POSITION PAPER

Positioning IPG - Austin's Product Stack

Compaq's strategy of providing one-stop shopping for current and future enterprise computing solutions relies on continual product innovation, acquisition (NetWorth and Thomas-Conrad), and partnering with multiple vendors to form fully integrated and reliable business solutions. The current product stack available from IPG in Austin (formerly Thomas-Conrad) provides customers with price/performance leading products in the legacy networking protocols, Ethernet and token ring as well as the full gamut of high-speed protocols including Fast Ethernet, 100VG-AnyLAN and 100Mbps TCNS (the industry's first 100Mbps solution for desktop connectivity and the only 100Mbps protocol currently available for coaxial cable). The company will build on its existing product line and provide product leadership as it implements the drive to build best of breed products that meet customers' end-to-end internetworking needs.

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COMPAQ

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COMPAQ'S STRATEGY FOR IPG

When Compaq announced its partnership with Cisco on June 26, 1995, Gary Stimac, senior vice president and general manager, Systems Division, first articulated the company's vision for internetworking:

> "With Cisco as our partner, Compaq delivers on its vision of simplified network computing through innovative internetworking solutions that are tightly integrated with our client/server strategy."

Four months later, on October 18th, Stimac elaborated on this vision statement when he announced the creation of the Internetworking Products Group (IPG) and the acquisition of Thomas-Conrad.

> "Both announcements support Compaq's strategy to create end-to-end, easy-to-use computing solutions -- that is, to provide customers with clients, servers, network interface cards (NICs), routers, hubs, and network management, all tightly integrated and tested. As Compaq delivers on its promise of a complete line of internetworking products, it provides customers single-vendor accountability, Compaq-branded high performance NICs that are compatible with all x86 computers, and hub and router solutions that lead to tightly integrated products which are easy to deploy in client/server networks."

NETWORKING IS FOREVER

The '60s was the golden age of the mainframe. The '70s was the decade of the mini-computer. The 80's was decade of the PCs. The '90s is the decade of networking all those stand-alone computers, connecting them to LANs and to enterprise networks. IDC has estimated that by the end of 1994 40% of all PCs were networked, and it is clear that this percentage of networked machines continues to increase. Ray Noorda, former CEO of Novell, summarized this trend during a 1995 interview reported in the January 3, 1995, *Communications Week*. "...Networking is forever. It's only a question of where the emphasis is going to be at any particular time."

The emphasis at this particular time is actually a formidable three-pronged challenge for today's networking professional, who must simultaneously

    a) Protect a significant investment in legacy products connected to LANs that are daily growing in both size and number,

    b) Provide sufficient bandwidth using current technology for increasingly powerful desktop machines running increasingly demanding client/server applications, and

    c) Anticipate internetworking trends and migration paths for internetworking into the next century

Compaq stands apart from other vendors in the networking industry as the one best able to provide customers with solutions and leadership to meet all three of these challenges. The Systems Division's strategy is based on delivering "best-of-breed" products through innovation, acquisition, and partnering with multiple vendors to form fully integrated and reliable business solutions. The goal of the Systems Division is "...to help drive the internetworking market to this best-of-breed model and thus help to reduce the cost and provide its customers with a competitive edge in their respective markets" (Compaq's New Business Model for Internetworking Products, page 5).

PRODUCT OVERVIEW

In acquiring Austin-based Thomas-Conrad, Compaq immediately gained access to a company with ten years of experience in designing and delivering hardware and software for heterogeneous networking environments. Historically, Thomas-Conrad pioneered ARCNET technology for NetWare environments and established a reputation for high quality products and excellent customer support. In 1989 the company introduced its first token ring product (a 16-port MAU), and the following year shipped it first NDIS drivers with a 4Mbps token ring ISA adapter That same year (1990), at NetWorld-Dallas, Thomas-Conrad introduced its 100Mbps TCNS products as the first cost-effective high speed protocol to the desktop. The company's initial Ethernet products shipped in 1991. Throughout the '80s and '90s, Thomas-Conrad developed management software for all of its products, most recently delivering in a Windows-based product for SNMP compliant devices. In the first half of 1995 the company also shipped products for Fast Ethernet and
100VG-AnyLAN high-speed protocols.

