Virtual Router Redundancy Protocol-A Best Open Standard Protocol in Maintaining Redundancy

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ABSTRACT

The paper addresses the interoperability and redundancy issues between Hot Standby Router Protocol (HSRP) and open standard Virtual Router Redundancy Protocol (VRRP). Furthermore, it shows how the redundancy is maintained in VRRP and how the tracking can be done in VRRP though direct tracking is not possible. The new concept of tracking by creating objects serves the purpose of directly tracking ensuring proper redundancy. The paper further discusses the algorithm of the redundancy in HSRP and VRRP. Demonstration of this proposed algorithm is presented through diagrams for both the protocols, and how VRRP stands a better place in maintaining redundancy than HSRP is shown. Practical implementation of the presented issues and concepts was done and was found to be very effective in establishing efficient redundancy.

Keywords – HSRP; Tracking; Virtual router; VRRP.

1. INTRODUCTION

Redundancy means carriage of same information. Redundant links in the network provide more ways to get the data from its source to the destination. One failure which is likely to be considered is a cable failure. Someone digging a trench may cut through a fiber bundle, or a construction crew in a remote building may cut a copper cable, or someone may trip over a drop cable and damage a data outlet in the wall. All of these are potentially disruptive to the network operation, and thus the necessity of redundant links arises. The goal of creating redundant links is to eliminate network downtime caused by a single link failure. All networks need redundancy for enhanced redundancy. On a redundantly connected network if a router fails, then the connectivity would be preserved by routing traffic through a redundant connection. The main reason to create redundancy is to get rid of interruption in the work in case of a link failure. A network that is based on switches or bridges will introduce redundant links between those switches or bridges to overcome the failure of a single link. Thus the reliability is increased. Two of the main protocols used to create redundancy is Hot Standby Routing Protocol (HSRP) and Virtual router redundancy protocol (VRRP).

In this paper, I have had discussed the protocols that are used for creating redundancy, how the load balancing is been done and I want to show how tracking is possible to do by using open standard protocol though direct tracking is not possible in open standard protocol like VRRP.

This paper is organized as follows: Section 2 describes the redundancy without redundancy protocols configured. The flaws of redundancy without redundancy protocols are explained in section 3. HSRP, its tracking and its shortcomings are discussed in section 4, 5 and 6. VRRP and its new concept of tracking by creating objects are explained in section 7 and 8. Benefits of VRRP over HSRP are explained in Section 9 and finally conclusion, analytical assessment and are aggregated in the Section 10 and11 respectively.
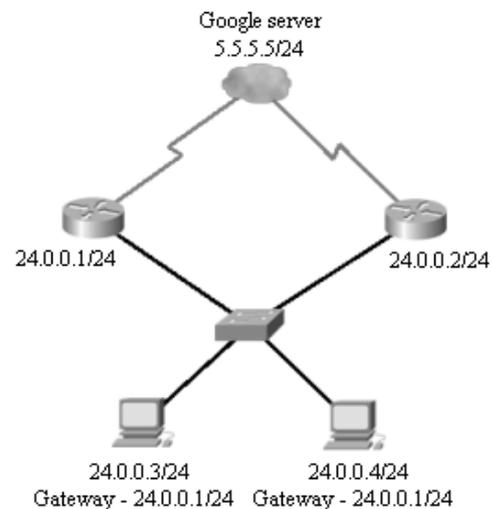
2. REDUNDANCY

Figure 1. Redundancy link created for PC's to connect to www.google.com server having 5.5.5.5/24 IP address.

Consider that the two computers having ip address 24.0.0.1 with subnet mask 255.255.255.0 and 24.0.0.4 with subnet mask 255.255.255.0 are in the same network. To establish connection with the google server having ip address 5.5.5.5 with subnet mask 255.255.255.0 two paths are created one is the active path and another redundant path is the backup path as shown in the Figure 1.

