ACI Advanced Monitoring and Troubleshooting

Sadiq Memon, CCIE® No. 47508
Joseph Ristaino, CCIE® No. 41799
Carlo Schmidt, CCIE® No. 41842

Forewords written by **Yusuf Bhaiji,** Director of Certifications, Cisco Systems;
and **Ronak Desai,** VP of Engineering for the Data Center
Networking Business Unit, Cisco Systems

ciscopress.com

ACI Advanced Monitoring and Troubleshooting

Sadiq Memon (CCIE No. 47508)
Joseph Ristaino (CCIE No. 41799)
Carlo Schmidt (CCIE No. 41842)

Cisco Press

221 River St.

Hoboken, NJ 07030 USA

Chapter 6

VMM Integration

Cisco ACI virtual machine (VM) networking supports hypervisors from multiple vendors. It allows for multivendor hypervisors along with programmable and automated access to high-performance scalable virtualized data center infrastructure. In this chapter, you will learn about Virtual Machine Manager (VMM) and its integration into Cisco Application Centric Infrastructure (ACI) from the following virtualization-supported products and vendors:

- VMware
- Microsoft
- OpenStack
- Kubernetes
- OpenShift

You will also learn about VMM integration with ACI at multiple locations.

Virtual Machine Manager (VMM)

VMM integration enables the ACI fabric to extend network policies and policy group definitions into the virtualization switching layer on end hosts. This integration automates critical network plumbing steps that typically create delays in the deployment of overall virtual and compute resources in legacy network environments. VMM integration into ACI also provides value in getting visibility up to the virtualization layer of the application, which is a perpetually conflicting factor between network and server virtualization teams.

VMM Domain Policy Model

VMM domain profiles (vmmDomP) specify connectivity policies that enable virtual machine controllers to connect to the ACI fabric. Figure 6-1 shows the general hierarchy of VMM configuration.

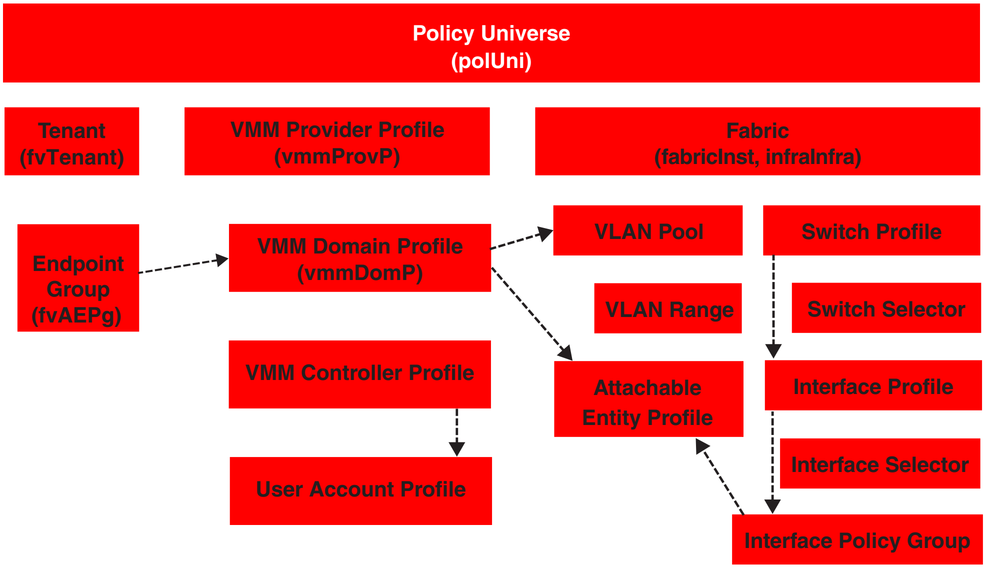

Figure 6-1 *VMM Policy Model*

VMM Domain Components

VMM domains enable an administrator to configure connectivity policies for virtual machine controllers in ACI. The essential components of an ACI VMM domain policy include the following:

