Cisco ACI Virtual Pod Getting Started Guide, Release 4.2(x)

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C O N T E N T S

New and Changed

- New and Changed Information, on page 1

New and Changed Information

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

Table 1: New Features and Changed Behavior in the Cisco ACI Virtual Pod Getting Started Guide

Cisco APIC Release Version	Feature	Description	Where Documented
4.2(1)	There are no new installation-related features for Cisco ACI Virtual Pod (vPod).	N/A	For a list of all new features, limitations, and bugs, see the *Cisco ACI Virtual Pod Release Notes, Release 4.2(1)*
4.2(1)	Layer 4 to Layer 7 service graph support for Cisco ACI vPod	Layer 4 to Layer 7 service graphs support is extended to Cisco ACI Virtual Edge when it is part of with Cisco ACI vPod.	*Cisco ACI Configuration Guide, Release 2.2(x)*
4.2(1)	Microsegmentation with Cisco ACI support for Cisco ACI vPod	Support for Microsegmentation with Cisco ACI is extended for Cisco ACI Virtual Edge endpoints when Cisco ACI Virtual is part of Cisco ACI vPod.	The chapter "Microsegmentation with Cisco ACI" in *Cisco ACI Virtualization Guide Release 4.2(x)*

Cisco APIC Release Version	Feature	Description	Where Documented
4.2(1)	DHCP relay support for Cisco ACI vPod	Support for configuring a DHCP relay policy is extended to Cisco ACI Virtual Edge virtual machines (VMs) when Cisco ACI Virtual Edge is part of Cisco ACI vPod.	The section "Configuring a DHCP Relay Policy" in the chapter "Provisioning Core ACI Fabric Services" of the *Cisco APIC Basic Configuration Guide, Release 2.2(x)*

Cisco ACI vPod Overview

Cisco ACI vPod: Extending the Cisco ACI Fabric

Organizations increasingly adopt hybrid data center models to meet infrastructure demands, flexibility, and reduce costs. They combine various technologies—including virtual private clouds and other internal IT resources—with remote locations. The remote locations can be hosted data centers, satellite data centers, or multicloud environments.

However, hybrid deployments require consistent management and policy for workloads regardless of their location. They also require support for disaster recovery and the ability to migrate workloads between data centers. Meanwhile, they can lack compatible hardware or space to add new equipment.

By deploying Cisco Application Centric Infrastructure (ACI) Virtual Pod (vPod), you can overcome these challenges and virtually extend the Cisco ACI fabric into various remote locations.

What Cisco ACI vPod Is

Cisco ACI vPod was introduced with general availability in Cisco APIC Release 4.0(2). It is a software-only solution that you can deploy wherever you have at least two servers on which you can run the VMware ESXi hypervisor. Cisco ACI vPod and its components—a virtual spine (vSpine), virtual leaf (vLeaf), and Cisco ACI Virtual Edge, run on the ESXi hypervisor.

Cisco ACI vPod allows you to use Cisco ACI Virtual Edge where you do not have a physical leaf. You can use up to eight instances of Cisco ACI Virtual Edge in each Cisco ACI vPod in the remote location as you would in your on-premises data center.

Cisco ACI vPod communicates with a physical, on-premises pod or multipod over an interpod network (IPN). You configure the physical pod or multipod, the IPN connection, and Cisco ACI vPod in Cisco Application Policy Infrastructure Controller (APIC). You then use the Cisco ACI vCenter plug-in, a Python script, or PowerCLI to deploy Cisco ACI vPod components.

Benefits of Cisco ACI vPod

Once Cisco ACI vPod is installed, you can use it with Cisco APIC to enforce Cisco ACI fabric policy in the remote location.

Cisco APIC provides central management of workloads in the on-premises data center and the remote location. It enables you to enforce policy easily and consistently in both on-premises and remote locations.

