Transport Gateway

Feature history for transport gateway

This table describes the developments of this feature, by release.

Table 1: Feature History Table

Feature Name	Release Information	Description
Transport Gateway	Cisco IOS XE Catalyst SD-WAN Release 17.12.1a Cisco Catalyst SD-WAN Manager Release 20.12.1	A transport gateway operates as the hub in a hub-and-spoke routing topology. It offers the advantage of achieving this topology without requiring complex routing policy configuration. The following are some uses of a transport gateway: • Providing connectivity to routers in disjoint underlay networks • Serving as a gateway (hub) for all traffic in one discrete network to reach another discrete network, such as directing all local network traffic to a cloud gateway

Transport gateways for connecting networks in Cisco SD-WAN

A transport gateway is a network device that:

• connects routers that may or may not have direct connectivity,

- simplifies the process of providing connectivity between disjoint networks (such as between a physical LAN and a cloud-based network), and

- enables indirect connectivity without the complexity and limitations of manual control policy configuration.

A transport gateway facilitates communication between routers that are not directly connected, often bridging networks that are physically or logically separate (for example, connecting a traditional LAN to a cloud-based network).

A transport gateway connects routers that may or may not have direct connectivity. A common use case for transport gateways is to provide connectivity between routers in disjoint networks, such as between a physical LAN and a cloud-based network.

Without a transport gateway, one method of configuring indirect connectivity for these routers is to create a control policy that configures routes through an intermediate device with connectivity to both networks. This provides indirect connectivity between the disjoint routers. This approach has the following problems:

- Complexity: Configuring a control policy to advertise prefixes is complicated.

- Potential unavailable traffic endpoint: The control policy cannot detect whether a device or a configured route is unavailable. This can lead to packet loss if a route becomes unavailable.

Configuring a router to operate as a transport gateway solves the same issue, but with a simpler configuration process.

Figure 1: Transport Gateway
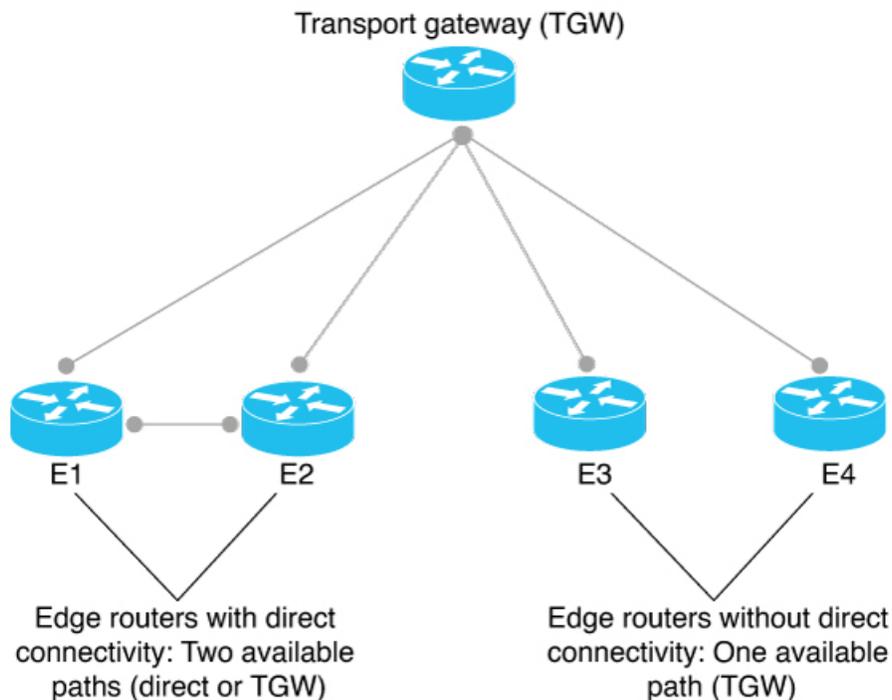
In the context of Cisco Catalyst SD-WAN, you can efficiently configure a hub-and-spoke routing topology by using transport gateways as hubs. This enables you to create the hub-and-spoke topology without requiring complex routing policy configuration. For information, see *Hub-and-Spoke*.

