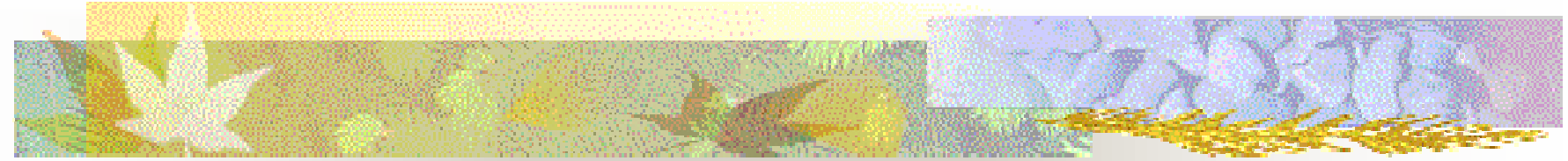
Networking and Internetworking



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3.1 Introduction

- The principles on which computer networks are based include protocol layering, packet switching, routing and data streaming. Internetworking techniques enable heterogeneous networks to be integrated. They are now undergoing revision to accommodate future growth and to meet new application requirements for mobility, security, quality of service.

3.1 Introduction (2)

- The networks used in distributed systems are built from a variety of transmission media, *hardware devices and software components (communication subsystem).*
- This chapter is intended to provide an introductory overview of computer networking with reference to the communication requirements of distributed systems. In the remainder of this section we discuss the communication requirements of distributed systems.

3.1.1 Networking issues for DS

- Performance
- Scalability
- Reliability
- Security
- Mobility
- Quality of service
- Multicasting

3.2 Type of network

	Range	*Bandwidth (Mbps)*	*Latency (ms)*
LAN	1-2 kms	10-1000	01-Okt
WAN	worldwide	0,010-600	100-500
MAN	2-50 kms	1-150	10
Wireless LAN	0,15-1,5 km	2-11	5-20
Wireless WAN	worldwide	0,010-2	100-500
Internet	worldwide	0,010-2	100-500

3.3 Network principles

- The basis for computer networks is the packet-switching technique first developed in the 1960s. Packet switching was a radical step, this enables packets addressed to different destinations to share a single communications link. Packets are queued in a buffer and trasmitted when the link is available.

3.3.1 Packet Transmission

- In most applications of computer networks the requirement is for the transmission of logical units of information or messages. But before a message is transmitted it is subdivided into *packets*, sequence of binary data of restricted length, together with addressing information sufficient to identify the source and destination computer.

3.3.1 Packet Transmission (2)

- Packets of restricted length are used:
  - So that each computer in the network can allocate sufficient buffer storage to hold the largest possible incoming packet;
  - To avoid the undue delays that would occur in waiting for communication channels to become free if long messages were transmitted without subdivision.

3.3.2 Data Streaming

- The timely delivery of such data streams depends upon the availability of connections with guaranteed quality of service – bandwidth, latency and reliability must all be guaranteed.
- ATM networks are specifically designed to provide high bandwidths and low latencies and to support quality of service by the reservation of network resources. IPv6, the new network protocol for the internet that will be brought into use over the coming decade, include features that enable each IP packet that forms part of a real-time stream to be identified and treated separately from other data at the network level.

Switching schemes

- A network consists of a set of nodes connected together by circuits. To transmit information between two arbitrary nodes, a switching system is required.
  - Broadcast
  - Circuit switching
  - Packet switching
  - Frame relay

3.3.4 Protocols

- The term protocol is used to refer to a well known set of rules and formats to be used for communication between processes in order to perform a given task. The definition of a protocol gas two important parts to it:
  - A specification of the sequence of messages that must be exchanged;
  - A specification of the format of the data in the messages.

3.3.4 Protocols (Protocol layers)

Layer	*Examples*
Application	HTTP, FTP, SMTP, CORBA IIOP
Presentation	Secure Sockets (SSL), CORBA Data Rep.
Session	
Transport	TCP, UDP
Network	IP, ATM virtual circuits
Data link	Ethernet MAC, ATM cell transfer, PPP
Physical	Ethernet baseband signalling, ISDN