LEGACY PRODUCTS

Thomas-Conrad's products have been targeted at the workgroup. They support all the industry protocols, all the standard PC bus architectures, as well as the major network operating systems. Additionally, the company's hubs and adapters support a wide variety of media, including shielded and unshielded twisted-pair, coaxial cable, and fiber. Because the products are designed for the best mix of price and performance, the Thomas-Conrad brand has been consistently cited for its exceptional value. These legacy products support IEEE 802.3 Ethernet and IEEE 802.5 token ring environments.

While it has become an industry commonplace to point out that standard Ethernet and token ring network protocols have exhausted their usefulness, the reality is that few customers are throwing away their existing technology. Instead, what constitutes value to these customers has changed as the technology has shifted to commodity products. Now, customers look for performance, compatibility, price, and support; the Thomas-Conrad legacy products continue to be viable because it is precisely in these areas that the company has excelled.

ETHERNET PRODUCTS

Compaq's 10Mbps Ethernet solutions consist of auto-configurable ISA and PCI adapters as well as PCMCIA adapters for 10BASE-T and 10BASE2 environments, plus an 8 port unmanaged concentrator.

TC5143 ISA Adapter:

The TC5143 is an NE2000-compatible adapter, pre-configured for Base I/O 300h, IRQ 3, which allows most users to drop it in a slot, attached the cable, load their NE2000 driver, and be running in a matter of minutes.

- Available for either 10BASE-T or 10BASE2 with AUI connector

- Software configurable for making customized installations quickly without even taking the cover off a machine

- Auto-bus sensing allows the TC5143 to work in either an 8-bit or 16-bit slot

- Boot ROM socket for remote booting. When remote booting is not needed, the adapter can be left at its default "ROM Disabled" setting to save valuable memory for other uses

- Ships with two configuration utilities. Quickset is a command line for users who want to "talk directly to the adapter." EtherTools is a menu-driven setup and diagnostics utility.

- Four bracket-mounted LEDs for "at-a-glance" troubleshooting

- Ships with SNMP Agent for complete network manageability

ADVANTAGES OF TC5143 OVER 3COM ISA FOR 10BASE-T

	Compaq	3Com UTP Only
Product Part No.	TC5143-T	3C509B-TPO
Bus Type	8/16-bit ISA	16-bit ISA Only
Diagnostic LEDs	4 (TX, RX, Collision, Link)	1 (Link)
Data Transfer Method	I/O or Memory Mapped	I/O Only
Software Override Option	Yes	No
Onboard Memory	16 KB	0 KB
SNMP	Yes (free)	Yes ($395/network)
NE2000 Compatible	Yes	No

TC5048 PCI Adapter

The TC5048, a 32-bit software-configurable PCI adapter, has enjoyed industry leadership since its first availability. It ranked first in performance/efficiency in the *PC Week* Labs Top 10 NIC Index dated November 14, 1994, and ranked first again when new test results were published in the July 24, 1995 Index. The TC5048 was also selected as the top performer among other PCI Ethernet adapters in *PC Computing's* December 1995 issue.

- Available for either 10BASE-T or 10BASE2, in single or multi-pack quantities

- PCI Plug and Play auto-configurable design

- Bus-master design for high throughput with low CPU utilization, making it ideal for servers supporting multiple segments

- Bracket-mounted LEDs showing activity status and link integrity for "at-a-glance" troubleshooting

- Ships with SNMP Agent for complete network manageability

TC5048 THROUGHPUT IN KBPS

Maximum throughput.	1020KBps
Average throughput	925KBps
Average CPU Utilization	12%
Performance Index	1277

Perform3, Packet sizes: 64-4096 bytes, 1 server, 6 workstations

TC5055 8-Port Ethernet Concentrator

Designed for small workgroups, the TC5055 8-port 10BASE-T concentrator allows users to expand their network with a reliable, cost-effective, unmanaged repeater that fully complies with the IEEE 802.3 specification.