- VMM domain
- VLAN pool association
- Attachable access entity profile association
- VMM domain endpoint group (EPG) association

VMM Domains

VMM domains make it possible to group VM controllers with similar networking policy requirements. For example, VM controllers can share VLAN pools and application EPGs. The Cisco Application Policy Infrastructure Controller (APIC) communicates with the VM controller to publish network configurations such as port groups, which are then applied to the virtual workloads. The VMM domain profile includes the following essential components:

- **Credential:** Associates a valid VM controller user credential with an APIC VMM domain.
- **Controller:** Specifies how to connect to a VM controller that is part of a policy enforcement domain. For example, the controller specifies the connection to a VMware vCenter instance that is part of a VMM domain.

Note A single VMM domain can contain multiple instances of VM controllers, but they must be from the same vendor (for example, VMware, Microsoft).

An APIC VMM domain profile is a policy that defines a VMM domain. The VMM domain policy is created on an APIC and pushed into the leaf switches. Figure 6-2 illustrates VM controllers of the same vendor as part of the same VMM domain.

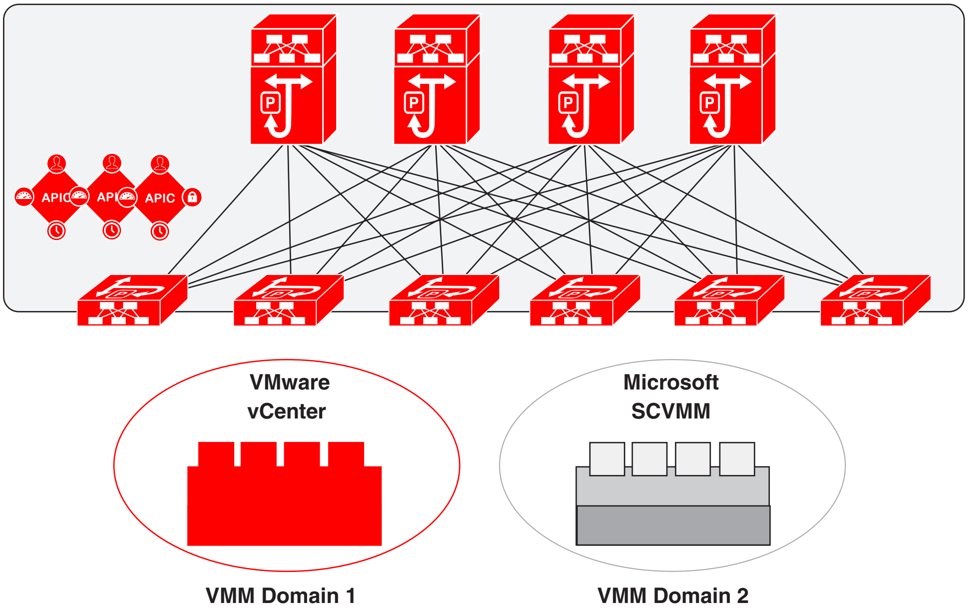

Figure 6-2 *VMM Domain Integration*

VMM domains provide the following:

- A common layer in the ACI fabric that enables scalable fault-tolerant support for multiple VM controller platforms.
- VMM support for multiple tenants within the ACI fabric.

VMM domains contain VM controllers such as VMware vCenter or Microsoft System Center Virtual Machine Manager (SCVMM) and the credentials required for the ACI API to interact with the VM controllers. A VMM domain enables VM mobility within the domain but not across domains. A single VMM domain can contain multiple instances of VM controllers, but they must be from the same vendor. For example, a VMM domain can contain many VMware vCenter instances managing multiple controllers, each running multiple VMs; however, it cannot contain Microsoft SCVMM instances. A VMM domain inventories controller elements (such as pNICs, vNICs, and VM names) and pushes policies into the controllers, creating port groups or VM networks and other necessary elements. The ACI VMM domain listens for controller events such as VM mobility events and responds accordingly.

