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Operation and Comparative Performance Analysis of Enhanced Interior Routing Protocol (EIGRP) over IPv4 and IPv6 Networks

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Abstract: - The use of technology in communication today has reached the level that anybody could not believe in the past two decades. Through Internet of things everyone will be involved him/herself or his/her device at home, at work, on road, at field or anywhere else. This leads to the need of big enough Internet Protocol (IP) addressing space IPv6 replacing IPv4 which is now exhausted. Routes of information (packets) are established by appropriate routing protocols which should support IPv6. Enhanced Interior routing protocol (EIGRP) as one of the best routing protocols has to be configured to route IPv6 packets. For the best path determination, EIGRP uses different parameters with bandwidth and delay as default ones. Analysis on configuration of EIGRP metric values has been carried out in order to know if this can affect metric calculation and hence best route determination for IPv4 and IPv6. Of course some of EIGRP metric calculation found the same in both IPv4 and IPv6 while others are different.

Keywords: EIGRP, Metric, K Values, IPv4, IPv6, Routing Protocols

I. INTRODUCTION

For any network topology, the function of router is to receive pieces of data (packets), look at their final destination and forward them to the next network via exit interface. Selection of next network the packet has to pass through is made based on routing table. Routing table contains information about different destinations that router has learned and in case there is no any entry in the routing table that matches with the destination of received packet, packet will be dropped.
The routing table is made by routing protocols which work differently according to their algorithms. They are of two main categories: Static or Dynamic. Static routing protocol is unique while dynamic routing protocols are of different types [3]. The diagram below indicates those types.

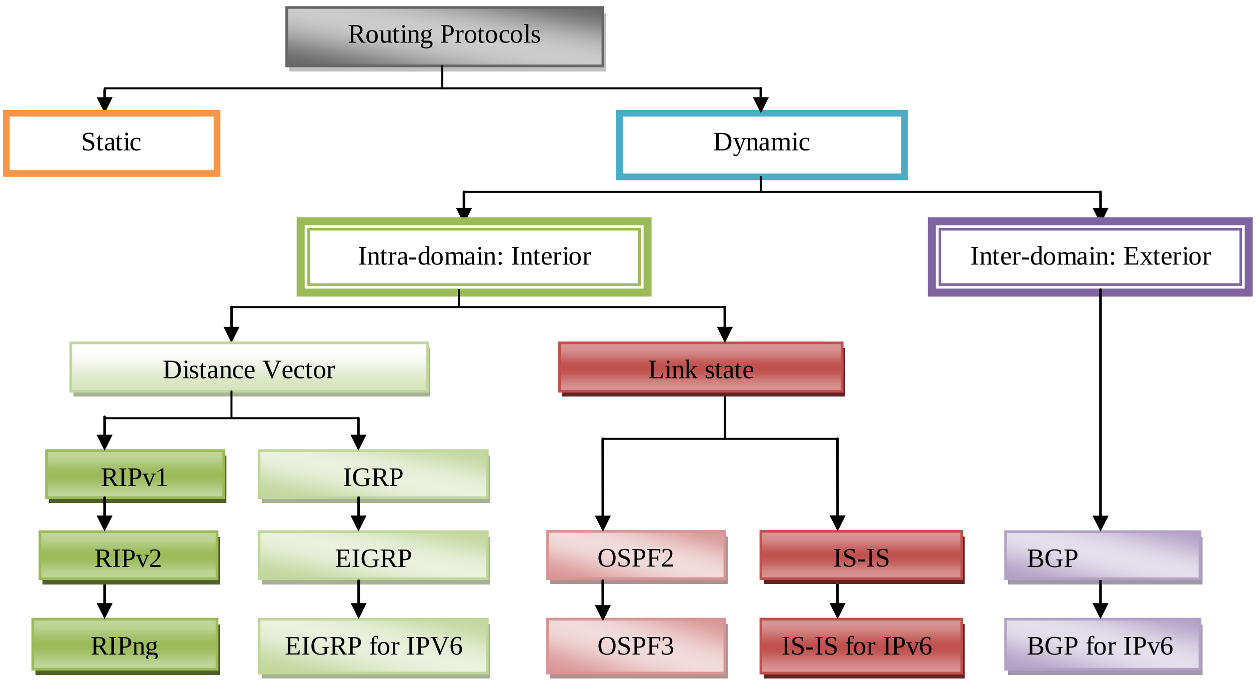

Figure 1: Categorization of routing protocols

As per the diagram above, dynamic routing protocols are of two main categories, which are interior or exterior. Interior protocols are those that operate within one same autonomous system (AS) and route packets between different AS there should be an exterior protocol configured. Interior routing protocols are also in two classes namely distance vector and link state.

