HP AdvanceNet for Engineering

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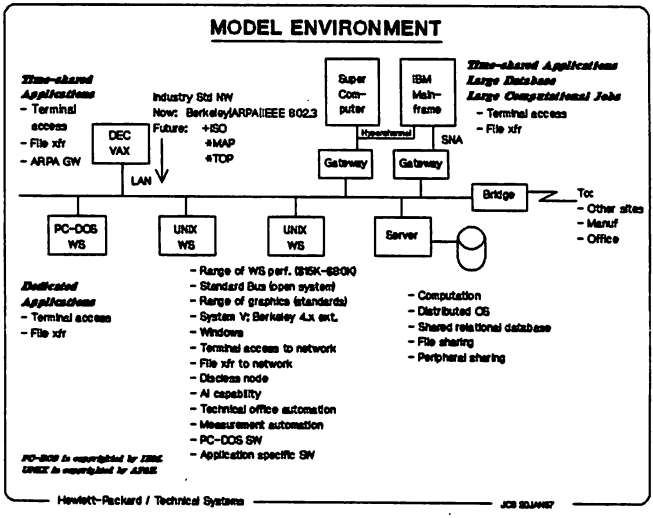
INTRODUCTION

As one of the five solutions in the HP AdvanceNet offering, HP AdvanceNet for Engineering addresses the networking needs of technical professionals engaged in engineering and other technical pursuits. This solution features the same emphasis on standards common to the other solutions. The solution is best understood by considering a model computing environment for engineering.



The diagram of the environment shows many of the key characteristics of both the computers and the network. A major trend in the engineering area in the past few years has

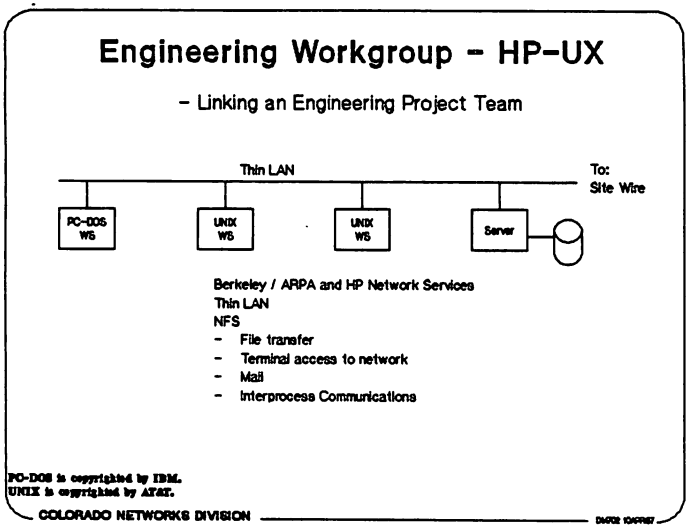
been a move to engineering workstations and acceptance of the UNIX operating system as a defacto standard. These workstations offer many advantages in terms of powerful graphics and consistent performance; but in order to be effective, they must easily integrate with the installed base of timeshare computers and other larger computers which may be added in the future. The resulting environment represents a range of computing power from personal computers to mainframes and super computers. In almost all cases, these computers will be supplied by several different vendors. In order for users to realize the maximum benefit of this environment, they should retain the desirable characteristics of the timeshare environment - easy information sharing and centralized system management - and also gain the benefits of the workstations in terms of distributed computing power. The network plays the key role in providing this.

The basic purpose of the network is to provide information and resource sharing. Users should be able to transfer files from one computer to another, log on to other computers, run applications on other computers, run applications on a local computer using data on remote computers, access peripherals connected to any computer and, in general, make the best use of the available resources to perform a wide variety of different tasks. In fact, it is not possible to do an effective job of providing computing for engineers without providing the supporting network.

The Engineering Solution, like the other HP AdvanceNet solutions, is comprised of modules. There are five modules in the Engineering Solution: Engineering Workgroup, Engineering Computer Center, Site Computer Center Access, Site Wire, and Company-wide Access. Each module consists of a collection of products which together meet the user requirements.

The first three modules represent a three-tiered hierarchy commonly found in engineering environments - workstations, super minicomputers, and mainframes. The workstations and super-minicomputers are often administered by the engineering department. The mainframes are often facility resources administered by the EDP or MIS departments.

ENGINEERING WORKGROUP MODULE



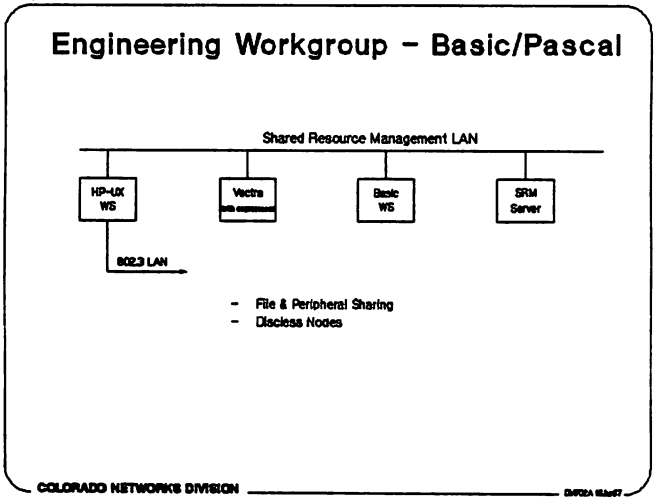
The most effective and productive way to connect a group of workstations is with a local area network (LAN). The LAN that has emerged as a standard for engineering networks is the IEEE 802.3 LAN. Early engineering networks utilized the Ethernet protocol, which served as basis for the IEEE 802.3 standard. HP offers IEEE 802.3 LAN as the basis for the engineering workgroup of UNIX workstations. For compatibility with existing networks, the Ethernet protocol is also supported. The IEEE 802.3 standard only defines part of the protocols necessary to provide communication among the computers. The other protocols employed are the Transmission Control Protocol (TCP) and Internet Protocol (IP) and the Berkeley and ARPA network services. The IEEE 802.3 standard defines the link used to connect the computers, TCP/IP provides a reliable connection from one computer to another, and the Berkeley and ARPA network services provide the specific functions required, such as file transfer, virtual terminal, etc.

The IEEE 802.3 standard allows for two types of cable - thin and thick. Because of ease of installation and

configuration, HP recommends use of the thin cable for the engineering workgroup.

One necessary capability not provided by either Berkeley or ARPA services is the ability to share files without copying the entire file from one computer to another. HP has augmented the Berkeley and ARPA services with an HP developed service called Remote File Access. Recently, a service known as the Network File System* (NFS) has been endorsed by a number of vendors and has emerged as a defacto standard for file sharing. One of the major advantages of NFS is that it is independent of the operating system and thus allows sharing of files among computers with UNIX and other operating systems. HP has announced NFS for the HP 9000 computers with initial shipments planned for late 1987.

