



IBM Netfinity 8500R Overview

Upcoming IBM server offers more than just 8-way performance

Executive Summary

With the recent announcement of the Intel® Profusion™ chipset, 8-way industry-standard servers are preparing to make a bold entrance into the enterprise computing market. IBM is leading this drive by leveraging its experience and expertise in mainframe and midrange server design.

As the #1 server vendor in the world, IBM has earned its reputation as a leader in:

- w Designing powerful and scalable systems for business-critical, data-intensive environments
- w Creating solutions that help ensure application availability
- w Building technical support infrastructures that include procedures, skill and tools for service and support worldwide

IBM's leadership in engineering highly reliable and available servers is well known. In fact, 80% of legacy data resides on IBM mainframes.¹ This is a reflection of the confidence and trust that the world's largest companies place in IBM servers and technology.

By teaming with other industry leaders, IBM server designers are helping to remove the major barriers to delivering effective, scalable 8-way servers. Some recent Netfinity server and industry advances include:

- w Enhanced reliability and high-availability features through the Netfinity X-architecture² and OnForever™ initiatives
- w Improved operating system support with Microsoft® Windows NT® 4.0 Enterprise Edition
- w More powerful and scalable processor and chipset technologies with the new Pentium III Xeon and Profusion technology from Intel.

¹ Winter Corporation's 1997 annual VLDB survey.

² For more information on IBM Netfinity X-architecture for Netfinity servers, visit our Web site at www.ibm.com/netfinity.

High availability and 8-way performance with IBM Netfinity advantages

All of these factors are coming together to speed traditional industry-standard applications and to make it possible for systems in this class to perform tasks previously reserved for “big iron” servers. The true benefit for Netfinity server customers is the opportunity to reduce their total cost of computing. Netfinity servers provide this opportunity by achieving superior performance, reliability and manageability at the value prices associated with industry-standard servers.

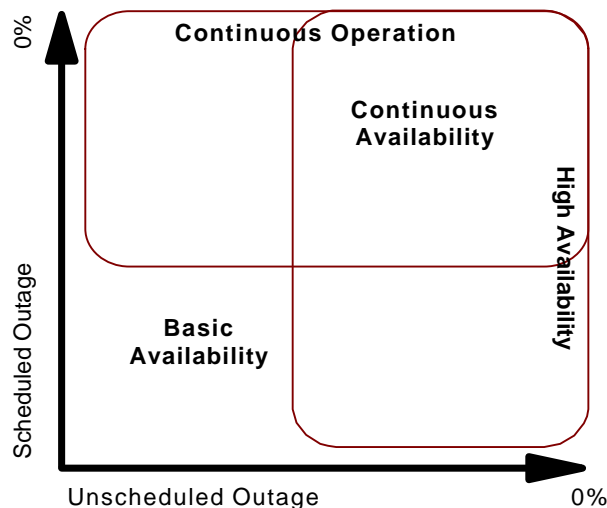
This paper describes the advantages, features and performance of the upcoming Netfinity 8500R server. Because of the dynamic nature of the computer industry, changes may occur in IBM's actual implementations and timing of product announcements.

High Availability Through Netfinity X-architecture Innovations

The Netfinity X-architecture design blueprint leverages existing, innovative IBM mainframe and midrange server technologies to build the most powerful, scalable and reliable Intel processor-based servers for your business. Many of these innovations are designed to make our servers more resilient and resistant to failures, and Netfinity servers are propelling these technologies into the market at a dramatic pace.

Why? Because among 8-way server brands, power and scalability will likely be equivalent. These characteristics are typically driven by standard hardware components such as processors and chipsets, as well as software components including the operating system and applications. In the industry-standard server market, most vendors are using the same basic components. Thus, a major differentiation between industry-standard 8-way servers will be in their ability to withstand and recover from failures.

In many situations, the sheer volume of data and transactions being processed demands the unsurpassed power and scalability found in the highly integrated solutions offered by IBM's mainframe and midrange servers. In an effort to reduce costs, however, more and more companies are looking to strategically integrate industry-standard technologies into their businesses as well. Recognizing this, IBM launched the Netfinity X-architecture and OnForever initiatives for Netfinity servers with the goal of achieving continuous computing. The figure below illustrates this goal.



High availability and 8-way performance with IBM Netfinity advantages

Our research indicates that high-availability features will be the primary reason for choosing the IBM Netfinity 8500R. According to an estimate by the Standish Group³, the average cost per minute of downtime is \$10,000 in revenue, or as much as \$600,000 per hour. As you can see, the penalties for downtime can be severe. In the past, the technologies designed to combat it were also expensive.

That's why Netfinity designers are not content just to bring mainframe and midrange system technology to industry-standard servers. We are also leveraging the economies of scale within IBM to drive down the cost of these technologies, thus making Netfinity servers an exceptional value compared to more "commodity-based" servers.