Distance vector protocols are:

- Routing Information Protocol (RIP version 1 and version 2)
- Interior Gateway routing protocol (IGRP)
- Enhanced Interior Gateway routing protocol (EIGRP)

Link State routing protocols include:

- Open Shortest Path First (OSPF)
- Intermediate System to Intermediate System (IS-IS)

Border Gateway Protocol (BGP) is an example of exterior routing protocol Unlike static routing protocol, dynamic routing protocols have versions for IPv4 and IPv6. Initially Cisco Systems has developed a distance vector routing protocol named "Interior Gateway Routing Protocol (IGRP)" and in 1992 has released its advanced version named "Enhanced Interior Gateway Routing Protocol (EIGRP)". Because of different weaknesses and being classful protocol, IGRP has been replaced by EIGRP since IOS 12.3 release. EIGRP is a distance vector routing protocol but has some in link state features and therefore is called hybrid routing protocol. Since 2013, EIGRP is an open standard to EITF, meaning that other network equipment vendors can implement EIGRP in their equipments and this ensures interoperability between Cisco and non-Cisco devices [13].

This research is interested on EIGRP based on the fact that is distance vector but having some features of link state routing protocols and interoperable. EIGRP has different considerations for cost calculations including Bandwidth, Delay, Load and reliability. The research will analyze how those different parameters will affect the path selection if different values are given and hence how configurations can influence the router choice of the best path to the particular destination. Cisco Packet Tracer simulator will be used for building network topology and packet analysis.

II. RELATED WORKS

Many different books and articles have been published on dynamic routing protocols. Cisco Systems has online course titled "Cisco Certified Network Associate Academy" (CCNA Routing and Switching) via https:www.netcad.com. CCNA books have also been published in different editions. The course introduces basics of network, concepts and configuration of routing protocols and Internet technologies. Three authors [1] performed evaluation of OSPF and EIGRP routing protocols for IPv6 and they compared OSPF and EIGRP in terms of strength and weaknesses and through their comparative analysis came to the conclusion that EIGRP has advantages over OSPF by consideration of convergence time but OSPF is better for the big network.

In the research carried out in [16], they compared OSPF, RIP, IGRP and EIGRP performances in terms of cost of delivery, router updates, route additions, next hop updates, link utilization, queuing delay and the result was that EIGRP performs good as it has cost of transmission just above OSPF and has optimum router over head and overall performance in terms of throughput, Queuing delay and link utilization. According to them, for best effort service that is transmission of data packets OSPF performs better than other protocols for throughput, queuing delay, utilization and overhead. Similar results of analysis done by [9], EIGRP is the best among other routing protocols and OSPF is the second. The same comparison of performance analysis has been conducted by [17] and concluded that there is no single mechanism that can overcome the unreliable nature of the network in a reliable way.

An extensive review of OSPF and EIGRP as per [4], realized that in the Hybrid networks (OSPF vs. EIGRP protocols with Different AS) route redistribution should be used in order to advertise route from source network to destination. They also concluded that OSPF support unlimited hop count value (unlimited routers network) and due to large network, the size of routing table, CPU and Memory utilization of the routers and also traffic of networks will increase that can be successfully reduced by route summarization.

The similar performance Analysis of EIGRP and OSPF has also been done by 4 authors [2] where they compared OSPF, EIGRP and the combination of OSPF_EIGRP in terms of throughput and packet delay and found that the combined implementation of EIGRP and OSPF routing protocols used in the network scenario performs far better than OSPF and EIGRP.

Three authors [6] worked on different performance issues of RIPv2, EIGRP and OSPF. Performance of redistribution command for the purpose of establishing communication between different networks with different routing protocols has also been analyzed. Their analysis resulted to conclude that EIGRP is the better routing protocol for non very big network and OSPF is better for large network.

