BIG-IP® Cloud Interconnect with Equinix: Implementation

Version 12.1

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Creating a Cloud Interconnection with the BIG-IP System

About Cloud Interconnections with the BIG-IP system

A *Cloud Interconnection* provides connectivity between your network and multiple public or managed private cloud providers. This gives you an alternative to public internet or multiple dedicated private connections to cloud providers.
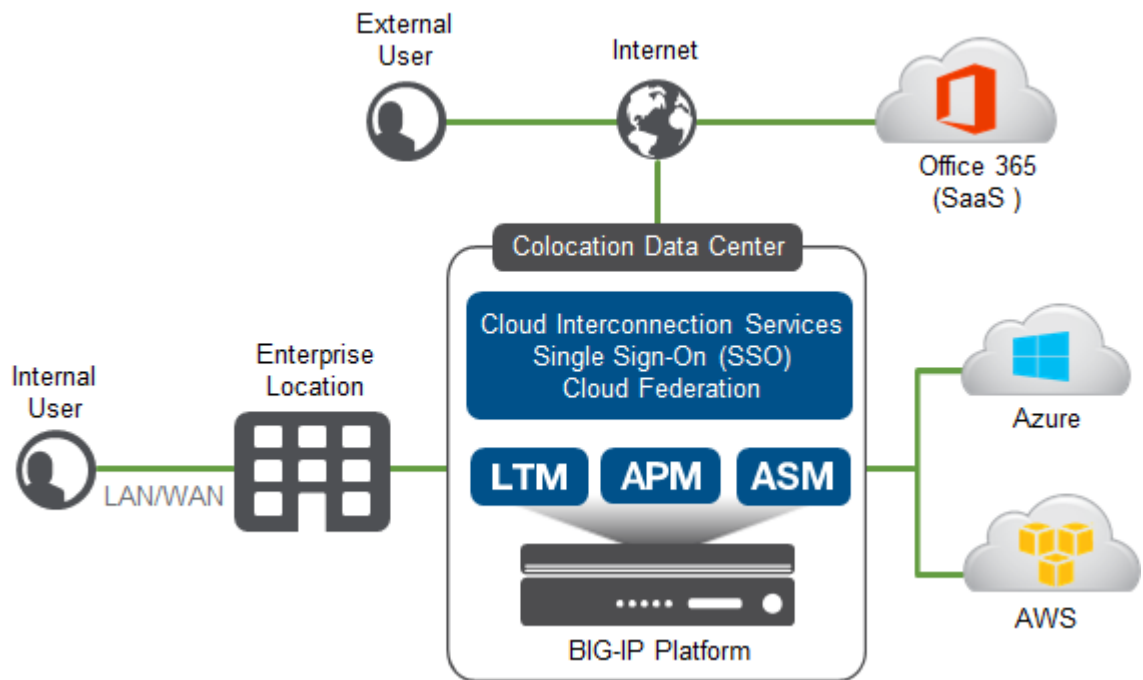
Your public cloud resources may not be connected to the internet at all. You might access them solely through the cloud exchange, making the cloud a true extension of the data center. This creates a central point where public cloud, private cloud, and corporate networks intersect. This is where F5 services add value.

Equinix is an F5 partner that offers these services at very high speed and low latency.

Note: Equinix uses the term cloud exchange for their Cloud Interconnection service.

This document explains how to configure a BIG-IP® system in a Cloud Interconnection configuration with Microsoft Azure and Amazon Web Services.

When the deployment is complete, you can continue configuring the BIG-IP system, just as you would if the BIG-IP system were in your corporate data center.

Cloud Interconnection tasks

Complete the following tasks to set up a Cloud Interconnection. Each task is described in detail later in this document.

1. Contact Equinix and tell them you have equipment you want to connect to their cloud exchange. Equinix will provide you with information (like public IP addresses) that you need to connect to the BIG-IP®system remotely.

