

## **Distributed And Dynamic Routing Control Using Virtualized Local Area Network**

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**Abstract**-The switches in the network layer, forwards IP packets that flow from transmitter to the flow cache memory and get stored within them. When the traffic occurs in network layer, flow cache get exhausted due to overload .In order to avoid that, VLAN technology using HSRP protocol was designed. The HSRP provides a mechanism to support non-disruptive failover of IP packets in the traffic. To find a solution for overload, the implementation of HSRP gives robustness to the network and allows load sharing between links. HSRP provides automatic Router backup and allows building resiliency when an active router in the group fails. The standby router assumes the role of active router and continues to route the packets. HSRP enables two or more routers to work together in a group and emulate a single virtual router to the source hosts in LAN. The hosts default gateway address is assigned as their HSRP virtual IP address. When the hosts need to send packets to the server, host sends them to their default gateway or to router which is active. Because only one router is active, packets from the hosts to the servers traverse only one of the two available paths. By this way the packet loss and the convergence loss can be avoided.

**Index terms** –Ip packets, HSRP, Active router, Default gateway, Packet loss.

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### **I. INTRODUCTION**

Enterprises, universities and other organizations of internal network are built using VLAN technology. It is any broadcast domain that is partitioned and isolated in a computer network at the data link layer (OSI layer 2). VLANs allow network administrators to group hosts together even if the hosts are not on the same network switch. This can greatly simplify network design and deployment, because VLAN membership can be configured through software. Without VLANs, grouping hosts according to their resource needs necessitates the labor of relocating nodes or rewiring data links. VLANs can also help create multiple layer 3 networks on a single physical infrastructure [1]. For example, if a DHCP server is plugged into as witch it will serve any host that is configured for DHCP. By using VLANs, the network can, easily be split up so some host will not use that DHCP server and will obtain link-local addresses, or obtain an address from a different DHCP server. VLANs are data link layer (OSI layer 2) constructs, analogous to IP subnets, which are network layer (OSI layer 3) constructs. In an environment employing VLANs, a one-to-one relationship often exists between VLANs and IP subnets, although it is possible to have multiple subnets on one VLAN.

By using VLANs, one can control traffic patterns and react quickly to relocations. VLANs provide the flexibility to adapt to changes in network requirements and allow for simplified administration. A common infrastructure shared across VLAN trunks can provide a very high level of security with great flexibility for a comparatively low cost. Quality of service schemes can optimize traffic on trunk links for real-time (e.g. VoIP) or low-latency requirements (e.g. SAN).developed a method in a network by coordinating multiple devices controlled through routing points .in this network design , it is difficult to balance the relay traffic of L3 switch by redundant traffic waste the link capacity[2,3]. it is also important to integrate L2 and L3 information like upper-layer client traffic.

### **II. HSRP**

The Hot Standby Router Protocol (HSRP), provides a mechanism which is designed to support non-disruptive failover of IP traffic in certain circumstances. In particular, the protocol protects against the failure of the first hop router when the source host cannot read the IP address of the first hop router dynamically. The protocol is designed for use over multi-access, multicast or broadcast capable LANs (e.g., Ethernet).HSRP is not intended as a replacement for existing dynamic router discovery mechanisms and those protocols should be used instead whenever possible[4]. Large classes of legacy host implementations that do not support dynamic discovery are capable of configuring a default router. HSRP provides failover services to those hosts. All of the routers participating in HSRP are assumed to be running IP routing protocols and have a consistent set of routes.

Using HSRP, a set of routers work in concert to present the illusion of a single virtual router to the hosts on the LAN. This set is known as an HSRP group or a standby group. A single router elected from the group is responsible for forwarding the packets that hosts send to the virtual router. This router is known as the active router. Another router is elected as the standby router. In the event that the active router fails, the standby assumes the packet forwarding duties of the active router. Although an arbitrary number of routers may run HSRP, only the active router forwards the packets sent to the virtual router[5]. To minimize network traffic, only the active and the standby routers send periodic HSRP messages once the protocol has completed the election process. If the active router fails, the standby router takes over as the active router. If the standby router fails or becomes the active router another router is elected as the standby router.

