CHAPTER 5

Component Assessment

This chapter discusses the function of each component and how it helps to address HIPAA compliance requirements. Each component was assessed by Verizon Business, and the full reference architecture report is available in Appendix C, "Reference Architecture Assessment Report—Cisco Healthcare Solution."

This assessment took place at a specific point in time using currently available versions of products and software.

Component Section Overview

Each component section includes the following:

- Description
- Assessment summary
- Primary function
- Design considerations
- Assessment detail

Description

A high level overview of the products, features, and capabilities with relevance to compliance.

Assessment Summary

For each component, the Assessment Summary table lists each of the HIPAA safeguards that were addressed or failed.

Table 5-1 shows an example.

Table 5-1 PHI HIPAA Assessment Summary—Cisco ISR Router

Models Assessed	
CISCO891W version c890-universalk9-mz.151-3.T.bin	
CISCO1941W-A/K9 version c1900-universalk9-mz.SPA.151-3.T.bin	
CISCO2921/K9 version c2900-universalk9-mz.SPA.151-3.T.bin	
CISCO2951/K9 version c2951-universalk9-mz.SPA.151-3.T.bin	
CISCO3945-SPE150/K9 version c3900-universalk9-mz.SPA.151-3.T.bin	
HIPAA Safeguards Addressed	
Administrative	**Standards/Implementation Specifications**
164.308	(a)(1)(i) Security Management Process
	(a)(3)(i) Authorization/Supervision
	(a)(4)(i) Access Authorization
	(a)(5)(i) Log-in Monitoring
	(a)(6)(i) Response and Reporting
Technical	**Standards/Implementation Specifications**
164.312	(a)(1) Access Control
	(b) Audit Controls
	(e)(2)(ii) Encryption
HIPAA Standards Failed	
No HIPAA standards were failed.	
HIPAA Implementation Specifications Failed	
No HIPAA implementation specifications were failed.	

Primary Function

A HIPAA-relevant description of how this device is useful in an enterprise for addressing HIPAA compliance.

Design Considerations

This section provides compliance principles as well as best practices for each technology deployed within a clinic or hospital environment.

Assessment Details

A comprehensive list of the HIPAA safeguard citations addressed including sample device configurations.

Endpoints

The endpoints layer of the solution framework addresses the components such as voice, e-mail, and physical security.

Voice

Cisco Unified Communications Manager and IP Phones

The Cisco Unified Communication Manager is a suite of voice applications, signaling control, and utilities that provide IP communications capabilities using devices such as the IP phones. It is configured as an appliance that is easy to deploy, flexible to manage, and allows robust security.

Table 5-2 PHI HIPAA Assessment Summary—Cisco IP Voice Control

Models Assessed	
Cisco Unified Communication Manager 8.5.1	
HIPAA Safeguards Addressed	
Administrative	**Standards/Implementation Specifications**
164.308	(a)(1)(i) Security Management Process
	(a)(3)(i) Authorization/Supervision
	(a)(4)(i) Access Authorization
	(a)(6)(i) Response and Reporting
	(a)(6)(ii) Security Incident Procedures
Technical	**Standards/Implementation Specifications**
164.312	(a)(i) Access Control
	(b) Audit Controls
	(c)(1) Data Integrity
HIPAA Standards Failed	
No HIPAA standards were failed.	
HIPAA Implementation Specifications Failed	
No HIPAA implementation specifications were failed.	

Primary PHI Function

The primary function of the Cisco Unified Communications Manager in a healthcare network environment is to securely manage IP phones and communications flows, as well as securing publicly accessible network jacks in clinics and hospitals.

Design Considerations

The Cisco Unified Communication Manager is used to configure all of the communications infrastructure within the enterprise including ip phones, video endpoints, recording devices and conferencing bridges. Additionally it can also configure the flow of communications throughout the network.

The design features for improving security for the Cisco Unified Communications Manager appliance include:

- Deployment as a clustered redundancy model that includes a publisher server and several subscriber servers
- Downloading and installing security patches when vulnerabilities are announced by the Cisco Product Security Incident Response Team (PSIRT)
- Implementing Transport Layer Security (TLS) messaging for secure signaling and Secure RTP (SRTP) for encrypted media throughout the enterprise
- Enabling device authentication and communication encryption using X.509 certificates that are signed by the Certificate Authority Proxy Function (CAPF) feature on the server

Best practices for Cisco Unified Communications Manager phone security are as follows:

- Disable the gratuitous ARP setting on the Cisco Unified IP Phones.
- Disabling the web access setting prevents the phone from opening the HTTP port 80; this blocks access to the phone's internal web pages.
- Disabling the PC Voice VLAN access setting in the phone configuration window prevents the devices connected to the PC port from using the voice VLAN functionality.
- Disabling the Setting Access option in the phone configuration window prevents users from viewing and changing the phone options, including the Network Configuration options, directly on the phone.
- Cisco Unified IP Phones can be configured for authentication and encryption by installing a CTL file on the phones that includes security tokens, trusted server and firewall information, and CAPF.

For more information on securing Unified Communications, see the *Cisco Unified Communications System 8.x SRND* at the following URL:
http://www.cisco.com/en/US/docs/voice_ip_comm/cucm/srnd/8x/security.html

HIPAA Assessment Detail—HIPAA Safeguards Addressed

Here is a brief on communications from the HIPAA final rule:

Treatment sessions provided via video and audio conferencing software are not covered by the Security Rule. The HIPAA Final Rule specifically states "because 'paper-to-paper' faxes, person-to-person telephone calls, video teleconferencing, or messages left on voice-mail were not in electronic form before the transmission, those activities are not covered by this rule" (page 8342). If, however, the provider records the session and saves a copy, the saved version would be subject to Security Rule provisions for data at rest. Regardless, the treatment session and all related information and documentation from it are subject to the Privacy Rule provisions. To ensure the patient's privacy during treatment sessions, clinicians should consider the use of private networks or encrypted videoconferencing software.

The HIPAA definition of electronic media is as follows:

Subpart A – General Provisions

§160-103

Electronic Media means:

(1) Electronic storage material on which data is or may be recorded electronically, including, for example, devices in computers (hard drives) and any removable/transportable digital memory medium, such as magnetic tape or disk, optical disk, or digital memory card;

(2) Transmission media used to exchange information already in electronic storage media. Transmission media include, for example, the Internet, extranet or intranet, leased lines, dial-up lines, private networks, and the physical movement of removable/transportable electronic storage media. Certain transmissions, including of paper, via facsimile, and of voice, via telephone, are not considered to be transmissions via electronic media if the information being exchanged did not exist in electronic form immediately before the transmission.

This solution validation did not include storage or recording of voice or video communications, therefore no implementation steps are shown on how to secure recorded ePHI.

All of the sample configurations shown below were used to meet the following list of satisfied controls:

- Access Control—Restrict access to ePHI data as required by HIPAA Administrative and Technical safeguards
  - §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.308(a)(3)(ii)(A) Authorization/Supervision. Implement procedures for the authorization and/or supervision of workforce members who work with ePHI or in locations where it might be accessed. Requirements addressed include: Auditing.
  - §164.308(a)(4)(ii)(B) Access authorization. Implement policies and procedures for granting access to electronic protected health information, for example, through access to a workstation, transaction, program, process, or other mechanism. Requirements addressed include: Access Control and Auditing.
  - §164.312(a)(1) Access Control. Implement technical policies and procedures for electronic information systems that maintain ePHI to allow access only to those persons or software programs that have been granted access rights as specified in §164.308(a)(4).
- Incident response—Implement security incident response as required by HIPAA Administrative safeguards.
  - §164.308(a)(6)(i) Security Incident Procedures. Implement policies and procedures to address security incidents.
  - §164.308(a)(6)(ii) Response and Reporting. Identify and respond to suspected or known security incidents; mitigate, to the extent practicable, harmful effects of security incidents that are known to the covered entity or business associate; and document security incidents and their outcomes. Requirements addressed include: Incident Response and Auditing.
- Auditing—Implement mechanisms to record and examine activity in systems that contain or use ePHI as required by HIPAA Technical safeguards.
  - §164.312(b) Audit controls. Implement hardware, software, and/or procedural mechanisms that record and examine activity in information systems that contain or use electronic protected health information. Requirements addressed include: Auditing.
  - §164.308(a)(5)(ii)(C) Log-in Monitoring. Procedures for monitoring log-in attempts and reporting discrepancies. Requirements addressed include: Access Control and Auditing.
- Integrity—Protect electronic protected health information from improper alteration or destruction as required by HIPAA Technical safeguards.

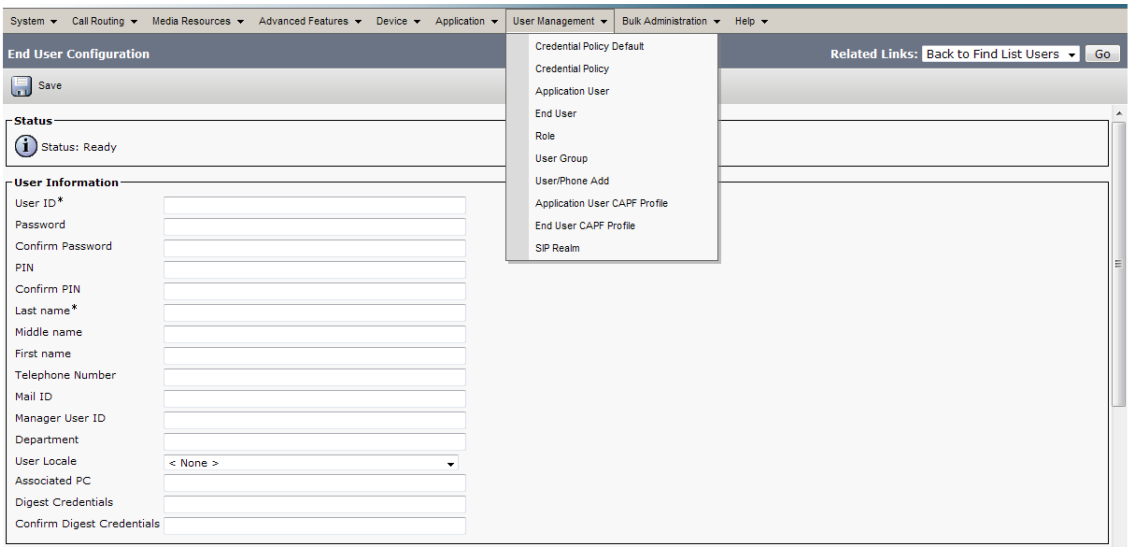
– §164.312(c)(1) Data Integrity. Implement policies and procedures to protect health information from improper alteration or destruction.

Sample Configuration

Cisco Unified Communication Manager is designed to track and monitor all administrative user access and events, thereby addressing all of the safeguards listed under Access Control above. They were met using the Cisco Unified Communication Manager's internal user database, because it has extensive features for administering users. Cisco Unified Communication Manager also supports linking to a centralized user database such as Active Directory using LDAP. Within Cisco Unified Communication Manager, individual user IDs are assigned and roles are based on group membership.

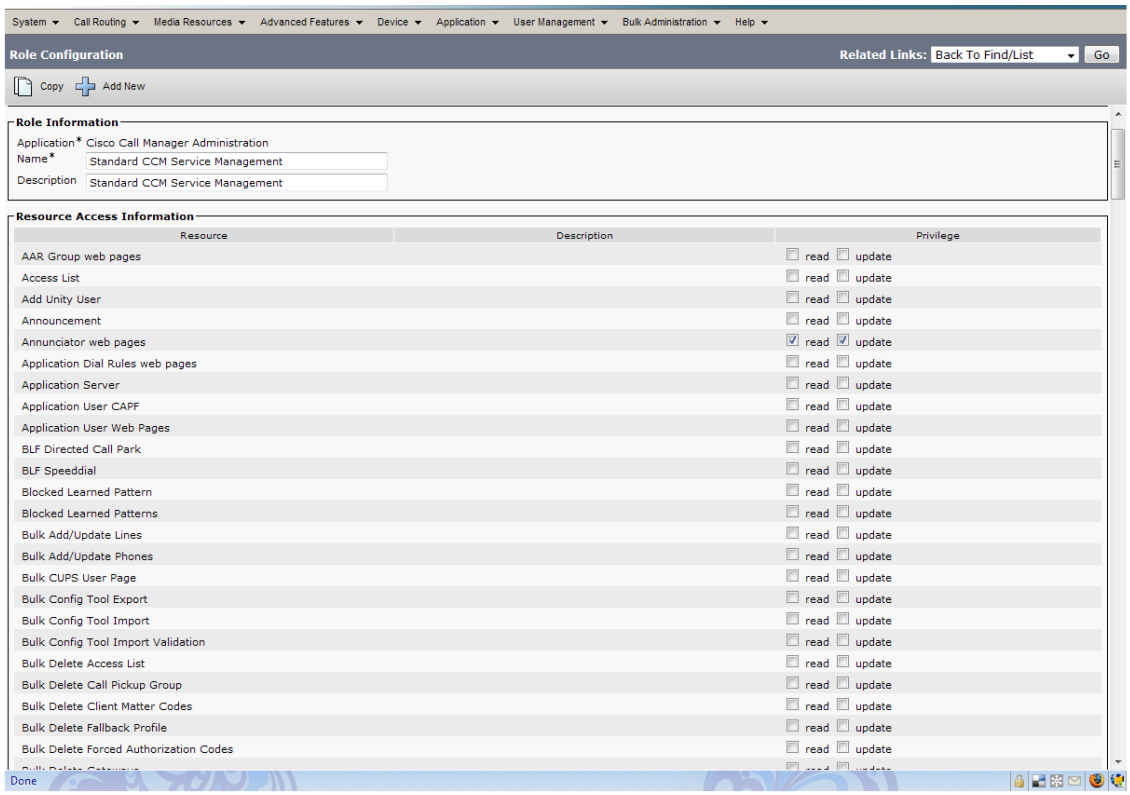
End users and administrators are added to the system by creating user IDs and passwords in the User Management section of the Cisco Unified Communication manager web interface, as shown in Figure 5-1.

Figure 5-1 End User Configuration



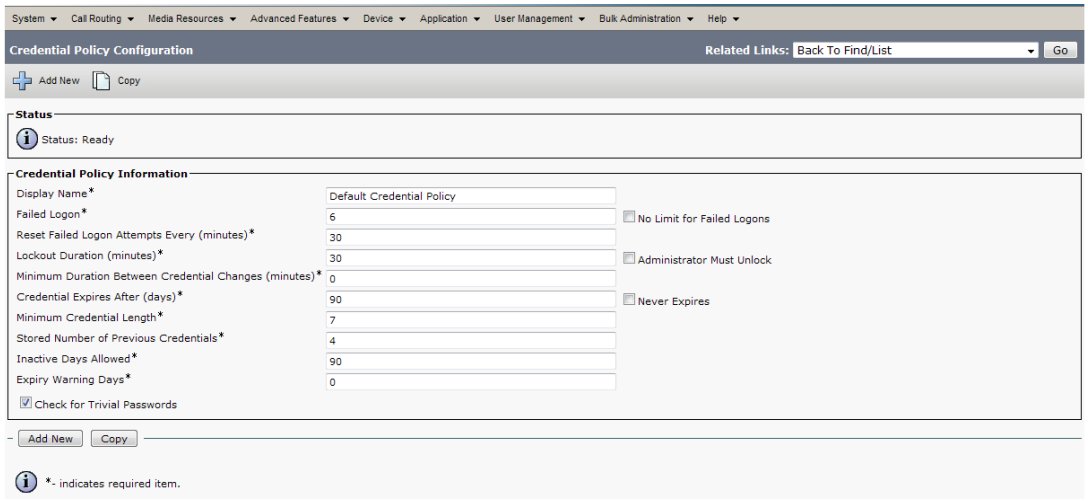
The role configuration menu in the Cisco Unified Communication Manager server allows specifying the assignment of privileges based on the role description. No systems access is permitted without an account. (See Figure 5-2.)

Figure 5-2 Role Configuration



Cisco Unified Communication Manager supports configuring a credential policy for user management and applying that policy to a designated group. Figure 5-3 shows a modified default credential policy.

Figure 5-3 User Credential Policy Configuration



The system provides trivial credential checks to disallow credentials that are easily hacked. You enable trivial credential checks by checking the Check for Trivial Passwords check box in the Credential Policy Configuration window.

Check for Trivial Passwords	Check this check box to require the system to disallow credential that are easily hacked, such as common words, repeated character patterns, and so on. The default setting checks the check box.

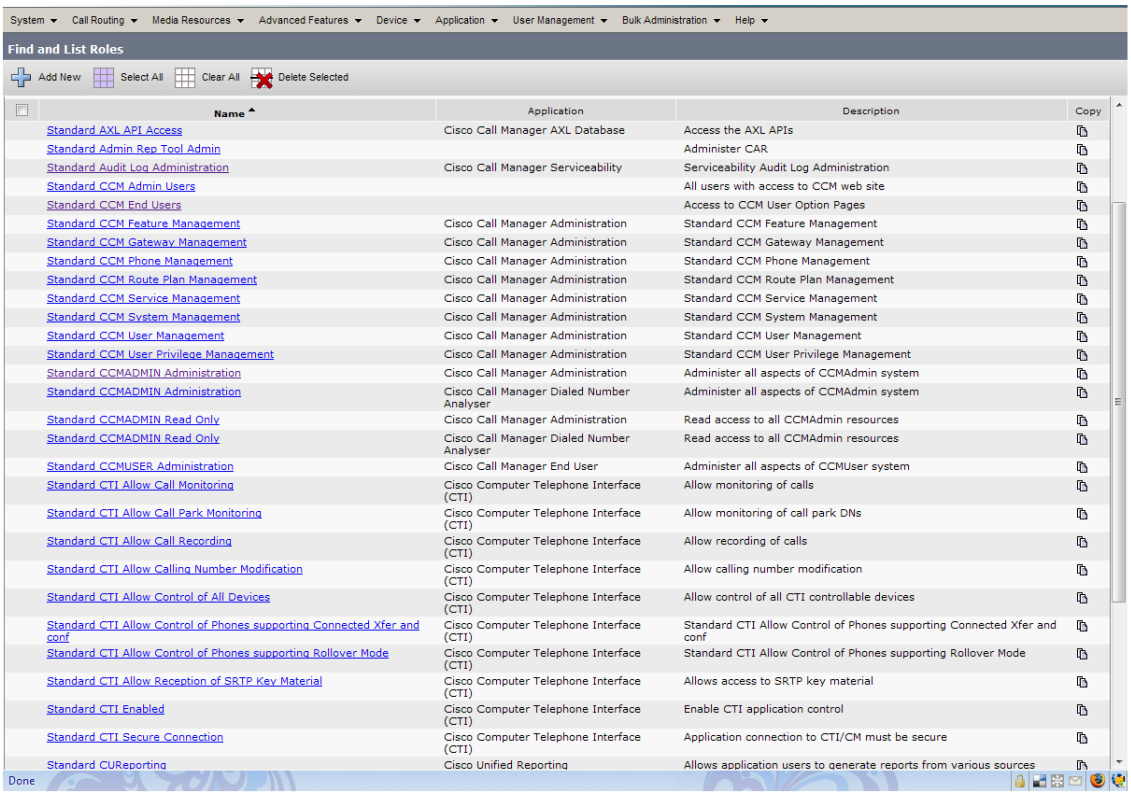
290984

Passwords can contain any alphanumeric ASCII character and all ASCII special characters. A non-trivial password meets the following criteria:

- Must contain three of the four allowable characteristics: uppercase character, lowercase character, number, and symbol.
- Must not use a character or number more than three times consecutively.
- Must not repeat or include the alias, username, or extension.
- Cannot consist of consecutive characters or numbers (for example, passwords such as 654321 or ABCDEFG)

The Cisco Unified Communication Manager uses various role definitions for permitting access to various application components on the server. (See Figure 5-4.)

Figure 5-4 Find and List Roles



290980

HIPAA Safeguard 164.312(a)(2)(ii) requires the enabling of automatic logoff options. Cisco Unified Communications Manager enforces this as part of the default system behavior. The system locks the user's session if the session has been idle for fifteen minutes, requiring the user to login again.

To address the Incident Response and Auditing HIPAA Safeguards identified above, Cisco Unified Communication Manager can be configured to send the logs to an external syslog server where it cannot be altered by the appliance users. Figure 5-5 and Figure 5-6 show the configurations necessary for log forwarding.

Figure 5-5 Enterprise Parameters Configuration

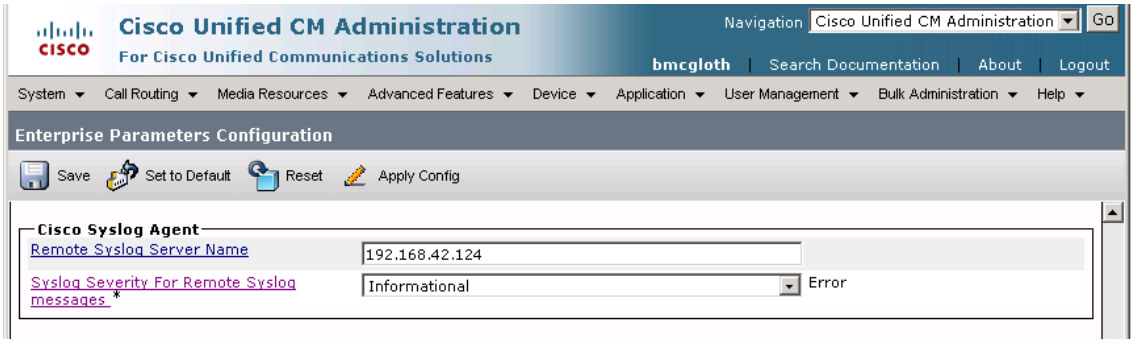
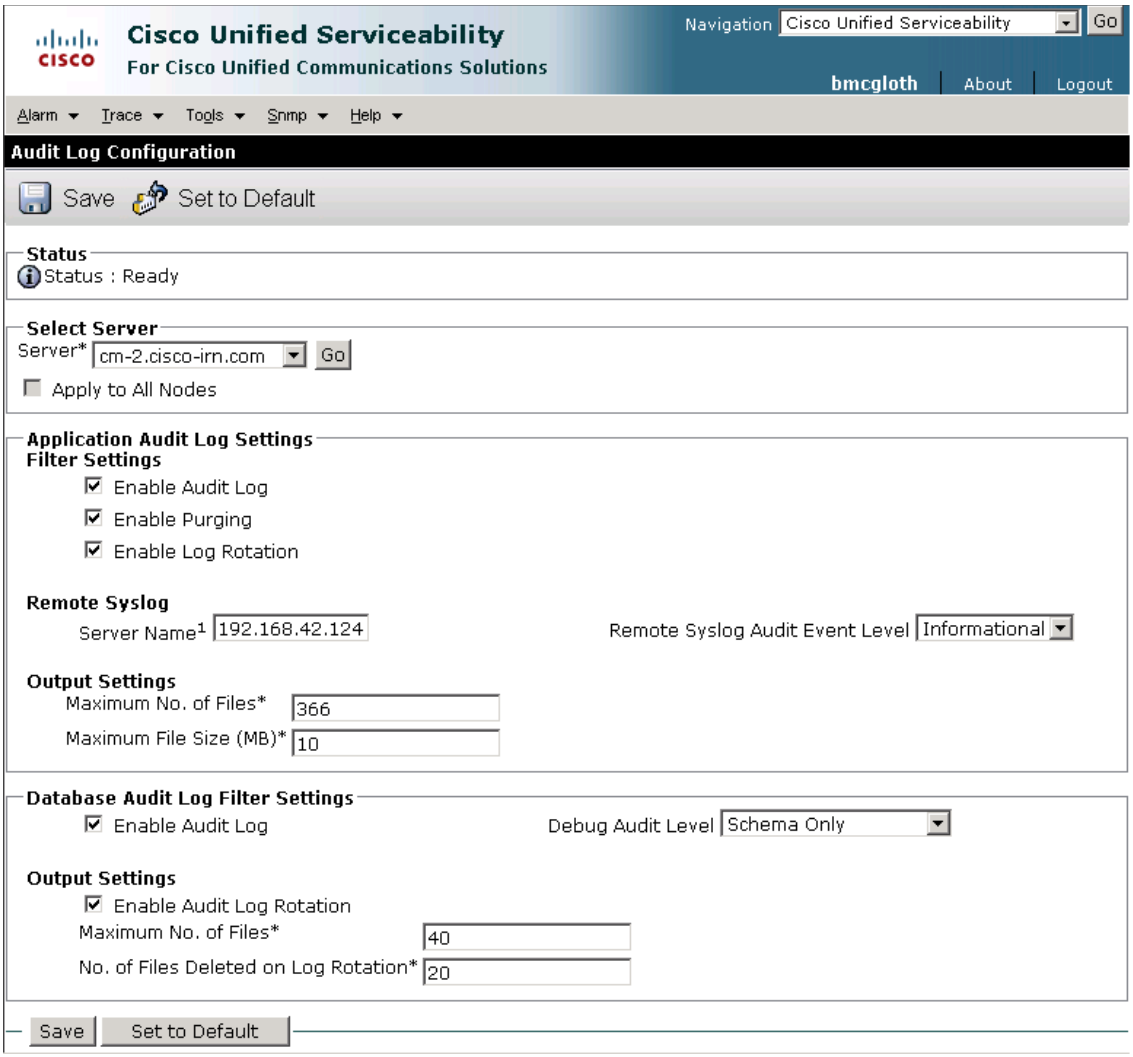


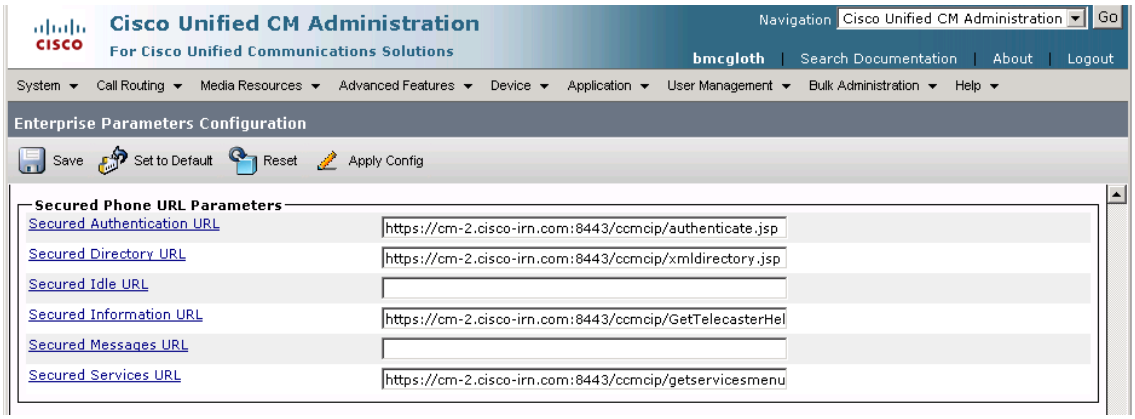
Figure 5-6 shows the necessary configuration under Cisco Unified Serviceability.

Figure 5-6 Audit Log Configuration



Within the Cisco Unified Communications Manager appliance operating system, root access to the OS is disabled and this prevents any unwanted services from being implemented. To secure authentication information and management of the server, addressing safeguard 164.308(a)(1)(i) Security Management, Telnet and HTTP access to the server for administration is disabled. The communication between phones and server over HTTP can be secured using SSL. (See Figure 5-7.)

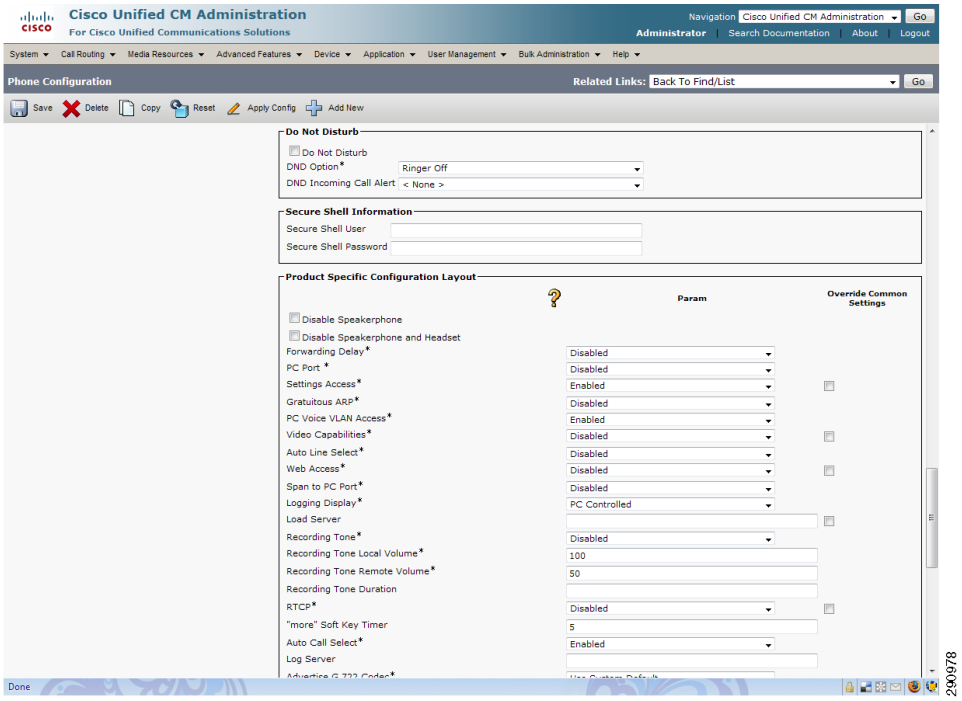
Figure 5-7 Enterprise Parameters Configuration



The Cisco Unified Communication Manager appliance does not allow changes to the operating system, or to the database or installation of unsupported hardware or of unsupported third-party software.

As a best practice, it is recommended to restrict physical and or logical access to publicly accessible network jacks. For example, areas accessible to visitors should not have network ports enabled unless network access is explicitly authorized. As Cisco IP phones include a pass-through port on them allowing a device to be connected to the network on which an IP phone resides, it is recommended to disable these ports or have them connect to a guest network segment when not intended for use on the ePHI network. Disabling the PC port can be accomplished in the phone configuration window for ports that are not in use, as shown in Figure 5-8.

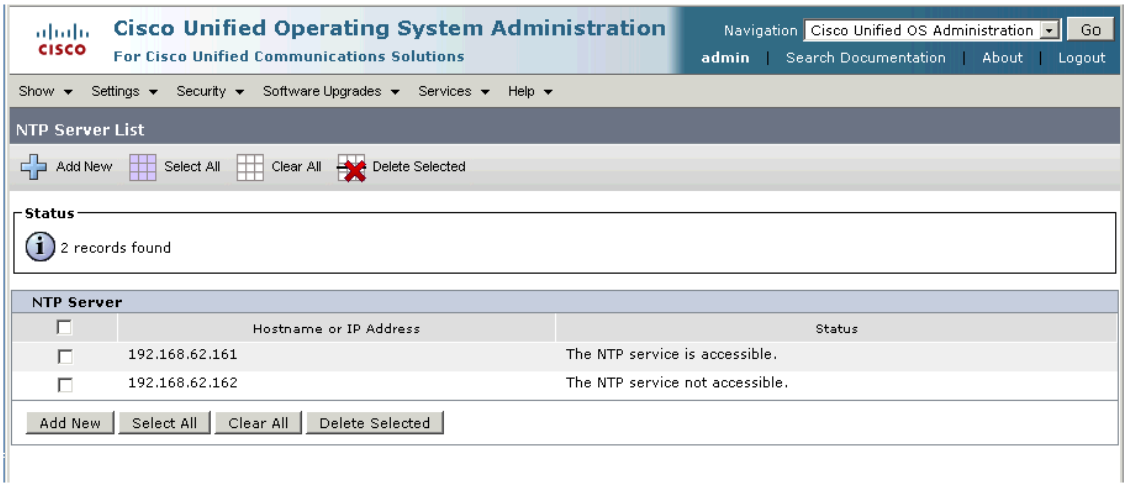
Figure 5-8 Phone Configuration



As a best practice, NTP is used to synchronize clocks among network devices. This synchronization allows events to be correlated when system logs are created and when other time-specific events occur. All devices in the network used NTP to synchronize their clocks. The NTP servers were hosted at the

data center site. The Cisco Lab uses two NTP servers that are synchronized to external reference sources. All systems and devices in the lab are pointed to these two servers. Cisco Unified Communications Manager uses NTP by configuring the NTP server, as shown in Figure 5-9.

Figure 5-9 NTP Server List



Clock synchronization is a requirement for common industry security frameworks such as the HiTrust Common Security Framework (CSF), ISO 27002, and NIST Security Publications, as well as other industry-based standards.

HIPAA Standards Failed

No HIPAA standards were failed.

HIPAA Implementation Specifications Failed

No HIPAA implementation specifications were failed.

Physical Security

Cisco Physical Security solutions provide broad capabilities in video surveillance, IP cameras, electronic access control, and groundbreaking technology that converges voice, data, and physical security in one modular platform. Cisco Physical Security solutions enable customers to use the IP network as an open platform to build more collaborative and integrated physical security systems while preserving their existing investments in analog-based technology. As customers converge physical security infrastructures and operations and begin using the IP network as the platform, they can gain significant value through rapid access to relevant information and interoperability between systems. This creates a higher level of situational awareness and allows intelligent decisions to be made more quickly.

Cisco Video Surveillance

Video surveillance technology provides security monitoring capabilities within a clinic, hospital, and data center environment. Video surveillance for loss prevention can now be extended into the area of protecting the ePHI data environment.

As the core component of Cisco's video surveillance software portfolio, the Cisco Video Surveillance Media Server offers the power and flexibility to meet a diverse range of video surveillance requirements. The media server:

- Uses IP technology to provide outstanding scalability in terms of sites, cameras, viewers, and storage
- Delivers low-latency, high-quality, event-tagged video
- Supports a broad range of cameras, codecs (such as JPEG, and MPEG-4, and H.264), viewing platforms, and network topologies
- Archives at various frame rates, durations, and locations

Quickly and effectively configure and manage video throughout your enterprise with the Cisco Video Surveillance Operations Manager (VSOM). Working in conjunction with the Cisco Video Surveillance Media Server and Cisco Video Surveillance Virtual Matrix, the Operations Manager meets the diverse needs of administrators, systems integrators, and operators by providing:

- A web-based toolkit for configuration, management, display, and control of video from a wide variety of both Cisco and third-party surveillance endpoints
- Management of a large number of Cisco Video Surveillance Media Servers, Virtual Matrixes, cameras, and users
- Flexible video recording options including motion-based, scheduled, and event-based
- Comprehensive control of users and user roles including scheduling of operator shifts, event filters, and user-specific video views
- Detailed activity reports and system audit

Table 5-3 PHI HIPAA Assessment Summary— Cisco Video Surveillance

Models Assessed	
Cisco Video Surveillance Manager version 6.3.1	
HIPAA Safeguards Addressed	
Administrative	**Standards/Implementation Specifications**
164.308	(a)(1)(i) Security Management Process
	(a)(3)(i) Authorization/Supervision
	(a)(4)(i) Access Authorization
	(a)(6)(i) Response and Reporting
	(a)(6)(ii) Security Incident Procedures
Physical	**Standards/Implementation Specifications**
164.310	(a)(1) Facility Access Controls
HIPAA Standards Failed	
No HIPAA standards were failed.	
HIPAA Implementation Specifications Failed	
No HIPAA implementation specifications were failed.	

Primary PHI Function

The primary function of video surveillance is to monitor physical access to sensitive areas within the ePHI data environment.

Design Considerations

- Ensure that cameras are positioned to monitor servers or systems within the ePHI data environment.
- Cameras should be appropriately positioned to identify personnel accessing these systems.
- Ensure adequate storage of video for three months or as specified by company policy.

For more information, see the Cisco IP Video Surveillance Guide at the following URL: http://www.cisco.com/en/US/docs/solutions/Enterprise/Video/IPVS/IPVS_DG/IPVSchap4.html

A best practices guide is available for *Securing Cisco Video Surveillance Manage*r at the following URL: http://www.cisco.com/en/US/docs/security/physical_security/video_surveillance/network/design/bestprac.html#wp62691

HIPAA Assessment Detail—HIPAA Safeguards Addressed

All of the sample configurations of Cisco Video Surveillance shown below were used to meet the following list of satisfied controls:

- Access Control—Restrict Access to ePHI Data as required by HIPAA Administrative and Technical Safeguards
  - §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.308(a)(3)(ii)(A) Authorization/Supervision. Implement procedures for the authorization and/or supervision of workforce members who work with ePHI or in locations where it might be accessed. Requirements addressed include: Auditing.
  - §164.308(a)(4)(ii)(B) Access authorization. Implement policies and procedures for granting access to electronic protected health information, for example, through access to a workstation, transaction, program, process, or other mechanism. Requirements addressed include: Access Control and Auditing.
  - §164.310(a)(1) Facility Access Control: Implement policies and procedures to limit physical access to its electronic information systems and the facility or facilities in which they are housed, while ensuring that properly authorized access is allowed.
- Auditing—Implement mechanisms to record and examine activity in systems that contain or use ePHI as required by HIPAA Technical safeguards.
  - §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.308(a)(4)(ii)(B) Access authorization. Implement policies and procedures for granting access to electronic protected health information, for example, through access to a workstation, transaction, program, process, or other mechanism. Requirements addressed include: Access Control and Auditing.
- Incident response—Implement security incident response as required by HIPAA Administrative safeguards.

