of an IBM FAStT700 Storage Controller with IBM FAStT EXP500 Storage Expansion Units.

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[1] OTN is free and provides technical information about products and access to downloads, training, support, and Oracle Partners. MetaLink provides technical support and is free for Oracle customers with current product support contracts. Both require user registration.
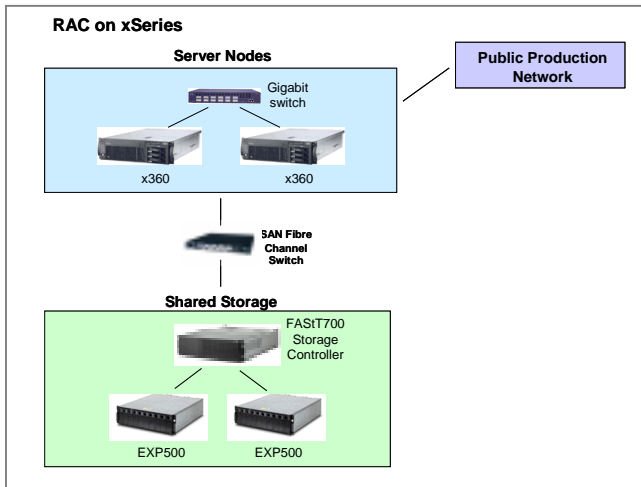
Figure 1. Typical xSeries RAC configuration

Operating System	Certified xSeries Configuration	Certification Date	Oracle Certification Program
Microsoft Windows 2000 Advanced Server	x360, four-node/4-way	April, 2002	Prior to 8/28/2002
Linux	x360, four-node/4-way	August, 2002	Prior to 8/28/2002
Linux	x440, four-node/8-way	September, 2002	Prior to 8/28/2002
Microsoft Windows 2000 Advanced Server	X440, four-node/8-way	September, 2002	After 8/28/2002

Table 1. Certified xSeries configurations

Raw devices and clustered file systems

Oracle9*i* RAC requires that shared data accessed by the database instances be on raw partitions or devices. Raw partitions are disk partitions that are not formatted. There is no file system on a raw partition. Raw partitions provide more direct access to the physical device and allow the application (in this case, RAC) more control over the timing of IO to that device. The main drawback is that raw devices are more difficult to manage.

To simplify management of database storage, Oracle will be providing clustered file system support designed for use with RAC. On Windows, Oracle has announced Oracle Clustered File System for NT and Windows 2000, available for download from OTN. For Linux, Oracle released source code for a new clustered file system on Linux on 8/14/2002. This source code is now available from OTN as a developer's release, and general availability is projected for 4th Quarter of 2002.

Other clustered file system products are available from 3rd parties. Examples include IBM GPFS, PolyServe Matrix Server, etc. which are not certified for RAC. Oracle's position regarding 3rd party clustered file systems is that unless Oracle has certified it, the solution partners (IBM) are responsible for support.

For ease of management, most customers will prefer to use a clustered file system. In proposing a clustered file system, it is important to recommend one that is supported by Oracle or IBM in a RAC solution.

Certified xSeries Configurations

Table 1 lists the xSeries configurations that have been certified to date.

The following sections list the hardware components and supported variances for each certified configuration. Following each hardware component list is a list of software required to enable the RAC solution.

These lists are not intended to provide complete xSeries configurations. Since part numbers can change, the latest IBM configuration tools should be used to create or validate any solution configuration.

The information provided here is a snapshot at a point in time. IBM is currently constructing an externally available web site, where certified hardware components, updated configurations, sales guides, configuration guides, and related material for RAC on xSeries will be published. This web site will be the source for IBM's xSeries/RAC solutions, and referenced by Oracle's OTN and MetaLink sites. It can be accessed at the URL listed in "
List of pertinent web sites" below.

