



IBM Netfinity 5500 Server Family

Raising the bar for affordable performance

Executive Summary

Netfinity 5500 servers, including the Netfinity 5500, Netfinity 5500 M10 and Netfinity 5500 M20 servers delivers power, scalability, manageability and high levels of availability and performance to business-critical applications at an affordable price.

The Netfinity 5500 family spans a two-way capable server running either Pentium II or Pentium III processors (Netfinity 5500), two-way capable Pentium II Xeon processors (Netfinity 5500 M10), or four-way capable Pentium III Xeon processors (Netfinity 5500 M20).

The family of Netfinity 5500 servers delivers innovative advantages for e-business. IBM's exclusive Web Server Accelerator technology can make the Netfinity 5500 server respond faster to Web requests. And you can download Web Server Accelerator software from the Netfinity Web site at no additional charge and add the application to your Netfinity 5500 server running Microsoft® Windows NT®. For ISPs, the Web Server Accelerator for Windows NT can deliver economical, fast and reliable Web service.

The combination of Web Server Accelerator software and the Netfinity 5500 server gives you advantages you can't readily get from other Intel processor-based platforms.

Through advances in migration and integration technologies, reliability, scalability, availability, manageability, security and serviceability, IBM Netfinity X-architecture provides enhanced performance for Netfinity 5500 servers while helping you maintain compatibility with many of your existing systems. Based on IBM's vast enterprise experience and server technology, Netfinity X-architecture sets the standard for affordable enterprise servers through unmatched testing, systems integration and compatibility.

Netfinity 5500 servers excel in network server applications using either two-way or four-way symmetrical multiprocessing (SMP) Pentium III, Pentium II Xeon and Pentium III Xeon processors with integrated 512KB or 1MB ECC Level 2 (L2) cache.

These processors, combined with 100MHz SDRAM memory, hot-plug and hot-add PCI, Netfinity Advanced System Management processor, standard hot-plug redundant cooling, in addition to optional 10,000 rpm hard disk drives (HDDs) and redundant hot-plug cooling fans and power supplies, advance departmental or workgroup server performance to new levels.

Netfinity 5500 servers combine excellent processor, memory and disk subsystem features to create solid performance at an affordable price. This combination is perfect for mid-sized database and application server environments.

Netfinity 5500 server family: High availability and peak performance for business-critical applications

The Netfinity 5500 server family is designed for high availability. IBM Netfinity Predictive Failure Analysis (PFA) for processors, voltage regulator modules (VRMs), memory, fans, power supplies and HDD options can warn you before problems occur. Exclusive light-path diagnostics, hot-pluggable PCI card slots, drive bays, fans and power supplies allow replacement of components and upgrades without powering down the server, keeping your business up and running.

Because it includes the following features, as a Web server every Netfinity 5500 family server is the perfect platform for building your e-business infrastructure:

- High availability, so that users get what they want, when they want it
- Performance, so that users get what they need quickly

The Netfinity 5500 server family provides both capabilities at departmental or workgroup server pricing.

All Netfinity 5500 servers include the following valuable services, groupware, utilities and systems management software to help improve productivity and make ownership easier than ever:

- Three-year, on-site, limited warranty¹
- Remote Connect, MoST Connect, Update Connector and Web support
- 90-day IBM Start Up Support
- Netfinity Manager and ServerGuide

The Netfinity 5500 delivers availability, manageability and reliability so you can proactively manage your networked business system from virtually anywhere, at any time.

This white paper describes advantages, features and performance of the Netfinity 5500 family of servers.

Performance

In June 1998, the Netfinity 5500 was judged best of show at PC Expo, winning *PC Week's* Expo Excellence Award. Furthermore, in the enterprise computing category, *PC Week* also named the Netfinity 5500 the winner.

From *Government Computer News* at FOSE in March, 1999, the Netfinity 5500 M10 won the "Best New Product Award" in the workgroup and departmental category.

The Netfinity 5500 M10 extends the performance of the popular, award-winning Netfinity 5500 server product line to deliver even higher levels of network performance to business-critical applications.

Netfinity 5500 servers excel in network server applications using from one to four-way SMP Pentium III to Pentium III Xeon processors with either 512KB or 1MB of L2 cache. The Netfinity 5500 server includes 512KB of L2 cache, while the Netfinity 5500 M10 and Netfinity 5500 M20 servers include 512KB or 1MB of L2 cache.

These processors combined with memory accessible at 100MHz, PCI bus features, high-performance integrated Ethernet and RAID controllers, and optional 10,000 rpm hard disk drives (HDDs) advance departmental or workgroup server performance to new levels.

¹ For information regarding IBM's statement of limited warranty, please call 1 800 772-2227 or contact your reseller. Copies available upon request.

Netfinity 5500 server family: High availability and peak performance for business-critical applications

The Netfinity 5500 server family provides outstanding performance with the latest Intel processors that perform external operations to memory at 100MHz. The Pentium II and Pentium III processor performs internal operations to L2 cache at half the core speed of the processor. The Pentium II Xeon and Pentium III Xeon processors have the advantage of performing internal operations to L2 cache at core processing speed. Therefore, if a Pentium II Xeon or Pentium III Xeon processor is installed, the cache operates at the same speed as the processor.

Fault-tolerant and high-availability features for Netfinity 5500 family of servers give you cost-savings manageability through:

- Easy access removable processing complex shuttle
- Easy access sliding system board
- Exclusive Netfinity light-path diagnostics
- Integrated Netfinity Advanced System Management processor
- Remote diagnostics, setup and power on self-test (POST)
- Vital product data (VPD)

Additional fault-tolerant and high-availability features include:

- Error correction code (ECC) memory
- Hot-plug and hot-add PCI card slots
- Hot-plug redundant cooling fans
- Hot-plug drive bays
- Hot-plug power supply (optionally redundant)
- Integrated dual-channel RAID
- Predictive Failure Analysis

For the latest information on Netfinity 5500 performance, visit our Web site at www.pc.ibm.com/us/techlink/srvperf.html.

