Switches and Bridges - Comparison and Contrast

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Switches and Bridges

Introduction

This paper presents a comparison and contrast of switches and bridges. The paper discusses the Open Systems Interconnection (OSI) model for the layers used by the devices. The intelligence and specific functions of each device are also mentioned. The paper also presents the location of each device in a network

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OSI Model

The OSI model defines at a conceptual level the internal functions of a communication system by partitioning the system into layers of abstraction. The model defines seven logical layers of a communication system. These layers are physical, data link, network, transport, session, presentation, and application. The first three layers are classified as media layers and last four layers as host layers. The second layer, the data link layer, serves as a link between two directly connected nodes. The data link layer is further divided into Media Access Control (MAC) layer and Logical Link Control (LLC) layer. MAC Layer controls access to data and permissions to transmit the data. LLC layer controls packet synchronization and error checking. Bridges and switches are devices of data communication. They operate at layer 2 of the OSI model (Dean, 2012).

Level of Intelligence

A bridge is a product that connects one local area network (LAN) to another LAN having the same protocol. Bridges can also connect two segments of the same LAN provided that both segments use the same protocol. When a bridge is used, all computers that are bridged come under the same network subnet. The only data that can cross the bridge is the one that is being sent to a valid address on the other side of the bridge. Bridges learn about the addresses on the network and develop a learning table. Based on the learning table, subsequent messages are forwarded to the right network. Bridges learn the addresses not through programming, but by listening to the data flowing through them (Lammle, 2012). The main benefits of bridges are joining networks of different media types into larger networks.

A switch is a network device whose function is to select a path for sending data to the next destination. In a nutshell, bridges and switches analyze incoming frames, decide on the forwarding mechanism, and forward the frames. The bridging can be source-route as well as transparent. In source-route bridging, the entire destination path is defined in each frame. In transparent bridging, the forwarding of frames is done one hop at a time. Bridges have the capability of filtering frames. They can be used for rejecting all frames from a particular network. Bridges and switches divide large networks into self-contained units. There are several benefits of using bridges and switches. In both cases, only a certain portion of the network traffic is forwarded. Hence, they provide the benefit of diminishing the traffic at all connected segments. They also perform the function of firewall for some potentially damaging network errors (Kizza, 2013). They increase the effective length of LAN. It is achieved by allowing the attachment of distant stations.

Specific Functions

There are several distinctions between bridges and switches. Usually, switches are used for segmenting a large LAN and converting it into smaller segments. There are a few ports of bridges for LAN connectivity. Switches usually have many ports for LAN connectivity. Even a small switch typically has 24 ports. These ports can create 24 different segments of network for a LAN. Switches are also used for connecting LAN with different media. Switches supporting cut-through mechanism reduce delays and latency in the network. Bridges do not support cut-through switching. They only support store and forward switching. Switches facilitate collision-reduction on network segments due to their ability of providing dedicated bandwidth. Switches are used for isolating data flow and improving performance in heavily loaded networks. A key feature of switch is the use of Application Specific Integrated Circuits (ASICs) for building and maintaining filter tables (Palmer, 2012). All switches go through the three stages during the operation. These include address learning, decisions of forwarding/filtering, and loop avoidance. Using the MAC addresses in the filtering table in the switch, the devices are able to make a point-to-point connection. When a frame reaches the switch, the destination hardware address is checked. The address is compared with the MAC database. If the address is known, transmission will be performed to the correct port. If the address is not known, frame will be filtered.

Bridges can be classified as local bridges or remote bridges. Local bridges connect multiple LAN segments in the same area. Remote bridges connect them in different areas. Mac Layer bridges provide a bridge between homogeneous networks. Other bridges provide a bridge between different link layer protocols. However, the translation of bridge between heterogeneous networks can never attain perfection. It is due to the difference in frame fields and protocol functions between networks. Bridges are not aware about protocols. They perform the function

of just forwarding the data based on the destination address in the data packet. The address in the data packet is the Media Access Control (MAC) address. This address is uniquely assigned to each network adapter card.

Switches are classified based on whether they use cut through switching technique or store and forward switching technique. Examples of switches include ATM switch and LAN switch. Asynchronous Transfer Mode (ATM) switches provide scalable switching bandwidths and high speed switching. These switches are used to switch cells, the fixed size information units. LAN switches are used for connecting multiple segments of LAN. They provide collision free and dedicated communication between devices.

Switches are regarded as superior in comparison to bridges. In bridges, packet forwarding is done through the use of software. However, in switches, the forwarding mechanism is performed through ASICs. Switches are higher in speed in comparison to bridges. The only method of switching in a bridge is store and forward. Switches apply several methods including store and forward, fragment-free, and cut-through. The ports in switch are greater than the ports in bridge. The only mode that can be operated in bridge is half duplex mode. In a switch, there can be half duplex mode as well as full duplex mode (Tomsho, 2011). Hence, the switches support full duplex communication in LAN.

Position in the Network

A large network can be divided into multiple segments. Bridges are used for the communication of nodes between different segments. Hence, in a network, bridges appear between the network segments. A switch also connects multiple network segments. Hence, in a network, switches also appear between the network segments. In case of bridge, there is only one

incoming port and one outgoing port. The use of bridge is particularly beneficial when there is a need to separate parts of a network that do not communicate on a regular basis; however, there still exists a need for them to be connected. The key benefit of switch is that it has multiple ports. Switches are beneficial for connecting computers in the same subnet. Switches can operate on half duplex mode as well as full duplex mode. The computers that are connected to switch ports can transfer data to any other computers on the switch. They can do this one at a time and there will be no interference in the transmissions. However, in the half duplex mode, each transmission line can either receive data or transmit data. In full duplex mode, this condition is not applied and transmission lines can receive and transmit data simultaneously.

Conclusion

Bridges and switches are devices of data communication and operate at data link layer of the OSI model. Bridges are classified as local and remote bridges. Switches are classified based on whether they use cut through switching technique or store and forward switching technique. A bridge can connect one LAN to another LAN having the same protocol. It can also connect two segments of the same LAN. Bridges learn the addresses by listening to the data flowing through them. A switch is also used for selecting a path for sending data to the next destination. Switches are considered superior to bridges. In switches, packet forwarding is done through ASICs. Their speed is higher than bridges. They allow different methods of switching such as store and forward, cut through and fragment free. They have greater number of ports than switches. They allow half duplex mode as well as full duplex mode.

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