Performance Comparison between Cisco proprietary Routing protocols and Open Standard routing protocols

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Abstract: In a network topology for sending packet various routing protocol are used. Every router maintains a routing table for successful delivery from source to destination. A routing protocol specifies how routers communicate with each other, disseminating information that enables them to select routes between any two nodes on a computer network. Routing algorithms determine the specific choice of route. Cisco is the largest router manufacturing company in the world, which has its own proprietary routing protocols i.e. vendor specific.[1] Another world of routing protocols is open standard where the term "open" implies that technical specification are widely, perhaps even freely , available for implementation .The research paper shows advantages and disadvantages of both type of routing protocols.

Keywords: Hop count, routing, load balancing, and topology.

I. INTRODUCTION

The TCP/IP protocol suite allows communication between computer networks of different sizes, produced by different vendors and run on different operating systems. TCP [1-4] provides end to end connectivity and also govern how data should be formatted, transmitted, and received at the end point. These services are basically provided by data link layer, internet layer, transport layer and application layer. Each layer provides unique functionality. For example, Data Link layer contains communication technology for local network, Internet layer connects local network and prepare internetwork communication. Transport layer handle host to host Communication and application layer for protocol specific data communication service. If we talk about data, it is wrapped i.e. enclosing of a set of data into another set of data to protect its integrity .At each and every layer a particular set of header and footer is added. At the receiving end, these headers and footers are removed sequentially to get the original message [2].

II. COMPARISON CRITERIA

A. LAN / WAN:

In case of LAN EIGRP is the fastest converging protocol. However OSPF is the preferred choice in case of WAN.OSPF recognizes 3 different network types [3]:

 i. Broadcast multi-access
 ii. Point-to-point
 iii. Non-broadcast multi-access (NBMA)

Each has different characteristics and is handled uniquely by OSPF. The most notable characteristic of a broadcast multi-access network is the fact that, many devices share the same media. All devices on the network hear any information sent. There is no hop count limit.

B. Scalability:

Scalability can be defined as ability to grow or expand the network. In routing protocols like RIP1 and RIP2, scalability is restricted and supports routers up to 15 hops .In contrast IGRP and EIGRP has default hop count limit of 100 which can be increased up to 255. OSPF has no hop count limits; hence it's called as the protocol of the internet [4].

C. Metrics:

It can be defined as set of attributes used for formation & selection of the path.Complex metrics can be calculated by combining several path characteristics. The metrics that routing protocols most commonly use are as follows [5]:

 a. *Hop count:* The number of times that a packet passes through the output port of one router
 b. *Bandwidth:* The data capacity of a link; for instance, normally, a 10-Mbps Ethernet link is preferable to a 64-kbps leased line
 c. *Delay:* The length of time that is required to move a packet from source to destination
 d. *Load:* The amount of activity on a network resource, such as a router or link
 e. *Reliability:* Usually refers to the bit error rate of each network link
 f. *Cost:* A configurable value that on Cisco routers is based by default on the bandwidth of the Interface

RIP1 and RIP2 is a distance vector protocol which uses *hop count* to determine the best path through the network. The path with the fewest number of routed hops is considered as the shortest path. But EIGRP consider hop count as well as bandwidth and delay [6].

The main OSPF metric is the cost, which is inversely proportional to the bandwidth of that interface.

Table -1: Bandwidth vs. Metrics

Bandwidth	Metrics
10 Mbps	10
100 Mbps	1
1000Mbps	1
10 Gbps	1

There are ways to handle the situations of High bandwidth scenarios.

Table-2: Metric Comparison

Routing Protocols	Metric	Description
RIP	Hop count	How many layer 3 hops away from the destination
EIGRP	Bandwidth	Default
EIGRP	Delay	Default
EIGRP	Load	The path with the least utilization
EIGRP	MTU	The path that supports the largest frame sizes
EIGRP	Reliability	The path with the least amount of errors or down time
OSPF	Cost	Measurement in the inverse of the bandwidth of the links

D. Convergence :

The term convergence can be defined as the time it takes for all the routers to understand the instance i.e. current topology of the network. When a particular router gets the update from a nearest neighboring router, it immediately updates its own routing table .The routers adds the cost of reaching neighboring router to the path cost reported by the neighbor to establish the new metric . If the router learns about a better route to its surrounding , the router update its own routing table .It is a time consuming process .Because in a 25 router network last router will aware about the first router only when all middle router will complete their periodic update. EIGRP is the fastest converging routing protocol as it's based on DUAL (Diffusing Update Algorithm) algorithm and RTP (Reliable Transport Protocol). EIGRP uses three tables [7]

  a. **Routing Table:** The routes of particular destinations are stored in the routing tables. The information contains the network topology that is immediately around it. The primary goal of routing protocols and routes is the construction of routing tables. Network id, cost of the packet path and next hop are the details available in the routing table.

  b. **Topology table:** Routers use topology table which routes traffic in the network. All routing tables inside the autonomous system are available in this table, where the router is positioned. Each router uses routing protocol and maintains a topology table for each configured network protocol. The routes leading to a destination are found in the topology table.

  c. **Neighbour table:** The neighbour relationships are recorded in this table which are the basis for EIGRP routing and convergence activity. The address and the interface of a neighbour is discovered and recorded in a new entry of the neighbour table, whenever a new neighbour is found. These tables are used for reliable and sequenced delivery of packets.

