
Next Generation Connectivity Solutions: AMD's Managed Performance Portfolio



White Paper

The leading integrator of industry-standard networking silicon is delivering powerful new software tools that enhance network management.

INTRODUCTION

Within enterprises, LANs continue to grow in importance as strategic assets for executing mission-critical tasks. In the early 1990's, the emphasis in LAN deployment was just getting users connected so they could share access to mainframes, file servers and printers. Getting the corporation wired was the key goal. Connectivity was an end unto itself.

In the late 1990's, network topologies became more widespread and complex. Corporations that began with a few workgroups grew into networks with hundreds of nodes. As users embraced the client/server architecture and deployed networks that extended to all corners of their business operations, Information Technology (IT) managers struggled to keep pace with the growth of the network and the associated management needs.

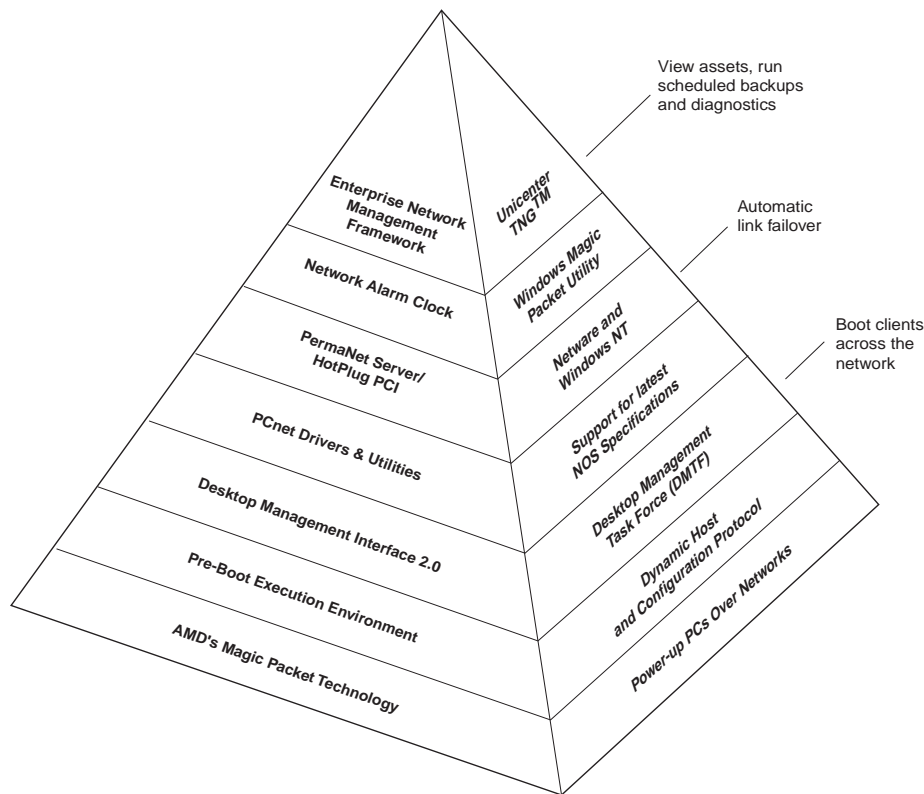
Network management, which ranges from the desktop all the way up to the enterprise, is one of the most critical issues facing information technology departments. As networks become more sophisticated, there is an increasing requirement to manage networked systems more efficiently. IT managers are looking for ways to reduce the support and deployment costs associated with PC-based LANs.

The major costs for deploying a network are not the PCs themselves, but the support costs that accrue. Although the average business PC can be purchased for around \$3,000, when a PC is added to a LAN, the total cost of ownership (TCO) over a five year period may be as high as \$60,000 for a single system, according to the GartnerGroup.

These costs include items such as software upgrades, maintenance, user support and training. One of the largest items is the cost of system upgrades, which can account for up to 55% of the systems' total cost. To lower the TCO, network managers need automated ways to perform routine tasks such as making data backups and software upgrades.

