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SURVEY – ROUTING PROTOCOLS (IPV6)

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ABSTRACT: With the increased growth in the area of Internet, the use of IPv6 addresses in communication has been changed. The network communication in the feild of IP network is made by using Routing Protocols. The IPv6 will change the Routing techniques with the change in Routing Protocol features. The following survey paper will explains all Routing Protocols that used in IPv6 I mean these are RIPng, EIGRP (IPv6), OSPFv3, IS-IS (IPv6) and BGP4+. These protocols are discussed on the basis of their performance parameters.
KEYWORDS: IPv6, Routing Protocols, Performance Metrics.

I. INTRODUCTION

Currently, computers have become device which cannot be separated from our daily lives. From the simple task, up to the need to socialize using social networking sites such as facebook, twitter, etc.[1] Computers that had not connected essential to connect with the other computers. Whether it is modem, while internet connections are becoming increasingly affordable price to everyone. Initially, the computers in the network are using IPv4 addressing method. So each computer can communicate with the other using its IP address as the identity while connected to the network. However, IPv4 has much limitations, such of the number of address that can be used and some much address that cannot be employed because it has been reserved for some purpose. Because of limited IPv4 addresses that can be used, then the developing IPv6 has been done and there is much number of IP addresses can be used compared to IPv4 IP address. As long as a number of IP addresses can be used, the routing configuration is required so that these computers can communicates with each other even in different network. Misconfiguration of the routing table can cause problems that can interfere the data transmission such as packet loss and delay. The worst problem that can happen is the loss of important information that is sent. This disorder can occur because the improper configuration of routing tables on the routers device is down, or loss connections between routers.

II. OVERVIEW OF IPV6

IP version (IPv6) or IPng (IP next generation) is a technology developed to overcome the limitations of current standard, IP version (IPv4), which allow end systems to communicate and forms the foundation of the Internet as we identify it today.[2] One of the major limitations of IPv4 is its limited amount of address space. The detonation of new IP-enabled devices and growth of undeveloped regions have fuelled the need for more addresses. February 3, 2011, ICANN announced that IPv4 addresses have been exhausted. As we know, ability to scale networks for future demands necessitates a limitless supply of IP addresses and enhanced mobility. IPv6 combines stretched addressing with a more well-organized and feature-rich header to meet the demands for scalable networks in the future.

III. WHY IPV6?

IPv6 is a 128 bits or 16 bytes addressing scheme, which is represented by a series of eight 16 bits field separated by colons [5]. The format of IPv6 is x:x:x:x:x:x:x:x ,where x is 16 bits hexadecimal numbers with leading zeros in each x field are optional. Successive x fields with zero can be representas: but only once, for example2031:0000:0000:013f:0000:0000:0000:0001.

Security in IPv6 is inherit, which affords authentication and encryption and has simple header format for higher processing.

IPv6 provides several improvements over its predecessors. These factors explain why we have to use IPv6.

a)Larger Address Space: Increased address size from 32 bits to 128 bits.

b)Streamlined Protocol Header: Improves Packet-Forwarding efficiency.

c)Stateless Configuration: The ability for needs to determine their own address.

d)Jumbograms: The ability to have very large packet payloads for greater efficiency.

e)Network-layer Security: Encryption and authentication of communications.

f)Multicast: Increased use of efficient one-to-many communications.

g)Quality of Service Capabilities: QoS markings of packets and flow labels that help identify priority traffic.

h)Anycast: Redundant services using non-unique addresses.

i)Mobility: Simpler management of mobile or roaming nodes.

IV. ROUTING IN IPV6

The selection of a path for transmitting data grams is called routing. The important task of a router in a network is to determine the best path during the packet forwarding process. The routing process need a router to use routing table and the routing table contains entries information of different paths through the routing protocols. The IPv6 uses the similar kind of routing protocols with IPv4 but with some modifications. However, IPv6 is a new version of protocol and different from IPv4. The routing table is also managed separately from IPv4 routing table when both protocols were enabled on a router. There are two different ways to configure routing tables in router. The routing table on the router can be configured using Static Routing and Dynamic Routing.

