

DMZ Virtualization Using VMware vSphere 4 and the Cisco Nexus 1000V Virtual Switch

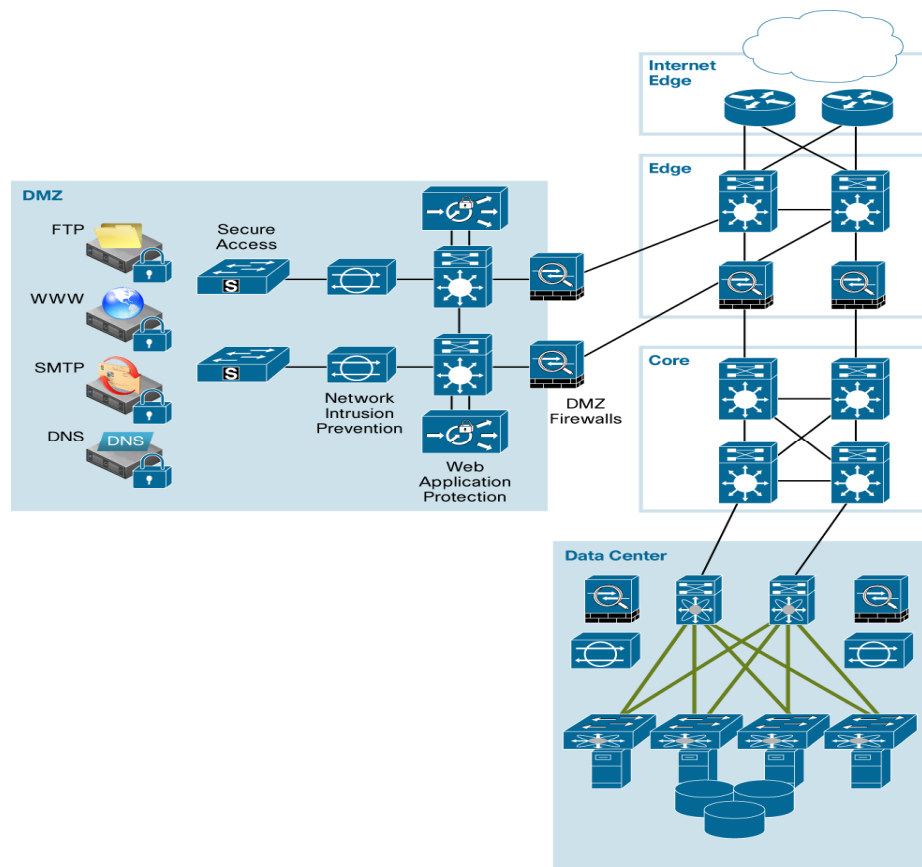


What You Will Learn

A demilitarized zone (DMZ) is a separate network located in the neutral zone between a private (inside) network and a public (outside) network. A DMZ environment consists of numerous service and infrastructure devices depending on the business model of the organization. Often, servers, firewalls, network intrusion prevention systems (IPSs), host IPSs, switches, routers, application firewalls, and server load balancers are used in various combinations within a DMZ (Figure 1).

The use of virtualization is becoming increasingly commonplace throughout IT departments and these platforms. This document discusses DMZ virtualization and security.

