



VRF Lite, Release 12.2.2

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# New and Changed Information

The following table provides an overview of the significant changes up to this current release. The table does not provide an exhaustive list of all changes or of the new features up to this release.

Release Version	Feature	Description
NDFC 12.2.2 release	Support for connecting fabrics using inter-fabric links with MACsec using a QKD server or a preshared key	<p>With this feature, you can connect two fabrics using inter-fabric links with Media Access Control Security (MACsec) using a quantum key distribution (QKD) server for secure exchange of encryption keys.</p> <p>Beginning with NDFC 12.2.2, NDFC added support for MACsec for inter-fabric links for the following fabric types:</p> <ul style="list-style-type: none"><li>• Data Center VXLAN EVPN</li><li>• Enhanced Classic LAN</li><li>• External Connectivity Network</li></ul> <p>Prior to NDFC 12.2.2, NDFC supported MACsec for intra-fabric links for the Data Center VXLAN EVPN fabric and the BGP fabric.</p> <p>With this release, NDFC added a new <b>Security</b> tab and a Layer 2 template, <b>ext_l2_dci_link</b>, for configuring a Layer 2 DCI link. For more information, see <a href="#">Security</a> and <a href="#">Create a Layer 2 DCI Link</a>.</p> <p>For more information on MACsec with a quantum key distribution (QKD) server, see <a href="#">Connecting Two Fabrics with MACsec Using QKD</a>.</p>

# VRF Lite

External connectivity from data centers is a prime requirement where workloads that are part of a data center fabric can communicate with an outside fabric over WAN or Backbone services. To enable Layer 3 for north-south traffic flow, use virtual routing and forwarding instances (VRF)-Lite peering between data center border devices and the external fabric edge routers.

A VXLAN (Virtual Extensible Local Area Network) EVPN (Ethernet Virtual Private Network) based data center fabrics provide connectivity by distributing IP-MAC reachability information among various devices within the fabric. The VRF Lite feature is used for connecting the fabric to an external Layer 3 domain. This can be a border router or a Border Gateway router.

You can enable VRF Lite on the following devices:

- Border
- Border Spine
- Border Gateway
- Border Gateway Spine
- Border Super Spine

# Prerequisites and Guidelines

- VRF Lite requires Cisco Nexus 9000 Series Cisco Nexus Operating System (NX-OS) Release 7.0(3)I6(2) or later.
- Familiarity with VXLAN BGP EVPN data center fabric architecture and VXLAN overlay provisioning through NDFC.
- Fully configured VXLAN BGP EVPN fabrics including underlay and overlay configurations for the various leafs and spine devices, external fabric configuration through NDFC, and relevant external fabric device configuration (edge routers, for example).
  - You can configure a VXLAN BGP EVPN fabric (and connectivity to an external Layer 3 domain for north-south traffic flow) manually or using NDFC.

This document explains the process to connect the fabric to an edge router (outside the fabric, toward the external fabric) through NDFC. You must know how to configure and deploy VXLAN BGP EVPN and external fabrics through NDFC.

- You can enable VRF Lite on a physical ethernet interface or on a Layer 3 port channel. A subinterface over a physical interface or Layer 3 port-channel interface is created in NDFC at the VRF extension moment for each VRF-Lite link for which the VRF is extended over.
- When you create a VXLAN VRF, ensure that you check the following three fields:

Field	Description
<b>Advertise Host Routes</b>	By default, over the VRF-Lite peering session, only nonhost (/32 or /128) prefixes are advertised. If host routes (/32 or /128) must be enabled and advertised from the border device to the edge/WAN router, check the <b>Advertise Host Routes</b> check box. Route-map does outbound filtering. By default, this check box is disabled.
<b>Advertise Default Route</b>	This field controls whether a network statement 0/0 is enabled under the VRF. This in turn advertises 0/0 route in BGP. By default, this field is enabled. When you choose this check box, this ensures that a 0/0 route is advertised inside the fabric over EVPN route type 5 to the leafs, thereby providing a default route out of the leafs toward the border devices.
<b>Config Static 0/0 Route</b>	By default, this check box is checked. This field controls whether a static 0/0 route to the edge/WAN router must be configured under the VRF on the border device. By default, this field is enabled. If WAN/edge routers are advertising a default route over the VRF-Lite peering to the border device in the fabric, then this field must be disabled. In addition, the <b>Advertise Default Route</b> field must be disabled. The 0/0 route that is advertised over the External Border Gateway Protocol sends over EVPN to the leafs without requiring more configuration. The clean IBGP EVPN separation inside the fabric with eBGP for external out-of-fabric peering provides for this desired behavior.

- To delete a VRF-Lite IFC, remove all the VRF extensions that are enabled on the IFC. Otherwise an error message displays. After you remove the VRF-Lite attachments, recalculate and deploy the fabric to remove any pending Layer 3 extension configurations. NDFC removes the per-VRF subinterface and per-VRF External Border Gateway Protocol configuration on the devices.

# Sample Scenarios

The following sections explain different use cases for configuring VRF Lite:

- [Automatic VRF Lite \(IFC\) Configuration](#)
- [VRF Lite Between Cisco Nexus 9000 Based Border and Cisco Nexus 9000 Based Edge Router](#)
- [VRF Lite Between Cisco Nexus 9000 Based Border and Non-Cisco Device](#)
- [VRF Lite Between Cisco Nexus 9000 Based Border and Non-Nexus Device](#)

This is a typical use case of a Cisco ASR 9000 based edge router in managed mode.