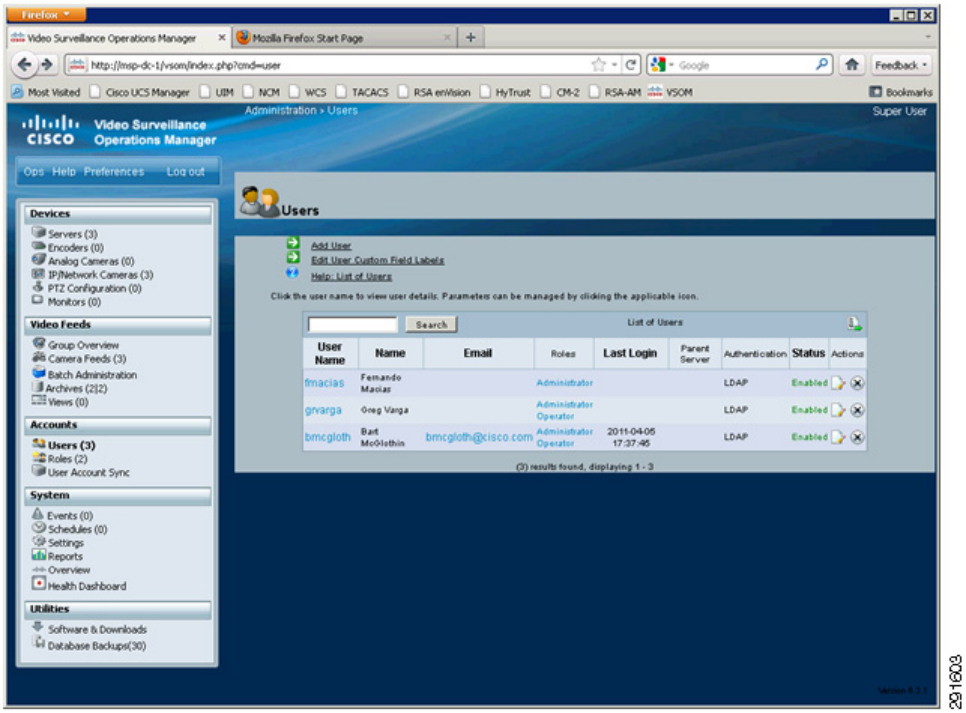
  - §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.308(a)(6)(i) Response and Reporting. Implement policies and procedures to address security incidents. Requirements addressed include: Incident Response and Auditing.
  - §164.308(a)(6)(ii) Response and Reporting. Identify and respond to suspected or known security incidents; mitigate, to the extent practicable, harmful effects of security incidents that are known to the covered entity or business associate; and document security incidents and their outcomes. Requirements addressed include: Incident Response and Auditing.

- Integrity—Protect electronic protected health information from improper alteration or destruction as required by HIPAA Technical safeguards.
  - §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.

Cisco VSOM is designed to track and monitor all administrative user access and events, thereby addressing all of the safeguards listed under Access Control above. User access throughout the solution uses a centralized user database in the Active Directory, which is linked through authentication servers via LDAP, RADIUS, and TACACS+ services, enabling verification of users and administrators of devices and endpoints. These services are located in the data center. Individual user IDs are assigned, and roles are based on group membership. The role configuration menu in the VSOM server allows specifying the assignment of privileges based on the role description. No systems access is permitted without an account.

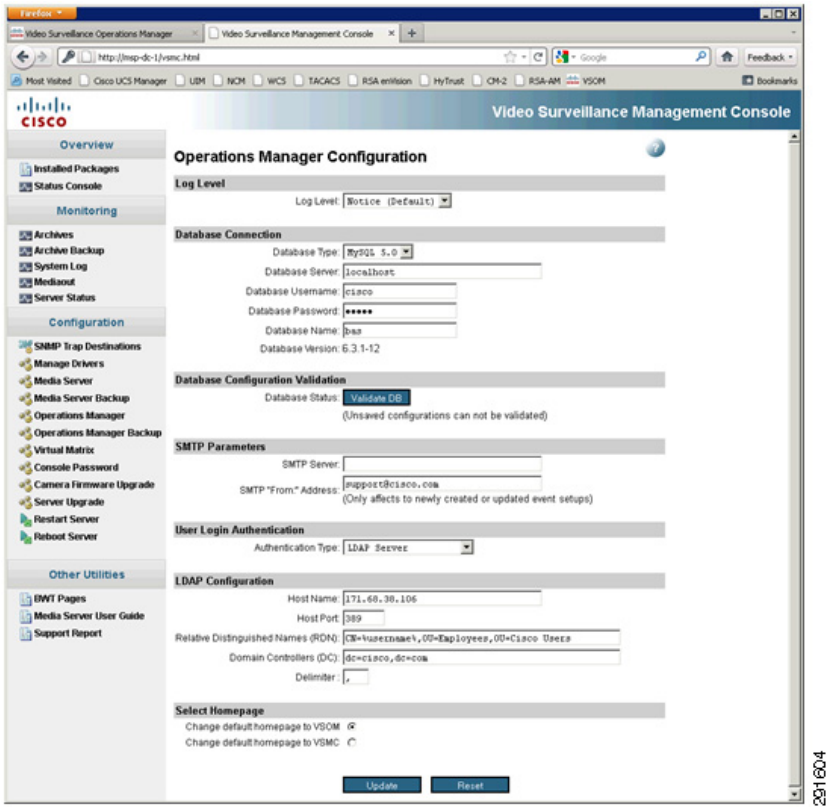
Individual users and roles are created locally and authentication directed to LDAP, as shown in Figure 5-10.

Figure 5-10 VSOM Users Authenticate to LDAP Service



Using the Video Surveillance Management Console, configure LDAP as specified in the installation guide. Figure 5-11 shows the LDAP configuration implemented for validation.

Figure 5-11 VSOM LDAP Configuration



HIPAA Safeguard 164.312(a)(2)(ii) requires the enabling of automatic logoff options. Cisco VSOM can be configured to enable session timeout and has a minimum session timeout of 30 minutes in the configuration for the version validated. To configure session timeouts navigate to Settings in the Administrator pages and select the Settings Tab.

To secure the authentication information and management of the server, addressing Safeguard 164.308(a)(1)(i) Security Management, the Cisco Video Surveillance Manager uses SSL for web-based administration and operator access, and uses SSH for remote terminal access. Use the Cisco Video Surveillance Operations Manager Secure Login feature, found within the Administrative Settings, to enable and force secure HTTPS application login. SSH access should be used to securely login to the VSM host.

To address the Incident Response and Auditing HIPAA Safeguards identified above, Cisco VSOM can be configured to send its log data to the RSA enVision log management platform. The following configuration script was implemented to send the local log files to the RSA enVision server to be secured and the integrity established:

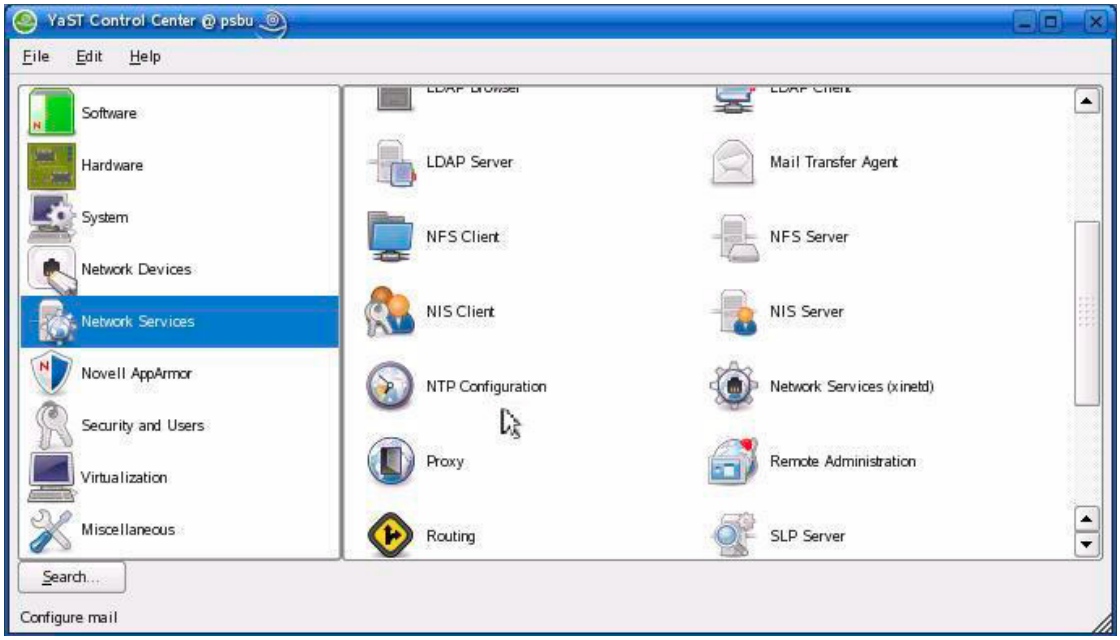
```
Directory:  /etc/cron.daily
Filename:  ftp-backup-files.cron

#!/bin/sh
FTP_USER=anonymous
FTP_PASS='vsom@cisco.com'
    localDIR="/usr/BWhttpd/bas/db/backups"
serverDIR="/vsom_backup/"
```

```
cd $localDIR
ftp -n -i 192.168.42.124   <<EOF
user $FTP_USER $FTP_PASS
binary
cd $serverDIR
mput VSOM_MSP-DC-1_backup_20$(date +%y%m%d)*.tar.gz
quit
EOF
exit 0
```

As a best practice, NTP is used to synchronize clocks among network devices. This synchronization allows events to be correlated when system logs are created and when other time-specific events occur. All devices in the network used NTP to synchronize their clocks. The NTP servers were hosted at the data center site. The Cisco Lab uses two NTP servers that are synchronized to external reference sources. All systems and devices in the lab are pointed to these two servers. Network Time Protocol (NTP) is supported and must be enabled within both the IP cameras and Video Surveillance Manager.

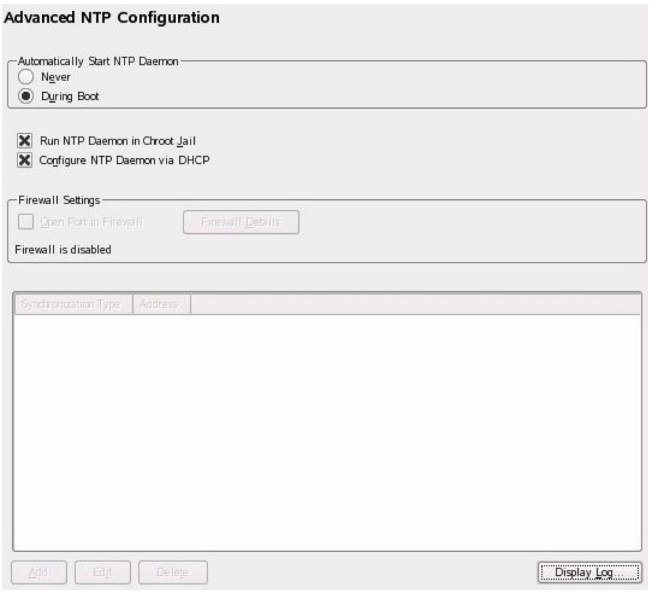
Step 1 In the YaST Control Center window, click **Network Services**, then click **NTP Configuration** in the right panel, as shown in Figure 5-12.

Figure 5-12 Accessing NTP Options



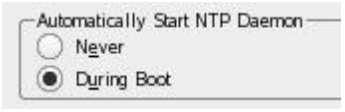
The Advanced NTP Configuration area appears, as shown in Figure 5-13.

Figure 5-13 Advanced NTP Configuration Area



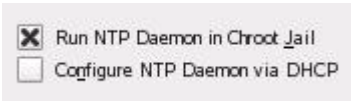
Step 2 Make sure that the During Boot radio button is selected, as shown in Figure 5-14.

Figure 5-14 Choosing the During Boot Radio Button



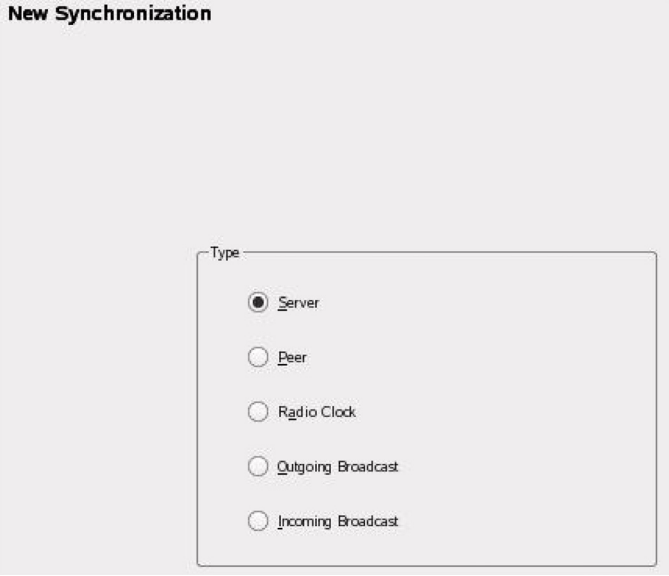
Step 3 Uncheck the **Configure NTP Daemon via DHCP** check box, as shown in Figure 5-15.

Figure 5-15 Unchecking the Configure NTP Daemon via DHCP Check Box



Step 4 Then click the **Add** button. The New Synchronization area appears, as shown in Figure 5-16.

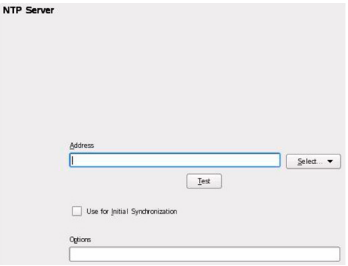
Figure 5-16 New Synchronization Area



Step 5 In the New Synchronization area, make sure that the Server radio button is selected, and click **Next**.

The NTP Server panel appears, as shown in Figure 5-17.

Figure 5-17 NTP Server Area



Step 6 In the NTP Server area, take these actions:

a. In the Address field, enter the IP address or host name of your NTP server.

b. (Optional) Click **Test** to make sure that the Multi Services Platform can access the NTP server.

c. Check the **Use for Initial Synchronization** check box.

d. Click **OK**.

e. When complete, in the Advanced NTP Configuration screen, click **Finish**.

Clock synchronization is a requirement for common industry security frameworks such as the HiTrust Common Security Framework (CSF), ISO 27002, and NIST Security Publications, as well as other industry-based standards.

HIPAA Standards Failed

No HIPAA standards were failed.

HIPAA Implementation Specifications Failed

No HIPAA implementation specifications were failed.

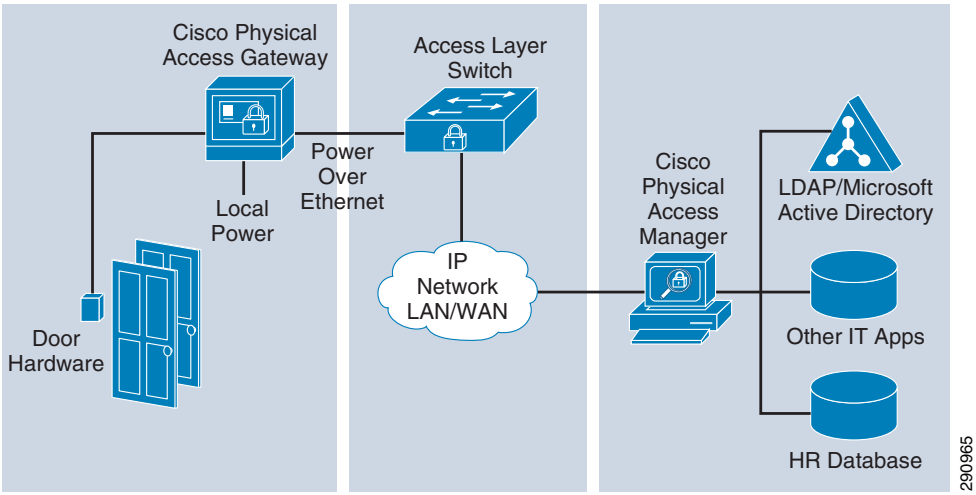
Cisco Physical Access Control

Cisco Physical Access Control allows organizations to secure their physical doors and locations. Cisco Physical Access Control addresses specific HIPAA safeguards by providing:

- Secure access to the server by supporting secure protocols such as HTTPS and also securing the accounts using strong passwords
- Role-based access to the system by making use of profiles that can restrict access to the modules, depending on the roles
- Automated backup of events to a centralized server
- Ability to archive audit reports on a centralized server

Cisco Physical Access Control is a comprehensive IP-based solution that uses the IP network as a platform for integrated security operations (see Figure 5-18). It works with existing card readers, locks, and biometric devices and is integrated with Cisco Video Surveillance Manager (VSM) and with Cisco IP Interoperability and Collaboration System (IPICS).

Figure 5-18 Scalable, Modular Architecture



Cisco Physical Access Control has two components:

- The hardware component, Cisco Physical Access Gateway, provides a modular and scalable platform to connect readers, inputs, and outputs to the system. The gateway scales from a single door to thousands of doors at a fixed cost per door.
- The software component, Cisco Physical Access Manager, manages the hardware, monitors activity, enrolls users, and integrates with IT applications and data stores.

Table 5-4 PHI HIPAA Assessment Summary—Cisco Physical Access Control

Models Assessed
Cisco Physical Access Manager version 1.2.0
HIPAA Safeguards Addressed

Table 5-4 PHI HIPAA Assessment Summary—Cisco Physical Access Control (continued)

Administrative	**Standards/Implementation Specifications**
164.308	(a)(1)(i) Security Management Process
	(a)(3)(i) Authorization/Supervision
	(a)(4)(i) Access Authorization
	(a)(6)(i) Response and Reporting
	(a)(6)(ii) Security Incident Procedures
Physical	**Standards/Implementation Specifications**
164.310	(a)(1) Facility Access Controls
HIPAA Standards Failed	
No HIPAA standards were failed.	
HIPAA Implementation Specifications Failed	
No HIPAA implementation specifications were failed.	

Primary PHI Function

The primary function of the CPAM appliance is to configure, manage, monitor, and report on the physical doors and door hardware, protecting sensitive areas within the healthcare ePHI data environment.

Design Considerations

Best practices are as follows:

- Use high availability for Cisco Physical Access Manager (PAM) servers.
- Map each branch location and identify the following:
  - Actual doors and modules
  - Door devices and module ports
- Use backup power supply for servers, modules, and devices.
- Cisco PAM was implemented following the Cisco Physical Access Manager Appliance User Guide, Release 1.2.0: http://www.cisco.com/en/US/docs/security/physical_security/access_control/cpam/1_2_0/english/user_guide/cpam_1_2_0.html

HIPAA Assessment Detail—HIPAA Safeguards Addressed

All of the sample configurations of the CPAM shown below were used to meet the following list of satisfied controls:

- Access Control—Restrict access to ePHI data as required by HIPAA Administrative and Technical safeguards
  - §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.

  - §164.308(a)(3)(ii)(A) Authorization/Supervision. Implement procedures for the authorization and/or supervision of workforce members who work with ePHI or in locations where it might be accessed. Requirements addressed include: Auditing.
  - §164.308(a)(4)(ii)(B) Access authorization. Implement policies and procedures for granting access to electronic protected health information, for example, through access to a workstation, transaction, program, process, or other mechanism. Requirements addressed include: Access Control and Auditing.
  - §164.310(a)(1) Facility Access Control: Implement policies and procedures to limit physical access to its electronic information systems and the facility or facilities in which they are housed, while ensuring that properly authorized access is allowed.
- Auditing—Implement mechanisms to record and examine activity in systems that contain or use ePHI as required by HIPAA Technical safeguards.
  - §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.308(a)(4)(ii)(B) Access authorization. Implement policies and procedures for granting access to electronic protected health information, for example, through access to a workstation, transaction, program, process, or other mechanism. Requirements addressed include: Access Control and Auditing.
- Incident response—Implement security incident response as required by HIPAA Administrative safeguards.
  - §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.308(a)(6)(i) Response and Reporting. Implement policies and procedures to address security incidents. Requirements addressed include: Incident Response and Auditing.
  - §164.308(a)(6)(ii) Response and Reporting. Identify and respond to suspected or known security incidents; mitigate, to the extent practicable, harmful effects of security incidents that are known to the covered entity or business associate; and document security incidents and their outcomes. Requirements addressed include: Incident Response and Auditing.
- Integrity—Protect electronic protected health information from improper alteration or destruction as required by HIPAA Technical safeguards.
  - §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.

Sample Configuration

Cisco PAM is designed to track and monitor all administrative user access and events, thereby addressing all of the safeguards listed under Access Control above. User access throughout the solution uses a centralized user database in the Active Directory, which is linked through authentication servers via LDAP, RADIUS, and TACACS+ services, enabling verification of users and administrators of devices and endpoints. These services are located in the data center. Individual user IDs are assigned, and roles are based on group membership.

Role-based access can be configured on Cisco PAM by making use of profiles. Profiles are pre-defined sets of access privileges that define the Cisco PAM modules and commands available to a user. For example, users that should have all privileges can be assigned to the Administrators profile.

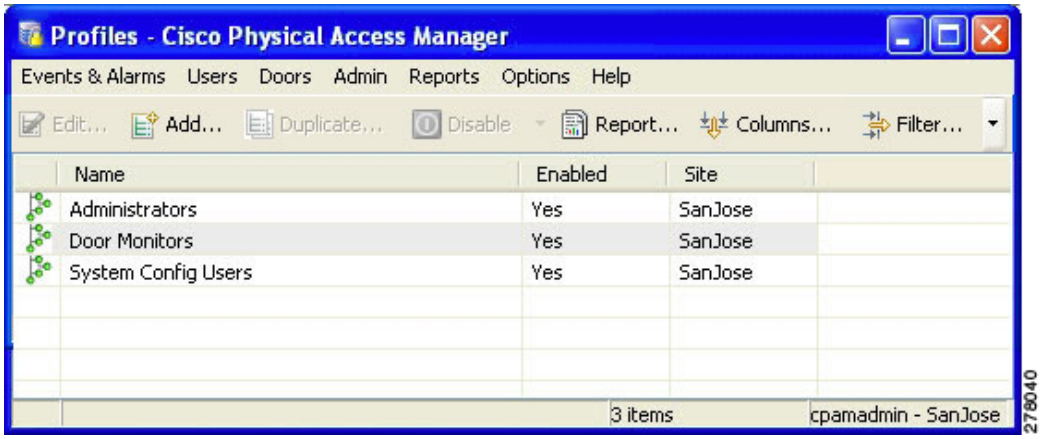
Note The Administrator profile is read-only and cannot be changed.

To create profiles, do the following:

Step 1 Select **Profiles** from the Users menu.

Step 2 To add a profile, choose Add.(See Figure 5-19.)

Figure 5-19 Profiles Module Main Window



Note To modify an existing profile, select the entry and choose **Edit**. To remove a profile, select the entry and choose **Delete**. The Administrator profile is read-only and cannot be changed.

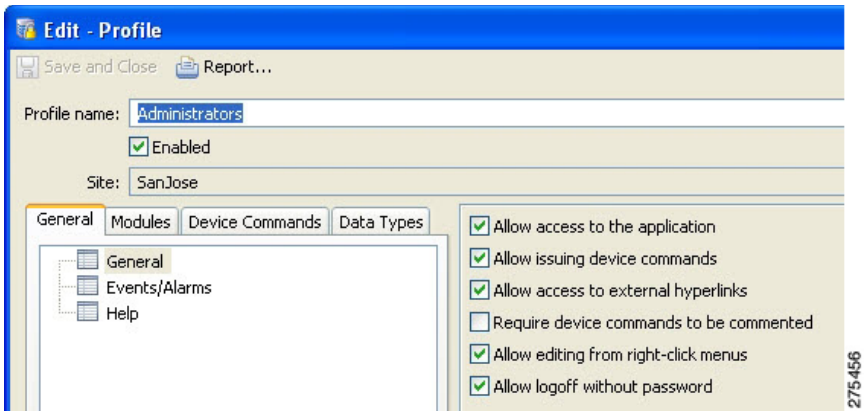
Step 3 Select a Profile template that most closely matches the desired level of user access, as shown in Figure 5-20:

- Default—A basic set of privileges is set.
- Most Restrictive—No privileges are set.
- Least Restrictive—All privileges are set.

Figure 5-20 Profile Templates

Step 4 Enter the basic profile settings, as shown in Figure 5-21.

Figure 5-21 Profile—General Tab



- Profile name—Enter a descriptive name for the profile.
- Enabled—Select the check box to enable the profile, or deselect the box to disable the profile.
- Partition—Select the partition from the drop-down menu.

Step 5 Click the **General** tab to define the basic profile properties. Click the checkbox next to each field to enable or disable the privilege, as described in Table 5-5.

Table 5-5 General Settings—Profile Module

Field	Description
General	
Allow access to the application	Allows access to the application.
Allow issuing device commands	Allows user to issue device commands directly to hardware.
Allow access to external hyperlinks	Allows access to external hyperlinks.
Require device commands to be commented	Requires the user to enter a comment with each device command issued in the system.
Allow editing from right-click menus	Allows access to the right-click the Edit menu.
Allow logoff without password	Allows user to logoff without a password.
Events/Alarms: Alarm Annotations (Ack., Clear, Comment)	
Allow annotations	Allows user to acknowledge, clear, and comment alarms. Click the **Filter** button to define the events that trigger the action.
Allow multiple annotations	Allows the user to acknowledge, clear, and comment multiple alarms at one time.
Allow clearing of unacknowledged alarms	Allows the user to clear unacknowledged alarms from active devices.
Allow clearing of active device alarms	Allows the user to clear alarms from active devices.
Events/Alarms—On new alarms	
Open Alarms Module	The **Alarms** module automatically opens with new system alarms. Click the **Filter** button to define the events that trigger the action.

Table 5-5 General Settings—Profile Module (continued)

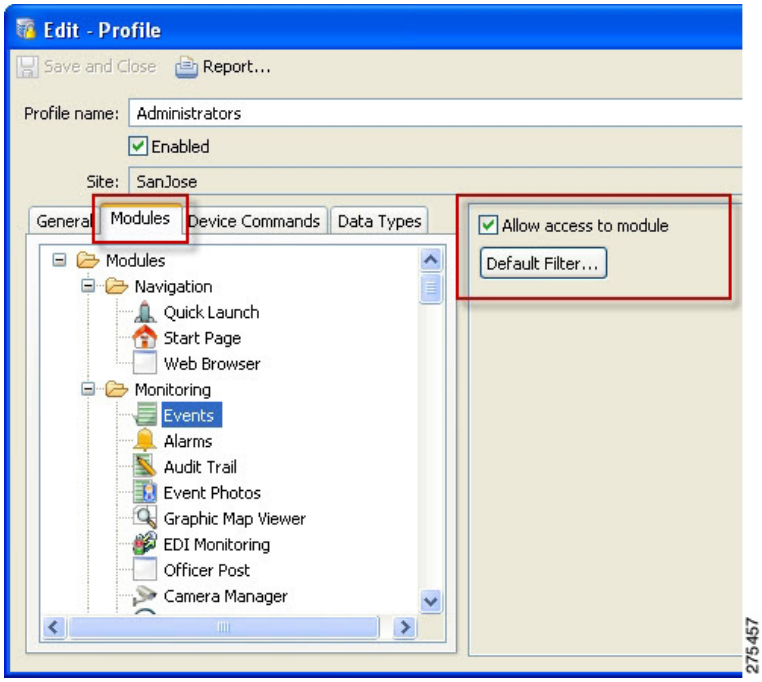
Open Manage Alarm window	The **Alarms** module automatically opens with new system alarms. Click the **Filter** button to define the events that trigger the action.
Open graphic map	The **Graphic Map** module automatically opens with new system alarms. Click the **Filter** button to define the events that trigger the action.
Show recorded video	Displays recorded video with new system alarms. Click the **Filter** button to define the events that trigger the action.
Show live video	Displays live video with new system alarms. Click the **Filter** button to define the events that trigger the action.
Help—Defines access to the various help systems	
Allow access to help documentation	Allows access to help documentation.
Enable context menu in help browser	Allows the user to view the help context menu.
Allow access to help PDF	Allows the user to access the help PDF. Adobe PDF viewer is required.

Step 6 Click the **Modules** tab to define the modules accessible to the profile, as shown in Figure 5-22.

a. Select a Cisco PAM module.

b. Select **Allow access to module** to enable access to the module.

Figure 5-22 Profile—Modules Tab



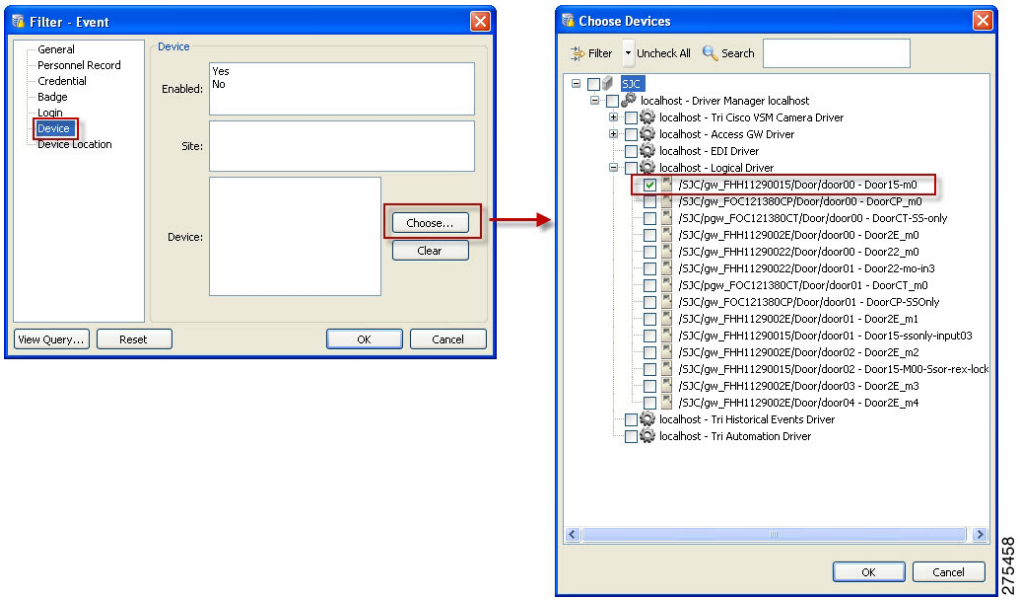
c. (Optional) Use the **Default Filter** with modules such as Event, Badge, and Personnel to define the filter applied when a user opens the module.

For example, to create a profile with access to the Events module that displays events for a specific door by default, complete the following sample steps:

1. Create a profile with access to the Events module, as described in the previous steps.
2. Click **Default Filter**, as shown in Figure 5-22.
3. Select the **Device** tab, as shown in Figure 5-23.
4. Click **Choose**.

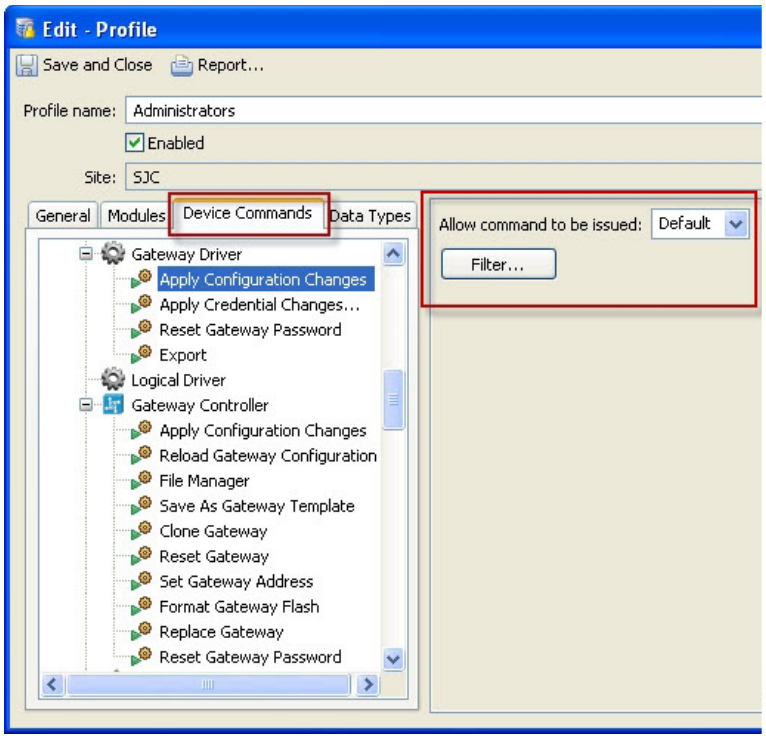
   In the Choose Devices window, expand the Logical Driver device tree and select a door (Figure 5-23).
5. Click **OK** to save the changes and close the windows.

Figure 5-23 Default Filter: Device Settings



Step 7 Click the **Device Commands** tab to define the hardware configuration commands available to the user (see Figure 5-24).

Figure 5-24 Profile—Device Commands Tab



a. Expand or collapse the list of commands for a device.

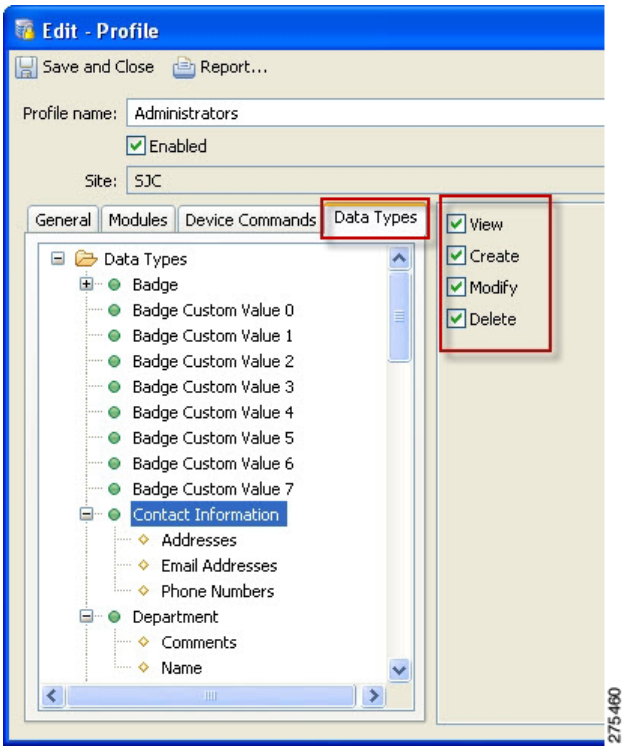
b. Highlight a command.

c. Select the following options:

- Allow command to be issued:
  - Default—If user has access to issue device commands, the command access is enabled by default.
  - No—Denies access to the command.
  - Yes—Allows access to the command.
- Filter—Apply a filter to limit the devices for the command.

Step 8 Click the **Data Types** tab to define the data available to the profile, as shown in Figure 5-25.

Figure 5-25 Profile—Data Types Tab



a. Select a module and the type of data in the list.

b. To restrict the data, click the check boxes for the properties listed in Table 5-6.

Table 5-6 Profile—Data Types

Field	Description
View	Allows the user to view the selected data type.
Create	Allows the user to add and create the selected data types.
Modify	Allows the user to modify existing data.
Delete	Allows the user to delete data.
Default Filter...	Allows the user to apply a default filter to limit objects from view.

Step 9 Click **Save and Close** to save the profile settings.

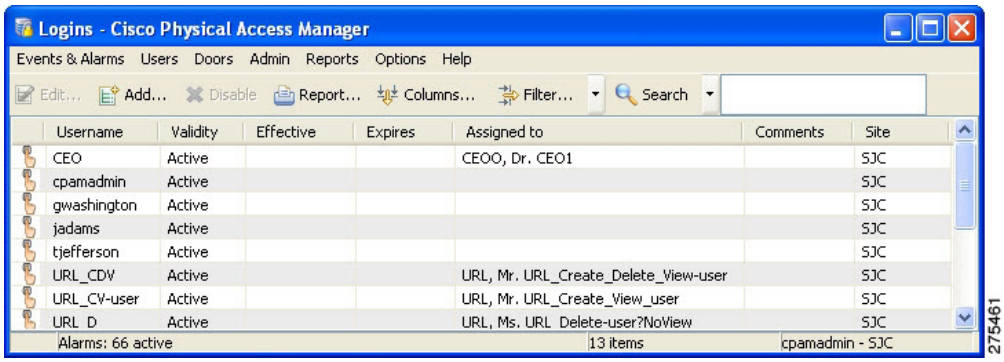
Step 10 Assign the profile to one or more Cisco PAM operators using the Logins module. (See the following section).