Figure 1. Traditional DMZ



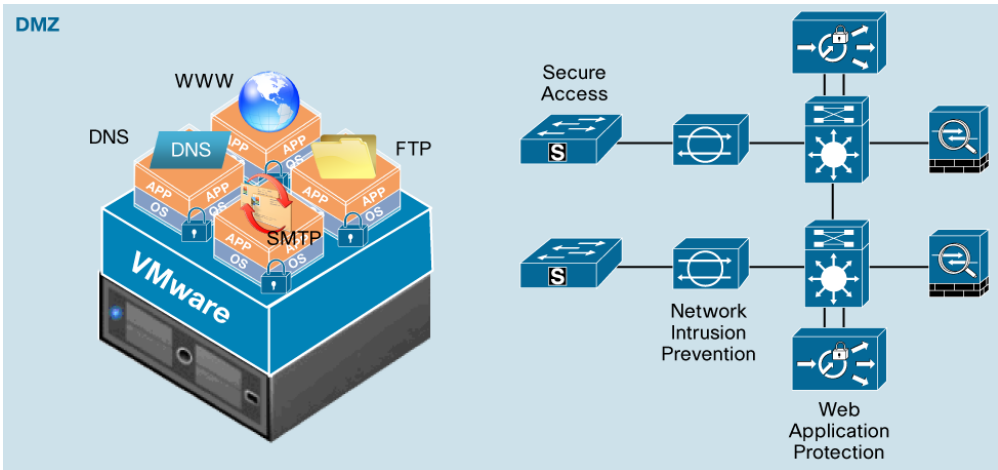


DMZ Virtualization

The virtualized DMZ takes advantage of virtualization technologies to reduce the DMZ footprint, thereby freeing valuable rack space, which in turn reduces power consumption and overall operating costs. Server and infrastructure virtualization are two main components of the virtualized DMZ.

Through the use of server virtualization, applications residing in the DMZ are moved to virtual machines, many of which can reside on the same physical server (Figure 2).

Figure 2. Server Virtualization in the DMZ

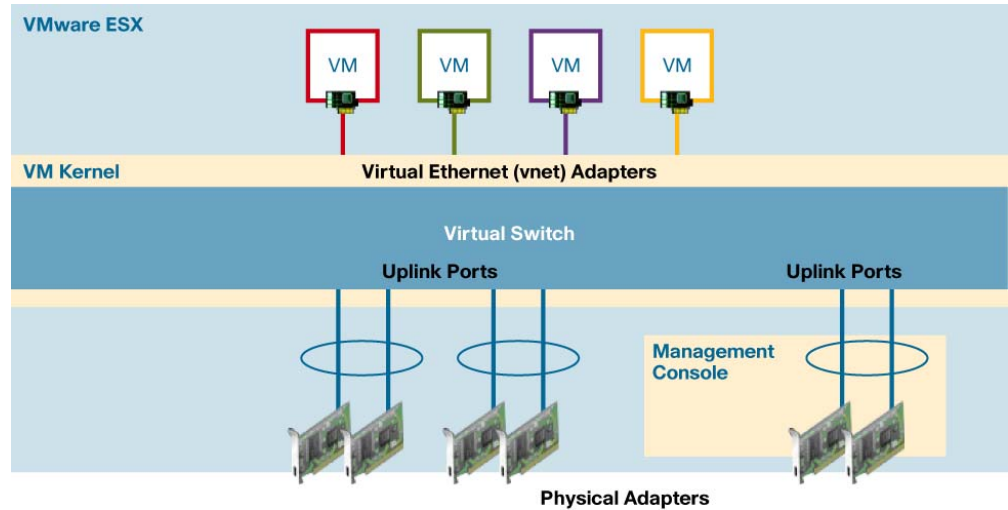


Security requirements for the physical DMZ design remain applicable in the virtual design. Firewalls, network intrusion prevention systems, web application firewalls, and endpoint security are all recommended components of the virtual DMZ design. In addition, some virtualization-specific considerations need to be taken into account. In the traditional DMZ model, each physical server is connected to an access port, and any communication to and from a particular server or between servers goes through a physical access switch and any associated appliances such as a firewall or a load balancer. In a virtualized server environment, applications can reside on virtual machines, and multiple virtual machines may reside within the same physical server. Traffic may not need to leave the physical server and pass through a physical access switch for one virtual machine to communicate with another. In this environment, a virtual network (vnet) is created within each server. Multiple VLANs, IP subnets, and access ports can all reside within the server as part of a virtual network.

The virtual switch is configured to provide connectivity for all virtual machines. The virtual network policies and port mappings are all configured on the virtual switching component. Although this new virtual access layer resides within the server, it shares the same role and basic concepts as the traditional physical access layer. Figure 3 shows an example of a virtual network.



