

# Overview of Internetworking Technology

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# Presentation Content

- Review the OSI model
- Repeaters & Hubs
- Cables
- Bridges
- Switches
- Routers
- Gateways

# OSI Model

There are seven layers in the OSI model

- Layer 1 : Physical Layer
- Layer 2 : Data Link Layer
- Layer 3 : Network Layer
- Layer 4 : Transport Layer
- Layer 5 : Session Layer
- Layer 6 : Presentation Layer
- Layer 7 : Application Layer

# Repeaters & Hubs

- Repeater
  - Propagate signals from one cable to another
  - Regenerate the signal to its original form
  - Operate on layer 1 of the OSI Model
- Hub
  - A multiport repeaters
  - Fault tolerance by isolating network electrically

# Cables

- There are three kinds of cables
  - Coaxial Cable
    - Thin wire
    - Thick wire
  - Twisted Pairs Cable
    - Shield -- CAT 4 & CAT 5
    - Un-shield -- CAT 1, CAT 2 & CAT 3
  - Fiber Optics Cable
    - Single Mode
    - Multi Mode

# Bridges

- Forward frames from one physical LAN to another
- Regenerate the signal strength
- Operate layer 2 of the OSI Model
- Network protocol independent
- Store and error check frames before they forward frames
- Promiscuous mode
- Can operate two different LANs

# Bridges Cont.....

- Provides access control
- Divide a LAN into small segment
- Removes any physical constrain
- Learn the topology of the network on their own
- No configuration
- Performance Problem
- Buffer Problem
- Broadcast problem

# Types of Bridges

There are three types of bridges

- Transparent or Learning Bridges
- Source Routing Bridges
- Mix-Media (Source Routing Transparent)
  - Translation
  - Source Routing Transparent

# Transparent Bridges

- Study the source address of each frame they receive and then build a table that associates addresses with ports
- Operation is complete all other devices
- Do not Know the entire network
- Create Routing Loop
- Mostly used in Ethernet LAN

# Source Routing Bridges

- Sending machine is responsible for placing a field on each frame that contains the entire route that the frame will travel on the network to reach to its destination.
- Very broadcast intense initially
- Mostly used in Token Ring LAN

# Switches

- Very similar to Bridges
- Operate on layer 2 of the OSI model
- Switching process takes place in the hardware
- Learn the network topology
- Provide Cut-through mode
  - FastForward
  - FragmentFree
- Provide multiple simultaneous connection

# Routers

- Forward packet from one logical network to another
- Intelligent enough to determine the most efficient path to send data through the network
- Operate layer 3 of the OSI Model
- Network protocol dependent
- Act only packets that specifically addressed to it
- Packet filtering

# Routed vs. Routing

- Routed Protocols
  - Routers use routed protocols to deliver packets from one network to another.
  - The protocols define the network address fields of a packet.
  - IP and IPX are routed protocols.
- Routing Protocols
  - Routing protocols allow routing information to be shared between routers.
  - Routing information is stored in routing tables which contain information about available routes.
  - RIP and OSPF are routing protocols.

# Types of Routes

There are three types of routes

- **Static Route**
  - Defined manually by the network administrator.
- **Default Route**
  - A route when it does not know how to forward the packet.
- **Dynamic Route**
  - allows route information to be automatically updated and shared between routers.

# Routing Algorithms

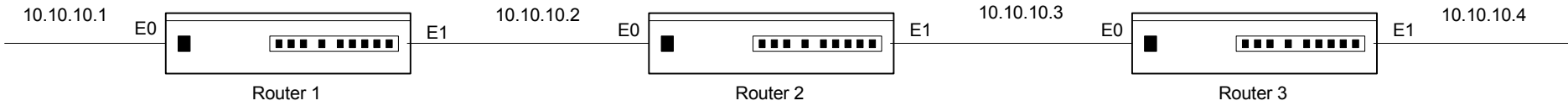
- There are two routing algorithms
  - Distance Vector Algorithm
    - Determine the distance and direction of routes relative to neighboring routers.
    - Router receives routing table updates from neighboring routers
    - Router has complete knowledge of network topology
  - Link State or Shortest Path First (SPF) Algorithm
    - Router maintains complete knowledge of network topology, including all routers in the network and the connections between them.
    - Learns about the network through neighbor notification
    - Uses Link State Packet (LSP) to populate router's table

# Routing Algorithms Cont.....

- **Balanced Hybrids**
  - combines aspects of both link-state and distance vector routing.
- **Metric of Routing Algorithms**
  - Determine the best path through a network. As a rule, the smaller the metric, the better the path.
  - Metrics commonly used are
    - Hop Count
    - Ticks
    - Path Cost Bandwidth
    - Link Delay
    - Load
    - Reliability
    - MTU (maximum transmission unit)