Routing protocols should use IPv6 address as the IPv4 addresses are depleted day-by-day. EIGRP has better capabilities hence EIGRP will be mainly used in the future [7].

In this article, operation and performance of EIGRP will be analyzed on both IPv4 and IPv6 through different metric values (k values) of diffusing update algorithm.

III. EIGRP OPERATION

EIGRP has both distance-vector and link-state routing protocols characteristics and hence is called hybrid. It is distance-vector because routers in their routing updates send information containing destination network and the cost of reaching via a given next hop. It is also link-state routing protocol as routers make updates immediately when there is a change of routing information. Main features of EIGRP are (ONLINE, Features of EIGRP, 2012):

- Support both IPv4 and IPv6
- Classless
- Support of VLSM/CIDR
- Support of route summaries and discontiguous networks
- Efficient neighbor discovery
- Communication via Reliable Transport Protocol (RTP)
- Best path selection via Diffusing Update Algorithm (DUAL)

A. EIGRP metrics

Selection of the best path is based on the cost. This means that if there are multiple paths to the particular destination, EIGRP will compare them and choose the best based on the cost. The path with low cost will be the best. Cost is calculated by using 5 parameters: bandwidth, delay, reliability, load and Maximum Transmission Unit (MTU).
Composite metric formula:

❖ Complete:

Metric= [K1*bandwidth+(K2*bandwidth)/(256-load)+K3*delay]*[K5/(reliability+K4)] [11]

❖ Default:

By default K1(bandwidth)=1 and K3(delay)=1 while K2(load), K4(reliability) and K5(MTU) are equal to 0. This makes the formula above to become:

Metric= (**Bandwidth + delay)*256** which is the default formula [14]

K values are just numbers used in algorithm to influence metric calculations. Bandwidth is calculated by taking reference bandwidth equals to 10,000,000 divided by the bandwidth of the slowest router interface to the destination (10,000,000/slowest bandwidth in Kbps) while the delay is calculated by taking the sum of delays for all outgoing interfaces to the destination [14].

B. Diffusing Update Algorithm

EIGRP uses *Diffusing Update Algorithm* **(DUAL)** for selecting and maintaining the best path to each destination. DUAL allows [8]:

- Backup route determination if one is available
- Support of Variable Length Subnet Mask (VLSM)
- Dynamic route recoveries
- Queries for an alternate if no route can be found

DUAL algorithm [8 &10] makes EIGRP to converge faster than other dynamic distance vector routing protocols because all routers involved in topology change synchronize at the same time and routers that are not affected by the topology changes are not involved in the recomputation. The decision process for all route computations is done by DUAL Finite State Machine (FSM). FSM is a workflow model, similar to a flow chart that is composed of the following [5]:

- A fine number of stages (states)
- Transitions between those stages
- Operations

The DUAL FSM tracks all routes, uses EIGRP metrics to select efficient, loop-free paths, and identify the routes with the least path to be inserted into the routing table.

C. Successor, Feasible distance and Feasible successor

EIGRP uses DUAL algorithm to establish routing table to different remote networks. Multiple path to one destination network may exist. When there is more than one path to one destination network, DUAL identifies which should be considered the best. Best path is the one with the low metric (known as cost) which is also known as Feasible Distance (FD) and the next router toward destination using the lowest cost is called a **Successor**. The second alternative to reach destination is the path with second low cost (metric) and this is a backup path and the router towards destination network by using the second best path is called Feasible Successor. Feasible successor becomes successor when the link to successor is no longer operational [12].

D. Feasibility condition

The FC is met when a neighbor's Reported Distance (RD) to a network is less than the local router's feasible distance to the same destination network. If the reported distance is less, it represents a loop-free path. The reported distance is simply an EIGRP neighbor's feasible distance to the same destination network. The reported distance is the metric that a router reports to a neighbor about its own cost to that network [12].