Key Netfinity X-architecture elements planned for the Netfinity 8500R include:

- w 99.9% Netfinity Availability Guarantee Program
- w Light-Path Diagnostics
- w Active PCI solutions
- w Mainframe and midrange system design
- w Technology-enabled services, including:
 - MoST Connect
 - Remote Connect
 - Update Connector
- w Integrated Advanced System Management

99.9% Netfinity Availability Guarantee Program

IBM Netfinity servers continue to provide value to our customers through the IBM Netfinity X-architecture initiative. The 99.9% Netfinity Availability Guarantee Program⁴ is an extension of this initiative.

This solution wraps a robust suite of required services from IBM Global Services around specific bounded, clustered systems up to 8 nodes to address unplanned downtime. These services include:

- w Installation services
- w Project manager
- w Setup for Remote Connect and remote monitoring
- w Solution assurance
- w Warranty upgrades and maintenance options
- w Weekly review of system logs

³ Standish Group Research Note: Pound Foolishness, 1998 High Availability Forecast.

⁴ Available only on select Netfinity servers meeting predefined criteria, including completed Microsoft Cluster Server certification as listed on the ServerProven Web site; IBM reserves the right to change the terms and conditions of the program at any time without notice. For more details, refer to <http://www.pc.ibm.com/us/solutions/netfinity/999guarantee.html> or your IBM PSG sales representative.

High availability and 8-way performance with IBM Netfinity advantages

A high-availability solution with components working together to keep businesses running offers added comfort and confidence that data will be there when it's needed most.

Light-Path Diagnostics

IBM continually strives to produce the most reliable and fault-tolerant servers in the world, but occasionally components fail. Should that happen, our goal is to return the server to operation as rapidly and efficiently as possible, with the fault corrected the first time, every time.

Accordingly, the IBM Netfinity 8500R will include an easy-to-understand innovation in diagnostic support called **Light-Path Diagnostics** for Netfinity servers. This feature for Netfinity servers is a milestone in Intel processor-based server maintenance and repair.

The following three-step lighted guidance system can assist you in the quick identification and replacement of failing components:

1. Our integrated systems management processor can detect a hardware component that requires replacement. The management processor activates a display panel on the front of the server, alerting you that the system requires service. For example, a faulty fan, memory DIMM or a voltage regulator may require replacement and can activate a light on the front panel.
2. Without tools, you can open the server. A set of lights within the server immediately points to the area of the system where the fault is located.
3. Light-Path Diagnostics activate an indicator light in close proximity to the faulty component so that you can find the component quickly and easily.

Some 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 Netfinity server maintenance by eliminating this time-consuming step. The Light-Path Diagnostics panel indicates when a specific component is failing or has failed.

On an 8500R, the Netfinity Light-Path Diagnostics design feature will be even more valuable because of the increased number of components, such as memory, processors and PCI adapters. Therefore, Light-Path Diagnostics can contribute to advanced manageability for Netfinity servers and support our high-availability mandate. No other manufacturer on the market today can offer you this level of convenience and support.

Active PCI Solutions

In conjunction with our OnForever initiative, Netfinity server designers intend to deliver Active PCI solutions—part of our ongoing efforts to maximize the availability of our server systems. These functions are designed to increase total server availability and can be described in three major categories:

- w Hot Add, allowing you to add adapters to the server to expand capacity
- w Hot Replace, allowing you to replace an adapter in the system that is no longer operating correctly
- w Fail-over, so that if the first adapter fails, a second adapter can pick up the workload

High availability and 8-way performance with IBM Netfinity advantages

Hot Add. Currently, IBM is the only major industry-standard server manufacturer to offer Hot Add capabilities. This technology allows you to actively scale your server as your needs increase. Traditionally, when businesses experienced the exhaustion of computer resources and determined the need to expand their systems, an operator would schedule downtime in order to expand the capacity. Active PCI is designed to reduce, if not eliminate, the downtime associated with inadequate or missing resources and the associated loss in productivity.

Hot Add lets you add I/O adapters while the system is still running. For example, if you need to add users or balance your network traffic, you can add a LAN adapter to your Netfinity server. The device driver will be loaded, the service started and users will continue to work uninterrupted. This same procedure can be utilized with RAID adapters, allowing Netfinity server customers to dynamically increase their storage capacity to meet the growing needs of their businesses.

Hot Replace. Netfinity Active PCI also allows you to replace an adapter that has stopped operating or appears to have a problem. When the hot-plug services module recognizes that an adapter has failed, it unloads the device driver and detaches the device from the services using the adapter. The adapter can then be replaced and the new adapter brought online.

Failover. There might be cases where some operating system services cannot sustain the loss of an adapter. This varies among different combinations of operating systems, adapters and applications. In an effort to move beyond this limitation, Netfinity Active PCI implements a fail-over solution for selected adapters that allows the operating system to continue.

To support the fail-over capability of an adapter, a redundant pair of adapters is used. Two identical adapters (a primary and a backup) are inserted in the I/O expansion slots. A special device driver closely monitors the activities of the primary adapter. If the primary adapter fails, the device driver quickly switches the operations to the back-up adapter. When a failure occurs, the system administrator is notified. The failed adapter can be hot replaced and brought back online. Thus, the redundant solution is restored.