# Routing Problems

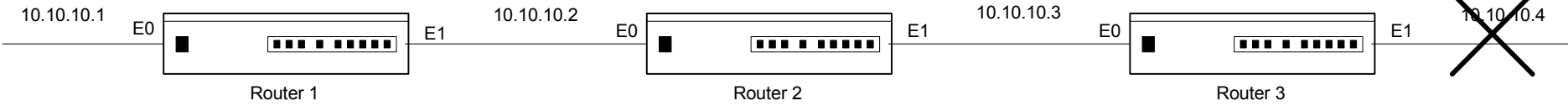
- Routing Loop
  - Packet bounces between routers instead of being sent to its proper destination due to inconsistent routing table
- Unsynchronized LSP
  - Router does not receive the most recent LSP, then the routing tables will vary between routers, and routes will become unreachable.



10.10.10.1	E0	0
10.10.10.2	E0	0
10.10.10.3	E0	1
10.10.10.4	E0	2

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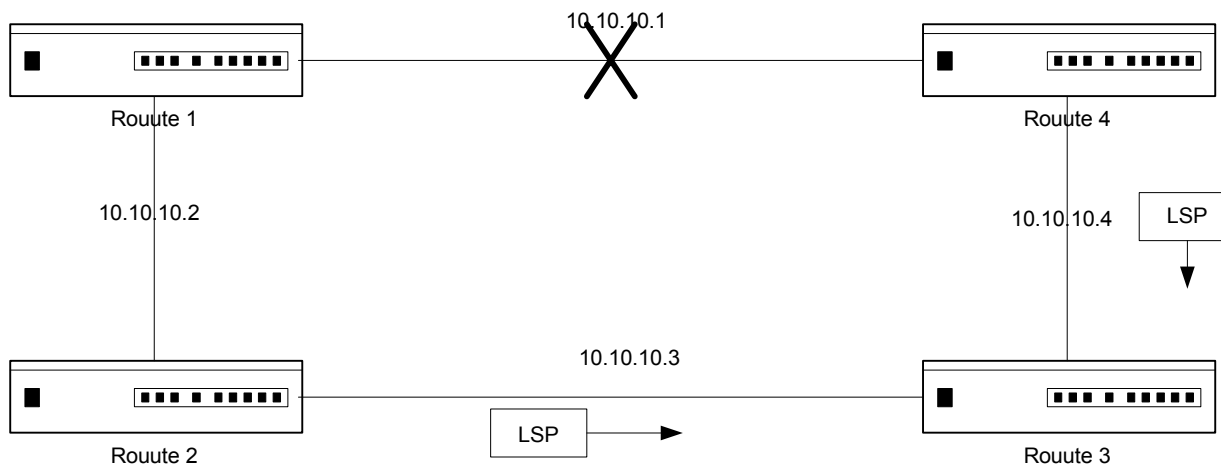


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10.10.10.1	E0	1
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10.10.10.1	E0	2
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10.10.10.4	E0	2

## Routing Loop Problem



## Unsynchronized LSP Problem

# Solution of Routing Problems

- Solution of Routing Loop
  - Defined maximum hop count
  - Time-to-Live (TTL) parameters
  - Split horizon
  - Poison reverse,
  - Hold-down timers,
- Solution of Unsynchronized LSP
  - Network Hierarchy
  - Designate Router
  - Time Stamp

# Routing Protocols

- Intra-domain Protocols
  - For IP
    - RIP (DV)
    - IGRP (DV)
    - EIGRP (Hybrid)
    - OSPF (LS)
  - For IPX
    - RIP (DV)
    - NLSP (LS)

# Routing Protocols Cont.....

- Inter-domain Protocols
  - EGP (DV)
  - BGP (DV)
  - IGRP (DV)
  - EIGRP (Hybrid)
  - OSPF (LS)

# Gateways

- Is simply the point that acts as an entrance to a network.
- Routers are commonly used as gateways

# LAN Standard

- IEEE 802.1 Document, Management & Interconnection
- IEEE 802.2 Logical Link Control
- IEEE 802.3 CSMA/CD Ethernet
- IEEE 802.4 Token Ring Bus (Arcnet)
- IEEE 802.5 Token Ring
- IEEE 802.6 MANs
- IEEE 802.11 Wireless LAN

# LAN Technology

- Ethernet
- Token Bus (Arcnet)
- Token Ring
- Fiber Distributed-Data Interface (FDDI)

# WAN Technology

- ATM
- Frame Relay
- X.25
- ISDN