Creating User Login Accounts and Assigning Profiles

To give users access to Cisco PAM functionality, create a login account and assign one or more access profiles to the username.

Step 1 Select **Logins** from the Users menu. The main window (Figure 5-26) lists all the usernames in the system.

Figure 5-26 Logins Module Main Window



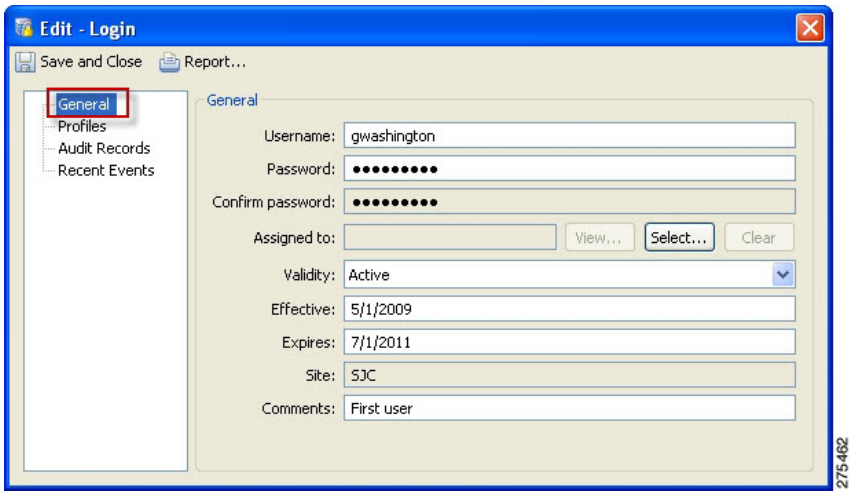
Step 2 To add a login, choose **Add**.

- To modify an existing login, select the entry and choose **Edit**.
- To remove a login, select the entry and choose **Delete**.

Note Most properties of the *cpamadmin* login are read-only.

Step 3 Complete fields in the General tab, as shown in Figure 5-27. Table 5-7 describes the field properties.

Figure 5-27 Logins Module—General Tab



Note The Username, Password, and Confirm password fields are required.

Table 5-7 General Tab Fields

Field	Description
Username	Required—The username of the login.
Password	Required—Password to access the system.
Confirm password	Required—The value must be entered exactly as it was in the Password field.

Table 5-7 General Tab Fields

Assigned to	The personnel record the login is assigned to. If the login is for an operator already entered in the Personnel module, click the **Select...** button. For more information on adding personnel to the system, see Chapter 8, "Configuring Personnel and Badges" of the CPAM User guide.
Validity	Active or Inactive—Only active accounts can access the system.
Effective	The beginning date the user can log in—If left blank, the user can log in immediately.
Expires	The day the login expires and access is denied—If left blank, access is allowed indefinitely.
Site	Read-only—A site is a single instance of a Cisco PAM database.
Comments	Comments or notes about the login.

Step 4 Assign access privileges for the login:

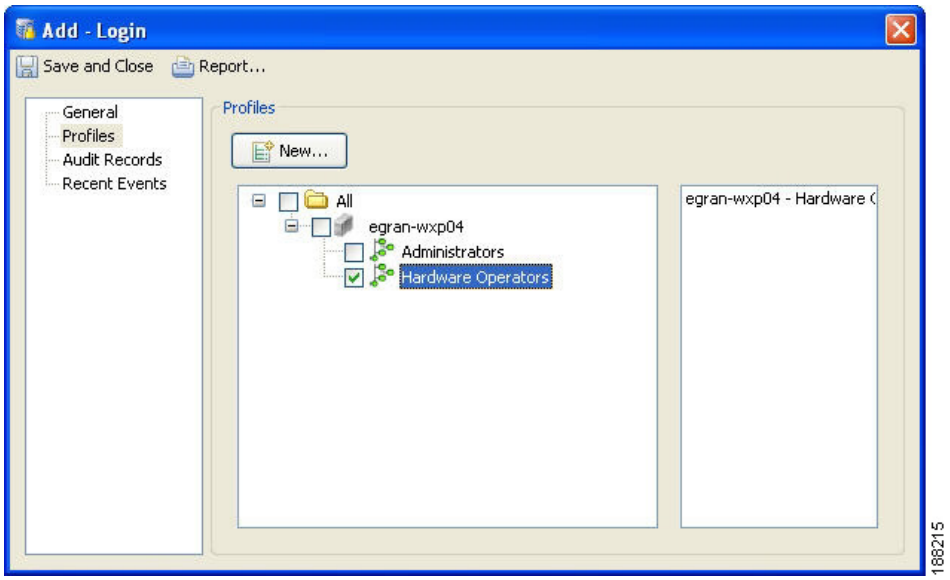
a. Select the **Profiles** tab, as shown in Figure 5-28.

b. Select the checkbox next to each profile to enable or disable access rights as defined by the access profile. For more information, see Defining User Profiles for Desktop Application Access.

c. Click **Save and Close** to save the changes and close the window.

Tip To create a new access profile, click the New button to open the Profiles module and refer to Defining User Profiles for Desktop Application Access.

Figure 5-28 Assigning One or More Profiles



Step 5 To verify the changes, log off and then log in with the new username and password. Verify that you can access the modules and functions specified by the assigned profiles.

Cisco PAM has a default policy of "Deny-all". If a specific badge has to get access to certain set of doors, an access policy must be created.

Cisco PAM supports authentication through LDAP. Because LDAP supports this feature, Cisco supports the methods listed above.

Configuring LDAP User Authentication on Cisco PAM

To authenticate users using a Lightweight Directory Access Protocol (LDAP) server, do the following:

1. Configure the LDAP Server
2. Create the LDAP User Account in Cisco PAM

Configure the LDAP Server

Enter the LDAP server settings to configure the LDAP server connection and user authentication, as described in the following steps.

Step 1 Select **System Configuration** from the Admin menu, and then select the **LDAP** tab.

Step 2 Enter the LDAP user authentication settings. The LDAP configuration depends on the authentication mode:

- User principal name (recommended method)—The user principal name is unique in the organization.
- sAMAccountName—The sAMAccount username is unique only in the search domain.

LDAP uses a principle to authenticate. The principle is formed from the username: prefix + username + suffix. The exact format of the principle varies based on the type of LDAP server, and the domain.

For OpenLDAP, the prefix should be: uid=
The suffix should be changed to reflect the actual domain.
So for my-domain.com, this would be:
,dc=my-domain, dc=com

For more information, see the following:

- LDAP Example: User Principal Name
- LDAP Example: sAMAccountName

Step 3 Enter the other LDAP server settings, as listed in Table 5-8.

Table 5-8 LDAP System Configuration Settings

Field	Description
Enable LDAP	Click the checkbox to enable or disable LDAP support.
LDAP server URL	URL of LDAP server, must begin with ldap:// Example: ldap://192.168.1.1:389 **Note** 389 is the port number.
Principle suffix	Appended to the username for authentication. See above.
Principle prefix	Prepended to the username for authentication. See above.

Table 5-8 LDAP System Configuration Settings (continued)

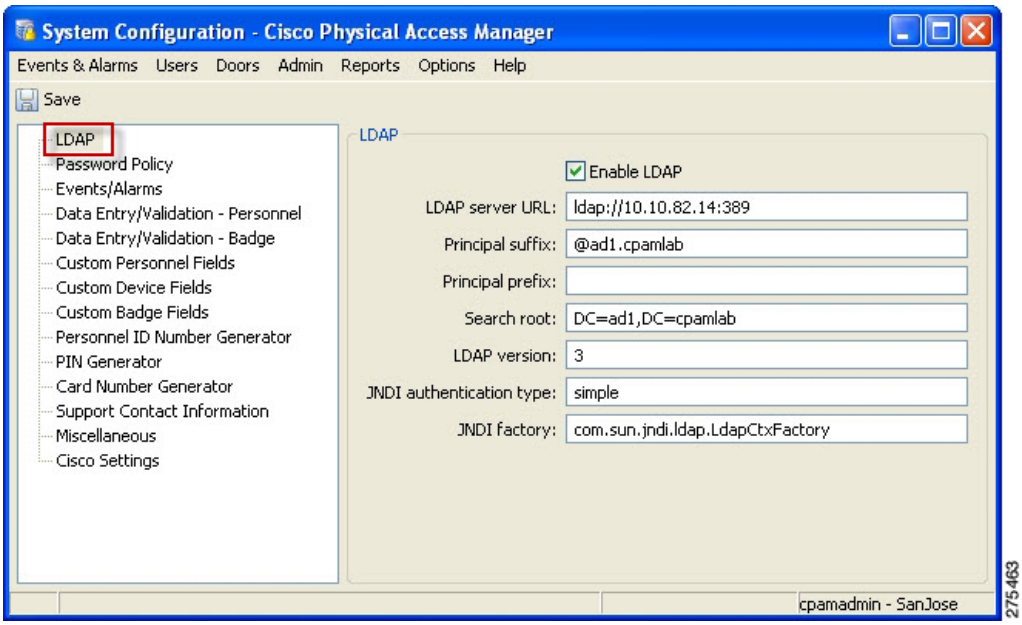
Search root	LDAP search root. The search root is the node in the LDAP tree, the subtree under which the user account should be found. • For Active Directory, the dc components should be changed to match the full domain name managed by the directory. The following example is for my-domain.com: cn=Users, dc=my-domain, dc=com. • For OpenLDAP, the 2 dc components should be changed to match the full domain name managed by the directory. The following example is for my-domain.com:dc=my-domain,dc=com.
LDAP version	An advanced setting that generally should be left unchanged.
JNDI authentication type	An advanced setting that generally should be left unchanged as simple.
JNDI factory	An advanced setting that generally should be left unchanged as com.sun.jndi.ldap.LdapCtxFactory

Step 4 Log out and log back in to the Cisco PAM application to enable the changes (select **Logout** from the Options menu).

LDAP Example—User Principal Name

In the example shown in Figure 5-29, the user principal name is *cpsm.user@ad1.cpamlab*. The Cisco PAM user login must be the same (*cpsm.user*).

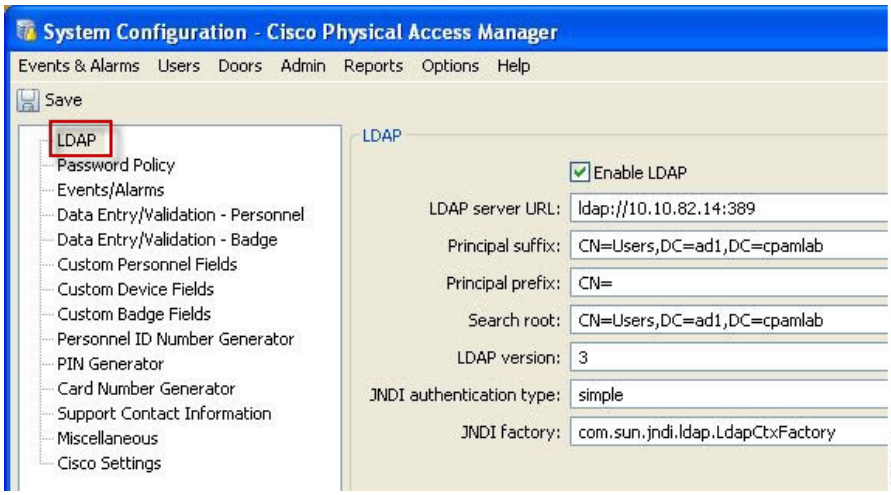
Figure 5-29 User Principal LDAP Configuration Example



LDAP Example—sAMAccountName

In the example shown in Figure 5-30, the user login is the same as the samaccount name (*cpsmuser*).

Figure 5-30 sAMAccountName—LDAP Configuration Example

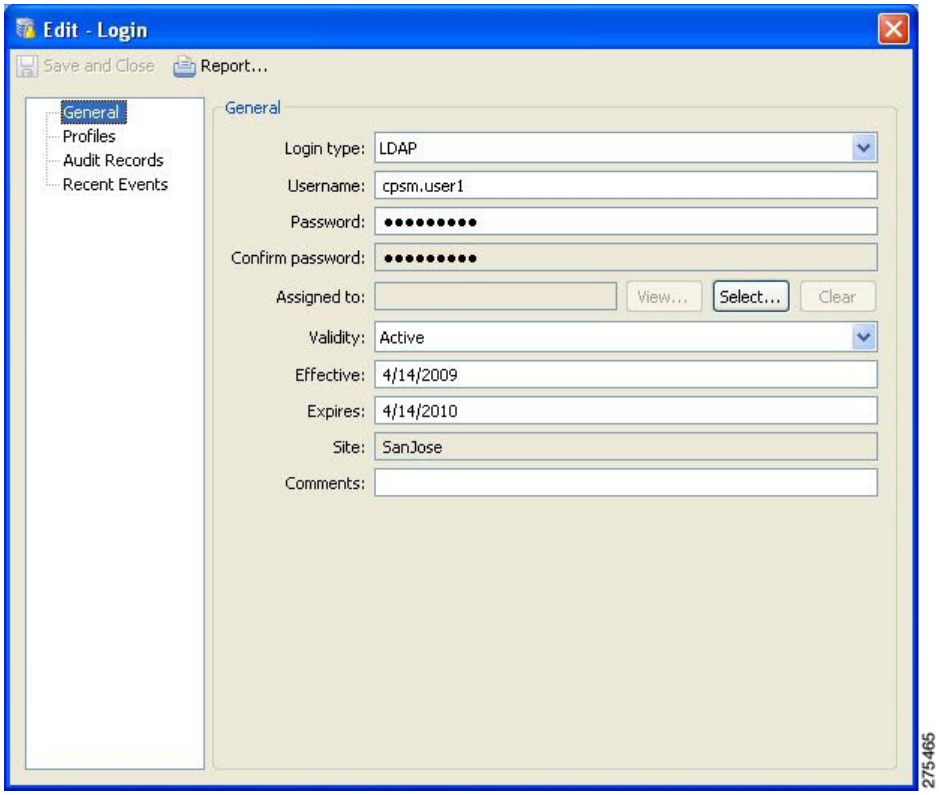


Creating the LDAP User Account in Cisco PAM

Create the user account to be authenticated using an LDAP server with the following steps.

Step 1 Select **Logins** from the Users menu. (See Figure 5-31.)

Figure 5-31 Login Window: LDAP Login Type



Step 2 Click **Add**, or select an existing login and click **Edit**.

Step 3 Select the Login type **LDAP**. The Login type field appears only if LDAP was enabled and the Cisco PAM application was restarted (see Configure the LDAP Server).

Step 4 Enter the username, password, and other settings for the LDAP login. See Creating User Login Accounts and Assigning Profiles.

Note Although a password must be entered for all user Login records, it is not used for LDAP authentication. LDAP servers use the password entered when the user logs in to Cisco PAM.

Step 5 Click **Profiles** and select the user's Cisco PAM profiles. See Defining User Profiles for Desktop Application Access for more information.

Note Cisco PAM does not synchronize the LDAP profiles.

Step 6 Click **Save and Close**.

To secure authentication information and management of the server, addressing Safeguard 164.308(a)(1)(i) Security Management, SSL is enabled by default on the Cisco PAM appliance. All the communication between the Cisco PAM client and the gateway is encrypted using the 128-bit AES encryption. Console access to Cisco PAM is through SSH. The Cisco PAM appliance should also be configured to disable unsecure protocols. To disable unsecure protocols, you must edit one of the configuration files on the Cisco PAM appliance. The step-by-step instructions are as follows:

1. SSH into the Cisco PAM server
2. sudo su
3. Enter the cpamadmin password
4. Stop the service: /etc/init.d/cpamadmin stop
5. Comment out a configuration from the file /opt/cisco/cpam/apache-tomcat/conf/server.xml.

   Remove or comment the snippet below.

```
<Connector executor="tomcatThreadPool"
port="8080" protocol="HTTP/1.1"
connectionTimeout="20000"
redirectPort="8443" />
```

6. Re-start the service: /etc/init.d/cpamadmin start

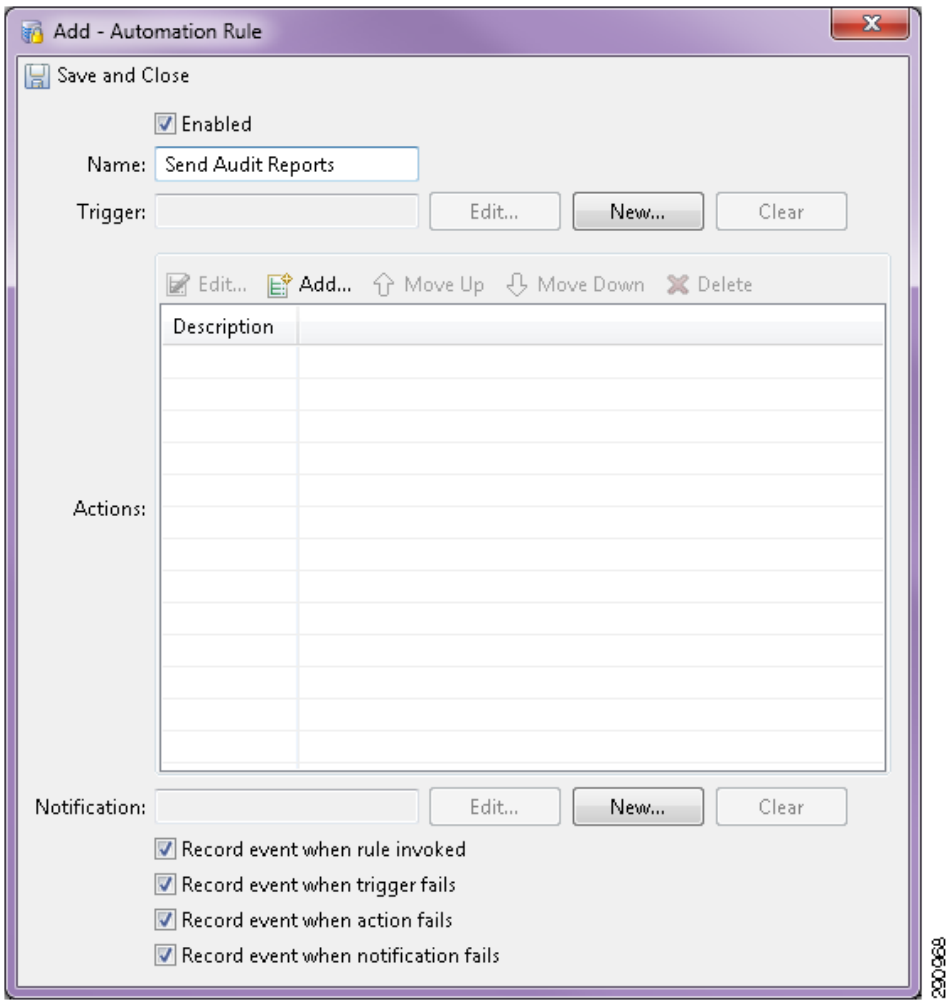
When you try to launch the web UI using HTTP, you see “Page cannot be displayed”.

To address the Incident Response and Auditing HIPAA Safeguards identified above, Cisco PAM allows for the creation of global I/O rules to trigger sending audit reports to a centralized server. Following are the instructions to create a global I/O with audit reports.

Step 1 In the Cisco PAM client, click **Events & Alarms -> Global I/O > Add**.

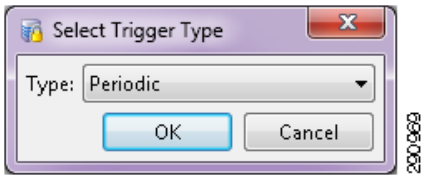
Step 2 Enter a name and click **New** in the Trigger field. (See Figure 5-32.)

Figure 5-32 Creating a Global I/O with Audit Reports



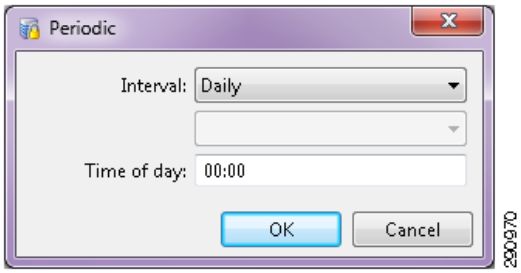
Step 3 Select **Periodic** and click **OK**. (See Figure 5-33.)

Figure 5-33 Selecting Periodic



Step 4 Choose the Interval and enter the Time of Day. Click **OK**. (See Figure 5-34.)

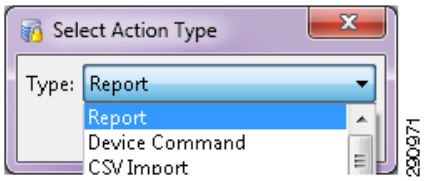
Figure 5-34 Selecting Interval and Time of Day



Step 5 Under Actions, Click **Add…**

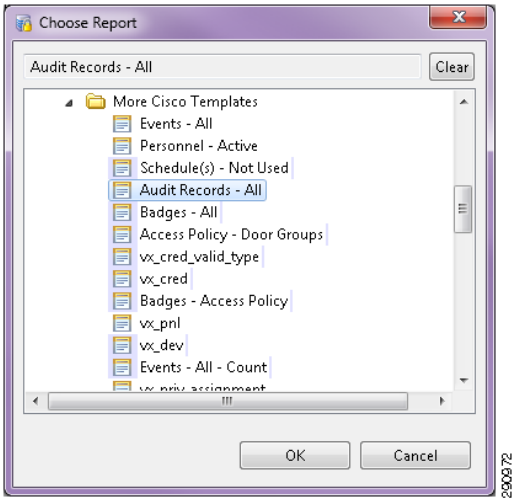
Step 6 Select **Report.** (See Figure 5-35.)

Figure 5-35 Selecting Action Type



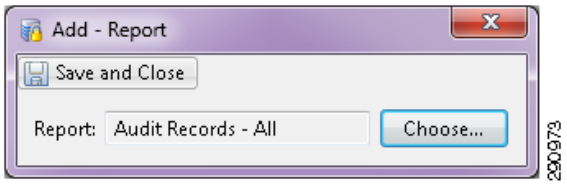
Step 7 Choose **Audit Records–All** and click **OK**. (See Figure 5-36.)

Figure 5-36 Audit Records–All



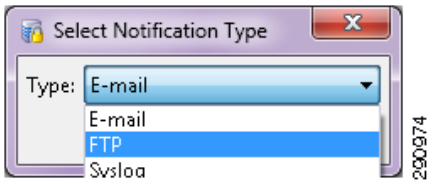
Step 8 Click **Save and Close**. (See Figure 5-37.)

Figure 5-37 Save and Close



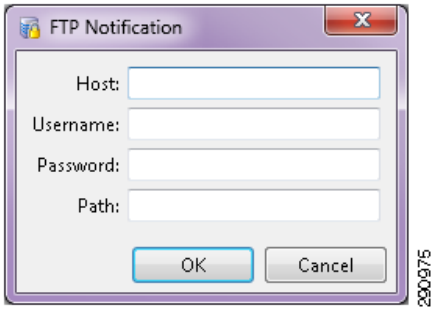
Step 9 Under Notification section of the Global I/O, click **New** and Choose **FTP**. Click **OK**. (See Figure 5-38.)

Figure 5-38 Select Notification Type



Step 10 Enter the FTP Host, Username, Password, and Path. Click **OK**. (See Figure 5-39.)

Figure 5-39 FTP Notification



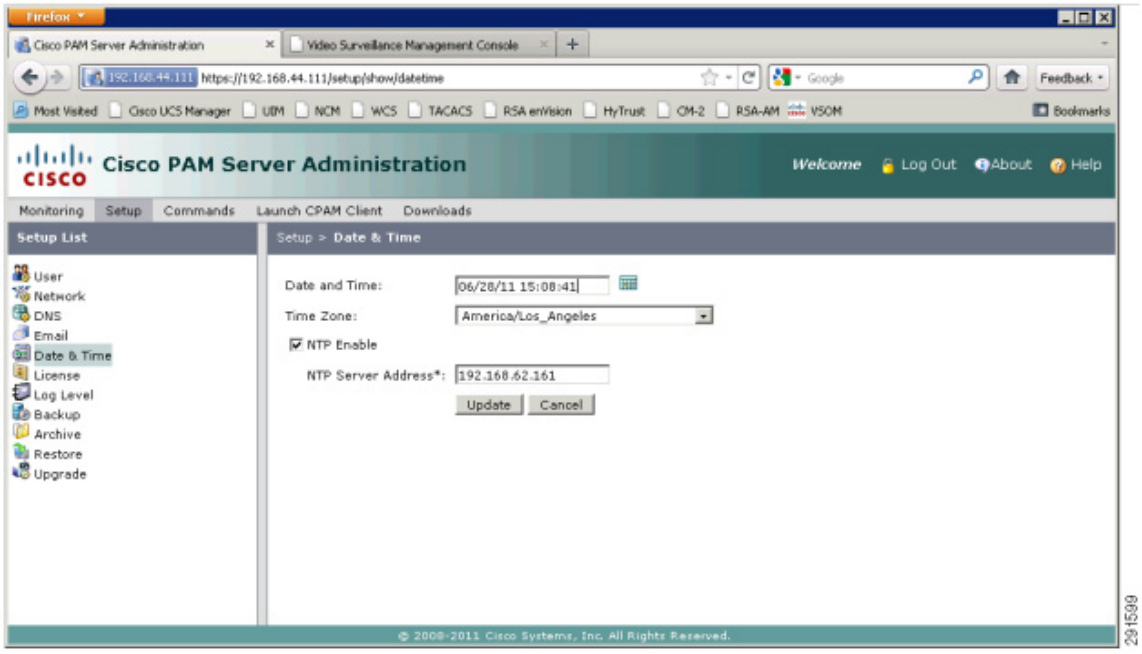
Step 11 Click **Save and Close**. You should see a new entry created. You can create similar global I/O rules for every hour.

The audit report is read into RSA enVision server, which then maintains and protects the integrity of the file.

HIPAA Safeguard 164.312(a)(2)(ii) requires the enabling of automatic logoff options. Cisco PAM has a hard-coded session timeout of 30 minutes in the configuration for the version validated.

As a best practice, NTP is used to synchronize clocks among network devices. This synchronization allows events to be correlated when system logs are created and when other time-specific events occur. All devices in the network used NTP to synchronize their clocks. The NTP servers were hosted at the data center site. The Cisco Lab uses two NTP servers that are synchronized to external reference sources. All systems and devices in the lab are pointed to these two servers. All the events in the Access Control system have a time stamp associated to them. Cisco PAM and the gateway are configured to use NTP, as shown in Figure 5-40.

Figure 5-40 Cisco PAM NTP Configuration



HIPAA Standards Failed

No HIPAA standards were failed.

HIPAA Implementation Specifications Failed

No HIPAA implementation specifications were failed.

Cisco Unified Computing System

The Cisco Unified Computing System (UCS) is designed to securely deploy sensitive and compliance-related applications. Provisioning options, including virtualization technology, allow the mixing of sensitive and non-sensitive applications without compromising scope boundaries.

Improve IT responsiveness to rapidly changing business demands with this next-generation data center platform. Cisco UCS accelerates the delivery of new services simply, reliably, and securely through end-to-end provisioning and migration support.

Benefits include the following:

- Streamlines data center resources to reduce total cost of ownership
- Scales service delivery to increase business agility
- Radically reduces the number of devices requiring setup, management, power, cooling, and cabling

Table 5-9 PHI HIPAA Assessment Summary—Cisco UCS

Models Assessed
Cisco UCS Manager version 1.3(1p)
HIPAA Safeguards Addressed

Table 5-9 PHI HIPAA Assessment Summary—Cisco UCS (continued)

Administrative	Standards/Implementation Specifications
164.308	(a)(1)(i) Security Management Process
	(a)(3)(ii)(A) Authorization/Supervision
	(a)(4)(ii)(A) Isolating Clearing House Functions
	(a)(4)(ii)(B) Access Authorization
	(a)(5)(ii)(C) Log-in Monitoring
	(a)(6)(ii) Response and Reporting
Technical	**Standards/Implementation Specifications**
164.312	(a)(i) Access Control
	(b) Audit Controls
	(c)(1) Data Integrity
HIPAA Standards Failed	
No HIPAA standards were failed.	
HIPAA Implementation Specifications Failed	
No HIPAA implementation specifications were failed.	

Primary PHI Function

The primary function of Cisco UCS is to securely host one primary compliance-related function per physical or virtual server.

It provides segmentation of sensitive applications from out-of-scope applications via physical and virtualization technology. Cisco UCS extends Layer 3 boundaries to virtual network and storage adapters within the chassis. Using VLANs and VSANs, Cisco UCS allows an organization to separate its ePHI systems (in-scope) from other non-sensitive data (out-of-scope).

Design Considerations

- Cisco UCS allows for the provisioning of individual servers on blades. Each blade can host a native operating system such as Windows 2008 server, or a virtualization hypervisor system such as VMware ESX/ESXi. These provisioning options represent a primary function for the server blade. In the lab validation, VMware ESX was installed on each of the Cisco UCS blades, and several VM hosts were then configured, each with one primary function. Each server blade is provisioned via a profile. Profiles can be created locally in Cisco UCS Manager or centrally using the Vblock provisioning utility, Unified Infrastructure Manager (UIM), which provides simplified Vblock management by combining provisioning with configuration, change, and compliance management.
- EMC SAN is a primary component of the VCE architecture for Vblock Infrastructure Platforms. Vblock 1 is designed for medium to high numbers of virtual machines, and is ideally suited to a broad range of usage scenarios, including shared services, e-mail, file and print, virtual desktops, and collaboration.
- Cisco UCS allows for the provisioning of individual servers on blades. Each blade can host a native operating system such as Windows 2008 server, or a virtualization hypervisor system such as VMware ESX/ESXi.

- Each Cisco UCS server blade is provisioned via a profile. Profiles can be created locally in Cisco UCS Manager or centrally using the Vblock provisioning utility, EMC Unified Infrastructure Manager (UIM), which provides simplified Vblock management by combining provisioning with configuration, change, and compliance management.
- The hypervisor of an individual blade is considered insecure for segmenting scopes of compliance. Therefore, when putting non-sensitive VM servers with sensitive VM servers on the same physical blade, the non-sensitive would be included in the scope of the audit.
- The UCS system securely segments network and storage to each blade, which allows mixing of sensitive and non-sensitive applications across different physical blades of the chassis.
- Cisco UCS does not feature an explicit session timeout. Administration time limits would need to be enabled systemically through active directory policy to the admin workstation desktops, locking them when there is no activity.

  Cisco UCS was implemented using the Cisco UCS installation guides: http://www.cisco.com/en/US/products/ps10276/prod_installation_guides_list.html

HIPAA Assessment Detail—HIPAA Safeguards Addressed

All of the sample configurations of the Cisco UCS shown below were used to meet the following list of satisfied controls:

- Access Control—Restrict access to ePHI data as required by HIPAA Administrative and Technical safeguards
  - §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.308(a)(3)(ii)(A) Authorization/Supervision. Implement procedures for the authorization and/or supervision of workforce members who work with ePHI or in locations where it might be accessed. Requirements addressed include: Auditing.
  - §164.308(a)(4)(ii)(A) Isolating healthcare clearinghouse function. If a healthcare clearinghouse is part of a larger organization, the clearinghouse must implement policies and procedures that protect the electronic protected health information of the clearinghouse from unauthorized access by the larger organization. Requirements addressed include: Access Control, Integrity, Incident Response and Auditing.
  - §164.308(a)(4)(ii)(B) Access authorization. Implement policies and procedures for granting access to electronic protected health information, for example, through access to a workstation, transaction, program, process, or other mechanism. Requirements addressed include: Access Control and Auditing.
  - §164.312(a)(1) Access Control. Implement technical policies and procedures for electronic information systems that maintain ePHI to allow access only to those persons or software programs that have been granted access rights as specified in §164.308(a)(4). Requirements addressed include: Access Control and Auditing.
- Auditing—Implement mechanisms to record and examine activity in systems that contain or use ePHI as required by HIPAA Technical safeguards.
  - §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.312(b) Audit controls. Implement hardware, software, and/or procedural mechanisms that record and examine activity in information systems that contain or use electronic protected health information. Requirements addressed include: Auditing.

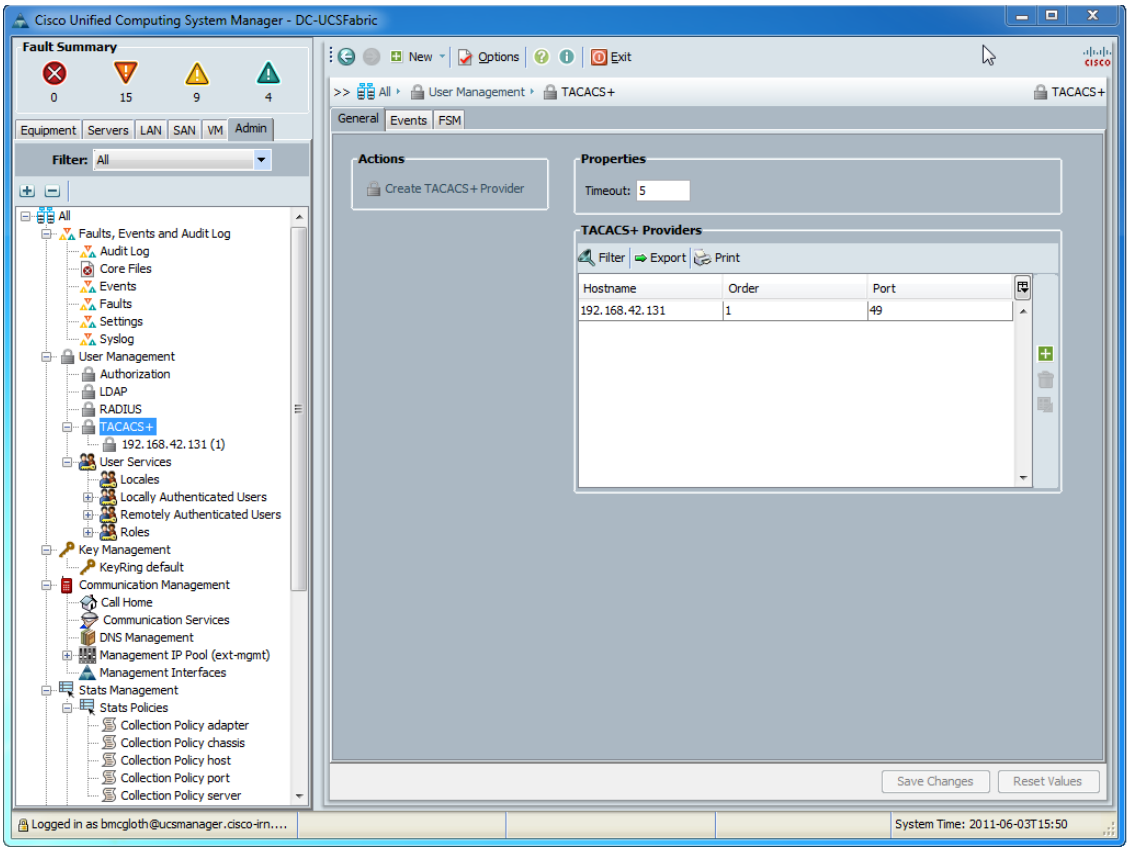
  - §164.308(a)(5)(ii)(C) Log-in Monitoring. Procedures for monitoring log-in attempts and reporting discrepancies. Requirements addressed include: Access Control and Auditing.
  - §164.308(a)(4)(ii)(B) Access authorization. Implement policies and procedures for granting access to electronic protected health information, for example, through access to a workstation, transaction, program, process, or other mechanism. Requirements addressed include: Access Control and Auditing.
  - §164.312(a)(1) Access Control. Implement technical policies and procedures for electronic information systems that maintain ePHI to allow access only to those persons or software programs that have been granted access rights as specified in §164.308(a)(4). Requirements addressed include: Access Control and Auditing.
- Incident response—Implement security incident response as required by HIPAA Administrative safeguards.
  - §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.308(a)(6)(i) Response and Reporting. Implement policies and procedures to address security incidents. Requirements addressed include: Incident Response and Auditing.
  - §164.308(a)(6)(ii) Response and Reporting. Identify and respond to suspected or known security incidents; mitigate, to the extent practicable, harmful effects of security incidents that are known to the covered entity or business associate; and document security incidents and their outcomes. Requirements addressed include: Incident Response and Auditing.
- Integrity—Protect electronic protected health information from improper alteration or destruction as required by HIPAA Technical safeguards.
  - §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.312(c)(1) Data Integrity. Implement policies and procedures to protect health information from improper alteration or destruction.