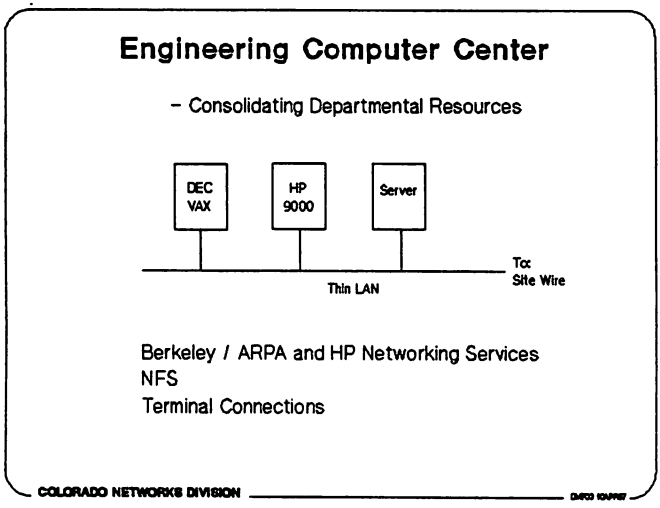
* NFS is a a trademark of SUN MicroSystems



Many engineering applications require use of computers to control various types of test and measurement equipment. HP offers several computers optimized for this task. One widely used computer is an HP 9000 Series 200 or 300 running the BASIC operating system (Rocky Mountain BASIC). The HP network for these systems is the Shared Resource Manager (SRM). The SRM features peripheral and file sharing and allows operation of the workstations without local discs.

SRM also supports the PASCAL workstation and HP-UX. SRM networks can be connected to IEEE 802.3 LANs through a workstation running HP-UX or a Vectra PC with the BASIC co-processor.

ENGINEERING COMPUTER CENTER MODULE



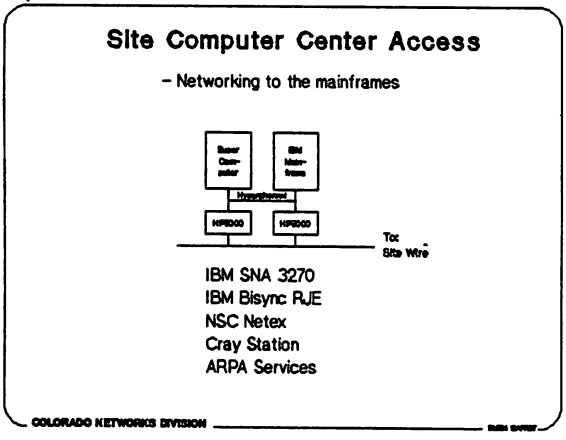
The engineering computer center represents the second tier in the engineering computing hierarchy. Computers in the engineering computer center are typically departmental resources, shared by several project teams. A timeshare super-minicomputer, such as the Digital Equipment Corporation VAX is very commonly used in this environment. Recently introduced HP Precision Architecture computers such and the HP 9000 Models 825, 840, and 850 will be installed here.

The engineering computer center could also house various types of servers for the engineering workgroups. These servers could manage large ensembles of discs or other peripherals such as laser printers. An advantage of putting servers in the engineering computer center is that they are centralized with the timeshare computers for convenient disc backups. Placing the majority of the discs and other peripherals here also isolates the workgroups from the noise generated by these devices.

HP's recommended wiring for the engineering computer center is again the ThinLan cabling. This allows for easy configuration of the computer center and permits convenient reconfiguration as necessary. The ThinLan network for the computer center can then be connected to the site backbone for communication with other workgroups or computer centers.

The ARPA and Berkeley network services can be used with any computers running UNIX. For example, the HP 9000 Series 800 computers can all be configured with ARPA and Berkeley network services to augment the HP-UX operating system. DEC VAX computers running the VMS operating system can be equipped with ARPA services via software packages available from DEC and several third parties. An alternative means to connect DEC VAX computers with VMS is to install HP Network Services on the VAX computer. This product provides HP AdvanceNet Network File Transfer (NFT), allowing file transfers between the VAX and any HP computer supporting NFT. The HP Network Services for the VAX run in user space and utilize standard DEC LAN hardware, permitting coexistence with DECNet. The engineering computer center would also provide terminal connections for the various timeshare computers.

SITE COMPUTER ACCESS MODULE



The site computer center is the province of the mainframe and supercomputer. IBM and IBM compatible mainframes are commonly found here. Engineers utilize these resources to

execute jobs requiring extensive computational power or to access large databases. Because of the dominance of IBM in this environment, required networking capabilities fall into two categories - IBM communications and "other".

Today the most commonly used protocol to communicate with IBM mainframes is IBM Systems Network Architecture (SNA). An older protocol, Binary Synchronous Communications (Bisync), is still in use in some installations. Either of these alternatives offers convenient communications to IBM because the engineering computers emulate standard IBM devices, such as interactive terminals or remote job entry stations. From the IBM mainframe's perspective, it is communicating with another IBM device. This greatly simplifies the task of the mainframe system managers, since they deal with standard IBM software. HP offers both SNA and Bisync communications products for communication with IBM mainframes.

A disadvantage of utilizing standard IBM SNA communications is that the performance is generally limited to that attainable over 56 Kbit/second links, far short of what can be obtained with a LAN. Because of the performance limitations, many site computer centers support alternative, non-IBM, connections to the mainframes.

Probably the most commonly encountered product is Hyperchannel, provided by Network Systems Corporation (NSC). Hyperchannel features a 50 Mbit/second link and supports a wide variety of computers in addition to IBM. Hyperchannel connections are available from NSC for HP 9000 computers.

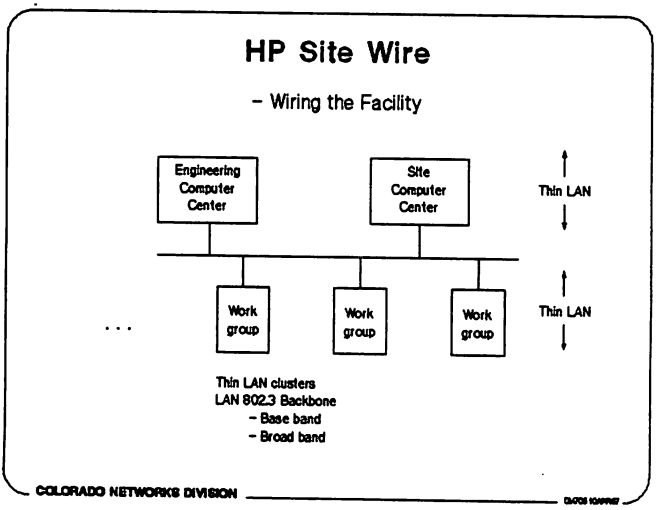
It is also possible to support the ARPA services on an IBM mainframe. Products are available from a variety of vendors. IBM also sells a TCP/IP/Ethernet product. Many of these products are new on the market and are not commonly installed. Where they are supported by the site computer center, they offer an additional high speed connection from the HP computers to IBM.

