



Fabric Initialization and Switch Discovery

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Initializing the Fabric

About Fabric Initialization

You can build a fabric by adding switches to be managed by the APIC and then validating the steps using the GUI, the CLI, or the API.



Note Before you can build a fabric, you must have already created an APIC cluster over the out-of-band network.

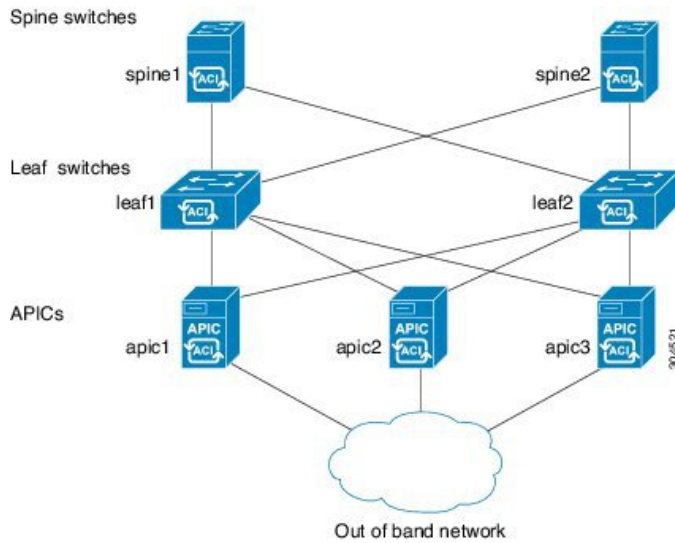
Example Topology

An example topology is as follows:

- Two spine switches (spine1, spine2)
- Two leaf switches (leaf1, leaf2)
- Three instances of APIC (apic1, apic2, apic3)

The following figure shows an example of a fabric topology.

Figure 1: Example Fabric Topology



Example Topology Connections

An example topology with connection details is as follows:

Name	Connection Details
leaf1	eth1/1 = apic1 (eth2/1) eth1/2 = apic2 (eth2/1) eth1/3 = apic3 (eth2/1) eth1/49 = spine1 (eth5/1) eth1/50 = spine2 (eth5/2)
leaf2	eth1/1 = apic1 (eth 2/2) eth1/2 = apic2 (eth 2/2) eth1/3 = apic3 (eth 2/2) eth1/49 = spine2 (eth5/1) eth1/50 = spine1 (eth5/2)
spine1	eth5/1 = leaf1 (eth1/49) eth5/2 = leaf2 (eth1/50)
spine2	eth5/1 = leaf2 (eth1/49) eth5/2 = leaf1 (eth1/50)

Switch Discovery

About Switch Discovery with the APIC

The APIC is a central point of automated provisioning and management for all the switches that are part of the ACI fabric. A single data center might include multiple ACI fabrics; each data center might have its own APIC cluster and Cisco Nexus 9000 Series switches that are part of the fabric. To ensure that a switch is managed only by a single APIC cluster, each switch must be registered with that specific APIC cluster that manages the fabric.

The APIC discovers new switches that are directly connected to any switch it currently manages. Each APIC instance in the cluster first discovers only the leaf switch to which it is directly connected. After the leaf switch is registered with the APIC, the APIC discovers all spine switches that are directly connected to the leaf switch. As each spine switch is registered, that APIC discovers all the leaf switches that are connected to that spine switch. This cascaded discovery allows the APIC to discover the entire fabric topology in a few simple steps.

Switch Registration with the APIC Cluster

After a switch is registered with the Cisco Application Policy Infrastructure Controller (APIC), the switch is part of the Cisco APIC-managed fabric inventory. With the Cisco Application Centric Infrastructure (ACI) fabric, the Cisco APIC is the single point of provisioning, management, and monitoring for switches in the infrastructure.