General Configuration Guidelines

When configuring xSeries hardware for Oracle9*i* RAC, the following components are critical cluster components and must either be certified or supported as a variance:
- Number of servers
- Server model and number of CPUs
- Interconnect technology
- Operating system version, kernel version (Linux)
- SAN switches
- Storage controller

The following are components not considered critical for RAC. Selection may be based on other requirements, including customer requirements, hardware limitations, physical installation requirements, etc.
- Server memory
- Local disks
- Hardware and cabling for public production network

- Number of disk expansion units
- Number and type of disks in the shared storage subsystem
- Cable lengths

New Requirements

Contact your IBM sales representative or IBM Business Partner for additional information or configurations.

List of pertinent web sites

Oracle Technology Network:
http://otn.oracle.com

Oracle MetaLink:
http://metalink.oracle.com

Compatible technology list for Linux:
http://otn.oracle.com/products/oracle9i/RAC/TECH
_GENERIC_LINUX.html

Compatible technology list for Windows:
http://otn.oracle.com/products/oracle9i/RAC/TECH
_GENERIC_WINDOWS.html

Oracle certification matrices:
http://metalink.oracle.com/metalink/certify/certify.ist
ore_welcome

Currently under construction: IBM web site -
Clustering with Oracle 9i Real Application Cluster
(RAC)
http://www.pc.ibm.com/ww/eserver/xseries/clusterin
g/parallel_server.html

Support Contacts

For further assistance or information, contact:

Americas:
   Americas Techline
     Notes: Techline/Philadelphia/IBM @IBMUS
     Internet: techline@us.ibm.com

EMEA:
   IBM / Oracle Joint Solutions Centre
     Internet: oraclibm@fr.ibm.com

Asia Pacific:
   IBM Japan / Oracle Competency Center
     Internet: ibmoracc@jp.ibm.com
   ASEAN Techline
     Notes: ASEAN Techline/Malaysia/IBM
     Internet: techline@my.ibm.com

Worldwide:
   IBM / Oracle International Competency Center

Notes: Oracle Competency Center/San
            Jose/IBM @IBMUS
Internet: ibmoracl@us.ibm.com

Microsoft Windows 2000 Advanced Server, 4-node/4-way x360

	Certified Hardware			Supported Variances		
	Description	Quantity	Part #	Description	Quantity	Part #
Server	xSeries x360 • 2 Std. Intel Xeon MP 1.6GHz, 2GB Std. Memory, 72.8GB Std. Disk • 1.6GHz Intel Xeon MP (total 4 CPU per server) • 1GB PC1600 ECC DDR SDRAM RDIM (total 4GB memory per server) • PRO/1000XT Server Adapter by Intel (for production network)	4 servers 2 per server 2 per server 1 per server	86863RX	xSeries 360 • 1.4, 1.5, 1.6GHz Intel® Xeon™ MP processors • 1 – 4 CPUs per server • 2 – 4GB memory per server	2 - 4 servers	8686xxx
Server Interconnect	Network adapter • IBM Gigabit Ethernet SX adapter	2 per server	06P3701		1 – 2 per server	
	Network Switch • Cisco Gigabit Ethernet Catalyst 4912G switch	2		• Cisco Gigabit Catalyst 4908G switch • Cisco Gigabit Catalyst 6509 switch	1 - 2	

	Network Cables
	Cabling for 1000Base-SX:
	• 850 nanometer fiber:
	  - 50 micron multimode = 550 meters max.
	  - 63.5 micron multimode = 220 meters max.
	Connector: fiber SC duplex
		2 per server				