Netfinity Technology Advantages

The Netfinity 5500 server contains a powerful Pentium II or Pentium III processor, with the option of adding a second processor for more performance. For even greater power and performance, the award-winning Netfinity 5500 server can be upgraded with an upgrade kit to a 2-way Pentium II Xeon-capable server or a 4-way Pentium III Xeon-capable server. The kits include everything you need except for the processors and memory to grow your server as your business grows.

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The following table illustrates the differences between the Netfinity 5500 family servers.

Netfinity 5500 server	Netfinity 5500 M10 server	Netfinity 5500 M20 server
Pentium II or Pentium III processor	Pentium II Xeon processor	Pentium III Xeon processor
Processor complex supports one or two Pentium II or Pentium III processors. Can be upgraded to a two-way Pentium II Xeon, or a four-way Pentium III Xeon server.	Processor complex supports one or two Pentium II Xeon processors, and can be upgraded to four-way capable Pentium III Xeon server	Processor complex supports one to four Pentium III Xeon processors.
With one processor, provides two-way processing capability. With two processors, can be upgraded to four-way processing capability.	With one processor, provides two-way processing capability. With two processors, can be upgraded to four-way processing capability.	Provides four-way processing capability.
Maximum of 1GB of memory supported.	Maximum of 2GB of memory supported.	Maximum of 4GB of memory supported.
400W power supply	400W power supply	500W power supply

Through advances in migration and integration technologies, reliability, scalability, availability, manageability, security and serviceability, IBM Netfinity X-architecture provides maximum performance for the Netfinity 5500 server family while maintaining compatibility with your existing systems.

Netfinity X-architecture sets the standard for affordable enterprise quality through unmatched testing, systems integration and compatibility.

To optimize IBM Netfinity X-architecture for your current and expanding business needs, IBM designed this architecture to provide the following:

- Bring down the cost of enterprise-class servers and technologies
- Leverage IBM's vast technology portfolio and server expertise into industry-standard computing
- Set the standard for enterprise quality through unmatched testing, systems integration and compatibility

Key elements of the Netfinity X-architecture in the Netfinity 5500 server family include powerful processors, reliable and available memory systems, scaleable I/O, advanced caching software and world-class silicon and module technology. Netfinity X-architecture also includes clustered systems featuring technology from IBM's industry-leading S/390® and RS/6000® SP™ product lines, as well as interoperability with existing large and midrange systems.

IBM Netfinity Web Server Accelerator Advantages

Performance isn't just about handling the greatest number of requests ("hits"); it's also about the most efficient use of hardware. The Netfinity 5500 server with IBM Web Server Accelerator technology can cut server response time in half, while substantially lowering the time your server's processor spends responding to requests for static Web page content. This is performance value.

For more information on Netfinity Web Server Accelerator advantages, visit our Web site at www.pc.ibm.com/us/solutions/netfinity/server_accelerator.html.

Options By IBM

IBM Netfinity ESCON Adapter

The IBM Netfinity ESCON® Adapter opens a high-capacity, bi-directional and reliable data highway between Netfinity servers and mainframe-resident data and applications. The Netfinity ESCON Adapter implements the multipath channel (MPC) protocol, an IBM technology that significantly improves the efficiency of communications across the ESCON channel. The MPC protocol and the Netfinity ESCON adapter can yield performance improvements, as well as reductions in IBM System/390 CPU cycles.

As an example of performance, the Netfinity ESCON Adapter delivers transfer rates of 200MBps and 64KB per block. In comparison, an Ethernet adapter yields only 100/10MBps and 1,500 bytes per block.

With the Netfinity ESCON adapter, each member of the Netfinity 5500 server family can act as a data warehousing and data mining coprocessor for business intelligence applications. The combination of the Netfinity 5500 server and the Netfinity ESCON Adapter is excellent for running enterprise resource planning applications, such as those from Baan, J.D. Edwards, PeopleSoft and SAP.

The superior speed of the Netfinity ESCON Adapter, combined with its nondisruptive fail-safe recovery and very low error rates across the channel lets you confidently run business-critical applications on the Netfinity 5500 server family while interacting with mainframe computers.

By supporting the ESCON Multiple Image Facility, the Netfinity ESCON Adapter enables multiple Netfinity users to access multiple mainframes quickly and efficiently. You can also consolidate multiple, distributed LAN-to-mainframe gateways into a single, centralized, channel-attached Netfinity 5500 server. This greatly simplifies network administration, network management and change control for now and the future.

Netfinity Enterprise Storage Options

The Netfinity 5500 server enterprise storage options provide the following benefits:

- Flexible scalability provided by a wide array of rack, RAID, tape and IBM Netfinity Fibre Channel storage solutions that allow your network to grow with your business. For example, because Netfinity Fibre Channel storage solutions can support transfers over distances up to 10 km (6.2 miles), companies can more easily configure off-site server and storage systems to keep critical data available around the clock—even in the event of a catastrophe. Netfinity Fibre Channel hot-pluggable and redundant RAID controllers help support the uninterrupted flow of your business.
- Greater control and reliability derived from extensive testing for compatibility of hardware and software to industry-leading local and remote system management tools.
- Peak performance delivered by high-capacity hard disk drives and high-speed tape drives. For example, IBM's hot-pluggable hard-disk drives provide storage capacity of up to 36.4GB at speeds up to 10,000 rpm.