Introducing AMD's Managed Performance Portfolio

With the Managed Performance Portfolio, AMD is offering an extended set of network technologies, software and tools that improve the remote accessibility of networked systems. The portfolio includes a set of drivers, utilities, and application-level solutions that help IT departments manage enterprise networks (Figure 1). The Managed Performance Portfolio consists of the following modules:



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Figure 1. AMD's PCnet™ Networking Software—Managed Performance Portfolio CD

1. **Magic Packet™ Technology:** The basic underlying technology that enables sleeping PCs to be remotely powered-on by sending them a special 'Magic Packet' frame.
2. **Pre-Boot Execution Boot Environment:** Dynamic Host Configuration Protocol (DHCP) software and boot code for PCnet™ controllers and motherboards that allows a server to establish an IP connection and boot a networked system. This allows the server to download software such as an operating system.
3. **Desktop Management Interface (DMI) 2.0 Support:** Full compliance with the latest Desktop Management Task Force (DMTF) DMI 2.0 specification, an emerging industry standard.
4. **PCnet Drivers and Utilities:** AMD's latest operating system drivers and utilities for the PCnet family of controllers. Driver Release 4.0 includes new drivers and enhancements for: Novell Network 4.X and 5.0, OS/2, SCO Open Server and Unix, Windows 95, Windows NT 3.5, 3.51 and 4.0, and Wind River VxWorks.
5. **PermaNet™ Server with HotPlug PCI:** A new driver for Netware 4.11, Windows NT 4.0 and Inter-

netware I that supports automatic failover operation for mission-critical server links using a redundant backup link. For AMD's PCnet PCI controllers, the new HotPlug PCI feature enables users to swap Network Interface Cards (NICs) without powering down the system, an industry first.

6. **Network Alarm Clock:** A Windows-based utility program that can be used to boot a single PC or group of PCs on the network according to a time schedule.
7. **Unicenter TNG Framework from Computer Associates:** An enterprise network management software package that takes advantage of AMD's Magic Packet technology to automate activities such as making software upgrades, and running backups and diagnostics.

The software portfolio enhances the performance and manageability of the PCnet family of Ethernet controllers manufactured by AMD's Network Products Division. The division supplies networking silicon for both computing applications (e.g. Network Interface Cards and personal computer motherboards) and embedded applications (e.g. industrial control and network infrastructure devices such as hubs, routers and switches).

Each element in the Managed Performance Portfolio is designed to enhance the control and manageability of enterprise networks. The capabilities it provides help IT managers and network administrators simplify operations and cut costs as their network operations grow. The facilities of the Managed Performance Portfolio help network administrators streamline fundamental tasks such as:

- Configuring desktop systems: Keeping operating systems and software up-to-date
- Running diagnostics: Keeping computers and disks running optimally and virus-free
- Data management: Publishing, warehousing and analyzing data throughout the enterprise
- Data backup: Simplifying and streamlining the process of backing up data.

System Access Challenge

A major challenge that IT managers face in coordinating support tasks is how to access all of the individual systems on the network. Typically, PCs are not left up and running 24 hours a day. Powering individual systems down when they are not in use conserves energy. Unfortunately for network administrators, manually flipping a power switch has been the only way to gain access to networked systems.

The implications for system administrators are significant. Personnel must be deployed to power on systems in order to access them. Not only is this costly, but gaining access to locked offices and rooms after hours can be difficult. Manually powering on systems is a barrier to performing routine maintenance and data backups.

To alleviate this situation, AMD and Hewlett-Packard developed Magic Packet technology for LAN-based PCs in mid-1995. Magic Packet technology gives network administrators the ability to power up a PC across the network. When Magic Packet-capable PCs are powered down they go into "sleep" mode, but remain connected to the LAN. There they wait, monitoring the link for the transmission of a Magic Packet frame. When another PC sends the Magic Packet

frame, which is the PC's node address repeated sixteen times, it automatically powers up.

