Dataplane IP Address Learning

This chapter contains the following sections:

Overview of Dataplane IP Address Learning

Endpoint IP and MAC addresses are learned by the Cisco Application Centric Infrastructure (ACI) fabric through common network methods such as ARP, GARP, and ND. Cisco ACI also uses an internal method that learns IP and MAC addresses through the dataplane. Dataplane IP address learning is enabled by default on the Cisco ACI fabric.

Dataplane IP address learning per VRF instance is unique to the Cisco ACI network much in the same way as endpoint learning. While endpoint learning is identified as both IP address and MAC address, dataplane IP address learning is specific to IP addressing only in VRF instances. In the Cisco Application Policy Infrastructure Controller (APIC), you can enable or disable dataplane IP address learning at the VRF instance level.

Beginning with Cisco APIC release 5.2(1), you can disable dataplane IP address learning for specific endpoints or subnets for more granular control.

Guidelines and Limitations for Dataplane IP Address Learning

The following guidelines and limitations apply to dataplane IP address learning per VRF instance, bridge domain subnet, and EPG subnet:

- When dataplane IP address learning is disabled, all the remote IP address entries in the tenant VRF instance are removed. The local IP entries are aged out and, subsequently, will not be re-learned through the dataplane, but can still be learned from the control plane.

- When dataplane IP address learning is disabled, already learned local IP endpoints are retained and require control plane refreshes (ARP) to be kept alive (assuming IP aging is also enabled). Dataplane Layer 3 traffic will not keep IP endpoints alive.

- For EPG-to-EPG intra-VRF instance Layer 3 traffic, the policy is always applied on the egress leaf switch because the ingress leaf switch cannot resolve the destination class. The remote IP address is not learned.

- For EPG-to-EPG intra-VRF instance Layer 2 traffic, the policy can be applied on the ingress leaf switch because the switch can still learn the remote MAC address, but not the remote IP address.

- When dataplane IP address learning is enabled for an endpoint or subnet, a dataplane IP address is not learned using an endpoint-to-endpoint ARP request that does not reach a CPU. However, an ARP request to a bridge domain SVI gateway is still learned.

- When dataplane IP address learning is enabled for a VRF instance, local and remote MAC addresses are learned using an endpoint-to-endpoint ARP request.

The following guidelines and limitations apply to disabling dataplane IP address learning per endpoint or subnet:

- If there is communication between endpoints in the same bridge domain, the **L2 unknown Unicast** property must be set to **Flood** on the bridge domain. ARP flooding must also be enabled. Otherwise, ARP between endpoints in the same bridge domain does not work because the local MAC address and remote MAC address are not learned through an endpoint-to-endpoint ARP request.

- Instead of flushing, the local IP address is converted to the `dp-lrn-dis` (dataplane learn disabled) state.

- You cannot have endpoint dataplane IP address learning enabled when the subnet for an endpoint is configured with dataplane IP address learning disabled. For example, you cannot have a bridge domain with subnet 100.10.0.1/24 with learning disabled and an EPG with 100.10.0.100/32 with learning enabled.

- When dataplane IP address learning is disabled for an endpoint or subnet, the switch will not learn/refresh Layer 2 MAC addresses from routed Layer 3 data traffic. Layer 2 MAC addresses will only be learned from Layer 2 data traffic or ARP packets.

- When dataplane IP address learning is disabled for an endpoint or subnet, an IP address learn or move triggered from a GARP packet is only possible with the ARP flood mode along with GARP-based endpoint move detection enabled.

Feature Interaction for Dataplane IP Address Learning Being Disabled

This section provides information about the interaction of disabling dataplane IP address learning with other features.

- Anycast

  - Enabled: Local anycast IP addresses can be learned from both the data and control planes.

  - Disabled: Local anycast IP addresses are aged out, but can be learned through the control plane and host tracking.

  - Remote IP addresses are not learned in anycast regardless of how dataplane IP address learning per VRF instance is configured.

- Rogue Endpoint Detection

  - Enabled: A rogue IP address is generated and moves are detected as expected.

- Disabled: Remote IP addresses are flushed and rogue IP addresses are aged out. Rogue IP address are not detected on local moves. The only moves that are detected are from control traffic. Bounce is learned from COOP, but these are dropped once the bounce timer expires.

- Layer 4 to Layer 7 services virtual IP (VIP) address

  - Enabled: A Layer 4 to Layer 7 services VIP address functions as expected (endpoint IP address learning for a VIP address is only through the control plane). Consider the following functional stream:

    1. From client to load balancer (Layer 3 traffic)

    2. Load balancer to server (Layer 2 traffic)

    3. Server to client (Layer 3)

    Clients (IP endpoints) behind the EPG are learned through the data/control plane. The VIP address is learned only through the control plane on the load balancer EPG. Even though it is through the control plane, the VIP address is not learned on other EPGs.

