
Amazon VPC

AWS Transit Gateway



Amazon VPC: AWS Transit Gateway

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What is a transit gateway?

A *transit gateway* is a network transit hub that you can use to interconnect your virtual private clouds (VPCs) and on-premises networks. As your cloud infrastructure expands globally, inter-Region peering connects transit gateways together using the AWS Global Infrastructure. Your data is automatically encrypted and never travels over the public internet.

For more information, see [AWS Transit Gateway](#).

Transit gateway concepts

The following are the key concepts for transit gateways:

- **Attachments** — You can attach the following:
 - One or more VPCs
 - A Connect SD-WAN/third-party network appliance
 - An AWS Direct Connect gateway
 - A peering connection with another transit gateway
 - A VPN connection to a transit gateway
- **Transit gateway Maximum Transmission Unit (MTU)** — The maximum transmission unit (MTU) of a network connection is the size, in bytes, of the largest permissible packet that can be passed over the connection. The larger the MTU of a connection, the more data that can be passed in a single packet. A transit gateway supports an MTU of 8500 bytes for traffic between VPCs, AWS Direct Connect, Transit Gateway Connect, and peering attachments. Traffic over VPN connections can have an MTU of 1500 bytes.
- **Transit gateway route table** — A transit gateway has a default route table and can optionally have additional route tables. A route table includes dynamic and static routes that decide the next hop based on the destination IP address of the packet. The target of these routes could be any transit gateway attachment. By default, transit gateway attachments are associated with the default transit gateway route table.
- **Associations** — Each attachment is associated with exactly one route table. Each route table can be associated with zero to many attachments.
- **Route propagation** — A VPC, VPN connection, or Direct Connect gateway can dynamically propagate routes to a transit gateway route table. With a Connect attachment, the routes are propagated to a transit gateway route table by default. With a VPC, you must create static routes to send traffic to the transit gateway. With a VPN connection or a Direct Connect gateway, routes are propagated from the transit gateway to your on-premises router using Border Gateway Protocol (BGP). With a peering attachment, you must create a static route in the transit gateway route table to point to the peering attachment.

How to get started with transit gateways

Use the following resources to help you create and use a transit gateway.

- [How transit gateways work \(p. 3\)](#)
- [Getting started \(p. 8\)](#)
- [Design best practices \(p. 11\)](#)

Work with transit gateways

You can create, access, and manage your transit gateways using any of the following interfaces:

- **AWS Management Console** — Provides a web interface that you can use to access your transit gateways.
- **AWS Command Line Interface (AWS CLI)** — Provides commands for a broad set of AWS services, including Amazon VPC, and is supported on Windows, macOS, and Linux. For more information, see [AWS Command Line Interface](#).
- **AWS SDKs** — Provides language-specific API operations and takes care of many of the connection details, such as calculating signatures, handling request retries, and handling errors. For more information, see [AWS SDKs](#).
- **Query API** — Provides low-level API actions that you call using HTTPS requests. Using the Query API is the most direct way to access Amazon VPC, but it requires that your application handle low-level details such as generating the hash to sign the request, and handling errors. For more information, see the [Amazon EC2 API Reference](#).

Pricing

You are charged hourly for each attachment on a transit gateway, and you are charged for the amount of traffic processed on the transit gateway. For more information, see [AWS Transit Gateway pricing](#).

How transit gateways work

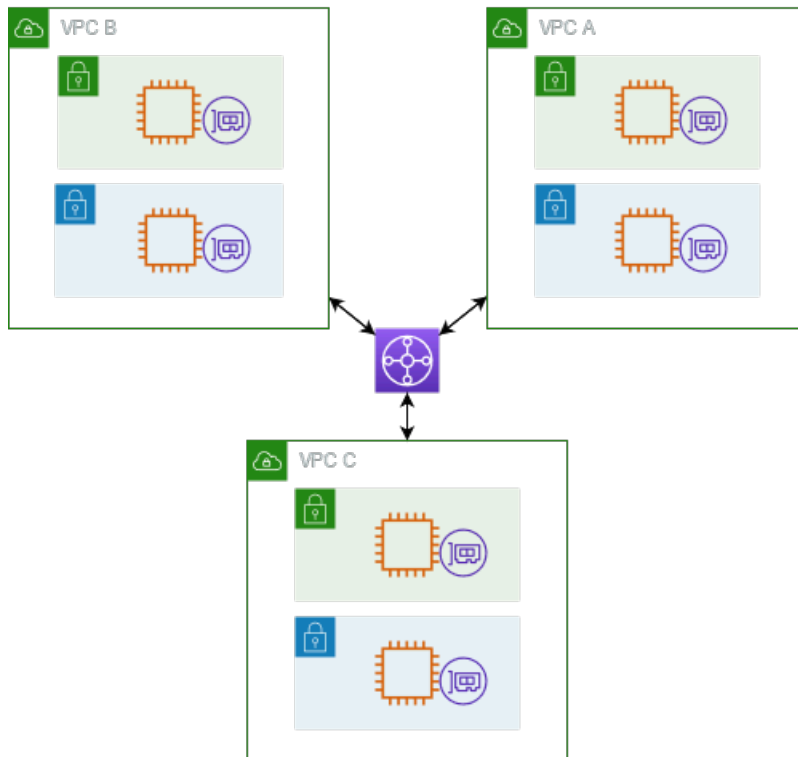
A *transit gateway* acts as a Regional virtual router for traffic flowing between your virtual private clouds (VPCs) and on-premises networks. A transit gateway scales elastically based on the volume of network traffic. Routing through a transit gateway operates at layer 3, where the packets are sent to a specific next-hop attachment, based on their destination IP addresses.

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- [Architecture diagram \(p. 3\)](#)
- [Resource attachments \(p. 4\)](#)
- [Availability Zones \(p. 4\)](#)
- [Routing \(p. 4\)](#)

Architecture diagram

The following diagram shows a transit gateway with three VPC attachments. The route table for each of these VPCs includes the local route and routes that send traffic destined for the other two VPCs to the transit gateway.



The following is an example of a default transit gateway route table for the attachments shown in the previous diagram. The CIDR blocks for each VPC propagate to the route table. Therefore, each attachment can route packets to the other two attachments.

Destination	Target	Route type
VPC A CIDR	Attachment for VPC A	propagated

Destination	Target	Route type
VPC B CIDR	Attachment for VPC B	propagated
VPC C CIDR	Attachment for VPC C	propagated

Resource attachments

A transit gateway attachment is both a source and a destination of packets. You can attach the following resources to your transit gateway:

- One or more VPCs. AWS Transit Gateway deploys an elastic network interface within VPC subnets, which is then used by the transit gateway to route traffic to and from the chosen subnets. You must have at least one subnet for each Availability Zone, which then enables traffic to reach resources in every subnet of that zone. During attachment creation, resources within a particular Availability Zone can reach a transit gateway only if a subnet is enabled within the same zone. If a subnet route table includes a route to the transit gateway, traffic is only forwarded to the transit gateway if the transit gateway has an attachment in the subnet of the same Availability Zone.
- One or more VPN connections
- One or more AWS Direct Connect gateways
- One or more Transit Gateway Connect attachments
- One or more transit gateway peering connections

Intra-region peering connections are supported. You can have different transit gateways in different Regions.

Availability Zones

When you attach a VPC to a transit gateway, you must enable one or more Availability Zones to be used by the transit gateway to route traffic to resources in the VPC subnets. To enable each Availability Zone, you specify exactly one subnet. The transit gateway places a network interface in that subnet using one IP address from the subnet. After you enable an Availability Zone, traffic can be routed to all subnets in that zone, not just the specified subnet. Resources that reside in Availability Zones where there is no transit gateway attachment cannot reach the transit gateway.

We recommend that you enable multiple Availability Zones to ensure availability.

Using appliance mode support

If you plan to configure a stateful network appliance in your VPC, you can enable appliance mode support for the VPC attachment in which the appliance is located. This ensures that the transit gateway uses the same Availability Zone for that VPC attachment for the lifetime of a flow of traffic between source and destination. It also allows the transit gateway to send traffic to any Availability Zone in the VPC, as long as there is a subnet association in that zone. For more information, see [Example: Appliance in a shared services VPC \(p. 23\)](#).

Routing

Your transit gateway routes IPv4 and IPv6 packets between attachments using transit gateway route tables. You can configure these route tables to propagate routes from the route tables for the attached VPCs, VPN connections, and Direct Connect gateways. You can also add static routes to the transit

gateway route tables. When a packet comes from one attachment, it is routed to another attachment using the route that matches the destination IP address.

For transit gateway peering attachments, only static routes are supported.

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- [Route tables \(p. 5\)](#)
- [Route table association \(p. 5\)](#)
- [Route propagation \(p. 5\)](#)
- [Routes for peering attachments \(p. 6\)](#)
- [Route evaluation order \(p. 6\)](#)

Route tables

Your transit gateway automatically comes with a default route table. By default, this route table is the default association route table and the default propagation route table. Alternatively, if you disable route propagation and route table association, AWS does not create a default route table for the transit gateway.

You can create additional route tables for your transit gateway. This enables you to isolate subsets of attachments. Each attachment can be associated with one route table. An attachment can propagate its routes to one or more route tables.

You can create a blackhole route in your transit gateway route table that drops traffic that matches the route.

When you attach a VPC to a transit gateway, you must add a route to your subnet route table in order for traffic to route through the transit gateway. For more information, see [Routing for a Transit Gateway](#) in the *Amazon VPC User Guide*.

Route table association

You can associate a transit gateway attachment with a single route table. Each route table can be associated with zero to many attachments and can forward packets to other attachments.

Route propagation

Each attachment comes with routes that can be installed in one or more transit gateway route tables. When an attachment is propagated to a transit gateway route table, these routes are installed in the route table.

For a VPC attachment, the CIDR blocks of the VPC are propagated to the transit gateway route table.

When dynamic routing is used with a VPN attachment or a Direct Connect gateway attachment, you can propagate the routes learned from the on-premises router through BGP to any of the transit gateway route tables.

When dynamic routing is used with a VPN attachment, the routes in the route table associated with the VPN attachment are advertised to the customer gateway through BGP.

For a Connect attachment, routes in the route table associated with the Connect attachment are advertised to the third-party virtual appliances, such as SD-WAN appliances, running in a VPC through BGP.

For a Direct Connect gateway attachment, [allowed prefixes interactions](#) control which routes are advertised to the customer network from AWS.

When a static route and a propagated route have the same destination, the static route has the higher priority, so the propagated route is not included in the route table. If you remove the static route, the overlapping propagated route is included in the route table.

Routes for peering attachments

You can peer two transit gateways, and route traffic between them. To do this, you create a peering attachment on your transit gateway, and specify the peer transit gateway with which to create the peering connection. You then create a static route in your transit gateway route table to route traffic to the transit gateway peering attachment. Traffic that's routed to the peer transit gateway can then be routed to the VPC and VPN attachments for the peer transit gateway.

For more information, see [Example: Peered transit gateways \(p. 18\)](#).

Route evaluation order

Transit gateway routes are evaluated in the following order:

- The most specific route for the destination address.
- For routes with the same destination IP address but different targets, the route priority is as follows:
 - Static routes (for example, Site-to-Site VPN static routes)
 - Prefix list referenced routes
 - VPC propagated routes
 - Direct Connect gateway propagated routes
 - Transit Gateway Connect propagated routes
 - Site-to-Site VPN propagated routes

Transit Gateway only shows a preferred route. A backup route will only appear in the Transit Gateway route table if that route is no longer advertised. For example, if you are advertising the same routes over the Direct Connect gateway and over Site-to-Site VPN. AWS Transit Gateway will only show the routes received from the Direct Connect gateway route, which is the preferred route. The Site-to-Site VPN, which is the backup route, will only display when the Direct Connect gateway is no longer advertised.

Consider the following VPC route table. The VPC local route has the highest priority, followed by the routes that are the most specific. When a static route and a propagated route have the same destination, the static route has a higher priority.

Destination	Target	Priority
10.0.0.0/16	local	1
192.168.0.0/16	pcx-12345	2
172.31.0.0/16	vgw-12345 (static) or tgw-12345 (static)	2
172.31.0.0/16	vgw-12345 (propagated)	3
0.0.0.0/0	igw-12345	4

Consider the following transit gateway route table. If you prefer the AWS Direct Connect gateway attachment to the VPN attachment, use a BGP VPN connection and propagate the routes in the transit gateway route table.

Amazon VPC AWS Transit Gateway
Route evaluation order

Destination	Attachment (Target)	Resource type	Route type	Priority
10.0.0.0/16	tgw-attach-123 vpc-1234	VPC	Static or propagated	1
192.168.0.0/16	tgw-attach-789 vpn-5678	VPN	Static	2
172.31.0.0/16	tgw-attach-456 dxgw_id	AWS Direct Connect gateway	Propagated	3
172.31.0.0/16	tgw-attach-789 tgw-connect- peer-123	Connect	Propagated	4
172.31.0.0/16	tgw-attach-789 vpn-5678	VPN	Propagated	5

Getting started with transit gateways

The following tasks help you become familiar with transit gateways. You will create a transit gateway and then connect two of your VPCs using the transit gateway.

Tasks

- [Prerequisites \(p. 8\)](#)
- [Step 1: Create the transit gateway \(p. 8\)](#)
- [Step 2: Attach your VPCs to your transit gateway \(p. 9\)](#)
- [Step 3: Add routes between the transit gateway and your VPCs \(p. 9\)](#)
- [Step 4: Test the transit gateway \(p. 10\)](#)
- [Step 5: Delete the transit gateway \(p. 10\)](#)

Prerequisites

- To demonstrate a simple example of using a transit gateway, create two VPCs in the same Region. The VPCs cannot have overlapping CIDRs. Launch one Amazon EC2 instance in each VPC. For more information, see [Get started with Amazon VPC](#) in the *Amazon VPC User Guide*.
- You cannot have identical routes pointing to two different VPCs. A transit gateway does not propagate the CIDRs of a newly attached VPC if an identical route exists in the transit gateway route tables.
- Verify that you have the permissions required to work with transit gateways. For more information, see [Authentication and access control for your transit gateways \(p. 101\)](#).
- You can't ping between hosts if you haven't added an ICMP rule to each of the host security groups. For more information, see [Work with security groups](#) in the *Amazon VPC User Guide*.

Step 1: Create the transit gateway

When you create a transit gateway, we create a default transit gateway route table and use it as the default association route table and the default propagation route table.

To create a transit gateway

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. In the Region selector, choose the Region that you used when you created the VPCs.
3. On the navigation pane, choose **Transit Gateways**.
4. Choose **Create transit gateway**.
5. (Optional) For **Name tag**, enter a name for the transit gateway. This creates a tag with "Name" as the key and the name that you specified as the value.
6. (Optional) For **Description**, enter a description for the transit gateway.
7. For **Amazon side Autonomous System Number (ASN)**, enter the private ASN for your transit gateway. This should be the ASN for the AWS side of a Border Gateway Protocol (BGP) session.

The range is from 64512 to 65534 for 16-bit ASNs.

The range is from 4200000000 to 4294967294 for 32-bit ASNs.

If you have a multi-Region deployment, we recommend that you use a unique ASN for each of your transit gateways.

8. (Optional) You can modify the default settings if you need to disable DNS support, or if you don't want the default association route table or default propagation route table.
9. Choose **Create transit gateway**. When the gateway is created, the initial state of the transit gateway is pending.

Step 2: Attach your VPCs to your transit gateway

Wait until the transit gateway you created in the previous section shows as available before proceeding with creating an attachment. Create an attachment for each VPC.

Confirm that you have created two VPCs and launched an EC2 instance in each, as described in [Prerequisites \(p. 8\)](#).

Create a transit gateway attachment to a VPC

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Attachments**.
3. Choose **Create transit gateway attachment**.
4. (Optional) For **Name tag**, enter a name for the attachment.
5. For **Transit gateway ID**, choose the transit gateway to use for the attachment.
6. For **Attachment type**, choose **VPC**.
7. Choose whether to enable **DNS support**. For this exercise, do not enable **IPv6 support**.
8. For **VPC ID**, choose the VPC to attach to the transit gateway.
9. For **Subnet IDs**, select one subnet for each Availability Zone to be used by the transit gateway to route traffic. You must select at least one subnet. You can select only one subnet per Availability Zone.
10. Choose **Create transit gateway attachment**.

Each attachment is always associated with exactly one route table. Route tables can be associated with zero to many attachments. To determine the routes to configure, decide on the use case for your transit gateway, and then configure the routes. For more information, see [Examples \(p. 12\)](#).

Step 3: Add routes between the transit gateway and your VPCs

A route table includes dynamic and static routes that determine the next hop for associated VPCs based on the destination IP address of the packet. Configure a route that has a destination for non-local routes and the target of the transit gateway attachment ID. For more information, see [Routing for a transit gateway](#) in the *Amazon VPC User Guide*.

To add a route to a VPC route table

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Route Tables**.

3. Choose the route table associated with your VPC.
4. Choose the **Routes** tab, then choose **Edit routes**.
5. Choose **Add route**.
6. In the **Destination** column, enter the destination IP address range. For **Target**, choose **Transit Gateway**, and then choose the transit gateway ID.
7. Choose **Save changes**.

Step 4: Test the transit gateway

You can confirm that the transit gateway was successfully created by connecting to an Amazon EC2 instance in each VPC, and then sending data between them, such as a ping command. For more information, see [Connect to your Linux instance](#) or [Connecting to your Windows instance](#).

Step 5: Delete the transit gateway

When you no longer need a transit gateway, you can delete it.

You cannot delete a transit gateway that has resource attachments. If you try to delete a transit gateway with attachments, you'll be prompted to first delete those attachments before you can delete the transit gateway. As soon as the transit gateway is deleted, you stop incurring charges for it.

To delete your transit gateway

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateways**.
3. Select the transit gateway, and then choose **Actions, Delete transit gateway**.
4. Enter **delete** and choose **Delete**.

The **State** of the transit gateway on the **Transit gateways** page is **Deleting**. Once deleted the transit gateway is removed from the page.

Transit gateway design best practices

The following are best practices for your transit gateway design:

- Use a separate subnet for each transit gateway VPC attachment. For each subnet, use a small CIDR, for example /28, so that you have more addresses for EC2 resources. When you use a separate subnet, you can configure the following:
 - Keep the inbound and outbound network ACLs associated with the transit gateway subnets open.
 - Depending on your traffic flow, you can apply network ACLs to your workload subnets.
- Create one network ACL and associate it with all of the subnets that are associated with the transit gateway. Keep the network ACL open in both the inbound and outbound directions.
- Associate the same VPC route table with all of the subnets that are associated with the transit gateway, unless your network design requires multiple VPC route tables (for example, a middle-box VPC that routes traffic through multiple NAT gateways).
- Use Border Gateway Protocol (BGP) Site-to-Site VPN connections. If your customer gateway device or firewall for the connection supports multipath, enable the feature.
- Enable route propagation for AWS Direct Connect gateway attachments and BGP Site-to-Site VPN attachments.
- When migrating from VPC peering to use an AWS Transit Gateway,
 - A transit gateway does not support Security Group referencing.
 - An MTU size mismatch between VPC peering and the transit gateway might result in some packets dropping for asymmetric traffic. Update both VPCs at the same time to avoid jumbo packets dropping due to size mismatch.
- You do not need additional transit gateways for high availability, because transit gateways are highly available by design.
- Limit the number of transit gateway route tables unless your design requires multiple transit gateway route tables.
- For redundancy, use a single Transit Gateway in each Region for disaster recovery.
- For deployments with multiple transit gateways, we recommend that you use a unique Autonomous System Number (ASN) for each of your transit gateways. Transit Gateway also supports intra-Region peering. For more information, see [Building a global network using AWS Transit Gateway Intra-Region peering](#).

Examples

The following are common use cases for transit gateways. Your transit gateways are not limited to these use cases.

Examples

- [Example: Centralized router \(p. 12\)](#)
- [Example: Isolated VPCs \(p. 14\)](#)
- [Example: Isolated VPCs with shared services \(p. 16\)](#)
- [Example: Peered transit gateways \(p. 18\)](#)
- [Example: Centralized outbound routing to the internet \(p. 20\)](#)
- [Example: Appliance in a shared services VPC \(p. 23\)](#)

Example: Centralized router

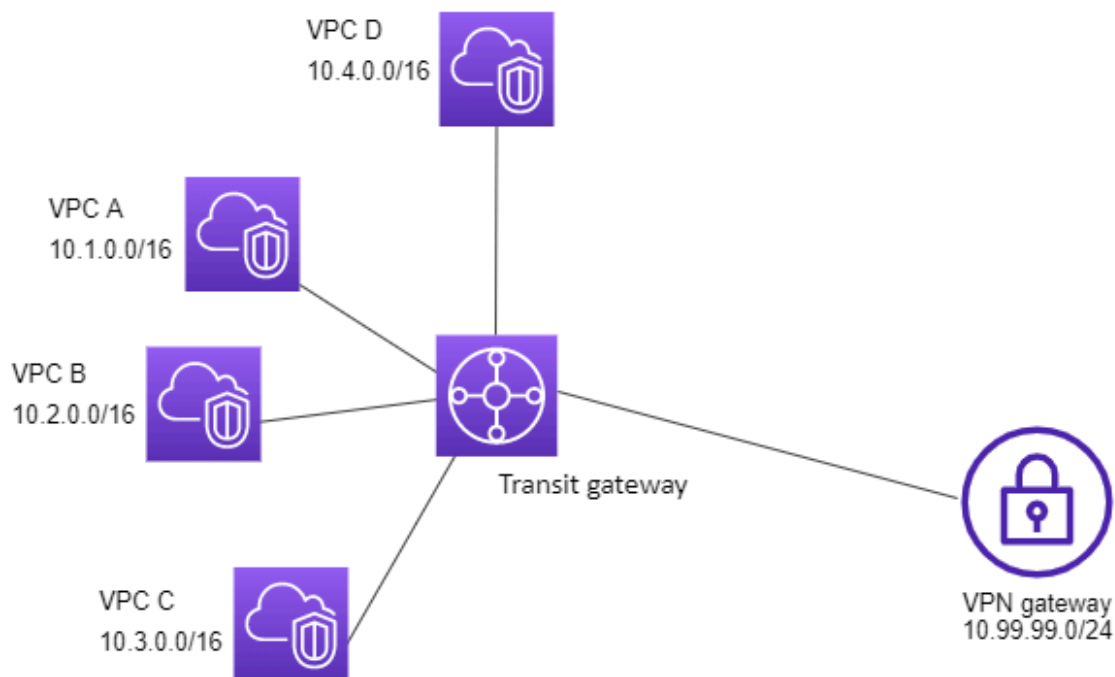
You can configure your transit gateway as a centralized router that connects all of your VPCs, AWS Direct Connect, and Site-to-Site VPN connections. In this scenario, all attachments are associated with the transit gateway default route table and propagate to the transit gateway default route table. Therefore, all attachments can route packets to each other, with the transit gateway serving as a simple layer 3 IP router.

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Overview

The following diagram shows the key components of the configuration for this scenario. In this scenario, there are three VPC attachments and one Site-to-Site VPN attachment to the transit gateway. Packets from the subnets in VPC A, VPC B, and VPC C that are destined for a subnet in another VPC or for the VPN connection first route through the transit gateway.



Resources

Create the following resources for this scenario:

- Three VPCs. For information about creating a VPC, see [Create a VPC](#) in the *Amazon VPC User Guide*.
- A transit gateway. For more information, see [the section called "Create a transit gateway"](#) (p. 29).
- Three VPC attachments on the transit gateway. For more information, see [the section called "Create a transit gateway attachment to a VPC"](#) (p. 37).
- A Site-to-Site VPN attachment on the transit gateway. The CIDR blocks for each VPC propagate to the transit gateway route table. When the VPN connection is up, the BGP session is established and the Site-to-Site VPN CIDR propagates to the transit gateway route table and the VPC CIDRs are added to the customer gateway BGP table. For more information, see [the section called "Create a transit gateway attachment to a VPN"](#) (p. 40).

Ensure that you review the [requirements for your customer gateway device](#) in the *AWS Site-to-Site VPN User Guide*.

Routing

Each VPC has a route table and there is a route table for the transit gateway.

VPC route tables

Each VPC has a route table with 2 entries. The first entry is the default entry for local IPv4 routing in the VPC; this entry enables the instances in this VPC to communicate with each other. The second entry routes all other IPv4 subnet traffic to the transit gateway. The following table shows the VPC A routes.

Destination	Target
10.1.0.0/16	local
0.0.0.0/0	<i>tgw-id</i>

Transit gateway route table

The following is an example of a default route table for the attachments shown in the previous diagram, with route propagation enabled.

Destination	Target	Route type
10.1.0.0/16	<i>Attachment for VPC A</i>	propagated
10.2.0.0/16	<i>Attachment for VPC B</i>	propagated
10.3.0.0/16	<i>Attachment for VPC C</i>	propagated
10.99.99.0/24	<i>Attachment for VPN connection</i>	propagated

Customer gateway BGP table

The customer gateway BGP table contains the following VPC CIDRs.

- 10.1.0.0/16
- 10.2.0.0/16
- 10.3.0.0/16

Example: Isolated VPCs

You can configure your transit gateway as multiple isolated routers. This is similar to using multiple transit gateways, but provides more flexibility in cases where the routes and attachments might change. In this scenario, each isolated router has a single route table. All attachments associated with an isolated router propagate and associate with its route table. Attachments associated with one isolated router can route packets to each other, but cannot route packets to or receive packets from the attachments for another isolated router.

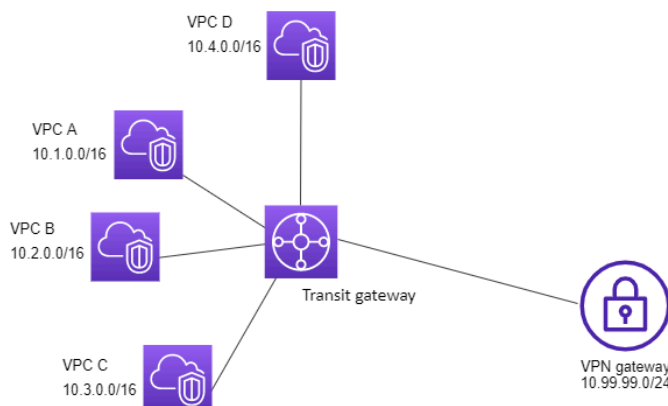
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- [Routing \(p. 15\)](#)

Overview

The following diagram shows the key components of the configuration for this scenario. Packets from VPC A, VPC B, and VPC C route to the transit gateway. Packets from the subnets in VPC A, VPC B, and VPC C that have the internet as a destination first route through the transit gateway and then route to the Site-to-Site VPN connection (if the destination is within that network). Packets from one VPC that have a destination of a subnet in another VPC, for example from 10.1.0.0 to 10.2.0.0, route through the

transit gateway, where they are blocked because there is no route for them in the transit gateway route table.



