Upgrading and Repairing Networks

Introduction

Understanding Networks

page 5

Network background

The nature of the network

Heterogeneity

Modularity

Separate choices for network adapters, cabling systems, interconnection devices, network operating systems (NOSs), and network applications.

Standards

What to expect as input, and what the system must generate as output.
Hardware and software standards.

The scope of networking

6 mil internet host computers
20 mil people with internet access
enterprise level computing impossible to measure, isolated.

Growth rate

Network awareness

Network readiness

Technology

not new, 1970's technology.

Today's networks

Mix of old and new hardware and software.

Legacy systems

Progressive companies. Reluctance to move on to new network systems.

Upgrading and Repairing Networks

The modern network

Planned obsolescence.
No matter what capacity is provided, users will exhaust it within a matter of months.

Hardware

IBM-compatible PC's
Macintoshes
UNIX systems
in that order. Apple PowerPC, as yet, has not made a significant impact.

Software

LocalTalk, LAN Manager, and many others have faded from prominence.
Winners in the desktop market **are Novel NetWare for client-server systems** and **Microsoft Windows for peer-to-peer systems**.
Larger systems and a significant number of smaller systems are **TCP/IP based**.

Networking

The bulk of new **LANs** are **Ethernet** based.
Fiber-optic links between buildings.
Leased telecommunications lines, replacing public data network for wide area links.

LANs that are strictly local make less and less sense. ***Electronic mail*** *for network access. This requires a gateway machine and a connection to the outside world.* ***Internet access*** *may have replaced e-mail*

The future

Trying to predict future of computer networking is folly.
A number of trends:

Desktop hardware and software products.

Domestic network access.

Laptop and pocket PC's in the cellular communications world.

Utility companies providing complete network packages; where provider bundles a physical link with gateway and domain management services.
(Jury still out as to whether they can persuade network managers to go for this.)

Summary

Overview of network systems and services

A network is an interconnected system of computing devices that provide shared access to computer services.

Upgrading and Repairing Networks

Network operating system manages this access.
This chapter provides a high level view of the two main types of local area networks: client-server and peer to peer.
It also examines the LAN basic hardware structure.
LAN features and services.
Introduces many basic networking terms and concepts.

The Client/Server Network

The client/server concept describes a computing system in which the actual processing needed to complete a particular task is divided between a centralized host computer, the server, and a user's individual workstation, the client. The two are connected for communication (by cables, or infrared, radio, or microwaves).
The client requests services from the server, the server responds by providing those services.

A few examples:

A computer running DOS, requesting a file that is stored on a NetWare file server.

A PC running Windows 95, dialing out to a bulletin board using a modem connected to a RISC-based computer running Windows NT Advanced Server.

A Windows application on a user's PC, requesting data from a computer running Lotus Notes.

A PC running DOS and Sun's PC-NFS product, printing a large report using a high speed printer attached to a SparcServer.

A computer running OS/2, connected to a mainframe, receiving up-to-the-minute data about commodity prices, and displaying a constantly updated chart reflecting the price changes.

An Apple Macintosh Performa being used for photo-retouching of a high-resolution scanned image from a Scitex publishing system.

A PC, connected to the Internet, running Netscape Navigator and viewing multi-media documents stored on a UNIX host on another continent.

Upgrading and Repairing Networks

Server is generally more powerful, complex, and expensive machine -- running more powerful, complex and expensive software.

Concentrating the most expensive pieces of the network at the server allows those items to be maintained by professionals, while allowing many more people to use them.

Centralized location is not new -- mainframe host based systems run all the applications.

Distributed processing -- the server does some of the processing and the client does some.

Degree of distribution:

Basic File server

Performs high-performance data storage duty for multiple clients, perhaps providing shared print services as well.

Large Application server

Run high volume applications--such as database access, updating, indexing, selection, and retrieval--on behalf of less powerful clients.

Smaller, special-purpose servers

Provide fax services, electronic mail pickup and delivery, or modem sharing.

Software distinguishes difference between client and server.

