Routing Algorithms

Overview

The routing algorithm can establish a route or path to transmit data packets from source to destination. They help to direct Internet traffic effectively. Once the knowledge pack leaves its source, you can choose between different routes to succeed at its destination. The routing algorithm calculates the simplest route mathematically, the "lowest cost route" that data packets often pass through.

- To transmit data from source to destination, the network layer must determine the simplest route through which data packets are often transmitted.
- Regardless of whether the network layer provides datagram services or virtual circuit services, most of the work of the network layer is to provide the simplest route. The routing protocol provides this job.
- The routing protocol can be a routing algorithm that provides the simplest route from source to destination. The simplest route is the "lowest cost route" from the start point to the endpoint.
- Routing is the process of forwarding data packets from source to destination, but the routing algorithm determines the simplest route for sending data packets.

These routing algorithms are designed for SAF networks that use central queues. Avoid deadlocks by dividing the buffer into multiple classes and restricting the movement of packets from one buffer to another so that the buffer classes do not decrease. These algorithms are called jump algorithms. The single-hop algorithm first injects the data packet into the current node's zero complexity buffer. Whenever a data packet is stored in a complexity buffer, I reach a different node through a hop; it will be moved to a complexity buffer I + 1. This routing algorithm is understood as a positive hop algorithm. Every time a data packet requests a replacement buffer, deadlock can be avoided by using the best buffer.

Flooding

Flooding can be a non-adaptive routing technology that follows this simple method. When a knowledge packet arrives at the router, it is sent to all outgoing links except the one it reaches. When source data packets (without routing data) are transmitted to any connected network nodes, flooding similar to broadcast occurs. Since flood uses all routers in the network, it also uses the shortest route. The flooding algorithm is easy to implement. The network routing data is not initially included in the data packet. The hop count algorithm is used to track the visited network route or topology. The data packet tries to access all available network paths and finally reaches its destination, but there is always the possibility of the data packet being copied. Hop count and some selective flooding techniques are used to avoid communication delay and duplication. Flood is further used as a denial of service attack, interrupting network services by flooding network traffic. The service is flooded with many incomplete server connection requests. Due to the flood of requests, the server or host is not ready to handle real requests simultaneously. The flood attack fills up the memory buffer on the server or host; once it is full, no more connections can be established, resulting in a denial of service. The different types of floods are:

- In controlled floods, two algorithms are used to ensure that floods are frequently controlled. These algorithms are reverse path forwarding and sequence number control flooding.
- There is no conditional logic to regulate how a node distributes information packets to its counterparts in an uncontrolled flood. Without these restrictions, equivalent packages may be distributed repeatedly. These are called broadcast storms or ping storms.
- In selective flooding, a node is configured only to send incoming packets to routers in one direction. This will help prevent many accidents from uncontrolled floods, but it is not as complicated as controlled floods.

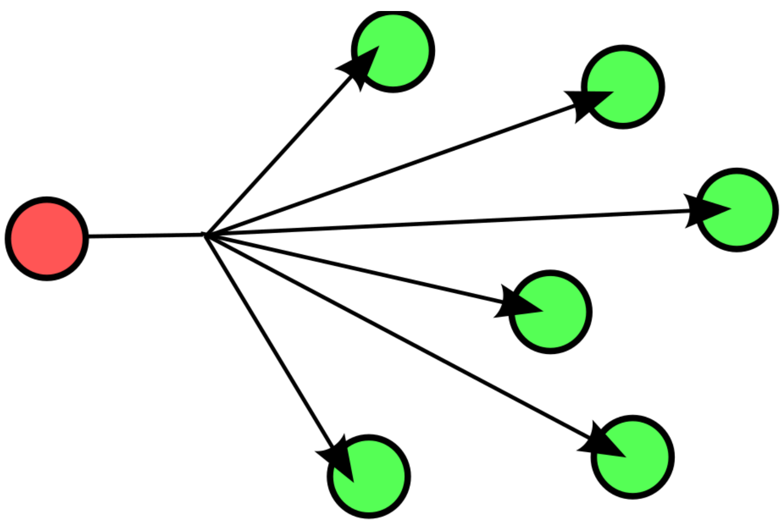

Figure 1: Flooding

Distance Vector

Distance vector routing protocols fall into two categories: distance vector or link state. Here, we examine the distance vector routing protocol; the next section introduces the link-state routing protocol. The distance vector algorithm was developed by R. E. Bellman, L. R. Ford, and D. R. Fulkerson are sometimes referred to as the BellmanFord or FordFulkerson algorithms. The name distance vector is derived from the fact that the route is advertised as a vector of (distance, direction), where the metric defines the distance, and the next-hop router defines the direction. For example, "Destination A can be within five hops, within the address of router X in the next-hop." As the statement implies, each router learns routes from the perspective of its neighbors and then advertises routes from its perspective. Because each router relies on its neighbors to obtain information, and this information may be learned from neighbors, etc., distance vector routing is often jokingly called "rumor routing." Distance vector routing protocols include:

- IP Routing Information Protocol (RIP)
- XNS RIP of Xerox Network System
- Novell IPX RIP
- Cisco Internet Gateway Routing Protocol (IGRP)
- DEC DNA Phase IV
- Routing Table Maintenance Protocol (RTMP)

The routing protocol is an efficient distributed database system. They spread information about the network topology between the routers on the network. Each router on the web uses this distributed database to formulate the most straightforward acyclic route through the network to succeed at any given destination. There are two basic methods for disseminating information over the web:

- By distributing the vector, each router on the network advertises the destinations it can reach, and specific information is used to determine the easiest route to each accessible destination. The router can determine the simplest vector (path) by checking the goals that can be reached through each neighboring or neighboring router and combining some additional information (as a measure of the convenience of the route). There are two vector-based protocols: distance vector and path vector.
- Distributes the connected link status to routers; each router floods (or to everyone in the network or any other router, whether directly adjacent or not) the quality of each link it connects. This information is used independently by each router in the routing domain to create a tree representing the network

topology (called the shortest-path tree). The routing protocol that distributes the link state of the connection is called the link-state algorithm.

Link State

The link-state router is updated from all routers in the entire network, passing information to the nearest router. The link-state protocol router does not continuously broadcast its routing table like the distance vector protocol but only informs neighboring routers when a change is detected. Distance vector routing protocols are considered easy to learn, while link-state routing protocols are known for being very complex and even daunting. However, link-state routing protocols and ideas are not difficult to learn. In some respects, the link-state process is easier to understand than the distance vector concept. Updating the processing system seems to be the key to the robustness of the link-state protocol. Although there are some differences between these two protocols, in general, the link-state protocol differs from the distance vector protocol in the following ways:

- Infrequent routing updates.
- High scalability supports more extensive networks.
- Divides the entire network into smaller segments to limit the scope of routing changes.
- Only updates about link status and topology changes are sent.
- The triggered update can immediately notify the system of differences, reducing convergence time.
- The network design may reduce the size of the link-state database. When the network ID is set by doubling the support path summary, the reduction in the number of paths will reduce the dimensionality of the link-state database.
- The knowledge age is limited because LSA aging always keeps the information up to date.
- The routing loop is almost eliminated because the router knows what the entire topology is like.
- Must support the routing table, the link-state database, and the adjacency database (which can be a table that lists adjacent devices), which requires a lot of memory.
- Running Dijkstra's algorithm (the mathematical formula usually calculates the shortest path) requires CPU cycles on the router. For more extensive networks, this requirement means more CPU time is spent on calculations.
- In large network deployments, the link-state protocol may require extensive adjustments to function correctly. This demand will pose a significant challenge for network administrators.

Path Vector

The Route Vector Protocol does not believe in the value of reaching a particular destination to calculate whether each available route is acyclic. In contrast, the path-vector protocol believes that path analysis will succeed at the goal of determining if it is acyclic. This protocol is a distance-vector protocol; it does not believe in space to ensure an acyclic path but is based on the analysis of the course itself. It is typically implemented in environments where it is difficult to guarantee a uniform metric (distance) between routing domains. The route is accumulated on each router and included in each advertisement so that any router that receives it can verify the acyclic course before spreading the knowledge. BGP4 is the best example of PR using this technology. The most significant disadvantage is the size of the ad, which grows with the number of jumps. As far as IPv6 is concerned, BGP4 enhanced through multi-protocol extension is still the preferred routing vector RP for exchanging IPv6 routes between autonomous systems.

Path Vector (PV) protocols, such as BGP, are used in all domains called autonomous systems. During the path vector protocol, routers not only receive space vectors for specific destinations from their neighbors; on the contrary, nodes also receive space as routing information (also known as BGP routing attributes), which can be calculated by nodes (through the BGP routing process) How the traffic is routed to the destination.