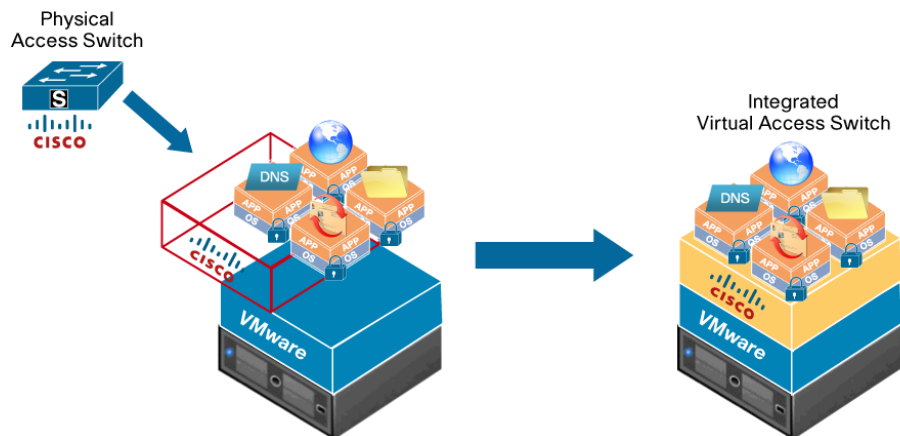
Figure 3. VMware ESX



The virtual access layer does create some challenges for both the network and server teams. The creation of a virtual infrastructure within the server environment can place increased networking responsibilities on the server team. The network team can be challenged to maintain the visibility and enforce the policies that are implemented at the physical access layer. Traditional methods for gaining visibility into server and application traffic flows may not function for inter-virtual machine traffic that resides within a physical server, and enforcement of network policies can become difficult if the enforcement is performed through different methods and by different teams in the virtual environment, leading to possible misconfiguration and resulting in improper implementation of policies.

The Cisco Nexus™ 1000V Series Switches address these concerns by allowing network and server teams to maintain their traditional roles and responsibilities in a virtual networking environment through features and functions comparable to those in today's physical network switches (Figure 4).

Figure 4. Migration from Physical to Virtual Access



Cisco Nexus 1000V Series Virtual Switch

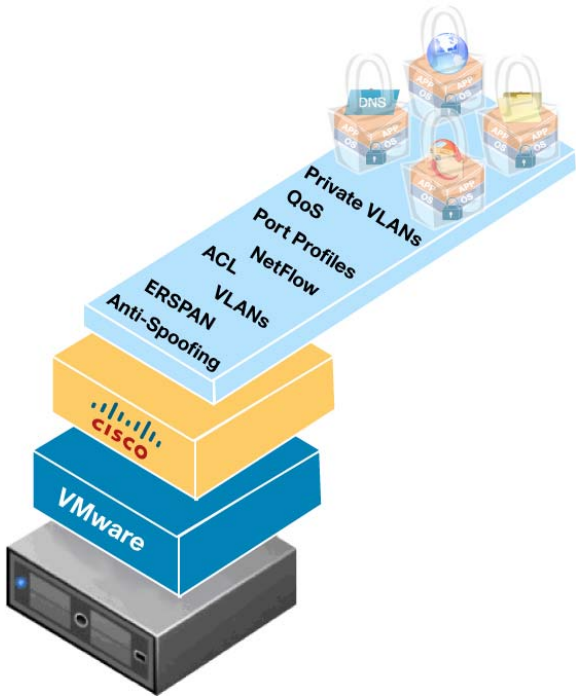
The Cisco Nexus 1000V Series is a virtual network distributed switch (vDS) platform supported by the VMware vSphere product. The Cisco Nexus 1000V Series consists of two components: the virtual supervisor module (VSM) and the virtual Ethernet module (VEM). The VSM acts in a similar fashion to a traditional Cisco® supervisor module. The networking and policy configurations are performed on the VSM and applied to the ports on each VEM. The VEM is similar to a traditional Cisco line card and provides the ports for host (virtual machine) connectivity. The VEM resides in the physical server as the virtual switching component.

Many of the same physical access switch capabilities are maintained by the Cisco Nexus 1000V Series in a virtual switching footprint (Figure 5). Some of the main features are:

- VLANs
- Private VLANs
- Port mirroring (Switched Port Analyzer [SPAN] and Encapsulated Remote SPAN [ERSPAN])
- Access control lists (ACLs)
- Anti-spoofing features
- Quality of service (QoS)
- NetFlow Version 9
- Port profiles

Port profiles are used to map features and policies to specific virtual ports. Port profiles are discussed later in this document.