Sample Configuration

Cisco UCS servers are able to track and monitor all administrative user access and events, thereby addressing all of the safeguards listed under Access Control above. User access throughout the solution uses a centralized user database in the Active Directory, which is linked through authentication servers via LDAP, RADIUS, and TACACS+ services, enabling verification of users and administrators of devices and endpoints. These services are located in the data center. Individual user IDs are assigned, and roles are based on group membership. Cisco UCS includes extensive controls for defining user privileges and by default denies access to all individuals without a system user ID.

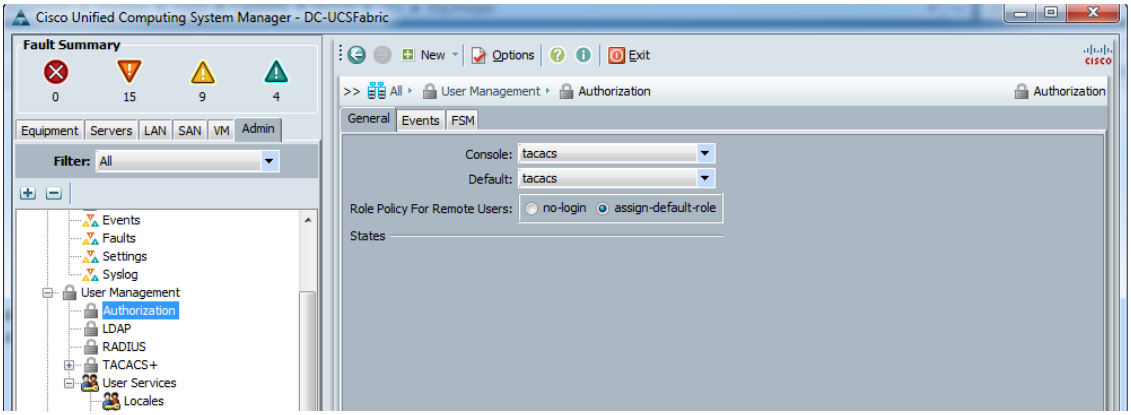
Add the Cisco Secure ACS server under the TACACS+ protocol option, as shown in Figure 5-41.

Figure 5-41 Adding the Cisco Secure ACS Server



Select **tacacs** from the Console and Default dropdown menus on the Authorization page, as shown in Figure 5-42.

Figure 5-42 Authorization—Selecting Console and Default Settings



On the TACACS+ server, create custom attributes defining the desired role for the user or group accessing the Cisco UCS Manager (see Figure 5-43):

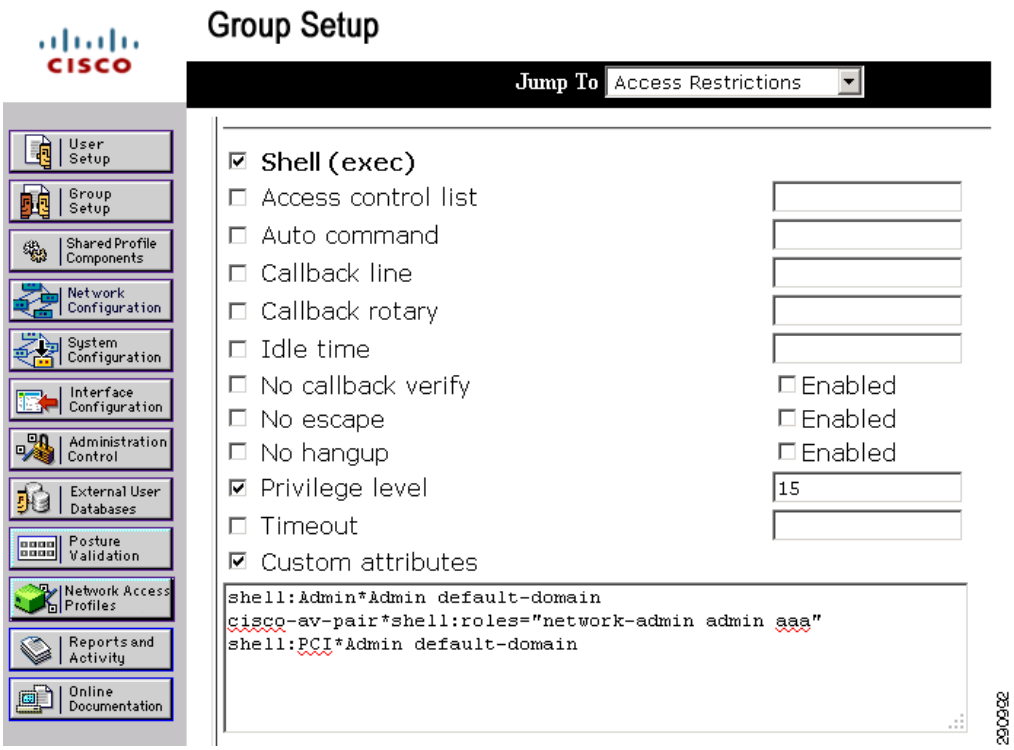
- TACACS+ custom attributes for UCS Manager:

```
cisco-av-pair*shell:roles="admin aaa"
```

- If combined with other systems roles, such as for the Nexus;

```
cisco-av-pair*shell:roles="network-admin admin aaa"
```

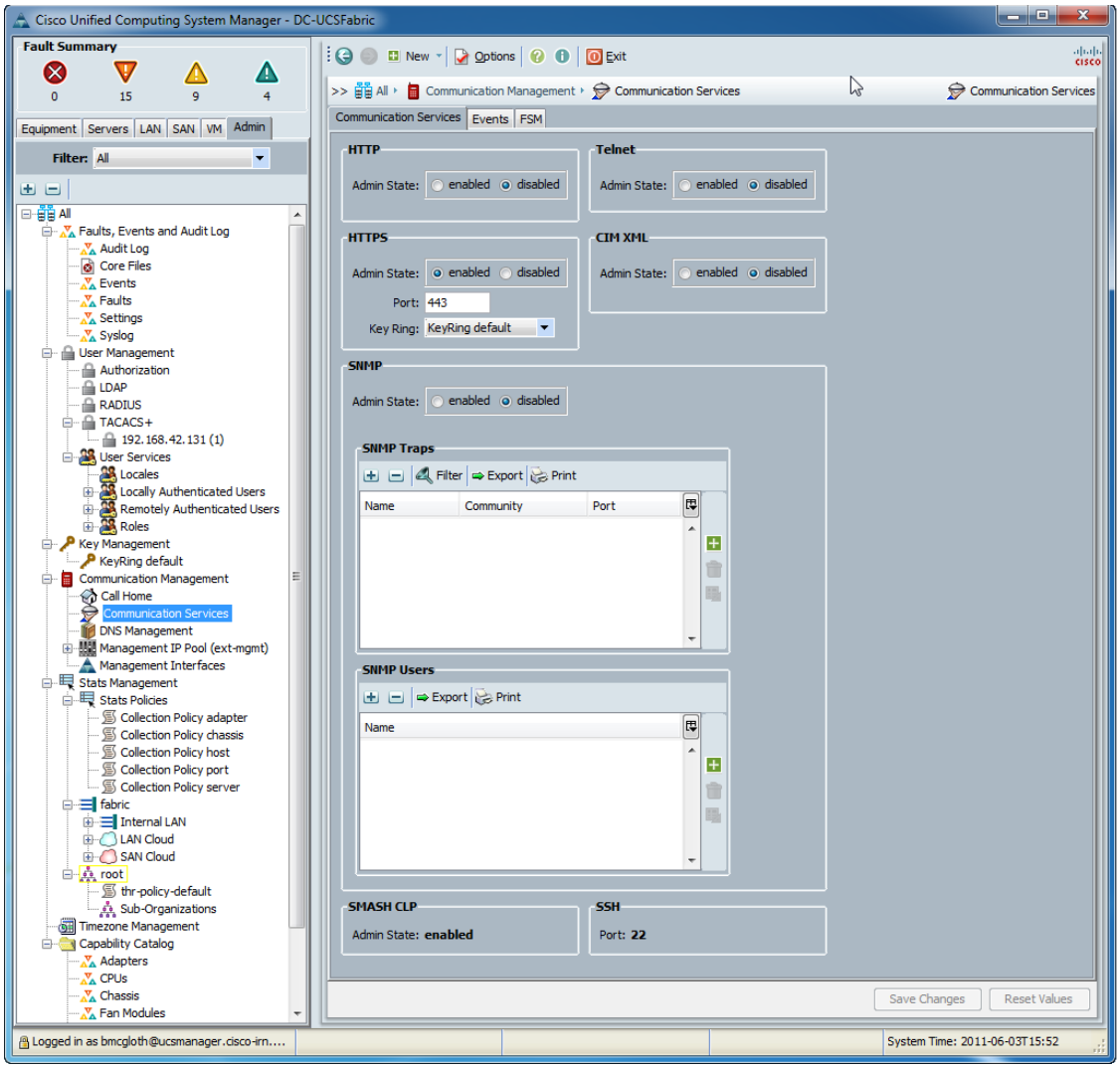
Figure 5-43 Group Configuration Page on TACACS+ Server



Local individual user accounts can be configured in the event that the centralized authentication server cannot be reached. These accounts must be manually updated to maintain compliance requirements regarding password rotation and expiration as specified in established policies for passwords.

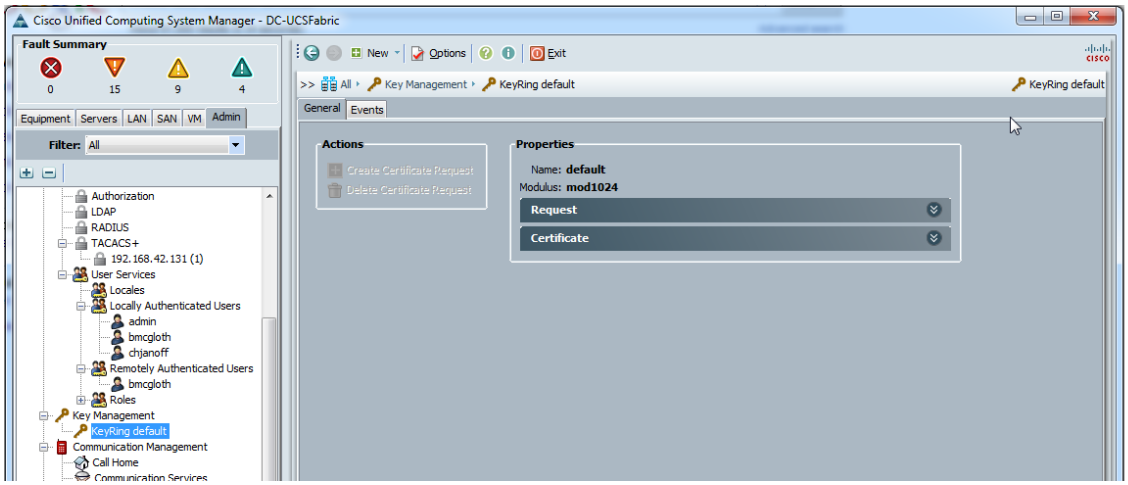
To secure authentication information and management of the UCS Manager, addressing Safeguard 164.308(a)(1)(i) Security Management, the Cisco UCS allows for the disabling of non-secure administrative interfaces. Figure 5-44 shows that the secure management protocols of SSH and HTTPS for administration. Telnet, HTTP, and other unused protocols are disabled.

Figure 5-44 Secure Management Protocols



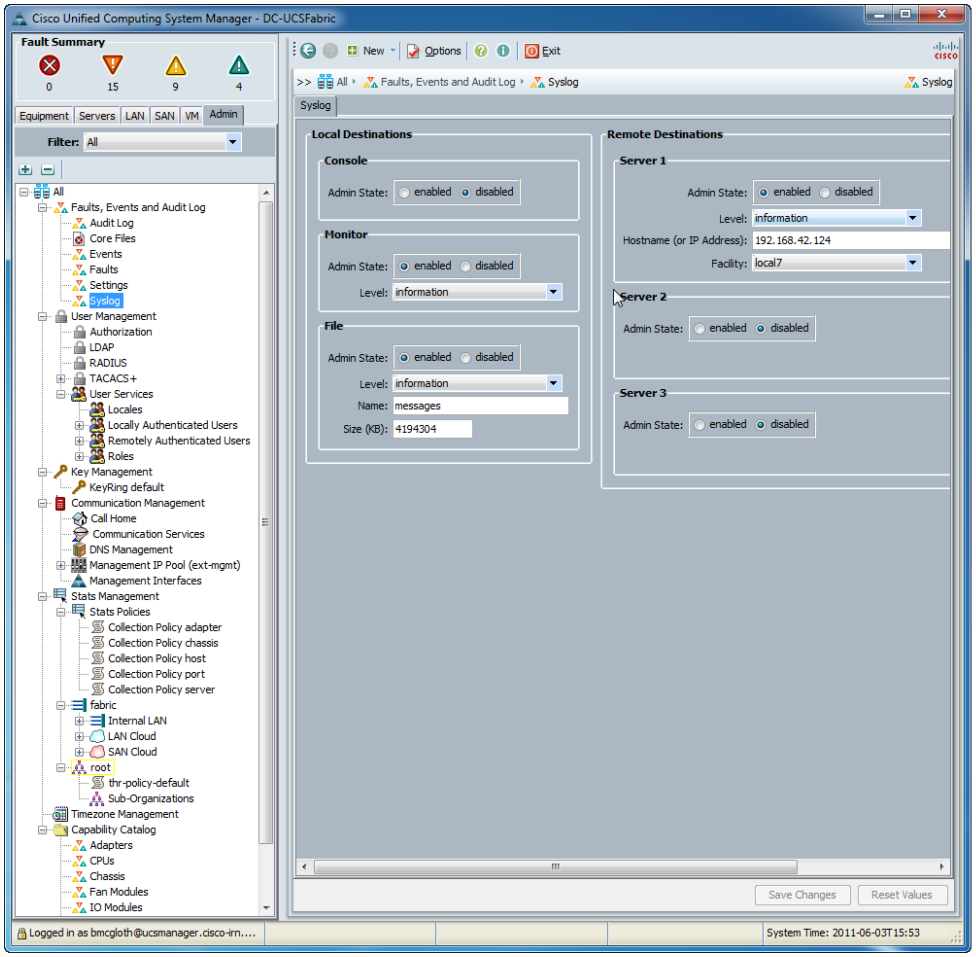
Cisco UCS uses strong encryption for SSH and HTTPS connections. Encryption keys are created and managed under the Key Management feature. (See Figure 5-45.)

Figure 5-45 1024-Bit Mod Key Default Keyring



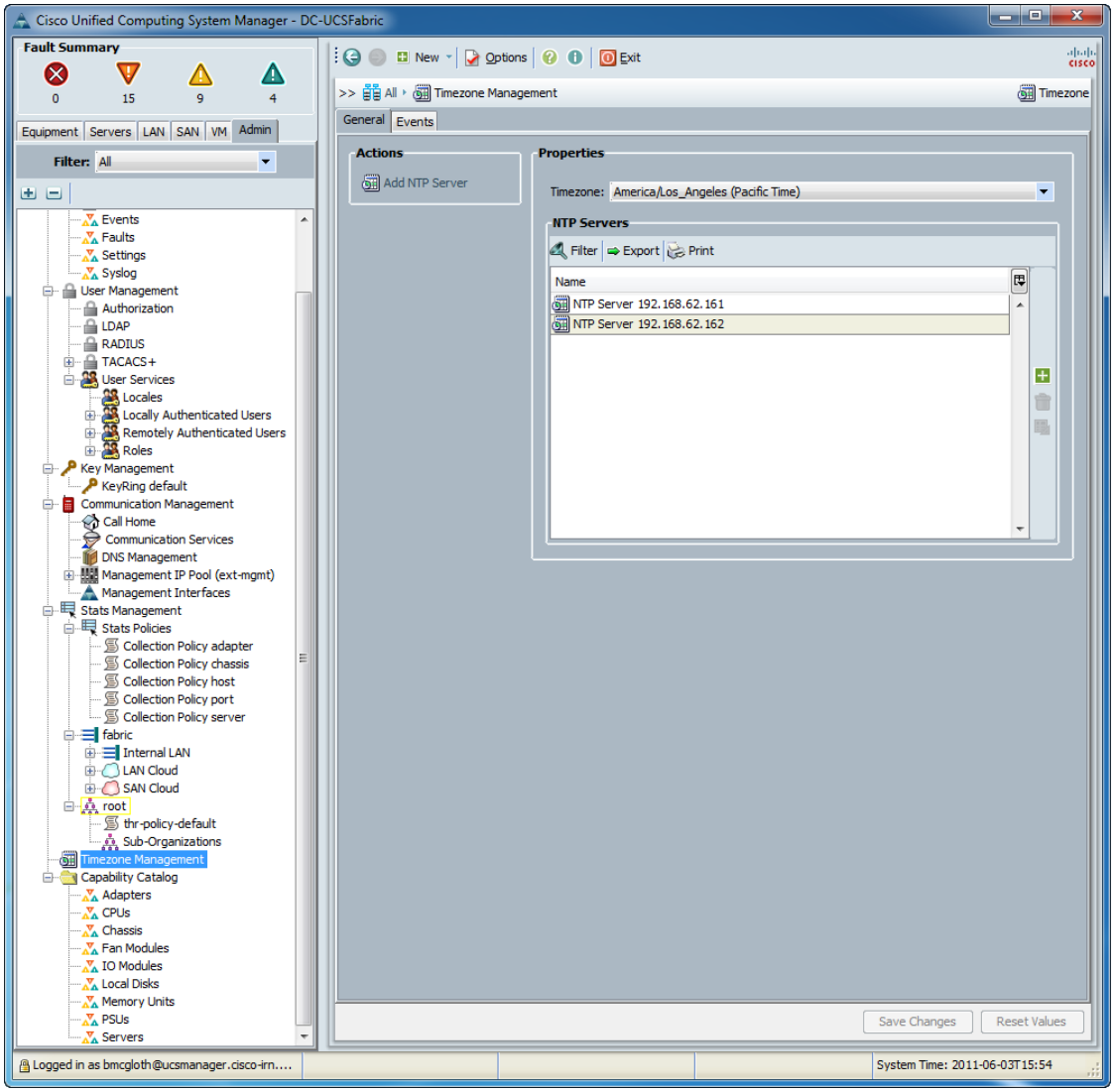
To address the Incident Response and Auditing HIPAA Safeguards identified above, Cisco UCS can be configured to send its data to the RSA enVision log management platform using the syslog function and/or SNMP traps. In the solution, only syslog was used. (See Figure 5-46).

Figure 5-46 Using Syslog



As a best practice, NTP is used to synchronize clocks among network devices (see Figure 5-47). This synchronization allows events to be correlated when system logs are created and when other time-specific events occur. All devices in the network used NTP to synchronize their clocks. The NTP servers were hosted at the data center site. The Cisco Lab uses two NTP servers that are synchronized to external reference sources. All systems and devices in the lab are pointed to these two servers.

Figure 5-47 NTP Screen



Clock synchronization is a requirement for common industry security frameworks such as the HiTrust Common Security Framework (CSF), ISO 27002, and NIST Security Publications, as well as other industry-based standards.

HIPAA Standards Failed

No HIPAA standards were failed.

HIPAA Implementation Specifications Failed

No HIPAA implementation specifications were failed.

Cisco UCS Express on Services Ready Engine

The Cisco Unified Computing System (UCS) Express and Services Ready Engine (SRE) is designed to allow organizations to securely deploy sensitive applications directly within the routing platform. By using the UCS E-series, organizations can remove legacy compute resources in the branch, saving space, energy, and operational costs.

Cisco UCS E-series is a converged networking, computing, and virtualization platform for hosting essential business applications in the clinic location. The SRE modules are router blades for the second generation of Cisco Integrated Services Routers (ISR G2) that provide the capability to host Cisco, third-party, and custom applications. A service-ready deployment model enables clinic applications to be provisioned remotely on the modules at any time. Cisco SRE modules have their own processors, storage, network interfaces, and memory, which operate independently of the host router resources and help ensure maximum concurrent routing and application performance.

Table 5-10 PHI HIPAA Assessment Summary—Cisco UCS Express

Models Assessed	
Cisco UCS Express version 1.1 on SRE900	
HIPAA Safeguards Addressed	
Administrative	**Standards/Implementation Specifications**
164.308	(a)(1)(i) Security Management Process
	(a)(3)(ii)(A) Authorization/Supervision
	(a)(4)(ii)(A) Isolating Clearing House Functions
	(a)(4)(i) Access Authorization
	(a)(5)(i) Log-in Monitoring
	(a)(6)(i) Security Incident Procedures
	(a)(6)(ii) Response and Reporting
Technical	**Standards/Implementation Specifications**
164.312	(a)(i) Access Control
	(b) Audit Controls
	(c)(1) Data Integrity
HIPAA Standards Failed	
No HIPAA standards were failed.	
HIPAA Implementation Specifications Failed	
No HIPAA implementation specifications were failed.	

Primary PHI Function

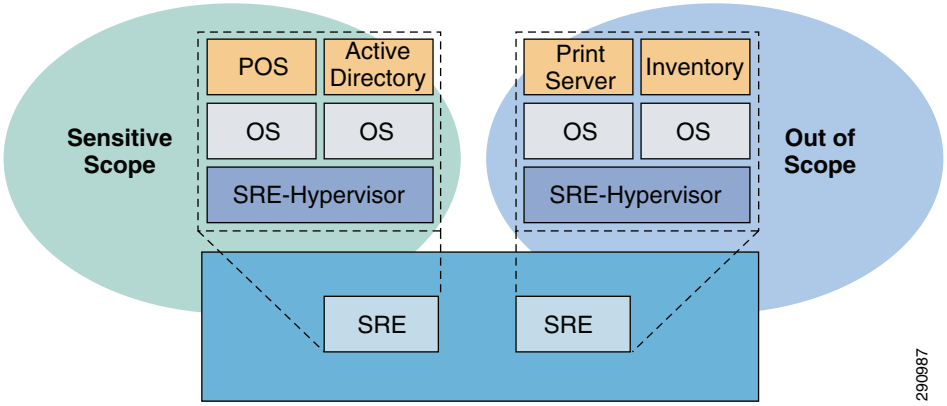
The primary function of the Cisco UCS Express is to securely host one primary compliance-related function per physical or virtual server.

It provides segmentation of sensitive applications from out-of-scope applications via physical and virtualization technology. UCS extends Layer 3 boundaries to virtual NIC and storage adapters within the chassis. Using VLANs and VSANs, Cisco UCS allows an organization to separate its sensitive ePHI (in-scope) from other non-sensitive data (out-of-scope).

Design Considerations

The major consideration when using Cisco UCS Express with sensitive applications is the security of the hypervisor. Verizon considers all hypervisors to be insecure because of vulnerabilities that may exist resulting in data leakage between VMs. Therefore, use separate Cisco UCS Express implementations when scoping. Although it is acceptable to mix non-sensitive applications onto a Cisco UCS Express deployment with sensitive applications, doing so brings those applications into scope and audit. (See Figure 5-48.)

Figure 5-48 Using UCS Express with Cisco SRE



Note Newer versions of UCS Express (version 1.5 +) enable central management of the VMware ESXi on Cisco UCS Express through vCenter (upgrade license required) as well as eliminate the Cisco console VM and local user management/VMware ESXi management restrictions. With the new release, Cisco UCS can manage users on VMware ESXi exactly as it would on a standalone VMware ESXi 4.1 server.

Note The Cisco UCS Express module comes installed with VMware ESXi. This is the primary function for the server module. Each module can host several independent operating systems as virtual servers. Each virtual server should have only one primary function.

- Cisco UCS Express requires the use of VLANs in the router. Depending on the deployment within the clinic, this may require the use of bridged virtual interfaces.
- Cisco UCS Express is based on VMware's ESXi and uses vSphere client for management.

HIPAA Assessment Detail—HIPAA Safeguards Addressed

All of the sample configurations of the UCS Express shown below were used to meet the following list of satisfied controls:

- Access Control—Restrict access to ePHI data as required by HIPAA Administrative and Technical safeguards

  - §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.308(a)(3)(ii)(A) Authorization/Supervision. Implement procedures for the authorization and/or supervision of workforce members who work with ePHI or in locations where it might be accessed. Requirements addressed include: Auditing.
  - §164.308(a)(4)(ii)(A) Isolating healthcare clearinghouse function. If a healthcare clearinghouse is part of a larger organization, the clearinghouse must implement policies and procedures that protect the electronic protected health information of the clearinghouse from unauthorized access by the larger organization. Requirements addressed include: Access Control, Integrity, Incident Response and Auditing.
  - §164.308(a)(4)(ii)(B) Access authorization. Implement policies and procedures for granting access to electronic protected health information, for example, through access to a workstation, transaction, program, process, or other mechanism. Requirements addressed include: Access Control and Auditing.
  - §164.312(a)(1) Access Control. Implement technical policies and procedures for electronic information systems that maintain ePHI to allow access only to those persons or software programs that have been granted access rights as specified in §164.308(a)(4). Requirements addressed include: Access Control and Auditing.
- Auditing—Implement mechanisms to record and examine activity in systems that contain or use ePHI as required by HIPAA Technical Safeguards.
  - §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.312(b) Audit controls. Implement hardware, software, and/or procedural mechanisms that record and examine activity in information systems that contain or use electronic protected health information. Requirements addressed include: Auditing.
  - §164.308(a)(5)(ii)(C) Log-in Monitoring. Procedures for monitoring log-in attempts and reporting discrepancies. Requirements addressed include: Access Control and Auditing.
  - §164.308(a)(4)(ii)(B) Access authorization. Implement policies and procedures for granting access to electronic protected health information, for example, through access to a workstation, transaction, program, process, or other mechanism. Requirements addressed include: Access Control and Auditing.
  - §164.312(a)(1) Access Control. Implement technical policies and procedures for electronic information systems that maintain ePHI to allow access only to those persons or software programs that have been granted access rights as specified in §164.308(a)(4). Requirements addressed include: Access Control and Auditing.
- Incident response—Implement security incident response as required by HIPAA Administrative safeguards.
  - §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.308(a)(6)(i) Response and Reporting. Implement policies and procedures to address security incidents. Requirements addressed include: Incident Response and Auditing.

  - §164.308(a)(6)(ii) Response and Reporting. Identify and respond to suspected or known security incidents; mitigate, to the extent practicable, harmful effects of security incidents that are known to the covered entity or business associate; and document security incidents and their outcomes. Requirements addressed include: Incident Response and Auditing.

- Integrity—Protect electronic protected health information from improper alteration or destruction as required by HIPAA Technical safeguards.
  - §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.312(c)(1) Data Integrity. Implement policies and procedures to protect health information from improper alteration or destruction.

Sample Configuration

Cisco UCS servers are able to track and monitor all administrative user access and events, thereby addressing all of the safeguards listed under Access Control above. User access throughout the solution uses a centralized user database in the Active Directory, which is linked through authentication servers via LDAP, RADIUS, and TACACS+ services, enabling verification of users and administrators of devices and endpoints. These services are located in the data center. Individual user IDs are assigned, and roles are based on group membership. Cisco UCS Express includes extensive controls for defining user privileges and by default denies access to all individuals without a system user ID. On the UCS server configuration of the ESX hypervisor is part of the vSphere and vCenter infrastructure.

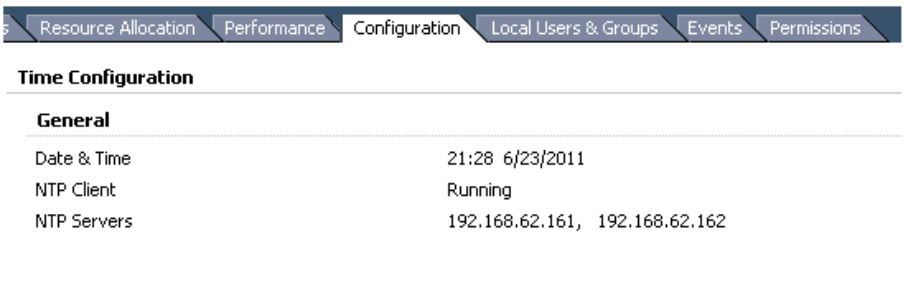
Local individual user accounts are configured in the event that the centralized authentication server cannot be reached. These accounts must be manually updated to maintain compliance requirements regarding password rotation and expiration as specified in established policies for passwords.

To secure authentication information and management of the UCS server, addressing Safeguard 164.308(a)(1)(i) Security Management, the UCS management console supports only HTTPS and SSH access.

Cisco UCS Express is designed to track and monitor all administrative user access, events such as profile creation, interface up/down, and device authentications. All of these events are sent to the vSphere and vCenter infrastructure.

NTP is used to synchronize clocks among network devices. This synchronization allows events to be correlated when system logs are created and when other time-specific events occur. All devices in the network used NTP to synchronize their clocks. The NTP servers were hosted at the data center site. The Cisco Lab uses two NTP servers that are synchronized to external reference sources. All systems and devices in the lab are pointed to these two servers, as shown in Figure 5-49.

Figure 5-49 UCS E-Series NTP Servers



HIPAA Standards Failed

No HIPAA standards were failed.

HIPAA Implementation Specifications Failed

No HIPAA implementation specifications were failed.

Administration

Authentication

Cisco Secure Access Control Server

Cisco Secure Access Control Server (ACS) was used as a central authentication system for the majority of products validated in this solution. It links user authentication to Windows Active Directory using group mapping that segments users based on their role and function.

Cisco Secure ACS is an access policy control platform that helps you comply with growing regulatory and corporate requirements. By using a single authentication method for all system devices, insight into who made changes is simplified for internal administration, assessors, and post-breach audits. It supports multiple scenarios simultaneously, including the following:

- Device administration—Authenticates administrators, authorizes commands, and provides an audit trail
- Remote access—Works with VPN and other remote network access devices to enforce access policies
- Wireless—Authenticates and authorizes wireless users and hosts and enforces wireless-specific policies
- Network admission control—Communicates with posture and audit servers to enforce admission control policies

Cisco Secure ACS lets you centrally manage access to network resources for a growing variety of access types, devices, and user groups. These key features address the current complexities of network access control:

- Support for a range of protocols including Extensible Authentication Protocol (EAP) and non-EAP protocols provides the flexibility to meet all your authentication requirements
- Integration with Cisco products for device administration access control allows for centralized control and auditing of administrative actions
- Support for external databases, posture brokers, and audit servers centralizes access policy control and lets you integrate identity and access control systems

Table 5-11 PHI HIPAA Assessment Summary—Cisco ACS

Models Assessed	
Cisco Secure Access Control Server	Release 4.2(1) Build 15 Patch 3
HIPAA Safeguards Addressed	

Table 5-11 PHI HIPAA Assessment Summary—Cisco ACS

Administrative	Standards/Implementation Specifications
164.308	(a)(1)(i) Security Management Process
	(a)(3)(ii)(A) Authorization/Supervision
	(a)(3)(ii)(C) Termination Procedures
	(a)(4)(ii)(B) Access Authorization
	(a)(4)(ii)(C) Access Establishment and Modification
	(a)(5)(ii)(C) Log-in Monitoring
	(a)(6)(ii) Response and Reporting
Technical	**Standards/Implementation Specifications**
164.312	(a)(2)(i) Unique User Identification
	(a)(2)(ii) Emergency Access Procedures
	(a)(2)(ii) Automatic Logoff
	(b) Audit Controls
	(d) Person or Entity Authentication
HIPAA Standards Failed	
No HIPAA standards were failed.	
HIPAA Implementation Specifications Failed	
No HIPAA implementation specifications were failed.	

Primary PHI Function

The primary function of Cisco Secure ACS is to securely authenticate users to the systems within the ePHI environment. The ACS allows for management of user access (authorization) to systems containing ePHI. Additionally, the ACS can prevent unauthorized devices from accessing systems containing ePHI and protect access from unauthorized locations. Users can be assigned to groups and, based on privilege levels, have access to only the information they require for their job function.

HIPAA Assessment Detail—HIPAA Safeguards Addressed

HIPAA safeguards are spread across multiple categories. ACS allows healthcare-covered entities and business associates to meet access control safeguards in the Administrative and Technical categories. The access control can be applied to both internal and external users that access ePHI data.

All of the sample configurations of the ACS shown below were used to meet the following list of satisfied controls:

- Access Control—Restrict access to ePHI data as required by HIPAA Administrative and Technical safeguards
  - §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.308(a)(3)(ii)(A) Authorization/Supervision. Implement procedures for the authorization and/or supervision of workforce members who work with ePHI or in locations it might be accessed. Requirements addressed include: Access Control and Auditing.

  - §164.308(a)(4)(ii)(B) Access authorization. Implement policies and procedures for granting access to electronic protected health information, for example, through access to a workstation, transaction, program, process, or other mechanism. Requirements addressed include: Access Control and Auditing.
  - §164.308(a)(4)(ii)(C) Access Establishment and Modification. Implement policies and procedures that, based upon the covered entity's or the business associate's access authorization policies, establish, document, review, and modify a user's right of access to a workstation, transaction, program, or process. Requirements addressed include: Access Control, Incident Response, and Auditing.
  - §164.308(a)(5)(ii)(C) Log-in Monitoring. Procedures for monitoring log-in attempts and reporting discrepancies. Requirements addressed include: Access Control and Auditing.
  - §164.312(a)(2)(ii) Automatic logoff. Implement electronic procedures that terminate an electronic session after a predetermined time of inactivity. Requirements addressed include: Access Control.
- Incident response—Implement security incident response as required by HIPAA Administrative safeguards.
  - §164.308(a)(6)(ii) Response and Reporting. Identify and respond to suspected or known security incidents; mitigate, to the extent practicable, harmful effects of security incidents that are known to the covered entity or business associate; and document security incidents and their outcomes. Requirements addressed include: Incident Response and Auditing.
  - §164.312(a)(2)(i) Unique User Identification. Assign a unique name and/or number for identifying and tracking user identity. Requirements addressed include: Access Control and Auditing.
  - §164.312(a)(2)(ii) Emergency Access Procedures. Establish (and implement as necessary) procedures for obtaining necessary ePHI during an emergency. Requirements addressed include: Access Control.
  - §164.312(d) Person or entity authentication. Implement procedures to verify that a person or entity seeking access to electronic protected health information is the one claimed. Requirements addressed include: Access Control and Auditing.
- Auditing—Implement mechanisms to record and examine activity in systems that contain or use ePHI as required by HIPAA Technical Safeguards.
  - §164.312(b) Audit controls. Implement hardware, software, and/or procedural mechanisms that record and examine activity in information systems that contain or use electronic protected health information. Requirements addressed include: Auditing.

Design Considerations

- Cisco Secure ACS has been configured to authenticate individual users using Active Directory (AD). This is accomplished by creating user groups in AD and mapping them to role-based groups in Cisco Secure ACS. This provides the granularity of secure authentication needed to address the HIPAA specification.
- The solution used the windows versions of Cisco Secure ACS. The CSA client was installed to protect and alert on unauthorized access of the log and audit trail.
- Remove the default accounts for administration.
- Enable HTTPS and disable HTTP.