Mainframe and Midrange Class System Design

Acknowledging the importance of the 8-way marketplace, IBM is extending the Netfinity X-architecture strategy even further. Not only are we continuing to integrate revolutionary technologies from our mainframe and midrange servers, but we are using their engineering and design expertise to develop the Netfinity 8500R. Only IBM can bring the creators of the most flexible and available systems in the world to the industry-standard computing environment.

The experience of the IBM team who developed the AS/400®, RS/6000® and S/390® platforms is having a dramatic impact on our development efforts for Netfinity servers. Our experts recognized that this class of system must accommodate today's technologies and be sensitive to tomorrow's as well. In analyzing the overall mechanical package for the 8500R, they determined that while it might be physically possible to fit everything into a smaller form factor, the thermal characteristics of processors and other subsystems would compromise availability. Looking to the future, this problem would likely become worse as requirements for speed and power in Intel processor-based systems increase.

One way we are combating this problem is by designing Netfinity server power supplies to act as cooling conduits. The flow-through design allows the normal fans of a power supply to act as a supplemental cooling system for the processors, which are extremely sensitive to heat. This design benefits our customers by keeping the overall size of the Netfinity 8500R small and eliminating the cost of adding additional fans.

High availability and 8-way performance with IBM Netfinity advantages

Our goal is to deliver an 8-way Netfinity server that is optimized for rack environments, while maintaining extraordinary levels of reliability. Additional benefits of using technologies from our larger systems include:

- Heightened scalability features to support increasing numbers of users per server
- Industry-leading interoperability with existing mainframe and midrange systems
- Enhanced clustering and SAN capabilities to increase user access to critical data and applications

Netfinity Technology-enabled Services: Get Connected

IBM offers the latest technology-enabled services for the Netfinity 8500R, including MoST Connect, Remote Connect and Update Connector.

MoST Connect. MoST Connect provides a direct communication link to the experts. Leveraging the latest technology advancements in Netfinity servers and Netfinity Manager™, IBM increases onsite support by enhancing the Mobile Solution Terminal (MoST), carried by our server field-service representatives.

MoST Connect provides a direct communication link between the IBM field service specialist at your location and the experts at the IBM HelpCenter®. Continuing to improve onsite support, IBM delivers 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 onsite to address the most complex problems without delay.

Remote Connect. IBM's Remote Connect⁵ is a major enhancement to our service and support for Netfinity servers. Using multiple technologies in Netfinity servers, Netfinity Manager software and the Advanced System Management PCI Adapter, IBM offers a "Call Home" remote support feature in an industry-standard server. If your Netfinity 8-way system experiences a problem, the Netfinity 8500R can immediately dial you or IBM and contact the right level of support to keep your system up and running. You can also select options to contact your approved warranty service provider.

IBM intends to include 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. Update Connector is a quick and convenient way to access the latest available BIOS and driver code for Netfinity servers. 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.

Integrated Advanced System Management

With our Netfinity Manager software and Advanced System Management PCI Adapter, IBM Netfinity servers provide customers with the most sophisticated and easy-to-use local and remote systems management tools.

⁵ Remote Connect availability is limited to certain high-end and industry-standard Netfinity servers (U.S. only) and supports selected network operating systems. Remote Connect is offered exclusively through IBM Global Services.

High availability and 8-way performance with IBM Netfinity advantages

In fact, in a 1998 Datapro Survey⁶ by the Gartner Group, Netfinity Manager ranked first place in all categories in the server management portion of the survey. Furthermore, Netfinity Manager ranked first in overall satisfaction.

Server users ranked Netfinity Manager higher than competing products from Compaq, Dell, Hewlett-Packard, Intel, Microsoft and Novell. IBM intends to provide Netfinity Manager and the Advanced System Management PCI Adapter at no additional charge with every Netfinity 8500R.

Advanced manageability and serviceability features can help you control the Netfinity servers and diagnose problems quickly from remote locations, even if your system is without power. The Netfinity 8500R server offers an integrated IBM Netfinity Advanced System Management PCI Adapter, in a dedicated PCI slot. It is combined with IBM Netfinity Manager software to support remote power-on self test (POST), in addition to setup and diagnostics via a LAN, a modem or the Web.

The Event Log in the Advanced System Management PCI Adapter in a Netfinity server logs:

- Alerting information
- Application events
- Nonrecoverable error information
- PFA information
- POST/BIOS information
- Power on/off information
- Recoverable error information
- Remote connection information

Using a remote connection to the Advanced System Management PCI Adapter, a system administrator can perform the following tasks from almost any location:

- w Control power to the system
- w Get error indications from the system
- w Monitor the system
- w Run remote applications on the system

Netfinity Manager complements hardware instrumentation by collecting, analyzing, storing and forwarding information from the Advanced System Management PCI Adapter.

Netfinity Manager software offers a graphical user interface for easy local and remote access and control, control over the processor and smooth integration into higher levels of workgroup or enterprise management tools such as Microsoft System Management Server (SMS), Intel LANDesk[®] and Tivoli[™] Management Software.