# Automatic VRF Lite (IFC) Configuration

## Guidelines

- Auto IFC is supported on Cisco Nexus devices only.
- You can configure Cisco ASR 1000 Series routers and Cisco Catalyst 9000 Series switches as edge routers. To configure, set up a VRF Lite IFC, and connect it as a border device with easy fabric.
- You can configure Cisco ASR 9000 Series routers as edge routers in managed mode.
- If the device in the External fabric is non-Nexus, you must create IFC manually.
- Ensure that no user policy is enabled on the interface that connects to the edge router. If a policy exists, then the interface will not be configured.
- Autoconfiguration is supported for the following cases:
  - **Border** role in the VXLAN fabric and **Edge Router** role in the connected external fabric device
  - **Border Gateway** role in the VXLAN fabric and **Edge Router** role in the connected external fabric device
  - **Border** role to another **Border** role directly



Autoconfiguration is not provided between two Border Gateways (BGWs).

If VRF Lite is required between other roles, you must deploy it manually on the NDFC Web UI.

- To deploy configurations in the external fabric, you must uncheck the **Fabric Monitor Mode** check box in the external fabric settings. When an external fabric is set to **Fabric Monitor Mode Only**, you cannot deploy configurations on the switches.

## Easy Fabric Settings

The following are the 2 modes in which you can deploy VRF Lite. By default, VRF Lite deployment is set to Manual. You can change the settings based on your requirement.

- **Manual** - Use this option to deploy the VRF Lite IFCs manually between the source and the destination devices.
- **Back2Back&ToExternal** - Use this option to automatically configure VRF Lite IFCs between a border switch and the edge or core switches in external fabric or between back-to-back border switches in VXLAN EVPN fabric.



Though VRF Lite mode is set to **Manual** for NDFC resource handling, Data Center Interconnectivity (DCI) subnet is required.

The **Manual** mode is the default mode in fabric settings. To change the default mode to other mode, click **Edit** fabric settings. On **Resource** tab, modify **VRF Lite Deployment** field to the above mentioned auto configuration modes.

**Auto Deploy Peer** - This check box is applicable for VRF Lite deployment. When you check this check box, IFCs are automatically created for peer devices. You can check or uncheck this check box when the **VRF Lite Deployment** field is not set to **Manual**. The value you choose takes priority. This

configuration only affects the new auto-created IFCs and does not affect the existing IFCs.

**Auto Deploy Default VRF** - When you select this check box, the **Auto Generate Configuration on default VRF** field is automatically enabled for auto-created VRF Lite IFCs. You can check or uncheck this checkbox when the VRF Lite Deployment field is not set to **Manual**. The **Auto Generate Configuration on default VRF** field when set, automatically configures the physical interface for the border device in the default VRF, and establishes an EBGP connection between the border device and the edge device or another border device in a different VXLAN EVPN fabric.

**Auto Deploy Default VRF for Peer** - When you select this checkbox, the **Auto Generate Configuration for NX-OS Peer on default VRF** field is automatically enabled for auto-created VRF Lite IFCs. You can check or uncheck this checkbox when the **VRF Lite Deployment** field is not set to **Manual**. The **Auto Generate Configuration for NX-OS Peer on default VRF** field when set, automatically configures the physical interface and the EBGP commands for the peer NX-OS switch.



You can access the **Auto Generate Configuration on default VRF** and **Auto Generate Configuration for NX-OS Peer on default VRF** fields for an IFC link by navigating to **Actions > Edit > VRF Lite**.

**Redistribute BGP Route-map Name** - Defines the route map for redistributing the BGP routes in default VRF.

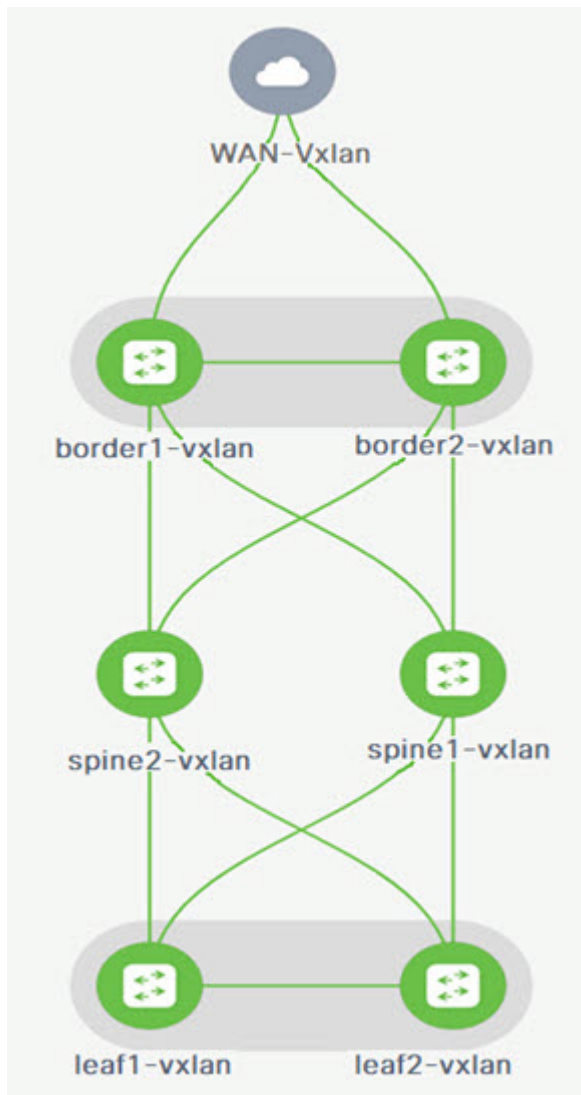
**VRF Lite Subnet IP Range:** The IP address for VRF Lite IFC deployment is chosen from this range. The default value is 10.33.0.0/16. Ensure that each fabric has its own unique range and is distinct from any underlay range to avoid possible duplication. These addresses are reserved with the Resource Manager.