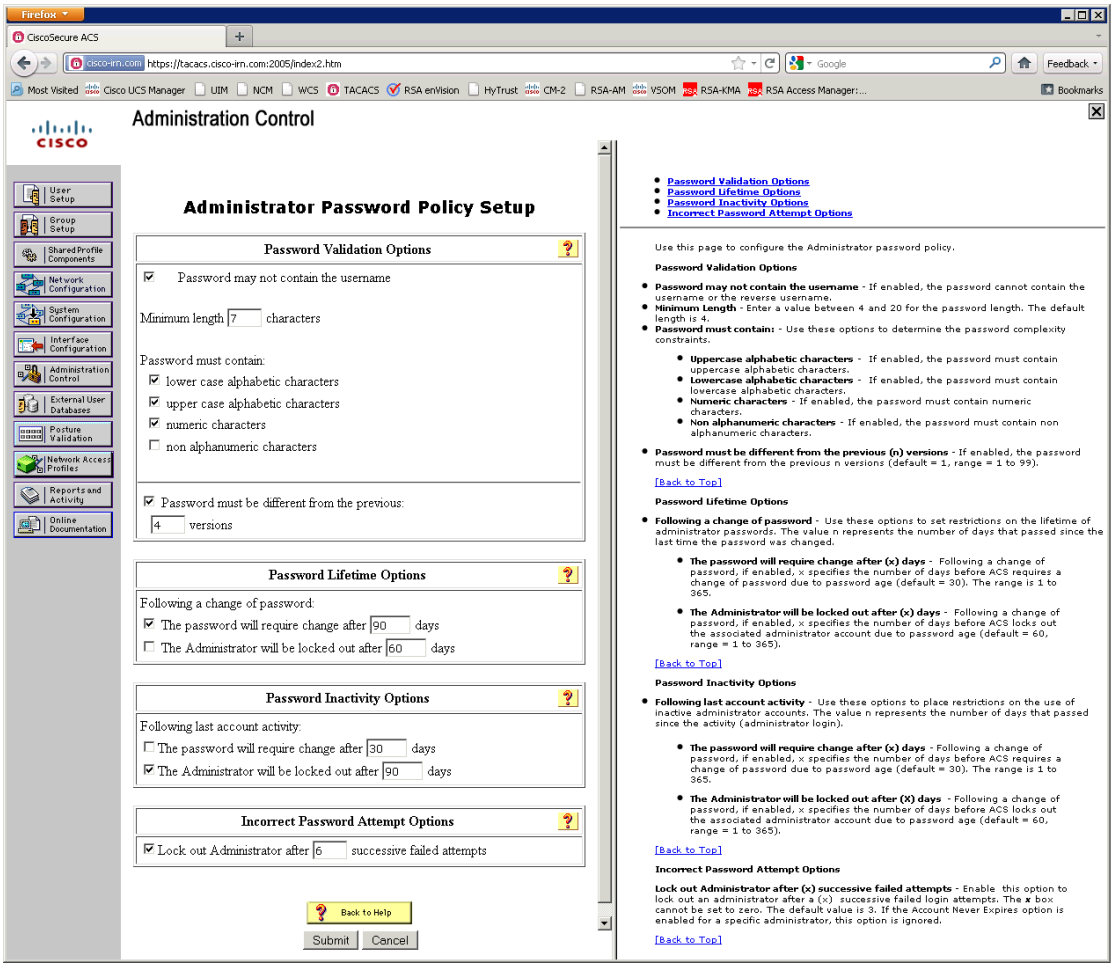
User authentication services for Cisco Secure ACS are linked to a centralized Active Directory user database. When personnel are added or removed from Active Directory, their access to infrastructure is similarly affected addressing Safeguard 164.308(a)(3)(ii)(C) Termination Procedures.

Sample Configuration

Cisco ACS is designed to track and monitor all administrative user access and events, thereby addressing all of the safeguards listed under Access Control above. User access throughout the solution uses a centralized user database in the Active Directory, which is linked through Cisco ACS and ISE via LDAP, RADIUS, and TACACS+ services enabling verification of users and administrators of devices and endpoints. These services are located in the data center. Individual user IDs are assigned, and roles are based on group membership.

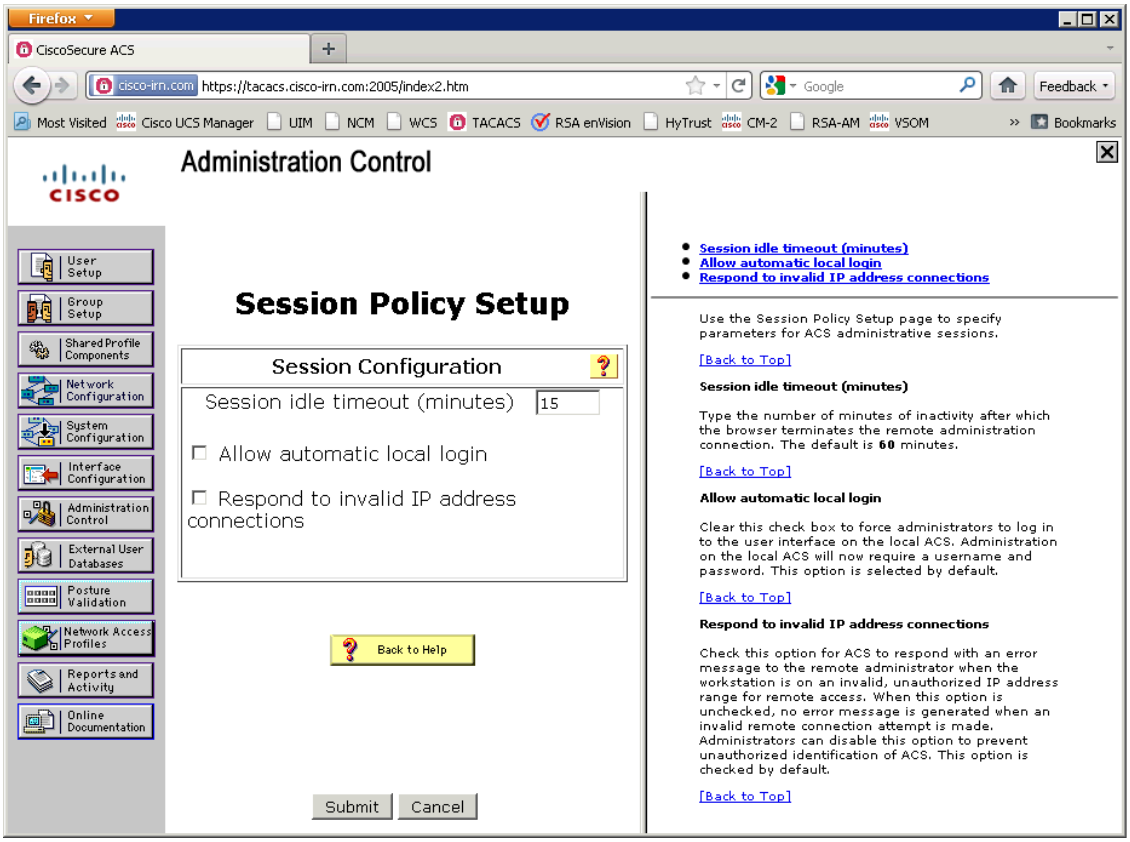
Cisco Secure ACS supports the creation of local administrative users. Each user must be assigned a unique ID. Cisco Secure ACS password policy enables setting of an inactivity option where an administrator is locked out after a specified period of inactivity determined by company policies. Local administrator user accounts in Cisco Secure ACS require the setting of a password according to the password requirements, as shown in Figure 5-50. By default, Cisco Secure ACS requires another administrator to re-enable locked out accounts.

Figure 5-50 Administrator Password Requirements



HIPAA Safeguard 164.312(a)(2)(ii) requires the enabling of automatic logoff options. Cisco Secure ACS supports session policies under the Administration Control/Session tab. The default session timeout is 60 minutes. It is a best practice to change the session timeout to 15 minutes, as shown in Figure 5-51.

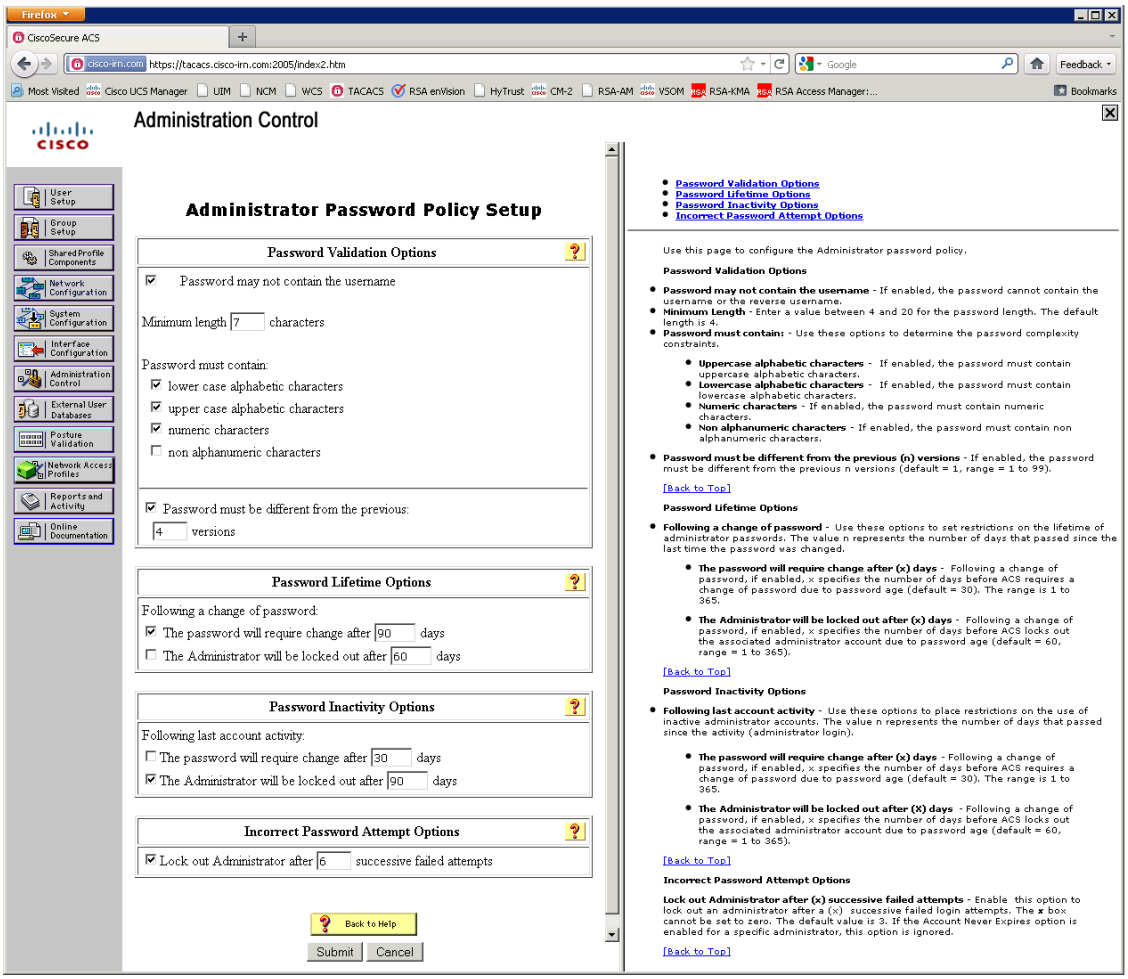
Figure 5-51 Session Timeout



To address the Incident Response and Auditing HIPAA Safeguards identified above, Cisco Secure ACS can be configured to send its log data to the RSA enVision log management platform. The configuration procedure is documented in the RSA enVision Event Source Configuration Guide for Cisco Secure ACS, which can be found at RSA Secure Care Online (https://knowledge.rsasecurity.com/).

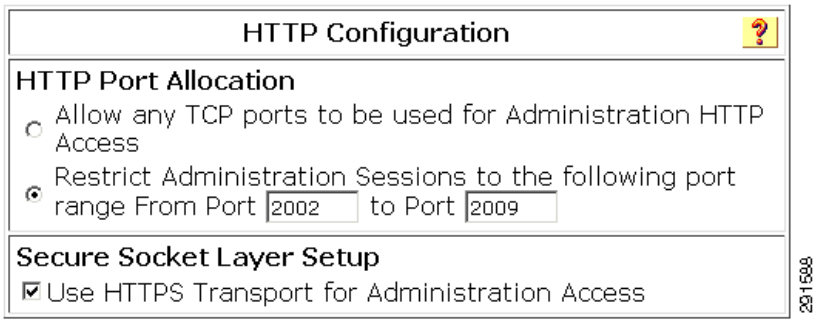
RSA enVision requires that specific attributes for each reporting function to be specified and configured in a particular order. Figure 5-52 shows the required items for generating Syslog Passed Authentications. Settings for other event types are available in the RSA enVision Event Source Configuration Guide for Cisco Secure ACS.

Figure 5-52 Syslog for Passed Authentications



To secure authentication information and management of the ACS server, addressing Safeguard 164.308(a)(1)(i) Security Management, the ACS management console was configured to support HTTPS access, with HTTP access disabled. Cisco Secure ACS is configured to use SSL as a highly secure management portal technology (see Figure 5-53). Cisco Secure ACS employs port hopping to a random high port for secured communication transport.

Figure 5-53 HTTP Configuration



As a best practice, NTP is used to synchronize clocks among network devices. This synchronization allows events to be correlated when system logs are created and when other time-specific events occur. Time synchronization for Windows servers is specified through the domain policy. Servers synchronize their clocks with the domain controller, which in turn is synchronized using NTP. This implementation of Cisco ACS was Windows-based.

Clock synchronization is a requirement for common industry security frameworks such as the HiTrust Common Security Framework (CSF), ISO 27002, and NIST Security Publications, as well as other industry-based standards.

HIPAA Standards Failed

No HIPAA standards were failed.

HIPAA Implementation Specifications Failed

No HIPAA implementation specifications were failed.

RSA Authentication Manager

RSA Authentication Manager is the management component of the RSA SecurID®, a two-factor authentication solution, which provides a much more reliable level of user authentication than reusable passwords. SecurID authentication is based on something you know (a password or PIN) and something you have (an authenticator). As the management component, RSA Authentication Manager is used to verify authentication requests and centrally administer authentication policies for enterprise networks.

Table 5-12 PHI HIPAA Assessment Summary—Cisco RSA Authentication Manager

Models Assessed	
RSA Authentication Manager 7.1 Service Pack 2	
HIPAA Safeguards Addressed	
Administrative	**Standards/Implementation Specifications**
164.308	(a)(1)(i) Security Management Process
	(a)(3)(i) Authorization/Supervision
	(a)(4)(i) Access Authorization
	(a)(5)(i) Log-in Monitoring
	(a)(6)(i) Security Incident Procedures
	(a)(6)(ii) Response and Reporting
Technical	**Standards/Implementation Specifications**
164.312	(a)(i) Access Control
	(b) Audit Controls
	(c)(1) Data Integrity
HIPAA Standards Failed	
No HIPAA standards were failed.	
HIPAA Implementation Specifications Failed	
No HIPAA implementation specifications were failed.	

Primary PHI Function

The primary function of RSA Authentication Manager is to securely authenticate remote users using two-factor authentication.

Design Considerations

RSA Authentication Manager stores and processes highly sensitive authentication information and should be deployed and operated in a secure manner. Detailed recommendations are found in the RSA Authentication Manager Security Best Practices Guide, which can be downloaded from RSA Secure Care Online (https://knowledge.rsasecurity.com/).

HIPAA Assessment Detail—HIPAA Safeguards Addressed

All of the sample configurations of the RSA Authentication Manager shown below were used to meet the following list of satisfied controls:

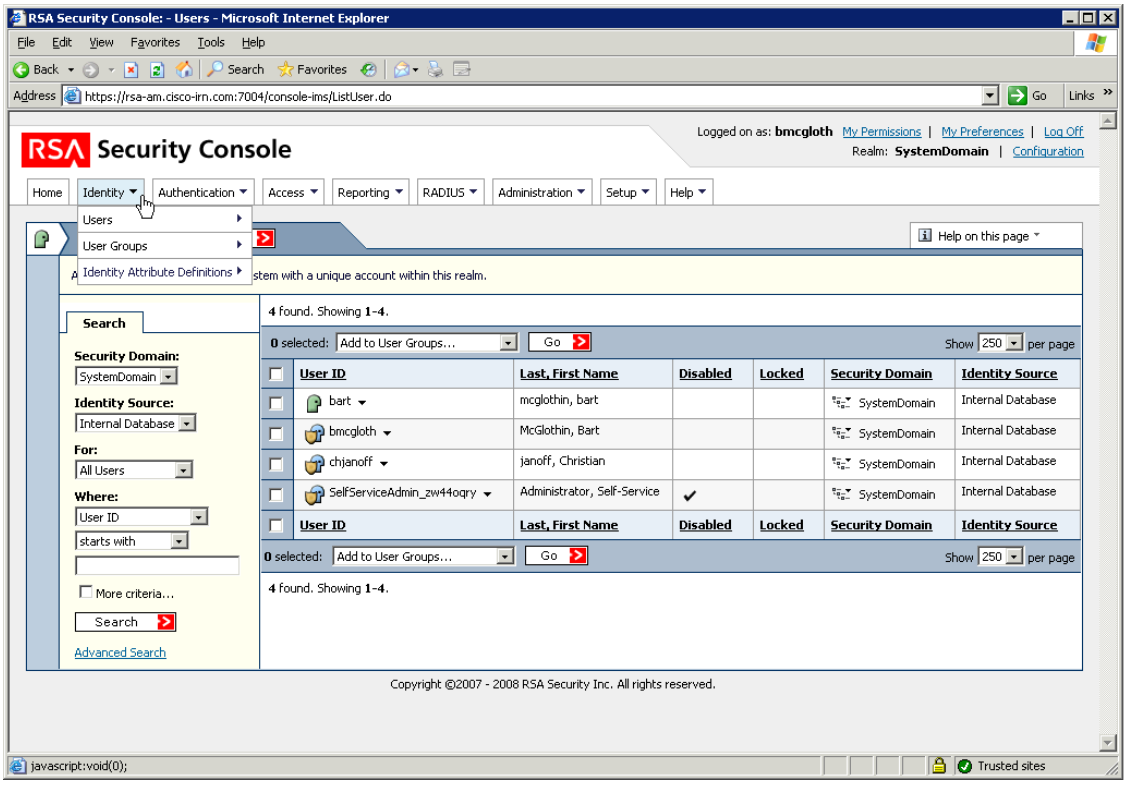
- Access Control—Restrict access to ePHI data as required by HIPAA Administrative and Technical safeguards
  - §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.308(a)(3)(ii)(A) Authorization/Supervision. Implement procedures for the authorization and/or supervision of workforce members who work with ePHI or in locations where it might be accessed. Requirements addressed include: Auditing.
  - §164.308(a)(4)(ii)(B) Access authorization. Implement policies and procedures for granting access to electronic protected health information, for example, through access to a workstation, transaction, program, process, or other mechanism. Requirements addressed include: Access Control and Auditing.
  - §164.312(a)(1) Access Control. Implement technical policies and procedures for electronic information systems that maintain ePHI to allow access only to those persons or software programs that have been granted access rights as specified in §164.308(a)(4).
- Incident response—Implement security incident response as required by HIPAA Administrative safeguards.
  - §164.308(a)(6)(i) Security Incident Procedures. Implement policies and procedures to address security incidents.
  - §164.308(a)(6)(ii) Response and Reporting. Identify and respond to suspected or known security incidents; mitigate, to the extent practicable, harmful effects of security incidents that are known to the covered entity or business associate; and document security incidents and their outcomes. Requirements addressed include: Incident Response and Auditing.
- Auditing—Implement mechanisms to record and examine activity in systems that contain or use ePHI as required by HIPAA Technical safeguards.
  - §164.312(b) Audit controls. Implement hardware, software, and/or procedural mechanisms that record and examine activity in information systems that contain or use electronic protected health information. Requirements addressed include: Auditing.
  - §164.308(a)(5)(ii)(C) Log-in Monitoring. Procedures for monitoring log-in attempts and reporting discrepancies. Requirements addressed include: Access Control and Auditing.
- Integrity—Protect electronic protected health information from improper alteration or destruction as required by HIPAA Technical safeguards.

– §164.312(c)(1) Data Integrity. Implement policies and procedures to protect health information from improper alteration or destruction.

Sample Configuration

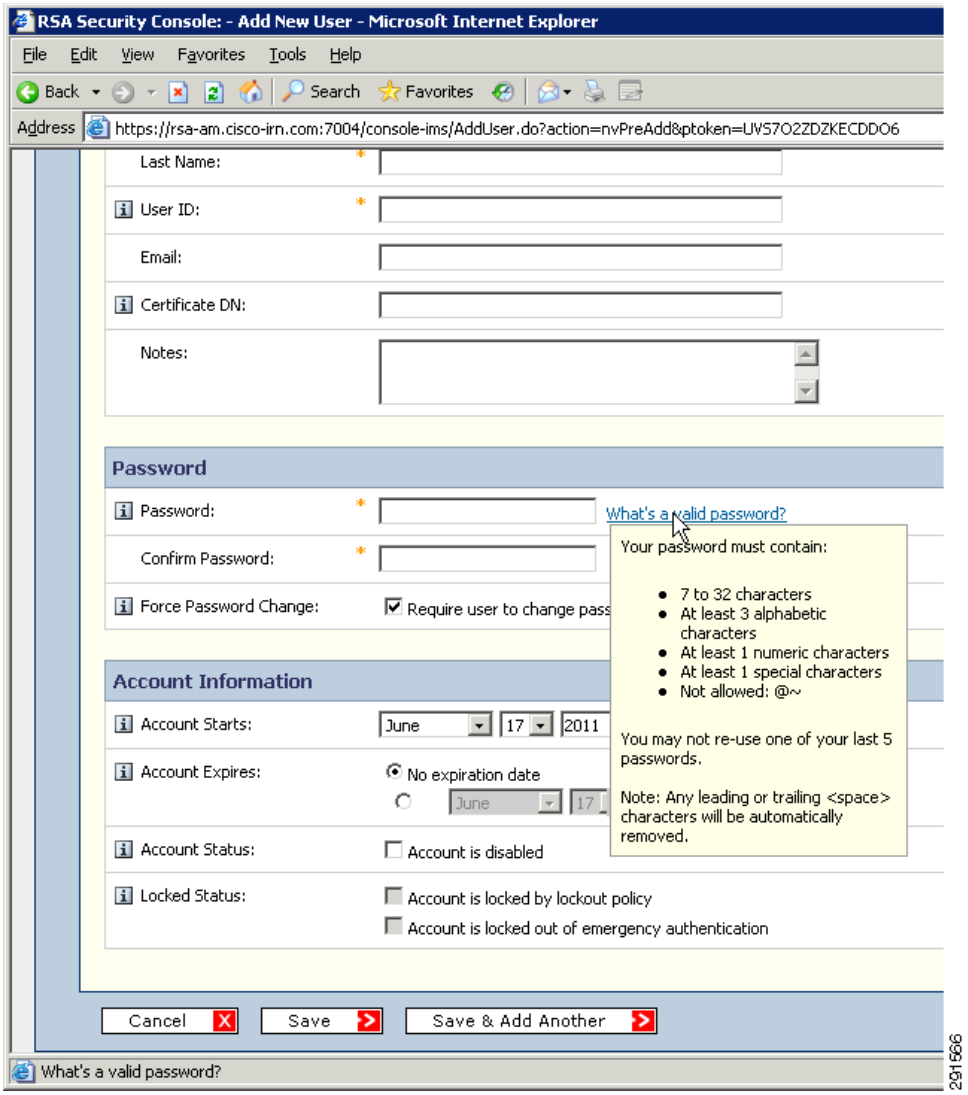
RSA Authentication Manager has powerful access control capabilities to limit, track, and monitor all user access and events, thereby addressing all of the safeguards listed under Access Control above. User access throughout the solution uses a centralized user database in the Active Directory, which is linked through authentication servers via LDAP, RADIUS, and TACACS+ services, enabling verification of users and administrators of devices and endpoints. These services are located in the data center. RSA Authentication Manager protects epHI data based on user role or group membership. Users and groups are created under the Identity tab of the Security console, as shown in Figure 5-54.

Figure 5-54 Users and Groups



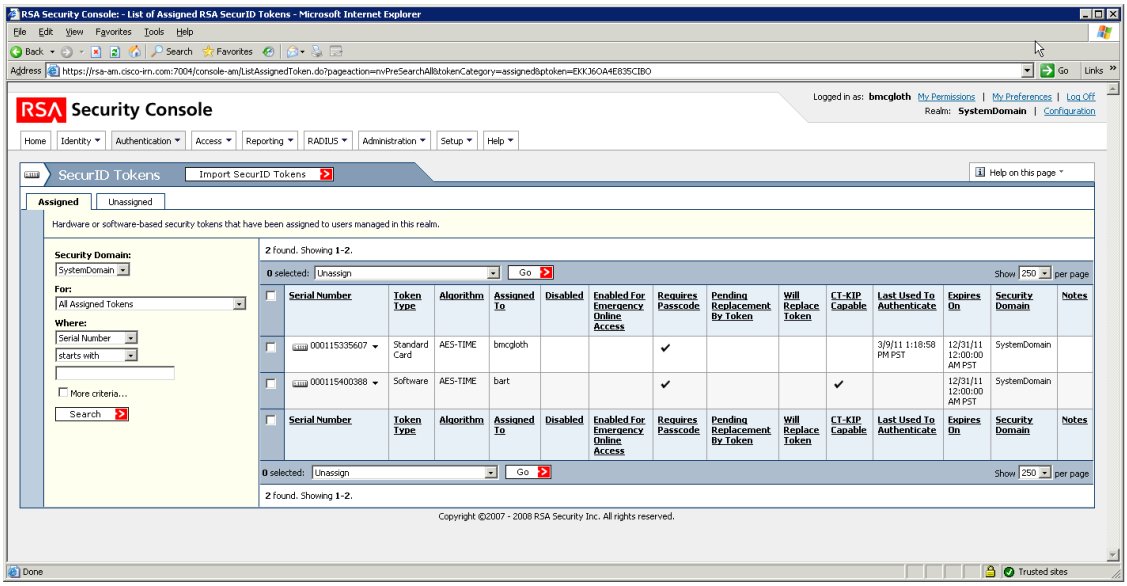
Local individual user accounts are configured in the event that the centralized authentication server cannot be reached, and support advanced policies regarding password rotation and expiration as can be configured as necessary. Local user accounts in RSA Authentication Manager require setting of a password according to the assigned password policy as shown in Figure 5-55.

Figure 5-55 User Password Requirements Based on Policy



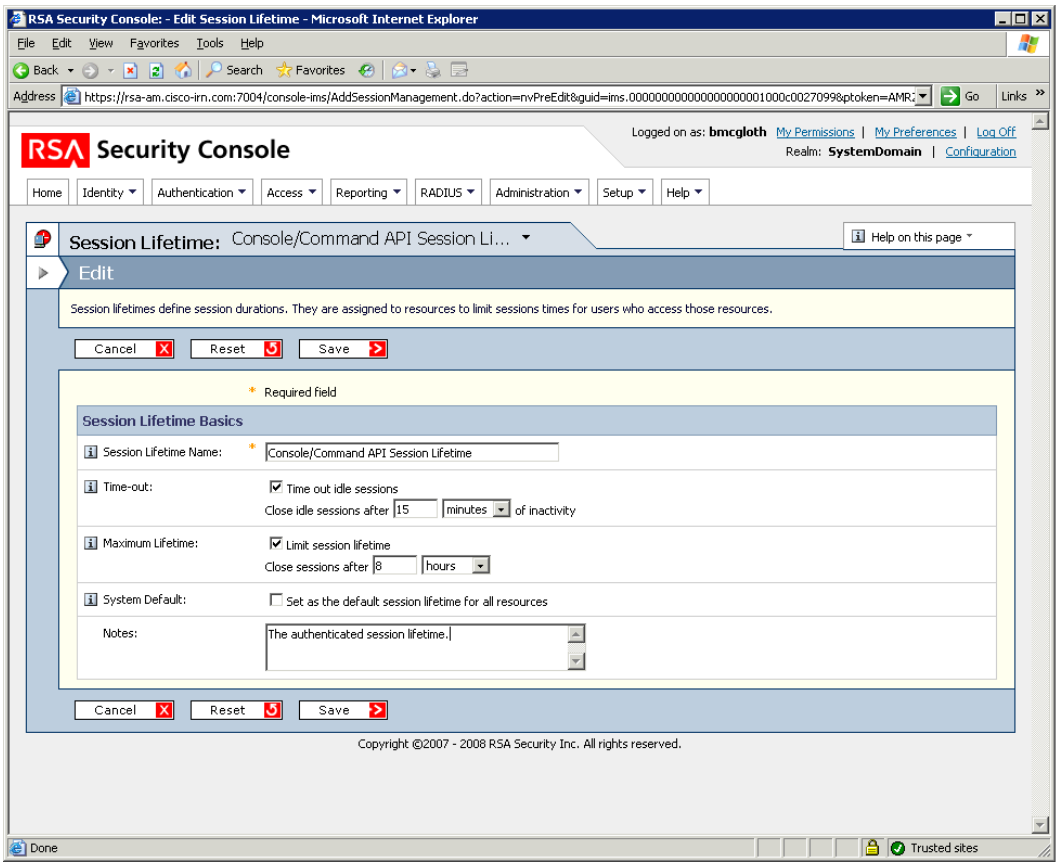
Additional authentication tokens can also be assigned to each user, as shown in Figure 5-56.

Figure 5-56 Assigned Tokens



HIPAA Safeguard 164.312(a)(2)(ii) requires the enabling of automatic logoff options. RSA Authentication Manager supports session policies under the Access tab. Change the Session Time-out for the Console/Command API to 15 minutes from the default, as shown in Figure 5-57.

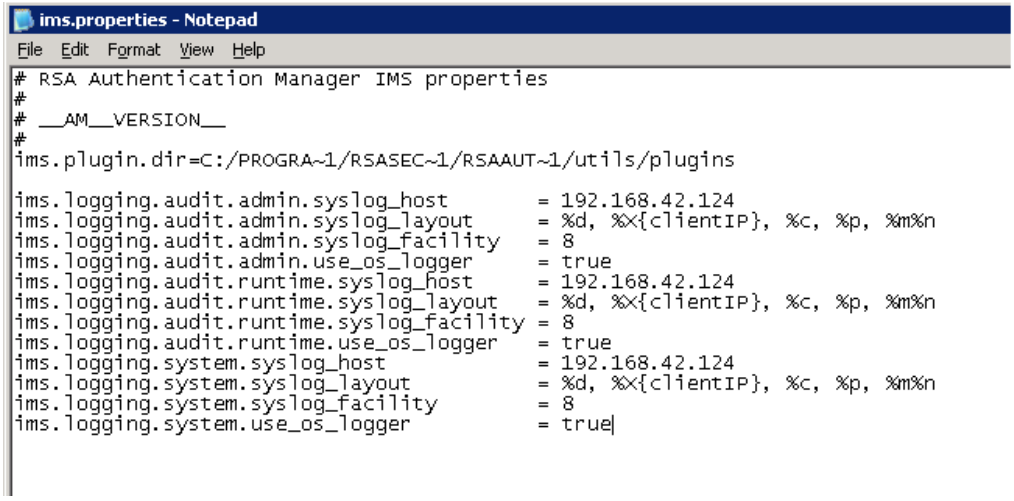
Figure 5-57 Session Lifetime for Console



To secure authentication information and management of the server, addressing Safeguard 164.308(a)(1)(i) Security Management, the management console supports only HTTPS access by default.

To address the Incident Response and Auditing HIPAA Safeguards identified above, RSA Authentication Manager can be configured to send its log data to the RSA enVision log management. The configuration procedure is documented in the enVision Event Source Configuration Guide for RSA Authentication Manager, which can be found at RSA Secure Care Online (https://knowledge.rsasecurity.com/). One step is editing the IMS.Properties file, as shown in Figure 5-58.

Figure 5-58 IMS Properties File



As a best practice, NTP is used to synchronize clocks among network devices. This synchronization allows events to be correlated when system logs are created and when other time-specific events occur. Time synchronization for Windows servers is specified through the domain policy. Servers synchronize their clocks with the domain controller, which in turn is synchronized using NTP. This implementation was Windows-based.

Clock synchronization is a requirement for common industry security frameworks such as the HiTrust Common Security Framework (CSF), ISO 27002, and NIST Security Publications, as well as other industry-based standards.

HIPAA Standards Failed

No HIPAA standards were failed.

HIPAA Implementation Specifications Failed

No HIPAA implementation specifications were failed.

Cisco Identity Services Engine

The Cisco Identity Services Engine (ISE) allows for management of user access (authorization) to systems containing PHI. Additionally, the Access Control Server is designed to prevent unauthorized devices from accessing systems containing PHI and protect access from unauthorized locations. ISE is a security component that provides visibility and control into who and what is connected to the network. Cisco ISE allows organizations to embrace the rapidly changing business environment of mobility,

virtualization, and collaboration while enforcing compliance, maintaining data integrity and confidentiality, and establishing a consistent global access policy. Cisco ISE allows businesses to gain complete control over the access points into their networks. This includes all wired, wireless, and VPN network entry points.

Cisco ISE allow you to see what devices and users are on your network, and that those devices and users comply with your security policies via the following components:

- Cisco Identity Services Engine—A next-generation policy manager that delivers authentication, authorization, and accounting (AAA); posture; profiling; and guest management services on a single platform. The Cisco ISE automatically discovers and classifies endpoints, provides the right level of access based on identity, and provides the ability to enforce endpoint compliance by checking a device's posture. The Cisco ISE also provides advanced authorization and enforcement capabilities, including Security Group Access (SGA) through the use of security group tags (SGTs) and security group access control lists (ACLs). Administrators can centrally create and manage access control policies for users and endpoints in a consistent fashion, and gain end-to-end visibility into everything that is connected to the network.
- Cisco ISE Identity on Cisco Networking Infrastructure—Identity-based networking services on the Cisco routing, switching, and wireless infrastructure provides the ability to authenticate users and devices via features such as 802.1x, MAC authentication bypass, and web authentication. In addition, this same infrastructure is what enforces the appropriate access into parts of the network via VLANs, downloadable or named ACLs and security group ACLs.
- Client—Cisco AnyConnect is a software client that enables you to deploy a single 802.1x authentication framework to access wired and wireless networks while the Cisco NAC agent delivers endpoint posture information. The Cisco ISE architecture also supports native O/S supplicants.

The Cisco Identity Services Engine solution offers the following benefits:

- Allows enterprises to authenticate and authorize users and endpoints via wired, wireless, and VPN with consistent policy throughout the enterprise
- Prevents unauthorized network access to protect corporate assets
- Provides complete guest lifecycle management by empowering sponsors to on-board guests, thus reducing IT workload
- Discovers, classifies, and controls endpoints connecting to the network to enable the appropriate services per endpoint type
- Enforces security policies by blocking, isolating, and repairing noncompliant machines in a quarantine area without needing administrator attention
- Offers a built-in monitoring, reporting, and troubleshooting console to assist helpdesk operators and administrators streamline operations.

Figure 5-59 shows an example of a Cisco ISE-based LAN deployment.

Figure 5-59 Cisco ISE-Based LAN Deployment

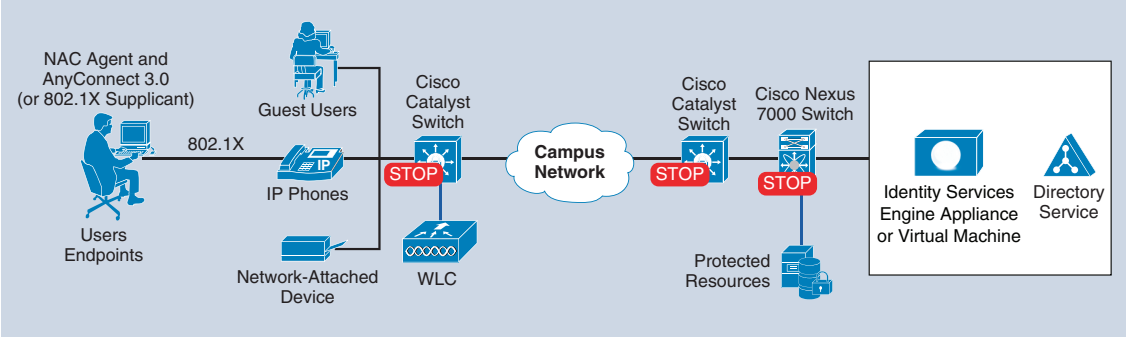


Table 5-13 PHI HIPAA Assessment Summary—Cisco ISE

Models Assessed	
Cisco Identity Service Engine version 1.0.3.377	
HIPAA Safeguards Addressed	
Administrative	**Standards/Implementation Specifications**
164.308	(a)(1)(i) Security Management Process
	(a)(3)(ii)(A) Authorization/Supervision
	(a)(4)(ii)(A) Isolating Clearing House Functions
	(a)(4)(ii)(B) Access Authorization
	(a)(4)(ii)(C) Access Est./Modification
	(a)(5)(ii)(C) Log-in Monitoring
	(a)(5)(ii)(D) Password Management
	(a)(6)(i) Security Incident Procedures
	(a)(6)(ii) Response and Reporting
Technical	**Standards/Implementation Specifications**
164.312	(a)(i) Access Control
	(b) Audit Controls
	(a)(2)(ii) Emergency Access Procedures
	(a)(d) Personal Entity Authentication
HIPAA Standards Failed	
No HIPAA standards were failed.	
HIPAA Implementation Specifications Failed	
No HIPAA implementation specifications were failed.	

Primary PHI Function

Cisco ISE identity features are designed to detect and prevent rogue wireless devices from connecting to in-scope PHI networks; in addition, Cisco ISE locks down publicly accessible network ports to only authorized devices and users.

The Identity Services Engine allows for management of user access (authorization) to systems containing PHI. Additionally, the Access Control Server can prevent unauthorized devices from accessing systems containing PHI and protect access from unauthorized locations.

Identity Services Engine logs can be used to identify unauthorized attempts to connect to systems containing PHI to help meet the supervision requirements.

