

PC Integration with HP AdvanceNet

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Personal computers have become common in the workplace because they offer increased productivity with specialized applications, user independence, and desktop power. They are found on the desks of executives, programmers, and clerical personnel alike. The use of PCs to improve productivity has resulted from technological progress and the need for more computing power in the hands of users. Many companies are tolerating segregation between their PCs, and between their PCs and their departmental computers. Other companies have provided terminal connections to departmental computers with terminal emulation and file transfer for their PCs via point-to-point RS-232 links. These companies now see that further growth in productivity will come from increased communication between their desktop PCs and departmental computers.

These companies now face the challenge of integrating these PCs into the larger information systems of their organizations. This effort is both a challenge and a tremendous opportunity to gain the benefits that come from increased communication, network services, and the central administration of assets - computing hardware and peripherals, applications and data, and technical expertise. These benefits are increased productivity, improved quality, and lower overall costs.

This paper focuses on how PC integration is achieved with HP AdvanceNet to increase communication and productivity. The topics covered are:

- o The advantages and disadvantages of PC integration using a LAN
- o Network cabling
- o Network links
- o Network services software

The Advantages and Disadvantages of PC integration Using a LAN

An HP AdvanceNet LAN is the most effective method to achieve PC integration because it enables the PC to become the entry point into an entire corporate computing environment at whatever level the user requires, either the local workgroup, department, site, or corporate processing level. Rather than connecting PCs to departmental computers as terminals, or to other PCs using a PC-only LAN with point-to-point connections to a departmental computer, an HP AdvanceNet LAN integrates every PC with all other computers on the network, from PCs to corporate mainframes.

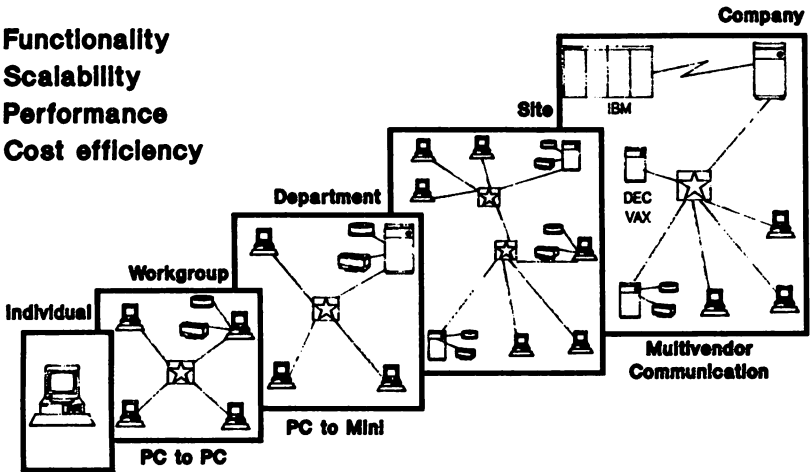
The LAN provides this interconnectivity, with shared data and resources residing on multiple CPUs, and allows multivendor connectivity via terminal access and file transfer. The LAN also enables you to use distributed applications across multiple CPUs. With HP AdvanceNet, the PC user has access to all of these capabilities with only one, consistent network user interface.

Using an HP AdvanceNet LAN for PC integration allows for completely scalable growth from an individual PC all the way up to a corporate mainframe. It enables you to add users and servers when and where they are needed. People may work individually, as a local workgroup with a PC and/or HP 3000 server, with multiple workgroups integrated

with a departmental computer, as an integrated site with many interconnected departments, and finally, with many integrated sites as a company.

PC Integration with HP AdvanceNet

- **Functionality**
- **Scalability**
- **Performance**
- **Cost efficiency**



The price/performance ratio is generally better with a LAN than with point-to-point connections. A LAN provides better file transfer speed with only a little more HP 3000 processing overhead. Also, more users don't degrade each others' individual performance because they each have their own processing power. An industry move is on to take advantage of this distributed computing environment by developing distributed applications that minimize data transfer between processes, e.g., concentrated database access. Because the price per PC MIP is coming down faster than that of minicomputers,

it is easy and cost effective for users to add more PCs to a network to get more processing power.

