

Review of Routing and Switching

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ABSTRACT

The computer network are playing an important role in providing services to large organization as well as to individual person. A network is a group of interconnected computers that allows to share information and resources (such as printers) from one computer to another. A network with the right software helps to increase employee productivity and reduce costs. Network consists of Nodes (computers), connecting medium (wired or wireless), specialized network equipment like routers or hub.

Routing is the act of moving information across an internetwork from a source to a destination. Routing occurs in Layer 3 ie. Networking layer which distinguishes it from bridging that occurs in Link layer of the OSI model. The two basic activities of routing: It determines the optimal routing paths and transports information in groups (packets) through an internetwork. Path determination takes place with the help of

various Routing Algorithms. Routing algorithms initialize and sustain routing tables, which contain route information. When a router receives an incoming packet, it checks the destination address and attempts to associate this address with a next hop. Switches are another vital part of many networks because they speed things up. Switches allow different nodes of a network to link directly with one another in a smooth and efficient manner. Switches providing a separate connection for individual node's in a company's internal network are called LAN switches. A LAN switch generates a series of instant networks that contain only the two devices communicating with each other at that particular moment. Hence in this report we will study the usages of Routing and Switching in the arena of Networking.

Keywords:

Routing, Switching, Network, OSI Layers, MAC address, IP address

1.INTRODUCTION

A computer network is two or more computers connected together so that they can exchange information. Two computers linked together by a single cable can be a small network. Networking permits computer users to share resources. A network is simply a collection of computers or other hardware devices that are connected together either logically or physically using special hardware and software that allows the devices to exchange information and cooperate. At high level networks are advantages because they allow computers and people to be connected together so that they can share resources. Some of the specific benefits of networking include communication, data sharing, internet access, data security and management, application performance enhancement and entertainment.

1.1.NETWORKING DEVICES

- **Hubs**-Hubs amplify signals. They do not require filtering. They contain multiple ports. Hubs commonly connect segments of the LAN, when a packet arrives at one port it is copied to other ports so that all the LAN segments can access all the packets. They are used as network-concentration points.

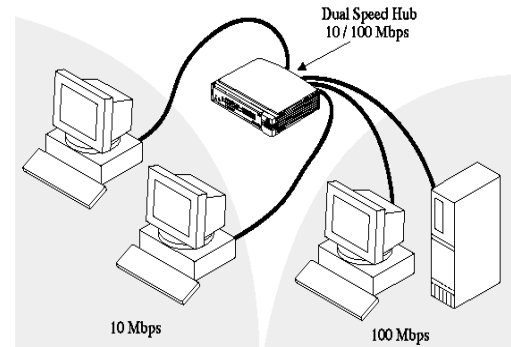


Fig.1.Hub

- **Switches**-A small hardware device that junctions multiple computers together within one local area network (LAN) is called a switch. Switches operate at layer two (Data Link Layer) of the OSI model. It maps the IP address with the MAC address of the LAN card. The data is not broadcast to all the computers in a Switch, it sends the data packets only to the destined computer. They are basically used in LAN, MAN, and WAN. Switches use three methods to transmit the data i.e. store and forward, cut through and fragment free.

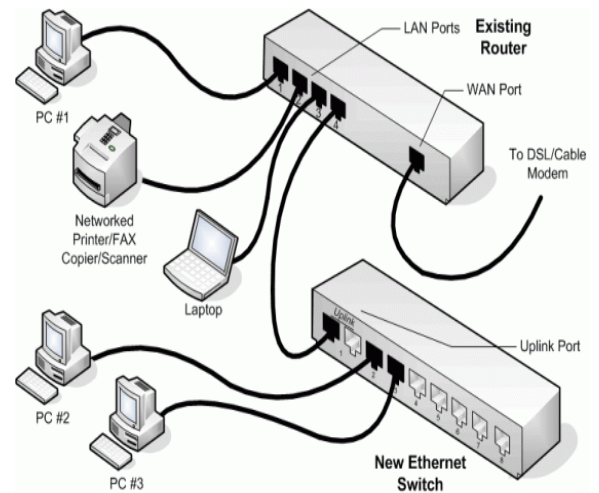


Fig.2.Switch

- Routers-** Physical devices that join multiple wired or wireless networks together are Routers. Routers operate at layer three (Network Layer) of the OSI model. Sorting and the distribution of the data packets to their destinations based on their IP addresses is the main function of the routers. Every router has a routing software called IOS (Internetwork Operating system). Router does not broadcast the data packets.