Netfinity Manager is a powerful suite of tools and utilities designed to manage servers in the environment you currently have, including Microsoft Windows NT, IBM OS/2[®], Novell NetWare and SCO UnixWare operating on both IBM and non-IBM systems. Plus, it supports industry standards, such as the Desktop Management Interface (DMI), Simple Network Management Protocol (SNMP) and the Multi-Platform Management (MPM) API.

⁶ Netfinity Manager was rated #1 by users in the Datapro "1998 User Ratings Survey of PC Servers," for PC server management.

High availability and 8-way performance with IBM Netfinity advantages

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:

- w **Asset 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.

For example, rather than 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 from a central location, right from your Netfinity Manager server.

- w **Capacity management.** The Capacity Manager function collects server performance data and displays this data graphically to help system administrators easily determine how every server on their network is performing.

System administrators can proactively perform component analysis and provide recommendations to prevent potential bottlenecks, knowing in advance which systems will require additional resources such as faster processors, larger disk capacity and more memory.

- w **Problem detection and notification.** Netfinity Manager has an extensive range of monitoring functions that, in conjunction with the Advanced System Management PCI Adapter, 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.

- w **Remote console control.** Netfinity Manager allows network administrators to take complete control of a target system and have full graphics control. The managing system must be running Windows 95, Windows 98 or OS/2. However, by utilizing Client Services for Netfinity Manager, the target system can be running Novell Netware, OS/2 or any Windows operating system, including Windows 3.1. Conveniently, the managing and targeting system can be any one of the Netfinity Manager-supported platforms.

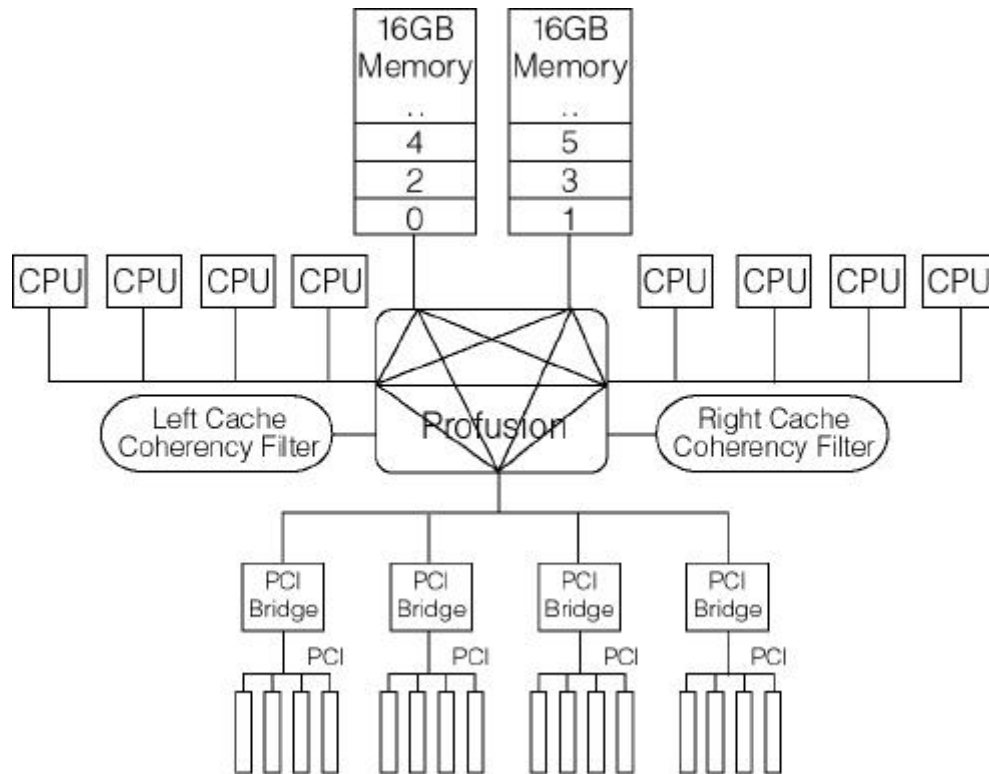
- w **Server management tools.** Netfinity Manager allows system administrators to perform many routine tasks and mass configuration over a network connection or over a serial dial-in connection. Many tasks such as system backup, file updates, inventory and system reboots can be automated and scheduled outside normal working hours. Netfinity Manager also integrates valuable tools to give administrators remote support for some server-unique functions such as RAID and cluster management.

Together, Netfinity Manager software and the integrated Netfinity Advanced System Management PCI Adapter simplify network and server management and offer proactive, local and remote control of networked business systems. Only IBM can deliver this combination of hardware and software innovations for Netfinity servers.

Integrating the Latest Industry-standard Technologies

IBM's commitment to open standards, while integrating the best in Netfinity X-architecture innovations, sets Netfinity servers apart from other industry-standard competitors. Thus, Netfinity server designers are seeking to strengthen the Netfinity line by incorporating the latest processor, chipset, memory and I/O technologies in the Netfinity 8500R.