How a router functions as a transport gateway

Summary

Starting from Cisco Catalyst SD-WAN Manager Release 20.16.1, routes that are reoriginated from a site through the transport gateway are filtered out by the Cisco SD-WAN Controller. These reoriginated routes are not sent back to the originating site or the sites which share same site ID as the originating site. The reoriginated routes are only distributed to different sites within the Cisco Catalyst SD-WAN network.

This change in routing mechanism is also backported to Cisco Catalyst SD-WAN Manager Release 20.15.2, and Cisco Catalyst SD-WAN Manager Release 20.12.5.

When a router is configured to function as a transport gateway, it does the following for each route that it learns from the Cisco SD-WAN Controllers:

1. The transport gateway re-originates each route, substituting its own TLOCs as the next hop for the routes. This means that it substitutes its TLOCs as the next hop for each route.

2. The transport gateway advertises the re-originated routes to the Cisco SD-WAN Controllers.

3. The transport gateway attaches its own affinity attribute to routes that it re-originates. In scenarios in which routers in the network have re-originated routes available from more than one transport gateway, the routers apply affinity group preference logic to choose a route.

In the following illustration, E11 advertises prefix P1 and E22 advertises prefix P2. E11 and E22 are disjoint—they do not have direct connectivity. The transport gateway re-originates routes from E11 and E22, providing a P1 route to E22 and a P2 route to E11.

Workflow

Figure 2: Transport Gateway Re-Originating Routes
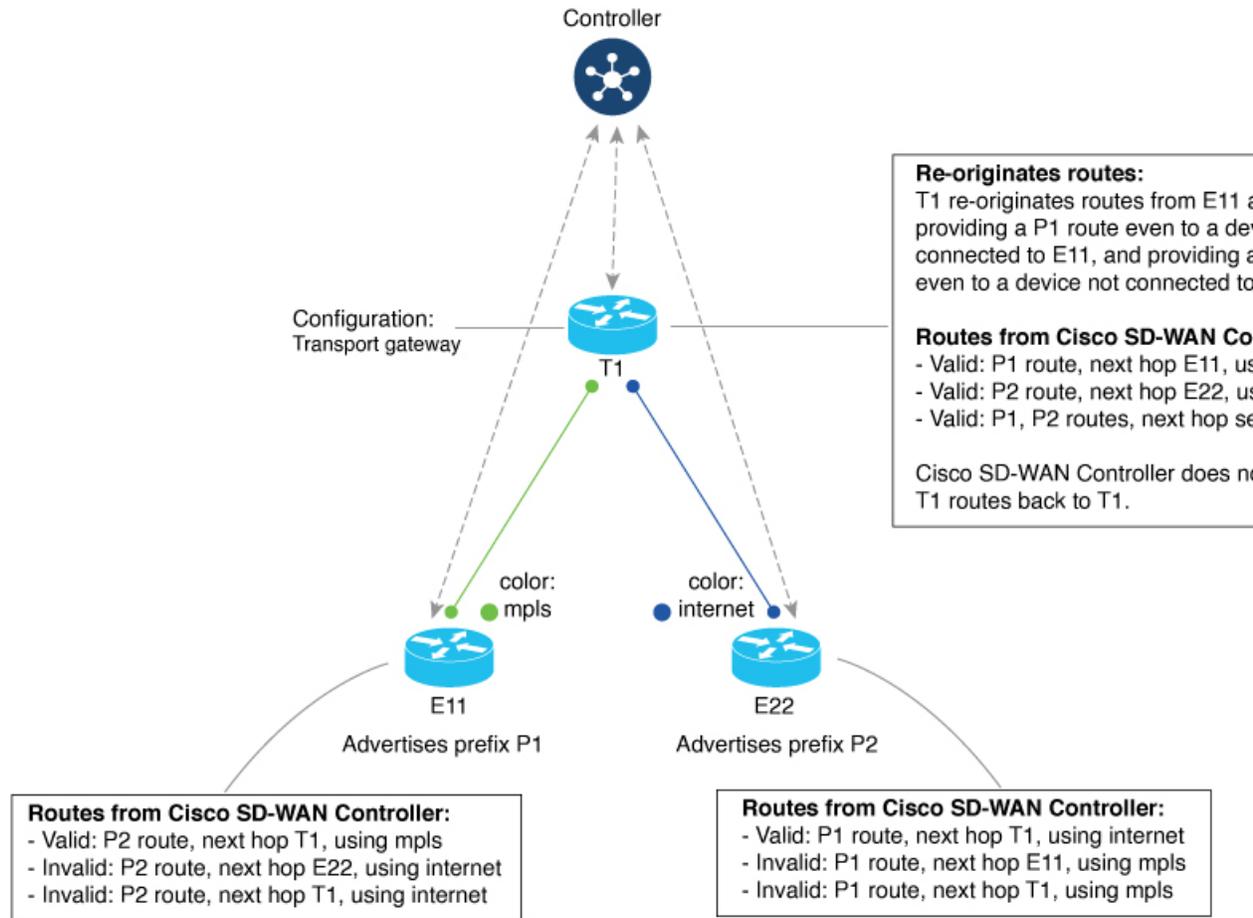
Site type