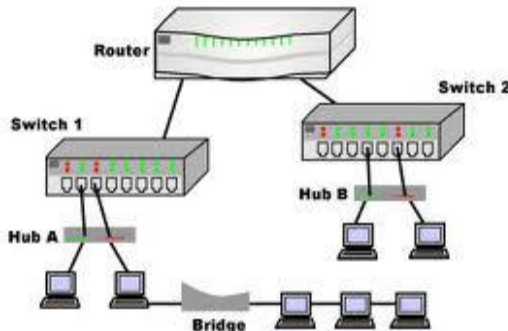


Fig 3. Router

1.2. OSI-(Open system interconnection) Layer Model

OSI is a set of internationally recognized, non-proprietary standards for networking and for operating system involved in networking functions. OSI defines seven levels in a communication system. The seven layers are mentioned below:

Table 1 : OSI Layers[4]

OSI-Layer	Name	Functional Description
Layer 1	Physical layer	Moving bits between devices. Specification of voltage, wire speed and cable pinouts
Layer 2	Data link layer	Combination of bits into bytes, and bytes into 802.3/802.2 frames. Access to media using MAC-address. HDLC Error detection and error recovery
Layer 3	Network layer	Logical addressing, which routers use for path determination
Layer 4	Transport layer	Reliable or unreliable delivery, Multiplexing
Layer 5	Session layer	Establishing maintaining and managing end-to-end bidirectional flows between endpoints
Layer 6	Presentation layer	How data is presented, Encryption
Layer 7	Application layer	Interface between network and application Telnet, HTTP, software

2. ROUTING

Routing is dispatching network packets from a source network to a destination network. Router is the designated networking device for forwarding packets between networks. The internetwork information and the logic mandatory to make the correct decision

about how best to forward the packet is made by a router.

There are two basic methods of building a routing table:

- Static Routing
- Dynamic Routing

2.1.Static Routing

Populating a routing table manually with routes to a destination network is called Static routing. There are fixed paths described to route through a data network. The System administrator usually enters the routes into the router. Entire network can be configured using static routes. Rerouting will not be done in case of the failure or a change in the network occurs between two statically defined nodes.

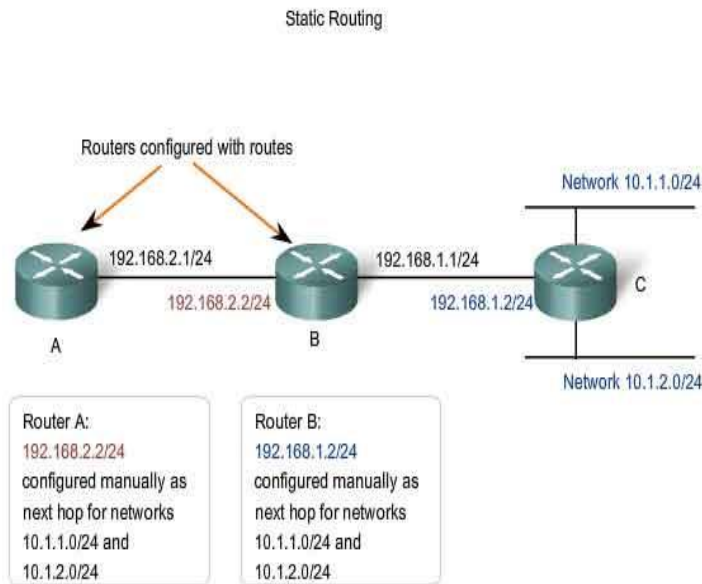


Fig.4.Static routing

2.2.Dynamic Routing

In a dynamic routing routers acquire the condition of the network automatically and modify the route tables. Dynamic routing can be

deployed on any size network. A dynamic routing table is created, maintained, and updated by a routing protocol running on the router.

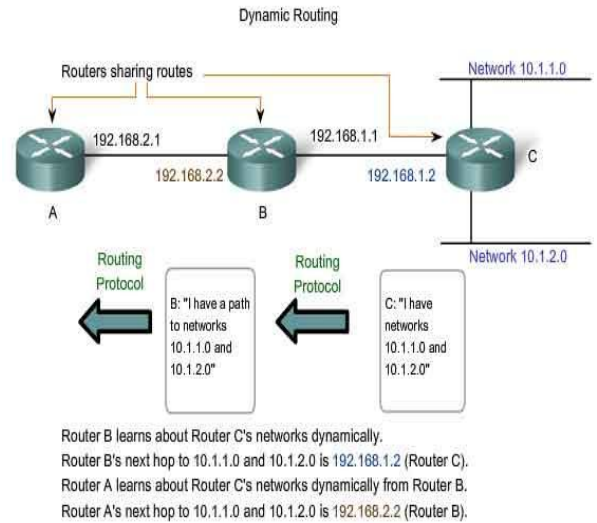


Fig.5.Dynamic Routing

2.3.Routing Metrics[1]

Metrics delineate the cost of a route in terms of how long it takes to deliver packets through a particular path. Every routing protocol has its own formula for allocating a metric value to a route based on factors such as hop count, bandwidth, reliability of link etc. If a routing protocol crams of more than one path to a particular network, it will mount the route with the lowest metric into the route table. Duplicate routes are kept as backup if the primary route fails, or the routing protocol may install multiple routes into the route table and forward packets through all paths to increase throughput.

