

Unit - 3#) Link Layer or Data Link Layer

- The data link layer is 4<sup>th</sup> layer from top and 2<sup>nd</sup> layer from the bottom.
- The communication channel that connects the adjacent Nodes is known as links and in order to move the datagram from source to destination, the destination datagram must be moved across an individual link.
- The main responsibility of the data link layer is to transfer the datagram across an individual link.
- The Data Link Layer protocol defines the format of the packet exchanged across the nodes as well as the actions such as error detection, retransmission, flow control & random access.

Services of Data Link Layer

- Framing & link access
- Reliable delivery
- Flow control
- Error detection
- Error correction
- Half duplex & full-duplex.

## #2) Network Layer

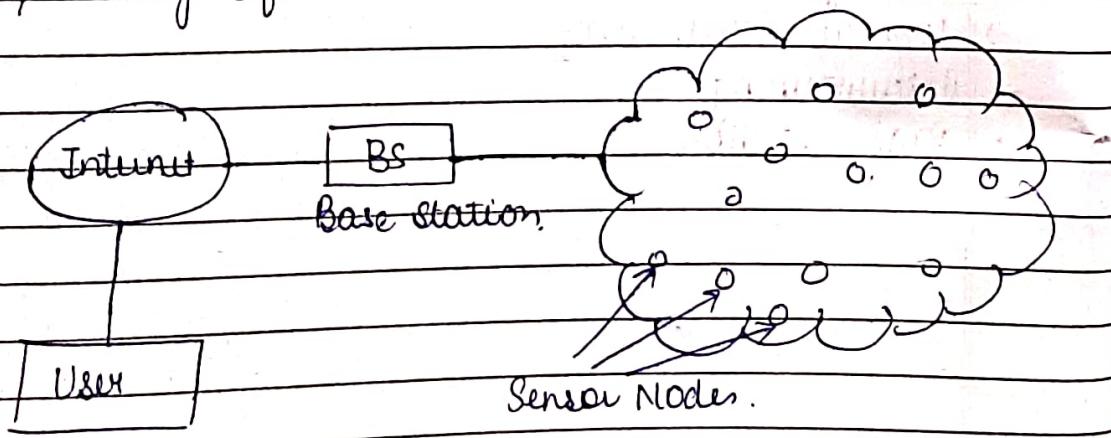
- The Network Layer is the third layer of the OSI Layer Model.
- It handles the service request from the transport layer & further forwards the service request to the data link layer.
- The Network layer translates the logical address into physical address.
- It determines the route from the source to the destination & also manages the traffic problems such as switching, routing & controls the congestion of data packets.
- The main role of the Network layer is to move the packets from sending host to the receiving host.

Main functions performed by the Network layer are:-

- Routing
- Logical Addressing
- Fragmentation
- Anteworking

## #) Wireless Sensor Networks (WSN)

- A WSN (Wireless Sensor Network) is a wireless network consisting of large number of heterogeneous sensor nodes which spread over a large field to monitor physical or environmental conditions such as temperature, sound, vibration, pressure etc.
- A WSN is a network of many tiny disposable low power devices (nodes) that communicate through wireless channels for information sharing.
- Sensor nodes are used in WSN with the onboard processor that manages & monitors the environment in particular area.
- They are connected to the base station which acts as processing unit in the WSN system.
- Base station in a WSN system is connected through the internet to share data.
- WSN can be used for processing, analysis, storage & mining of the data.



## Components

Sensors :- They are used to capture the environmental variables and which is used for data acquisition. Sensor signals are converted into electrical signal

Radio Nodes :- It is used to receive the data produced by the Sensors and send it to the WLAN access points

WLAN Access Points :- It receive the data which is absen by Radio Nodes wirelessly, generally through the Internet.

Evaluation Software :- The data received by the WLAN Access Point is processed by a Software called as Evaluation Software for presenting the report to the user. for processing the data

## challenges of WSN

Quality of service

Security Issue

Energy Efficiency

Network Throughput

Performance

Ability to cope with Node Failure

Cross layer optimisation

Scalability to large scale of deployment

### Advantages

- It avoids cost of wiring
- it can accommodate New devices at any time
- It is flexible to go through physical partitions
- It can be accessed through a centralized monitor

### Disadvantages

- Lower speed as compared to wired Networks
- less secure, hackers can easily hack the Network
- More complex to configure than wired Network
- Gets disturbed by various wireless elements like Bluetooth

### Applications

① Military Surveillance & Target tracking :- WSN can be rapidly deployed for Surveillance & used to provide battlefield intelligence regarding the location, Number, Movement, & Identity of -troops & vehicles & for detection of Chemical, Biological & Nuclear weapons.