2. Log in to each BIG-IP system and configure remote access to it, so you can access it after it's in the colo facility. In this example, there are two BIG-IP systems: primary and secondary.
3. Ship the BIG-IP systems to the colo facility.
   Equinix has a service that can rack, connect, and power on the BIG-IP system. You can proceed with the following tasks, even if they have not powered on the BIG-IP system yet.
4. Create routes for private connectivity between the cloud provider and your facility. To do this, you use the Equinix portal along with:

   - AWS Direct Connect (`https://aws.amazon.com/directconnect`)
   - Azure Express Route (`https://azure.microsoft.com/en-us/services/expressroute`)
   - Google, Oracle, and/or other cloud providers' direct connectivity solutions

5. Configure the BIG-IP system to act as a router between your facility and the cloud exchange.
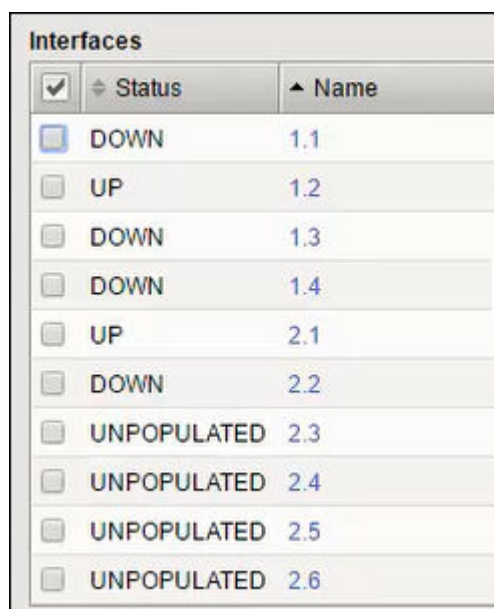6. Configure additional BIG-IP services (like SSO, WAF, or SSL intercept, for example).

This document uses the following example names and addresses:

BIG-IP system	Virtual interface name	VLAN ID	Cloud router IP address	BIG-IP self IP address
AWS primary	aws_pri	3010	172.16.1.9	172.16.1.10
AWS secondary	aws_sec	3010	172.16.1.13	172.16.1.14
Azure primary	azure_pri	3011	172.16.1.1	172.16.1.2
Azure secondary	azure_sec	3011	172.16.1.5	172.16.1.6

Configure remote access to the BIG-IP system

When the BIG-IP® system is in the colo facility, you might not be able to physically access it, so you need to configure remote access to it.

1. Connect to the BIG-IP Configuration Utility.
2. On the Main tab, click **Network** > **Interfaces**. Determine which of the **UP** interfaces you want to use for internet connectivity.

In this example, 1.2 is used for internet connectivity and 2.1 is for the connection to the cloud servers.

3. Now create a VLAN. On the Main tab, click **Network** > **VLANs**.

4. Click **Create**.

   In this example, the internet VLAN is using interface 1.2.

5. Now create a self IP address. On the Main tab, click **Network** > **Self IPs**.

6. Click **Create**. Ensure that for **VLAN/Tunnel** you select **internet**, and for **Port Lockdown**, select **Allow Default**.

   Allow Default allows management connectivity via the data plane interface. (There is no cable connected to the management interface in this example.)

Now complete these steps on the secondary BIG-IP system.

Configuring Cloud Interconnection for AWS

Create connections for AWS in the Equinix portal

You must create virtual circuits over the dedicated links that are directly connected to the BIG-IP® systems.

1. In the Equinix Cloud Exchange Portal, on the top toolbar, click **Create Connection**.
2. Complete the fields.

Option	Description
Metro	The colo location where the BIG-IP systems will physically be located.
Service	AWS Direct Connect
Virtual Circuit Name	A name, for example `aws_pri` for the primary BIG-IP system in AWS.
Buyer-side Port	The primary BIG-IP system port.
Buyer-side VLAN ID	A tag you will use in a BIG-IP system. In this example, it is `3010`.
AWS Account ID	In the AWS Management console, at the top right, click **Support** > **Support Center**. The account number displays at the top right.

3. Click **Create Virtual Circuit**.
4. Open the AWS Management Console and from the Services menu at the top of the screen, under Networking & Content Delivery, click **Direct Connect**.
5. In the left pane, click **Connections**.
   Within a few minutes, the connection you created in Equinix should appear.
6. Expand the connection to view details, and select the check box to accept the connection.
7. Now return to the Equinix portal. From the menu at the top of the page, click **Connections** and expand your connection again.
8. Click **Accept Hosted Connection** and enter your access key and secret key.

The state of the connection in AWS changes to `available`.

Now complete these steps for the secondary BIG-IP system.

Create a virtual interface in the AWS Management Console

AWS requires you to configure endpoints that the Direct Connections will terminate on. In AWS terminology, these are called *virtual interfaces*.