The flexibility, scalability, and central management of the Cisco ACI vPod solution enable you to take advantage of the following use case scenarios:

- Extension of the Cisco ACI fabric to the bare-metal cloud

- Extension of the Cisco ACI fabric to brownfield deployments

- Extension of the Cisco ACI fabric to colocation data centers

- Migration of workloads from non-Cisco hardware to the Cisco ACI fabric

Where to Find More Information

For general information, see the *Cisco ACI Virtual Pod Release Notes* on Cisco.com.

Cisco ACI vPod Architecture

Cisco Application Centric Infrastructure (ACI) Virtual Pod (vPod) extends the multipod architecture into the virtual infrastructure. It consists of virtual spines (vSpines), virtual leafs (vLeafs), and one to 32 instances of Cisco ACI Virtual Edge. These elements are deployed on a VMware ESXi hypervisor in the remote site.

The vSpines and Cisco ACI Virtual Edge logically connect to the on-premises data center over an interpod network (IPN). The Cisco Application Policy Infrastructure Controller (APIC) cluster in the on-premises data center discovers, configures, and extends the policy on the Cisco ACI vPod.

Figure 1: Cisco ACI vPod on Remote Site
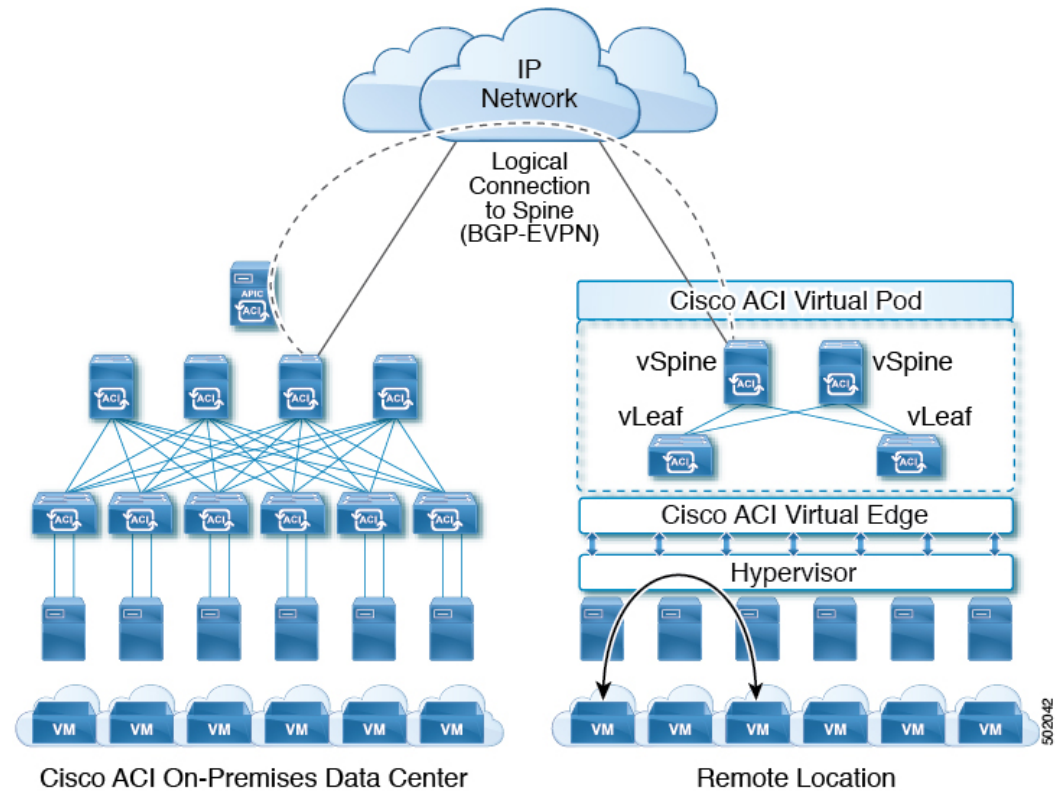
Cisco ACI vPod includes the following elements:

- **Virtual spine (vSpine) and Virtual leaf (vLeaf):** The vSpine and vLeaf are separate virtual machines (VMs) within Cisco ACI vPod. They emulate the functionality of a physical spine and physical leaf. The vSpines and Cisco ACI Virtual Edge logically connect to the on-premises data center over an IPN.