- Diagnostic LEDs monitor each port's activity

- MDIX port for daisy-chaining to other concentrators for even greater expansion

- AUI port for connecting to any Ethernet segment using an external transceiver

- Automatic partitioning, link integrity testing, automatic polarity correction, and manual control of each port

TC5141 PCMCIA Adapter

The TC5141 meets the needs of today's mobile workforce for 10BASE-T or 10BASE2 Ethernet networks. It is fully compatible with laptops featuring a PCMCIA Type II slot. Its ODI and NDIS drivers provide ready access to NetWare, LAN Manager, and LAN Server.

TOKEN RING PRODUCTS

To borrow and adapt the often-quoted line from Mark Twain, reports of token ring's demise are greatly exaggerated. It has been estimated that there are 12 million token ring nodes installed, and that token ring networks are growing about 20% a year. One measure of the protocol's viability is new technology designed to boost token ring performance. For example, network managers now have a wide range of token ring switches available from vendors such as, 3Com, Cabletron, Cisco, IBM, Madge, Nashoba, SMC and Xylan.

TC4145 ISA Adapter

The TC4145 was the industry's first Plug and Play ISA token ring adapter. With Plug and Play technology, first championed by Intel and Microsoft in the early '90s, users simply insert the adapter into the machine and the adapter automatically identifies itself and the resources it requires. The system's software automatically scans all installed adapters and devices to prevent potential resource conflicts and then sets up suitable configurations for each installed device.

- Plug and Play configuration means that there are no jumpers or switches to set

- Bus-mastering data transfer maximizes throughput and minimizes CPU utilization. Selectable programmed I/O mode for non-bus-mastering machines with full 16-bit I/O operation

- Automatic media detection and configurations for STP or UTP cable

- Exclusive Scalable Clock Architecture for adjusting onboard clock speed from 4MHz to 6MHz, which significantly increases packet processing rates

- Socket for optional RPL ROM to support use in a diskless workstation

- Non-Plug and Play support is provided by two configuration programs: QUICKSET, a command-line program, and Ring Tools, a menu-driven set-up and diagnostics utility

ADVANTAGES OF TC4145 OVER IBM AND MADGE

	Compaq	IBM Auto16/4 TR ISA	Madge Smart 16 Client PnP
Part No.	TC4145-C	92G7632	22-04
List Price	$249	$276	$295
Interrupt Levels	2,3,5,6,7,9,10,11,12	2,3,10,11	2,3,7,10,11,15
DMA Support	0,1,5,6,7	None	None
I/O Addresses	8	2	12
# LEDs/ function	2, insertion & activity	2, insertion & activity	None
Connectors	DB9 & RJ45	RJ45	DB9 & RJ45
Data Transfer	Bus-master & I/O	Shared Memory	Programmed I/O
Onboard memory	128KB	64KB	128KB

TC4048 PCI Adapter

The TC4048 token ring adapter is a high-performance 32-bit product for the PCI bus architecture that is fast becoming an industry standard. The high throughput/low CPU utilization of the TC4048 makes it particularly suitable for server environments where multiple rings can be supported without having the network adapter become a network bottleneck.

- Bus-mastering data transfer maximizes throughput and minimizes CPU utilization

- Fully compliant with the v2.0 PCI local bus specification

- Automatic media detection for Type 1 STP or Type 3 UTP

- Exclusive Scalable Clock Architecture for adjusting onboard clock speed from 4MHz to 6MHz, which significantly increases packet processing rates

- Socket for optional RPL ROM to support use in a diskless workstation

- Easy troubleshooting with TRTools, Compaq's exclusive diagnostic utility

ADVANTAGES OF TC4048 OVER IBM AND MADGE

	Compaq	IBM	Madge
Part No.	TC4048	O4H8095	51-06 (PCI/EISA) 51-08 (PCI/MC)
List Price	$345	$435	$725
# LEDs/ function	2, insertion & activity	2, insertion & activity	None
Connectors	DB9 & RJ45	RJ45	DB9 & RJ45
Data Transfer	Bus-master	LAN Streamer	Programmed I/O
Onboard memory	128KB	0KB	512KB
RPL support	optional	included	none
SNMP Agent	yes	no	yes

TC4141 PCMCIA Adapter

The TC4141 ships with Type 1 STP and Type 3 UTP connectors. This credit card sized adapter complies fully with the PCMCIA specification and works in all Type II compatible slots. Its performance rivals that of ISA adapters.