This gives system administrators the ability to automatically turn on systems to inventory assets, download software, and manipulate and view networked devices. Magic Packet technology is also a powerful underlying capability that is being utilized by the developers of desktop LAN management software such as asset managers, automated inventory applications, and electronic software distribution applications. IT departments are adopting these tools to reduce PC LAN deployment and operation costs.

Asset managers typically track the model, manufacturer and serial number of PCs connected to the LAN, along with information about their processor and memory configuration. Automatic inventory applications keep track of information about the PCs, peripherals, and servers as they are added and removed from the LAN, including a profile of the software they possess. Electronic software distribution applications are used to download applications and operating systems to individual workstations from a centralized server.

Since Magic Packet debuted in AMD's PCnet™-PCI II device, which was initially designed into PCs from Hewlett-Packard's Performance Desktop Company, it has been widely proliferated and accepted in the industry. Major PC vendors have designed-in AMD's PCnet controllers into their systems to take advantage of Magic Packet technology including IBM with its series of "Wake-On LAN" systems, and Gateway 2000 in its new E-1000N series Net PCs. Hewlett-Packard also integrated AMD's Magic Packet technology to its new Kayak line of PCs.

AMD has also licensed the technology to 3COM, Intel, Digital Equipment and others for use in their Ethernet controllers. Subsequently, PC makers such as Hewlett-Packard, IBM and others, have produced systems that utilize the technology. AMD estimates that over five million Magic Packet-enabled LAN controllers have been shipped to date.