Many site computer centers also contain supercomputers such as Crays. Cray computers running the Cray Operating System (COS) support access via a protocol called Cray Station, which runs over 50 MBit/second Hyperchannel hardware. Cray Station software is available from Cray Research for the HP 9000 computers. Cray computers running the Cray version of UNIX (UNICOS) support ARPA services over an Ethernet LAN and can communicate with HP 9000 computers using this protocol.

In general, communication with the site computer center will

be via gateways between the engineering or facility LAN and the computer center. The gateways provide access to the computer center for other computers on the network and eliminate the need to install individual mainframe communication links for each computer. HP 9000 Series 300 computers can serve as these gateways.

HP SITEWIRE MODULE



The network of choice for most engineering applications today is IEEE 802.3. IEEE 802.3 supports two cabling options ThinLAN and ThickLAN. HP's recommended wiring scheme utilizes ThinLAN clusters for the engineering workgroups and engineering computer center. These ThinLAN clusters are connected to a ThickLAN backbone which runs throughout the facility. A device known as a ThinLAN Hub provides the connection between up to 4 ThinLAN subnets and the ThickLAN backbone. The ThinLAN and ThickLAN segments run at the same 10 Mbit/second link speed.

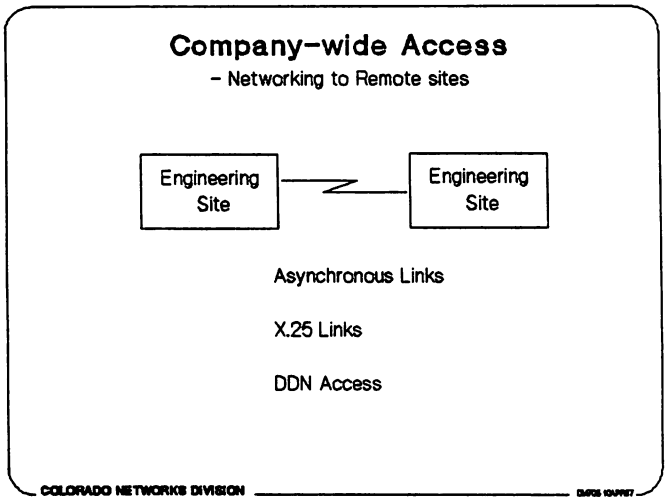
Small engineering networks can be created by using only a single ThinLAN network or by connecting up to four ThinLAN clusters with a single ThinLAN Hub.

ThickLANs can serve as backbones for networks of 1-2 kilometers in length. ThickLANs are baseband networks.

Broadband backbones are utilized to connect larger facilities or campuses. Broadband backbones use cable television technology to cover distances spanning many kilometers. Broadband backbones have the additional advantage of supporting many channels of communication. A single LAN can thus be used for computer to computer communications, terminal to computer communications, closed circuit television, and a variety of other uses. For this reasons, broadband backbones are sometimes installed instead of baseband backbones even for small networks.

HP supplies baseband networks. HP also supports broadband backbones through the use of recommended products from Ungermann Bass, such as the Buffered Repeater, which connects ThinLAN clusters to broadband backbones.

COMPANY-WIDE ACCESS MODULE



Although many engineering networks involve only a single site, there is often a requirement to connect engineering communities at several locations into a common network.

If the traffic between sites is not extensive, the simplest alternative is to use dial-up telephone lines and asynchronous modems. HP 9000 computers support standard UNIX communications services such as uucp and mail which utilize

these asynchronous modems.

In addition, the UNIX communications services can utilize X.25 networks through the use of an HP supplied X.25 multiplexer. The X.25 networks have the additional benefit of more reliable data transmission. In many cases they are also more cost effective than dial-up communications lines.

X.25 communications can be provided by public X.25 networks such and Telenet in the United States or Transpac in France. HP also provides switches which can be used to create a private X.25 network which would carry traffic for only a single company. Such a network may be of interest, for example, if there are special security or performance requirements. A private X.25 network also allows very tight control of network operations.

SUMMARY

HP AdvanceNet for Engineering provides comprehensive, standards based networking which meets the diverse needs of today's engineering community. Since HP AdvanceNet is based on standards, it provides a network which will evolve and endure for many years. Since it supports a multivendor computing environment, it offers flexibility in the selection of engineering computers.

HP is an active participant in the organizations defining future networking standards, such as the IEEE 802 committee, X/OPEN, the MAP Users Group, and the Corporation for Open Systems (COS). HP chairs several key working groups in these organizations.

As the requirements for engineering networks grow, HP AdvanceNet for Engineering will grow with them.

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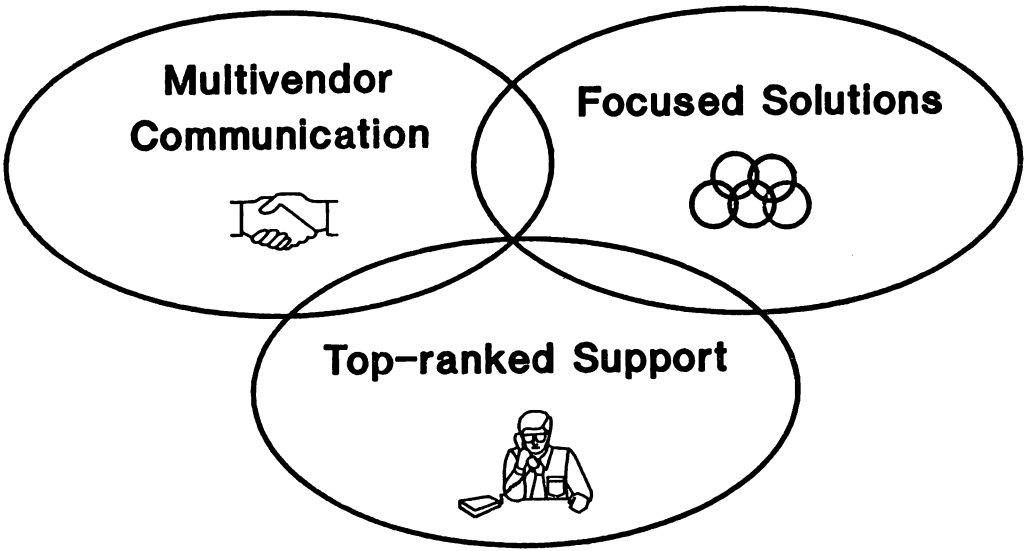
HP AdvanceNet

