**Unit-2**

**Q.1] Explain The Following Protocols ?**

**A] Stop and Wait**

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* It is the simplest flow control method. In this, the sender will transmit one frame at a time to the receiver. The sender will **stop and wait** for the acknowledgement from the receiver.
* This time is the sender’s waiting time, and the sender is idle during this time.
* When the sender gets the acknowledgement (ACK), it will send the next data packet to the receiver and wait for the disclosure again, and this process will continue as long as the sender has the data to send.
* While sending the data from the sender to the receiver, the data flow needs to be controlled. If the sender is transmitting the data at a rate higher than the receiver can receive and process it, the data will get lost.
* The Flow-control methods will help in ensuring that the data doesn't get lost. The flow control method will check that the senders send the data only at a rate that the receiver can receive and process.

**B] Sliding Windows Flow Control:** In the sliding window technique, each data packet (for most data link layers) and byte (in TCP) includes a unique consecutive sequence number used by the receiving computer to place data in the correct order. The objective of the sliding window technique is to use the sequence numbers to avoid duplicate data and to request missing data.Their are the two types of Sliding Window Protocol :

1. **Go Back-n Protocol**: Go-Back-N Automatic Repeat Query (ARQ) protocol is also referred to as Go-Back-N Automatic Repeat Request. It is a data link layer protocol that helps a sliding window method. In this, if any frame is manipulated or lost, all subsequent frames have to be sent again. For example, in GO- Back –N, the N is the sender’s window size; if it is GO-Back-5, the sender will send frame 1 to 5 before receiving the knowledge of frame 1. All the frames are numbers to deal with the most and duplicate frames. If the sender does not receive the receiver’s acknowledgement, then all the frames available in the current window will be retransmitted.
2. **Selective Repetitive ARQ:** Selective Repeat ARQ is also referred to as the Selective Repeat Automatic Repeat Request. It is a data link layer protocol that facilitates a sliding window method. The Goback-N ARQ protocol operates well if it has fewer errors.

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| https://www.tutorialspoint.com/assets/questions/media/51813/ARQ_protocol.jpg |

**C] High Level Data Link Control[HLDLC]**

* High-level Data Link Control (HDLC) is a group of communication protocols of the data link layer for transmitting data between network points or nodes. Since it is a data link protocol, data is organized into frames. A frame is transmitted via the network to the destination that verifies its successful arrival.
* **HDLC Station Types:**
* **1..Primary station:** Controls operation of link, Frames issued are called commands, Maintains separate logical link to each secondary station.
* **2. Secondary station:** Under control of primary station, Frames issued called responses
* **3. Combined station:** May issue commands and responses
* **4. Unbalanced:** One primary and one or more secondary stations, Supports full duplex and half duplex
* **5. Balanced:** Two combined stations, Supports full duplex and half duplex
* **HDLC Transfer Modes:**
* **Normal Response Mode (NRM):** Unbalanced configuration, Primary initiates transfer to secondary, Secondary may only transmit data in response to command from primary, Used on multi-drop lines, Host computer as primary, Terminals as secondary
* **Asynchronous Balanced Mode (ABM):** Balanced configuration, Either station may initiate transmission without receiving permission, Most widely used, No polling overhead.
* **Asynchronous Response Mode (ARM):** Unbalanced configuration, Secondary may initiate transmission without permission form primary, Primary responsible for line, rarely used.

**Q.2] Give The Classification of Multiple Access Protocols.**

* Multiple access protocols are a set of protocols operating in the Medium Access Control sublayer (MAC sublayer) of the Open Systems Interconnection (OSI) model. These protocols allow a number of nodes or users to access a shared network channel. Several data streams originating from several nodes are transferred through the multi-point transmission channel. Multiple access protocols can be broadly classified into three categories

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* **1. Random Access Protocols:** Random access protocols assign uniform priority to all connected nodes. Any node can send data if the transmission channel is idle. No fixed time or fixed sequence is given for data transmission.The four random access protocols are **1.** ALOHA

1. Carrier sense multiple access (CMSA) **3.** Carrier sense multiple access with collision detection (CMSA/CD) **4.** Carrier sense multiple access with collision avoidance (CMSA/CA)

* **2. Controlled Access Protocols**: Controlled access protocols allow only one node to send data at a given time.Before initiating transmission, a node seeks information from other nodes to determine which station has the right to send. This avoids collision of messages on the shared channel.The station can be assigned the right to send by the following three methods−

1. Reservation **2.** Polling **3.** Token Passing

## 3.Channelization: Channelization are a set of methods by which the available bandwidth is divided among the different nodes for simultaneous data transfer. The three channelization methods are 1. Frequency division multiple access (FDMA) 2. Time division multiple access (TDMA) 3. Code division multiple access (CDMA)

**Q.3] Explain The Following Protocols ?**

**A] Aloha Protocol:** It is designed for wireless LAN (Local Area Network) but can also be used in a shared medium to transmit data. Using this method, any station can transmit data across a network simultaneously when a data frameset is available for transmission.

* **Types of Aloha:**

1. **Pure Aloha:** Whenever data is available for sending over a channel at stations, we use Pure Aloha. In pure Aloha, when each station transmits data to a channel without checking whether the channel is idle or not, the chances of collision may occur, and the data frame can be lost. When any station transmits the data frame to a channel, the pure Aloha waits for the receiver's acknowledgment.

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1. **Slotted Aloha:** The slotted Aloha is designed to overcome the pure Aloha's efficiency because pure Aloha has a very high possibility of frame hitting. In slotted Aloha, the shared channel is divided into a fixed time interval called **slots**. So that, if a station wants to send a frame to a shared channel, the frame can only be sent at the beginning of the slot, and only one frame is allowed to be sent to each slot.