**VRF Lite Subnet Mask:** By default, it is set to /30, which is a best practice for point-to-point (P2P) links.



# VRF Lite Between Cisco Nexus 9000 Based Border and Cisco Nexus 9000 Based Edge Router

In the following example topology, the DC-VXLAN fabric is connected to a WAN-VXLAN cloud. The easy fabric has a border leaf role and the WAN-VXLAN cloud has a device with the role edge router. NDFC shows the physical and logical representation of the topology with Cisco Discovery Protocol/Link Layer Discovery Protocol (LLDP) link discovery.



In this example, enable a VRF-Lite connection between a DC-VXLAN border leaf and a WAN-VXLAN edge router.

For a VRF-Lite configuration, you must enable External Border Gateway Protocol (EBGP) peering between the fabric's border interfaces and the edge router's interfaces through point-to-point (P2P) connections.

The border physical interfaces are:

- **eth1/1** on **border1-Vxlan**, toward **eth1/1** on **WAN1-Vxlan**.
- **eth1/2** on **border2-Vxlan**, toward **eth1/2** on **WAN1-Vxlan**.

# Workflow for Configuring an IPv4 or an IPv6 Overlay Network

1. Create an inter-fabric connection using source and destination IPv4 or IPv6 addresses.

For more information, see [Create a VRF-Lite Inter-Fabric Link](#).

2. Add a VRF-Lite extension.
3. Attach the VRF and the VRF-Lite extension to the border device.

For more information, see [Attach the VRF and the VRF-Lite Extension to the Border Device](#).

4. Create a network configured with an IPv4 or an IPv6 gateway.

For more information, see the section "Creating Network for Standalone Fabrics" in [About Fabric Overview for LAN Operational Mode Setups](#).

5. Recalculate and deploy the configuration.

## Create a VRF-Lite Inter-Fabric Link

1. Choose **Manage > Fabrics** and double-click on a VXLAN EVPN fabric.

The **Fabric Overview** page appears.

2. Navigate to the **Links** tab.
3. On the **Links** tab, click **Actions > Create**.

The **Link Management - Create Link** page appears.

4. To configure a VRF-Lite inter-fabric link, enter the required parameters on the **Link Management - Create Link** page.

Field	Description
<b>Link Type</b>	Specifies the inter-fabric connection (IFC) link between two different fabrics within NDFC. By default, the <b>Inter-Fabric</b> option displays.
<b>Link Sub-Type</b>	Specifies the subtype of link. By default, the <b>VRF_LITE</b> option displays.
<b>Link Template</b>	Specifies the template for the link. The default template for a VRF-Lite IFC is <b>ext_fabric_setup</b> . The template enables the source and destination interfaces as Layer 3 interfaces, configures the <b>no shutdown</b> command, and sets the Maximum Transmission Unit (MTU) value to 9216.
<b>Source Fabric</b>	NDFC autodetects and populates the <b>Source Fabric</b> field based on the Cisco Discovery Protocol or LLDP discovery.
<b>Destination Fabric</b>	NDFC autodetects and populates the <b>Destination Fabric</b> field based on the Cisco Discovery Protocol or LLDP discovery.
<b>Source Interface</b>	NDFC autodetects and populates the <b>Source Interface</b> field based on the Cisco Discovery Protocol or LLDP discovery.

Field	Description
<b>Destination Device</b>	NDFC autodetects and populates the <b>Destination Device</b> field based on the Cisco Discovery Protocol or LLDP discovery.
<b>Source Interface</b>	NDFC autodetects and populates the <b>Source Interface</b> field based on the Cisco Discovery Protocol or LLDP discovery.
<b>Destination Interface</b>	NDFC autodetects and populates the <b>Destination Interface</b> field based on the Cisco Discovery Protocol or LLDP discovery.

5. Enter the necessary field values to configure an inter-fabric link.

The tabs and their fields on the page are explained in the following sections.

- o [General Parameters](#)
- o [Advanced](#)
- o [Default VRF](#)
- o [Security](#)

6. When you have completed the necessary configurations, click **Save**.

## General Parameters

The **General Parameters** tab is displayed by default. The fields in this tab are described in the following table.