② Environmental Monitoring - Environmental Monitoring can be used for animal tracking, forest surveillance, flood detection & weather forecasting. Some of areas where WSN's are used here as follows :-

forest fire detection - A Network of Sensor Node can be installed in a forest to detect when a fire has started. Sensor Nodes measure temperature, humidity & gaseous which are produced by fire in the areas.

Air Pollution Maintaining - WSN have been displayed in several cities to monitor the concentration of dangerous gases for citizens.

Landslide detection - A Landslide detection system makes use of WSN to detect the slight moments of soil and changes in parameters.

Health monitoring - WSN can be embedded into a hospital building to track & monitor patients & all medical resources. There are various kind of Sensors which can measure Blood pressure, Body temperature & ECG.

Traffic Control - WSN can be used for Vehicle traffic Monitoring & control. WSN will completely change the landscape of traffic, monitoring and cheap sensor nodes in the car, at the parking lots, streetline.

(5) Industrial Monitoring - WSN make it economically feasible to monitor the 'health' of machines & to ensure the safe operation by embedding sensor nodes into machines.

Monitoring corrosion using manual processes is extremely costly, time consuming & unreliable. A Network of wireless sensors can be economically deployed to reliably identify issues before they

#### #) Design Issues of WSN Architecture

The design issues of WSN mainly include the following :-

(1) Energy Consumption :- In WSN, power consumption is one of the main issue. As an energy source, the battery is used by equipping with Sensor Nodes. The Sensor network is arranged with in dangerous situations so it turns complicated for changing otherwise recharging Battery. The Energy Consumption depends on the sensor Node operations.

(2) Localization - Sensor localization is a operation as well as critical problem for network. The Sensor Networks are deployed in ad hoc manner so they do not have any information about their position. The Problem of determining the physical location of Sensors after they have been deployed is called localization.

Clocks - Clock Synchronization is a critical service in WSN. The goal of time synchronization is to provide a common timescale for local clocks of nodes in Sensor Network.

Coverage - The Sensor Nodes use coverage algorithm to sense the data and send them using routing alg. For good coverage, sensor nodes must be selected in such a manner so that whole Network should be covered.

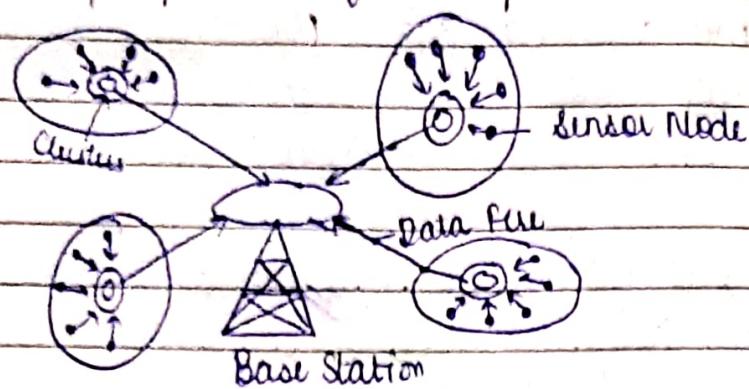
Computation - The amount of data processed by every node is called Computation. The major problem in computation is that it should minimize the use of resources.

Production Cost - Large Number of Nodes are deployed in the Sensor Network. So if the cost of every single node will be very high then the overall cost of Network will also be very high. Cost of each Sensor Node in the network is the challenging issue.

Quality of Service - QoS means data should be delivered within time period. If data should not be delivered on time to receiver, it will become useless. There are various Quality of Service issues in Sensor Network such as Network Topology.

## #) Clustered Network

In this kind of Network, separately Sensor nodes add into groups known as Cluster which depend on the "Leach Protocol" because it uses cluster head term stands for "Low Energy Adaptive Clustering Hierarchy". The Main purpose of this protocol :-



- This is two tier hierarchy clustering architecture.
- This distributed Algorithm is used to arrange the Sensor Nodes in Groups known as clusters.
- In every Cluster which is formed separately, the Head Nodes of the Cluster will create the TDMA plans.
- It uses the Data fusion concept so that it will make the Network Energy Efficient.

This kind of Network architecture is used due to data fusion property. In Every Cluster, every node can interact through the Head of the Cluster to get the data. All the Cluster will share their collected data towards the Base station.