Shared Storage	SAN Host Adapter • IBM TotalStorage FAStT FC-2 Host Bus Adapter	2 per server	19K1246		1 - 2	
	SAN switch • SAN Fibre Channel Switch, 16-port	2	2109S16	• TotalStorage SAN Switch F08, 8-port • TotalStorage SAN Switch F16, 16-port • SAN Fibre Channel Switch, 8-port • Brocade 2800 • Brocade 2400	1 - 2	3534-F08 2109-F16 2109-S16
	Storage Server • IBM TotalStorage FAStT700 Storage Server	1	17421RU	• IBM FAStT500 Storage Server • IBM FAStT200 Storage Server • IBM FAStT200 HA Storage Server	1	35521RU 35421RU 35422RU
	Storage Expansion • IBM FAStT EXP500 Storage Expansion Unit • Netfinity 18.2 GB 15Krpm FC Hot-swap HDD	1 10	35601RU 06P5707	• TotalStorage FAStT EXP700 Storage Expansion Unit	Storage Server dependent, as required	17401RU

Certified Hardware			Supported Variances		
Description	Quantity	Part #	Description	Quantity	Part #
Fibre Channel cables • 1M LC-LC Fibre Channel Cable • Short-wave SFP Module • LC-SC Fibre Channel Adapter Cable	6 4 6	19K1247 19K1271 19K1250	Refer to xSeries Configuration and Options Guide, Supported Cable Groups		

Table 2. x360/Windows certified hardware

Software for x360/Windows 2000 configuration

Description	Source	Notes:
Microsoft Windows 2000 Advanced Server	Microsoft	OS Service Pack required: • Service Pack 2
Oracle9*i* Enterprise Server (9.0.1 and 9.2)	Oracle	
Oracle OSD Clusterware (Ethernet) Version 9.0.1.1	Oracle	Provided with Oracle9*i*
Microsoft Windows 95, Windows 98, Windows NT 4.0, Windows 2000, Windows XP 32, and Itanium 64 Drivers software package for all IBM Intel-based 10/100 and Gigabit Ethernet Adapters	IBM	http://www.pc.ibm.com/qtechinfo/MIGR-4R3GWL.html?lang=en_US&page=brand&brand=IBM+Options&doctype=&subtype=Cat&up=unknownuser
IBM FAStT FC-2 Host Bus Adapter device driver for Windows 2000 (Version 8.1.5.60)	IBM	Refer to document MIGR-43793[2]
IBM FAStT Storage Manager for Microsoft Windows NT and Windows 2000 (Version 8.21)	IBM	Refer to document MIGR-43793
IBM FAStT Management Suite Java (MSJ) Diagnostic and Configuration Utility for Microsoft Windows 2000, Windows NT 4.0 and Novell NetWare v5.x (Version 2.0 Release 33)	IBM	Refer to document MIGR-43793

Table 3. x360/Windows software

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[2] Access http://www-1.ibm.com/support/search/index.html and search for the document id.

Linux, 4-node/4-way x360

	Certified Hardware			Supported Variances		
	Description	**Quantity**	**Part #**	**Description**	**Quantity**	**Part #**
Server	xSeries x360 • 2 Std. Intel Xeon MP 1.6GHz, 2GB Std. Memory, 72.8GB Std. Disk • 1.6GHz Intel Xeon MP (total 4 CPU per server) • 1GB PC1600 ECC DDR SDRAM RDIM (total 4GB memory per server) • PRO/1000XT Server Adapter by Intel (for production network)	4 servers 2 per server 2 per server 1 per server	86863RX 19K4647 33L3285 22P6801	xSeries 360 • 1.4, 1.5, 1.6GHz Intel® Xeon™ MP processors • 1 – 4 CPUs per server • 2 – 4GB memory per server xSeries 335 • 2, 2.2, 2.4GHz Intel® Xeon™ MP processors • 1 – 2 CPUs per server • 1 – 4GB memory per server xSeries 345 • 2, 2.2, 2.4GHz Intel® Xeon™ processors • 1 – 2 CPUs per server • 1 – 4GB memory per server	2 – 4 servers	8686xxx 8676xxx 8670xxx
Server Interconnect	Network Adapter • IBM Gigabit Ethernet SX adapter	2 per server	06P3701			
	Network Switch • Cisco Gigabit Ethernet Catalyst 4912G switch	2		• Cisco Gigabit Catalyst 4908G switch • Cisco Gigabit Catalyst 6509 switch	1 - 2	