Access to the Latest Netfinity 5500 Server Features and Performance

You can start with the Netfinity 5500 server, then grow your business to the features and performance of the Netfinity 5500 M20 and later models as your needs increase and your budget allows.

Additionally, Netfinity 5500 customers will be able to easily upgrade to the Pentium III Xeon™ processors with a simple upgrade kit that can be installed in less than four minutes.

The integrated Netfinity Advanced System Management processor in every Netfinity 5500 server automatically recognizes various upgrades to the server.

With the above features, the Netfinity 5500 server's ability and performance can grow to meet your needs.

For more information on upgrading Netfinity 5500 servers, visit our Web site at www.pc.ibm.com/us/news/netfinity/net027.html.

Bus Architecture

Netfinity 5500 servers support primary and secondary PCI buses. The outstanding performance of the Pentium II, Pentium II Xeon, Pentium III and Pentium III Xeon processors provide greater throughput to and from memory and the primary and secondary PCI buses.

Netfinity 5500 servers are enterprise LAN servers using industry-standard architectures. They contain two bus architectures:

- **Industry Standard Architecture (ISA).** ISA architecture supports data transfer rates of up to 8.33MB/sec and runs at 8.33MHz clock speeds.
- **Peripheral Component Interconnect (PCI).** PCI architecture supports data transfer rates of up to 132MB/sec and runs at 33MHz clock speeds.

The Netfinity 5500 and Netfinity 5500 M10 server allow you to install a maximum of seven adapters in the following expansion slots:

- Four 32-bit hot-plug and hot-add PCI slots. With operating system support, you can replace failing hot-plug PCI adapters without turning off the server. If the hot-add feature is supported by your operating system and the PCI adapter, you can also add PCI adapters in these slots without turning off the server.
- One 16-bit ISA slot (for legacy adapters)
- Two standard (not hot-plug) 32-bit PCI slots

The Netfinity 5500 M20 server allows you to install a maximum of six adapters in the following expansion slots:

- Four 32-bit hot-plug and hot-add PCI slots. With operating system support, you can replace failing hot-plug PCI adapters without turning off the server. If the hot-add feature is supported by your operating system and the PCI adapter, you can also add PCI adapters in these slots without turning off the server.
- One 16-bit ISA slot (for legacy adapters)
- One standard (not hot-plug) 32-bit PCI slot

High-speed, 100MHz SDRAM provides excellent processor to memory subsystem performance due to the synchronization of processor and memory clock speeds. The

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Netfinity 5500 server uses the Intel 440BX chipset and the Netfinity 5500 M10 and Netfinity 5500 M20 servers use the Intel 440GX chipset. These chipsets are designed to maximize memory and bus performance by synchronizing them with the 100MHz external speed of the Pentium II, Pentium III, Pentium II Xeon and Pentium III Xeon processors.

ECC Server Memory

The Netfinity 5500 server can support a maximum of 1GB of system memory. The Netfinity 5500 M10 server can support a maximum of 2GB of system memory. The Netfinity 5500 M20 server can scale up to 4GB of system memory.

All supported system memory is addressable through direct memory access (DMA). The Netfinity 5500 server supports 128MB and 256MB 100MHz 72-bit ECC SDRAM registered DIMMs. The Netfinity 5500 M10 and Netfinity 5500 M20 servers support 128MB, 256MB, and 512MB 100MHz 72-bit ECC SDRAM registered DIMMs. All supported DIMMs can coexist in the same Netfinity 5500 server.

The Netfinity 5500 server memory subsystem is designed for maximum performance. The Netfinity 5500 server processor card includes the following features:

- If a DIMM is failing, the Netfinity Advanced System Management processor activates the light-path diagnostics, which activate an error LED on the processor card. Each DIMM socket has a corresponding LED.
- Single-bit memory errors are isolated to a single DIMM.
- With ECC enabled, double-bit memory errors are isolated to a DIMM.
- With ECC enabled, ECC detects single-bit errors, records the errors and automatically corrects the errors.

High Availability

Overview

The Netfinity 5500 server family provides high availability to users with advantages including hot-plug PCI slots, drive bays, fans and power supplies that allow replacement of components without powering down the server.

If problems occur, Predictive Failure Analysis on processors, voltage regulator module (VRM), memory, fans, power supply and hard drive options can warn you. The optional redundant hot-plug power supply helps keep your business up and running. Power supplies can be removed and replaced without tools.

For more information on PCI hot-plug advantages, visit our Web site at www.pc.ibm.com/us/techlink/wtpapers/index.html.

Hot-Plug PCI Features

Hot-Plug Controller. The hot-plug controller hardware controls power and signals to the PCI adapter slot. This controller sequences the power-on and power-off cycles for each adapter slot. When power is applied to the slot, the controller monitors the power to see that the voltages are correct. When the voltages are at the required levels and the PCI bus is idle, the controller switches the adapter onto the host system bus.

The hot-plug controller monitors each hot-plug slot for a power fault and signals the host system if such an event occurs. The controller also monitors a latch with integrated optical sensors which, if opened or closed, signals a user's intent to remove or add a PCI adapter in the corresponding expansion slot.

Note: Although the switch is in place, it is not appropriate to open the switch when an active adapter is installed and the slot is powered. Initiate all hot-plug operations at the system console for orderly network operating system² interaction with the hot-plug slots.

To prevent accidental contact between PCI adapters, there is a divider between each PCI hot-plug slot.

Hot-Plug System Driver. The hot-plug system driver provides the interface to the hot-plug controller and the hot-plug service. This driver works much like a traditional device driver. It accepts requests from a higher level software component, the hot-plug service, and sends instructions to the hot-plug controller. In addition, it maintains the system configuration and is responsible for configuring the hot-plug adapters.