On a particular LAN, multiple hot standby groups may coexist and overlap. Each standby group emulates a single virtual router. For each standby group, a single well-known MAC address is allocated to the group, as well as an IP address. The IP address should belong to the primary subnet in use on the LAN, but must differ from the addresses allocated as interface addresses on all routers and hosts on the LAN, including virtual IP addresses assigned to other HSRP groups

If multiple groups are used on a single LAN, load splitting can be achieved by distributing hosts among different standby groups. The remainder of this specification discusses the operation of a single standby group[6]. In the case of multiple groups, each group operates independently of other groups on the LAN and according to this specification. Note that individual routers may participate in multiple group. In this case the router maintains separate state and timers for each group.

HSRP provides automatic Router backup and allows building resiliency when an active router in the group fails. The standby router assumes the role of the active router and continues routing packets. HSRP enables two or more routers to work together in a group to emulate a single virtual router to the source hosts on the LAN.

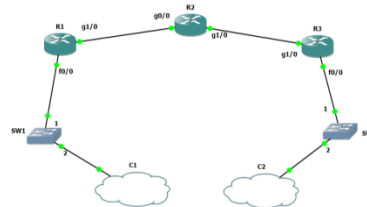


Fig: 1 Dynamic Routing

The hosts' default gateway address is assigned as their HSRP virtual IP address. When the hosts need to send packets to the server network, they send them to their default gateway, or to whichever router is active. Because only one router is active, packets from the hosts to the servers traverse only one of the two available paths.[7,9] The routers are to be configured to run HSRP.

### III. IMPLEMENTATION OF PROTOCOL

HSRP is configured in each router as follows:

- 1) Initially design the IPV6 network.
- 2) Then assign address for each router and the devices located.
- 3) Implement HSRP in each router with priority value.
- 4) If the router is below the priority value then the router is standby router. Otherwise the router is active router.
- 5) The router is elected as active one by the election process by the priority value.
- 6) The packets get transferred through the active router and the standby router remains silent.
- 7) If the active router fails due to overload or the traffic in the network, in that situation the standby router with next priority takes up the position of active router.

#### A. HSRP GROUP MEMBERS

- 1) Active Router -The router that is currently forwarding packets for the virtual router.
- 2) Standby Router - The primary backup router
- 3) Standby Group - The set of routers participating in HSRP that jointly emulate a virtual router.

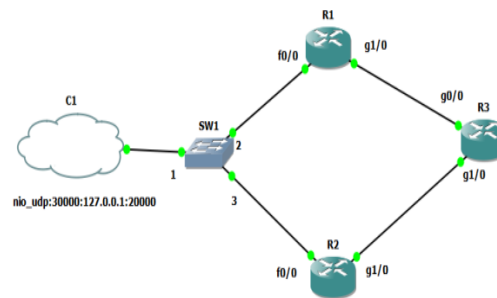


Fig: 2 Network Topology

Here the router R1 acts as the active router that transfers the data to other router in the network. The other routers R2, R3 remains the standby router that works as follows:

1. Initial

This is the starting state and indicates that HSRP is not running. This state is entered via a configuration change or when an interface first comes up.

2. Learn

The router has not determined the virtual IP address, and not yet seen an authenticated hello message from the active router. In this state the router is still waiting to hear from the active router.

3. Listen

The router knows the virtual IP address, but is neither the active router nor the standby router. It listens for hello messages from those routers.

4. Speak

The router sends periodic hello messages and is actively participating in the election of the active and/or standby router. A router cannot enter speak state unless it has the virtual IP address.

5. Standby

The router is a candidate to become the next active router and sends periodic hello messages. Excluding transient conditions, there must be at most one router in the group in standby state.

6. Active

The router is currently forwarding packets that are sent to the group's virtual MAC address. The router sends periodic hello messages. Excluding transient conditions, there must be at most one router in active state in the group.

#### IV. RESULT AND DISCUSSION

GNS3 is used by major corporations including Exxon, Walmart, AT&T and NASA, and is also popular with people preparing for network professional certification exams.

GNS3 was developed primarily by Jeremy Grossmann. Additional developers involved in creating GNS3 are David Ruiz, Romain Lamaison, Aurelien Levesque and Xavier Alt. Dynamips was developed by Christophe Fillot[8]. Dynagen's primary developer was Greg Anuzelli. GNS3 depends on several other programs to operate. Those dependencies include WinPcap, Dyamips and Pemuwrapper. These components along with GNS3 are all chosen by default installation. Graphical Network Simulator-3 is a software emulator for networks, launched in 2008. It allows the combination of virtual devices and real devices, and so can be used to simulate complex networks. It uses Dynamips emulation software to simulate Cisco IOS.