	Network Cables
	Cabling for 1000Base-SX:
	• 850 nanometer fiber:
	  - 50 micron multimode = 550 meters max.
	  - 63.5 micron multimode = 220 meters max.
	Connector: fiber SC duplex
		2 per server				

Shared Storage	SAN Host Adapter • IBM TotalStorage FAStT FC-2 Host Bus Adapter	2 per server	19K1246		1 – 2 per server	
	SAN switch • SAN Fibre Channel Switch, 16-port	2	2109S16	• TotalStorage SAN Switch F08, 8-port • TotalStorage SAN Switch F16, 16-port • SAN Fibre Channel Switch, 8-port	1 - 2	3534-F08 2109-F16 2109-S16
	Storage Server • IBM TotalStorage FAStT700 Storage Server	1	17421RU	• IBM FAStT500 Storage Server • IBM FAStT200 Storage Server • IBM FAStT200 HA Storage Server	1	35521RU 35421RU 35422RU

Certified Hardware			Supported Variances		
Description	Quantity	Part #	Description	Quantity	Part #
Storage Expansion • IBM FAStT EXP500 Storage Expansion Unit • Netfinity 18.2 GB 15Krpm FC Hot-swap HDD	1 10	35601RU 06P5707	• TotalStorage FAStT EXP700 Storage Expansion Unit	Storage Server dependent, as required	17401RU
Fibre Channel cables • 1M LC-LC Fibre Channel Cable • Short-wave SFP Module • LC-SC Fibre Channel Adapter Cable	6 4 6	19K1247 19K1271 19K1250	Refer to xSeries Configuration and Options Guide, Supported Cable Groups		

Table 4. x360/Linux certified hardware

Software for x360/Linux configuration

Description	Source	Notes:
Red Hat Linux Advanced Server 2.1 OR Suse Linux Enterprise Server 7	Red Hat SuSE	OS patch required: • kernel 2.4.9-e3-summit, glibc 2.2.4 • Refer to documents MIGR-43850, MIGR-43798[3] • Logical Volume Manager is not supported by Red Hat for RAC OS requirements: • kernel 2.4.18 • SLES7 Patch CD2 and CD3
Oracle9*i* Enterprise Server	Oracle	RDBMS patch set required: • Patch set 9.2.0.1
Linux Drivers for IBM Intel-based 10/100 and Gigabit Ethernet Adapters	IBM	http://www.pc.ibm.com/qtechinfo/MIGR-4R3GWL.html?lang=en_US&page=brand&brand=IBM+Options&doctype=&subtype=Cat&up=unknownuser
IBM FAStT Host Adapter failover device driver version 6.0 for Linux	IBM	Refer to document MIGR-43754
IBM FAStT Storage Manager version 8.2 for Linux	IBM	Refer to document MIGR-42058
IBM FAStT Management Suite Java (MSJ) Diagnostic and Configuration Utility version 2.0 release 32 for Red Hat Linux	IBM	Refer to document MIGR-42065

Table 5. x360/Linux software

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[3] Access http://www-1.ibm.com/support/search/index.html and search for the document id.

Linux, 4-node/8-way x440

	Certified Hardware			Supported Variances		
	Description	Quantity	Part #	Description	Quantity	Part #
Server	xSeries 440 • 2 std. Intel Xeon MP 1.6GHz, 2GB std. Memory, onboard 10/100/1000 Ethernet • 1.6GHz Intel Xeon MP (total 8 CPU per server) • xSeries SMP Expansion Module • 512MB PC133 SDRAM ECC RDIMM (total 8GB memory per server) • PRO/1000XT Server Adapter by Intel (for production network)	4 servers 6 per server 1 per server 12 per server 1	86873RX 32P8707 32P8340 33L3324 22P6801	xSeries 440 • 1.4, 1.5, 1.6GHz Intel® Xeon™ MP processors • 2 – 8 CPUs per server • 2 – 8GB memory per server	2 – 4 servers	8687xxx
Server Interconnect	Network Adapter • IBM Gigabit Ethernet SX adapter	2 per server	06P3701			
	Network Switch • Cisco Gigabit Ethernet Catalyst 4912G switch	2		• Cisco Gigabit Catalyst 4908G switch • Cisco Gigabit Catalyst 6509 switch	1 - 2	