Resources

Create the following resources for this scenario:

- Three VPCs. For information about creating a VPC, see [Create a VPC](#) in the *Amazon VPC User Guide*.
- A transit gateway. For more information, see [the section called “Create a transit gateway”](#) (p. 29).
- Three attachments on the transit gateway for the three VPCs. For more information, see [the section called “Create a transit gateway attachment to a VPC”](#) (p. 37).
- A Site-to-Site VPN attachment on the transit gateway. For more information, see [the section called “Create a transit gateway attachment to a VPN”](#) (p. 40). Ensure that you review the [requirements for your customer gateway device](#) in the *AWS Site-to-Site VPN User Guide*.

When the VPN connection is up, the BGP session is established and the VPN CIDR propagates to the transit gateway route table and the VPC CIDRs are added to the customer gateway BGP table.

Routing

Each VPC has a route table, and the transit gateway has two route tables—one for the VPCs and one for the VPN connection.

VPC A, VPC B, and VPC C route tables

Each VPC has a route table with 2 entries. The first entry is the default entry for local IPv4 routing in the VPC. This entry enables the instances in this VPC to communicate with each other. The second entry routes all other IPv4 subnet traffic to the transit gateway. The following table shows the VPC A routes.

Destination	Target
10.1.0.0/16	local
0.0.0.0/0	<i>tgw-id</i>

Transit gateway route tables

This scenario uses one route table for the VPCs and one route table for the VPN connection.

The VPC attachments are associated with the following route table, which has a propagated route for the VPN attachment.

Destination	Target	Route type
10.99.99.0/24	<i>Attachment for VPN connection</i>	propagated

The VPN attachment is associated with the following route table, which has propagated routes for each of the VPC attachments.

Destination	Target	Route type
10.1.0.0/16	<i>Attachment for VPC A</i>	propagated
10.2.0.0/16	<i>Attachment for VPC B</i>	propagated
10.3.0.0/16	<i>Attachment for VPC C</i>	propagated

For more information about propagating routes in a transit gateway route table, see [Propagate a route to a transit gateway route table \(p. 52\)](#).

Customer gateway BGP table

The customer gateway BGP table contains the following VPC CIDRs.

- 10.1.0.0/16
- 10.2.0.0/16
- 10.3.0.0/16

Example: Isolated VPCs with shared services

You can configure your transit gateway as multiple isolated routers that use a shared service. This is similar to using multiple transit gateways, but provides more flexibility in cases where the routes and attachments might change. In this scenario, each isolated router has a single route table. All attachments associated with an isolated router propagate and associate with its route table. Attachments associated with one isolated router can route packets to each other, but cannot route packets to or receive packets from the attachments for another isolated router. Attachments can route packets to or receive packets from the shared services. You can use this scenario when you have groups that need to be isolated, but use a shared service, for example a production system.

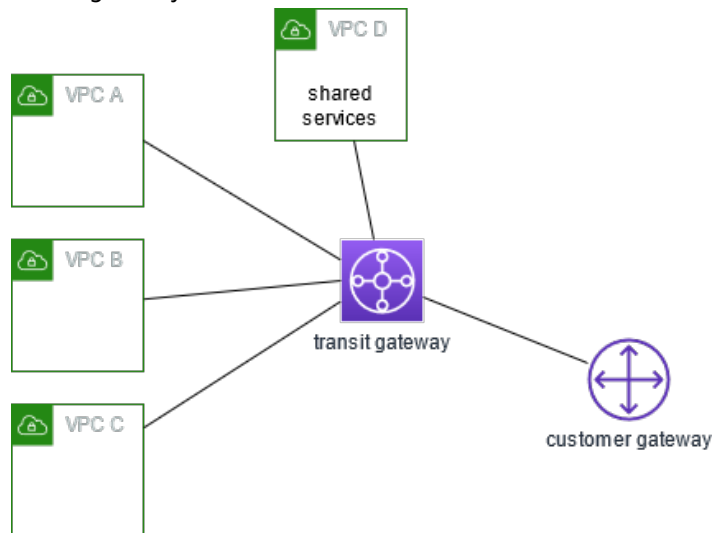
Contents

- [Overview \(p. 16\)](#)
- [Resources \(p. 17\)](#)
- [Routing \(p. 17\)](#)

Overview

The following diagram shows the key components of the configuration for this scenario. Packets from the subnets in VPC A, VPC B, and VPC C that have the internet as a destination, first route through the transit gateway and then route to the customer gateway for Site-to-Site VPN. Packets from subnets

in VPC A, VPC B, or VPC C that have a destination of a subnet in VPC A, VPC B, or VPC C route through the transit gateway, where they are blocked because there is no route for them in the transit gateway route table. Packets from VPC A, VPC B, and VPC C that have VPC D as the destination route through the transit gateway and then to VPC D.



Resources

Create the following resources for this scenario:

- Four VPCs. For information about creating a VPC, see [Create a VPC](#) in the *Amazon VPC User Guide*.
- A transit gateway. For more information, see [Create a transit gateway](#).
- Four attachments on the transit gateway, one per VPC. For more information, see [the section called "Create a transit gateway attachment to a VPC" \(p. 37\)](#).
- A Site-to-Site VPN attachment on the transit gateway. For more information, see [the section called "Create a transit gateway attachment to a VPN" \(p. 40\)](#).

Ensure that you review the [requirements for your customer gateway device](#) in the *AWS Site-to-Site VPN User Guide*.

When the VPN connection is up, the BGP session is established and the VPN CIDR propagates to the transit gateway route table and the VPC CIDRs are added to the customer gateway BGP table.

- Each isolated VPC is associated with the isolated route table and propagated to the shared route table.
- Each shared services VPC is associated with the shared route table and propagated to both route tables.

Routing

Each VPC has a route table, and the transit gateway has two route tables—one for the VPCs and one for the VPN connection and shared services VPC.

VPC A, VPC B, VPC C, and VPC D route tables

Each VPC has a route table with two entries. The first entry is the default entry for local routing in the VPC; this entry enables the instances in this VPC to communicate with each other. The second entry routes all other IPv4 subnet traffic to the transit gateway.

Destination	Target
<i>VPC CIDR</i>	local
0.0.0.0/0	<i>transit gateway ID</i>

Transit gateway route tables

This scenario uses one route table for the VPCs and one route table for the VPN connection.

The VPC A, B, and C attachments are associated with the following route table, which has a propagated route for the VPN attachment and a propagated route for the attachment for VPC D.

Destination	Target	Route type
<i>Customer gateway IP address</i>	<i>Attachment for VPN connection</i>	propagated
<i>VPC D CIDR</i>	<i>Attachment for VPC D</i>	propagated

The VPN attachment and shared services VPC (VPC D) attachments are associated with the following route table, which has entries that point to each of the VPC attachments. This enables communication to the VPCs from the VPN connection and the shared services VPC.

Destination	Target	Route type
<i>VPC A CIDR</i>	<i>Attachment for VPC A</i>	propagated
<i>VPC B CIDR</i>	<i>Attachment for VPC B</i>	propagated
<i>VPC C CIDR</i>	<i>Attachment for VPC C</i>	propagated

For more information, see [Propagate a route to a transit gateway route table \(p. 52\)](#).

Customer gateway BGP table

The customer gateway BGP table contains the CIDRs for all four VPCs.

Example: Peered transit gateways

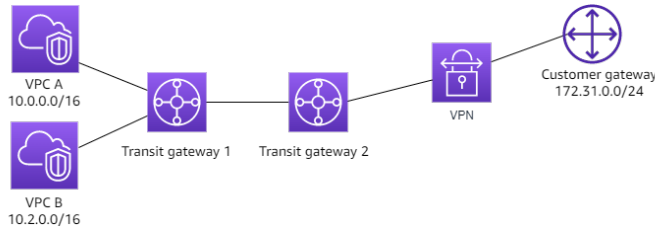
You can create a transit gateway peering connection between transit gateways. You can then route traffic between the attachments for each of the transit gateways. In this scenario, VPC and VPN attachments are associated with the transit gateway default route tables, and they propagate to the transit gateway default route tables. Each transit gateway route table has a static route that points to the transit gateway peering attachment.

Contents

- [Overview \(p. 19\)](#)
- [Resources \(p. 19\)](#)
- [Routing \(p. 19\)](#)

Overview

The following diagram shows the key components of the configuration for this scenario. Transit gateway 1 has two VPC attachments, and transit gateway 2 has one Site-to-Site VPN attachment. Packets from the subnets in VPC A and VPC B that have the internet as a destination first route through transit gateway 1, then transit gateway 2, and then route to the VPN connection.



Resources

Create the following resources for this scenario:

- Two VPCs. For information about creating a VPC, see [Create a VPC](#) in the *Amazon VPC User Guide*.
- Two transit gateways. They can be in the same Region or in different Regions. For more information, see [the section called "Create a transit gateway"](#) (p. 29).
- Two VPC attachments on the first transit gateway. For more information, see [the section called "Create a transit gateway attachment to a VPC"](#) (p. 37).
- A Site-to-Site VPN attachment on the transit gateway. For more information, see [the section called "Create a transit gateway attachment to a VPN"](#) (p. 40). Ensure that you review the [requirements for your customer gateway device](#) in the *AWS Site-to-Site VPN User Guide*.
- A transit gateway peering attachment between the two transit gateways. For more information, see [Transit gateway peering attachments](#) (p. 41).

When you create the VPC attachments, the CIDRs for each VPC propagate to the route table for transit gateway 1. When the VPN connection is up, the following actions occur:

- The BGP session is established
- The Site-to-Site VPN CIDR propagates to the route table for transit gateway 2
- The VPC CIDRs are added to the customer gateway BGP table

Routing

Each VPC has a route table and each transit gateway has a route table.

VPC A and VPC B route tables

Each VPC has a route table with 2 entries. The first entry is the default entry for local IPv4 routing in the VPC. This default entry enables the resources in this VPC to communicate with each other. The second entry routes all other IPv4 subnet traffic to the transit gateway. The following table shows the VPC A routes.

Destination	Target
10.0.0.0/16	local

Destination	Target
0.0.0.0/0	<i>tgw-1-id</i>

Transit gateway route tables

The following is an example of the default route table for transit gateway 1, with route propagation enabled.

Destination	Target	Route type
10.0.0.0/16	<i>Attachment ID for VPC A</i>	propagated
10.2.0.0/16	<i>Attachment ID for VPC B</i>	propagated
0.0.0.0/0	<i>Attachment ID for peering connection</i>	static

The following is an example of the default route table for transit gateway 2, with route propagation enabled.

Destination	Target	Route type
172.31.0.0/24	<i>Attachment ID for VPN connection</i>	propagated
10.0.0.0/16	<i>Attachment ID for peering connection</i>	static
10.2.0.0/16	<i>Attachment ID for peering connection</i>	static

Customer gateway BGP table

The customer gateway BGP table contains the following VPC CIDRs.

- 10.0.0.0/16
- 10.2.0.0/16

Example: Centralized outbound routing to the internet

You can configure a transit gateway to route outbound internet traffic from a VPC without an internet gateway to a VPC that contains a NAT gateway and an internet gateway.

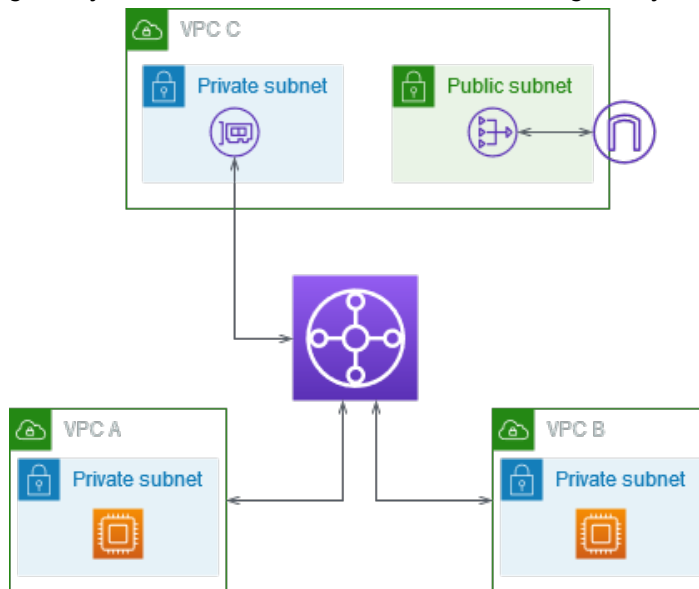
Contents

- [Overview \(p. 21\)](#)
- [Resources \(p. 21\)](#)

- [Routing \(p. 21\)](#)

Overview

The following diagram shows the key components of the configuration for this scenario. You have applications in VPC A and VPC B that need outbound only internet access. You configure VPC C with a NAT gateway and an internet gateway. Connect all VPCs to a transit gateway. Configure routing so that outbound internet traffic from VPC A and VPC B traverses the transit gateway to VPC C. The NAT gateway in VPC C routes the traffic to the internet gateway.



Resources

Create the following resources for this scenario:

- Three VPCs with IP address ranges that do not overlap. For more information, see [Create a VPC](#) in the *Amazon VPC User Guide*.
- VPC A and VPC B each have private subnets with EC2 instances.
- VPC C has the following:
 - An internet gateway attached to the VPC. For more information, see [Create and attach an internet gateway](#) in the *Amazon VPC User Guide*.
 - Two subnets.
 - A NAT gateway using one of the subnets. For more information, see [Create a NAT gateway](#) in the *Amazon VPC User Guide*.
- One transit gateway. For more information, see [the section called "Create a transit gateway" \(p. 29\)](#).
- Three VPC attachments on the transit gateway. The CIDR blocks for each VPC propagate to the transit gateway route table. For more information, see [the section called "Create a transit gateway attachment to a VPC" \(p. 37\)](#).

Routing

There are route tables for each VPC and a route table for the transit gateway.

Route tables

- [Route table for VPC A \(p. 22\)](#)
- [Route table for VPC B \(p. 22\)](#)
- [Route tables for VPC C \(p. 22\)](#)
- [Transit gateway route table \(p. 23\)](#)

Route table for VPC A

The following is an example route table. The first entry enables instances in the VPC to communicate with each other. The second entry routes all other IPv4 subnet traffic to the transit gateway.

Destination	Target
<i>VPC A CIDR</i>	local
0.0.0.0/0	<i>transit-gateway-id</i>

Route table for VPC B

The following is an example route table. The first entry enables the instances in the VPC to communicate with each other. The second entry routes all other IPv4 subnet traffic to the transit gateway.

Destination	Target
<i>VPC B CIDR</i>	local
0.0.0.0/0	<i>transit-gateway-id</i>

Route tables for VPC C

Configure the subnet with the NAT gateway as a public subnet by adding a route to the internet gateway. Leave the other subnet as a private subnet.

The following is an example route table for the public subnet. The first entry enables instances in the VPC to communicate with each other. The second and third entries route traffic for VPC A and VPC B to the transit gateway. The remaining entry routes all other IPv4 subnet traffic to the internet gateway.

Destination	Target
<i>VPC C CIDR</i>	local
<i>VPC A CIDR</i>	<i>transit-gateway-id</i>
<i>VPC B CIDR</i>	<i>transit-gateway-id</i>
0.0.0.0/0	<i>internet-gateway-id</i>

The following is an example route table for the private subnet. The first entry enables instances in the VPC to communicate with each other. The second entry routes all other IPv4 subnet traffic to the NAT gateway.

Destination	Target
<i>VPC C CIDR</i>	local
0.0.0.0/0	<i>nat-gateway-id</i>

Transit gateway route table

The following is an example of the transit gateway route table. The CIDR blocks for each VPC propagate to the transit gateway route table. The static route sends outbound internet traffic to VPC C. You can optionally prevent inter-VPC communication by adding a blackhole route for each VPC CIDR.

CIDR	Attachment	Route type
<i>VPC A CIDR</i>	<i>Attachment for VPC A</i>	propagated
<i>VPC B CIDR</i>	<i>Attachment for VPC B</i>	propagated
<i>VPC C CIDR</i>	<i>Attachment for VPC C</i>	propagated
0.0.0.0/0	<i>Attachment for VPC C</i>	static

Example: Appliance in a shared services VPC

You can configure an appliance (such as a security appliance) in a shared services VPC. All traffic that's routed between transit gateway attachments is first inspected by the appliance in the shared services VPC.

You must connect exactly one transit gateway to the appliance VPC to guarantee flow stickiness. Connecting multiple transit gateways to a single appliance VPC does not guarantee flow stickiness because the transit gateways do not share flow state information with each other.

Note

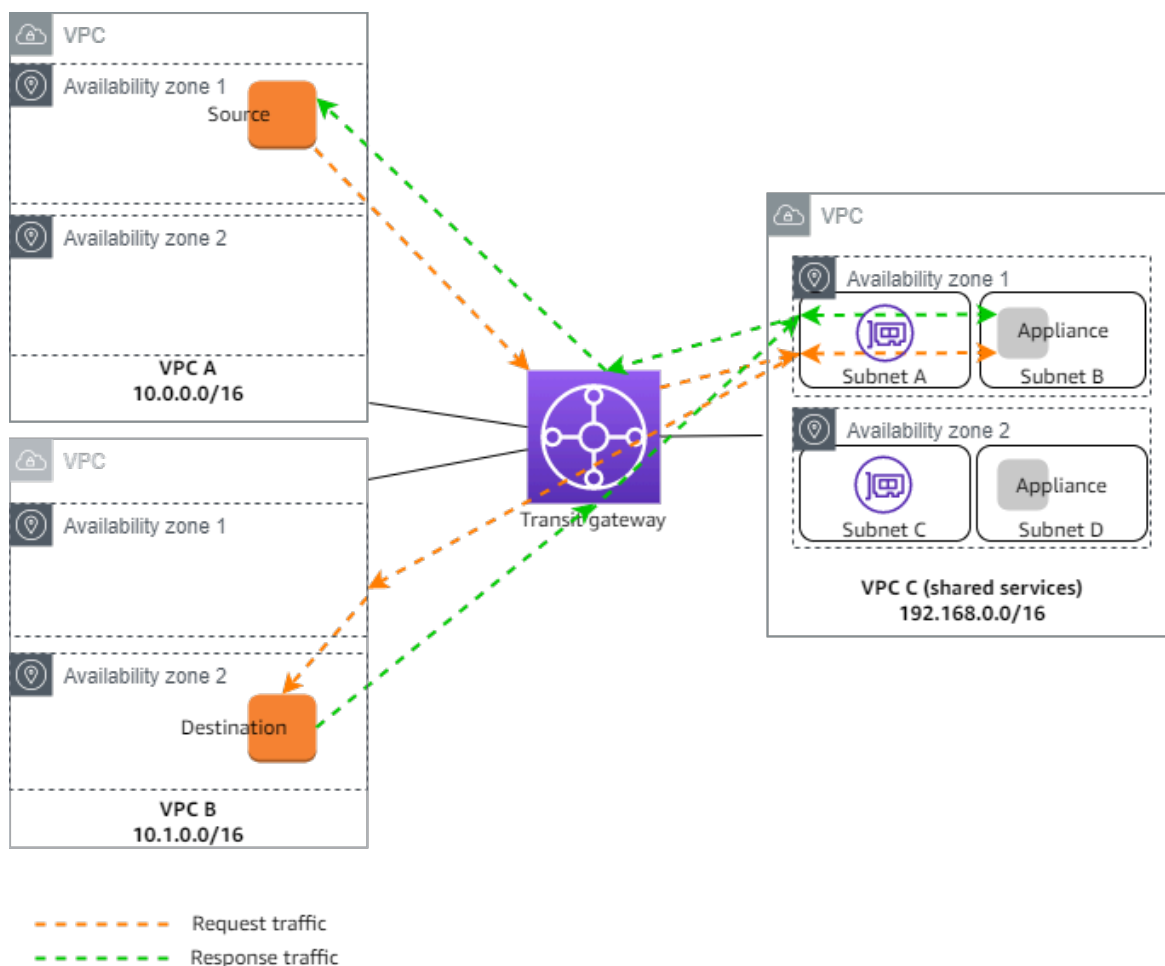
Traffic in appliance mode is routed correctly as long as the source and destination traffic are coming to a centralized VPC (Inspection VPC) from the same transit gateway attachment. Traffic can drop if the source and destination are entering from two different transit gateway attachments. Appliance mode does not apply to traffic entering the network through a VPN.

Contents

- [Overview \(p. 23\)](#)
- [Stateful appliances and appliance mode \(p. 25\)](#)
- [Routing \(p. 26\)](#)

Overview

The following diagram shows the key components of the configuration for this scenario. The transit gateway has three VPC attachments. VPC C is a shared services VPC. Traffic between VPC A and VPC B is routed to the transit gateway, then routed to a security appliance in VPC C for inspection before it's routed to the final destination. The appliance is a stateful appliance, therefore both the request and response traffic is inspected. For high availability, there is an appliance in each Availability Zone in VPC C.



You create the following resources for this scenario:

- Three VPCs. For information about creating a VPC, see [Creating a VPC](#) in the *Amazon Virtual Private Cloud User Guide*.
- A transit gateway. For more information, see [the section called "Create a transit gateway"](#) (p. 29).
- Three VPC attachments - one for each of the VPCs. For more information, see [the section called "Create a transit gateway attachment to a VPC"](#) (p. 37).

For each VPC attachment, specify a subnet in each Availability Zone. For the shared services VPC, these are the subnets where traffic is routed to the VPC from the transit gateway. In the preceding example, these are subnets A and C.

For the VPC attachment for VPC C, enable appliance mode support so that response traffic is routed to the same Availability Zone in VPC C as the source traffic.

The Amazon VPC console does not support appliance mode. You can use the Amazon VPC API, an AWS SDK, the AWS CLI to enable appliance mode, or AWS CloudFormation. For example, add `--options ApplianceModeSupport=enable` to the [create-transit-gateway-vpc-attachment](#) or [modify-transit-gateway-vpc-attachment](#) command.

Stateful appliances and appliance mode

When appliance mode is enabled, a transit gateway selects a single network interface in the appliance VPC, using a flow hash algorithm, to send traffic to for the life of the flow. The transit gateway uses the same network interface for the return traffic. This ensures that bidirectional traffic is routed symmetrically—it's routed through the same Availability Zone in the VPC attachment for the life of the flow. If you have multiple transit gateways in your architecture, each transit gateway maintains its own session affinity, and each transit gateway can select a different network interface.

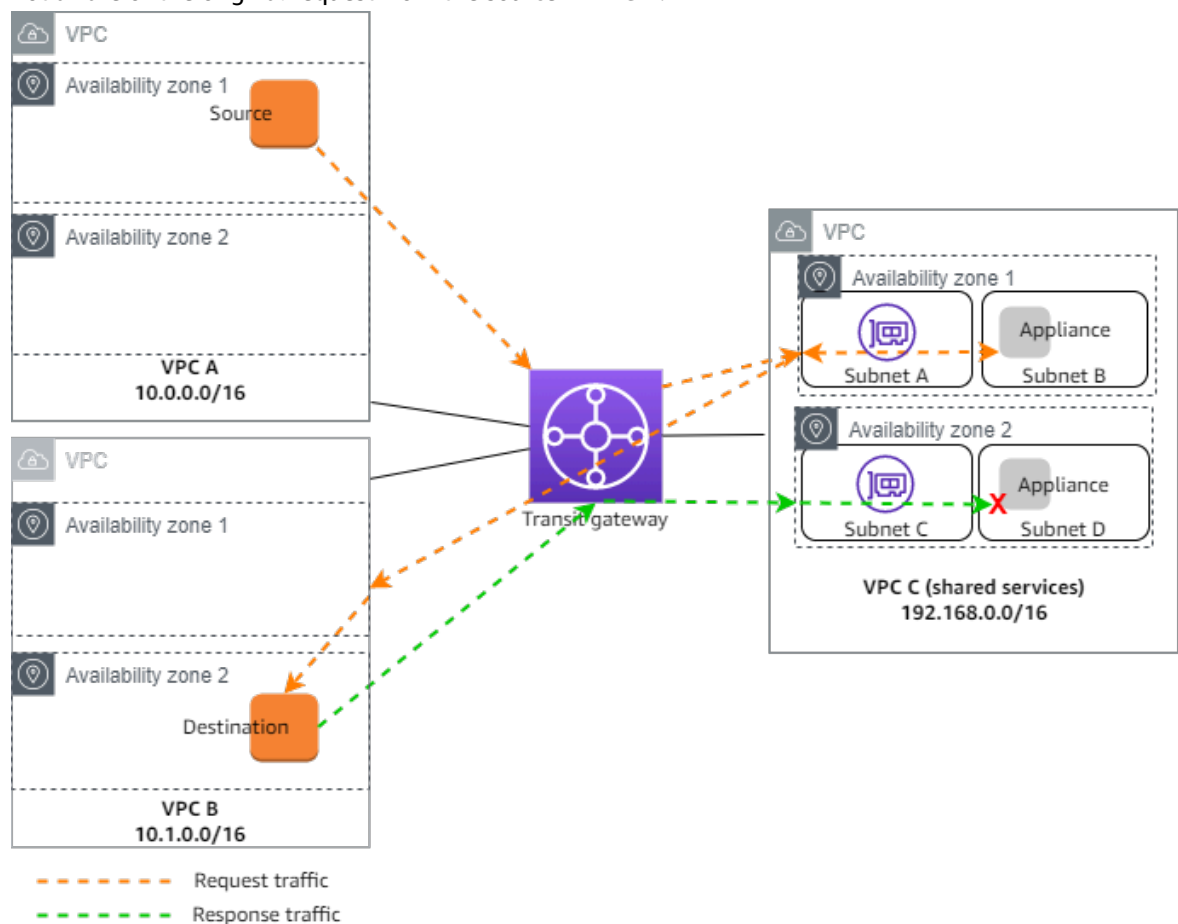
If your VPC attachments span multiple Availability Zones and you require traffic between source and destination hosts to be routed through the same appliance for stateful inspection, enable appliance mode support for the VPC attachment in which the appliance is located.

For more information, see [Centralized inspection architecture](#) in the AWS blog.

Behavior when appliance mode is not enabled

When appliance mode is not enabled, a transit gateway attempts to keep traffic routed between VPC attachments in the originating Availability Zone until it reaches its destination. Traffic crosses Availability Zones between attachments only if there is an Availability Zone failure or if there are no subnets associated with a VPC attachment in that Availability Zone.

