Computer Communication and Networking
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- The Need for Networking
- Types of Network
- Means of Communication
- Communication Software
- Network Topology
- Protocol
The Need for Networking

- **Hardware sharing**
  - esp. to expensive hardware devices
    - e.g., laser printer or plotter
  - allows cost to be shared

- **Communication**
  - allows other forms of communication
    - e.g., electronic mail (e-mail)

- **Data sharing**
  - many applications require access to data kept in a common data pool (or database), e.g.,
    - airline reservation system
    - point-of-sale system
    - banking system
Types of Network

- **Micro/mainframe link**
  - a central computer (usually a mainframe) is connected to a no. of terminals
  - performs all the applications processing
  - terminals can either be
    - ‘dumb’ terminals (input/output only)
    - microcomputers that act as dump terminals

- **Local area network (LAN)**

- **Wide area network (WAN)**
◆ **Local area network**
  - links independent computers & other peripheral devices over short distances
  - within the same bldg.
    ✷ school / small business
  - hardware is connected by cable
  - sharing
    ✷ peripheral equipment
    ✷ data & programs held in the server
  - allows high speed communications

◆ **Wide area network**
  - links computer systems over long distances
  - a network of LANs
  - provides many of the facilities found in LANs
  - its geographical scope is much larger than LANs
Means of Communication

- Twisted-pair wire
- Modem
- Coaxial cable
- Optical fibre
- Microwave
- Satellite
Twisted-pair wire
◆ for telephone lines
◆ adv:
  – cheap
◆ disadv:
  – has the lowest capacity
◆ a special device, called modem, is needed for signal conversion
  (fr. digital to analogue & vice versa)

Modem
◆ needed when two computers communicate over a telephone line
◆ device for signal conversion
  – modulation
    ◆ digital → analogue
    ◆ analogue → digital
Coaxial cable

- commonly used for LAN applications
- **disadv:**
  - more expensive than twisted-pair wire
- **adv:**
  - has greater capacity to transmit data
  - more reliable

Optical fibre

- **High capacity**
  - carry many signals simultaneously
  - carry on the same line both voice & data
- **Fast**
  - operates using the principle of light
- **some are buried under the sea**
Microwave
- Data can be transmitted via microwave radio signals
  - Radio signal
    - Travel in a direct line from one relay station to the next
  - Relay stations
    - Usually on tops of hills and towers

Satellite
- Are launched into space to relay data communication
  - Data can be transmitted from one location to any no. of locations on Earth
Communication Software

- It is needed because:
  - A modem cannot function by itself
  - Enable computers with diff. configurations to send messages to each other
- Novell
  - A common communication software used in LAN

- In the sending computer
  - Packages the message
  - Addresses it to a destination computer
  - Sends it

- In the receiving comp.
  - Accepts the message
  - Unpackages the message
  - Verifies (good condition?)
  - Acknowledgment
Network Topology

- describes how computers are connected together to form a network

- Three of the major topologies:
  - star
  - ring
  - bus
Star

◆ has one central computer
  – connects all other computers & devices
  – act as a message-switching centre
    ◆ receives messages from a sending node
    ◆ directs them to a receiving node

◆ adv:
  – easy to install
  – easy to connect with cable

◆ disadv:
  – too depend on the central computer
Ring

◆ the computers & devices are connected in a circle
◆ signals
  – are sent around the ring at high speed
  – each station checks the signals & picks up any that are addressed to it
  – returned to the sender
    ❁ not accepted
    ❁ unsuccessfully transmitted
◆ disadv:
  – dependency among the computers
    ❁ if one fails, the whole LAN fails
    ❁ if one is slow, all will be slow
Bus

- commonly used in LANs
- several computers are connected to a single communication line
- data
  - pass along the bus in both directions
  - are picked up by a receiving node

Adv:
- easy to install & cheap
- a breakdown of any one station will not cause the whole system to shut down

Disadv:
- poor performance
- only allows a small no. of microcomputers to be connected in a LAN
Protocol

- set of rules (for communications) that are followed by interconnected computers for proper data transmission
- ensures
  - the computers recognize the same set of communication control codes
  - the receivers use the same data coding system as the sender
  - all messages are transmitted correctly using an agreed error checking method
  - the sender sends the same amount of data as the receiver expects to receive
The Internet

- **ARPANET (US Dept. of Defense)**
  - Internet: a TCP/IP based WAN

- **Protocol: TCP/IP**
  - (Transmission Control Protocol / Internet Protocol)
  - IP addresses: 4 numbers (each 8 bits)
  - e.g. (66.218.71.198 for www.yahoo.com)
  - Each computer/server has a unique IP address
TCP/IP

- **TCP**
  - Responsible for establishing the connection between two hosts and undergoes reliable data exchange
  - Guarantees the correct delivery of packets

- **IP**
  - Responsible for moving packets (datagram) assembled by the TCP network
  - Attempts to find the best comm. path bet. Source and destn.
Packet Switching

- Messages are divided into packets of fixed length, with destn. address, and encapsulated with header and trailer.
- Packets are sent individually and reach the destn. through the network by its own path through different nodes (routers, switches etc.).
- Packets are received and assembled back in sequence with the headers and trailers removed.
IP address of yahoo.com
(66.218.71.198)

Microsoft Windows 2000 [版本 5.00.2195]
(C) Copyright 1985-2000 Microsoft Corp.

