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A Comparative Study of Routing Protocols

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Abstract— **This paper is focus on the different routing protocols used for routing in computer network. A routing protocol is a protocol that specifies how routers communicate with each other, disseminating information that enables them to select routes between any two nodes on a computer network, the choice of the route being done by routing algorithms. Each router has a priori knowledge only of networks attached to it directly. A routing protocol shares this information first among immediate neighbours, and then throughout the network. This way, routers gain knowledge of the topology of the network. There are many routing protocols used for routing purpose like RIP, IGRP, EIGRP and OSPF etc**

Keywords— **RIP, IGRP, EIGRP, OSPF, LSA, MTU**

I. INTRODUCTION

Routing is the process of selecting paths in network along which to send network traffic. Routing is performed for many kinds of networks, including the telephone network (Circuit switching) electronic data networks (such as the Internet), and transportation networks. This article is concerned primarily with routing in electronic data networks using packet switching technology.

A. Routing Information Protocol:

Routing information protocol is the most commonly used interior gateway protocol in the internet. RIP employs hop count as a metric. RIP was first developed in 1969 as a part of ARAPNET. RIP uses a distributed version of Bellman-Ford algorithm. The Routing Information Protocol (RIP) helps a router dynamically adapt to changes of network connections by communicating information about which networks each router can reach and how far away those networks are. RIP uses a distributed version of Bellman-Ford algorithm. Bellman-Ford algorithm computes single-source shortest paths in a weighted graph (where some of the edge weights may be negative). Bellman Ford runs in O(VE) time, where V and E are the number of vertices and edges.

B. Interior Gateway Routing Protocol

Interior Gateway Routing Protocol (IGRP) is a distance vector interior routing protocol (IGP) invented by Cisco. It is used by routers to exchange routing data within an autonomous system. IGRP is a proprietary protocol. IGRP was created in part to overcome the limitations of RIP (maximum hop count of only 15, and a single routing metric) when used within large networks. IGRP supports multiple metrics for each route, including bandwidth, delay, load, MTU, and reliability; to compare two routes these metrics are combined together into a single metric, using a formula which can be adjusted through the use of pre-set constants. The maximum hop count of IGRP-routed packets is 255 (default 100), and routing updates are broadcast every 90 seconds (by default). IGRP is considered a classful routing protocol.

C. Enhanced Interior Gateway Routing Protocol

Enhanced Interior Gateway Routing Protocol - (EIGRP) is a Cisco proprietary routing protocol loosely based on their original IGRP. EIGRP is an advanced distance-vector routing protocol, with optimizations to minimize both the routing instability incurred after topology changes, as well as the use of bandwidth and processing power in the router. Routers that support EIGRP will automatically redistribute route information to IGRP neighbors by converting the 32 bit EIGRP metric to the 24 bit IGRP metric. Most of the routing optimizations are based on the Diffusing Update Algorithm (DUAL) work from SRI, which guarantees loop-free operation and provides a mechanism for fast convergence.

D. Open Shortest Path First

Open Shortest Path First (OSPF) is another Interior Gateway Protocol like RIP. It is a routing protocol developed for Internet Protocol (IP) networks by the Interior Gateway Protocol (IGP) working group of the Internet Engineering Task Force (IETF). OSPF was created because in the mid-1980s, the Routing Information Protocol (RIP) was increasingly incapable of serving large, heterogeneous inter-networks. OSPF being a SPF algorithm scales better than RIP. This protocol is open, which means that its specification is in the public domain. OSPF is based on the SPF algorithm.