2.4.Advantages[1]

Static routing

- Minimal CPU/Memory overhead
- No bandwidth overhead
- Granular control on how traffic is routed

Dynamic Routing

- Simpler to configure on larger networks
- Will dynamically choose a different route if a link goes down
- Ability to load balance between multiple links

2.5.Disadvantages[1]

Static routing

- Impractical on large network
- Infrastructure changes must be manually adjusted
- No “dynamic” fault tolerance if a link goes down

Dynamic Routing

- Updates are shared between routers, thus consuming bandwidth
- Routing protocols put additional load on router CPU/RAM
- The choice of the “best route” is in the hands of the routing protocol, and not the network administrator

3.SWITCHING[2]

Switching is an important technique that can determine how connections are made and how data movement is handled as a WAN. Data sent across the public switched telephone network or other internetworks can travel along different paths from

sender to receiver. Switching sends data along different routes. There are three switching techniques:

- Circuit switching
- Message switching
- Packet switching

3.1.Circuit switching

In circuit switching the routing decision is made when the path is set up across the network. After the link has been set between the sender and receiver, the information is forwarded continuously over the link. After the link has been set up no additional address information about the receiver or destination machine is required. In circuit switching a dedicated path is established between the sender and the receiver which is maintained for the entire duration of conversation.

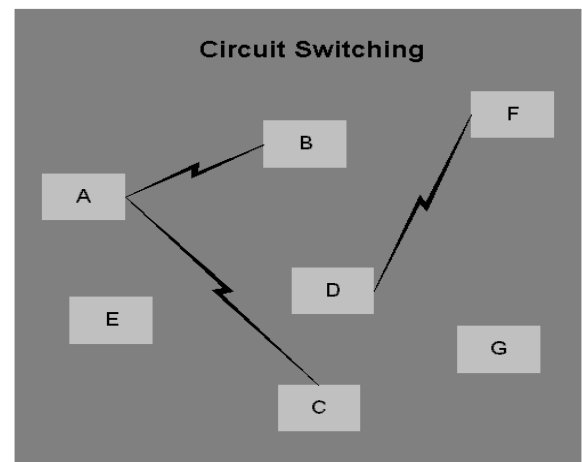


Fig 6.Circuit switching

3.2.Message switching

Message switching does not establish a dedicated path between two communicating devices. In message

switching each message is treated as an independent unit and includes its own destination and source address. Each complete message is then transmitted from device to device through the internetwork. Each intermediate device receives the message, stores it until the next device is ready to receive it and then forward it to the next device. Hence it is sometimes called a store and forward network.

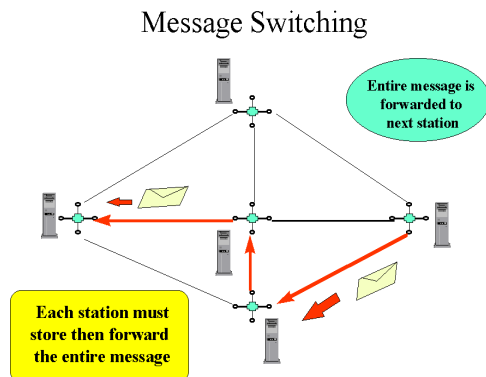


Fig 7. Message switching

3.3. Packet switching

In packet switching, messages are broken into packets each of which include a header with source, destination and intermediate node address information. Individual packets take different routes to reach the destination. In packet switching the packet length is restricted to a maximum length. This length is short enough to allow the switching devices to store the packet data in memory without writing any of it to disk. A switching node can route the packet as and when required.

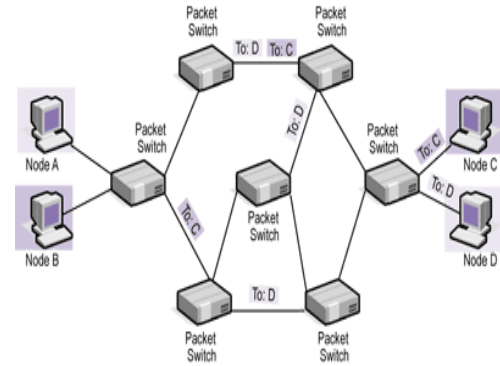


Fig 8. Packet switching

4. CONCLUSION

Switching and routing are theoretically two different things, making a link in the connection and forward data from the source to the destination. For the larger network Dynamic routing is the best routing technique. Since static routing has no bandwidth overhead it is also one of the best routing technique. Compared to Message and Circuit switching Packet switching is the most appropriate switching technique as it transfers data in the form packet.

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