  The vSpine and vLeaf function as services inside the VMs in the Cisco ACI vPod, handling control plane management. They are contained in the Cisco ACI vPod installation package.

  - **vSpine:** Establishes a Border Gateway Protocol (BGP) Ethernet VPN (EVPN) connection to the on-premises spine and the vPod control plane.

  - **vLeaf:** Distributes the policies that are created on Cisco Application Policy Infrastructure Controller (APIC) to the Cisco ACI Virtual Edge.

- **Cisco ACI Virtual Edge:** Connects to spines and border leaves in the physical Cisco ACI fabric through Insieme VXLAN (iVXLAN) tunnels. It also uses iVXLAN for communication within the remote site. Cisco ACI Virtual Edge handles packet forwarding, policy enforcement, and all data plane management. The iVXLAN overlay technology in the data plane provides Layer 2 and Layer 3 connectivity services between endpoints, regardless of their location.

  You deploy one Cisco ACI Virtual Edge on each VMware ESXi hypervisor host that participates in the virtual pod, creating a distributed data plane across the virtual pod. You can have up to 32 Cisco ACI Virtual Edge virtual leafs in a Cisco ACI vPod, one on each host.

  Cisco ACI Virtual Edge uses the fast packet-processing framework Data Plane Development Kit (DPDK) for high-performance forwarding in the user space.

Figure 2: Cisco ACI vPod Components
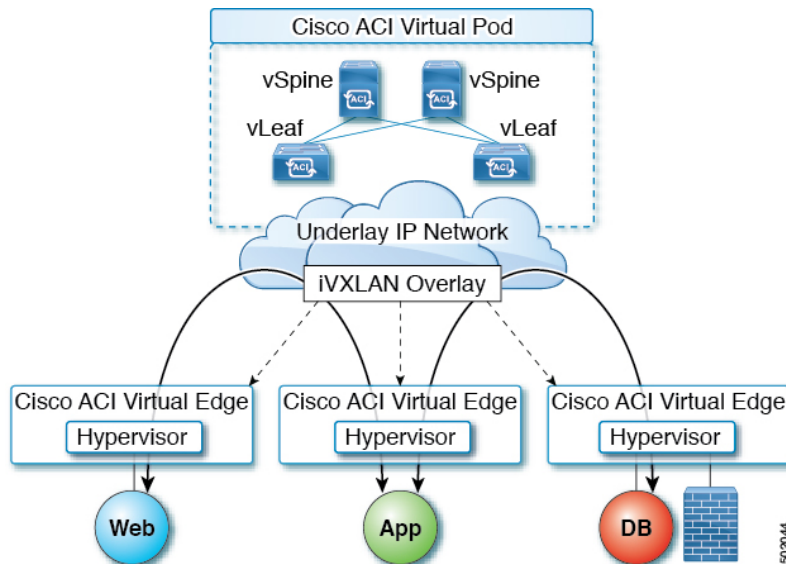
A single Cisco ACI can contain multiple physical pods and multiple virtual pods. A single Cisco APIC manages the entire fabric. Tenant configurations—including virtual routing and forwarding (VRF), bridge domains, and endpoint groups (EPGs)—are available across all the pods.

Cisco ACI vPod Licensing

You obtain the following two licenses for Cisco Application Centric Infrastructure (ACI) Virtual Pod (vPod) on Cisco.com:

- **Management Cluster:** You need a single license for each Cisco ACI vPod.

  The management cluster is licensed as a pair of redundant virtual spine (vSpine) and virtual leaf (vLeaf) virtual machines (VMs). The cluster provides Cisco ACI management and control plane functions. It also programs the individual Cisco Application Centric Infrastructure (ACI) Virtual Edge within the Cisco ACI vPod.

  The single Cisco ACI vPod management cluster license includes the redundant vSpines and vLeafs, a total of four VMs.