Field	Description
<b>Source BGP ASN</b>	Specifies the Border Gateway Protocol (BGP) Autonomous System Number (ASN) for the selected source fabric.
<b>Source Address/Mask</b>	<p><b>IP</b> Specifies the NDFC auto allocated IP pool from the resource manager pool of the VRF-Lite subnet pool for the <b>Ethernet1/1</b> subinterface, the source interface of the IFC. A subinterface is created for each VRF extended over this IFC, and a unique 802.1Q ID is assigned to it. The IP address/mask entered here, along with the BGP neighbor IP field (explained below) is used as the default value for the subinterface that is created as a VRF extension and can be overwritten.</p> <p>For example, an 802.1Q ID of 2 is associated with subinterface Eth 1/1.2 for VRF corporate traffic, and 802.1Q ID of 3 is associated with Eth 1/1.3 and VRF engineering, and so on.</p> <p>The IP prefix is reserved by the NDFC resource manager. Ensure that you use a unique IP address prefix for each IFC you create in the topology.</p>
<b>Destination IP Address</b>	<p>Specifies the NDFC auto allocated IP pool from the resource manager pool of the VRF-Lite subnet pool. This is a BGP neighbor IP on the device.</p> <p>Inter-fabric traffic from different VRFs for an IFC with the same source IP address (10.33.0.1/30) and destination IP address (10.33.0.2) as an example.</p>

Field	Description
<b>Source IPv6 Address/Mask</b>	Specifies the source IPv6 address and mask if you are configuring an IPv6-only inter-fabric link or a dual stack (IPv6 and IPv4) inter-fabric link.
<b>Destination IPv6 Address</b>	Specifies the destination IPv6 address if you are configuring an IPv6-only inter-fabric link or a dual stack (IPv6 and IPv4) inter-fabric link.
<b>Destination BGP ASN</b>	Specifies the BGP ASN of the selected destination fabric.
<b>Link MTU</b>	Specifies the default MTU value of 9216.
<b>Auto Generate Configuration for Peer</b>	Specifies to auto generate a VRF-Lite configuration for managed NX-OS neighbor devices. This knob autoconfigures the neighbor VRF on the neighboring managed device. For example, NDFC automatically creates a VRF on the edge router inside the WAN-Vxlan external fabric.

**What's next:** Complete the configurations in another tab if necessary, or click **Save** when you have completed the necessary configurations for this link.

## Advanced

The **Advanced** tab is added in the **Link Profile** section. The fields in this tab are:


Field	Description
<b>Source Interface Description</b>	Enter a description for the source interface.
<b>Destination Interface Description</b>	Enter a description for the destination interface.
<b>Source Interface Freeform Config</b>	Specifies a freeform configuration for the source interface.
<b>Destination Interface Freeform Config</b>	Specifies a freeform configuration for the destination interface.
<b>Template for Configuration Generation on Peer</b>	Specifies a Python template for VRF-Lite configuration on an NX-OS peer in an external fabric. This is an auto populated field.

**What's next:** Complete the configurations in another tab if necessary, or click **Save** when you have completed the necessary configurations for this link.

## Default VRF

Enter the following details in the **Default VRF** tab.



Field	Description
<b>Auto Generate Configuration on default VRF</b>	Automatically configures the physical interface for the border device for the default VRF. Establishes an External Border Gateway Protocol (EBGP) connection between the border device and its peer in the VRF-LITE IFC (edge router or another border device in a different VXLAN EVPN fabric).



Field	Description
<b>Auto Generate Configuration for NX-OS/IOS XE Peer on default VRF</b>	Automatically configures the physical interface and the BGP commands for the NX-OS or the IOS XE peer switch corresponding to the default VRF.
<b>Redistribute BGP Route-map Name</b>	Defines the route map used for redistributing the BGP routes in the default VRF.
<b>Default VRF BGP Neighbor Password</b>	Allows you to provide additional security by specifying a password for the BGP neighbor.
<b>Default VRF BGP Password Key Encryption Type</b>	Specifies the encryption type for the BGP password.
<b>VRF Name in NX-OS Peer Switch</b>	Enables you to provide a name for the VRF in the peer switch. By default, the peer device is configured with the default VRF, if left blank.
<b>Enable DCI tracking</b>	Enables Data Center Interconnectivity (DCI) tracking on the physical interface, which allows you to use an existing VRF-Lite link as the VXLAN EVPN multi-site underlay link. Note that you must enable this option only on a border gateway device.
<b>Routing TAG</b>	Specifies the routing tag associated with the interface IP for the default VRF.  <div style="display: flex; align-items: center;">  <p>All the configuration changes made to the devices as a result of the above configurations are displayed on the <b>Pending Config</b> page.</p> </div>

## Security

The fields in the **Security** tab are described in the following table.

For more information on configuring MACsec using QKD, see [Connecting Two Fabrics with MACsec Using QKD](#).