A *Strategy* for Integrated Networked Solutions



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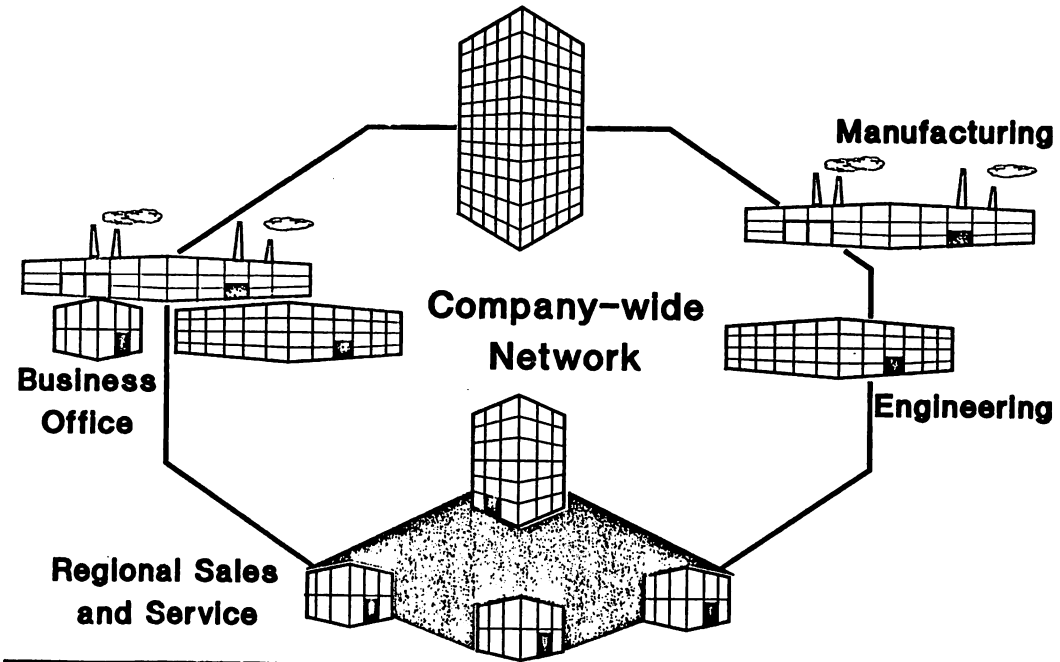
HP AdvanceNet: 5 Networking Solutions



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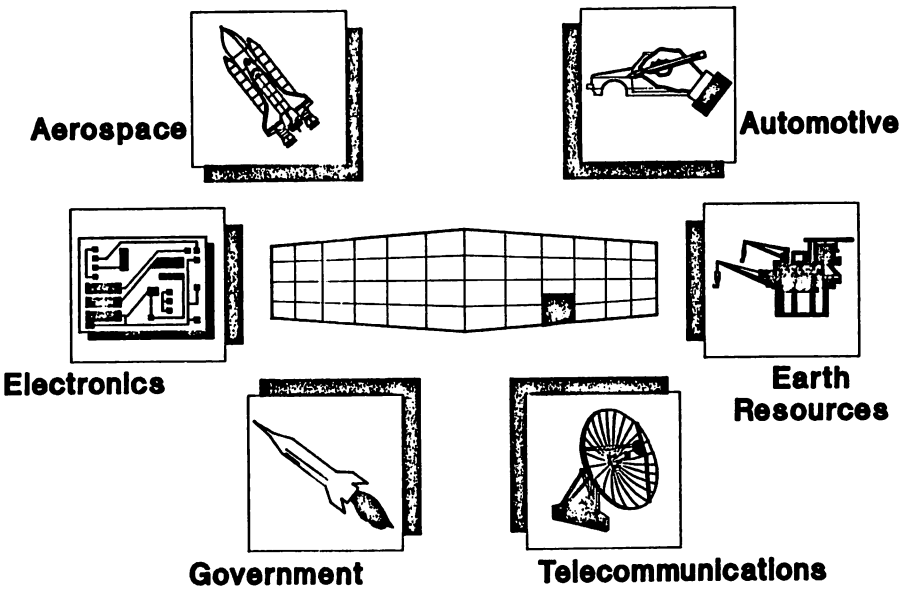
Engineering

HP AdvanceNet in Engineering



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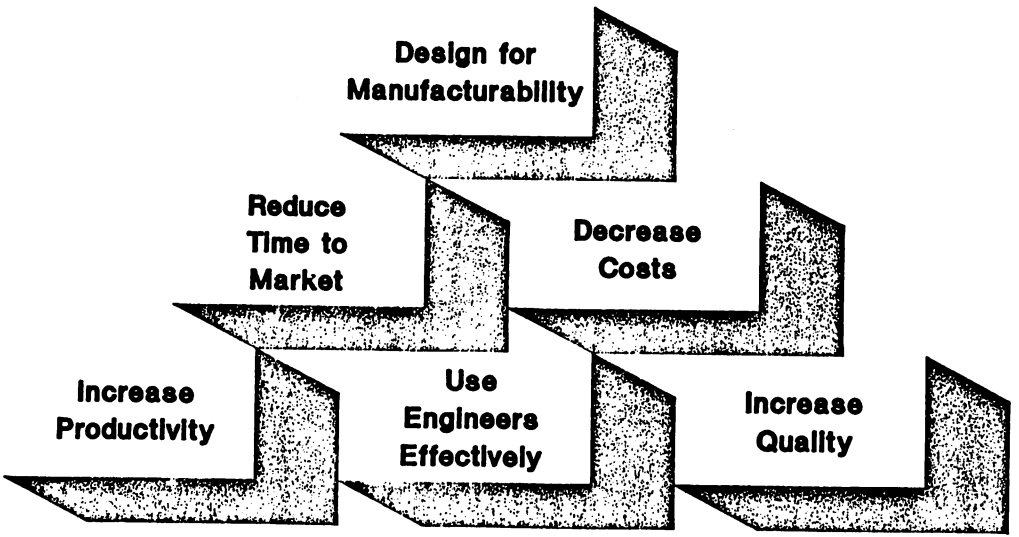
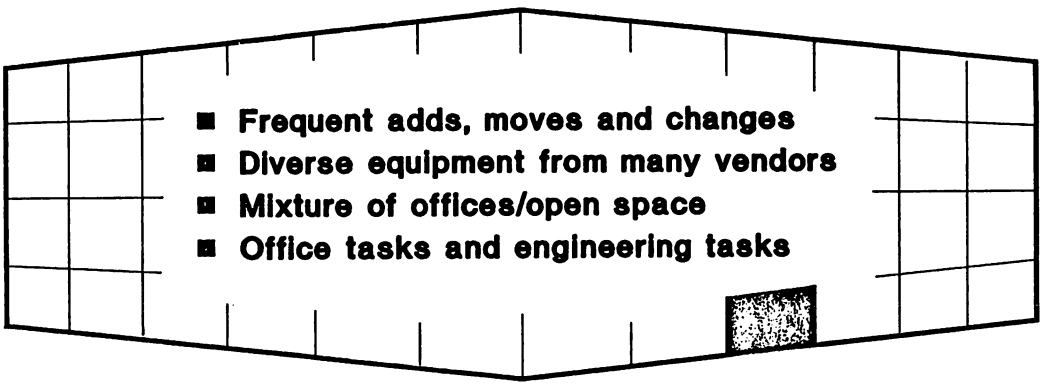
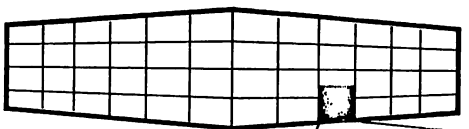
Engineering Management Challenges