After each adapter is powered on and ready to receive information from the host, the adapter is configured. The adapter must be programmed to describe where it resides in the system (its address) and how to signal the host to service the adapter (its interrupt setting). Turning the adapter on and off and configuring the adapter is managed by the hot-plug system driver. To allocate addresses and interrupts to the adapters, the hot-plug system driver ensures that no two adapters have conflicting resources assigned.

The hot-plug system driver also ensures that the operating system does not try to communicate with the adapter until the adapter is configured correctly. The hot-plug system driver receives commands from the hot-plug service and issues appropriate instructions to the hot-plug controller.

Relation of Hot-Plug to Device Drivers. An adapter's device driver is very important in the hot-plug scenario. One of the hot-plug PCI specification requirements is that the device driver quiesce. *Quiesce* means that the adapter driver does not send any requests to the adapter and the adapter does not generate any interrupts or bus activity.

Quiescence is necessary prior to removing the adapter from the server. The device driver must be written to support quiescence. Operating system vendors who support hot-plug PCI are required to design quiescence into their device-driver specifications. System vendors who provide hot-plug support prior to operating-system support must include this function in device drivers. IBM provides this for Windows NT 4.0.

Hot-Plug Service. The hot-plug service is an operating system module that ties together several key aspects of a hot-plug PCI solution. The hot-plug service provides a user interface and a program interface for monitoring and controlling hot-plug PCI adapter slots. It can also identify the device drivers that are loaded and identify the adapters located in a hot-plug expansion slot.

Operating system vendors providing the hot-plug service define the software and the interface in their documentation. The program interface, if implemented by the operating system vendor, allows for system management applications to interact with the hot-plug PCI solution.

The hot-plug system driver receives instructions from the hot-plug service software, which is a higher-level software component. When you issue a command through the interface to perform a task, such as switching on a slot, the hot-plug service instructs the hot-plug system driver to power on, reset and configure the adapter. Then the hot-plug service helps install and initialize the new adapter's device driver.

² Additional support and certification information on network operating systems can be accessed via the World Wide Web at www.ibm.com/pc/us/compat.

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The following table summarizes the hardware and software functions of the hot-plug PCI infrastructure.

	Subsystems	Functions
Hardware	Hot-plug controller	Controls power Connects the adapter to the system Monitors for power fault
Software	Hot-plug system driver	Maintains the configuration Presents a single view of the hardware to hot-plug service
	Hot-plug service	Enables user control Cooperates with other operating system servers Optionally presents a management interface

Power Isolation. The hot-plug PCI feature of the Netfinity 5500 server family provides you with the ability to add adapters to a server without switching it off. The Netfinity 5500 server family provides hardware and software features designed to prevent an adapter and the server from damage during hot plug. To allow other adapters to continue operation without interruption, the power and all other signals to the adapter you're adding are isolated.

After power is applied to a newly-added adapter, the Netfinity 5500 server pauses for less than a microsecond while the new adapter is connected to the system. Even though the solution is commonly referred to as *hot-plug PCI*, the expansion slots are not actually "hot" (powered up and connected to the bus) when adapters are being added or removed.

When an adapter has been inserted into the expansion slot and all connections and cables are in place, the power is switched on with a user command. The power applied to the adapter is brought up slowly rather than instantaneously. A power control module works with the hot-plug controller and the power transistor to smoothly apply power to the adapter. This eliminates power surges, which could potentially upset operation of the system.

Fault Detection. The Netfinity hot-plug solution detects power faults on the hot-plug expansion slots. In the event of a power fault on an adapter, power is removed from the slot almost instantaneously.

Inserting, replacing and removing hot-plug PCI adapters in a running system can save time and enhance system availability. When you want to add, remove or replace an adapter, power is shut off to the adapter slot. The system gives positive confirmation of this action by turning off the power light of the adapter slot.

Before an adapter can be inserted, a physical switch must be opened. Opening the switch physically turns the power off to the corresponding slot. Between each of the hot-plug slots, there are plastic dividers that prevent the adapter being inserted or removed from touching the adapters in adjoining slots that are still active. Finally, there is a plastic shield designed to protect the PCI board from incidental contact. With these important availability and system management features, the Netfinity 5500 server is ready to reliably deliver the latest availability functions.

Hot-Plug Hard Drives

The Netfinity 5500 server family can support up to six hot-pluggable hard disk drives providing a maximum of 109.2GB storage. Hot-plug technology makes it possible to add and remove hard drives with little or no downtime.

Hard drive capacity can be expanded to 473.2GB by adding the optional EXP 15 external Rack Storage Enclosure with ten 36.4GB hard disk drives.

Hot-Plug Power Supplies

Each Netfinity 5500 and Netfinity 5500 M10 server includes a 400W power supply as standard equipment. Every Netfinity 5500 M20 server contains a 500W power supply. In all Netfinity 5500 family servers, a second, redundant power supply is optional. Adding an optional power supply makes it possible to add and remove a power supply with no downtime. Adding and removing power supplies does not require tools.

By adding an optional redundant hot-plug power supply, you can increase server availability if a power supply fails. Load balancing allows one power supply to quickly pick up the load in the event of a failure. Your server need never lose power, because if a power supply fails, the other power supply can take over power-supply needs, keeping your Netfinity 5500 server up and running.

Hot-Plug Redundant Fans

For system cooling, the Netfinity 5500 server has extensive, redundant fan cooling. Adding even greater cooling capacity, with two redundant hot-pluggable fans to cool the processor complex and the hard-drive bays. Another fan cools the I/O adapter cards. In addition, each power supply has its own cooling fan.