Server software

The server is running a NOS or a smaller application on top of a high-performance general purpose operating system (OS), like IBM LAN Server or Microsoft LAN Manager running on OS/2.

This server software has special features:

extensive security measures designed to protect the system and the data it contains from unauthorized access,

enhanced file system software with features to protect files from damage or loss while handling simultaneous requests from multiple users,

communication system capable of receiving, sorting out, and responding correctly to hundreds or thousands of varied requests each second from different clients.

Dedicated computer

To support the demands placed on a server, it usually runs on a computer dedicated solely to the purpose of hosting that software and supporting it’s services.

Upgrading and Repairing Networks

The Peer-To-Peer Network

There are still clients and servers in a peer-to-peer network, but any fully functioning client may simultaneously act as a server.

The resources of any computer on the network are available to any computer on the network.

Peer-to-peer networking software

included to the base client OS, or

purchased separately as an add-on feature.

all nodes running same client OS
DOS, Windows for Workgroups, OS/2 Warp Connect, Windows NT, or Macintosh System 7.

some exceptions:

A PC running DOS can be a client in a Windows for Workgroups network, but it cannot be a server.

With TOPS, both PCs and Macintoshes can share resources as clients and servers.

ArtiSoft's LANtastic pee-to-peer systems can accommodate Macintoshes as clients, but servers must be DOS-based.

A PC running OS/2 usually can be configured to be either a client or server
in a DOS-based peer-to-peer network by running the DOS software in one or more DOS virtual machines, although the network resources may not be available to OS/2 applications.

Windows 95 provides peer-to-peer operability between all Windows OSs.

Windows for Workgroups, Windows 95, and Windows NT all ship with a fully integrated peer-to-peer networking functionality.

The ease which basic networking functions can be configured in these Microsoft operating systems bodes ill for add-on products like LANtastic and Personal NetWare, which offer few additional features.

Upper limit on number of nodes between 10 and 25.
Then use one of the peer to peer machines for dedicated server to handle as many as 50 or 100 clients that aren't too demanding.

When networks grow beyond this point,

it is time to migrate to a full client/server architecture.

The distinctions between client/server and peer-to-peer NOSs can get blurry at times.

common for a computer to be more or less dedicated to the role of a server, to provide good responsiveness.

conversely, the server OS in most client/server networks allows one or more client sessions to run on the same computer as the server.

Older computers can live on as:

print, mail, and fax servers.

Client/Server versus Peer-to-peer

Administrative factor

Low cost peer-to-peer

without the need for high-priced consultants or administrative talent.

Client/server

either hire an administrator

or engage consultants for a high hourly fee

High cost of NOS software

Migration from peer-to-peer to client/server has become simpler.

Simply adding a machine running Windows NT Advanced Server to an existing network of Windows for Workgroups, or Windows 95 machines all but accomplishes the task.

Adding a NetWare server to such is not difficult either, although it will be necessary to reconfigure all the workstations to accommodate both network types.

Fundamental Networking Concepts

The network itself, the medium that links all of the component computers and the data communications conducted through it.

Communication Levels

OSI network model

designed to illustrate the seven basic levels of network communication

from physical medium of a network all the way up to the application interface appearing at the workstation.

Upgrading and Repairing Networks

Protocols
Communication rules for the communication levels.

Unshielded twisted pair (UTP)
refers to the physical layer.

Ethernet
functions at the data link layer.

Transport control protocol/ Internet protocol (TCP/IP)
works at the network, transport, and session layers.

NetWare core protocol (NCP)
govern the presentation and application layers.

Cable Types

Coaxial Cable

similar to TV cable

Twisted-Pair Cable

Shielded (STP)or
used in some token ring networks

Unshielded (UTP)

by far the most popular LAN cabling

used in many token ring, majority of ethernet

Telephone network

Fiber-Optic Cable

Network Topologies
cabling pattern

Bus topology

Star topology

Ring topology

Mesh topology

Upgrading and Repairing Networks

Hybrid topology

Data Link Standards

Ethernet

Token Ring

Fiber Distributed Data Interface (FDDI)

Copper Distributed Data Interface (CDDI)

LocalTalk

ARCnet (Attached Resource Computing Network)

Repeaters, Bridges, Routers, and Switches

This section deals with the ways individual data link segments can be connected to form large networks.