Engineering Environment

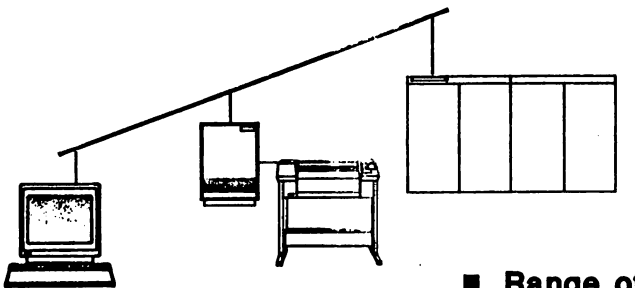


Trends In Engineering



- Engineering/CIM integration
- More simulation; less build and test
- Engineering resources scarcer and more expensive
- Tools more effective and less expensive

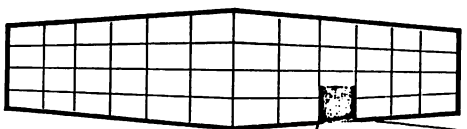
Engineering Computing Environment



- Range of computing power
- Multivendor networks
- Multiple versions of information
- Application dependent data
- System dependent applications

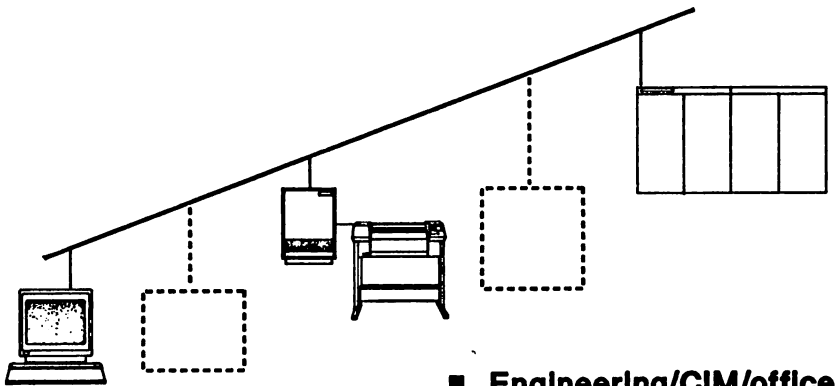
Engineering

Engineering Computing Trends



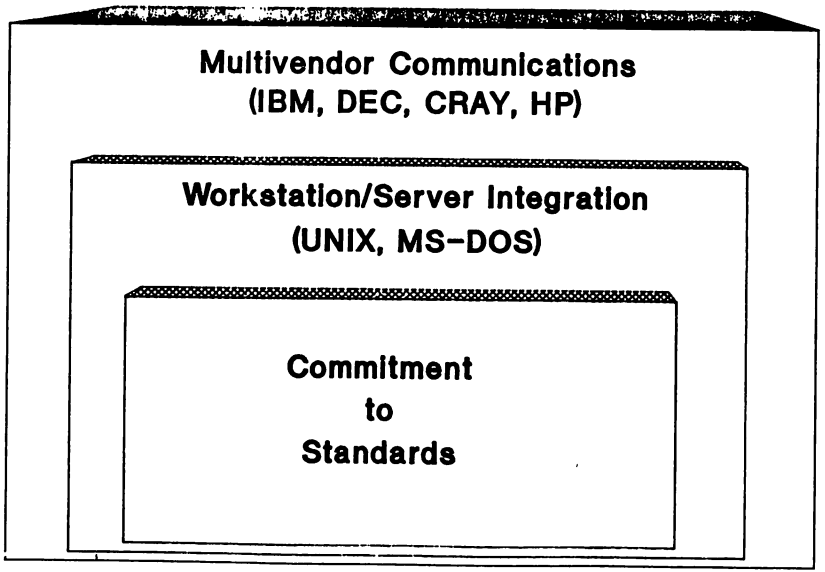
- Higher speed systems and networking
- Workstation/server integration
- Emergence of protocol standards
- Proposals for management standards