The following guidelines and limitations apply:

- Before you begin registering a switch, make sure that all switches in the fabric are physically connected and booted in the desired configuration. For information about the installation of the chassis, see <http://www.cisco.com/c/en/us/support/cloud-systems-management/application-policy-infrastructure-controller-apic/products-installation-guides-list.html>.
- The infrastructure IP address range must not overlap with other IP addresses used in the ACI fabric for in-band and out-of-band networks.
- When a switch is power cycled or upgraded, downlink interfaces will be in the admin-down state until the switch can download the configurations again from the Cisco APICs to prevent external devices from sending traffic to the switch that is not yet ready. Fabric links and down links for Cisco APIC connectivity are exempt from being changed to the admin-down state. To achieve this exemption, the leaf switch remembers the downlink interface that was connected to the Cisco APICs prior to the power cycle or upgrade. Because of this, you must not change the Cisco APIC connectivity until the switches are fully operational again after the power cycle or upgrade.

Registering the Unregistered Switches Using the GUI

**Note**

The infrastructure IP address range must not overlap with other IP addresses used in the ACI fabric for in-band and out-of-band networks.

Before you begin

Make sure that all switches in the fabric are physically connected and booted.

Procedure

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- Step 1** On the menu bar, choose **FABRIC > INVENTORY**.
- Step 2** In the **Navigation** pane, click **Fabric Membership**.
In the **Work** pane, in the **Fabric Membership** table, a single leaf switch is displayed with an ID of 0. It is the leaf switch that is connected to apic1.
- Step 3** Configure the ID by double-clicking the leaf switch row, and performing the following actions:
- In the **ID** field, add the appropriate ID (leaf1 is ID 201, and leaf 2 is ID 202).
The ID must be a number that is greater than 100 because the first 100 IDs are for APIC appliance nodes.
 - In the **Switch Name** field, add the name of the switch, and click **Update**.
- Note** After an ID is assigned, it cannot be updated. The switch name can be updated by double-clicking the name and updating the **Switch Name** field.
- An IP address gets assigned to the switch, and in the **Navigation** pane, the switch is displayed under the pod.
- Step 4** Monitor the **Work** pane until one or more spine switches appear.
- Step 5** Configure the ID by double-clicking the spine switch row, and perform the following actions:
- In the **ID** field, add the appropriate ID (spine1 is ID 101 and spine 2 is ID 102).
Note It is recommended that leaf nodes and spine nodes be numbered differently. For example, number spines in the 100 range and number leafs in the 200 range.
 - In the **Switch Name** field, add the name of the switch, and click **Update**.
An IP address gets assigned to the switch, and in the **Navigation** pane, the switch is displayed under the pod. Wait until all remaining switches appear in the **Node Configurations** table before you go to the next step.
- Step 6** For each switch listed in the **Fabric Membership** table, perform the following steps:
- Double-click the switch, enter an **ID** and a **Name**, and click **Update**.
 - Repeat for the next switch in the list.
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Switch Discovery Validation and Switch Management from the APIC

After the switches are registered with the APIC, the APIC performs fabric topology discovery automatically to gain a view of the entire network and to manage all the switches in the fabric topology.

Each switch can be configured, monitored, and upgraded from the APIC without having to access the individual switches.

Validating the Registered Switches Using the GUI

Procedure


- Step 1** On the menu bar, choose **FABRIC > INVENTORY**.
- Step 2** In the **Navigation** pane, expand **Fabric Membership**.
The switches in the fabric are displayed with their node IDs. In the **Work** pane, all the registered switches are displayed with the IP addresses that are assigned to them.
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Validating the Fabric Topology

After all the switches are registered with the APIC cluster, the APIC automatically discovers all the links and connectivity in the fabric and discovers the entire topology as a result.

