International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Articles available online http://www.ijoer.in

Vol.3., Issue.5., 2015
(Sept.-Oct.)

REVIEW ARTICLE

ISSN: 2321-7758

COMPUTER NETWORKING USING ROUTING ALGORITHMS

AJAY KUMAR[1], PREETI YADAV[2]

[1]Asst. Prof. in IGU Meerpur Rewari(Haryana)

[2]Asst. Prof. in Govt college Gurgoan(Haryana)

AJAY KUMAR

ABSTRACT

It is the information technology era where the internet plays a vital role in every field of life. Computer Networking is the base of information technology, which stresses the issues of transferring information from one location to another through the use of Computer networking within seconds with very high speeds. A person can communicate with another person sitting thousands of kilometers away with the help of this advanced technology and is made possible with latest advancements in Computer Networking field. Most of the current routing algorithms in the internet are based on the simple shortest path routing algorithm which uses a single shortest path from ingress to egress router. Although the shortest path algorithm is simple and easy to implement, but the network resources in this situation are not utilized efficiently and the problem of traffic congestion may occur due to increased traffic after being available paths between the ingress and egress pair of router.

Keywords— Networking, Routing algorithm, router, OSI model.

I. INTRODUCTION

Routing is the act of moving information across an inter- network from a source to a destination router. Routing is usually performed by a dedicated device called a router. Routing is a key feature of the internet because it enables messages to pass from one computer to another computer and eventually reach the target machine. Each intermediate computer performs routing by passing along the message to the next computer. Part of this process involves analyzing a routing table to determine the best path. Routing is often confused with bridging which performs a similar function. The primary difference between the routing and bridging is that bridging occurs at layer 2 while the routing occurs at layer 3 of the OSI reference model. Another difference is that bridging occurs at a lower level and is therefore more of a hardware function whereas routing occurs at a higher level where the software component is more important. Routing occurs at higher level therefore it can perform more complex analysis to determine the optimal path for packet.

Routing involves two basic activities:

- Determining the optimal paths.
- Transporting information groups (typically called a packet) through an internetwork.

The routers are considered as specialized computers that send our messages and those of every other internet user speeding to their destinations along thousands of pathways. The router is the only device that sees every message sent by any computer on either of the company's networks. One of the tools a router uses to decide where a packet should go is a configuration table. A configuration table is a collection of information including.

- Informance on which connections lead to particular groups of addresses
- Priorities for connections to be used
- Rules for handling both routine and special cases of Traffic.

A configuration table can be as half-dozen lines in the smallest router, but can grow to massive size and complexity in the very large routers that can handle the bulk of internet messages. The two important jobs of routers are

- The router ensures that information doesn't go where it is not needed.
- The router makes sure that information does make it to the intended destination.

In performing these two jobs, a router is extremely useful in dealing with two separate computer networks. It joins the two networks, passing information from one to the other and in some cases performing translations of various protocols between the two networks. It also protects the networks from one another, preventing the traffic on one from unnecessary spilling over to the other's the number of networks attached to one another grows, the configuration table for handling traffic among them grows, and the processing power of the router is increased. Regardless of how many networks are attached, though the basic operation and function of the router remains the same. Since the internet is one huge network made up of tens of thousands of smaller networks, its use of routers is an absolutely necessity.

Routers use routing algorithms to find the best route to a destination. The best route is decided by the parameters like number of hops, time delay and communication cost of packet transmission. Routing algorithm is a method used to create and update the routing tables.

It is a formula stored in the router's memory. Routing algorithms is the part of the network layer software responsible for deciding which output line an incoming packet should be transmitted on. Some authors classify the routing algorithms in two types as

- Non-adaptive routing algorithms
- Adaptive routing algorithms

A. Requirements of Routing Algorithm

There are the following requirements of the routing algorithms:

1. Routing algorithms are required for better path determination of a network so that data can be transported without loss as well as speedily.
2. The routing algorithms help the router in making better decisions for path selection.
3. The routing algorithms also help in improving the throughput and efficiency of the network by making rapid and accurate delivery of packets.
4. The routing algorithms should be capable to route packets away from temporarily congested links. A routing algorithm should avoid heavily congested links.
5. The routing algorithm should be capable to avoid routing loops. Inconsistent information in distributed computation may lead to routing tables that create routing loops. The routing system should avoid persistent routing loops even in the presence of distributed routing systems.
6. The routing algorithm should have low overhead. A routing system typically obtains the connectivity information by exchanging control messages with other routing systems. These messages represent an overhead on bandwidth usage that should be minimized.
7. The routing algorithm should have to determine the connectivity of the network.

