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SBA

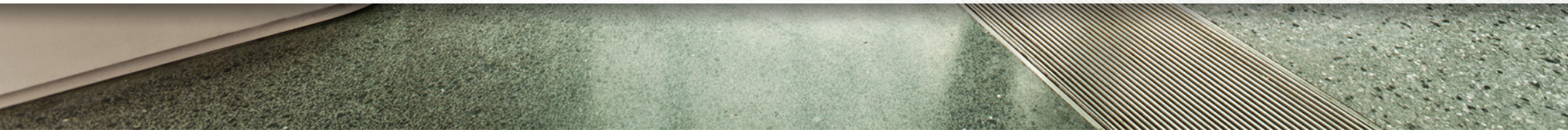
BORDERLESS NETWORKS

DEPLOYMENT GUIDE

Firewall and IPS Deployment Guide

SMART BUSINESS ARCHITECTURE

August 2012 Series



Preface

Who Should Read This Guide

This Cisco® Smart Business Architecture (SBA) guide is for people who fill a variety of roles:

- Systems engineers who need standard procedures for implementing solutions
- Project managers who create statements of work for Cisco SBA implementations
- Sales partners who sell new technology or who create implementation documentation
- Trainers who need material for classroom instruction or on-the-job training

In general, you can also use Cisco SBA guides to improve consistency among engineers and deployments, as well as to improve scoping and costing of deployment jobs.

Release Series

Cisco strives to update and enhance SBA guides on a regular basis. As we develop a series of SBA guides, we test them together, as a complete system. To ensure the mutual compatibility of designs in Cisco SBA guides, you should use guides that belong to the same series.

The Release Notes for a series provides a summary of additions and changes made in the series.

All Cisco SBA guides include the series name on the cover and at the bottom left of each page. We name the series for the month and year that we release them, as follows:

month year Series

For example, the series of guides that we released in August 2012 are the "August 2012 Series".

You can find the most recent series of SBA guides at the following sites:

Customer access: http://www.cisco.com/go/sba

Partner access: http://www.cisco.com/go/sbachannel

How to Read Commands

Many Cisco SBA guides provide specific details about how to configure Cisco network devices that run Cisco IOS, Cisco NX-OS, or other operating systems that you configure at a command-line interface (CLI). This section describes the conventions used to specify commands that you must enter.

Commands to enter at a CLI appear as follows:

```
configure terminal
```

Commands that specify a value for a variable appear as follows:

```
ntp server 10.10.48.17
```

Commands with variables that you must define appear as follows:

```
class-map [highest class name]
```

Commands shown in an interactive example, such as a script or when the command prompt is included, appear as follows:

```
Router# enable
```

Long commands that line wrap are underlined. Enter them as one command:

```
wrr-queue random-detect max-threshold 1 100 100 100 100 100
100 100 100
```

Noteworthy parts of system output or device configuration files appear highlighted, as follows:

```
interface Vlan64
  ip address 10.5.204.5 255.255.255.0
```

Comments and Questions

If you would like to comment on a guide or ask questions, please use the SBA feedback form.

If you would like to be notified when new comments are posted, an RSS feed is available from the SBA customer and partner pages.

Table of Contents

What's In This SBA Guide

Cisco SBA Borderless Networks

Cisco SBA helps you design and quickly deploy a full-service business network. A Cisco SBA deployment is prescriptive, out-of-the-box, scalable, and flexible.

Cisco SBA incorporates LAN, WAN, wireless, security, data center, application optimization, and unified communication technologies—tested together as a complete system. This component-level approach simplifies system integration of multiple technologies, allowing you to select solutions that solve your organization's problems—without worrying about the technical complexity.

Cisco SBA Borderless Networks is a comprehensive network design targeted at organizations with up to 10,000 connected users. The SBA Borderless Network architecture incorporates wired and wireless local area network (LAN) access, wide-area network (WAN) connectivity, WAN application optimization, and Internet edge security infrastructure.

Route to Success

To ensure your success when implementing the designs in this guide, you should first read any guides that this guide depends upon—shown to the left of this guide on the route below. As you read this guide, specific prerequisites are cited where they are applicable.

About This Guide

This *deployment guide* contains one or more deployment chapters, which each include the following sections:

- **Business Overview**—Describes the business use case for the design. Business decision makers may find this section especially useful.
- **Technology Overview**—Describes the technical design for the business use case, including an introduction to the Cisco products that make up the design. Technical decision makers can use this section to understand how the design works.
- **Deployment Details**—Provides step-by-step instructions for deploying and configuring the design. Systems engineers can use this section to get the design up and running quickly and reliably.

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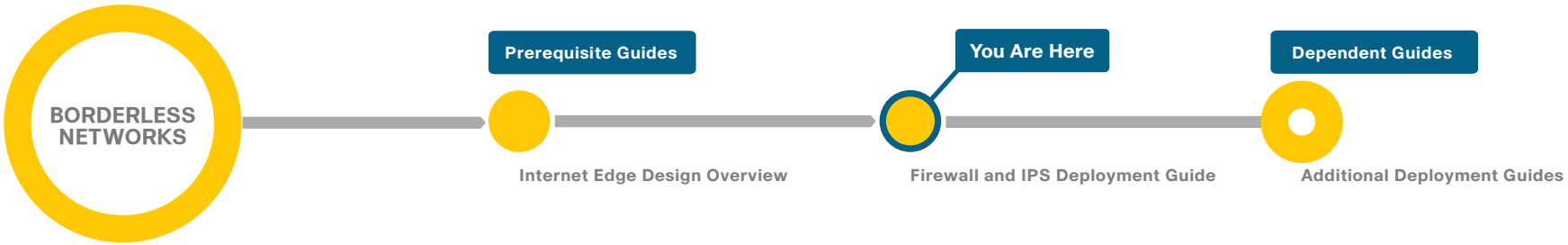


Introduction

Cisco SBA Borderless Networks is a solid network foundation designed to provide networks with up to 10,000 connected users the flexibility to support new users and network services without re-engineering the network. We created a prescriptive, out-of-the-box deployment guide that is based on best-practice design principles and that delivers flexibility and scalability.

The *Firewall and IPS Deployment Guide* focuses on the Internet edge firewall and intrusion prevention system (IPS) security services that protect your organization's gateway to the Internet. Internet service-provider connectivity and routing options provide resiliency to the design. This guide covers the creation and use of DMZ segments for use with Internet-facing services like a web presence. The IPS guidance covers Internet edge inline deployments as well as internal distribution layer IDS (promiscuous) deployments.

Related Reading

The *Internet Edge Design Overview* orients you to the overall Cisco SBA design and explains the requirements that were considered when selecting specific products.

The *Remote Access VPN Deployment Guide* focuses on provisioning the network to provide remote access (RA) services. The deployment includes VPN access as part of the Internet edge firewalls as well as the ability to deploy RA VPN services on separate dedicated devices.

The *Web Security Using WSA Deployment Guide* covers deploying the Cisco Web Security Appliance for clients accessing the Internet. This covers protection from malware and viruses as well as acceptable use controls for what sites are appropriate to be visited.

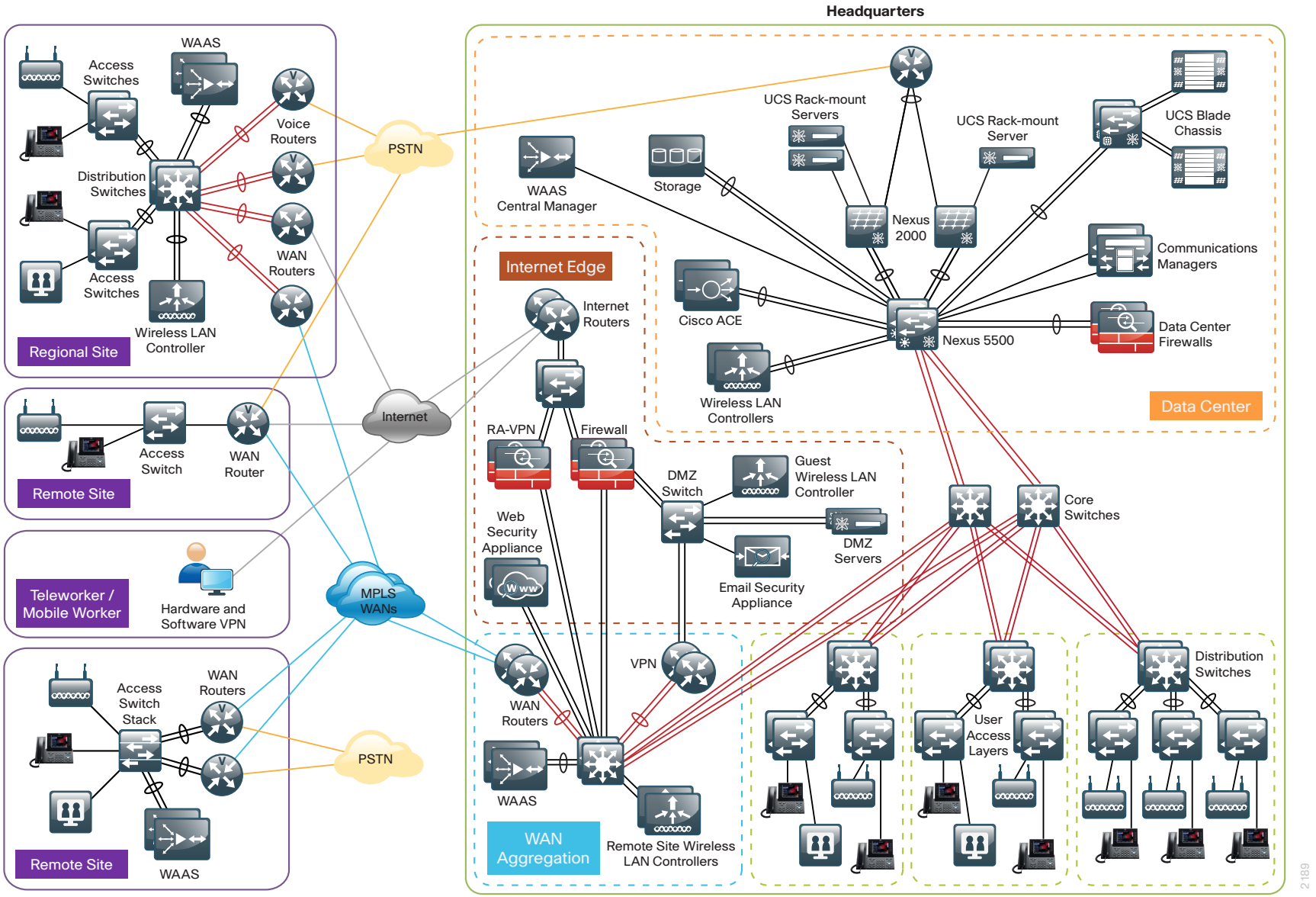
The *Email Security Using ESA Deployment Guide* covers deployment of the Email Security Appliance in order to provide protection for the organization's email system. Inspection of inbound emails for spam and malicious content is the focus of the deployment. It also covers adding an email demilitarized zone (DMZ) to the Internet Firewall to increase the overall security.

Notes

Design Goals

This architecture is based on requirements gathered from customers, partners, and Cisco field personnel for organizations with up to 10,000 connected users. When designing the architecture, we considered the gathered requirements and the following design goals.

Figure 1 - Borderless Networks overview



Ease of Deployment, Flexibility, and Scalability

Organizations with up 10,000 users are often spread out among different geographical locations, making flexibility and scalability a critical requirement of the network. This design uses several methods to create and maintain a scalable network:

- By keeping a small number of standard designs for common portions of the network, support staff is able to design services for, implement, and support the network more effectively.
- Our modular design approach enhances scalability. Beginning with a set of standard, global building blocks, we can assemble a scalable network to meet requirements.
- Many of the plug-in modules look identical for several service areas; this common look provides consistency and scalability in that the same support methods can be used to maintain multiple areas of the network. These modules follow standard core-distribution-access network design models and use layer separation to ensure that interfaces between the plug-ins are well defined.

Resiliency and Security

One of the keys to maintaining a highly available network is building the appropriate resilience into the network links and platforms in order to guard against single points of failure in the network. The resilience in the SBA Internet edge architecture is carefully balanced with the complexity inherent in redundant systems.

With the addition of a significant amount of delay-sensitive and drop-sensitive traffic such as voice and video conferencing, we also place a strong emphasis on recovery times. Choosing designs that reduce the time between failure detection and recovery is important for ensuring that the network stays available even in the face of a link or component failure.

Network security is also a strong component of the architecture. In a large network, there are many entry points, and we ensure that they are as secure as possible without making the network too difficult to use. Securing the network not only helps keep the network safe from attacks but is also a key component to network-wide resiliency.

Ease of Management

While this guide focuses on the deployment of the network foundation, the design takes next-phase management and operation into consideration. The configurations in the deployment guides are designed to allow the devices to be managed via normal device-management connections, such as Secure Shell (SSH) Protocol and HTTPS, as well as via Network Management System (NMS). The configuration of the NMS is not covered in this guide.

Advanced Technology–Ready

Flexibility, scalability, resiliency, and security all are characteristics of an advanced technology-ready network. The modular design of the architecture means that technologies can be added when the organization is ready to deploy them. However, the deployment of advanced technologies, such as collaboration, is eased because the architecture includes products and configurations that are ready to support collaboration from day one. For example:

- Access switches provide Power over Ethernet (PoE) for phone deployments without the need for a local power outlet.
- The entire network is preconfigured with quality of service (QoS) to support high-quality voice.
- Multicast is configured in the network to support efficient voice and broadcast-video delivery.
- The wireless network is preconfigured for devices that send voice over the wireless LAN, providing IP telephony over 802.11 Wi-Fi (referred to as mobility) at all locations.

The Internet edge is ready to provide soft phones via VPN, as well as traditional hard or desk phones, as configured in a teleworker deployment.

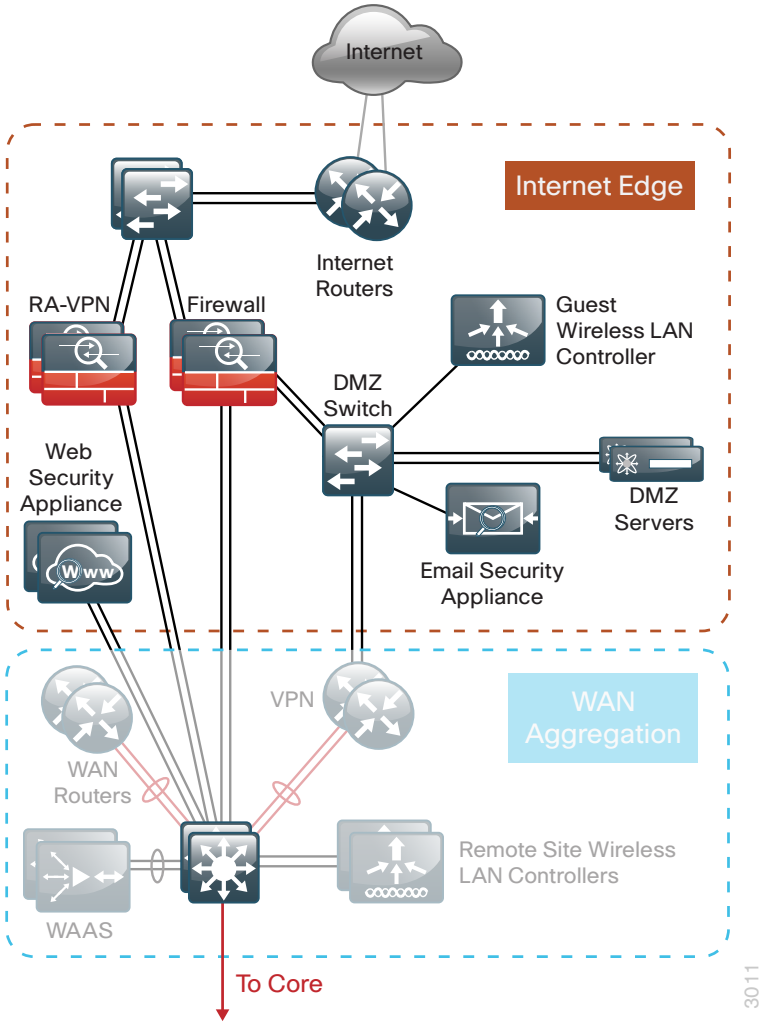
Architecture Overview

The *Firewall and IPS Deployment Guide* is a component of the larger Internet edge design, which uses a modular design model to break the Internet edge into functional blocks by service. By modularizing the design, an organization can deploy the services as required.

The Internet edge design includes the following functional blocks:

- **Firewall**—Controls access into and out of the different segments of the Internet edge and provides a suite of other services, such as Network Address Translation (NAT) and DMZ creation.
- **Intrusion Prevention**—Inspects traffic traversing the Internet edge, looking for malicious behaviors.
- **Remote Access VPN**—Provides secure, consistent access to resources, regardless of where the user is when connecting.
- **Email Security**—Provides spam and malware filtering service to manage the risk associated with email.
- **Web Security**—Provides acceptable-use control and monitoring while managing the increasing risk associated with clients browsing the Internet.

Figure 2 - Internet edge in the Borderless Networks design



The primary differences in module design options are scale, performance, and resilience. To accommodate these requirements, each module of the Internet edge design is independent of the others, so you can mix and match the different design components to best meet your business requirements.

Internet Edge Connectivity

Business demand for Internet connectivity has increased steadily over the last few decades; for many organizations, access to Internet-based services is a fundamental requirement for conducting day-to-day activity. Email, web access, remote-access VPN, and, more recently, cloud-based services are critical functions enabling businesses to pursue their missions. An Internet connection that supports these services must be designed to enable the organization to accomplish its Internet-based business goals.

Three factors define the business requirements for an organization's Internet connection:

- Value of Internet-based business activity:
  - revenue realized from Internet business
  - savings realized by Internet-based services
- Revenue impact from loss of Internet connectivity
- Capital and operational expense of implementing and maintaining various Internet connectivity options

The organization must identify and understand its Internet connection requirements in order to effectively meet the demands of Internet-based business activity.

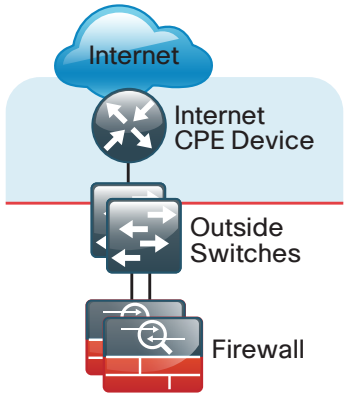
Internet connection speed, availability, and address space requirements are criteria that will shape an Internet connection design. The Internet connection must be able to accommodate an organization's requirements for data volume to the Internet, offer sufficient resiliency to meet service-level agreements, and provide sufficient IP address space to accommodate both Internet-facing and Internet-based services.

An organization's IT staff needs to address three main requirements when designing and implementing an Internet edge architecture:

- **Connectivity speed**—What is the expected throughput required? Are short bursts of high-volume traffic expected?
- **IP address space**—A small organization or one that does not rely heavily on web-based services to the Internet will have a different IP space requirement than a large organization that depends heavily on email, remote-access VPN, and content or cloud-based services offered to the Internet.
- **Availability**—Connection speed is only part of the equation; if connectivity must be maintained when the primary Internet connection fails, then the design must offer a resilient Internet connection via a secondary Internet connection.

Internet connectivity options vary widely by geographic region and service provider. An organization may be able to choose between cable, DSL, leased line, or Ethernet for the physical connection to the Internet. A common denominator of Internet connectivity is the Ethernet connection to the customer-premises equipment (CPE) device (cable modem, T1 CPE router, etc.), and this is assumed as the demarcation for this design.

Figure 3 - Internet connectivity demarcation for this design



Organizations deploying this design typically fall into the following Internet connection speed ranges.

Table 1 - Internet connection speed requirements

Number of connected users	Internet connection speed
Up to 4,500	20–50 Mbps
3,000 to 7,000	35–75 Mbps
6,000 to 10,000	70–130 Mbps

If the business needs include WAN connectivity to connect geographically diverse sites, a cost savings can be realized by combining WAN and Internet connectivity over the same service. A service provider may offer hardware to terminate WAN/Internet connectivity on premise and manage the Internet/WAN connection device. Provider-supplied hardware and service offerings may reduce operational burden. The organization must assess the impact of configuration-change lead times and configuration flexibility.

Regardless of how access is delivered, design and configuration discussions for this guide begin at the Ethernet handoff on the outside switch in the Internet edge.

High Availability Overview

The decision to use a single or dual Internet connection should be made on your organization's connection availability requirements. If a loss of Internet access will cause a business interruption that has a greater cost impact than the cost of a backup Internet connection, then the Dual ISP design should be used. A backup Internet connection assures continued Internet access in the event of a failure to the primary Internet connection, although some services may experience a temporary outage during the switch to the backup link. Most outbound services should be available in a few seconds. The Dual ISP design provides the following:

- Resilient outbound Internet access and inbound email services.
- Additional inbound services that can be provisioned to recover in the event of a failure, although some services may experience longer outages.
- Inbound web service that does not have seamless failover protection and requires user interaction to point the Domain Name System (DNS) records at the alternate IP address on the secondary ISP. To achieve higher web-service availability, an organization can host its web service at a colocation facility or use a fully redundant Border Gateway Protocol (BGP) design that advertises the same IP address out to different ISPs. Organizations with services that require a very high level of Internet availability should consider hosting these services at a provider's Internet colocation facility.

Internet Routing

There are a variety of ways to control routing to and from the Internet. BGP and other dynamic routing options offer various methods to influence Internet routing. For the majority of organizations with up to 10,000 connected users, a static default route is adequate to establish access to the Internet and has the least operational complexity.

Reader Tip

If an organization's routing requirements exceed what can be addressed by static routing, refer to the *Cisco Enterprise Internet Edge Design Guide,* which covers more complex Internet connectivity deployments:

http://www.cisco.com/en/US/docs/solutions/Enterprise/Security/IE_DG.html

Active/Standby vs. Active/Active Internet Connectivity

The Dual ISP design is a resilient design with primary and backup Internet connections. If Internet access via the primary link is lost, the design will automatically fail over to the secondary link. These configurations are typically sufficient for organizations of up to 10,000 connected users that are not hosting critical content or eCommerce in their DMZ. In the Dual ISP design, Cisco Adaptive Security Appliance (Cisco ASA) firewalls send Internet Control Message Protocol (ICMP) probes to an Internet IP address. If the firewall stops getting responses to the probes, it will fail over to the secondary link. This resilient design offers a simple but effective solution to maintain the users' Internet access and email (with an appropriately configured DNS). Further detail on configuration of this capability will be addressed in the 'Firewall' and 'Intrusion Prevention' sections of this document.

Reader Tip

The Dual ISP design does not address multi-homed routing options, e.g., using BGP with multiple Internet connections to multiple ISPs. For more information on multi-homed Internet connectivity designs, refer to the *Cisco Enterprise Internet Edge Design Guide* in the Cisco Design Zone:

http://www.cisco.com/en/US/docs/solutions/Enterprise/Security/IE_DG.html

Firewall

Business Overview

The Internet edge is the point where the organization's network connects to the Internet. This is the perimeter of the network, where a line is drawn between the public Internet and the private resources contained with an organization's network. Worm, virus, and botnet infiltrations pose substantial threats to network performance, availability, and data security. To add to these problems, an organizations' Internet connection can contribute to employee productivity loss and leakage of confidential data.

Internet-based attackers are a threat to an organization's network infrastructures and data resources. Most networks connected to the Internet are subject to a constant barrage of worms, viruses, and targeted attacks. Organizations must vigilantly protect their network, user data, and customer information. Additionally, most network addresses must be translated to an Internet-routable address, and the firewall is the logical place for this function.

Network security, as applied at the firewall, must assure that the organization's data resources are protected from snooping and tampering, and it must prevent compromise of hosts by resource-consuming worms, viruses, and botnets. Additionally, the firewall policy must establish the appropriate balance in order to provide security without interfering with access to Internet-based applications or hindering connectivity to business partners' data via extranet VPN connections.

Firewall security is an integral part of every Internet edge deployment, as it protects information while meeting the need for secure, reliable networks and enforces policy in order to maintain employee productivity. Where industry regulations apply, firewalls play a crucial role in an organization's ability to address regulatory compliance requirements. Regulatory requirements vary by country and industry; this document does not cover specific regulatory compliance requirements.

Technology Overview

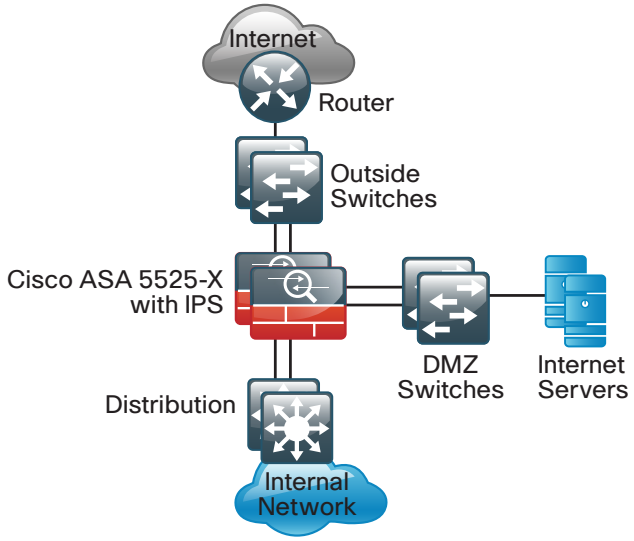
The Cisco ASA firewall family sits between the organization's internal network and the Internet and is a fundamental infrastructural component that minimizes the impact of network intrusions while maintaining worker productivity and data security.

This design uses Cisco ASA 5500-X Series for Internet edge firewall security. They are configured in an active/standby pair for high availability in order to ensure that Internet access is minimally impacted by firewall software maintenance or hardware failure. The Cisco ASAs are configured in routing mode. They apply Network Address Translation (NAT) and firewall policy, and they host intrusion prevention system modules to detect and mitigate malicious or harmful traffic.

Two deployment options are discussed to address Internet access requirements for high availability and to meet operational requirements for device-level separation between remote-access VPN and firewall.

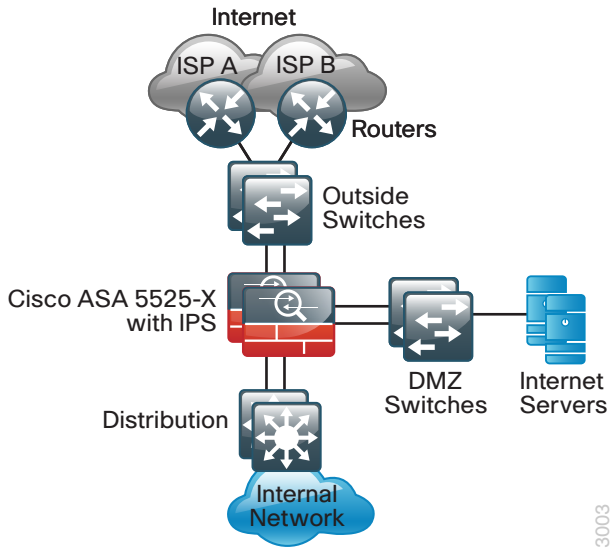
One firewall design uses a single Internet connection and integrates the remote-access VPN function in the same Cisco ASA pair that provides the firewall functionality.