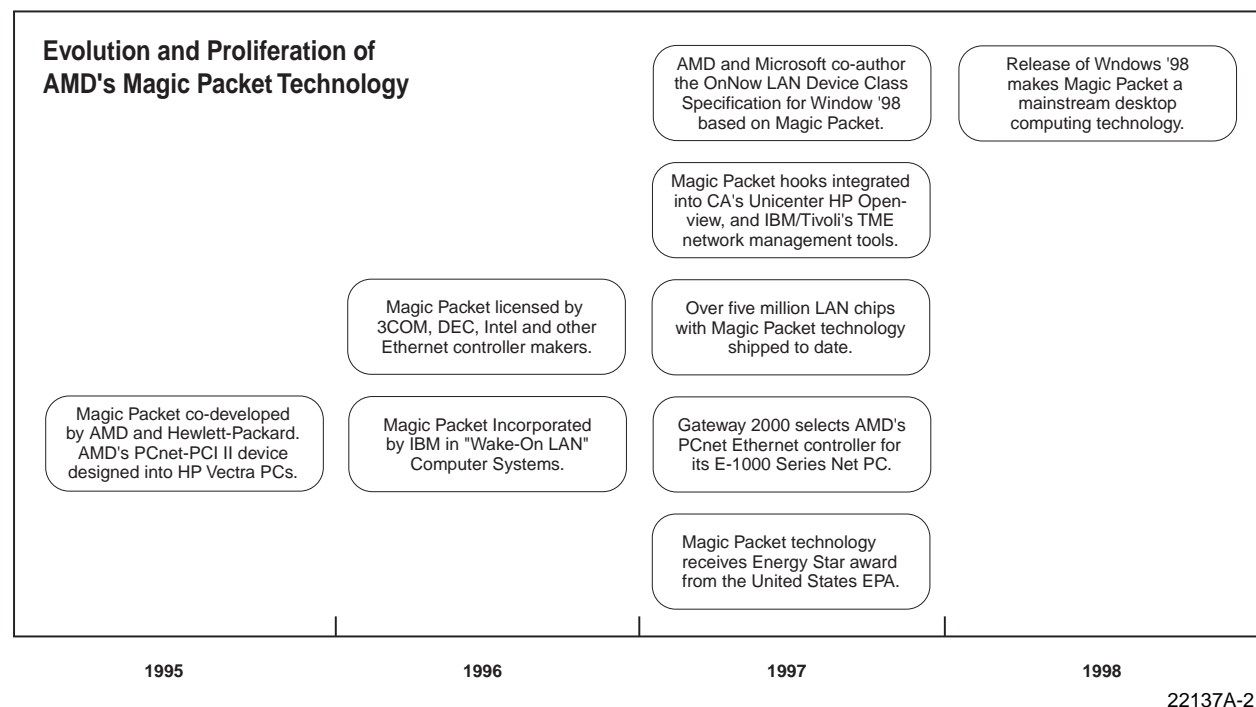


Figure 2. Evolution of AMD's Magic Packet technology

Magic Packet technology is also the basis for the industry's OnNow initiative, a comprehensive, system-wide approach to system and device power management. Together with Microsoft, AMD wrote the Networking Class Power Management Reference specification for the OnNow. With its inclusion in the mid-1998 release of Windows '98, remote PC accessibility is entering into the mainstream (Figure 2). A majority of new PCs on the drawing board are being designed to take advantage of OnNow power management.

Network Alarm Clock

With the release of the Network Alarm Clock, AMD's Network Products Group is expanding the set of software utilities for the PCnet family of Ethernet controllers. The Network Alarm Clock is a standalone program for Microsoft Windows 95 and Windows NT 4.0 that utilizes AMD's Magic Packet technology to wake up an individual node or a group of nodes on a network on a timed basis. This remote power management capability helps simplify desktop and enterprise network management.

The Network Alarm Clock is a convenient utility that allows system administrators to power up PCs at preset times. The utility first creates a table of IP and hardware addresses for all of the Magic Packet-capable PCs and hosts on the LAN. It then associates each group of PCs and hosts with an alarm clock, and powers them on at the appropriate time.

Remote network management capabilities are becoming more vital as corporate networks spread across multiple facilities and locations. With the Network Alarm Clock, network administration can be centralized and handled from a remote location. This helps reduce the service time and labor costs associated with the network management.

The Network Alarm Clock gives the network administrators the ability to wake up an individual PC or set of PCs at a specific time. The wake-up time can be staggered across the network so that each system has time to boot-up and be ready for use before users need to log into the network. It can also be used to turn on a group of machines prior to installing software or when running periodic data backups. System diagnostics and virus checks can be run at regular times when users are not on the network.

Remote power management helps network managers improve the level of service and reduce the Total Cost of Ownership (TCO) of the network. Providing a fully functional system each time the user requires one eliminates the waiting time associated with a boot-up procedure. Staggering the initialization procedure for the systems on the network can also reduce the load on servers which are called on to provide initialization services.

Power management conserves energy and prolongs the life of the system. If large numbers of users attempt to start their systems at the same time, there is a risk

of a power surge which can lead to a brown-out. This situation can be avoided by managing the wake-up time of systems using the Network Alarm Clock.

Pre-Boot Execution Boot Environment (PXE)

AMD is addressing the need to integrate remote accessibility into networked PCs with the Pre-boot Execution Environment (PXE) for the PCnet Family of Ethernet Controllers. The PXE software enables a client PC system on the network to be booted remotely, even though it does not possess an operating system (OS).

AMD provides the software components needed to embed pre-OS accessibility into a computer on the network. PXE code can be integrated on a Network Interface Card (NIC) or embedded on a PC motherboard. The PXE code includes the Dynamic Host Configuration Protocol (DHCP) which works in conjunction with a PCnet Ethernet controller-based Network Computer to dynamically generate an IP address for the client node. This allows the PC to establish an IP connection with the network for communication with a remote machine, even before the local operating system loads.

With the Pre-boot Execution Environment, the PC becomes bootable off of the network. The PXE capability gives PC manufacturers and system administrators a way to boot a system without having to know anything about its operating environment.

With pre-OS accessibility built in, PC manufacturers can automate software installation, system configuration and burn-in procedures. This approach reduces staff costs for installation and eliminates human errors. The ability to customize software loading is a key element in the latest build-to-order PC manufacturing strategies.

The remote boot capability that PXE provides works hand-in-hand with AMD's Magic Packet remote wake-up capability to help system administrators maintain and upgrade PCs across the network. A host of desktop and enterprise network management tools such as Computer Associates' Unicenter TNG Framework, IBM's Tivoli network management system, and Intel's LANdesk Configuration Manager are designed to take advantage of PXE-based remote access and the Magic Packet wake-up feature for remote software delivery.