Now, consider that for both the pc's gateway set is 24.0.0.1 255.255.255.0. Therefore now this being the active path all the data flow is done through that link. But what if this link fails? Though the redundant link is ready, data flow cannot be established through that redundant link because the gateway set is 24.0.0.1 having subnet mask 255.255.255.0

3. LOOPHOLES FACED IN DATA FLOW IN SPITE OF MAINTAINING REDUNDANT LINK

In real scenario, one local area network has a minimum of 100 computers. So in order to make the backup link active the gateway of all the pc's has to be changed to 24.0.0.2 255.255.255.0 and changing the gateway IP address of all the pc's is not feasible. This is the major problem. To get rid of this, HSRP protocol is best solution.

4. HSRP (HOT STANDBY ROUTING PROTOCOL)

HSRP stands for Hot Standby Router Protocol (Cisco proprietary protocol) and it is designed to provide LAN redundancy by providing a backup of the default gateway that each machine on the LAN has set. This can be illustrated with following Figure 2. In order not to change the gateway again and again HSRP give the facility of creating virtual router. The virtual router is created in between two routers of two different paths as shown. 0000.0c07.acxx is the default MAC address of this virtual router. To create a virtual router following command is given to the Ethernet interface of both the routers which are connected to the pc's via switch.

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Consider the ip address given to the virtual router be 24.0.0.10. The commands are to be given on both the routers.
On the Ethernet interface

Standby 1 ip 24.0.0.10

After the creation of virtual router, the gateways have to be assigned with the same ip address of the virual router i.e. 24.0.0.10. This IP is held by one of the routers at a time, the routers send messages to each other in order to check whether the link is active and the data flow is been done. If one of the routers goes down and that router had the gateway IP, then other router will pick up the gateway ip from that router. So automatically the redundant path is utilized.
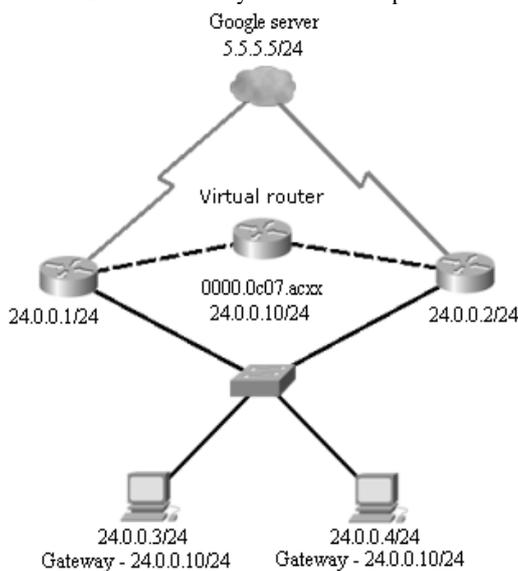

Figure 2. Virtual router created using Hot Standby Routing Protocol

Thus, one path is active and the other is backup. But how can one path be made active over other? It can be made by setting the priority to the routers. The default priority is 100 but it can be changed by using following command.
On the Ethernet interface

Standby 1 priority 110

Consider on first router 1 gave priority 110 and the second has by default 110. So priority with 110 becomes active router. In case the router fails then by default the backup router will become the active now. But the problem lies when the first router goes up again because as preempt is not allowed by default, though the priority be 110 of first router it won't become active anytime. This problem becomes major when the first router link is 100mbps and second router link is 10mbps. To get rid of this preempt is enabled using following command.
On the Ethernet interface

Standby 1 preempt

After enabling this command on both the routers, router to router election is done based on the priority. So if by chance first router goes up when backup router is active, as first router has the high priority this router will win the election and first router will become active.

5. TRACKING WITH HSRP

The main problem arises when the serial link goes down, as virtual router command can only be given to the Ethernet interface. The serial link is directly connected to the server for e.g. www.google.com. Now in spite of redundant links presence it can't be use. To get rid of this problem tracking is done. Tracking helps in decreasing the priority on the router by some number which helps in selecting the backup link. Thus redundancy is maintained.
On Ethernet interface

Standby 1 track serial0/0 20

Here, this commands tracks the serial link port 0/0 and check whether this is active or not. When the serial link fails it automatically decreases the priority of router by 20 i.e. 110-20=90. So naturally as second router is having high priority i.e. 100 it becomes active now. Default decrement of the router is 10. Thus redundant link is successfully used.