TC4050 16-Port MAU

The TC4050 is designed for use in either 4 or 16Mbps token ring networks and is fully compatible with the IBM 8228. It offers twice the number of ports as found on most other MAUs, thereby reducing the overall cost per port connection.

- 16 ports - available in UTP or STP versions. Additional ring-in/ring-out ports with Type 1 or Type 3 connectors for added flexibility

- Status and activity LEDs and enable/disable switches for easy troubleshooting

HIGH SPEED PRODUCTS

Legacy technologies continue to be heavily utilized, but they also continue to endure traffic for which they were never designed. Extending the life of these technologies involves switching and segmenting networks into increasingly small domains. Improving throughput helps, but more powerful machines, combined with the mission-critical use of many client/server applications, regularly maximizes the limited bandwidth of 4, 10, and 16Mbps technologies. The response of most network and MIS directors has been to install 100Mbps protocols whenever possible.

As a pioneer in high-speed LAN technologies, Thomas-Conrad began shipping its own 100Mbps LAN products in September, 1990. As standards emerged for Fast Ethernet and 100VG-AnyLAN, the company eagerly embraced both technologies to provide the optimum high speed solution for their customers' particular environment. Thomas-Conrad has been dedicated to providing a variety of high performing, high-quality network transport solutions to meet the needs of our customers.

100MBPS TCNS

100Mbps TCNS has enjoyed considerable success of the last five years, even though it is a proprietary technology, there are approximately 74,000 installed nodes, according to IDC. TCNS is sometimes referred to as "Fast ARCNET." TCNS uses a token-bus access method, and is based on extending the ANSI 878.1 ARCNET specification to 100Mbps. Deployed primarily as a workgroup solution, TCNS provides support for coaxial, UTP and fiber optic cable.

Unlike 100BASE-T or 100VG-AnyLAN, TCNS topology does not restrict the number of hubs between nodes. TCNS cabling rules allow distances of 100 meters for RG62A/U coaxial cable as well as for Category 5 UTP, and 900 meters for fiber optic cable.

100Mbps TCNS Example Using Coax Cable
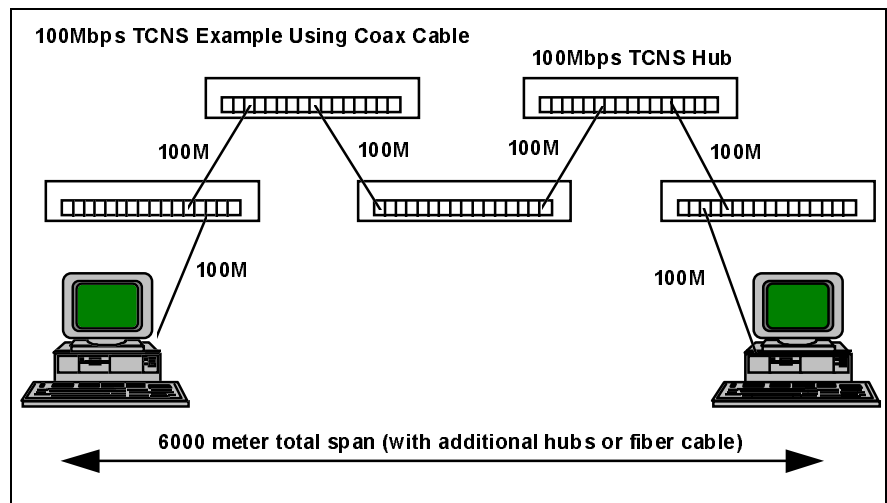
100Mbps TCNS Products

There are three 100Mbps adapters for TCNS and a Smart Hub to support TCNS networks using coax, UTP or fiber-optic media. The adapters are Novell certified for SFT III environments.

- **TC3045:** 8/16-bit ISA adapter

- **TC3046:** 16/32-bit Micro Channel adapter

- **TC3047:** 32-bit EISA adapter

- **TC3050:** 8 port, rack-mountable hub for coax, UTP, and fiber optic, or a combination of fiber/coax and fiber/UTP networks

Advantages of 100Mbps TCNS

100Mbps TCNS represents a mature, proven technology. Because it maintains use of the ARCNET MAC, TCNS offers driver compatibility with existing ARCNET drivers. This provides the capability to operate in all major LAN operating systems. Interconnection to standards-based networks is accomplished via server-based or software-based multi-protocol routers.