One part of configuring networks to use transport gateways is assigning a site type parameter to routers in the network. Site type helps to classify the intended function of a router, helping to define its position within the topology. Site type values include br, branch, cloud, spoke, type-1, type-2, and type-3.

After assigning site types, you can configure routers to prefer a transport gateway path only for traffic destined to a specific site type. This provides greater granularity when configuring a preference for transport gateway paths.

Site types are arbitrary, with no specific meaning, except br (border router) and spoke, which have specific uses for Multi-Region Fabric or intent-based hub-and-spoke topology, respectively.

Site Type Inheritance

Every OMP vRoute and TLOC originated from a router inherits the site type attributes of the router.

For information about configuring a site type for a router, see Configure the Site Type for a Router Using Cisco SD-WAN Manager.

OMP best path logic and transport gateway path preference

In general, when multiple paths are available between two routers, the overlay management protocol (OMP) applies best path selection logic to choose the best path. The best path selection logic is biased toward paths with fewer hops.

Summary

When you have configured a transport gateway, you can configure routers to apply a specific preference for transport-gateway-re-originated paths, if available. This alters the OMP best path calculation to include the transport gateway, according to the details of the configuration, as described below.

For information about configuring the preference for transport-gateway-re-originated paths, see Configure the Transport Gateway Path Preference.

Workflow

This table describes the best path logic.

Router Configuration		Resulting Best Path Behavior
Transport Gateway Path Behavior	**Specify Site Type(s)**	
1. Not configured	Not applicable	(This is the default behavior.) Prefer a direct path.
Prefer Transport Gateway Path	No	Prefer a transport-gateway path over a direct path.
Prefer Transport Gateway Path	Yes	For a transport-gateway path that matches a specified site type, prefer a transport-gateway path over a direct path. For a transport-gateway path that does not match a specified site type, prefer a direct path over a transport-gateway path.
Do ECMP Between Direct and Transport Gateway Paths	No	Treat a direct path and a transport-gateway path as equal.
Do ECMP Between Direct and Transport Gateway Paths	Yes	For a transport-gateway path that matches a specified site type, treat a direct path and a transport-gateway path as equal. For a transport-gateway path that does not match a specified site type, prefer a direct path over a transport-gateway path.

As described earlier, a transport gateway attaches its own affinity attribute to paths that it re-originates. In scenarios in which routers in the network have re-originated paths available from more than one transport gateway, the routers apply affinity group preference logic to choose a path.

How the transport gateway configuration works

Summary

1. To configure a router to function as a transport gateway, use a System feature template or CLI add-on template. See Configure a Router as a Transport Gateway Using Cisco SD-WAN Manager.