Engineering Computing Needs

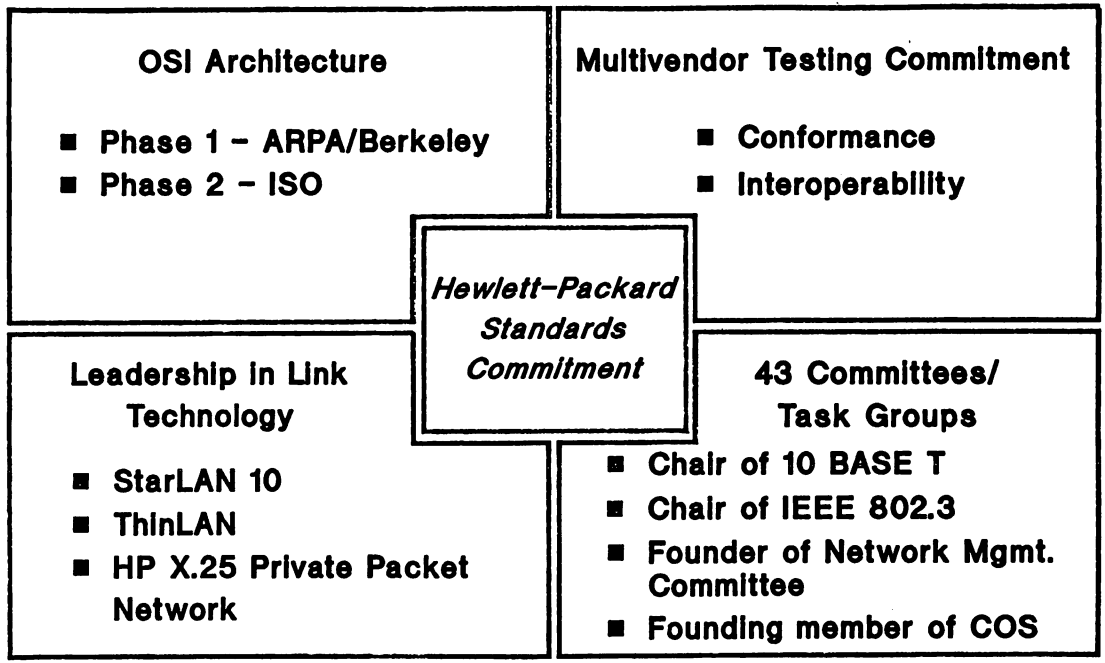


- **Engineering/CIM/office integration**
- **Invisible networks**
- **Simple, standard human interface**
- **Management control**

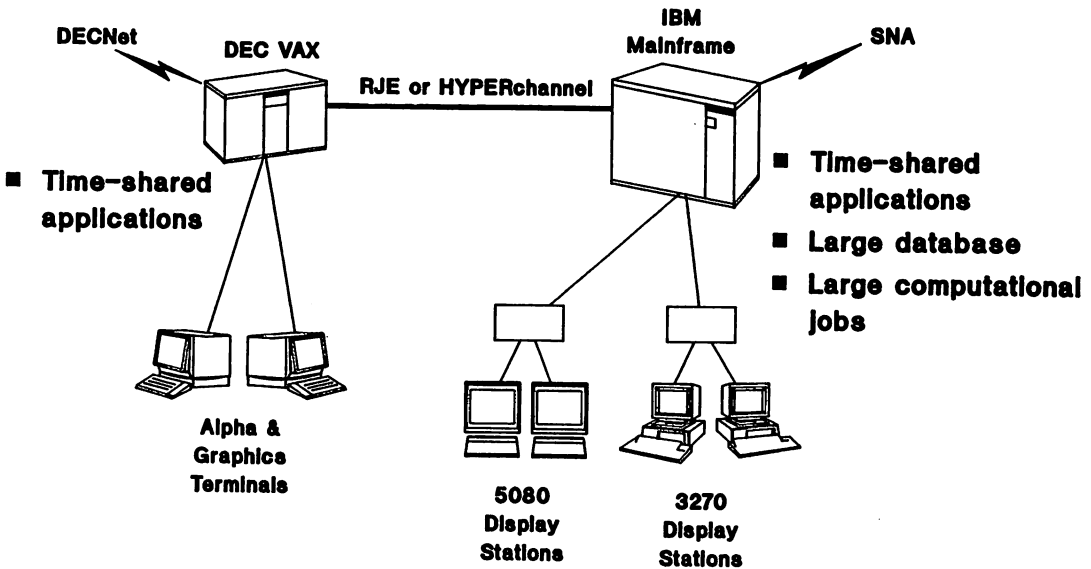
Engineering Network Strategy



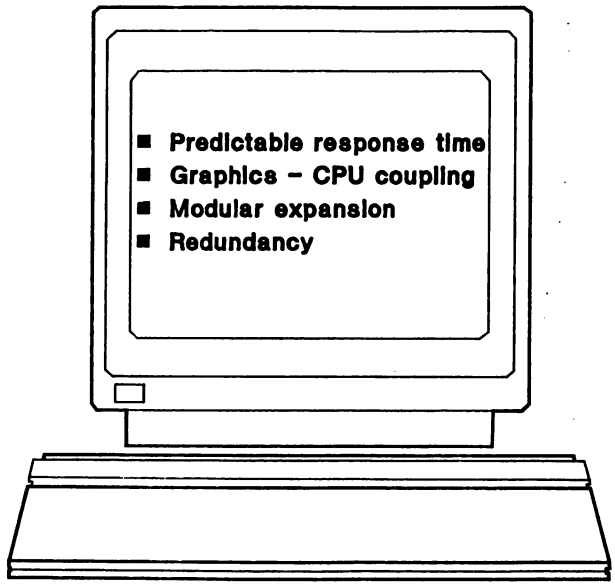
HP and Engineering Network Standards



Time-share Environment

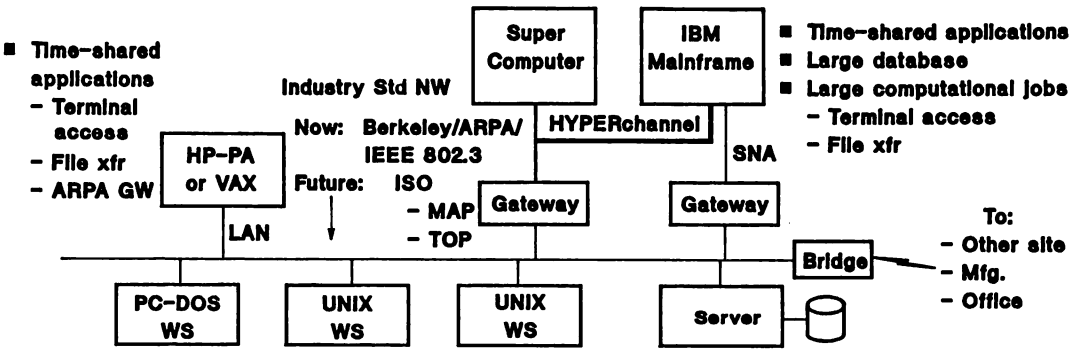


Engineering Workstations



Engineering

Model Environment



- Time-shared applications
  - Terminal access
  - File xfr
  - ARPA GW

- Time-shared applications
- Large database
- Large computational jobs
  - Terminal access
  - File xfr

- Dedicated applications
  - Terminal access
  - File xfr

- Range of WS perf. ($5K - $80K)
- Standard Bus (open system)
- Range of graphics (standards)
- System V; Berkeley 4.X ext.
- Windows
- Terminal access to network
- File xfr to network
- Diskless node
- AI capability
- Technical office automation
- Measurement automation
- PC-DOS SW
- Application specific SW

- Computation
- Distributed OS
- Shared relational database
- File sharing
- Peripheral sharing