The following diagram shows a traffic flow when appliance mode support is not enabled. The response traffic that originates from Availability Zone 2 in VPC B is routed by the transit gateway to the same Availability Zone in VPC C. The traffic is therefore dropped, because the appliance in Availability Zone 2 is not aware of the original request from the source in VPC A.



Routing

Each VPC has one or more route tables and the transit gateway has two route tables.

VPC route tables

VPC A and VPC B

VPCs A and B have route tables with 2 entries. The first entry is the default entry for local IPv4 routing in the VPC. This default entry enables the resources in this VPC to communicate with each other. The second entry routes all other IPv4 subnet traffic to the transit gateway. The following is the route table for VPC A.

Destination	Target
10.0.0.0/16	local
0.0.0.0/0	<i>tgw-id</i>

VPC C

The shared services VPC (VPC C) has different route tables for each subnet. Subnet A is used by the transit gateway (you specify this subnet when you create the VPC attachment). The route table for subnet A routes all traffic to the appliance in subnet B.

Destination	Target
192.168.0.0/16	local
0.0.0.0/0	<i>appliance-eni-id</i>

The route table for subnet B (which contains the appliance) routes the traffic back to the transit gateway.

Destination	Target
192.168.0.0/16	local
0.0.0.0/0	<i>tgw-id</i>

Transit gateway route tables

This transit gateway uses one route table for VPC A and VPC B, and one route table for the shared services VPC (VPC C).

The VPC A and VPC B attachments are associated with the following route table. The route table routes all traffic to VPC C.

Destination	Target	Route type
0.0.0.0/0	<i>Attachment ID for VPC C</i>	static

The VPC C attachment is associated with the following route table. It routes traffic to VPC A and VPC B.

Destination	Target	Route type
10.0.0.0/16	<i>Attachment ID for VPC A</i>	propagated
10.1.0.0/16	<i>Attachment ID for VPC B</i>	propagated

Work with transit gateways

You can work with transit gateways using the Amazon VPC console or the AWS CLI.

Contents

- [Transit gateways \(p. 28\)](#)
- [Transit gateway attachments to a VPC \(p. 32\)](#)
- [Transit gateway attachments to a Direct Connect gateway \(p. 39\)](#)
- [Transit gateway VPN attachments \(p. 40\)](#)
- [Transit gateway peering attachments \(p. 41\)](#)
- [Transit gateway Connect attachments and Transit Gateway Connect peers \(p. 44\)](#)
- [Transit gateway route tables \(p. 50\)](#)
- [Transit gateway policy tables \(p. 57\)](#)
- [Multicast on transit gateways \(p. 58\)](#)

Transit gateways

A transit gateway enables you to attach VPCs and VPN connections in the same Region and route traffic between them. A transit gateway works across AWS accounts, and you can use AWS RAM to share your transit gateway with other accounts. After you share a transit gateway with another AWS account, the account owner can attach their VPCs to your transit gateway. A user from either account can delete the attachment at any time.

You can enable multicast on a transit gateway, and then create a transit gateway multicast domain that allows multicast traffic to be sent from your multicast source to multicast group members over VPC attachments that you associate with the domain.

Each VPC or VPN attachment is associated with a single route table. That route table decides the next hop for the traffic coming from that resource attachment. A route table inside the transit gateway allows for both IPv4 or IPv6 CIDRs and targets. The targets are VPCs and VPN connections. When you attach a VPC or create a VPN connection on a transit gateway, the attachment is associated with the default route table of the transit gateway.

You can create additional route tables inside the transit gateway, and change the VPC or VPN association to these route tables. This enables you to segment your network. For example, you can associate development VPCs with one route table and production VPCs with a different route table. This enables you to create isolated networks inside a transit gateway similar to virtual routing and forwarding (VRFs) in traditional networks.

Transit gateways support dynamic and static routing between attached VPCs and VPN connections. You can enable or disable route propagation for each attachment. Transit gateway peering attachments support static routing only.

You can optionally associate one or more IPv4 or IPv6 CIDR blocks with your transit gateway. You specify an IP address from the CIDR block when you establish a Transit Gateway Connect peer for a [transit gateway Connect attachment \(p. 44\)](#). You can associate any public or private IP address range, except

for addresses in the 169.254.0.0/16 range, and ranges that overlap with addresses for your VPC attachments and on-premises networks. For more information about IPv4 and IPv6 CIDR blocks, see [VPCs and subnets](#) in the Amazon VPC User Guide.

Tasks

- [Create a transit gateway](#) (p. 29)
- [View your transit gateways](#) (p. 30)
- [Add or edit tags for a transit gateway](#) (p. 30)
- [Modify a transit gateway](#) (p. 31)
- [Share a transit gateway](#) (p. 31)
- [Accept a resource share](#) (p. 31)
- [Accept a shared attachment](#) (p. 32)
- [Delete a transit gateway](#) (p. 32)

Create a transit gateway

When you create a transit gateway, we create a default transit gateway route table and use it as the default association route table and the default propagation route table. If you choose not to create the default transit gateway route table, you can create one later on. For more information about routes and route tables, see [??? \(p. 4\)](#).

To create a transit gateway using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateways**.
3. Choose **Create transit gateway**.
4. For **Name tag**, optionally enter a name for the transit gateway. A name tag can make it easier to identify a specific gateway from the list of gateways. When you add a **Name tag**, a tag is created with a key of **Name** and with a value equal to the value you enter.
5. For **Description**, optionally enter a description for the transit gateway.
6. For **Amazon side Autonomous System Number (ASN)**, either leave the default value to use the default ASN or enter the private ASN for your transit gateway. This should be the ASN for the AWS side of a Border Gateway Protocol (BGP) session.

The range is 64512 to 65534 for 16-bit ASNs.

The range is 4200000000 to 4294967294 for 32-bit ASNs.

If you have a multi-Region deployment, we recommend that you use a unique ASN for each of your transit gateways.

7. For **DNS support**, select this option if you need the VPC to resolve public IPv4 DNS host names to private IPv4 addresses when queried from instances in another VPC attached to the transit gateway.
8. For **VPN ECMP support**, select this option if you need Equal Cost Multipath (ECMP) routing support between VPN tunnels. If connections advertise the same CIDRs, the traffic is distributed equally between them.

When you select this option, the advertised BGP ASN, the BGP attributes such as the AS-path, and the communities for preference must be the same.

Note

To use ECMP, you must create a VPN connection that uses dynamic routing. VPN connections that use static routing do not support ECMP.

9. For **Default route table association**, select this option to automatically associate transit gateway attachments with the default route table for the transit gateway.
10. For **Default route table propagation**, select this option to automatically propagate transit gateway attachments to the default route table for the transit gateway.
11. (Optional) To use the transit gateway as a router for multicast traffic, select **Multicast support**.
12. For **Auto accept shared attachments**, select this option to automatically accept cross-account attachments.
13. (Optional) For **Transit gateway CIDR blocks**, specify one or more IPv4 or IPv6 CIDR blocks for your transit gateway.

You can specify a size /24 CIDR block or larger (for example, /23 or /22) for IPv4, or a size /64 CIDR block or larger (for example, /63 or /62) for IPv6. You can associate any public or private IP address range, except for addresses in the 169.254.0.0/16 range, and ranges that overlap with the addresses for your VPC attachments and on-premises networks.

14. Choose **Create transit gateway**.

To create a transit gateway using the AWS CLI

Use the [create-transit-gateway](#) command.

View your transit gateways

To view your transit gateways using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateways**. The details for the transit gateway are displayed below the list of gateways on the page.

To view your transit gateways using the AWS CLI

Use the [describe-transit-gateways](#) command.

Add or edit tags for a transit gateway

Add tags to your resources to help organize and identify them, such as by purpose, owner, or environment. You can add multiple tags to each transit gateway. Tag keys must be unique for each transit gateway. If you add a tag with a key that is already associated with the transit gateway, it updates the value of that tag. For more information, see [Tagging your Amazon EC2 Resources](#).

Add tags to a transit gateway using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateways**.
3. Choose the transit gateway for which to add or edit tags.
4. Choose the **Tags** tab in the lower part of the page.
5. Choose **Manage tags**.
6. Choose **Add new tag**.
7. Enter a **Key** and **Value** for the tag.
8. Choose **Save**.

Modify a transit gateway

You can modify the configuration options for your transit gateway. When you modify a transit gateway, the modified options are applied to new transit gateway attachments only. Your existing transit gateway attachments are not modified.

You cannot modify a transit gateway that has been shared with you.

You cannot remove a CIDR block for the transit gateway if any of the IP addresses are currently used for a [Transit Gateway Connect peer](#) (p. 44).

To modify a transit gateway

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateways**.
3. Choose the transit gateway to modify.
4. Choose **Actions, Modify transit gateway**.
5. Modify the options as needed, and choose **Modify transit gateway**.

To modify your transit gateway using the AWS CLI

Use the `modify-transit-gateway` command.

Share a transit gateway

You can use AWS RAM to [share a transit gateway](#) (p. 74) across accounts or across your organization in AWS Organizations. Use the following procedure to share a transit gateway that you own.

You must enable resource sharing from the management account for your organization. For information about enabling resource sharing, see [Enable Sharing with AWS Organizations](#) in the *AWS RAM User Guide*.

To share a transit gateway

1. Open the AWS RAM console at <https://console.aws.amazon.com/ram/>.
2. Choose **Create a resource share**.
3. Under **Name**, type a descriptive name for the resource share.
4. For **Select resource type**, choose **Transit Gateways**. Select the transit gateway.
5. (Optional) For **Principals**, add principals to the resource share. For each AWS account, OU, or organization, specify its ID and choose **Add**.

For **Allow external accounts**, choose whether to allow sharing for this resource with AWS accounts that are external to your organization.

6. (Optional) Under **Tags**, type a tag key and tag value pair for each tag. These tags are applied to the resource share but not to the transit gateway.
7. Choose **Create resource share**.

Accept a resource share

If you were added to a resource share, you receive an invitation to join the resource share. You must accept the resource share before you can access the shared resources.

To accept a resource share

1. Open the AWS RAM console at <https://console.aws.amazon.com/ram/>.
2. On the navigation pane, choose **Shared with me, Resource shares**.
3. Select the resource share.
4. Choose **Accept resource share**.
5. To view the shared transit gateway, open the **Transit Gateways** page in the Amazon VPC console.

Accept a shared attachment

If you didn't enable the **Auto accept shared attachments** functionality when you created your transit gateway, you must manually accept cross-account (shared) attachments.

To manually accept a shared attachment

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Attachments**.
3. Select the transit gateway attachment that's pending acceptance.
4. Choose **Actions, Accept transit gateway attachment**.

To accept a shared attachment using the AWS CLI

Use the [accept-transit-gateway-vpc-attachment](#) command.

Delete a transit gateway

You can't delete a transit gateway with existing attachments. You need to delete all attachments before you can delete a transit gateway.

To delete a transit gateway using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. Choose the transit gateway to delete.
3. Choose **Actions, Delete transit gateway**. Enter **delete** and choose **Delete** to confirm the deletion.

To delete a transit gateway using the AWS CLI

Use the [delete-transit-gateway](#) command.

Transit gateway attachments to a VPC

When you attach a VPC to a transit gateway, you must specify one subnet from each Availability Zone to be used by the transit gateway to route traffic. Specifying one subnet from an Availability Zone enables traffic to reach resources in every subnet in that Availability Zone.

Limits

- When you attach a VPC to a transit gateway, any resources in Availability Zones where there is no transit gateway attachment cannot reach the transit gateway. If there is a route to the transit gateway

in a subnet route table, traffic is forwarded to the transit gateway only when the transit gateway has an attachment in a subnet in the same Availability Zone.

- The resources in a VPC attached to a transit gateway cannot access the security groups of a different VPC that is also attached to the same transit gateway.
- A transit gateway does not support DNS resolution for custom DNS names of attached VPCs set up using private hosted zones in Amazon Route 53. To configure name resolution for private hosted zones for all VPCs attached to a transit gateway, see [Centralized DNS management of hybrid cloud with Amazon Route 53 and AWS Transit Gateway](#).
- A transit gateway doesn't support routing between VPCs with identical CIDRs. If you attach a VPC to a transit gateway and its CIDR is identical to the CIDR of another VPC that's already attached to the transit gateway, the routes for the newly attached VPC aren't propagated to the transit gateway route table.
- You can't create an attachment for a VPC subnet that resides in a Local Zone. However, you can configure your network so that subnets in the Local Zone can connect to a transit gateway through the parent Availability Zone. For more information, see [Connect Local Zone subnets to a transit gateway](#).
- You can't create a transit gateway attachment using IPv6-only subnets. Transit gateway attachment subnets must also support IPv4 addresses

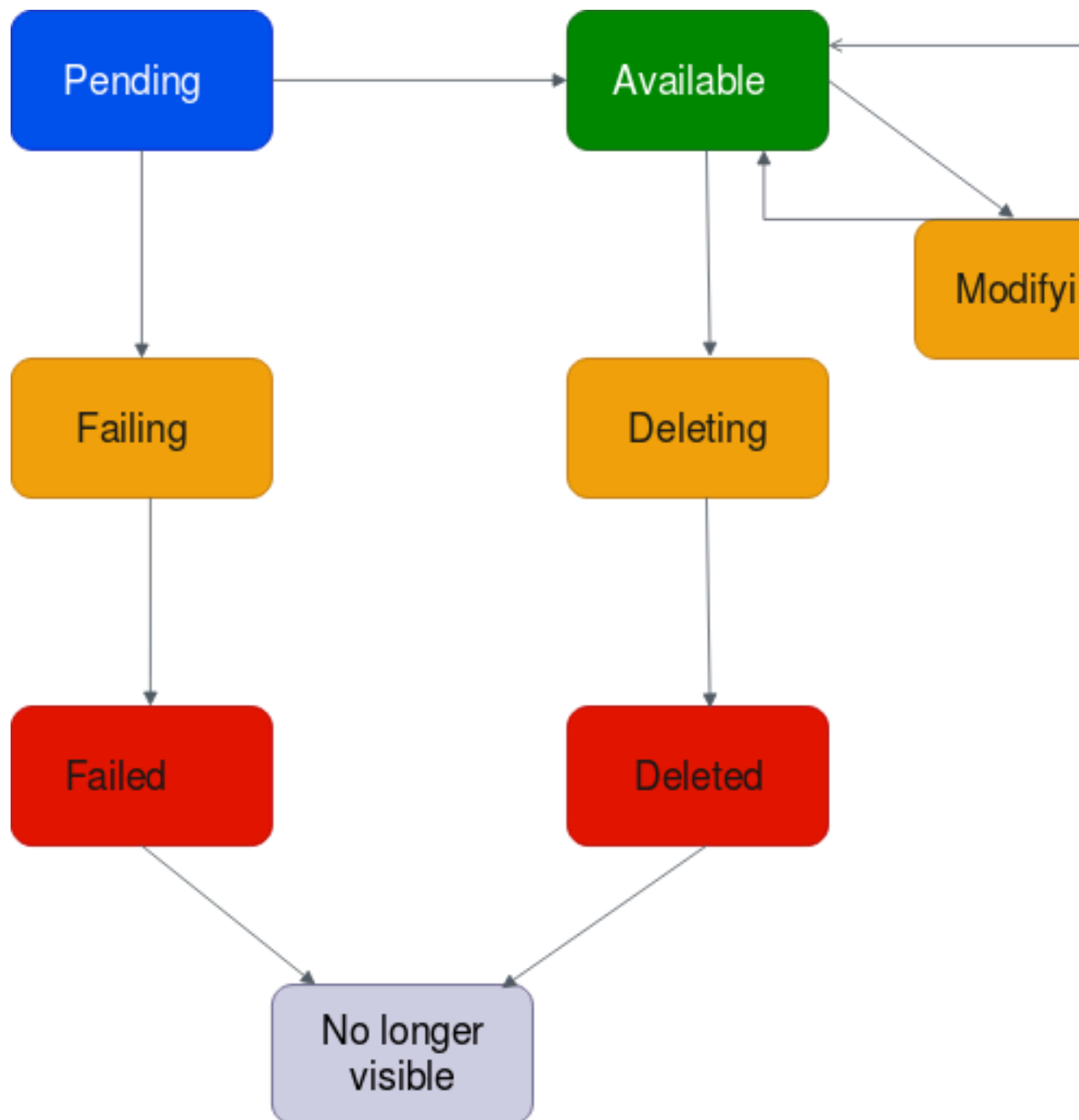
Contents

- [VPC attachment lifecycle \(p. 33\)](#)
- [Create a transit gateway attachment to a VPC \(p. 37\)](#)
- [Modify your VPC attachment \(p. 37\)](#)
- [Modify your VPC attachment tags \(p. 38\)](#)
- [View your VPC attachments \(p. 38\)](#)
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- [Troubleshoot VPC attachment creation \(p. 39\)](#)

VPC attachment lifecycle

A VPC attachment goes through various stages, starting when the request is initiated. At each stage, there may be actions that you can take, and at the end of its lifecycle, the VPC attachment remains visible in the Amazon Virtual Private Cloud Console and in API or command line output, for a period of time.

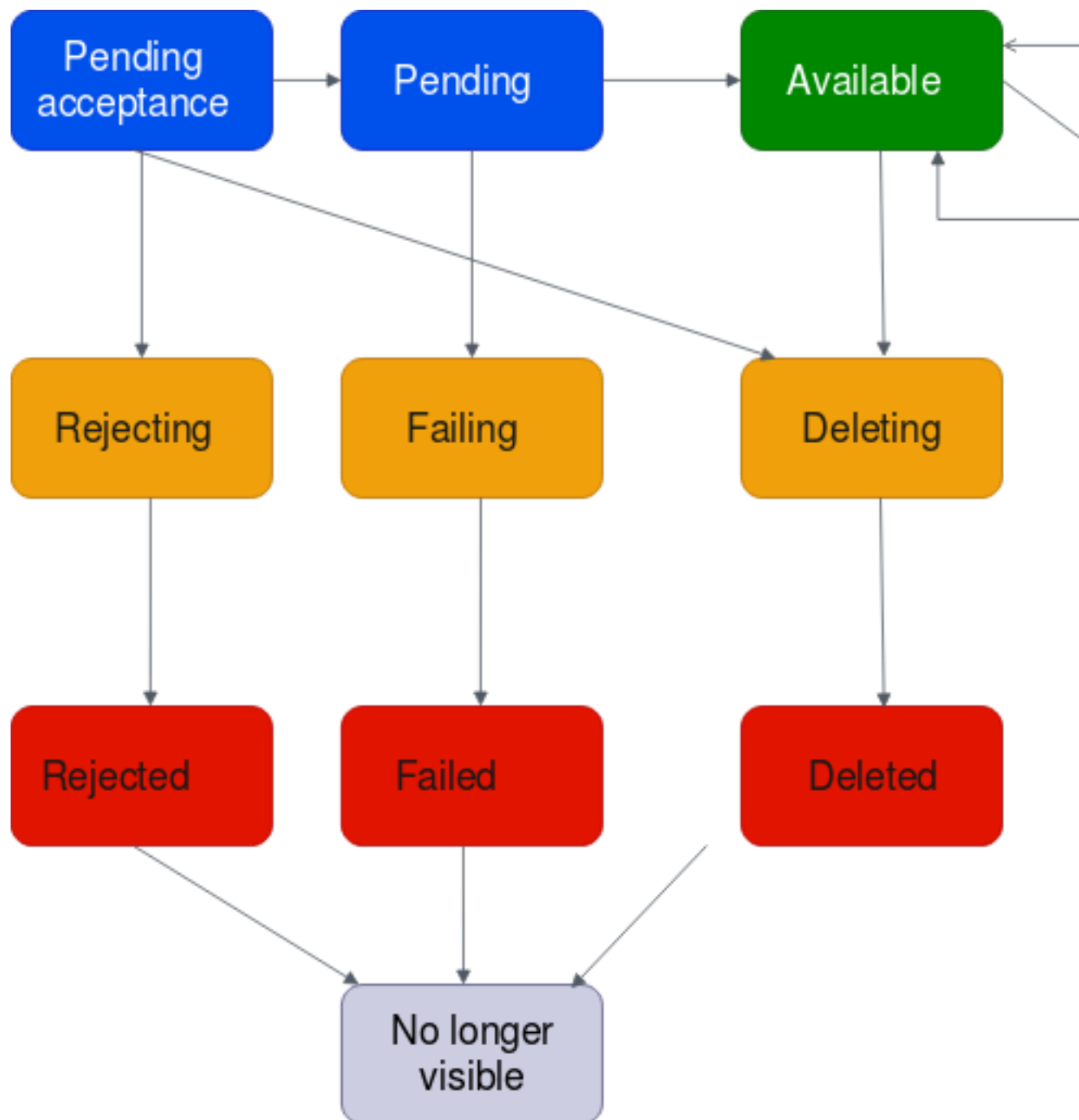
The following diagram shows the states an attachment can go through in a single account configuration, or a cross-account configuration that has **Auto accept shared attachments** turned on.



- **Pending:** A request for a VPC attachment has been initiated and is in the provisioning process. At this stage, the attachment can fail, or can go to available.
- **Failing:** A request for a VPC attachment is failing. At this stage, the VPC attachment goes to failed.
- **Failed:** The request for the VPC attachment has failed. While in this state, it cannot be deleted. The failed VPC attachment remains visible for 2 hours, and then is no longer visible.
- **Available:** The VPC attachment is available, and traffic can flow between the VPC and the transit gateway. At this stage, the attachment can go to modifying, or go to deleting.

- **Deleting:** A VPC attachment that is in the process of being deleted. At this stage, the attachment can go to `deleted`.
- **Deleted:** An available VPC attachment has been deleted. While in this state, the VPC attachment cannot be modified. The VPC attachment remains visible for 2 hours, and then is no longer visible.
- **Modifying:** A request has been made to modify the properties of the VPC attachment. At this stage, the attachment can go to `available`, or go to `rolling back`.
- **Rolling back:** The VPC attachment modification request cannot be completed, and the system is undoing any changes that were made. At this stage, the attachment can go to `available`.

The following diagram shows the states an attachment can go through in a cross-account configuration that has **Auto accept shared attachments** turned off.



- **Pending-acceptance:** The VPC attachment request is awaiting acceptance. At this stage, the attachment can go to pending, to rejecting, or to deleting.
- **Rejecting:** A VPC attachment that is in the process of being rejected. At this stage, the attachment can go to rejected.
- **Rejected:** A pending acceptance VPC attachment has been rejected. While in this state, the VPC attachment cannot be modified. The VPC attachment remains visible for 2 hours, and then is no longer visible.

- **Pending:** The VPC attachment has been accepted and is in the provisioning process. At this stage, the attachment can fail, or can go to available.
- **Failing:** A request for a VPC attachment is failing. At this stage, the VPC attachment goes to failed.
- **Failed:** The request for the VPC attachment has failed. While in this state, it cannot be deleted. The failed VPC attachment remains visible for 2 hours, and then is no longer visible.
- **Available:** The VPC attachment is available, and traffic can flow between the VPC and the transit gateway. At this stage, the attachment can go to modifying, or go to deleting.
- **Deleting:** A VPC attachment that is in the process of being deleted. At this stage, the attachment can go to deleted.
- **Deleted:** An available or pending acceptance VPC attachment has been deleted. While in this state, the VPC attachment cannot be modified. The VPC attachment remains visible 2 hours, and then is no longer visible.
- **Modifying:** A request has been made to modify the properties of the VPC attachment. At this stage, the attachment can go to available, or go to rolling back.
- **Rolling back:** The VPC attachment modification request cannot be completed, and the system is undoing any changes that were made. At this stage, the attachment can go to available.

Create a transit gateway attachment to a VPC

To create a VPC attachment using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Attachments**.
3. Choose **Create transit gateway attachment**.
4. For **Name tag**, optionally enter a name for the transit gateway attachment.
5. For **Transit gateway ID**, choose the transit gateway for the attachment. You can choose a transit gateway that you own or a transit gateway that was shared with you.
6. For **Attachment type**, choose **VPC**.
7. Choose whether to enable **DNS Support** and **IPv6 Support**.
8. For **VPC ID**, choose the VPC to attach to the transit gateway.

This VPC must have at least one subnet associated with it.

9. For **Subnet IDs**, select one subnet for each Availability Zone to be used by the transit gateway to route traffic. You must select at least one subnet. You can select only one subnet per Availability Zone.
10. Choose **Create transit gateway attachment**.

To create a VPC attachment using the AWS CLI

Use the [create-transit-gateway-vpc-attachment](#) command.

Modify your VPC attachment

To modify your VPC attachments using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Attachments**.
3. Select the VPC attachment, and then choose **Actions, Modify transit gateway attachment**.

4. To enable DNS support, select **DNS support**.
5. To add a subnet to the attachment, next to the subnet, select the box.

Adding or modifying a VPC attachment subnet might impact data traffic while the attachment is in a modifying state.

6. Choose **Modify transit gateway attachment**.

To modify your VPC attachments using the AWS CLI

Use the [modify-transit-gateway-vpc-attachment](#) command.

Modify your VPC attachment tags

To modify your VPC attachment tags using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Attachments**.
3. Select the VPC attachment, and then choose **Actions, Manage tags**.
4. [Add a tag] Choose **Add new tag** and do the following:
 - For **Key**, enter the key name.
 - For **Value**, enter the key value.
5. [Remove a tag] Next to the tag, choose **Remove**.
6. Choose **Save**.

VPC attachment tags can only be modified using the console.

View your VPC attachments

To view your VPC attachments using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Attachments**.
3. In the **Resource type** column, look for **VPC**. These are the VPC attachments.
4. Choose an attachment to view its details.

To view your VPC attachments using the AWS CLI

Use the [describe-transit-gateway-vpc-attachments](#) command.

Delete a VPC attachment

To delete a VPC attachment using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Attachments**.
3. Select the VPC attachment.
4. Choose **Actions, Delete transit gateway attachment**.

5. When prompted, enter **delete** and choose **Delete**.

To delete a VPC attachment using the AWS CLI

Use the [delete-transit-gateway-vpc-attachment](#) command.

Troubleshoot VPC attachment creation

The following topic can help you troubleshoot problems that you might have when you create a VPC attachment.

Problem

The VPC attachment failed.

Cause

The cause might be one of the following:

1. The user that is creating the VPC attachment does not have correct permissions to create service-linked role.
2. There is a throttling issue because of too many IAM requests, for example you are using AWS CloudFormation to create permissions and roles.
3. The account has the service-linked role, and the service-linked role has been modified.
4. The transit gateway is not in the available state.