Validating the Fabric Topology Using the GUI

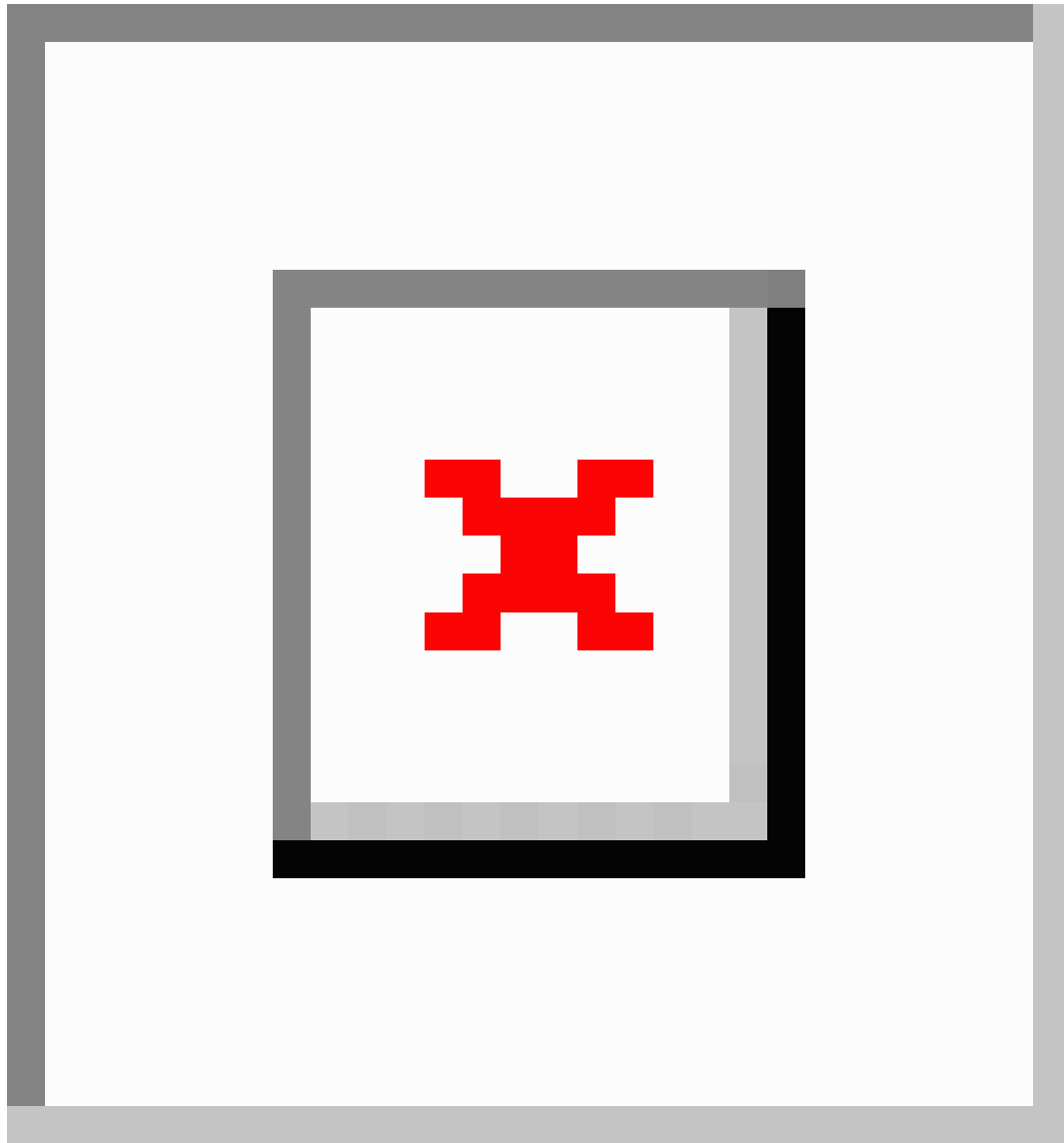
Procedure

- Step 1** On the menu bar, choose **FABRIC > INVENTORY**.
- Step 2** In the **Navigation** pane, click **TOPOLOGY**.
The displayed summary shows the quantity and health of all pods, switches, APIC instances, and EPGs.
- Step 3** In the **Work** pane, click the **TOPOLOGY** tab.
If an Inter-Pod Network block diagram is displayed, click **View Pod** in the desired pod.
The displayed diagram shows all attached switches, APIC instances, and links.
- Step 4** (Optional) Hover over any component to view its health, status, and inventory information.
- Step 5** (Optional) To view the port-level connectivity of a leaf switch or spine switch, double-click its icon in the topology diagram.
- Step 6** (Optional) To refresh the topology diagram, click the  icon in the upper right corner of the **Work** pane.
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Unmanaged Switch Connectivity in VM Management

The hosts that are managed by the VM controller (for example, a vCenter), can be connected to the leaf port through a Layer 2 switch. The only prerequisite required is that the Layer 2 switch must be configured with a management address, and this management address must be advertised by Link Layer Discovery Protocol (LLDP) on the ports that are connected to the switches. Layer 2 switches are automatically discovered by the APIC, and they are identified by the management address. The following figure shows the APIC GUI displaying unmanaged switches in the **Fabric > Inventory** view.

Figure 2: Unmanaged Layer 2 Switches in the APIC Fabric Inventory



Maintenance Mode

Maintenance Mode

Following are terms that are helpful to understand when using maintenance mode:

- **Maintenance mode:** Used to isolate a switch from user traffic for debugging purposes. You can put a switch in **maintenance mode** by enabling the **Maintenance (GIR)** field in the **Fabric Membership** page in the APIC GUI, located at **Fabric > Inventory > Fabric Membership** (right-click on a switch and choose **Maintenance (GIR)**).

If you put a switch in **maintenance mode**, that switch is not considered as a part of the operational ACI fabric infra and it will not accept regular APIC communications.

You can use maintenance mode to gracefully remove a switch and isolate it from the network in order to perform debugging operations. The switch is removed from the regular forwarding path with minimal traffic disruption.

