Network Topologies

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Introduction

● Classification
- – Transmission technology
  - ● broadcast
  - ● multicast
  - ● point-to-point

Introduction

● Classification
- – Distance among processors

● data flow machines	0.001 m
● multicomputers	0.01 m
● Near Field Communications	0.1 m
● Body Area Network (BAN)	2 m
● Personal Area Networks (PAN)	10 m
● Local Area Networks (LAN)	1 km
● Metropolitan Area Networks (MAN)	10 km
● Wide Area Networks (WAN)	1000 km
● Internet	10 000 km

- – Wired and Wireless

Topology

● Bus
● Ring
● Star
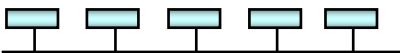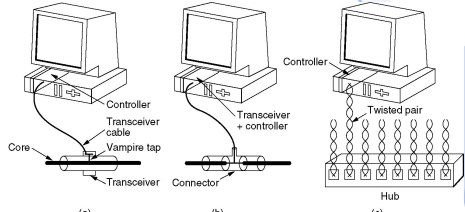● Nested

Bus

- Characteristics
  - Signal **broadcasted** to all the nodes
  - Several simultaneous senders → collision
  - All nodes receive simultaneously except by the propagation delay

Ethernet Cabling [2]

Three kinds of Ethernet cabling
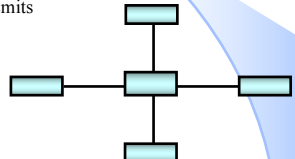(a) 10Base5, (b) 10Base2, (c) 10Base-T.

Controller

Transceiver cable
Core
Vampire tap
Transceiver

Transceiver + controller
Connector

Controller
Twisted pair

Hub

(a)   (b)   (c)

Star

- Characteristics
  - One central node
  - It receives and transmits

Star

- Characteristics
  - Central node
    - Active star
      The central node receives and sends the messages to the destination address (store and forward)
    - Passive star
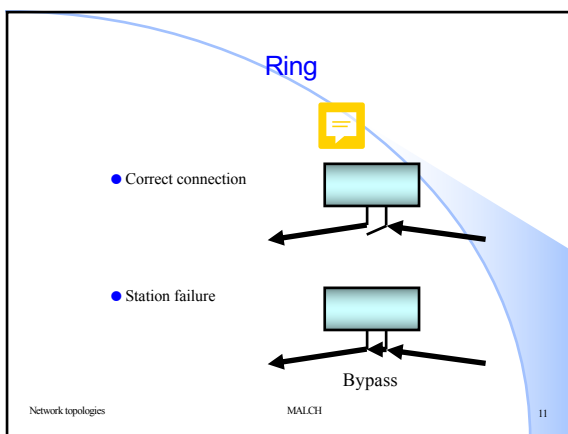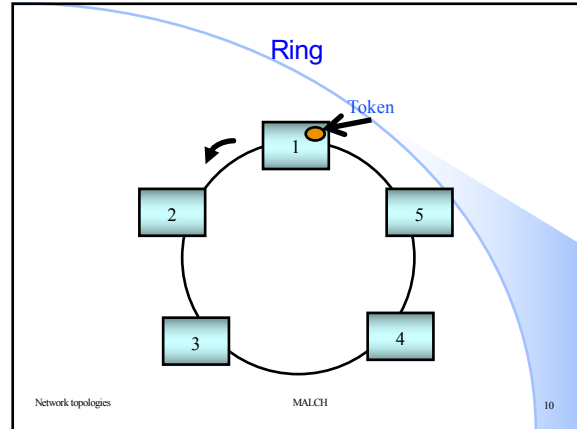   All the messages are physically broadcasted to all the destination

2

Ring

- **Characteristics**
  - All the nodes are connected point to point
  - There is a Token
  - The node having the Token has the rigth to transmit the frames
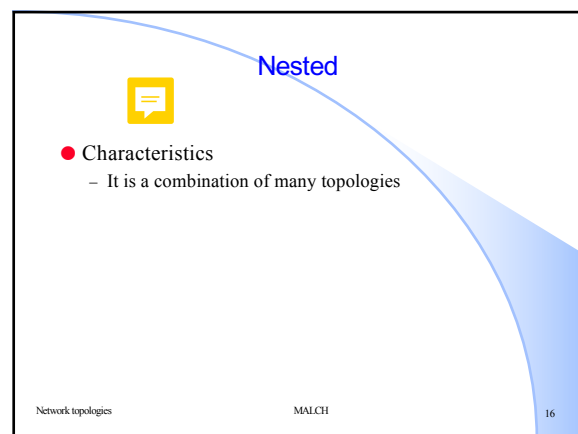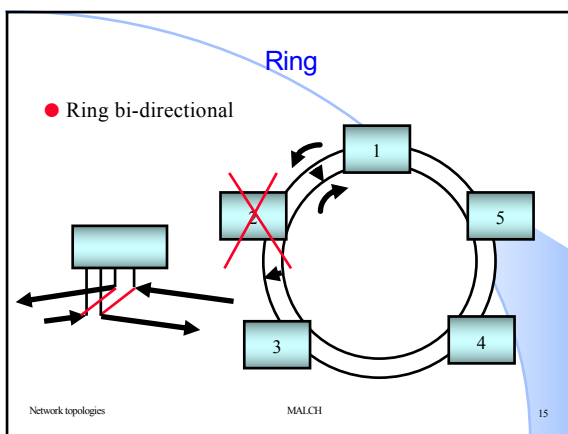 - After a token holding time, the node must transmit the Token to the next node in the ring

