Track Static Routes for Service VPNs

Note To achieve simplification and consistency, the Cisco SD-WAN solution has been rebranded as Cisco Catalyst SD-WAN. In addition, from Cisco IOS XE SD-WAN Release 17.12.1a and Cisco Catalyst SD-WAN Release 20.12.1, the following component changes are applicable: **Cisco vManage** to **Cisco Catalyst SD-WAN Manager**, **Cisco vAnalytics** to **Cisco Catalyst SD-WAN Analytics**, **Cisco vBond** to **Cisco Catalyst SD-WAN Validator**, **Cisco vSmart** to **Cisco Catalyst SD-WAN Controller**, and **Cisco Controllers** to **Cisco Catalyst SD-WAN Control Components**. See the latest Release Notes for a comprehensive list of all the component brand name changes. While we transition to the new names, some inconsistencies might be present in the documentation set because of a phased approach to the user interface updates of the software product.

Table 1: Feature History

Feature Name	Release Information	Description
Static Route Tracker for Service VPNs	Cisco IOS XE Catalyst SD-WAN Release 17.3.1a Cisco vManage Release 20.3.1	This feature enables you to configure IPv4 static route endpoint tracking for service VPNs. For static routes, endpoint tracking determines whether the configured endpoint is reachable before adding that route to the route table of the device.
TCP/UDP Endpoint Tracker and Dual Endpoint Static Route Tracker for Cisco IOS XE Catalyst SD-WAN devices	Cisco IOS XE Catalyst SD-WAN Release 17.7.1a Cisco vManage Release 20.7.1	This feature enables you to configure the TCP/UDP static route endpoint trackers. Using this feature you can also configure IPv4, TCP/UDP dual endpoint static-route tracker groups for service VPNs to enhance the reliability of probes.

Information About Static Route Tracking

Static-route tracking for service VPNs enables you to track the availability of the configured endpoint address to determine if the static route can be included in the routing table of a device. This is applicable when a site uses a static route in a service VPN to advertise its route over Overlay Management Protocol (OMP). The static route tracker periodically sends ICMP ping probes to the configured endpoint. If the tracker does not receive a response, the static route is not included in the routing table and is not advertised to OMP. You can configure an alternative next-hop address or a static route with a higher administrative distance to provide a backup path. This path is advertised over OMP.

Note From Cisco IOS XE Catalyst SD-WAN Release 17.7.1a, you can configure TCP/UDP individual endpoint trackers and configure a tracker group with dual endpoints (using two trackers), and associate the trackers and tracker group to a static route. Dual endpoints help in avoiding false negatives that might be introduced because of the unavailability of the routes.

Supported Platforms

- Cisco ASR 1000 Series Aggregated Services Routers
- Cisco ISR 1000 Series-Integrated Services Routers
- Cisco ISR 4000 Series Integrated Services Routers
- Cisco CSR 1000 Series Cloud Service Routers

Restrictions for IPv4 Static Route Tracking

- Only one endpoint tracker is supported per static route per next-hop address.
- IPv6 static routes are not supported.
- To configure a static route with tracker:
  1. Delete any existing static route, if it is already configured without a tracker. Plan for any connectivity downtime that might occur during this step for static route advertisement.
  2. Configure a new static route with tracker using the same prefix and next-hop as the deleted static route.
- To add a new tracker after you reach maximum tracker limit per router:
  1. Delete an old tracker and attach the template to the device.

2. Add a new tracker and attach the device to the template again.

- UDP tracker endpoint enabled with IP SLA UDP packet responder is supported only on Cisco IOS XE Catalyst SD-WAN devices.
- You cannot link the same endpoint-tracker to static routes in different VPNs. Endpoint-tracker is identified by a name and can be used for multiple static routes in a single VPN.

Workflow to Configure IPv4 Static Route Tracking

1. Configure an endpoint tracker using the System template.
2. Configure a static route using the VPN template.
3. Apply the tracker to the next-hop address.

Create a Static Route Tracker

Use the **System Template** to create a tracker for static routes.

Note Delete existing static routes, if any, before you create a static route tracker. Configure a new static route tracker using the same prefix and next hop as the deleted static route.

1. From Cisco SD-WAN Manager menu, choose **Configuration** > **Templates**.
2. Click **Feature Templates**.

   Note In Cisco vManage Release 20.7.x and earlier releases, **Feature Templates** is titled **Feature**.

3. Navigate to the **Cisco System** template for the device.

   Note For information about creating a System template, see Create System Template.

4. Click **Tracker**. Click **New Endpoint Tracker** to configure the tracker parameters.

Table 2: Tracker Parameters

Field	Description
Name	Name of the tracker. The name can be up to 128 alphanumeric characters.