Repeaters

Repeat every signal received on one port out to all it's other ports.

Bridges

Extend a network's reach beyond the strict limits of the repeaters.
Operate at a higher OSI layer, the data link layer.

Routers

Operate at a higher OSI layer, the network layer.
Extend a network's reach beyond the strict limits of the repeaters.
Each network is identified with a unique network address.

Switches

Recent technology designed to meet the demand for more bandwidth in Ethernet networks.
Ethernet switches are just extremely fast bridges with many ports
May replace the traditional router.

Network Services

File serving and sharing

The (DOS) file allocation table (FAT) file system

The Macintosh file system

Upgrading and Repairing Networks

The high performance file system

The windows NT file system

The NetWare file system

File sharing

Single and multi-user file access methods.

Automatic and Manual file locking.

Sharable files and transactions.

Page, block, or record locking.

Printer sharing.

NetWare print queues

NetWare print servers

Network printers under NetWare

Printing security

Network accounting and auditing

Local area network communications applications

E-Mail

Group Scheduling

Forms-Based Workflow

Summary

The OSI Model: bringing order to chaos

Open Systems Interconnection (OSI)
A structure that was designed as a general guideline to the various levels of communication that take place in a data network.

Upgrading and Repairing Networks

The Physical Layer

The Data Link Layer

The Network Layer

The Transport Layer

The Session Layer

The Presentation Layer

The Application Layer

extremely complex protocols
interface between the workstation and the network.
90% of the bits actually transmitted over the network.
therefore, the efficiencey of the network is more dependent on the application layer.

Application service elements (ASEs)

All the basic standards of the application layer are now referred as ASEs.

Application program interface (API)

APIs are tools which application developers use to call on specific (network) functions from within their programs.

Association service control element (ASCE)

An ASE used by all applications requiring network access, which allows association to be made between two application processes (Aps) located on different end systems. At the application layer we speak of associations between applications, not connections.

Upgrading to a WAN

Wide area network. Beyond the boundaries of a single building. Why? Flexibility of location, improved communication between branch offices, centralized, company-wide backup system. central file storage, access to each other's information.

Differentiating a WAN from a LAN

Speed

Until recently, WAN was generally slower.

Accessibility

Remote control access.
allows client to control a physical computer attached to the network.

Upgrading and Repairing Networks

Remote node access.

allows the client to dial in and become a member of the LAN, but a much slower one.

Telecommuting

Most remote connections are more LAN like than WAN like.

What's a MAN?

Metropolitan area network.
Defines the area of a local access telephone area (LATA).

Understanding WAN Terminology

WAN-specific terminology

Packets

contain both the data and the means to get the data to it's specific destination.

Think of regular postal mail

An "envelope" identifies the packet as a unit in the flow of correspondence.

The addressing information on the envelope notes the recipient and usually the sender.

The envelope contains the actual data, which makes the bulk of the packet.

The Envelope

Some kind of standard container.

The Addressing

address of intended recipient.
senders address, for acknowledgment.
datagrams, don't require acknowledgment.

The Data

amount of data in packet depends on type of packet.
frames, used in frame relay, contain more data than cells.
the size of the packet will always be greater than the amount of data in it.

Packet switching versus circuit switching

Packets use different method of getting from point A to point B than other data forms do. This method is known as packet switching.

Upgrading and Repairing Networks

Establishing virtual connections

Practical differences

A packet switching network requires some additional information to get the data to its destination.
There may be a slight delay as the packets get to their destination, as the network figures out where they're going and how to get them there.
Until recently, packet-switching networks did not allow for transmission of time-sensitive information such as real-time video or voice.

Speed, bandwidth, and throughput

WANs are usually slower than LANs.