A LAN is also the most cost effective method for integrating PCs with HP 3000s, other PCs, and minicomputers. The initial incremental cost of LAN connections compared to point-to-point connections is attractive when considering the additional functionality, connectivity, and scalability a LAN provides. A LAN protects users' investments in new and existing PCs, peripherals, software and data, and paves the way for their use of future LAN functionality including new distributed applications.

The disadvantage of using a LAN to integrate PCs is the initial incremental cost of the network components and time required to install and manage the network above point-to-point connections. This initial incremental cost varies by HP 3000 processor size and the number of PCs to be connected, but generally averages about \$500 per PC. When considering the advantages of a LAN and the value of users' time acquiring, creating, and communicating information, this initial incremental cost is marginable. The functionality provided over an HP AdvanceNet LAN is superior to point-to-point connections because RS-232 links cannot provide the interconnectivity, services, and scalability of a LAN. The advantages of using a LAN to integrate PCs outweigh the disadvantages.

The Network Components

Three basic network components are used to integrate PCs into an HP AdvanceNet LAN. They are:

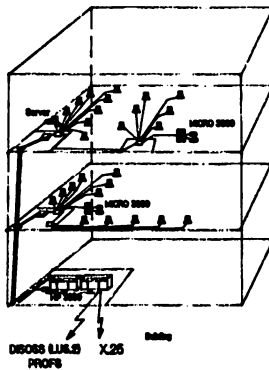
- o the network cabling
- o the network links (the PC interfaces on that cabling)
- o the network services software.

Network Cabling

The wiring infrastructure of a building or campus is the foundation upon which every well-conceived network design must rest. If this foundation is inadequate or missing, it will be impossible to build an effective, flexible and manageable network solution.

Wiring is a Business Asset

- Wiring is the network foundation
- A strategic business decision
- HP provides all necessary guidelines, products and services



Every business environment has its own unique needs, characteristics and computing automation programs. The network must be versatile to meet the wide range of information needs in your organization, and be flexible so it can grow as those needs

change. The network must provide connections to many vendors' systems to protect user investment, and solve complex communication problems.

To achieve all this connectivity, the network must be based on a comprehensive wiring foundation. Users need to be connected together in logical workgroups to share data and resources. Workgroups then must be connected to a site backbone to provide facility-wide communication. The office wiring system must be well defined and limited to a uniform medium to eliminate costly rewiring for computer moves, adds or changes.

Although the cost of network user interface hardware and software has been decreasing significantly, the cost of network cabling has remained relatively constant. When we also consider that building wiring has a life span two to six times greater than the equipment it connects, we realize that wiring, which was once a secondary network consideration, is of strategic importance. The choice of wiring media is one of the most important long-term decisions an MIS manager can make.

Recognizing the importance of cabling, HP has developed a complete set of communications wiring guidelines, products, and services, called *HP SiteWire*, to help customers with their wiring decisions. HP SiteWire adheres to an open, proven multi-vendor wiring foundation that follows the guidelines of an emerging industry standard, EIA (Electronic Industries Association) TR-41.8. Adherence to standards ensures that the wiring system will provide multi-vendor compatibility and lasting value.

The framework for HP SiteWire is a wiring architecture based on this standard. HP's wiring architecture addresses the needs of any physical environment and also provides a way to implement networks in a controlled, step-by-step manner. The wiring architecture is based upon a distributed star topology compatible with existing telecommunication systems. The distributed star topology provides easy network cable administration and

flexible growth. Such a structured wiring system simplifies network management and reduces the cost of adding and moving network users from an average of \$1,000-\$1,500 to \$200-\$300 each.¹

The architecture includes the use of a thin or thick coaxial backbone cable running horizontally and/or vertically through a building with horizontal subnets of unshielded twisted pair or coaxial cabling, depending on the environment. With unshielded twisted pair wiring, the wiring system that once supported only the phone system can now be used to also support data applications.