Design Considerations

For the purposes of this guide, Cisco ISE is configured to authenticate individual users and ISE Admin users using Active Directory (AD). Cisco ISE is also used to profile and assess the posture of individual wired and wireless devices to ensure that they comply with the HIPAA standard. Cisco ISE relies on TrustSec wired and wireless identity features such as 802.1x, MAB, and web portal authentication on Cisco infrastructure to collect user identity information. It relies on the Cisco ISE NAC agent and the Cisco ISE profiler engine to collect posture and profiling information from devices.

Note the following ISE configuration best practices for HIPAA compliance:

- The solution tested used the virtual machine appliance version of Cisco ISE running on an ESX platform.
- The default accounts for administration are removed.
- ISE only supports HTTPS and SSH access
- Cisco ISE communicates with the Cisco switches and wireless controllers using RADIUS.
- Cisco ISE can use dynamic VLAN and port or VLAN access control rules to provide HIPAA segmentation of a network. For example, members of the HIPAA active directory group are automatically moved to the HIPAA VLAN when they connect to the network. Cisco ISE can then apply strong access lists to this VLAN or directly to the user switch port to accomplish segmentation.
- Access control rule sets must adhere to a “least amount of access necessary” policy. Rules must be defined by specific source/destination addressing and TCP/UDP ports required for the PHI data environment.
- Configure appropriate banner messages on login, incoming, and exec modes of the router. The login banner warning should not reveal the identity of the company that owns or manages the router. The incoming and executive banners should state that these areas are considered private and that unauthorized access will result in prosecution to the full extent of the law.
- The Cisco ISE system is configured to be compliance with all of the access controls, logging controls, and other general system controls required by HIPAA.

HIPAA Assessment Detail—HIPAA Safeguards Passed

All of the sample configurations of the Cisco ISE shown below were used to meet the following list of satisfied controls:

- Access Control—Restrict access to ePHI data as required by HIPAA Administrative and Technical safeguards
  - §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.

  - §164.308(a)(4)(ii)(A) Isolating healthcare clearinghouse function. If a healthcare clearinghouse is part of a larger organization, the clearinghouse must implement policies and procedures that protect the electronic protected health information of the clearinghouse from unauthorized access by the larger organization. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.308(a)(4)(ii)(B) Access authorization. Implement policies and procedures for granting access to electronic protected health information, for example, through access to a workstation, transaction, program, process, or other mechanism. Requirements addressed include: Access Control and Auditing.
  - §164.308(a)(4)(ii)(C) Access Establishment and Modification. Implement policies and procedures that, based upon the covered entity's or the business associate's access authorization policies, establish, document, review, and modify a user's right of access to a workstation, transaction, program, or process. Requirements addressed include: Access Control, Incident Response, and Auditing.
  - §164.312(a)(1) Access Control. Implement technical policies and procedures for electronic information systems that maintain ePHI to allow access only to those persons or software programs that have been granted access rights as specified in §164.308(a)(4).
  - §164.312(d) Person or entity authentication. Implement procedures to verify that a person or entity seeking access to electronic protected health information is the one claimed. Requirements addressed include: Access Control and Auditing.
  - §164.308(a)(5)(ii)(C) Log-in Monitoring. Procedures for monitoring log-in attempts and reporting discrepancies. Requirements addressed include: Access Control and Auditing.
- Incident response—Implement security incident response as required by HIPAA Administrative safeguards.
  - §164.308(a)(6)(ii) Response and Reporting. Identify and respond to suspected or known security incidents; mitigate, to the extent practicable, harmful effects of security incidents that are known to the covered entity or business associate; and document security incidents and their outcomes. Requirements addressed include: Incident Response and Auditing.
- Auditing—Implement mechanisms to record and examine activity in systems that contain or use ePHI as required by HIPAA Technical safeguards.
  - §164.308(a)(3)(ii)(A) Authorization/Supervision. Implement procedures for the authorization and/or supervision of workforce members who work with ePHI or in locations where it might be accessed. Requirements addressed include: Auditing.
  - §164.312(b) Audit controls. Implement hardware, software, and/or procedural mechanisms that record and examine activity in information systems that contain or use electronic protected health information. Requirements addressed include: Auditing.
  - §164.308(a)(5)(ii)(C) Log-in Monitoring. Procedures for monitoring log-in attempts and reporting discrepancies. Requirements addressed include: Access Control and Auditing.
  - §164.312(d) Person or entity authentication. Implement procedures to verify that a person or entity seeking access to electronic protected health information is the one claimed. Requirements addressed include: Access Control and Auditing.

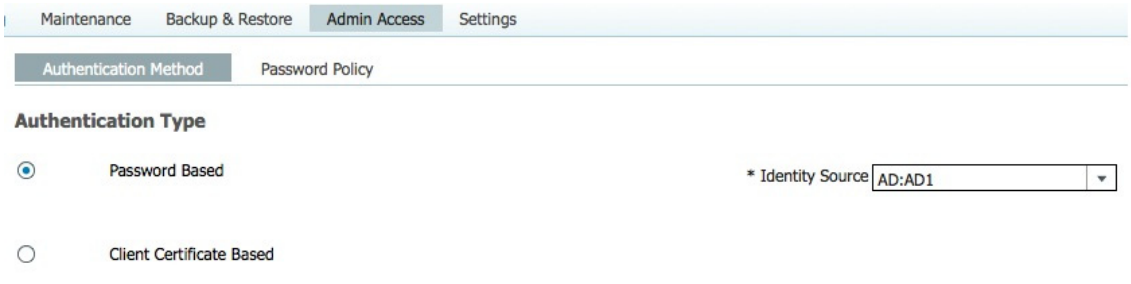
Sample Configuration

Cisco ISE is designed to track and monitor all administrative user access and events, thereby addressing all of the safeguards listed under Access Control above. User access throughout the solution uses a centralized user database in the Active Directory, which is linked through authentication servers via

LDAP and RADIUS services, enabling verification of users and administrators of devices and endpoints. These services are located in the data center. Individual user IDs are assigned, and roles are based on group membership.

Figure 5-60 shows admin authentication configured to use Active Directory.

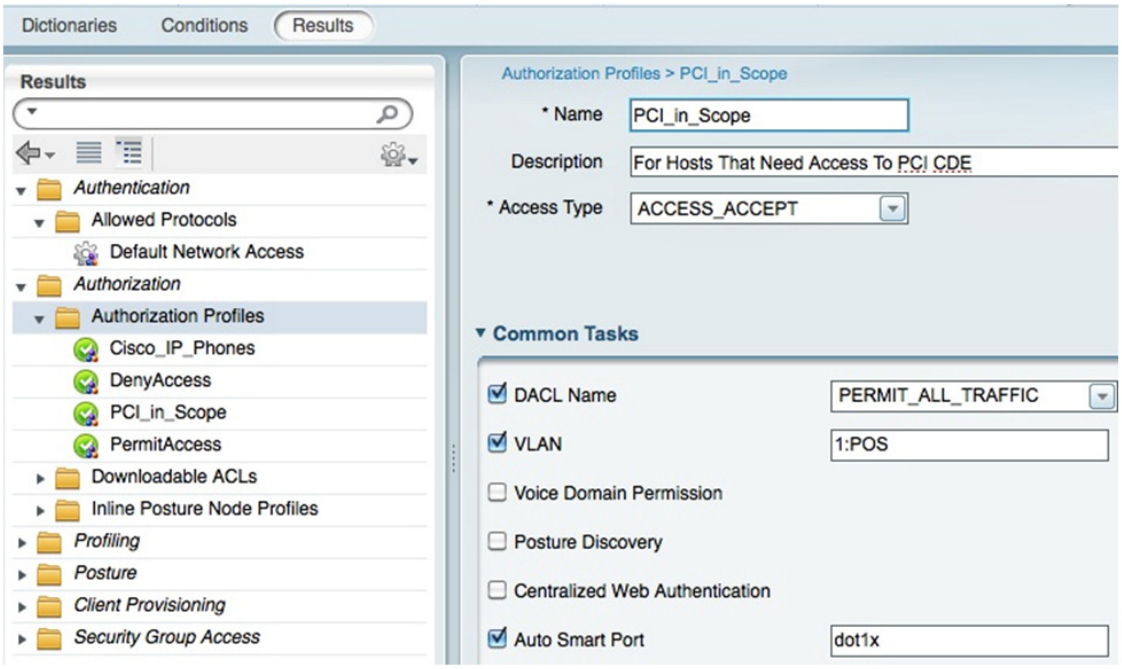
Figure 5-60 Admin Access Using Active Directory for Authentication



Cisco ISE cntrols access so that only privileged users can access the ePHI environment. This is done using the authentication credentials supplied by the wired and wireless infrastructure, along with the AD attributes of a user connecting to the network. Based on a Cisco ISE authorization profile match, that user is put onto the proper VLAN and given a group-specific port access control list to control where they can go on the network. Additionally, a Cisco SmartPort macro can be run on the switchport for proper configuration.

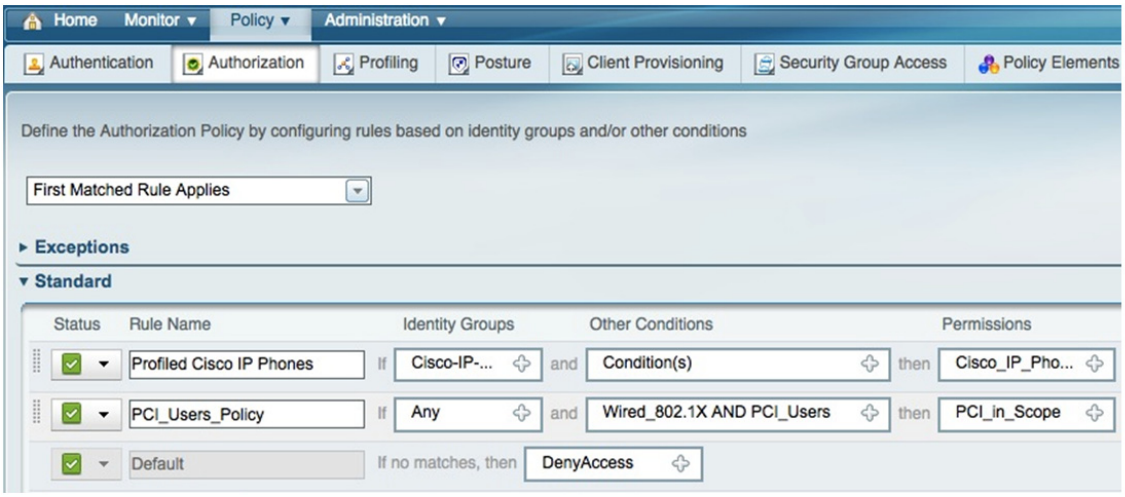
Figure 5-61 shows the Authorization Profiles screen.

Figure 5-61 Authorization Profiles



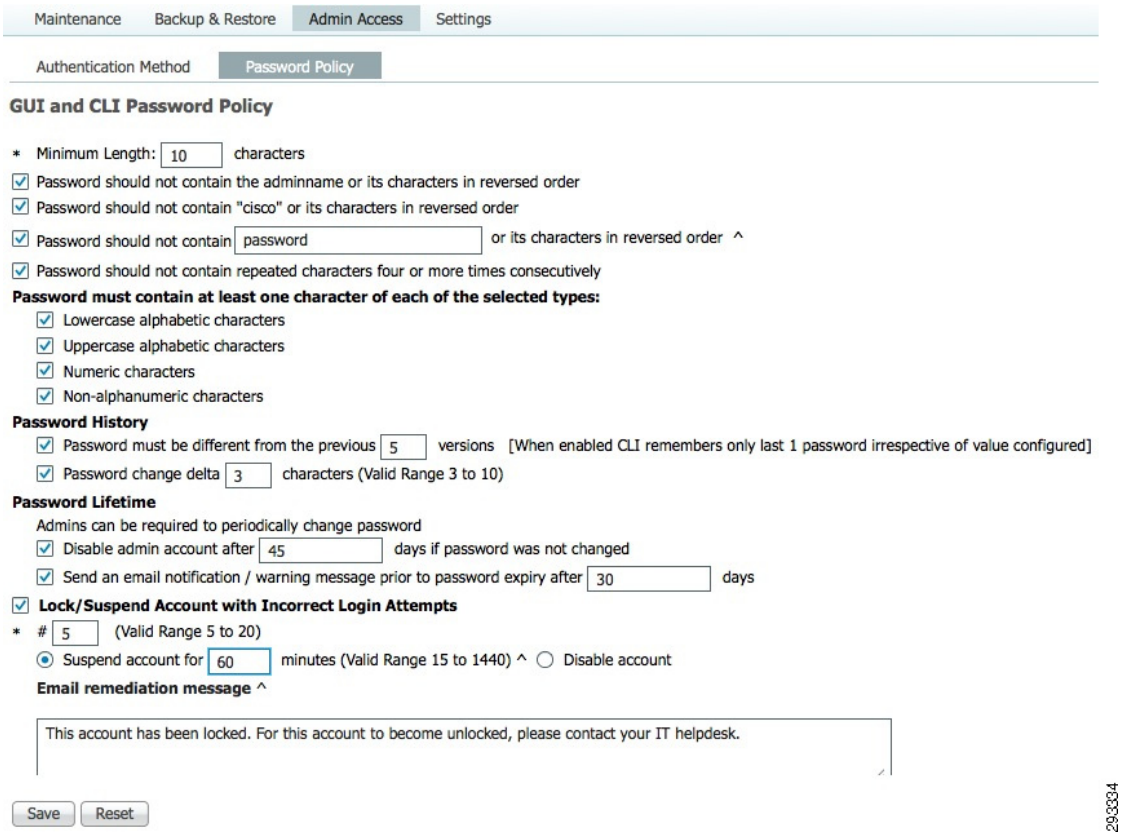
If Cisco ISE does not explicitly match an authorization policy as shown in Figure 5-62, network access is denied.

Figure 5-62 Authorization Policy



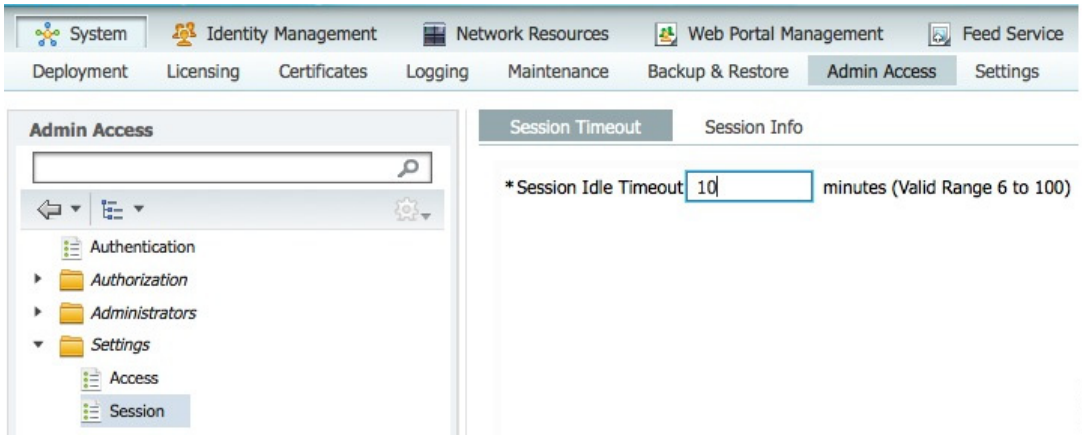
Local individual user accounts are configured in the event that the centralized authentication server cannot be reached. These accounts must be manually updated to maintain compliance requirements regarding password rotation and expiration as specified in established policies for passwords. The passwords used for these accounts can be tailored by editing of the Password Policy to match corporate requirements as shown in Figure 5-63.

Figure 5-63 ISE Admin Password Policy Settings



HIPAA Safeguard 164.312(a)(2)(ii) requires the enabling of automatic logoff options. Cisco ISE supports session idle timeout under the Administration Access/Session tab. It is a best practice to change the session timeout to 15 minutes, as shown in Figure 5-64, which will re-authenticate both admin users and RADIUS users.

Figure 5-64 Admin Access



To secure authentication information and management of the ISE server, addressing Safeguard 164.308(a)(1)(i) Security Management, the ISE management console supports only HTTPS access.

Additionally, Cisco ISE NAC capabilities can be configured on the clinic and hospital switches to automate the verification of approved devices being attached to the network. In addition to configuring the ISE authentication services in the data center, adding the following configurations to all switch and switch interface ports where ISE network access control is required. In most cases, every access switch port in your network should be protected using ISE. However, as a minimum, any switch port that could potentially let a host find its way to the ePHI security domain should be protected by Cisco ISE.

Pre-requirements for ISE NAC (domain name, name server, time settings, crypto keys):

```
ip domain-name cisco-irn.com
ip name-server 192.168.42.130
Crypto key generate rsa 1024
ntp server 192.168.62.161 prefer
ntp server 192.168.62.162
clock timezone PST -8
clock summer-time PDT recurring
!
! ----Configurations to add for NAC ----
!
aaa new-model
!
!
aaa authentication dot1x default group radius local
aaa authorization network default group radius
aaa authorization auth-proxy default group radius
aaa accounting dot1x default start-stop group radius
!
aaa server radius dynamic-author
client 192.168.42.111
server-key 7 <removed>
!
radius-server attribute 6 on-for-login-auth
radius-server attribute 6 support-multiple
radius-server attribute 8 include-in-access-req
radius-server dead-criteria time 5 tries 3
```

```
radius-server host 192.168.42.111 auth-port 1812 acct-port 1813 key 7 <removed>
radius-server vsa send accounting
radius-server vsa send authentication
!
authentication mac-move permit
!
!
ip device tracking
ip admission name ise proxy http inactivity-time 60
!
cts sxp enable
cts sxp default source-ip 10.10.111.13 {use Switch Management IP}
!
dot1x system-auth-control
!
fallback profile ise
ip access-group ACL-DEFAULT in
ip admission ise
!
! ----Auto Smart Ports Macro method for port configurations-------
!
macro name dot1x
switchport access vlan 11
switchport mode access
switchport voice vlan 13
ip arp inspection limit rate 1000
ip access-group ACL-DEFAULT in
authentication event fail action next-method
authentication host-mode multi-auth
authentication open
authentication order dot1x mab webauth
authentication priority dot1x mab
authentication port-control auto
authentication timer reauthenticate server
authentication timer inactivity server
authentication violation restrict
authentication fallback ise
mab
snmp trap mac-notification change added
dot1x pae authenticator
dot1x timeout tx-period 5
```

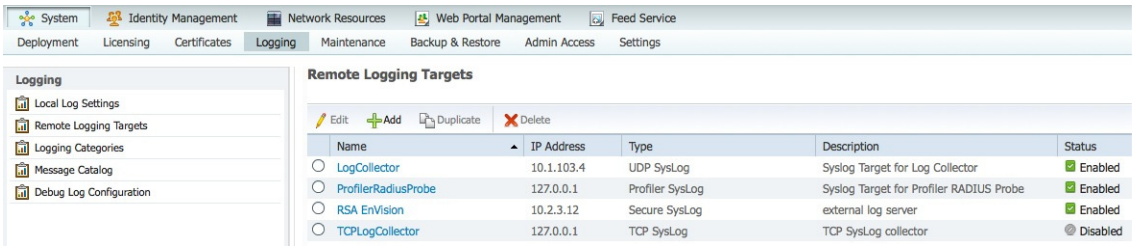
Methods that may be used in the process include, but are not limited to, wireless network scans, physical site inspections, Network Access Control (NAC), or wireless IDS/IPS.

Cisco ISE Identity features were enabled on the wired infrastructure to authenticate users and devices. The Cisco ISE Policy Manager was configured to not allow an unauthorized device to connect to the wired network. Cisco ISE was configured to alert and mitigate this threat.

Cisco ISE was configured to profile all devices connected to the network. Any devices detected were allowed only if they were in the approved list. All wired ports were set up to authenticate and posture-assess users and devices connecting to the network switches. The device posture assessment included checks for the setup of peer-to-peer wireless network and the setup of a wireless card as an access point on the device. If either of these were true, the device would be denied network access.

To address the Incident Response and Auditing HIPAA Safeguards identified above, Cisco ISE can be configured to send its log data to the RSA enVision log management platform. Figure 5-65 shows the configuration of logging servers.

Figure 5-65 Remote Logging Targets



As a best practice, NTP is used to synchronize clocks among network devices. This synchronization allows events to be correlated when system logs are created and when other time-specific events occur. All devices in the network used NTP to synchronize their clocks. The NTP servers were hosted at the data center site. The Cisco Lab uses two NTP servers that are synchronized to external reference sources. All systems and devices in the lab are pointed to these two servers. Cisco ISE uses NTP to meet these requirements by implementing the following configuration statement:

```
ntp server 192.168.62.161 192.168.62.162
```

HIPAA Standards Failed

No HIPAA standards were failed.

HIPAA Implementation Specifications Failed

No HIPAA implementation specifications were failed.

Management

Cisco Prime LAN Management Solution (LMS)

Cisco Prime LAN Management Solution (LMS), a part of Cisco Prime Infrastructure, delivers powerful network lifecycle management by simplifying the configuration, compliance, monitoring, troubleshooting, and administration of Cisco networks. Cisco Prime LMS offers end-to-end management for Cisco's latest business-critical technologies and services such as Medianet, Cisco ISE, and Cisco EnergyWise while complying with corporate and regulatory requirements.

Table 5-14 PHI HIPAA Assessment Summary—Cisco LMS

Models Assessed	
Cisco Prime Management Solution	
HIPAA Safeguards Addressed	
Administrative	**Standards/Implementation Specifications**
164.308	(a)(1)(i) Security Management Process
	(a)(3)(i) Authorization/Supervision
	(a)(4)(i) Access Authorization
	(a)(5)(i) Log-in Monitoring
	(a)(6)(i) Response and Reporting
Technical	**Standards/Implementation Specifications**
164.312	(a)(i) Access Control
	(b) Audit Controls
HIPAA Standards Failed	
No HIPAA standards were failed.	
HIPAA Implementation Specifications Failed	
No HIPAA implementation specifications were failed.	

Primary PHI Function

LMS simplifies compliance by ensuring that all of the devices across the network adhere to the security policy of the company. In addition, it will verify that device configurations; match templates, are synchronized, and includes a customized compliance dashboard to simplify the ongoing management for administrators.

Design Considerations

- Provide sufficient licenses to cover all devices in your network.
- Provide proper host system sizing including CPUs, memory, and storage for the selected operating system.
- Restrict access behind a firewall or access list to only those administrative clients that need access.
- Activate the NMC capability license for compliance audits.

Licensed/Unlicensed Compliance and Audit Reports

The following compliance and audit reports require a regulatory compliance management license:

- HIPAA Compliance Reports
- SOX (COBIT) Compliance Reports
- ISO/IEC 27002 Compliance Reports
- NSA Compliance Reports
- PCI DSS Compliance Reports
- DHS Checklist Reports
- DISA Checklists Report
- CIS Benchmarks

The following compliance and audit reports are supported by the LMS license alone and do not require a regulatory compliance management license:

- Service Reports
- Lifecycle Management Reports
- Vendor Advisory Reports
- Change Audit Reports

For compliance and audit license information, see the topic "Regulatory Compliance Management License in Administration with Cisco Prime LAN Management Solution 4.2.2".

The Compliance and Audit Report module uses the stored configurations within the LMS database and evaluates them against specifically defined criteria of the selected devices.

HIPAA Assessment Detail—HIPAA Safeguards Passed

All of the sample configurations of the LMS shown below were used to meet the following list of satisfied controls:

- Access Control—Restrict access to ePHI data as required by HIPAA Administrative and Technical safeguards
  - §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.308(a)(3)(ii)(A) Authorization/Supervision. Implement procedures for the authorization and/or supervision of workforce members who work with ePHI or in locations where it might be accessed. Requirements addressed include: Auditing.
  - §164.308(a)(4)(ii)(B) Access authorization. Implement policies and procedures for granting access to electronic protected health information, for example, through access to a workstation, transaction, program, process, or other mechanism. Requirements addressed include: Access Control and Auditing.
  - §164.312(a)(1) Access Control. Implement technical policies and procedures for electronic information systems that maintain ePHI to allow access only to those persons or software programs that have been granted access rights as specified in §164.308(a)(4).
  - §164.308(a)(5)(ii)(C) Log-in Monitoring. Procedures for monitoring log-in attempts and reporting discrepancies. Requirements addressed include: Access Control and Auditing.

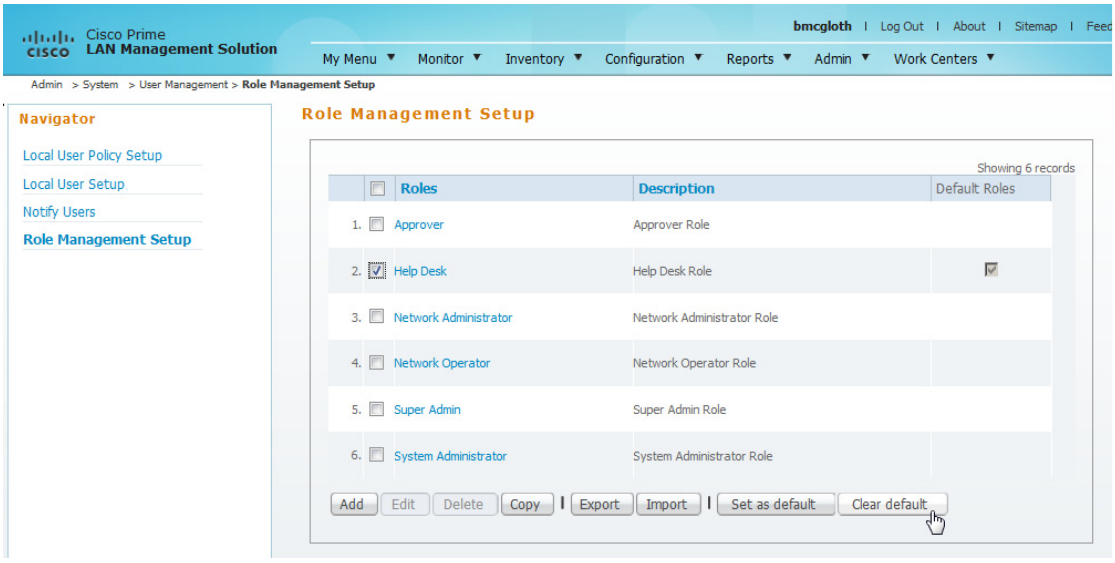
- Incident response—Implement security incident response as required by HIPAA Administrative safeguards.
  - §164.308(a)(6)(ii) Response and Reporting. Identify and respond to suspected or known security incidents; mitigate, to the extent practicable, harmful effects of security incidents that are known to the covered entity or business associate; and document security incidents and their outcomes. Requirements addressed include: Incident Response and Auditing.
- Auditing—Implement mechanisms to record and examine activity in systems that contain or use ePHI as required by HIPAA Technical safeguards.
  - §164.312(b) Audit controls. Implement hardware, software, and/or procedural mechanisms that record and examine activity in information systems that contain or use electronic protected health information. Requirements addressed include: Auditing.
  - §164.308(a)(5)(ii)(C) Log-in Monitoring. Procedures for monitoring log-in attempts and reporting discrepancies. Requirements addressed include: Access Control and Auditing.

Sample Configuration

A centralized user database (Active Directory) is accessed by Cisco Secure ACS using TACACS+ services. Individual user IDs are assigned. Roles are defined within LMS and based on group membership. This configuration was used to address all of the safeguards listed under Access Control above.

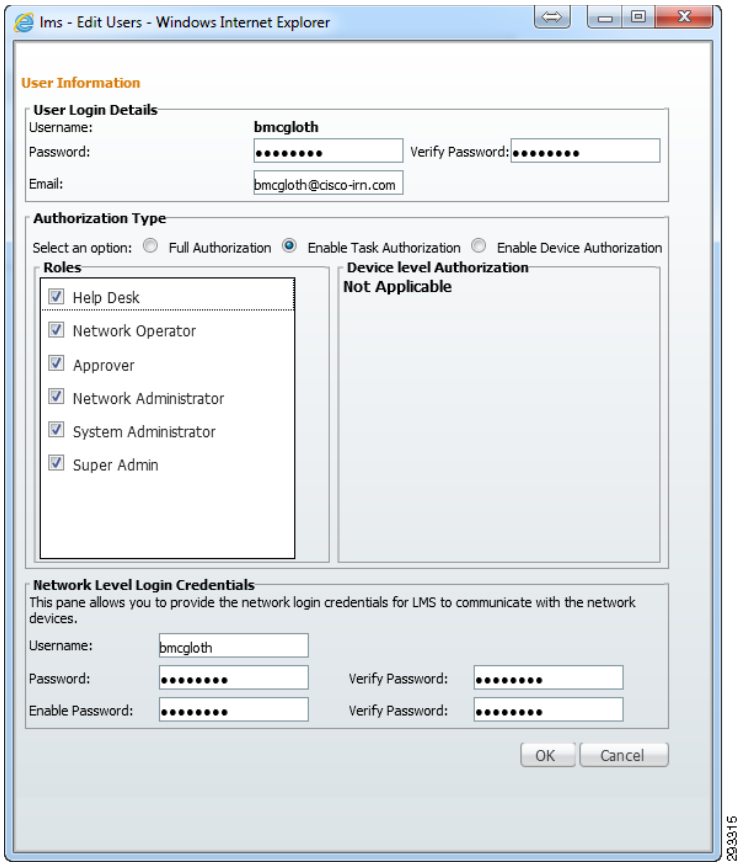
Cisco Prime LMS supports role-based user access. Users can be assigned to role groups and, based on privilege levels, have access to only the tasks they require for their job function. By default in Cisco Prime LMS, authenticated users are allowed help desk level access unless specifically configured and assigned to appropriate roles. To restrict access to only configured users, clear the default role option under Admin > System > User Management > Role Management Setup (see Figure 5-66).

Figure 5-66 Role Management Setup



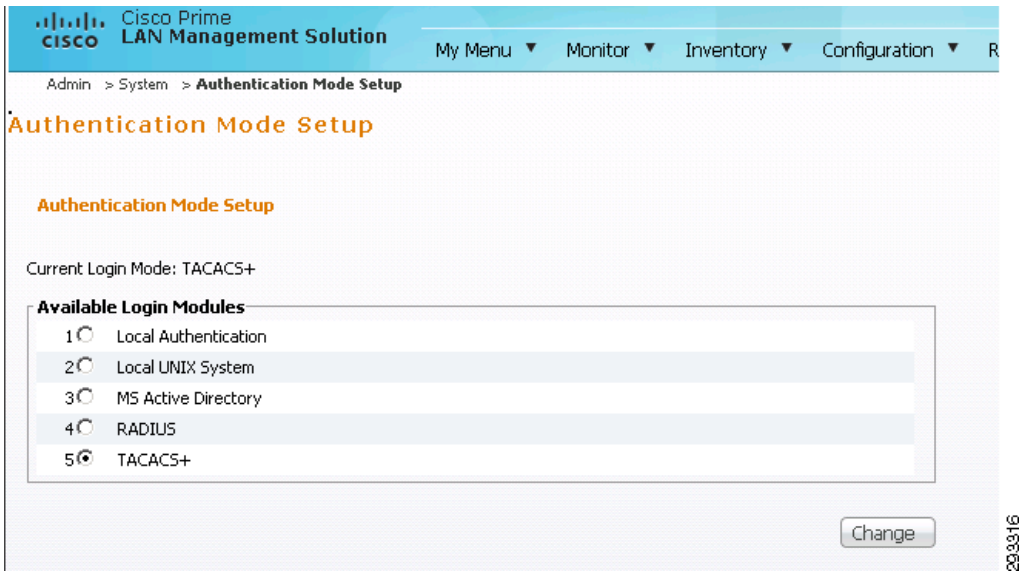
Local user accounts are configured to authorize role privileges and can also be used as fallback if the central authentication server cannot be reached. These accounts must be manually updated to maintain compliance requirements regarding password rotation and expiration. (See Figure 5-67.)

Figure 5-67 LMS Local User Profile and Roles



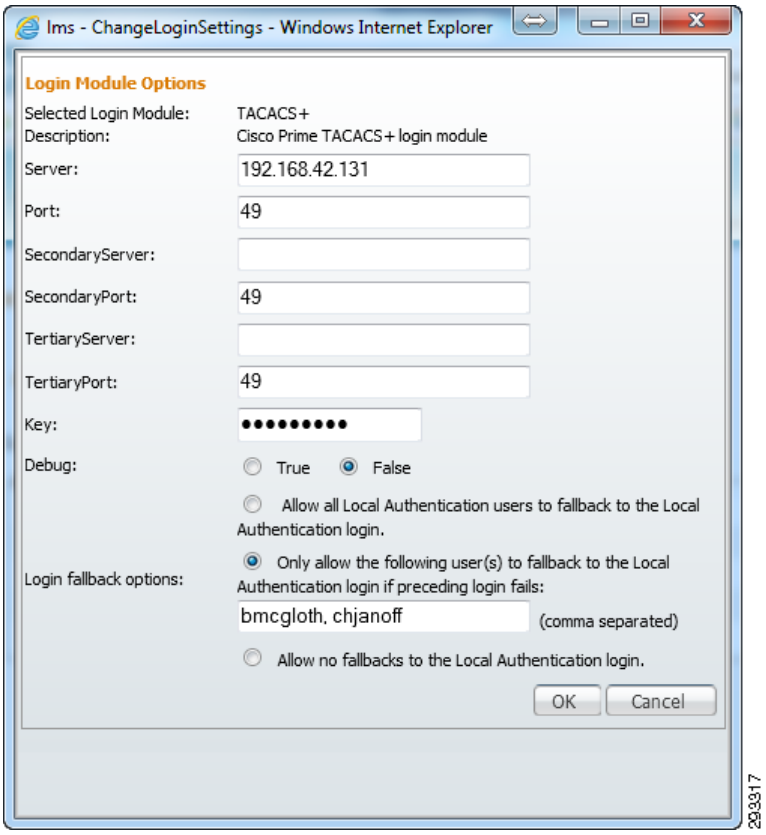
Several AAA services are available to externally authenticate users assigned to administer the system. Roles for these individuals are created and managed within the LMS system (see Figure 5-68). As of version 4, LMS no longer supports external authorization.

Figure 5-68 Authentication Mode Setup



In the TACACS server configuration, either all accounts or only specified accounts can be allowed for authentication in the event that the ACS server cannot be reached. (See Figure 5-69.)

Figure 5-69 Login Module Options

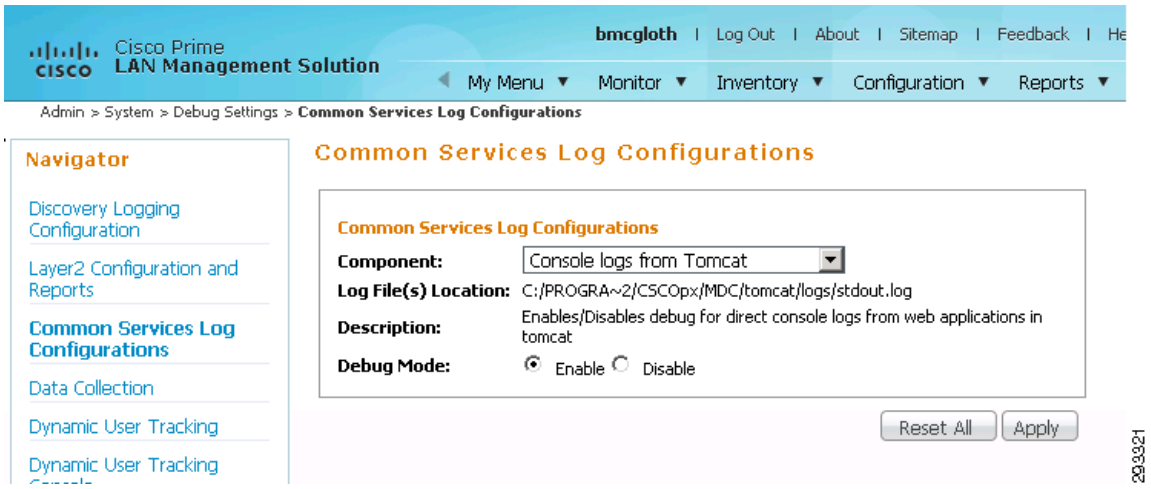


The majority of LMS system activities on the server are accomplished through jobs. Each of these jobs tracks the requestor, the success or failure, the type of event, and the systems against which they are executed. The Job Browser shows status of scheduled, current and past jobs. The jobs browser is located at Admin > Jobs > Browser.

To address the Incident Response and Auditing HIPAA Safeguards identified above, additional audit trail information for system configuration changes (for example, changing the authentication mode of the LMS Server from local to TACACS and back to local) require enabling debug mode logging for the Tomcat service. With debug mode enabled, the server is able to capture sufficient information for logging this configuration change and other similar system changes.

To enable debug mode for the Tomcat console, navigate to Admin > System > Debug Settings > Common Services Log Configurations (see Figure 5-70). Select “Console logs from Tomcat” in the component dropdown. Click the **Enable** radio button and then click **Apply**.