Solution

Depending on the cause, try the following:

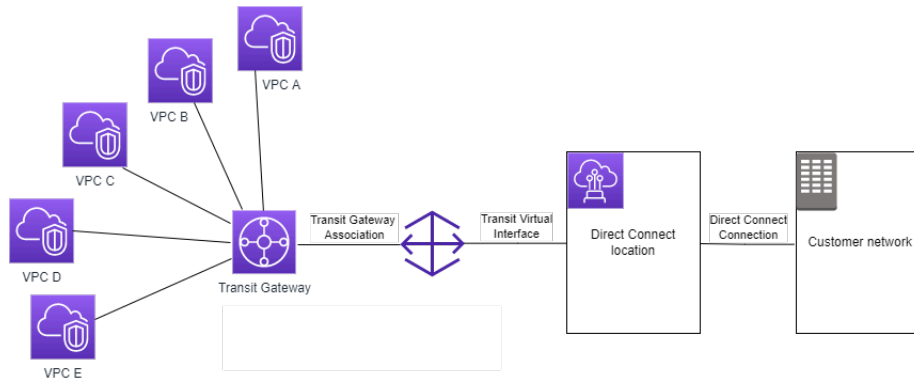
1. Verify that the user has the correct permissions to create service-linked roles. For more information, see [Service-linked role permissions](#) in the *IAM User Guide*. After the user has the permissions, create the VPC attachment.
2. Create the VPC attachment manually through the console or API. For more information, see [the section called "Create a transit gateway attachment to a VPC" \(p. 37\)](#).
3. Verify that the service-linked role has the correct permissions. For more information, see [the section called "Transit gateway" \(p. 103\)](#).
4. Verify that the transit gateway is in the available state. For more information, see [the section called "View your transit gateways" \(p. 30\)](#).

Transit gateway attachments to a Direct Connect gateway

Attach a transit gateway to a Direct Connect gateway using a transit virtual interface. This configuration offers the following benefits. You can:

- Manage a single connection for multiple VPCs or VPNs that are in the same Region.
- Advertise prefixes from on-premises to AWS and from AWS to on-premises.

The following diagram illustrates how the Direct Connect gateway enables you to create a single connection to your Direct Connect connection that all of your VPCs can use.



The solution involves the following components:

- A transit gateway.
- A Direct Connect gateway.
- An association between the Direct Connect gateway and the transit gateway.
- A transit virtual interface that is attached to the Direct Connect gateway.

For information about configuring Direct Connect gateways with transit gateways, see [Transit gateway associations](#) in the *AWS Direct Connect User Guide*.

Transit gateway VPN attachments

To attach a VPN connection to your transit gateway, you must specify the customer gateway. For more information about the requirements for a customer gateway device, see [Requirements for your customer gateway device](#) in the *AWS Site-to-Site VPN User Guide*.

For static VPNs, add the static routes to the transit gateway route table.

Create a transit gateway attachment to a VPN

To create a VPN attachment using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Attachments**.
3. Choose **Create transit gateway attachment**.
4. For **Transit gateway ID**, choose the transit gateway for the attachment. You can choose a transit gateway that you own.
5. For **Attachment type**, choose **VPN**.
6. For **Customer Gateway**, do one of the following:

- To use an existing customer gateway, choose **Existing**, and then select the gateway to use.

If your customer gateway is behind a network address translation (NAT) device that's enabled for NAT traversal (NAT-T), use the public IP address of your NAT device, and adjust your firewall rules to unblock UDP port 4500.

- To create a customer gateway, choose **New**, then for **IP Address**, type a static public IP address and **BGP ASN**.

For **Routing options**, choose whether to use **Dynamic** or **Static**. For more information, see [Site-to-Site VPN Routing Options](#) in the *AWS Site-to-Site VPN User Guide*.

7. For **Tunnel Options**, enter the CIDR ranges and pre-shared keys for your tunnel. For more information, see [Site-to-Site VPN architectures](#).
8. Choose **Create transit gateway attachment**.

To create a VPN attachment using the AWS CLI

Use the [create-vpn-connection](#) command.

View your VPN attachments

To view your VPN attachments using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Attachments**.
3. In the **Resource type** column, look for **VPN**. These are the VPN attachments.
4. Choose an attachment to view its details or to add tags.

To view your VPN attachments using the AWS CLI

Use the [describe-transit-gateway-attachments](#) command.

Transit gateway peering attachments

You can peer both Intra-Region and Inter-Region transit gateways, and route traffic between them, which includes IPv4 and IPv6 traffic. To do this, create a peering attachment on your transit gateway, and specify a transit gateway. The peer transit gateway can be in your account or a different AWS account.

After you create a peering attachment request, the owner of the peer transit gateway (also referred to as the *accepter transit gateway*) must accept the request. To route traffic between the transit gateways, add a static route to the transit gateway route table that points to the transit gateway peering attachment.

We recommend using unique ASNs for the peered transit gateways to take advantage of future route propagation capabilities.

Transit gateway peering does not support resolving public or private IPv4 DNS host names to private IPv4 addresses across VPCs on either side of the transit gateway peering attachment.

Inter-Region gateway peering uses the same network infrastructure as VPC peering. Therefore traffic is encrypted using AES-256 encryption at the virtual network layer as it travels between Regions. Traffic is also encrypted using AES-256 encryption at the physical layer when it traverses network links that are outside of the physical control of AWS. As a result, traffic is double encrypted on network links outside the physical control of AWS. Within the same Region, traffic is encrypted at the physical layer only when it traverses network links that are outside of the physical control of AWS.

For information about which Regions support transit gateway peering attachments, see [AWS Transit Gateways FAQs](#).

Create a peering attachment

Before you begin, ensure that you have the ID of the transit gateway that you want to attach. If the transit gateway is in another AWS account, ensure that you have the AWS account ID of the owner of the transit gateway.

After you create the peering attachment, the owner of the accepter transit gateway must accept the attachment request.

To create a peering attachment using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Attachments**.
3. Choose **Create transit gateway attachment**.
4. For **Transit gateway ID**, choose the transit gateway for the attachment. You can choose a transit gateway that you own or a transit gateway that was shared with you.
5. For **Attachment type**, choose **Peering Connection**.
6. Optionally enter a name tag for the attachment.
7. For **Account**, do one of the following:
 - If the transit gateway is in your account, choose **My account**.
 - If the transit gateway is in different AWS account, choose **Other account**. For **Account ID**, enter the AWS account ID.
8. For **Region**, choose the Region that the transit gateway is located in.
9. For **Transit gateway (accepter)**, enter the ID of the transit gateway that you want to attach.
10. Choose **Create transit gateway attachment**.

To create a peering attachment using the AWS CLI

Use the `create-transit-gateway-peering-attachment` command.

Accept or reject a peering attachment request

To activate the peering attachment, the owner of the accepter transit gateway must accept the peering attachment request. This is required even if both transit gateways are in the same account. The peering attachment must be in the `pendingAcceptance` state. Accept the peering attachment request from the Region that the accepter transit gateway is located in.

Alternatively, you can reject any peering connection request that you've received that's in the `pendingAcceptance` state. You must reject the request from the Region that the accepter transit gateway is located in.

To accept a peering attachment request using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Attachments**.
3. Select the transit gateway peering attachment that's pending acceptance.
4. Choose **Actions, Accept transit gateway attachment**.
5. Add the static route to the transit gateway route table. For more information, see [the section called "Create a static route" \(p. 53\)](#).

To reject a peering attachment request using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Attachments**.
3. Select the transit gateway peering attachment that's pending acceptance.
4. Choose **Actions, Reject transit gateway attachment**.

To accept or reject a peering attachment using the AWS CLI

Use the [accept-transit-gateway-peering-attachment](#) and [reject-transit-gateway-peering-attachment](#) commands.

Add a route to the transit gateway route table

To route traffic between the peered transit gateways, you must add a static route to the transit gateway route table that points to the transit gateway peering attachment. The owner of the accepter transit gateway must also add a static route to their transit gateway's route table.

To create a static route using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Route Tables**.
3. Select the route table for which to create a route.
4. Choose **Actions**, **Create static route**.
5. On the **Create static route** page, enter the CIDR block for which to create the route. For example, specify the CIDR block of a VPC that's attached to the peer transit gateway.
6. Choose the peering attachment for the route.
7. Choose **Create static route**.

To create a static route using the AWS CLI

Use the [create-transit-gateway-route](#) command.

Important

After you create the route, associate the transit gateway route table with the transit gateway peering attachment. For more information, see [the section called "Associate a transit gateway route table"](#) (p. 51).

View your transit gateway peering connection attachments

You can view your transit gateway peering attachments and information about them.

To view your peering attachments using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Attachments**.
3. In the **Resource type** column, look for **Peering**. These are the peering attachments.
4. Choose an attachment to view its details.

To view your transit gateway peering attachments using the AWS CLI

Use the [describe-transit-gateway-peering-attachments](#) command.

Delete a peering attachment

You can delete a transit gateway peering attachment. The owner of either of the transit gateways can delete the attachment.

To delete a peering attachment using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Attachments**.
3. Select the transit gateway peering attachment.
4. Choose **Actions, Delete transit gateway attachment**.
5. Enter **delete** and choose **Delete**.

To delete a peering attachment using the AWS CLI

Use the `delete-transit-gateway-peering-attachment` command.

Opt-in AWS Region considerations

You can peer transit gateways across opt-in Region boundaries. For information about these Regions, and how to opt in, see [Managing AWS Regions](#) in the *Amazon Web Services General Reference*. Take the following into consideration when you use transit gateway peering in these Regions:

- You can peer into an opt-in Region as long as the account that accepts the peering attachment has opted into that Region.
- Regardless of the Region opt-in status, AWS shares the following account data with the account that accepts the peering attachment:
 - AWS account ID
 - Transit gateway ID
 - Region code
- When you delete the transit gateway attachment, the above account data is deleted.
- We recommend that you delete the transit gateway peering attachment before you opt out of the Region. If you do not delete the peering attachment, traffic might continue to go over the attachment and you continue to incur charges. If you do not delete the attachment, you can opt back in, and then delete the attachment.
- In general, the transit gateway has a sender pays model. By using a transit gateway peering attachment across an opt in boundary, you might incur charges in a Region accepting the attachment, including those Regions you have not opted into. For more information, see [AWS Transit Gateway Pricing](#).

Transit gateway Connect attachments and Transit Gateway Connect peers

You can create a *transit gateway Connect attachment* to establish a connection between a transit gateway and third-party virtual appliances (such as SD-WAN appliances) running in a VPC. A Connect attachment supports the Generic Routing Encapsulation (GRE) tunnel protocol for high performance, and Border Gateway Protocol (BGP) for dynamic routing. After you create a Connect attachment, you can create one or more GRE tunnels (also referred to as *Transit Gateway Connect peers*) on the Connect attachment to connect the transit gateway and the third-party appliance. You establish two BGP sessions over the GRE tunnel to exchange routing information.

Important

A Transit Gateway Connect peer consists of two BGP peering sessions terminating on AWS-managed infrastructure. The two BGP peering sessions provide routing plane redundancy, ensuring that losing one BGP peering session does not impact your routing operation. The routing information received from both BGP sessions is accumulated for the given Connect peer.

The two BGP peering sessions also protect against any AWS infrastructure operations such as routine maintenance, patching, hardware upgrades, and replacements. If your Connect peer is operating without the recommended dual BGP peering session configured for redundancy, it might experience a momentary loss of connectivity during AWS infrastructure operations. We strongly recommend that you configure both the BGP peering sessions on your Connect peer. If you have configured multiple Connect peers to support high availability on the appliance side, we strongly recommend that you configure both the BGP peering sessions on each of your Connect peers.

A Connect attachment uses an existing VPC or AWS Direct Connect attachment as the underlying transport mechanism. This is referred to as the *transport attachment*. The transit gateway identifies matched GRE packets from the third-party appliance as traffic from the Connect attachment. It treats any other packets, including GRE packets with incorrect source or destination information, as traffic from the transport attachment.

Contents

- [Transit Gateway Connect peers \(p. 45\)](#)
- [Requirements and considerations \(p. 47\)](#)
- [Create a transit gateway Connect attachment \(p. 48\)](#)
- [Create a Transit Gateway Connect peer \(GRE tunnel\) \(p. 48\)](#)
- [View your transit gateway Connect attachments and Transit Gateway Connect peers \(p. 49\)](#)
- [Modify your Connect attachment and Transit Gateway Connect peer tags \(p. 49\)](#)
- [Delete a Transit Gateway Connect peer \(p. 50\)](#)
- [Delete a transit gateway Connect attachment \(p. 50\)](#)

Transit Gateway Connect peers

A Transit Gateway Connect peer (GRE tunnel) consists of the following components.

Inside CIDR blocks (BGP addresses)

The inside IP addresses that are used for BGP peering. You must specify a /29 CIDR block from the 169.254.0.0/16 range for IPv4. You can optionally specify a /125 CIDR block from the fd00::/8 range for IPv6. The following CIDR blocks are reserved and cannot be used:

- 169.254.0.0/29
- 169.254.1.0/29
- 169.254.2.0/29
- 169.254.3.0/29
- 169.254.4.0/29
- 169.254.5.0/29
- 169.254.169.248/29

You must configure the first address from the IPv4 range on the appliance as the BGP IP address. When you use IPv6, if your inside CIDR block is fd00::/125, then you must configure the first address in this range (fd00::1) on the tunnel interface of the appliance.

The BGP addresses must be unique across all tunnels on a transit gateway.

Peer IP address

The peer IP address (GRE outer IP address) on the appliance side of the Transit Gateway Connect peer. This can be any IP address. The IP address can be an IPv4 or IPv6 address, but it must be the same IP address family as the transit gateway address.

Transit gateway address

The peer IP address (GRE outer IP address) on the transit gateway side of the Transit Gateway Connect peer. The IP address must be specified from the transit gateway CIDR block, and must be unique across Connect attachments on the transit gateway. If you don't specify an IP address, we use the first available address from the transit gateway CIDR block.

You can add a transit gateway CIDR block when you [create \(p. 29\)](#) or [modify \(p. 31\)](#) a transit gateway.

The IP address can be an IPv4 or IPv6 address, but it must be the same IP address family as the peer IP address.

The peer IP address and transit gateway address are used to uniquely identify the GRE tunnel. You can reuse either address across multiple tunnels, but not both in the same tunnel.

Transit Gateway Connect for the BGP peering only supports Multiprotocol BGP (MP-BGP), where IPv4 Unicast addressing is required to also establish a BGP session for IPv6 Unicast. You can use both IPv4 and IPv6 addresses for the GRE outer IP addresses.

The following example shows a Connect attachment between a transit gateway and an appliance in a VPC.

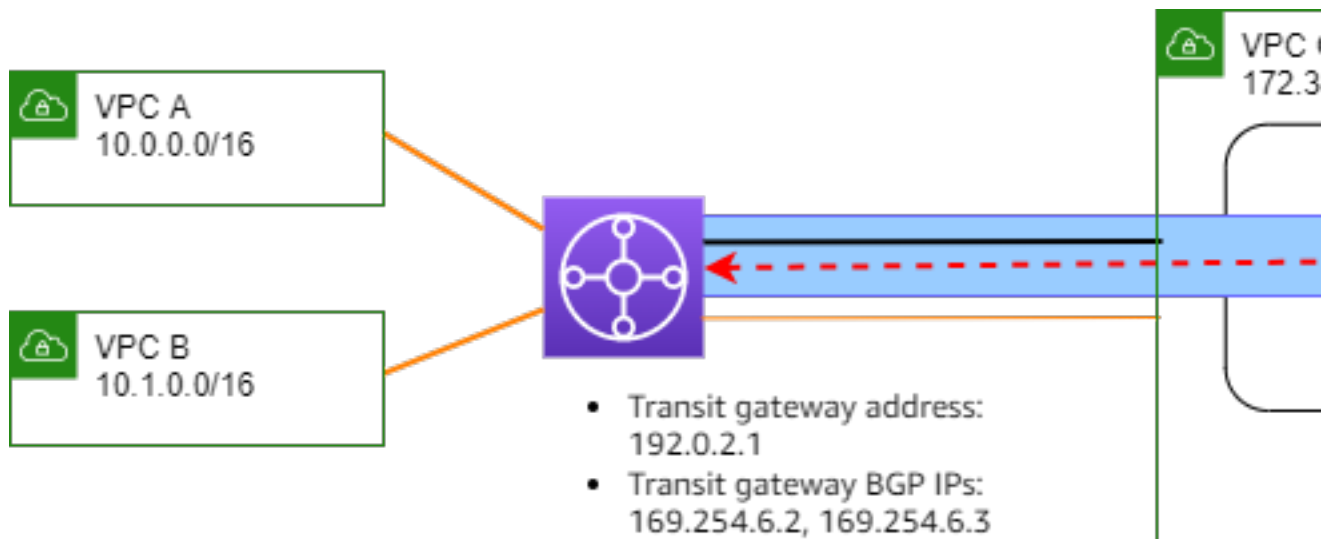






Diagram component	Description
	VPC attachment
	Connect attachment
	GRE tunnel (Transit Gateway Connect peer)
	BGP peering session

In the preceding example, a transit gateway Connect attachment is created on an existing VPC attachment (the transport attachment). A Transit Gateway Connect peer is created on the Connect attachment to establish a connection to an appliance in the VPC. The transit gateway address is 192.0.2.1, and the range of BGP addresses is 169.254.6.0/29. The first IP address in the range (169.254.6.1) is configured on the appliance as the peer BGP IP address.

The subnet route table for VPC C has a route that points traffic destined for the transit gateway CIDR block to the transit gateway.

Destination	Target
172.31.0.0/16	Local
192.0.2.0/24	<i>tgw-id</i>

Requirements and considerations

The following are the requirements and considerations for a Connect attachment.

- For information about what Regions support Connect attachments, see [AWS Transit Gateways FAQs](#).
- The third-party appliance must be configured to send and receive traffic over a GRE tunnel to and from the transit gateway using the Connect attachment.
- The third-party appliance must be configured to use BGP for dynamic route updates and health checks.
- The following types of BGP are supported:
 - Exterior BGP (eBGP): Used for connecting to routers that are in a different autonomous system than the transit gateway. If you use eBGP, you must configure `ebgp-multihop` with a time-to-live (TTL) value of 2.
 - Interior BGP (iBGP): Used for connecting to routers that are in the same autonomous system as the transit gateway. The transit gateway will not install routes from an iBGP peer (third-party appliance), unless the routes are originated from an eBGP peer. The routes advertised by third-party appliance over the iBGP peering must have an ASN.
 - MP-BGP (multiprotocol extensions for BGP): Used for supporting multiple protocol types, such as IPv4 and IPv6 address families.
- The default BGP keep-alive timeout is 10 seconds and the default hold timer is 30 seconds.
- IPv6 BGP peering is not supported; only IPv4-based BGP peering is supported. IPv6 prefixes are exchanged over IPv4 BGP peering using MP-BGP.
- Bidirectional Forwarding Detection (BFD) is not supported.
- BGP graceful restart is supported.
- When you create a transit gateway peer, if you do not specify a peer ASN number, we pick the transit gateway ASN number. This means that your appliance and transit gateway will be in the same autonomous system doing iBGP.
- To use equal-cost multi-path (ECMP) routing between multiple appliances, you must configure the appliance to advertise the same prefixes to the transit gateway with the same BGP AS-PATH attribute. For the transit gateway to choose all of the available ECMP paths, the AS-PATH and Autonomous System Number (ASN) must match. The transit gateway can use ECMP between Transit Gateway Connect peers for the same Connect attachment or between Connect attachments on the same transit gateway. The transit gateway cannot use ECMP between both of the redundant BGP peerings a single peer establishes to it.
- With a Connect attachment, the routes are propagated to a transit gateway route table by default.

- Static routes are not supported.

Create a transit gateway Connect attachment

To create a Connect attachment, you must specify an existing attachment as the transport attachment. You can specify a VPC attachment or an AWS Direct Connect attachment as the transport attachment.

To create a Connect attachment using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. In the navigation pane, choose **Transit Gateway Attachments**.
3. Choose **Create transit gateway attachment**.
4. (Optional) For **Name tag**, specify a name tag for the attachment.
5. For **Transit gateway ID**, choose the transit gateway for the attachment.
6. For **Attachment type**, choose **Connect**.
7. For **Transport attachment ID**, choose the ID of an existing attachment (the transport attachment).
8. Choose **Create transit gateway attachment**.

To create a Connect attachment using the AWS CLI

Use the `create-transit-gateway-connect` command.

Create a Transit Gateway Connect peer (GRE tunnel)

You can create a Transit Gateway Connect peer (GRE tunnel) for an existing Connect attachment. Before you begin, ensure that you have configured a transit gateway CIDR block. You can configure a transit gateway CIDR block when you [create](#) (p. 29) or [modify](#) (p. 31) a transit gateway.

When you create the Transit Gateway Connect peer, you must specify the GRE outer IP address on the appliance side of the Transit Gateway Connect peer.

To create a Transit Gateway Connect peer using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. In the navigation pane, choose **Transit Gateway Attachments**.
3. Select the Connect attachment, and choose **Actions, Create connect peer**.
4. (Optional) For **Name tag**, specify a name tag for the Transit Gateway Connect peer.
5. (Optional) For **Transit gateway GRE Address**, specify the GRE outer IP address for the transit gateway. By default, the first available address from the transit gateway CIDR block is used.
6. For **Peer GRE address**, specify the GRE outer IP address for the appliance side of the Transit Gateway Connect peer.
7. For **BGP Inside CIDR blocks IPv4**, specify the range of inside IPv4 addresses that are used for BGP peering. Specify a /29 CIDR block from the 169.254.0.0/16 range.
8. (Optional) For **BGP Inside CIDR blocks IPv6**, specify the range of inside IPv6 addresses that are used for BGP peering. Specify a /125 CIDR block from the fd00:::/8 range.
9. (Optional) For **Peer ASN**, specify the Border Gateway Protocol (BGP) Autonomous System Number (ASN) for the appliance. You can use an existing ASN assigned to your network. If you do not have one, you can use a private ASN in the 64512–65534 (16-bit ASN) or 4200000000–4294967294 (32-bit ASN) range.

The default is the same ASN as the transit gateway. If you configure the **Peer ASN** to be different than the transit gateway ASN (eBGP), you must configure `ebgp-multihop` with a time-to-live (TTL) value of 2.

10. Choose **Create connect peer**.

To create a Transit Gateway Connect peer using the AWS CLI

Use the `create-transit-gateway-connect-peer` command.

View your transit gateway Connect attachments and Transit Gateway Connect peers

You can view your transit gateway Connect attachments and Transit Gateway Connect peers.

To view your Connect attachments and Transit Gateway Connect peers using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. In the navigation pane, choose **Transit Gateway Attachments**.
3. Select the Connect attachment.
4. To view the Transit Gateway Connect peers for the attachment, choose the **Connect Peers** tab.

To view your Connect attachments and Transit Gateway Connect peers using the AWS CLI

Use the `describe-transit-gateway-connects` and `describe-transit-gateway-connect-peers` commands.

Modify your Connect attachment and Transit Gateway Connect peer tags

You can modify the tags for your Connect attachment.

To modify your Connect attachment tags using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. In the navigation pane, choose **Transit Gateway Attachments**.
3. Select the Connect attachment, and then choose **Actions, Manage tags**.
4. To add a tag, choose **Add new tag** and specify the key name and key value.
5. To remove a tag, choose **Remove**.
6. Choose **Save**.

You can modify the tags for your Transit Gateway Connect peer.

To modify your Transit Gateway Connect peer tags using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. In the navigation pane, choose **Transit Gateway Attachments**.
3. Select the Connect attachment, and then choose **Connect peers**.
4. Select the Transit Gateway Connect peer and then choose **Actions, Manage tags**.
5. To add a tag, choose **Add new tag** and specify the key name and key value.

6. To remove a tag, choose **Remove**.
7. Choose **Save**.

To modify your Connect attachment and Transit Gateway Connect peer tags using the AWS CLI

Use the [create-tags](#) and [delete-tags](#) commands.

Delete a Transit Gateway Connect peer

If you no longer need a Transit Gateway Connect peer, you can delete it.

To delete a Transit Gateway Connect peer using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. In the navigation pane, choose **Transit Gateway Attachments**.
3. Select the Connect attachment.
4. In the **Connect Peers** tab, select the Transit Gateway Connect peer and choose **Actions, Delete connect peer**.

To delete a Transit Gateway Connect peer using the AWS CLI

Use the [delete-transit-gateway-connect-peer](#) command.

Delete a transit gateway Connect attachment

If you no longer need a transit gateway Connect attachment, you can delete it. You must first delete any Transit Gateway Connect peers for the attachment.

To delete a Connect attachment using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. In the navigation pane, choose **Transit Gateway Attachments**.
3. Select the Connect attachment, and choose **Actions, Delete transit gateway attachment**.
4. Enter **delete** and choose **Delete**.

To delete a Connect attachment using the AWS CLI

Use the [delete-transit-gateway-connect](#) command.

Transit gateway route tables

Use transit gateway route tables to configure routing for your transit gateway attachments.

Create a transit gateway route table

To create a transit gateway route table using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Route Tables**.

3. Choose **Create transit gateway route table**.
4. (Optional) For **Name tag**, type a name for the transit gateway route table. This creates a tag with the tag key "Name", where the tag value is the name that you specify.
5. For **Transit gateway ID**, select the transit gateway for the route table.
6. Choose **Create transit gateway route table**.

To create a transit gateway route table using the AWS CLI

Use the [create-transit-gateway-route-table](#) command.

View transit gateway route tables

To view your transit gateway route tables using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Route Tables**.
3. (Optional) To find a specific route table or set of tables, enter all or part of the name, keyword, or attribute in the filter field.
4. Select the check box for a route table, or choose its ID, to display information about its associations, propagations, routes, and tags.

To view your transit gateway route tables using the AWS CLI

Use the [describe-transit-gateway-route-tables](#) command.

To view the routes for a transit gateway route table using the AWS CLI

Use the [search-transit-gateway-routes](#) command.

To view the route propagations for a transit gateway route table using the AWS CLI

Use the [get-transit-gateway-route-table-propagations](#) command.

To view the associations for a transit gateway route table using the AWS CLI

Use the [get-transit-gateway-route-table-associations](#) command.

Associate a transit gateway route table

You can associate a transit gateway route table with a transit gateway attachment.

To associate a transit gateway route table using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Route Tables**.
3. Select the route table.
4. In the lower part of the page, choose the **Associations** tab.
5. Choose **Create association**.
6. Choose the attachment to associate and then choose **Create association**.

To associate a transit gateway route table using the AWS CLI

Use the [associate-transit-gateway-route-table](#) command.

Delete an association for a transit gateway route table

You can disassociate a transit gateway route table from a transit gateway attachment.

To disassociate a transit gateway route table using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Route Tables**.
3. Select the route table.
4. In the lower part of the page, choose the **Associations** tab.
5. Choose the attachment to disassociate and then choose **Delete association**.
6. When prompted for confirmation, choose **Delete association**.