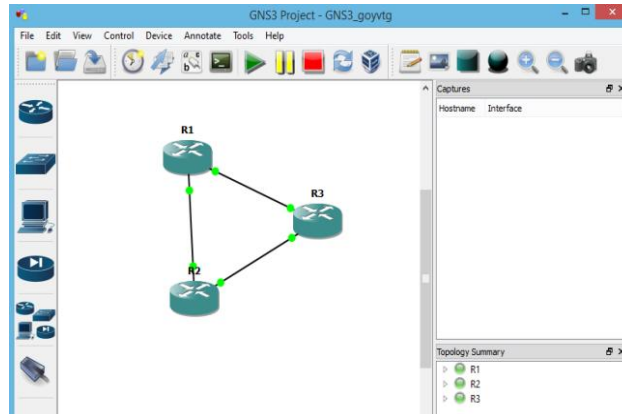


Fig: 3 Configured Routers

```
R1
Active router is local
Standby router is FE80::C801:EFF:FE94:8, priority 110 (expires in 8.864 sec)
Priority 110 (configured 120)
Track interface FastEthernet0/0 state Up decrement 10
Track interface FastEthernet0/1 state Down decrement 10
Group name is "hsrp-Fa0/0-1" (default)
R1#
R1#show standby
FastEthernet0/0 - Group 1 (version 2)
State is Active
2 state changes, last state change 00:42:45
Virtual IP address is FE80::5:73FF:FEA0:1
Active virtual MAC address is 0005.73a0.0001 (MAC In Use)
Local virtual MAC address is 0005.73a0.0001 (v2 IPv6 default)
Hello time 3 sec, hold time 10 sec
Next hello sent in 0.752 secs
Preemption enabled, delay min 30 secs
Active router is local
Standby router is FE80::C801:EFF:FE94:8, priority 110 (expires in 11.120 sec)
Priority 110 (configured 120)
Track interface FastEthernet0/0 state Up decrement 10
Track interface FastEthernet0/1 state Down decrement 10
Group name is "hsrp-Fa0/0-1" (default)
```

Fig: 4 Router R1 is Active State

```
R2
R2#show standby
FastEthernet0/0 - Group 1 (version 2)
State is Standby
1 state change, last state change 00:36:21
Virtual IP address is FE80::5:73FF:FEA0:1
Active virtual MAC address is 0005.73a0.0001 (MAC Not In Use)
Local virtual MAC address is 0005.73a0.0001 (v2 IPv6 default)
Hello time 3 sec, hold time 10 sec
Next hello sent in 0.832 secs
Preemption enabled, delay min 30 secs
Active router is FE80::C800:EFF:FE94:8, priority 110 (expires in 9.568 sec)
MAC address is ca00.0e94.0000
Standby router is local
Priority 110 (configured 120)
Track interface FastEthernet0/0 state Up decrement 10
Track interface FastEthernet0/1 state Down decrement 10
Group name is "hsrp-Fa0/0-1" (default)
```

Fig: 5 Router R2 is Standby State

```
R3#show standby
FastEthernet0/0 - Group 1 (version 2)
  State is Init (interface down)
    3 state changes, last state change 00:08:16
  Virtual IP address is FE80::5:73FF:FEA0::1
  Active virtual MAC address is unknown (MAC Not In Use)
    Local virtual MAC address is 0005.73a0.0001 (v2 IPv6 default)
  Hello time 3 sec, hold time 10 sec
  Preemption enabled, delay min 30 secs
  Active router is unknown
  Standby router is unknown
  Priority 110 (configured 120)
  Track interface FastEthernet0/1 state Down decrement 10
```