Figure 4 - Single ISP topology



The larger firewall design uses dual Internet connections for resilient access to the Internet. A separate pair of appliances provides remote-access VPN, allowing additional scalability and operational flexibility.

Figure 5 - Dual ISP topology



A good portion of the configuration described in this section is common to both the single and dual ISP designs. If a section describes configuration that is only used in one of the designs, this is mentioned in that section.

The configurations are for any of the one-rack-unit Cisco ASA security appliances.

Hardware applied in this design is selected based on the following performance values. It is important to note that Internet connection speed is not the only data point when considering Cisco ASA device performance. To choose the correct platform, you must consider traffic that traverses the firewall from the internal network to the DMZ as well as inter-DMZ traffic.

Table 2 - Cisco ASA family device performance

Cisco ASA family product	Real-World Firewall Throughput (EMIX)
Cisco ASA 5512-X	500 Mbps
Cisco ASA 5515-X	600 Mbps
Cisco ASA 5525-X	1 Gbps
Cisco ASA 5545-X	1.5 Gbps

Deployment Details

Process

Configuring the Firewall

1. Configure the LAN distribution switch
2. Apply Cisco ASA initial configuration
3. Configure internal routing
4. Configure user authentication
5. Configure NTP and logging
6. Configure device-management protocols

The Cisco ASA can be configured from the command line or from the graphical user interface, Cisco Adaptive Security Device Manager (ASDM). Cisco ASDM is the primary method of configuration illustrated in this deployment guide. This process uses the command line to initially configure the appliance and then uses Cisco ASDM to manage the configuration.

Only the primary Cisco ASA in the high availability pair needs to be configured. The Configuring Firewall High Availability process will set up high availability and synchronize the configuration from the primary to the secondary device.

Procedure 1 Configure the LAN distribution switch

The LAN distribution switch is the path to the organization's internal network. A unique VLAN supports the Internet edge devices, and the routing protocol peers with the appliances across this network. To support future use, the connections from the ASAs to the inside LAN distribution switches are configured as trunks.

Reader Tip

This procedure assumes that the distribution switch has already been configured following the guidance in the *Cisco SBA—Borderless Networks LAN Deployment Guide*. Only the procedures required to support the integration of the firewall into the deployment are included in this guide.

Step 1: Configure the Internet edge VLAN on the LAN distribution switch.

```
vlan 300
 name InternetEdge
!
```

Step 2: Configure Layer 3.

Configure a switched virtual interface (SVI) so devices in the VLAN can communicate with the rest of the network.

```
interface vlan 300
 description Internet Edge SVI
 ip address 10.4.24.1 255.255.255.224
 no shutdown
```

Step 3: Configure the interfaces that are connected to the Internet edge firewall.

An 802.1Q trunk is used for the connection to the Internet edge firewall, which allows the distribution switch to provide the Layer 3 services to all the VLANs defined on the firewall. The VLANs allowed on the trunk are pruned to only the VLANs that are active on the firewall.

```
interface GigabitEthernet1/0/24
 description IE-ASA5545a Gig0/0
!
interface GigabitEthernet2/0/24
 description IE-ASA5545b Gig0/0
!
interface range GigabitEthernet1/0/24, GigabitEthernet2/0/24
switchport
switchport trunk encapsulation dot1q
 switchport trunk allowed vlan 300
 switchport mode trunk
 spanning-tree portfast trunk
 macro apply EgressQoS
logging event link-status
logging event trunk-status
no shutdown
```

The Cisco Catalyst 6500 uses the command **spanning-tree portfast edge trunk** to enable portfast on a trunk port. The Catalyst 4500 does not require the **switchport trunk encapsulation dot1q** command.

Step 4: Summarize the Internet edge network range towards the core.

Summarization of routes only applies to networks that use separate distribution and core layers. If your network has a collapsed core and distribution, proceed to the next step.

```
interface range TenGigabitEthernet1/1/1,
TenGigabitEthernet2/1/1
 ip summary-address eigrp 100 10.4.24.0 255.255.248.0
```

Step 5: Configure the routing protocol to form neighbor relationships on the Internet edge VLAN.

```
router eigrp 100
  no passive-interface Vlan300
```

Procedure 2 Apply Cisco ASA initial configuration

This procedure configures connectivity to the appliance from the internal network in order to enable management access.

Step 1: Configure the appliance host name.

```
hostname IE-ASA5545
```

Step 2: Configure the appliance interface that is connected to the internal LAN distribution switch as a subinterface on VLAN 300. The interface is configured as a VLAN trunk port in order to allow flexibility to add additional connectivity.

```
interface GigabitEthernet0/0
no shutdown
```

```
!
interface GigabitEthernet0/0.300
 vlan 300
 nameif inside
 ip address 10.4.24.30 255.255.255.224
```

Step 3: Enable the dedicated management interface and remove any IP address that might be applied. This interface will only be used for IPS management.

```
interface Management0/0
 nameif IPS-mgmt
 no ip address
 no shutdown
```

Step 4: Configure an administrative username and password.

```
username admin password [password] privilege 15
```

Tech Tip

All passwords in this document are examples and should not be used in production configurations. Follow your organization's policy, or if no policy exists, create a password using a minimum of 8 characters with a combination of uppercase, lowercase, and numbers.

Procedure 3 Configure internal routing

A dynamic routing protocol is used to easily configure reachability between networks connected to the appliance and those that are internal to the organization.

Step 1: Enable Enhanced Interior Gateway Routing Protocol (EIGRP) on the appliance.

```
router eigrp 100
```

Step 2: Configure the appliance to advertise its statically defined routes and connected networks that are inside the Internet edge network range.

```
no auto-summary
network 10.4.24.0 255.255.252.0
redistribute static
```

Step 3: Configure EIGRP to peer with neighbors across the inside interface only.

```
passive-interface default
no passive-interface inside
```

Step 4: Configure a network object for the summary address of the internal network. The network object will be used later during security policy configuration.

```
object network internal-network
 subnet 10.4.0.0 255.254.0.0
 description The organization's internal network range
```

Procedure 4 Configure user authentication

(Optional)

As networks scale in the number of devices to maintain, it poses an operational burden to maintain local user accounts on every device. A centralized authentication, authorization, and accounting (AAA) service reduces operational tasks per device and provides an audit log of user access, for security compliance and root cause analysis. When AAA is enabled for access control, all management access to the network infrastructure devices (SSH and HTTPS) is controlled by AAA.

Reader Tip

The AAA server used in this architecture is the Cisco Secure Authentication Control Server (ACS). Configuration of Cisco Secure ACS is discussed in the *Cisco SBA—Borderless Networks LAN and Wireless LAN 802.1x Authentication Deployment Guide*.

TACACS+ is the primary protocol used to authenticate management logins on the infrastructure devices to the AAA server. A local AAA user database was defined already to provide a fallback authentication source in case the centralized TACACS+ server is unavailable.

Step 1: Configure the TACACS+ server.

```
aaa-server AAA-SERVER protocol tacacs+
aaa-server AAA-SERVER (inside) host 10.4.48.15 SecretKey
```

Step 2: Configure the appliance's management authentication to use the TACACS+ server first and then the local user database if the TACACS+ server is unavailable.

```
aaa authentication enable console AAA-SERVER LOCAL
aaa authentication ssh console AAA-SERVER LOCAL
aaa authentication http console AAA-SERVER LOCAL
aaa authentication serial console AAA-SERVER LOCAL
```

Step 3: Configure the appliance to use AAA to authorize management users.

```
aaa authorization exec authentication-server
```

Tech Tip

User authorization on the Cisco ASA firewall does not automatically present the user with the enable prompt if they have a privilege level of 15, unlike Cisco IOS devices.

Procedure 5 Configure NTP and logging

Logging and monitoring are critical aspects of network security devices in order to support troubleshooting and policy-compliance auditing.

The Network Time Protocol (NTP) is designed to synchronize time across a network of devices. An NTP network usually gets its time from an authoritative time source, such as a radio clock or an atomic clock attached to a time server. NTP then distributes this time across the organization's network.

Network devices should be programmed to synchronize to a local NTP server in the network. The local NTP server typically references a more accurate clock feed from an outside source.

There is a range of detail that can be logged on the appliance. Informational-level logging provides the ideal balance between detail and log-message volume. Lower log levels produce fewer messages, but they do not produce enough detail to effectively audit network activity. Higher log levels produce a larger volume of messages but do not add sufficient value to justify the number of messages logged.

Step 1: Configure the NTP server.

```
ntp server 10.4.48.17
```

Step 2: Configure the time zone.

```
clock timezone PST -8
clock summer-time PDT recurring
```

Step 3: Configure which logs to store on the appliance.

```
logging enable
logging buffered informational
```

Procedure 6 Configure device-management protocols

Cisco ASDM requires that the appliance's HTTPS server be available. Be sure that the configuration includes networks where administrative staff has access to the device through Cisco ASDM; the appliance can offer controlled Cisco ASDM access for a single address or management subnet (in this case, 10.4.48.0/24).

HTTPS and Secure Shell (SSH) are more secure replacements for the HTTP and Telnet protocols. They use Secure Sockets Layer (SSL) and Transport Layer Security (TLS) to provide device authentication and data encryption.

Use SSH and HTTPS protocols in order to more securely manage the device. Both protocols are encrypted for privacy, and the non-secure protocols, Telnet and HTTP, are turned off.

Simple Network Management Protocol (SNMP) is enabled to allow the network infrastructure devices to be managed by a Network Management System (NMS). SNMPv2c is configured for a read-only community string.

Step 1: Allow internal administrators to remotely manage the appliance over HTTPS and SSH.

```
domain-name cisco.local
http server enable
http 10.4.48.0 255.255.255.0 inside
ssh 10.4.48.0 255.255.255.0 inside
ssh version 2
```

Step 2: Configure the appliance to allow SNMP polling from the NMS.

```
snmp-server host inside 10.4.48.35 community cisco
snmp-server community cisco
```

Process

Configuring Firewall High Availability

1. Configure resilience on the primary firewall
2. Configuring standby firewall for resilience

The Cisco ASA appliances are set up as a highly available active/standby pair. Active/standby is used, rather than an active/active configuration, because this allows the same appliance to be used for firewall and VPN services (VPN functionality is disabled on the appliance in active/active configuration). In the event that the active ASA appliance fails or needs to be taken out of service for maintenance, the secondary ASA appliance assumes all active firewall, IPS, and VPN functions. In an active/standby configuration, only one device is passing traffic at a time; thus, the Cisco ASAs must be sized so that the entire traffic load can be handled by either device in the pair.

Both units in the failover pair must be the same model, with identical feature licenses and IPS (if the software module is installed). For failover to be enabled, the secondary Cisco ASA unit needs to be powered up and cabled to the same networks as the primary unit.

One interface on each Cisco ASA is configured as the state-synchronization interface, which the appliances use to share configuration updates, determine which device in the high availability pair is active, and exchange state information for active connections. The failover interface carries the state synchronization information. All session state is replicated from the primary to the standby unit though this interface. There can be a substantial amount of data, and it is recommended that this be a dedicated interface.

By default, the appliance can take from 2 to 25 seconds to recover from a failure. Tuning the failover poll times can reduce that to 0.5 to 5 seconds. On an appropriately sized ASA, the poll times can be tuned down without performance impact to the appliance, which minimizes the downtime a user experiences during failover. Reducing the failover timer intervals below the values in this guide is not recommended.

Procedure 1 Configure resilience on primary firewall

This procedure describes how to configure active/standby failover. The failover key value must match on both devices in an active/standby pair. This key is used for two purposes: to authenticate the two devices to each other, and to secure state synchronization messages between the devices, which enables the Cisco ASA pair to maintain service for existing connections in the event of a failover.

Step 1: On the primary Cisco ASA, enable failover.

```
failover
```

Step 2: Configure the Cisco ASA as the primary appliance of the high availability pair.

```
failover lan unit primary
```

Step 3: Configure the failover interface.

```
failover lan interface failover GigabitEthernet0/2
failover key FailoverKey
failover replication http
failover link failover GigabitEthernet0/2
```

Step 4: To minimize the downtime experienced during failover, tune the failover poll timers.

```
failover polltime unit msec 200 holdtime msec 800
failover polltime interface msec 500 holdtime 5
```

Step 5: Configure the failover interface IP address.

```
failover interface ip failover 10.4.24.33 255.255.255.248
standby 10.4.24.34
```

Step 6: Enable the failover interface.

```
interface GigabitEthernet0/2
 no shutdown
```

Step 7: Configure the standby IP address and monitoring of the inside interface.

```
interface GigabitEthernet0/0.300
 ip address 10.4.24.30 255.255.255.224 standby 10.4.24.29
monitor-interface inside
```

Procedure 2 Configuring standby firewall for resilience

Step 1: On the secondary Cisco ASA, enable failover.

```
failover
```

Step 2: Configure the Cisco ASA as the secondary appliance of the high availability pair.

```
failover lan unit secondary
```

Step 3: Configure the failover interface.

```
failover lan interface failover GigabitEthernet0/2
failover key FailoverKey
failover replication http
failover link failover GigabitEthernet0/2
```

Step 4: To minimize the downtime experienced during failover, tune the failover poll timers.

```
failover polltime unit msec 200 holdtime msec 800
failover polltime interface msec 500 holdtime 5
```

Step 5: Configure the failover interface IP address.

```
failover interface ip failover 10.4.24.33 255.255.255.248
standby 10.4.24.34
```

Step 6: Enable the failover interface.

```
interface GigabitEthernet0/2
 no shutdown
```

Step 7: To verify standby synchronization between the Cisco ASA devices, on the command-line interface of the primary appliance, issue the **show failover state** command.

```
IE-ASA5545# show failover state

               State         Last Failure Reason      Date/Time
This host  -   Primary
               Active        None
Other host -   Secondary
               Standby Ready  None

====Configuration State===
        Sync Done
====Communication State===
        Mac set
```

Process

Configuring Management DMZ

1. Configure the DMZ switch
2. Configure the demilitarized zone interface
3. Configure the DMZ routing
4. Configure the DMZ security policy

The firewall's demilitarized zone (DMZ) is a portion of the network where, typically, traffic to and from other parts of the network is tightly restricted. Organizations place network services in a DMZ for exposure to the Internet. These devices are typically not allowed to initiate connections to the internal network, except for specific circumstances.

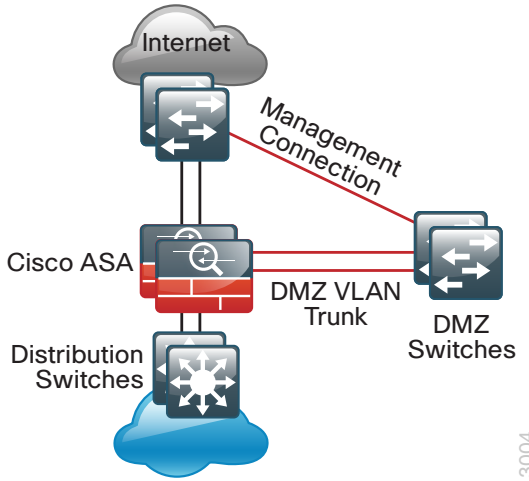
One of those special circumstances is for device management. However, the security policy on the firewall must still limit what traffic should be allowed inside from the DMZ because devices in the DMZ can be a security risk for the internal network.

To ease the configuration of the security policy, create a DMZ dedicated for the management of devices that are connected only to the DMZ or outside the firewall.

The DMZ network is connected to the appliances on the appliances' Gigabit Ethernet interface via a VLAN trunk in order to allow the greatest flexibility if new VLANs must be added in order to connect additional DMZs. In this architecture, the trunk connects the appliances to a 3750x switch stack that provides resiliency.

The DMZ interface on the Cisco ASA is assigned an IP address, which will be the default gateway for each DMZ network. The DMZ switch is configured to offer Layer-2 switching capability only; the DMZ switch does not have a switched virtual interface (SVI) for any VLAN, except for the management DMZ VLAN. This SVI is used for the management of the switch.

Figure 6 - DMZ VLAN topology and services



Procedure 1 Configure the DMZ switch

The DMZ switch in this deployment is a pair of 3750X switches in a stacked configuration. The configuration below is complete for the features required for the DMZ switch. This configuration is taken from the *Cisco SBA—Borderless Networks LAN Deployment Guide*.

Step 1: Set the stack master switch.

```
switch [switch number] priority 15
```

Step 2: Run the **stack-mac persistent timer 0** command to ensure that the original master MAC address remains the stack MAC address after a failure.

```
stack-mac persistent timer 0
```

Step 3: To make consistent deployment of QoS easier, each platform defines a macro that you will use in later procedures to apply the platform-specific QoS configuration. Because AutoQoS might not be configured on this device, run the following commands to manually configure the global QoS settings:

```
mls qos map policed-dscp  0 10 18 to 8
mls qos map cos-dscp 0 8 16 24 32 46 48 56
mls qos srr-queue input bandwidth 70 30
```

```
mls qos srr-queue input threshold 1 80 90
mls qos srr-queue input priority-queue 2 bandwidth 30
mls qos srr-queue input cos-map queue 1 threshold 2 3
mls qos srr-queue input cos-map queue 1 threshold 3 6 7
mls qos srr-queue input cos-map queue 2 threshold 1 4
mls qos srr-queue input dscp-map queue 1 threshold 2 24
mls qos srr-queue input dscp-map queue 1 threshold 3 48 49 50
51 52 53 54 55
mls qos srr-queue input dscp-map queue 1 threshold 3 56 57 58
59 60 61 62 63
mls qos srr-queue input dscp-map queue 2 threshold 3 32 33 40
41 42 43 44 45
mls qos srr-queue input dscp-map queue 2 threshold 3 46 47
mls qos srr-queue output cos-map queue 1 threshold 3 4 5
mls qos srr-queue output cos-map queue 2 threshold 1 2
mls qos srr-queue output cos-map queue 2 threshold 2 3
mls qos srr-queue output cos-map queue 2 threshold 3 6 7
mls qos srr-queue output cos-map queue 3 threshold 3 0
mls qos srr-queue output cos-map queue 4 threshold 3 1
mls qos srr-queue output dscp-map queue 1 threshold 3 32 33 40
41 42 43 44 45
mls qos srr-queue output dscp-map queue 1 threshold 3 46 47
mls qos srr-queue output dscp-map queue 2 threshold 1 16 17 18
19 20 21 22 23
mls qos srr-queue output dscp-map queue 2 threshold 1 26 27 28
29 30 31 34 35
mls qos srr-queue output dscp-map queue 2 threshold 1 36 37 38
39
mls qos srr-queue output dscp-map queue 2 threshold 2 24
mls qos srr-queue output dscp-map queue 2 threshold 3 48 49 50
51 52 53 54 55
mls qos srr-queue output dscp-map queue 2 threshold 3 56 57 58
59 60 61 62 63
mls qos srr-queue output dscp-map queue 3 threshold 3 0 1 2 3
4 5 6 7
mls qos srr-queue output dscp-map queue 4 threshold 1 8 9 11
13 15
mls qos srr-queue output dscp-map queue 4 threshold 2 10 12 14
mls qos queue-set output 1 threshold 1 100 100 50 200
mls qos queue-set output 1 threshold 2 125 125 100 400
mls qos queue-set output 1 threshold 3 100 100 100 3200
mls qos queue-set output 1 threshold 4 60 150 50 200
mls qos queue-set output 1 buffers 15 25 40 20
mls qos
!
macro name EgressQoS
 mls qos trust dscp
 queue-set 1
 srr-queue bandwidth share 1 30 35 5
 priority-queue out
@
!
```

Step 4: Configure the device hostname.

```
hostname DMZ-3750X
```

Step 5: Configure VLAN Trunking Protocol (VTP) transparent mode.

```
vtp mode transparent
```

Step 6: Enable Rapid Per-VLAN Spanning-Tree (PVST+).

```
spanning-tree mode rapid-pvst
```

Step 7: Enable Unidirectional Link Detection (UDLD).

```
udld enable
```

Step 8: Set EtherChannels to use the traffic source and destination IP address.

```
port-channel load-balance src-dst-ip
```

Step 9: Configure device management protocols.

```
ip domain-name cisco.local
ip ssh version 2
no ip http server
ip http secure-server
line vty 0 15
  transport input ssh
```

```
  transport preferred none
snmp-server community cisco RO
snmp-server community cisco123 RW
```

Step 10: (Optional) In networks where network operational support is centralized, you can increase network security by using an access list to limit the networks that can access your device. In this example, only devices on the 10.4.48.0/24 network will be able to access the device via SSH or SNMP.

```
access-list 55 permit 10.4.48.0 0.0.0.255
line vty 0 15
  access-class 55 in
!
snmp-server community cisco RO 55
snmp-server community cisco123 RW 55
```

Step 11: Configure DNS for host lookup.

```
ip name-server 10.4.48.10
```

Step 12: Configure local login and password.

```
username admin password c1sco123
enable secret c1sco123
service password-encryption
aaa new-model
```

Step 13: (Optional) Configure centralized user authentication.

As networks scale in the number of devices to maintain, it poses an operational burden to maintain local user accounts on every device. A centralized authentication, authorization, and accounting (AAA) service reduces operational tasks per device and provides an audit log of user access, for security compliance and root cause analysis. When AAA is enabled for access control, all management access to the network infrastructure devices (SSH and HTTPS) is controlled by AAA.

Reader Tip

The AAA server used in this architecture is the Cisco Authentication Control Server. For details about ACS configuration, see the *Cisco SBA—Borderless Networks LAN and Wireless LAN 802.1x Authentication Deployment Guide*.

TACACS+ is the primary protocol used to authenticate management logins on the infrastructure devices to the AAA server. In Step 12, a local AAA user database is also defined on each network infrastructure device in order to provide a fallback authentication source in case the centralized TACACS+ server is unavailable.

```
tacacs server TACACS-SERVER-1
address ipv4 10.4.48.15
key SecretKey
!
aaa group server tacacs+ TACACS-SERVERS
  server name TACACS-SERVER-1
!
aaa authentication login default group TACACS-SERVERS local
aaa authorization exec default group TACACS-SERVERS local
aaa authorization console
ip http authentication aaa
```

Step 14: Configure a synchronized clock.

```
ntp server 10.4.48.17
!
clock timezone PST -8
clock summer-time PDT recurring
!
service timestamps debug datetime msec localtime
service timestamps log datetime msec localtime
```

Step 15: Configure the management VLAN and set the DMZ switch to be the spanning tree root for the management VLAN.

```
vlan 1123
 name dmz-mgmt
spanning-tree vlan 1-4094 root primary
```

Step 16: Configure the interfaces that connect to the Cisco ASA firewalls.

```
interface GigabitEthernet1/0/24
 description IE-ASA5545a Gig0/1
!
interface GigabitEthernet2/0/24
 description IE-ASA5545b Gig0/1
!
interface range GigabitEthernet1/0/24, GigabitEthernet2/0/24
 switchport trunk encapsulation dot1q
 switchport trunk allowed vlan 1123
 switchport mode trunk
 spanning-tree portfast trunk
 macro apply EgressQoS
 logging event link-status
 logging event trunk-status
 no shutdown
```

Step 17: Configure the switch with an IP address so that it can be managed via in-band connectivity.

```
interface Vlan1123
 description In-band management
 ip address 192.168.23.5 255.255.255.0
 no shutdown
```

Step 18: Configure the appliance as the DMZ switch's default route.

```
ip default-gateway 192.168.23.1
```

Step 19: Configure bridge protocol data unit (BPDU) Guard globally to protect portfast-enabled interfaces.

```
spanning-tree portfast bpduguard default
```

Procedure 2 Configure the demilitarized zone interface

Step 1: Connect to Cisco Adaptive Security Device Manager (ASDM) by navigating to https://ie-asa5545.cisco.local/admin, and then logging in with your username and password.

Step 2: Navigate to **Configuration** > **Device Setup** > **Interfaces.**

Step 3: Select the interface that is connected to the DMZ switch, and then click **Edit** (Example: GigabitEthernet0/1). The Edit Interface dialog box appears.

Step 4: Select **Enable Interface**, and then click **OK**.

Step 5: In the Interface pane, click **Add** and choose **Interface**. The Add Interface dialog box appears.

Step 6: In the Add Interface window, in the **Hardware Port** list, select the interface configured in Step 3 (Example: GigabitEthernet0/1)

Step 7: In the **VLAN ID** box, enter the VLAN number for the DMZ VLAN. (Example: 1123)

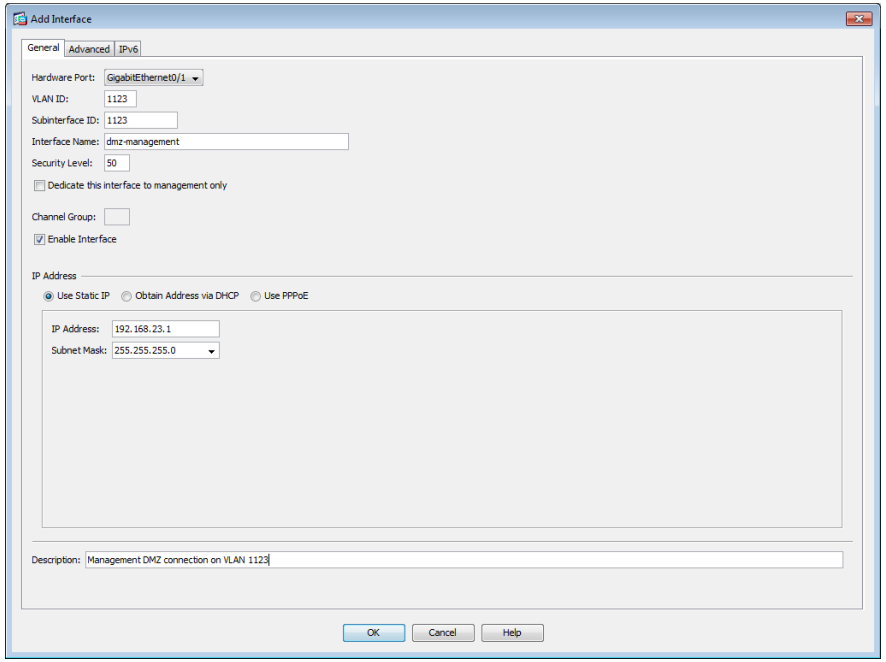
Step 8: In the **Subinterface ID** box, enter the VLAN number for the DMZ VLAN. (Example: 1123)

Step 9: Enter an **Interface Name**. (Example: dmz-management)

Step 10: In the **Security Level** box, enter a value of **50**.

