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Compare OSPF Routing Protocol with other Interior Gateway Routing Protocols

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Abstract: Routing Protocols are used to facilitate the exchange of routing information between routers. Routing Protocols determine the best path to each network, which is then added to routing table. Dynamic Routing protocols are typically used in larger networks to ease the administrative overhead. OSPF is a route distribution protocol. In this paper OSPF protocol is discussed and compared with other interior gateway routing protocols.

Keywords: Dynamic Routing Protocol ;OSPF ;DBD; Cost ;Convergence; SPF ;VLSM

I. Introduction

Dynamic routing protocols have been used in N/Ws since early 1980. As N/W have evolved so become more complex new routing protocols have emerged [1]. Dynamic routing use Routing Protocol that dynamically discover N/W destinations. Dynamic routing protocols have big impact on network resource utilization [9]. If router on the route goes down then dynamic routing allow routing tables in routers to change.

There are mainly three classes which are used on IP networks.

1. Interior Gateway Routing via link state routing protocols- IGP exchange routing information within a single administration. Link state routing protocol use sophisticated algorithms. that maintain a data base of internetwork topology [6] ..e.g. OSPF and IS-IS.
2. Interior gateway routing via distance vector routing protocols- It uses simple algorithm that calculates a cumulative distance value between routers based on hop count.
3. Exterior gateway routing- Border gateway protocol (BGP) is the routing protocol used on internet for exchange traffic between autonomous systems.

In this paper various Interior Gateway Routing Protocols are compared.

In link state routing, each node build a roadmap of connectivity to the network, showing which node are connected to which other nodes [10]. Each node then independently calculates the next best logical path from it to every possible destination in the network. The collection of best path will then form the routing table. In LSP the only information passed between nodes is connectivity related. Link State Routing Protocols converge more quickly and they are less prone to routing loops. Convergence is when all routers to share information calculate best path and update the routing table. Faster the convergence better is the routing protocol.

Link State Routing Protocol work best in situation where:

1. Network Design is Hierarchical
2. Administrator has a good knowledge of implementation
3. Fast convergence of network is crucial.

Example of link state routing are OSPF / IS-IS Routing protocols. In this paper OSPF routing protocol is discussed.

II. OSPF (Open Shortest Path First)

OSPF is based on link state protocol, developed by IETF, (internet engineering task force) it is defined as OSPF v2 in RFC2328 [5] and OSPF v3 in RFC5340. OSPF get whole network information by exchange the link state

information, with all other routers. v2 uses IPV4 header and v3 uses IPV6 header. It is a map which describes the network topology, then use SPF (shortest path first) algorithm to get the routing table [6]. OSPF are also called the route redistribution, it means if multiple routers are used in a network and not all of them are Cisco then OSPF routing protocol is used. OSPF works on Dijkstra Algorithm. OSPF is supposed to design in hierarchical fashion we can divide large internetwork into smaller internetworks called Areas. OSPF is an example of fast convergence. A network of few routers can converge in a matter of seconds [7]. It is one of the main design goals and an important performance indicator for routing protocols to implement a mechanism that allows all routers running this protocol to quickly and reliably converge [3].

All areas must be connected to Area0 with ABR. All the routers within same area have same topology table. ASBR is used to connect the one autonomous system to outer autonomous system. The goal of design is to localize the updates within area. ABR is called Area Border Router connects different areas with the backbone area i.e. Area 0. ASBR is Autonomous System Border Router. It connects different autonomous systems. This is the area design of OSPF routing protocol. The OSPF divides the network into areas to minimize the routing update traffic [15]. Fig 1 shows the area design of OSPF Routing Protocol.

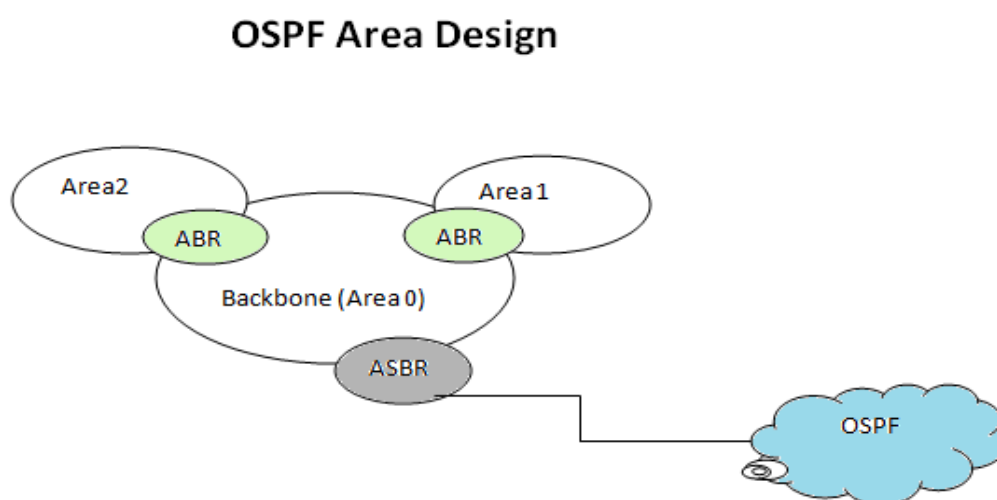


Fig 1: Area Design of OSPF Routing Protocol

A. *OSPF Terminology*

1) *Link:*

It is the network or interface assigned to any given network. In OSPF a link will have state information associated with it

2) *Router ID :*

It is an IP address used to identify router.