Field	Description
Threshold	Wait time for the probe to return a response before declaring that the configured endpoint is down. Range is from 100 to 1000 milliseconds. Default is 300 milliseconds.
Interval	Time interval between probes to determine the status of the configured endpoint. Default is 60 seconds (1 minute). Range is from 20 to 600 seconds.
Multiplier	Number of times probes are sent before declaring that the endpoint is down. Range is from 1 to 10. Default is 3.
Tracker Type	From the drop-down, choose Global. From the Tracker Type field drop-down, choose Static Route. From Cisco IOS XE Catalyst SD-WAN Release 17.7.1a, you can configure a tracker group with dual endpoints on Cisco IOS XE Catalyst SD-WAN devices and associate this tracker group to a static route.
Endpoint Type	Choose endpoint type IP Address. **Note** Configuring the tracker type Static Route using endpoint URL or endpoint DNS name is not supported.
End-Point Type: IP Address	IP address of the static route end point. This is the destination on the internet to which the router sends probes to determine the status of the route.

5. Click **Add**.
6. Click **Save**.
7. To create a tracker group, click **Tracker Groups** > **New Endpoint Tracker Groups** and configure the tracker parameters.

Note Ensure that you have created two trackers to form a tracker group.

Table 3: Tracker Group Parameters

Fields	Description
Name	Name of the tracker group.
Tracker Type	From the drop-down, choose **Global**. From the Tracker Type field drop-down, choose **Static Route**. From Cisco IOS XE Catalyst SD-WAN Release 17.7.1a, you can configure a tracker group with dual endpoints on Cisco IOS XE Catalyst SD-WAN devices and associate this tracker group to a static route.

Fields	Description
Tracker Elements	This field is displayed only if you chose **Tracker-group** as the tracker type. Add the existing interface tracker names (separated by a space). When you add this tracker to the template, the tracker group is associated with these individual trackers, and you can then associate the tracker group to a static route.
Tracker Boolean	From the drop-down list, choose **Global**. This field is displayed only if you chose **tracker-group** as the **Tracker Type**. By default, the **OR** option is selected. Choose **AND** or **OR**. **OR** ensures that the static route status is reported as active if either one of the associated trackers of the tracker group report that the route is active. If you select **AND**, the static route status is reported as active if both the associated trackers of the tracker group report that the route is active.

8. Click **Add**.
9. Click **Save**.

Note Complete all the mandatory actions before you save the template.

Configure a Next Hop Static Route with Tracker

Use the **VPN** template to associate a tracker to a static route next hop.

Note You can apply only one tracker per static route next hop.

1. From the Cisco SD-WAN Manager menu, choose **Configuration** > **Templates**.
2. Click **Feature Templates**.

Note In Cisco vManage Release 20.7.x and earlier releases, **Feature Templates** is titled **Feature**.

3. Navigate to the **Cisco VPN Template** for the device.

Note For information about creating a VPN template, see Create VPN Template.

4. Enter **Template Name** and **Description** as required.

5. In Basic Configuration, by default, VPN is set to 0. Set a VPN value within (1–511, 513–65530) range for service VPNs, for service-side data traffic on Cisco IOS XE Catalyst SD-WAN devices.

Note You can configure static route tracker only on service VPNs.

6. Click **IPv4 Route**.
7. Click **New IPv4 Route**.
8. In the **IPv4 Prefix** field, enter a value.
9. Click **Next Hop**.
10. Click **Add Next Hop with Tracker** and enter values for the fields listed in the table.

Parameter Name	Description
Address	Specify the next-hop IPv4 address.
Distance	Specify the administrative distance for the route.
Tracker	Enter the name of the gateway tracker to determine whether the next hop is reachable before adding that route to the route table of the device.
Add Next Hop with Tracker	Enter the name of the gateway tracker with the next hop address to determine whether the next hop is reachable before adding that route to the route table of the device.

11. Click **Add** to create the static route with the next-hop tracker.
12. Click **Save**.

Note You need to fill all the mandatory fields in the form to save the VPN template.

Monitor Static Route Tracker Configuration

View Static Route Tracker

To view information about a static tracker on a transport interface:

1. From the Cisco SD-WAN Manager menu, choose **Monitor** > **Devices**.

   Cisco vManage Release 20.6.x and earlier: From the Cisco SD-WAN Manager menu, choose **Monitor** > **Network**.

2. Choose a device from the list of devices.
3. Click **Real Time**.

4. From the **Device Options** drop-down list, choose **Endpoint Tracker Info**.

Configure Static Routes Using CLI

The following sections provide information about how to configure static routes using the CLI.