Field	Description
<b>Enable MACsec</b>	<p>Check the check box to enable MACsec on the VRF-Lite inter-fabric connection (IFC) link.</p> <div style="border-left: 1px solid #ccc; padding-left: 10px; margin-left: 20px;">  <p>If you enable the <b>Enable MACsec</b> option and you disable the <b>Use Link MACsec Setting</b> option, NDFC uses the fabric settings for configuring MACsec on the VRF-Lite inter-fabric link (IFC).</p> </div> <p>When MACsec is configured on the link, NDFC generates the following configurations:</p> <ul style="list-style-type: none"> <li>▪ Switch-level MACsec configurations if this is the first link that enables MACsec.</li> <li>▪ MACsec configurations for the link.</li> </ul>
<b>Source MACsec Policy/Key-Chain Name Prefix</b>	<p>Specify the prefix for the policy and the key-chain names for the MACsec configuration at the source.</p> <p>The default value is <b>DCI</b>, and you can change the value.</p>
<b>Destination MACsec Policy/Key-Chain Name Prefix</b>	<p>Specify the prefix for the policy and the key-chain names for the MACsec configuration at the destination.</p> <p>The default value is <b>DCI</b>, and you can change the value.</p>
<b>Enable QKD</b>	<p>Check the check box to enable the QKD server for generating quantum keys for encryption.</p> <div style="border-left: 1px solid #ccc; padding-left: 10px; margin-left: 20px;">  <p>If you choose to not enable the <b>Enable QKD</b> option, NDFC uses preshared keys provided by the user instead of using the QKD server to generate the keys. If you disable the <b>Enable QKD</b> option, all the fields pertaining to QKD are grayed out.</p> </div>
<b>Use Link MACsec Setting</b>	<p>Check this check box as the override option for using the link settings instead of using the fabric settings.</p>
<b>MACsec Cipher Suite</b>	<p>Choose one of the following MACsec cipher suites for the MACsec policy:</p> <ul style="list-style-type: none"> <li>▪ <b>GCM-AES-128</b></li> <li>▪ <b>GCM-AES-256</b></li> <li>▪ <b>GCM-AES-XPB-128</b></li> <li>▪ <b>GCM-AES-XPB-256</b></li> </ul> <p>The default value is <b>GCM-AES-XPB-256</b>.</p>

Field	Description
<b>MACsec Primary Key String</b>	<p>Specify a Cisco Type 7 encrypted octet string that is used for establishing the primary DCI MACsec session. For <b>AES_256_CMAC</b>, the key string length must be 130 and for <b>AES_128_CMAC</b>, the key string length must be 66. If these values are not specified correctly, an error is displayed when you save the fabric.</p> <p> The default key lifetime is infinite.</p>
<b>MACsec Primary Cryptographic Algorithm</b>	<p>Choose the cryptographic algorithm used for the primary key string. It can be <b>AES_128_CMAC</b> or <b>AES_256_CMAC</b>. The default value is <b>AES_128_CMAC</b>.</p> <p>You can configure a fallback key on the device to initiate a backup session if the primary session fails.</p>
<b>MACsec Fallback Key String</b>	<p>Specify a Cisco Type 7 encrypted octet string that is used for establishing a fallback MACsec session. For <b>AES_256_CMAC</b>, the key string length must be 130 and for <b>AES_128_CMAC</b>, the key string length must be 66. If these values are not specified correctly, an error is displayed when you save the fabric.</p> <p> This parameter is mandatory if <b>Enable QKD</b> is not selected.</p>
<b>MACsec Fallback Cryptographic Algorithm</b>	<p>Choose the cryptographic algorithm used for the fallback key string. It can be <b>AES_128_CMAC</b> or <b>AES_256_CMAC</b>. The default value is <b>AES_128_CMAC</b>.</p>
<b>Source QKD Profile Name</b>	<p>Specify the source crypto profile name.</p> <p>The maximum size is 63.</p>
<b>Source KME Server IP</b>	<p>Specify the source IPv4 address for the Key Management Entity (KME) server.</p>
<b>Source KME Server Port Number</b>	<p>Specify the source port number for the KME server.</p>
<b>Source Trustpoint Label</b>	<p>Specify the source authentication trustpoint label.</p> <p>The maximum size is 64.</p>
<b>Destination QKD Profile Name</b>	<p>Specify the destination crypto profile name.</p>
<b>Destination KME Server IP</b>	<p>Specify the destination IPv4 address for the KME server.</p>
<b>Destination KME Server Port Number</b>	<p>Specify the destination port number for the KME server.</p>
<b>Destination Trustpoint Label</b>	<p>Specify the destination authentication type trustpoint label.</p> <p>The maximum size is 64.</p>
<b>Ignore Certificate</b>	<p>Specify if you want to skip verification of incoming certificates.</p>

Click **Save** to save the configuration.

## Create a Layer 2 DCI Link

Beginning with NDFC release 12.2.2, NDFC added a Layer 2 link template, **ext\_I2\_dci\_link**, for configuring a Layer 2 link for MACsec with QKD. For more information on MACsec with QKD, see [Connecting Two Fabrics with MACsec Using QKD](#).

1. On the **Manage > Fabrics** page, double-click on a VXLAN EVPN fabric.

The **Fabric Overview** page appears.

2. Navigate to the **Links** tab.
3. On the **Links** tab, click **Actions > Create**.

The **Link Management - Create Link** page appears.

4. To configure a Layer 2 DCI link, enter the following parameters on the **Link Management - Create Link** page:

Field	Description
<b>Link Type</b>	Choose <b>Inter-Fabric</b> from the drop-down menu.
<b>Link Sub-Type</b>	Choose <b>L2_DCI</b> as the <b>Link Sub-Type</b> .
<b>Link Template</b>	Choose <b>ext_I2_dci_link</b> as the link template for a DCI link.

The link template enables the source and destination interfaces as Layer 2 interfaces.

5. When you have completed the necessary configurations, click **Save**.

## Attach the VRF and the VRF-Lite Extension to the Border Device

1. Click the **VRFs** tab.
2. Double-click on a **VRF Name**.

The **VRF Overview** page displays.