E. EIGRP Packet types

To create, maintain, and update routing information EIGRP uses different types of packets which DUAL uses to determine the best path and converge fast. The following the types of EIGRP packets [15]:

- **Hello packets** - Used for neighbor discovery and to maintain neighbor adjacencies. Sent with unreliable delivery (no acknowledgement expected)
- **Update packets** - Propagates routing information to EIGRP neighbors. Sent with reliable delivery. Acknowledgement is expected. If no acknowledgement is received by the sender, update packet should be retransmitted.
- **Acknowledgment packets** - Used to acknowledge the receipt of an EIGRP message that was sent using reliable delivery. Sent with unreliable delivery
- **Query packets** - Used to query routes from neighbors. Sent with reliable delivery
- **Reply packets** - Sent in response to an EIGRP query. Sent with unreliable delivery
-

IV. EIGRP PERFORMANCE ANALYSIS

A. Network Topology

Cisco Packet tracer is used to design a dual-stack network topology that will help to analyze the operation of EIGRP over IPv4 and IPv6. The network is made of four 2901 routers, four 2960 switches, four desktop. Connection of these different devices made 5 serial (WAN) links and 4 local (LAN) links. The network uses both IPv4 and IPv6 (dual-stack) and EIGRP for IPv4 and IPv6.

Initially, analysis is done for EIGRP default metric values and then after, analysis shall be based on the modification of default metric values and analyze how this can influence eigrp routes. As discussed earlier, eigrp uses five different metric values (k) to determine the best path to each remote destination. Those are bandwidth, delay, load, reliability and MTU. Bandwidth and delay are used by default, meaning that their k1 and k2 are equal to 0 while other k values are equal to 0. This makes the complete EIGRP formula for path determination to become: **(bandwidth + delay)*256** since other k values are 0s.