1-2 megabits per second (MBps) - for a good wide area connection.
10 Mbps for an ordinary Ethernet.
16 Mbps for a fast token ring.

WANs speed not bad at all for the proper applications,

as long as you've got your system configured properly. For example, keep as many applications on the LAN as possible and make sure that applications don't automatically search the wide area connections first.

"Throughput", not speed,

is the accurate measure of a WANs effectiveness. Throughput is the measure of how much data actually gets from point A to point B in a given time period. Throughput is a function of the speed combined with the size of the pipe, or bandwidth.

Bandwidth is

the amount of data that can be squeezed into the physical medium of the cable at one time.

Speed is

easier to get than bandwidth.

Key is using bandwidth

Effective use of bandwidth to increase throughput is the key to making many WAN technologies work for you.

Speed x Bandwidth = Throughput

Error control

Send duplicate packets

Cyclic redundancy checking (CRC)

Upgrading and Repairing Networks

Data flow

Half duplex connection

one direction at once

Full duplex connection

both directions at once

Access areas and WAN's

The way the telephone system is structured drives the way data services are structured.

The FCC mapped the US into LATAs.

within - local carrier.

between - long distance carrier.

LATAs affect the cost of data services.

Types of WANs

Integrated services digital network (ISDN)

Distance

Connection charges

Preparing for ISDN

.....

Switched multimegabit data service (SMDS)

How SMDS works

Security: Creating virtual private networks

.....

Using fiber distributed data interface (FDDI) across a WAN

Applications

Hardware requirements

Upgrading and Repairing Networks

Security

.....

Wide area ATM

Frame relay

How frame relay works

Shared bandwidth

Guaranteed throughput

Congestion handling

X.25

For places with less reliable wide area connections.
X.25 is an access protocol.

Physical layer

Link layer

Network layer

Summary: Choosing a WAN type

ISDN

....

SMDS

....

FNS

....

Frame Relay

....

Upgrading and Repairing Networks

X.25

....

Questions to consider:

....

Hardware Platforms: Servers and Workstations

page 133

The server platform

The file server

Gateway to computing resources.

Security device.

Usually, no hardware difference between file server and normal workstation PC.

same resources, but, greater abundance: faster processor, more memory, greater disk space, wider array of peripherals.

Software

file server -- Network operating system (NOS)

client -- client operating system (OS), such as DOS.

How many Servers

super-server

admin. tasks are centralized

many servers

distributed network environment

fault tolerance

Upgrading and Repairing Networks

geographical organization

About the motherboard

The motherboard provides the means by which data is transferred from the storage medium to the processor and back again.

Backplanes

In years past minicomputers and mainframes used backpanes or wiring systems of a modular design that allowed for the simple replacement of individual parts.

Documentation

Document your file server's motherboard!

Microprocessors

CPU

Central processing unit (CPU) is where all the calculations take place.

Storage media

Hard drive space, memory, and even caching RAM are all merely storage media.

Integrated circuits

thin silicon wafers, grown like crystals, exposed to intense heat, exposed to gases containing particles, conductivity in precisely specified areas.

Microprocessors

A microprocessor is a component that, when furnished with a particular set of electrical signals input at specific points, will always return exactly the same response.

CISC and RISC Processors

Complex instruction set computing.
Reduced instruction set computing.

CISC

- microcode - the alphabet upon which its command set or language is based.
- microcode runs on a nanoprocessor operating level within the microporcessor.
- allows a rich and varied instruction set,
- but, also introduces an added layer of processing overhead that can lessen the overall instruction execution speed.
- operational model for the entire Intel PC microprocessor family.

RISC

- 20% of the instructions in the command set were performing 80% of the work.

- RISC design optimized performance of these frequently used commands at the expense of the seldom used ones.
- RISC processors eliminate the microcode layer, substituting a relatively small vocabulary of simpler commands that can be combined to emulate the seldom used commands.
- RISC processors: Windows NT, UNIX, SunSoft's Solaris,

File Server Processing

Do not overtax server

Normally the average file server should not be overtaxed, However, in the case of servers that run database, or other processor intensive applications, it is important the server not be overtaxed because delays in network file access may result.