E. Summarization:

Route summarization can defined as representing a group of routes as a single route. It has following benefits [8]

  a. It reduces the size of the routing table.
  b. It also reduce the size of routing updates
  c. Enhance the network manageability.

Route summarization is used in the network to reduce the size of Routing tables. Summarization should be done carefully, as it can cause breach in security. That's why Summarization is to implemented in Internal or Trusted networks only.

Further OSPF has manual summarization while EIGRP has auto summarization Auto Summarization of EIGRP has been turned to manual summarization by Cisco.

F. Timer:

Various protocols use different timers to regulate it's performance [9].

There are four types of timer.

  a. Update / Hello Timer: The routing-update timer clocks the interval between periodic routing updates. Generally, it is set to 30 seconds, with a small random number of seconds added every time the timer is reset to avoid the collisions. Each routing-table entry has a route-timeout timer associated with it. When the route-timeout timer expires, the route is marked invalid but is retained in the table until the route-flush timer expires. In nutshell it is an indicator of how often to send updates in seconds.

  b. Route Invalid Timer: how many seconds, since waiting a valid update, to consider the route invalid, and placing the route into hold down.

  c. Hold down Timer: Once in hold down, how long (in seconds) to "not believe" any equal or less impressive (worse) route updates for routes that are in hold down.

  d. Route Flush Timer: How many seconds, since the last valid update, until we throw that route in the trash (garbage collection for un-loved non-updated routes)

Table-3: Summary of comparison between OSPF and EIGRP [10]

Issue	OSPF	EIGRP
Standard	Open standard of IETF , supported by most vendors.	Cisco owned private routing protocol, not been supported by any other vendors.
Popularity	Most popular IGP in the world	Only a few networks designed by EIGRP
Algorithm	SPF algorithm fast convergence, loop free.	DUAL algorithm could be in SIA (Stuck in Action) status, query could spread out the whole network.
Topology	Can build a hierarchy and scalable network.	Cannot build a hierarchy network with this protocol.

G. Hop count:

Each hop in a path from source to destination is assigned a hop-count value, which is typically 1. When a router receives a routing update that contains a new or changed destination-network entry, the router adds one to the metric value indicated in the update and enters the network in the routing table. The IP address of the sender is used as the next hop. OSPF has no hop count limit. Various Routing protocol support different number of hopes whose graphical presentation is as follows.
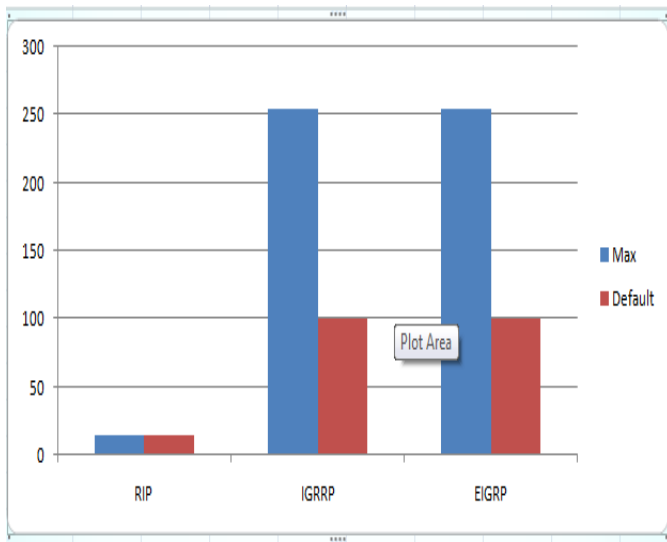
Figure-1.0 Hop count in various Protocol

H. Router Information Update:

In computer networking a routing table or Routing Information Base, is a data table stored in a router or a networked computer that lists the routes to particular network destinations, and in some cases, metrics (distances) associated with those routes. The routing table contains information about the topology of the network immediately around it. The construction of routing tables is the primary goal of routing protocols. Static routes are entries made in a routing table by non-automatic means and which are fixed rather than being the result of some network topology "discovery" procedure. Various routing protocol update on different interval for RIP it is 30 second while for EIGRP it is 90 second [11].

III. CONCLUSION

This paper evaluates and compares the performance of the three Protocols RIP,EGRP and OSPF .The performance of RIP is good for small network also it is open source so it can work with any router. But for big organization EIGRP is good due to its fast convergence and reliability and also work better way with Cisco because it is Cisco proprietary. EIGRP is the clear choice for the Client network because it is faster and easier to implement and more configurable, and performs better in a wireless environment. In cases without any financial restriction, undoubtedly it's Cisco. And in other cases i.e. with financial limitation for big networks OSPF should be considered, as it's an Open Standard.

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