Remote accessibility can eliminate the need to manually install software on new PCs on the network. With PXE in place, the network administrator can automatically load and configure the operating system and all needed application software from a remote PC or server on the LAN.

To upgrade a remote PC, a system administrator first issues the Magic Packet frame to wake up the PC. PXE code residing on the client works in conjunction with the remote PC to set up an IP address to establish

LAN-based communication. With PXE in place, it is possible to communicate with a new PC that does not have an operating system, or a PC that fails to boot because of a problem.

PXE-based remote access enables system administrators to automate support tasks such as backing up disk drives, and running diagnostics and virus scans. Maintenance and troubleshooting activities can be performed from a remote location on a scheduled basis. This helps keep PCs on the network up and running, and reduces support calls.

PXE-based remote access is an attractive new feature for PC manufacturers because it helps end users reduce support expenses, simplify network administration, and improve network manageability. All of these factors help reduce the TCO of the network. With the emergence of the Wired for Management specification (WfM), remote access and management features are gaining industry-wide acceptance and are quickly becoming industry standards.

The remote access capabilities that PXE provides are also required in the emerging new classes of network PC clients (thin clients, thick clients and NetPCs) that have limited resources, and are thus reliant on servers in the network. Gateway 2000 and Hewlett-Packard are taking advantage of the PXE support in AMD's PCnet Ethernet controller software in new systems that boot from the network. PXE code for the AMD PCnet family of Ethernet Controllers enables OEMs to offer a competitive feature that is of great value to end users at no additional cost.

PCnet Drivers and Utilities

AMD's new Managed Performance Portfolio CD includes PCnet Driver Release 4.0, which includes many brand new drivers and enhancements to existing drivers. The updated driver set provides many new features and increased performance. The PCnet drivers are also optimized for forward driver compatibility. PCnet Driver Release 4.0 includes the following NOS support:

- DOS: Enhanced AHSM ODI Driver, NDIS 2.0.1 Drivers for DOS version 6.x
- Netware: New CHSM ODI (Netware 5.0), AHSM 32-bit ODI, DOS ODI and RPL boot ROM.
- Novell UnixWare: v1.1 and 2.0 DLPI drivers.
- OS/2: Enhanced AHSM ODI driver, enhanced NDIS 2.0.1 driver for OS/2 version 3.x and 4.x
- OS/2 Server: Enhanced AHSM ODI driver
- Packet Driver
- SCO UNIX: New MDI driver (Gemini 1.0), enhanced MDI for Open Server 5.0, SCO ODT 3.0 LLI
- Sun Solaris: v2.4 driver.

- Windows For Workgroups 3.11: NDIS 3.x MAC driver
- Windows 95: New NDIS 3.x Miniport, enhanced NDIS 4.x (OSR 2), NDIS 3.x MAC driver
- Windows NT 3.5: NDIS 3.x MAC driver
- Windows NT 3.51: New NDIS 3.x Miniport, NDIS 3.x MAC Driver
- Windows NT 4.0: Enhanced NDIS 4.x Miniport driver with DMI 2.0 support, NDIS 3.x MAC driver
- Wind River VxWorks: New x86 driver (real-time operating system support)

AMD also updated the set of tools that enable users to check the functionality of Network Interface Cards (NICs). The PCnet Diagnostics Utility version 2.1 includes a setup utility for network card installation, the Netdiag diagnostic utility for testing PCnet-based boards, and the low level diagnostic, Emon.

The utilities have a simple-to-use DOS interface allowing users to run resources tests (I/O addresses, IRQ, MAC addresses) and perform internal loopback and external loopback tests that verify LAN functionality. The tools also support link tests for peer-to-peer clients to verify connections. These PCnet utilities allow users to evaluate network cards at the system level, and verify correct network operation during production, system integration and field support.

