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**A COMPARATIVE ASSESSMENT OF TOPOLOGIES AND THEIR ISSUES IN  
WIRELESS SENSOR NETWORKS**

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**ABSTRACT**

A Wireless Sensor Network consists of small, self-configurable sensor nodes, which have very small storage capacity and low processing power. Sensor nodes are scattered over a field and they organize themselves in specific manner automatically to interchange information they sense. The organization of nodes plays a vital role from the point of view of efficiency of network. In this paper, a comparative assessment of WSN topologies is given, which leads the judgment of efficiency of sensor networks.

**KEYWORDS:** WSN, sink, sensor field, topology.

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**INTRODUCTION**

A Wireless Sensor Network consists of sensor nodes, which are having very limited processing supremacy and storage but have ability to sense their surrounding and this information is sent to a central location called sink. Sink acts as interface between user and sensor network. The area in which sensor nodes are scattered is known as sensor field. Information collected by sensor field is passed to sink and then sink passes this information to user phase.

WSNs do well to examine environment wirelessly such as judgment of temperature, pressure, humidity, moisture, level of rainfall etc. Applicability of WSNs is not limited up to judgment of environmental activities only but they can be used in making intellectual buildings, farming and all other mechanical, civil and electrical evaluations.

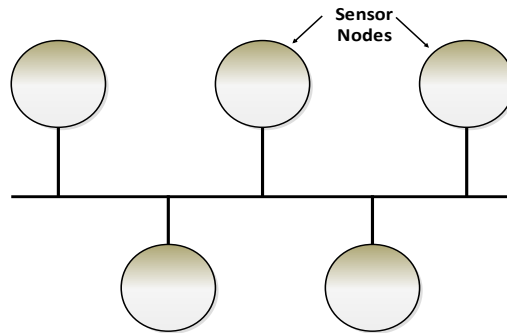
**TOPOLOGIES IN WSN**

Wireless sensor networks have various designs of connectivity of nodes, called topologies. While designing the network, the developer has several choices of topologies for configuring the network. In this section, different topologies such as bus, tree, star, ring and mesh are discussed with their advantages and disadvantages.

**Bus Topology**

This topology is generally used when one has to broadcast message or it can be said that in this topology a node broadcasts message if it wants to send any information to any other node in network. All nodes see or receive the message but only recipient actually processes the message and rest nodes discard the message. In this topology, single communication path creates problem of traffic congestion but this topology is very easy to install. When there is limited number of nodes then bus topology is best. The lines shown in figures depict wireless connectivity [1], [2], [6].

Figure 1:

*Bus Topology***Advantages of Bus topology**

- It is cost effective i.e. less establishment cost.
- Small networks use this topology.
- It is too simple to understand and set up.
- Lesser connectivity installation is required as compared to other network topologies.
- It is very easy to expand the joining of more sensors to the network.

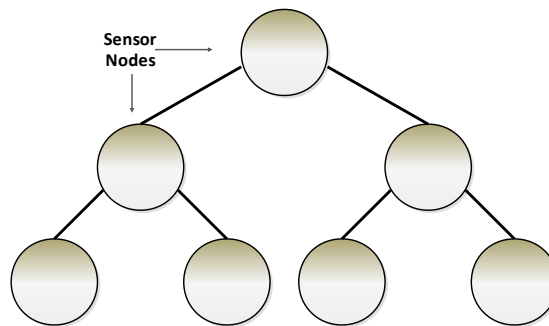
**Disadvantages of Bus topology**

- If connection fails or cut then whole network fails.
- The performance of network decreases if there is heavy traffic in network.
- Connectivity has limited length and range.
- Information exchange is slower than ring topology.

**Tree Topology**

In this topology, the main communication router is called central hub, which is the root node. The tree can be called a fusion of both Peer-to-Peer and Star topology. If we see the lower level then it looks like a star network. In this topology, parent node maintains the children nodes. In this, the communication path can be single hop or multi hop. Sensor nodes sense the data or information and communicate it to the sink node via parent. The parent node forwards the data it gets from its children to upper level. For the maximum lifetime of sensor, it is necessary to find the shortest path, which is optimal to other, shorter time delay and proper distribution of nodes. The main problem is load balancing i.e. distribution of workload between siblings to save power and increase lifetime [2], [3], [6].

