ISSN 2278-9723
DOI:10.31838/ijccts/08.02.02

Research Article

A Secondary Study Examining the Effectiveness of Network Topologies: The Case of Ring, Bus, and Star Topologies

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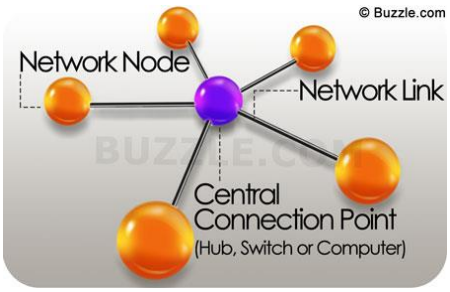
Received: 27.11.19, Revised: 26.12.19, Accepted: 17.01.20

ABSTRACT
Topologies arise from the practice of design development. Notably, network topologies refer to the manner in which nodes are connect to foster an interaction. Specifically, topologies constitute network structures that define the process through which nodes communicate. This paper focuses on the bus, ring, and star topologies, examining their performance strengths and demerits.
Keywords: Topologies constitute network structures, star topology, bus, ring, strengths and demerits.

INTRODUCTION
In the star topology, all the network components are connected to central devices. The latter constitute network hubs that could be substituted by switches or routers (Barab´asi, Albert & Jeong, 2000). Therefore, the star topology arises when all workstations rely on a central device, assuming the form of a point-to-point connection. The overall implication is that each computer is connected to other computers indirectly, with the hub playing a critical role (Fabien, Bruno & Pascal, 2013). It is also worth noting that the star topology has its entire data reaching the intended destination by passing through the central device. In a study by Guimer'a, Arenas, D´ıaz-Guilera and Giralt (2002), it was affirmed that the hub acts as a junction that is responsible for connecting different nodes, managing and controlling the entire network system. Areas of application include homes and offices. The figure below illustrates the star topology.



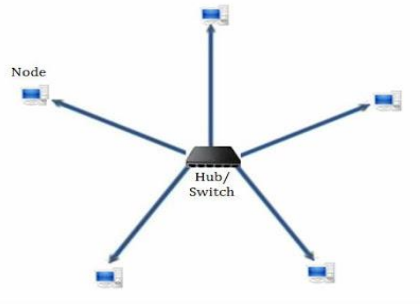


Figure 1: Illustrations of the Star Topology

Source: Fabien, Bruno and Pascal (2013)

According to Lehmann, Lautrup and Jackson (2003), the bus topology forms a simple network topology in which all nodes (that constitute servers and computers) are connected to single cables. The single cables are referred to as "buses". Notably, the connections are achieved using interface connectors. Therefore, a bus topology operates in such a way that the central cable forms a backbone of the entire network. Upon the connection, communications among network workstations occur through the formulated "bus". Also, a signal broadcasted from the source travels to the rest of workstations. The latter are connected to the cable of the bus. Whereas broadcasting operations focus on the entire message, only the intended recipients accept the message. Specifically, intended recipients are expected to match in terms of the IP address and the MAC address (Barab´asi, Albert & Jeong, 2000). In situations where the MAC and IP addresses fail to match with the

intended addresses, signals are discarded by machines. To prevent the signal bouncing process, central cables have terminators added to their ends. Furthermore, barrel connectors may be adopted in a quest to extend the terminators. This type of topology is applied in technology centers and business. The following figures depict the bus topology.

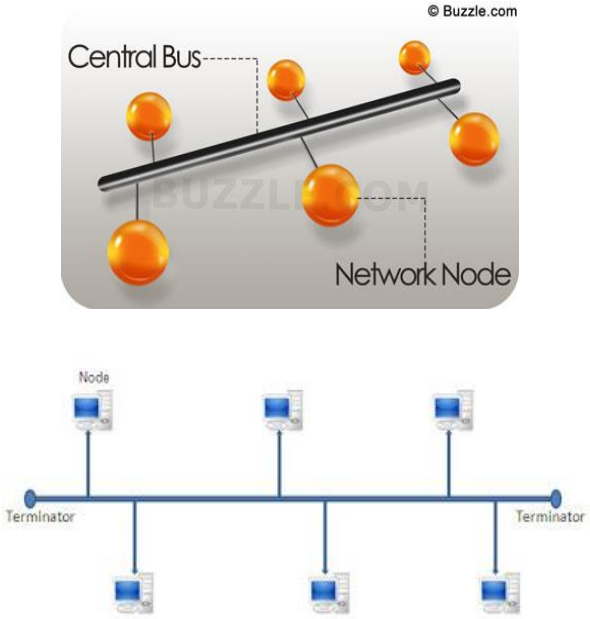


Figure 2: Depictions of the Bus Topology

Source: Fabien, Bruno and Pascal (2013)

In the case of the ring topology, a closed loop characterizes the connection of nodes. As such, individuals workstations exhibit connections to two other components; occurring on either side. In turn, the workstations communicate with the two immediate neighbors to enable the data travel around the formulated network. It is also worth highlighting that the process of data traveling in the ring topology is unidirectional, with the token aiding in data sending and reception (Barab´asi, Albert & Jeong, 2000).