PFA and Netfinity Manager in every Netfinity 5500 server can monitor fan performance and if necessary, generate alerts to alert the system administrator. Each Netfinity 5500 server can increase the performance of the redundant fans so that the temperature within the enclosure does not rise to an unacceptable level. The fans are run at less than maximum speed for quieter and more reliable performance.

If either the power supply or processor fan is removed, the other fan automatically increases its speed to provide extra cooling capacity.

Clustering

Clustering solutions let you interconnect your computers so that they function as a single entity, providing the high levels of availability and confidence you need for business-critical applications. The Netfinity 5500 server family shares the benefits of IBM's advanced clustering and parallel computing technologies.

The Netfinity 5500 server family offers the following advantages for clustering:

- Full integration with Netfinity Manager, Microsoft Cluster Server and leading enterprise systems management software products
- Fully tested and certified IBM Netfinity/shared-storage configurations for Microsoft Cluster Server
- High-speed interconnections between nodes

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- IBM Netfinity Cluster Pack solutions for NetWare and OS/2
- Proven clustering configurations for Oracle, Oracle Parallel Server and DB2 enterprise databases plus Lotus Domino Enterprise Server
- Scalable input/output (I/O) technologies to enhance storage and memory performance
- Single-console control of multiple clusters and their respective cluster resources
- WebSphere Performance Pack lets busy Web sites increase capability by allowing multiple Netfinity servers to function as one

IBM ServerGuide

The IBM ServerGuide CDs included with the Netfinity 5500 server family provides software programs to help you set up your server and install your network operating system. ServerGuide detects the hardware options installed and provides the correct configuration program and device drivers.

In addition, the ServerGuide CDs include a variety of application programs such as IBM Update Connector to help keep your server BIOS and microcode updated and IBM Netfinity Manager for systems management.

IBM ServerGuide provides an improved way to get upgraded and updated software. As part of IBM's goal of continually enhancing and improving ServerGuide, IBM provides a one-year, fee-based subscription service that helps you receive updated software as it is made available.

In addition, if you are a certified member of IBM's TechConnect® program and have reached Professional Server Expert (PSE) or Professional Server Specialist (PSS) status, you can receive select ServerGuide CDs in your priority box shipments. To learn more about TechConnect, visit our Web site at www.pc.ibm.com/techconnect/index.html.

Advanced Systems Management

The Netfinity 5500 server family and Netfinity Manager contain advanced management features to help diagnose problems quickly, even from remote locations.

Netfinity 5500 server family management features include the following:

- The integrated Netfinity Advanced System Management processor supports remote power on self-test (POST), setup and diagnostics so your service technician or IBM HelpCenter, can get your Netfinity server back on-line quickly.
- Netfinity Manager software to manage your Netfinity server locally or from remote locations, including the Web, so you can proactively maintain control of your networked business system from anywhere at any time.
- Servicing or upgrading to new options is easier through design points that incorporate light-path diagnostics, a removable processor shuttle and a sliding system drawer.
- Easy accessibility to give you the ability to remove and replace components of the Netfinity 5500 server with little or no downtime.
- PFA to warn you of potential problems before they occur.

Predictive Failure Analysis (PFA) Alerts

PFA for Netfinity servers helps you run your business with less unscheduled downtime. PFA allows the Netfinity 5500 server family to monitor the status of critical subsystems and to notify the system administrator when components appear to be degrading.

In most cases, replacements of failing parts can be performed as part of planned maintenance activity. As a result, unscheduled outages can be prevented and your system stays up and running for your users.

Netfinity PFA uses a dedicated Netfinity Advanced System Management processor that runs independently of the system processor and provides the intelligence for remote management, system monitoring, alert notification, error logging and environmental monitoring.

The Netfinity 5500 server family includes the following PFA features to alert you of possible problems:

Power subsystems and voltage regulator modules (VRMs). Netfinity PFA for the power supply subsystem provides an additional measure of protection. The Netfinity Advanced System Management processor monitors the power supply voltages (+5v, +12v, -12v and 3.3v). Additionally, each processor on the Netfinity 5500 server family is powered by VRMs. The Advanced System Management processor also monitors the voltage of each VRM.

Each voltage has an upper and lower threshold for which a PFA alert is issued. If any voltage is out of tolerance, the system-management processor sends an alert to Netfinity Manager and the error is logged to the system-management error log.

For extreme deviations of power supply voltage from the specification, the Netfinity Advanced System Management processor issues shutdown commands to prevent hardware damage and protect customer data from unstable circuitry that can result from fluctuating voltage levels.

Processors. Using IBM's PFA, Netfinity 5500 servers can monitor processor problems. If these errors become too frequent, the likelihood of a disruptive failure increases. The processor PFA feature monitors corrected errors reported by the processors. If the frequency of these errors exceeds the preset threshold, the Netfinity Advanced System Management processor generates an alert. Processor replacement can then be scheduled as part of normal maintenance.

Self-Monitoring Analysis and Reporting Technology (S.M.A.R.T.). PFA in the S.M.A.R.T. specification provides early warning of some hard-disk drive failures, allowing critical data to be protected. S.M.A.R.T. is the industry-standard reliability prediction indicator for hard disk drives. IBM paved the way for S.M.A.R.T. by marketing the industry's first failure-prediction capability for SCSI hard disk drives. Regular backups, combined with S.M.A.R.T.-capable hard disk drives, help safeguard against data loss.

There are two kinds of hard-disk drive failures: unpredictable and predictable. As you might expect, unpredictable failures happen quickly, without warning. These failures can be caused by static electricity, handling damage or thermal-related solder problems. Predictable failures, on the other hand, are the types of failures that S.M.A.R.T. attempts to detect. These failures result from the gradual degradation of the drive's performance. In fact, 60% of drive failures are mechanical—and that's just the kind of failure S.M.A.R.T. is designed to predict.