VMM Domain VLAN Pool Association

A VLAN pool specifies a single VLAN ID or a range of VLAN IDs for VLAN encapsulation. It is a shared resource that can be consumed by multiple domains, such as physical, VMM, or external domains.

In ACI, you can create a VLAN pool with allocation type static or dynamic. With static allocation, the fabric administrator configures a VLAN; with dynamic allocation, the APIC assigns the VLAN to the domain dynamically. In ACI, only one VLAN or VXLAN pool can be assigned to a VMM domain.

A fabric administrator can assign a VLAN ID statically to an EPG. However, in this case, the VLAN ID must be included in the VLAN pool with the static allocation type, or the APIC will generate a fault. By default, the assignment of VLAN IDs to EPGs that are associated with the VMM domain is done dynamically by the APIC. The APIC provisions VMM domain VLAN IDs on leaf switch ports based on EPG events, either statically binding or based on VM events from controllers such as VMware vCenter or Microsoft SCVMM.

Attachable Access Entity Profile Association

An attachable access entity profile (AAEP) associates a VMM domain with the physical network infrastructure where the vSphere hosts are connected. The AAEP defines which VLANs will be permitted on a host-facing interface. When a domain is mapped to an endpoint group, the AAEP validates that the VLAN can be deployed on certain interfaces. An AAEP is a network interface template that enables the deployment of VM controller policies on a large set of leaf switch ports. An AAEP specifies which switches and ports are available and how they are configured. The AAEP can be created on-the-fly during the creation of the VMM domain itself.

VMM Domain EPG Association

Endpoint groups regulate connectivity and visibility among the endpoints within the scope of the VMM domain policy. VMM domain EPGs behave as follows:

- The APIC pushes these EPGs as port groups into the VM controller.
- An EPG can span multiple VMM domains, and a VMM domain can contain multiple EPGs.

The ACI fabric associates EPGs to VMM domains, either automatically through an orchestration component such as VMware vRealize suite (vRA/vRO) or Microsoft Azure, or when an APIC administrator creates such configurations. An EPG can span multiple VMM domains, and a VMM domain can contain multiple EPGs.

In Figure 6-3, endpoints (EPs) of the same color are part of the same EPG. For example, all the gray EPs are in the same EPG, even though they are in different VMM domains.