TCNS uses a token-bus access scheme, allowing each node equal access to the network and providing deterministic operation. With low protocol overhead, TCNS provides a reliable platform for transaction-oriented or time-critical applications.

TCNS can be connected to coax and fiber cable plants. Fiber, although supported in the standards of 100VG-AnyLAN and 100BASE-T, is not currently available, and there are no plans to implement coax support for the standards-based high speed protocols.

Inhibitors to 100Mbps TCNS

Thomas-Conrad had built a reputation for high-quality products; however, TCNS is a single-vendor solution. As a proprietary product, TCNS is sometimes mistaken as "non-interoperable" with other networks. Although TCNS can usually be configured to overcome interoperability issues, it must rely on PC-based routers.

While TCNS enjoys low protocol overhead, it suffers from a lack of complete management capabilities. Most notable of these are protocol analysis tools and SNMP support, although SNMP adapter agents are now available.

TCNS does not support Category 3 UTP cabling. Although Compaq has a Category 5 UTP adapter available, it is unlikely the technology will support Category 3 cable.

Summary: Positioning 100Mbps TCNS

TCNS continues to be an excellent LAN solution for high-speed workgroup computing. Because of its support for existing RG62A/U and Type 1 cabling, TCNS is well-suited for upgrading existing 3270, token ring, and ARCNET environments to 100Mbps performance. TCNS over fiber is particularly appropriate for long cable runs and at sites where customers need to protect against high EMI and RFI conditions. TCNS also enjoys market leadership as a certified mirrored server link solution for Novell's SFT III operating system.

100BASE-T

100BASE-T was adopted as one of two high speed standards in June of 1995 by the IEEE 802.3u committee. 100BASE-T is also known as Fast Ethernet, 100BASE-TX and 100BASE-T4. Both 100BASE-TX and 100BASE-T4 are subsets of 100BASE-T technology. The different names result from different physical layer implementations available for 100BASE-T. 100BASE-TX implementations operate using two cable pairs over Category 5 unshielded twisted-pair (UTP) cable, two pairs over Type 1 shielded twisted-pair (STP) cable, or two optical fibers. 100BASE-T4 implementations operate using four cable pairs over Category 3, 4, or 5 UTP.

100BASE-T is intended to be a 100Mbps extension to 10BASE-T Ethernet. Like 10BASE-T, 100BASE-T uses the CSMA/CD (Carrier Sense Multiple Access with Collision Detection) access scheme to determine how nodes gain access to "talk" on the network.

Because of its higher data transmission speed, cabling distances are shorter for 100BASE-T than they are for 10BASE-T. For UTP cable, 100BASE-T allows up to 100 meters between a network node and a concentrator, and allows cable lengths of 5 meters between two concentrators. 100BASE-T rules allow up to two concentrators between any two network nodes, making the maximum network segment span 205 meters.

100BASE-T Example

100BASE-T Concentrator   100BASE-T Concentrator

5M

100M   100M

205 meter total span
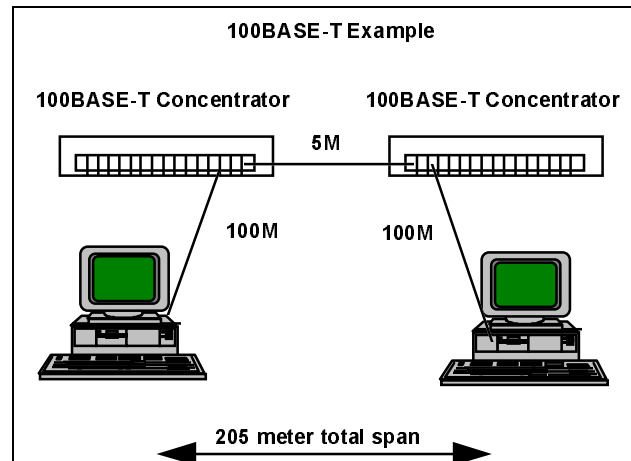
100BASE-T Products

Compaq ships the TCTX048 adapter for 10/100Mbps Ethernet environments. This PCI adapter fully complies with the IEEE802.3u standard.