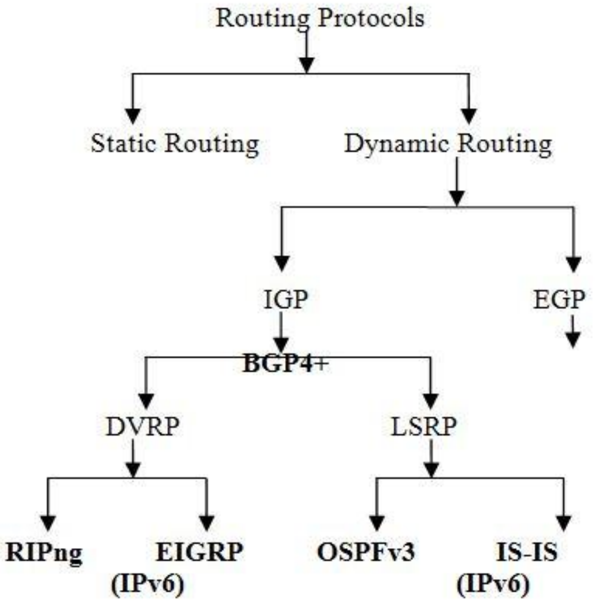

Fig: - Routing Protocol (IPv6)

4.1 Static Routing: Static routing is a form of routing that occurs when a router uses a manually-configured routing entry, rather than information from a dynamic routing protocol to forward traffic. For a computer network that is too large, it is advantageous to using static routing. In addition to save router resources, the configuration is not too difficult. When the computer network is larger, the use of static routing will be harder for administrators who are responsible to manage the routing table.

4.2 Dynamic Routing: A router with dynamically configured routing tables is known as a dynamic router. Dynamic routing involve of routing tables that are constructed and maintained automatically through an ongoing communication between routers. With a dynamic routing protocol, routers learn about the network topology by communicating with every other router. Every router declares its existence, and the routes it has available, to the other routers in the network. The capability to study about change to the network's configuration has implication beyond adding latest segments or moving old ones. It also means that the network can modify to failure. If a network has duplicated paths, then a partial network failure seems to the routers as if some segments got moved and some segments have been removed from the network. In short, there's no actual difference between a network stoppage and a configuration change.Dynamic routing have privileges the network to continue working, in a humiliate fashion, when a partial failure occurs. The chief advantage of dynamic routing over static routing is scalability and adaptability.

4.3Exterior Gateway Protocols
Exterior gateway protocols are used to exchange routing information among different Autonomous Systems (AS).
Example: -BGP 4+ (Border Gateway Protocol)

4.4 Interior Gateway Protocols
Interior gateway protocols are used to handle routing information withinAutonomous Systems (AS).The most common interior gateway routing protocols are twokinds, such as Distance vector protocols and link state protocols.

4.5 Distance vector protocols: Distance vector protocols use the distance calculation plus an outgoing network interface to choose the best path to a destination network. Routers that usage distance vector routing share information or a routing map with other routers on the network. When a change in network occurs, the router with the change spreads the new routing information to all neighbouring routers. Each recipient on this information adds a distance vector to the routing table before it forward it on to its neighbours.
Example: -• RIPng(Routing information Protocol)
• EIGRP (IPv6) (Enhanced Interior Gateway Routing Protocol)

4.6 Link state protocols: This type of routing protocol require every router to maintain atleast a partial map of the network. When a network link changes state, a notification, called a ink state advertisement (LSA) is flooded during the network. All the routers store a copy of all the LSAs it has seen in a database. The finalize topological database, also called the link state database, defines a graph of the internetwork. Using dijkstra algorithm, every router computes the shortest path to every network and enters this information into the route table. Neighbour discovery is the first step in getting a link state environment up and running. In keeping with the friendly neighbour terminology, a Hello packet is used for this step. After the adjacencies are recognized, the routers may begin sending out LSAs. The flooding process is the most difficult piece of a link state protocol. There are many ways to make flooding more efficient and more truthful, such as using unicast and multicast addresses, checksum and positive acknowledgements.
Example:–• OSPFv3 (Open Shortest Path First version 3)
• IS-IS (IPv6)(Intermediate System-to-Intermediate System)