In graceful removal, all external protocols are gracefully brought down except the fabric protocol (IS-IS) and the switch is isolated from the network. During maintenance mode, the maximum metric is advertised in IS-IS within the Cisco Application Centric Infrastructure (Cisco ACI) fabric and therefore the leaf switch in maintenance mode does not attract traffic from the spine switches. In addition, all front-panel interfaces on the switch are shutdown except for the fabric interfaces. To return the switch to its fully operational (normal) mode after the debugging operations, you must recommission the switch. This operation will trigger a stateless reload of the switch.

In graceful insertion, the switch is automatically decommissioned, rebooted, and recommissioned. When recommissioning is completed, all external protocols are restored and maximum metric in IS-IS is reset after 10 minutes.

The following protocols are supported:

- Border Gateway Protocol (BGP)
- Enhanced Interior Gateway Routing Protocol (EIGRP)
- Intermediate System-to-Intermediate System (IS-IS)
- Open Shortest Path First (OSPF)
- Link Aggregation Control Protocol (LACP)

Protocol Independent Multicast (PIM) is not supported.

Important Notes

- If a border leaf switch has a static route and is placed in maintenance mode, the route from the border leaf switch might not be removed from the routing table of switches in the ACI fabric, which causes routing issues.

To work around this issue, either:

- Configure the same static route with the same administrative distance on the other border leaf switch, or
 - Use IP SLA or BFD for track reachability to the next hop of the static route
- While the switch is in maintenance mode, the Ethernet port module stops propagating the interface related notifications. As a result, if the remote switch is rebooted or the fabric link is flapped during this time, the fabric link will not come up afterward unless the switch is manually rebooted (using the **acdiag touch clean** command), decommissioned, and recommissioned.
 - While the switch is in maintenance mode, CLI 'show' commands on the switch show the front panel ports as being in the up state and the BGP protocol as up and running. The interfaces are actually shut and all other adjacencies for BGP are brought down, but the displayed active states allow for debugging.