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S.M.A.R.T.-capable drives use a variety of techniques to monitor data availability. These techniques vary from one manufacturer to another. For example, a S.M.A.R.T. drive might monitor the fly height of the head above the magnetic media. If the head starts to fly too high or too low, there's a good chance the drive could fail. Other drives might monitor different conditions, such as ECC circuitry on the hard-drive card or soft-error rates. Depending on the circumstances, some drives might monitor all or none of these conditions.

Internal hard drives also support the SCSI Accessed Fault Tolerant Enclosure (SAF-TE) standard to protect hard drive data if failures occur.

If one of IBM's S.M.A.R.T.-capable drives predicts it is going to fail while it's still under warranty, IBM will repair or replace it at no additional cost to you.

System Fans. For system cooling, the Netfinity 5500 server family has extensive fan cooling. Each power supply has a cooling fan. Two redundant hot-pluggable fans are used to cool the processor and the drive bays. Another hot-pluggable fan is used to cool the I/O adapter cards. In addition, there is one fan in each power supply. The cooling system contains both fans and centrifugal blowers.

PFA and Netfinity Manager in the Netfinity 5500 server family can monitor fan performance and if necessary, generate alerts. If needed to ensure that the temperature within the enclosure does not rise to an unacceptable level, every Netfinity 5500 server can increase the performance of the redundant fans. The fans are run at less than maximum performance for quieter and reliable system performance.

System Memory. Netfinity memory PFA monitors the number of single-bit errors. A sophisticated algorithm determines when single-bit errors could present a concern to system performance. When a threshold is exceeded, the Netfinity Advanced System Management processor generates an alert.

Semiconductor memory is subject to both hard and soft errors. Erroneous data in memory due to a soft error can be corrected by rewriting the corrected bit to that location.

Erroneous data bits caused by a hard error cannot be corrected by rewriting the bad bit. If another data bit error occurs in the same Quad Word, it results in a double-bit, uncorrectable error. Because ECC corrects single-bit failures in the data prior to use, your system will continue to run without error, even when a single data bit is permanently bad.

Thermal. Netfinity Manager software monitors temperature and issues PFA warnings so corrective action can be taken if the server, due to a thermal problem, needs attention. If a thermal problem threatens the integrity of the server, the server will automatically perform a graceful system shutdown.

IBM Light-path Diagnostics for Netfinity 5500 Servers

IBM's unique light-path diagnostic feature, which is standard for Netfinity 5500 servers, is a milestone in Intel processor-based server maintenance and repair. Like the indicators on some photocopiers that show you where to look for paper jams, the light-path diagnostic panel indicates when a subsystem is failing or has failed and identifies the failing or failed component of the subsystem. Symptoms of pending failure can be very subtle or intermittent, requiring that technicians painstakingly test to identify the specific device that is failing. IBM's light-path diagnostics feature simplifies server maintenance by eliminating this time-consuming step.

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Light-path diagnostics rely on Predictive Failure Analysis and environmental self-monitoring features IBM has embedded in vital components. When the component PFA capability indicates potential problems, it alerts the system manager and switches on the indicator on the light-path diagnostics panel of the Netfinity server.

The display that indicates the error state of the server can also provide a reminder that something needs to be fixed, as well as indicate an error not yet apparent to the system administrator. An LED on the system board next to the failing component can identify failing components. The LEDs notify you of early detection of errors or failing components, as well as notify you of PFA alerts.

For example, four LEDs on the processor board can help you quickly and easily locate an individual memory DIMM, if one fails. System administrators and service personnel can quickly and easily identify failing components, potentially without even running diagnostics. The Netfinity 5500 server family not only has LED indicators on the front panel, but within the server.

IBM's revolutionary light-path diagnostics on the Netfinity 5500 server family contribute to advanced manageability. Netfinity servers are designed with fast problem isolation as a goal, and the light-path service panel in conjunction with the component LEDs meet that goal.

Easy Accessibility

The Netfinity 5500 server contains advanced manageability and serviceability features to help diagnose problems quickly, even from remote locations. And if servicing or upgrading is necessary, design features such as light-path diagnostics, a removable processor tray, thumb screws to gain internal access quickly and a sliding shuttle-drawer make it simple. This provides you with quick accessibility, even when you are not physically near the server.

IBM Netfinity Manager Software

With IBM Netfinity Manager's alert handling capabilities, various actions can be taken for alerts received from the Netfinity Advanced System Management processor, including the following:

- Execute commands to invoke software action
- Forward alert to another system through a networked or serial interface
- Log error in a local error log
- Page system administrator
- Provide pop-up error message on the administrator console

Because LANs are normally decentralized, management and control can be costly. The remote server management provided by Netfinity Manager can improve the LAN administrator's productivity and remote LAN management capability. This can contribute to lower network operating costs, less travel to remote sites, reduced downtime and better overall control through active monitoring, fault prevention and faster problem resolution.

If configured to do so, the Netfinity Manager can alert the system administrator remotely by contacting a numeric or alphanumeric pager. The system can also alert a Netfinity Manager Console running remotely of any errors in the system. The system administrator can gather all of this information and the information stored in the event

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log remotely and make a determination as to the source of the problem and required actions for solutions without having to be at the system site.

Netfinity Manager software offers a graphical user interface for easy local and remote access, control over these features and the processor, as well as seamless integration into higher levels of workgroup or enterprise management software tools, including:

- Intel LANDesk®
- Microsoft System Management Server (SMS)
- Tivoli™ Management

Netfinity Manager is a powerful suite of tools and utilities designed to manage servers in the environment you currently have, operating on both IBM and non-IBM systems, including:

- Microsoft Windows NT
- Novell NetWare
- Citrix WinFrame
- NCD WinCenterPro
- IBM OS/2®

In addition to these advantages, Netfinity Manager supports industry standards, including:

- Desktop Management Interface (DMI)
- Multi-Platform Management (MPM) API
- Simple Network Management Protocol (SNMP)

Netfinity Manager software can help you manage your server with ease and efficiency. And, most importantly, it can help you control many of the hidden costs of operation.