- Plug and Play auto-configurable design for fast setup

- Two pair operation over Category 5 UTP, the same as 10BASE-T

- Works in 10 or 100Mbps environments, allowing for easy migration to Fast Ethernet

- Ships with diagnostic utility and menu-driven configuration for customers who want to customize their installation

Advantages of 100BASE-T

Because 100BASE-T uses the CSMA/CD access scheme, it preserves the media access control (MAC) layer functions of 10Mbps Ethernet. This is likely to speed acceptance of 100BASE-T by allowing users to draw from experience learned working with 10BASE-T and maintain use of some existing network tools.

100BASE-TX implementations over two-pair Category 5 UTP will reduce some costs for 10BASE-T users who have already installed this cable type.

The cost of the technology will be moderately low relative to performance. Adapters are now priced approximately one and one half times the price of standard 10BASE-T Ethernet adapters, and this is sure to drop. Hubs are appearing that cost $158 per unmanaged port.

100BASE-T enjoys strong industry support. Several vendors, including 3Com, Grand Junction Networks, Standard Microsystems Corporation, Bay Networks, and NetWorth support the standard.

Inhibitors to 100BASE-T

One inhibitor for 100BASE-T is the market confusion that exists between it and 100VG-AnyLAN, the competing IEEE-based standard for 100Mbps Ethernet. Proponents of both standards have called their proposals "Fast Ethernet," and claim several benefits. These claims have led to much posturing the trade press, and the result is added confusion in a marketplace that doesn't like confusion.

Although one of the benefits of 100BASE-T is its capability to operate over "existing" Category 3 or Category 5 cabling, few sites will be able to do so without re-cabling. There are several reasons for this limitation. First, 100BASE-T4 requires four cable pairs to operate with Category 3 cable. Since 10BASE-T requires only two cable pairs, many sites have used the remaining pairs for other purposes, or may not have wired the unused pairs to the wall plate. These sites must either re-terminate their cable, or pull new cable to accommodate the additional pair needed.

Secondly, although 100BASE-T allows cable lengths of 100 meters from a concentrator to a network node, distances between concentrators are limited, and only two concentrators may be placed between any two nodes. By contrast, 10BASE-T allows up to 100 meters between concentrators, and allows up to four concentrators between any two nodes. Furthermore, 100BASE-T's network span of 205 meters may require re-cabling in sites that have been cabled to take advantage of 10BASE-T's span of 2,500 meters. But Compaq's IPG group has a solution to these problems.

To help customers avoid costly re-cabling, NetWorth's Smart Uplink Module allows hubs or stacks of hubs to be connected beyond the 100BASE-T distance limitations, thereby allowing duplication of 10BASE-T wiring designs with 100BASE-T. Smart Uplink Modules can be connected to any available 100BASE-TX, 100BASE-T4, or 100BASE-FX repeater port, and they can be stacked up to five units high for future expansion. Management hubs are available for each stack, thus bringing SNMP or RMON support to the largest of 100BASE-T networks.

Summary: Positioning 100BASE-T:

100BASE-T technology offers users a viable option for 100Mbps workgroup computing. Due to the appeal of its CSMA/CD access scheme and backing by major Ethernet vendors, 100BASE-T will be best deployed by existing Ethernet users whose cabling environments are consistent with 100BASE-T's capabilities. Because of its limited scalability, restrictive cabling requirements, and collision oriented data access, 100BASE-T will not be deployed widely as a backbone solution.

100BASE-T will be attractive to customers who are committed to CSMA/CD as providing true Ethernet compatibility.

100VG-AnyLAN

100VG-AnyLAN is the second of two new standards-based high speed protocols. 100VG-AnyLAN is also known as VG, Fast Ethernet, Fast Token Ring, and Demand Priority. Like 100BASE-T, 100VG-AnyLAN is intended to be a 100Mbps extension to 10BASE-T Ethernet and supports IEEE 802.3 Ethernet frame types. Unlike 100BASE-T, 100VG-AnyLAN is also designed to provide compatibility with IEEE 802.5 token ring data frames. "VG" stands for the "voice grade" cable, and support for both Ethernet and token ring frame types has led to the "AnyLAN" name.