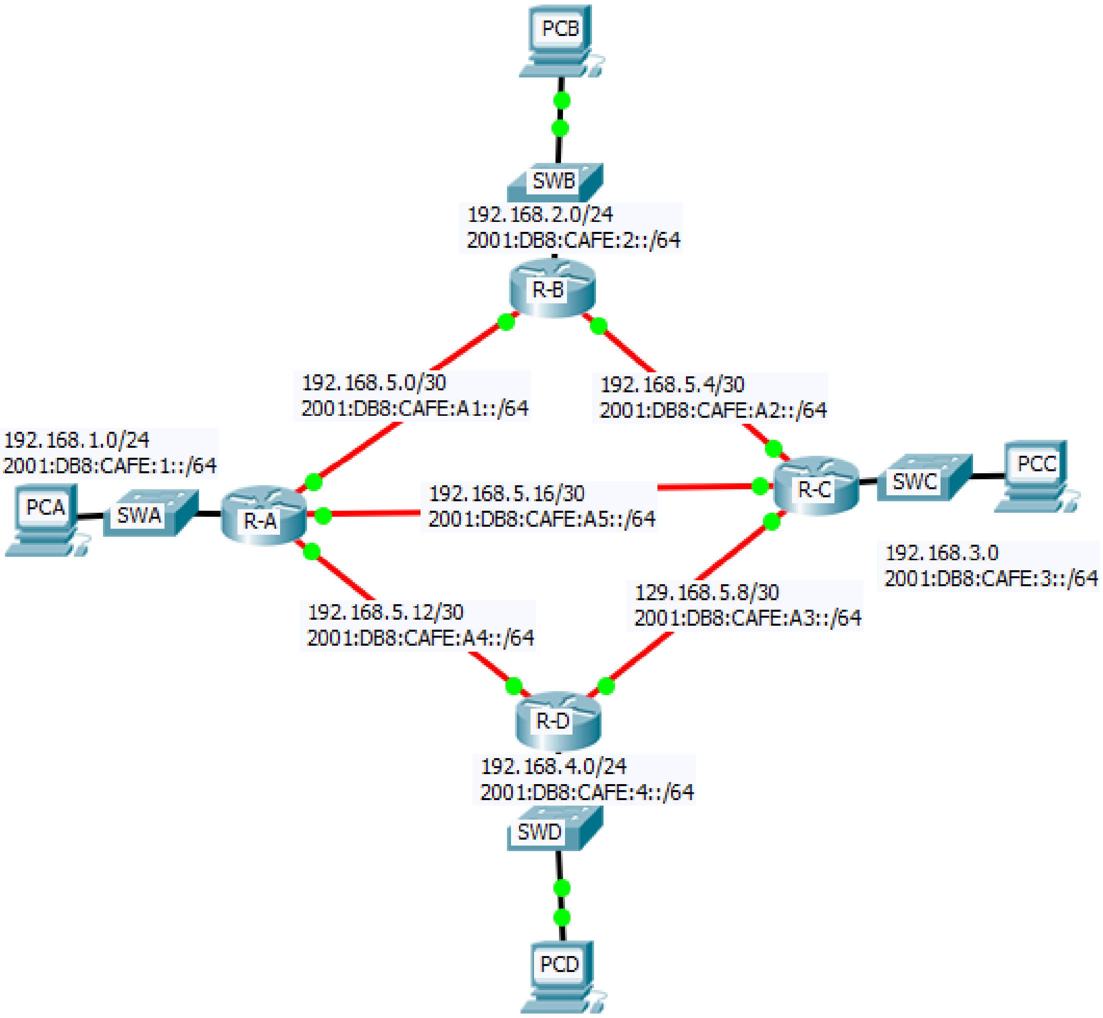

Figure 2: Network Topology

Upon full EIGRP configuration on all routers and IP (v4 and v6) addresses on both desktop and routers, this network is converged. This means that all routers have full information of accessing all destinations. Ping command has been used to test connectivity between end devices (PCs).

Analysis is done on the cost values (second number in square brackets []) from default to the customized k values between IPv4 and IPv6. After modifying k values, show command helps to identify and analyze what effect did k value made.

B. Default k values (K1=1, K2=0, k3=1, k4=0, k5=0) with default bandwidth and delay

Table I IPv4-IPv6 Default Metric Number Routing Table

R-A IPv4	*R-A IPv6*
R-A#show ip route eigrp *D 192.168.2.0/24 [90/2170112] via 192.168.5.2, Serial0/0/0* *D 192.168.3.0/24 [90/2170112] via 192.168.5.18, Serial0/1/0* *D 192.168.4.0/24 [90/2170112] via 192.168.5.14, Serial0/0/1* *D 192.168.5.4/30 [90/2681856] via 192.168.5.2, Serial0/0/0* *[90/2681856] via 192.168.5.18, Serial0/1/0* *D 192.168.5.8/30 [90/2681856] via 192.168.5.18, Serial0/1/0* *[90/2681856] via 192.168.5.14, Serial0/0/1*	R-A(config-router)#do show ipv6 route *D 2001:DB8:CAFE:2::/64 [90/2170112]* *via FE80::2, Serial0/0/0* *D 2001:DB8:CAFE:3::/64 [90/2170112]* *via FE80::3, Serial0/1/0* *D 2001:DB8:CAFE:4::/64 [90/2170112]* *via FE80::4, Serial0/0/1* *D 2001:DB8:CAFE:A2::/64 [90/2681856]* *via FE80::2, Serial0/0/0* *via FE80::3, Serial0/1/0* *D 2001:DB8:CAFE:A3::/64 [90/2681856]* *via FE80::3, Serial0/1/0* *via FE80::4, Serial0/0/1*

To the same destination, the metric number remains the same for IPv4 and IPv6

C. Default k values (K1=1, K2=0, k3=1, k4=0, k5=0) bandwidth and delay customized

The default value for bandwidth for serial interfaces is 1544 Kbit, delay is 20000 tens milliseconds, let us make these interfaces faster by increasing (doubling) bandwidth (BW) and decreasing (to half) delay(DLY). BW=3088; DLY=10000.

Command:

```
R-A(config)#int se0/0/0
            bandwidth 2000
            delay 10000
            int se0/0/1
            bandwidth 2000
            delay 10000
```