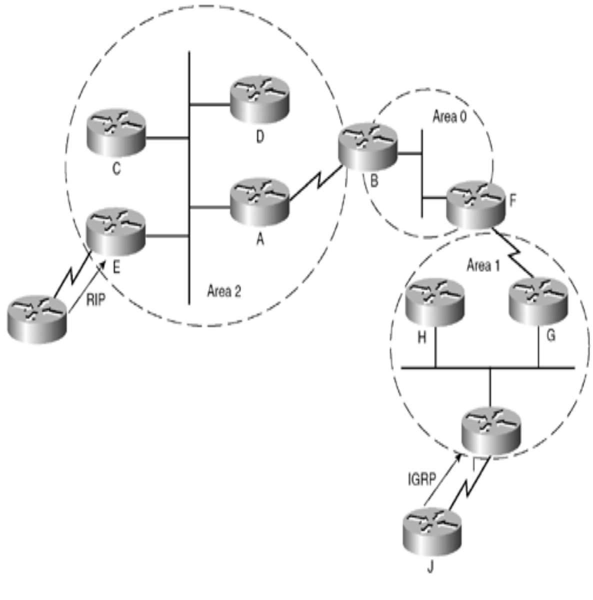

Fig. 1 OSPF Normal Area Example using colors

OSPF use the area for configuration and establishment of network as shown in above fig. 1. OSPF is a link-state routing protocol that calls for the sending of link-state advertisements (LSAs) to all other routers within the same hierarchical area. OSPF specifies that all the exchanges between routers must be authenticated. OSPF include Type of service Routing. OSPF provides Load Balancing. OSPF allows supports host-specific routes, Subnet-specific routes and also network-specific routes.

II. COMPARATIVE STUDY

There are two primary routing protocol types although many different routing protocols defined with those two types. Link state and distance vector protocols comprise the primary types. Distance vector protocols advertise their routing table to all directly connected neighbours at regular frequent intervals using a lot of bandwidth and are slow to converge. When a route becomes unavailable, all router tables must be updated with that new information. The problem is with each router having to advertise that new information to its neighbours, it takes a long time for all routers to have a current accurate view of the network. Distance vector protocols use fixed length subnet masks which aren't scalable. Link state protocols advertise routing updates only when they occur which uses bandwidth more effectively. Routers don't advertise the routing table which makes convergence faster. The routing protocol will flood the network with link state advertisements to all neighbour routers per area in an attempt to converge the network with new route information.

TABLE I
COMPARISON OF VARIOUS CHARACTERISTICS OF ROUTING PROTOCOLS

Characteristics	RIP	IGRP	EIGRP	OSPF
Type of Protocol	Distance Vector	Distance Vector	Hybrid Routing	Link State
Classless Support	No	No	Yes	Yes
VLSM Support	No	No	Yes	Yes
Auto-Summarization	Yes	Yes	Yes	No
Route Propagation	Periodic Broadcast	Periodic Routing updates	Periodic	Multicast on change
Path Metric	HOP	Bandwidth and delay of line	Bandwidth, delay, load and reliability	Bandwidth
Hop Count Limit	15	255	255	None
Convergence Time	Slow	Slow	Fast	Fast
Updates	Route Table updates	Periodic copies of routing tables	Only change is updated	Event-triggered
Route Computation	Bellman-Ford	Bellman-Ford	Diffusing update algorithm (DUAL)	Dijkastra

III. CONFIGURATION OF ROUTING PROTOCOLS

This section describes how to configure different routing protocols. We can only view and change the configuration of a Cisco router in privileged mode, which we get into with the enable command. When we want to make global changes to the router we have to use configure terminal command, which puts us in global configuration mode. A global command is set only once and affects the entire router.

A. Configuring RIP

To configure RIP routing, just turn on the protocol with the router rip command and tell the RIP routing protocol which network to advertise.

```
Router1> enable
Router1# configure terminal
Enter configuration commands, one per line.  End with
CNTL/Z.

Router1(config)# router rip
Router1(config-router)# network 172.20.0.0
```

B. Configuring IGRP

Same as RIP except you need an Autonomous System (AS) number when specifying the routing protocol. All routers in the same Autonomous System need the same AS in order to communicate with each other. If your network doesn't already have an autonomous number, you are free to use any one you like.

```
Router3> enable
Router3# configure terminal
Enter configuration commands, one per line.  End with
CNTL/Z.
Router3 (config)# router igrp?
<1-65535> Autonomous system number

Router3(config)# router igrp 200
Router3(config-router)# network 172.30.0.0
```

C. Configuring EIGRP

To start an EIGRP session on a router, use the router eigrp command followed by the autonomous system number of the network. Remember as with IGRP, we use the classful network address, which is all subnet and host bits turned off.

```
R1#conf t
Enter configuration commands, one per line. End with
CNTL/Z.
R1(config)#router eigrp ?
 <1-65535> Autonomous system number

R1(config)#router eigrp 10
R1(config-router)#network 10.0.0.0
R1(config-router)#
R1(config-router)#end
R1#
```

The AS number, as you see can be any number from 1 to 65 535. A router can be a member of as many ASes as you want it to be.