2. To configure routers to use the transport gateway path, use an OMP feature template or CLI add-on template. See Configure the Transport Gateway Path Preference Using Cisco SD-WAN Manager. You can configure the OMP logic as follows:

    • Prefer a transport gateway path over a direct path.

    • Prefer a transport gateway path only for specific traffic, according to the site type attribute. See Configure the Site Type for a Router Using Cisco SD-WAN Manager.

    • Consider direct paths and transport gateway paths as equal.

The following figure shows how routers in a network can operate with a transport gateway, preferentially directing all traffic or specific traffic through transport gateway routes.

Workflow

Figure 3: Edge Routers and Transport Gateway Path Preference

The devices in the illustration are configured as follows:

Device	Configuration
1. E0	**a.** Configure as a transport gateway. • By feature template: In a Cisco System template, use the **Transport Gateway** field. • By CLI add-on template: <code>system transport-gateway enable</code>

Device	Configuration

E1	**a.** Configure the site type as type-1.
	
	• By feature template:
	
	In a Cisco System template, use the **Site Type** field.
	
	• By CLI add-on template:
	
	`system site-type type-1`
	
	b. For best path, configure a preference for transport gateway routes.
	
	• By feature template:
	
	In an OMP template, use the **Transport Gateway Path Behavior** field. Choose the **Prefer Transport Gateway Path** option.
	
	• By CLI add-on template:
	
	`omp best-path transport-gateway prefer`

E2	**a.** Configure the site type as type-1.
	
	• By feature template:
	
	In a Cisco System template, use the **Site Type** field.
	
	• By CLI add-on template:
	
	`system site-type type-1`
	
	b. For best path, configure a preference for transport gateway routes for traffic to type-2 devices.
	
	• By feature template:
	
	In an OMP template, use the **Transport Gateway Path Behavior** field. Choose the **Prefer Transport Gateway Path** option. In the **Site Types** field, choose **type-2**.
	
	• By CLI add-on template:
	
	`omp best-path transport-gateway prefer transport-gateway-settings type-2`

Device	Configuration

E3 and E4	**a.** Configure the site type as type-2.
	
	    • By feature template:
	
	      In a Cisco System template, use the **Site Type** field.
	
	    • By CLI add-on template:
	
	      `system site-type type-2`
	
	b. For best path, configure a preference for transport gateway routes for traffic to type-1 devices.
	
	    • By feature template:
	
	      In an OMP template, use the **Transport Gateway Path Behavior** field. Choose the **Prefer Transport Gateway Path** option. In the **Site Types** field, choose **type-1**.
	
	    • By CLI add-on template:
	