Concentrating on administration and hardware management, Netfinity Manager performs four main functions:

- **Asset and capacity management.** With Netfinity Manager, you can obtain comprehensive and detailed information about your system hardware and software and export this information to a variety of popular databases. In addition, the Capacity Management service collects server performance data and displays this data graphically to help system administrators easily determine how every server on their network is performing. For example, instead of physically traveling to each LAN-connected system to perform asset management, noting serial numbers and configuration information, the Netfinity Manager auto-discovery feature lets you collect this data remotely, right from your Netfinity Manager system. You can perform capacity planning proactively, knowing in advance which systems will require additional resources, such as more memory, larger disk capacity or faster processors.
- **Problem detection and notification.** Netfinity Manager has an extensive range of monitoring functions that in conjunction with the Netfinity Advanced System Management processor provide advanced warning of potential and critical failures. A sophisticated and powerful Alert Manager function can notify the system administrator through a variety of methods or automatically take action in response to events.

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- **Remote console control.** Netfinity Manager allows network administrators to take complete control of a target system and have full graphics control. The target and managing system can be any one of the Netfinity Manager supported platforms—they do not have to be the same platform.
- **Server management tools.** Netfinity Manager allows network administrators to perform many routine tasks and mass configuration over a network connection or over a serial dial-in connection. Many tasks such as system backup, file updates, inventory and system reboots can be automated and scheduled outside normal working hours. Netfinity Manager also integrates valuable tools to give you remote support for some server-unique functions such as RAID and cluster management.

Business-critical Service and Support

IBM offers the best server support in the industry. For decades, IBM has been a leader in large and midrange system service and support, bar none. Now with that same expertise and focus on Netfinity products, IBM offers you an integrated system that provides you with high-availability service and support, designed and optimized to meet your business needs.

IBM is uniquely qualified to deliver a caliber of service and support that allows businesses to concentrate on doing their business. The statistics are impressive:

- Maintenance parts are available from IBM's 144 parts-stocking locations in the U.S. and 479 locations worldwide.
- More than 10,000 IBM and Business Partner specialists have been rigorously trained in the TechConnect® certification program for IBM Netfinity servers.
- 118,000 people worldwide deliver IBM service and support in 164 countries.
- 2500 IBM support specialists handle customer and Business Partner calls in 17 languages from our 15 HelpCenter® facilities around the world.

As you can see, IBM offers the most widespread global support and highly trained personnel available. This kind of coverage can make your life easier, as well as reduce potential risks for your business.

IBM continues to improve service and support for Netfinity servers. IBM's focus includes increasing availability of maintenance parts; providing support specialists at the local, regional and area levels; and assigning customer service representatives and technical support managers to your business.

For additional information on Netfinity service and support, refer to our Web site at www.pc.ibm.com/us/solutions/netfinity/services.html.

IBM Center for Microsoft Technologies

The 50,000 square foot, state-of-the-art IBM Center for Microsoft Technologies, which opened in 1993, is an integral part of IBM's Personal Systems Group (PSG). At the IBM Center for Microsoft Technologies, there are more than 110 software engineers, test and quality specialists, and enterprise solutions support staff members whose sole mission is to adapt Microsoft's products to IBM products.

IBM has made a major investment in the IBM Center for Microsoft Technologies and has deployed the resources needed to work hand in hand with Intel and Microsoft to ensure that Netfinity servers and other IBM hardware systems are clearly the superior platform for Windows NT and other Microsoft products.

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The IBM Enterprise Solutions team provides pre-sales and post-sales non-defect support to IBM marketing teams and enterprise customers. The team analyzes and documents evolving Microsoft software technology opportunities delivered on IBM hardware. They also conduct briefings, manage IBM PSG demonstration systems running Microsoft technology at industry trade shows, and assist customers in the initial design and architecture of current and future Microsoft technology solutions on IBM hardware. This group is made up of Microsoft Certified Systems Engineers, Trainers and Solution Developers.

IBM service and support offerings cover all your needs from pre-sales to installation to post-sales, and include remote, electronic and on-site support. IBM's goal is to offer you the best possible solution to meet your business requirements.

Remote Connect Support

IBM's Remote Connect³ is a major enhancement to service and support for Netfinity servers. Using the latest technology advances delivered by select models of the Netfinity product line, IBM offers a "Call Home" remote support feature in an Intel processor-based server. If your server experiences a problem, it will dial IBM and set in motion the right level of support to keep your system up and running. And, you can select options to have IBM contact you or your approved warranty service provider.

Using the multiple technologies in IBM's newest Netfinity servers, Netfinity Manager software and the Netfinity Advanced System Management processor, our support capability allows us to remotely deliver hardware problem determination, launch on-site resources if needed and invoke any level of support, including product engineering. Included in this offering is a comprehensive problem-management system that provides tracking, management, escalation and transfer of problem ownership to the appropriate skills required to resolve an issue.

Update Connector Provides Web Access to Latest BIOS and Driver Code

IBM's electronic-support Web site provides an automated service for updating your Netfinity BIOS and driver files called Update Connector. Update Connector is a quick and convenient way to access the latest available BIOS and driver code. Connecting and executing through the Web, Update Connector searches your system's configuration, determines the levels of BIOS and drivers currently installed and notifies you of the latest levels. At your discretion, Update Connector can send you the latest versions for your system and prepare them for installation at your convenience.

