

Computer Networks

BCST -502 BCSP- 502

B.Tech (CSE) 5th Semester

Course Instructor: Dr Bishwajeet Pandey



New 2020 Syllabus

Unit –I

Computer Network: Definitions, goals, components, Architecture, Classifications & Types. Layered Architecture: Protocol hierarchy, Design Issues, Interfaces and Services, Connection Oriented & Connectionless Services, Service primitives, Design issues & its functionality. ISO/OSI Reference Model: Principle, Model, Descriptions of various layers and its comparison with TCP/IP. Principles of physical layer: Media, Bandwidth, Data rate and Modulations

Unit-II

Data Link Layer: Need, Services Provided, Framing, Flow Control, Error control. Data Link Layer Protocol: Elementary & Sliding Window protocol: 1-bit, Go-Back-N, Selective Repeat, Hybrid ARQ. Protocol verification: Finite State Machine Models & Petri net models. ARP/RARP/GARP

Unit-III

MAC Sub layer: MAC Addressing, Binary Exponential Back-off (BEB) Algorithm, Distributed Random Access Schemes/Contention Schemes: for Data Services (ALOHA and Slotted- ALOHA), for Local-Area Networks (CSMA, CSMA/CD, CSMA/CA), Collision Free Protocols: Basic Bit Map, BRAP, Binary Count Down, MLMA Limited Contention Protocols: Adaptive Tree Walk, Performance Measuring Metrics. IEEE Standards 802 series & their variant.



New 2020 Syllabus

Unit-IV

Network Layer: Need, Services Provided, Design issues, Routing algorithms: Least Cost Routing algorithm, Dijkstra's algorithm, Bellman-ford algorithm, Hierarchical Routing, Broadcast Routing, Multicast Routing. IP Addresses, Header format, Packet forwarding, Fragmentation and reassembly, ICMP, Comparative study of IPv4 & IPv6

Unit-V

Transport Layer: Design Issues, UDP: Header Format, Per-Segment Checksum, Carrying Unicast/Multicast Real-Time Traffic, TCP: Connection Management, Reliability of Data Transfers, TCP Flow Control, TCP Congestion Control, TCP Header Format, TCP Timer Management. Application Layer: WWW and HTTP, FTP, SSH, Email (SMTP, MIME, IMAP), DNS, Network Management (SNMP).



About Course Instructor



- PhD from Gran Sasso Science Institute, Italy
- PhD Supervisor Prof Paolo Prinetto from Politecnico Di Torino, World Rank 13 in Electrical Engineering
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- Google Scholar: https://scholar.google.com/citations?user=UZ_8yAMAAAAAJ&hl=hi
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About Course Outline

- UNIT 1: Lecture No 1-4
- UNIT 2: Lecture No 5-11 (Including Lab on Vivado)
- UNIT 3: Lecture No 14-18
- UNIT 4: Lecture No 19-21, Lecture 12-13
- UNIT 5: Lecture No 22-28 (Including Lab on Packet Tracer)
- Lecture No 29-35: Discuss Previous Year Question of UKTU
- Out of 35 Lectures: Some will delivered by Professor From Foreign University



MAC SUB LAYER:

Lecture 14



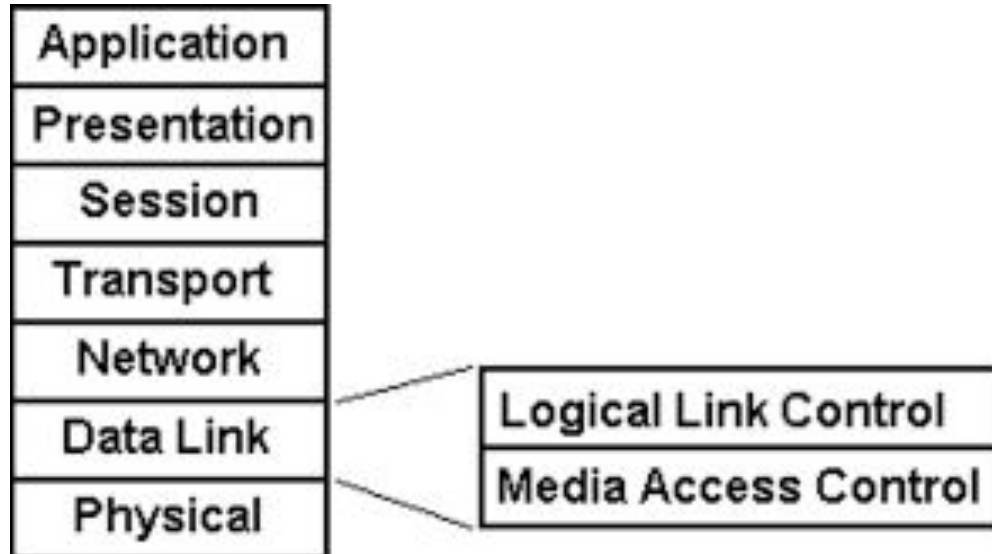
OUTLINE OF LECTURE 14

- MAC Sub layer:
 - MAC Addressing,
 - Binary Exponential Back-off (BEB) Algorithm



MAC Sub layer

- The MAC sublayer and the logical link control (LLC) sublayer together make up the data link layer.



MAC Sub layer

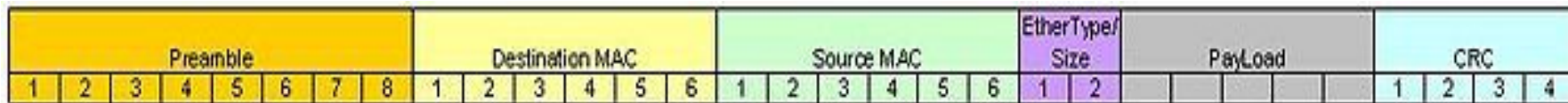
- In IEEE 802 LAN/MAN standards, the **medium access control (MAC**, also called **media access control**) sublayer is the layer that controls the hardware responsible for interaction with transmission medium.
- Within the data link layer, the LLC provides flow control and multiplexing for the logical link (i.e. EtherType, 802.1Q VLAN tag etc), while the MAC provides flow control and multiplexing for the transmission medium.



Logical Link

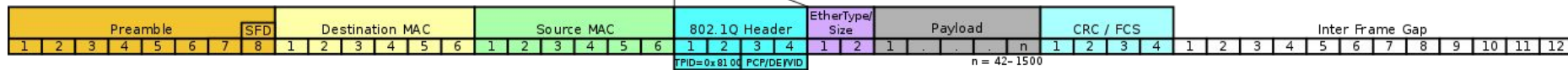
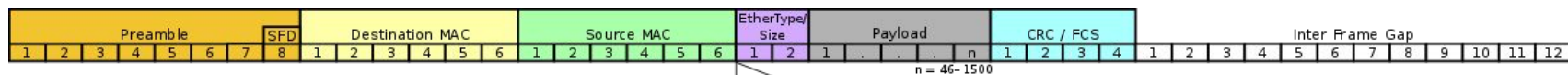
- **EtherType**

- **EtherType** is a two-octet field in an Ethernet frame. It is used to indicate which protocol is encapsulated in the payload of the frame and is used at the receiving end by the data link layer to determine how the payload is processed. The same field is also used to indicate the size of some Ethernet frames.



- **802.1Q VLAN tag**

- **IEEE 802.1Q**, often referred to as **Dot1q**, is the networking standard that supports virtual LANs (VLANs) on an IEEE 802.3 [Ethernet](#) network.