3. Click the **VRF Attachments** tab.
4. Choose a **VRF Name** and click **Actions > Edit**.

The **Edit VRF Attachment** page appears.

5. You can edit details in the **Extension** table.
6. Toggle the knob to **Attach**.
7. In **Extend**, choose **VRF\_LITE** from the drop-down list.
8. In the **Extension** table, choose one switch at a time and click **Edit**.
9. Enter the details for **PEER\_VRF\_NAME**.



This auto deploys the VRF on the neighboring device.

When you extend a VRF-Lite consecutive scenario, the VRF must be in the peer fabric and the VRF name must be the same. If the VRF is not in the peer fabric and if you try to extend VRF Lite, an error message is generated displaying the issue.

When you extend VRF Lite between an easy fabric and an external fabric, the VRF name can be the same as the name of the source fabric, or default name, or another VRF name.

10. Enter the required VRF name in the **PEER\_VRF\_NAME** field.

The child Policy Template Instances (PTIs) for subinterface, VRF creation, and BGP peering on the external fabric have source values that are populated in the PTI. You cannot edit or delete the policies.

11. Follow the above procedure for adding other inter-fabric links.
12. On the **Edit** page, click **Attach-All**, to attach the required VRF extension to the border device.
13. Click **Save**.

## Recalculate and Deploy the Configuration on the VXLAN EVPN Easy Fabric

1. On the **Fabric** page, double-click on the appropriate fabric to navigate to the **Fabric Overview** page.
2. Click **Actions > Recalculate & Deploy**.
3. Perform the same operation by choosing the required **VRF Name** on the **VRF Attachments** tab and clicking **Actions > Deploy** to initiate the VRF or VRF-Lite configuration on the border device.
4. Alternatively, on the **Fabric** page, click **Action > Recalculate and Deploy**.

You can also choose the VRF attachment, edit, and click **Deploy**.

NDFC pushes VRF and VRF-Lite configurations to the border devices.

## Recalculate and Deploy the Configuration on an External Fabric

Choose the external fabric and follow the same procedure.

# VRF Lite Between Cisco Nexus 9000 Based Border and Non-Cisco Device

This section describes the procedure for enabling a VRF-Lite connection between a VXLAN EVPN border leaf device and a non-Cisco device in an external fabric.

We recommend using the meta definition of a device instead of importing devices in an external fabric. This allows VRF-Lite configurations to extend Cisco Nexus 9000-managed border devices in an easy fabric. NDFC does not manage destination non-Cisco devices. You must configure the relevant VRF-Lite configuration on the destination device.

## Create New IFC Links Between a Border Device and an Edge Router

1. On the **Manage > Fabrics** page, double-click on a VXLAN EVPN fabric.

The **Fabric Overview** page appears.

2. Navigate to the **Links** tab.

3. On the **Links** tab, click **Actions > Create**.

The **Link Management - Create Link** page appears.

4. Enter the following required parameters.

Field	Description
<b>Link Type</b>	Specifies the inter-fabric connection (IFC) link between two different fabrics within NDFC. By default, the <b>Inter-Fabric</b> option displays.
<b>Link Sub-Type</b>	Specifies the subtype of the link. By default, the <b>VRF_LITE</b> option displays.
<b>Link Template</b>	Specifies the template for the link. The default template for a VRF-Lite IFC is <b>ext_fabric_setup</b> . The template enables the source and destination interfaces as Layer 3 interfaces, configures the <b>no shutdown</b> command, and sets the Maximum Transmission Unit (MTU) value to 9216.
<b>Source Fabric</b>	Select the <b>Source Fabric</b> . This is the easy fabric where a Cisco Nexus 9000 based border device resides.
<b>Destination Fabric</b>	Select any external or Classic LAN fabric. The fabric can be in monitor mode as well.
<b>Source Device</b>	Select the <b>Source Device</b> . This is the Cisco Nexus 9000 based border device.
<b>Destination Device</b>	You can create a "meta device definition". Type any name and click <b>Save</b> . For example, non-cisco.
<b>Source Interface</b>	Select the interface on the border device where the non-cisco device is connected.

Field	Description
<b>Destination Interface</b>	You can create a " meta device interface" . Type any interface name and click <b>Save</b> . For example, gig1, tengig1/10, eth1/1 are the valid interface names.

The tabs and their fields on the page are explained in the following sections.

- o [General Parameters](#)
- o [Advanced](#)
- o [Default VRF](#)

5. When you have completed the necessary configurations, click **Save**.

## General Parameters

The **General Parameters** tab is displayed by default. The fields in this tab are described in the following table.

