TUTORIAL 1: Ethernet Medium Access and Control

(a) How does a manufacturer decide which address to use?

(b) Why is the first bit never set in an *Ethernet Source Address*?

(c) What is the *Carrier Sense Circuit* used for?

(d) What is *Ethernet Capture*?

TUTORIAL 2: Ethernet Transmission

(a) Sketch the format of an Ethernet frame carrying 1000 B of data. Your answer should show all the protocol fields (headers) present in the frame.

(b) Sketch an outline block diagram of the process by which a byte is Manchester-Encoded by an Ethernet processor prior to transmission by the physical layer. Use the example of sending a byte with the hexadecimal value of 0x57.

(c) Explain the function of the Ethernet Preamble

(d) Plot the waveform which you would observe on an oscilloscope when the first byte of the preamble is sent along an Ethernet coaxial cable.

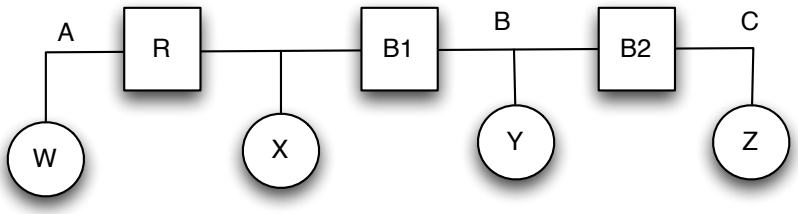
(e) Explain the function of the Ethernet *Cyclic Redundancy Check (CRC)*

TUTORIAL 3: Bridges and Switches

(a) Explain in detail the operation of an Ethernet bridge/switch, and describe how the bridge filters frames which need not be forwarded between Ethernet segments.

(b) What is the role of the *Ethernet Source Address*?

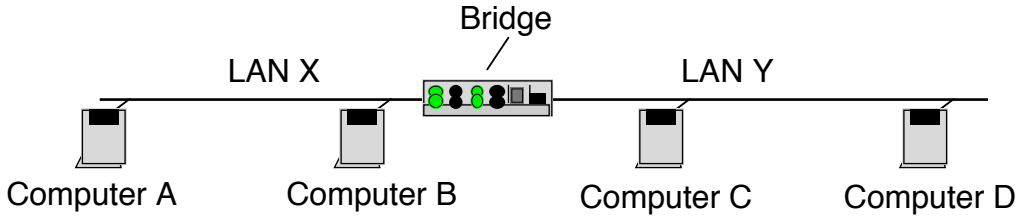
(c) Four computers (W,X,Y,Z) are connected by 3 Ethernet segments (A,B,C) using a Repeater /Hub (R) and a Bridge/Switch (B).



Which set of computers receive (at the network level) the following frames? (Make sure your answer also shows which LAN segments carry each frame.)

(d) The computers W and X have MAC addresses of W = 0x00102030 and X = 0x00102040. They are both also members of the multicast group 0x23. Sketch the MAC header for a multicast frame sent from X to the multicast group 0x23.

(e) A small Local Area Network (LAN) is shown in the figure showing four computers, A, B, C and D connected to a LAN. The LAN is formed from two shared Ethernet segments joined via a bridge/switch.



The computer A sends three simultaneous Unicast file transfer packets. each to computers B, C, and D. Calculate the size of a frame, that carries 1032 B of IP network payload data. Using this , calculate the Utilisation of LAN X, assuming that the transmission continues at 50 packets per second to each of the three destinations.

(f) What is the utilisation on LAN Y?

TUTORIAL 4: Faster & Gigabit Ethernet

(a) In the context of Fast Ethernet explain how the following sequence of bits {1 0 0 1 1 0 } are encoded using *Multi-Level Threshold*, MLT-3 line encoding.

(b) What is the purpose of 4b/5b encoding?

(c) What differences are present in the physical layer used by a Gigabit Ethernet compared to Fast Ethernet?

See also: The Spanning Tree Tutorial

TUORIAL A.1: IP

(a) Define the following terms:
(i) The IP Version Number
(ii) The IP Network Number
(iii) The Network Layer Address

(b) Describe in detail how a computer connected to an Ethernet LAN determines its own Ethernet address and how it determines the Ethernet address of other computers with which it needs to communicate.

(c) Two computers, A and B, are connected by an Ethernet LAN. A has not previously sent any packets to the LAN. It sends 20B of data to B in a single IP datagram.
(i) What is the type of the first Ethernet frame sent by A?
(ii) To which MAC address is the first frame sent?
(iii) What is the IP source address of the first IP packet received by B?

TUTORIAL B: ARP

(a) An Ethernet Local Area Network (LAN) connects two workstations (A and B). The following information is provided about the IP interfaces of the computers connected to the LAN, also giving the hardware address (ha, or MAC address) for each interface.

A: IP = 139.101.1.7; h.a.= 08:00:20:02:b7:f9
B: IP = 133.101.1.63; h.a.= 08:00:20:ff:00:00

The computer A has not previously sent any packets to the Ethernet LAN. The user at A runs a program which sends one IP packet and has a destination address of B. Explain the hardware address values in the first frame which is sent by the computer A.

(b) What are the hardware source and destination addresses and the source and destination IP addresses of the first network layer packet which is received by B?

(c) Calculate the time taken to transmit one ARP packet using an Ethernet LAN operating at 10 Mbps. Your answer should first calculate the total size of the ARP packet including ALL overhead introduced by each layer during the transmission process.

TUTORIAL C: IP

(a) An end to end connection may be checked in an IP internet using the ping program which uses the Internet Control Management Protocol, ICMP. Describe the operation of the ICMP echo request and ICMP echo reply to perform this check, and how this may measure the round trip delay across the network.

(b) Provide a step by step explanation using diagrams to show the way an Ethernet network interface card and the network layer protocol process an IP frame received from an Ethernet transceiver.

(c) For each packet, specify which computers addresses are used for the source and destination address at both the link layer AND the network layer.

TUTORIAL D: UDP Transport Layer

(a) What is the service provided by the UDP transport layer?

(b) Explain the function of each of the fields in the UDP packet header.

(c) A UDP packet containing 50 B of payload data is transmitted using IP over an Ethernet LAN. What is the total size of the frame transmitted on the Ethernet LAN?

(d) An Ethernet protocol analyser observes the following frame:

```
08 00 20 00 70 DF 08 00 20 01 62 F0 08 00 45 00
00 1E 4A 02 00 00 3C 17 84 53 8B 85 CC 16 8B 85
CC 13 06 1B 04 25 00 0A 00 00 42 42 00 00 00 00 ...
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By decoding the hexadecimal bytes of this frame using the header chart supplied, determine the values for the MAC source address, the EtherType field; the IP and UDP Checksums.

See also - TCP