- For multi-pod / multi-site, **IS-IS metric for redistributed routes** should be set to less than 63 to minimize the traffic disruption when bringing the node back into the fabric. To set the **IS-IS metric for redistributed routes**, choose **Fabric > Fabric Policies > Pod Policies > IS-IS Policy**.
- Existing GIR supports all Layer 3 traffic diversion. With LACP, all the Layer 2 traffic is also diverted to the redundant node. Once a node goes into maintenance mode, LACP running on the node immediately informs neighbors that it can no longer be aggregated as part of port-channel. All traffic is then diverted to the vPC peer node.
- The following operations are not allowed in maintenance mode:
 - **Upgrade**: Upgrading the network to a newer version
 - **Stateful Reload**: Restarting the GIR node or its connected peers
 - **Stateless Reload**: Restarting with a clean configuration or power-cycle of the GIR node or its connected peers
 - **Link Operations**: Shut / no-shut or optics OIR on the GIR node or its peer node
 - **Configuration Change**: Any configuration change (such as clean configuration, import, or snapshot rollback)
 - **Hardware Change**: Any hardware change (such as adding, swapping, removing FRU's or RMA)

Removing a Switch to Maintenance Mode Using the GUI

Use this procedure to remove a switch to maintenance mode using the GUI. During the removal of a switch to maintenance mode, the out-of-band management interfaces will remain up and accessible.

Procedure

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- Step 1** On the menu bar, choose **Fabric > Inventory**.
 - Step 2** In the navigation pane, click **Fabric Membership**.
 - Step 3** In the work pane, click **Actions > Maintenance (GIR)**
 - Step 4** Click **OK**.

The gracefully removed switch displays **Debug Mode** in the **Status** column.

Removing a Switch to Maintenance Mode Using the CLI

Use this procedure to remove a switch to maintenance mode using the CLI.



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- Note** While the switch is in maintenance mode, CLI 'show' commands on the switch show the front panel ports as being in the up state and the BGP protocol as up and running. The interfaces are actually shut and all other adjacencies for BGP are brought down, but the displayed active states allow for debugging.
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Procedure

[no]debug-switch *node_id or node_name*

Removes the switch to maintenance mode.

Removing a Switch to Maintenance Mode Using the REST API

Use this procedure to remove a switch to maintenance mode using the REST API.

Procedure

Remove a switch to maintenance mode.

Example:

```
POST
https://<IP address>/api/node/mo/uni/fabric/outofsvc
<fabricOOServicePol descr="" dn="" name="default" nameAlias="" ownerKey="" ownerTag="">
  <fabricRsDecommissionNode debug="yes" dn=""
removeFromController="no" tDn="topology/pod-1/node-102"/>
  </fabricOOServicePol>
```

Inserting a Switch to Operational Mode Using the GUI

Use this procedure to insert a switch to operational mode using the GUI.

Procedure

- Step 1** On the menu bar, choose **Fabric > Inventory**.
 - Step 2** In the navigation pane, click **Fabric Membership**.
 - Step 3** In the work pane, click **Actions > Commission**.
 - Step 4** Click **OK**.
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Inserting a Switch to Operation Mode Using the CLI

Use this procedure to insert a switch to operational mode using the CLI.

Procedure

[no]no debug-switch *node_id or node_name*

Inserts the switch to operational mode.

Inserting a Switch to Operational Mode Using the REST API

Use this procedure to insert a switch to operational mode using the REST API.

Procedure

Insert a switch to operational mode.

Example:

```
POST
https://1<IP address>/api/node/mo/uni/fabric/outofsvc.xml

<fabricOOServicePol descr="" dn="" name="default" nameAlias="" ownerKey="" ownerTag="">
    <fabricRsDecommissionNode debug="yes" dn=""
removeFromController="no" tDn="topology/pod-1/node-102" status="deleted"/>
</fabricOOServicePol>
```