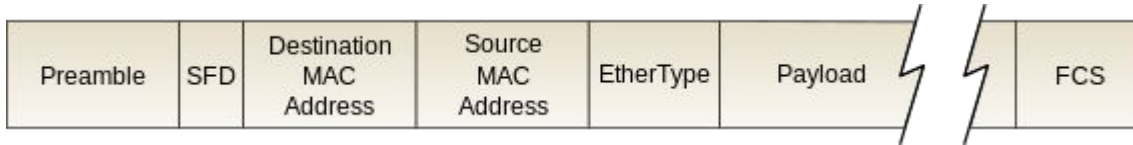


Logical Link Control (LLC) Sub Layer

- In the IEEE 802 reference model of computer networking, the **logical link control (LLC)** data communication protocol layer is the upper sublayer of the data link layer (layer 2) of the seven-layer OSI model.
- The LLC sublayer acts as an interface between the media access control (MAC) sublayer and the network layer.

Network	Unix IP SAP: 80	IBM Netbios SAP: F0	Novell IPX SAP: E0
Data Link	IEEE 802.2 Logical Link Control Layer (LLC)		
	IEEE 802.3 CSMA/CD Medium Access Control Layer		
Physical	802.3 - 10Base5	802.3a - 10Base2	802.3i - 10BaseT

Ethernet Frame



- In computer networking, an **Ethernet frame** is a data link layer protocol data unit and uses the underlying Ethernet physical layer transport mechanisms.
- An Ethernet frame is preceded by a preamble and start frame delimiter (SFD), which are both part of the Ethernet packet at the physical layer.
- Each Ethernet frame starts with an Ethernet header, which contains destination and source MAC addresses as its first two fields. The middle section of the frame is payload data including any headers for other protocols (for example, Internet Protocol) carried in the frame.
- The frame ends with a frame check sequence (FCS), which is a 32-bit cyclic redundancy check used to detect any in-transit corruption of data.

MAC Addressing

- A **media access control address (MAC address)** is a unique identifier assigned to a network interface controller (NIC) for use as a network address in communications within a network segment.
- MAC addresses are primarily assigned by device manufacturers, and are therefore often referred to as the **burned-in address**, or as an **Ethernet hardware address**, **hardware address**, and *physical address*.



MAC

Media Access Control Address



Organizationally Unique Identifier Network Interface Controller Specific

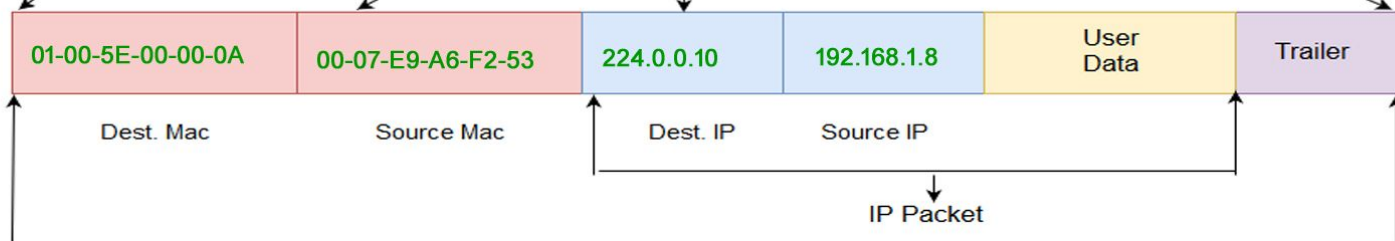
IP: 192.168.1.8
MAC: 00-07-E9-A6-F2-53



Host

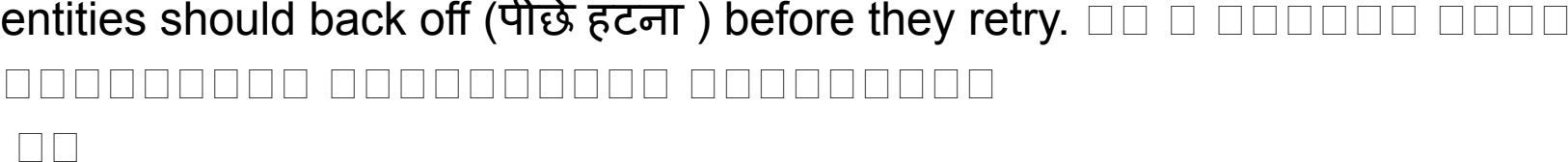


Multicast IP and MAC destination addresses deliver packet/frame to a specific group of hosts