	Network Cables
	  Cabling for 1000Base-SX:
	• 850 nanometer fiber:
	  - 50 micron multimode = 550 meters max.
	  - 63.5 micron multimode = 220 meters max.
	  Connector: fiber SC duplex
		2 per server				

Shared Storage	SAN Host Adapter • IBM TotalStorage FAStT FC-2 Host Bus Adapter	2 per server	19K1246		1 – 2 per server	
	SAN switch • SAN Fibre Channel Switch, 16-port	2	2109S16	• TotalStorage SAN Switch F08, 8-port • TotalStorage SAN Switch F16, 16-port • SAN Fibre Channel Switch, 8-port	1 - 2	3534-F08 2109-F16 2109-S16
	Storage Server • IBM TotalStorage FAStT700 Storage Server	1	17421RU	• IBM FAStT500 Storage Server • IBM FAStT200 Storage Server • IBM FAStT200 HA Storage Server	1	35521RU 35421RU 35422RU

Certified Hardware			Supported Variances		
Description	Quantity	Part #	Description	Quantity	Part #
Storage Expansion • IBM FAStT EXP500 Storage Expansion Unit • Netfinity 18.2 GB 15Krpm FC Hot-swap HDD	1 10	35601RU 06P5707	• TotalStorage FAStT EXP700 Storage Expansion Unit	Storage Server dependent, as required	17401RU
Fibre Channel cables • 1M LC-LC Fibre Channel Cable • Short-wave SFP Module • LC-SC Fibre Channel Adapter Cable	6 4 6	19K1247 19K1271 19K1250	Refer to xSeries Configuration and Options Guide, Supported Cable Groups		

Table 6. x440/Linux certified hardware

Software for x440/Linux configuration

Description	Source	Notes:
Red Hat Linux Advanced Server 2.1 OR SuSE Linux Enterprise Server 7	Red Hat SuSE	OS patch required: • kernel 2.4.9-e3-summit, glibc 2.2.4. • Refer to document ids MIGR-43851, MIGR-43798[4]. • Logical Volume Manager is not supported by Red Hat for RAC **IMPORTANT:** As of December 16, 2002, Red Hat has not certified the xSeries 440. The current projection is for certification is January 2003. OS requirements: • kernel 2.4.18 • SLES7 Patch CD2 and CD3
Oracle9i Enterprise Server	Oracle	RDBMS patch set required: • Patch set 9.2.0.1
Linux Drivers for IBM Intel-based 10/100 and Gigabit Ethernet Adapters	IBM	http://www.pc.ibm.com/qtechinfo/MIGR-4R3GWL.html?lang=en_US&page=brand&brand=IBM+Options&doctype=&subtype=Cat&up=unknownuser
IBM FAStT Host Adapter failover device driver version 6.0 for Linux	IBM	Refer to MIGR-43754
IBM FAStT Storage Manager version 8.2 for Linux	IBM	Refer to MIGR-42058
IBM FAStT Management Suite Java (MSJ) Diagnostic and Configuration Utility version 2.0 release 32 for Red Hat Linux	IBM	Refer to MIGR-42065

Table 7. x440/Linux software

[4]Access http://www-1.ibm.com/support/search/index.html and search for the document id.

