

# Network/Internet

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## Presentation Outline

- Introduction
- Network Hardware and topology
- Reference Models and data transmission
- Protocol
- Internet: past and current
- Common internet applications
- Advanced internet application
- What is the future?

## What is Network

Network:

- collection of computers that are interconnected so that any computer can send messages to any other computer simply by giving the receiver's network address at the start of the message.

• Ex:

*You work with one network every day, the telephone network.*

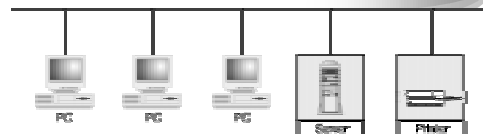
## Network Hardware

- Local Area Networks (LAN)
- Wide Area Networks (WAN)
- Wireless Networks
- Internetworks

## LAN Topology

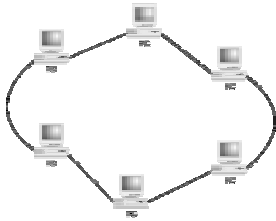
- 1. Bus Topology
- 2. Ring Topology
- 3. Star Topology
- 4. Switched Topology

## Bus Topology



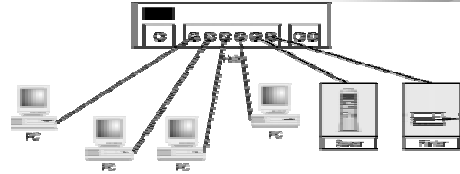
- all networked nodes interconnected
- peer-to-peer
- using a single, open-ended cable (bus)

## Ring Topology



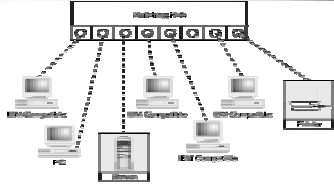
- physical loop, or ring
- unidirectionally
- repeater

## Star Topology



- Connections radiate out from a common point(hub)
- Each device can access the media independently.
- Share the hub's available bandwidth

## Switched Topology



- multiple connections to a switching hub
- increase the aggregate bandwidth
- reducing the number of devices to share the bandwidth.

## Data Transmission

How could data be transmitted?

## Airline System



## OSI Reference Model



- seven-layer model of communications
- protocol architectures

## OSI Model

- Physical Layer
  - provides the physical transmission service
- Data Link Layer
  - reliable transfer of data across the Physical link.
- Network Layer
  - providing routing services

## OSI Model (Cont.)

- Transport Layer
  - orderly and reliable delivery of data between end systems.
- Session, Presentation and Application layers
  - services useful to applications.

## Protocol

- What is protocol?
  - a set of mutually accepted and implemented rules at both ends of the communications channel, for the orderly exchange of data.

## TCP/IP

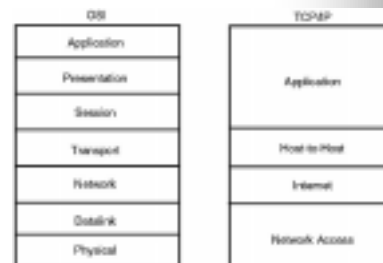
- Transmission Control Protocol/Internet Protocol
- Benefits of using TCP/IP as the transport provider
  - TCP/IP provides an enterprise-wide network solution.
  - TCP/IP is an open standard.
  - Connectivity to the Internet
  - TCP/IP provides robust WAN connectivity.

## TCP/IP Reference Model

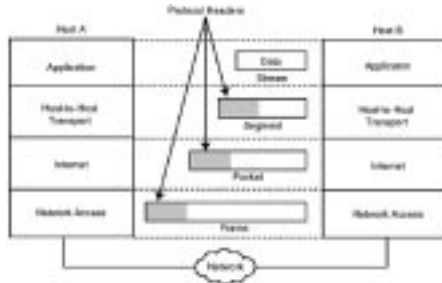


- four-layer model
- three sets of interdependent processes
  - application-specific
  - host-specific
  - network-specific

## TCP/IP architecture vs. OSI



## TCP/IP Peer Talk



## Network Access Layer

- Defines the protocols responsible for the delivery of data to devices that are sharing the same physical network
- Network Interface Card (NIC): The NIC is the piece of hardware interface that provides the physical communication service to the host to which it is attached.
- Network Access Protocols
  - Address Resolution Protocol (ARP): resolves symbolic IP addresses into their corresponding MAC addresses

## Internet Layer

- Routing data from point A to point B around the internetwork across intervening routers.
- Protocols
  - Internet Control Messaging Protocol (ICMP)
  - Internet Protocol (IP)

## IP main features

- A connectionless and unreliable protocol
  - connectionless: IP does not attempt to establish a connection with its peer before sending data to it.
  - Unreliable: IP does not care about the quality of the data it delivers around the network.
- Functions:
  - Data encapsulation and header formatting
  - Data routing across the internetwork
  - Exchanging data across protocol boundaries with other protocols
  - Fragmentation and reassembly

THE  
INTERNET

## The beginnings: ARPANET

- 1957, ARPA, Advanced Research Projects Agency of DoD.
- 1969, ARPA established ARPANET, the forerunner of the Internet.
- NSFnet Served as the major backbone until 1995.