1. Log in to the AWS Management Console (`https://console.aws.amazon.com`).
2. On the home page, in the Networking & Content Delivery section, click **Direct Connect**.
3. On the left pane, click **Connections**.
4. In the Connections list, click the row to view the connection details.
5. Click the **Create Virtual Interface** link.
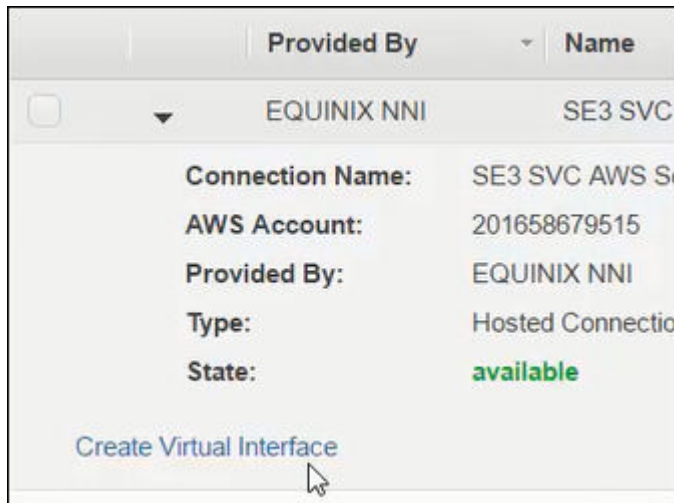
6. Complete the settings. When an option is not listed here, you can accept the default setting.

Option	Description
Connection	The primary connection name and ID.
Virtual Interface Name	A name, for example `aws_pri_vi`.
Auto-generate peer IPs	*Important: Clear this check box.*
Your router peer IP	The AWS router address, for example, `172.16.1.9/30`.
Amazon router peer IP	BIG-IP system's router address, for example, `172.16.1.10/30`.
BGP ASN	You can use any valid BGP ASN number, for example, `22317`.

7. Click **Continue**.
   The screen displays the interfaces. After a few minutes, the state changes from `pending` to `down`.

8. In the list of virtual interfaces, click the row to view the interface details.

9. Click the **Download Router Configuration** link.

10. Accept the defaults and click **Download**.
    The file, for example, uswest2-<>-cgate_vi_secondary.txt, is downloaded.

11. Open the file with a text editor and note the IP address and neighbor information. You will need this later for your BGP routing configuration.

Configuring Cloud Interconnection for Azure

Create an ExpressRoute circuit in the Azure portal

Equinix requires that you create an ExpressRoute circuit in order to set up connections in the Equinix portal.

1. Log in to the Azure portal (`https://portal.azure.com`).
2. Click **More Services** > **ExpressRoute circuits**.
3. Click **Add**.
4. Complete the fields.

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   *Note: **Metered** is a more cost-efficient billing model for a proof of concept.*

   ---
5. Click **Create**.
6. Now view the gateway properties and note the service key; you will need it when you create a connection in the Equinix portal.

Create connections for Azure in the Equinix portal

You must create virtual circuits over the dedicated links that are directly connected to the BIG-IP® systems.

1. In the Equinix Cloud Exchange Portal, on the top toolbar, click **Create Connection**.
2. Complete the fields in the Primary Buyer-side Information area.

Option	Description
Metro	The colo location where the BIG-IP systems will physically be located.
Service	Azure ExpressRoute
Primary Service Name	A name, for example `azure_pri` for the primary BIG-IP system in Azure.
Primary Buyer-side Port	The primary BIG-IP port.
Primary Buyer-side VLAN ID	A tag you will use in BIG-IP system configuration. In this example, `3011`.

