# Lecture 10 Local Area Networks

## Objectives

* Recognize computer systems network terminology and use it appropriately (unit LO1).
* Define the fundamental principles of computer networking topologies and professional standards (unit LO2).

## Covering

* Identify the distinguishing characteristics of Networks
* Understand the major features of Ethernet LANs
* Discuss the key issues related to LANs
* Discuss collision, broadcasts, shared Media, hubs, switches and addressing

## Legacy Ethernet

* Follows the rules of polite conversation
  + If no one else is talking, Speak when you want to
  + If someone else is talking, wait until they are finished and then speak
  + If someone else starts to talk at the same time you do, both should stop and try again later
* This is Carrier Sense Multiple Access with Collision Detection (CSMA/CD)
* The
* Devices attached to a LAN of this type share the bandwidth of the media
  + Shared Media LANs can only support a limited number of users
  + Generally limited by there limited size.

## LAN Interface cards and Addresses

* Any transmission on an shared interface card (NIC) will reach every other LAN interface card
* Each
* It
* It reads all multicast messages with addresses that it has been programmed to read
* The
* Software drivers are associated with a LAN interface

## Ethernet LAN Access Devices

* Client PCs etc have a cable between their PC and an access device in a Wire Closet
* This could be :
  + - * A repeater hub (legacy devices)
      * A switch
* Switches have became the dominant access device

## Access and distribution rules for shared media LANs

* Access rules for Ethernet repeater hubs
  + Listen
  + Stop

## Distribution rules for Ethernet repeater hubs

* + Only

## Access rules for switched Ethernet

* + Send whenever you want to
  + No Collisions

## Distributed rules for switched Ethernet

* + Traffic
  + Multiple
* Access and distribution rules for switched Ethernet LANs

## Unicast (single Destination) addressing)

* Unicast (one destination)
* Example: A client sending a frame to a router to gain access to an external server

## Multicast (Multiple but not all destinations) addressing

* Not all destinations
* Example: A client PC is sending a multicast frame that will reach all servers
* Broadcast (All destinations) addressing
* To everyone
* Example: A client PC is sending a broadcast frame that it wants to send to all devices

## How LANs Fit into the Networking Model

* LANs operate at the data link layer of our reference model
* IEEE divided the layers into two sub-layers
  + Logical link control (LLC)
  + Media Access Control (MAC)

## IEEE 802 LAN Standards

## Common Aspects of the LAN Standards

* Things in common
  + All use the same address length (48 bits)
    - The MAC address
  + Supports broadcast and multicast addresses (group addressing)
  + All have very good (32-bit) error checking
  + All standards are now in excess of 1Mbit/s

## Different Aspects of the LAN Standards

* Things that differ
  + Access methods (CSMA/CD vs Token passing)
  + Support for features like priority
  + S
  + Unique Addresses
* IEEE 802 addresses are very long (48 bits)
  + Allowing them to be universally unique
    - No two NIC have the same address
  + The manufacturer assigns the address to the interface
    - The LAN address id ‘burned in’

## The variation of IEEE 802.3

* 10 BASE5 (thickWire Ethernet)
  + - 10 mbit/s, baseband, 500 m maximum
* 10 BASE 2 (thinWire Ethernet)
  + - 10 mbit/s, baseband, 185 m maximum
* 10 BASE-T
  + - Uses unshelided twisted pair (UTP)
    - 10mbit/s, baseband, 100m Maximum
* 10 BASE-F
  + - Fibre optic ethernet (10mbit/s)
* 10 BASE-T and 100 BASE-F
  + - 10 mbit/s, baseband
* 1 Gigabit/s Ethernet (various forms)
* 10 Gigabit/s Ethernet
* 10 BASE-T and 100 BASE-T
* 10 BASE-T is a multiport repeater
  + can support up to four hubs (four repeater sets) along a data path
  + 10 mbit/s over two-pair Category 3 or better cabling
  + Supports up to 100m of cable length from the hub
* 100 BASE-T is a direct extension of 10 BASE-T
  + 100Mbit/s over two-pair category 5e UTP (fast Ethernet)
  + Support up to 100m of cable length from the hub
  + Two 100BASE-T hubs can be interconnected
* Stackable Hubs and Switches
* We often need more ports than one access device can support

## Some hubs and switches are stackable

* Gigabit Ethernet

## 10 Gbit/s Ethernet (802.3ae)

* There is a never ending demand for higher-data-rate communications
* Some things don’t change
  + Same 802.3/Ethernet frame format
  + S
  + S
* Other things do change (for 1 and 10 Gbit/s)
  + No CSMA/CD
  + Only full duplex communication
* 10 Gbit/s will be used in MANs, large networks, SAN,
  + - A replacement for SONET/SDH networks

## Power over Ethernet (PoE)

* Power over Ethernet utilizes the Ethernet cabling to deliver power to some Ethernet-attached devices, such as
  + Ethernet telephones
  + Wireless Access Points
  + PoE defined in 802.3af
* Advantages
  + Power outlets may not be near
  + Backup power may not be available in everyone's office

## Token Ring (802.5) and LLC (802.2)

* These were devised to meet IBM networking needs
* Generally a legacy system but still in implementation
* Token ring is similar to polling
  + Polling is achieved via a three-octet’ token’ that circulates around the ring
  + If you have the token you can send one frame and then you must pass the token on
* Token ring provide configurable options
  + 8 levels of priority
  + Selectable maximum frame size

## Switching and Transparent Spanning Tree

* Switches perform a form of forwarding
  + Find the path to the destination device
* The switches automatically form a tree topology
  + No Closed loops
  + Any possible loops result in some links being placed in standby mode
* Switches learn by observing traffic
  + Traffic originates on one side of the bridge
  + This would happen if loops were allowed
* The learning process is based on source addresses

## Switched Ethernet

* Switched Ethernet is a hardware implementation of bridging
* Switched Ethernet Characteristics
  + A
  + Forwards selectively to the destination
  + S
  + Supports full duplex on dedicated ports
* Switches can support different data rates on each port
* Ethernet switches normally operate in store-and-forward mode
  + T
* Some Ethernet switches may also support cut-through operation
  + Start to forward after receiving the destination-address part of the frame
    - I
  + Cut-through reduces the delay in getting through the switch

## Virtual LANs

* Software gives an appearance of a physical connection
* Purpose is to limited broadcast traffic to a defined group – workgroup
* The workgroup is defined by network management
* Membership is by:
  + S
  + Selecting a set of MAC addresses
  + L
* The network manager configures the VLAN membership
  + Better than recabling
* Multiple VLANs can be configured

## Summary

* Identify the distinguishing characteristics of Networks
* Understand the major features of Ethernet LANs
* Discuss the key issues related to LANs