	      `omp best-path transport-gateway prefer transport-gateway-settings type-1`

Use cases for transport gateways

In this use case, an organization needs to bridge a local network with a cloud services network, such as Azure or AWS. Edge routers in the local and cloud networks lack direct connectivity.
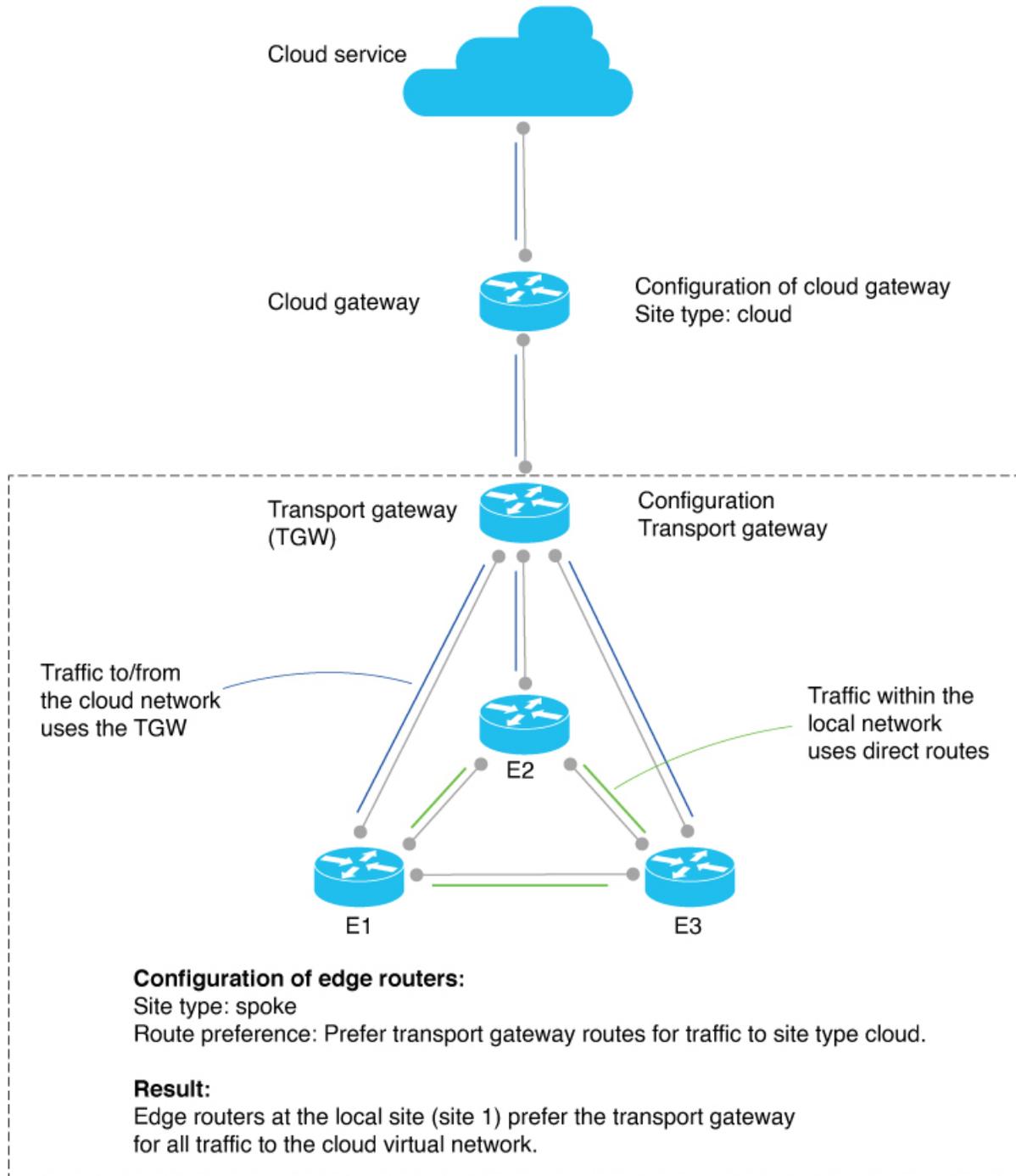
To create a transport gateway to bridge the local and cloud networks, network administrators configure the devices as follows:

Intent	Devices to Configure	Configuration

Configure the cloud gateway router with site type cloud.	Cloud gateway router	**1.** Configure the site type as cloud.
		
		    • By feature template: In a Cisco System template, use the **Site Type** field.
		
		    • By CLI template:
		
		      system site-type cloud

Deploy a transport gateway to operate as a hub for cloud-destined traffic from devices in a local network. The transport gateway attracts the cloud-destined traffic and routes it to the cloud gateway for the cloud-based network.	Transport gateway router	**1.** Enable as a transport gateway.
		
		    • By feature template: In a Cisco System template, use the **Transport Gateway** field.
		
		    • By CLI template:
		
		      system transport-gateway enable

Intent	Devices to Configure	Configuration
Traffic within the local network uses direct routes, not transport gateway routes. Traffic from the local network to the cloud uses a transport gateway route.	Edge routers in the local network	1. Use a transport gateway route for all cloud-destined traffic. • By feature template: In an OMP template, use the **Transport Gateway Path Behavior** field. Choose the **Prefer Transport Gateway Path** option. • By CLI template: **omp best-path transport-gateway prefer transport-gateway-settings cloud** 2. Configure the site type as spoke. • By feature template: In a Cisco System template, use the **Site Type** field. • By CLI template: **system site-type spoke**

The following illustration shows the topology and configuration:

Figure 4: Transport Gateway Topology and Configuration

Cloud service

Cloud gateway

Configuration of cloud gateway
Site type: cloud

Transport gateway
(TGW)

Configuration
Transport gateway

Traffic to/from
the cloud network
uses the TGW

Traffic within the
local network
uses direct routes

E2

E1

E3

Configuration of edge routers:
Site type: spoke
Route preference: Prefer transport gateway routes for traffic to site type cloud.