Field	Description
<b>Source BGP ASN</b>	Specifies the Border Gateway Protocol (BGP) Autonomous System Number (ASN) for the selected source fabric.
<b>Source Address/Mask</b>	<p><b>IP</b> Specifies the IP address and mask for the <b>Ethernet1/5</b> subinterfaces, the source interface of the IFC. The subinterface is created for each VRF extended over this IFC, and a unique 802.1Q ID is assigned to it. The IP address/mask entered here, along with the <b>BGP Neighbor IP</b> field (explained below) used as the default value for the subinterface that is created as a VRF extension and can be overwritten.</p> <p>For example, an 802.1Q ID of 2 is associated with subinterface Eth 1/5.2 for VRF CORP traffic, and 802.1Q ID of 3 is associated with Eth 1/5.3 and VRF ENG, and so on.</p> <p>The IP prefix is reserved with the NDFC resource manager. Ensure that you use a unique IP address prefix for each IFC you create in the topology.</p>
<b>Destination IP Address</b>	<p>Specifies the NDFC auto allocated IP pool from the resource manager pool of the VRF-Lite subnet pool. This is a BGP neighbor IP on the device.</p> <p>Interfabric traffic from different VRFs for an IFC with the same source IP address (10.33.0.1/30) and destination IP address (10.33.0.2) as an example.</p>
<b>Source Address/Mask</b>	<b>IPv6</b> Specifies the source IPv6 address and mask if you are configuring an IPv6-only inter-fabric link or a dual stack (IPv6 and IPv4) inter-fabric link.
<b>Destination Address</b>	<b>IPv6</b> Specifies the destination IPv6 address if you are configuring an IPv6-only inter-fabric link or a dual stack (IPv6 and IPv4) inter-fabric link.
<b>Destination BGP ASN</b>	Specifies the BGP ASN of the selected destination fabric.
<b>Link MTU</b>	Specifies the default MTU value of 9216.

Field	Description
<b>Auto Deploy Flag</b>	Not applicable as the destination device is a non-Nexus and a non-Cisco device.

## Advanced

Enter the following details in the **Advanced** tab. The fields in this tab are described in the following table.


Field	Description
<b>Source Interface Description</b>	Enter a description for the source interface.
<b>Destination Interface Description</b>	Enter a description for the destination interface.
<b>Source Interface Freeform Config</b>	Specifies a freeform configuration for the source interface.
<b>Destination Interface Freeform Config</b>	Specifies a freeform configuration for the destination interface.
<b>Template for Configuration Generation on Peer</b>	Specifies a Python template for VRF-Lite configuration on an NX-OS peer in an external fabric. This is an auto populated field.

**What's next:** Complete the configurations in another tab if necessary, or click **Save** when you have completed the necessary configurations for this link.

## Default VRF

Enter the following details in the **Default VRF** tab. The fields in this tab are described in the following table.

Field	Description
<b>Auto Generate Configuration on default VRF</b>	Automatically configures the physical interface for the border device for the default VRF. Establishes an External Border Gateway Protocol (EBGP) connection between the border device and its peer in the VRF-LITE IFC (edge router or another border device in a different VXLAN EVPN fabric).
<b>Auto Generate Configuration for NX-OS/IOS XE Peer on default VRF</b>	Automatically configures the physical interface and the BGP commands for the NX-OS or the IOS XE peer switch corresponding to the default VRF.
<b>Redistribute BGP Route-map Name</b>	Defines the route map used for redistributing the BGP routes in the default VRF.
<b>Default VRF BGP Neighbor Password</b>	Allows you to provide additional security by specifying a password for the BGP neighbor.

Field	Description
<b>Default VRF BGP Password Encryption Type</b>	Specifies the encryption type for the BGP password.
<b>VRF Name in NX-OS Peer Switch</b>	Enables you to provide a name for the VRF in the peer switch. By default, the peer device is configured with the default VRF, if left blank.
<b>Enable DCI tracking</b>	Enables Data Center Interconnectivity (DCI) tracking on the physical interface, which allows you to use an existing VRF-Lite link as the VXLAN EVPN multi-site underlay link. Note that you must enable this option only on a border gateway device.
<b>Routing TAG</b>	Specifies the routing tag associated with the interface IP for the default VRF.  <div style="display: flex; align-items: center;">  <p>All the configuration changes made to the devices as a result of the above configurations are displayed on the <b>Pending Config</b> page.</p> </div>

Click **Save** to create a new link with the parameters mentioned.

## Attach the VRF and the VRF-Lite Extension to the Border Device

1. On the **Manage > Fabrics** page, double-click on the **VXLAN EVPN** fabric.
2. On the **Fabric Overview** page, navigate to the **VRFs** tab.
3. Double-click on a **VRF Name**.

The **VRF Overview** page displays.

4. Click the **VRF Attachments** tab.
5. Choose a **VRF Name** and click **Actions > Edit**.

The **Edit VRF Attachment** page displays.

6. Click **Attach-All** to attach the required VRF-Lite extension to the border device and then click **Save**.

## Recalculate and Deploy the Configuration on the VXLAN EVPN Easy Fabric

1. On the **Manage > Fabrics** page, double-click on the appropriate fabric to navigate to the **Fabric Overview** page.
2. Click **Actions > Recalculate & Deploy**.
3. Perform the same action by choosing the required **VRF Name** on the **VRF Attachments** tab and clicking **Actions > Deploy** to initiate the VRF or VRF-Lite configuration on the border device.

# VRF Lite Between Cisco Nexus 9000 Based Border and Non-Nexus Device

In this example, you can enable VRF-Lite connections between a DC-VXLAN border leaf and a non-Nexus device in an external fabric.

Before Cisco NDFC Release 12.0.1a, ASR 9000 was supported for an external fabric in monitor-mode only. From Release 12.0.1a, ASR 9000 is supported in managed mode with an edge router role.

The following are the supported platforms:

- ASR 9000
- NCS 5501 and NCS 5001
- Cisco 8000

Configuration compliance is enabled for IOS-XR switches in an external fabric, similar to Cisco Nexus switches configured on an external fabric. NDFC pushes the configuration at the end of the deployment.