Fig: 6 Router R3 is Listening State

```
R4#show standby
FastEthernet0/0 - Group 1 (version 2)
  State is Init (interface down)
    3 state changes, last state change 00:01:38
  Virtual IP address is FE80::5:73FF:FEA0::1
  Active virtual MAC address is unknown (MAC Not In Use)
    Local virtual MAC address is 0005.73a0.0001 (v2 IPv6 default)
  Hello time 3 sec, hold time 10 sec
  Preemption enabled, delay min 30 secs
  Active router is unknown
  Standby router is unknown
  Priority 110 (configured 120)
  Track interface FastEthernet0/1 state Down decrement 10
  Group name is "harp-Pa0/0-1" (default)
```

Fig: 7 Router R4 is Listening State

```
R3#show standby
FastEthernet0/0 - Group 1 (version 2)
  State is Active
    5 state changes, last state change 00:03:01
  Virtual IP address is FE80::5:73FF:FEA0::1
  Active virtual MAC address is 0005.73a0.0001 (MAC In Use)
    Local virtual MAC address is 0005.73a0.0001 (v2 IPv6 default)
  Hello time 3 sec, hold time 10 sec
  Next hello sent in 2.192 secs
  Preemption enabled, delay min 30 secs
  Active router is local
  Standby router is unknown
  Priority 110 (configured 120)
  Track interface FastEthernet0/1 state Down decrement 10
  Group name is "harp-Pa0/0-1" (default)
```

Fig: 8 Router R3 Becomes Active When Router R1 Fails.

```

UPCS11) ping 2001:7777::2 -c 500
2001:7777::2 icmp6_seq=1 ttl=58 time=140.400 ms
2001:7777::2 icmp6_seq=2 ttl=58 time=140.400 ms
2001:7777::2 icmp6_seq=3 ttl=58 time=140.401 ms
2001:7777::2 icmp6_seq=4 ttl=58 time=140.400 ms
2001:7777::2 icmp6_seq=5 ttl=58 time=140.400 ms
2001:7777::2 icmp6_seq=6 ttl=58 time=140.401 ms
2001:7777::2 icmp6_seq=7 ttl=58 time=140.401 ms
2001:7777::2 icmp6_seq=8 ttl=58 time=140.400 ms
2001:7777::2 icmp6_seq=9 ttl=58 time=174.800 ms
2001:7777::2 icmp6_seq=10 ttl=58 time=140.400 ms
2001:7777::2 icmp6_seq=11 ttl=58 time=187.200 ms
2001:7777::2 icmp6_seq=12 ttl=58 time=140.400 ms
2001:7777::2 icmp6_seq=13 ttl=58 time=140.400 ms
2001:7777::2 icmp6_seq=14 ttl=58 time=140.401 ms
2001:7777::2 icmp6_seq=15 ttl=58 time=140.400 ms
2001:7777::2 icmp6_seq=16 timeout
2001:7777::2 icmp6_seq=17 timeout
2001:7777::2 icmp6_seq=18 timeout
2001:7777::2 icmp6_seq=19 timeout
2001:7777::2 icmp6_seq=20 timeout
2001:7777::2 icmp6_seq=21 timeout
2001:7777::2 icmp6_seq=22 timeout
2001:7777::2 icmp6_seq=23 timeout
2001:7777::2 icmp6_seq=24 timeout
2001:7777::2 icmp6_seq=25 timeout
2001:7777::2 icmp6_seq=26 timeout
2001:7777::2 icmp6_seq=27 timeout
2001:7777::2 icmp6_seq=28 timeout
2001:7777::2 icmp6_seq=29 ttl=56 time=234.001 ms
2001:7777::2 icmp6_seq=30 ttl=56 time=156.000 ms
2001:7777::2 icmp6_seq=31 ttl=56 time=171.600 ms
2001:7777::2 icmp6_seq=32 ttl=56 time=156.000 ms
2001:7777::2 icmp6_seq=33 ttl=56 time=171.601 ms
2001:7777::2 icmp6_seq=34 ttl=56 time=171.600 ms
2001:7777::2 icmp6_seq=35 ttl=56 time=171.600 ms
2001:7777::2 icmp6_seq=36 ttl=56 time=156.001 ms
2001:7777::2 icmp6_seq=37 ttl=56 time=140.400 ms
2001:7777::2 icmp6_seq=38 ttl=56 time=171.600 ms
2001:7777::2 icmp6_seq=39 ttl=56 time=156.001 ms
2001:7777::2 icmp6_seq=40 ttl=56 time=156.000 ms
2001:7777::2 icmp6_seq=41 ttl=56 time=156.000 ms
2001:7777::2 icmp6_seq=42 ttl=56 time=156.000 ms
2001:7777::2 icmp6_seq=43 ttl=56 time=140.400 ms
2001:7777::2 icmp6_seq=44 ttl=56 time=171.600 ms
2001:7777::2 icmp6_seq=45 ttl=56 time=171.600 ms
2001:7777::2 icmp6_seq=46 ttl=56 time=140.401 ms
2001:7777::2 icmp6_seq=47 ttl=56 time=156.000 ms
2001:7777::2 icmp6_seq=48 ttl=56 time=171.600 ms
2001:7777::2 icmp6_seq=49 ttl=56 time=171.601 ms
    
```