There are many benefits to the use of unshielded twisted pair wiring over shielded twisted pair and coaxial cable. Unshielded twisted pair cable costs less and is easier to install. "Unshielded cables offer much more flexibility. They are of small cross-section, making installation easier and requiring less space in ducts and satellite closets. They also currently support high-speed data transfer..."² In addition, the existing unshielded twisted pair voice system in a building may also be able to support data as well, virtually eliminating the large cabling cost component of a LAN. As network hardware and software costs continue to decrease compared to the relatively constant cost of wiring, the cost of adding a LAN to an appropriately cabled building will continue to drop substantially from that of a building requiring cabling installation.³

1 "Structured Distribution Systems", Local Area Communications (Gartner Group, Inc., January 30, 1987), Key Issues K-CBL-319.1

2 "Shielded vs. Unshielded Cable", Local Area Communications (Gartner Group, Inc., August 21, 1987), Technology T-WIR-377.1

3 "Data Switching: Price Trends", Local Area Communications (Gartner Group, Inc., September 5, 1986), Scenarios S-LAN-274.1

An unshielded twisted pair cabling system can support voice as well as data transmission, eliminating the need for two separate voice and data cabling systems. A coaxial cabling system for data requires a separate cabling system for voice. Using unshielded twisted pair wiring can save the cost of the additional system. It is less expensive to pull two parallel, voice and data systems at the same time than two separate systems. Whenever cabling must be installed, the cost of labor is the major component. Approximately 60% [or more] of the cost of wiring a new building is attributable to labor for installation.⁴ In many wiring quotes we have seen, the cost of labor has been as high as 80%-90% of the total quote. If walls must be opened or if new wiring troughs or conduits must be installed because the existing ones are full, the cost of installation increases dramatically. Because unshielded twisted pair is smaller, additional costs such as these may be avoided. An additional major benefit to using unshielded twisted pair wire over coaxial or shielded cable is that it often already exists, requiring *no* cable installation.

Testing Existing Wiring

When a customer wants to utilize an existing unshielded twisted pair wiring system whose condition is unknown, a wire test may be necessary. The wire specifications to support higher speed (1Mbps and 10Mbps) data communications is much stricter than that required to support voice communications.

HP offers a unique service, called *HP WireTest*, which strengthens HP's StarLAN offering by providing customers with an evaluation of the suitability of their existing unshielded twisted pair wiring for a StarLAN network. The availability of HP WireTest

⁴ "The Cost of Network Ownership" PC Netline (Hyatt Research Corp., July/Aug. 1987), p.1.

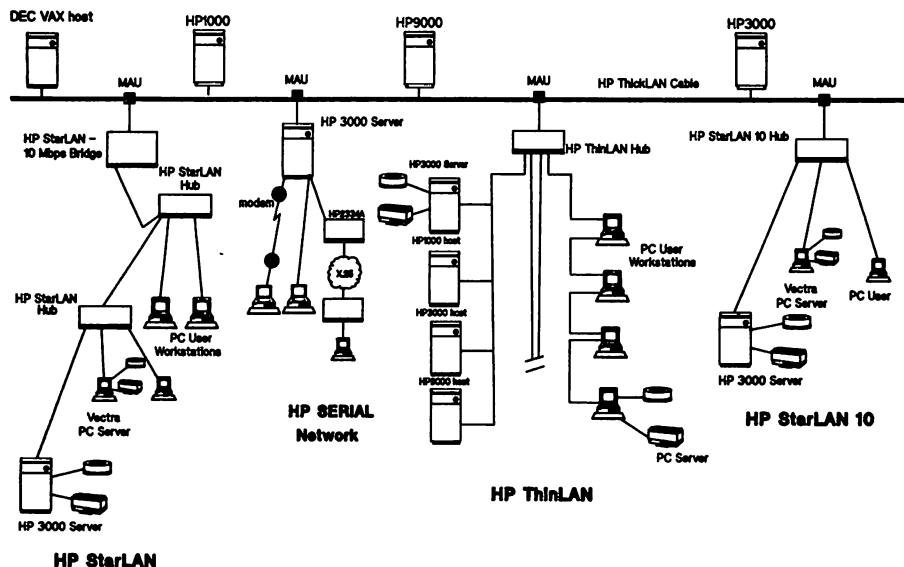
demonstrates HP's commitment to the development of complete customer networking solutions, and the cost is very low when compared to the cost of installing new wire.