MoST Connect Provides a Direct Communication Link to the Experts

Leveraging the latest technology advancements in Netfinity servers and Netfinity Manager, IBM increases its on-site support by enhancing the Mobile Solution Terminal (MoST), carried by our server field-service representatives. MoST Connect⁴ provides a direct communication link between the IBM field service specialist at your location and the experts at the IBM HelpCenter. Continuing to improve on-site support, IBM delivers

³ Remote Connect availability is limited to certain departmental, workgroup and high-end Netfinity servers (U.S. only) and supports selected network operating systems. Remote Connect is offered exclusively through IBM Global Services.

⁴ MoST Connect is not yet available in all countries. MoST Connect is offered exclusively through IBM Global Services.

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remote-console capability with both voice and data communications through a Netfinity server's serial port.

MoST Connect allows the HelpCenter support specialist to perform remote problem determination and launch additional resources, including product engineering if required, to solve a server problem. MoST Connect enables the HelpCenter to assemble a pool of skills and be *virtually* on-site to address the most complex problems.

Three-year Limited Warranty, Including Predictive-Failure Coverage

You never know where or when business-critical problems will occur. IBM stands behind its server products with a three-year, limited, on-site warranty⁵. This leading-edge warranty includes hardware problem determination performed on-site, as well as remotely, with IBM's latest technology and tools. Labor and IBM parts are covered for the full duration of the warranty period, including parts identified during PFA and the installation of required engineering changes.

This warranty offers more than the typical industry-standard warranty. For example, when you add Options by IBM to a Netfinity server, these options assume the warranty term of the server on which they are installed.

As an IBM customer you are entitled to seven-days-a-week, 24-hours-a-day access to the IBM HelpCenter for remote phone support of your IBM server hardware products⁶.

ServerProven Technology

The IBM Netfinity ServerProven™ program⁷ takes the complexity out of configuring, installing and setting up options, network operating systems and applications. IBM has carefully tested hundreds of products from Options by IBM and other leading industry vendors for compatibility⁸ with IBM Netfinity products, so you can add new capabilities with confidence. The results are published in a comprehensive list and updated frequently on the IBM Web site. The products listed as ServerProven operate in the tested environments.

And IBM has expanded the ServerProven program to incorporate ServerProven solutions, a commitment by IBM to work with independent software vendors and industry-leading hardware manufacturers to provide you with fully integrated solutions that meet your business needs. Comprehensive testing of both the software applications and hardware products during the development cycle of IBM servers will provide you with improved performance, simplified installation and guidelines for the correct configuration to meet your business requirements.

You can find a complete list of ServerProven Solutions and ServerProven options at **www.us.pc.ibm.com/compat**.

⁵ Warranties may vary by country.

⁶ Response time may vary.

⁷ IBM makes no warranties, expressed or implied, regarding non-IBM ServerProven products and services, including but not limited to Year 2000 readiness and the implied warranties of merchantability and fitness for a particular purpose.

⁸ The compatibility information provided by IBM should be used as a guide only, since hardware and software levels and releases may vary, and numerous hardware and software combinations are possible. IBM makes no representation or guarantee regarding the compatibility of specific hardware or software products. Unless otherwise specified, warranty, service and support for non-IBM products are provided directly to you by the product manufacturer, supplier or publisher of the product. IBM makes no representations or warranties regarding the non-IBM products.

Conclusion

The IBM Netfinity 5500 server family has the power, scalability and manageability today's complex network systems demand. There's support for up to four-way SMP, integral tape drives and the ultra-fast 10,000 rpm hard disk drives. Fully in step with Intel's processor technology, the Netfinity 5500 server is the affordable, powerful and reliable foundation upon which you can run your business-critical applications with supreme confidence.

The Netfinity 5500 server family reinforces IBM's commitment to small and medium businesses by delivering reliability, manageability, ease of use and power to run business-critical applications today, with scaleable features that keep pace with growing businesses.

With the IBM Netfinity 5500 server as your network server or your Web server for e-commerce, your business can stay open, because your server is designed for high availability. In every respect, the Netfinity 5500 server family provides you with a powerful, reliable foundation for your business-critical applications.

Additional Information

For more information on IBM Netfinity direction, products and services, refer to the following white papers, available from our Web site at **www.ibm.com/netfinity**.⁹

*Achieving Remote Access using Microsoft Virtual Private Networking
At Your Service... Differentiation beyond technology
Examples Implementing IBM Netfinity Server Management: Air Conditioning Failure
IBM Netfinity Cluster Directions
IBM Netfinity ESCON Adapter
IBM Netfinity 8-Way SMP Directions
IBM Netfinity Fibre Channel Directions
IBM Netfinity PCI Hot-Plug Solutions
IBM Netfinity Predictive Failure Analysis
IBM Netfinity Server Quality
IBM Netfinity Server Ultra2 SCSI Directions
IBM Netfinity Servers and Intel Architecture
IBM Netfinity 7000 M10 Server
IBM Netfinity Storage Management Using Tape Subsystems
IBM Netfinity System Management for Servers
IBM Netfinity System Management Processor
IBM Netfinity Web Server Accelerator
IBM Netfinity X-architecture
IBM ServerGuide for Netfinity and PC Server Systems
Integrating IBM Netfinity Manager with Intel LANDesk® Server Manager
Integrating IBM Netfinity Manager with Microsoft Systems Management Server
Lotus Domino® Clusters Installation Primer
Lotus Domino Clusters Overview*

⁹ Are you Year 2000 Ready? Visit **www.ibm.com/pc/year2000** or call 1 800 426-3395 (and request document 10020 from our faxback database) for the latest information.

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