New!! 8-way SMP with Intel Profusion Chipset



The Netfinity 8500R will feature the Intel/Corollary Profusion™ chipset, helping to ensure that you receive the greatest scalability and performance from your 8-way investment. Key attributes of this architecture include:

- w A memory coherency filter between the processor buses and the memory and I/O buses
- w Concurrent bus traffic between the multiple independent buses
- w Independent memory and I/O bus interconnections
- w Two Intel Pentium III Xeon processor buses running independently at 100MHz

New!! Pentium III Xeon Processors

IBM is on the Intel road map with the Pentium III Xeon processor. The continuing evolution of Netfinity servers provides increased performance and remains in step with Intel and industry innovation. The Netfinity 8500R is designed to support the latest Intel Pentium III Xeon CPU speeds and cache sizes, thus providing power and performance for your business needs.

New!! PC100 SDRAM

PC100[®] SDRAM, or synchronous DRAM, is fast, high-bandwidth memory designed to work best with systems employing high-performance PC chipsets and processors. This technology synchronizes itself with the system clock that controls the CPU, eliminating time delays and improving processor efficiency. Offering bandwidths of up to 100MHz—twice the bandwidth of EDO—SDRAM is a result of a major shift from EDO and Fast Page Mode DRAMs. As most new chipsets support SDRAM technology, it has become the new RAM standard.

New!! Increased Memory Expandability

By supporting 32 DIMM slots, the Netfinity 8500R will double expandability of the memory subsystem compared with the 4-way Netfinity 7000 M10 enterprise server. The flexibility provided by the extra DIMM slots not only increases the maximum memory supported (16GB today, with an architectural maximum of 32GB) by the server, but also increases the granularity of memory configurations, enabling customers to purchase the most cost-effective memory options for their environments. Thus you can expand the memory of the Netfinity 8500R further with less risk of “parts on the floor.”

New!! Wide Ultra2 SCSI

The Netfinity 8500R will also feature an integrated dual-channel Wide Ultra2 SCSI controller.

Wide Ultra2 SCSI is an emerging, powerful technology for businesses that need available, reliable, high-speed storage interconnected over longer distances than are currently possible. Wide Ultra2 is the next generation of SCSI. It will support data transfer rates of 80MBps, allowing cable lengths of up to 12m (40ft) and supporting flexible, inter-rack versus intra-rack storage solutions.

The new, faster data transfer rates will be particularly beneficial where large blocks of data are moved to and from disks frequently, such as some image and Web servers and data-mining servers.

New!! 64-Bit PCI Slots

The Netfinity 8500R will provide a total of 12 available 64-bit Active PCI slots. 64-bit PCI slots double the amount of data transferred across the bus when compared to servers built on 32-bit technology. This is important, because 8-way servers will need access to large data stores to fully take advantage of their immense processing power.

New!! 66MHz PCI Slots

The 12 PCI slots of the Netfinity 8500R will include four 66MHz slots and eight 33MHz slots. The increased speed of the 66MHz slots allows you to access your data twice as fast and provides relief to a server's often over-stressed I/O subsystem.

Additional High-availability Features

Component Isolation

If a component failure threatens to cause a system crash—a CPU or memory module failure, for example—the Netfinity 8500R can disable and isolate the failed component and automatically restart the system. The failure can be posted in the error log and the system can notify the system administrator of the failed component and the server restart.

Hot-plug Redundant Fans

The Netfinity 8500R will support hot-swappable fans that can be replaced while the server is operating, eliminating downtime for fan replacement. If a fan needs replacement and the temperature within the server rises, Netfinity Manager instructs the other fans to speed up and maintain optimum operating temperature.

Because the fans in the Netfinity 8500R will be able to be replaced individually, you won't have to leave your system without important cooling while you perform a fan replacement.

Some vendors use fans that run at two speeds, fast and slow. This means that at higher room temperatures, the fans go to full speed, cool the system and then return to slow speed as needed. In other words, they *thermal cycle* the electronics, which can reduce reliability.

The Netfinity 8500R design does not thermal cycle. Instead, the Netfinity 8500R increases fan speed gradually in response to temperature upswings, resulting in a cooler, quieter and more reliable system.

Hot-plug Power Supplies

Netfinity 8-way servers will use N+1 redundant, intelligent, hot-swap power supplies to increase server availability. The supplies are fully auto-ranging and have active power-factor correction to reduce input AC current, thus minimizing stress on your facilities.

Each power supply will have internal microcontrollers with I²C system management interfaces that perform continuous internal health checking and status reporting. Each power supply will have forced current sharing to within 10% to eliminate concentrated electrical and thermal stresses possible in other designs. This load balancing will allow the additional power supplies to quickly pick up the load in the event of a failure.

Furthermore, each power supply can monitor and report status on its sharing performance. This design feature of the Netfinity 8500R will provide a high level of confidence that network operations will continue uninterrupted in event of a power supply failure.