Figure 5-70 Common Services Log Configurations



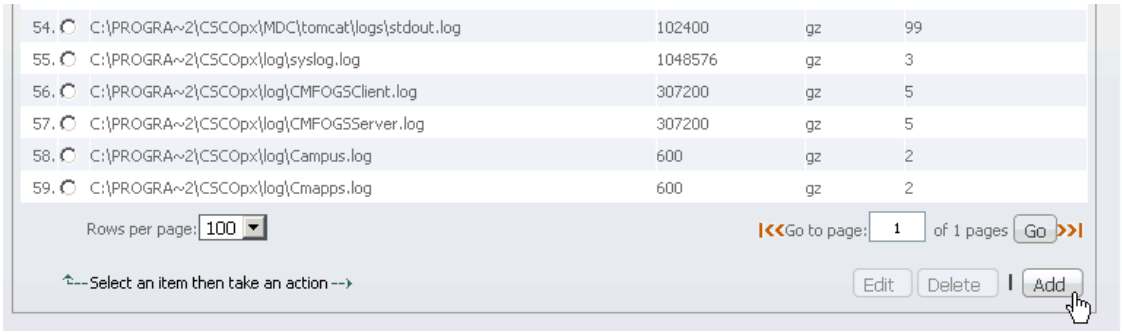
Note Enabling debugging may have a significant performance impact on the LMS system, depending on the number of users who are simultaneously accessing and managing the system. All web front end activity is logged in detail.

The "accesslogfilter.log" captures source IP address, date, time, and username for logged-in users as well as failed logins. Failed logins in this log have a "null" username. The attempted usernames of the failed logins appear in the Audit-Log-{date}.CSV report. These reports do not include the user's source IP address, so some manual correlation must be done between the two logs. These reports are generated at Reports > System Audit Reports > System, or available in \CSCOpx\MDC\log\audit. Information about currently logged-in users is available in Reports > System > Users > Who is logged On.

The "stdout.log" and "accesslogfilter.log" files should be added to the Log Rotation under Admin > System > Log Rotation.

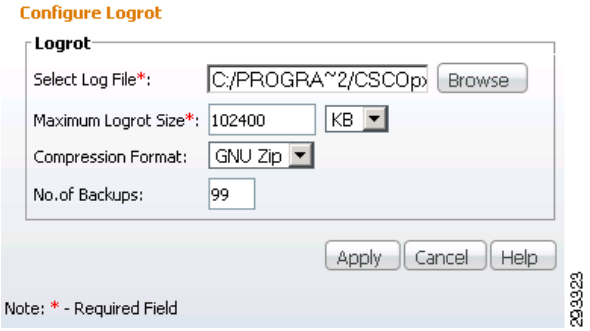
To add these logs to the rotation, click **Add** at the bottom of the page. (See Figure 5-71.)

Figure 5-71 Adding Logs to the Rotation



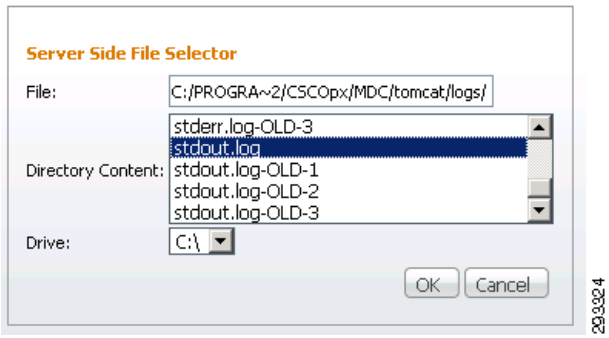
In the popup window, set the max file size needed to capture about a days' worth of information for your environment and usage. Set the number of backups to the maximum of 99. (See Figure 5-72.)

Figure 5-72 Configure Logrot



Click **Browse** and navigate to the file location as appropriate for the operating system; for example, C:/PROGRA~2/CSCOpx/MDC/tomcat/logs/stdout.log. (See Figure 0-8.)

Figure 5-73 Server Side File Selector



Click **OK** to complete the file section, and then **Apply** to complete the addition of the log rotation file.

The Cisco Prime LMS GUI and console scripts support periodic log rotation based on file size and can be configured for the maximum size of the file and number of files to maintain. A script must be created to copy these log files off the system to an external secure repository (for example, a directory on the RSA enVision server) because LMS is not natively capable of sending system events to a centralized repository or ensuring the integrity of the logs to the standards required. This script file should be automated and scheduled to run periodically at least daily (for example, every 1, 2, or 24 hours) via the operating system (Linux, Solaris, Windows) based on the deployment OS. Logs stored locally are buffered and require operator level privileges on the system to be viewed.

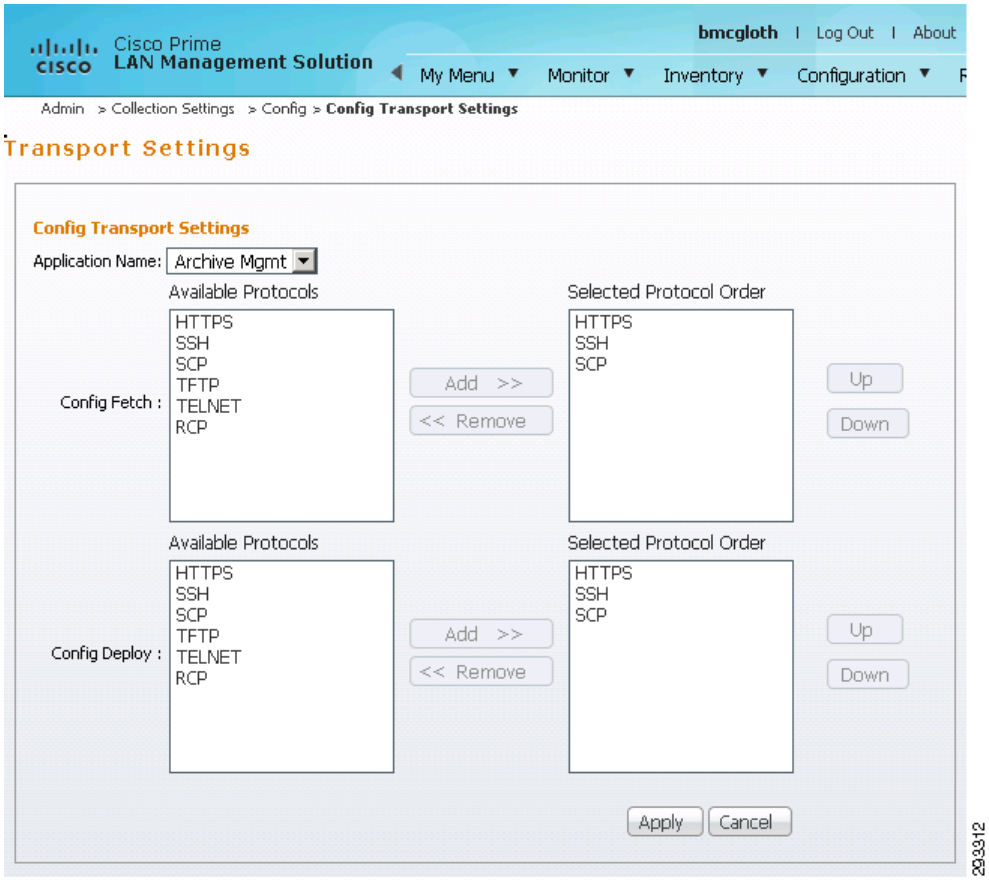
Logging enabled by implementing the following configuration statements in the CLI is only for system events such as software updates via the cars application utility:

```
logging 192.168.42.124
logging loglevel 6
```

RSA enVision supports the periodic collection of log files from Cisco LMS versions 3.2 and 4.0. The old method required the daily running of a .VBS script on the server (Windows only) where a file is created in the directory/files/rme/archive directory. It then required the installation of an RSA enVision NIC SFTP Agent, which is used to transfer the log files to the RSA enVision appliance. RSA recently added support for ODBC collection of change audit information from Cisco LMS. It is highly recommended to update to the latest RSA enVision ESU and move to this ODBC method as log collection occurs more frequently. ODBC importing was not validated for LMS at the time of this publication.

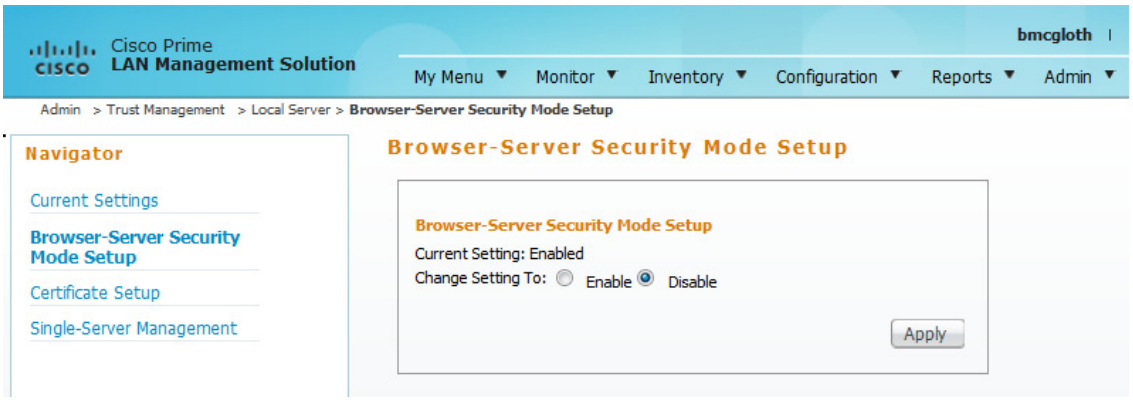
To secure authentication information and management of the LMS server and the devices that it manages, addressing Safeguard 164.308(a)(1)(i) Security Management, the LMS system was configured to support only encrypted protocols, as shown in Figure 5-74. Device management preferences are configured in Admin > Collection Settings > Config> Config Transport Settings. Add secure protocols to the list in order of preference and remove insecure protocols for each Application Named function.

Figure 5-74 Device Management Transport Settings



Cisco Prime LMS supports encrypted administrative access via SSH and HTTPS. SSH is enabled by default after installation. HTTPS can be enabled with a self-signed certificate or public certificate. To enforce the use of only SSL for the web interface of LMS, perform the following configurations, as shown in Figure 5-75. These configuration steps can also be found in the LMS 4.2 Administration Guide, page 53.

Figure 5-75 Enable Cisco Prime LMS Browser Security



To enable browser-server security, complete the following steps.

Procedure

Step 1 Select **Admin > Trust Management (4.2.2 patch) > Local Server > Browser-Server Security Mode Setup**.

The Browser-Server Security Mode Setup dialog box appears.

Step 2 Select the **Enable** option to enable SSL.

Step 3 Click **Apply**.

Step 4 Log out from your Cisco Prime session and close all browser sessions.

Step 5 Restart the Daemon Manager from the LMS Server CLI.

On Windows:

a. Enter `net stop crmdmgtd`

b. Enter `net start crmdmgtd`

On Solaris/Soft Appliance:

a. Enter `/etc/init.d/dmgtd stop`

b. Enter `/etc/init.d/dmgtd start`

Step 6 Restart the browser and the Cisco Prime session.

When accessing the LMS CLI, you need to enter the SHELL by using the **shell** command. Then you can execute the stop/start commands for the soft appliance.

If you have issues logging in to LMS (such as long delays), try disabling the launch of the LMS Getting Started page by default (as the first page after log in) by completing the following steps:

a. Open the properties file name “gs.properties” under the following path:

Windows:

```
/<<NMS-ROOT>>/MDC/tomcat/webapps/cwlms/WEB-INF/classes/com/Cisco/nm/gs/ui/gs.properties
```

Soft appliance:

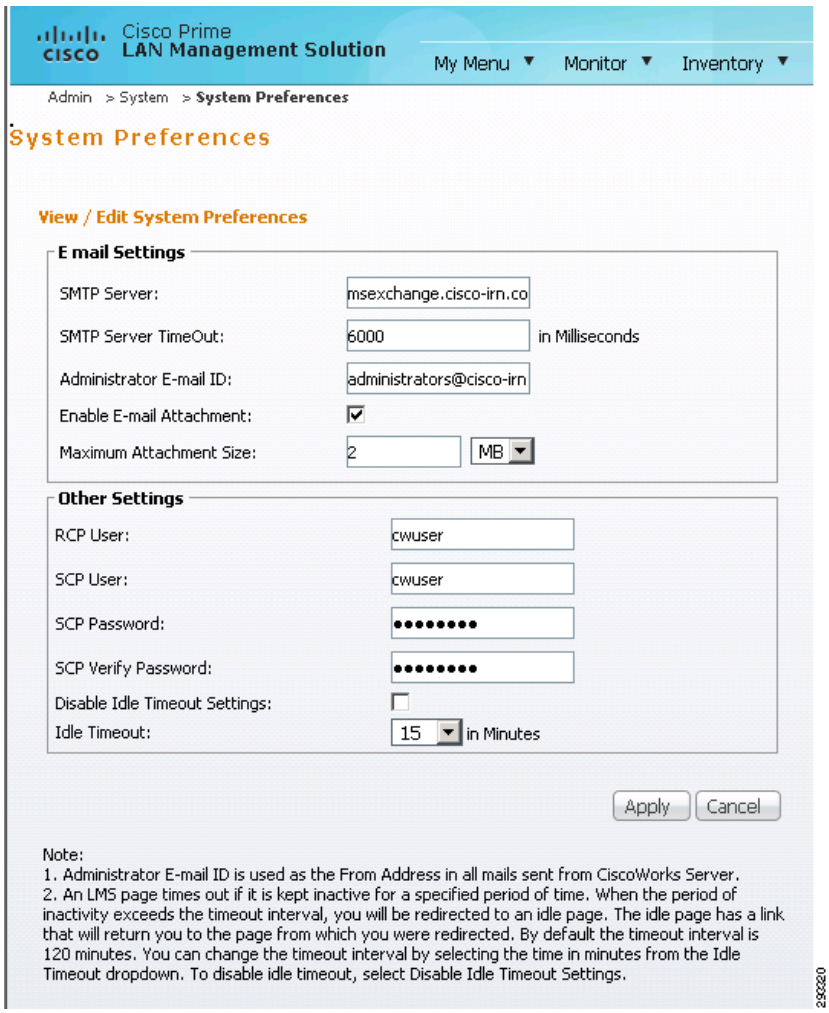
```
./opt/CSCOpx/MDC/tomcat/webapps/cwlms/WEB-INF/classes/com/cisco/nm/gs/ui/gs.properties
```

b. Update the field IS_DEFAULT_PAGE as “false”.

c. Clear the browser cache and login-in (Daemon restart not required).

HIPAA Safeguard 164.312(a)(2)(ii) requires the enabling of automatic logoff options. Cisco LMS supports session policies under the Admin > System > System Preferences tab. It is a best practice to change the session time-out to 15 minutes, as shown in Figure 5-76.

Figure 5-76 LMS System Preferences for Idle Timeout



As a best practice, NTP is used to synchronize clocks among network devices. This synchronization allows events to be correlated when system logs are created and when other time-specific events occur. All devices in the network used NTP to synchronize their clocks. The NTP servers were hosted at the data center site. The Cisco Lab uses two NTP servers that are synchronized to external reference sources. All systems and devices in the lab are pointed to these two servers. The Cisco Prime LMS appliance uses NTP to meet these requirements by implementing the following configuration statements:

```
ntp server 192.168.62.161 192.168.62.162
```

Clock synchronization is a requirement for common industry security frameworks such as the HiTrust Common Security Framework (CSF), ISO 27002, and NIST Security Publications, as well as other industry-based standards.

HIPAA Standards Failed

No HIPAA standards were failed.

HIPAA Implementation Specifications Failed

No HIPAA implementation specifications were failed.

Cisco Security Manager

The Cisco Security Manager is a powerful yet easy-to-use solution for configuring firewall, VPN, and IPS policies on Cisco security appliances, firewalls, routers, and switch modules.

Cisco Security Manager helps enable enterprises to manage and scale security operations efficiently and accurately. Its end-to-end tools provide consistent policy enforcement, quick troubleshooting of security events, and summarized reports from across the security deployment.

Cisco Security Manager enables you to centrally manage security policies over 250 types and models of Cisco security devices. Cisco Security Manager supports integrated provisioning of firewall, IPS, and VPN (most site-to-site, remote access, and SSL) services across the following:

- Cisco IOS/ISR/ASR routers
- Cisco Catalyst switches
- Cisco ASA and PIX security appliances
- Cisco Catalyst Service Modules related to firewall, VPN, and IPS
- Cisco IPS appliances and various service modules for routers and ASA devices

For a complete list of devices and OS versions supported by Cisco Security Manager, see *Supported Devices and Software Versions for Cisco Security Manager* at the following URL: http://www.cisco.com/en/US/products/ps6498/products_device_support_tables_list.html.

The high-performance and easy-to-use integrated event viewer allows you to centrally monitor events from IPS, ASA, and FWSM devices and correlate them to the related configuration policies. This helps identify problems and troubleshoot configurations. Then, using Configuration Manager, you can make adjustments to the configurations and deploy them. Event Viewer supports event management for Cisco ASA, IPS, and FWSM devices.

In addition to the Primary Event Data Store, events can be copied and stored in the Extended Event Data Store. The Extended Event Data Store can be used to back up and archive a larger number of events. This is useful for historical review and analysis of events where Event Viewer can gather event data from both the Primary Event Data Store and the Extended Event Data Store. The Extended Event Data Store can be enabled in Event Management in Security Manager's Administration settings.

For supported platforms and more information, see the “Monitoring and Diagnostics” section of the *User Guide for Cisco Security Manager 4.1* at the following URL: http://www.cisco.com/en/US/products/ps6498/products_user_guide_list.html.

The new integrated report management allows you to generate and schedule ASA, IPS, and remote access VPN reports. Reports for ASA and IPS devices are created by aggregating and summarizing events collected by the Event Viewer. Security reports can be used to efficiently monitor, track, and audit network use and security problems reported by managed devices. Report Manager helps in developing and customizing reports for Cisco ASA and IPS devices.

For supported platforms and more information, see the “Monitoring and Diagnostics” part of the *User Guide for Cisco Security Manager 4.1* at the following URL: http://www.cisco.com/en/US/products/ps6498/products_user_guide_list.html.

Table 5-15 PHI HIPAA Assessment Summary—Cisco Security Manager

Models Assessed	
Cisco Security Manager version 4.0.1	
HIPAA Safeguards Addressed	
Administrative	**Standards/Implementation Specifications**
164.308	(a)(1)(i) Security Management Process
	(a)(3)(ii)(A) Authorization/Supervision
	(a)(4)(ii)(B) Access Authorization
	(a)(4)(ii)(C) Access Establishment and Modification
	(a)(5)(ii)(C) Log-in Monitoring
	(a)(6)(i) Response and Reporting
Technical	**Standards/Implementation Specifications**
164.312	(a)((2)(i) Unique User Identification
	(b) Audit Controls
	(d) Person or entity authentication
HIPAA Standards Failed	
No HIPAA standards were failed.	
HIPAA Implementation Specifications Failed	
No HIPAA implementation specifications were failed.	

Primary PHI Function

The primary function of Cisco Security Manager is to implement security configuration in firewalls, routers, and intrusion detection devices based on policy templates to secure the ePHI data. The Cisco Security Manager allows for the secure configuration of network devices to enforce user access (authorization) to systems containing PHI. Additionally the Cisco Security Manager can run reports on access attempts and can help troubleshoot security events across the infrastructure allowing the organization to monitor access to systems and devices that contain ePHI.

Design Considerations

- Use descriptive notes for each rule set. These are displayed as remarks in the running configuration.
- Virtualize firewall rule set deployment by using a consistent interface naming standard.
- Apply the anti-spoofing feature to all interfaces using FlexConfig.

HIPAA Assessment Detail—HIPAA Safeguards Addressed

HIPAA safeguards are spread across multiple categories. The CSM allows healthcare-covered entities and business associates to meet access control safeguards in the Administrative and Technical categories. The access control can be applied to both internal and external users that access ePHI data.

All of the sample configurations of the CSM shown below were used to meet the following list of satisfied controls:

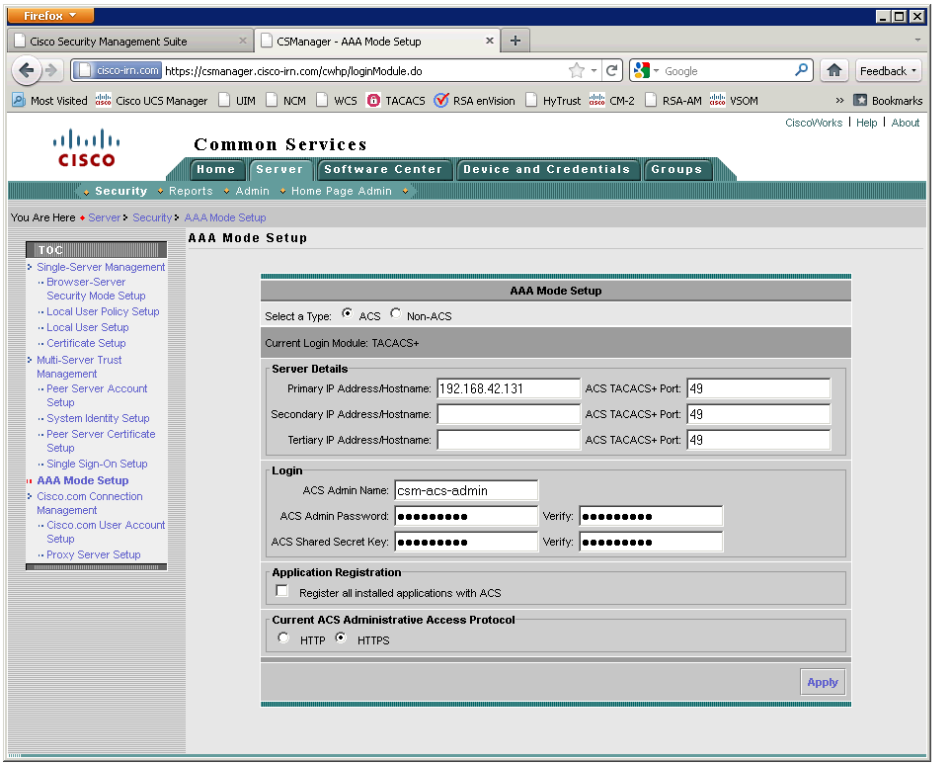
- Access Control—Restrict access to ePHI data as required by HIPAA Administrative and Technical safeguards
  - §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.308(a)(3)(ii)(A) Authorization/Supervision. Implement procedures for the authorization and/or supervision of workforce members who work with ePHI or in locations it might be accessed. Requirements addressed include: Access Control and Auditing.
  - §164.308(a)(4)(ii)(B) Access authorization. Implement policies and procedures for granting access to electronic protected health information, for example, through access to a workstation, transaction, program, process, or other mechanism. Requirements addressed include: Access Control and Auditing.
  - §164.308(a)(4)(ii)(C) Access Establishment and Modification. Implement policies and procedures that, based upon the covered entity's or the business associate's access authorization policies, establish, document, review, and modify a user's right of access to a workstation, transaction, program, or process. Requirements addressed include: Access Control, Incident Response, and Auditing.
  - §164.308(a)(5)(ii)(C) Log-in Monitoring. Procedures for monitoring log-in attempts and reporting discrepancies. Requirements addressed include: Access Control and Auditing.
- Incident response—Implement security incident response as required by HIPAA Administrative safeguards.
  - §164.308(a)(6)(ii) Response and Reporting. Identify and respond to suspected or known security incidents; mitigate, to the extent practicable, harmful effects of security incidents that are known to the covered entity or business associate; and document security incidents and their outcomes. Requirements addressed include: Incident Response and Auditing.
  - §164.312(a)(2)(i) Unique User Identification. Assign a unique name and/or number for identifying and tracking user identity. Requirements addressed include: Access Control and Auditing.
- Auditing—Implement mechanisms to record and examine activity in systems that contain or use ePHI as required by HIPAA Technical safeguards.
  - §164.312(b) Audit controls. Implement hardware, software, and/or procedural mechanisms that record and examine activity in information systems that contain or use electronic protected health information. Requirements addressed include: Auditing.
  - §164.312(d) Person or entity authentication. Implement procedures to verify that a person or entity seeking access to electronic protected health information is the one claimed. Requirements addressed include: Access Control and Auditing.

Sample Configuration

Cisco CSM is designed to track and monitor all administrative user access and events, thereby addressing all of the safeguards listed under Access Control above. User access throughout the solution uses a centralized user database in the Active Directory, which is linked through authentication servers via LDAP, RADIUS, and TACACS+ services, enabling verification of users and administrators of devices and endpoints. These services are located in the data center. Individual user IDs are assigned, and roles are based on group membership.

To secure authentication information and management of the CSM server, addressing Safeguard 164.308(a)(1)(i) Security Management, the CSM management console was configured to support HTTPS access only. Figure 5-77 shows that Cisco Security Manager is configured in Common Services so that only encrypted communications for administration are used, and AAA role setup type was implemented as Cisco Secure ACS and identified the appropriate Cisco Secure ACS servers.

Figure 5-77 CSM Secure Administration and AAA Policy



Sample Configuration

Cisco Security Manager is designed to track and monitor all administrative user access and events. To address the Incident Response and Auditing HIPAA safeguards identified above, Cisco Secure CSM can be configured to send its log data to the RSA enVision log management platform.

Figure 5-78, Figure 5-79, and Figure 5-80 show the Logs, Audit Report, and View Settings screens.

Figure 5-78 Logs

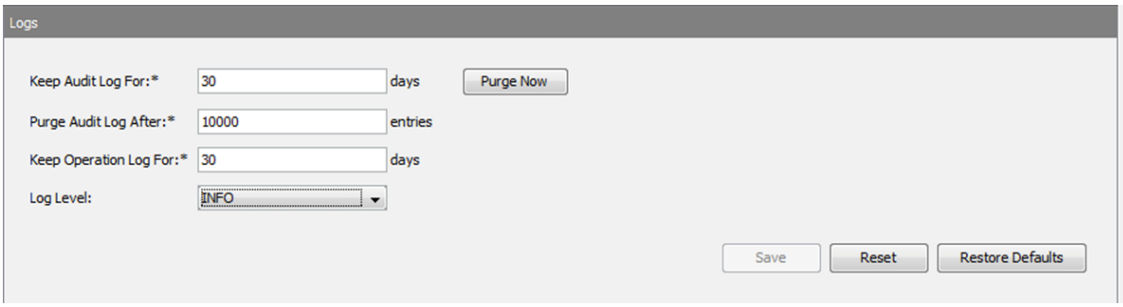


Figure 5-79 Audit Report

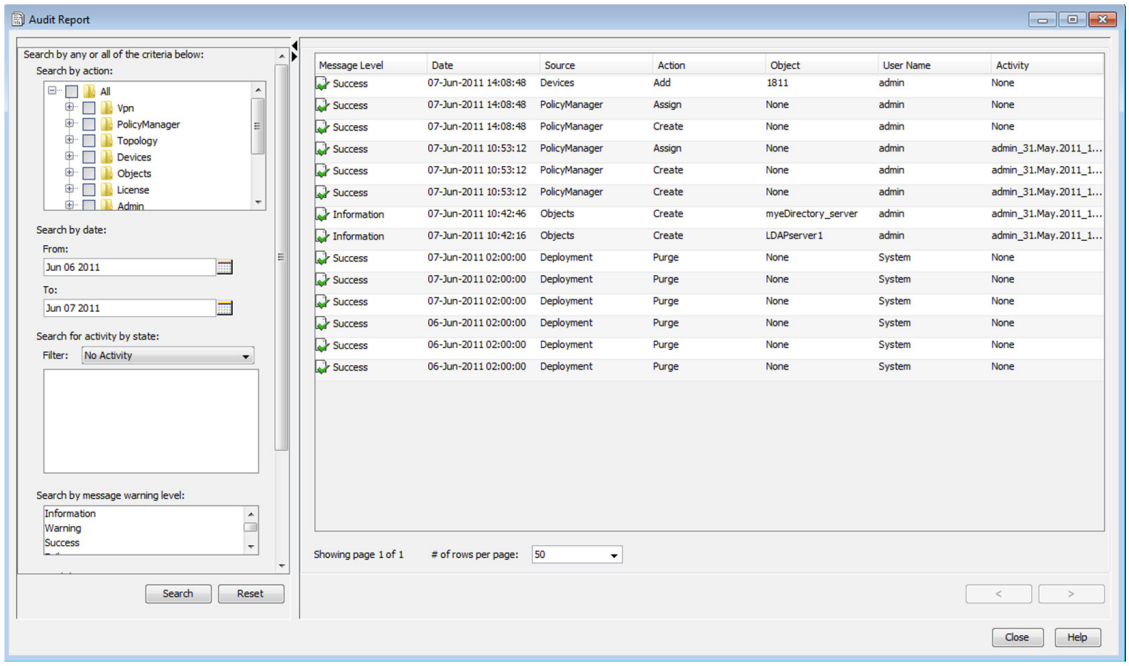
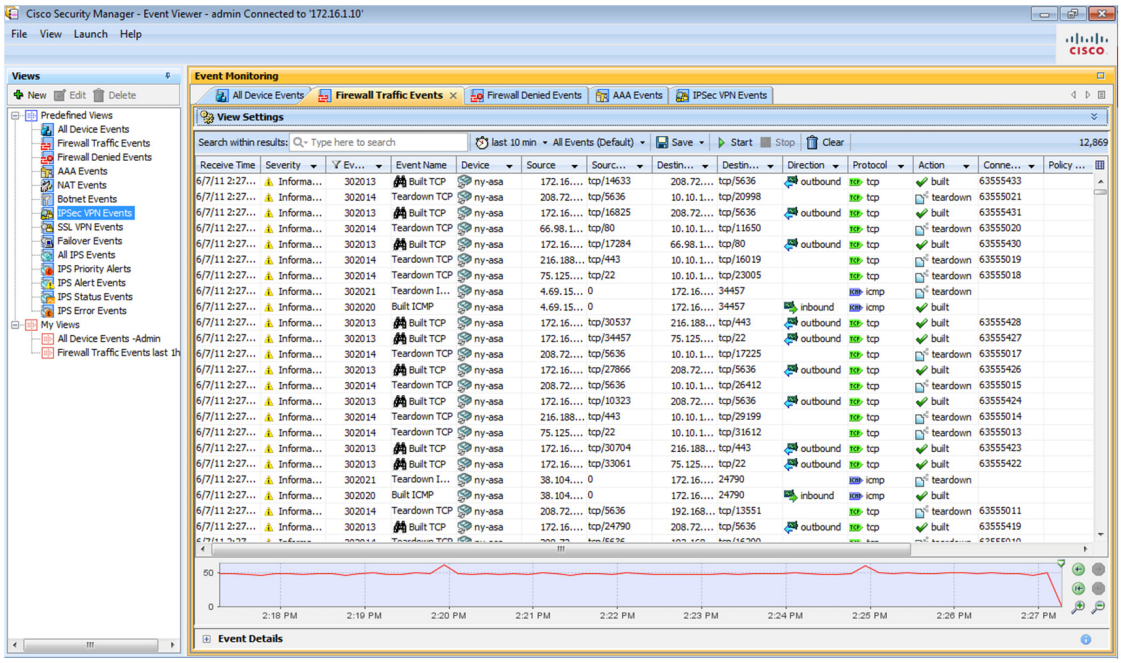
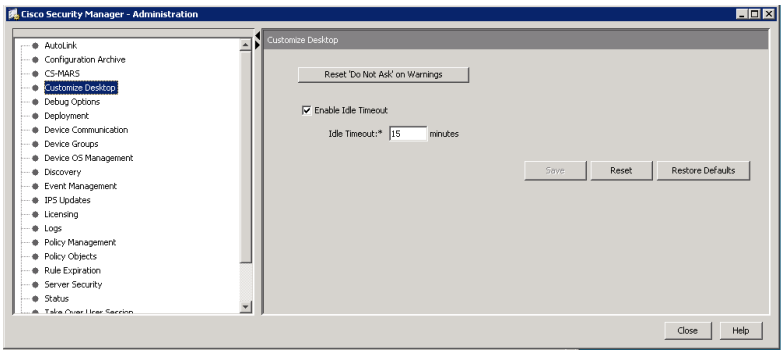


Figure 5-80 View Settings



HIPAA Safeguard 164.312(a)(2)(ii) requires the enabling of Automatic logoff options. Cisco CSM supports session idle timeout under the Administration Custom Desktop Settings tab. It is a best practice to change the session timeout to 15 minutes, as shown in Figure 5-81.

Figure 5-81 Customize Desktop



As a best practice, NTP is used to synchronize clocks among network devices. This synchronization allows events to be correlated when system logs are created and when other time-specific events occur. Time synchronization for Windows servers is specified through the domain policy. Servers synchronize their clocks with the domain controller, which in turn is synchronized using NTP. This implementation of Cisco CSM was Windows-based.

Clock synchronization is a requirement for common industry security frameworks such as the HiTrust Common Security Framework (CSF), ISO 27002, and NIST Security Publications, as well as other industry-based standards.

HIPAA Standards Failed

No HIPAA standards were failed.

HIPAA Implementation Specifications Failed

No HIPAA implementation specifications were failed.

Encryption

RSA Data Protection Manager

RSA Data Protection Manager (formerly RSA Key Manager) provides encryption, tokenization, and key management capabilities. It can be used to achieve HIPAA requirements for protecting stored ePHI data, regardless of where the information resides.

RSA Data Protection Manager is an easy-to-use management tool for encrypting keys at the database, file server, and storage layers. It is designed to lower the total cost of ownership and simplify the deployment of encryption throughout the enterprise. It also helps properly secure information and enables its accessibility when needed at any point in its lifecycle through a powerful management console and built-in high availability features. RSA Data Protection Manager provides a comprehensive platform for enforcing and managing the security of sensitive data.

Table 5-16 PHI HIPAA Assessment Summary—Cisco RSA Data Protection Manager

Models Assessed	
RSA Data Protection Manager	version KM-3.1 / AM-6.1.SP3
HIPAA Safeguards Addressed	

Table 5-16 PHI HIPAA Assessment Summary—Cisco RSA Data Protection Manager

Administrative	Standards/Implementation Specifications
164.308	(a)(1)(i) Security Management Process
	(a)(3)(i) Authorization/Supervision
	(a)(4)(i) Access Authorization
	(a)(5)(i) Log-in Monitoring
	(a)(6)(i) Security Incident Procedures
Technical	**Standards/Implementation Specifications**
164.312	(a)(i) Access Control
	(b) Audit Controls
	(c)(1) Data Integrity
HIPAA Standards Failed	
No HIPAA standards were failed.	
HIPAA Implementation Specifications Failed	
No HIPAA implementation specifications were failed.	

Primary PHI Function

The primary function of RSA Data Protection Manager is to securely manage the keys that protect ePHI data.

This safeguard was met using the RSA Data Protection Manager to encrypt data in the database, file server, and storage. All ePHI data is encrypted to prevent unauthorized access or modification to the data. Unauthorized access attempts are logged and automatic notification can be sent to authorized personnel. With automated event notification, the RSA Data Protection Manager's detection capabilities can help an organization quickly identify and contain security violations.

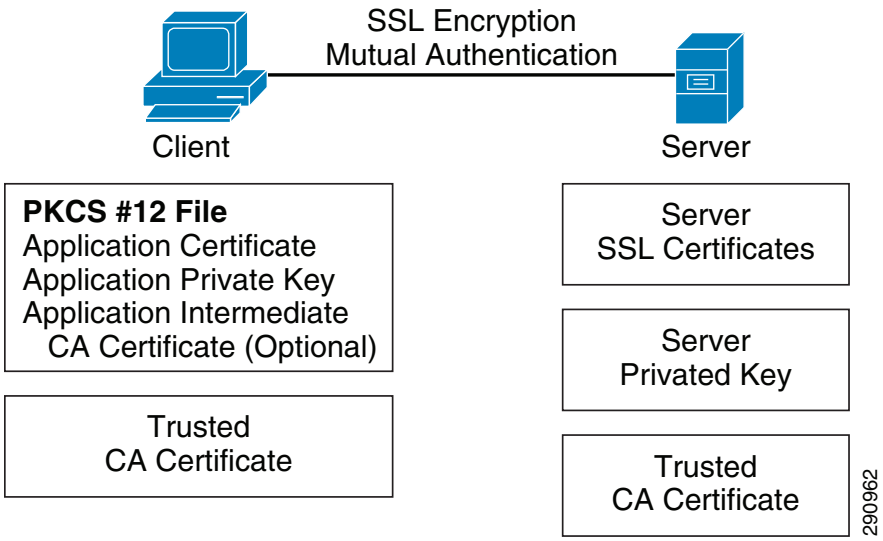
Design Considerations

RSA Data Protection Manager's encryption and key management capabilities can be used to store the data in a compliant manner. RSA Data Protection Manager provides application development libraries that support a wide range of development languages and enables developers to easily integrate encryption into point-of-sale, payment, CRM, ERP, and other business applications that create or process sensitive information. RSA Data Protection Manager can also be used to encrypt data as it flows to both disk and tape by providing key management services to Cisco MDS or EMC storage systems.