Z:\>ping yahoo.com

Pinging yahoo.com [66.218.71.198] with 32 bytes of data:

Reply from 66.218.71.198: bytes=32 time=210ms TTL=241
Reply from 66.218.71.198: bytes=32 time=230ms TTL=241
Reply from 66.218.71.198: bytes=32 time=241ms TTL=241
Reply from 66.218.71.198: bytes=32 time=190ms TTL=241

Ping statistics for 66.218.71.198:
   Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
   Minimum = 190ms, Maximum = 241ms, Average = 217ms

Z:\>
IP address of www.yahoo.com

Information packages transferred in network

Packet Transferred to USA and back to HK

True IP address of www.yahoo.akadns.net
### IP addresses

**Computer name**

- Host Name: ADMIN05

**Network interface card (NIC or LAN card) type**

- Mode Type: Hybrid

**Network interface card (NIC) physical address**

- Physical Address: 00-48-54-55-9B-71

**IP address of this computer (virtual IP)**

- IP Address: 10.123.16.124
- Subnet Mask: 255.255.0.0
- Default Gateway: 10.123.16.26
- DHCP Server: 10.123.16.23
- DNS Servers: 10.123.16.23
- Primary WINS Server: 10.123.16.23

**Class B Network**

- Connection-specific DNS Suffix: Realtek RTL8139(A) PCI Fast Ethernet

**Domain Name Server IP address**

- Lease Obtained: 2003-12-11 07:42:02
- Lease Expires: 2003-12-11 07:42:02
Domain Name System (DNS)

- A system to translate domain names into corresponding IP addresses (in order to communicate with a host on the internet or the TCP/IP network)
- Easier to remember than IP addresses

- **Educational bodies**
- **Country domain**

**www.sfcc.edu.hk**

- **Host name**
- **Domain name**
Address Resolution

- To contact a host in the internet the DNS is used to find the IP address of the target through the DNS server.
Other NW hardware

- **Hub** – central connection point for devices in a NW through multiple ports
- **Switch** – works like a hub but filtering instead of broadcasting packets
- **Repeater** – extends the length of a LAN by replicating and strengthening signals
- **Bridges** – connects two LANs of same protocol
- **Router** – connects any number of LANs and forwards signal bet. any two hosts (may be of diff. protocols) by the best route
Servers

- **Application server** – provides applications for the clients to use and data for sharing (e.g. DBMS)
- **Print server**
  - provides printer sharing service to clients
  - print jobs arranged in a queue and client may continue with other jobs
- **File server** – provides files sharing service to clients
- **VOD server** – provides video/audio clip viewing to clients individually (by streaming)
- **Proxy server**
  - examines client requests (e.g. connecting to internet web sites),
  - If page found in cache, forward to client, otherwise download from internet and update cache
  - Can filter client’s request (e.g. indecent web pages)
A firewall is a device that can prevent unauthorized access to the LAN from outside.
Other terms

**URL** – uniform resource locator
- An address used to refer to the resources on the internet (e.g. student.sfcc.edu.hk/~cwshek/tennis/)

**HTTP** – hypertext transfer protocol
- Application protocol for the WWW service
- (e.g. http://info.gov.hk)

**FTP** – file transfer protocol
- Provides a file management across machines on the internet (e.g. ftp://ftp.cuhk.edu.hk)
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN">
<html>
<head><title>Untitled Document</title><meta http-equiv="Content-Type" content="text/html; charset=big5">
</head>
<body>
<h3 align="center"><strong><font color="#CC3333" size="6">My first homepage</font></strong></h3>
<hr align="center" width="500" size="5" noshade>
<p align="center"><font color="#6633FF" size="6" face="Verdana, Arial, Helvetica, sans-serif"><strong><a href="main.htm">&lt;ENTER&gt;</a></strong></font></p>
</body>
</html>
Welcome to the Chinese University ftp server ftp.cuhk.edu.hk. You are user number 40 out of a possible total of 650 users. For beginners, login as "ftp", and give your eaddr (e.g. s123456@mailserv.cuhk.edu.hk) as password. Comments? Pls email to ftppadmin@ftp.cuhk.edu.hk.
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