Fig:9 Packet Loss

```

Virtual PC Simulator for DynaMips/GNS3
58 2001:2222::2 171.600 ms 171.601 ms 156.000 ms
59 2001:2222::2 171.600 ms 140.401 ms 171.600 ms
60 2001:2222::2 156.000 ms 140.400 ms 171.601 ms
61 2001:2222::2 171.600 ms 124.800 ms 124.801 ms
62 2001:2222::2 124.800 ms 124.800 ms 140.400 ms
63 2001:2222::2 140.401 ms 124.800 ms 171.600 ms
64 2001:2222::2 312.001 ms 187.200 ms 171.600 ms

UPCS11) trace 2001:7777::2
trace to 2001:7777::2, 64 hops max
1 2001:1111::1 62.400 ms 62.400 ms 31.200 ms
2 2001:2222::2 109.200 ms 78.000 ms 62.400 ms
3 2001:4444::1 124.801 ms 109.200 ms 109.200 ms
4 2001:5555::2 156.000 ms 109.201 ms 124.800 ms
5 2001:7777::2 140.400 ms 124.800 ms 187.201 ms

UPCS11) ping 2001:7777::2 -c 500
2001:7777::2 icmp6_seq=1 ttl=58 time=327.600 ms
2001:7777::2 icmp6_seq=2 ttl=58 time=140.400 ms
2001:7777::2 icmp6_seq=3 ttl=58 time=140.400 ms
2001:7777::2 icmp6_seq=4 ttl=58 time=124.800 ms
2001:7777::2 icmp6_seq=5 ttl=58 time=109.200 ms
2001:7777::2 icmp6_seq=6 ttl=58 time=109.201 ms
2001:7777::2 icmp6_seq=7 ttl=58 time=109.201 ms
2001:7777::2 icmp6_seq=8 ttl=58 time=124.800 ms
2001:7777::2 icmp6_seq=9 ttl=58 time=109.200 ms
2001:7777::2 icmp6_seq=10 ttl=58 time=156.000 ms
2001:7777::2 icmp6_seq=11 ttl=58 time=124.801 ms
2001:7777::2 icmp6_seq=12 ttl=58 time=124.800 ms
2001:7777::2 icmp6_seq=13 ttl=58 time=140.400 ms
2001:7777::2 icmp6_seq=14 ttl=58 time=93.600 ms
2001:7777::2 icmp6_seq=15 timeout
*2001:1111::1 icmp6_seq=16 ttl=64 time=62.400 ms <ICMP type:1, code:0, No rou
to destination>
*2001:1111::1 icmp6_seq=17 ttl=64 time=46.800 ms <ICMP type:1, code:0, No rou
to destination>
*2001:1111::1 icmp6_seq=18 ttl=64 time=62.401 ms <ICMP type:1, code:0, No rou
to destination>
*2001:1111::1 icmp6_seq=19 ttl=64 time=31.200 ms <ICMP type:1, code:0, No rou
to destination>
*2001:1111::1 icmp6_seq=20 ttl=64 time=46.800 ms <ICMP type:1, code:0, No rou
to destination>
*2001:1111::1 icmp6_seq=21 ttl=64 time=31.200 ms <ICMP type:1, code:0, No rou
to destination>
*2001:1111::1 icmp6_seq=22 ttl=64 time=46.800 ms <ICMP type:1, code:0, No rou
to destination>
*2001:1111::1 icmp6_seq=23 ttl=64 time=62.400 ms <ICMP type:1, code:0, No rou
to destination>
    
```

Fig:10 Convergence Time

### V. CONCLUSION

Distributed and dynamic routing control of VLAN using Hot Standby Routing Protocol process discussed in this paper. The measurement of packet loss and the convergence loss using HSRP is done. As a result, the performance of HSRP is increased.