Table II IPv4-IPv6 metrics upon bandwidth and delay modification

R-A IPv4	*R-A IPv6*
R-A#show ip route *D 192.168.2.0/24 [90/3389184] via 192.168.5.2, Serial0/0/0* *D 192.168.3.0/24 [90/3389184] via 192.168.5.18, Serial0/1/0* *D 192.168.4.0/24 [90/3389184] via 192.168.5.14, Serial0/0/1* *D 192.168.5.4/30 [90/5948928] via 192.168.5.18, Serial0/1/0* *[90/5948928] via 192.168.5.2, Serial0/0/0* *D 192.168.5.8/30 [90/5948928] via 192.168.5.18,Serial0/1/0* *[90/5948928] via 192.168.5.14, Serial0/0/1*	*R-A#show ipv6 route* *D 2001:DB8:CAFE:2::/64 [90/2170112]* *via FE80::2, Serial0/0/0* *D 2001:DB8:CAFE:3::/64 [90/2170112]* *via FE80::3, Serial0/1/0* *D 2001:DB8:CAFE:4::/64 [90/2170112]* *via FE80::4, Serial0/0/1* *D 2001:DB8:CAFE:A2::/64 [90/2681856]* *via FE80::2, Serial0/0/0* *via FE80::3, Serial0/1/0* *D 2001:DB8:CAFE:A3::/64 [90/2681856]* *via FE80::3, Serial0/1/0* *via FE80::4, Serial0/0/1*

After customization of bandwidth and delay, it is realized that the metric value has been affected on IPv4 but not on IPv6. Also realized that multiple equal paths are available from router R-A to *192.168.5.4/30 and network 192.168.5.8/30* which is the same case to IPv6 routes. Though metrics in IPv4 are different from those in IPv6, paths are still the same. This can also be observed in the topology table below.

Table II IPv4-IPv6 Topology Table

R-A IPv4	*R-A IPv6*
R-A#show ip eigrp topology *IP-EIGRP Topology Table for AS 10/ID(192.168.5.17)* *P 192.168.1.0/24, 1 successors, FD is 2816* *via Connected, GigabitEthernet0/0*	R-A#show ipv6 eigrp topology *IPv6-EIGRP Topology Table for AS 10/ID(1.1.1.1)* *P 2001:DB8:CAFE:1::/64, 1 successors, FD is 2816* *via Connected, GigabitEthernet0/0* *P 2001:DB8:CAFE:2::/64, 1 successors, FD is 2170112*

P 192.168.2.0/24, 1 successors, FD is 3389184 *via 192.168.5.2 (3389184/2816), Serial0/0/0* *P 192.168.3.0/24, 1 successors, FD is 3389184* *via 192.168.5.18 (3389184/2816), Serial0/1/0* *P 192.168.4.0/24, 1 successors, FD is 3389184* *via 192.168.5.14 (3389184/2816), Serial0/0/1* *P 192.168.5.0/30, 1 successors, FD is 3388928* *via Connected, Serial0/0/0* *P 192.168.5.4/30, 2 successors, FD is 5948928* *via 192.168.5.18 (5948928/3388928), Serial0/1/0* *via 192.168.5.2 (5948928/3388928), Serial0/0/0* *P 192.168.5.8/30, 2 successors, FD is 5948928* *via 192.168.5.18 (5948928/3388928), Serial0/1/0* *via 192.168.5.14 (5948928/3388928), Serial0/0/1* *P 192.168.5.12/30, 1 successors, FD is 3388928* *via Connected, Serial0/0/1* *P 192.168.5.16/30, 1 successors, FD is 3388928* *via Connected, Serial0/1/0*	*via FE80::2 (2170112/2816), Serial0/0/0* *P 2001:DB8:CAFE:3::/64, 1 successors, FD is 2170112* *via FE80::3 (2170112/2816), Serial0/1/0* *P 2001:DB8:CAFE:4::/64, 1 successors, FD is 2170112* *via FE80::4 (2170112/2816), Serial0/0/1* *P 2001:DB8:CAFE:A1::/64, 1 successors, FD is 2169856* *via Connected, Serial0/0/0* *P 2001:DB8:CAFE:A2::/64, 2 successors, FD is 2681856* *via FE80::2 (2681856/2169856), Serial0/0/0* *via FE80::3 (2681856/2169856), Serial0/1/0* *P 2001:DB8:CAFE:A3::/64, 2 successors, FD is 2681856* *via FE80::3 (2681856/2169856), Serial0/1/0* *via FE80::4 (2681856/2169856), Serial0/0/1* *P 2001:DB8:CAFE:A4::/64, 1 successors, FD is 2169856* *via Connected, Serial0/0/1* *P 2001:DB8:CAFE:A5::/64, 1 successors, FD is 2169856* *via Connected, Serial0/1/0*

The topology table indicates that in the same destination, the number of successors (next hop) is the same for both protocols and the feasible distance is different because their metric values were also different due to the bandwidth and delay configuration on serial interfaces. Here the feasible distance (FD) is the same as the metric value.