3. Complete the fields in the Secondary Buyer-side Information area.

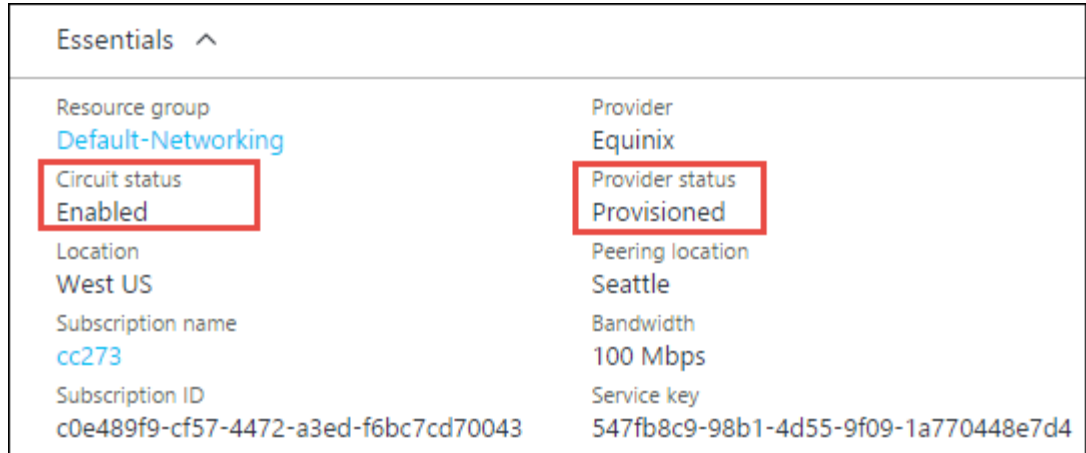 | Option | Description |
   |---|---|
   | **Secondary Service Name** | A name, for example `azure_sec` for the secondary BIG-IP system in Azure. |
   | **Secondary Buyer-side Port** | The secondary BIG-IP port. |
   | **Secondary Buyer-side VLAN ID** | This is populated for you and should match the Primary Buyer-side VLAN ID. |

4. In the Seller-side Information area, add the Azure service key.

   This key is listed in the Azure portal on the ExpressRoute you created.
5. In the **Email Address** field, type an email address for notifications from Equinix.

6. Click **Create Virtual Circuit**.

Within a few minutes, the state of the connection in Azure changes to `Provisioned`.

Create a connection and peering in the Azure portal

In the Azure portal, open the ExpressRoute and confirm that the **Circuit status** is `Enabled` and **Provider status** is `Provisioned`.

Azure requires you to configure peering and connections that the ExpressRoute will terminate on.

1. Select the ExpressRoute you created.
2. Click **Connections** and create one.
3. Click **Peerings** and create a private peering.

| Option	Description
Peer ASN	For example, `22317`.
Primary subnet	For example, `172.16.1.0/30`.
Secondary subnet	For example, `172.16.1.4/30`.
VLAN ID	For example, `3011`.
Shared key	For example, `gf43jsd92ksa-djkakf`.

4. Click **Save**.

Finish Configuring Cloud Interconnection in the BIG-IP System

Enable the BGP routing protocol

Cloud providers advertise their routes via BGP. The BIG-IP® system can act as a BGP router for your Cloud Interconnection configuration.

Note: The BIG-IP system does not need to be the router in this configuration.

1. Connect to the BIG-IP Configuration utility.
2. On the Main tab, click **Network** > **Route Domains**.
   The screen displays a list of route domains.
3. Click **0** to edit the record.
4. In the Dynamic Routing Protocols setting, move **BGP** from the **Available** to the **Enabled** list.
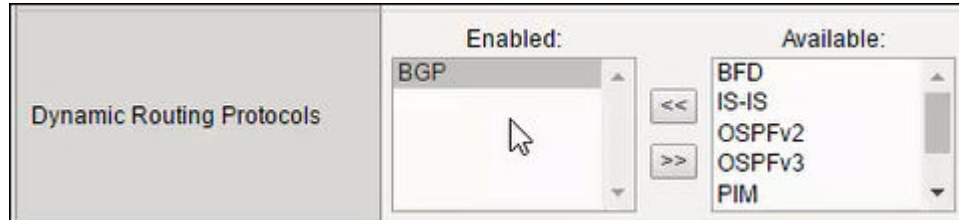
5. Click **Update**.

The BGP dynamic routing protocol is now enabled.

Create Cloud Interconnection VLANs

In BIG-IP® you must create VLANs that correspond to the ones you created in the Equinix portal.

1. In the BIG-IP Configuration utility, on the Main tab, click **Network** > **VLANs** and then click **Create**.
2. Create a VLAN for AWS:

Option	Description
Name	aws_3010
Tag	3010
Interface	2.1, tagged

3. Create a VLAN for Azure:

Option	Description
Name	azure_3011
Tag	3011
Interface	2.1, tagged

   Note: This is the same interface as the AWS VLAN.