High availability and 8-way performance with IBM Netfinity advantages

As noted previously, the Netfinity 8500R power supplies are designed to aid in system cooling. The 8500R will be able to withstand the loss of both a power supply and a regular fan and still remain within its thermal tolerances. This is redundancy at its best.

Hot-swap Hard Drives and Carrier

The Netfinity 8500R will support two hot-swap hard-drive bays, and it will support uninterrupted service for replacement of these drives. In addition, these new drives include a revolutionary converged tray design which enables the new Netfinity 8500R and EXP200 to use common Wide Ultra2 SCSI drives. This gives you the flexibility of swapping drives when you need to and reducing the number of parts you need to order and stock.

Predictive Failure Analysis

Netfinity server designers are proud to offer one of the most comprehensive Predictive Failure Analysis® (PFA) plans in the industry.

PFA for Netfinity servers helps reduce unscheduled downtime so you can keep your business up and running. PFA can allow the Netfinity 8500R to monitor the status of critical subsystems and to notify the system administrator when components appear to be failing. If a part predicts that it is going to fail while under warranty, IBM will repair or replace it at no additional cost.

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 PCI adapter that runs independently of the system processor and provides the intelligence for remote management, system monitoring, alert notification, error logging and environmental monitoring.

PFA features in the Netfinity 8500R include:

- Power subsystems and voltage regulator modules (VRMs)
- Processors
- System fans
- System memory
- Thermal
- Self-Monitoring Analysis and Reporting Technology (S.M.A.R.T.)

Power subsystems and VRMs. Netfinity PFA for the power supply subsystem provides an additional measure of protection. The Netfinity Advanced System Management PCI adapter monitors the power supply voltages (3.3v, +5v, -5v, +12v and -12v). Additionally, each processor on the Netfinity 8500R will be powered by VRMs. The Advanced System Management PCI adapter also monitors the voltage of each VRM.

PFA issues alerts when the server reaches lower or upper voltage thresholds. 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 Advanced System Management PCI Adapter issues shutdown commands to prevent hardware damage and protect customer data from unstable circuitry that can result from fluctuating voltage levels.

High availability and 8-way performance with IBM Netfinity advantages

Processors. Some processor problems, such as L2 cache and frontside bus error corrections, can be monitored by the system. 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 PCI adapter generates an alert. Processor replacement can then be scheduled as part of normal maintenance.

System fans. The Netfinity 8500R will have extensive fan cooling to control the temperature inside the server. PFA in the Netfinity 8500R solution will use tachometers to measure fan speed, so that Netfinity Manager can monitor fan performance and, if necessary, generate alerts.

System memory. 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.

Netfinity memory PFA monitors the number of single-bit errors. A sophisticated algorithm determines when single-bit errors could affect system performance. When a threshold is exceeded, the Netfinity Advanced System Management PCI adapter generates an alert. Netfinity memory PFA also monitors double-bit errors and can generate alerts for these errors.

Thermal. Netfinity Manager software monitors temperature and issues PFA alerts so that 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.

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. 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 a drive's performance.

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.

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

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.

High-Speed Performance and Interoperability

The Netfinity 8500R will provide the following high-speed performance and interoperability features.

High-Speed Cluster and SAN Interconnects

A core requirement of a cluster is the interconnection between nodes. Multi-node Netfinity 8500R clusters will be able to use interconnect technology from the IBM RS/6000 SP®, a high-bandwidth, low-latency switch system.

For many cluster configurations, existing industry-standard technologies such as Ethernet and ATM switching provide ample bandwidth for internode communications and messaging. As the clusters scale to 8, 16, 32 or more nodes per cluster, optimized interconnect technologies called Storage Area Networks (SANs) will become increasingly important. SANs provide access to high volume storage through the switch fabric.

The IBM RS/6000 SP switch and interconnection fabric will be adapted to industry-standard architecture for Netfinity servers, initially as an 8-port switch (switches are cascadable) with simultaneous, bi-directional 150MBps (300MBps total) per-port capacity, and 1.2GBps aggregate bandwidth. Port-to-port latency in the switch is less than 300ns.

Future versions will increase bandwidth to 500MBps in each direction and increase the number of ports to 16 and beyond. This switch technology, developed by IBM Research, is capable of scaling to thousands of ports. Using this same technology, customers have already installed RS/6000 SP systems with more than 500 nodes.

The basic building block of the interconnect is an eight-port switching module. Using multistate interconnection networking (MIN) techniques, this module scales the number of ports as well as aggregate bandwidth. MINs are particularly attractive because of their ability to linearly scale bisection bandwidth, a common and realistic indicator of aggregate network capacity.

In addition, by combining redundant switches within a single enclosure, functionality in the adapters, a switch service processor and software to tie it all together, multiple paths can be configured to provide fault-tolerant and load-balanced communications, thus providing superb scalability and extremely high availability.

IBM Netfinity ClusterProven Advantages

IBM's ClusterProven™ program is a means through which IBM works with application providers so their that applications can consistently provide high availability on the Netfinity 8500R.