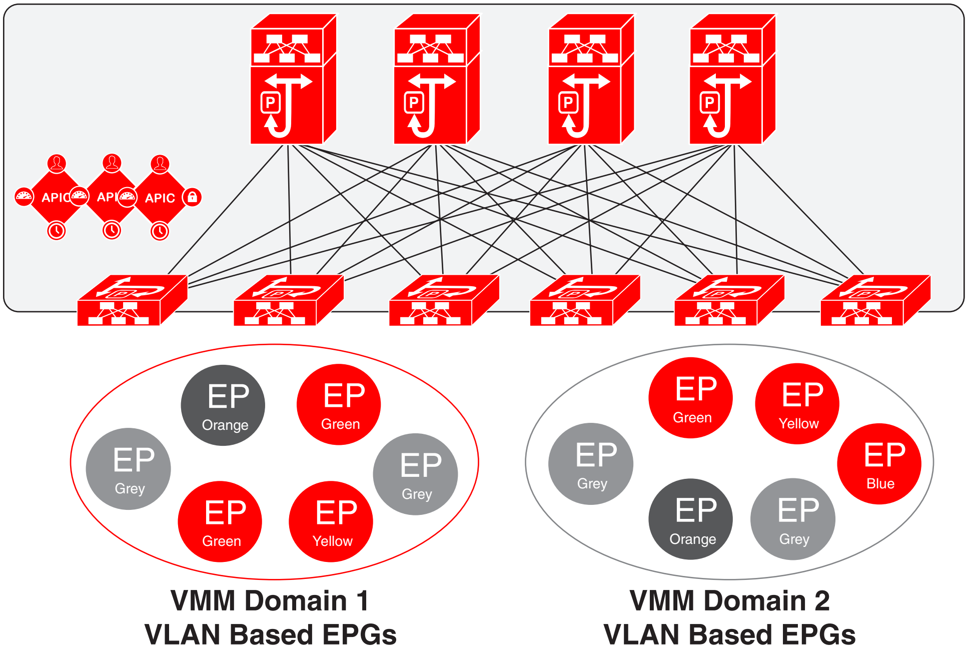

Figure 6-3 *VMM Domain EPG Association*

Note Refer to the latest *Verified Scalability Guide for Cisco ACI* at the Cisco website for virtual network and VMM domain EPG capacity information.

Figure 6-4 illustrates multiple VMM domains connecting to the same leaf switch if they do not have overlapping VLAN pools on the same port. Similarly, the same VLAN pools can be used across different domains if they do not use the same port of a leaf switch.

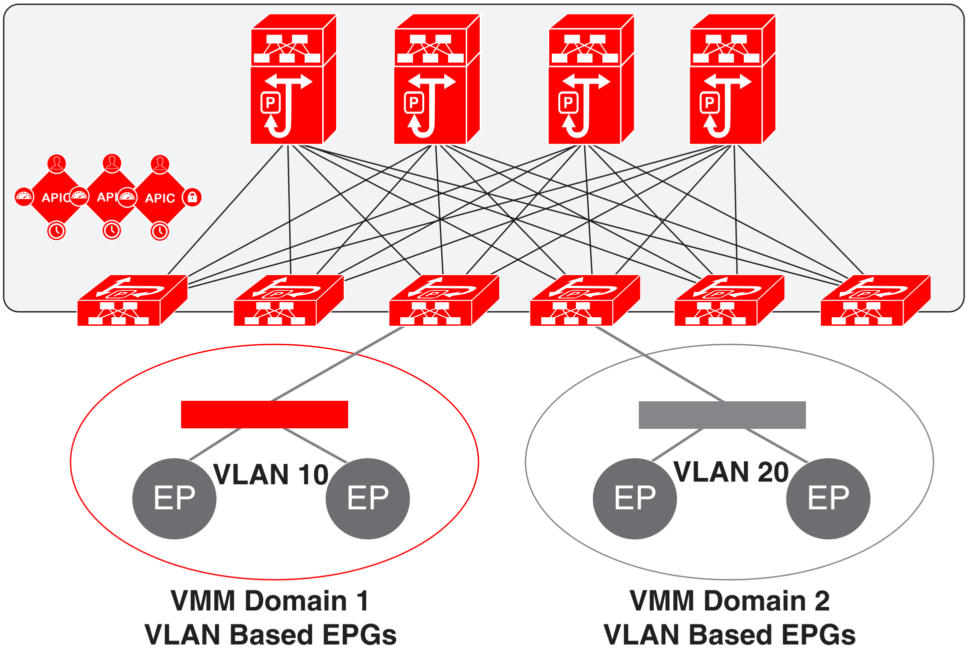

Figure 6-4 *VMM Domain EPG VLAN Consumption*

EPGs can use multiple VMM domains in the following ways:

- An EPG within a VMM domain is identified by an encapsulation identifier that is either automatically managed by the APIC or statically selected by the administrator. An example for a VLAN is a virtual network ID (VNID).
- An EPG can be mapped to multiple physical (for bare-metal servers) or virtual domains. It can use different VLAN or VNID encapsulations in each domain.

Note By default, an APIC dynamically manages the allocation of a VLAN for an EPG in a VMM integration. VMware vSphere Distributed Switch (VDS) administrators have the option of configuring a specific VLAN for an EPG. In that case, the VLAN is chosen from a static allocation block within the pool associated with the VMM domain.

Applications can be deployed across VMM domains, as illustrated in Figure 6-5. While live migration of VMs within a VMM domain is supported, live migration of VMs across VMM domains is not supported.