Result:
Edge routers at the local site (site 1) prefer the transport gateway
for all traffic to the cloud virtual network.

Restrictions for transport gateways

Restriction	Description
Resource demands of transport gateway functionality	Because of the resource demands of transport gateway functionality, we recommend enabling this only on a high-performance device with CPU and memory resources to handle the additional load. The specific resource requirements depend on your networking environment.
Multiple transport gateways: best path	If you enable transport gateway functionality on multiple devices, edge routers apply best path selection logic to determine the best path. This may include multiple transport gateway paths.
Multiple transport gateways: preventing routing loops	If you enable transport gateway functionality on multiple devices within network, the Cisco SD-WAN Controllers for the network do the following to avoid creating routing loops: When a Cisco SD-WAN Controller receives a route re-originated by one transport gateway, it does not advertise the route to another transport gateway. Avoiding advertising a transport gateway route to another transport gateway prevents routing loops.
On-demand tunnels	You cannot configure dynamic on-demand tunnels for a device configured as a transport gateway. However, edge routers that are not operating as transport gateways can use on-demand tunnels. For information about dynamic on-demand tunnels, see Dynamic On-Demand Tunnels in the *Cisco SD-WAN Systems and Interfaces Configuration Guide, Cisco IOS XE Release 17.x*.

Configure a router as a transport gateway

- Configure a router as a transport gateway using the CLI
- Configure a router as a transport gateway using SD-WAN Manager

Configure a router as a transport gateway using a CLI template

Before you begin

By default, CLI templates execute commands in global configuration mode.

For more information about using CLI templates, see CLI Add-On Feature Templates and CLI Templates.

Procedure

Step 1   Enter system configuration mode.

`system`

Step 2   Enable transport gateway functionality.

`transport-gateway enable`

Note

To disable transport gateway functionality, use the **no** form of the command.

```
system
  transport-gateway enable
```

Configure a router as a transport gateway using Cisco SD-WAN Manager

Procedure

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

Step 2 Click **Feature Templates**.

Step 3 Do one of the following:

- To create a new System template, click **Add Template**, choose a device type, and click **Cisco System**.

- To edit an existing System template, locate a System template in the table of existing feature templates, click **…** adjacent to the template, and choose **Edit**.

Step 4 In **Basic Configuration**, in the **Transport Gateway** field, choose **On**.

Step 5 Click **Save** if creating a new template, or **Update** if editing an existing template.

Configure the transport gateway path preference

The following sections describe methods for configuring a router's best path decision to handle transport-gateway-re-originated paths.

- Configure the transport gateway path preference using a CLI Template

- Configure the transport gateway path reference using Cisco SD-WAN Manager

Configure the transport gateway path preference using a CLI Template

Procedure

Step 1 Enter sdwan configuration mode.

sdwan

Step 2 Enter system OMP configuration mode.

omp

Step 3   Configure the transport gateway path preference, using one of the following options:

best-path transport-gateway {prefer | ecmp-with-direct-path}

Option	Description
ecmp-with-direct path	For devices that can connect through a transport gateway and through direct paths, apply equal-cost multi-path (ECMP) to all available paths.
prefer	For devices that can connect through a transport gateway, use only the transport gateway paths, even if other paths are available.