Step 11: Enter the interface **IP Address**. (Example: 192.168.23.1)

Step 12: Enter the interface **Subnet Mask**, and then click **OK**. (Example: 255.255.255.0)

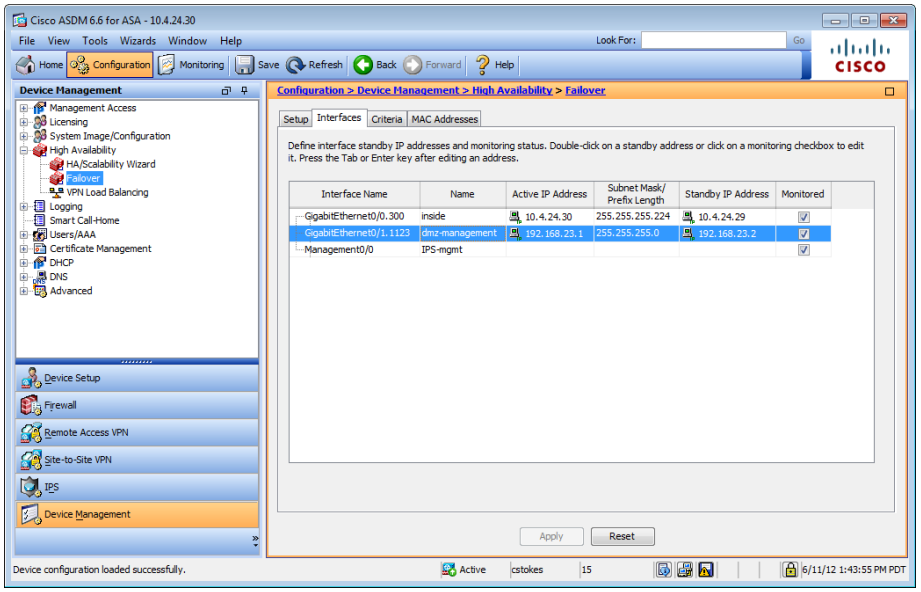


Step 13: Click **Apply** to save the configuration.

Step 14: Navigate to **Configuration > Device Management > High Availability > Failover.**

Step 15: On the Interfaces tab, in the **Standby IP address** column, enter the IP address of the standby unit for the interface you just created. (Example: 192.168.23.2)

Step 16: Select **Monitored**, and then click **Apply**.



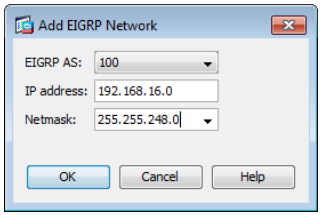
Procedure 3 Configure the DMZ routing

Step 1: Navigate to **Configuration > Device Setup > Routing > EIGRP > Setup**.

Step 2: On the Networks tab, click **Add**.

Step 3: In the Add EIGRP Network dialog box, in the **IP Address** box, enter the address that summarizes all DMZ networks. (Example: 192.168.16.0)

Step 4: In the **Netmask** box, enter the DMZ summary netmask, and then click **OK**. (Example: 255.255.248.0)



Step 5: In the Setup pane, click **Apply**. This saves the configuration.

Procedure 4 Configure the DMZ security policy

Tech Tip

Each security policy is unique to the policy and management requirements of an organization. Examples in this document are intended to illustrate policy configuration concepts.

The management DMZ provides connectivity to the internal network for devices in the DMZ and outside the firewall. This connectivity is limited to the protocols required to maintain and operate the devices.

Step 1: Navigate to **Configuration > Firewall > Access Rules**.

First, you will enable devices in the management DMZ to communicate with the internal network for management and user authentication.

Step 2: Click **Add**, and then choose **Add Access Rule**.

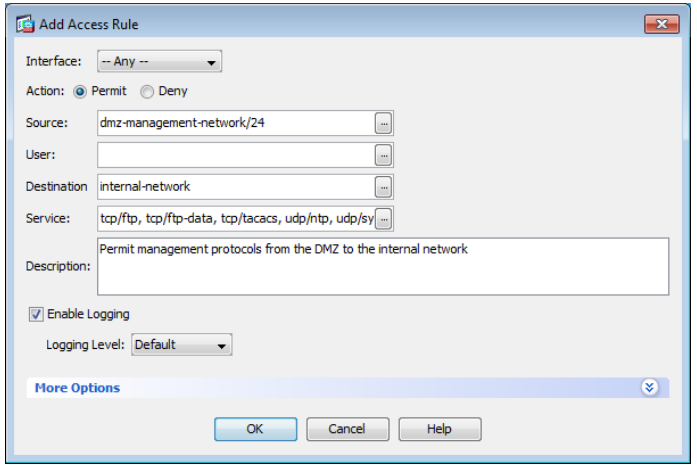
Step 3: In the Add Access Rule dialog box, in the **Interface** list, select **—Any—**.

Step 4: For **Action**, select **Permit**.

Step 5: In the **Source** list, select the network object automatically created for the management DMZ. (Example: dmz-management-network/24)

Step 6: In the **Destination** list, select the network object that summarizes the internal networks. (Example: internal-network)

Step 7: In the **Service** list, enter **tcp/ftp, tcp/ftp-data, tcp/tacacs, udp/ntp, udp/syslog**, and then click **OK**.



Next, you will ease the configuration of the security policy by creating a network object that summarizes all the DMZ networks. All the DMZ networks deployed in SBA for Enterprise Organizations can be summarized as 192.168.16.0/21.

Step 8: Navigate to **Configuration > Firewall > Objects > Network Objects/Groups**.

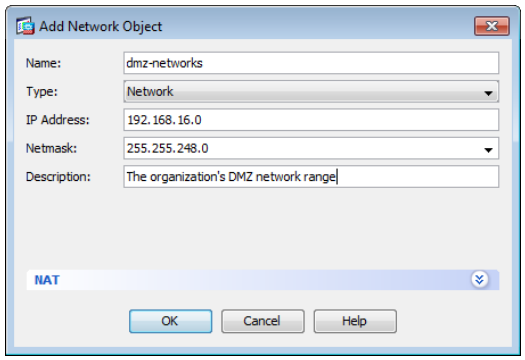
Step 9: Click **Add > Network Object**.

Step 10: In the Add Network Object dialog box, in the **Name box**, enter a description for the network summary. (Example: dmz-networks)

Step 11: In the **Type** list, select **Network**.

Step 12: In the **IP Address** box, enter the address that summarizes all DMZ networks. (Example: 192.168.16.0)

Step 13: In the **Netmask** box, enter the DMZ summary netmask, and then click **OK**. (Example: 255.255.248.0)



Next, you will deny access from the DMZs to all other networks, as open access poses a security risk.

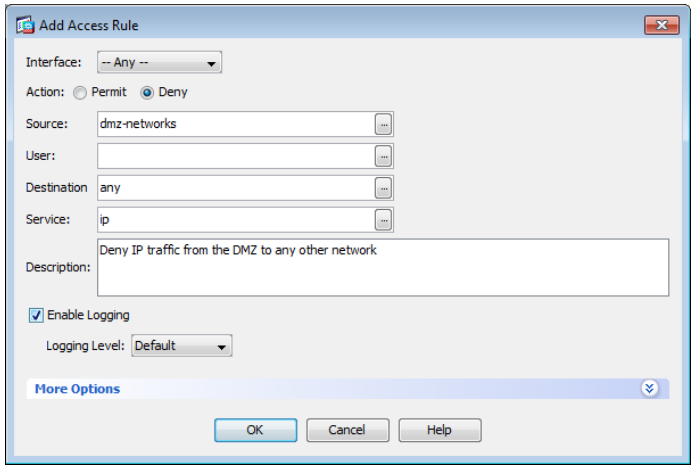
Step 14: Navigate to **Configuration** > **Firewall** > **Access Rules**.

Step 15: Click **Add** > **Add Access Rule**.

Step 16: In the Add Access Rule dialog box, in the **Interface** list, select **—Any—**.

Step 17: For **Action**, select **Deny**.

Step 18: In the **Source** list, select the network object created in Step 9, and then click **OK**. (Example dmz-networks)



Step 19: In the Access Rules pane, click **Apply**. This saves the configuration.

Process

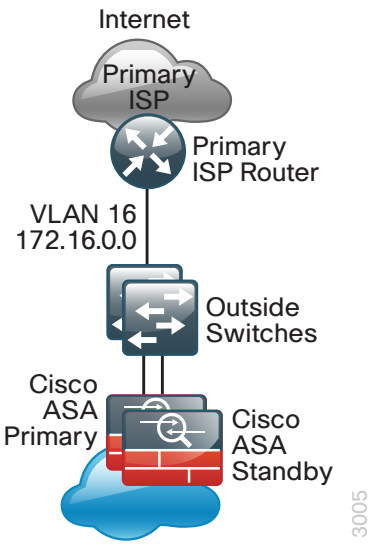
Configuring the Firewall Internet Edge

1. Configure the outside switch
2. ASA with non-trunked Internet access
3. ASA with trunked Internet access
4. Configure address translation
5. Configure security policy

Internet connectivity varies based on the organization's availability requirement for Internet access. Two options are available:

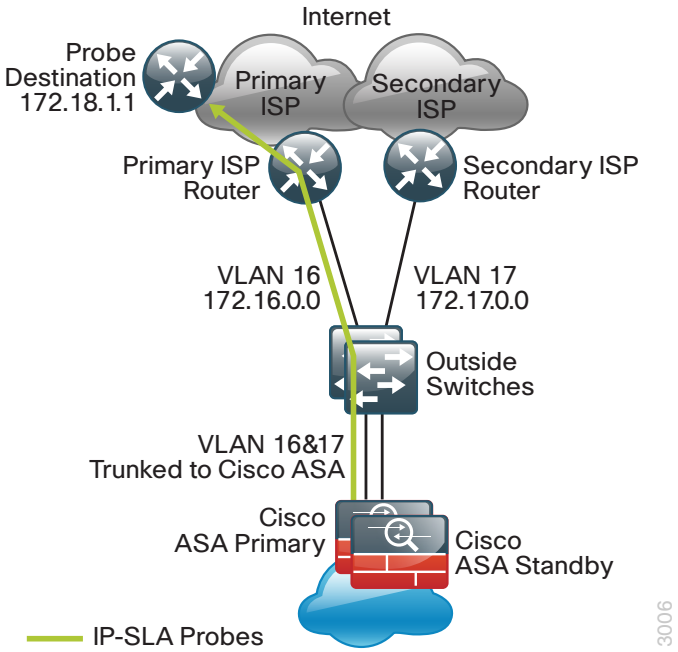
- Single ISP uses a single Internet connection via one router that carries the Internet traffic.

Figure 7 - Single ISP connectivity



- Dual ISP uses dual Internet connections via two routers (the primary and secondary ISP routers) that carry the Internet traffic.

Figure 8 - Dual ISP connectivity



An organization should have an IT security policy to use as a reference for defining its firewall policy. If there is no documented security policy, it is very difficult to create a firewall policy for the organization because no consistent set of rules can be enforced.

Policy Recommendations

Network security policies can be broken down into two basic categories: *whitelist* policies and *blacklist* policies. A whitelist-based policy offers a stronger initial security posture because all traffic is blocked except for applications that are explicitly allowed. However, whitelist policies are more likely to interfere with network applications and are more difficult to maintain, as each new application must be permitted through the firewall. A whitelist policy is easily recognized because the last access rule denies all traffic (i.e., "**deny ip any any**"). Whitelist policies are best suited for traffic from the Internet to services in the DMZ.

The following information is needed to be able to effectively define a whitelist security policy:

- What applications will be used on the network?
- Can their traffic be characterized at the protocol level?
- Is a detailed description of application behavior available in order to facilitate troubleshooting if the security policy interferes with the application?

A blacklist policy is generally more suitable for requests from the inside network to the Internet. This type of policy offers reduced operational burden and minimizes the likelihood that the security policy will interfere with Internet applications. Blacklist policies are the opposite of whitelist policies; they only stop traffic that is explicitly denied. Typically an application is blocked because of an organization's policy or because they expose the organization to malicious traffic. A blacklist policy is recognizable by the last access rule; the rule set permits all traffic that has not already been denied (that is, "**permit ip any any**").

In some cases, traffic (such as web content) of high business value is very difficult to distinguish from traffic with no business value, such as malware and entertainment traffic. As an adjunct to the Cisco ASA, the Cisco Web Security Appliance (WSA) offers web filtering for traffic that contains malware or negatively affects user productivity. Additionally, Cisco IPS can be used to block malicious traffic embedded within permitted applications. Cisco IPS concepts and configuration are discussed in the Intrusion Prevention chapter in this document. Cisco WSA concepts and configuration are discussed in the *Cisco SBA—Borderless Networks Web Security Using WSA Deployment Guide*.

Procedure 1 Configure the outside switch

If you already have a switch on the outside into which you are allowed to plug both Cisco ASAs, then you can skip this procedure. This switch could be ISP-provided gear, such as a cable modem with a 4-port switch or similar. The only requirement in Single ISP mode is that both Cisco ASAs' outside interfaces have to be plugged into the same Layer-2 domain in order to allow failover to function. In this deployment, a trunked outside interface is used, even in Single ISP mode, to allow easier migration to Dual ISP mode later. If you are using an outside switch that doesn't support trunking, you will need to assign the outside IP address directly to the interface of the Cisco ASA.

For this procedure, if you are using a Single ISP design, you will skip the Dual ISP section. If you are using a Dual ISP design, you will complete both sets of steps.

Single ISP design

The outside switch in this deployment is a pair of 2960S switches in a stacked configuration. The configuration below is complete for the features required for the outside switch. This configuration is taken from the *Cisco SBA—Borderless Networks LAN Deployment Guide*.

Step 1: Set the stack master switch.

```
switch [switch number] priority 15
```

Step 2: Run the **stack-mac persistent timer 0** command to ensure that the original master MAC address remains the stack MAC address after a failure.

```
stack-mac persistent timer 0
```

Step 3: To make consistent deployment of QoS easier, we define a macro that you will use in later steps to apply the specific QoS configuration. Because AutoQoS might not be configured on this device, run the following commands to manually configure the global QoS settings:

```
mls qos map policed-dscp  0 10 18 to 8
mls qos map cos-dscp 0 8 16 24 32 46 48 56
mls qos srr-queue input bandwidth 70 30
mls qos srr-queue input threshold 1 80 90
mls qos srr-queue input priority-queue 2 bandwidth 30
mls qos srr-queue input cos-map queue 1 threshold 2 3
mls qos srr-queue input cos-map queue 1 threshold 3 6 7
mls qos srr-queue input cos-map queue 2 threshold 1 4
mls qos srr-queue input dscp-map queue 1 threshold 2 24
mls qos srr-queue input dscp-map queue 1 threshold 3 48 49 50
51 52 53 54 55
mls qos srr-queue input dscp-map queue 1 threshold 3 56 57 58
59 60 61 62 63
mls qos srr-queue input dscp-map queue 2 threshold 3 32 33 40
41 42 43 44 45
mls qos srr-queue input dscp-map queue 2 threshold 3 46 47
mls qos srr-queue output cos-map queue 1 threshold 3 4 5
mls qos srr-queue output cos-map queue 2 threshold 1 2
mls qos srr-queue output cos-map queue 2 threshold 2 3
mls qos srr-queue output cos-map queue 2 threshold 3 6 7
mls qos srr-queue output cos-map queue 3 threshold 3 0
mls qos srr-queue output cos-map queue 4 threshold 3 1
mls qos srr-queue output dscp-map queue 1 threshold 3 32 33 40
41 42 43 44 45
mls qos srr-queue output dscp-map queue 1 threshold 3 46 47
mls qos srr-queue output dscp-map queue 2 threshold 1 16 17 18
19 20 21 22 23
mls qos srr-queue output dscp-map queue 2 threshold 1 26 27 28
29 30 31 34 35
mls qos srr-queue output dscp-map queue 2 threshold 1 36 37 38
39
mls qos srr-queue output dscp-map queue 2 threshold 2 24
mls qos srr-queue output dscp-map queue 2 threshold 3 48 49 50
51 52 53 54 55
mls qos srr-queue output dscp-map queue 2 threshold 3 56 57 58
59 60 61 62 63
mls qos srr-queue output dscp-map queue 3 threshold 3 0 1 2 3
4 5 6 7
mls qos srr-queue output dscp-map queue 4 threshold 1 8 9 11
13 15
mls qos srr-queue output dscp-map queue 4 threshold 2 10 12 14
mls qos queue-set output 1 threshold 1 100 100 50 200
mls qos queue-set output 1 threshold 2 125 125 100 400
mls qos queue-set output 1 threshold 3 100 100 100 3200
mls qos queue-set output 1 threshold 4 60 150 50 200
mls qos queue-set output 1 buffers 15 25 40 20
mls qos
!
macro name EgressQoS
 mls qos trust dscp
 queue-set 1
 srr-queue bandwidth share 1 30 35 5
 priority-queue out
@
!
```

Step 4: Configure the device hostname to make it easy to identify the device.

```
hostname OUT-2960S
```

Step 5: Configure VTP transparent mode.

```
vtp mode transparent
```

Step 6: Configure Spanning-Tree (PVST+).

```
spanning-tree mode rapid-pvst
spanning-tree vlan 1-4094 root primary
```

Step 7: Enable Unidirectional Link Detection (UDLD).

```
udld enable
```

Step 8: Set EtherChannels to use the traffic source and destination IP address.

```
port-channel load-balance src-dst-ip
```

Step 9: Configure device management protocols.

```
ip domain-name cisco.local
ip ssh version 2
no ip http server
ip http secure-server
line vty 0 15
  transport input ssh
  transport preferred none
```

Simple Network Management Protocol (SNMP) is enabled to allow the network infrastructure devices to be managed by a Network Management System (NMS). SNMPv2c is configured both for a read-only and a read-write community string.

```
snmp-server community cisco RO
snmp-server community cisco123 RW
```

Step 10: **(Optional)** In networks where network operational support is centralized you can increase network security by using an access list to limit the networks that can access your device. In this example, only devices on the 10.4.48.0/24 network will be able to access the device via SSH or SNMP.

```
access-list 55 permit 10.4.48.0 0.0.0.255
line vty 0 15
  access-class 55 in
!
snmp-server community cisco RO 55
snmp-server community cisco123 RW 55
```

Step 11: Configure DNS for host lookup.

```
ip name-server 10.4.48.10
```

Step 12: Configure local login and password.

```
username admin password c1sco123
enable secret c1sco123
service password-encryption
aaa new-model
```

Step 13: **(Optional)** Configure centralized user authentication.

```
tacacs server TACACS-SERVER-1
address ipv4 10.4.48.15
key SecretKey
!
aaa group server tacacs+ TACACS-SERVERS
  server name TACACS-SERVER-1
!
aaa authentication login default group TACACS-SERVERS local
aaa authorization exec default group TACACS-SERVERS local
aaa authorization console
ip http authentication aaa
```

Step 14: Configure a synchronized clock.

```
ntp server 10.4.48.17
!
clock timezone PST -8
clock summer-time PDT recurring
!
service timestamps debug datetime msec localtime
service timestamps log datetime msec localtime
```

Step 15: On the outside switch, configure the VLAN for the ISP.

```
vlan 16
 name ISP-A
```

Step 16: Configure the interface that is connected to the ISP router.

```
interface GigabitEthernet1/0/23
 description ISP-A
 switchport access vlan 16
 switchport host
 no cdp enable
```

Step 17: Configure the interfaces that connect to the appliances.

```
interface GigabitEthernet1/0/24
 description IE-ASA5545a Gig0/3
!
interface GigabitEthernet2/0/24
 description IE-ASA5545b Gig0/3
!
interface range GigabitEthernet1/0/24, GigabitEthernet2/0/24
 switchport trunk allowed vlan 16
 switchport mode trunk
 spanning-tree portfast trunk
 macro apply EgressQoS
 logging event link-status
 logging event trunk-status
 no shutdown
```

Step 18: Configure the switch with an IP address so that it can be managed via out-of-band connectivity.

```
interface FastEthernet0
 description to DMZ-3750X Gig1/0/17
 ip address 192.168.23.6 255.255.255.0
 no shutdown
```

Step 19: Configure the appliance as the DMZ switch's default route.

```
ip default-gateway 192.168.23.1
```

Step 20: On the DMZ switch, configure the interface connected to the outside switch to be in the management DMZ.

```
interface GigabitEthernet1/0/17
 description OUT-2960Sa Fas0
!
interface GigabitEthernet2/0/17
 description OUT-2960Sb Fas0
!
interface range GigabitEthernet1/0/17, GigabitEthernet2/0/17
 switchport access vlan 1123
 switchport host
 no shutdown
```

Step 21: On the outside switch, configure BPDU Guard globally to protect portfast-enabled interfaces.

```
spanning-tree portfast bpduguard default
```

If you are using a single ISP, you can skip to the next procedure.

Dual ISP design

Step 22: On the outside switch, add the VLAN for the backup ISP.

```
vlan 17
 name ISP-B
```

Step 23: Configure the interface that connects to the ISP router.

```
interface GigabitEthernet2/0/23
 description ISP-B
 switchport access vlan 17
 switchport host
 no cdp enable
```

Step 24: Configure the interfaces that connect to the appliances.

```
interface range GigabitEthernet1/0/24, GigabitEthernet2/0/24
 switchport trunk allowed vlan add 17
 no shutdown
```

Procedure 2 ASA with non-trunked Internet access

If you are using a non-trunked single ISP design, complete this procedure. If you are using a trunked design using either single or dual ISPs, skip to Procedure 3.

Step 1: From a client on the internal network, navigate to the firewall's inside IP address, and then launch the Cisco ASA Security Device Manager. (Example: https://ie-asa5545.cisco.local/)

Step 2: In **Configuration** > **Device Setup** > **Interfaces**, click the interface that is connected to the outside switch. (Example: GigabitEthernet0/3)

Step 3: Click **Edit**.

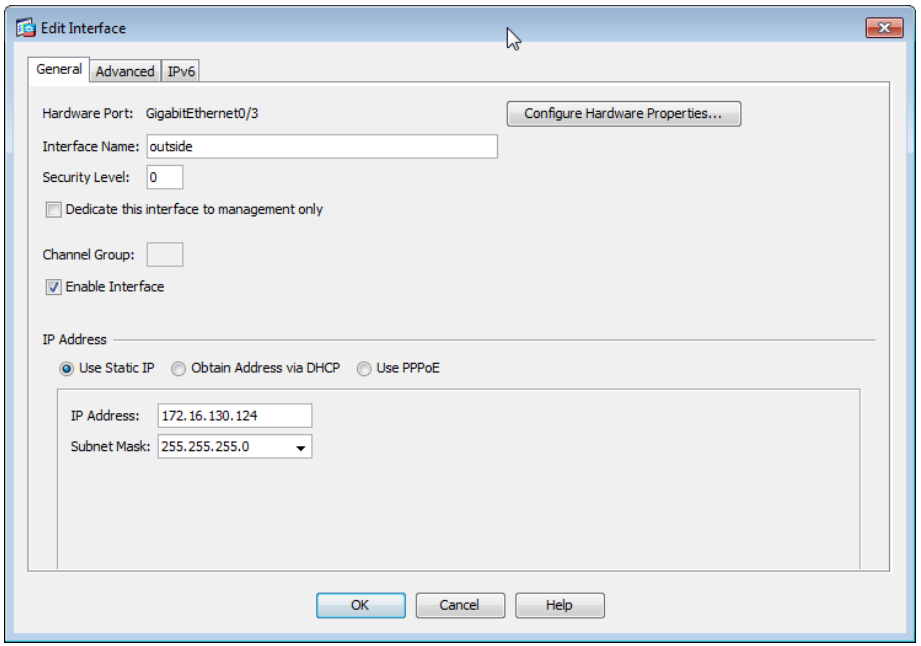
Step 4: In the Edit Interface dialog box, select **Enable Interface**.

Step 5: Enter an **Interface Name**. (Example: outside)

Step 6: In the **Security Level** box, enter a value of **0**.

Step 7: Enter the interface **IP Address**. (Example: 172.16.130.124)

Step 8: Enter the interface **Subnet Mask**, and then click **OK**. (Example: 255.255.255.0)

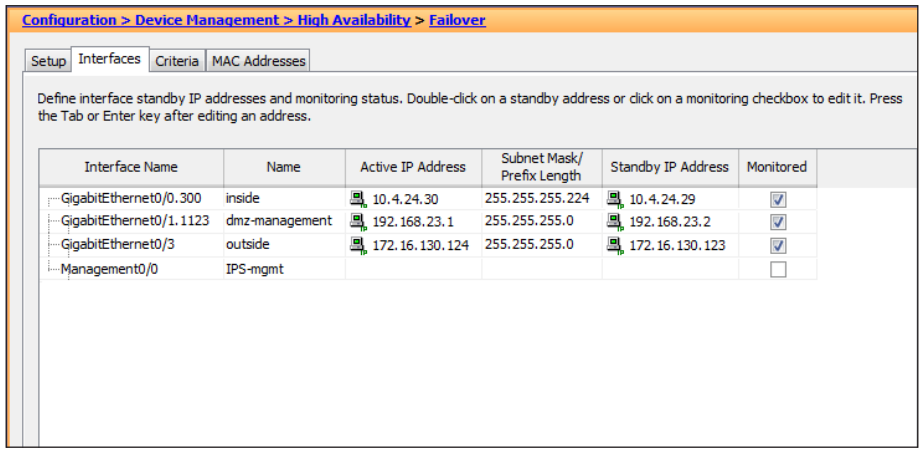


Step 9: On the Interface pane, click **Apply**.

Step 10: Navigate to **Configuration** > **Device Management** > **High Availability** > **Failover.**

Step 11: On the Interfaces tab, in the **Standby IP Address** column, enter the IP address of the standby unit for the interface you just created. (Example: 172.16.130.123)

Step 12: Select **Monitored, and then click Apply**.