Figure 2:

*Cluster Tree Topology*

**Advantages of Tree topology**

- It is fusion of bus and star topologies so it takes advantages of both.
- Nodes' expansion is possible and easy.
- Easy to manage and maintain.
- Errors can be detected easily and accurately.

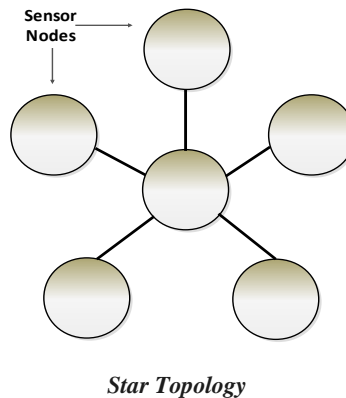
**Disadvantages of Tree topology**

- Heavily connected.
- Higher installation cost.
- If tree goes huge or more nodes are added then it becomes difficult to manage and maintain.

**Star Topology**

In star topology, network nodes cannot communicate or exchange data or information directly. Instead, they are connected to a centralized communication hub (sink) and with the help of centralized hub they communicate to each other. Centralized hub behaves as router for whole communication. The middle hub takes action as a server or a sink and all surrounding connected nodes act as "clients" [2], [4], [6].

**Figure 3:**



**Advantages of Star topology**

- It gives fast processing and higher performance with lower network traffic.
- Hub upgradation can be done easily.
- Troubleshooting is easy.
- Setup and modification is easy.
- Only a failed node is affected, rest of the nodes work smoothly.

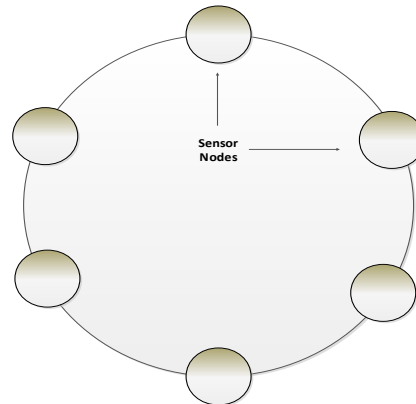
**Disadvantages of Star topology**

- High installation cost.
- Very expensive to use.
- All the nodes depend on hub so if hub is affected then whole network stops working.
- Performance depends on hub-capacity.

**Ring Topology**

In ring topology, each node is connected to exactly two neighbor nodes for communication. The direction of flow of message or information is simple i.e. either clockwise or counterclockwise. In this topology, there is obstruction of traffic and if any node fails, the loop breaks and entire network also fails [2], [5].

Figure 4:



*Ring Topology*

**Advantages of Ring topology**

- High traffic doesn't matter for transmitting network because the node having token, can only transmit data or information.
- It is very easy to expand and cheap to install.

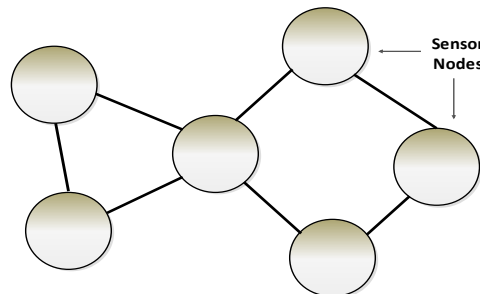
**Disadvantages of Ring topology**

- Difficult in troubleshooting.
- Node's addition and deletion disturbs the entire network.
- Whole network fails even if a single node is failed.

**Mesh Topology**

In mesh topology, several paths are used for communication of messages/information from source to destination. A fully connected mesh network is one in which every node connected with every other node in the network and in partial mesh networks, some nodes connect indirectly to others, means connectivity exists between all [2], [5], [6].

Figure 5:



*Mesh Topology*

**Advantages of Mesh topology**

- Each connection is having its own data load.
- Robust network structure.
- Easy fault diagnosis.
- Security and privacy is provided by it.
- If one path is down then another path is available for communication.

*Disadvantages of Mess topology*

- Difficult to Install and configure.
- Cost is more.
- Bulk connection is required.





**CONCLUSION**

As it is seen that arrangement of nodes in certain pattern decides efficiency of sensor network, so a proper arrangement is required. If a better arrangement can be defined then a more efficient network can be constructed.

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