Step 4   (Optional) Specify one or more site types to which to apply the transport gateway behavior. For information about how the Site Types parameter operates together with the Transport Gateway Path Behavior parameter, see OMP Best Path Logic and Transport Gateway Path Preference.

omp best-path transport-gateway-settings site-types *site-types*

Option	Description
site-types	Include one or more of the following site types, separated by spaces: **cloud**, **branch**, **br**, **type-1**, **type-2, type-3**

Note

To use this command, ensure that you use the **omp best-path transport-gateway prefer** command in the previous step.

The following example configures a device to prefer transport gateway routes.

```
sdwan
omp
  omp best-path transport-gateway prefer
```

The following example configures a device to prefer transport gateway routes only for traffic destined to sites with site type cloud.

```
sdwan
omp
  omp best-path transport-gateway prefer
  omp best-path transport-gateway-settings site-types cloud
```

Configure the transport gateway path preference using Cisco SD-WAN Manager

Procedure

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

Step 2   Click **Feature Templates**.

Step 3   Do one of the following:

- To create a new OMP template, click **Add Template**, choose a device type, and click **Cisco OMP**.

- To edit an existing OMP template, locate a OMP template in the table of existing feature templates, click **…** adjacent to the template, and choose **Edit**.

Step 4 In the **Best Path** section, in the **Transport Gateway Path Behavior** field, choose **Global** mode and choose one of the following options:

Option	Description
Do ECMP Between Direct and Transport Gateway Paths	For devices that can connect through a transport gateway and through direct paths, apply equal-cost multi-path (ECMP) to all available paths.
Prefer Transport Gateway Path	For devices that can connect through a transport gateway, use only the transport gateway paths, even if other paths are available.

Note
If you do not configure this field, by default, routers favor a direct path as the best path.

Step 5 (Optional) Click the **Site Types** field and choose one or more site types to which to apply the transport gateway behavior. For information about how the Site Types parameter operates together with the Transport Gateway Path Behavior parameter, see OMP Best Path Logic and Transport Gateway Path Preference.

Step 6 Click **Save** if creating a new template, or **Update** if editing an existing template.

Configure the site type for a router

- Configure the site type for a router using a CLI template
- Configure the site type for a router using Cisco SD-WAN Manager

Configure the site type for a router using a CLI template

Before you begin

By default, CLI templates execute commands in global configuration mode.

For more information about using CLI templates, see CLI Add-On Feature Templates and CLI Templates.

Procedure

Step 1 Enter system configuration mode.

```
system
```

Step 2 Configure up to four site types for the router. Possible values are br, branch, cloud, spoke, type-1, type-2, and type-3.

```
site-type site-type
```

Note
To disable transport gateway functionality, use the **no** form of the command.

Example:

The following example configures a router site type as cloud:

```
system
  site-type cloud
```

The following example configure a router with site types cloud and branch:

```
system
  site-type cloud branch
```

Configure the site type for a router using Cisco SD-WAN Manager

Procedure

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

Step 2　　Click **Feature Templates**.

Step 3　　Do one of the following:

- To create a new System template, click **Add Template**, choose a device type, and click **Cisco System**.
- To edit an existing System template, locate a System template in the table of existing feature templates, click **...** adjacent to the template, and choose **Edit**.

Step 4　　In **Basic Configuration**, click **Site Type** and choose a type from the drop-down list .

Step 5　　Click **Save** if creating a new template, or **Update** if editing an existing template.

Verify the site type of a router using the CLI

Procedure

Use the **show sdwan omp summary** command on a device to verify the site type configuration of a router. The output includes a site-type field and the configured value.

Example:

In this example, the router is configured with a site type, spoke:

```
Device#show sdwan omp summary
...
site-type    SPOKE
...
```

Verify a transport gateway configuration using the CLI

Procedure

Use the **show sdwan running-config system** command on a device to check whether it is configured as a transport gateway. In the output, **transport-gateway enable** indicates that it is configured.

```
Device#show sdwan running-config system
system
system-ip          192.168.1.1
domain-id          1
site-id            11100
region 1
!
role               border-router
transport-gateway enable
...
```

You can also use the **show sdwan omp summary** command on a device to check whether it is configured as a transport gateway. In the output, **transport-gateway enabled** indicates that transport gateway functionality is enabled.