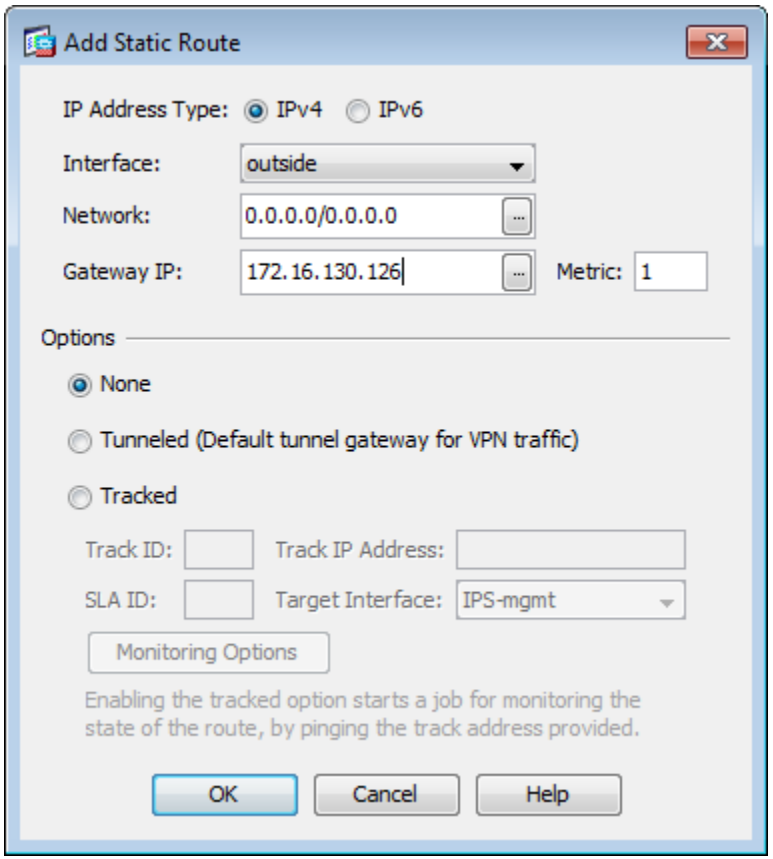
Next, you will create the default route to the primary Internet CPE's address.

Step 13: In **Configuration > Device Setup > Routing > Static Routes**, click **Add**.

Step 14: In the Add Static Route dialog box, in the **Interface** list, choose the interface edited in Step 2 (Example: outside)

Step 15: In the **Network** box, enter **0.0.0.0/0.0.0.0**.

Step 16: In the **Gateway IP** box, enter the primary Internet CPE's IP address, and then click **OK**. (Example: 172.16.130.126)



Step 17: On the Static Routes pane, click **Apply**.

Procedure 3 ASA with trunked Internet access

If you are configuring the ASA outside connectivity for a trunked single ISP design complete option 1. If using a trunked dual ISP design, then complete both option 1 and then option 2 for the second ISP.

Option 1. Using a Single ISP, trunked design

Step 1: From a client on the internal network, navigate to the firewall's inside IP address, and then launch the Cisco ASA Security Device Manager. (Example: https://ie-asa5545.cisco.local/)

Step 2: In **Configuration** > **Device Setup** > **Interfaces**, click the interface that is connected to the outside switch. (Example: GigabitEthernet0/3)

Step 3: Click **Edit**.

Step 4: In the Edit Interface dialog box, select **Enable Interface**, and then click **OK**.

Step 5: On the Interface pane, click **Add** > **Interface**.

Step 6: In the Add Interface dialog box, in the **Hardware Port** list, select the interface enabled in Step 4. (Example: GigabitEthernet0/3)

Step 7: In the **VLAN ID** box, enter the VLAN number for the primary Internet VLAN. (Example: 16)

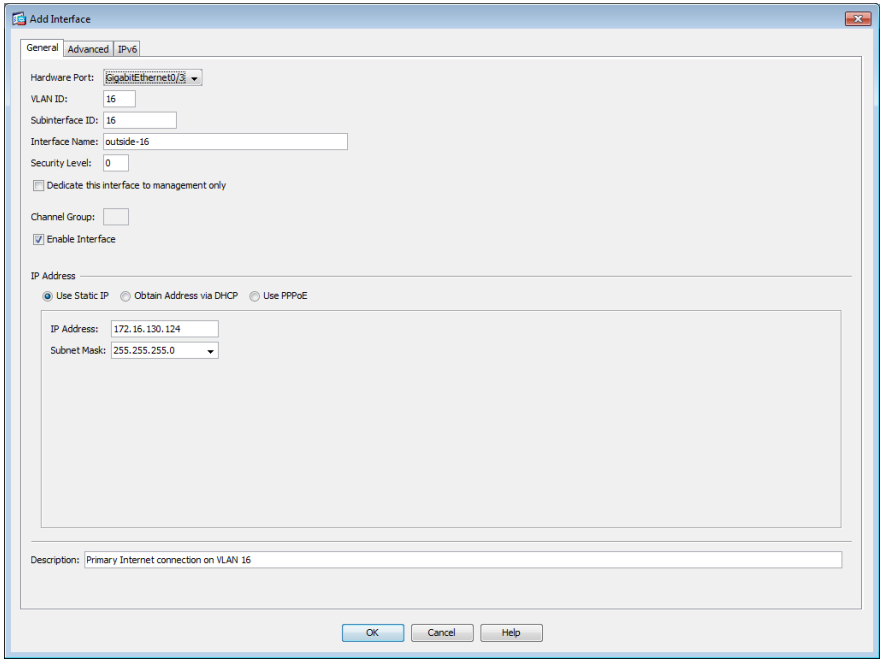
Step 8: In the **Subinterface ID** box, enter the VLAN number for the primary Internet VLAN. (Example: 16)

Step 9: Enter an **Interface Name**. (Example: outside-16)

Step 10: In the **Security Level** box, enter a value of **0**.

Step 11: Enter the interface **IP Address**. (Example: 172.16.130.124)

Step 12: Enter the interface **Subnet Mask**, and then click **OK**. (Example: 255.255.255.0)

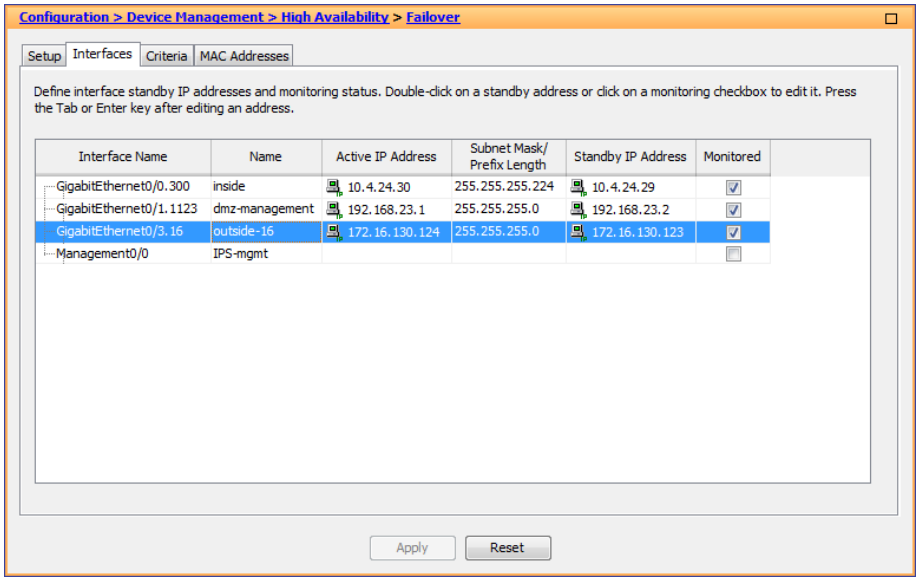


Step 13: On the Interface pane, click **Apply**.

Step 14: Navigate to **Configuration** > **Device Management** > **High Availability** > **Failover.**

Step 15: On the **Interfaces** tab, in the **Standby IP Address** column, enter the IP address of the standby unit for the interface you just created. (Example: 172.16.130.123)

Step 16: Select **Monitored**, and then click **Apply**.



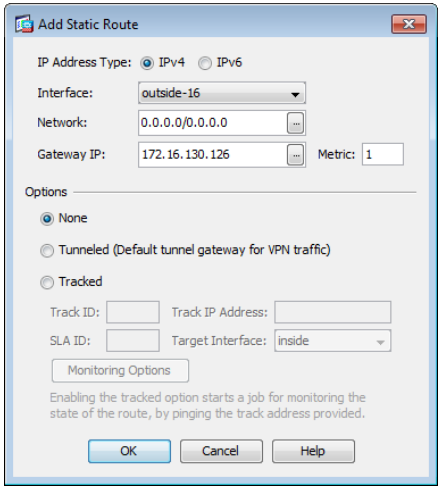
Next, you will create the default route to the primary Internet CPE's address.

Step 17: In **Configuration** > **Device Setup** > **Routing** > **Static Routes**, click **Add**.

Step 18: In the Add Static Route dialog box, in the **Interface** list, chose the interface created in Step 9 (Example: outside-16)

Step 19: In the **Network** box, enter **0.0.0.0/0.0.0.0**.

Step 20: In the **Gateway IP** box, enter the primary Internet CPE's IP address, and then click **OK**. (Example: 172.16.130.126)



Step 21: On the Static Routes pane, click **Apply**.

Option 2. Using a Trunked Dual ISP design

If Dual ISP access is not being used, skip to Procedure 4. This procedure assumes that the configuration in Procedure 3 Option 1: was completed for the primary ISP connection.

When resilient Internet access (Dual ISP) is required, the appliances' GigabitEthernet 0/3, which is configured as a VLAN trunk to the outside switch, is assigned an additional VLAN to use to connect to the secondary ISP. The VLAN trunk allows the appliance to use separate VLANs for the upstream internet routers.

The primary route carries a metric of 1, making the route preferred; the primary route's availability is determined by the state of the 'track 1' object that is appended to the primary route. The route-tracking configuration defines a target in ISP-1's network to which the appliance sends ICMP probes (pings) in order to determine if the network connection is active. The target is an object on the primary service provider's network, such as an intermediate router that can be discovered with traceroute.

The tracked object should be in the primary ISP's network. The point of tracking an object in the primary ISP's network is because if reachability to this object is available, then all connectivity to that point is working, including: the appliance's connection to the customer premise router, the WAN connection, and most routing inside the ISP's network. If the tracked object is unavailable, it is likely that the path to the primary ISP is down, and the appliance should prefer the secondary ISP's route.

Step 1: Navigate to **Configuration** > **Device Setup** > **Interfaces**.

Step 2: On the Interface pane, click **Add** > **Interface**.

Step 3: In the Add Interface dialog box, in the **Hardware Port** list, choose the interface configured in Step 4. (Example: GigabitEthernet0/3)

Step 4: In the **VLAN ID** box, enter the VLAN number for the resilient Internet VLAN. (Example: 17)

Step 5: In the **Subinterface ID** box, enter the VLAN number for the resilient Internet VLAN. (Example: 17)

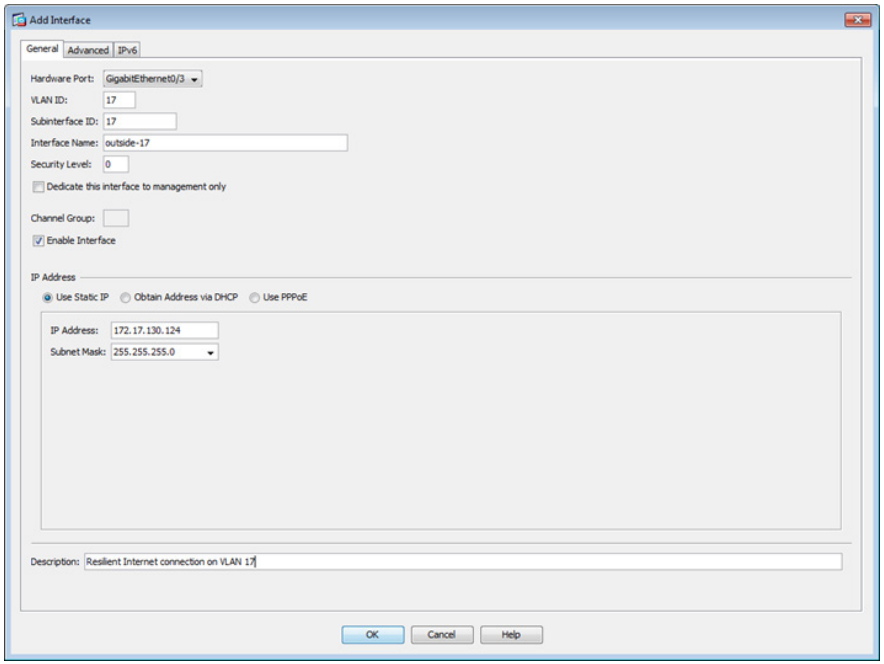
Step 6: Enter an **Interface Name**. (Example: outside-17)

Step 7: In the **Security Level** box, enter a value of **0**.

Step 8: Enter the interface **IP Address**. (Example: 172.17.130.124)

Step 9: Enter the interface **Subnet Mask**, and then click **OK**. (Example: 255.255.255.0)

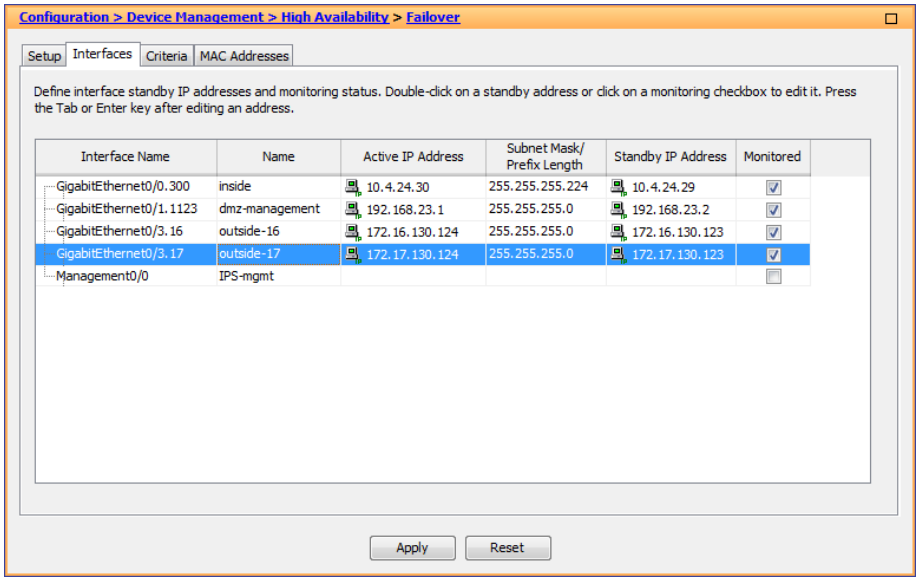
Step 10: On the Interface pane, click **Apply**.



Step 11: Navigate to **Configuration** > **Device Management** > **High Availability** > **Failover.**

Step 12: On the **Interfaces** tab, in the **Standby IP Address** column, enter the IP address of the standby unit for the interface you just created. (Example: 172.17.130.123)

Step 13: Select **Monitored**, and then click **Apply**.



Next, you will edit the default route to the primary Internet CPE's address.

Step 14: Navigate to **Configuration > Device Setup > Routing > Static Routes.**

Step 15: Select the default route created in Step 20, and click **Edit**.

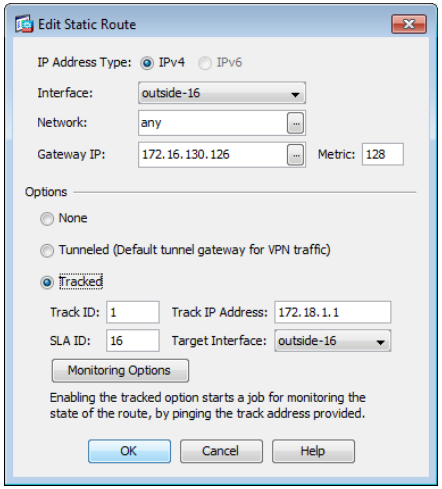
Step 16: In the Edit Static Route dialog box, in the **Options** pane, select **Tracked**.

Step 17: In the **Track ID** box, enter **1**.

Step 18: In the **Track IP Address** box, enter an IP address in the ISP's cloud. (Example: 172.18.1.1)

Step 19: In the **SLA ID** box, enter **16**.

Step 20: In the **Target Interface** list, select the primary Internet connection interface, and then click **OK**. (Example: outside-16)



Step 21: On the Information dialog box, click **OK**.

Next, you will create the secondary default route to the resilient Internet CPE's address.

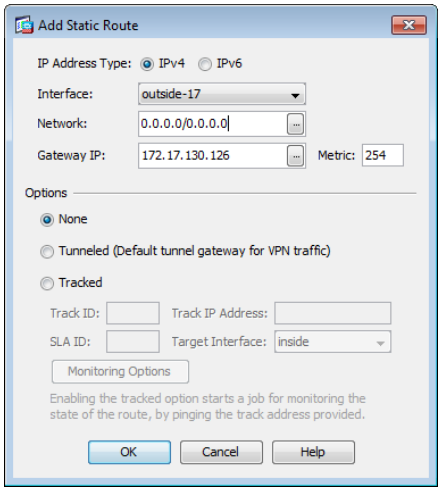
Step 22: In **Configuration > Device Setup > Routing > Static Routes**, click **Add**.

Step 23: In the Add Static Route dialog box, in the **Interface** list, select the resilient Internet connection interface created in Step 6. (Example: outside-17)

Step 24: In the **Network** box, enter **0.0.0.0/0.0.0.0**.

Step 25: In the **Gateway IP** box, enter the primary Internet CPE's IP address. (Example: 172.17.130.126)

Step 26: In the **Metric** box, enter **254**, and then click **OK**.



Step 27: On the Static Routes pane, click **Apply**.

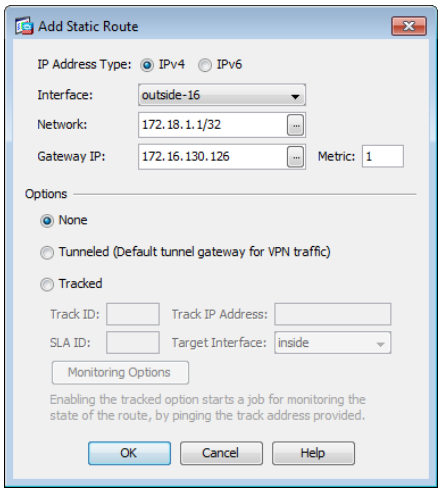
Next, you will add a host route for the tracked object via the Internet-CPE-1 address. This assures that probes to the tracked object will always use the primary ISP connection.

Step 28: In **Configuration** > **Device Setup** > **Routing** > **Static Routes**, click **Add**.

Step 29: In the Add Static Route dialog box, in the **Interface** list, select the primary Internet connection interface created in Step 9. (Example: outside-16)

Step 30: In the **Network** box, enter the IP address used for tracking in the primary default route. (Example: 172.18.1.1/32)

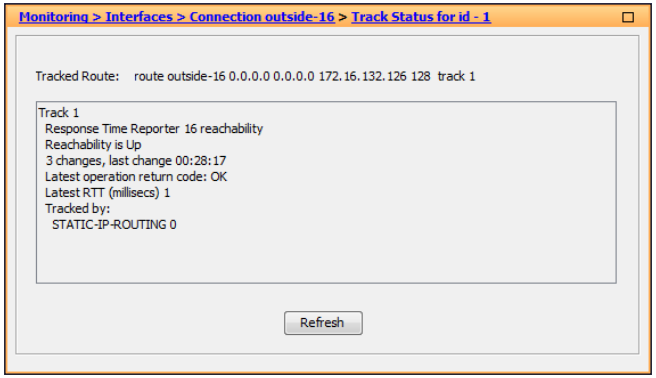
Step 31: In the **Gateway IP** box, enter the primary Internet CPE's IP address, and then click **OK**. (Example: 172.16.130.126)



Step 32: On the Static Routes pane, click **Apply**.

Step 33: In Cisco ASDM, refresh the configuration.

Step 34: You can monitor the reachability of the tracked object by navigating to **Monitoring** > **Interfaces** > **Connection outside-16** > **Track Status for id-1**.



Procedure 4 Configure address translation

Prior to completing this procedure, access to the Internet from within the inside network is not possible. This procedure is required to permit Internet traffic for the inside network and the DMZs; the inside and DMZ networks are numbered using private (RFC 1918) addressing that is not Internet-routable, so the appliances must translate the private addresses to outside Internet-routable addresses. For this configuration, all inside addresses are translated to the public address on the outside interface.

Tech Tip

As the address translation configuration described in this portion of the document is applied, the appliance enables its default access rule set. Review the expected traffic carefully; if any traffic allowed by the default rules should not be permitted, shut down the interfaces until the firewall rule set is completely configured.

NAT configuration varies depending on whether a Single or Dual ISP configuration is used. Most of the configuration is common to both designs, although there are some additional steps for configuring both outside interfaces in the Dual ISP design.

Step 1: Navigate to **Configuration** > **Firewall** > **Objects** > **Network Objects/Groups**.

Step 2: Click **Add** > **Network Object**.

Step 3: In the Add Network Object dialog box, in the **Name box**, enter a description for the address translation. (Example: internal-network-ISPa)

Step 4: In the **Type** list, select **Network**.

Step 5: In the **IP Address** box, enter the address that summarizes all internal networks. (Example: 10.4.0.0)

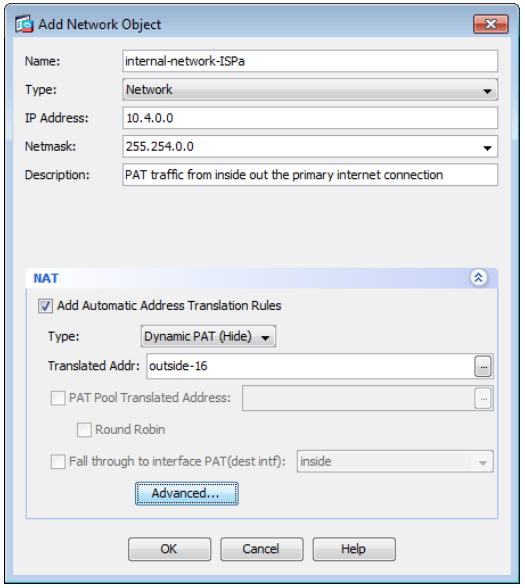
Step 6: In the **Netmask** box, enter the internal summary netmask. (Example: 255.254.0.0)

Step 7: Click the two down arrows. The **NAT** pane expands.

Step 8: Select **Add Automatic Address Translation Rules**.

Step 9: In the **Type** list, select **Dynamic PAT (Hide).**

Step 10: In the **Translated Addr.** box, enter the name of the primary Internet connection interface, and then click **OK**. (Example: outside-16)



Step 11: On the Network Objects/Groups pane, click **Apply**.

Step 12: If you are using a Single ISP design, continue to Procedure 5.

If you are using the Dual ISP design, repeat Step 1 - Step 11 for the resilient Internet connection, using the correct input for the alternate Internet connection. (Example: internal-network-ISPb, outside-17)

Procedure 5 Configure security policy

The security policy is typically configured so that internal network traffic to the DMZs or Internet is blocked only for high-risk services; all other access is allowed.

Telnet is an example of a network service that is high-risk, because it carries all of its data unencrypted. This poses a risk because hosts that can intercept the data can potentially view sensitive data.

Step 1: Navigate to **Configuration > Firewall > Access Rules**.

First, you will add a rule to deny the internal network from sending outbound Telnet requests.

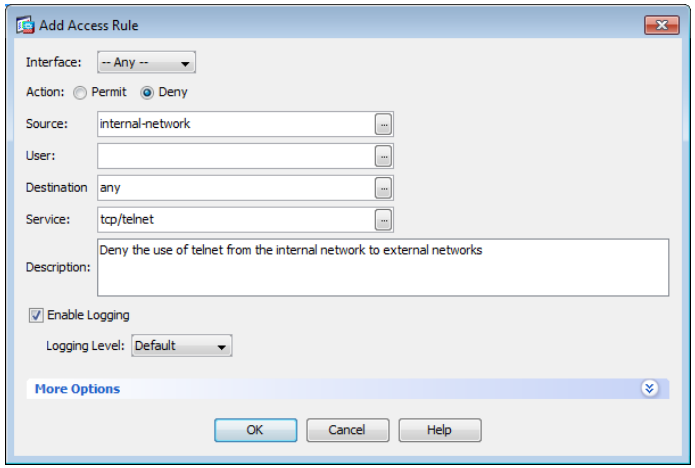
Step 2: Click **Add > Add Access Rule**.

Step 3: In the Add Access Rule dialog box, in the **Interface** list, select **—Any—**.

Step 4: For **Action**, select **Deny**.

Step 5: In the **Source** list, select the network object that summarizes the internal networks. (Example: internal-network)

Step 6: In the **Service** list, enter **tcp/telnet**, and then click **OK**.



Next, you will add a rule to permit all remaining traffic from the internal network.

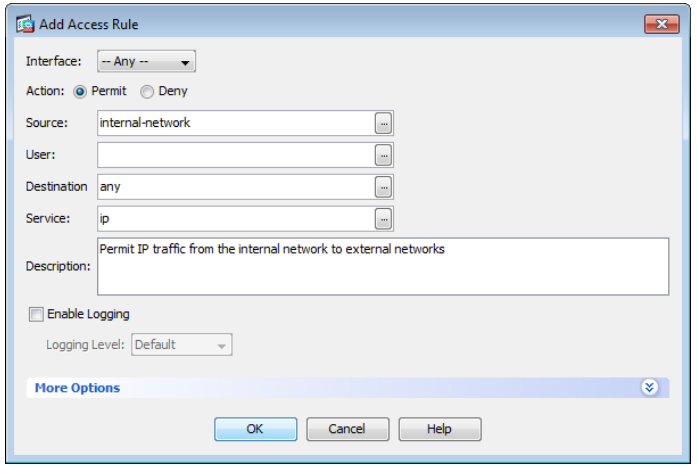
Step 7: Click **Add > Add Access Rule**.

Step 8: In the Add Access Rule dialog box, in the **Interface** list, select **—Any—**.

Step 9: For **Action**, select **Permit**.

Step 10: In the **Source** list, select the network object that summarizes the internal networks. (Example: internal-network)

Step 11: Clear **Enable Logging**, and then click **OK.**



Step 12: On the Access Rules pane, click **Apply.**

Process

Configuring the Web DMZ

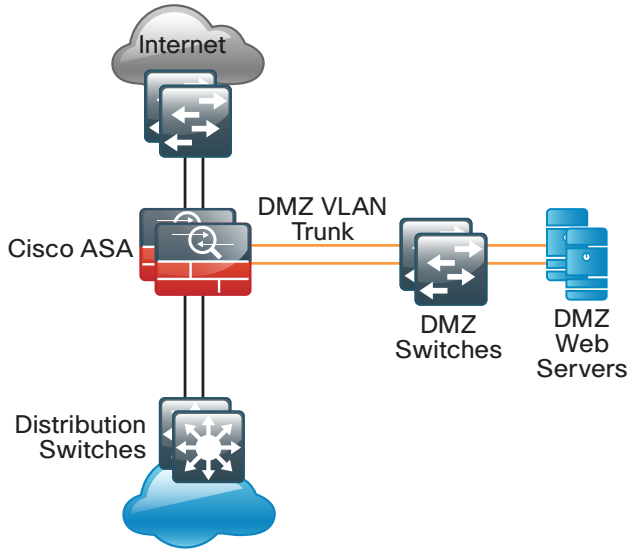
1. Configure the DMZ switch
2. Configure DMZ interface
3. Configure Network Address Translation
4. Configure security policy

The firewall's demilitarized zone (DMZ) is a portion of the network where, typically, traffic to and from other parts of the network is tightly restricted. Organizations place network services in a DMZ for exposure to the Internet. These servers are typically not allowed to initiate connections to the inside network, except for specific circumstances.