  Note VMware ESXi 6.0 or later is required for the management cluster.

- **Cisco ACI Virtual Edge** : You need one license for each instance of Cisco ACI Virtual Edge; you can have up to 32 instances on each Cisco ACI vPod.

  Cisco ACI Virtual Edge is licensed in vPod mode, when it is part of Cisco ACI vPod. It is licensed as a VM that operates on each workload server. It provides data plane and policy enforcement functions. (Cisco ACI Virtual Edge is not licensed when installed on a physical leaf—when it functions outside of Cisco ACI vPod deployments.)

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| **Note** | VMware ESXi 6.0 or later is required for the workload. |

Cisco ACI vPod in a Multipod Environment

Cisco Application Centric Infrastructure (ACI) Virtual Pod (vPod) can be used with multipod Cisco ACI fabrics. You must configure an interpod network (IPN) connection to a physical pod in the on-premises data center before you can add the Cisco ACI vPod.

Multipod environments enable a more fault-tolerant fabric comprising multiple pods with isolated control plane protocols. They also provide greater flexibility in full mesh cabling between leaf and spine switches.

For detailed information about multipod environments, see the following documents on Cisco.com:

- *Cisco Application Centric Infrastructure Fundamentals*

- *Cisco Layer 3 Network Configuration Guide*

- *Cisco APIC NX-OS Style Command-Line Interface Configuration Guide*

See the *Cisco ACI Virtual Edge Release Notes* for information about Cisco Application Centric Infrastructure (ACI) Virtual Edge for features not supported with multipod.

CHAPTER 3

Preparation for Installing and Using Cisco ACI vPod

Make sure to fulfill all the prerequisites, meet the requirements, and follow all the guidelines in this chapter before you install and use Cisco Application Centric Infrastructure (ACI) Virtual Pod (vPod).

- Prerequisites, Requirements, and Guidelines for Installing and Using Cisco ACI vPod, on page 9

Prerequisites, Requirements, and Guidelines for Installing and Using Cisco ACI vPod

You must fulfill several requirements before you can install and use Cisco Application Centric Infrastructure (ACI) Virtual Pod (vPod). These include:

- Preparing the Cisco ACI fabric
- Meeting scalability requirements
- Fulfilling hardware requirements
- Fulfilling software requirements

This section provides an overview of the prerequisites for installing Cisco ACI vPod.

Cisco ACI Fabric Preparation

Before you can install and use Cisco Application Centric Infrastructure (ACI) Virtual Pod (vPod), the Cisco ACI fabric must be properly configured. This section lists the necessary configuration tasks.

- Set up Cisco APIC.

  See the *Cisco APIC Getting Started Guide* and the *Cisco APIC Basic Configuration Guide* on Cisco.com for instructions on how to configure Cisco APIC for the first time.

- Set up at least one Cisco ACI physical pod or multipod.

  Follow instructions in the *Cisco ACI Layer 3 Network Configuration Guide*. Review the following Cisco Live session for information on how to bring up a Cisco ACI fabric from scratch: https://www.ciscolive.com/global/on-demand-library/?search=paggen#/.

- Physically connect the physical pod and the gateway for the Cisco ACI vPod tunnel endpoint (TEP) pool to the interpod network (IPN) devices.

- Configure the IPN devices with the correct IP addresses on the interfaces facing the spine switches.

- Ensure that the IPN supports the following functionalities so it can connect the physical on-premises data center to the Cisco ACI vPod:

  - **DHCP relay support**: Autoprovisioning of Cisco ACI fabric devices depends on DHCP relay support. It enables the Cisco ACI vPod components to automatically join the Cisco ACI fabric, as if Cisco ACI vPod were a physical pod, multipod, or remote leaf.

  - **OSPF support**: Open Shortest Path First (OSPF) v2 is the routing protocol that is supported on the physical spine interfaces connecting to IPN devices.