To find optimal paths, the routing system needs to know the connectivity information.

B. Algorithm types

The routing algorithms are mainly classified in two types but depending on the parameters like time, path, space, decision, computation, network size and path properties, routing algorithms can be classified [1] as under

1. Static versus dynamic
2. Single-path versus Multipath
3. Flat versus Hierarchical
4. Centralized versus Distributed
5. Host-intelligent versus Router-intelligent
6. Intra-domain versus inter-domain
7. Link-State versus distance-vector

II. STATIC VERSUS DYNAMIC ROUTING ALGORITHMS

Static routing algorithms are hardly algorithms at all, but are table mapping established by the network administrator before the beginning of routing. These mappings do not change unless the network administrator alerts them. Algorithms that use static routes are simple to design and work well in environments where network traffic is relatively predictable and where network design is relatively simple. In static routing [1], paths are pre-computed based on the network topology, link capacities, and other information. The computation is typically performed offline by a dedicated host. When the computation is completed, the paths are loaded to the routing table and remain fixed for a relatively long period of time. The biggest disadvantage of static routing is its inability to react rapidly to network failure. It is also known as non-adaptive routing [4].Dynamic routing algorithm is used to remove the disadvantage of static routing algorithm. It is also known as adaptive routing algorithm. In this algorithm each node continuously learns the state of the network by communicating with its neighbors. Thus a change in network topology is eventually propagated to all nodes. Based on the information collected; each node can compute the best paths to desired destinations. One disadvantage of dynamic routing algorithm is the added complexity in the node.

III. SINGLE PATH VERSUS MULTI-PATH ROUTING ALGORITHMS

The routing algorithms that route the data or packets from sources node to destination node through single path are known as single path routing algorithms while the algorithms that route the data or packets from the source node to destination node through many paths. Multipath routing algorithms have many advantages over single path routing algorithms. Multipath routing algorithms give better throughput, more reliability, better traffic engineering capability, less end-to-end delay etc as compared to single path routing algorithms.

IV. FLAT VERSUS HIERARCHICAL ROUTING ALGORITHMS

Some routing algorithms operate in a flat space, while others use routing hierarchies..In a flat routing system, the routers are peers of all others. In a hierarchical routing system, some routers form what amounts to a routing backbone. Packets from non-backbone routers travel to the backbone routers, where they are sent through the backbone until they reach the general area of the destination. At this point, they travel from last backbone router through one to more non-backbone routers to the final destination. Routing systems often designate logical groups of nodes, called domains, autonomous systems, or areas. In hierarchical systems, some routers in a domain can communicate with routers in other domains, while others can communicate only with routers within their domain. In very large network, addinational hierarchical levels may exist with routers at the highest hierarchical level forming the routing backbone.

V. CENTRALIZED VERSUS DISTRIBUTED ROUTING ALGORITHMS

In centralized routing a network a network control centre computes all paths and then uploads this information to the nodes in the network. In distributed routing, nodes cooperate by means of message exchanges and perform their own routing computations. Distributed routing algorithms generally scale better than centralized algorithms but are more likely to produce inconsistent results. If the paths calculated by different nodes are inconsistent, loops can be formed.

VI. HOST INTELLIGENT VERSUS ROUTER INTELLIGENT

Some routing algorithms assume that the source node will determine the entire route. This is usually referred to as source routing. In source routing systems, routers merely act as store and forward devices, mindlessly sending the packets to the next hop. Other algorithm assumes that hosts know nothing about routes. In these algorithms, routers determine the path through the inter-network based on their own calculations. In the first routing system, the hosts have the routing intelligence while in the later system, routers have the routing intelligence.

VII. INTRA-DOMAIN VERSUS INTERDOMAIN

Some routing algorithms work only within domains while others work within and between

domains. The nature of these two algorithms is different. It stands to reason, therefore that an optimal intra-domain routing algorithm would not necessarily be an optimal inter domain routing algorithm.