In this process a DMZ is configured to enable you to host Internet-accessible web servers to be on site.

The DMZ network is connected to the appliances on the appliances' GigabitEthernet interface via a VLAN trunk in order to allow the greatest flexibility if new VLANs must be added to connect additional DMZs. The trunk connects the appliances to a 3750x access-switch stack in order to provide resiliency. The DMZ VLAN interfaces on the Cisco ASA are each assigned an IP address that is the default gateway for each of the VLAN subnets. The DMZ switch only offers Layer-2 switching capability; the DMZ switch's VLAN interfaces do not have an IP address assigned, except for one VLAN interface with an IP address for management of the switch.

Figure 9 - Web DMZ VLAN topology



The number of secure VLANs is arbitrary. The following deployment illustrates an example of one secured network. If multiple types of hosts are to be connected in an Internet-facing DMZ, segmenting the DMZ along functional boundaries may be necessary, particularly because hosts that are exposed to the Internet are vulnerable to compromise and must not offer a springboard to other hosts. However, traffic between DMZ VLANs should be kept to a minimum. Placing servers that must share data on a single VLAN improves performance and reduces load on network devices.

Tech Tip

Setting the DMZ connectivity as a VLAN trunk offers the greatest flexibility.

Procedure 1 Configure the DMZ switch

This procedure assumes that the DMZ switch has already been configured following the guidance in Procedure 1, Configure the DMZ switch.

Step 1: Configure the DMZ Web VLAN on the DMZ switch

```
vlan 1116
 name dmz-web
```

Step 2: Configure the interfaces that connect to the appliances.

```
interface range GigabitEthernet1/0/24, GigabitEthernet2/0/24
 switchport trunk allowed vlan add 1116
```

Step 3: Configure the interfaces that are connected to the web servers.

```
interface GigabitEthernet1/0/2
 description Webserver
 switchport access vlan 1116
 switchport host
 macro apply EgressQoS
 logging event link-status
 no shutdown
```

Procedure 2 Configure DMZ interface

Step 1: Connect to Cisco Adaptive Security Device Manager (ASDM) by navigating to https://ie-asa5545.cisco.local/admin, and then logging in with your username and password.

Step 2: Navigate to **Configuration** > **Device Setup** > **Interfaces.**

Step 3: On the Interface pane, click **Add** > **Interface**.

Step 4: In the Add Interface dialog box, in the **Hardware Port** list, choose the interface connected to the DMZ switch.(Example: GigabitEthernet0/1)

Step 5: In the **VLAN ID** box, enter the VLAN number for the DMZ VLAN. (Example: 1116)

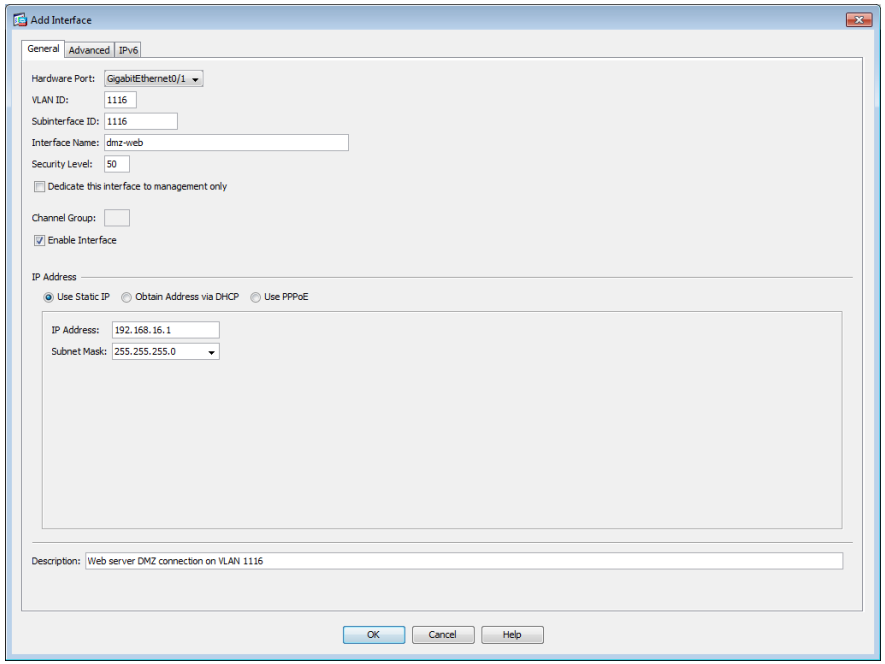
Step 6: In the **Subinterface ID** box, enter the VLAN number for the DMZ VLAN. (Example: 1116)

Step 7: Enter an **Interface Name**. (Example: dmz-web)

Step 8: In the **Security Level** box, enter a value of **50**.

Step 9: Enter the interface **IP Address**. (Example: 192.168.16.1)

Step 10: Enter the interface **Subnet Mask**, and then click **OK**. (Example: 255.255.255.0)

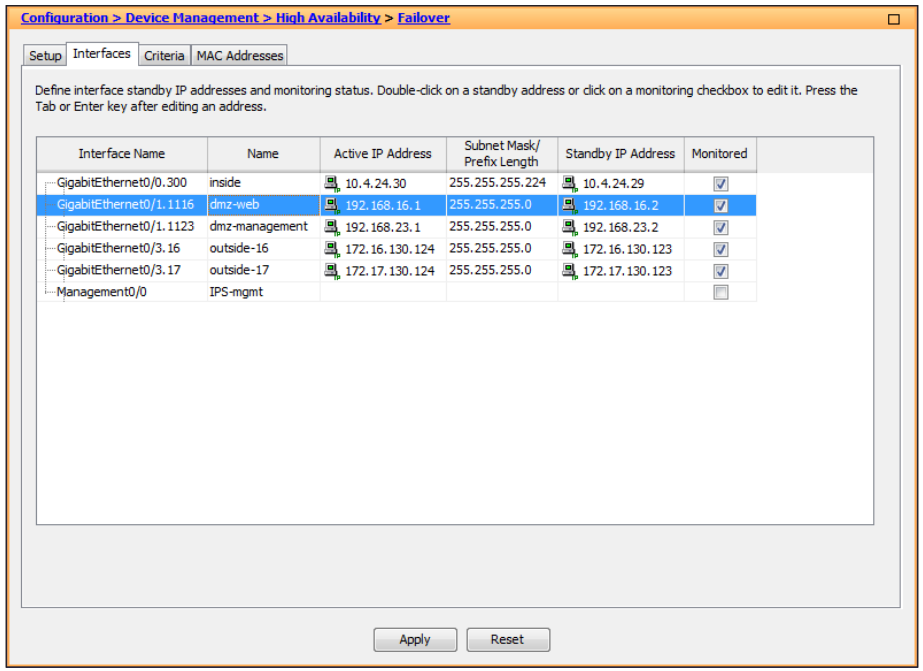


Step 11: On the Interface pane, click **Apply**.

Step 12: Navigate to **Configuration** > **Device Management** > **High Availability** > **Failover**.

Step 13: On the Interfaces tab, in the **Standby IP address** column, enter the IP address of the standby unit for the interface you just created. (Example: 192.168.16.2)

Step 14: Select **Monitored**, and then click **Apply**.



Procedure 3 Configure Network Address Translation

The DMZ network uses private network (RFC 1918) addressing that is not Internet-routable, so the firewall must translate the DMZ address of the web server to an outside public address. If there is a resilient Internet connection, the web server can have an address translation for each ISP. This resilient configuration, shown here for completeness, relies on the modification of DNS records in order to point incoming requests to the resilient web server address when the primary Internet connection is unavailable.

The example DMZ address to public IP address mapping is shown in the following table.

Table 3 - DMZ address mapping

Web server DMZ address	Web server public address (externally routable after NAT)
192.168.16.100	172.16.130.100 (ISP-A)
	172.17.130.100 (ISP-B for Dual ISP only)

Step 1: Navigate to **Configuration** > **Firewall** > **Objects** > **Network Objects/Groups**.

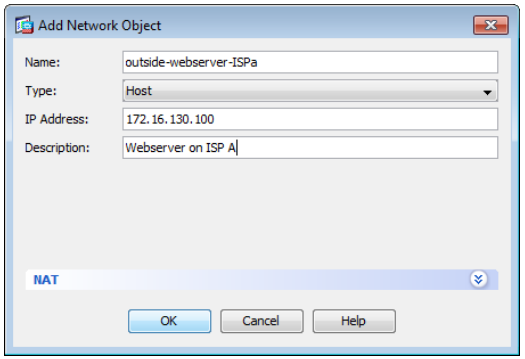
First, you will add a network object for the web server's IP address on the primary Internet connection.

Step 2: Click **Add** > **Network Object**.

Step 3: On the Add Network Object dialog box, in the **Name box**, enter a description for the web server's public IP address. (Example: outside-webserver-ISPa)

Step 4: In the **Type** list, select **Host**.

Step 5: In the **IP Address** box, enter the web server's public IP address, and then click **OK**. (Example: 172.16.130.100)



Step 6: On the Network Objects/Groups pane, click **Apply**.

Next, you will add a network object for the private DMZ address of the web server.

Step 7: Click **Add** > **Network Object**.

Step 8: On the Add Network Object dialog box, in the **Name box**, enter a description for the web server's private DMZ IP address. (Example: dmz-webserver-ISPa)

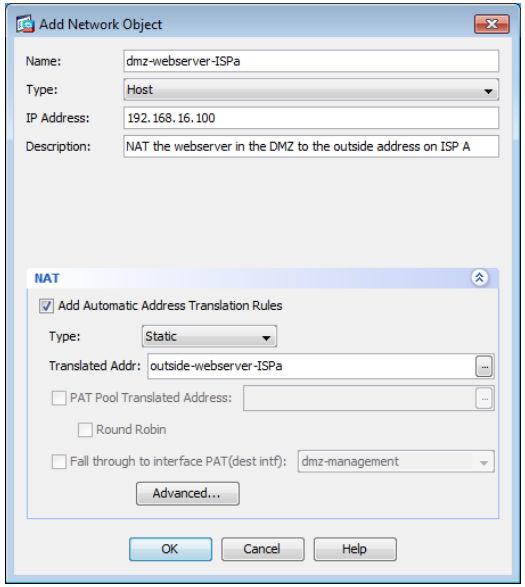
Step 9: In the **Type** list, select **Host**.

Step 10: In the **IP Address** box, enter the web server's private DMZ IP address. (Example: 192.168.16.100)

Step 11: Click the two down arrows. The **NAT** pane expands.

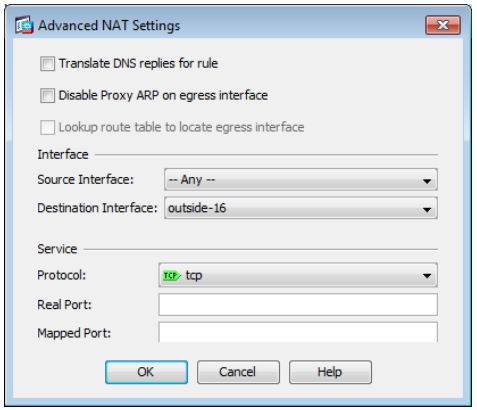
Step 12: Select **Add Automatic Address Translation Rules**.

Step 13: In the **Translated Addr** list, select the network object created in Step 2. (Example: outside-webserver-ISPa)



Step 14: Click **Advanced**.

Step 15: In the Advanced NAT Settings dialog box, in the **Destination Interface** list, select the interface name for the primary Internet connection, and then click **OK**. (Example: outside-16)



Step 16: In the Add Network Object dialog box, click **OK**.

Step 17: On the Network Objects/Groups pane, click **Apply**.

Step 18: If you are using the Dual ISP design with a resilient internet connection, repeat this procedure for the secondary Internet connection.

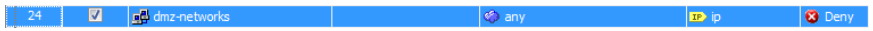
If you are using the Single ISP design, proceed to Procedure 4.

Procedure 4 Configure security policy

The web DMZ offers HTTP and HTTPS service for the Internet. This could provide capabilities to support employee/partner web-portal access, basic customer service and support, small-scale eCommerce or B2B service, or other appropriate tasks.

Step 1: Navigate to **Configuration** > **Firewall** > **Access Rules**.

Step 2: Click the rule that denies traffic from the DMZ toward other networks.



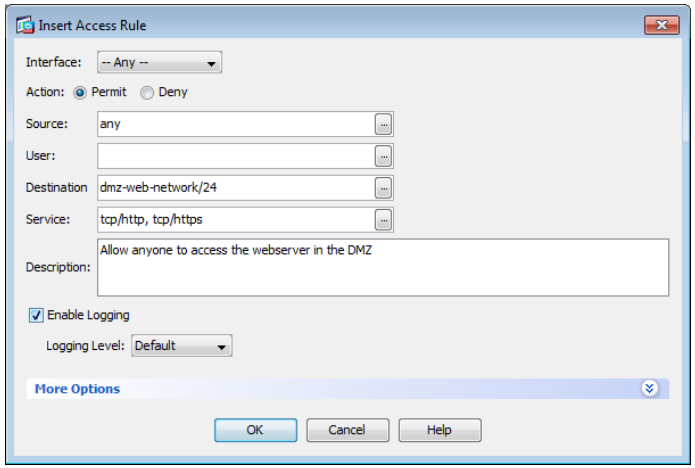
Step 3: Click **Add** > **Insert**.

Step 4: In the Insert Access Rule dialog box, in the **Interface** list, select **—Any—**.

Step 5: For **Action**, select **Permit**.

Step 6: In the **Destination** list, select the network object automatically created for the web DMZ. (Example: dmz-web-network/24)

Step 7: In the **Service** list, enter **tcp/http, tcp/https**, and then click **OK**.



Step 8: On the Access Rules pane, click **Apply**.

Firewall Summary

This section described concepts and configuration for:

- Routing to the Internet.
- Firewall management and monitoring.
- Inside-network NAT and firewall policy recommendations.
- DMZ configuration for internet-accessible web servers.

Notes

Intrusion Prevention

Business Overview

Internet services have become a key part of day-to-day operations for many organizations today. Providing secure Internet access, while preventing malicious content from entering an organization is critical to maintaining employee productivity. In addition to client access to the Internet, organizations have near-universal need to have a web presence available for partners and clients to access information about the organization. Placing corporate information on the Internet runs a risk of exposure of data through an attack on the public-facing services. For an organization to utilize the Internet effectively, solutions must be found for all of these concerns.

Technology Overview

Worms, viruses, and botnets pose a substantial threat to organizations. To minimize the impact of network intrusions, you can deploy intrusion prevention systems (IPSs) in order to provide additional protection for the organization from the traffic that is permitted through the Internet edge firewall. Cisco IPS technology complements the firewall and inspects traffic permitted by the firewall policy, for attacks.

Cisco IPS devices come in two formats: standalone appliances and hardware or software modules inside a Cisco ASA firewall. The differences between the devices generally revolve around how the devices get the traffic they inspect. An appliance uses physical interfaces that exist as part of the network. A module receives traffic from the ASA firewall in which it resides, according to the policy defined on the firewall.

With either type of device, there are two deployment modes available: promiscuous (IDS) or inline (IPS). There are specific reasons for each deployment mode, based on risk tolerance and fault tolerance. *Inline* or *IPS mode* means that the IPS device sits inline on the traffic flow in order to inspect the actual packets, and if an alert is triggered that includes a drop action, the IPS device can drop the actual malicious packet. *Promiscuous* or *IDS mode* (note that an IPS device can operate in IDS mode) means that an external device is copying the packets to the IPS device. For an appliance, the way packets get copied is generally a network tap or a switch running a SPAN session. For a module, the copying happens at the Cisco ASA firewall and is controlled by the ASA configuration. Because inline and promiscuous are operating modes, an IPS device can inspect traffic at multiple places, and each inspection point could be set up independently as inline or promiscuous.

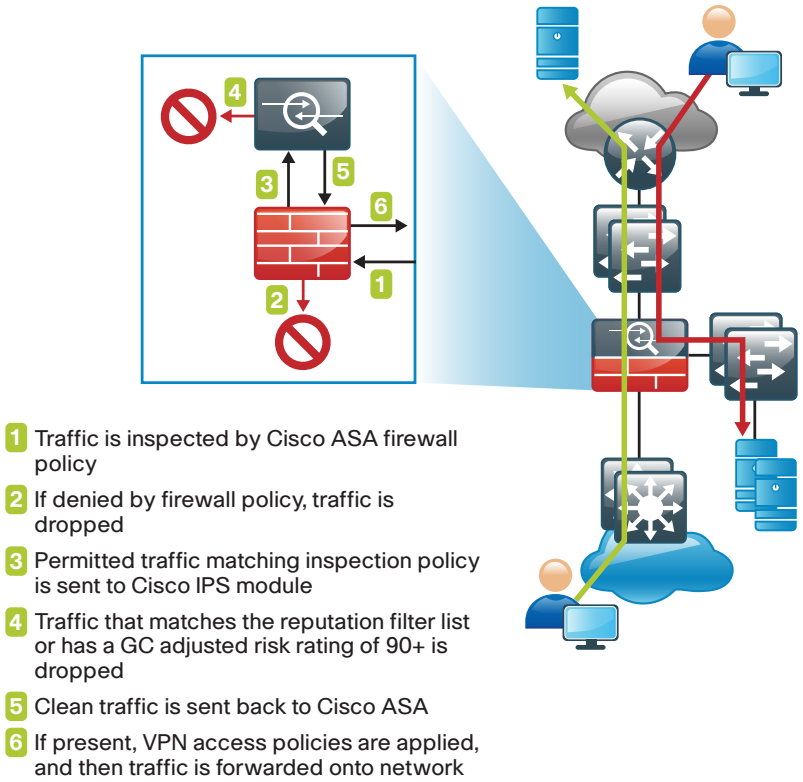
Using inline mode means that network traffic flows through an IPS device, and if the device fails or misbehaves, it will impact production traffic. The advantage inline mode offers is that when the sensor detects malicious behavior, the sensor can simply drop it. This allows the IPS device a much greater capacity to actually prevent attacks.

Using promiscuous mode means that the IPS device must use another inline enforcement device in order to stop malicious traffic. This means that for activity such as single-packet attacks (slammer worm over User Datagram Protocol), an IDS sensor could not prevent the attack from occurring. However, an IDS sensor can offer great value when identifying and cleaning up infected hosts.

This design uses the Cisco ASA 5500 Series IPS Solution (software module inside an ASA) at the Internet edge. The design offers several options that are based on the performance requirements of the organization. It is important to remember that the Internet edge firewall and IPS have more than just employee Internet traffic going through the box. Internal traffic to servers in the DMZ, wireless guest traffic, site-to-site VPN, and remote-access VPN traffic all combine to make the throughput requirements for the Internet edge firewall and IPS much higher than Internet connection speed.

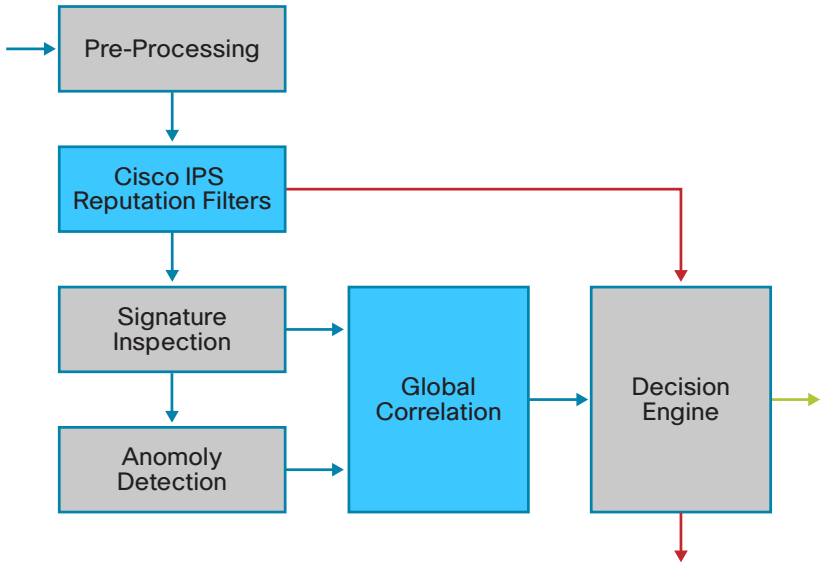
You will also deploy the standalone Cisco IPS 4300 Series Sensors in promiscuous mode. The ability to deploy a sensor internally on the network in order to watch traffic on any distribution switch can be very valuable. These sensors can be used to watch traffic going to and from the WAN network, traffic on the wireless network, or even traffic on a B2B network to a partner.

Figure 10 - Packet flow through a Cisco ASA firewall and IPS module



IPS services integrated into the ASA firewall rely on the firewalls for high availability services. The firewalls in the Internet edge are deployed in an active/standby configuration; if the primary firewall fails, then the secondary firewall will take over all firewall operations, and the IPS module in the secondary firewall inspects the traffic.

Figure 11 - IPS processing flowchart



Cisco IPS can make informed decisions on whether to permit or block traffic based off of reputation. Cisco IPS uses reputation in two key ways:

- **Reputation Filters**—a small list of IP addresses that have been hijacked or are owned by malicious groups
- **Global Correlation Inspection**—a rating system for IP addresses based off of prior behavior

Reputation Filters allow the IPS to block all traffic from known bad addresses before any significant inspection is done. Global Correlation Inspection uses the reputation of the attacker in conjunction with the risk rating associated with the signature in order to determine a new risk rating and drop traffic that is likely to be malicious.

Because Global Correlation Inspection depends on actual public IP addresses to function, any sensor that is deployed internally and sees only private addresses should have Global Correlation Inspection disabled because it will not add any value.

Figure 12 - Reputation effect on risk rating

Reputation Effect on Risk Rating
Standard Mode

Reputation of Attacker

Blue Deny Packet | Red Deny Attacker

Initial Risk Rating	-0.5	-1	-1.5	-2	-2.5	-3	-3.5	-4	-4.5	-5	-5.5	-6	-6.5	-7	-7.5	-8	-8.5	-9	-9.5	-10
80	80	80	84	87	90	92	94	95	97	98	99	99	100	100	100	100	100	100	100	100
81	81	81	84	87	90	92	94	96	97	98	99	100	100	100	100	100	100	100	100	100
82	82	82	85	88	91	93	95	96	97	98	99	100	100	100	100	100	100	100	100	100
83	83	83	85	88	91	93	95	96	98	99	99	100	100	100	100	100	100	100	100	100
84	84	84	86	89	92	94	95	97	98	99	100	100	100	100	100	100	100	100	100	100
85	85	85	87	90	92	94	96	97	98	99	100	100	100	100	100	100	100	100	100	100
86	86	86	87	90	92	94	96	97	98	99	100	100	100	100	100	100	100	100	100	100
87	87	87	88	91	93	95	96	98	99	100	100	100	100	100	100	100	100	100	100	100
88	88	88	88	91	93	95	97	98	99	100	100	100	100	100	100	100	100	100	100	100
89	89	89	89	92	94	96	97	98	99	100	100	100	100	100	100	100	100	100	100	100
90	90	90	90	92	94	96	97	99	100	100	100	100	100	100	100	100	100	100	100	100
91	91	91	91	93	95	97	98	99	100	100	100	100	100	100	100	100	100	100	100	100
92	92	92	92	93	95	97	98	99	100	100	100	100	100	100	100	100	100	100	100	100
93	93	93	93	94	96	97	99	100	100	100	100	100	100	100	100	100	100	100	100	100
94	94	94	94	95	96	98	99	100	100	100	100	100	100	100	100	100	100	100	100	100
95	95	95	95	95	96	98	99	100	100	100	100	100	100	100	100	100	100	100	100	100
96	96	96	96	96	97	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100
97	97	97	97	97	97	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100
98	98	98	98	98	98	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
99	99	99	99	99	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

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Reader Tip

For more information about how traffic moves through the Cisco ASA and IPS module combination, see the following: http://www.cisco.com/en/US/docs/security/asa/asa84/asdm64/configuration_guide/modules_ips.html#wp1087140

Deployment Details

In this deployment, you will deploy Cisco ASA IPS modules in inline mode in order to block inbound attacks to the Internet services in the DMZ. You will also deploy a standalone IPS appliance in promiscuous mode on the inside of the network. This appliance will be attached to a distribution switch and will watch for possible malicious activity in the traffic traversing the switch. The appliance is deployed on the WAN aggregation switch so that it can inspect the traffic going between the campus and remote sites. This could just as easily be deployed to watch other LAN sites, the traffic from the DMVPN connection, wireless traffic (after it enters the wired LAN), or possibly partner connections. Because it is possible to send too much traffic to an IPS device (too much for either the port or the hardware to handle), it is important to size the device carefully. The following tables give estimated performance for different models.

Table 4 - Performance levels

Cisco IPS appliance model	Average Inspection Throughput
IPS 4345	750 Mbps
IPS 4360	1.25 Gbps
IPS 4510	3 Gbps
IPS 4520	5 Gbps

Cisco ASA 5500 Series IPS Solution module	Firewall + IPS Throughput
ASA 5512-X	250 Mbps
ASA 5515-X	400 Mbps
ASA 5525-X	600 Mbps
ASA 5545-X	900 Gbps

For the Cisco IPS 4345 in this deployment, we use 2 gigabit interfaces, where each is attached to one of the switches in the switch stack. If faster models are used, options include either using a ten-gigabit interface or using a port channel of 2 or more gigabit interfaces (these options are switch-dependent, as some switches and code versions do not support using port channels as destinations for Switched Port Analyzer sessions).

The first step used to configure a Cisco ASA 5500 Series IPS Solution module is to session into the module from the firewall and set up basic networking such as IP address, gateway, and access lists in order to allow remote access to the GUI. Once the basic setup is complete, configuration is completed through a GUI such as Cisco ASA Security Device Manager (ASDM) or the Cisco IPS Manager Express.

Configuring the Cisco IPS 4300/4500 Series appliance follows similar steps with the addition of one procedure where you configure the switch to copy packets to the sensor's interface for inspection.

Use the following values when configuring IPS/IDS devices.

Table 5 - IPS device configuration

Device Type	Software module	Appliance
Location and mode	Internet edge IPS	Distribution IDS
Hostname	IPS-5545a&b	IDS-4300
IP Address	10.4.24.27&.28	10.4.32.171
Network Mask	255.255.255.224	255.255.255.192
Default Gateway	10.4.24.1	10.4.32.129
Location	Internet edge distribution switch	WAN aggregation distribution switch

Process

Deploying IPS

1. Configure LAN switch access port
2. Initialize the IPS module
3. Complete the initial setup
4. Complete the startup wizard
5. Add additional sensing interfaces
6. Modify the inline security policy

Procedure 1 Configure LAN switch access port

A LAN switch near the IPS sensor provides connectivity for the sensor's management interface. On the Cisco ASA 5500-X Series firewalls, the firewall and IPS modules share a single management interface. This deployment uses the management interface for IPS module access only.

