Advanced routing protocols 2012 case study examples

Technology, Development

Abstract - The routing protocols have significant effects on the consistency and the performance of the network. Categorization and determination of the best routing protocol can be quite a challenge. However, the choice of any given routing protocol mainly depends on the type of network being handled and the types of network infrastructure being used. All the routing protocols have their unique strengths and weaknesses. This section analyses the advantages and the disadvantages of various routing protocols and then offer guidance on which of the routing protocols is best suited to be used in the network under study. The wide Area network routing chosen should be compatible with the IPv6 and should be able to offer the best functionalities for the stated network.

Index Terms - IPV6, Network infrastructure, Routing protocols, Wide Area Network

1. 0 INTRODUCTION

The WAN Routing protocols which are commonly in use can be classified in several different ways. The classification is mainly done according to the operational characteristics, the field of use and the number of outmoded routes to each of the supported destinations. The choice of any of the routing protocols depends mainly on the number of network devices, the distance to be covered and the overall size of the network which is being considered. We can further classify the dynamic routing protocols as either Interior Gateway Protocols (IGPs) and Exterior Gateway Protocols (EGPs). The Interior Gateway Protocols are mainly used within an independent system while the Exterior Gateway Protocols are used between independent systems. There are three

WAN routing protocols which are commonly used in connecting different networks across different cities or even continents. The three commonly used protocols are HDLC, PPP and the Frame-relay[1].

High level Data link Control (HDLC) is a layer 2 protocol and has several advantages as compared to the other two WAN protocols. This is a simple protocol which is very instrumental in connecting two locations in two different cities. It is the protocol which has the least amount of configuration required to connect two or more different locations. Each router in the network would then be de-encapsulating HDLC then turn dropping it on to the LAN. 1 The HDLC is very good in performing error correction and can also be able to work with other Cisco devices. It is also considered as the default protocol. However in comparison with other routing protocols, OSPF and EIGRP have better performance. OSPF has been found to be of very high performance and is more robust than the EIGRP thus making it a routing protocol of choice [2].

In our case, there is need to use both the internal gateway protocol to connect the devices within an network and then involve the services of Exterior gateway protocols. The exterior gateway protocols can then be used to interconnect the different networks which are in different cities and different continents. The following section analyses the features of the interior gateway protocols and then justifies our choice of implementing OSPF. OSPF can be used both as a LAN and a WAN routing protocol and works quite well with different types of network components.

The capabilities of the OSPF and its robust nature makes it the protocol of choice as it can operate both as a LAN protocol and as a WAN routing protocol.

Features of the Interior Gateway Protocols

1. Distance-Vector Protocols

There are three different protocols under this category. They include:

Routing Information protocol (RIP v1)

This protocol uses class addressing whereby the network components are divided into classes labeled as Class A, B and C. it uses subnet mask and the maximum number of hop count is set at 16. It has periodic updates and also has full routing table updates.

This is a distance vector protocol which is based on Bellman-Ford distance vector algorithm. It can be measured using hop counts which is set at a maximum of 16. It selects routers which have the lowest hop count and then updates all the routers within the network. It is commonly used for small less dynamic networks.

Advantages

The main advantage of this protocol is that it is easy to configure and has been in use for a very long period of time thereby making it well known and widely used hence easy to find technicians well conversant with it thereby making it easy for troubleshooting operations in case of failure.

Disadvantages

However, this protocol has several disadvantages that jeopardize its usage. Since its maximum hop count is set at 16, it results into premature completion of packet journey especially when a packet has several routers to travel through (more than 16). This protocol also does not support the variable length subnet mask therefore routing updates are sent based on a fixed length subnet mask. It does not take into consideration information about the bandwidth of a link. This protocol also does not support multiple paths to be taken on the same route. It is also prone to routing loops

Routing Information protocol (RIP v2)

This protocol has classless addressing and is mainly prefix based. It has triggered updates and also has full routing table updates.

This is also distance vector protocol which is based on Bellman-Ford distance vector algorithm. Its advantages and disadvantages are very similar to RIP v1 except that this routing protocol supports the variable length subnet mask. It also adds onto authentication and route summarization which helps in making the routing process much easier [5].

Interior Gateway Routing Protocol (IGRP)

This protocol also makes use of the class addressing and uses single subnet mask. It also has full routing table updates and takes not of network parameters such as bandwidth, load and cost of data transmission in the system.

This routing protocol is also a distance vector protocol which is based on the Bellman-Ford distance vector algorithm. This protocol sends messages to the neighboring routers in order to establish whether they are still available. It updates routers only when the routes change. It can be used in any network size and all the routers being used in this network have to be from Cisco.

Advantages

This protocol is also easy to configure and use. It is very efficient in terms of accuracy when it comes to selecting the proper route to be taken as it makes use of bandwidth and reliability of the link as its metrics.

Weaknesses

This protocol is not an internet standard and requires that all routers come from Cisco. It is prone to routing loops and does not support variable length subnet mask. It is also slower than the RIP protocols.

Enhanced Interior Gateway Routing Protocol (EIGRP)

This is also a hybrid distance vector and is based only on the Cisco's implementation. It uses the diffusing Update Algorithm as metric. This protocol can operate together with the IGRP and updates other routers only when there is a change in the routes. It can also be used on any size of network.