3) *Neighbour:*

These are two or more router, that have an interface on a common network

4) *Adjacency:*

It is a relationship between two OSPF routers, that permit direct exchange of route updates.

5) *Hello protocol:*

It provides dynamic neighbour discovery and maintain relationships hello packets are address to 224.0.0.5. [2]

6) *Neighbourship Database:*

A variety of details including router ID and state are maintained on each router in this database.

7) *Topological Database:*

It contains the information from all of link state advertisement packets that have been received from an area.

8) *Link state advertisement:*

LSA is an OSPF data packet containing link state and routing information, that shared among OSPF routers

9) *OSPF areas :*

It is a grouping of contiguous networks and routers. area also play a role in establishing hierarchical network.

10) *Designated Router (DR) :*

It is elected whenever OSPF routers are connected to same multi-access network.

11) *Backup Designated Router (BDR) :*

BDR is a hot stand by DR on multi-access links. The BDR receives all updates from OSPF adjacent routers.

B. *OSPF Tables*

In OSPF there are different tables for storing different information regarding network

1) *Neighbour Table:*

It contains the information of connected OSPF routers in this table the information of neighbour status router ID are stored.

2) *Topology Table:*

Each router has full road map of its entire area

3) *Routing Table:*

Routing table has best route for reaching different network. OSPF uses this SPF for calculate best path in OSPF process.

C. *Packet Types*

Hello Packet, DBD, LSR, LSU, LSA are the name of the packets used in OSPF. Hello packet is used to discover or maintained neighbor. DBD (data base description) is used to summarized the content of database .LSR (link state request) is used to download the database .LSU (link state update) are used to make updating in the database , LSA (link state acknowledgment) are used for flooding the acknowledgment.

D. *Neighbour Relationship*

1) *Determine router ID . each router has its unique ID .*

2) *Add interfaces to link state database .*

3) *Send hello message on the chosen interface this state is called "Down State".*

4) *When the router received hello then this state is called "Init State". This state check the area ID , net mask , hello/dead interval of the router.*

5) *After checking the ID the router send reply hello i.e. it sends the reply hello to neighbours this state is called "2-way State".the router send that Am I listed as a neighbour in your hello packet?. If the reply is yes then it reset the dead timer . if the reply is no, add as new neighbour .If the routers are new neighbours than it goes to next step .*

6) *Master-slave relationship determined: this state is called "Exstart State". Master sends DBD packet. DBD is the summary of link state database.*

7) *DBD are acknowledged and reviewed : this state is called "Loading State" if DBD have some new network information that slave did not have in its routing table , it sends LSR to master then the master sends LSU updates.*

8) *Neighbours are synchronised: this state is called " Full State".*

OSPF uses a metric referred as Cost. Cost is associated with every outgoing interface included in SPF Tree. The formula for calculating cost in OSPF is as follows:

Cost =

More the bandwidth of OSPF less is the cost [2]. The Dijkstra algorithm is used to calculate shortest path.

III. Comparison

The interior gateway routing protocols are compared such as IGRP, EIGRP, OSPF, IS-IS. These protocols are compared according to different factors such that metric, Hop count, summarization, convergence etc. Table: 1 compares these routing protocols with different factors. If different routers are used in a network then OSPF routing protocol is the best option. If Max hop count is used then OSPF is used. OSPF, EIGRP [14], IS-IS uses VLSM sub netting Variable Length Sub net mask. Faster the Convergence better is the routing protocol [1].

Table 1: Various Interior Gateway Routing Protocol

Comparison	IGRP	EIGRP	OSPF	IS-IS
Type of Protocol	Distance Vector	Distance Vector	Link State	Link State
Path Metric	Delay, Bandwidth, Reliability, Load	Delay, Bandwidth, Reliability, Load	Bandwidth	Variable Cost
Routes	IP, IPX, AppleTalk	IP, IPX, AppleTalk	IP	IP, CLNS
Hop Count	100	255	None	None
Sub netting	FLSM	VLSM	VLSM	VLSM
Summarization	Network class Address	Network Class Address/Subnet Boundary	Network Class Address /Subnet Boundary	Network Class Address/Subnet Boundary
Convergence	Slow	Fast	Fast	Fast
Routing Advertisement	Every 90 sec.	Route Change	Partial	Partial
Route Computation	Dual	Dual	Dijkstra	Dijkstra
Metric Calculation	Bandwidth*Delay	Bandwidth*Delay*256	100/Bandwidth (Mbps)	Variable Cost
Hierarchical Network	No	No	Yes	Yes
Hello Timer	90 sec	5 sec	10 sec	10 sec
Dead Timer	280 sec	15 sec	40 sec	30 sec
Area Types	-	-	Backbone, stubby, Not-so-stubby, totally stubbing	Backbone, stubby, Not-so-stubby, totally stubbing
Router Types	-	-	Internal, Backbone, ABR, ASBR	Level 1 & Level 2
References	[18]	[11] [16] [17] [19]	[8] [12] [13]	[1]

IV. Conclusion

OSPF routing protocol is best routing protocol as compared to IGRP, IS-IS. It is better than EIGRP in case of route redistribution. In EIGRP CISCO proprietary protocols are used but in OSPF multi vendor deployment are used. OSPF converges quickly, supports equal cost routes to same destination. OSPF has many features and all of them contribute to fast, scalable and robust protocol that can be actively deployed in thousand of production networks.

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