To disassociate a transit gateway route table using the AWS CLI

Use the [disassociate-transit-gateway-route-table](#) command.

Propagate a route to a transit gateway route table

Use route propagation to add a route from an attachment to a route table.

To propagate a route to a transit gateway attachment route table

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Route Tables**.
3. Select the route table for which to create a propagation.
4. Choose **Actions**, **Create propagation**.
5. On the **Create propagation** page, choose the attachment.
6. Choose **Create propagation**.

To enable route propagation using the AWS CLI

Use the [enable-transit-gateway-route-table-propagation](#) command.

Disable route propagation

Remove a propagated route from a route table attachment.

To disable route propagation using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Route Tables**.
3. Select the route table to delete the propagation from.
4. On the lower part of the page, choose the **Propagations** tab.
5. Select the attachment and then choose **Delete propagation**.

6. When prompted for confirmation, choose **Delete propagation**.

To disable route propagation using the AWS CLI

Use the [disable-transit-gateway-route-table-propagation](#) command.

Create a static route

You can create a static route for a VPC, VPN, or transit gateway peering attachment, or you can create a blackhole route that drops traffic that matches the route.

Static routes in a transit gateway route table that target a VPN attachment are not filtered by the Site-to-Site VPN. This might allow unintended outbound traffic flow when using a BGP-based VPN.

To create a static route using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Route Tables**.
3. Select the route table for which to create a route.
4. Choose **Actions, Create static route**.
5. On the **Create static route** page, enter the CIDR block for which to create the route, and then choose **Active**.
6. Choose the attachment for the route.
7. Choose **Create static route**.

To create a blackhole route using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Route Tables**.
3. Select the route table for which to create a route.
4. Choose **Actions, Create static route**.
5. On the **Create static route** page, enter the CIDR block for which to create the route, and then choose **Blackhole**.
6. Choose **Create static route**.

To create a static route or blackhole route using the AWS CLI

Use the [create-transit-gateway-route](#) command.

Delete a static route

You can delete static routes from a transit gateway route table.

To delete a static route using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Route Tables**.
3. Select the route table for which to delete the route, and choose **Routes**.
4. Choose the route to delete.
5. Choose **Delete static route**.

6. In the confirmation box, choose **Delete static route**.

To delete a static route using the AWS CLI

Use the `delete-transit-gateway-route` command.

Export route tables to Amazon S3

You can export the routes in your transit gateway route tables to an Amazon S3 bucket. The routes are saved to the specified Amazon S3 bucket in a JSON file.

To export transit gateway route tables using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Route Tables**.
3. Choose the route table that includes the routes to export.
4. Choose **Actions, Export routes**.
5. On the **Export routes** page, for **S3 bucket name**, type the name of the S3 bucket.
6. To filter the routes exported, specify filter parameters in the **Filters** section of the page.
7. Choose **Export routes**.

To access the exported routes, open the Amazon S3 console at <https://console.aws.amazon.com/s3/>, and navigate to the bucket that you specified. The file name includes the AWS account ID, AWS Region, route table ID, and a timestamp. Select the file and choose **Download**. The following is an example of a JSON file that contains information about two propagated routes for VPC attachments.

```
{
  "filter": [
    {
      "name": "route-search.subnet-of-match",
      "values": [
        "0.0.0.0/0",
        "::/0"
      ]
    }
  ],
  "routes": [
    {
      "destinationCidrBlock": "10.0.0.0/16",
      "transitGatewayAttachments": [
        {
          "resourceId": "vpc-0123456abcd123456",
          "transitGatewayAttachmentId": "tgw-attach-1122334455aabbcc1",
          "resourceType": "vpc"
        }
      ],
      "type": "propagated",
      "state": "active"
    },
    {
      "destinationCidrBlock": "10.2.0.0/16",
      "transitGatewayAttachments": [
        {
          "resourceId": "vpc-abcabc123123abca",
          "transitGatewayAttachmentId": "tgw-attach-6677889900aabbcc7",
          "resourceType": "vpc"
        }
      ]
    }
  ]
}
```

```
    "type": "propagated",  
    "state": "active"  
  }  
]  
}
```

Delete a transit gateway route table

To delete a transit gateway route table using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Route Tables**.
3. Select the route table to delete.
4. Choose **Actions**, **Delete transit gateway route table**.
5. Enter **delete** and choose **Delete** to confirm the deletion.

To delete a transit gateway route table using the AWS CLI

Use the [delete-transit-gateway-route-table](#) command.

Prefix list references

You can reference a *prefix list* in your transit gateway route table. A prefix list is a set of one or more CIDR block entries that you define and manage. You can use a prefix list to simplify the management of the IP addresses that you reference in your resources to route network traffic. For example, if you frequently specify the same destination CIDRs across multiple transit gateway route tables, you can manage those CIDRs in a single prefix list, instead of repeatedly referencing the same CIDRs in each route table. If you need to remove a destination CIDR block, you can remove its entry from the prefix list instead of removing the route from every affected route table.

When you create a prefix list reference in your transit gateway route table, each entry in the prefix list is represented as a route in your transit gateway route table.

For more information about prefix lists, see [Prefix lists](#) in the *Amazon VPC User Guide*.

Create a prefix list reference

You can create a reference to a prefix list in your transit gateway route table.

To create a prefix list reference using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. In the navigation pane, choose **Transit Gateway Route Tables**.
3. Select the transit gateway route table.
4. Choose **Actions**, **Create prefix list reference**.
5. For **Prefix list ID**, choose the ID of the prefix list.
6. For **Type**, choose if traffic to this prefix list should be allowed (**Active**) or dropped (**Blackhole**).
7. For **Transit gateway attachment ID**, choose the ID of the attachment to which to route traffic.
8. Choose **Create prefix list reference**.

To create a prefix list reference using the AWS CLI

Use the [create-transit-gateway-prefix-list-reference](#) command.

View prefix list references

You can view the prefix list references in your transit gateway route table. You can also view each entry in the prefix list as an individual route in your transit gateway route table. The route type for a prefix list route is propagated.

To view a prefix list reference using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. In the navigation pane, choose **Transit Gateway Route Tables**.
3. Select the transit gateway route table.
4. In the lower pane, choose **Prefix list references**. The prefix list references are listed.
5. Choose **Routes**. Each prefix list entry is listed as a route in the route table.

To view a prefix list reference using the AWS CLI

Use the [get-transit-gateway-prefix-list-references](#) command.

Modify a prefix list reference

You can modify a prefix list reference by changing the attachment that the traffic is routed to, or indicating whether to drop traffic that matches the route.

You cannot modify the individual routes for a prefix list in the **Routes** tab. To modify the entries in the prefix list, use the **Managed Prefix Lists** screen. For more information, see [Modifying a prefix list](#) in the *Amazon VPC User Guide*.

To modify a prefix list reference using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. In the navigation pane, choose **Transit Gateway Route Tables**.
3. Select the transit gateway route table.
4. In the lower pane, choose **Prefix list references**.
5. Choose the prefix list reference, and choose **Modify references**.
6. For **Type**, choose if traffic to this prefix list should be allowed (**Active**) or dropped (**Blackhole**).
7. For **Transit gateway attachment ID**, choose the ID of the attachment to which to route traffic.
8. Choose **Modify prefix list reference**.

To modify a prefix list reference using the AWS CLI

Use the [modify-transit-gateway-prefix-list-reference](#) command.

Delete a prefix list reference

If you no longer need a prefix list reference, you can delete it from your transit gateway route table. Deleting the reference does not delete the prefix list.

To delete a prefix list reference using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.

2. In the navigation pane, choose **Transit Gateway Route Tables**.
3. Select the transit gateway route table.
4. Choose the prefix list reference, and choose **Delete references**.
5. Choose **Delete references**.

To delete a prefix list reference using the AWS CLI

Use the [delete-transit-gateway-prefix-list-reference](#) command.

Transit gateway policy tables

Transit gateway dynamic routing uses policy tables to route network traffic for AWS Cloud WAN. The table contains policy rules for matching network traffic by policy attributes, and then maps the traffic that matches the rule to a target route table.

Note

Transit gateway policy tables are currently only supported in Cloud WAN when creating a transit gateway peering connection. When creating a peering connection, you can associate that table with the connection. The association then populates the table automatically with the policy rules.

For more information about peering connections in Cloud WAN, see [Peerings](#) in the *AWS Cloud WAN User Guide*.

Create a transit gateway policy table

To create a transit gateway policy table using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit gateway policy table**.
3. Choose **Create transit gateway policy table**.
4. (Optional) For **Name tag**, enter a name for the transit gateway policy table. This creates a tag, where the tag value is the name that you specify.
5. For Transit gateway ID, select the transit gateway for the policy table.
6. Choose **Create transit gateway policy table**.

To create a transit gateway policy table using the AWS CLI

Use the [create-transit-gateway-policy-table](#) command.

Delete a transit gateway policy table

Delete a transit gateway policy table. When a table is deleted, all policy rules within that table are deleted.

To delete a transit gateway policy table using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit gateway policy tables**.
3. Choose the transit gateway policy table to delete.
4. Choose **Actions**, and then choose **Delete policy table**.

5. Confirm that you want to delete the table.

To delete a transit gateway policy table using the AWS CLI

Use the `delete-transit-gateway-policy-table` command.

Multicast on transit gateways

Multicast is a communication protocol used for delivering a single stream of data to multiple receiving computers simultaneously. Transit Gateway supports routing multicast traffic between subnets of attached VPCs, and it serves as a multicast router for instances sending traffic destined for multiple receiving instances.

Multicast concepts

The following are the key concepts for multicast:

- **Multicast domain** — Allows segmentation of a multicast network into different domains, and makes the transit gateway act as multiple multicast routers. You define multicast domain membership at the subnet level.
- **Multicast group** — Identifies a set of hosts that will send and receive the same multicast traffic. A multicast group is identified by a group IP address. Multicast group membership is defined by individual elastic network interfaces attached to EC2 instances.
- **Internet Group Management Protocol (IGMP)** — An internet protocol that allows hosts and routers to dynamically manage multicast group membership. An IGMP multicast domain contains hosts that use the IGMP protocol to join, leave, and send messages. AWS supports the IGMPv2 protocol and both IGMP and static (API-based) group membership multicast domains.
- **Multicast source** — An elastic network interface associated with a supported EC2 instance that is statically configured to send multicast traffic. A multicast source only applies to static source configurations.

A static source multicast domain contains hosts that do not use the IGMP protocol to join, leave, and send messages. You use the AWS CLI to add a source and group members. The statically-added source sends multicast traffic and the members receive multicast traffic.

- **Multicast group member** — An elastic network interface associated with a supported EC2 instance that receives multicast traffic. A multicast group has multiple group members. In a static source group membership configuration, multicast group members can only receive traffic. In an IGMP group configuration, members can both send and receive traffic.

Considerations

- For information about supported Regions, see [AWS Transit Gateway FAQs](#).
- You must create a new transit gateway to support multicast.
- Multicast group membership is managed using the Amazon Virtual Private Cloud Console or the AWS CLI, or IGMP.
- A subnet can only be in one multicast domain.
- If you use a non-Nitro instance, you must disable the **Source/Dest** check. For information about disabling the check, see [Changing the source or destination checking](#) in the *Amazon EC2 User Guide for Linux Instances*.

- A non-Nitro instance cannot be a multicast sender.
- Multicast routing is not supported over AWS Direct Connect, Site-to-Site VPN, peering attachments, or transit gateway Connect attachments.
- A transit gateway does not support fragmentation of multicast packets. Fragmented multicast packets are dropped. For more information, see [MTU \(p. 108\)](#).
- At startup, an IGMP host sends multiple IGMP JOIN messages to join a multicast group (typically 2 to 3 retries). In the unlikely event that all the IGMP JOIN messages get lost, the host will not become part of transit gateway multicast group. In such a scenario you will need to re-trigger the IGMP JOIN message from the host using application specific methods.
- A group membership starts with the receipt of IGMPv2 JOIN message by the transit gateway and ends with the receipt of the IGMPv2 LEAVE message. The transit gateway keeps track of hosts that successfully joined the group. As a cloud multicast router, transit gateway issues an IGMPv2 QUERY message to all members every two minutes. Each member sends an IGMPv2 JOIN message in response, which is how the members renew their membership. If a member fails to reply to three consecutive queries, the transit gateway removes this membership from all joined groups. However, it continues sending queries to this member for 12 hours before permanently removing the member from its to-be-queried list. An explicit IGMPv2 LEAVE message immediately and permanently removes the host from any further multicast processing.
- The transit gateway keeps track of hosts that successfully joined the group. In the event of a transit gateway outage, the transit gateway continues to send multicast data to the host for seven minutes (420 seconds) after the last successful IGMP JOIN message. The transit gateway continues to send membership queries to the host for up to 12 hours or until it receives a IGMP LEAVE message from the host.
- The transit gateway sends membership query packets to all the IGMP members so that it can track multicast group membership. The source IP of these IGMP query packets is 0.0.0.0/32, and the destination IP is 224.0.0.1/32 and the protocol is 2. Your security group configuration on the IGMP hosts (instances), and any ACLs configuration on the host subnets must allow these IGMP protocol messages.
- When the multicast source and destination are in the same VPC, you cannot use security group referencing to set the destination security group to accept traffic from the source's security group.

Multicast routing

When you enable multicast on a transit gateway, it acts as a multicast router. When you add a subnet to a multicast domain, we send all multicast traffic to the transit gateway that is associated with that multicast domain.

Network ACLs

Network ACL rules operate at the subnet level. They apply to multicast traffic, because transit gateways reside outside of the subnet. For more information, see [Network ACLs](#) in the *Amazon VPC User Guide*.

For Internet Group Management Protocol (IGMP) multicast traffic, you must have the following inbound rules at a minimum. The remote host is the host sending the multicast traffic.

Type	Protocol	Source	Destination	Description
Custom Protocol	IGMP(2)	0.0.0.0/32	224.0.0.1/32	IGMP query
Custom UDP Protocol	UDP	Remote host IP address	Multicast group IP address	Inbound multicast traffic

For IGMP multicast traffic, you must have the following outbound rules at a minimum.

Type	Protocol	Source	Destination	Description
Custom Protocol	IGMP(2)	Host IP address	224.0.0.2/32	IGMP leave
Custom Protocol	IGMP(2)	Host IP address	Multicast group IP address	IGMP join
Custom UDP Protocol	UDP	Host IP address	Multicast group IP address	Outbound multicast traffic

Security groups

Security group rules operate at the instance level. They can be applied to both inbound and outbound multicast traffic. The behavior is the same as with unicast traffic. For all group member instances, you must allow inbound traffic from the group source. For more information, see [Security groups](#) in the *Amazon VPC User Guide*.

For IGMP multicast traffic, you must have the following inbound rules at a minimum. The remote host is the host sending the multicast traffic. You can't specify a security group as the source of the UDP inbound rule.

Type	Protocol	Source	Description
Custom Protocol	2	0.0.0.0/32	IGMP query
Custom UDP Protocol	UDP	Remote host IP address	Inbound multicast traffic

For IGMP multicast traffic, you must have the following outbound rules at a minimum.

Type	Protocol	Destination	Description
Custom Protocol	2	224.0.0.2/32	IGMP leave
Custom Protocol	2	Multicast group IP address	IGMP join
Custom UDP Protocol	UDP	Multicast group IP address	Outbound multicast traffic

Working with multicast

You can configure multicast on transit gateways using the Amazon VPC console or the AWS CLI.

Before you create a multicast domain, you need to know if your hosts use the Internet Group Management Protocol (IGMP) protocol for multicast traffic.

Contents

- [Multicast domain attributes \(p. 61\)](#)
- [Managing IGMP configurations \(p. 61\)](#)
- [Managing static source configurations \(p. 62\)](#)
- [Managing static group member configurations \(p. 63\)](#)
- [Managing multicast domains \(p. 63\)](#)
- [Managing multicast groups \(p. 67\)](#)

- [Working with shared multicast domains \(p. 69\)](#)

Multicast domain attributes

The following table details the multicast domain attributes. You cannot enable both attributes at the same time.

Attribute	Description
<code>Igmpv2Support</code> (AWS CLI) IGMPv2 support (console)	<p>This attribute determines how group members join or leave a multicast group.</p> <p>When this attribute is disabled, you must add the group members to the domain manually.</p> <p>Enable this attribute if at least one member uses the IGMP protocol. Members join the multicast group in one of the following ways:</p> <ul style="list-style-type: none">• Members that support IGMP use the JOIN and LEAVE messages.• Members that do not support IGMP must be added or removed from the group using the Amazon VPC console or the AWS CLI. <p>If you register multicast group members, you must deregister them, too. The transit gateway ignores an IGMP LEAVE message sent by a manually added group member.</p>
<code>StaticSourcesSupport</code> (AWS CLI) Static sources support (console)	<p>This attribute determines whether there are static multicast sources for the group.</p> <p>When this attribute is enabled, you must add sources for a multicast domain using register-transit-gateway-multicast-group-sources . Only multicast sources can send multicast traffic.</p> <p>When this attribute is disabled, there are no designated multicast sources. Any instances that are in subnets associated with the multicast domain can send multicast traffic, and the group members receive the multicast traffic.</p>

Managing IGMP configurations

When you have at least one host that uses the IGMP protocol for multicast traffic, AWS automatically creates the multicast group when it receives an IGMP JOIN message from an instance, and then adds the instance as a member in this group. You can also statically add non-IGMP hosts as members to a group using the AWS CLI. Any instances that are in subnets associated with the multicast domain can send traffic, and the group members receive the multicast traffic.

Use the following steps to complete the configuration:

1. Create a VPC. For more information about creating VPCs, see [Creating a VPC](#) in the *Amazon VPC User Guide*.
2. Create a subnet in the VPC. For more information about creating subnets, see [Creating a subnet in your VPC](#) in the *Amazon VPC User Guide*.
3. Create a transit gateway configured for multicast traffic. For more information, see [the section called "Create a transit gateway"](#) (p. 29).

4. Create a VPC attachment. For more information, see [the section called “Create a transit gateway attachment to a VPC”](#) (p. 37).
5. Create a multicast domain configured for IGMP support. For more information, see [the section called “Creating an IGMP multicast domain”](#) (p. 63).

Use the following settings:

- Enable **IGMPv2 support**.
 - Disable **Static sources support**.
6. Create an association between subnets in the transit gateway VPC attachment and the multicast domain. For more information see [the section called “Associating VPC attachments and subnets with a multicast domain”](#) (p. 65).
 7. The default IGMP version for EC2 is IGMPv3. You need to change the version for all IGMP group members. You can run the following command:

```
sudo sysctl net.ipv4.conf.eth0.force_igmp_version=2
```

8. Add the members that do not use the IGMP protocol to the multicast group. For more information, see [the section called “Registering members with a multicast group”](#) (p. 67).

Managing static source configurations

In this configuration, you need to statically add multicast sources in a group. Hosts do not use the IGMP protocol to join or leave multicast groups. You need to statically add the group members that receive the multicast traffic.

Use the following steps to complete the configuration:

1. Create a VPC. For more information about creating VPCs, see [Creating a VPC](#) in the *Amazon VPC User Guide*.
2. Create a subnet in the VPC. For more information about creating subnets, see [Creating a subnet in your VPC](#) in the *Amazon VPC User Guide*.
3. Create a transit gateway configured for multicast traffic. For more information, see [the section called “Create a transit gateway”](#) (p. 29).
4. Create a VPC attachment. For more information, see [the section called “Create a transit gateway attachment to a VPC”](#) (p. 37).
5. Create a multicast domain configured for no IGMP support, and support for statically adding sources. For more information, see [the section called “Creating a static source multicast domain”](#) (p. 64).

Use the following settings:

- Disable **IGMPv2 support**.
- To manually add sources, enable **Static sources support**.

The sources are the only resources that can send multicast traffic when the attribute is enabled. Otherwise, any instances that are in subnets associated with the multicast domain can send multicast traffic, and the group members receive the multicast traffic.

6. Create an association between subnets in the transit gateway VPC attachment and the multicast domain. For more information see [the section called “Associating VPC attachments and subnets with a multicast domain”](#) (p. 65).
7. If you enable **Static sources support**, add the source to the multicast group. For more information, see [the section called “Registering sources with a multicast group”](#) (p. 67).

8. Add the members to the multicast group. For more information, see [the section called “Registering members with a multicast group”](#) (p. 67).

Managing static group member configurations

In this configuration, you need to statically add multicast members to a group. Hosts cannot use the IGMP protocol to join or leave multicast groups. Any instances that are in subnets associated with the multicast domain can send multicast traffic, and the group members receive the multicast traffic.

Use the following steps to complete the configuration:

1. Create a VPC. For more information about creating VPCs, see [Creating a VPC](#) in the *Amazon VPC User Guide*.
2. Create a subnet in the VPC. For more information about creating subnets, see [Creating a subnet in your VPC](#) in the *Amazon VPC User Guide*.
3. Create a transit gateway configured for multicast traffic. For more information, see [the section called “Create a transit gateway”](#) (p. 29).
4. Create a VPC attachment. For more information, see [the section called “Create a transit gateway attachment to a VPC”](#) (p. 37).
5. Create a multicast domain configured for no IGMP support, and support for statically adding sources. For more information, see [the section called “Creating a static source multicast domain”](#) (p. 64).

Use the following settings:

- Disable **IGMPv2 support**.
 - Disable **Static sources support**.
6. Create an association between subnets in the transit gateway VPC attachment and the multicast domain. For more information see [the section called “Associating VPC attachments and subnets with a multicast domain”](#) (p. 65).
 7. Add the members to the multicast group. For more information, see [the section called “Registering members with a multicast group”](#) (p. 67).

Managing multicast domains

To begin using multicast with a transit gateway, create a multicast domain, and then associate subnets with the domain.

Contents

- [Creating an IGMP multicast domain](#) (p. 63)
- [Creating a static source multicast domain](#) (p. 64)
- [Associating VPC attachments and subnets with a multicast domain](#) (p. 65)
- [Viewing your multicast domain associations](#) (p. 65)
- [Disassociating subnets from a multicast domain](#) (p. 65)
- [Adding tags to a multicast domain](#) (p. 66)
- [Deleting a multicast domain](#) (p. 66)

Creating an IGMP multicast domain

If you have not already done so, review the available multicast domain attributes. For more information, see [the section called “Working with multicast”](#) (p. 60).

Console

To create an IGMP multicast domain using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Multicast**.
3. Choose **Create transit gateway multicast domain**.
4. For **Name tag**, enter a name for the domain.
5. For **Transit gateway ID**, choose the transit gateway that processes the multicast traffic.
6. For **IGMPv2 support**, select the check box.
7. For **Static sources support**, clear the check box.
8. To automatically accept cross-account subnet associations for this multicast domain, select **Auto accept shared associations**.
9. Choose **Create transit gateway multicast domain**.

Command line

To create an IGMP multicast domain using the AWS CLI

Use the [create-transit-gateway-multicast-domain](#) command.

```
aws ec2 create-transit-gateway-multicast-domain --transit-gateway-id tgw-0xexampleid12345 --options StaticSourcesSupport=disable,Igmpv2Support=enable
```

Creating a static source multicast domain

If you have not already done so, review the available multicast domain attributes. For more information, see [the section called "Working with multicast"](#) (p. 60).

Console

To create a static multicast domain using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Multicast**.
3. Choose **Create transit gateway multicast domain**.
4. For **Name tag**, enter a name to identify the domain.
5. For **Transit gateway ID**, choose the transit gateway that processes the multicast traffic.
6. For **IGMPv2 support**, clear the check box.
7. For **Static sources support**, select the check box.
8. To automatically accept cross-account subnet associations for this multicast domain, select **Auto accept shared associations**.
9. Choose **Create transit gateway multicast domain**.

Command line

To create a static multicast domain using the AWS CLI

Use the [create-transit-gateway-multicast-domain](#) command.

```
aws ec2 create-transit-gateway-multicast-domain --transit-gateway-id tgw-0xexampleid12345 --options StaticSourcesSupport=enable,Igmpv2Support=disable
```

Associating VPC attachments and subnets with a multicast domain

Use the following procedure to associate a VPC attachment with a multicast domain. When you create an association, you can then select the subnets to include in the multicast domain.

Before you begin, you must create a VPC attachment on your transit gateway. For more information, see [Transit gateway attachments to a VPC \(p. 32\)](#).

Console

To associate VPC attachments with a multicast domain using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Multicast**.
3. Select the multicast domain, and then choose **Actions, Create association**.
4. For **Choose attachment to associate**, select the transit gateway attachment.
5. For **Choose subnets to associate**, select the subnets to include in the multicast domain.
6. Choose **Create association**.

Command line

To associate VPC attachments with a multicast domain using the AWS CLI

Use the [associate-transit-gateway-multicast-domain](#) command.

Viewing your multicast domain associations

You can view your multicast domains to verify that they are available, and that they contain the appropriate subnets and attachments.

Console

To view a multicast domain using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Multicast**.
3. Select the multicast domain.
4. Choose the **Associations** tab.

Command line

To view a multicast domain using the AWS CLI

Use the [describe-transit-gateway-multicast-domains](#) command.

Disassociating subnets from a multicast domain

Use the following procedure to disassociate subnets from a multicast domain.

Console

To disassociate subnets using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.

2. On the navigation pane, choose **Transit Gateway Multicast**.
3. Select the multicast domain.
4. Choose the **Associations** tab.
5. Select the subnet, and then choose **Actions, Delete association**.

Command line

To disassociate subnets using the AWS CLI

Use the `disassociate-transit-gateway-multicast-domain` command.

Adding tags to a multicast domain

Add tags to your resources to help organize and identify them, such as by purpose, owner, or environment. You can add multiple tags to each multicast domain. Tag keys must be unique for each multicast domain. If you add a tag with a key that is already associated with the multicast domain, it updates the value of that tag. For more information, see [Tagging your Amazon EC2 Resources](#).

Console

To add tags to a multicast domain using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Multicast**.
3. Select the multicast domain.
4. Choose **Actions, Manage tags**.
5. For each tag, choose **Add new tag** and enter a **Key** and **Value** for the tag.
6. Choose **Save**.

Command line

To add tags to a multicast domain using the AWS CLI

Use the `create-tags` command.

Deleting a multicast domain

Use the following procedure to delete a multicast domain.

Console

To delete a multicast domain using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Multicast**.
3. Select the multicast domain, and then choose **Actions, Delete multicast domain**.
4. When prompted for confirmation, enter **delete** and then choose **Delete**.

Command line

To delete a multicast domain using the AWS CLI

Use the [delete-transit-gateway-multicast-domain](#) command.