Configure a Static Route Tracker

Note You can configure static route tracking using the Cisco SD-WAN Manager CLI Add-on feature templates and CLI device templates. For more information on configuring using CLI templates, see CLI Templates.

```
Device# config-transaction
Device(config)# endpoint-tracker <tracker-name>
Device(config-endpoint-tracker)# tracker-type <tracker-type>
Device(config-endpoint-tracker)# endpoint-ip <ip-address>
Device(config-endpoint-tracker)# threshold <value>
Device(config-endpoint-tracker)# multiplier <value>
Device(config-endpoint-tracker)# interval <value>
Device(config-endpoint-tracker)# exit
Device(config)# track <tracker-name> endpoint-tracker
```

Configure a Static Route Tracker with TCP Port as the Endpoint

```
Device# config-transaction
Device(config)# endpoint-tracker <tracker-name>
Device(config-endpoint-tracker)# tracker-type <tracker-type>
Device(config-endpoint-tracker)# endpoint-ip <ip-address> tcp <port-number>
Device(config-endpoint-tracker)# threshold <value>
Device(config-endpoint-tracker)# multiplier <value>
Device(config-endpoint-tracker)# interval <value>
Device(config-endpoint-tracker)# exit
Device(config)# track <tracker-name> endpoint-tracker
```

Configure a Static Route Tracker with UDP Port as the Endpoint

```
Device# config-transaction
Device(config)# endpoint-tracker <tracker-name>
Device(config-endpoint-tracker)# tracker-type <tracker-type>
Device(config-endpoint-tracker)# endpoint-ip <ip-address> udp <port-number>
Device(config-endpoint-tracker)# threshold <value>
Device(config-endpoint-tracker)# multiplier <value>
Device(config-endpoint-tracker)# interval <value>
Device(config-endpoint-tracker)# exit
Device(config)# track <tracker-name> endpoint-tracker
```

Configure Tracker Groups

Note You can create tracker groups to probe static routes from Cisco IOS XE Catalyst SD-WAN Release 17.7.1a and Cisco vManage Release 20.7.1.

```
Device# config-transaction
Device(config)# endpoint-tracker <tracker-name1>
Device(config-endpoint-tracker)# tracker-type <tracker-type>
Device(config-endpoint-tracker)# endpoint-ip <ip-address> tcp <port-number>
Device(config-endpoint-tracker)# threshold <value>
Device(config-endpoint-tracker)# multiplier <value>
Device(config-endpoint-tracker)# interval <value>
Device(config-endpoint-tracker)# exit
Device(config)# track <tracker-name1> endpoint-tracker

Device# config-transaction
Device(config)# endpoint-tracker <tracker-name2>
Device(config-endpoint-tracker)# tracker-type <tracker-type>
Device(config-endpoint-tracker)# endpoint-ip <ip-address> udp <port-number>
Device(config-endpoint-tracker)# threshold <value>
Device(config-endpoint-tracker)# multiplier <value>
Device(config-endpoint-tracker)# interval <value>
Device(config-endpoint-tracker)# exit
Device(config)# track <tracker-name2> endpoint-tracker

Device(config)# endpoint-tracker <static-tracker-group>
Device(config-endpoint-tracker)# tracker-type tracker-group
Device(config-endpoint-tracker)# tracker-elements <tracker-name1> <tracker-name2>
Device(config-endpoint-tracker)# boolean {and | or}
Device(config-endpoint-tracker)# exit
Device(config)# track <static-tracker-group> endpoint-tracker

Device(config)# ip route vrf <vrf-name> <prefix> <mask> <nexthop-ipaddress>
<administrative-distance> track name <static-tracker-group>
```

Note

- Use the **ip route** command to bind a tracker or tracker group with a static route and to configure a backup route for administrative distance that is higher than the default value of 1.
- You can apply only one tracker to an endpoint.
- A tracker group can have a mix of endpoint trackers. For example, you can create a tracker group with an IP address tracker and UDP tracker.

Configuration Examples for Static Route Tracking Using the CLI

Configure Tracker

This example shows how to configure a single static route tracker:

```
config-transaction
```

```
!
 endpoint-tracker tracker1
!
  tracker-type static-route
  endpoint-ip 10.1.1.1
  threshold 100
  multiplier 5
  interval 20
  exit
!
track tracker1 endpoint-tracker
!
ip route vrf 1 192.168.0.0 255.255.0.0 10.1.19.16 100 track name tracker1
```

This example shows how to configure a tracker with TCP port as endpoint:

```
config-transaction
!
 endpoint-tracker tcp-10001
!
  tracker-type static-route
  endpoint-ip 10.0.0.1 tcp 10001
  threshold    100
  interval     10
  multiplier   1
  exit
!
track tcp-10001 endpoint-tracker
!
ip route vrf 1 192.168.0.0 255.255.0.0 10.1.19.16 100 track name tcp-10001
```