AMD is proactive in incorporating new industry-standard features and is continually updating its PCnet software portfolio to offer its customers the latest technology to its customers. AMD provides comprehensive support for all major NOS specifications and revisions at no additional cost. Since the software drivers and the latest diagnostics utilities are bundled with the hardware, value can be added at no additional cost.

Desktop Management

AMD is at the forefront of industry standards with support for the Desktop Management Initiative (DMI) 2.0 specification in the latest PCnet device drivers (NDIS 4 Miniport driver). DMI 2.0 is the industry standard for desktop and server management. DMI 2.0 support is driver-based and is currently supported in AMD's NDIS 4.0 driver. By offering DMI 2.0-compliant networking solutions, AMD enables the manufacturers of PC systems and Network Interface Cards (NICs) to tap into a new market—the new products that are certified by the Desktop Management Task Force (www.dmtf.org).

The DMI 2.0 standard is the basis for the industry's first truly open management platform that is both operating system- and protocol-independent. The DMI standard significantly increases the ease-of-management of desktop systems and servers by reducing platform-specific barriers. DMI-enabled systems can be monitored,

accessed, and controlled by DMI-based management tools running in heterogeneous environments. For the first time, systems can be mixed and matched, and managed in a consistent manner across multiple operating system and hardware platforms.

By adopting AMD's PCnet controllers with DMI 2.0 support, equipment vendors can build widely-interoperable management features into their products. The DMI standard continues to spur the development of new applications and services for desktop systems.

A wide range of DMI-enabled products are available from the suppliers of desktop computers and servers (Compaq Computer Corp., Dell Computer Corp., Hewlett-Packard Co., IBM Corp., NEC Technology Corp.), vendors of network management software (Computer Associates, Hewlett-Packard, IBM/Tivoli, Intel, and Sun), and operating systems (Apple Computer, Microsoft Corp., Novell Inc., Santa Cruz Operation, SunSoft Inc.).

As more customers demand DMI 2.0-compliant products and systems, having DMI support is a competitive advantage for equipment vendors. By relying on standard networking protocols, the DMI standard overcomes interoperability issues and reduces the level of platform-specific porting required for hardware and software developers.

For system customers, the benefits of adopting DMI include both greater ease-of-management and interoperability. DMI expands the reach of powerful management tools such as asset managers, automated inventory applications, electronic software distribution applications and network management tools. System management can be automated and simplified, and system status reporting can be streamlined and made more effective. These capabilities help reduce support costs and lower the Total Cost of Ownership (TCO) of PCs and servers.

Key DMI Features

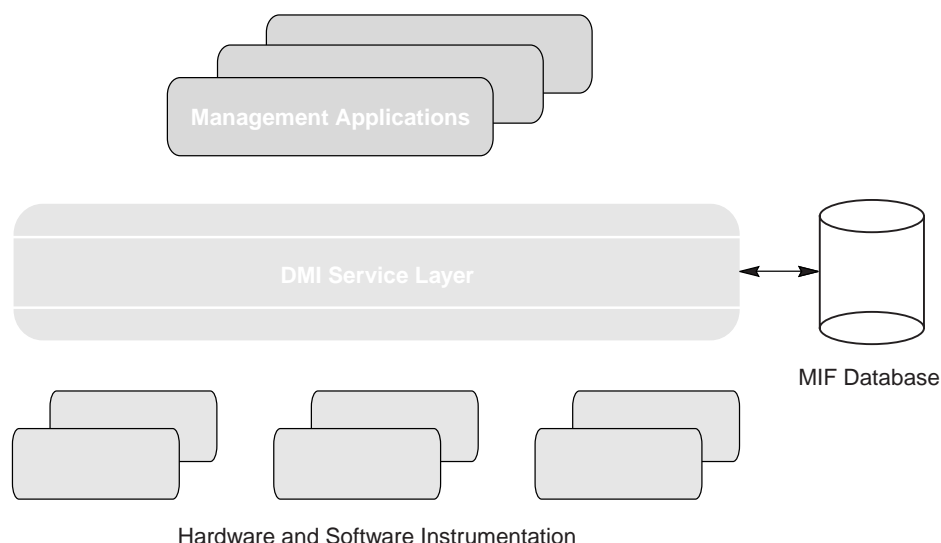
The DMI 2.0 framework provides support for heterogeneous environments using two key capabilities:

- Remote management support for access to DMI information across networks:

Network management applications use industry-standard Remote Procedure Calls (RPCs) to retrieve DMI information from systems connected to the network.