100VG-AnyLAN operates over Category 3, 4 or 5 UTP and uses an access scheme called "Demand Priority" to determine the order in which nodes share the network. Demand Priority uses the hub to act as a "traffic cop" to determine which node has access to the network. A round robin polling scheme insures each node has fair access to the network. 100VG-AnyLAN also allows for two levels of priority for network traffic, "normal" or "high." Demand Priority services high priority first during each "round," allowing time-critical network applications more immediate access to the network. Because all nodes requesting access are served during each "round," all nodes are assured access to the network.

100VG-AnyLAN offers four-pair operation over Category 3, 4 and 5 UTP, two-pair operation over Type-1 STP cable, and support for fiber optic cabling. Two-pair operation over Category 5 is currently being considered. Node-to-node or node-to-hub cabling distances are 100 meters for Category 3 and Type-1 cable, 200 meters for Category 5 cable, and 2,000 meters for fiber optic cable. 100VG-AnyLAN allows a network diameter of 2,000 meters and supports cascading up to two tiers of hubs below a "root" hub. However, it is recommended that you follow the 10BASE-T rule of no more than five concentrators between any two nodes. These cabling rules allow 100VG-AnyLAN to support all topologies used by 10BASE-T Ethernet or 802.5 token ring LANs.
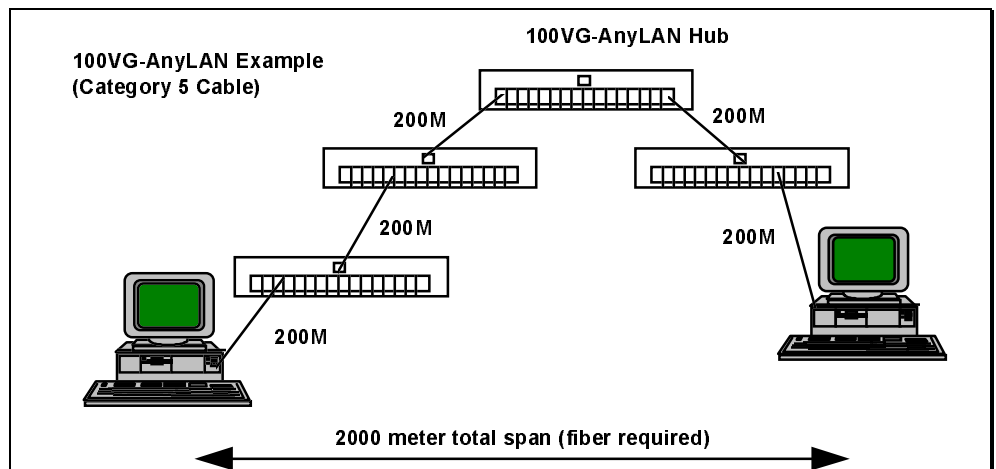
100VG-AnyLAN Products

Compaq ships two 100VG-AnyLAN adapters, a 24-port hub, and a management processor for the hub. All 100VG-AnyLAN products fully comply with the IEEE 802.12 standard. The 10/100Mbps adapters run over Category 3, 4, or 5 cable.

- **TCVG045:** 16-bit ISA adapter

- **TCVG047:** 32-bit EISA bus-mastering adapter

- **TCVG050:** 24 port hub with demand priority capability. Cost per unmanaged port is around $130; cost per managed port is about $170, less than half of most competitors' cost per *unmanaged* port. The TCVG050 was designated as a "Hot Product" in the January, 1996, issue of *Data Communications*.

- **TCVG020:** Optional management processor for TCVG050 hub. The TCVG020 ships with an SNMP agent. It also comes with a program embedded in the processor called "WebCheck," which allows users to gather basic network statistics and configure the hub remotely using any standard Internet browser.

Advantages of 100VG-AnyLAN

A key benefit of 100VG-AnyLAN technology is the deterministic operation resulting from the Demand Priority access scheme. This, combined with prioritization, provides high-bandwidth applications like multimedia or video guaranteed network access. Since all nodes are assured access to the network, network performance can be predicted, regardless of load.