Application servers

Machines such as these can be more appropriately be called application servers, rather than file servers. Consider using multiple servers to separate these functions.

Novell NetWare

Limited to the Intel processor.

Buying new processors

Get the best available.

Other microprocessors

- Cross platform support of Windows NT indicates the direction in which the networking industry is going.
- Several of the cross-platform NOSs now available might be better served by non-Intel processors.
- UNIX platforms more mature, more specialized.
- This section focuses on platforms supporting the newer NOSs that have attracted the attention of NetWare shops, due to the growing number of powerful applications which run on them.
- The future of networking will be in open, mixed environments, in which compatibility is a given.

MIPS technologies

RISC based

MIPS R4x00 microprocessors

These R4x00 can run Windows NT 3.5 or UNIX V.4 as well as specialized on-line transaction processing systems (OLTP).
Windows NT support allows for compatibility of the entire line of x86-based 16-bit DOS and Windows software, as well as the newer 32-bit applications being designed for the NT platform, thus opening the door for a whole new world of users.

Upgrading and Repairing Networks

64-bit architecture

MIPS R4x00 microprocessors are based on a true 64-bit architecture.

with

full 64-bit registers

virtual address space

integer and floating-point operations

an extended 36-bit address bus gives them a 64G physical address space.

The capability for a 64-bit wide virtual address space is what makes them true 64-bit processors with virtual address space of 1 terabyte.

Able to execute one instruction per clock cycle, the R4400 has separate 16K level 1 write-back caches for instructions and data. The caches are virtually indexed, to allow for simultaneous data accesses and the data cache has a two-entry store buffer so that two store operations per cycle can be executed without latency penalties or the need for instruction pairing, as in the Pentium.

DEC Alpha AXP

Designed for next 25 years, no bottle necks, more instructions per clock cycle, 64-bit RISC architecture.

DEC has the fastest microprocessors on the market.

High cost, though.

For heavy duty application server, one DEC might be able to replace a more complex multi-processor system.

PowerPC

High performance processors

- Developed jointly by IBM, Motorola, and Apple.
- 32-bit implementations, scaleable up to a full 64-bit data path.
- 32K instruction and data caches
- 133mhz clock speed.

Open standard

- Common instruction set architecture - open standard
- Open standard will eliminate the possibility of a single chip manufacturer monopoly.

Upgrading and Repairing Networks

Multiple processors

SMP

Symmetric multiprocessing (SMP)

Next step, multiple processors

Next step, previously demonstrated by the mainframe world. is to use multiple processors in a single machine, accessing a single memory array to share an application's processing tasks evenly among them.

Alterations required

- Multiple processing requires significant alterations in both hardware and software.
- Among LANs, it is primarily on various flavors of UNIX.

High performance workstations

used for graphics, CAD, and financial work, as well as large database and OLTP servers, have long made use of multiprocessors manufactured by IBM, DEC, and MIPS.

Windows NT multiprocessor support

made available the possibilities of multiprocessor systems to the Intel-based commercial desktop LAN environment.

Novell has released an SMP add on package for NetWare 4.1

Intel standard

APIC controller and ICC bus

The essential difference in hardware will be the inclusion of an advanced programmable interrupt controller (APIC) that allows communication between individual processors as well as between processors and the I/O system, over a separate bus called the interrupt controller communications (ICC) bus.

Memory

DRAM chips limit speed

Intel microprocessor speed has advanced from 4.7 MHz to 133 MHz, with more to come, and same for potential throughput, but the standard dynamic random access memory (DRAM) chips have a maximum refresh rate of 54 nanoseconds which works out to a peak transfer speed of 18.5 MHz on a bus that can run at speeds of up to 66 MHz.

Additional speed can be added

- through a layer of static RAM (SRAM) cache between main memory banks and the microprocessor.
- but, SRAM chips are larger, hotter, and ten times more expensive than normal DRAM.

