

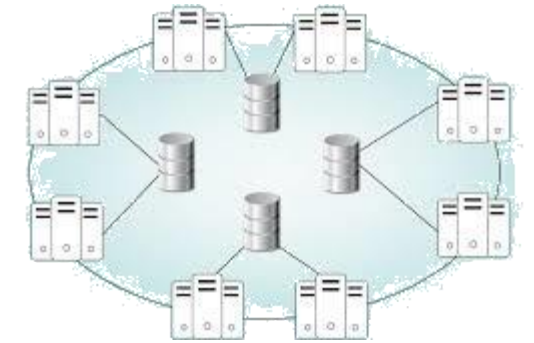


Distributed and Parallel Computer Systems

CSC 423

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Lecture 5



Networking and Internetworking

INSTRUCTOR

DR / AYMAN SOLIMAN

➤ Contents

- 1) Networking & Internetworking
- 2) Networking Issues for DS
- 3) Types of Networks
 - LANs
 - WANs
 - MANs
 - Wireless



□ Distributed System

- A **distributed system** is a collection of entities, communicating through a communication medium.
- Our **interest** in distributed systems involves
 - Design
 - Implementation
 - Maintenance
- **Entity** = a process on a device (PC, PDA)
- Communication Medium = **Wired** or **wireless** network

□ Networking & Internetworking

- Distributed systems use local area networks, wide area networks and internetworks for communication.
 - networks include layering, packet switching, routing and data streaming.
 - Internetworking techniques enable heterogeneous networks to be integrated.

□ Networking Issues for DS

- **Performance:** parameters that affecting the speed with which individual messages can be transferred.
 - These are the latency and data transfer rate.
 - **Propagation Delay (Lt):** the time it takes for the first bit of a packet to reach the destination
 - **Data Transfer Rate (Tr):** The speed at which data can be transferred between two computers in the network

$$\text{Message transmission time} = Lt + \text{packet size} / Tr$$

□ Networking Issues for DS

- Other components of latency
 - **Processing delay**: the time it takes for the OS to process/send/receive the message.
 - **Queuing delay**: the time it takes a message to be queued either at end hosts or intermediate nodes while waiting for transmission.
- **Bandwidth**: the total amount of information that can be transmitted over a given time, Expressed as messages/second or bytes per second

□ Types of Networks

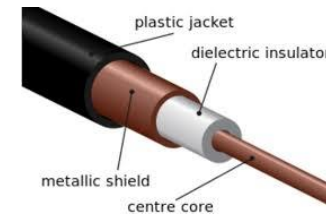
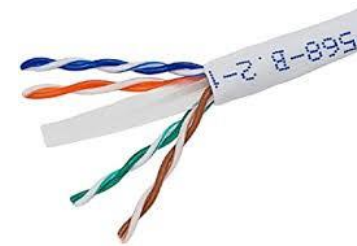
- **Types of networks:** how to choose
 - range, bandwidth, latency
- **Networking principles:** how it works conceptually
 - transfer mode, switching schemes
 - protocol suites, routing, congestion control
- **Sample protocols:** how it works in detail
 - Mobile-IP, TCP/UDP, Wireless LAN

□ Types of Networks

- **LANs** (Local Area Networks)
 - Technology suitable for small area
 - wire/fiber
- **WANs** (Wide Area Networks)
 - Large distances, inter-city/country/continental
- **MANs** (Metropolitan Area Networks)
 - intra-city, cable based, multimedia
- **Wireless** networks
 - WLANs, WPANs
- Distinguished by technology, not only distances.

□ LANs

- LANs carry messages at relatively **high speeds** between computers connected to a single communication medium,
- such as **twisted copper** wire,
- **coaxial** cable
- or **optical** fiber.



□ LANs

- **Technology** suitable for **small area**
- **High bandwidth** (total amount of data per unit of time)
- **Low latency** (time taken for the first bit to reach destination)
- **Technology**
 - Ethernet, now 100/1000Mbps
 - Earlier token ring

□ WANs

➤ WANs

- WANs carry messages at **lower speeds** between nodes that are often in different organizations and may be **separated by large distances**.
- large distances **country/continental**.
- **Low bandwidth, high latency**.
- Satellite/wire/cable.
- Routers introduce delays.

□ MANs

➤ MANs

- This type of network is based on the **high-bandwidth** copper and fiber optic cabling recently installed in some towns and cities for the transmission of **video, voice** and other data over distances of up to **50 kilometers**.
- intracity, cable based
- Wire/cable
- Range of technologies (ATM)

□ Wireless networks

- The convenient connection of **portable and handheld** devices requires wireless communication
 - **WLANs, WPANs**
- **WLANs** (Wireless Local Area Networks)
 - to replace wired LANs
- **WPANs** (Wireless Personal Area Networks)
 - variety of technologies
 - Bluetooth

□ Inter-networks

- An inter-network is a communication subsystem in which **several networks** are linked together to provide common data **communication facilities** that conceal the technologies and protocols of the individual component networks and the methods used for their interconnection.

□ Inter-networks

- The **Internet** is the major instance of internetworking, and its **TCP/IP** protocols.
 - They are interconnected by dedicated switching computers called **routers** and general-purpose computers called **gateways**,

❑ Network comparison

	<i>Range</i>	<i>Bandwidth (Mbps)</i>	<i>Latency (ms)</i>
LAN	1-2 kms	10-1000	1-10
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

Thank
you