6. SHORTCOMINGS USING HSRP

The major disadvantage of Hot Standby Router Protocol is that it's a Cisco proprietary protocol i.e. it cannot run on Juniper, Alkatel routers.

The second disadvantage is that it has a large hello message interval of 3 seconds i.e. hello packets are exchanged between routers for every 3 seconds. To get rid of all these problems Virtual Router Redundancy Protocol serves the best.

7. VRRP (VIRTUAL ROUTER REDUNDANCY PROTOCOL)

Virtual Router Redundancy Protocol is an open standard protocol, which means it is in use by multiple vendors. In an all Cisco environment, HSRP is the most commonly used. When there are many routers of multiple vendors HSRP cannot be used. Cisco routers support VRRP also, which means if you want to use a single gateway redundancy protocol throughout your network VRRP is answer to the requirement.
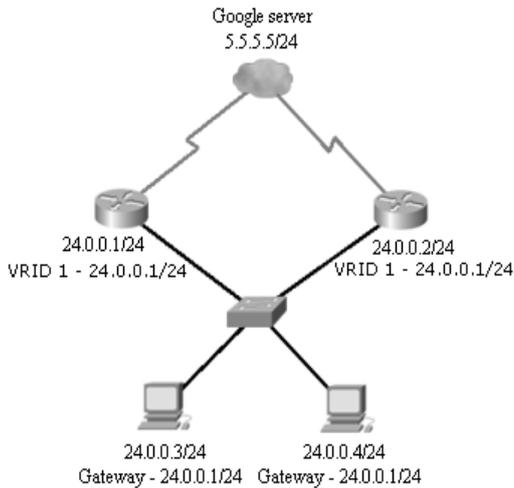
Figure 3. Redundancy using VRRP

In VRRP the main active router is considered to be Master router and the rest all are considered backup routers. The advantage of using VRRP is that we gain a higher availability for the default path without requiring configuration of dynamic routing or router discovery protocols on every end host. VRRP creates virtual router identifier. This is the ip address of the master router. Consider first router is the master router while other is the backup router. Thus the VRID on both the routers is given to be 24.0.0.1 which is the ip of the master router as shown in Figure 3. The PC's are also given the master router's gateway i.e. 24.0.0.1/24

If Router having ip address 24.0.0.1 255.255.255.0 becomes unavailable, then the other router takes over VRID 1 and its associated IP addresses. Packets sent to IP destinations outside the 10.x.x.x subnet using 10.0.0.1 as the router are then forwarded by Router with ip 24.0.0.2 255.255.255.0. When first router becomes active again, it takes over as the master and the other router reverts to backup.

The VRRP MAC address is always: 00-00-5e-00-01-vrid. The valid VRID range is 0x01-0xFF. Rest all working of VRRP is very similar to HSRP.

8. HOW THE TRACKING WITH OPEN STANDARD VRRP PROTOCOL CAN BE DONE THOUGH DIRECT TRACKING IS NOT POSSIBLE?

The main advantage of VRRP is that it is an open standard protocol but it has a shortcoming too. In VRRP if the serial link between the Server and the router fails then redundant link though is present it cannot be utilized because direct tracking is not allowed in VRRP. But this can be achieved. The tracking can be done by creating objects. To create object command is given on the configure terminal mode i.e. privilege mode.

Track 1 interface serial 0/0 line-protocol

Then on the Ethernet interface

Vrrp 1 ip 24.0.0.10
Vrrp 1 priority 110
Vrrp 1 description cisco
Vrrp 1 track 1 decrement 20

The last command is given to call the object from the global configuration mode. Thus this will decrement the priority of that router by 20if the serial link is not working properly. Thus this disadvantage is also overcome.

9. BENEFITS OF OPEN STANDARD VRRP OVER HSRP

Virtual Router Redundancy Protocol has a faster timer for its default hello over HSRP. Hello packets in VRRP are sent for every 1 second and in HSRP they are send for every 3 seconds making VRRP very efficient. Figure 4 illustrates the aforesaid statement. This makes HSRP work slower as it have low hello interval.