Upgrading and Repairing Networks

The primary memory array (DRAM)

- capacitors - hold a charge.
- transistors - read the state of the capacitor's charge.
- refresh overhead imposes a speed limit on the technology.
- SIMMS (single inline memory modules): small circuit boards, mounts for the memory chips.

Adding and replacing memory

- Identifying SIMMS
- Removing SIMMS from the motherboard
- Number of pins
- Chip speed
- Parity
- Error checking and correcting memory
- Purchasing memory
- Installing memory
- RAM Caches (SRAM)
- How caches work
- Cache designs
- Memory interleaving
- New memory technologies
- EDO DRAM
- Synchronous DRAM
- Cached DRAM
- RDRAM

I/O Bus Types

- ISA (industry standard architecture)
- MCA (micro channel architecture)
- EISA
- VESA local bus
- PCI
- Combining VLB and PCI
- Motherboards and chipsets

Disk Subsystems

Storage technologies

ESDI (enhanced small device interface)
early 1980's
good for workstation use, but poor choice for file server, because of downtime if they fail.

SCSI (small computer systems interface)

"scuzzy" is the predominant file server storage interface.

SCSI storage technology

The SCSI standards

- SCSI-2
- SCSI-2 options
- Differential SCSI
- Tagged I/O process queuing
- Fast SCSI
- Wide SCSI
- SCSI cables
- Termination
- SCSI-3
- SCSI hardware
- SCSI hard disk drives
- SCSI ID and termination
- Other SCSI hard drive settings
- Other SCSI devices
- Logical unit numbers
- Compatibility
- SCSI host adapters
- Host adapter configuration
- SCSI drivers
- ASPI
- One final note

Network Interface Cards (NIC)

The Case and the Power Supply

Pre-Built or "Roll-Your-Own"

Summary

The workstation platform

Workstation Types and Specifications

Upgrading and Repairing Networks

The IBM PC

The XT

The AT

286
1984

Real Mode versus Protected Mode

Real mode emulates the 8086 processor, including the ability to address only 1M of memory.

Protected mode allows the computer to access all the memory capabilities, both physical and virtual that are present in the machine. Plus provides processor with ability to multitask.

Several problems with protected mode:

Memory still broken up into 64K blocks.

Could not be set back to real mode without restarting the computer.

Full three years before an OS developed to take advantage of protected mode, OS/2.

Some time later, Windows 3.0 became first commercially successful OS to make use of the 80286's protected mode.

Due to the lack of software support, the 286-based computer was relegated to the role of a somewhat faster version of the XT.

The Clone Wars

Networking ATs

Primary drawback

general inability to load drivers into the upper memory blocks above 640K, for most ATs and AT clones.

all network drivers have to be loaded into conventional memory, which can seriously diminish the capability to run programs.

Upgrading Ats

"snap in 386" performance gain would not be worth the effort, if you could find the chip. Upgrade to video graphics array (VGA), or even EGA to conserve the sight of your users.

Upgrading and Repairing Networks

The Intel 80386

1987
faster chip
wider bus
fundamental architectural changes , capability to move personal computing into the age of multitasking.

80386DX and 80386SX

386DX was full 32-bit processor: internal registers, data bus, and memory address lines. This doubled the width of the pathway in and out of the processor when compared to the 286. 386 could address up to 4G of actual, physical memory chips, and up to 64 terabytes of total memory. Speeds up to 25 MHz and 33 Mhz.
386SX was designed as an entry-level processor. Speeds of 16MHz and 20MHz. Identical to the DX in every way except external bus was only 16 bits wide and that it had only 24 address lines, same memory -handling capacities as the 286: 16M physical and 1G of total physical and virtual.

Operational Modes

The real innovation behind the 386.

Real mode and Protected mode.

system always boots into real mode, which still emulates the 8086 processor exactly, for compatibility with existing DOS programs.
Switch from protected to real mode and back, without resetting.

Virtual Real mode

allowed existing DOS programs to be multitasked, without altering their code.

allows individual virtual machines to be created on a single system.