    Increased MTU support: The IPN must support sufficient maximum transmission unit (MTU) to accommodate VXLAN data plan traffic between the physical and virtual pods. The required MTU in the IPN must be 50 bytes higher than the maximum frame size used by endpoints within the fabric to accommodate the additional VXLAN headers.

- Enable DHCP relay on the Cisco ACI vPod routers to direct DHCP requests to the Cisco APIC cluster external IP addresses assigned to Cisco APIC. The DHCP requests assignment of IP addresses from the configured TEP pool to new vSpines and vLeafs.

  Note You can find the external IP addresses assigned to Cisco APIC from Cisco APIC from the command **acidic avread** or from the physical pod spine switch with the command .

Scalability Requirements

Cisco Application Centric Infrastructure (ACI) Virtual Pod (vPod) is part of the Cisco ACI fabric and is managed by a single Cisco Application Policy Infrastructure Controller (APIC) controller. Observe the scalability limits in the *Verified Scalability Guide for Cisco APIC* on Cisco.com.

Hardware Requirements

Cisco Application Centric Infrastructure (ACI) Virtual Pod (vPod) components connect to an existing Cisco ACI fabric over an interpod network (IPN). Cisco ACI vPod uses head-end replication for broadcast, unknown unicast, and multicast (BUM) traffic across physical and virtual pods. Doing so reduces IPN requirements and allows Cisco ACI vPod to extend further into the enterprise backbone or WAN.

The use of head-end replication for BUM traffic requires that you use second-generation physical spines on the Cisco ACI fabrics that connect to the IPN. The following table shows the physical spine switches that support Cisco ACI vPod in Cisco APIC Release 4.0(1).

Switch Type	Supported Hardware
Fixed Spine Switches	- N9364C - N9332C

Switch Type	Supported Hardware
Modular Switches	Supported with the following line cards: • N9732C-EX • N9732C-FX • N9736C-FX

First-generation spine switches, which do not support Cisco ACI vPod, can be part of a Cisco ACI fabric that contains second-generation spine switches. However, make sure that only second-generation spine switches connect to the IPN to support Cisco ACI vPod.

Software Requirements

Make sure that you meet the software-related requirements in this section for Cisco Application Centric Infrastructure (ACI) Virtual Pod (vPod):

Component	Description
Cisco APIC	Cisco ACI vPod is supported beginning with the Cisco APIC 4.0(1) release.
Cisco ACI Virtual Edge	• Version: Cisco ACI Virtual Edge Release 2.0(1a) and later. • Hypervisor requirement: ESXi 6.0 and later. • Virtual Machine (VM) resources: 2 vCPU, 4 GB of RAM, and 24 GB of storage.
VMware vCenter	Cisco ACI vPod is compatible with VMware vCenter Server release 6.0 and later.
VMware vSphere bare-metal servers	Cisco ACI vPod is supported as a virtual infrastructure for the Cisco APIC in remote sites with release 6.0 and later of the VMware ESXi hypervisor. **Note** Make sure that the ESXi server is time-synchronized with a Network Time Protocol (NTP) server. This ensures that the VMs are discovered.
Virtual spine (vSpine)	• Hypervisor requirement: ESXi 6.0 or later. • Virtual Machine (VM) resources: 2 vCPU, 8 GB of RAM, and 100 GB of storage.
Virtual leaf (vLeaf)	• Hypervisor requirement: ESXi 6.0 or later. • Virtual Machine (VM) resources: 2 vCPU, 8 GB of RAM, and 100 GB of storage.

Component	Description
Cisco ACI vCenter plug-in	The latest available version.

Cisco ACI vPod Deployment Recommendations

We recommend that you follow the recommendations in this section when planning to deploy Cisco Application Centric Infrastructure (ACI) Virtual Pod (vPod) and its components.

- **vSpine and vLeaf deployment:** Deploy the vSpine and vLeaf in pairs. When you deploy the vSpine and vLeaf in pairs, both components provide active-active redundancy. Deploy each pair on two separate hosts with one vSpine and one vLeaf on each host. During deployment, the deployment tool prevents both vSpines and both vLeafs from residing on the same host. Ensuring that each vSpine-vLeaf pair is on separate hosts allows Cisco ACI vPod to remain operational if a physical host fails.