This example shows how to configure a tracker with UDP port as endpoint:

```
config-transaction
!
  endpoint-tracker udp-10001
!
    tracker-type static-route
    endpoint-ip 10.0.0.1 udp 10001
    threshold    100
    interval     10
    multiplier   1
    exit
!
track udp-10001 endpoint-tracker
!
ip route vrf 1 192.168.0.0 255.255.0.0 10.1.19.16 100 track name udp-10001
```

Configure Tracker Groups

This example shows how to configure a tracker group with two trackers (two endpoints). You can create tracker groups to probes static routes from Cisco IOS XE Catalyst SD-WAN Release 17.7.1a.

```
config-transaction
!
 endpoint-tracker tcp-10001
!
    tracker-type static-route
    endpoint-ip 10.1.1.1 tcp 10001
    threshold 100
    multiplier 5
    interval 20
```

```
    track tcp-10001 endpoint-tracker
!
 endpoint-tracker udp-10002
!
   tracker-type static-route
   endpoint-ip 10.2.2.2 udp 10002
   threshold 100
   multiplier 5
   interval 20
   track udp-10002 endpoint-tracker
!
endpoint-tracker static-tracker-group
!
  tracker-type tracker-group
  tracker-elements tcp-10001 udp-10002
  boolean and
  track static-tracker-group endpoint-tracker
!
ip route vrf 1 192.168.0.0 255.255.0.0 10.1.19.16 100 track name static-tracker-group
```

Note

- You must configure an administrative distance when you are configuring through CLI templates.
- Use the **ip route** command to bind the tracker or tracker group with a static route and to configure a backup route for administrative distance when it is higher than the default value of 1.
- You can apply only one tracker to an endpoint.

Verify Static Route Tracking Configuration Using CLI

Command Verification

Use the following command to verify if the configuration is committed. The following sample configuration shows tracker definition for a static route tracker and it's application to an IPv4 static route:

```
Device# show running-config | sec endpoint-tracker
endpoint-tracker tracker1
endpoint-ip 10.1.1.1
interval 60
multiplier 5
tracker-type static-route
endpoint-tracker tracker2
endpoint-ip 10.1.1.12
interval 40
multiplier 2
tracker-type static-route
track tracker2 endpoint-tracker
track tracker1 endpoint-tracker
```

Use the following command to verify the IPv4 route:

```
Device# show running-config | inc ip route
ip route vrf 1 10.1.1.11 255.255.0.0 10.20.2.17 track name tracker2
ip route vrf 1 10.1.1.12 255.255.0.0 10.20.24.17 track name tracker1
```

The following is a sample output from the **show endpoint-tracker static-route** command displaying individual static route tracker status:

```
Device#  show endpoint-tracker static-route
Tracker Name   Status     RTT (in msec)  Probe ID
tcp-10001         UP         3              1
udp-10002         UP         1              6
```

The following is a sample output from the **show endpoint-tracker tracker-group** command displaying tracker group status:

```
Device# show endpoint-tracker group
Tracker Name                Element trackers name    Status         RTT in msec  Probe ID

group-tcp-10001-udp-10002  tcp-10001, udp-10002     UP(UP AND UP)  5, 1          9, 10
```

The following is a sample output from the **show endpoint-tracker records** command displaying tracker/tracker group configuration:

```
Device# show endpoint-tracker records
Record Name                Endpoint                 EndPoint Type Threshold(ms) Multiplier
 Interval(s) Tracker-Type
group-tcp-10001-udp-10002  tcp-10001 AND udp-10002  N/A           N/A           N/A
 N/A         static-tracker-group
tcp-10001                  10.1.1.1                 TCP           100           1
 20          static-route
udp-10002                  10.2.2.2                 UDP           100           1
 20          static-route
```

The following is a sample output from the **show ip static route vrf** command:

```
Device# show ip static route vrf 1
Codes: M - Manual static, A - AAA download, N - IP NAT, D - DHCP,
       G - GPRS, V - Crypto VPN, C - CASA, P - Channel interface processor,
       B - BootP, S - Service selection gateway
       DN - Default Network, T - Tracking object
       L - TL1, E - OER, I - iEdge
       D1 - Dot1x Vlan Network, K - MWAM Route
       PP - PPP default route, MR - MRIPv6, SS - SSLVPN
       H - IPe Host, ID - IPe Domain Broadcast
       U - User GPRS, TE - MPLS Traffic-eng, LI - LIIN
       IR - ICMP Redirect, Vx - VXLAN static route
       LT - Cellular LTE, Ev - L2EVPN static route
Codes in []: A - active, N - non-active, B - BFD-tracked, D - Not Tracked, P - permanent,
-T Default Track
Codes in (): UP - up, DN - Down, AD-DN - Admin-Down, DL - Deleted
Static local RIB for 1
T  192.168.0.0 [1/0] via 10.1.19.16 [A]
```