Advantages

It supports IP and IPX. It is also offers a loop free network and has very quick convergence which is achieved as a result of using the DUAL. It requires less of the CPU and also needs very little bandwidth for routing the updates. It

supports both the VLSM and the CIDR. It is also very accurate in selecting proper routes and offers backward compatibility with IGRP.

Disadvantages

The main disadvantage of this routing protocol is that it is not an internet standard and therefore all the routers have to come from Cisco.

Link-State Protocols

This category of protocols can be further subdivided into two main categories namely:

Open Shortest Path First (OSPF)

It has two levels of hierarchical scaling and has incremental updates. It also makes use of the Dijkstra's shortest path first algorithm (SPF) and has a per area topology database.

This is a link state protocol and uses the Dijkstra algorithm to calculate the shortest path. It takes the bandwidth of the links into consideration as it calculates the cost to negotiate between router links in order to reach the required destination. It can be used on any size of the network.

Advantages

It has quick convergence as compared to the distance vector protocols. The routing packet updates are very small and it is not prone to routing loops. It supports very many features that other protocols do not support. This protocol also scales very well with the large networks and supports the VLSM.

Disadvantages

This protocol is more difficult to configure and understand as compared to the distance vector protocols.

Integrated Intermediate System-to-Intermediate System (IS-IS)

This protocol supports both the connectionless Network protocol and the IP. It also has two levels of hierarchical scaling and uses the Dijkstra's algorithm.

Exterior Gateway protocols

The exterior gateway protocols that are commonly used are characterized by the following features: they have classless addressing and their addressing mode is mainly prefix based. They have route reflectors and also make use of internal scaling. This class of routing protocols also uses extensive routing policy filtering and addresses aggregation [10].

Future development of Routing protocol

The OSPF protocol only allows arbitrary link costs to be used but does not allow the specification of the link cost directly in the network configuration. It is propagated that this capability will be provided in the future releases of OPSF so as to achieve even more accurate and efficient functionalities. It is also propagated that the future releases of new versions of OSPF will take into consideration support for multiple areas and that it would be possible to implement the use of IP multicast in future releases [11]. There are plans which are underway to develop OSPF protocol that will not rely on IP addresses but will operate based on the name of each router in the network. Therefore each router in the network will have to be named and this protocol

can then operate depending on the name of the router and the interface used. This will also make it possible to calculate the multiple forwarding choices without the need for user configuration. Since OSPF uses only Cisco proprietary protocols, a new initiative ought to be considered which will ensure that the protocol can operate on multivendor platforms. This will help in enhancing the routing processes for various networking operations. In future the OSPF protocol is anticipated to be able to operate on a multivendor platform.

APPENDIX

The figure shown below shows the general overview of the entire network

Figure 1: WAN Representation

NB: the cities close to each other are connected using a wired cable while those ones far apart are connected through the internet.

The network is further composed of several network devices which include servers, printers, computers and telephones.

The figure shown below shows the individual Local Area network of one of the cities as a sample.

Figure 2: LAN representation

The switches are used to establish more connections for the numerous numbers of computers in the system. The switches are then connected to the server which is in turn connected to the router for WAN access.

In both the LAN and WAN connections mentioned above, we use the OSPF protocols to route the messages and determine the best possible route for message transmission [7].

ACKNOWLEGMENT

I thank my instructor for the support and guidance accorded to me during the research process. I also thank my family members for the motivational and material support that they gave me as I was working on the project.

REFERENCES

[1] Anastasia Zoldak, How to Set Up a WAN Between Sites in a Business, 2008

[2] Bernard Fortz, Jennifer Rexford and Mikkel Thorup., Traffic Engineering With Traditional IP Routing Protocols." IEEE Communications Magazine. October 2002, pp. 118-124.

[3] David Davis, 3 WAN Protocols you should know: HDLC, PPP, and Frame-Relay, 2009

[4] J. Moy. OSPF version 2. RFC 2328, Apr. 1998.

[5] Khan, Razurehman., " Computet Communication and Networks/." Course website. [Online] 01 25, 2010. [Cited: 11 03, 2010.] Lectures website for student.

[6] L. Berger, I. Brystkin, A. Zinin, and R. Coltun. The OSPF opaque LSA option. RFC 5250,. 2008.

[7] L. Zhang et al. Named data networking (NDN) project. Technical Report NDN-0001, PARC, October 2010.

[8] Lan Wang_, A K M Mahmudul Hoque_, Cheng Yiy, Adam Alyyan_,

Beichuan Zhangy OSPFN: An OSPF Based Routing Protocol for Named Data Networking, 2012

[9] Mehboob Nazim Shehzad, Najam-Ul-Sahar, " Simulation of OSPF Routing Protocol Using OPNET Module"(A Routing Protocol Based on the Link-State Algorithm)

[10] Thornier, S. G., " Dynamic Routing Protocol Implementation Decision between EIGRP, OSPF and RIP Based on Technical Background Using OPNET Modeler." [Ed.] Wipro Technol. Bangkok: Bangalore, India, April 23-25, 2010. Computer and Network Technology (ICCNT), 2010 Second International Conference. Vol. 1, pp. 191-195. b. 11358172 .

[11] V. Jacobson, D. K. Smetters, J. D. Thornton, M. F. Plass, N. H. Briggs, and R. L. Braynard. Networking named content. In Proceedings of ACM CoNEXT, 2009.