Figure 5. Nexus 1000V Feature Overview

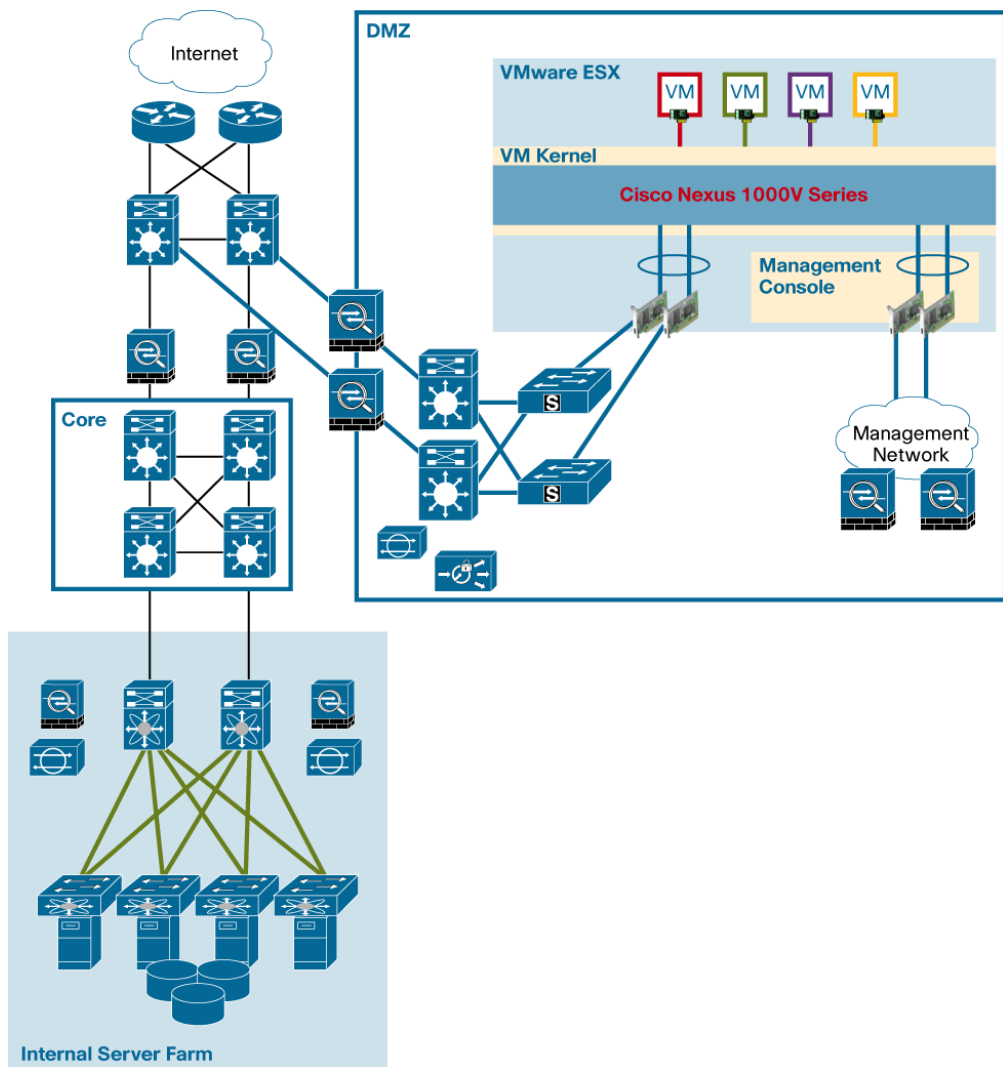


DMZ Virtualization with Cisco Nexus 1000V Series

In the virtualized DMZ, the Cisco Nexus 1000V Series provides virtual access switching in a VMware vSphere server environment. The virtual switch provides connectivity between the virtual machine virtual network interface cards (NICs) and the physical NICs of the server. The physical NICs are configured as uplink ports on the Cisco Nexus 1000V Series.

Figure 6 shows a DMZ using both Cisco and VMware virtual infrastructure.

Figure 6. Virtualized DMZ with Nexus 1000V



In this design, traditional networking policies can be enforced while still maintaining a separation of duties for the network and server teams. Virtual machine isolation can be enforced and port mirroring features can increase visibility for virtual machine traffic flows. By using separate interfaces and applying the appropriate ACLs, separation is maintained between the physical production network and the out-of-band management network. The out-of-band network is accessed through the VMware vSphere service console and the associated physical server NICs.



The following sections describe some of the Cisco Nexus 1000V Series features and how they can be applied to the virtual infrastructure.