- A sophisticated event model for monitoring system alerts and indications:

Information on the status of attached system components (NICs, PCs, and servers) is automatically sent to and filtered by DMI-enabled network management applications running on multiple platforms.



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Figure 3. The core DMI model uses the client/server model. Management application vendors build DMI clients that use Remote Procedure Calls (RPCs) that communicate using the Management Interface (MI). AMD's PCnet controller functions as a DMI server, providing standard DMI responses and information using the Component Interface (CI).

AMD is strongly committed to supporting the DMTF and the evolution of the DMI-based framework. As the standards progress, AMD will continue to deliver DMI-enabled solutions that are DMTF certified and conforms with DMI standard specifications. By offering DMI 2.0-compliant solutions today, AMD is keeping its customers at the cutting edge of networking technology.

Server Fault Tolerance: PermaNet Server and HotPlug PCI

Another vital issue facing network managers is server availability. Servers have taken center stage in the enterprise, handling mission-critical applications such as hosting corporate databases and communications gateways for the Intranet, Internet, and corporate wide-area networks. Mission-critical users include brokerages and financial institutions, insurance companies, governmental agencies, industrial sites and medical facilities that rely on having very reliable network connections.

Cost-of-ownership studies conducted as part of the MERIT (Maximizing the Efficiency of Resources in IT) Project sponsored by Computer Associates and International Data Corporation (IDC) compared the availability of mainframe and client/server systems. According to the study, 70% of mainframe-oriented sites reported availability of mission-critical systems to

be greater than 99.5% while only 55% of client/server environments reported similar availability.

For mission critical applications, server customers are demanding mainframe-class levels of availability from their client/server systems. IBM's Network Server Division is deploying AMD's PermaNet Server automatic failover technology to reduce the number of outages from network errors. AMD's PermaNet driver supports automatic failover operation for its 10/100 Ethernet solutions used to connect servers to the enterprise.

AMD's PermaNet Server technology brings a unprecedented level of fault tolerance to network servers running Novell Netware, Intranetware I and Microsoft Windows NT. The PermaNet Server provides support for a vital secondary 10/100 Ethernet backup link on the most heavily-used path in a network, the pipeline to the server. The new functionality is incorporated in the ODI and NDIS drivers that AMD provides for its PCnet Ethernet controller family.

To deploy the PermaNet Server capability, two Network Interface Cards (NIC) are installed in the server. The Network Operating System (NOS) manages the primary and secondary links, and the PermaNet Server driver works in the background, monitoring the network's link status.

Link failure can occur for a variety of reasons, including an interruption in the LAN cabling or in rare cases hardware failure. In the unlikely event that the primary NIC fails, the secondary NIC automatically reestablishes the link. The backup link is automatically and transparently engaged, and it maintains the connection without interrupting or corrupting the data transmission. When a failover event occurs, the link failure status is logged to alert the network administrator.

With AMD's unique new HotPlug PCI capability, which is supported on AMD's PCnet controllers, network managers can replace a NIC without disrupting network activity or powering down the system. The HotPlug PCI feature eliminates network downtime and is an industry first. While the secondary adapter is in operation, the PermaNet Server driver continuously polls the link status in the primary adapter. If the link status in the primary adapter is restored, the driver automatically switches operation back to the primary adapter.

The PermaNet Server provides link protection for AMD's entire family of PCnet-PCI-bus 10 Mbit/s and 10/100 Mbit/s Ethernet controllers. These include: PCnet-PCI, PCnet-PCI II, PCnet-FAST and PCnet-FAST+ and future members of the family. It can be deployed in clustering environments to protect the link between servers or to protect the link between a server and a LAN switch or hub.