Microsoft Windows 2000 Advanced Server, 4-node/8-way x440

	Certified Hardware			Supported Variances		
	Description	**Quantity**	**Part #**	**Description**	**Quantity**	**Part #**
Server	xSeries x440 • 2 std. Intel Xeon MP 1.6GHz, 2GB std. Memory, onboard 10/100/1000 Ethernet • 1.6GHz Intel Xeon MP (total 8 CPU per server) • xSeries SMP Expansion Module • 512MB PC133 SDRAM ECC RDIMM (total 8GB memory per server) • PRO/1000XT Server Adapter by Intel (for production network)	4 servers 6 per server 1 per server 12 per server 1	86873RX 32P8707 32P8340 33L3324 22P6801	xSeries 440 • 1.4, 1.5, 1.6GHz Intel® Xeon™ MP processors • 2 – 8 CPUs per server • 2 – 8GB memory per server	2 – 4 servers	8687xxx
Server Interconnect	Network Adapter • IBM Gigabit Ethernet SX adapter	2 per server	06P3701			
	Network Switch • Cisco Gigabit Ethernet Catalyst 4912G switch	2		• Cisco Gigabit Catalyst 4908G switch • Cisco Gigabit Catalyst 6509 switch	1 - 2	

	Network Cables
	Cabling for 1000Base-SX:
	• 850 nanometer fiber:
	  - 50 micron multimode = 550 meters max.
	  - 63.5 micron multimode = 220 meters max.
	Connector: fiber SC duplex
		2 per server				

Shared Storage	SAN Host Adapter • IBM TotalStorage FAStT FC-2 Host Bus Adapter	2 per server	19K1246		1 – 2 per server	
	SAN switch • SAN Fibre Channel Switch, 16-port	2	2109S16	• TotalStorage SAN Switch F08, 8-port • TotalStorage SAN Switch F16, 16-port • SAN Fibre Channel Switch, 8-port	1 - 2	3534-F08 2109-F16 2109-S16
	Storage Server • IBM TotalStorage FAStT700 Storage Server	1	17421RU	• IBM FAStT500 Storage Server • IBM FAStT200 Storage Server • IBM FAStT200 HA Storage Server	1	35521RU 35421RU 35422RU
	Storage Expansion • IBM FAStT EXP500 Storage Expansion Unit • Netfinity 18.2 GB 15Krpm FC Hot-swap HDD	1 10	35601RU 06P5707	• TotalStorage FAStT EXP700 Storage Expansion Unit	Storage Server dependent, as required	17401RU

Certified Hardware			Supported Variances		
Description	Quantity	Part #	Description	Quantity	Part #
Fibre Channel cables • 1M LC-LC Fibre Channel Cable • Short-wave SFP Module • LC-SC Fibre Channel Adapter Cable	 6 4 6	 19K1247 19K1271 19K1250	Refer to xSeries Configuration and Options Guide, Supported Cable Groups		

Table 8. x440/Windows certified hardware

Software for x440/Windows 2000 configuration

Description	Source	Notes:
Microsoft Windows 2000 Advanced Server	Microsoft	OS Service Pack required: • Service Pack 2
Oracle9*i* Enterprise Server (9.0.1 and 9.2)	Oracle	
Oracle OSD Clusterware (Ethernet) Version 9.0.1.1	Oracle	Provided with Oracle9*i*
Microsoft Windows 95, Windows 98, Windows NT 4.0, Windows 2000, Windows XP 32, and Itanium 64 Drivers software package for all IBM Intel-based 10/100 and Gigabit Ethernet Adapters	IBM	Refer to MIGR-4R3GWL[5]
IBM FAStT FC-2 Host Bus Adapter device driver for Windows 2000 (Version 8.1.5.60)	IBM	Refer to MIGR-43793
IBM FAStT Storage Manager for Microsoft Windows NT and Windows 2000 (Version 8.21)	IBM	Refer to MIGR-43793
IBM FAStT Management Suite Java (MSJ) Diagnostic and Configuration Utility for Microsoft Windows 2000, Windows NT 4.0 and Novell NetWare v5.x (Version 2.0 Release 33)	IBM	Refer to MIGR-43793

Table 9. x440/Windows software

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[5] Access http://www-1.ibm.com/support/search/index.html and search for the document id.