Regarding the process of token passing, tokens in the ring topology constitute pieces of data that is sent by source computers – along with the information. In turn, the token passes to the nodes that follow, confirming whether the signal is intended to the next node or not. If the next node's details match with that of the source computer, the former receives the signal. The process is repetitive and takes place until the signal reaches the intended destination. Notably, only network nodes that constitute networks are permitted to send information in the ring topology. Therefore, other nodes wait to receive empty tokens. Some of the areas where the ring node is applied include small buildings, schools, and offices (Fabien, Bruno & Pascal, 2013). The following figure provides illustrations of the functionality of the ring topology.

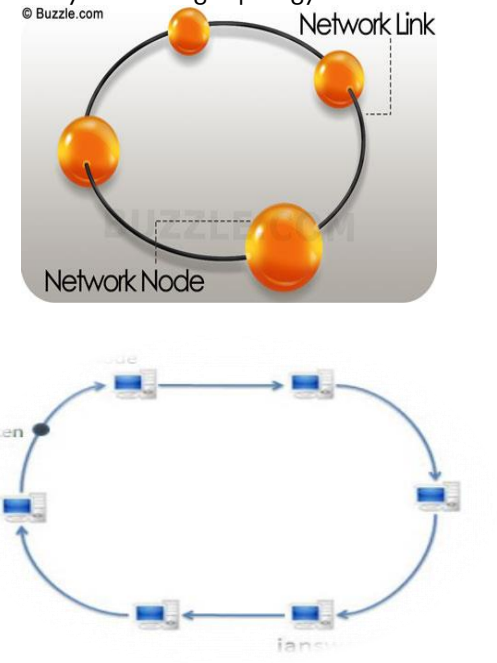


Figure 3: Illustrations of the Functionality of the Ring Topology

Source: Fabien, Bruno and Pascal (2013)

SECONDARY DATA RESULTS AND DISCUSSION

One of the strengths of the star topology is that it offers operational simplicity. Additionally, the star topology achieves individual device isolations in the network while making it easy to add or remove network nodes. Furthermore, the star topology is beneficial in such a way that an addition or removal of network nodes can be achieved without interfering with the rest of the network (Lehmann, Lautrup & Jackson, 2003). A centralized nature of the star topology implies further that it is easy to detect possible faults among devices. Therefore, an easier form of traffic management makes the star topology to pose fewer security risks (Barab´asi, Albert & Jeong, 2000).

Despite the strengths, the star topology poses demerits. For instance, the entire network's operation relies on the functionality of the central hubs. Therefore, a failure in the functionality of central hubs is likely to stall progress in such a way that the entire network fails (Fabien, Bruno & Pascal, 2013). Furthermore, the capacity of the central hub determines the number of nodes that can be added or removed from the star topology. As such, lower capacity among hubs limits the number of nodes that can be added to the topology. Lastly, the cost of setting up a star topology is high (Guimer'a, Arenas, D ´ıaz-Guilera and Giralt, 2002).

The strength arising from a bus topology is that it is easy to implement, handle, and set up. Furthermore, the process of installing a bus topology costs less. Lastly, the bus topology is strengthous in such a way that it is suitable for small networks (Fabien, Bruno & Pascal, 2013). However, the bus topology is problematic in such a way that the length of the cable is limited. The limitation implies that the number of network nodes that can interact is restricted. Additionally, the bus topology an increase in the number of devices connected to the bus topology causes a decrease in the mechanism's efficiency (Guimer'a, Arenas, D ´ıaz-Guilera and Giralt, 2002). It is further notable that the bus topology exhibits a heavy reliance on the "bus". Therefore, potential faults in the "bus" lead to failures in the entire network. Also, it is difficult to isolate faults among the network nodes that rely on the bus topology. Lastly, each device on the network is capable of accessing the transmitted data, posing security risks (Lehmann, Lautrup & Jackson, 2003).

The strength with the ring topology is that, all the intermediate nodes support the data transmission process. As such, the ring topology does not require central servers during the management process. The implication is that the approach is cost-effective. Another merit is that the ring topology supports a high-speed transmission of data, attributed to the unidirectional nature of traffic flow (Guimer's, Arenas, D´ıaz-Guilera and Giralt, 2002). Also, the ring topology handles the load to a better extent – compared to the bus topology. Furthermore, the process of adding or removing network is easier in the case of the ring topology. The latter merit arises from the mechanism's requirement to change only two connections (Lehmann, Lautrup & Jackson, 2003). The ring topology poses a further merit in such a way that its configuration makes it easier for the network operators to identify potential faults that could arise in the network nodes. Lastly, the ring topology is less costly (compared to the star topology) and, each node has the capacity to foster the data transmission process. Therefore, the ring topology constitutes a highly organized operation (Barab´asi, Albert & Jeong, 2000).

CONCLUSION

Whereas several strengths characterize the ring topology, the mechanism falters in various ways. For instance, a failure in one network node is likely to affect the entire network. Additionally, the performance of the whole network is affected by the process of adding or removing a node. The system is also problematic in such a way that the data sent from a particular node passes through all other intermediate nodes. This functionality slows the transmission process; compared to the case of the star topology. Therefore, the speed of data transmission in the ring topology reduces with the addition of nodes.

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DOI: 10.4103/0975-3583.74263