D. Configuring OSPF

After identifying the OSPF process need to identify the interfaces that want OSPF communication on, as well as the area in which each resides. This will also configure the network that you are going to advertise to others. OSPF uses wildcards in the configuration which are also used in access list configuration.

```
R1(config)#router ospf 123
R1(config-router)#
R1(config-router)#net 10.10.1.0 0.0.0.255 ?
  area  Set the OSPF area ID

R1(config-router)#net 10.10.1.0 0.0.0.255 area ?
  <0-4294967295> OSPF area ID as a decimal value
  A.B.C.D      OSPF area ID in IP address format

R1(config-router)#net 10.10.1.0 0.0.0.255 area 0
R1(config-router)#net 10.10.4.0 0.0.0.255 area 0
R1(config-router)#
R1(config-router)#end
R1#
```

IV. FUTURE WORK

Routing is a fundamental component of internetworking. Several diverse protocols have either been developed or have evolved to handle specific problem domains. The advent of IP version 6 represents both a challenge and an opportunity -- one hand, IPv6 must coexist peacefully with existing routing protocols; on the other hand, it gives developers an opportunity to migrate to protocols that are better suited to the demands of the present-day Internet. This document discusses the issues involved. Some new routing protocols are being developed that attempt to build on current knowledge of routing protocols. The most prominent of these is Nimrod, and its ATM offshoot called PNNI. The Nimrod routing architecture is a new scalable routing architecture still in the design stage. It is geared towards IPv6 while not being tied to it, and supports dynamic internetworking with arbitrary network sizes, provides service-specific routing, and allows incremental deployment within an internet-work. PNNI is an evolving routing architecture for use with ATM networks. PNNI is based on the Nimrod protocol suite being developed by the IETF, but it is a distinct protocol and not just a version of Nimrod.

V. CONCLUSIONS

Routing protocols are special-purpose protocols designed specifically for use by network routers on the Internet. Common routing protocols include EIGRP, OSPF and BGP. RIP2 offers many substantial features used to increase the efficiency of RIP1. RIPng is complete new protocol designed for Ipv6. It uses the same operations as that of RIP1 and RIP2. In order to address the issues of address space and other factors EIGRP adds supports for VLSM and diffusing update algorithm (DUAL) in order to improve routing. IGRP supports multiple metrics for each route, including bandwidth, delay, load, MTU and reliability to compare two routes. These metrics are combined together into a single metric. OSPF is a link-state routing protocol that calls for the sending of link-state advertisements (LSAs) to all other routers within the same hierarchical area. OSPF specifies that all the exchanges between routers must be authenticated. OSPF include Type of service Routing. OSPF provides Load Balancing. OSPF allows supports host-specific routes, Subnet-specific routes and also network-specific routes. The move from IPv4 to IPv6 is inevitable, as is the fact that the transition will be somewhat painful. The newer routing protocols (OSPF, IDRP) support classless routing (CIDR), which extends naturally to IPv6 prefix-based routing. Older protocols which are rigidly tied to the 32-bit IPv4 address format (at least on the implementation level) will likely become obsolete, since there is no real reason to keep using them if one is going to upgrade to IPv6. In the near future, IPv6 sites should expect to run OSPF for IPv6 as an internal routing protocol and a version of IDRP for external routing. In the not-so-near future the picture is far less clear -- what is seen as the "right" technology right now may not be suitable for the Internet of tomorrow.

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REFERENCES

[1] CCNA by Todd Lammle, 5th edition.
[2] Petri Wessman, Akumiitti Oy “Existing Routing Protocols and IPv6
[3] ”Internet Routing -- Overview & RIP” Available: http://www.cellsoft.de/telecom/internetrouting.htm
[4] Steven law, Pravin Varaiya,”Stability of a class of dynamic routing protocols(IGRP)”
[5] Bates, T., R. Chandra, Y. Rekhter, and D. Katz. "Multi-Protocol Extensions for BGP4." RFC 2858, 2000.
[6] Bennett, Geoff. Designing TCP/IP Internetworks. New York, NY: John Wiley & Sons; 1997.
[7] Callon, R. "Use of OSI IS-IS for Routing in TCP/IP and Dual Environments." RFC 1195. IETF 1990.
[8] Fuller, V., T. Li, J. Yu, and K. Varadhan. "Classless Interdomain Routing (CIDR): An Address Assignment and Aggregation Strategy." RFC 1519. IETF 1992.
[9] Computer Networks by Andrew s Tenenbaum, 4th edition.
[10] High speed network by William Stalling, 2009.
[11] TCP/IP and Internetworking by Douglas E Comer, 2009.