Step 1: Configure an access port to the management VLAN on the appropriate switch where the IPS device's management port will be connected.

```
interface GigabitEthernet1/0/19
 description IPS-5545a
 switchport
 switchport access vlan 300
 switchport mode access
 spanning-tree portfast
```

Step 2: Configure the LAN distribution switch interfaces that are connected to the Cisco ASA management interface to allow access to the IPS module for management.

```
interface GigabitEthernet1/0/19
 description IPS-5545a
!
interface GigabitEthernet2/0/19
 description IPS-5545b
!
interface range GigabitEthernet1/0/19, GigabitEthernet2/0/19
 switchport access vlan 300
 switchport mode access
 spanning-tree portfast
```

Tech Tip

The IPS module and the Cisco ASA share the same physical port for management traffic. In this deployment, the ASA is managed in-band and the IPS, either module or appliance, is always managed from the dedicated management port.

Procedure 2 Initialize the IPS module

When a Cisco ASA 5500 Series IPS Solution is initially deployed, the software IPS module may not be initialized, resulting in the ASA firewall being unaware of what code version to boot for the IPS module. This procedure verifies the IPS module status and prepares for configuration completion.

Step 1: From the Cisco ASA command line interface, run the following command.

```
IE-ASA5545X# sho module ips detail
```

Step 2: If the status shown below is **Up**, then the IPS module software has been loaded and you can skip to Procedure 3.

```
IE-ASA5545X# sho module ips detail
Getting details from the Service Module, please wait...

Card Type:          ASA 5545-X IPS Security Services Processor
Model:              ASA5545-IPS
Hardware version:   N/A
Serial Number:      FCH161170MA
Firmware version:   N/A
Software version:   7.1(4)E4
MAC Address Range:  c464.1339.a354 to c464.1339.a354
App. name:          IPS
App. Status:        Up
App. Status Desc:   Normal Operation
App. version:       7.1(4)E4
Data Plane Status:  Up
Status:             Up
```

If the status shown is **Status: Unresponsive No Image Present**, then the IPS module software has never been loaded. Continue to the next step.

```
IE-ASA5545X# sho module ips detail
Getting details from the Service Module, please wait...
Unable to read details from module ips

Card Type:          Unknown
Model:              N/A
Hardware version:   N/A
Serial Number:      FCH16097J3F
Firmware version:   N/A
Software version:
MAC Address Range:  c464.1339.2cf1 to c464.1339.2cf1
Data Plane Status:  Not Applicable
Status:             Unresponsive   No Image Present
...
```

Step 3: Verify you have the correct IPS image on the Cisco ASA firewall **disk0:**.

```
IE-ASA5545X# dir
Directory of disk0:/
113    -rwx  34523136     16:55:06 Apr 19 2012  asa861-smp-k8.
bin
114    -rwx  42637312     16:57:00 Apr 19 2012  IPS-SSP_5545-
K9-sys-1.1-a-7.1-4-E4.aip
115    -rwx  17851400     16:57:32 Apr 19 2012  asdm-66114.bin
123    -rwx  34523136     13:40:30 May 22 2012  asa861-1-
smp-k8.bin
```

Step 4: Configure the IPS module to load the software on **disk0:** and then boot with that software.

```
IE-ASA5545X# sw-module module ips recover configure image
disk0:/IPS-SSP_5545-K9-sys-1.1-a-7.1-4-E4.aip
IE-ASA5545X# sw-module module ips recover boot


Module ips will be recovered. This may erase all configuration
and all data on that device and attempt to download/install a
new image for it. This may take several minutes.

Recover module ips? [confirm]y
Recover issued for module ips.
```

Step 5: After a few minutes, run the following command, and then verify that the module status is **Up**.

```
Show module ips detail
```

Procedure 3 Complete the initial setup

The initial setup will involve configuring each IPS device (module or appliance with the initial networking information to allow the use of the GUI to complete the configuration.

Table 6 - IPS device configuration

	Internet Edge IPS	Distribution IDS
Device Type	Software module	Appliance
Hostname	IPS-5545a&b	IDS-4300
IP Address	10.4.24.27&.28	10.4.32.171
Network Mask	255.255.255.224	255.255.255.192
Default Gateway	10.4.24.1	10.4.32.129
Location	Internet Edge distribution switch	WAN aggregation distribution switch

Step 1: If you are using the Cisco ASA 5545-X, log into the ASA appliance, and then access the IPS module by issuing the following command.

```
ASA5545# session ips
Opening command session with module ips.
Connected to module ips. Escape character sequence is 'CTRL-
^X'.
```

If you are using a Cisco IPS 4x00 Series appliance, open a CLI session on the sensor's console port.

Tech Tip

The default username and password for the IPS module is cisco/cisco. If this is the first time the sensor has been logged into, there will be a prompt to change the password. Enter the current password, and then input a new password. Change the password to a value that complies with the security policy of the organization.

```
login: cisco
Password:[password]
```

Step 2: Run the **setup** command for either the module or an IPS appliance.

```
sensor# setup
Enter host name[sensor]: IPS-5545a
Enter IP interface[]: 10.4.24.27/27,10.4.24.1
Modify current access list?[no]: yes
Current access list entries:
   No entries
Permit: 10.4.48.0/24
Permit:
Use DNS server for Global Correlation?[no]: yes
   DNS server IP address[]: 10.4.48.10
Use HTTP proxy server for Global Correlation?[no]: no
Modify system clock settings?[no]: no
Participation in the SensorBase Network allows Cisco to
collect aggregated statistics about traffic sent to your IPS.
SensorBase Network Participation level?[off]: partial
...
Do you agree to participate in the SensorBase Network?[no]:yes
...
[0] Go to the command prompt without saving this config.
[1] Return to setup without saving this config.
[2] Save this configuration and exit setup.
[3] Continue to Advanced setup.
Enter your selection[3]: 2
...
Warning: The node must be rebooted for the changes to go into
effect.
Continue with reboot? [yes]:yes
```

Step 3: To return to the Cisco ASA command line, type **exit**.

Step 4: Repeat Step 2 for the IPS module in the standby ASA appliance or for the IPS appliance being deployed in IDS mode on a distribution switch.

Tech Tip

A different host name and IP address must be used on each IPS device so that monitoring systems do not get confused. In this example, IPS-5545b and 10.4.24.28 were used on the standby ASA 5500 Series IPS.

Procedure 4 Complete the startup wizard

Once the basic setup in the System Configuration Dialog is complete, you will use the startup wizard in the integrated management tool, Cisco Adaptive Security Device Manager/IPS Device Manager (ASDM/IDM) for Cisco ASAs, or Cisco IDM for IPS Sensor appliances, to complete the remaining IPS configuration tasks:

- Configure time settings
- Configure DNS and NTP servers
- Define a basic IPS configuration
- Configure Inspection Service Rule Policy
- Assign interfaces to virtual sensors

This procedure offers two options. Which you use depends on whether you will be configuring IPS modules in Cisco ASA appliances, or whether you will be configuring IPS appliances.

Option 1. Complete the basic configuration for Cisco ASA IPS modules

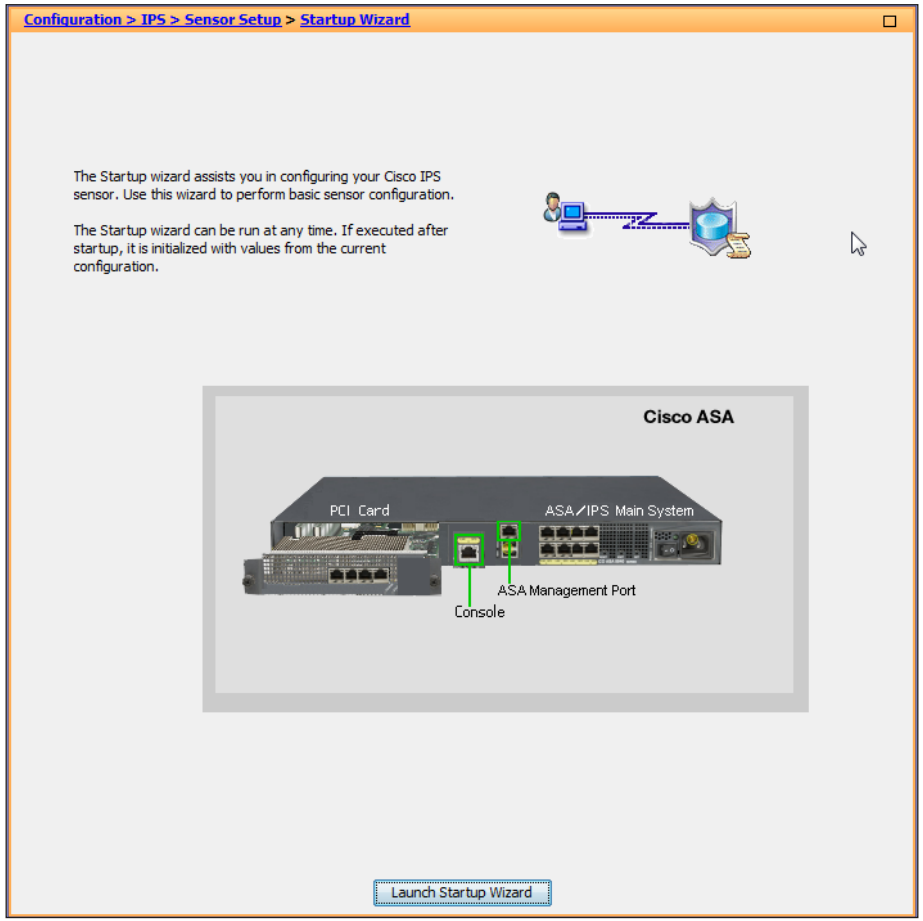
Step 1: From a client on the internal network, navigate to the firewall's inside IP address, and launch the Cisco ASA Security Device Manager. (Example:)

Step 2: Click on the Configuration tab, and then click **IPS**.

Step 3: In the Connecting to IPS dialog box, enter the IP address, username and password you specified on the IPS sensor, and then click **Continue.**

Cisco ASDM imports the current configuration from the IPS sensor, and the startup wizard launcher is displayed in the main window.

Step 4: Click **Launch Startup Wizard**.

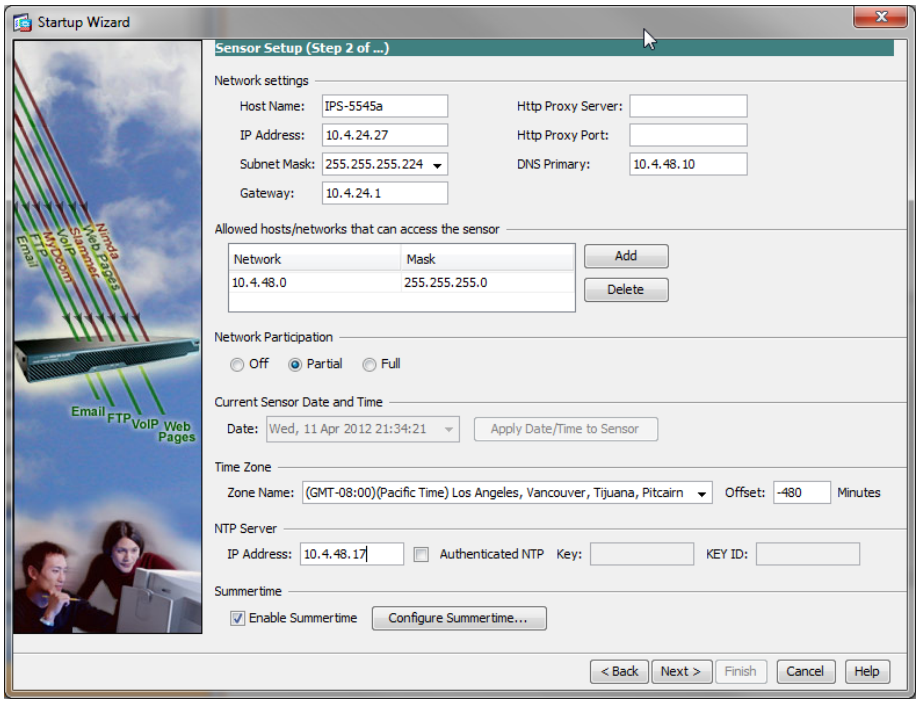


Step 5: In the **Startup Wizard: Sensor Setup**, enter an NTP server and any necessary credentials for the server, set the time zone and summertime settings, and then click **Next.**

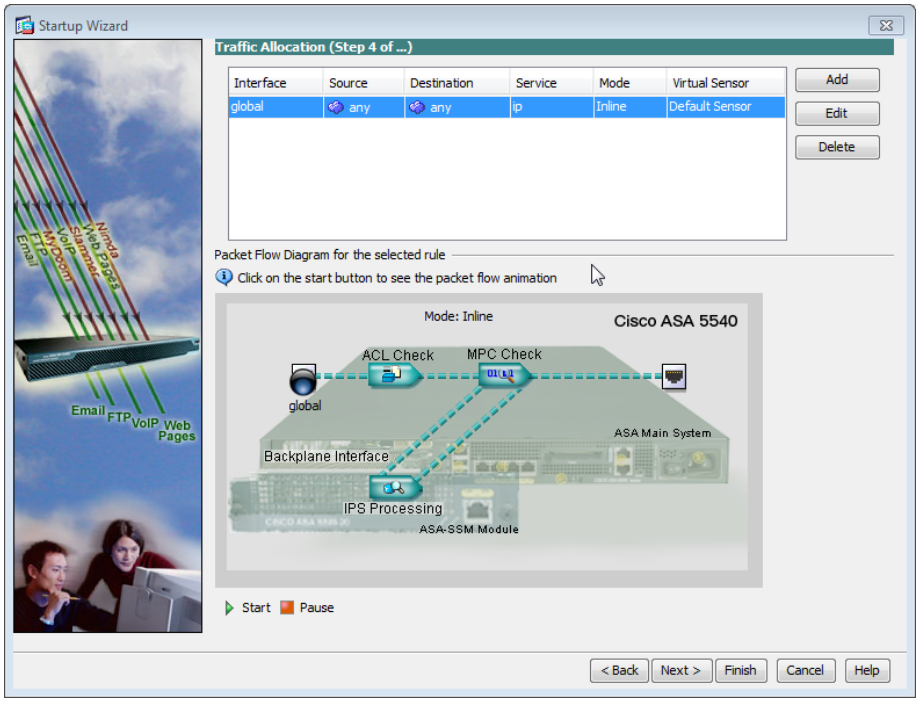
Step 6: In the **DNS Primary** box, enter the DNS server address (Ex: 10.4.48.10)

Step 7: In the **Zone Name** drop-down list, select the appropriate time zone.

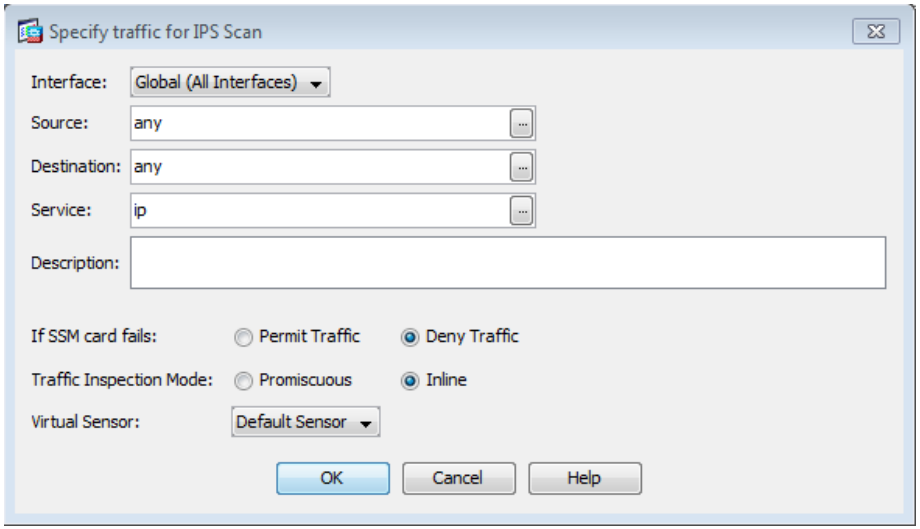
Step 8: Enter the NTP Server IP address (Ex: 10.4.48.17), ensure that **Authenticated NTP** is clear, and then click **Next**.



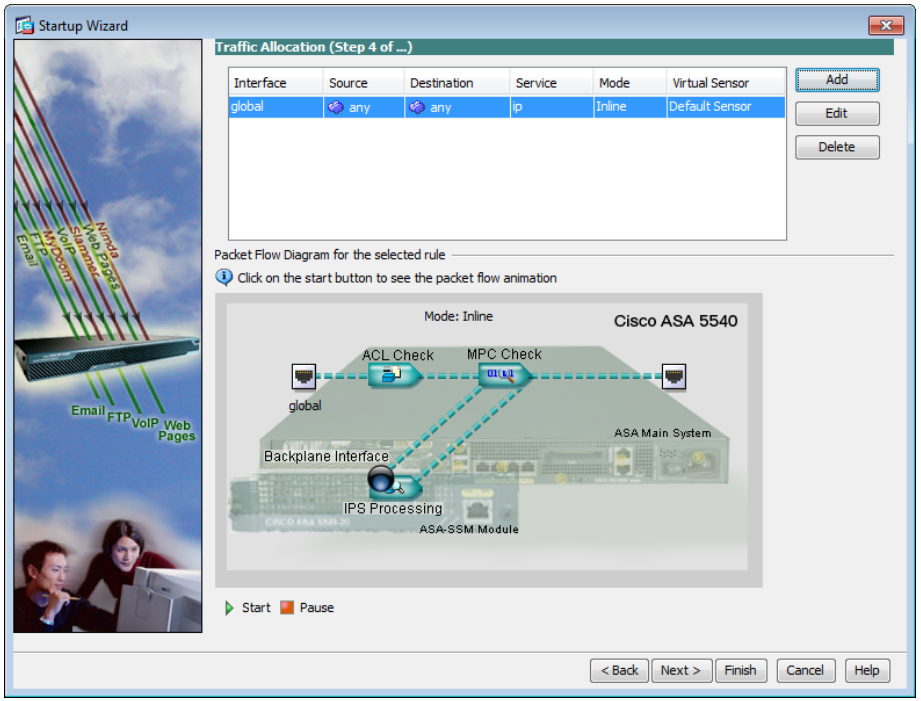
Step 9: In the Traffic Allocation window, click **Add**.



Step 10: In the **Specify traffic for IPS Scan** dialog box, under **Traffic Inspection Mode**, select **Inline**, and then click **OK**. If the Cisco ASA already had a default traffic allocation policy, IDM will throw a warning window that "The Service Rule Policy you are trying to create already exists." If you receive this warning window, cancel the current window and proceed to the next step.



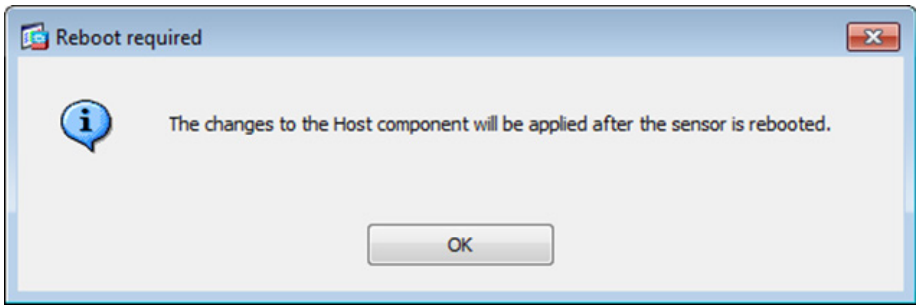
Step 11: Below the **Packet Flow Diagram for the selected Rule** panel, click **Start**. This verifies the Traffic Allocation configuration**.** The animation illustrates a packet being sent to the IPS module and the egress interface. The animation may display a different platform that might be incorrect compared to the one that you are configuring. This will not impact the deployment and is merely a known cosmetic bug.



Step 12: At the bottom of the Startup Wizard screen, click **Finish**.

Step 13: When you are prompted if you want to commit your changes to the sensor, click **Yes**.

Step 14: IDM applies your changes, and replies with a **Reboot required** message. Click **OK**.



Step 15: Repeat the steps in Option 1 for the IPS module in the resilient Cisco ASA firewall. There is no configuration synchronization between the two devices like there is between the ASA firewalls.

Option 2. Complete the basic configuration for IPS 4x00 Series Sensor appliance

Step 1: On the distribution switch to which the sensor's monitoring ports are connected, in a command-line interface, enter the following:

```
interface GigabitEthernet1/0/24
 description IPS4300 G0/0
 no switchport
 no ip address
 no shutdown

interface GigabitEthernet2/0/24
 description IPS4300 G0/1
 no switchport
 no ip address
 no shutdown

monitor session 1 source interface tenGigabitEthernet1/1/1,ten
GigabitEthernet2/1/1 both
monitor session 1 destination interface GigabitEthernet1/0/24,
GigabitEthernet2/0/24
```

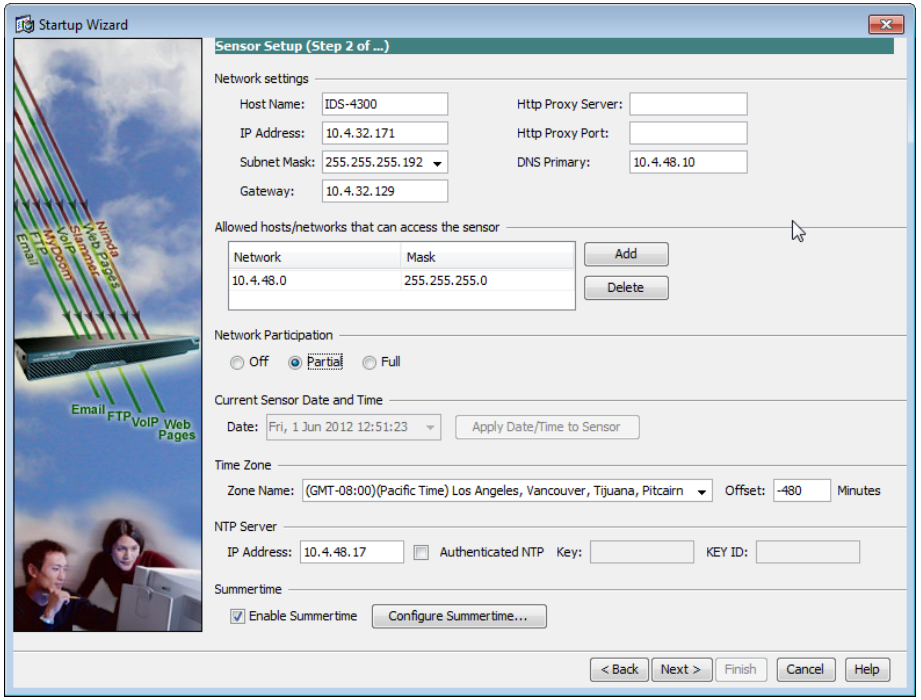
Step 2: HTTPS to the management IP address on the Cisco IPS appliance (Example: https://10.4.32.171) to launch IDM.

Step 3: Navigate to **Configuration > Sensor Setup > Startup Wizard**, and then click **Launch Startup Wizard**.

Step 4: Review the Startup Wizard Introduction, and then click **Next**.

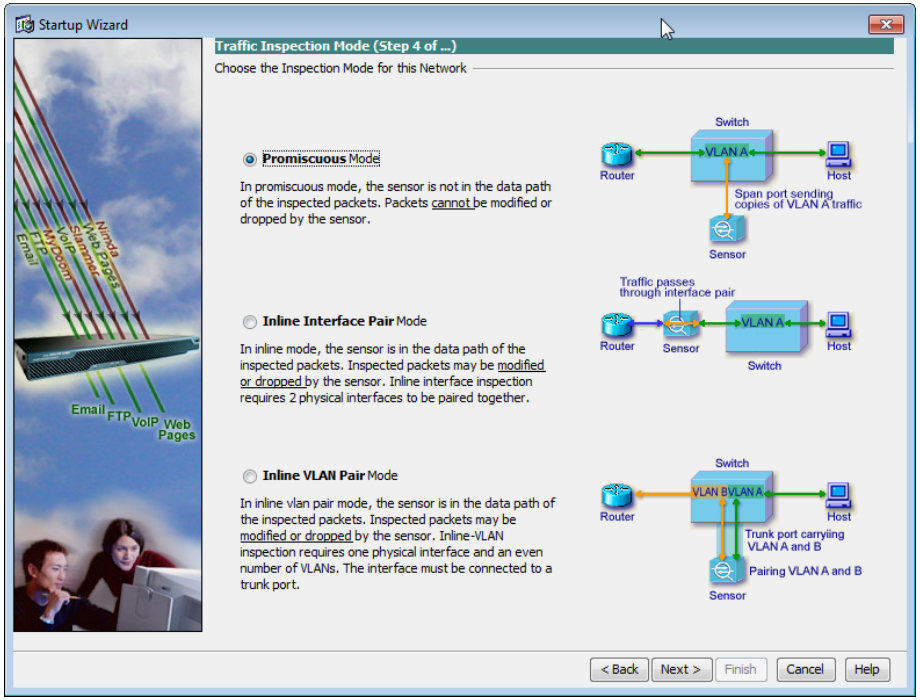
Step 5: In **Sensor Setup**, configure the DNS Primary server address, time zone, and NTP server address. If necessary for your time zone, select **Enable Summertime**.

Step 6: Verify that the **Authenticated NTP** check box is clear, and then click **Next**.



Step 7: On the **Interface Summary** page, click **Next.**

Step 8: On the Traffic Inspection Mode page, select **Promiscuous**, and then click **Next**.



Step 9: On the Interface Selection page, in the **Select Interface** drop-down list, select **GigabitEthernet0/0**, and then click **Next**.

Step 10: On the Virtual Sensors page, review the configuration, and then click **Next.**

Step 11: In this step, you will configure the IPS device to automatically pull updates from Cisco.com. On the Auto Update page, select the **Enable Signature and Engine Updates** option. Provide a valid cisco.com username and password that holds entitlement to download IPS software updates. Select **Daily**, enter a time between 12:00 AM and 4:00 AM for the update **Start Time**, and then select **Every Day**. Click **Finish**

Step 12: When asked to confirm configuration changes, click **Yes**.

Step 13: If a message indicates that a reboot is required, click **OK.**

Procedure 5 Add additional sensing interfaces

Because the appliance has multiple physical interfaces, more than one can be used to inspect traffic (either in inline or promiscuous mode). In this deployment, you will assign an additional interface on the appliance to be used for promiscuous mode as a resilient interface on the other switch in the switch stack.