Managing multicast groups

Contents

- [Registering sources with a multicast group](#) (p. 67)
- [Registering members with a multicast group](#) (p. 67)
- [Deregistering sources from a multicast group](#) (p. 68)
- [Deregistering members from a multicast group](#) (p. 68)
- [Viewing your multicast groups](#) (p. 69)

Registering sources with a multicast group

Note

This procedure is only required when you have set the **Static sources support** attribute to **enable**.

Use the following procedure to register sources with a multicast group. The source is the network interface that sends multicast traffic.

You need the following information before you add a source:

- The ID of the multicast domain
- The IDs of the sources' network interfaces
- The multicast group IP address

Console

To register sources using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Multicast**.
3. Select the multicast domain, and then choose **Actions, Add group sources**.
4. For **Group IP address**, enter either the IPv4 CIDR block or IPv6 CIDR block to assign to the multicast domain.
5. Under **Choose network interfaces**, select the multicast senders' network interfaces.
6. Choose **Add sources**.

Command line

To register sources using the AWS CLI

Use the [register-transit-gateway-multicast-group-sources](#) command.

Registering members with a multicast group

Use the following procedure to register group members with a multicast group.

You need the following information before you add members:

- The ID of the multicast domain
- The IDs of the group members' network interfaces

- The multicast group IP address

Console

To register members using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Multicast**.
3. Select the multicast domain, and then choose **Actions, Add group members**.
4. For **Group IP address**, enter either the IPv4 CIDR block or IPv6 CIDR block to assign to the multicast domain.
5. Under **Choose network interfaces**, select the multicast receivers' network interfaces.
6. Choose **Add members**.

Command line

To register members using the AWS CLI

Use the [register-transit-gateway-multicast-group-members](#) command.

Deregistering sources from a multicast group

You don't need to follow this procedure unless you manually added a source to the multicast group.

Console

To remove a source using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Multicast**.
3. Select the multicast domain.
4. Choose the **Groups** tab.
5. Select the sources, and then choose **Remove source**.

Command line

To remove a source using the AWS CLI

Use the [deregister-transit-gateway-multicast-group-sources](#) command.

Deregistering members from a multicast group

You don't need to follow this procedure unless you manually added a member to the multicast group.

Console

To deregister members using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Multicast**.
3. Select the multicast domain.
4. Choose the **Groups** tab.

5. Select the members, and then choose **Remove member**.

Command line

To deregister members using the AWS CLI

Use the `deregister-transit-gateway-multicast-group-members` command.

Viewing your multicast groups

You can view information about your multicast groups to verify that members were discovered using the IGMPv2 protocol. **Member type** (in the console), or `MemberType` (in the AWS CLI) displays IGMP when AWS discovered members with the protocol.

Console

To view multicast groups using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. On the navigation pane, choose **Transit Gateway Multicast**.
3. Select the multicast domain.
4. Choose the **Groups** tab.

Command line

To view multicast groups using the AWS CLI

Use the `search-transit-gateway-multicast-groups` command.

The following example shows that the IGMP protocol discovered multicast group members.

```
aws ec2 search-transit-gateway-multicast-groups --transit-gateway-multicast-domain tgw-  
mcast-domain-000fb24d04EXAMPLE  
{  
  "MulticastGroups": [  
    {  
      "GroupIpAddress": "224.0.1.0",  
      "TransitGatewayAttachmentId": "tgw-attach-0372e72386EXAMPLE",  
      "SubnetId": "subnet-0187aff814EXAMPLE",  
      "ResourceId": "vpc-0065acced4EXAMPLE",  
      "ResourceType": "vpc",  
      "NetworkInterfaceId": "eni-03847706f6EXAMPLE",  
      "MemberType": "igmp"  
    }  
  ]  
}
```

Working with shared multicast domains

With multicast domain sharing, multicast domain owners can share the domain with other AWS accounts inside its organization in AWS Organizations. As the multicast domain owner, you can create and manage the multicast domain centrally. Consumers can perform the following operations on a shared multicast domain:

- Register and deregister group members or group sources in the multicast domain
- Associate a subnet with the multicast domain, and disassociate subnets from the multicast domain

A multicast domain owner can share a multicast domain with:

- AWS accounts inside its organization or across organizations in AWS Organizations
- An organizational unit inside its organization in AWS Organizations
- Its entire organization in AWS Organizations

Contents

- [Prerequisites for sharing a multicast domain \(p. 70\)](#)
- [Related services \(p. 70\)](#)
- [Sharing across Availability Zones \(p. 70\)](#)
- [Sharing a multicast domain \(p. 71\)](#)
- [Unsharing a shared multicast domain \(p. 71\)](#)
- [Identifying a shared multicast domain \(p. 72\)](#)
- [Shared multicast domain permissions \(p. 72\)](#)
- [Billing and metering \(p. 72\)](#)
- [Quotas \(p. 73\)](#)

Prerequisites for sharing a multicast domain

- To share a multicast domain, you must own it in your AWS account. You cannot share a multicast domain that has been shared with you.
- To share a multicast domain with your organization or an organizational unit in AWS Organizations, you must enable sharing with AWS Organizations. For more information, see [Enable Sharing with AWS Organizations](#) in the *AWS RAM User Guide*.

Related services

Multicast domain sharing integrates with AWS Resource Access Manager (AWS RAM). AWS RAM is a service that enables you to share your AWS resources with any AWS account or through AWS Organizations. With AWS RAM, you share resources that you own by creating a *resource share*. A resource share specifies the resources to share, and the consumers with whom to share them. Consumers can be individual AWS accounts, or organizational units or an entire organization in AWS Organizations.

For more information about AWS RAM, see the [AWS RAM User Guide](#).

Sharing across Availability Zones

To ensure that resources are distributed across the Availability Zones for a Region, we independently map Availability Zones to names for each account. This could lead to Availability Zone naming differences across accounts. For example, the Availability Zone us-east-1a for your AWS account might not have the same location as us-east-1a for another AWS account.

To identify the location of your multicast domain relative to your accounts, you must use the *Availability Zone ID* (AZ ID). The AZ ID is a unique and consistent identifier for an Availability Zone across all AWS accounts. For example, use1-az1 is an AZ ID for the us-east-1 Region and it is the same location in every AWS account.

To view the AZ IDs for the Availability Zones in your account

1. Open the AWS RAM console at <https://console.aws.amazon.com/ram>.
2. The AZ IDs for the current Region are displayed in the **Your AZ ID** panel on the right-hand side of the screen.

Sharing a multicast domain

When an owner shares a multicast domain with a consumer, the consumer can do the following:

- Register and deregister group members or group sources
- Associate and disassociate subnets

To share a multicast domain, you must add it to a resource share. A resource share is an AWS RAM resource that lets you share your resources across AWS accounts. A resource share specifies the resources to share, and the consumers with whom they are shared. When you share a multicast domain using the Amazon Virtual Private Cloud Console, you add it to an existing resource share. To add the multicast domain to a new resource share, you must first create the resource share using the [AWS RAM console](#).

If you are part of an organization in AWS Organizations and sharing within your organization is enabled, consumers in your organization are automatically granted access to the shared multicast domain. Otherwise, consumers receive an invitation to join the resource share and are granted access to the shared multicast domain after accepting the invitation.

You can share a multicast domain that you own using the *Amazon Virtual Private Cloud Console console, AWS RAM console, or the AWS CLI.

To share a multicast domain that you own using the *Amazon Virtual Private Cloud Console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. In the navigation pane, choose **Multicast Domains**.
3. Select your multicast domain, and then choose **Actions, Share multicast domain**.
4. Select your resource share and choose **Share multicast domain**.

To share a multicast domain that you own using the AWS RAM console

See [Creating a Resource Share](#) in the *AWS RAM User Guide*.

To share a multicast domain that you own using the AWS CLI

Use the `create-resource-share` command.

Unsharing a shared multicast domain

When a shared multicast domain is unshared, the following happens to consumer multicast domain resources:

- Consumer subnets are disassociated from the multicast domain. The subnets remain in the consumer account.
- Consumer group sources and group members are disassociated from the multicast domain, and then deleted from the consumer account.

To unshare a multicast domain, you must remove it from the resource share. You can do this from the AWS RAM console or the AWS CLI.

To unshare a shared multicast domain that you own, you must remove it from the resource share. You can do this using the *Amazon Virtual Private Cloud Console, AWS RAM console, or the AWS CLI.

To unshare a shared multicast domain that you own using the *Amazon Virtual Private Cloud Console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.

2. In the navigation pane, choose **Multicast Domains**.
3. Select your multicast domain, and then choose **Actions, Stop sharing**.

To unshare a shared multicast domain that you own using the AWS RAM console

See [Updating a Resource Share](#) in the *AWS RAM User Guide*.

To unshare a shared multicast domain that you own using the AWS CLI

Use the [disassociate-resource-share](#) command.

Identifying a shared multicast domain

Owners and consumers can identify shared multicast domains using the *Amazon Virtual Private Cloud Console and AWS CLI

To identify a shared multicast domain using the *Amazon Virtual Private Cloud Console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. In the navigation pane, choose **Multicast Domains**.
3. Select your multicast domain.
4. On the **Transit Multicast Domain Details** page, view the **Owner ID** to identify the AWS account ID of the multicast domain.

To identify a shared multicast domain using the AWS CLI

Use the [describe-transit-gateway-multicast-domains](#) command. The command returns the multicast domains that you own and multicast domains that are shared with you. `OwnerId` shows the AWS account ID of the multicast domain owner.

Shared multicast domain permissions

Permissions for owners

Owners are responsible for managing the multicast domain and the members and attachments that they register or associate with the domain. Owners can change or revoke shared access at any time. They can use AWS Organizations to view, modify, and delete resources that consumers create on shared multicast domains.

Permissions for consumers

Consumers can perform the following operations on shared multicast domains in the same way that they would on multicast domains that they created:

- Register and deregister group members or group sources in the multicast domain
- Associate a subnet with the multicast domain, and disassociate subnets from the multicast domain

Consumers are responsible for managing the resources that they create on the shared multicast domain.

Customers cannot view or modify resources owned by other consumers or by the multicast domain owner, and they cannot modify multicast domains that are shared with them.

Billing and metering

There are no additional charges for sharing multicast domains for either the owner, or consumers.

Quotas

A shared multicast domain counts toward the owner's and consumer's multicast domain quotas.

Transit gateway sharing considerations

You can use AWS Resource Access Manager (RAM) to share a transit gateway for VPC attachments across accounts or across your organization in AWS Organizations. Take the following into account when you want to share a transit gateway. For more information about shared resources and RAM, see [Working with shared AWS resources](#) in the *AWS RAM User Guide*.

An AWS Site-to-Site VPN attachment must be created in the same AWS account that owns the transit gateway.

An attachment to a Direct Connect gateway uses a transit gateway association and can be in the same AWS account as the Direct Connect gateway, or a different one from the Direct Connect gateway.

By default, IAM users do not have permission to create or modify AWS RAM resources. To allow IAM users to create or modify resources and perform tasks, you must create IAM policies that grant permission to use specific resources and API actions. You then attach those policies to the IAM users or groups that require those permissions.

Only the resource owner can perform the following operations:

- Create a resource share.
- Update a resource share.
- View a resource share.
- View the resources that are shared by your account, across all resource shares.
- View the principals with whom you are sharing your resources, across all resource shares. Viewing the principals with whom you are sharing enables you to determine who has access to your shared resources.
- Delete a resource share.
- Run all transit gateway, transit gateway attachment, and transit gateway route tables APIs.

You can perform the following operations on resources that are shared with you:

- Accept, or reject a resource share invitation.
- View a resource share.
- View the shared resources that you can access.
- View a list of all the principals that are sharing resources with you. You can see which resources and resource shares they have shared with you.
- Can run the `DescribeTransitGateways` API.
- Run the APIs that create and describe attachments, for example `CreateTransitGatewayVpcAttachment` and `DescribeTransitGatewayVpcAttachments`, in their VPCs.
- Leave a resource share.

When a transit gateway is shared with you, you cannot create, modify, or delete its transit gateway route tables, or its transit gateway route table propagations and associations.

When you create a transit gateway, the transit gateway is created in the Availability Zone that is mapped to your account and is independent from other accounts. When the transit gateway and the attachment

entities are in different accounts, use the Availability Zone ID to uniquely and consistently identify the Availability Zone. For example, use1-az1 is an AZ ID for the us-east-1 Region and maps to the same location in every AWS account.

Unshare a transit gateway

When the share owner unshares the transit gateway, the following rules apply:

- The transit gateway attachment remains functional.
- The shared account can not describe the transit gateway.
- The transit gateway owner, and the share owner can delete the transit gateway attachment.

When a transit gateway is unshared with another AWS account, or if the AWS account that the transit gateway is shared with is removed from the organization, the transit gateway itself won't be impacted.

Logging network traffic using Transit Gateway Flow Logs

Transit Gateway Flow Logs is a feature that enables you to capture information about the IP traffic going to and from your transit gateways. Flow log data can be published to Amazon CloudWatch Logs or Amazon S3. After you create a flow log, you can retrieve and view its data in the chosen destination. Flow log data is collected outside of the path of your network traffic, and therefore does not affect network throughput or latency. You can create or delete flow logs without any risk of impact to network performance. Transit Gateway Flow Logs capture information related only to transit gateways, described in [the section called “Transit Gateway Flow Log records” \(p. 77\)](#). If you want to capture information about IP traffic going to and from network interfaces in your VPCs, use VPC Flow Logs. See [Logging IP traffic using VPC Flow Logs](#) in the *Amazon VPC User Guide* for more information.

Note

To create a transit gateway flow log, you must either be the owner of the transit gateway, or if you are not the owner, the transit gateway owner must give you permission.

Flow log data for a monitored transit gateway is recorded as *flow log records*, which are log events consisting of fields that describe the traffic flow. For more information, see [Transit Gateway Flow Log records \(p. 77\)](#).

To create a flow log, you specify:

- The resource for which to create the flow log
- The destinations to which you want to publish the flow log data

After you create a flow log, it can take several minutes to begin collecting and publishing data to the chosen destinations. Flow logs do not capture real-time log streams for your transit gateways. For more information, see [Create a flow log \(p. 91\)](#).

You can apply tags to your flow logs. Each tag consists of a key and an optional value, both of which you define. Tags can help you organize your flow logs, for example by purpose or owner.

If you no longer require a flow log, you can delete it. Deleting a flow log disables the flow log service for the resource, and no new flow log records are created or published to CloudWatch Logs or Amazon S3. Deleting the flow log does not delete any existing flow log records or log streams (for CloudWatch Logs) or log file objects (for Amazon S3) for a transit gateway. To delete an existing log stream, use the CloudWatch Logs console. To delete existing log file objects, use the Amazon S3 console. After you've deleted a flow log, it can take several minutes to stop collecting data. For more information, see [Delete a flow log \(p. 94\)](#).

Note

Querying a transit gateway flow log using Amazon Athena is not supported.

Contents

- [Transit Gateway Flow Log records \(p. 77\)](#)
- [Publish flow logs to CloudWatch Logs \(p. 81\)](#)
- [Publish flow logs to Amazon S3 \(p. 85\)](#)
- [Work with Transit Gateway Flow Logs \(p. 91\)](#)

Transit Gateway Flow Log records

A flow log record represents a network flow in your transit gateway. Each record is a string with fields separated by spaces. A record includes values for the different components of the traffic flow, for example, the source, destination, and protocol.

When you create a flow log, you can use the default format for the flow log record, or you can specify a custom format.

Contents

- [Default format \(p. 77\)](#)
- [Custom format \(p. 77\)](#)
- [Available fields \(p. 77\)](#)

Default format

With the default format, the flow log records includes all version 2 to version 6 fields, in the order shown in the [available fields \(p. 77\)](#) table. You cannot customize or change the default format. To capture additional fields or a different subset of fields, specify a custom format instead.

Custom format

With a custom format, you specify which fields are included in the flow log records and in which order. This enables you to create flow logs that are specific to your needs, and to omit fields that are not relevant. Using a custom format can reduce the need for separate processes to extract specific information from the published flow logs. You can specify any number of the available flow log fields, but you must specify at least one.

Available fields

The following table describes all of the available fields for a transit gateway flow log record. The **Version** column indicates which version the field was introduced in.

When publishing flow log data to Amazon S3, the data type for the fields depends on the flow log format. If the format is plain text, all fields are of type STRING. If the format is Parquet, see the table for the field data types.

If a field is not applicable or could not be computed for a specific record, the record displays a '-' symbol for that entry. Metadata fields that do not come directly from the packet header are best effort approximations, and their values might be missing or inaccurate.

Field	Description	Version
version	Indicates the version in which the field was introduced. The default format includes all version 2 fields, in the same order that they appear in the table. Parquet data type: INT_32	2
resource-type	The type of resource on which the subscription is created. This can be TransitGateway or TransitGatewayAttachment. Parquet data type: STRING	6
account-id	The AWS account ID of the owner of the source transit gateway.	2

Field	Description	Version
	Parquet data type: STRING	
tgw-id	The ID of the transit gateway for which traffic is being recorded. Parquet data type: STRING	6
tgw-attachment-id	The ID of the transit gateway attachment for which traffic is being recorded. Parquet data type: STRING	6
tgw-src-vpc-account-id	The AWS account ID for the source VPC traffic. Parquet data type: STRING	6
tgw-dst-vpc-account-id	The AWS account ID for the destination VPC traffic. Parquet data type: STRING	6
tgw-src-vpc-id	The ID of the source VPC for the transit gateway Parquet data type: STRING	6
tgw-dst-vpc-id	The ID of the destination VPC for the transit gateway. Parquet data type: STRING	6
tgw-src-subnet-id	The ID of the subnet for the transit gateway source traffic. Parquet data type: STRING	6
tgw-dst-subnet-id	The ID of the subnet for the transit gateway destination traffic. Parquet data type: STRING	6
tgw-src-eni	The ID of the source transit gateway attachment ENI for the flow. Parquet data type: STRING	6
tgw-dst-eni	The ID of the destination transit gateway attachment ENI for the flow. Parquet data type: STRING	6
tgw-src-az-id	The ID of the Availability Zone that contains the source transit gateway for which traffic is recorded. If the traffic is from a sublocation, the record displays a '-' symbol for this field. Parquet data type: STRING	6
tgw-dst-az-id	The ID of the Availability Zone that contains the destination transit gateway for which traffic is recorded. Parquet data type: STRING	6
tgw-pair-attachment-id	Depending on the flow direction, this is either the egress or ingress attachment ID of the flow. Parquet data type: STRING	6

Field	Description	Version
srcaddr	The source address for incoming traffic, or the IPv4 or IPv6 address of the transit gateway for outgoing traffic on the transit gateway. The IPv4 address of the transit gateway is always its private IPv4 address. Parquet data type: STRING	2
dstaddr	The destination address for outgoing traffic, or the IPv4 or IPv6 address of the transit gateway for incoming traffic on the transit gateway. The IPv4 address of the transit gateway is always its private IPv4 address. Parquet data type: STRING	2
srcport	The source port of the traffic. Parquet data type: INT_32	2
dstport	The destination port of the traffic. Parquet data type: INT_32	2
protocol	The IANA protocol number of the traffic. For more information, see Assigned Internet Protocol Numbers . Parquet data type: INT_64	2
packets	The number of packets transferred during the flow. Parquet data type: INT_64	2
bytes	The number of bytes transferred during the flow. Parquet data type: INT_64	2
start	The time, in Unix seconds, when the first packet of the flow was received within the aggregation interval. This might be up to 60 seconds after the packet was transmitted or received on the transit gateway. Parquet data type: INT_64	2
end	The time, in Unix seconds, when the last packet of the flow was received within the aggregation interval. This might be up to 60 seconds after the packet was transmitted or received on the transit gateway. Parquet data type: INT_64	2
log-status	The status of the flow log: <ul style="list-style-type: none"> OK — Data is logging normally to the chosen destinations. NODATA — There was no network traffic to or from the network interface during the aggregation interval. SKIPDATA — Some flow log records were skipped during the aggregation interval. This might be because of an internal capacity constraint, or an internal error. Parquet data type: STRING	2

Field	Description	Version
type	<p>The type of traffic. Possible values are IPv4 IPv6 EFA. For more information, see Elastic Fabric Adapter in the <i>Amazon EC2 User Guide for Linux Instances</i>.</p> <p>Parquet data type: STRING</p>	3
packets-lost-no-route	<p>The packets lost due to no route being specified.</p> <p>Parquet data type: INT_64</p>	6
packets-lost-blackhole	<p>The packets lost due to a black hole.</p> <p>Parquet data type: INT_64</p>	6
packets-lost-mtu-exceeded	<p>The packets lost due to the size exceeding the MTU.</p> <p>Parquet data type: INT_64</p>	6
packets-lost-ttl-expired	<p>The packets lost due to the expiration of time-to-live.</p> <p>Parquet data type: INT_64</p>	6
tcp-flags	<p>The bitmask value for the following TCP flags:</p> <ul style="list-style-type: none"> • FIN — 1 • SYN — 2 • RST — 4 • PSH — 8 • ACK — 16 • SYN-ACK — 18 • URG — 32 <p>Important When a flow log entry consists of only ACK packets, the flag value is 0, not 16.</p> <p>For general information about TCP flags (such as the meaning of flags like FIN, SYN, and ACK), see TCP segment structure on Wikipedia.</p> <p>TCP flags can be OR-ed during the aggregation interval. For short connections, the flags might be set on the same line in the flow log record, for example, 19 for SYN-ACK and FIN, and 3 for SYN and FIN.</p> <p>Parquet data type: INT_32</p>	3
region	<p>The Region that contains the transit gateway where traffic is recorded.</p> <p>Parquet data type: STRING</p>	4
flow-direction	<p>The direction of the flow with respect to the interface where traffic is captured. The possible values are: ingress egress.</p> <p>Parquet data type: STRING</p>	5

Field	Description	Version
pkt-src-aws-service	The name of the subset of IP address ranges for the srcaddr if the source IP address is for an AWS service. The possible values are: AMAZON AMAZON_APPFLOW AMAZON_CONNECT API_GATEWAY CHIME_MEETINGS CHIME_VOICECONNECTOR CLOUD9 CLOUDFRONT CODEBUILD DYNAMODB EBS EC2 EC2_INSTANCE_CONNECT GLOBALACCELERATOR KINESIS_VIDEO_STREAMS ROUTE53 ROUTE53_HEALTHCHECKS ROUTE53_HEALTHCHECKS_PUBLISHING ROUTE53_RESOLVER S3 WORKSPACES_GATEWAYS. Parquet data type: STRING	5
pkt-dst-aws-service	The name of the subset of IP address ranges for the dstaddr field, if the destination IP address is for an AWS service. For a list of possible values, see the pkt-src-aws-service field. Parquet data type: STRING	5

Publish flow logs to CloudWatch Logs

Flow logs can publish flow log data directly to Amazon CloudWatch.

When published to CloudWatch Logs, the flow log data is published to a log group, and each transit gateway has a unique log stream in the log group. Log streams contain flow log records. You can create multiple flow logs that publish data to the same log group. If the same transit gateway is present in one or more flow logs in the same log group, it has one combined log stream. If you've specified that one flow log should capture rejected traffic, and the other flow log should capture accepted traffic, then the combined log stream captures all traffic.

Data ingestion and archival charges for vended logs apply when you publish flow logs to CloudWatch Logs. For more information, see [Amazon CloudWatch Pricing](#).

In CloudWatch Logs, the **timestamp** field corresponds to the start time that's captured in the flow log record. The **ingestionTime** field provides the date and time when the flow log record was received by CloudWatch Logs. The timestamp is later than the end time that's captured in the flow log record.

For more information about CloudWatch Logs, see [Logs sent to CloudWatch Logs](#) in the *Amazon CloudWatch Logs User Guide*.

Contents

- [IAM roles for publishing flow logs to CloudWatch Logs \(p. 81\)](#)
- [Permissions for IAM users to pass a role \(p. 83\)](#)
- [Create a flow log that publishes to CloudWatch Logs \(p. 83\)](#)
- [Process flow log records in CloudWatch Logs \(p. 84\)](#)

IAM roles for publishing flow logs to CloudWatch Logs

The IAM role that's associated with your flow log must have sufficient permissions to publish flow logs to the specified log group in CloudWatch Logs. The IAM role must belong to your AWS account.

The IAM policy that's attached to your IAM role must include at least the following permissions.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "logs:CreateLogGroup",
        "logs:CreateLogStream",
        "logs:PutLogEvents",
        "logs:DescribeLogGroups",
        "logs:DescribeLogStreams"
      ],
      "Resource": "*"
    }
  ]
}
```

Also ensure that your role has a trust relationship that allows the flow logs service to assume the role.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Principal": {
        "Service": "vpc-flow-logs.amazonaws.com"
      },
      "Action": "sts:AssumeRole"
    }
  ]
}
```

We recommend that you use the `aws:SourceAccount` and `aws:SourceArn` condition keys to protect yourself against [the confused deputy problem](#). For example, you could add the following condition block to the previous trust policy. The source account is the owner of the flow log and the source ARN is the flow log ARN. If you don't know the flow log ID, you can replace that portion of the ARN with a wildcard (*) and then update the policy after you create the flow log.

```
"Condition": {
  "StringEquals": {
    "aws:SourceAccount": "account_id"
  },
  "ArnLike": {
    "aws:SourceArn": "arn:aws:ec2:region:account_id:vpc-flow-log/flow-log-id"
  }
}
```

Create or update an IAM role for flow logs

You can update an existing role or use the following procedure to create a new role for use with flow logs.

To create an IAM role for flow logs

1. Open the IAM console at <https://console.aws.amazon.com/iam/>.
2. In the navigation pane, choose **Roles**, **Create role**.
3. For **Select type of trusted entity**, choose **AWS service**. For **Use case**, choose **EC2**. Choose **Next: Permissions**.

4. On the **Attach permissions policies** page, choose **Next: Tags** and optionally add tags. Choose **Next: Review**.
5. Enter a name for your role and optionally provide a description. Choose **Create role**.
6. Select the name of your role. For **Permissions**, choose **Add inline policy, JSON**.
7. Copy the first policy from [IAM roles for publishing flow logs to CloudWatch Logs \(p. 81\)](#) and paste it in the window. Choose **Review policy**.
8. Enter a name for your policy, and choose **Create policy**.
9. Select the name of your role. For **Trust relationships**, choose **Edit trust relationship**. In the existing policy document, change the service from `ec2.amazonaws.com` to `vpc-flow-logs.amazonaws.com`. Choose **Update Trust Policy**.
10. On the **Summary** page, note the ARN for your role. You need this ARN when you create your flow log.