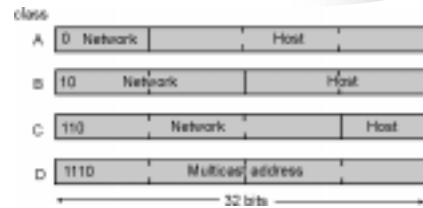
## Theoretical Limit

- $(2^{32})$  (for 32 bits IPv4)
- $\approx (2^{10})(2^{10})(2^{10}) * (2^2)$
- $= 1000 * 1000 * 1000 * 4$
- $= 4,000,000,000$

Now: 70,000,000 active

## IP Addressing

IP = Network address + Host address



## Addressing scheme

- IP = Network address + Host address
- A: 0-127
- B: 128-191
- C: 192-223
- D: 224- 254 (reserved)

## How to be part of it

- Getting your feet wet
- Jumping into the sea
- Swimming alone

## Getting your feet wet

- Objective: to experiment with the Web as a business channel
- How: <http://store.yahoo.com>  
– <http://www.bigstep.com>
- Advantage: online store, cheap and quick
- Disadvantage: cookie-cut style

## Jumping into the sea

- Objective: Give e-commerce a shot as part of your business
- How: Enlisting an ISP  
– local ISP: [www2.hawaii.edu/~hoelsche](http://www2.hawaii.edu/~hoelsche)
- Advantage: expandable
- Disadvantage: still reply on others

## *Swimming alone*

- Objective: make e-commerce your core business
- How: now
- Advantage: best control of your site performance
- Disadvantage: cost, technical challenge, security and other issues

## *Be prepared*

- IP and Domain Name
- Set up your server
  - [www.ablecommerce.com](http://www.ablecommerce.com) (\$1,595)
  - [Microsoft Site Server 3.0 Commerce Edition](#) (\$4,609)
- Developing...

## *Domain Name Registration*

- [www.internic.net](http://www.internic.net) has a list of domain name registrars that are currently taking registration in the .com, .net and .org domains.
- You can also try [www.register.com](http://www.register.com), [www.networksolutions.com](http://www.networksolutions.com), [www.namesecure.com](http://www.namesecure.com).

## *Common Internet applications*

- HTTP
- FTP
- Telnet
- useful tricks: ping, whois, hostname

## *Hyper Text Transfer Protocol*



An HTTP server with [source code](#)

## *Web Client (Browser)*

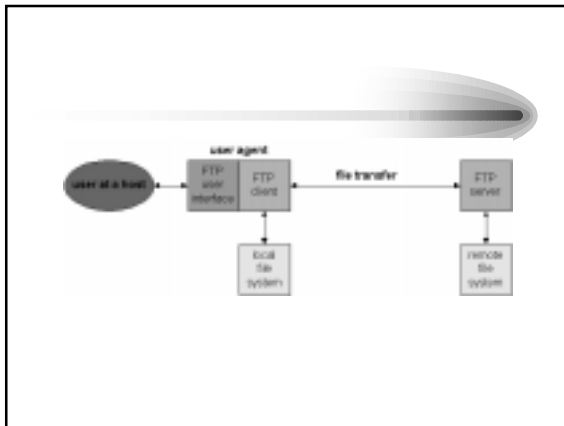
- Software to find, retrieve, view, and send information over the Internet.
  - Send and receive electronic-mail (or e-mail) messages nearly instantaneously.
  - Read messages from newsgroups (or forums) about thousands of topics in which users share information and opinions.
  - Browse the World Wide Web (or Web) where you can find a rich variety of text, graphics, and interactive information.

### *Web Server (host site)*

- Manages resources on the network.
- Provides a centralized storage area.

### *File Transfer Protocol*

- a system of rules for communicating over the Internet
- transfer files to and download files from other computers



### *Telnet*

- telnet uhunix.its.hawaii.edu
- telnet 128.171.44.6

### *Ping (still connected?)*

- ping uhunix.its.hawaii.edu
- ping 128.171.44.6

### *Limitations of the current Internet?*

- IPv4 running out of IP addresses?
- Not fast enough?

## *IPv6*

- 128-bit address space
- provide over 1500 addresses per square foot of the earth's surface

## *Internet2*

- Over 170 U.S. universities and partners in industry and government.
- To enable advanced applications, such as telemedicine, digital libraries and virtual laboratories.

## *GigaPoPs (points of presence)*

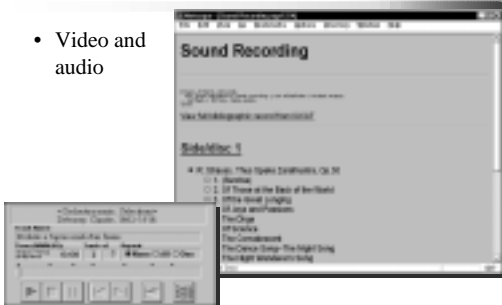


## *Advanced Applications*

- Virtual Laboratories
- Visualization and virtual reality
- Digital Libraries

## *Digital Libraries*

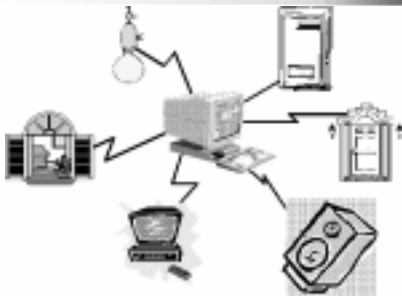
- Video and audio



## *Digital Village*



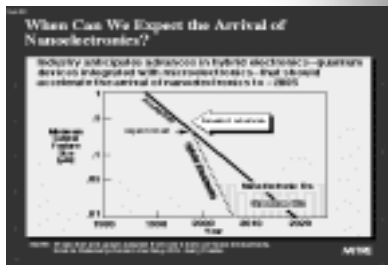
### Smart house



### Soft-WEAR



### NanoComputing



### Demo

- Configure TCP/IP
- ftp
- Ping

### Future ?



### Future !