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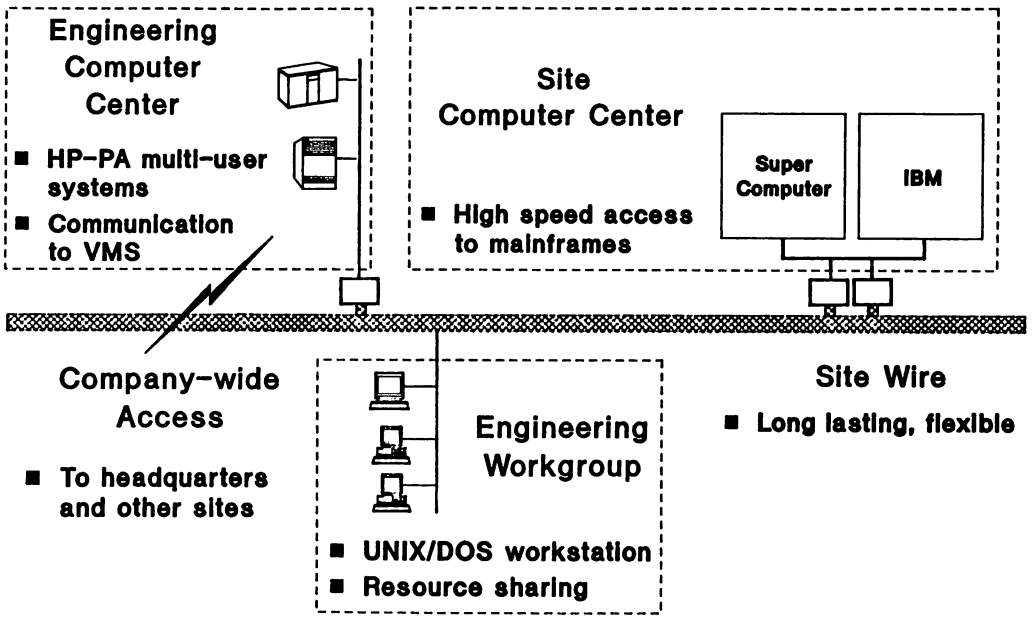
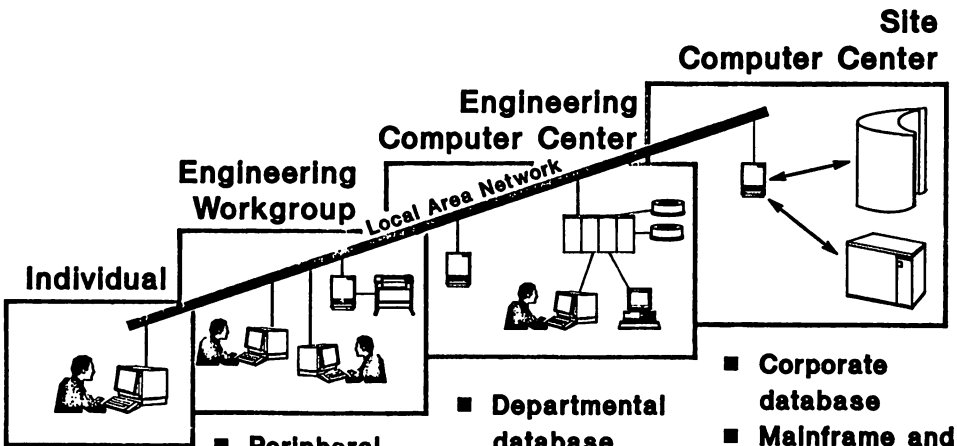
HP AdvanceNet Solution

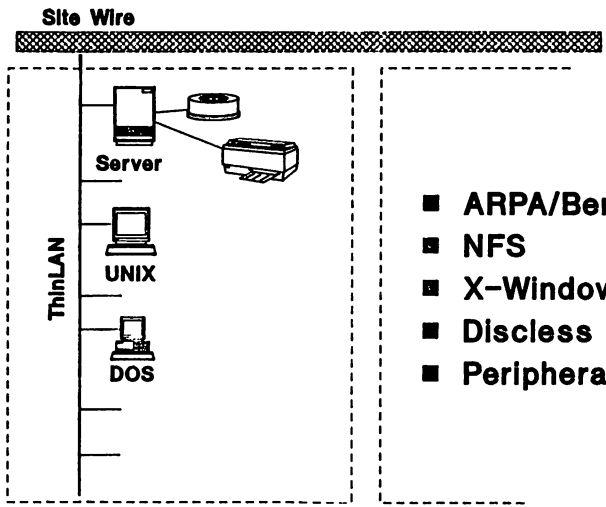


Engineering Computing Tiers



Engineering Workgroup Solution

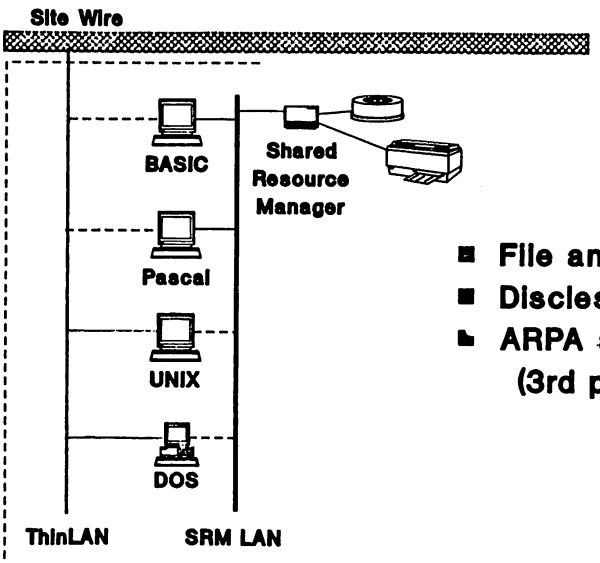
Linking an Engineering Project Team



- ARPA/Berkeley/HP NS (TCP/IP)
- NFS
- X-Windows
- Discless nodes
- Peripheral and file servers