HSRP has larger benefits than VRRP protocol. For future improvement the protocol can be analyzed using ns2 software and also improve the packet loss and convergence loss by using GLBP protocol.

### REFERENCES

- [1]. R. Davis and A. Burns, "Resource sharing in hierarchical fixed priority pre-emptive systems," in Proc. Real-Time Syst. Symp., Dec. 2006, pp. 257–267.
- [2]. M. Behnam, I. Shin, T. Nolte, and M. Nolin, "SIRAP: A synchronization protocol for hierarchical resource sharing in real-time open systems," in Proc. Conf. Embedded Softw., Oct. 2013, pp. 279–288.
- [3]. M. Bertogna, N. Fisher, and S. Baruah, "Resource-sharing servers for open environments," IEEE Trans. Ind. Informat., vol. 5, no. 3, pp. 202–219, Aug. 2012
- [4]. T. M. Ghazalie and T. P. Baker, "Aperiodic servers in a deadline scheduling environment," Real-Time Syst., vol. 9, no. 1, pp. 31–67, 2009.
- [5]. M. Behnam, T. Nolte, M. Åsberg, and I. Shin, "Synchronization protocols for hierarchical real-time scheduling frameworks," in Proc. Workshop on Compositional Theory Technol. Real-Time Embedded Syst., Nov. 2013, pp. 53–60.
- [6]. M. Behnam, T. Nolte, M. Åsberg, and R. J. Bril, "Overrun and skipping in hierarchically scheduled real-time systems," in Proc. Conf. Embedded Real-Time Comput. Syst. Appl., Aug. 2012, pp. 519–526.

- [7]. M. M. H. P. van den Heuvel, R. J. Bril, and J. J. Lukkien, "Protocoltransparent resource sharing in hierarchically scheduled real-time systems," in Proc. Conf. Emerging Technol. Factory Autom., Sep. 2010, pp. 1–8.
- [8]. M. Behnam, T. Nolte, M. Sjodin, and I. Shin, "Overrun methods and resource holding times for hierarchical scheduling of semi-independent real-time systems," IEEE Trans. Ind. Informat., vol. 6, no. 1, pp. 93–104, Feb. 2010.
- [9]. M. Åsberg, M. Behnam, T. Nolte, and R. J. Bril, "Implementation of overrun and skipping in VxWorks," in Proc. Workshop on Operating Syst. Platforms Embedded Real-Time Appl., Jul. 2010, pp. 45–52.
- [10]. M. M. H. P. van den Heuvel, R. J. Bril, J. J. Lukkien, and M. Behnam, "Extending a HSF-enabled open-source real-time operating system with resource sharing," in Proc. Workshop on Operating Syst. Platforms Embedded Real-Time Appl., Jul. 2013, pp. 71–81.
- [11]. M. M. H. P. van den Heuvel, M. Holenderski, R. J. Bril, and J. J. Lukkien, "Constant-bandwidth supply for priority processing," IEEE Trans. Consumer Electron., vol. 57, no. 2, pp. 873–881, May 2011.
- [12]. A. Rowe, K. Lakshmanan, H. Zhu, and R. Rajkumar, "Rate-harmonized scheduling and its applicability to energy management," IEEE Trans. Ind. Informat., vol. 6, no. 3, pp. 265–275, Aug. 2010.
- [13]. R. J. Bril, U. Keskin, T. Nolte, and M. Behnam, "Schedulability analysis of synchronization protocols based on overrun without payback for hierarchical scheduling frameworks revisited," Eindhoven Univ. Technol., Eindhoven, The Netherlands, Tech. Rep. CS 10-05, Jun. 2013. [Online]. Available:
- [14]. J. Regehr, A. Reid, K. Webb, M. Parker, and J. Lepreau, "Evolving realtime systems using hierarchical scheduling and concurrency analysis," in Proc. Real-Time Syst. Symp., Dec. 2003, pp. 25–36. 336 IEEE Transactions on Industrial Informatics, Vol. 8, no. 2, May 2012.