Mapping Roles and Responsibilities

Port Profiles and Port Groups

The use of server virtualization has increased some of the responsibilities of the server administration team. Traditionally the network and security teams are responsible for configuring all network components for server connectivity; server administrators simply connect the server to the preconfigured access port. In a virtual environment, some of the network functions now reside in the virtual server platform. VLAN assignment, port mapping, and inter-virtual machine communication can all be configured within the virtual server. VMware vCenter Server enables server administrators to configure the virtual networking components.

This approach often brings some contention as to who is responsible for the networking and security policies and this virtualized layer. Miscommunication or a simple configuration mistake can subsequently lead to assignment of the wrong VLAN and policy to a virtual machine. In most cases, the server teams have no desire to become network engineers and would rather save time and work by simply applying a predefined network policy to their servers.

The Cisco Nexus 1000V Series offers a significant administration benefit. When a network policy is defined on the Cisco Nexus 1000V Series, it is updated in VMware vCenter and displayed as an option on the Port Group drop-down list. This updating is achieved through the use of an API for communication between the virtual supervisor module and the VMware vCenter Server. The network teams can configure a predefined server policy and make it available for selection (through VMware vCenter) to the server administrators in the same manner as is used to apply policies today through port groups.

The Cisco Nexus 1000V Series policies are defined through a feature called port profiles. Port profiles allow you to configure network and security features in a single profile, which can be applied to multiple switch interfaces. After you define a port profile, you can apply that profile and any settings defined to one or more interfaces. Multiple profiles can be defined and assigned to individual interfaces to provide specific policies based on the type of server and application connecting to the port. Figure 7 shows an example of a port profile.



Figure 7. Port Profile Configuration Example

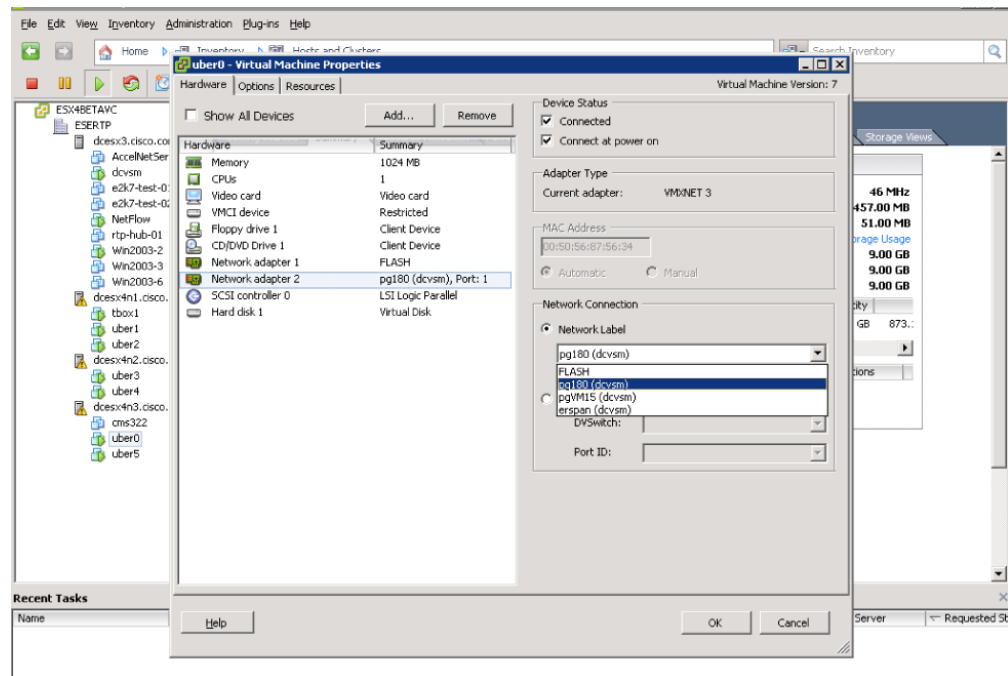
```
port-profile vm180
vmware port-group pg180
switchport mode access
switchport access vlan 180
ip flow monitor ESE-flow input
ip flow monitor ESE-flow output
no shutdown
state enabled

interface Vethernet9
inherit port-profile vm180

interface Vethernet10
inherit port-profile vm180
```