Increasing server availability is a vital issue facing network managers, especially in enterprise client/server applications that are mission-critical. Server downtime can disrupt mission-critical functions and halt business operations. Automatic failover is a cost-effective way to reduce network downtime, and to maintain data integrity and continuous link status. By reducing the number of outages from network errors, the PermaNet Server increases the availability of server systems. Increased fault tolerance and reliability are tremendous benefits for end users.

The time associated with determining and correcting faults in the network is also significant and costly. With the PermaNet Server, expensive corrective service is not required immediately to fix failed links. The HotPlug PCI feature gives network managers the unprecedented ability to swap out cards while the server is running, while maintaining network operation. These factors help reduce the labor costs associated with isolating and replacing faulty links. Lower network administrative and maintenance costs help reduce the TCO of the network.

The PermaNet Server feature can be implemented using two separate plug-in NIC cards, although some OEMs are integrating two controllers directly on the motherboard. Other systems combine one controller on the server motherboard and one NIC add-in card. In each of these cases, PermaNet Server provides a low cost insurance policy for the most used pathways in the enterprise.

The PermaNet Server provides an easy and cost-effective way to add redundancy to network servers. The new HotPlug PCI capability revolutionizes network card maintenance. Since the PermaNet and HotPlug features are integrated into AMD's standard set of device drivers, OEMs can offer end users the benefits of fault tolerance and simplified network management at no additional cost.

Enterprise Network Management

Included on the Managed Performance Portfolio CD is the Unicenter TNG Framework from Computer Associates International Inc. of Islandia, New York. This integrated enterprise network management tool for Windows NT enhances the manageability of systems takes advantage of AMD's Magic Packet technology. It provides end-to-end management of computers, hosts, internetworking devices, and servers in an enterprise.

The Unicenter TNG Framework utilizes AMD's Magic Packet technology and its remote wake-up capability to enhance the remote accessibility and manageability of networked systems. Individual resources can be accessed, identified, monitored and managed from a single console from any remote location in the enterprise.

The Unicenter TNG Framework offers management capabilities such as auto discovery, event management, scheduling, and virus detection from within an integrated framework. The automated discovery capability compiles an inventory of all of the assets on the network. It also creates 2-and 3-dimensional diagrams that display the topology of the network.

The Framework's scheduling feature can be used in conjunction with the Magic Packet wake up capability to access PCs that are powered down to distribute software and files, and run data backups and diagnostics.

The version of the framework that is bundled with the Managed Performance Portfolio provides a base level of functionality, which includes the ability to scan all of the systems on a network for computer viruses. Users can add functionality to the Unicenter TNG framework by purchasing optional modules from Computer Associates and third-parties.

Unicenter TNG Framework Benefits

The Unicenter TNG Framework provides an integrated management infrastructure that features an event notification and scheduling environment to automate and streamline network and desktop administration. By supporting AMD's Magic Packet technology, the Unicenter TNG Framework delivers enterprise-wide management facilities that will enable organizations to:

- Reduce deployment costs of new desktops, upgrades and applications by automating manual tasks remotely, over the network.
- Improve end-user productivity by implementing a standardized approach to configuring desktops and servers according to predefined policies.
- Reduce life-cycle maintenance costs by minimizing the need to visit individual desktops for software distribution, upgrades and other "housekeeping" tasks.
- Improve the availability of critical services by proactively performing maintenance after-hours in a scheduled, consistent manner.

The PCnet Advantage

By incorporating AMD's PCnet controllers into computer and networking systems, both manufacturers and end users are assured that their products will interoperate with the industry's most significant desktop and network management standards.

With the Managed Performance Portfolio, AMD's Network Products Division is addressing the vital need for enterprise network management tools. With the new software, AMD is reaching beyond its core set of OEM customers, delivering valuable software solutions to IT managers and end users with Magic Packet-based systems. By using AMD's Magic Packet technology and the unique end-to-end network management and software tools provided by the Managed Performance Portfolio, IT departments can automate costly support tasks and bring new levels of control to their networks.

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