Ring

Ring

- Correct connection
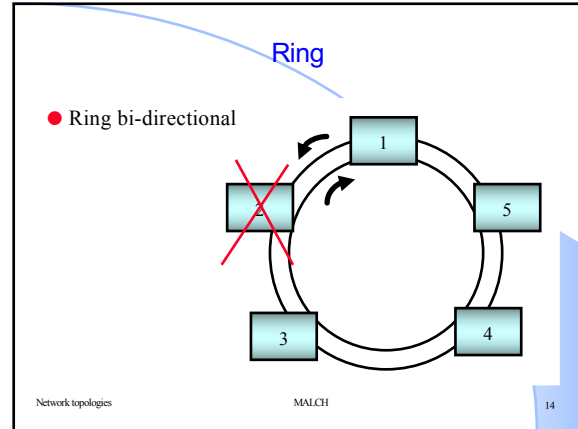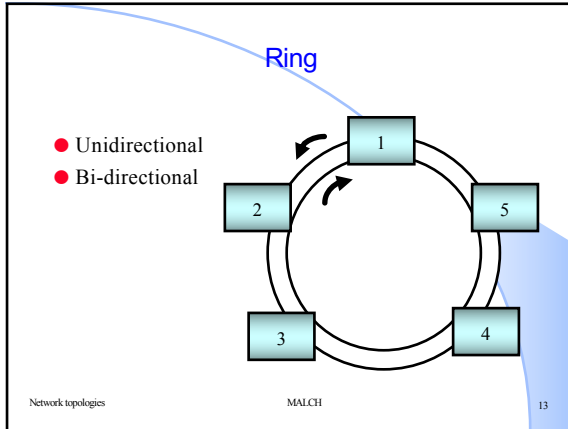
- Station failure

Bypass

Ring

- **Characteristics**
  - A frame is partially and temporary stored in each node
  - Each node receives and retransmits the frame
  - A frame may turn indefinitely, the sending node must remove it of the ring
  - Distance between stations increases with station failures

Ring

- Unidirectional
- Bi-directional

Ring

- Ring bi-directional

Ring

- Ring bi-directional

Nested

- Characteristics
  - It is a combination of many topologies

Nested

Physical and logical devices

Application	⟷	Gategay
Presentation		
Session		
Transport	⟷	Gategay
Network	⟷	Router
Data Link	⟷	Bridge/Switch
Physical	⟷	Repeater/Hub
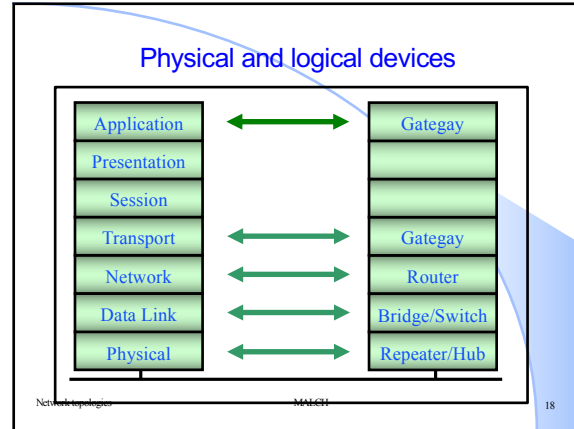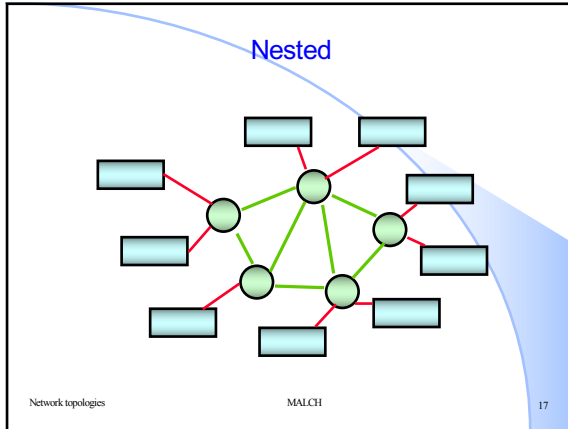
Repeater/Amplifier

- Repeater
  - to increase the digital signal strength

- Amplifier
  - to increase the analog signal strength

Hub

- It acts as a repeater
- When a node transmits the Hub retransmits to all connected nodes (**one to all**)
- However, if two nodes transmit at the same time there will be a collision
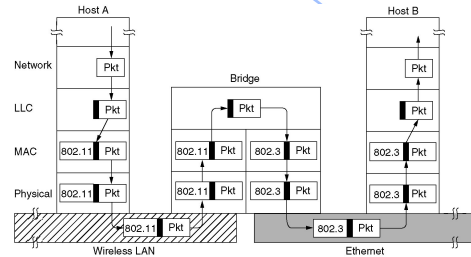
Bridge

- It allows to interconnect two local area networks (LAN) with the same profile
  - With the same protocols at the physical layer, MAC and LLC sublayers
- It allows to interconnect two LANs with different profiles
  - at the physical layer and MAC sublayer
  - e.g. IEEE 802.3 and IEEE 802.11

Bridge [1]

Switch

- It allows to interconnect two or more LANs
- It acts as a switch (on, off) based on **MAC address**
- It receives a frame, analyzes the MAC address, and then retransmits it only to the appropriate destination

Router

- It allows to interconnect two or more networks
- It stores and forwards an incoming packet to its destination based on the **IP address**
- It is a physical device that defines only the following layers:
  - Network
  - Data link
  - Physical

Gategay

- It is a logical device (software implementation)
- It acts as a Bridge at the:
  - Transport layer
  - Application layer
- It allows to interconnect two nodes with different:
  - Transport protocols
  - Application protocols

References

- [1] A. Tanembaum. Computer Networks. Pearson,4Ed., 2003