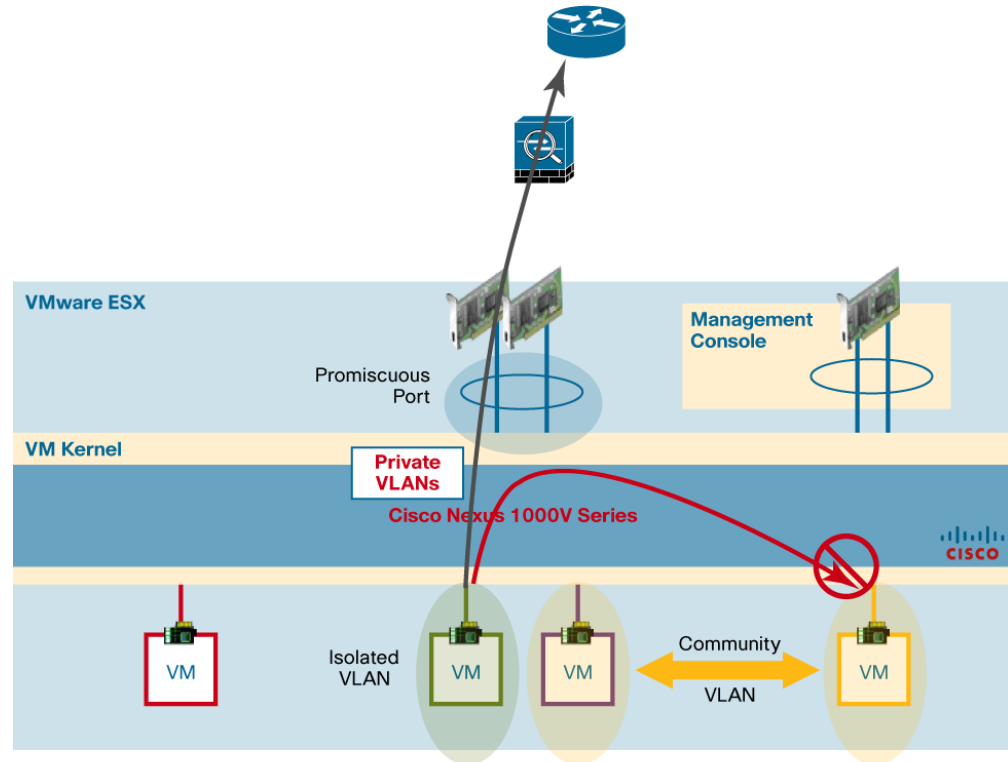
After a profile is configured on the Cisco Nexus 1000V Series, it can be applied to a specific virtual machine as a port group in VMware vCenter (Figure 8).

Figure 8. Port Profile Displayed as a Port Group in vCenter



This feature also provides multiple security benefits. First, network security policies are still defined by the network and security administrators and are applied to the virtual switch the same way they are on physical access switches today. Second, after the features are defined in a port profile and assigned to an interface, the server administrator needs only choose an available port group and assign it to the virtual machine, reducing the possibility of misconfiguration or application of overlapping, noncompliant security policies.

Figure 9. Virtual Machine Isolation Using Private VLANs



Two types of VLANs are used in private VLANs: primary and secondary. The primary VLAN is usually the current VLAN being used for access and is the VLAN carried throughout the infrastructure. The secondary VLAN is known only within the physical or virtual switch in which it is configured. Each secondary VLAN is associated with a primary VLAN. Multiple secondary VLANs can be associated with a single primary VLAN. Each primary VLAN is usually allocated a single IP subnet. In private VLANs, multiple secondary VLANs can be associated with the same IP subnet.

Three types of ports are available when configuring private VLANs: promiscuous, isolated, and community. A promiscuous port is the aggregation point for access to and from each of the secondary VLANs. The promiscuous port is usually the uplink port for the switch and carries the primary VLAN. The secondary VLAN can be configured as either an isolated port or a community port. Isolated ports can communicate only with the promiscuous port and cannot communicate directly with other isolated ports on the switch. This feature is useful when you need to maintain isolation between virtual machines within the virtual infrastructure. Community ports can communicate with other ports in the same community and the promiscuous port. If direct virtual machine-to-virtual machine communication is required or if server clustering is being used, a community VLAN can be a valuable feature.