Network Links

A network link is the interface by which a PC is connected to the network cabling. The network links can be used with the cabling for some networking applications independent of the network services software, and are therefore sold separately from the services. The network services software can also be used over any of the network links, offering an extremely flexible and scalable architecture. Every link can be integrated into a single, enterprise-wide HP AdvanceNet LAN to provide all users with the access and services they need.

HP AdvanceNet offers four network links. *HP StarLAN* and *StarLAN 10* allow customers to use existing telephone wiring to support their office data communication needs. HP *StarLAN* and *StarLAN 10* are compatible and complementary, offering flexibility in meeting users' data communication needs, while preserving the investment in their wiring asset. *HP ThinLAN* is available for those customers who have coaxial cable already installed for PC connectivity, and the *HP SERIAL Network* link provides a remote, asynchronous (point-to-point) link to network services on an HP 3000.

Network Links



o HP StarLAN

HP StarLAN is a 1 Mbps LAN link using unshielded twisted pair wiring. This wiring often already exists, running parallel with the customers telephone wiring. The link supports HP Vectra, IBM™ PC/XT™/AT™, IBM PS/2™ Models 25 and 30 personal computers, and the Micro 3000 and HP 3000 Series 37. Personal computers on a StarLAN

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network can communicate with other PCs and minicomputers that are on StarLAN 10, ThinLAN or ThickLAN networks via a StarLAN bridge.

o HP StarLAN 10

StarLAN 10 is a 10 Mbps LAN link, using unshielded twisted pair wiring, for HP Vectra, IBM PC/XT/AT, IBM PS/2 Models 25 and 30, HP Touchscreen (North America only) personal computers, and HP minicomputers. HP StarLAN 10 will allow customers to use high-speed applications and workstations, such as 80386 processor-based personal computers, without the need to install new building wiring in many cases. It is a flexible network solution for integrating PCs and minicomputers in complete office automation solutions. It is especially useful in business office environments that require a large number of nodes and experience heavy network traffic.

o HP ThinLAN

HP ThinLAN is a 10 Mbps thin coaxial cable LAN link, supporting HP Vectra, IBM PC/XT/AT, IBM PS/2 Models 25 and 30, and HP Touchscreen PCs, as well as HP minicomputers. It is especially useful where coaxial cable is already installed, or in engineering and manufacturing environments.

o HP SERIAL Network

The HP SERIAL Network link provides an asynchronous connection to HP 3000 computers for HP Vectra PCs, HP Touchscreen PCs, IBM PC/XT/AT, and IBM PS/2 Models 25, 30, 50, 60 and 80. This connection allows remote PC access to shared peripherals and PC files residing on HP 3000 servers, distributed applications, terminal emulation, and network file transfer (NFT). HP Vectra and IBM PCs can also make this connection via back-to-back HP 2334A multiplexers over an X.25 network.

Mixed Link Networks

As specified by HP SiteWire guidelines for the greatest growth potential with minimal geographic restraints, ThinLAN or ThickLAN coaxial cable can be used as a backbone for a site-wide LAN. HP StarLAN, StarLAN 10, and ThinLAN sub-networks can be attached to a backbone cable to increase distances, the number of network nodes, and to provide intercommunication for all of the computers on these LANs.

HP's support of all these links provides customers with complete flexibility to meet specific and multiple connectivity needs for the least cost.