  - Disabled:

    - Client to load balancer: No remote IP address learned for VIP address. The remote IP address is cleared. It will use the spine-proxy. If the IP address of the VIP address is learned, spine-proxy look-up will be successful, otherwise it will generate glean for the VIP address and learn it through the control plane.

    - Load balancer to server: No effect. Only bridging between the load balancer/server is supported for the DSR use case.

    - Server to client: The remote IP address for the client is cleared and the spine-proxy will be used. If the remote IP address for the client entry is deleted in the spine switch, it is re-learned through glean. For clients behind an L3Out, there is no Layer 3 remote IP address.

Configuring Dataplane IP Address Learning per VRF Instance Using the GUI

This section explains how to disable dataplane IP address learning per VRF instance.

The following procedure assumes that you have already configured a tenant and VRF instance.

Procedure

Step 1   Navigate to **Tenants** > *tenant_name* > **Networking** > **VRFs** > *vrf_name*.

Step 2   On the **VRF - *vrf_name*** work pane, click the **Policy** tab.

Step 3   Scroll to the bottom of the **Policy** work pane and locate **IP Data-plane Learning**.

Step 4   Click one of the following:

- **Disabled**: Disables dataplane IP address learning on the VRF instance.

• **Enabled**: Enables dataplane IP address learning on the VRF instance.

Step 5   Click **Submit**.

Configuring Dataplane IP Address Learning per Endpoint Using the GUI

The following procedure enables or disables dataplane IP address learning for an endpoint of the chosen endpoint group. You can configure dataplane IP address learning for an endpoint only if the EPG subnet IP address has a mask of /32 for an IPv4 address or /128 for an IPv6 address. Dataplane IP address learning is enabled by default.

Procedure

Step 1   On the menu bar, choose **Tenants** > **All Tenants**.

Step 2   In the Work pane, double-click the tenant's name.

Step 3   If you are modifying an existing subnet, perform the following substeps:

a)   In the Navigation pane, choose **Tenant** *tenant_name* > **Application Profiles** > *app_profile_name* > **Application EPGs** > *app_epg_name* > **Subnets** > *subnet_address*.

The chosen subnet must meet the following requirements:

• The **Default Gateway IP** field must have a mask of /32 for an IPv4 address or /128 for an IPv6 address.

• There must be a check in the **No Default SVI Gateway** checkbox.

• The **Type Behind Subnet** must be **None** or **Anycast MAC**.

b)   In the Work pane, for the **IP Data-plane Learning** toggle, choose **Enable** or **Disable**, as desired.

This enables or disables IP address dataplane learning for the endpoint.

Step 4   If you are creating a new subnet, perform the following substeps:

a)   In the Navigation pane, choose **Tenant** *tenant_name* > **Application Profiles** > *app_profile_name* > **Application EPGs** > *app_epg_name* > **Subnets**.

b)   Right click **Subnets** and choose **Create EPG Subnet**.

c)   For the **Default Gateway IP** field, you must specify a mask of /32 for an IPv4 address or /128 for an IPv6 address.

d)   Put a check in the **No Default SVI Gateway** checkbox.

e)   For the **Type Behind Subnet** buttons, choose **None** or **Anycast MAC**.

f)   For the **IP Data-plane Learning** toggle, choose **Enable** or **Disable**, as desired.

This enables or disables IP address dataplane learning for the endpoint.

g)   Fill out the remaining fields as necessary.

Step 5   Click **Submit**.

Configuring Dataplane IP Address Learning per Subnet Using the GUI

The following procedure enables or disables dataplane IP address learning for a subnet. Dataplane IP address learning is enabled by default.

Procedure

Step 1   On the menu bar, choose **Tenants** > **All Tenants**.

Step 2   In the Work pane, double-click the tenant's name.

Step 3   If you are modifying an existing subnet, perform the following substeps:

   a)   In the Navigation pane, choose **Tenant** *tenant_name* > **Networking** > **Bridge Domains** > *bridge_domain_name* > **Subnets** > *subnet_address*.

   If you want to disable dataplane IP address learning, there must not be a check in the **No Default SVI Gateway** checkbox.

   b)   In the Work pane, for the **IP Data-plane Learning** toggle, choose **Enable** or **Disable**, as desired.

   This enables or disables IP address dataplane learning for the subnet.

Step 4   If you are creating a new subnet, perform the following substeps:

   a)   In the Navigation pane, choose **Tenant** *tenant_name* > **Networking** > **Bridge Domains** > *bridge_domain_name* > **Subnets**.

   b)   Right click **Subnets** and choose **Create Subnet**.

   c)   For the **Default Gateway IP** field, enter the IP address and mask.

   d)   If you want to disable dataplane IP address learning, do not put a check in the **No Default SVI Gateway** checkbox.

   e)   For the **IP Data-plane Learning** toggle, choose **Enable** or **Disable**, as desired.

   This enables or disables IP address dataplane learning for the subnet.

   f)   Fill out the remaining fields as necessary.

Step 5   Click **Submit**.