Because 100VG-AnyLAN supports both 802.3 Ethernet and 802.5 token ring frame compatibility, it provides a high-speed migration path for enterprise networks currently using both technologies, including source routing support for 802.5 token ring frames. Frame compatibility also enables use of many of the network tools and services whose operation is based on support for 802.3 or 802.5 frames.

100VG-AnyLAN offers a network topology very similar to existing 10BASE-T networks. This will allow its use in several users' environments whose current wiring layout is inconsistent with 100BASE-T's more limited cabling capabilities.

Although not supported by some key Ethernet vendors, 100VG-AnyLAN enjoys support from several vendors besides Compaq. These include AT&T, Hewlett-Packard, IBM, Texas Instruments, and Motorola.

Inhibitors to 100VG-AnyLAN

100VG-AnyLAN suffers from market confusion because of multiple high-speed standards. This confusion is aggravated by the technology's putative support of both Ethernet and token ring frames; at this point (January, 1996), only Ethernet frame support is commercially available. Users may also be concerned that "name" vendors like 3Com and SMC have not publicly supported 100VG-AnyLAN. Most customers associate 100VG-AnyLAN only with HP, thereby perceiving it as a single vendor protocol.

100VG-AnyLAN must also overcome users' concern regarding the relatively new Demand Priority access scheme. Many current Ethernet users believe Demand Priority is unproven and are more comfortable with "proven" CSMA/CD technology.

Finally, although many proponents cite the technology's capability to operate over existing wiring, it is unclear as to how many end-user nodes have been configured for four-pair operation. Based on this, many sites may have to re-cable in order to support 100VG-AnyLAN technology.

Summary: Positioning 100VG-AnyLAN

100VG-AnyLAN will be primarily deployed as a workgroup solution, but offers some scalability for smaller backbone applications. 100VG-AnyLAN technology offers several technical advantages, including deterministic operation, prioritization, connection distances, and the ability to support both Ethernet and token ring frame types These products offer an upgrade to existing Ethernet or token ring environments at a cost similar to 100BASE-T, with adapter prices about one and one half times that of 10BASE-T, and hub prices ranging from $150-$250 per port. If performance and compatibility are as expected, "proven" CSMA/CD versus "new" Demand Priority will become a non-issue for end users.

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STATEMENT OF DIRECTION

Although Compaq is well-known as the market leader in PCs, the company also has a strong but unappreciated position as a networking vendor. During 1995 alone, Compaq shipped over 450,000 adapters with its server products, along with an additional 1,800,000 for its desktop computing platforms. This tradition of designing and delivering high quality networking product forms the foundation of the new Internetworking Products Group.

IPG's goal is focused on delivering "best-of-breed" internetworking products through partnerships and product innovation. "Best-of-breed" products exist when customers receive exceptional value for every dollar spent. Delivering on this commitment involves adding value in three ways:

a) Providing cost benefits through volume manufacturing and distribution

b) Making available complete solutions that are fully tested for heterogeneous internetworking environments. Some solutions will come from partnering with vendors who have the required expertise, and others will come from internal product innovation

c) Pushing product innovation to create easy-to-use, better management products that will drive down the level of expertise required to install, manage, and maintain an enterprise network

IPG will improve the performance and range of legacy products for Ethernet and token ring technologies. When necessary, driver performance will be enhanced; when required, new products will be developed; when feasible, current products will be made more cost-effective. These programs will allow customers to protect their investment in legacy products.

Customers can expect expanded offerings in the 100Mbps protocols, particularly the standards-based high speed technologies. The product offerings will range from new and improved adapters to shared media hubs, switches, and newly designed sophisticated management tools. These products will address the needs of workgroup and departmental client/server applications.

Finally, over time, Compaq customers can expect a range of products that will provide an orderly migration from today's technologies to WAN connectivity and remote access. As in other arenas, this will involve both partnering and product innovation. This product direction supports our announced business strategy:

> "We are building a world-class internetworking business and are preparing to be a leader in this industry within the next few years."
>
> Gary Stimac, senior vice president and general manager,
> Systems Division, Compaq Computer Corporation,
> October 18, 1995.