OVERVIEW OF TREE TOPOLOGY

Dr. Sunil Kumar

PGT, Computer Science, Jawahar Navodaya Vidyalaya, Kotia, Mohindergarh, Haryana, India

***Email ID**: sunilvats1981@gmail.com*

Received: 08.01.2016 **Accepted**: 12.02.2016

Keywords: Networks, Tree Topology

Abstract

Tree Topology integrates the characteristics of Star and Bus Topology. Earlier we saw how in Physical Star network Topology, computers (nodes) are connected by each other through central hub. And we also saw in Bus Topology, work station devices are connected by the common cable called Bus. After understanding these two network configurations, we can understand tree topology better. In Tree Topology, the number of Star networks are connected using Bus. This main cable seems like a main stem of a tree, and other star networks as the branches. It is also called Expanded Star Topology. Ethernet protocol is commonly used in this type of topology.

Paper Identification

1. Introduction

Network topology is the arrangement of the various elements (links, nodes, etc.) of a computer network. Essentially, it is the topological structure of a network and may be depicted physically or logically. Physical topology is the placement of the various components of a network, including device location and cable installation, while logical topology illustrates how data flows within a network, regardless of its physical design. Distances between nodes, physical interconnections, transmission rates, or signal types may differ between two networks, yet their topologies may be identical.

An example is a local area network (LAN): Any given node in the LAN has one or more physical links to other devices in the network; graphically mapping these links results in a geometric shape that can be used to describe the physical topology of the network. Conversely, mapping the data flow between the components determines the logical topology of the network.

A tree topology is essentially a combination of bus topology and star topology. The nodes of bus topology are replaced with standalone star topology networks. This results in both disadvantages of bus topology and advantages of star topology.

For example, if the connection between two groups of networks is broken down due to breaking of the connection on the central linear core, then those two groups cannot communicate, much like nodes of a bus topology. However, the star topology nodes will effectively communicate with each other.

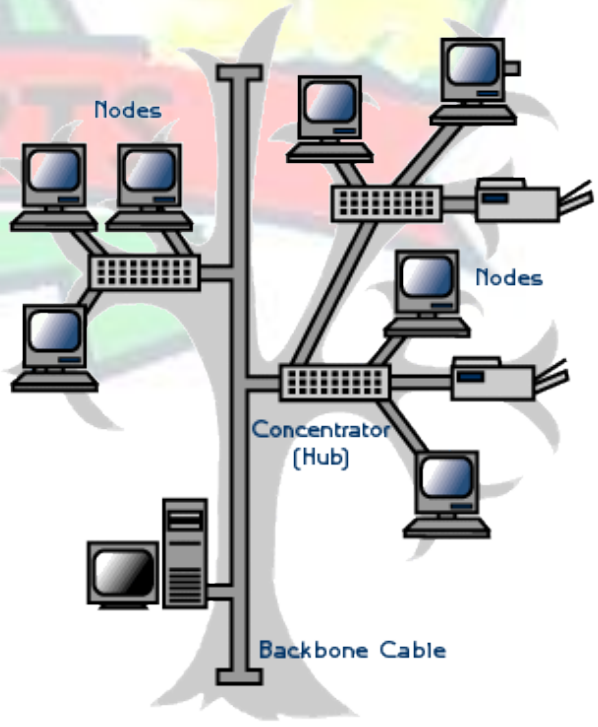
It has a root node, intermediate nodes, and ultimate nodes. This structure is arranged in a hierarchical form and any intermediate node can have any number of the child nodes.

But the tree topology is practically impossible to construct, because the node in the network is nothing, but the computing device can have maximum one or two connections, so we cannot attach more than 2 child nodes to the computing device (or parent node). There are many sub structures under tree topology, but the most convenient is B-tree topology whereby finding errors is relatively easy.

2. Tree Topology

Many supercomputers use a fat tree network,[6] including the Yellowstone (supercomputer), the Tianhe-2, the Meiko Scientific CS-2, the Earth Simulator, the Cray X2, the CM-5, and many Altix supercomputers. A tree topology (a.k.a. hierarchical topology) can be viewed as a collection of star networks arranged in a hierarchy. This tree has individual peripheral nodes (e.g. leaves) which are required to transmit to and receive from one other node only and are not required to act as repeaters or regenerators. Unlike the star network, the functionality of the central node may be distributed.

- A network that is based upon the physical hierarchical topology must have at least three levels in the hierarchy of the tree, since a network with a central 'root' node and only one hierarchical level below it would exhibit the physical topology of a star.
- A network that is based upon the physical hierarchical topology and with a branching factor of 1 would be classified as a physical linear topology.
- The branching factor, f, is independent of the total number of nodes in the network and, therefore, if the nodes in the network require ports for connection to other nodes the total number of ports per node may be kept low even though the total number of nodes is large; – this makes the effect of the cost of adding ports to each node totally dependent upon the branching factor and may therefore be kept as low as required without any effect upon the total number of nodes that are possible.
- The total number of point-to-point links in a network that is based upon the physical hierarchical topology will be one less than the total number of nodes in the network.
- If the nodes in a network that is based upon the physical hierarchical topology are required to perform any processing upon the data that is transmitted between nodes in the network, the nodes that are at higher levels in the hierarchy will be required to perform more processing operations on behalf of other nodes than the nodes that are lower in the hierarchy. Such a type of network topology is very useful and highly recommended.