V. ROUTING PROTOCOL IN IPV6

5.1 RIPng
RIPng is an interior gateway routing protocol for IPv6 and also called RoutingInformation Protocol next generation. It is based on RIPv2 for IPv6 and defined in [RFC2080]. It has the same features and capabilities as RIPv2. RIPng allocate routers to exchangeinformation for computing routes through an IPv6 network [6]. RIPng is a distance vectorprotocol and like RIP, it is also limited to radius of maximum 15-hops. User DatagramProtocol is used to send and receive routing information by RIPng. For IPv6 RIPng hasbeen updated some extra features such as IPv6 prefix of the destination,

IPv6 address of the next router along with path to the destination (next-hop address), Transport (RIPng messages are sent over IPv6 packets), UDP port number of 521 used to send and receive information between RIPng routers, and Link-local address FE80:: /10 use as the source address for RIPng updates sent to adjacent routers. Metrics in RIPng is determined by computing hop-count, where hops are the routers through which data is passed from source to destination, which is calculated in this way:

Hop-Count= No. Of routers through which data is passes from source to destination.

Advantages of RIPng:-
• Easy and efficient in smaller networks.
• Easy configuration.
• Low resource usage.
Disadvantages of RIPng:-
• Loop creation.
• Slow convergence.
• Scalability problem.
• Lack of metrics.

5.2 EIGRP for IPv6
EIGRP is an Enhanced version of IGRP developed by Cisco, uses the same distance vector algorithm and distance information as IGRP [7]. IPv6 supportive EIGRP is known as EIGRP for IPv6 and is similar to EIGRP used with IPv4. EIGRP provide features such as increased network width of 224 hopes in compare to 15 hopes of RIP and simple hello mechanism for neighbour discovery. EIGRP afford fast convergence, which allows quick routing information and EIGRP can scales to large network. EIGRP for IPv6provides route filtering, and also has a protocol-dependent module for IPv4, IPv6 [8]. Metrics in EIGRP is determined by computing bandwidth, reliability, delay and load for each link connected to the router. The composition metrics are shown below. Where K1=1, K2=0, K3=1, K4=0 and K5=0.

$$\text{Metric} = \left[K1 * \text{bandwidth} + \frac{(K2 * \text{bandwidth})}{(256 - \text{load})} + K3 * \text{delay}\right] * \left[\frac{K5}{(\text{reliability} + K4)}\right] * 256$$

Advantages of EIGRP (IPv6):-
• Easy to configure.
• Loop free routes.
• Keeps backup path to the destination network.
• Convergence time is low and bandwidth utilization.
• Support Variable Length Subnet Mask (VLSM) and
• Classless Inter Domain Routing (CIDR).
• Supports authentication.
Disadvantages of EIGRP (IPv6):-
• Considered as Cisco proprietary routing protocol.
• Routers from other vendor are not able to utilize EIGRP.