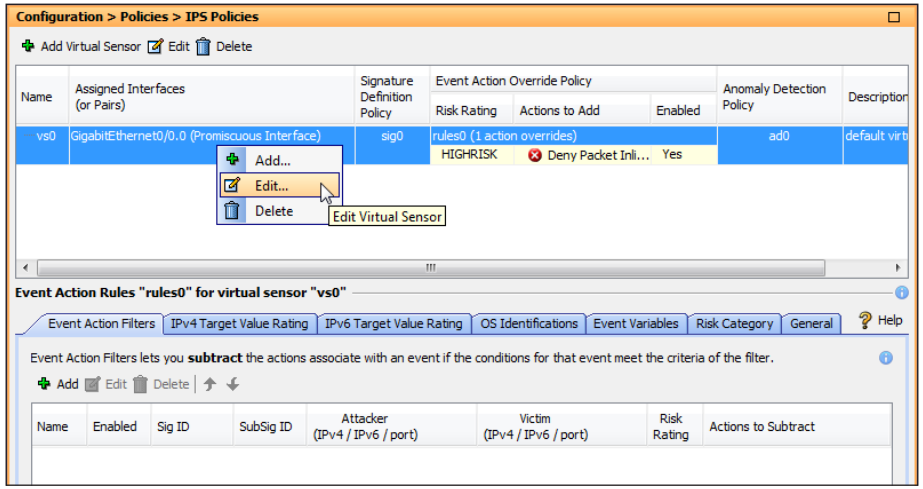
Step 1: In the IPS configuration pane of ASDM (or in IDM itself), navigate to **Configuration > Interfaces > Interfaces**.

Step 2: Select interface **GigabitEthernet 0/1**, and then click **Enable**.

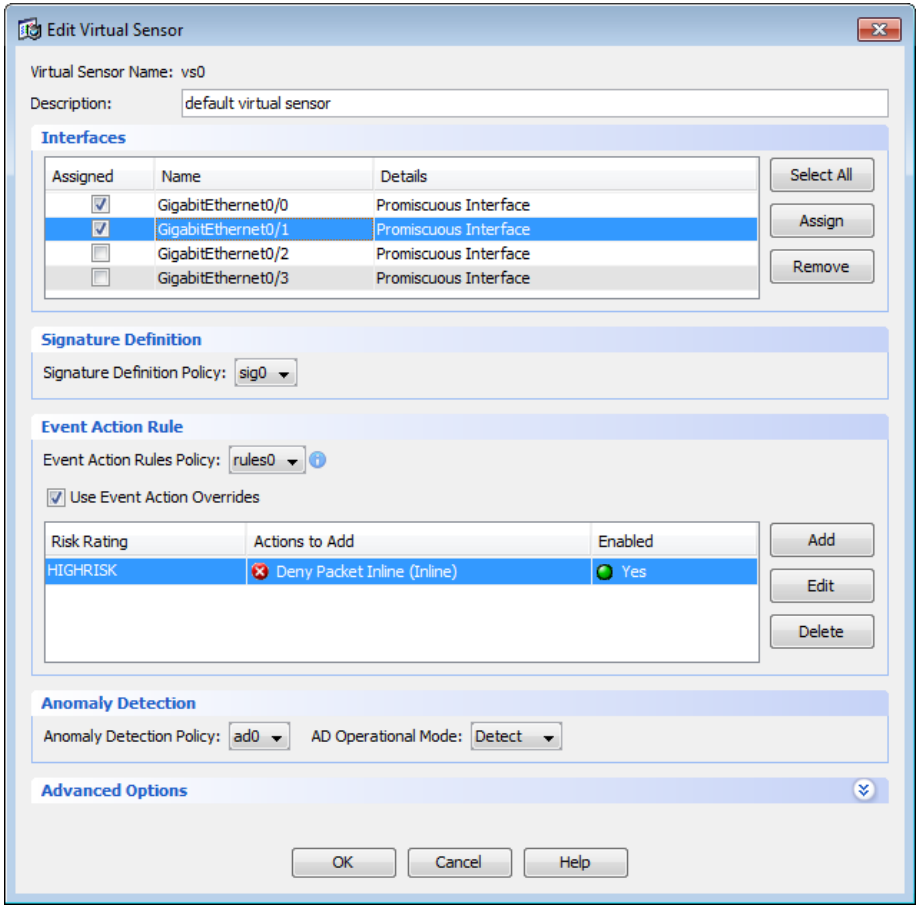
Step 3: Click **Apply**.

Step 4: Navigate to **Configuration > Policies > IPS Policies**.

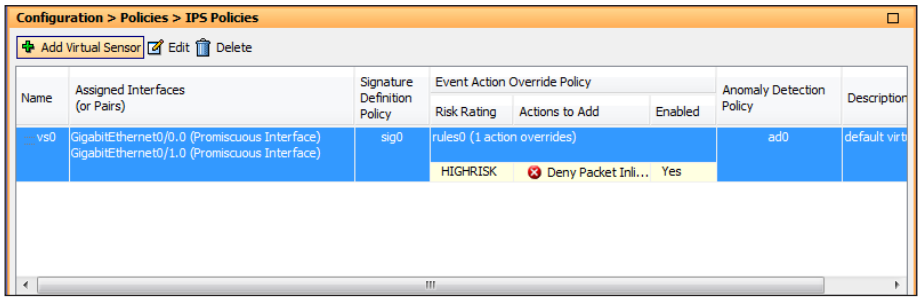
Step 5: Right click **vs0**, and then select **Edit**.



Step 6: In the Edit Virtual Sensor dialog box, for **GigabitEthernet0/1**, select the **Assigned** box, and then click **OK**.



Step 7: Click **Apply**.



Procedure 6 Modify the inline security policy

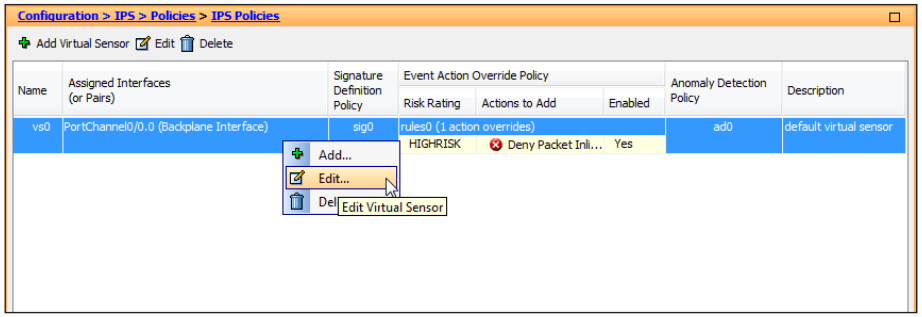
(Optional)

If you opted to run inline mode on an IPS device, the sensor is configured to drop high-risk traffic. By default, this means that if an alert fires with a risk rating of at least 90 or if the traffic comes from an IP address with a negative reputation that raises the risk rating to 90 or higher, the sensor drops the traffic. If the risk rating is raised to 100 because of the source address reputation score, then the sensor drops all traffic from that IP address.

The chances of the IPS dropping traffic that is not malicious when using a risk threshold of 90 is very low. However, if you want to adopt a more conservative policy, for the risk threshold, raise the value to 100.

Step 1: Navigate to **Configuration > IPS > Policies > IPS Policies** (when using ASDM to configure an IPS module).

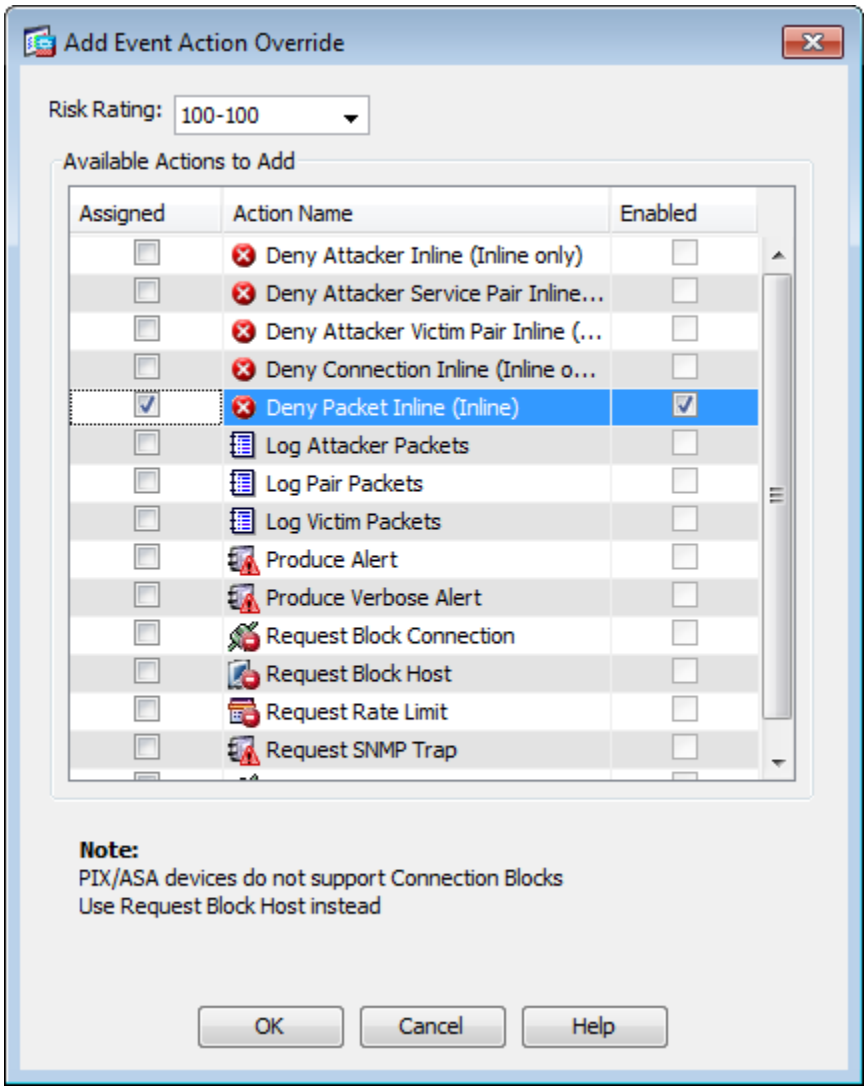
Step 2: In the Virtual Sensor panel, right-click the **vs0** entry, and then select **Edit**.



Step 3: In the Event Action Rule work pane, click **Deny Packet Inline Override**, and then click **Delete**.

Step 4: In the Event Action Rule work pane, Click **Add**.

Step 5: In the Add Event Action Override dialog box, in the **Risk Rating** list, select **100-100**, select **Deny Packet Inline**, and then click **OK**.



Step 6: Click **Apply**.

Intrusion Prevention Summary

Organizations are exposed to a large number of threats from the Internet. Cisco IPS deployed in the Internet edge of an organization or internally plays a significant role in identifying and blocking malicious traffic, and it improves the availability and security of the Internet-facing services as well as helping to identify issues and problems occurring on the LAN.

Appendix A: Product List

Internet Edge

Functional Area	Product Description	Part Numbers	Software
Firewall	Cisco ASA 5545-X IPS Edition - security appliance	ASA5545-IPS-K9	ASA 8.6(1)1 IPS 7.1(4) E4
	Cisco ASA 5525-X IPS Edition - security appliance	ASA5525-IPS-K9	
	Cisco ASA 5515-X IPS Edition - security appliance	ASA5515-IPS-K9	
	Cisco ASA 5512-X IPS Edition - security appliance	ASA5512-IPS-K9	
	Cisco ASA5512-X Security Plus license	ASA5512-SEC-PL	
	Firewall Management	ASDM	6.6.114

Internet Edge LAN

Functional Area	Product Description	Part Numbers	Software
DMZ Switch	Cisco Catalyst 3750-X Series Stackable 24 10/100/1000 Ethernet ports	WS-C3750X-24T-S	15.0(1)SE2 IP Base
Outside Switch	Catalyst 2960S 24 GigE 4 x SFP LAN Base	WS-C2960S-24TS-L	15.0(1)SE2 LAN Base

IPS

Functional Area	Product Description	Part Numbers	Software
Distribution IDS	Cisco IPS 4345	IPS-4345-K9	7.1(4)E4
	Cisco IPS 4360	IPS-4360-K9	
	Cisco IPS 4510	IPS-4510-K9	
	Cisco IPS 4520	IPS-4520-K9	

LAN Distribution Layer

Functional Area	Product Description	Part Numbers	Software
Modular Distribution Layer Virtual Switch Pair	Cisco Catalyst 6500 E-Series 6-Slot Chassis	WS-C6506-E	15.0(1)SY1 IP services
	Cisco Catalyst 6500 VSS Supervisor 2T with 2 ports 10GbE and PFC4	VS-S2T-10G	
	Cisco Catalyst 6500 16-port 10GbE Fiber Module w/DFC4	WS-X6816-10G-2T	
	Cisco Catalyst 6500 24-port GbE SFP Fiber Module w/DFC4	WS-X6824-SFP	
	Cisco Catalyst 6500 4-port 40GbE/16-port 10GbE Fiber Module w/DFC4	WS-X6904-40G-2T	
	Cisco Catalyst 6500 4-port 10GbE SFP+ adapter for WX-X6904-40G module	CVR-CFP-4SFP10G	
Modular Distribution Layer Switch	Cisco Catalyst 4507R+E 7-slot Chassis with 48Gbps per slot	WS-C4507R+E	3.3.0.SG(15.1-1SG) Enterprise Services
	Cisco Catalyst 4500 E-Series Supervisor Engine 7-E, 848Gbps	WS-X45-SUP7-E	
	Cisco Catalyst 4500 E-Series 24-port GbE SFP Fiber Module	WS-X4624-SFP-E	
	Cisco Catalyst 4500 E-Series 12-port 10GbE SFP+ Fiber Module	WS-X4712-SFP+E	
Stackable Distribution Layer Switch	Cisco Catalyst 3750-X Series Stackable 12 GbE SFP ports	WS-C3750X-12S-E	15.0(1)SE2 IP Services
	Cisco Catalyst 3750-X Series Two 10GbE SFP+ and Two GbE SFP ports network module	C3KX-NM-10G	
	Cisco Catalyst 3750-X Series Four GbE SFP ports network module	C3KX-NM-1G	

Appendix B: Configuration Example

ASA Firewall 5545-X

```
!
ASA Version 8.6(1)1
!
terminal width 511
hostname IE-ASA5545X
domain-name cisco.local
enable password 2y4FIGBVVyBLau0Q encrypted
passwd 2y4FIGBVVyBLau0Q encrypted
names
!
interface GigabitEthernet0/0
 no nameif
 no security-level
 no ip address
!
interface GigabitEthernet0/0.300
 vlan 300
 nameif inside
 security-level 100
 ip address 10.4.24.30 255.255.255.224 standby 10.4.24.29
!
interface GigabitEthernet0/1
 no nameif
 no security-level
 no ip address
!
interface GigabitEthernet0/1.1116
 description Web server DMZ connection on vlan 1116
 vlan 1116
 nameif dmz-web
 security-level 50
 ip address 192.168.16.1 255.255.255.0 standby 192.168.16.2
!
interface GigabitEthernet0/1.1117
 description Email Security Appliance DMZ connection on VLAN 1117
 vlan 1117
 nameif dmz-mail
 security-level 50
 ip address 192.168.17.1 255.255.255.0 standby 192.168.17.2
!
interface GigabitEthernet0/1.1118
 description DMVPN aggregation router connections on VLAN 1118
 vlan 1118
 nameif dmz-dmvpn
 security-level 75
 ip address 192.168.18.1 255.255.255.0
!
interface GigabitEthernet0/1.1119
 vlan 1119
 nameif dmz-wlc
 security-level 50
 ip address 192.168.19.1 255.255.255.0
!
interface GigabitEthernet0/1.1123
 description Management DMZ connection on VLAN 1123
 vlan 1123
 nameif dmz-management
 security-level 50
 ip address 192.168.23.1 255.255.255.0 standby 192.168.23.2
!
interface GigabitEthernet0/1.1128
 vlan 1128
 nameif dmz-guests
 security-level 10
 ip address 192.168.28.1 255.255.252.0
```

```
!
interface GigabitEthernet0/2
 description LAN/STATE Failover Interface
!
interface GigabitEthernet0/3
 no nameif
 no security-level
 no ip address
!
interface GigabitEthernet0/3.16
 description Primary Internet connection on VLAN 16
 vlan 16
 nameif outside-16
 security-level 0
 ip address 172.16.130.124 255.255.255.0 standby 172.16.130.123
!
interface GigabitEthernet0/3.17
 description Resilient Internet connection on VLAN 17
 vlan 17
 nameif outside-17
 security-level 0
 ip address 172.17.130.124 255.255.255.0 standby 172.17.130.123
!
interface GigabitEthernet0/4
 shutdown
 no nameif
 no security-level
 no ip address
!
interface GigabitEthernet0/5
 shutdown
 no nameif
 no security-level
 no ip address
!
interface GigabitEthernet0/6
 shutdown
 no nameif
 no security-level
 no ip address
!
interface GigabitEthernet0/7
 shutdown
 no nameif
 no security-level
 no ip address
!
interface Management0/0
 nameif IPS-mgmt
 security-level 0
 no ip address
 management-only
!
boot system disk0:/asa861-1-smp-k8.bin
ftp mode passive
clock timezone PST -8
clock summer-time PDT recurring
dns server-group DefaultDNS
 domain-name cisco.local
object network dmz-networks
 subnet 192.168.16.0 255.255.248.0
 description The Organization's DMZ network range
object network Internal-network-ISPb
 subnet 10.4.0.0 255.254.0.0
 description All Internal Networks
object network internal-network-ISPa
 subnet 10.4.0.0 255.254.0.0
 description All Internal Networks
object network internall-network-ISPb
 subnet 10.4.0.0 255.254.0.0
 description All Internal Networks
object network outside-webserver-ISPa
 host 172.16.130.100
 description Webserver on ISP A
```

```
object network dmz-webserver-ISPa
 host 192.168.16.100
 description NAT the webserver in the DMZ to the outside address
on ISP A
object network dmz-webserver-ISPb
 host 192.168.17.100
 description NAT the webserver in the DMZ to the outside address
on ISP B
object network outside-webserver-ISPb
 host 172.17.130.100
 description Webserver on ISP B
object network dmz-cvo-1
 host 192.168.18.20
object network outside-cvo-1
 host 172.16.130.2
object network dmz-dmvpn-1
 host 192.168.18.10
 description NAT the primary DMVPN hub router in the DMZ to ISP A
object network outside-dmvpn-ISPa
 host 172.16.130.1
 description DMVPN hub router on ISP A
object network dmz-dmvpn-2
 host 192.168.18.11
 description NAT the secondary DMVPN hub router in the DMZ to ISP
B
object network outside-dmvpn-ISPb
 host 172.17.130.1
 description DMVPN hub router on ISP B
object network dmz-esa-ISPa
 host 192.168.17.25
 description NAT the ESA in the DMZ to the outside address on ISP
A
object network outside-esa-ISPa
 host 172.16.130.25
 description ESA on ISP A
object network internal-dns
 host 10.4.48.10
 description DNS in the internal data center
object network internal-exchange
 host 10.4.48.25
 description Exchange server in the internal datacenter
object network internal-ntp
 host 10.4.48.17
 description NTP server in the internal data center
object network 5505-pool
 subnet 10.4.156.0 255.255.252.0
 description 5505 Teleworker Subnet
object network internal-network
 subnet 10.4.0.0 255.254.0.0
 description The organization's internal network range
object network dmz-guests-network-ISPa
 subnet 192.168.28.0 255.255.252.0
object network guest-wlc-1
 host 192.168.19.54
 description Dedicated DMZ WLC
object network internal-acs
 host 10.4.48.15
 description Internal ACS
object network internal-dhcp
 host 10.4.48.10
 description DC DHCP
object network internal-flex-WLC7500-1
 host 10.4.46.68
 description Primary  FlexConnect Controller
object network internal-flex-WLC7500-2
 host 10.4.46.69
 description Secondary FlexConnect Controller
object network internalWLC5508-1
 host 10.4.46.64
 description Primary HQ Controller
object network internalWLC5508-2
 host 10.4.46.65
 description Secondary HQ Controller
object network outside-cvo-2
```

```
 host 172.17.130.2
 description Aggregation Router to support CVO on ISP B
object network dmz-cvo-2
 host 192.168.18.21
object-group service DM_INLINE_SERVICE_1
 service-object tcp destination eq ftp
 service-object tcp destination eq ftp-data
 service-object tcp destination eq tacacs
 service-object udp destination eq ntp
 service-object udp destination eq syslog
object-group service DM_INLINE_TCP_1 tcp
 port-object eq www
 port-object eq https
object-group service DM_INLINE_SERVICE_2
 service-object esp
 service-object tcp destination eq 3389
 service-object tcp destination eq https
 service-object udp destination eq 4500
 service-object udp destination eq isakmp
object-group icmp-type DM_INLINE_ICMP_1
 icmp-object echo
 icmp-object echo-reply
object-group service DM_INLINE_SERVICE_3
 service-object esp
 service-object udp destination eq 4500
 service-object udp destination eq isakmp
object-group service DM_INLINE_SERVICE_4
 service-object tcp destination eq domain
 service-object udp destination eq domain
object-group service DM_INLINE_TCP_2 tcp
 port-object eq www
 port-object eq https
object-group network dmz-wlcs
 network-object object guest-wlc-1
object-group network internal-wlcs
 network-object object internal-flex-WLC7500-1
 network-object object internal-flex-WLC7500-2
 network-object object internalWLC5508-1
 network-object object internalWLC5508-2
object-group service DM_INLINE_SERVICE_5
 service-object tcp destination eq tacacs
 service-object udp destination eq 1812
 service-object udp destination eq 1813
object-group service DM_INLINE_SERVICE_6
 service-object 97
 service-object udp destination eq 16666
object-group service DM_INLINE_TCP_3 tcp
 port-object eq ftp
 port-object eq ftp-data
object-group service DM_INLINE_TCP_4 tcp
 port-object eq www
 port-object eq https
object-group network DM_INLINE_NETWORK_1
 network-object object dmz-networks
 network-object object internal-network
object-group service DM_INLINE_SERVICE_7
 service-object esp
 service-object tcp destination eq 8000
 service-object tcp destination eq https
 service-object udp destination eq 4500
 service-object udp destination eq isakmp
access-list global_access remark Allow Service tcp/ftp, tcp/ftp,
tcp/tacacs, udp/ntp, udp/syslogs
access-list global_access extended permit object-group DM_INLINE_
SERVICE_1 192.168.23.0 255.255.255.0 object internal-network-ISPa
access-list global_access remark Permit the DMZ to update
software over HTTP/HTTPS
access-list global_access extended permit tcp 192.168.17.0
255.255.255.0 any object-group DM_INLINE_TCP_2
access-list global_access remark Permit the mail DMZ to sync with
the internal NTP server
access-list global_access extended permit udp 192.168.17.0
255.255.255.0 object internal-ntp eq ntp
access-list global_access remark Permit the mail DMZ to do
```

```
lookups on the internal DNS
access-list global_access extended permit object-group DM_INLINE_
SERVICE_4 192.168.17.0 255.255.255.0 object internal-dns
access-list global_access remark Permit the mail DMZ to send SMTP
to the internal exchange server
access-list global_access extended permit tcp 192.168.17.0
255.255.255.0 object internal-exchange eq smtp
access-list global_access remark Permit SMTP traffic into the
email DMZ
access-list global_access extended permit tcp any 192.168.17.0
255.255.255.0 eq smtp
access-list global_access remark Allow anyone to access the
webserver in the DMZ
access-list global_access extended permit tcp any 192.168.16.0
255.255.255.0 object-group DM_INLINE_TCP_1
access-list global_access extended permit object-group DM_INLINE_
SERVICE_2 any 192.168.18.0 255.255.255.0
access-list global_access remark Allow diagnostic traffic to the
DMVPN aggregation routers
access-list global_access extended permit icmp any 192.168.18.0
255.255.255.0 object-group DM_INLINE_ICMP_1
access-list global_access remark Allow traffic to the DMVPN hub
routers
access-list global_access extended permit object-group DM_INLINE_
SERVICE_3 any 192.168.18.0 255.255.255.0
access-list global_access remark Allow WLCs to Communicate with
the Internal WLCs
access-list global_access extended permit object-group DM_INLINE_
SERVICE_6 object-group dmz-wlcs object-group internal-wlcs
access-list global_access remark Allow WLCs to Communicate with
FTP Servers
access-list global_access extended permit tcp object-group dmz-
wlcs any object-group DM_INLINE_TCP_3
access-list global_access remark Allow WLCs to Communicate with
the NTP Server
access-list global_access extended permit udp object-group dmz-
wlcs object internal-ntp eq ntp
access-list global_access extended permit object-group DM_INLINE_
SERVICE_5 object-group dmz-wlcs object internal-acs
access-list global_access extended permit udp object-group dmz-
wlcs object internal-dhcp eq bootps
access-list global_access remark Allow guest traffic to the
internet
access-list global_access extended permit ip 192.168.28.0
255.255.252.0 any
access-list global_access extended permit tcp 192.168.28.0
255.255.252.0 192.168.16.0 255.255.255.0 object-group DM_INLINE_
TCP_4
access-list global_access extended permit udp 192.168.28.0
255.255.252.0 object internal-dhcp eq bootps
access-list global_access extended deny ip 192.168.28.0
255.255.252.0 object-group DM_INLINE_NETWORK_1
access-list global_access extended permit object-group DM_INLINE_
SERVICE_7 any 192.168.18.0 255.255.255.0
access-list global_access remark Deny IP traffic from the DMZ to
any other network
access-list global_access extended deny ip object dmz-networks
any
access-list global_access remark Deny the use of telnet from
internal network to external networks
access-list global_access extended deny tcp object internal-
network-ISPa any eq telnet
access-list global_access remark Permit IP Traffic from the
internal network to external network
access-list global_access extended permit ip object internal-
network-ISPa any
access-list global_mpc extended permit ip any any
access-list WCCP_Redirect extended permit ip any any
access-list global_mpc_1 extended permit ip any any
no pager
logging enable
logging buffered informational
logging asdm informational
mtu inside 1500
```

```
mtu dmz-web 1500
mtu dmz-mail 1500
mtu dmz-dmvpn 1500
mtu dmz-wlc 1500
mtu dmz-management 1500
mtu dmz-guests 1500
mtu outside-16 1500
mtu outside-17 1500
mtu IPS-mgmt 1500
failover
failover lan unit primary
failover lan interface failover GigabitEthernet0/2
failover polltime unit msec 200 holdtime msec 800
failover polltime interface msec 500 holdtime 5
failover key *****
failover replication http
failover link failover GigabitEthernet0/2
failover interface ip failover 10.4.24.33 255.255.255.248 standby
10.4.24.34
monitor-interface inside
monitor-interface dmz-web
monitor-interface dmz-mail
monitor-interface dmz-management
monitor-interface outside-16
monitor-interface outside-17
icmp unreachable rate-limit 1 burst-size 1
asdm image disk0:/asdm-66114.bin
no asdm history enable
arp timeout 14400
!
object network Internal-network-ISPb
 nat (any,outside-17) dynamic interface
object network internal-network-ISPa
 nat (any,outside-16) dynamic interface
object network dmz-webserver-ISPa
 nat (any,outside-16) static outside-webserver-ISPa
object network dmz-webserver-ISPb
 nat (any,outside-17) static outside-webserver-ISPb
object network dmz-cvo-1
 nat (any,outside-16) static outside-cvo-1
object network dmz-dmvpn-1
 nat (any,any) static outside-dmvpn-ISPa
object network dmz-dmvpn-2
 nat (any,any) static outside-dmvpn-ISPb
object network dmz-esa-ISPa
 nat (any,outside-16) static outside-esa-ISPa
object network dmz-guests-network-ISPa
 nat (any,outside-16) dynamic interface
object network dmz-cvo-2
 nat (any,outside-17) static outside-cvo-2
access-group global_access global
!
router eigrp 100
 network 10.4.24.0 255.255.252.0
 network 192.168.16.0 255.255.248.0
 passive-interface default
 no passive-interface inside
 redistribute static
!
route outside-16 0.0.0.0 0.0.0.0 172.16.130.126 128 track 1
route outside-17 0.0.0.0 0.0.0.0 172.17.130.126 254
route outside-16 172.18.1.1 255.255.255.255 172.16.130.126 1
timeout xlate 3:00:00
timeout conn 1:00:00 half-closed 0:10:00 udp 0:02:00 icmp 0:00:02
timeout sunrpc 0:10:00 h323 0:05:00 h225 1:00:00 mgcp 0:05:00
mgcp-pat 0:05:00
timeout sip 0:30:00 sip_media 0:02:00 sip-invite 0:03:00 sip-
disconnect 0:02:00
timeout sip-provisional-media 0:02:00 uauth 0:05:00 absolute
timeout tcp-proxy-reassembly 0:01:00
timeout floating-conn 0:00:00
dynamic-access-policy-record DfltAccessPolicy
aaa-server AAA-SERVER protocol tacacs+
aaa-server AAA-SERVER (inside) host 10.4.48.15
```

```
 timeout 5
 key SecretKey
user-identity default-domain LOCAL
aaa authentication enable console AAA-SERVER LOCAL
aaa authentication ssh console AAA-SERVER LOCAL
aaa authentication http console AAA-SERVER LOCAL
aaa authentication serial console AAA-SERVER LOCAL
aaa authorization exec authentication-server
http server enable
http 10.4.0.0 255.254.0.0 inside
snmp-server host inside 10.4.48.35 community *****
no snmp-server location
no snmp-server contact
snmp-server community *****
snmp-server enable traps snmp authentication linkup linkdown
coldstart warmstart
sla monitor 16
 type echo protocol ipIcmpEcho 172.18.1.1 interface outside-16
sla monitor schedule 16 life forever start-time now
crypto ipsec ikev1 transform-set ESP-AES-256-MD5 esp-aes-256 esp-
md5-hmac
crypto ipsec ikev1 transform-set ESP-DES-SHA esp-des esp-sha-hmac
crypto ipsec ikev1 transform-set ESP-3DES-SHA esp-3des esp-sha-
hmac
crypto ipsec ikev1 transform-set ESP-DES-MD5 esp-des esp-md5-hmac
crypto ipsec ikev1 transform-set ESP-AES-192-MD5 esp-aes-192 esp-
md5-hmac
crypto ipsec ikev1 transform-set ESP-3DES-MD5 esp-3des esp-md5-
hmac
crypto ipsec ikev1 transform-set ESP-AES-256-SHA esp-aes-256 esp-
sha-hmac
crypto ipsec ikev1 transform-set ESP-AES-128-SHA esp-aes esp-sha-
hmac
crypto ipsec ikev1 transform-set ESP-AES-192-SHA esp-aes-192 esp-
sha-hmac
crypto ipsec ikev1 transform-set ESP-AES-128-MD5 esp-aes esp-md5-
hmac
crypto dynamic-map SYSTEM_DEFAULT_CRYPTO_MAP 65535 set ikev1
transform-set ESP-AES-128-SHA ESP-AES-128-MD5 ESP-AES-192-SHA
ESP-AES-192-MD5 ESP-AES-256-SHA ESP-AES-256-MD5 ESP-3DES-SHA ESP-
3DES-MD5 ESP-DES-SHA ESP-DES-MD5
!
track 1 rtr 16 reachability
telnet timeout 5
ssh 10.4.0.0 255.254.0.0 inside
ssh timeout 5
ssh version 2
console timeout 0
!
tls-proxy maximum-session 1000
!
threat-detection basic-threat
threat-detection statistics access-list
no threat-detection statistics tcp-intercept
wccp 90 redirect-list WCCP_Redirect
ntp server 10.4.48.17
webvpn
 csd image disk0:/csd_3.5.2008-k9.pkg
 anyconnect image disk0:/anyconnect-linux-3.0.07059-k9.pkg 1
 anyconnect image disk0:/anyconnect-macosx-i386-3.0.07059-k9.pkg
2
 anyconnect image disk0:/anyconnect-win-3.0.07059-k9.pkg 3
username admin password w2Y.6Op4j7clVDk2 encrypted privilege 15
!
class-map global-class
 match access-list global_mpc
class-map inspection_default
 match default-inspection-traffic
class-map global-class1
 match access-list global_mpc_1
!
!
policy-map type inspect dns preset_dns_map
 parameters
  message-length maximum client auto
  message-length maximum 512
```

```
policy-map global_policy
 class inspection_default
  inspect dns preset_dns_map
  inspect ftp
  inspect h323 h225
  inspect h323 ras
  inspect ip-options
  inspect netbios
  inspect rsh
  inspect rtsp
  inspect skinny
  inspect esmtp
  inspect sqlnet
  inspect sunrpc
  inspect tftp
  inspect sip
  inspect xdmcp
 class global-class
 class global-class1
  ips inline fail-close
!
service-policy global_policy global
prompt hostname context
no call-home reporting anonymous
call-home
 profile CiscoTAC-1
  no active
  destination address http https://tools.cisco.com/its/service/
oddce/services/DDCEService
  destination address email callhome@cisco.com
  destination transport-method http
  subscribe-to-alert-group diagnostic
  subscribe-to-alert-group environment
  subscribe-to-alert-group inventory periodic monthly
  subscribe-to-alert-group configuration periodic monthly
  subscribe-to-alert-group telemetry periodic daily
```