4. Create a VLAN for the virtual server:

Option	Description
Name	services_VLAN
Interface	2.1, tagged

Note: This is the same interface as the other VLANs.

If you have been following this example, when you are done, you have the following VLANs configured:

- aws_3010
- azure_3011
- services_vlan
- internet

Create Cloud Interconnection self IP addresses

After you create the VLANs, create the related self IP addresses.

1. For AWS, in the BIG-IP® Configuration utility, on the Main tab, click **Network** > **Self IPs** and then click **Create**.
2. Complete the fields:

Option	Description
Name	aws_IP
IP Address	172.16.1.10 This is the self IP address of the BIG-IP system.
Netmask	255.255.255.252
VLAN / Tunnel	aws_3011
Port Lockdown	**Allow Custom** > **TCP** > **Port 179** > **Add**

3. Now create the self IP address for Azure:

Option	Description
Name	azure_IP
IP Address	172.16.1.2 This is the self IP address of the BIG-IP system.
Netmask	255.255.255.252
VLAN / Tunnel	azure_3011

Option	Description
Port Lockdown	**Allow Custom** > **TCP** > **Port 179** > **Add**

4. Create the self IP address for the virtual server:

Option	Description
Name	`services_IP`
IP Address	`172.16.2.1`
Netmask	`255.255.255.0`
VLAN / Tunnel	`services_vlan`
Port Lockdown	`Allow None`

Create the router configuration for AWS

In order to advertise your network's routes to AWS, you must configure the BIG-IP® system's BGP router.

1. Use SSH to connect to the BIG-IP system, and ensure you are at the bash prompt.

2. Create the BGP router configuration for AWS.

   a) Type: `imish`
      You are now working in ZebOS™.

   b) Type: `enable`

   c) Type: `enable`

   d) Then type: `show running-config`

      At this point there is no running configuration.

   e) Type: `config terminal`

      You can now run configuration commands.

3. Now create the interfaces to ensure that they're turned on.

   a) Create the AWS interface by typing: `interface aws_3010`

      This is the VLAN name.

   b) Type a description for the interface: `description AWS Interface`

   c) Type: `no shut`

   d) Type: `exit`

   e) Confirm that the interface was created correctly by typing: `show running-config`

   f) Type: `router bgp 22317`
      You are now at the router configuration.

4. Configure the router to advertise your network's routes.

   a) Type: `network 192.168.0.0/16`

   b) Add the neighbor configuration by pasting information from the router configuration information you downloaded from AWS. For example:

```
neighbor 172.16.1.10 remote-as 7224
neighbor 172.16.1.10 password 423SDA342lksh28443hdds
```

   c) Type: `show running-config`

   d) Now to save it, type: `wr`

   e) To get out of router config, type: `exit`

   f) Type: `show ip route`

`B` means that BGP has advertised the route.

Create the router configuration for Azure

In order to advertise your network's routes to Azure, you must configure the BIG-IP® system's BGP router.

1. Use SSH to connect to the BIG-IP system and ensure that you are at the bash prompt.
2. Create the BGP router configuration for Azure.
   a) Type: `imish`
      You are now working in ZebOS™.
   b) Type: `enable`
   c) Type: `enable`
   d) Then type: `show running-config`

      At this point there is no running configuration.
   e) Type: `config terminal`

      You can now run configuration commands.
3. Now create the interfaces to ensure that they're turned on.
   a) Create the AWS interface by typing: `interface azure_3011`

      This is the VLAN name.
   b) Type a description for the interface: `description Azure Interface`
   c) Type: `no shut`
   d) Type: `exit`
   e) Confirm that the interface was created correctly by typing: `show running-config`
   f) Type: `router bgp 22317`
      You are now at the router configuration.
4. Configure the router to advertise your network's routes.
   a) Type: `network 192.168.0.0/16`
   b) Add the neighbor configuration.

```
neighbor 172.16.1.2 remote-as 7224
neighbor 172.16.1.2 password <password>
```

> *Note: You can find the password in the Azure portal by viewing the ExpressRoute; the password is in the **Shared Key** field.*

   c) Type: `show running-config`
   d) Now to save it, type: `wr`
   e) To get out of router config, type: `exit`
   f) Type: `show ip route`

      `B` means that BGP has advertised the route.

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