  We recommend that you deploy the vSpines and vLeafs on a dedicated management VMware cluster that does not host Cisco ACI Virtual Edge or VMs that use the Cisco ACI vPod as a transport.

CHAPTER **4**

Next Steps for Cisco ACI vPod

Next Steps for Cisco ACI vPod

Once you've read and understood the requirements, you can install Cisco Application Centric Infrastructure (ACI) Virtual Pod (vPod). This section provides a high-level overview of the installation process and provides links to the *Cisco ACI Virtual Pod Installation Guide* and other resources that provide instruction and information.

1. Fulfill all prerequisites, which include tasks in the Cisco APIC and VMware vCenter.

   See the section Preparation for Installing and Using Cisco ACI vPod, on page 9 in this guide and the section "Prerequisites for Installing Cisco ACI vPod" in the *Cisco ACI Virtual Pod Installation Guide*.

2. Using Cisco APIC, prepare a physical pod in the on-premises data center to communicate with the Cisco ACI vPod in the remote site over an interpod network (IPN).

   Preparation includes defining a tunnel endpoint (TEP), and configuring Border Gateway Protocol (BGP), a Layer 3 outside connection, and Open Shortest Path First (OSPF). Also make sure that the physical pod or all the physical pods in a multipod setup have external TEP pools configured.

   See the sections "Preparing the Physical Pod IPN Connectivity" and Configuring Routable Subnets for Physical Pods" in the *Cisco ACI Virtual Pod Installation Guide.*.

3. Using Cisco APIC, create a Cisco ACI Virtual Edge VMM domain.

   See the section "vCenter Domain, Interface, and Switch Profile Creation" in the Installation chapter of the *Cisco ACI Virtual Pod Installation Guide.*.

4. Using Cisco APIC, add the Cisco ACI vPod.

   This task includes defining the virtual spine (vSpine) and virtual leaf (vLeaf) virtual machines (VMs)—one vSpine VM and one vLeaf VM for each node where you will deploy Cisco ACI vPod.

   See the section "Adding the Cisco ACI vPod" in the *Cisco ACI Virtual Pod Installation Guide.*.

5. Download the Cisco ACI vPod and Cisco ACI Virtual Edge OVF files from Cisco.com and then upload them to the VMware vCenter content library.

   The Cisco ACI vPod OVF file contains the vSpine and vLeaf. The Cisco ACI Virtual Edge OVF file contains the Cisco ACI Virtual Edge image.

See the sections "Uploading the Cisco ACI vPod OVF File to the VMware vCenter Content Library" and "Upload the Cisco ACI Virtual Edge VM OVF File to the VMware vCenter Content Library" in the *Cisco ACI Virtual Pod Installation Guide.*.

6. In VMware vCenter, deploy the Cisco ACI vPod vSpine and vLeaf VMs on the ESXi hosts.

   See the section "Deploying Cisco ACI vPod VMs on the ESXi Hosts Using the Cisco ACI vCenter Plug-In" in the *Cisco ACI Virtual Pod Installation Guide*.

7. Install the Cisco ACI Virtual Edge, making sure to enable it in vPod mode and choose the Cisco ACI vPod that you want it to be part of.

   See the chapter "Cisco ACI Virtual Edge Installation" in the *Cisco ACI Virtual Edge Installation Guide*.

8. Perform postinstallation configuration tasks for Cisco ACI Virtual Edge.

   • Deploy an application profile, which includes creating a tenant, application profile, endpoint groups (EPGs), filters, and contracts. It also includes assigning port groups to VMs. Then verify the application profile.S ee the *Cisco APIC Basic Configuration Guide* for instructions.

   • If you want to use Distributed Firewall, enable it after installation. See the chapter "Distributed Firewall" in the *Cisco ACI Virtual Edge Configuration Guide* for instructions.