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Comparison of Routing Protocols

Introduction to routing

Routers uses so called algorithms to find the best suited way through an LAN. Most Routers has the ability to connect more networks together through the same Router. This means there could be more alternative ways to the destination on the mentioned network.

These ways (routes) can either be static (manually created) or dynamic (updates automatically whenever there's a change in the network). Dynamic routing works on different methods. One method works on finding the fastest way through the LAN with the less amount of router-jumps. Another way is to calculate/time how fast a packet arrives at a given destination of the LAN. A 3^{rd} way could be based on the cost of the communication within the different ways, and a 4^{th} way could be to pick an alternative way if the 1^{st} pick somehow got canceled (redundancy). Most new routers has some if not all of these functions and they can usually be configured as it pleases you.

No matter what you decided to use, you'll always have to update your routers whenever you change network equipment from your LAN. So if you have picked to static function as your routing protocols it means you will have to manually update your routing tables. It takes a lot of time compared to the dynamic functions but in the other hand you'll have full control over your routing protocols.

Dynamic routing works with a special kind of protocols to update the routing tables. These protocols are called, as I've mentioned a few times already "routing-protocols". There are two main kinds of protocols. "Distance-vektor" and "link-state". What distance-vektor protocols does is it sends all the routing-tables to all routers in the LAN (This could be every minute or so). This created a huge amount of traffic on the network and this is even worse when we're talking about public networks since the bandwidth usually are low and the cost expensive. Examples of distance-vektor protocols are RIP-protocols (Routing in-formation protocol) in TCP/IP and NetWare (A Computers network operating system, usually using the IPX network protocol).

Link-state protocols are actually created to minimize the problems of distance-vektor protocols. When you are using Link-State functionally the routers only sends out information whenever there are changes in the network, and they only send the changes not the entire table. Example of Link-state protocols are OSPF (Open Shortest path First) in TCP/IP, Cisco's IGRP 8Interior Gateway Routing Protocol) and NLSP (Netware Link-State Protocol) in Netware.

Comparison of the routing protocols used in enterprises

In more expanded firms you'll find a lot of different LANs and generally a lot of network equipment. So to maintain the fastest speed across the network and make it cost less you'll have to ask you self what kind of protocols you will use in your network. So in next pages I'll go through three different protocols, RIPv2 (Routing Information Protocol Version 2), OSPF (Open shortest Path First) and EIGRP (Enhanced Interior Routing Protocol) and then comment on what would work best in a given scenario.

Routing Information Protocol Version 2

So if you're similar to me and quite new in the field of protocol I'm sure you're asking you self, "Version 2?" Yes before a version 2 can be build we need a version 1 so I'll walk you through RIPv1 quite fast.

RIP version 1 were created back in the last 80's based on the Bellman – Ford Algorithm. It's a so called Distance-vektor protocol which I've already mentioned earlier. It calculates the routes data are transmitted on jumps from one router to another. Routers are regularly sending out updates through the network if there has been any kinds of changes within the network equipment on the given Network. These routing-tables starts an update on the given router so that router can be updated with the new information so they now know where to route the data to the new IPs. A route destination are determined within a 15 jump limit. So if the packets doesn't reach a destination within those 15 jumps it automatically marks it as destination unreachable.

So back to Version 2. Version 2 are better in some functionalities compared to version 1. In Version 2 we know have something called "Subnet Mask". This is a really great feature and an important one since it determine if the network are intern or extern. One of the reasons of the approval of version 2 is because it permits information to be hacked or sniffed during routing. It's still limited since it's only affects the first 15 jumps so it's works with version 1. This makes Version 2 quite bad for larger networks.

Version 1 and Version 2 are protocols used on the IPV4, which are the most used Internet protocol. Internet protocol defines how IP-addressing are done. We are currently running out of IP on the IPV4 system so that's why the IPV6 are created. So as more devices are getting an IP we will eventually move over to the IPV6 system and there for a new RIP version at some point. This version will be called RIPng and it's what version 2 are for version 1. It still contains the 15-jump limit, uses the same kind of approval system and solving the same "counting endless problem".

OSPF (Open Shortest Path First)

OSPF also known as Open shortest path first is a routing algorithm which are forwarding packets on a network. This protocol are classified as an "Interior Gateway Protocol", which means that the functionality of this protocol does not workout outside of where it "belongs".

OSPF was created by the Internet Engineering Task Force (IETF) as a replacement to RIP. Unlike the EIGRP protocol which was created by Cisco to replace RIPv2, OSPF is a vendor independent and is currently the most used routing protocol by enterprise networks today.

OSPF decides how a packet are transmitted through the network calculated on the facts of the destination and actual network connections in the registered routing table. This table then attribute an estimated "price" for each route across the network. This price are transmitted into a number which is based on distance, throughput and reliability.

So each router keeps track of its "neighbor" router. This means whenever there's a change in the Network the router will let the other routers know about it. The other routers then recreate a complete map of the internetwork. The biggest problems of OSPF are unsynchronized updates and inconsistent path decisions. By this I mean that routers cannot determine the most recent update when two different link-state updates arrived at exactly the same time.

Advantages and disadvantages of RIP protocols:

- RIP sends out intervallic routing updates(every minute or so)
- RIP sends out the full routing table every intervallic update
- RIP uses a form of distance as its metric (as I’ve mentioned earlier, the hop count)
- RIP uses the Bellman-ford distance Vector algorithm to define the best route to a specific destination.
- RIP has a maximum hop count of 15 hops.

Advantages and disadvantages of OSPF:

- It is at this time the highest-performance open regular routing protocol
- It’s open routing protocol
- It provides shortest path routing and is fast to fault-discovery and rerouting
- It demands a higher handling and remembrance requirement than RIP
- It consumes a large bandwidth at the original link-state packet flooding

EIGRP (Enhanced Interior Routing Protocol)

Compared to other routing protocols like RIP and OSPF, EIGRP does not use a single attribute to determine the metric of its routes. EIGRP are based on the IGRP (Interior Gateway Routing Protocol). IGRP is a distance-vector interior gateway routing protocol developed by Cisco. In RIP we used hop count to figure out the metric. This means that all the routes collected from the same router will have the same metric. This is nevertheless of what kind of interface we receive that route from.

The OSPF metric is a bit rougher. Instead of hop counts as we know from RIP, the OSPF metric is the sum of interface costs. The cost apportioned to an interface is an antithetical function of the bandwidth of the interfaces, this seems to scale well since the routes established on the interfaces with higher bandwidths are favored to interfaces with lower bandwidth.

EIGRP uses four kinds of topographies to figure out its metric. These features are:

Bandwidth are used by EIGRP in its metric calculations, but it's used in a different manner than usual. The lowest bandwidth is always used for metric calculation. So if we look at this as a topology, the information will always be exchanged from one neighbor to another.

Delay are also a part of these features since it uses interface delays to calculate the matric of the interface.

Load, this is the measure of the application for the interface. It is not considered in the EIGRP metric calculation by default, but you can include it into the metric calculation by changing the default values.

Reliability—the reliability is a value between 0 and 255 that shows the "superiority" of the interface. Usually, interfaces have a reliability value of 255/255. This shows that the interface is stable and there are no errors on the interface.