Network Services Software

The network services software runs on the PCs that are connected via the hardware links. This software provides the network services which allow the PCs to communicate with each other and with HP 3000, HP 1000, HP 9000, and DECTM VAXTM computers, and enable communication with corporate mainframes. The *HP OfficeShare Family of Networking Software for PCs* is the group of software which provides these network services to PCs. The HP OfficeShare software supports the HP Vectra Family of PCs, the HP Touchscreen, IBM PC/XT/AT and PS/2 Model 25, 30, 50, 60, and 80 personal computers, preserving users' investments in PCs.

Like all HP AdvanceNet products, OfficeShare is based on the International Standards Organization OSI networking model. OfficeShare provides compatibility with IEEE 802.3 industry standards, and employs de facto standards such as MicrosoftTM Networks,

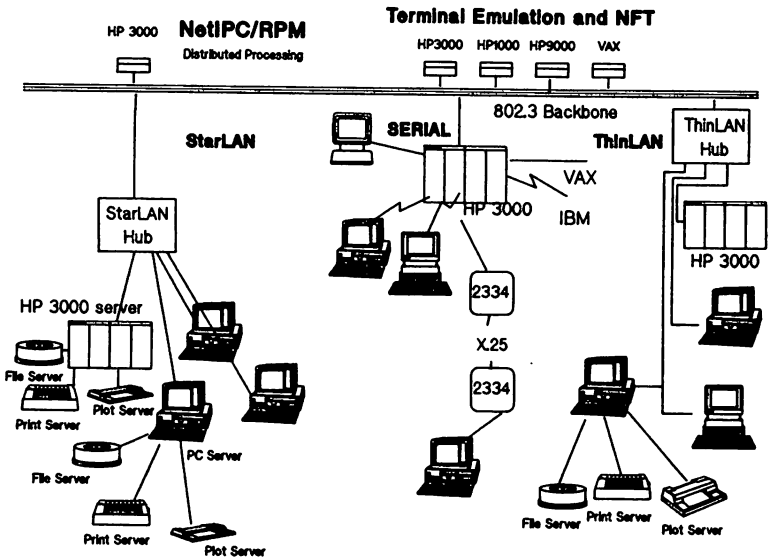
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allowing applications written to the MS-Net™ interface to function on the network. This support of industry standards protects your investment and ensures the widest selection of growth options available. The OfficeShare products also provide a single, consistent PC user interface to all network services, providing easy user integration into an enterprise-wide LAN.

Resource Sharing is the network software which enables the HP 3000 to function as a server on a network. Resource Sharing is a component of *HP Business System Plus*, an integrated system of business applications for networked PCs and HP 3000s.

Network Services for PCs



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The network services software provides:

o Peripheral Sharing

The PC server software and the HP 3000 server software enable users to enhance communication, increase productivity, and reduce costs by sharing files and peripheral devices such as discs, printers, and plotters. Users can store and retrieve files on discs connected to the servers as if they were local. There are no new commands to learn; users only need to know the MSTM-DOS device letter (C:, D:, etc.) of the files they want to access. Network discs are structured using the MS-DOS hierarchical directory structure and can be tailored to suit users' needs. Normally, the network manager creates a directory for each user; users can easily create their own subdirectories. Users can share files among all types of HP and IBM PCs, using passwords and three access levels (read, write, and create) to provide the proper security for their files. PCs, HP 3000s, and combinations of both may function as servers to network users. Printers and plotters connected to a network server may also be shared as if they were locally connected devices. Multiuser access to printers and plotters is transparent through the use of a spooler.

o Terminal Access to HP 1000, HP 9000, and DEC VAX Hosts

Additional connectivity is offered to PC users through terminal access to HP3000, HP 1000, HP 9000, and DEC VAX computers. PCs on a LAN can serve as terminals to many different computers, thus saving money by reducing equipment investment and saving time by providing multihost connectivity from a single workstation. This virtual terminal capability provides block mode terminal emulation to the HP 3000, and telnet service to

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the HP 1000, HP 9000 (all models except the 500) and DEC VAX computers. The terminal emulation capability is accessed by the user via the HP Terminal Program.