If you are concerned about applications that cannot afford even a temporary lapse in availability, the Netfinity 8500R is designed to support:

- w 8-node clustering using IBM Netfinity Availability Extensions for Microsoft Cluster Server (MSCS)
- w A Novell NetWare environment using Netfinity Cluster Pack
- w Multiple-node clusters running Oracle Parallel Server
- w 2-node, shared disk clusters in a Microsoft Windows NT environment using MSCS

High availability and 8-way performance with IBM Netfinity advantages

In this environment, external disk subsystems are needed to meet the large capacities and the clustered high-availability requirements. The Netfinity 8500R will have the flexibility to be configured with technology leadership products including high-speed ServeRAID™, SSA RAID or Netfinity Fibre Channel RAID adapters to access data with blazing speed and from distances up to 10km (6 mi.) from the production servers.

ESCON Adapter

The IBM Netfinity ESCON® Adapter from Options by IBM opens a high-capacity, bi-directional and reliable data highway between Netfinity servers and mainframe and midrange-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 up to 40% performance improvement and 60% reduction 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, the Netfinity 8500R can act as a data warehousing and data mining coprocessor for business intelligence applications. The combination of the Netfinity 8500R and the Netfinity ESCON Adapter is intended to be an excellent configuration 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 low error rates across the channel, should let you confidently run business-critical applications on the Netfinity 8500R while interacting with mainframe and midrange systems.

By supporting the ESCON Multiple Image Facility, the Netfinity ESCON Adapter enables multiple Netfinity users to access multiple mainframe and midrange systems efficiently and quickly. You will also be able to consolidate multiple, distributed LAN-to-mainframe or LAN-to-midrange gateways into a single, centralized, channel-attached Netfinity 8500R. This greatly simplifies network administration, network management and change control for now and the future.

Other IBM Netfinity Advantages

Netfinity Enterprise Storage Options

Netfinity server enterprise storage options from Options by IBM provide the following benefits:

- w 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 10km (6.2 mi.), companies can more easily configure offsite 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 support the uninterrupted flow of your business.
- w Maximum control and reliability derived from extensive testing for compatibility of hardware and software to industry-leading local and remote system management tools.

High availability and 8-way performance with IBM Netfinity advantages

- The Netfinity EXP200 Storage Expansion Unit will provide flexibility, high availability, high performance, and scalability for the Netfinity 8500R. The EXP200 supports full Wide Ultra2 performance of 80MBps at 12m (40ft) cable lengths to meet your enterprise storage expansion requirements. The expansion unit will support 10 half-high or slim-high hard disk drives in a rack, stack or tower configuration. The Netfinity EXP200 Storage Expansion Unit supports clustering, PFA and systems management.
- w 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. In addition, the drives for the Netfinity 8500R are interchangeable with the new Netfinity EXP200, giving you the flexibility to swap drives when you need to and reducing the number of parts you need to order and stock.

Easy Accessibility

The Netfinity 8500R chassis is designed with ease-of-use in mind to assist with rapid installation and replacement of key components. This system provides no-tools access to the CPUs, PCI adapters, fans, memory, hard drives, VRMs and power supplies. In addition, the Netfinity 8500R features convenient cams and levers to assist in the proper removal and seating of key components, plus quick release tabs for the floppy and CD.

The smart design of the Netfinity 8500R reduces the hassle involved in server maintenance and upgrades, allowing for shorter repair times and greater system availability.

Business-critical Support and Service

IBM offers the best server support in the industry. IBM service and support offerings cover your needs from pre-sales to installation to post-sales, and include remote, electronic and onsite support. For decades, IBM has been a leader in mainframe and midrange system service and support, bar none.

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. With IBM's expertise and focus on Netfinity products, IBM offers you an integrated system that provides 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:

- w 118,000 people worldwide deliver IBM service and support in 164 countries.
- w 2500 IBM support specialists handle customer and Business Partner calls in 17 languages from our 10 HelpCenter facilities around the world.
- w Maintenance parts are available from IBM's 144 parts-stocking locations in the U.S. and 479 locations worldwide.
- w More than 4000 IBM and Business Partner specialists have been rigorously trained in the TechConnect® certification program for IBM Netfinity servers.

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.

IBM Center for Microsoft Technologies

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 Microsoft to help ensure that Netfinity servers and other IBM hardware systems are clearly the superior platform for Windows NT and other Microsoft products.

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 120 software engineers, test and quality specialists, and enterprise solutions support staff whose sole mission is to optimize Microsoft's products on IBM systems.

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.

Three-year Limited Onsite 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, onsite warranty.⁷ This leading-edge warranty includes hardware problem determination performed onsite, 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.⁸

As an IBM customer you have access to the IBM HelpCenter 7 days per week, 24 hours per day⁹ for remote phone support of your IBM Netfinity hardware.

ServerProven Technology

The IBM Netfinity ServerProven™¹⁰ program takes the complexity out of configuring, installing and setting up options, network operating systems and applications. Hundreds of products from Options by IBM and other leading industry vendors have been tested for compatibility¹¹ 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.