Ethernet Frame

Binary Exponential Back-off (BEB) Algorithm

- Binary Exponential Backoff (BEB) is an algorithm to determine how long entities should back off (પીછે હટના) before they retry. 
- BEB was initially proposed for computer networking where multiple computers share a single medium or channel.
- It's most famously used in Ethernet and Wi-Fi networking standards.



Binary Exponential Back-off (BEB) Algorithm

- Binary Exponential Algorithm is widely used as a network congestion avoidance or collision resolution protocol.
- Binary exponential is a special case of exponential back off when $r = 2$, where r is a back off factor.
- With every unsuccessful attempt, the maximum backoff interval is doubled. BEB prevents congestion and reduces the probability of entities requesting access at the same time, thereby improving system efficiency and capacity utilization. □ □ □ □ □ □ □ □ □ □



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expanding the proceedings book - gy... Lecture 14-18: Computer Network - G... (1) WhatsApp Of Backoff Method – Effect Of Backoff... Binar

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Performance Evaluation of Backoff Method -- Effect of Backoff Factor on Exponential Backoff Algorithm

Publisher: IEEE

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4 Author(s)

Deepa Singh ; Bishwajeet Pandey ; G.S. Tomar ; B.K. Sarkar All Authors

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Abstract

Document Sections

- I. Introduction
- II. Literature Survey
- III. Results

Abstract:

In this paper the effect of back off factor on exponential algorithm is analyzed and binary exponential algorithm is implemented in Mat lab. Binary Exponential Algorithm is widely used as a network congestion avoidance or collision resolution protocol. The detailed analysis of saturation throughput is done in this work. This work also covers packet's medium access delay for a given number of node N. Binary exponential is a special case of exponential back off when $r=2$, where r is a back off factor and we basically analyse the effect of back off factor $r=1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 2.0$ on exponential back off algorithm. All the result is obtained through Matlab (Matrix Laboratory) simulation language.

<https://ieeexplore.ieee.org/document/6657959>

2nd Assignment

- Binary Exponential Algorithm is widely used as a network congestion avoidance or collision resolution protocol.
 - Q.1 Analyze the effect of back off factor on exponential algorithm.
 - Q.2 Implement binary exponential algorithm in any network simulation tool or any programming language.
 - Related Resource:
 - <https://cloud.google.com/iot/docs/how-tos/exponential-backoff>
 - <https://ieeexplore.ieee.org/document/6657959>
- Date of Submission: 15th October

3rd Assignment

- Using Cisco Packet Tracer, do the following assignment.
 - Q.1 Design an IP Addressing Schemes.
 - Q.2 Assign IP Addresses to Network Devices and Verify Connectivity
- Date of Submission: 30th October

4th Assignment

- Implement any topics related to Software Define Network (SDN) using any of the following tools.
 - Mininet,
 - NS3,
 - OMNET++
 - OFLOPS
- Date of Submission: 15th November

OUTLINE OF LECTURE 15

- Distributed Random Access Schemes/Contention Schemes:
 - For Data Services (ALOHA and Slotted- ALOHA),
 - ALOHA
 - Slotted-ALOHA
 - For Local-Area Networks (CSMA, CSMA/CD, CSMA/CA),
 - CSMA
 - CMA/CD
 - CSMA/CA



OUTLINE OF LECTURE 16

- Collision Free Protocols:
 - Basic Bit Map
 - Backup Route Aware Routing Program (BRAP)
 - Binary Count Down