Another benefit of Virtual Router Redundancy Protocol over Hot Standby Router Protocol is that it is an open standard protocol whereas HSRP is a CISCO proprietary protocol
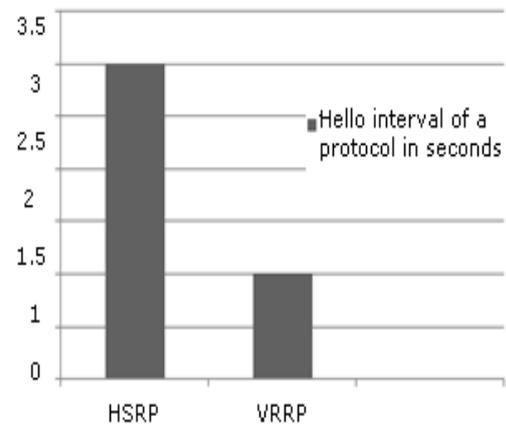

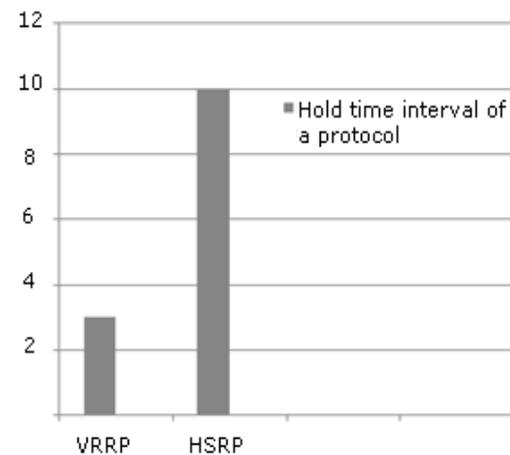**Figure 4. Hello interval of VRRP and HSRP protocols in seconds**

Figure 5. Hold time interval of VRRP and HSRP

So this protocol can be used in any network topologies containing different vendor routers. Hold time interval is also large in HSRP i.e. 10seconds than VRRP i.e. 3 seconds as illustrated in the figure 5. In sum, the open standard Virtual Router Redundancy Protocol is found to be more efficient over Cisco proprietary's Hot Standby Router Protocol.

10. CONCLUSION

The paper studies the fault recovery performance from direct tracking in VRRP with tracking by creating

objects. The analysis highlights insightful features of redundancy and tracking with HSRP and VRRP. Furthermore, after careful examining the algorithm of redundancy of both the protocols, it is found that various loopholes generated by HSRP are overcame by VRRP making VRRP the best efficient protocol to be used in generation of redundancy and backups.

11. ANALYTICAL ASSESSMENT

I have made practical implementation of these two HSRP and VRRP protocols for rendering redundancy and have also implemented the tracking in VRRP by creating objects in CISCO labs at Thane centre, Maharashtra, India and I further investigated the working of VRRP, which was found to be very efficient over HSRP in terms of hello timer, hold time interval and feasibly. The main advantage of VRRP being an open standard is that it is too fast in sending hello packets which makes it effective in maintaining redundancy.

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BIOGRAPHY

Nikhil Hemant Bhagat is currently pursuing his Final year of B.E. Electronics and Telecomm. Engineering from Lokmanya Tilak College of Engineering, Mumbai University, INDIA 2011-2012. He is the Head of the Department of Student Affairs of IEEE, 2011. He has also completed Network + technician and PC technician certifications from NIIT in the year 2010. He became Microsoft Certified in Dec. 2010 and was regarded as Microsoft Office Specialist 2007. He underwent practical experience in Mobile Communications from Mahanagar Telephone Nigam Ltd. (Govt. of India), Mumbai in June-July 2011. He went deep into Computer Networks by acquiring Cisco certifications like Cisco Certified Network Associate (CCNA Routing & Switching) in July 2011 and Cisco Certified Network Professional (CCNP Routing & Switching) in Oct. 2011. He further assimilated couple of certifications like Windows XP Professional and IT Technology Professional 2010 from Ranksheet.com. He is currently targeting Cisco Certified Internet Expert (CCIE Routing and Switching) certification. His areas of interests are Computer Networks, Neural Networks and Network Security.