Engineering Workgroup Solution

BASIC/Pascal Workstations

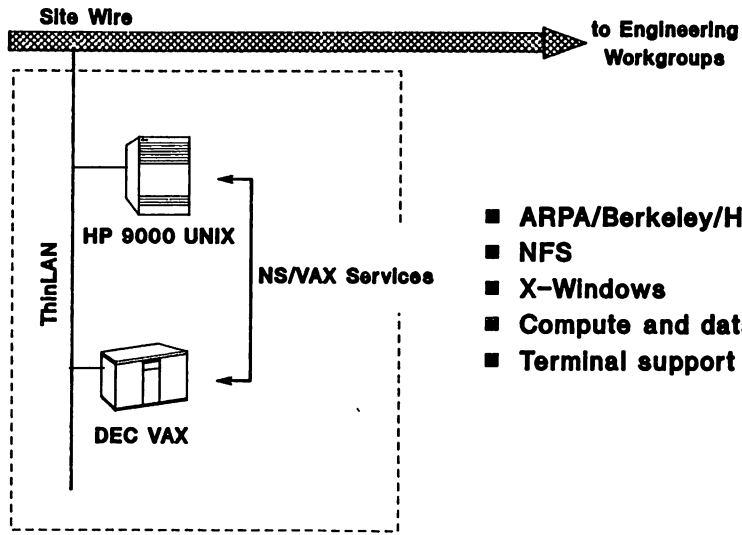


- File and peripheral sharing
- Discless nodes
- ARPA support via FUSION (3rd party)

Engineering

Engineering Computer Center Solution

Consolidate Departmental Resources



- ARPA/Berkeley/HP NS (TCP/IP)
- NFS
- X-Windows
- Compute and database servers
- Terminal support

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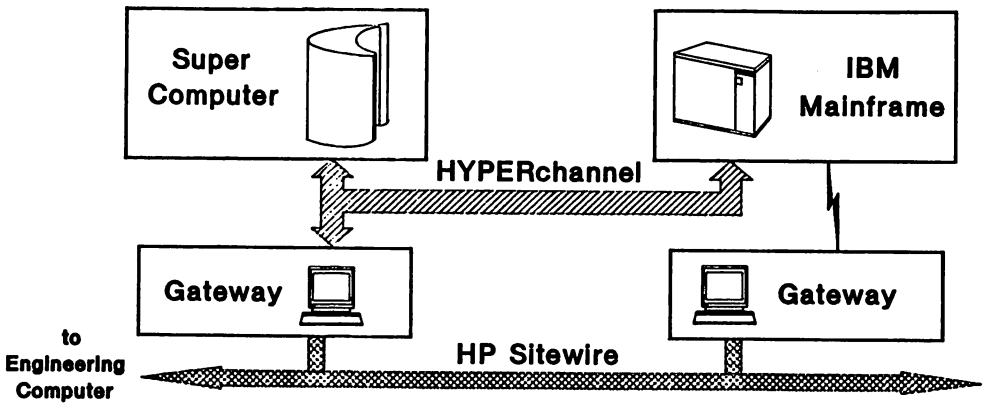
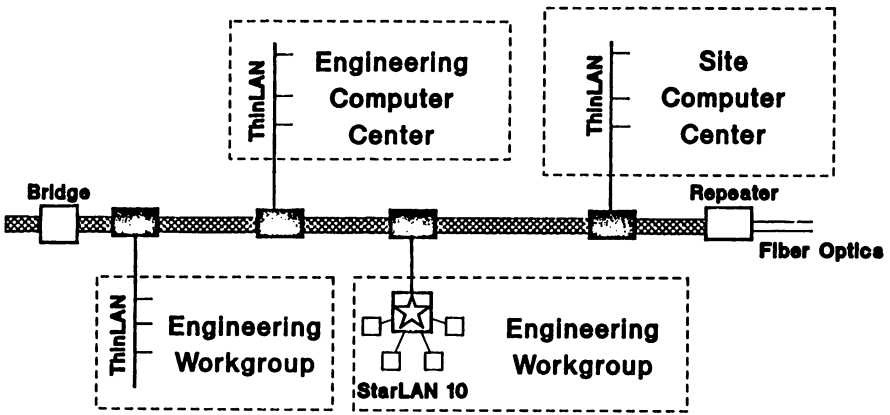
Site Computer Center Access Solution

Networking to the Mainframes



Site Wire Solution

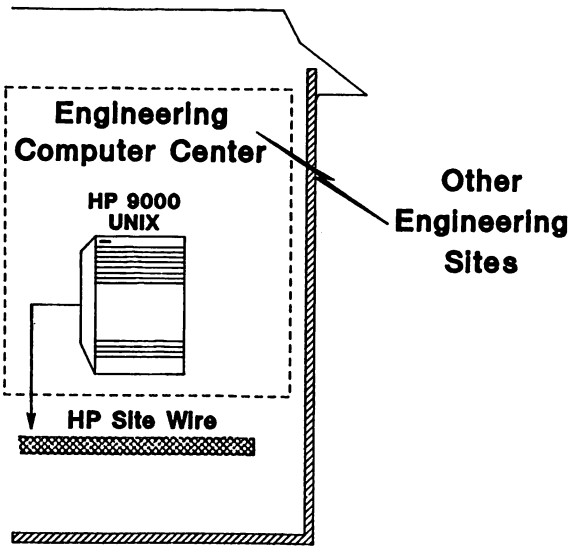
Wiring The Facility



- **Backbone**
  - Ethernet/IEEE 802.3 ThickLAN
  - Baseband or broadband
- **Subnets**
  - ThinLAN and StarLAN 10

Company-wide Access Solution

Networking to Remote Sites

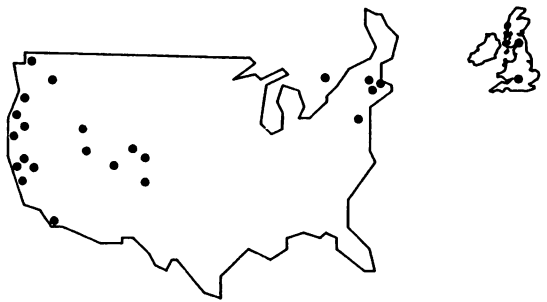


- X.25 links
  - ARPA services
  - Level III access
- DDN access
  - ARPA/TCP/iP
- Asynchronous links
  - uucp, cu

Engineering

HP Internet: Connecting HP R&D Labs

Largest TCP/IP Based Network in the World



Sites	*Operating Systems*	*Technology*
▪ 4500 nodes ▪ 27 divisions ▪ Expansion to include Canada, Europe, Japan, Singapore, Australia	▪ HP-UX ▪ VMS ▪ TOPS 20 ▪ Apollo Domain ▪ Symbolics LISP ▪ MS-DOS	▪ Broadband ▪ Baseband – (ThickLAN, ThinLAN, StarLAN) ▪ Satellite links ▪ Serial links: 9.6 Kbps, 56 Kbps, T-1, X.25

Engineering

HP Multivendor Network Support

PLAN	IMPLEMENT	OPERATE
	Network Support	
Network Planning & Design	Network Startup Network Prepare	NetAssure PPN Network Operation
	Systems Support	

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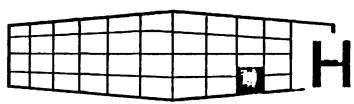

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