VIII. LINK STATE VERSUS DISTANCE ROUTING ALGORITHMS

The link-state algorithms flood routing information to all nodes in the inter-network. Each router however sends only the portion of the routing table that describes the state of its own links. In link state algorithms, each router builds a picture of the entire network in its routing tables. The distance vector call for each router is to send all or some portion of its routing tables, but only to its neighbours. In essence, link-state algorithms send small updates everywhere, while distance vector algorithm sends larger updates only to neighboring routers. The link state algorithm is generally dynamic in nature. As the network topology and link cost change, routers exchange information and recomputed shortest path trees to ensure that their local database is consistent with the current state of the network. The optimality principal ensures that as long the topological maps are consistent; the routing table computed by each router will also be consistent. Distance vector algorithms know only about their neighbors. Because of quick convergence, link-state algorithms are somewhat less prone to routing loops than distance vector algorithms. The link-state routing algorithms require more CPU power and memory than distance vector algorithms. Link state algorithms, therefore, can be more expensive to implement and support. Link-state protocols are generally more scalable than distance vector protocols. The examples of distance vector routing algorithms are than distance vector protocols. The examples of distance vector routing algorithms are

1. Routing Information Protocol (RIP)
2. Interior Gateway Routing Protocol (IGRP)
3. Enhanced Interior Gateway Routing Protocol (EIGRP)
4. The example of link-state routing algorithm Open Shortest-Intermediate System (IS-IS)

The optimal path may be the shortest route or widest route or multiple paths of equal costs. The shortest path between two nodes represents the best or optimal path which can be used to transfer information between the two nodes. There may be different metrics which can be used to measure the shortest path like number of links, distance, delay, bit-rates and cost. The shortest path between two nodes using the number of links as the only criterion may not necessarily be the same if delay was the criterion. In determining the best/shortest/optimal paths in a network it is necessary to label each link with a weighting which has to be computed using the metrics of interest. The particular metric can, of course, vary from network to network. Links with lower weighting are more suitable than ones with a higher weighting. Formal methods known as algorithms are used for this purpose. Algorithms such as Bellman-Ford and Dijkstra [6] take a single node and calculate the shortest paths between this node and all other nodes in the network. Other algorithms, such as Floyd's find the shortest paths between all pairs of nodes within the network. The distance vector routing algorithm is sometimes called by other names, most commonly the distributed Bellman-Ford routing algorithm and the Ford-Fulkerson algorithm after the researchers who developed these algorithms. In Distance Vector (DV) algorithms, each router has to follow the given steps.

- It counts the weight of the links directly connected to it and saves the information to its table.
- In a specific period of time, it sends its table to its neighbor routers and receives the routing table of each of its neighbors.
- Based on the information in its neighbors, routing tables, it updates its own.
- One of the most important problems with DV algorithms is called "could to infinity."

In LS algorithms, every router has to follow these steps given as

- Identify the routers that are physically connected to them and get their IP addresses. When a router starts working, it first sends a "HELLO" packet over network. Each router that receives this packet replies with a message that contains its IP address.

- Measures the delay time for neighbour routers. In order to do that, routers send echo packets over the network. Every router that receives these packets replies with an echo reply packet. By dividing round trip time by 2, routers can count the time delay time.
- Broadcast its information over the network for other routers and receive the other router's information .In this step, all routers share their knowledge and broadcast their information to each other.
- Using an appropriate algorithm, identify the best route between two nodes of the network. In this step, routers choose the best route to every node.

They do this using an algorithm, such as the Dijkstra shortest path algorithm.

IX. CONCLUSION

This paper introduces the objectives, features, and networking applications of routing. The focus was made on the description of algorithms used in routing. The applications properties of various algorithms have been discussed on comparative basis. The multi-path packet distribution techniques have been found attractive and useful to route the data in a network effectively.

X. REFERENCES

[1] Alberto Leon-Garcia, and Indra Widjaja,"Communication Networks, Fundamental Concepts and Key Architectures", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2nd Edition, 2005.

[2] James Irvine, and David Harley," Data Communication and Networks", John Wiley & Sons Ltd., New York, USA, 2002.

[3] Brian Hill, "The Complete Reference, CISCO", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 3rd reprint 2004.

[4] William Stallings, "Data and Computer Communications", PHIPvt.Ltd. New Delhi, 7th Edition, 2003.

[5] Behrouz A. FOROUZAN, "Data communications and Networking", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 7th reprint, 2004.

[6] James Martien,"Computer Networks and Distributed Processing Software, Techniques and Architecture"

Authors' Profiles:

AJAY KUMAR: Ajay Kumar did his MCA from LIMAT Faridabad, Haryana (India) and M.Tech (Computer Science) from GITAM Jhajjar, Haryana (India). He has teaching experience about 4 years in India. He has UGC NET qualified. At present he has been working as Assistant Professor (Guest Faculty) in Department of Computer Science & Application, Indira Gandhi University, Meerpur, Rewari (India). His research interest in Networks Security and database management System. He has about 5 international journal publications.