3. Advantages & Disadvantages

Advantages

- It is an extension of Star and bus Topologies, so in networks where these topologies can't be implemented individually for reasons related to scalability, tree topology is the best alternative.
- Expansion of Network is possible and easy.
- Here, we divide the whole network into segments (star networks), which can be easily managed and maintained.
- Error detection and correction is easy.
- Each segment is provided with dedicated point-to-point wiring to the central hub.
- If one segment is damaged, other segments are not affected.

Disadvantages

- Because of its basic structure, tree topology, relies heavily on the main bus cable, if it breaks whole network is crippled.
- As more and more nodes and segments are added, the maintenance becomes difficult.
- Scalability of the network depends on the type of cable used.

An example of this network could be cable TV technology. Other examples are in dynamic tree based wireless networks for military, mining and otherwise mobile applications. The Naval Postgraduate School, Monterey CA, demonstrated such tree based wireless networks for border security. In a pilot system, aerial cameras kept aloft by balloons relayed real time high resolution video to ground personnel via a dynamic self healing tree based network.

4. 5-4-3 Rule

A consideration in setting up a tree topology using Ethernet protocol is the 5-4-3 rule. One aspect of the Ethernet protocol requires that a signal sent out on the network cable reach every part of the network within a specified length of time. Each concentrator or repeater that a signal goes through adds a small amount of time. This leads to the rule that between any two nodes on the network there can only be a maximum of 5 segments, connected through 4 repeaters/concentrators. In addition, only 3 of the segments may be populated (trunk) segments if they are made of coaxial cable. A populated segment is one that has one or more nodes attached to it. This rule does not apply to other network protocols or Ethernet networks where all fiber optic cabling or a combination of a fiber backbone with UTP cabling is used. If there is a combination of fiber optic backbone and UTP cabling, the rule would translate to a 7-6-5 rule. The speed of networking switches is vastly improved over older technologies, and while every effort should be made to limit network segment traversal, efficient switching can allow much larger numbers of segments to be traversed with little or no impact to the network.

5. Conclusion

Among all the Network Topologies we can derive that the Tree Topology is a combination of the bus and the Star Topology. The tree like structure allows you to have many servers on the network and you can branch out the network in many ways. This is particularly helpful for colleges, universities and schools so that each of the branches can identify the relevant systems in their own network and yet connect to the big network in some way. A Tree Structure suits best when the network is widely spread and vastly divided into many branches. Like any other topologies, the Tree Topology has its advantages and disadvantages. A Tree Network may not suit small networks and it may be a waste of cable to use it for small networks. Tree Topology has some limitations and the configuration should suit those limitations.

The Tree Topology follows a hierarchical pattern where each level is connected to the next higher level

in a symmetrical pattern. Each level in the hierarchy follows a certain pattern in connecting the nodes. Like the top most level might have only one node or two nodes and the following level in the hierarchy might have few more nodes which work on the point to point connectivity and the third level also has asymmetrical node to node pattern and each of these levels are connected to the root level in the hierarchy. Think of a tree that branches out in various directions and all these branches need the roots and the tree trunk to survive. A Tree Structured network is very similar to this and that is why it is called the Tree Topology.

The signals that are being transmitted by the root node are received by all the nodes at the same time. This increases the efficiency of the over all functioning of the network. The Tree Network topology can be extended easily to function and there are no limitations to how big it can be extended. Additional root nodes can be added and they can be interconnected within one single network.

RÉFÉRENCIAS

[1] Groth, David; Toby Skandier (2005). Network+ Study Guide, Fourth Edition'. Sybex, Inc. ISBN 0-7821-4406-3.

[2] ATIS committee PRQC. "mesh topology". ATIS Telecom Glossary 2007. Alliance for Telecommunications Industry Solutions. Retrieved 2008-10-10.

[3] Chiang, Mung; Yang, Michael (2004). "Towards Network X-ities From a Topological Point of View: Evolvability and Scalability" (PDF). Proc. 42nd Allerton Conference.

[4] Inc, S., (2002). Networking Complete. Third Edition. San Francisco: Sybex

[5] Bicsi, B., (2002). Network Design Basics for Cabling Professionals. City: McGraw-Hill Professional

[6] Yuefan Deng. "Applied Parallel Computing". 2013. p. 25

[7] "Meshdynamics : Highest performance Voice, Video and Data Outdoors". meshdynamics.com. Archived from the original on December 13, 2007. Retrieved 2008-02-23.

[8] Robert Lee Lounsbury, Jr. (September 2007). "Optimum Antenna Configuration for Maximizing Access Point Range of an IEEE 802.11 Wireless Mesh Network in Support of Multimission Operations Relative to Hastily Formed Scalable Deployments" (PDF). Retrieved 2008-02-23.

[9] "Avaya Extends the Automated Campus to End the Network Waiting Game". Avaya. 1 April 2014. Retrieved 18 April 2014.

[10] Peter Ashwood-Smith (24 February 2011). "Shortest Path Bridging IEEE 802.1aq Overview" (PDF). Huawei. Retrieved 11 May 2012.

[11] Jim Duffy (11 May 2012). "Largest Illinois healthcare system uproots Cisco to build $40M private cloud". PC Advisor. Retrieved 11 May 2012. Shortest Path Bridging will replace Spanning Tree in the Ethernet fabric.

[12] "IEEE Approves New IEEE 802.1aq Shortest Path Bridging Standard". Tech Power Up. 7 May 2012. Retrieved 11 May 2012.

[13] D. Fedyk, Ed.,; P. Ashwood-Smith, Ed.,; D. Allan, A. Bragg,; P. Unbehagen (April 2012). "IS-IS Extensions Supporting IEEE 802.1aq". IETF. Retrieved 12 May 2012.