D. Customizing k1 and k3

Let us set k1=2 and k3=2, other k values remain to their default values.
Commands:

```
enable
configure terminal
router eigrp 10
metric weights 0 2 0 2 0 0
exit
ipv6 router eigrp 10
metric weights 0 2 0 2 0 0
end
```

Table IV IPv4-IPv6 Routing Table K1=2, K3=2

R-A IPv4	*R-A IPv6*
R-A#show ip route *D 192.168.2.0/24 [90/4340224] via 192.168.5.2, Serial0/0/0* *D 192.168.3.0/24 [90/4340224] via 192.168.5.18, Serial0/1/0* *D 192.168.4.0/24 [90/4340224] via 192.168.5.14, Serial0/0/1* *D 192.168.5.4/30 [90/5363712] via 192.168.5.2, Serial0/0/0* *[90/5363712] via 192.168.5.18, Serial0/1/0* *D 192.168.5.8/30 [90/5363712] via 192.168.5.18, Serial0/1/0* *[90/5363712] via 192.168.5.14, Serial0/0/1*	*R-A#show ipv6 route* *D 2001:DB8:CAFE:2::/64 [90/4340224]* *via FE80::2, Serial0/0/0* *D 2001:DB8:CAFE:3::/64 [90/4340224]* *via FE80::3, Serial0/1/0* *D 2001:DB8:CAFE:4::/64 [90/4340224]* *via FE80::4, Serial0/0/1* *D 2001:DB8:CAFE:A2::/64 [90/5363712]* *via FE80::2, Serial0/0/0* *via FE80::3, Serial0/1/0* *D 2001:DB8:CAFE:A3::/64 [90/5363712]* *via FE80::3, Serial0/1/0* *via FE80::4, Serial0/0/1*

Assignment of the same value to both k1 and k3 changes the metric number but to the same destination, this number keeps to be the same for both IPv4 and IPv6.

E. Customizing all k values

Let us set k1=2, k2=1, k3=2, k4=1 and k5=0, other k values remain to their default values.
Commands:

```
enable
configure terminal
router eigrp 10
metric weights 0 2 1 2 1 0
```



```
exit
ipv6 router eigrp 10
metric weights 0 2 1 2 1 0
end
```

Table V IPv4-IPv6 Routing Table K Values Customized

R-A IPv4	*R-A IPv6*
R-A#show ip route D 192.168.2.0/24 [90/4346624] via 192.168.5.2, Serial0/0/0 D 192.168.3.0/24 [90/4346624] via 192.168.5.18, Serial0/1/0 D 192.168.4.0/24 [90/4346624] via 192.168.5.14, Serial0/0/1 D 192.168.5.4/30 [90/5370112] via 192.168.5.2, Serial0/0/0 [90/5370112] via 192.168.5.18, Serial0/1/0 D 192.168.5.8/30 [90/5370112] via 192.168.5.18, Serial0/1/0 [90/5370112] via 192.168.5.14, Serial0/0/1	R-A#show ipv6 route D 2001:DB8:CAFE:2::/64 [90/4346624] via FE80::2, Serial0/0/0 D 2001:DB8:CAFE:3::/64 [90/4346624] via FE80::3, Serial0/1/0 D 2001:DB8:CAFE:4::/64 [90/4346624] via FE80::4, Serial0/0/1 D 2001:DB8:CAFE:A2::/64 [90/5370112] via FE80::2, Serial0/0/0 via FE80::3, Serial0/1/0 D 2001:DB8:CAFE:A3::/64 [90/5370112] via FE80::3, Serial0/1/0 via FE80::4, Serial0/0/1

It is now realized that customization of k values on both IPv4 and IPv6 does not affect the calculation of route metric.

F. Influencing best route selection

Network administrator may choose a particular path due to some reasons by influencing router metric calculations. This can be done by configuring bandwidth or delay (or both) on router interfaces involved in routing packets to the destination of choice. Let us now reset the default bandwidth and delay and then choose destination to be 192.168.4.0 or 2001:DB8:CAFE:4::/64 from R-A. The chosen route is RA->R-B->B-C->R-D. Then route to destination will be observed for both IPv4 and IPv6. Bandwidth=15440 (default x10) and delay=2000 (default divided by 10). Involved interfaces are serial0/0/0(R-A), serial0/0/0 and se0/0/1(R-B), serial0/0/0 and se0/0/1(R-C), serial0/0/0(R-D).