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**B] Multiple Access:** The Data Link Layer is responsible for transmission of data between two nodes. Its main functions are- **1.**Data Link Control **2.**Multiple Access Control.

* **1.Data Link control :** The data link control is responsible for reliable transmission of message over transmission channel by using techniques like framing, error control and flow control.
* **2.Multiple Access Control** :If there is a dedicated link between the sender and the receiver then data link control layer is sufficient, however if there is no dedicated link present then multiple stations can access the channel simultaneously. Hence multiple access protocols are required to decrease collision and avoid crosstalk. For example, in a classroom full of students, when a teacher asks a question and all the students (or stations) start answering simultaneously (send data at same time) then a lot of chaos is created( data overlap or data lost) then it is the job of the teacher (multiple access protocols) to manage the students and make them answer one at a time.

**C] Carrier Sense Multiple Access[CSMA]:**

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* **Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA) –**The basic idea behind CSMA/CA is that the station should be able to receive while transmitting to detect a collision from different stations. In wired networks, if a collision has occurred then the energy of the received signal almost doubles, and the station can sense the possibility of collision**. CSMA/CA has been specially designed for wireless networks.**
* There are 4 types of access modes available in CSMA.
* **1-Persistent:**It senses the shared channel first and delivers the data right away if the channel is idle. If not, it must wait and ***continuously*** track for the channel to become idle and then broadcast the frame without condition as soon as it does. It is an aggressive transmission algorithm.
* **2. Non-Persistent:** It first assesses the channel before transmitting data; if the channel is idle, the node transmits data right away. If not, the station must wait for an arbitrary amount of time (***not continuously***), and when it discovers the channel is empty, it sends the frames.
* **3. P-Persistent:**It consists of the 1-Persistent and Non-Persistent modes combined. Each node observes the channel in the P-Persistent mode, and if the channel is idle, it sends a frame with a P probability. If the data is not transferred, the frame restarts with the following time slot after waiting for a (q = 1-p probability) random period.
* **4. O-Persistent:**A supervisory node gives each node a transmission order. Nodes wait for their time slot according to their allocated transmission sequence when the transmission medium is idle.

**Q.4] Explain The service Provide by Data link Layer?**

1. **Actual Communication :** In this communication, physical medium is present through which Data Link Layer simply transmits data frames. The actual path is Network Layer -> Data link layer -> Physical Layer on sending machine, then to physical media and after that to Physical Layer -> Data link layer -> Network Layer on receiving machine. In Data Link Layer, if anyhow frame is lost due to noise, there will be no attempt made just to detect or determine loss or recovery from it. This simply means that there will be no error or flow control. An example can be Ethernet.

* **2. Virtual Communication :** In this communication, no physical medium is present for Data Link Layer to transmit data. It can be only be visualized and imagined that two Data Link Layers are communicating with each other with the help of or using data link protocol.
* **Types of Services provided by Data Link Layer :**

1. **Unacknowledged Connectionless Service :** Unacknowledged connectionless service simply provides datagram styles delivery without any error, issue, or flow control. In this service, source machine generally transmits independent frames to destination machine without having destination machine to acknowledge these frames.
2. **Acknowledged Connectionless Service :** This service simply provides acknowledged connectionless service i.e. packet delivery is simply acknowledged, with help of stop and wait for protocol.In this service, each frame that is transmitted by Data Link Layer is simply acknowledged individually and then sender usually knows whether or not these transmitted data frames received safely. There is no logical connection established and each frame that is transmitted is acknowledged individually. This service is more reliable than unacknowledged connectionless service. This service is generally useful over several unreliable channels, like wireless systems, Wi-Fi services, etc.
3. **Acknowledged Connection-Oriented Service :**In this type of service, connection is established first among sender and receiver or source and destination before data is transferred.Then data is transferred or transmitted along with this established connection. In this service, each of frames that are transmitted is provided individual numbers first, so as to confirm and guarantee that each of frames is received only once that too in an appropriate order and sequence.

**Q.5] Explain the Design Issues for the Network Layers ?**

* **1. Store and Forward packet switching:** The host sends the packet to the nearest router.
* This packet is stored there until it has fully arrived once the link is fully processed by verifying the checksum then it is forwarded to the next router till it reaches the destination. This mechanism is called “Store and Forward packet switching.
* **2. Services provided to Transport Layer:** Through the network/transport layer interface, the network layer transfers it’s services to the transport layer. These services are described below.  
  But before providing these services to the transfer layer following goals must be kept in mind :-
* The Offering services must not depend on router technology.
* The transport layer needs to be protected from the type, number and topology of the available router.
* The network addresses for the transport layer should use uniform numbering pattern also at LAN and WAN connections.
* **3. Implementation of Connectionless Service:** Packet are termed as “datagrams” and corresponding subnet as “datagram subnets”. When the message size that has to be transmitted is 4 times the size of the packet, then the network layer divides into 4 packets and transmits each packet to router via. a few protocol.Each data packet has destination address and is routed independently irrespective of the packets.
* **4. Implementation of Connection Oriented service:** To use a connection-oriented service, first we establishes a connection, use it and then release it. In connection-oriented services, the data packets are delivered to the receiver in the same order in which they have been sent by the sender.
* **Self-Study:** Data link layer design issues, Error detection and correction, Elementary data link protocols, The channel allocation problem, Multiple access protocols, Network layer design issues, Routing algorithms in a single network, Traffic management at the network layer, internetworking, software-defined networking, The network layer in the internet.