o Network File Transfer

Network File Transfer (NFT) allows better communications and data exchange between PC users and their network computing environment. NFT provides network file transfer between PCs and HP 1000, HP 3000, HP 9000 and DEC VAX hosts. The NFT service is accessed by the PC user with the DSCOPY command, and may also be accessed programmatically.

o PC-to-PC Communications

OfficeShare implements a NetBIOS application interface supporting specific NetBIOS applications for PC-to-PC communication. NetBIOS support for tested third party applications allows users access to key multi-user applications including modem-sharing and electronic mail. Currently, these listed communications applications are *Hayes Smartcom II*, and *Network Courier*.

o MS-Networks and MS-DOS 3.X Windows Support

By employing MS-Networks, popular MS-DOS application programs can be used on the network, protecting users' investments in application software. Support of MS-DOS 3.X Windows allows for increased productivity by permitting users to run applications in windows for easier movement and interaction between programs.

o Distributed Application Development

Distributed application development software provides programmatic tools which enable application developers to write integrated, distributed applications utilizing the processing power of PCs and HP 3000s.

Distributed applications are extremely important today. Applications which transparently run on two or more computers and communicate over the network can make the most efficient use of distributed systems and provide timely information when and where it's needed. Using distributed application development tools, application developers may now easily integrate PCs - the most widely distributed, and often untapped, level of computing power across an enterprise-wide network.

HP offers two distributed applications development software tools, *Cooperative Services* for applications requiring HP 3000 TurboIMAGE database access from a PC on the network, and *NetIPC/RPM* for PC and HP 3000 task-to-task communication over the network.

Tailored for the development of commercial applications, Cooperative Services allows PC applications to programmatically access and update HP 3000 IMAGE and MPE file data, or call HP 3000 procedures. Cooperative Services simplifies development by eliminating the need for software designers to code in lower-level network intrinsics or provide parallel coding on the HP 3000.

The NetIPC/RPM Development Package for PCs allows developers to write distributed applications using PCs on a network. The software package is a set of Network InterProcess Communication (NetIPC) and Remote Process Management (RPM) program intrinsic libraries that provide standard communication between concurrent peer processes

on PCs and HP 3000s, and the ability for PCs to start and manage processes on HP 3000s. HP's distributed applications such as AdvanceMail, Information Access, and Cooperative Services use NetIPC for LAN communications.

The NetIPC/RPM Development Package for PCs contains program libraries for use in Microsoft C and Lattice C programs. Other languages, such as Pascal, can call C routines, providing flexibility in the programming languages developers may use. The libraries are linked by the programmer to the PC application being developed, and called by the application to provide the network communications required. On the HP 3000, concurrent processes are developed using NetIPC/3000 and RPM/3000. NetIPC/3000 is provided with the HP 3000 network link product, such as the ThinLAN/3000 LAN Link, and RPM/3000 is part of NS/3000.

To use the distributed application, users only need the appropriate HP OfficeShare PC link (StarLAN 10, StarLAN, ThinLAN or SERIAL Network), and network configuration software. They do not need the network services software. Applications using the NetIPC/RPM libraries may, however, be run concurrently with network services software, allowing users to take advantage of both the application and services such as HP Vectra and HP 3000 servers.

Conclusion

PC integration goes beyond tracing a connective media from PCs to departmental computers. It is the seamless integration of the services and capacity, data, and applications residing on all computers interconnected throughout an entire company. This integration is the basis for further productivity gains at the desktop.

HP AdvanceNet integrates PC users into scalable, low-cost networks that provide enhanced PC-to-mini integration, multi-vendor communication, and PC-to-PC communications, for increased productivity, improved quality, and lower overall costs.

PC integration is a key part of HP AdvanceNet, Hewlett-Packard's long-term strategy for providing high-quality networking solutions for HP and non-HP computers. This strategy is based on the International Standards Organization OSI networking model and includes compatibility with industry standards, such as IEEE 802.3, and de facto standards such as Microsoft Networks, to ensure lasting value. HP AdvanceNet signifies a commitment by Hewlett-Packard to provide powerful yet easy to use networks with a well-supported growth path.