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Overview

This document will help understand how the "hardware ip glean throttle" feature works with examples and the intention of this feature.

When forwarding an incoming IP packet in a line card, if the Address Resolution Protocol (ARP) request for the next hop is not resolved, the line card forwards the packets to the supervisor to generate an ARP request. Once the ARP request is responded to the supervisor resolves the MAC address for the next hop and programs the hardware.

If the supervisor cannot resolve the ARP entry then the linecard keeps sending all packets destined to that address to the supervisor. The supervisor will keep generating ARP requests indefinitely until the ARP entry is resolved. There is a hardware rate limiter called glean in place to protect the supervisor's processor (CPU) from excessive traffic.

An issue that can arise is a single destination IP drops off the network due to maintenance or a hardware problem, and suddenly all traffic destined to it is being sent to the CPU. Since the rate limiter is in place the CPU does not go high but this single destination IP can consume the entire rate limiter and not give other legitimate IP's access to the CPU. It is for this scenario that "hardware ip glean throttle" was created.

With the "hardware ip glean throttle" configuration, a single packet is sent to the CPU for each destination IP to generate the ARP request. Then the software adds a /32 drop adjacency in the hardware to prevent additional packets to the same next-hop IP address to be forwarded to the supervisor. While this drop adjacency is added all subsequent packets are dropped yet the supervisor continues to generate ARP requests until the next-hop is resolved. The drop adjacency is installed for a short period of time, which is configurable. Once the timer expires one packet will again be sent to the CPU and the process repeats. The number of entries being installed in this fashion is limited to 1000 by default, but is configurable to a larger number of desired. This is to limit the impact on the Routing Information Base (RIB) table size.

Prerequisites

Requirements

Ensure that you meet these requirements before you attempt this configuration:

- Have a basic knowledge of Nexus 7000 Series Switches configuration

Components Used

The information in this document is based on these software and hardware versions:

- Nexus 7000 with Release 6.2.x and later.
- F2e series line card.

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, make sure that you understand the potential impact of any command.

Lab test

In this case you have a server, 172.28.191.200, which is down due to a hardware failure, and is currently unavailable to service traffic. **There is no ARP entry for the host and no adjacency is created.**

```
N7K# show ip route vrf VRF_ABC 172.28.191.200
IP Route Table for VRF "VRF_ABC"
'*' denotes best ucast next-hop
'***' denotes best mcast next-hop
'[x/y]' denotes [preference/metric]
'%<string>' in via output denotes VRF <string>
```

```
172.28.191.192/28, ubest/mbest: 1/0, attached >>> There is no /32 entry
 *via 172.28.191.195, Vlan1601, [0/0], 02:01:17, direct
```

Traffic is sent to the supervisor in order to generate an ARP request

```
N7K# show system internal forwarding vrf VRF_ABC ipv4 route 172.28.191.200 detail
slot 1
=====
RPF Flags legend:
  S - Directly attached route (S_Star)
  V - RPF valid
  M - SMAC IP check enabled
  G - SGT valid
  E - RPF External table valid
172.28.191.192/28 , sup-eth2
Dev: 0 , Idx: 0x65fb , Prio: 0x8487 , RPF Flags: VS , DGT: 0 , VPN: 9
RPF_Intf_5: Vlan1601 (0x19 )
AdjIdx: 0x5a , LIFB: 0 , LIF: sup-eth2 (0x1fe1 ), DI: 0xc01
DMAC: 0000.0000.0000 SMAC: 0000.0000.0000
172.28.191.192/28 , sup-eth2
Dev: 1 , Idx: 0x65fb , Prio: 0x8487 , RPF Flags: VS , DGT: 0 , VPN: 9
RPF_Intf_5: Vlan1601 (0x19 )
AdjIdx: 0x5a , LIFB: 0 , LIF: sup-eth2 (0x1fe1 ), DI: 0xc01
DMAC: 0000.0000.0000 SMAC: 0000.0000.0000
172.28.191.192/28 , sup-eth2
Dev: 2 , Idx: 0x65fb , Prio: 0x8487 , RPF Flags: VS , DGT: 0 , VPN: 9
RPF_Intf_5: Vlan1601 (0x19 )
AdjIdx: 0x5a , LIFB: 0 , LIF: sup-eth2 (0x1fe1 ), DI: 0xc01
DMAC: 0000.0000.0000 SMAC: 0000.0000.0000
172.28.191.192/28 , sup-eth2
Dev: 5 , Idx: 0x65f1 , Prio: 0x84f2 , RPF Flags: VS , DGT: 0 , VPN: 9
RPF_Intf_5: Vlan1601 (0x19 )
AdjIdx: 0x5a , LIFB: 0 , LIF: sup-eth2 (0x1fe1 ), DI: 0xc01
```

DMAC: 0000.0000.0000 SMAC: 0000.0000.0000

The glean rate limiter for the specific module will be throttling the traffic to 100 packets per second, per module. You can see that some of the packets are getting dropped.

```
N7K# show hardware rate-limiter
Units for Config: packets per second
Allowed, Dropped & Total: aggregated since last clear counters
rl-1: STP and Fabricpath-ISIS
rl-2: L3-ISIS and OTV-ISIS
rl-3: UDLD, LACP, CDP and LLDP
rl-4: Q-in-Q and ARP request
rl-5: IGMP, NTP, DHCP-Snoop, Port-Security, Mgmt and Copy traffic
```

```
Module: 1
```