⁷ Limited warranty includes Warranty Service in those countries where this product is sold by IBM or an IBM Business Partner. For information on IBM's Statement of Limited Warranty, please call 1-800-772-2227 in the U.S. or contact your IBM representative or reseller. Warranties may vary by country.

⁸ Warranty terms for different options may vary.

⁹ Response time varies. May exclude some holidays.

¹⁰ IBM makes no warranties, expressed or implied, regarding non-IBM ServerProven products and services, including but not

High availability and 8-way performance with IBM Netfinity advantages

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 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.

Conclusion

IBM is applying the expertise and experience that built our enterprise systems to the design of the IBM Netfinity 8500R. At IBM, we believe that we must raise the availability and performance standards for Intel-processor-based servers to provide maximum value to our customers.

Our goal for the Netfinity 8500R is to provide exceptionally high levels of power and scalability that support your business-critical needs at greater performance levels, while supporting more clients than previously possible with industry-standard servers. Because we are able to capitalize on our vast storehouse of proven technologies, IBM can deliver the benefits of technology leadership in Netfinity servers for your business.

Netfinity engineers are committed to balanced system design. IBM Netfinity X-architecture designers strive to set the standard for affordable enterprise quality through unmatched testing, systems integration and compatibility. The Netfinity 8500R will offer exceptional fault-tolerant and high-availability functions integrated within the server as standard features, including:

- w 99.9% Netfinity Availability Guarantee Program
- w Light-Path Diagnostics
- w Active PCI
- w Mainframe and midrange system design
- w Technology-enabled services
- w Integrated Advanced System Management

We're also integrating the latest industry-standard technologies into the 8500R, including Pentium III Xeon processors, PC100 SDRAM, increased memory expandability, Wide Ultra2 SCSI and 64-bit PCI slots. Additional high-availability features will include component isolation, hot-plug redundant fans, hot-plug power supplies, hot-swap hard drives and Predictive Failure Analysis. High-speed performance and interoperability with high-speed cluster and SAN interconnects, Netfinity ClusterProven advantages and the ESCON adapter. Plus, the Netfinity 8500R comes with IBM service and support offerings to cover your business needs, from pre-sales to installation to post sales.

IBM Netfinity servers bring over 20 years of experience in SMP technology to the industry-standard server marketplace. As the world's largest information technology company, no one is better positioned than IBM to deliver the most cost-effective and sophisticated solutions.

limited to Year 2000 readiness and the implied warranties of merchantability and fitness for a particular purpose.

¹¹The 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.

High availability and 8-way performance with IBM Netfinity advantages

8-way SMP architecture is a quantum leap in industry-standard technology. If you're planning to move your business-critical applications to an 8-way SMP system, you need a business partner you can trust—a partner with experience and who offers the service and support to keep your business running smoothly. Make IBM that business partner!

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.¹²

*Achieving Remote Access using Microsoft Virtual Private Networking
At your service... Differentiation beyond technology
Capacity Planning for IBM Netfinity Servers Running Microsoft Windows NT Server,
Terminal Server Edition*

*Examples Implementing IBM Netfinity Server Management: Air Conditioning Failure
Fibre Channel Directions
IBM Chipkill Memory
IBM Netfinity 5000 Server
IBM Netfinity 5500 Server Family
IBM Netfinity 7000 M10 Server
IBM Netfinity Availability Extensions for Microsoft Cluster Server
IBM Netfinity Advanced Systems Management
IBM Netfinity Cluster Directions
IBM Netfinity ClusterProven Program
IBM Netfinity Enterprise Storage Solutions
IBM Netfinity ESCON Adapter
IBM Netfinity Manager 5.2
IBM Netfinity Manager Plus for Tivoli Enterprise Overview
IBM Netfinity PCI Hot-Plug Solutions
IBM Netfinity Predictive Failure Analysis
IBM Netfinity Server Quality
IBM Netfinity Server Ultra2 SCSI Directions
IBM Netfinity Storage Management Using Tape Subsystems
IBM Netfinity Systems Management for Servers
IBM Netfinity Web Server Accelerator
IBM Netfinity X-architecture
IBM ServerGuide for Netfinity and PC Server Systems
Implementing Microsoft IIS on Netfinity 5500 M10
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*

¹²Are you Year 2000 Ready? See our Web site at www.ibm.com/pc/year2000 or call 1 800 426-3395 (and request document 10020 from our faxback database) for the latest information.

High availability and 8-way performance with IBM Netfinity advantages

For additional information on Netfinity systems and services, see the following Web sites:

Netfinity Manager: **www.pc.ibm.com/us/netfinity/system_management.html**

Netfinity Enterprise Storage Options:

www.pc.ibm.com/us/accessories/netfinity/index.html

Netfinity service and support: **www.pc.ibm.com/us/solutions/netfinity/services.html**

IBM Netfinity ServerProven advantages:

www.pc.ibm.com/us/solutions/netfinity/system_management.html

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



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1999

IBM Personal Systems Group
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3039 Cornwallis Road
Research Triangle Park NC 27709

Printed in the United States of America

6-99
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