

Lecture 20 (Ethernet)

1 Introduction

1. First widely used LAN technology
2. Single chip, multiple speeds
3. Initially the bus topology was used, and now switched topology is used

2 Ethernet Frame Structure

1. Preamble - 7 bytes of 10101010 followed by one byte of 10101011
2. Destination address - 6 bytes
3. Source address - 6 bytes
4. Type
5. Data (payload)
6. CRC

3 Properties

1. Connectionless - no handshaking
2. Unreliable - no ACKs or NAKs sent
3. Unslotted CSMA/CD with binary exponential backoff is used
4. Follows IEEE 802.3 standards

4 Ethernet Switch

1. It is an active device
2. It stores and forwards Ethernet frames
3. It examines incoming frame's MAC address and selectively forwards frame to one-or-more outgoing links using CSMA/CD
4. Works in a transparent manner, host doesn't know existence of switch
5. Switch is a plug-and-play device, no configuration needed

4.1 Working of Switch

1. Identifies the neighbours
2. Broadcast data to all neighbours initially - flooding
3. Learns locations of addresses wrt ports with time
4. The table thus learnt is called Bridge (MAC Address) Learning Table

4.2 Interconnecting Switches

Switches in this case as well learn that multiple nodes are located on a single link

5 Virtual LANs (VLANs)

1. Different physical link but same logical link
2. Naive implementation will lead to multiple broadcasts and can lead to unauthorised snooping hence

5.1 Port Based VLAN

Single physical switch having multiple VLAN units - traffic isolation

5.2 Trunk Port

Links VLANs over multiple switches, prevents broadcasting (defined in 802.1q standard)

Header changes as:

1. Preamble, destination address, source address
2. 2-byte tag protocol identifier (value between 81-00)
3. Tag control information - 12 bit VLAN ID, 3 bit priority field
4. Type, payload, CRC

6 Multiprotocol Label Switching

Goal is to have high-speed IP forwarding among network of MPLS capable routers using fixed length label instead of shortest prefix matching

7 Datacenter Networks

1. Connecting servers which are located far away, effectively
2. Server racks are created and a Top of Rack (ToR) switch is created
3. This ToR switch is connected to a Tier-2 switch, which connects ~16 ToRs
4. These T-2 switches are connected to Tier-1 switches in turn

8 Other Examples

1. Facebook F16 data center uses spine and fabric switches over ToR switches
2. Application layer routing is also performs similar to SDNs
3. RoCE: Remove DMA over Converger Ethernet