R-L Class	Config	Allowed	Dropped	Total
L3 mtu	500	0	0	0
L3 ttl	500	0	0	0
L3 control	10000	0	0	0
L3 glean	100	3326	3190	6516
L3 mcast dirconn	3000	0	0	0
L3 mcast loc-grp	3000	0	0	0
L3 mcast rpf-leak	500	0	0	0
L2 storm-ctrl	Disable			
access-list-log	100	0	0	0
copy	30000	1877	0	1877
receive	30000	318	0	318

When the hardware ip glean throttle command is configured

```
N7K# show hardware rate-limiter
Units for Config: packets per second
Allowed, Dropped & Total: aggregated since last clear counters
rl-1: STP and Fabricpath-ISIS
rl-2: L3-ISIS and OTV-ISIS
rl-3: UDLD, LACP, CDP and LLDP
rl-4: Q-in-Q and ARP request
rl-5: IGMP, NTP, DHCP-Snoop, Port-Security, Mgmt and Copy traffic
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```
Module: 1
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R-L Class	Config	Allowed	Dropped	Total
L3 mtu	500	0	0	0
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L3 control	10000	0	0	0
L3 glean	100	3326	3190	6516
L3 mcast dirconn	3000	0	0	0
L3 mcast loc-grp	3000	0	0	0
L3 mcast rpf-leak	500	0	0	0
L2 storm-ctrl	Disable			
access-list-log	100	0	0	0
copy	30000	1877	0	1877
receive	30000	318	0	318

An adjacency in installed in the RIB

```
N7K# show hardware rate-limiter
Units for Config: packets per second
Allowed, Dropped & Total: aggregated since last clear counters
rl-1: STP and Fabricpath-ISIS
rl-2: L3-ISIS and OTV-ISIS
rl-3: UDLD, LACP, CDP and LLDP
rl-4: Q-in-Q and ARP request
rl-5: IGMP, NTP, DHCP-Snoop, Port-Security, Mgmt and Copy traffic
```

Module: 1

R-L Class	Config	Allowed	Dropped	Total
L3 mtu	500	0	0	0
L3 ttl	500	0	0	0
L3 control	10000	0	0	0
L3 glean	100	3326	3190	6516
L3 mcast dirconn	3000	0	0	0
L3 mcast loc-grp	3000	0	0	0
L3 mcast rpf-leak	500	0	0	0
L2 storm-ctrl	Disable			
access-list-log	100	0	0	0
copy	30000	1877	0	1877
receive	30000	318	0	318

When looking at the hardware programming a drop index is installed

```
N7K# show system internal forwarding vrf VRF_ABC ipv4 route 172.28.191.200 detail
```

```
slot 1
```

```
=====
```

RPF Flags legend:

S - Directly attached route (S_Star)

V - RPF valid

M - SMAC IP check enabled

G - SGT valid

E - RPF External table valid

172.28.191.200/32 , Drop

Dev: 0 , Idx: 0x1a5 , Prio: 0x8b61 , RPF Flags: VS , DGT: 0 , VPN: 9

RPF_Intf_5: Vlan1601 (0x19)

AdjIdx: 0x8913 , LIFB: 0 , **LIF: Drop** (0x0), DI: 0x0

DMAC: 0000.0000.0000 SMAC: 0000.0000.0000

172.28.191.200/32 , Drop

Dev: 1 , Idx: 0x1a5 , Prio: 0x8b61 , RPF Flags: VS , DGT: 0 , VPN: 9

RPF_Intf_5: Vlan1601 (0x19)

AdjIdx: 0x8913 , LIFB: 0 , **LIF: Drop** (0x0), DI: 0x0

DMAC: 0000.0000.0000 SMAC: 0000.0000.0000

172.28.191.200/32 , Drop

Dev: 2 , Idx: 0x1a5 , Prio: 0x8b61 , RPF Flags: VS , DGT: 0 , VPN: 9

RPF_Intf_5: Vlan1601 (0x19)

AdjIdx: 0x8913 , LIFB: 0 , **LIF: Drop** (0x0), DI: 0x0

DMAC: 0000.0000.0000 SMAC: 0000.0000.0000

172.28.191.200/32 , Drop

Dev: 5 , Idx: 0x1e1 , Prio: 0x88ee , RPF Flags: VS , DGT: 0 , VPN: 9

RPF_Intf_5: Vlan1601 (0x19)

AdjIdx: 0x8914 , LIFB: 0 , **LIF: Drop** (0x0), DI: 0x0

DMAC: 0000.0000.0000 SMAC: 0000.0000.0000

You can now see that the hardware rate-limiter is not seeing any drops.

```
N7K# show hardware rate-limiter
```

Units for Config: packets per second

Allowed, Dropped & Total: aggregated since last clear counters

rl-1: STP and Fabricpath-ISIS

rl-2: L3-ISIS and OTV-ISIS

rl-3: UDLD, LACP, CDP and LLDP

rl-4: Q-in-Q and ARP request

rl-5: IGMP, NTP, DHCP-Snoop, Port-Security, Mgmt and Copy traffic

Module: 1

R-L Class	Config	Allowed	Dropped	Total
-----------	--------	---------	---------	-------

```

+-----+-----+-----+-----+-----+
L3 mtu                500                0                0                0
L3 ttl                500                0                0                0
L3 control            10000             0                0                0
L3 glean             100              0              0              0
L3 mcast dirconn     3000                0                0                0
L3 mcast loc-grp     3000                0                0                0
L3 mcast rpf-leak    500                 0                0                0
L2 storm-ctrl        Disable
access-list-log       100                 0                0                0
copy                  30000              1877             0                1877
receive               30000              318              0                318

```

Further Reading

[Configuring IP Glean Throttling](#)