Ensure that the VXLAN BGP EVPN border device is active.

1. Navigate to **Manage > Fabrics** to create an external fabric.
2. Choose **Create Fabric** from the **Actions** drop-down list.
3. Enter a name for the external fabric.
4. Choose a fabric type on the **Select Type of Fabric** page.
5. On the **Create Fabric** page, enter the appropriate ASN number, uncheck the **Fabric Monitor Mode** check box, and then click **Save**.
6. Navigate to the **Manage > Inventory > Switches** tab and click **Actions > Add Switches**.



Beginning with NDFC 12.2.1, you do not need to configure the Simple Network Management Protocol (SNMP) for IOS-XR discovery of switches. NDFC uses Secure Shell (SSH) for IOS-XR device discovery.

To add non-Nexus devices to external fabrics, see the section "Adding Non-Nexus Devices to External Fabrics" in [External Connectivity Network](#).

7. On the **Add Switches** page, choose **Discover** and click **IOS-XR** from the **Device Type** drop-down list.
8. After the router is discovered, you can view the switch name in the **Discovery Results** field.
9. Choose the discovered router and add it to the external fabric.

Ensure that the **Discovery Status** displays **OK** in the **Status** column.

An edge router role is supported.

After successful discovery, you can view the links between the devices in the **Links** tab.

10. To create a VRF-Lite Inter-Fabric Connection (IFC) for an external fabric with a Cisco Nexus 9000 border leaf, choose the appropriate link and click **Edit** from the **Actions** drop-down list.
11. On the **Link Management-Edit Link** page, fill in the required details for creating an inter-fabric connection link.

A few fields are auto-populated.



For a non-NX-OS device, the deploy flag is not applicable.

12. To extend a VRF-Lite configuration on a VXLAN border device, navigate to the **VRFs** tab.
13. Choose the VRF name.
14. Click **Edit** from the **Actions** drop-down list.
15. Extend the configuration as **VRF\_Lite**.
16. Deploy the configuration on a VXLAN border device.
17. Navigate to the **Manage > Fabrics** page.

Ensure that the external fabric has the discovered router.

18. Click **Apply** for **VRF Lite BGP** policies.
19. Navigate to the **Policies** tab.
20. Add the **ios\_xr\_base\_bgp** policy and enter the required details.
21. Click **Save**.
22. Add another policy **ios\_xr\_Ext\_VRF\_Lite\_Jython** and enter the required details.
23. Click **Save**.
24. Deploy the configuration on the IOS-XR router.

## Appendix

### Nexus 9000 Border device configurations

Border-Vxlan (base border configurations) generated by template ext\_base\_border\_vrflite\_11\_1

```
switch configure terminal
switch(config)#
ip prefix-list default-route seq 5 permit 0.0.0.0/0 le 1
ip prefix-list host-route seq 5 permit 0.0.0.0/0 eq 32
route-map extcon-rmap-filter deny 10
    match ip address prefix-list default-route
route-map extcon-rmap-filter deny 20
    match ip address prefix-list host-route
route-map extcon-rmap-filter permit 1000
route-map extcon-rmap-filter-allow-host deny 10
    match ip address prefix-list default-route
route-map extcon-rmap-filter-allow-host permit 1000
```

```
ipv6 prefix-list default-route-v6 seq 5 permit 0::/0
ipv6 prefix-list host-route-v6 seq 5 permit 0::/0 eq 128
route-map extcon-rmap-filter-v6 deny 10
    match ipv6 address prefix-list default-route-v6
route-map extcon-rmap-filter-v6 deny 20
    match ip address prefix-list host-route-v6
route-map extcon-rmap-filter-v6 permit 1000
route-map extcon-rmap-filter-v6-allow-host deny 10
    match ipv6 address prefix-list default-route-v6
route-map extcon-rmap-filter-v6-allow-host permit 1000
```

## Border-Vxlan VRF Lite Extension configuration

```
switch configure terminal
vrf context CORP
    ip route 0.0.0.0/0 2.2.2.2
exit
router bgp 100
    vrf CORP
        address-family ipv4 unicast
            network 0.0.0.0/0
            exit
        neighbor 2.2.2.2
            remote-as 200
            address-family ipv4 unicast
                send-community both
                route-map extcon-rmap-filter out
exit
configure terminal
interface ethernet1/1.2
    encapsulation dot1q 2
    mtu 9216
    vrf member CORP
    ip address 2.2.2.22/24
    no shutdown
configure terminal
```

## WAN-Vxlan (External fabric Edge Router) VRF Lite Extension configuration

```
switch configure terminal
vrf context CORP
    address-family ipv4 unicast
exit
router bgp 200
```



```

vrf CORP
  address-family ipv4 unicast
  neighbor 10.33.0.2
  remote-as 100
  address-family ipv4 unicast
  send-community both
  exit
exit
neighbor 10.33.0.6
remote-as 100
address-family ipv4 unicast
  send-community both
configure terminal
interface ethernet1/1.2
  mtu 9216
  vrf member CORP
  encapsulation dot1q 2
  ip address 10.33.0.1/30
  no shutdown
interface ethernet1/2.2
  vrf member CORP
  mtu 9216
  encapsulation dot1q 2
  ip address 10.33.0.5/30
  no shutdown
configure terminal

```

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