DMZ Switch 3750X

```
version 15.0
no service pad
service timestamps debug datetime msec localtime
service timestamps log datetime msec localtime
service password-encryption
!
hostname DMZ-3750X
!
boot-start-marker
boot-end-marker
!
!
enable secret 5 $1$YNl8$x7AuTu0NEYaEbM1oPRkDg1
!
username admin password 7 08221D5D0A16544541
aaa new-model
!
!
aaa group server tacacs+ TACACS-SERVERS
 server name TACACS-SERVER-1
!
aaa authentication login default group TACACS-SERVERS local
aaa authorization console
aaa authorization exec default group TACACS-SERVERS local
!
!
!
!
!
aaa session-id common
clock timezone PST -8 0
clock summer-time PDT recurring
switch 1 provision ws-c3750x-24
switch 2 provision ws-c3750x-24
stack-mac persistent timer 0
system mtu routing 1500
```

```
!
!
!
ip domain-name cisco.local
ip name-server 10.4.48.10
vtp mode transparent
udld enable

!
!
crypto pki trustpoint TP-self-signed-162045056
 enrollment selfsigned
 subject-name cn=IOS-Self-Signed-Certificate-162045056
 revocation-check none
 rsakeypair TP-self-signed-162045056
!
!
crypto pki certificate chain TP-self-signed-162045056
 certificate self-signed 01
  3082024C 308201B5 A0030201 02020101 300D0609 2A864886 F70D0101
04050030
  30312E30 2C060355 04031325 494F532D 53656C66 2D536967 6E65642D
43657274
  69666963 6174652D 31363230 34353035 36301E17 0D393330 33303130
30333033
  385A170D 32303031 30313030 30303030 5A303031 2E302C06 03550403
1325494F
  532D5365 6C662D53 69676E65 642D4365 72746966 69636174 652D3136
32303435
  30353630 819F300D 06092A86 4886F70D 01010105 0003818D 00308189
02818100
  ABF9F6FB D94E88B6 1B12C51F 9056324B 97446240 F269E7E5 52BD382E
D901B588
  EDD64589 C3B7197C 3681571C 7C773EF2 CD07FF17 ABE2256F 4E361E67
44BDB749
  DD588BC4 A350965B 08F54E1E CCEAD9E6 40110ECE 3078F46C 4DBBBD63
22C360BA
  44A4A30C 5E7E7758 F28A429B D9F3A413 33E38B0E 98FB827C C96238A8
35911A25
  02030100 01A37630 74300F06 03551D13 0101FF04 05300301 01FF3021
0603551D
  11041A30 18821644 4D5A2D33 37353058 612E6369 73636F2E 6C6F6361
6C301F06
  03551D23 04183016 80145462 690ED4BB 124834FB 3A6E746C BF14589E
2143301D
  0603551D 0E041604 14546269 0ED4BB12 4834FB3A 6E746CBF 14589E21
43300D06
  092A8648 86F70D01 01040500 03818100 393DB7B1 AECAFEAD A19D181C
BAEFC9DA
  5D8ECAA7 1512E5B6 336F0B54 5FBF2D22 8F3EAA0C CA1F3448 16F00909
6BC204BE
  CEEA7038 C0A3EC37 7AA24E15 903AA502 BFD5F0BC CAA44853 5B4DBD75
47F59E1A
  815D3E93 45E51538 9C3BCCE2 1E3EB1EA CA5551A2 21DDF747 8147CB2C
2A446354
  1A372F3F 3A68872A F2D13C6D 07EB0DE4
        quit
!
!
!
!
spanning-tree mode rapid-pvst
spanning-tree extend system-id
spanning-tree vlan 1116-1118 priority 24576
!
!
!
port-channel load-balance src-dst-ip
!
vlan internal allocation policy ascending
!
vlan 1116
 name DMZ-WEB
!
```

```
vlan 1117
!
vlan 1118
 name DMZ-DMVPN
!
vlan 1119
 name WLAN_Mgmt
!
vlan 1123
 name DMZ-MANAGEMENT
!
vlan 1128
 name Guest_Wireless
!
ip ssh version 2
!
!
!
!
macro name AccessEdgeQoS
 auto qos voip cisco-phone
@
macro name EgressQoS
 mls qos trust dscp
 queue-set 1
 srr-queue bandwidth share 1 30 35 5
 priority-queue out
@
!
!
interface Port-channel12
 description DMZ-WLC-Guest
 switchport trunk encapsulation dot1q
 switchport trunk allowed vlan 1119,1128
 switchport mode trunk
 logging event link-status
!
interface FastEthernet0
 no ip address
 shutdown
!
interface GigabitEthernet1/0/1
 description DMZ-WLC-Guest-1 Port 1
 switchport trunk encapsulation dot1q
 switchport trunk allowed vlan 1119,1128
 switchport mode trunk
 logging event link-status
 logging event trunk-status
 logging event bundle-status
 srr-queue bandwidth share 1 30 35 5

 priority-queue out
 mls qos trust dscp
 macro description EgressQoS
 channel-group 12 mode on
!
interface GigabitEthernet1/0/2
 description WEBSERVER
 switchport access vlan 1116
 switchport mode access
 logging event link-status
 srr-queue bandwidth share 1 30 35 5

 priority-queue out
 mls qos trust dscp
 macro description EgressQoS
 spanning-tree portfast
!
interface GigabitEthernet1/0/3
!
interface GigabitEthernet1/0/4
!
interface GigabitEthernet1/0/5
!
```

```
interface GigabitEthernet1/0/6
!
interface GigabitEthernet1/0/7
 description VPN-ASR1002-1 Gig0/0/3
 switchport access vlan 1118
 switchport mode access
 logging event link-status
 srr-queue bandwidth share 1 30 35 5

 priority-queue out
 mls qos trust dscp
 macro description EgressQoS
 spanning-tree portfast
!
interface GigabitEthernet1/0/8
!
interface GigabitEthernet1/0/9
 description CVOAGG-3945E-1 Gig0/3
 switchport access vlan 1118
 switchport mode access
 logging event link-status
 srr-queue bandwidth share 1 30 35 5

 priority-queue out
 mls qos trust dscp
 macro description EgressQoS
 spanning-tree portfast
!
interface GigabitEthernet1/0/10
!
interface GigabitEthernet1/0/11
!
interface GigabitEthernet1/0/12
!
interface GigabitEthernet1/0/13
!
interface GigabitEthernet1/0/14
!
interface GigabitEthernet1/0/15
!
interface GigabitEthernet1/0/16
!
interface GigabitEthernet1/0/17
 description OUT-2960Sa Fas0
 switchport access vlan 1123
 switchport mode access
 spanning-tree portfast
!
interface GigabitEthernet1/0/18
!
interface GigabitEthernet1/0/19
!
interface GigabitEthernet1/0/20
!
interface GigabitEthernet1/0/21
!
interface GigabitEthernet1/0/22
 description DMZ-ESAc370
 switchport access vlan 1117
 switchport mode access
 logging event link-status
 srr-queue bandwidth share 1 30 35 5

 priority-queue out
 mls qos trust dscp
 macro description EgressQoS
 spanning-tree portfast
!
interface GigabitEthernet1/0/23
!
interface GigabitEthernet1/0/24
 description IE-ASA5550a Gig0/1
 switchport trunk encapsulation dot1q
 switchport trunk allowed vlan 1116-1119,1123,1128
```

```
 switchport mode trunk
 logging event link-status
 logging event trunk-status
 srr-queue bandwidth share 1 30 35 5

 priority-queue out
 mls qos trust dscp
 macro description EgressQoS | EgressQoS | EgressQoS
!
interface GigabitEthernet1/1/1
!
interface GigabitEthernet1/1/2
!
interface GigabitEthernet1/1/3
!
interface GigabitEthernet1/1/4
!
interface TenGigabitEthernet1/1/1
!
interface TenGigabitEthernet1/1/2
!
interface GigabitEthernet2/0/1
 description DMZ-WLC-Guest-1 Port 2
 switchport trunk encapsulation dot1q
 switchport trunk allowed vlan 1119,1128
 switchport mode trunk
 logging event link-status
 logging event trunk-status
 logging event bundle-status
 srr-queue bandwidth share 1 30 35 5

 priority-queue out
 mls qos trust dscp
 macro description EgressQoS
 channel-group 12 mode on
!
interface GigabitEthernet2/0/2
 description WEBSERVER
 switchport access vlan 1116
 switchport mode access
 logging event link-status
 srr-queue bandwidth share 1 30 35 5

 priority-queue out
 mls qos trust dscp
 macro description EgressQoS
 spanning-tree portfast
!
interface GigabitEthernet2/0/3
!
interface GigabitEthernet2/0/4
!
interface GigabitEthernet2/0/5
!
interface GigabitEthernet2/0/6
!
interface GigabitEthernet2/0/7
 description VPN-ASR1002-1 Gig0/0/3
 switchport access vlan 1118
 switchport mode access
 logging event link-status
 srr-queue bandwidth share 1 30 35 5

 priority-queue out
 mls qos trust dscp
 macro description EgressQoS
 spanning-tree portfast
!
interface GigabitEthernet2/0/8
!
interface GigabitEthernet2/0/9
 description CVOAGG-3945E-2 Gig0/3
 switchport access vlan 1118
 switchport mode access
```

```
 logging event link-status
 srr-queue bandwidth share 1 30 35 5

 priority-queue out
 mls qos trust dscp
 macro description EgressQoS
 spanning-tree portfast
!
interface GigabitEthernet2/0/10
!
interface GigabitEthernet2/0/11
!
interface GigabitEthernet2/0/12
!
interface GigabitEthernet2/0/13
!
interface GigabitEthernet2/0/14
!
interface GigabitEthernet2/0/15
!
interface GigabitEthernet2/0/16
!
interface GigabitEthernet2/0/17
 description OUT-2960Sb Fas0
 switchport access vlan 1123
 switchport mode access
 spanning-tree portfast
!
interface GigabitEthernet2/0/18
!
interface GigabitEthernet2/0/19
!
interface GigabitEthernet2/0/20
!
interface GigabitEthernet2/0/21
!
interface GigabitEthernet2/0/22
!
interface GigabitEthernet2/0/23
!
interface GigabitEthernet2/0/24
 description IE-ASA5550b Gig0/1
 switchport trunk encapsulation dot1q
 switchport trunk allowed vlan 1116-1119,1123,1128
 switchport mode trunk
 logging event link-status
 logging event trunk-status
 srr-queue bandwidth share 1 30 35 5

 priority-queue out
 mls qos trust dscp
 macro description EgressQoS | EgressQoS | EgressQoS
!
interface GigabitEthernet2/1/1
!
interface GigabitEthernet2/1/2
!
interface GigabitEthernet2/1/3
!
interface GigabitEthernet2/1/4
!
interface TenGigabitEthernet2/1/1
!
interface TenGigabitEthernet2/1/2
!
interface Vlan1
 no ip address
 shutdown
!
interface Vlan1123
 description In-band management
 ip address 192.168.23.5 255.255.255.0
!
ip default-gateway 192.168.23.1
```

```
!
no ip http server
ip http authentication aaa
ip http secure-server
!
!
ip sla enable reaction-alerts
logging esm config
access-list 55 permit 10.4.48.0 0.0.0.255
!
snmp-server community cisco RO 55
snmp-server community cisco123 RW 55
tacacs server TACACS-SERVER-1
 address ipv4 10.4.48.15
 key 7 15210E0F162F3F0F2D2A
!
!
!
!
line con 0
line vty 0 4
 access-class 55 in
 exec-timeout 0 0
 transport preferred none
line vty 5 15
 access-class 55 in
 exec-timeout 0 0
 transport preferred none
!
ntp server 10.4.48.17
end
```

Outside Switch 2960S

```
version 15.0
no service pad
service timestamps debug datetime msec localtime
service timestamps log datetime msec localtime
service password-encryption
!
hostname OUT-2960S
!
boot-start-marker
boot-end-marker
!
enable secret 5 $1$5Ppb$vHrfB3souElPj8sw3s9i/1
!
username admin password 7 070C705F4D06485744
aaa new-model
!
!
aaa group server tacacs+ TACACS-SERVERS
 server name TACACS-SERVER-1
!
aaa authentication login default group TACACS-SERVERS local
aaa authorization console
aaa authorization exec default group TACACS-SERVERS local
!
!
!
!
!
aaa session-id common
clock timezone PST -8 0
clock summer-time PDT recurring
switch 1 provision ws-c2960s-24td-l
switch 2 provision ws-c2960s-24td-l
stack-mac persistent timer 0
!
!
ip domain-name cisco.local
ip name-server 10.4.48.10
vtp mode transparent
udld enable
```

```
!
!
crypto pki trustpoint TP-self-signed-2884366080
 enrollment selfsigned
 subject-name cn=IOS-Self-Signed-Certificate-2884366080
 revocation-check none
 rsakeypair TP-self-signed-2884366080
!
!
crypto pki certificate chain TP-self-signed-2884366080
 certificate self-signed 01
  3082024D 308201B6 A0030201 02020101 300D0609 2A864886 F70D0101
04050030
  31312F30 2D060355 04031326 494F532D 53656C66 2D536967 6E65642D
43657274
  69666963 6174652D 32383834 33363630 3830301E 170D3933 30333031
30303034
  31345A17 0D323030 31303130 30303030 305A3031 312F302D 06035504
03132649
  4F532D53 656C662D 5369676E 65642D43 65727469 66696361 74652D32
38383433
  36363038 3030819F 300D0609 2A864886 F70D0101 01050003 818D0030
81890281
  8100CDE0 05A73F90 39EC8403 7936B649 0D86E4A5 2E2E89D2 5F84A608
74025D7D
  4EE76C1A 67D2AA23 3F319FE2 1FC1EEA0 3889FA56 E14BAC0B 9FC7C4C7
CA588FAF
  51512C0A 8364EE7E 32AEF7ED 9F2E2F34 7960D18B 97BDAEDF FBE8CE03
56AB5E72
  06A8E0FB 01292FE2 557D6A03 1915699D 60831E4F 6796837B F99AFF28
03E33A4C
  68EB0203 010001A3 75307330 0F060355 1D130101 FF040530 030101FF
30200603
  551D1104 19301782 154F5554 2D323936 30532E63 6973636F 2E6C6F63
616C301F
  0603551D 23041830 168014BB 0761C4C5 EAFAE9B2 A6784242 EAF62A2F
AF384E30
  1D060355 1D0E0416 0414BB07 61C4C5EA FAE9B2A6 784242EA F62A2FAF
384E300D
  06092A86 4886F70D 01010405 00038181 000EDDF7 09D4444E 042EE9EA
6FD8ECA2
  850F23DA 479019E7 21FC9330 C1A52154 980C5AE5 8DC83721 F8E11639
75646249
  CEC1D84D 6B5FBC8B 6109D9C8 FE862478 FB585206 1DA4C575 4741711F
B4B4AFBF
  1E509FF4 9AC5B408 E7564D05 1111D571 83C1F4E6 DB8F19E8 E88D9F2C
9261BBF6
  89B9B56E B31EA747 EEDF5193 30727224 91
        quit
!
spanning-tree mode rapid-pvst
spanning-tree extend system-id
spanning-tree vlan 16-17 priority 24576
!
!
!
port-channel load-balance src-dst-ip
!
vlan internal allocation policy ascending
!
vlan 16
 name ISP-A
!
vlan 17
 name ISP-B
!
ip ssh version 2
!
!
!
macro name AccessEdgeQoS
 auto qos voip cisco-phone
@
macro name EgressQoS
```

```
 mls qos trust dscp
 queue-set 1
 srr-queue bandwidth share 1 30 35 5
 priority-queue out
@
!
!
interface FastEthernet0
 description DMZ-3750X Gig1/0/17
 ip address 192.168.23.6 255.255.255.0
!
interface GigabitEthernet1/0/1
!
interface GigabitEthernet1/0/2
!
interface GigabitEthernet1/0/3
!
interface GigabitEthernet1/0/4
!
interface GigabitEthernet1/0/5
!
interface GigabitEthernet1/0/6
!
interface GigabitEthernet1/0/7
!
interface GigabitEthernet1/0/8
!
interface GigabitEthernet1/0/9
!
interface GigabitEthernet1/0/10
!
interface GigabitEthernet1/0/11
!
interface GigabitEthernet1/0/12
!
interface GigabitEthernet1/0/13
!
interface GigabitEthernet1/0/14
!
interface GigabitEthernet1/0/15
!
interface GigabitEthernet1/0/16
!
interface GigabitEthernet1/0/17
!
interface GigabitEthernet1/0/18
!
interface GigabitEthernet1/0/19
!
interface GigabitEthernet1/0/20
 description VPN-ASA5525a Gig0/3
 switchport trunk allowed vlan 16,17
 switchport mode trunk
 logging event link-status
 logging event trunk-status
 srr-queue bandwidth share 1 30 35 5

 priority-queue out
 mls qos trust dscp
 macro description EgressQoS
 spanning-tree portfast trunk
!
interface GigabitEthernet1/0/21
!
interface GigabitEthernet1/0/22
!
interface GigabitEthernet1/0/23
 description ISP-A
 switchport access vlan 16
 switchport mode access
 duplex full
 spanning-tree portfast
!
interface GigabitEthernet1/0/24
```

```
 description IE-ASA5540a Gig0/3
 switchport trunk allowed vlan 16,17
 switchport mode trunk
 logging event link-status
 logging event trunk-status
!
interface GigabitEthernet1/0/25
!
interface GigabitEthernet1/0/26
!
interface TenGigabitEthernet1/0/1
!
interface TenGigabitEthernet1/0/2
!
interface GigabitEthernet2/0/1
!
interface GigabitEthernet2/0/2
!
interface GigabitEthernet2/0/3
!
interface GigabitEthernet2/0/4
!
interface GigabitEthernet2/0/5
!
interface GigabitEthernet2/0/6
!
interface GigabitEthernet2/0/7
!
interface GigabitEthernet2/0/8
!
interface GigabitEthernet2/0/9
!
interface GigabitEthernet2/0/10
!
interface GigabitEthernet2/0/11
!
interface GigabitEthernet2/0/12
!
interface GigabitEthernet2/0/13
!
interface GigabitEthernet2/0/14
!
interface GigabitEthernet2/0/15
!
interface GigabitEthernet2/0/16
!
interface GigabitEthernet2/0/17
!
interface GigabitEthernet2/0/18
!
interface GigabitEthernet2/0/19
!
interface GigabitEthernet2/0/20
 description VPN-ASA5525b Gig0/3
 switchport trunk allowed vlan 16,17
 switchport mode trunk
 logging event link-status
 logging event trunk-status
 srr-queue bandwidth share 1 30 35 5

 priority-queue out
 mls qos trust dscp
 macro description EgressQoS
 spanning-tree portfast trunk
!
interface GigabitEthernet2/0/21
!
interface GigabitEthernet2/0/22
!
interface GigabitEthernet2/0/23
 description ISP-B
 switchport access vlan 17
 switchport mode access
 spanning-tree portfast
```

```
!
interface GigabitEthernet2/0/24
 description IE-ASA5540b Gig0/3
 switchport trunk allowed vlan 16,17
 switchport mode trunk
 logging event link-status
 logging event trunk-status
!
interface GigabitEthernet2/0/25
!
interface GigabitEthernet2/0/26
!
interface TenGigabitEthernet2/0/1
!
interface TenGigabitEthernet2/0/2
!
interface Vlan1
 no ip address
 shutdown
!
ip default-gateway 192.168.23.1
no ip http server
ip http authentication aaa
ip http secure-server
!
logging esm config
access-list 55 permit 10.4.48.0 0.0.0.255
snmp-server community cisco RO 55
snmp-server community cisco123 RW 55
tacacs server TACACS-SERVER-1
 address ipv4 10.4.48.15
 key 7 00371605165E1F2D0A38
!
!
!
line con 0
line vty 0 4
 access-class 55 in
 transport preferred none
 transport input ssh
line vty 5 15
 access-class 55 in
 transport preferred none
 transport input ssh
!
ntp source FastEthernet0
ntp server 10.4.48.17
end
```

Appendix C: Changes

This appendix summarizes the changes to this guide since the previous Cisco SBA series.

- In The Firewall section, we added additional information about how to deploy the outside and DMZ switches. In the previous series, this information was not complete.
- In Intrusion Prevention, we added an IPS appliance in promiscuous mode for internal inspection. We also rewrote the technical overview to better explain the differences between IPS modules and appliances and between deploying a device in inline or promiscuous mode.

Notes

Feedback

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