Permissions for IAM users to pass a role

Users must also have permissions to use the `iam:PassRole` action for the IAM role that's associated with the flow log.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": ["iam:PassRole"],
      "Resource": "arn:aws:iam::account-id:role/flow-log-role-name"
    }
  ]
}
```

Create a flow log that publishes to CloudWatch Logs

You can create flow logs for transit gateways. If you perform these steps as an IAM user, ensure that you have permissions to use the `iam:PassRole` action. For more information, see [Permissions for IAM users to pass a role \(p. 83\)](#).

Prerequisite

Create the destination log group. Open the [Log groups page](#) in the CloudWatch console and choose **Create log group**. Enter a name for the log group and choose **Create**.

To create a transit gateway flow log using the console

1. Sign in to the AWS Management Console and open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. In the navigation pane, choose **Transit gateways**.
3. Select the check boxes for one or more transit gateways and choose **Actions, Create flow log**.
4. For **Destination**, choose **Send to CloudWatch Logs**.
5. For **Destination log group**, choose the name of the destination log group that you created.
6. For **IAM role**, specify the name of the role that has permissions to publish logs to CloudWatch Logs.
7. For **Log record format**, select the format for the flow log record.
 - To use the default format, choose **AWS default format**.

- To use a custom format, choose **Custom format** and then select fields from **Log format**.
8. (Optional) Choose **Add new tag** to apply tags to the flow log.
 9. Choose **Create flow log**.

To create a flow log for a VPC or a subnet using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. In the navigation pane, choose **Transit gateways** or **Transit gateway attachments**.
3. Select the checkbox for one or more transit gateways or transit gateway attachments, and then choose **Actions, Create flow**.
4. For **Filter**, specify the type of traffic to log. Choose **All** to log accepted and rejected traffic, **Reject** to log only rejected traffic, or **Accept** to log only accepted traffic.
5. For **Destination**, choose **Send to CloudWatch Logs**.
6. For **Destination log group**, choose the name of the destination log group that you created.
7. For **IAM role**, specify the name of the role that has permissions to publish logs to CloudWatch Logs.
8. For **Log record format**, select the format for the flow log record.
 - To use the default format, choose **AWS default format**.
 - To use a custom format, choose **Custom format** and then select fields from **Log format**.
9. (Optional) Choose **Add new tag** to apply tags to the flow log.
10. Choose **Create flow log**.

To create a flow log using the command line

Use one of the following commands.

- [create-flow-logs](#) (AWS CLI)
- [New-EC2FlowLogs](#) (AWS Tools for Windows PowerShell)
- [CreateFlowLogs](#) (Amazon EC2 Query API)

The following AWS CLI example creates a flow log that captures transit gateway information. The flow logs are delivered to a log group in CloudWatch Logs called `my-flow-logs`, in account `123456789101`, using the IAM role `publishFlowLogs`.

```
aws ec2 create-flow-logs --resource-type TransitGateway --resource-ids tgw-1a2b3c4d --log-group-name my-flow-logs --deliver-logs-permission-arn arn:aws:iam::123456789101:role/publishFlowLogs
```

Process flow log records in CloudWatch Logs

You can work with flow log records as you would with any other log events collected by CloudWatch Logs. For more information about monitoring log data and metric filters, see [Searching and Filtering Log Data](#) in the *Amazon CloudWatch User Guide*.

Example: Create a CloudWatch metric filter and alarm for a flow log

In this example, you have a flow log for `eni-1a2b3c4d`. You want to create an alarm that alerts you if there have been 10 or more rejected attempts to connect to your instance over TCP port 22 (SSH) within

a 1-hour time period. First, you must create a metric filter that matches the pattern of the traffic for which to create the alarm. Then, you can create an alarm for the metric filter.

To create a metric filter for rejected SSH traffic and create an alarm for the filter

1. Open the CloudWatch console at <https://console.aws.amazon.com/cloudwatch/>.
2. In the navigation pane, choose **Logs, Log groups**.
3. Select the check box for the log group, and then choose **Actions, Create metric filter**.
4. For **Filter Pattern**, enter the following.

```
[version, resource_type, account_id,tgw_id="tgw-123abc456bca", tgw_attachment_id,
tgw_src_vpc_account_id, tgw_dst_vpc_account_id, tgw_src_vpc_id, tgw_dst_vpc_id,
tgw_src_subnet_id, tgw_dst_subnet_id, tgw_src_eni, tgw_dst_eni, tgw_src_az_id,
tgw_dst_az_id, tgw_pair_attachment_id, srcaddr= "10.0.0.1", dstaddr,
srcport="80", dstport, protocol="6", packets, bytes,start,end, log_status,
type,packets_lost_no_route, packets_lost_blackhole, packets_lost_mtu_exceeded,
packets_lost_ttl_expired, tcp_flags,region, flow_direction, pkt_src_aws_service,
pkt_dst_aws_service]
```

5. For **Select log data to test**, select the log stream for your transit gateway. (Optional) To view the lines of log data that match the filter pattern, choose **Test pattern**. When you're ready, choose **Next**.
6. Enter a filter name, metric namespace, and metric name. Set the metric value to **1**. When you're done, choose **Next** and then choose **Create metric filter**.
7. In the navigation pane, choose **Alarms, All alarms**.
8. Choose **Create alarm**.
9. Choose the namespace for the metric filter that you created.

It can take a few minutes for a new metric to display in the console.
10. Select the metric name that you created, and then choose **Select metric**.
11. Configure the alarm as follows, and then choose **Next**:
 - For **Statistic**, choose **Sum**. This ensure that you capture the total number of data points for the specified time period.
 - For **Period**, choose **1 hour**.
 - For **Whenever**, choose **Greater/Equal** and enter **10** for the threshold.
 - For **Additional configuration, Datapoints to alarm**, leave the default of **1**.
12. For **Notification**, select an existing SNS topic, or choose **Create new topic** to create a new one. Choose **Next**.
13. Enter a name and description for the alarm and choose **Next**.
14. When you are done configuring the alarm, choose **Create alarm**.

Publish flow logs to Amazon S3

Flow logs can publish flow log data to Amazon S3.

When publishing to Amazon S3, flow log data is published to an existing Amazon S3 bucket that you specify. Flow log records for all of the monitored transit gateways are published to a series of log file objects that are stored in the bucket.

Data ingestion and archival charges for vended logs apply when you publish flow logs to Amazon S3. For more information, see [Amazon CloudWatch Pricing](#).

To create an Amazon S3 bucket for use with flow logs, see [Create a bucket](#) in the *Amazon Simple Storage Service User Guide*.

For more information about multiple account logging, see [Central Logging](#) in the AWS Solutions Library.

For more information about CloudWatch Logs, see [Logs sent to Amazon S3](#) in the *Amazon CloudWatch Logs User Guide*.

Contents

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- [IAM policy for IAM principals that publish flow logs to Amazon S3](#) (p. 87)
- [Amazon S3 bucket permissions for flow logs](#) (p. 88)
- [Required key policy for use with SSE-KMS](#) (p. 89)
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- [Create a flow log that publishes to Amazon S3](#) (p. 89)
- [Process flow log records in Amazon S3](#) (p. 91)

Flow log files

VPC Flow Logs is a feature that collects flow log records, consolidates them into log files, and then publishes the log files to the Amazon S3 bucket at 5-minute intervals. Each log file contains flow log records for the IP traffic recorded in the previous five minutes.

The maximum file size for a log file is 75 MB. If the log file reaches the file size limit within the 5-minute period, the flow log stops adding flow log records to it. Then it publishes the flow log to the Amazon S3 bucket, and creates a new log file.

In Amazon S3, the **Last modified** field for the flow log file indicates the date and time when the file was uploaded to the Amazon S3 bucket. This is later than the timestamp in the file name, and differs by the amount of time taken to upload the file to the Amazon S3 bucket.

Log file format

You can specify one of the following formats for the log files. Each file is compressed into a single Gzip file.

- **Text** – Plain text. This is the default format.
- **Parquet** – Apache Parquet is a columnar data format. Queries on data in Parquet format are 10 to 100 times faster compared to queries on data in plain text. Data in Parquet format with Gzip compression takes 20 percent less storage space than plain text with Gzip compression.

Log file options

You can optionally specify the following options.

- **Hive-compatible S3 prefixes** – Enable Hive-compatible prefixes instead of importing partitions into your Hive-compatible tools. Before you run queries, use the **MSCK REPAIR TABLE** command.
- **Hourly partitions** – If you have a large volume of logs and typically target queries to a specific hour, you can get faster results and save on query costs by partitioning logs on an hourly basis.

Log file S3 bucket structure

Log files are saved to the specified Amazon S3 bucket using a folder structure that is based on the flow log's ID, Region, creation date, and destination options.

By default, the files are delivered to the following location.

```
bucket-and-optional-prefix/AWSLogs/account_id/vpcflowlogs/region/year/month/day/
```

If you enable Hive-compatible S3 prefixes, the files are delivered to the following location.

```
bucket-and-optional-prefix/AWSLogs/aws-account-id=account_id/service=vpcflowlogs/aws-  
region=region/year=year/month=month/day=day/
```

If you enable hourly partitions, the files are delivered to the following location.

```
bucket-and-optional-prefix/AWSLogs/account_id/vpcflowlogs/region/year/month/day/hour/
```

If you enable Hive-compatible partitions and partition the flow log per hour, the files are delivered to the following location.

```
bucket-and-optional-prefix/AWSLogs/aws-account-id=account_id/service=vpcflowlogs/aws-  
region=region/year=year/month=month/day=day/hour=hour/
```

Log file names

The file name of a log file is based on the flow log ID, Region, and creation date and time. File names use the following format.

```
aws_account_id_vpcflowlogs_region_flow_log_id_YYYYMMDDTHHmmZ_hash.log.gz
```

The following is an example of a log file for a flow log created by AWS account 123456789012, for a resource in the us-east-1 Region, on June 20, 2018 at 16:20 UTC. The file contains the flow log records with an end time between 16:20:00 and 16:24:59.

```
123456789012_vpcflowlogs_us-east-1_fl-1234abcd_20180620T1620Z_fe123456.log.gz
```

IAM policy for IAM principals that publish flow logs to Amazon S3

The IAM principal that creates the flow log, such as an IAM user, must have the following permissions, which are required to publish flow logs to the destination Amazon S3 bucket.

```
{  
  "Version": "2012-10-17",  
  "Statement": [  
    {  
      "Effect": "Allow",  
      "Action": [  
        "logs:CreateLogDelivery",  
        "logs>DeleteLogDelivery"  
      ],  
      "Resource": "*"   
    }  
  ]  
}
```

Amazon S3 bucket permissions for flow logs

By default, Amazon S3 buckets and the objects they contain are private. Only the bucket owner can access the bucket and the objects stored in it. However, the bucket owner can grant access to other resources and users by writing an access policy.

If the user creating the flow log owns the bucket and has `PutBucketPolicy` and `GetBucketPolicy` permissions for the bucket, we automatically attach the following policy to the bucket. This policy overwrites any existing policy attached to the bucket.

Otherwise, the bucket owner must add this policy to the bucket, specifying the AWS account ID of the flow log creator, or flow log creation fails. For more information, see [Using bucket policies](#) in the *Amazon Simple Storage Service User Guide*.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "AWSLogDeliveryWrite",
      "Effect": "Allow",
      "Principal": {"Service": "delivery.logs.amazonaws.com"},
      "Action": "s3:PutObject",
      "Resource": "my-s3-arn",
      "Condition": {
        "StringEquals": {
          "s3:x-amz-acl": "bucket-owner-full-control",
          "aws:SourceAccount": account_id
        },
        "ArnLike": {
          "aws:SourceArn": "arn:aws:logs:region:account_id:*"
        }
      }
    },
    {
      "Sid": "AWSLogDeliveryCheck",
      "Effect": "Allow",
      "Principal": {"Service": "delivery.logs.amazonaws.com"},
      "Action": ["s3:GetBucketAcl", "s3:ListBucket"],
      "Resource": "arn:aws:s3:::bucket_name",
      "Condition": {
        "StringEquals": {
          "aws:SourceAccount": account_id
        },
        "ArnLike": {
          "aws:SourceArn": "arn:aws:logs:region:account_id:*"
        }
      }
    }
  ]
}
```

The ARN that you specify for `my-s3-arn` depends on whether you use Hive-compatible S3 prefixes.

- Default prefixes

```
arn:aws:s3:::bucket_name/optional_folder/AWSLogs/account_id/*
```

- Hive-compatible S3 prefixes

```
arn:aws:s3:::bucket_name/optional_folder/AWSLogs/aws-account-id=account_id/*
```

As a best practice, we recommend that you grant these permissions to the log delivery service principal instead of individual AWS account ARNs. It is also a best practice to use the `aws:SourceAccount` and `aws:SourceArn` condition keys to protect against [the confused deputy problem](#). The source account is the owner of the flow log and the source ARN is the wildcard (*) ARN of the logs service.

Required key policy for use with SSE-KMS

You can protect the data in your Amazon S3 bucket by enabling either Server-Side Encryption with Amazon S3-Managed Keys (SSE-S3) or Server-Side Encryption with KMS Keys (SSE-KMS). For more information, see [Protecting data using server-side encryption](#) in the *Amazon S3 User Guide*.

With SSE-KMS, you can use either an AWS managed key or a customer managed key. With an AWS managed key, you can't use cross-account delivery. Flow logs are delivered from the log delivery account, so you must grant access for cross-account delivery. To grant cross-account access to your S3 bucket, use a customer managed key and specify the Amazon Resource Name (ARN) of the customer managed key when you enable bucket encryption. For more information, see [Specifying server-side encryption with AWS KMS](#) in the *Amazon S3 User Guide*.

When you use SSE-KMS with a customer managed key, you must add the following to the key policy for your key (not the bucket policy for your S3 bucket), so that VPC Flow Logs can write to your S3 bucket.

```
{
  "Sid": "Allow VPC Flow Logs to use the key",
  "Effect": "Allow",
  "Principal": {
    "Service": [
      "delivery.logs.amazonaws.com"
    ]
  },
  "Action": [
    "kms:Encrypt",
    "kms:Decrypt",
    "kms:ReEncrypt*",
    "kms:GenerateDataKey*",
    "kms:DescribeKey"
  ],
  "Resource": "*"
}
```

Amazon S3 log file permissions

In addition to the required bucket policies, Amazon S3 uses access control lists (ACLs) to manage access to the log files created by a flow log. By default, the bucket owner has `FULL_CONTROL` permissions on each log file. The log delivery owner, if different from the bucket owner, has no permissions. The log delivery account has `READ` and `WRITE` permissions. For more information, see [Access Control List \(ACL\) Overview](#) in the *Amazon Simple Storage Service User Guide*.

Create a flow log that publishes to Amazon S3

After you have created and configured your Amazon S3 bucket, you can create flow logs for transit gateways.

To create a transit gateway flow log that publishes to Amazon S3 using the console

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. In the navigation pane, choose **Transit gateways** or **Transit gateway attachments**.

3. Select the checkboxes for one or more transit gateways or transit gateway attachments.

Select the check boxes for one or more transit gateways.
4. Choose **Actions, Create flow log**.
5. Configure the flow log settings. For more information, see [To configure flow log settings \(p. 90\)](#).

To configure flow log settings using the console

1. For **Destination**, choose **Send to an S3 bucket**.
2. For **S3 bucket ARN**, specify the Amazon Resource Name (ARN) of an existing Amazon S3 bucket. You can optionally include a subfolder. For example, to specify a subfolder named my-logs in a bucket named my-bucket, use the following ARN:

```
arn:aws:s3::my-bucket/my-logs/
```

The bucket cannot use AWSLogs as a subfolder name, as this is a reserved term.

If you own the bucket, we automatically create a resource policy and attach it to the bucket. For more information, see [Amazon S3 bucket permissions for flow logs \(p. 88\)](#).

3. For **Log record format**, specify the format for the flow log record.
 - To use the default flow log record format, choose **AWS default format**.
 - To create a custom format, choose **Custom format**. For **Log format**, choose the fields to include in the flow log record.
4. For **Log file format**, specify the format for the log file.
 - **Text** – Plain text. This is the default format.
 - **Parquet** – Apache Parquet is a columnar data format. Queries on data in Parquet format are 10 to 100 times faster compared to queries on data in plain text. Data in Parquet format with Gzip compression takes 20 percent less storage space than plain text with Gzip compression.
5. (Optional) To use Hive-compatible S3 prefixes, choose **Hive-compatible S3 prefix, Enable**.
6. (Optional) To partition your flow logs per hour, choose **Every 1 hour (60 mins)**.
7. (Optional) To add a tag to the flow log, choose **Add new tag** and specify the tag key and value.
8. Choose **Create flow log**.

To create a flow log that publishes to Amazon S3 using a command line tool

Use one of the following commands.

- [create-flow-logs](#) (AWS CLI)
- [New-EC2FlowLogs](#) (AWS Tools for Windows PowerShell)
- [CreateFlowLogs](#) (Amazon EC2 Query API)

The following AWS CLI example creates a flow log that captures all transit gateway traffic for VPC tgw-00112233344556677 and delivers the flow logs to an Amazon S3 bucket called flow-log-bucket. The --log-format parameter specifies a custom format for the flow log records.

```
aws ec2 create-flow-logs --resource-type TransitGateway --resource-ids
tgw-00112233344556677 --log-destination-type s3 --log-destination arn:aws:s3::flow-log-
bucket/my-custom-flow-logs/
```

Process flow log records in Amazon S3

The log files are compressed. If you open the log files using the Amazon S3 console, they are decompressed and the flow log records are displayed. If you download the files, you must decompress them to view the flow log records.

Work with Transit Gateway Flow Logs

You can work with Transit Gateway Flow Logs using the Amazon EC2, Amazon VPC, CloudWatch, and Amazon S3 consoles.

Tasks

- [Control the use of flow logs \(p. 91\)](#)
- [Create a flow log \(p. 91\)](#)
- [View flow logs \(p. 92\)](#)
- [Add or remove tags for flow logs \(p. 92\)](#)
- [View flow log records \(p. 92\)](#)
- [Search flow log records \(p. 93\)](#)
- [Delete a flow log \(p. 94\)](#)
- [API and CLI overview and limitations \(p. 94\)](#)

Control the use of flow logs

By default, IAM users do not have permission to work with flow logs. You can create an IAM user policy that grants users the permissions to create, describe, and delete flow logs. For more information, see [Granting IAM Users Required Permissions for Amazon EC2 Resources](#) in the *Amazon EC2 API Reference*.

The following is an example policy that grants users full permissions to create, describe, and delete flow logs.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "ec2:DeleteFlowLogs",
        "ec2:CreateFlowLogs",
        "ec2:DescribeFlowLogs"
      ],
      "Resource": "*"
    }
  ]
}
```

Some additional IAM role and permission configuration is required, depending on whether you're publishing to CloudWatch Logs or Amazon S3. For more information, see [Publish flow logs to CloudWatch Logs \(p. 81\)](#) and [Publish flow logs to Amazon S3 \(p. 85\)](#).

Create a flow log

You can create flow logs for your transit gateways that can publish data to CloudWatch Logs or Amazon S3.

For more information, see [Create a flow log that publishes to CloudWatch Logs \(p. 83\)](#) and [Create a flow log that publishes to Amazon S3 \(p. 89\)](#).

View flow logs

You can view information about your flow logs in the Amazon VPC console by viewing the **Flow Logs** tab for a specific resource. When you select the resource, all of the flow logs for that resource are listed. The information displayed includes the ID of the flow log, the flow log configuration, and information about the status of the flow log.

To view information about flow logs for transit gateways

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. In the navigation pane, choose **Transit gateways** or **Transit gateway attachments**.
3. Select a transit gateway or transit gateway attachment and choose **Flow Logs**. Information about the flow logs is displayed on the tab. The **Destination type** column indicates the destination to which the flow logs are published.

Add or remove tags for flow logs

You can add or remove tags for a flow log in the Amazon EC2 and Amazon VPC consoles.

To add or remove tags for a transit gateway flow log

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. In the navigation pane, choose **Transit gateways** or **Transit gateway attachments**.
3. Select a transit gateway or transit gateway attachment.
4. Choose **Manage tags** for the required flow log.
5. To add a new tag, choose **Create Tag**. To remove a tag, choose the delete button (x).
6. Choose **Save**.

View flow log records

You can view your flow log records using the CloudWatch Logs console or Amazon S3 console, depending on the chosen destination type. It might take a few minutes after you've created your flow log for it to be visible in the console.

To view flow log records published to CloudWatch Logs

1. Open the CloudWatch console at <https://console.aws.amazon.com/cloudwatch/>.
2. In the navigation pane, choose **Logs**, and select the log group that contains your flow log. A list of log streams for each transit gateway is displayed.
3. Select the log stream that contains the ID of the transit gateway that you want to view the flow log records for. For more information, see [Transit Gateway Flow Log records \(p. 77\)](#).

To view flow log records published to Amazon S3

1. Open the Amazon S3 console at <https://console.aws.amazon.com/s3/>.
2. For **Bucket name**, select the bucket to which the flow logs are published.

3. For **Name**, select the check box next to the log file. On the object overview panel, choose **Download**.

Search flow log records

You can search your flow log records that are published to CloudWatch Logs by using the CloudWatch Logs console. You can use [metric filters](#) to filter flow log records. Flow log records are space delimited.

To search flow log records using the CloudWatch Logs console

1. Open the CloudWatch console at <https://console.aws.amazon.com/cloudwatch/>.
2. In the navigation pane, choose **Logs**, and then choose **Log groups**.
3. Select the log group that contains your flow log. A list of log streams for each transit gateway is displayed.
4. Select the individual log stream if you know the transit gateway that you are searching for. Alternatively, choose **Search Log Group** to search the entire log group. This might take some time if there are many transit gateways in your log group, or depending on the time range that you select.
5. For **Filter events**, enter the following string. This assumes that the flow log record uses the [default format](#) (p. 77).

```
[version, resource_type, account_id,tgw_id, tgw_attachment_id, tgw_src_vpc_account_id,
tgw_dst_vpc_account_id, tgw_src_vpc_id, tgw_dst_vpc_id, tgw_src_subnet_id,
tgw_dst_subnet_id, tgw_src_eni, tgw_dst_eni, tgw_src_az_id, tgw_dst_az_id,
tgw_pair_attachment_id, srcaddr, dstaddr, srcport, dstport, protocol, packets,
bytes,start,end, log_status, type,packets_lost_no_route, packets_lost_blackhole,
packets_lost_mtu_exceeded, packets_lost_ttl_expired, tcp_flags,region, flow_direction,
pkt_src_aws_service, pkt_dst_aws_service]
```

6. Modify the filter as needed by specifying values for the fields. The following examples filter by specific source IP addresses.

```
[version, resource_type, account_id,tgw_id, tgw_attachment_id, tgw_src_vpc_account_id,
tgw_dst_vpc_account_id, tgw_src_vpc_id, tgw_dst_vpc_id, tgw_src_subnet_id,
tgw_dst_subnet_id, tgw_src_eni, tgw_dst_eni, tgw_src_az_id, tgw_dst_az_id,
tgw_pair_attachment_id, srcaddr= 10.0.0.1, dstaddr, srcport, dstport,
protocol, packets, bytes,start,end, log_status, type,packets_lost_no_route,
packets_lost_blackhole, packets_lost_mtu_exceeded, packets_lost_ttl_expired,
tcp_flags,region, flow_direction, pkt_src_aws_service, pkt_dst_aws_service]
[version, resource_type, account_id,tgw_id, tgw_attachment_id, tgw_src_vpc_account_id,
tgw_dst_vpc_account_id, tgw_src_vpc_id, tgw_dst_vpc_id, tgw_src_subnet_id,
tgw_dst_subnet_id, tgw_src_eni, tgw_dst_eni, tgw_src_az_id, tgw_dst_az_id,
tgw_pair_attachment_id, srcaddr= 10.0.2.*, dstaddr, srcport, dstport,
protocol, packets, bytes,start,end, log_status, type,packets_lost_no_route,
packets_lost_blackhole, packets_lost_mtu_exceeded, packets_lost_ttl_expired,
tcp_flags,region, flow_direction, pkt_src_aws_service, pkt_dst_aws_service]
```

The following example filters by transit gateway ID tgw-123abc456bca, destination port, and number of bytes.