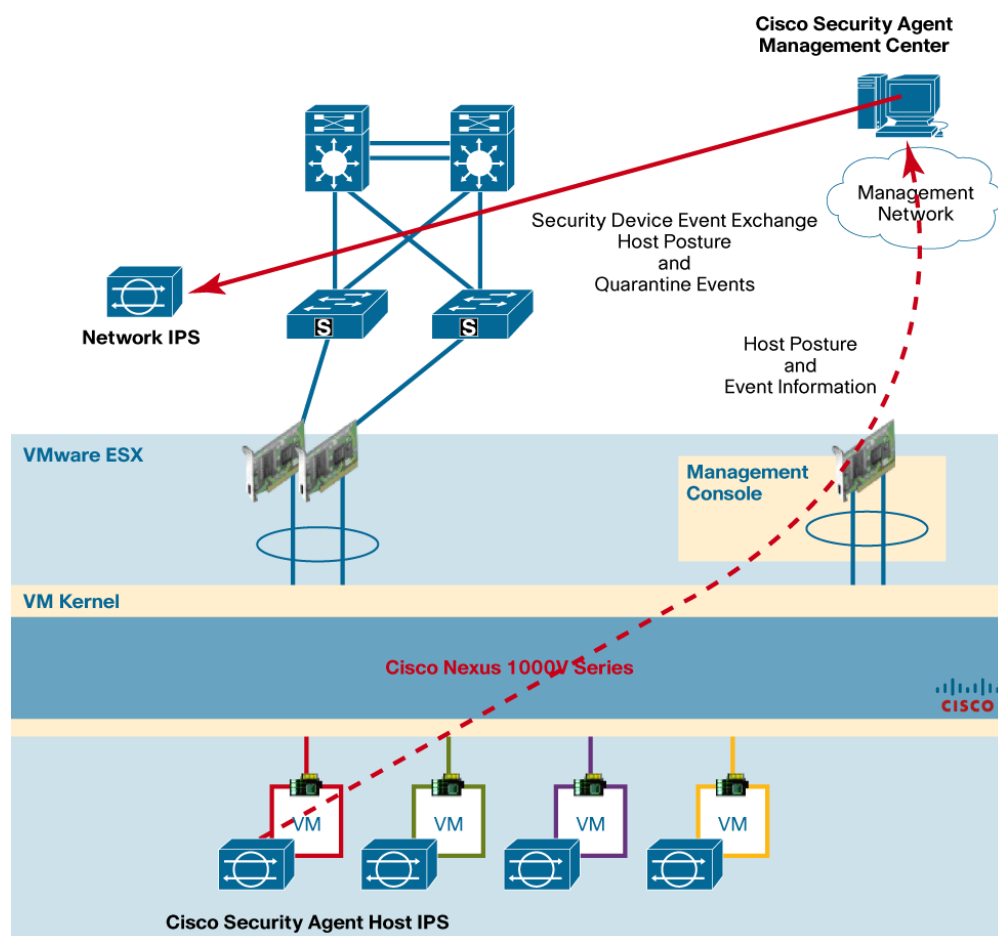
Cisco private VLANs are supported on many of the Cisco Catalyst[®] switches and security devices (such as the Cisco Catalyst 6500 Series Firewall Services Module) and the Cisco Nexus switches. This support allows private VLANs to be configured and carried throughout the virtual and physical infrastructures.



IPS solution. Cisco Security Agent can mitigate known attacks is also effective at thwarting zero-day attacks. By looking at the behavioral aspects of an attack, Cisco Security Agent can detect and stop new attacks without first needing installation of a signature before it can identify the particular attack (Figure 15).

The use of host-based IPS and network IPS is common in most DMZ and server-farm environments. The Cisco Security Agent and network IPS solutions can integrate and share information for increased security and visibility for the virtual infrastructure.

Figure 15. Protecting Virtual Machines with Cisco Security Agent (Host-Based IPS)



This integration has several main benefits for the network IPS:

- Adds the capability to use Cisco Security Agent endpoint information to influence IPS actions. Using the endpoint contextual information, Cisco IPS can determine the appropriate severity of a network threat and provide instructions for the appropriate response action.
- Reduces false positives: Cisco Security Agent provides the OS type and other endpoint posture information that helps Cisco IPS determine the relevance of a threat, reducing the chances for false positives.



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