The fundamental innovation of Microsoft Windows: distributing the processor's clock cycles evenly among the virtual machines in a rotational manner.

This mode dependent on the Windows OS.

Windows bundled with nearly every PC, by OEM agreement with PC vendors.

Upgrading and Repairing Networks

Upgrading and Repairing Networks

Processor Upgrades

80386 Upgrades

80486 Upgrades

Replacing the Chip

Microprocessor Interchangeability

Memory Upgrades

Workstation Storage Subsystems

Older Technologies: ST-506/ST-412

ESDI

SCSI

IDE

The AT Attachment Standard

Enhancements to the IDE Command Set

Sector Translation

IDE Drive Limitations

Enhanced IDE

ATA Enhancements

Breaking the 504M Barrier

Fast Data Transfers

Non-Hard Disk Device Support

Dual host adapters

The future of enhanced IDE

Upgrading and Repairing Networks

Network interface cards

Two interfaces

System bus parameters

Network connections

Performance features

Workstation NIC selection

NIC configuration settings

I/O port address

Shared RAM

DMA Channel

Optional ROM

Connector Type

Configuring the adapter

Choosing NIC Settings

Setting the NIC

Testing

Resolving conflicts

Cases

Summary

Major network types

Understanding Terminology

Chapter 3 “The OSI Model: Bringing Order to Chaos,” . Each of the seven layers has its own set of terms, definitions, and industry jargon.

This chapter is concerned with the two lowest layers, the physical and data link layers.

Upgrading and Repairing Networks

Fundamental of Network Communications

Packet

The packet is the basic unit used to send data over a network connection. At this level it is also referred to as a frame. (Each level adds frames, this level's frame is the packet.)

Attributes of Network types covered in this chapter

A physical medium

used to carry signals between networked devices.

A packet

or frame configuration that consists of a standardized set of bits used to carry data over that medium.

A set of media access rules

that allow multiple networked devices to arbitrate access to the shared network medium.

Ethernet and its variants

Ethernet Standards

Digital Equipment, Intex and Xerox, DIX Ethernet, Institute of Electrical and Electronics Engineers

IEEE 802.3 Carrier Sense Multiple Access and Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications

Thick Ethernet, or Thicknet (10base5)

Logical Link Control (LLC) Sublayer

LLC function is to effectively isolate all of the functions that occur below this layer from all the functions occuring above it.

Media Access Control (MAC) Sublayer

MAC sublayer arbitrates access to the network medium.
Carrier sense multiple access with collision detection (CSMA/CD)

CSMA/CD: The Ethernet MAC Mechanism

Upon collision detection, transmitt jam pattern. Randomized delay interval.

The Capture Effect

The Ethernet/ 802.3 Frame (Format) Specification

Preamble

Start of Frame Delimiter (SFD)

Destination Address

Source Address

Length

Data and Pad

Frame Check Sequence (FCS)

Media Access Components

Medium dependent interface (MDI)

Transceiver (MAU)

Thin Ethernet

Thinnet, cheapernet, or 10Base2

Unsheilded twisted pair (UTP)

802.3I 10BaseT, An adaption of telephone cabling to Lan use.
Uses distributed star topology, concentrator or hub. Avoids Christmas tree effect.

Fiber-Optic Ethernet

FDDI

Broadband Ethernet

Multiplexing

Multiple signals are all transmitted at the same time, and the receiving station chooses the appropriate one by selecting a certain frequency to monitor.
10Broad36

Configuration guidelines for multiple ethernet segments

Software Platforms: NOSs and Clients

page 311

Upgrading and Repairing Networks

Upgrading and Repairing Networks

Adding network printing

Adding network CD-ROMs

Adding network modems

Adding internet access

Adding remote network access (telecommuting)

Adding diskless workstations

Adding wireless networking

Troubleshooting Hardware and Software Problems

page 967

Network management and SNMP

(simple network management protocol)

Locating the problem: server versus workstation versus links

Repairing common types of problems

Appendixes

page 1045

Upgrading and Repairing Networks