```
[version, resource_type, account_id,tgw_id=tgw-123abc456bca, tgw_attachment_id,
tgw_src_vpc_account_id, tgw_dst_vpc_account_id, tgw_src_vpc_id, tgw_dst_vpc_id,
tgw_src_subnet_id, tgw_dst_subnet_id, tgw_src_eni, tgw_dst_eni, tgw_src_az_id,
tgw_dst_az_id, tgw_pair_attachment_id, srcaddr, dstaddr, srcport, dstport =
80 || dstport = 8080, protocol, packets, bytes >= 500,start,end, log_status,
type,packets_lost_no_route, packets_lost_blackhole, packets_lost_mtu_exceeded,
packets_lost_ttl_expired, tcp_flags,region, flow_direction, pkt_src_aws_service,
pkt_dst_aws_service]
```

Delete a flow log

You can delete a transit gateway flow log using the Amazon VPC console.

These procedures disable the flow log service for a resource. Deleting a flow log does not delete the existing log streams from CloudWatch Logs or log files from Amazon S3. Existing flow log data must be deleted using the respective service's console. In addition, deleting a flow log that publishes to Amazon S3 does not remove the bucket policies and log file access control lists (ACLs).

To delete a transit gateway flow log

1. Open the Amazon VPC console at <https://console.aws.amazon.com/vpc/>.
2. In the navigation pane, choose **Transit gateways**.
3. Choose a **Transit gateway ID**.
4. In the Flow logs section, choose the flow logs that you want to delete.
5. Choose **Actions**, and then choose **Delete flow logs**.
6. Confirm that you want to delete the flow by choosing **Delete**.

API and CLI overview and limitations

You can perform the tasks described on this page using the command line or API.

The following limitations apply when using the `CreateFlowLogs` API or the `create-flow-logs` CLI:

- `--resource-ids` has a maximum constraint of 25 TransitGateway or TransitGatewayAttachment resource types.
- `--traffic-type` is not a required field by default. An error is returned if you provide this for transit gateway resource types. This limit applies only to transit gateway resource types.
- `--max-aggregation-interval` has a default value of 60, and is the only accepted value for transit gateway resource types. An error is returned if you try to pass any other value. This limit applies only to transit gateway resource types.
- `--resource-type` supports two new resource types, TransitGateway and TransitGatewayAttachment.
- `--log-format` includes all log fields for transit gateway resource types if you do not set which fields you want to include. This applies only to transit gateway resource types.

Create a flow log

- `create-flow-logs` (AWS CLI)
- `New-EC2FlowLog` (AWS Tools for Windows PowerShell)
- `CreateFlowLogs` (Amazon EC2 Query API)

Describe your flow logs

- `describe-flow-logs` (AWS CLI)
- `Get-EC2FlowLog` (AWS Tools for Windows PowerShell)
- `DescribeFlowLogs` (Amazon EC2 Query API)

View your flow log records (log events)

- `get-log-events` (AWS CLI)

- [Get-CWLLogEvent](#) (AWS Tools for Windows PowerShell)
- [GetLogEvents](#) (CloudWatch API)

Delete a flow log

- [delete-flow-logs](#) (AWS CLI)
- [Remove-EC2FlowLog](#) (AWS Tools for Windows PowerShell)
- [DeleteFlowLogs](#) (Amazon EC2 Query API)

Monitor your transit gateways

You can use the following features to monitor your transit gateways, analyze traffic patterns, and troubleshoot issues with your transit gateways.

CloudWatch metrics

You can use Amazon CloudWatch to retrieve statistics about data points for your transit gateways as an ordered set of time series data, known as *metrics*. You can use these metrics to verify that your system is performing as expected. For more information, see [CloudWatch metrics for your transit gateways \(p. 96\)](#).

Transit Gateway Flow Logs

You can use Transit Gateway Flow Logs to capture detailed information about the network traffic on your transit gateways. For more information, see [Transit Gateway Flow Logs \(p. 76\)](#).

VPC Flow Logs

You can use VPC Flow Logs to capture detailed information about the traffic going to and from the VPCs that are attached to your transit gateways. For more information, see [VPC Flow Logs](#) in the *Amazon VPC User Guide*.

CloudTrail logs

You can use AWS CloudTrail to capture detailed information about the calls made to the transit gateway API and store them as log files in Amazon S3. You can use these CloudTrail logs to determine which calls were made, the source IP address where the call came from, who made the call, when the call was made, and so on. For more information, see [Logging API calls for your transit gateway using AWS CloudTrail \(p. 98\)](#).

CloudWatch metrics for your transit gateways

Amazon VPC publishes data points to Amazon CloudWatch for your transit gateways and transit gateway attachments. CloudWatch enables you to retrieve statistics about those data points as an ordered set of time series data, known as *metrics*. Think of a metric as a variable to monitor, and the data points as the values of that variable over time. Each data point has an associated timestamp and an optional unit of measurement.

You can use metrics to verify that your system is performing as expected. For example, you can create a CloudWatch alarm to monitor a specified metric and initiate an action (such as sending a notification to an email address) if the metric goes outside what you consider an acceptable range.

Amazon VPC measures and sends its metrics to CloudWatch in 60-second intervals.

For more information, see the [Amazon CloudWatch User Guide](#).

Contents

- [Transit gateway metrics \(p. 96\)](#)
- [Metric dimensions for transit gateways \(p. 97\)](#)

Transit gateway metrics

The AWS/TransitGateway namespace includes the following metrics.

Metric	Description
BytesDropCountBlackhole	The number of bytes dropped because they matched a blackhole route.
BytesDropCountNoRoute	The number of bytes dropped because they did not match a route.
BytesIn	The number of bytes received by the transit gateway.
BytesOut	The number of bytes sent from the transit gateway.
PacketsIn	The number of packets received by the transit gateway.
PacketsOut	The number of packets sent by the transit gateway.
PacketDropCountBlackhole	The number of packets dropped because they matched a blackhole route.
PacketDropCountNoRoute	The number of packets dropped because they did not match a route.

Attachment-level metrics

The following metrics are available for transit gateway attachments. All attachment metrics are published to the transit gateway owner's account. Individual attachment metrics are also published to the attachment owner's account. The attachment owner can view only the metrics for their own attachment. For more information on the supported attachment types, see [the section called "Resource attachments" \(p. 4\)](#).

Metric	Description
BytesDropCountBlackhole	The number of bytes dropped because they matched a blackhole route on the transit gateway attachment.
BytesDropCountNoRoute	The number of bytes dropped because they did not match a route on the transit gateway attachment.
BytesIn	The number of bytes received by the transit gateway from the attachment.
BytesOut	The number of bytes sent from the transit gateway to the attachment.
PacketsIn	The number of packets received by the transit gateway from the attachment.
PacketsOut	The number of packets sent by the transit gateway to the attachment.
PacketDropCountBlackhole	The number of packets dropped because they matched a blackhole route on the transit gateway attachment.
PacketDropCountNoRoute	The number of packets dropped because they did not match a route on the transit gateway attachment.

Metric dimensions for transit gateways

To filter the metrics for your transit gateways, use the following dimensions.

Dimension	Description
TransitGateway	Filters the metric data by transit gateway.
TransitGatewayAttachment	Filters the metric data by transit gateway attachment.

Logging API calls for your transit gateway using AWS CloudTrail

AWS CloudTrail is a service that provides a record of actions taken by a user, role, or an AWS service. CloudTrail captures all transit gateway API calls as events. The calls captured include calls from the AWS Management Console and code calls to the transit gateway API operations. If you create a trail, you can enable continuous delivery of CloudTrail events to an Amazon S3 bucket, including events for transit gateways. If you don't configure a trail, you can still view the most recent events in the CloudTrail console in **Event history**. Using the information collected by CloudTrail, you can determine what request was made to the transit gateway API, the IP address from which the request was made, who made the request, when it was made, and additional details.

For more information about transit gateway APIs, see [AWS Transit Gateway actions](#) in the *Amazon EC2 API Reference*.

For more information about CloudTrail, see the [AWS CloudTrail User Guide](#).

Transit gateway information in CloudTrail

CloudTrail is enabled on your AWS account when you create the account. When activity occurs through the transit gateway API, that activity is recorded in a CloudTrail event along with other AWS service events in **Event history**. You can view, search, and download recent events in your AWS account. For more information, see [Viewing Events with CloudTrail Event History](#).

For an ongoing record of events in your AWS account, including events for the transit gateway API, create a trail. A *trail* enables CloudTrail to deliver log files to an Amazon S3 bucket. By default, when you create a trail in the console, the trail applies to all Regions. The trail logs events from all Regions in the AWS partition and delivers the log files to the Amazon S3 bucket that you specify. Additionally, you can configure other AWS services to further analyze and act upon the event data collected in CloudTrail logs. For more information, see the following:

- [Overview for Creating a Trail](#)
- [CloudTrail Supported Services and Integrations](#)
- [Configuring Amazon SNS Notifications for CloudTrail](#)
- [Receiving CloudTrail Log Files from Multiple Regions](#) and [Receiving CloudTrail Log Files from Multiple Accounts](#)

All calls to transit gateway actions are logged by CloudTrail. For example, calls to the `CreateTransitGateway` action generates entries in the CloudTrail log files.

Every event or log entry contains information about who generated the request. The identity information helps you determine the following:

- Whether the request was made with root or AWS Identity and Access Management (IAM) user credentials.
- Whether the request was made with temporary security credentials for a role or federated user.

- Whether the request was made by another AWS service.

For more information, see the [CloudTrail userIdentity Element](#).

Understanding transit gateway log file entries

A trail is a configuration that enables delivery of events as log files to an Amazon S3 bucket that you specify. CloudTrail log files contain one or more log entries. An event represents a single request from any source and includes information about the requested action, the date and time of the action, request parameters, and so on. CloudTrail log files aren't an ordered stack trace of the public API calls, so they don't appear in any specific order.

The log files include events for all API calls for your AWS account, not just transit gateway API calls. You can locate calls to the transit gateway API by checking for eventSource elements with the value `ec2.amazonaws.com`. To view a record for a specific action, such as `CreateTransitGateway`, check for eventName elements with the action name.

The following are example CloudTrail log records for the transit gateway API for a user who created a transit gateway using the console. You can identify the console using the `userAgent` element. You can identify the requested API call using the `eventName` elements. Information about the user (Alice) can be found in the `userIdentity` element.

Example Example: CreateTransitGateway

```
{
  "eventVersion": "1.05",
  "userIdentity": {
    "type": "IAMUser",
    "principalId": "123456789012",
    "arn": "arn:aws:iam::123456789012:user/Alice",
    "accountId": "123456789012",
    "accessKeyId": "AKIAIOSFODNN7EXAMPLE",
    "userName": "Alice"
  },
  "eventTime": "2018-11-15T05:25:50Z",
  "eventSource": "ec2.amazonaws.com",
  "eventName": "CreateTransitGateway",
  "awsRegion": "us-west-2",
  "sourceIPAddress": "198.51.100.1",
  "userAgent": "console.ec2.amazonaws.com",
  "requestParameters": {
    "CreateTransitGatewayRequest": {
      "Options": {
        "DefaultRouteTablePropagation": "enable",
        "AutoAcceptSharedAttachments": "disable",
        "DefaultRouteTableAssociation": "enable",
        "VpnEcmpSupport": "enable",
        "DnsSupport": "enable"
      },
      "TagSpecification": {
        "ResourceType": "transit-gateway",
        "tag": 1,
        "Tag": {
          "Value": "my-tgw",
          "tag": 1,
          "Key": "Name"
        }
      }
    }
  },
  "responseElements": {
```



```
    "CreateTransitGatewayResponse": {
      "xmlns": "http://ec2.amazonaws.com/doc/2016-11-15/",
      "requestId": "a07c1edf-c201-4e44-bffb-3ce90EXAMPLE",
      "transitGateway": {
        "tagSet": {
          "item": {
            "value": "my-tgw",
            "key": "Name"
          }
        },
        "creationTime": "2018-11-15T05:25:50.000Z",
        "transitGatewayId": "tgw-0a13743bd6c1f5fcb",
        "options": {
          "propagationDefaultRouteTableId": "tgw-rtb-0123cd602be10b00a",
          "amazonSideAsn": 64512,
          "defaultRouteTablePropagation": "enable",
          "vpnEcmpSupport": "enable",
          "autoAcceptSharedAttachments": "disable",
          "defaultRouteTableAssociation": "enable",
          "dnsSupport": "enable",
          "associationDefaultRouteTableId": "tgw-rtb-0123cd602be10b00a"
        },
        "state": "pending",
        "ownerId": 123456789012
      }
    },
    "requestId": "a07c1edf-c201-4e44-bffb-3ce90EXAMPLE",
    "eventID": "e8fa575f-4964-4ab9-8ca4-6b5b4EXAMPLE",
    "eventType": "AwsApiCall",
    "recipientAccountId": "123456789012"
  }
```

Authentication and access control for your transit gateways

AWS uses security credentials to identify you and to grant you access to your AWS resources. You can use features of AWS Identity and Access Management (IAM) to allow other users, services, and applications to use your AWS resources fully or in a limited way, without sharing your security credentials.

By default, IAM users don't have permission to create, view, or modify AWS resources. To allow an IAM user to access resources, such as a transit gateway, and perform tasks, you must create an IAM policy that grants the IAM user permission to use the specific resources and API actions they'll need, then attach the policy to the IAM user or the group to which the IAM user belongs. When you attach a policy to a user or group of users, it allows or denies the users permission to perform the specified tasks on the specified resources.

To work with a transit gateway, one of the following AWS managed policies might meet your needs:

- **PowerUserAccess**
- **ReadOnlyAccess**
- **AmazonEC2FullAccess**
- **AmazonEC2ReadOnlyAccess**

For more information, see [IAM policies for Amazon EC2](#) in the *Amazon EC2 User Guide*.

Example policies to manage transit gateways

The following are example IAM policies for working with transit gateways.

Create a transit gateway with required tags

The following example enables users to create transit gateway. The `aws:RequestTag` condition key requires users to tag the transit gateway with the tag `stack=prod`. The `aws:TagKeys` condition key uses the `ForAllValues` modifier to indicate that only the key `stack` is allowed in the request (no other tags can be specified). If users don't pass this specific tag when they create the transit gateway, or if they don't specify tags at all, the request fails.

The second statement uses the `ec2:CreateAction` condition key to allow users to create tags only in the context of `CreateTransitGateway`.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "AllowCreateTaggedTGWs",
      "Effect": "Allow",
      "Action": "ec2:CreateTransitGateway",
      "Resource": "arn:aws:ec2:region:account-id:transit-gateway/*",
      "Condition": {
        "StringEquals": {
          "aws:RequestTag/stack": "prod"
        }
      }
    }
  ]
}
```

```
        "ForAllValues:StringEquals": {
            "aws:TagKeys": [
                "stack"
            ]
        }
    },
    {
        "Effect": "Allow",
        "Action": [
            "ec2:CreateTags"
        ],
        "Resource": "arn:aws:ec2:region:account-id:transit-gateway/*",
        "Condition": {
            "StringEquals": {
                "ec2:CreateAction": "CreateTransitGateway"
            }
        }
    }
]
```

Working with transit gateway route tables

The following example enables users to create and delete transit gateway route tables for a specific transit gateway only (tgw-11223344556677889). Users can also create and replace routes in any transit gateway route table, but only for attachments that have the tag network=new-york-office.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "ec2:DeleteTransitGatewayRouteTable",
        "ec2:CreateTransitGatewayRouteTable"
      ],
      "Resource": [
        "arn:aws:ec2:region:account-id:transit-gateway/tgw-11223344556677889",
        "arn:aws:ec2:*:*:transit-gateway-route-table/*"
      ]
    },
    {
      "Effect": "Allow",
      "Action": [
        "ec2:CreateTransitGatewayRoute",
        "ec2:ReplaceTransitGatewayRoute"
      ],
      "Resource": "arn:aws:ec2:*:*:transit-gateway-attachment/*",
      "Condition": {
        "StringEquals": {
          "ec2:ResourceTag/network": "new-york-office"
        }
      }
    }
  ],
  {
    "Effect": "Allow",
    "Action": [
      "ec2:CreateTransitGatewayRoute",
      "ec2:ReplaceTransitGatewayRoute"
    ],
    "Resource": "arn:aws:ec2:*:*:transit-gateway-route-table/*"
  }
]
```

```
}
```

Example policies to manage AWS Network Manager

For example policies, see [Example policies to manage Network Manager](#).

Use service-linked roles for transit gateway

Amazon VPC uses service-linked roles for the permissions that it requires to call other AWS services on your behalf. For more information, see [Using service-linked roles](#) in the *IAM User Guide*.

Transit gateway service-linked role

Amazon VPC uses service-linked roles for the permissions that it requires to call other AWS services on your behalf when you work with a transit gateway.

Permissions granted by the service-linked role

Amazon VPC uses the service-linked role named **AWSServiceRoleForVPCTransitGateway** to call the following actions on your behalf when you work with a transit gateway:

- `ec2:CreateNetworkInterface`
- `ec2:DescribeNetworkInterface`
- `ec2:ModifyNetworkInterfaceAttribute`
- `ec2>DeleteNetworkInterface`
- `ec2:CreateNetworkInterfacePermission`
- `ec2:AssignIpv6Addresses`
- `ec2:UnAssignIpv6Addresses`

AWSServiceRoleForVPCTransitGateway trusts the `transitgateway.amazonaws.com` service to assume the role.

Create the service-linked role

You don't need to manually create the **AWSServiceRoleForVPCTransitGateway** role. Amazon VPC creates this role for you when you attach a VPC in your account to a transit gateway.

For Amazon VPC to create a service-linked role on your behalf, you must have the required permissions. For more information, see [Service-linked role permissions](#) in the *IAM User Guide*.

Edit the service-linked role

You can edit the description of **AWSServiceRoleForVPCTransitGateway** using IAM. For more information, see [Editing a service-linked role](#) in the *IAM User Guide*.

Delete the service-linked role

If you no longer need to use transit gateways, we recommend that you delete **AWSServiceRoleForVPCTransitGateway**.

You can delete this service-linked role only after you delete all transit gateway VPC attachments in your AWS account. This ensures that you can't inadvertently remove permission to access your VPC attachments.

You can use the IAM console, the IAM CLI, or the IAM API to delete service-linked roles. For more information, see [Deleting a service-linked role](#) in the *IAM User Guide*.

After you delete **AWSServiceRoleForVPCTransitGateway**, Amazon VPC creates the role again if you attach a VPC in your account to a transit gateway.

AWS managed policies for transit gateways and AWS Network Manager

To add permissions to users, groups, and roles, it is easier to use AWS managed policies than to write policies yourself. It takes time and expertise to [create IAM customer managed policies](#) that provide your team with only the permissions they need. To get started quickly, you can use our AWS managed policies. These policies cover common use cases and are available in your AWS account. For more information about AWS managed policies, see [AWS managed policies](#) in the *IAM User Guide*.

AWS services maintain and update AWS managed policies. You can't change the permissions in AWS managed policies. Services occasionally add additional permissions to an AWS managed policy to support new features. This type of update affects all identities (users, groups, and roles) where the policy is attached. Services are most likely to update an AWS managed policy when a new feature is launched or when new operations become available. Services do not remove permissions from an AWS managed policy, so policy updates won't break your existing permissions.

Additionally, AWS supports managed policies for job functions that span multiple services. For example, the **ReadOnlyAccess** AWS managed policy provides read-only access to all AWS services and resources. When a service launches a new feature, AWS adds read-only permissions for new operations and resources. For a list and descriptions of job function policies, see [AWS managed policies for job functions](#) in the *IAM User Guide*.

Information about AWS managed policies for Network Manager can be found in [AWS managed policies for Network Manager](#) in the *Network Manager User Guide*.

How Network ACLs work with transit gateways

A network access control list (NACL) is an optional layer of security.

Network access control list (NACL) rules are applied differently, depending on the scenario:

- [the section called "Same subnet for EC2 instances and transit gateway association"](#) (p. 104)
- [the section called "Different subnets for EC2 instances and transit gateway association"](#) (p. 105)

Same subnet for EC2 instances and transit gateway association

Consider a configuration where you have an EC2 instances and a transit gateway association in the same subnet. The same network ACL is used for both the traffic from the EC2 instances to the transit gateway and traffic from the transit gateway to the instances.

NACL rules are applied as follows for traffic from instances to the transit gateway:

- Outbound rules use the destination IP address for evaluation.
- Inbound rules use the source IP address for evaluation.

NACL rules are applied as follows for traffic from the transit gateway to the instances:

- Outbound rules are not evaluated.
- Inbound rules are not evaluated.

Different subnets for EC2 instances and transit gateway association

Consider a configuration where you have EC2 instances in one subnet and the transit gateway association in a different subnet, and each subnet is associated with a different network ACL.

Network ACL rules are applied as follows for the EC2 instance subnet:

- Outbound rules use the destination IP address to evaluate traffic from the instances to the transit gateway.
- Inbound rules use the source IP address to evaluate traffic from the transit gateway to the instances.

NACL rules are applied as follows for the transit gateway subnet:

- Outbound rules use the destination IP address to evaluate traffic from the transit gateway to the instances.
- Outbound rules are not used to evaluate traffic from the instances to the transit gateway.
- Inbound rules use the source IP address to evaluate traffic from the instances to the transit gateway.
- Inbound rules are not used to evaluate traffic from the transit gateway to the instances.

Best Practices

Use a separate subnet for each transit gateway VPC attachment. For each subnet, use a small CIDR, for example /28, so that you have more addresses for EC2 resources. When you use a separate subnet, you can configure the following:

- Keep the inbound and outbound NACL that is associated with the transit gateway subnets open.
- Depending on your traffic flow, you can apply NACLs to your workload subnets.

For more information about how VPC attachments work, see [the section called “Resource attachments” \(p. 4\)](#).

Quotas for your transit gateways

Your AWS account has the following quotas (previously referred to as *limits*) related to transit gateways.

The Service Quotas console provides information about Network Manager quotas. You can use the Service Quotas console to view default quotas and [request quota increases](#) for adjustable quotas. For more information, see [Requesting a quota increase](#) in the *Service Quotas User Guide*.

If an adjustable quota is not yet available in Service Quotas, you can open a support case.

General

Note

AWS Transit Gateway doesn't support Security Group referencing when migrating from VPC peering to use transit gateways.

Name	Default	Adjustable
Transit gateways per account	5	Yes
CIDR blocks per transit gateway	5	No

The CIDR blocks are used in the [the section called “Transit gateway Connect attachments and Transit Gateway Connect peers” \(p. 44\)](#) feature.

Routing

Name	Default	Adjustable
Transit gateway route tables per transit gateway	20	Yes
Static routes per transit gateway	10,000	Yes
Dynamic routes advertised from a virtual router appliance to a Transit Gateway Connect peer	1,000	No
Routes advertised from a Transit Gateway Connect peer on a transit gateway to a virtual router appliance	5,000	No
Static routes for a prefix to a single attachment	1	No

Advertised routes come from the route table that's associated with the Connect attachment.

Transit gateway attachments

A transit gateway cannot have more than one VPC attachment to the same VPC.

Name	Default	Adjustable
Attachments per transit gateway	5,000	No
Transit gateways per VPC	5	No
Peering attachments per transit gateway	50	Yes
Pending peering attachments per transit gateway	10	Yes
Peering attachments between two transit gateways	1	No
Transit Gateway Connect peers (GRE tunnels) per transit gateway Connect attachment	4	No

Bandwidth

There are many factors that can affect realized bandwidth through a Site-to-Site VPN connection, including but not limited to: packet size, traffic mix (TCP/UDP), shaping or throttling policies on intermediate networks, internet weather, and specific application requirements.

Name	Default	Adjustable
Maximum bandwidth per VPC attachment, AWS Direct Connect gateway, or peered transit gateway connection	Up to 50 Gbps	No
Maximum packets per second per transit gateway attachment (VPC, VPN, Direct Connect, and peering attachments)	Up to 5,000,000	No
Maximum bandwidth per VPN tunnel	Up to 1.25 Gbps	No
Maximum packets per second per VPN tunnel	Up to 140,000	No
Maximum bandwidth per Transit Gateway Connect peer (GRE tunnel) per Connect attachment	Up to 5 Gbps	No
Maximum packets per second per Connect peer	Up to 300,000	No

You can use equal-cost multipath routing (ECMP) to get higher VPN bandwidth by aggregating multiple VPN tunnels. To use ECMP, the VPN connection must be configured for dynamic routing. ECMP is not supported on VPN connections that use static routing.

You can create up to 4 Transit Gateway Connect peers per Connect attachment (up to 20 Gbps in total bandwidth per Connect attachment), as long as the underlying transport (VPC or AWS Direct Connect) attachment supports the required bandwidth. You can use ECMP to get higher bandwidth by scaling horizontally across multiple Transit Gateway Connect peers of the same Connect attachment or across multiple Connect attachments on the same transit gateway. The transit gateway cannot use ECMP between the BGP peerings of the same Transit Gateway Connect peer.

AWS Direct Connect gateways

Name	Default	Adjustable
AWS Direct Connect gateways per transit gateway	20	No
Transit gateways per AWS Direct Connect gateway	3	No

MTU

- The maximum transmission unit (MTU) of a network connection is the size, in bytes, of the largest permissible packet that can be passed over the connection. The larger the MTU of a connection, the more data that can be passed in a single packet. A transit gateway supports an MTU of 8500 bytes for traffic between VPCs, Direct Connect gateway, and peering attachments. Traffic over VPN connections can have an MTU of 1500 bytes.
- When migrating from VPC peering to use a transit gateway, an MTU size mismatch between VPC peering and the transit gateway might result in some asymmetric traffic packets dropping. Update both VPCs at the same time to avoid jumbo packets dropping due to a size mismatch.
- Packets with a size larger than 8500 bytes that arrive at the transit gateway are dropped.
- The transit gateway does not generate the FRAG_NEEDED for ICMPv4 packet, or the Packet Too Big (PTB) for ICMPv6 packet. Therefore, the Path MTU Discovery (PMTUD) is not supported.
- The transit gateway enforces Maximum Segment Size (MSS) clamping for all packets. For more information, see [RFC879](#).
- For details about Site-to-Site VPN quotas for MTU, see [Maximum transmission unit \(MTU\)](#) in the *AWS Site-to-Site VPN User Guide*.

Multicast

Name	Default	Adjustable
Multicast domains per transit gateway	20	Yes
Multicast network interfaces per transit gateway	1,000	Yes
Members per transit gateway multicast group	100	Yes
Multicast domain associations per VPC	20	Yes
Sources per transit gateway multicast group	1	Yes
Static and IGMPv2 multicast group members and sources per transit gateway	10,000	No
Static and IGMPv2 multicast group members per transit gateway multicast group	100	No
Maximum multicast throughput per flow	1 Gbps	No
Maximum aggregate multicast throughput per Availability Zone	20 Gbps	No

AWS Network Manager

Name	Default	Adjustable
Global networks per AWS account	5	Yes
Devices per global network	200	Yes
Links per global network	200	Yes
Sites per global network	200	Yes
Connections per global network	500	No

Additional quota resources

For more information, see the following:

- [Site-to-Site VPN quotas](#) in the *AWS Site-to-Site VPN User Guide*
- [Amazon VPC quotas](#) in the *Amazon VPC User Guide*
- [AWS Direct Connect quotas](#) in the *AWS Direct Connect User Guide*

Document history for transit gateways

The following table describes the releases for transit gateways.

Change	Description	Date
AWS Transit Gateway Flow Logs	Transit Gateways now support Transit Gateway Flow Logs, allowing you to monitor and log network traffic between transit gateways.	July 14, 2022
Transit gateway policy tables	Use policy tables to set up dynamic routing for transit gateways for automatically exchanging routing and reachability information with peered transit gateway types.	July 13, 2022
Network Manager User Guide	Network Manager was created as a standalone guide, and is no longer included as part of the <i>AWS Transit Gateway User Guide</i> .	December 2, 2021
Peering attachments	You can create a peering connection with a transit gateway in the same Region.	December 1, 2021
Transit Gateway Connect	You can establish a connection between a transit gateway and third-party virtual appliances running in a VPC.	December 10, 2020
Appliance mode	You can enable appliance mode on a VPC attachment to ensure that bidirectional traffic flows through the same Availability Zone for the attachment.	October 29, 2020
Prefix list references	You can reference a prefix list in your transit gateway route table.	August 24, 2020
Modify transit gateway	You can modify the configuration options for your transit gateway.	August 24, 2020
CloudWatch metrics for transit gateway attachments	You can view CloudWatch metrics for individual transit gateway attachments.	July 6, 2020
Network Manager Route Analyzer	You can analyze the routes in your transit gateway route tables in your global network.	May 4, 2020

Peering attachments	You can create a peering connection with a transit gateway in another Region.	December 3, 2019
Multicast support	Transit Gateway supports routing multicast traffic between subnets of attached VPCs and serves as a multicast router for instances sending traffic destined for multiple receiving instances.	December 3, 2019
AWS Network Manager	You can visualize and monitor your global networks that are built around transit gateways.	December 3, 2019
AWS Direct Connect support	You can use an AWS Direct Connect gateway to connect your AWS Direct Connect connection over a transit virtual interface to the VPCs or VPNs attached to your transit gateway.	March 27, 2019
Initial release (p. 110)	This release introduces transit gateways.	November 26, 2018