5.3 OSPFv3
OSPFv3 is an interior gateway routing protocol for IPv6 defined in RFC 2740 and sit is based on OSPFv2. Most of the functions provide by OSPFv3 is similar to OSPFv2such as both uses same 5 packet type hello, database description (DDP), link state request(LSR), link state update (LSU) and link state acknowledgement (LSA), similar mechanismfor neighbour discovery. However to handle the large address space some changes havebeen made in OSPFv3 such as OSPFv3 runs over a link instead of IPv4 behaviour of per subnet[9]. OSPFv3 uses the IPv6 Link-Local address to identify neighbours. OSPFv3uses IPSec Authentication Headers and IPSec Encapsulating Security Payload for securitypurposes. LSA (Link-state acknowledgement) format have been changed in OSPFv3 andthe new Link-LSA and Intra-Area-Prefix-LSA have been added. OSPFv3 allows IPv6-over-IPv4 tunnel configuration by sending OSPFv3 messages over IPv6 packet. OSPFv3can support the ability to run multiple OSPF protocol instances on a single link [4].In a Dual-Stack environment, for running OSPF need both OSPFv2 (IPv4) and OSPFv3 (IPv6) is needed because OSPFv3 is an IPv6-only protocol.
The path cost of an interface in OSPFv3 is called metric. The metric is calculated on the basis of bandwidth of each interface. The calculation is shown below:-

$$\text{Cost} = \frac{10^8}{\text{bandwidthinbps}}$$

Advantages of IS-IS (IPv6):-
• Hierarchical routing
• Classless behaviour
•Rapid flooding of new information
• Fast Convergence
• Very scalable
• Flexible timer tuning

Disadvantages of IS-IS (IPv6):-
• Link state scaling problem.
• More memory requirements.

5.5 BGP4+
The most common exterior gateway routing protocol for IPv6, is a new version of Border Gateway Protocol 4 (BGP4+), known as multiprotocol BGP or BGP4+. BGP4+ is a path vector routing protocol that uses Transmission Control Protocol (TCP) to enable connections with other BGP neighbours. BGP4+ is a multiprotocol BGP, so it can carry routing information for IPv6 as well as other protocol such as IPv4. BGP4+ can support the same features and functionality as IPv4 BGP. In the BGP4+ their are multiple attributes are used as metric like cost, hop-count, delay, reliability, bandwidth and delay etc. So all metric are comes under this category which are calculated in this way:

$\text{Metric} = \left[K1 * \text{bandwidth} + \frac{(K2 * \text{bandwidth})}{(256 - \text{load})} + K3 * \text{delay}\right] * \left[\frac{K5}{(\text{reliability} + K4)}\right] * 256$
Hop-Count= No. Of routers through which data is passes from source to destination.
$\text{Cost} = \frac{10^8}{\text{bandwidthinbps}}$

Advantages of BGP+:-
• It corrects a lots of previous errors, illuminating vagueness in the previous versions.
• Very robust and commonly used throughout the internet.
• Allows for an administrator to modify what determines the

cost of a link to another node.
Disadvantages of BGP4+:-
• BGP is not used on an internal corporate network.
Comparison of Routing Protocols (IPv6)

Parameters	RIPng	EIGRP (IPv6)	OSPFv3	IS-IS (IPv6)	BGP4+
Interior/Exterior?	Interior	Interior	Interior	Interior	Exterior
Type	Distance Vector	Hybrid	Link-state	Link-state	Path Vector
Convergence	Slow	Very Fast	Fast	Fast	Average
Classless	No	Yes	Yes	Yes	Yes
Algorithm	Bellman-Ford Algorithm	DUAL	Dijkstra Algorithm	Dijkstra Algorithm	Best Path Algorithm
Default Metric	Hop Count	Bandwidth, Delay	Cost	Cost	Multiple Attributes
Administrative Distance	120	90	110	115	200
Update Timer	30 Seconds	Only when changes occur	Only when changes occur	Only when changes occur	Only when changes occur
Updates	Full Table	Only Changes	Only Changes	Only Changes	Only Changes
Cisco proprietary	No	Yes	No	No	Yes
Implementation and Maintenance	Simple	Complex	complex	complex	Complex

Table 1:-comparison of Routing Protocols (IPv6)

VI. CONCLUSION

Routing is the method of moving packets from one network to the other network. Mostly, the routing involves two actions: determining best path and forwarding packets through this path. These two actions of routing vary on the basis of selection of routing protocol. While we have to study about IPv6 protocols the link-state protocols (OSPFv3, IS-IS (IPv6) gives better performance as compared to rest of all.

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