Configuration of se0/0/0:

```
configure terminal
interface serial0/0/0
bandwidth 15440
delay 2000
```

Configuration of se0/0/1:

```
configure terminal
interface serial0/0/0
bandwidth 15440
delay 2000
```

Table VI Routing Table to Specific Destination

IPv4 route to 192.168.4.0/24	Ipv6 route 2001:db8:cafe:4::/64
R-A#show ip route 192.168.4.0 Routing entry for 192.168.4.0/24 Known via "eigrp 10", distance 90, metric 1701888, type internal * 192.168.5.2, from 192.168.5.2, 00:01:00 ago, via Serial0/0/0 Route metric is 1701888, traffic share count is 1 Total delay is 60010 microseconds, minimum bandwidth is 15440 Kbit	R-A#show ipv6 route 2001:db8:cafe:4::/64 Routing entry for 2001:DB8:CAFE:4::/64 Known via "eigrp 10", distance 90, metric 3840256, type internal Route count is 1/1, share count 0 Routing paths: FE80::4,Serial0/0/1

Table VII Topology table to specific destination

IPv4 route topology to 192.168.4.0/24	Ipv6 route topology 2001:db8:cafe:4::/64
R-A#sho ip eigrp top 192.168.4.0 IP-EIGRP (AS 10): Topology entry for 192.168.4.0/24 State is Passive, Query origin flag is 1, 1 Successor(s),	R-A#sho ipv6 eigrp top 2001:db8:cafe:4::/64 IPv6-EIGRP (AS 10): Topology entry for 2001:DB8:CAFE:4::/64

FD is 1701888 Routing Descriptor Blocks: 192.168.5.2 (Serial0/0/0), from 192.168.5.2, Composite metric is (1701888/1189888), Minimum bandwidth is 15440 Kbit Total delay is 60010 microseconds Hop count is 3 192.168.5.14 (Serial0/0/1), from 192.168.5.14, Composite metric is (2170112/2816), Vector metric: Minimum bandwidth is 1544 Kbit Total delay is 20010 microseconds Hop count is 1 192.168.5.18 (Serial0/1/0), from 192.168.5.18, Composite metric is (2682112/677888), Vector metric: Minimum bandwidth is 1544 Kbit Total delay is 40010 microseconds Hop count is 2	State is Passive, Query origin flag is 1, 1 Successor(s), FD is 3840256 Routing Descriptor Blocks: FE80::4 (Serial0/0/1), from FE80::4, Composite metric is (3840256/2816), Minimum bandwidth is 2000 Kbit Total delay is 100010 microseconds Reliability is 255/255 Load is 1/255 Minimum MTU is 1500 Hop count is 1

It is now clear that on both output of routing table and eigrp topology table that since the configuration of bandwidth and delay affect calculation of metric in IPv4 but doesn't in IPv6, the best route to network 192.168.4.0/24 or 2001:DB8:CAFE:4::/64 has been affected for IPv4 but IPv6 keeps on using the same route it has before customization of bandwidth and delay. It is also observed that IPv4 topology table indicates all other possible routes to the preferred network.

V. CONCLUSION

Today, the world is migrating from Internet Protocol version 4 (IPv4) to IPv6. This migration requires configuration of networks to support IPv6 routing. Then routing protocol for this latest IP version should be configured as well. In this article, a comparative analysis has been done on IPv4 and IPv6 on effect brought by configuration of different values of composite metric to path selection.

It has been realized that bandwidth and delay can affect path selection for IPv4 but it is not the case for IPv6 as the metric value for IPv4 changes according to the values assigned to these two parameters while by customizing other parameters of composite metric (load, reliability, MTU) does not affect the cost calculation (metric value is the same for both IPv4 and IPv6).

By default EIGRP uses bandwidth and delay to calculate metric. Although there is possibility for a network administrator to configure EIGRP k values to affect cost calculation, it is not recommended since changing k1 values may affect router performance by overloading it.

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