Because there were no PHI applications in the simulated lab environment, RSA Data Protection Manager was integrated with Cisco MDS to encrypt all data in the environment regardless of whether it was ePHI data or not.

In an RSA Data Protection Manager deployment, a PKI needs to be set up to enable secure communication between the RSA Data Protection server and its clients. (See Figure 5-82.)

Figure 5-82 RSA Data Protection Manager Deployment



The certificates and credentials that need to be prepared include:

- Client PKCS#12 certificate and key pair—Used to authenticate RSA Data Protection Manager clients to the RSA Data Protection Server
- Server SSL certificate and key pair—Used by RSA Data Protection Manager Clients to authenticate the server
- Trusted CA certificate—Installed on both clients and the server to verify the signature of certificates sent by a peer. For example, a RSA Key Manager Client has a trusted CA certificate to verify the signature of the server certificate.
- Middle CA certificate (optional)—If a certificate is not signed directly by a trusted CA certificate, a middle CA certificate should be installed and sent during SSL connection to verify the certificate chain.

Because of vulnerabilities with RSA signatures with a small public exponent, especially 3, RSA recommends that an exponent of F4 (216+1) be used.

HIPAA Assessment Detail—HIPAA Safeguards Addressed

All of the sample configurations of RSA Data Protection Manager shown below were used to meet the following list of satisfied controls:

- Access Control—Restrict access to ePHI data as required by HIPAA Administrative and Technical safeguards
  - §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.308(a)(3)(ii)(A) Authorization/Supervision. Implement procedures for the authorization and/or supervision of workforce members who work with ePHI or in locations where it might be accessed. Requirements addressed include: Auditing.
  - §164.308(a)(4)(ii)(B) Access authorization. Implement policies and procedures for granting access to electronic protected health information, for example, through access to a workstation, transaction, program, process, or other mechanism. Requirements addressed include: Access Control and Auditing.

  - §164.312(a)(1) Access Control. Implement technical policies and procedures for electronic information systems that maintain ePHI to allow access only to those persons or software programs that have been granted access rights as specified in §164.308(a)(4).
- Incident response—Implement security incident response as required by HIPAA Administrative safeguards.
  - §164.308(a)(6)(ii) Response and Reporting. Identify and respond to suspected or known security incidents; mitigate, to the extent practicable, harmful effects of security incidents that are known to the covered entity or business associate; and document security incidents and their outcomes. Requirements addressed include: Incident Response and Auditing.
- Auditing—Implement mechanisms to record and examine activity in systems that contain or use ePHI as required by HIPAA Technical safeguards.
  - §164.312(b) Audit controls. Implement hardware, software, and/or procedural mechanisms that record and examine activity in information systems that contain or use electronic protected health information. Requirements addressed include: Auditing.
  - §164.308(a)(5)(ii)(C) Log-in Monitoring. Procedures for monitoring log-in attempts and reporting discrepancies. Requirements addressed include: Access Control and Auditing.
- Integrity—Protect electronic protected health information from improper alteration or destruction as required by HIPAA Technical Safeguards.
  - §164.312(c)(1) Data Integrity. Implement policies and procedures to protect health information from improper alteration or destruction.

Sample Configuration

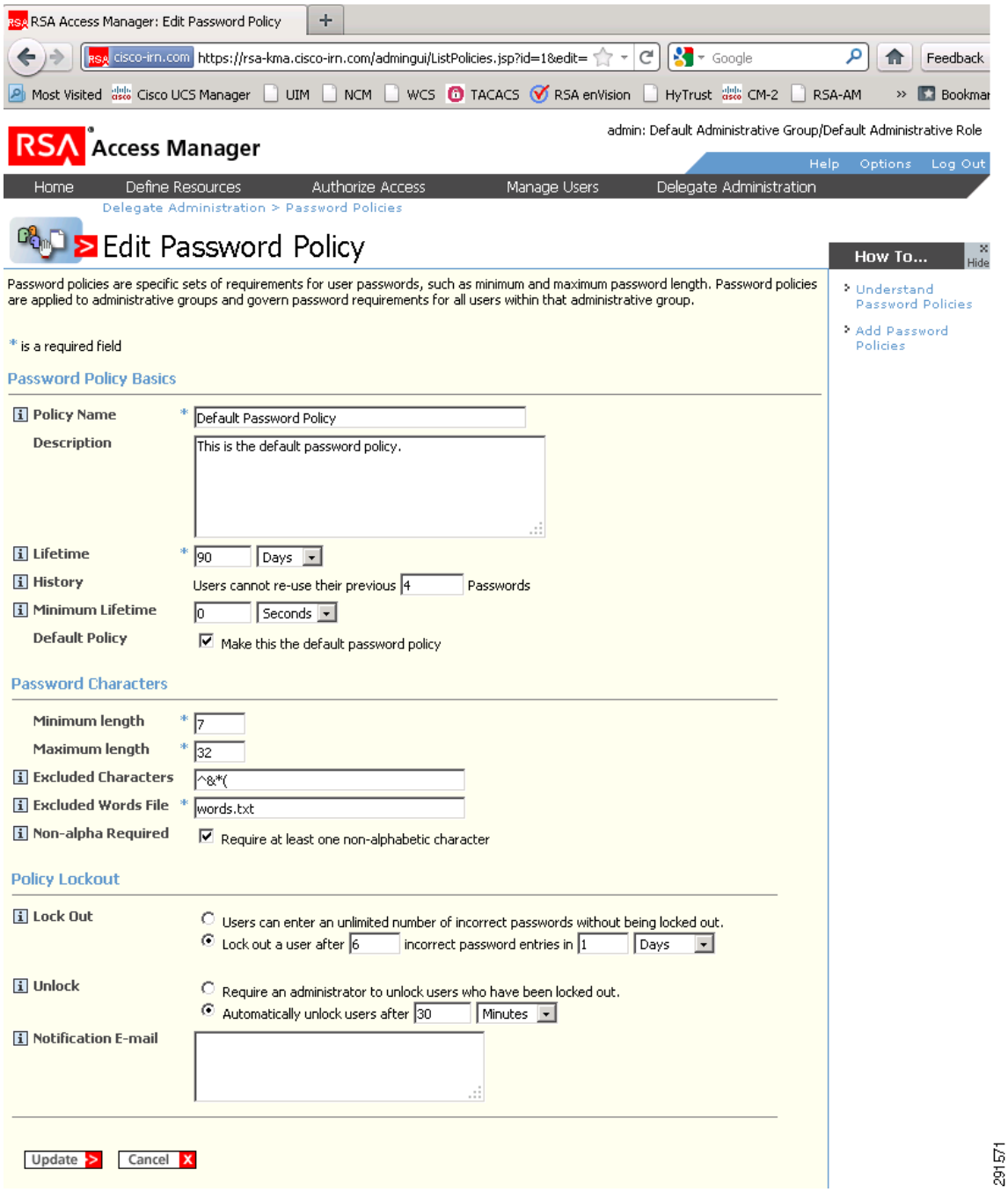
RSA Data Protection Manager embeds and is protected by RSA Access Manager, which has very powerful and flexible capabilities to define password and account lockout policies and is designed to meet all of the Access Control safeguards above. The included RSA Access Manager Internal Database is used. Within RSA Data Protection Manager (and the included Access Manager), individual user IDs are assigned. Roles are defined and based on group membership.

RSA Data Protection Manager embeds and is protected by RSA Access Manager, which has very powerful and flexible capabilities to define password and account lockout policies that can meet all of the above criteria.

Configuration of user policies is performed via the administration console that can be accessed at the following URL: https://<server address>/admingui/Login.jsp.

Figure 5-83 shows an appropriate password policy for compliance.

Figure 5-83 Password Policy Settings



RSA Data Protection Manager is designed to track and monitor all administrative user access and events. RSA Data Protection Manager can be configured to send its log data to the RSA enVision log management platform to address the Incident Response and Auditing HIPAA Safeguards identified above. The configuration procedure is documented in the enVision Event Source Configuration Guide for RSA Data Protection Manager, which can be found at RSA Secure Care Online (https://knowledge.rsasecurity.com/).

NTP is used to synchronize clocks among network devices. This synchronization allows events to be correlated when system logs are created and when other time-specific events occur. All devices in the network used NTP to synchronize their clocks. The NTP servers were hosted at the data center site. The Cisco Lab uses two NTP servers that are synchronized to external reference sources. All systems and devices in the lab are pointed to these two servers. The appliance uses NTP to meet these requirements by specifying the appropriate NTP servers during the installation steps. If NTP servers need to be modified, use the following steps:

1. Open the /etc/ntp.conf file.
2. Under the List Servers section, provide the ntp server ip address or host name to the server parameter.
3. Save the /etc/ntp.conf file.
4. Execute the following commands (as root) to forcibly synchronize the clock of the appliance to the NTP server:

a. Stop the NTPD daemon by typing the following:

```
service ntpd stop
```

b. Execute the following command at least three times (to minimize the offset):

```
ntpdate -u <ntpserver>
```

c. Start the NTPD daemon by typing the following:

```
service ntpd start
```

Clock synchronization is a requirement for common industry security frameworks such as the HiTrust Common Security Framework (CSF), ISO 27002, and NIST Security Publications, as well as other industry-based standards.

HIPAA Standards Failed

No HIPAA standards were failed.

HIPAA Implementation Specifications Failed

No HIPAA implementation specifications were failed.

Storage

EMC SAN Disk Array

The EMC SAN disk array is used to securely store sensitive compliance data within the data center. Using virtual storage technology, organizations are able to safely combine (in-scope) sensitive date with (out-of-scope) data while maintaining the compliance boundary.

EMC technology combines midrange networked storage with innovative technology and robust software capabilities to manage and consolidate your data.

Table 5-17 PHI HIPAA Assessment Summary—EMC SAN Disk Array

Models Assessed	
EMC CLARiiON CX-240	
EMC Unified Infrastructure Manager version 2.0.1.1.160	
HIPAA Safeguards Addressed	
Administrative	**Standards/Implementation Specifications**
164.308	(a)(1)(i) Security Management Process
	(a)(3)(ii)(A) Authorization/Supervision
	(a)(4)(ii)(B) Access Authorization
	(a)(5)(ii)(C) Log-in Monitoring
	(a)(6)(ii) Response and Reporting
Technical	**Standards/Implementation Specifications**
164.312	(a)(i) Unique User Identification
	(b) Audit Controls
	(c)(1) Data Integrity
HIPAA Standards Failed	
No HIPAA standards were failed.	
HIPAA Implementation Specifications Failed	
No HIPAA implementation specifications were failed.	

Primary PHI Function

The primary function of the EMC SAN disk array is to store ePHI data. There is no direct PHI requirement for this storage function. This control was met using the EMC SAN Disk Array granular access control to minimize the access to the ePHI data in storage. Additionally the EMC SAN Disk Array can work with application security controls to minimize access privileges to ePHI data. This helps meet the requirement for minimal use by allowing the individual to only access what is needed to perform the job function. Users can be assigned to groups and, based on privilege levels, have access to only the information they require for their job function.

Design Considerations

The EMC SAN disk array is a primary component of VCE Vblock architecture. Vblock 1 is designed for medium-to-high numbers of virtual machines, and is ideally suited to a broad range of usage scenarios, including shared services, e-mail, file and print, virtual desktops, and collaboration.

HIPAA Assessment Detail—HIPAA Safeguards Addressed

HIPAA safeguards are spread across multiple categories. The EMC SAN allows healthcare covered entities and business associates to meet access control safeguards in the Administrative and Technical categories. The access control can be applied to both internal and external users that access ePHI data.

All of the sample configurations of the EMC SAN Disk Array shown below were used to meet the following list of satisfied controls:

- Access Control—Restrict access to ePHI data as required by HIPAA Administrative and Technical safeguards
  - §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.308(a)(3)(ii)(A) Authorization/Supervision. Implement procedures for the authorization and/or supervision of workforce members who work with ePHI or in locations it might be accessed. Requirements addressed include: Access Control and Auditing.
  - §164.308(a)(4)(ii)(B) Access authorization. Implement policies and procedures for granting access to electronic protected health information, for example, through access to a workstation, transaction, program, process, or other mechanism. Requirements addressed include: Access Control and Auditing.
  - §164.308(a)(5)(ii)(C) Log-in Monitoring. Procedures for monitoring log-in attempts and reporting discrepancies. Requirements addressed include: Access Control and Auditing.
  - §164.312(a)(2)(i) Unique User Identification. Assign a unique name and/or number for identifying and tracking user identity. Requirements addressed include: Access Control and Auditing.
- Incident response—Implement security incident response as required by HIPAA Administrative safeguards.
  - §164.308(a)(6)(ii) Response and Reporting. Identify and respond to suspected or known security incidents; mitigate, to the extent practicable, harmful effects of security incidents that are known to the covered entity or business associate; and document security incidents and their outcomes. Requirements addressed include: Incident Response and Auditing.
- Auditing—Implement mechanisms to record and examine activity in systems that contain or use ePHI as required by HIPAA Technical safeguards.
  - §164.312(b) Audit controls. Implement hardware, software, and/or procedural mechanisms that record and examine activity in information systems that contain or use electronic protected health information. Requirements addressed include: Auditing.
- Integrity—Protect electronic protected health information from improper alteration or destruction as required by HIPAA Technical safeguards.
  - §164.312(c)(1) Data Integrity. Implement policies and procedures to protect ePHI from improper alteration or destruction. Requirements addressed include: Encryption, Integrity, and Auditing.

Sample Configuration

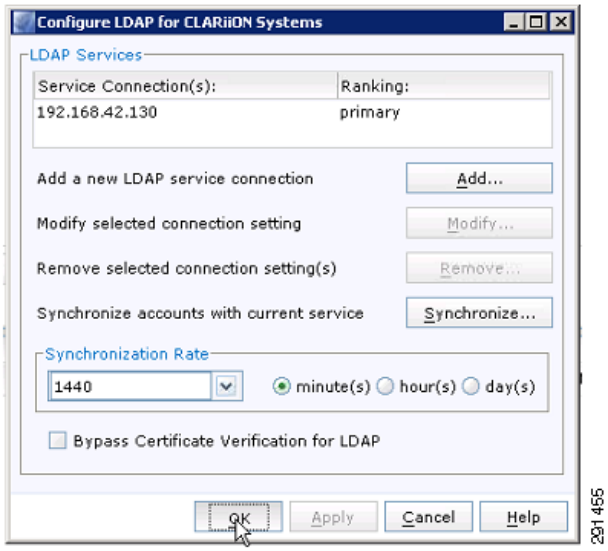
EMC SAN Disk Array is designed to track and monitor all administrative user access and events, thereby addressing all of the safeguards listed under Access Control above. A centralized user database (Active Directory) is accessed by the EMC SAN Disk Array using LDAP services. Individual user IDs are assigned. Roles are defined and based on group membership

When you start a session, Unisphere prompts you for a username, password, and scope (local, global, or LDAP). These credentials are encrypted and sent to the storage management server. The storage management server then attempts to find a match within the user account information. If a match is found, you are identified as an authenticated user.

Step 1 To configure LDAP authentication, go to the Domains tab, then select **Configure LDAP for CLARiiON Systems** from the Users menu on the left.

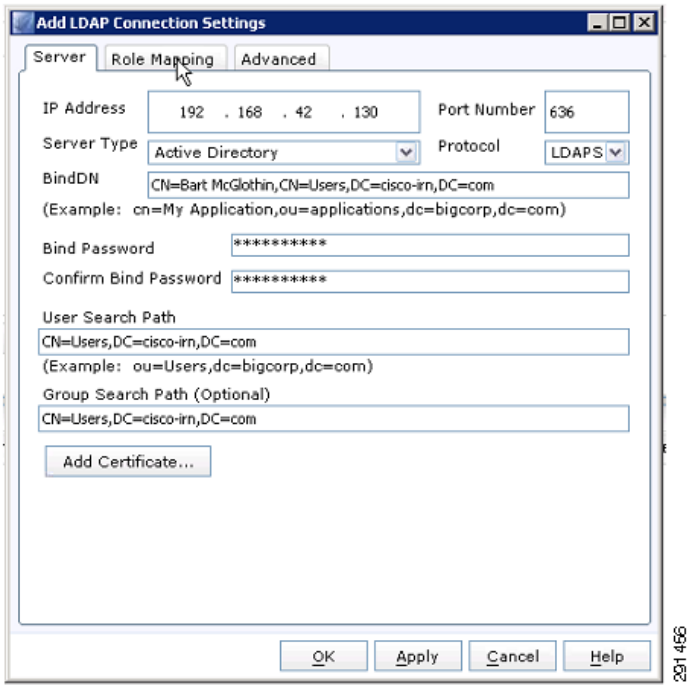
Step 2 Add a new LDAP service by clicking **Add** and then **OK**, as shown in Figure 5-84.

Figure 5-84 Adding LDAP Service



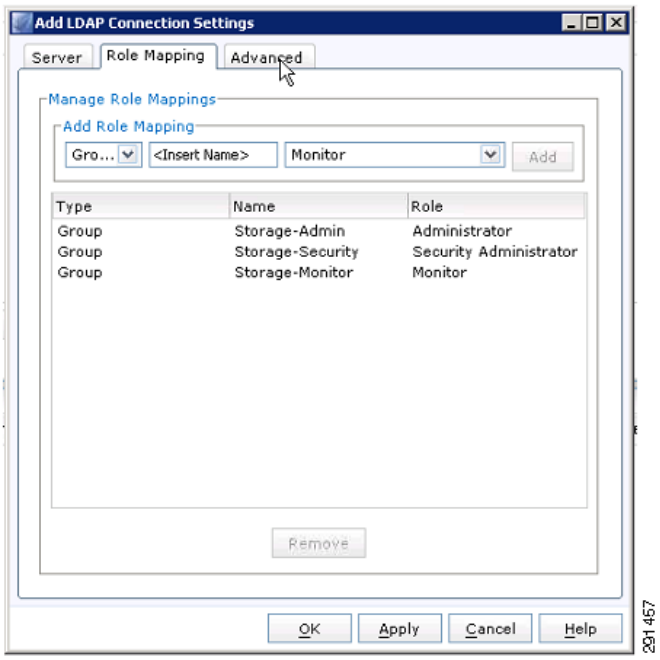
Step 3 Configure the LDAP server for Active Directory, as shown in Figure 5-85.

Figure 5-85 Configuring the LDAP Server for Active Directory



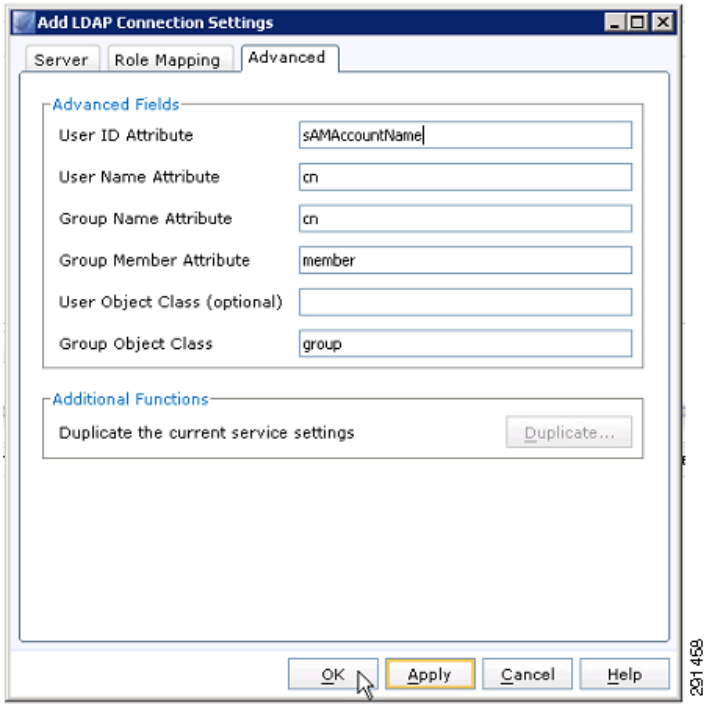
Step 4 After communications are established with the LDAP service, specific LDAP users or groups must be given access to Unisphere by mapping them to Unisphere roles. The LDAP service merely performs the authentication. Once authenticated, user authorization is determined by the assigned Unisphere role. The most flexible configuration is to create LDAP groups that correspond to Unisphere roles. This allows you to control access to Unisphere by managing the members of the LDAP groups. Roles were configured as shown in Figure 5-86.

Figure 5-86 Role Mapping



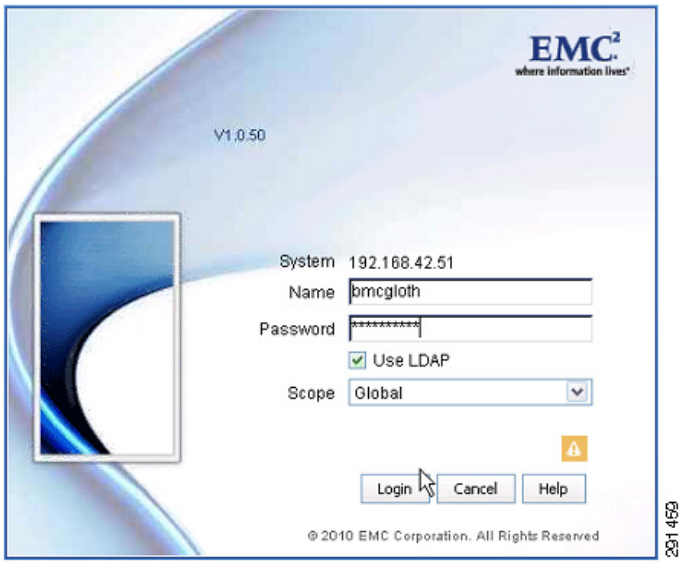
Step 5 The Advanced features were left at their default settings, as shown in Figure 5-87.

Figure 5-87 Advanced Settings



Step 6 You can then log out, and log back in, selecting the **Use LDAP** option for centralized authentication, as shown in Figure 5-88.

Figure 5-88 Selecting Use LDAP Function



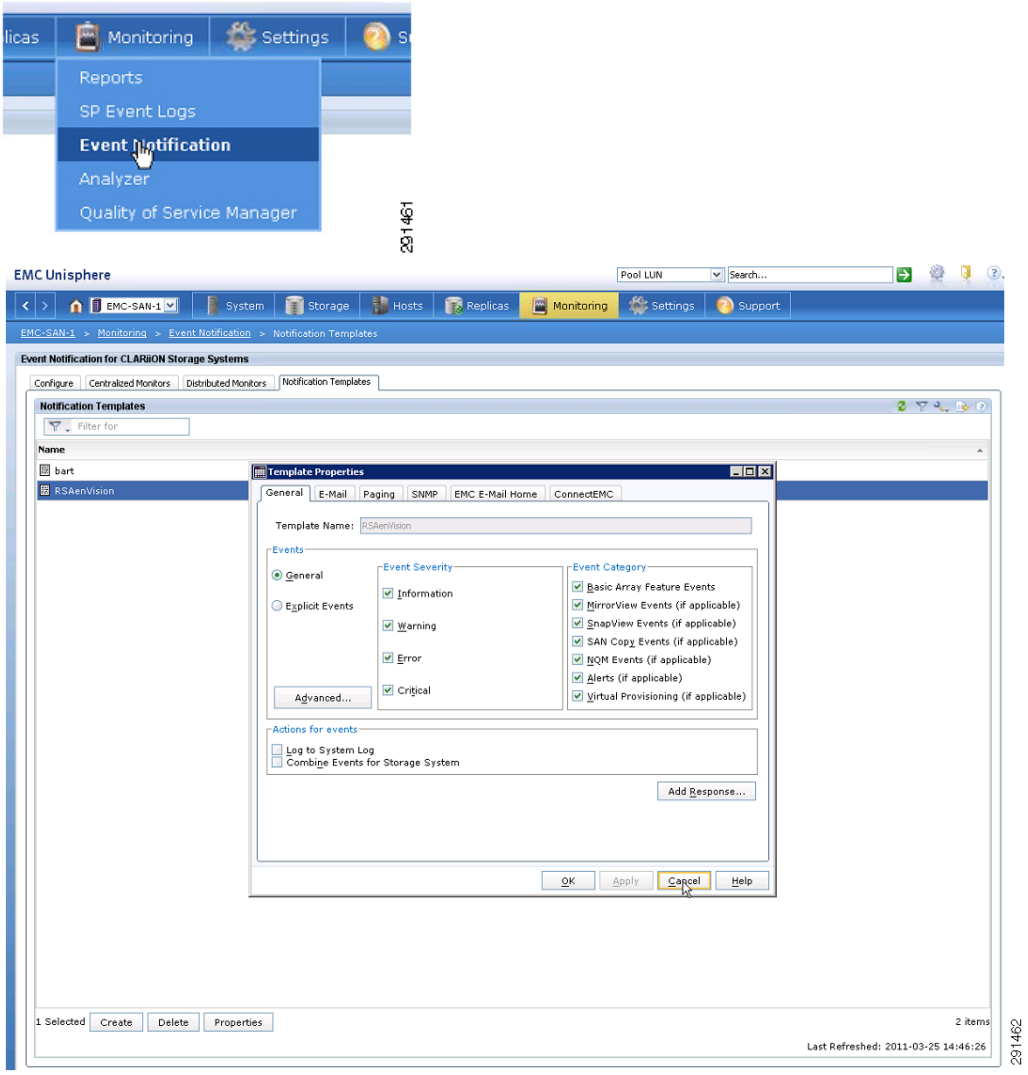
Step 7 For further installation information, see the *FLARE 30 Security Configuration Guide* on EMC Powerlink for configuring LDAP/Active Directory authentication.

EMC CLARiiON is designed to track and monitor all administrative user access and events.

To address the Incident Response and Auditing HIPAA safeguards identified above, SP event logs on CLARiiON storage systems can store only a fixed number of events, and wrap if that limit is exceeded. This may take days, weeks, months, or years depending on the logging activity. To keep all logs for a set period of time, you need to archive the logs from the CLARiiON storage system on a regular basis. You can do this with the CLI **getlog** command, but a much more integrated method is to use the "log to system log" option of the Event Monitor template to log events to the Windows system log. You can then archive these logs as required.

Additional SNMP Traps are configured to send event notifications directly and immediately to RSA enVision. (See Figure 5-89.)

Figure 5-89 Using Log to System Log Option

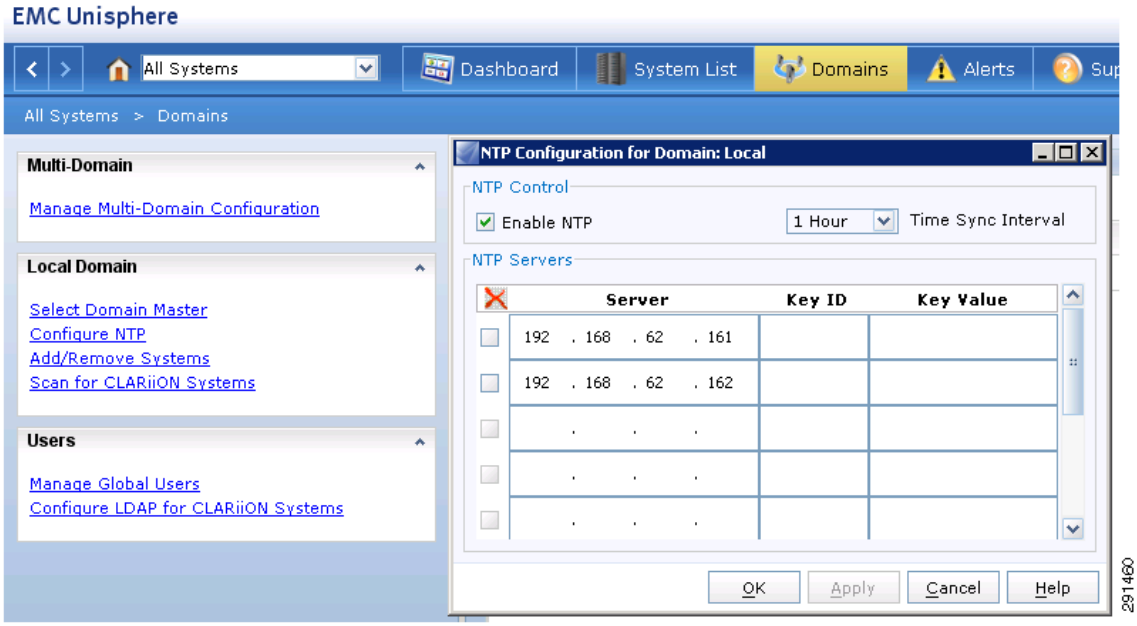


To secure authentication and management of the EMC Array, addressing Safeguard 164.308(a)(1)(i) Security Management, when you connect to Unisphere through http://<clariion_ip> (port 80), a Java applet is delivered to the browser on your computer. The applet establishes a secure connection over SSL/TLS (port 443) with the storage management server on the CLARiiON storage system. Therefore, even though “https://” is not displayed in the browser, the connection is secure.

As a best practice, NTP is used to synchronize clocks among network devices. This synchronization allows events to be correlated when system logs are created and when other time-specific events occur. EMC CLARiiON uses Network Time Protocol (NTP) to update and synchronize local clock facilities.

CLARiion uses the NTP configuration statements shown in Figure 5-90.

Figure 5-90 NTP Configuration for Domain: Local



Clock synchronization is a requirement for common industry security frameworks such as the HiTrust Common Security Framework (CSF), ISO 27002, and NIST Security Publications, as well as other industry based standards.

HIPAA Standards Failed

No HIPAA standards were failed.

HIPAA Implementation Specifications Failed

No HIPAA implementation specifications were failed.

Monitoring

RSA enVision

RSA enVision is a security information and event management (SIEM) platform that addresses HIPAA safeguards to track and monitor all access to systems and network resources containing ePHI data. RSA enVision does this by collecting, permanently archiving, and processing all the log and event data generated by devices and applications within your network, and generating alerts when it observes suspicious patterns of behavior. Administrators can interrogate the full volume of stored data through an intuitive dashboard, and can use advanced analytical software to gain visibility and understanding of how their network is used and the threats and risks to the infrastructure and applications.

The RSA enVision platform can draw logs from tens of thousands of devices at once, including Cisco network devices, the VCE Vblock infrastructure, the VMware virtual environment, Cisco ASA firewalls, Cisco IPS devices, Cisco IronPort E-mail Appliance, other RSA products, and the HyTrust appliance. Out of the box, RSA enVision can produce compliance reports and alerts based on the log and event data it collects. RSA enVision also offers powerful tools to create custom reports and alerts specific to your environment.

Table 5-18 PHI HIPAA Assessment Summary—RSA enVision

Models Assessed	
RSA enVision version 4.0, Revision 5	
HIPAA Safeguards Addressed	
Administrative	**Standards/Implementation Specifications**
164.308	(a)(1)(i) Security Management Process
	(a)(1)(ii)(D) Information System Activity Review
	(a)(3)(i) Authorization/Supervision
	(a)(5)(i) Log-in Monitoring
	(a)(6)(i) Security Incident Procedures
	(a)(6)(ii) Response and Reporting
Technical	**Standards/Implementation Specifications**
164.312	(b) Audit Controls
HIPAA Standards Failed	
No HIPAA standards were failed.	
HIPAA Implementation Specifications Failed	
No HIPAA implementation specifications were failed.	

Primary PHI Function

The primary function of RSA enVision is to securely store and correlate the system logs that is receives.

Design Considerations

Depending on the size of your network, RSA enVision may be deployed as a standalone, self-contained, security-hardened appliance or in a distributed deployment to cope with the demands of the largest enterprise networks. When deployed in a distributed architecture, multiple dedicated appliances are deployed where required to perform key roles. Local and remote collectors perform data collection. Data servers manage the data. Application servers perform analysis and reporting. Data itself can be stored using direct attached, online, near-line or offline storage from the full EMC storage portfolio.

RSA enVision does not require any client-side agents to pull log or event data from your infrastructure or applications. RSA enVision can integrate with event sources through standard protocols such as syslog or SNMP by configuring the event source to send data to enVision. For richer event data, enVision integrates with some event sources through their APIs or directly with their database backends. Specific event source device configuration procedures can be found at RSA Secure Care Online (https://knowledge.rsasecurity.com/)

RSA enVision is sold as a standalone appliance. It is available in a variety of hardware options based on the requirements of the enterprise design. The system comes pre-installed on an already hardened operation system.

HIPAA Assessment Detail—HIPAA Safeguards Addressed

All of the sample configurations of the RSA enVision shown below were used to meet the following list of satisfied controls:

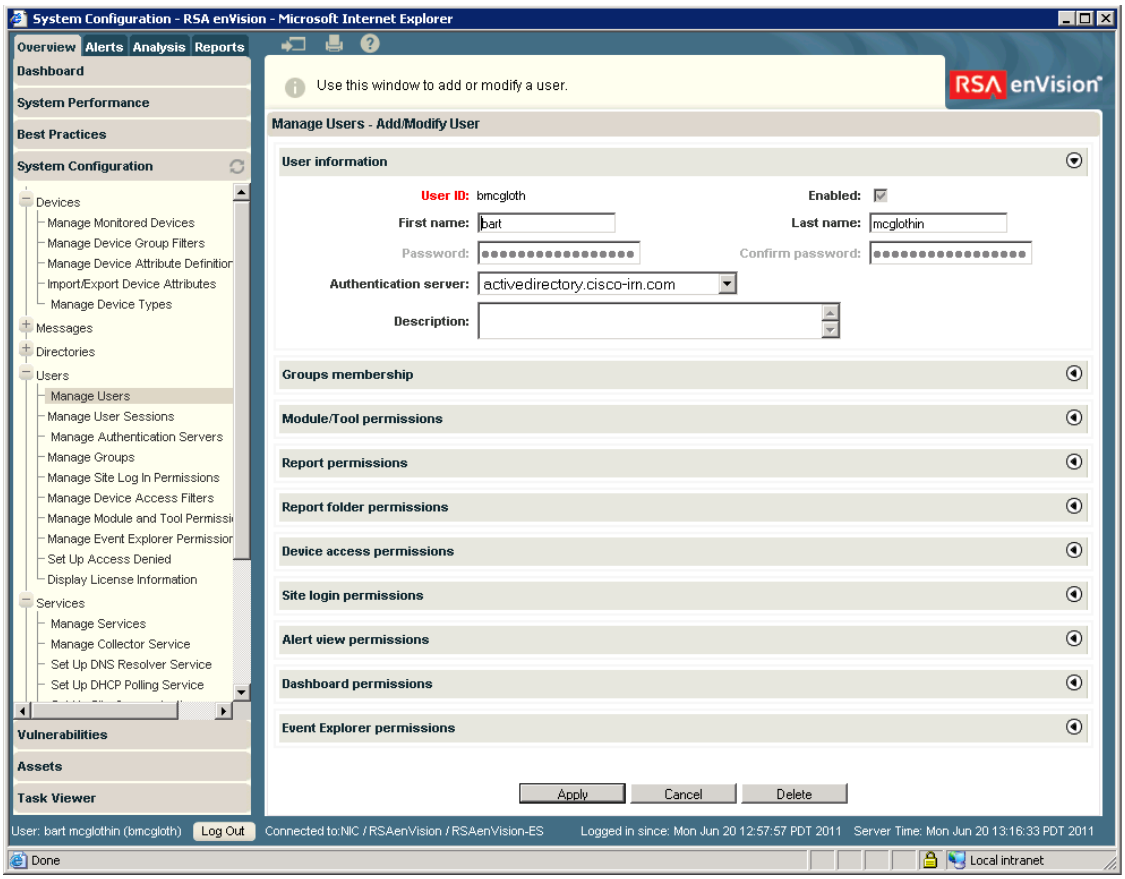
- Access Control—Restrict access to ePHI data as required by HIPAA Administrative and Technical safeguards
  - §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.308(a)(1)(ii)(D)Information System Activity Review. Implement procedures to regularly review records of information system activity, such as audit logs, access reports and security incident tracking.
  - §164.308(a)(3)(ii)(A) Authorization/Supervision. Implement procedures for the authorization and/or supervision of workforce members who work with ePHI or in locations where it might be accessed. Requirements addressed include: Auditing.
- Incident response—Implement security incident response as required by HIPAA Administrative safeguards.
  - §164.308(a)(6)(ii) Response and Reporting. Identify and respond to suspected or known security incidents; mitigate, to the extent practicable, harmful effects of security incidents that are known to the covered entity or business associate; and document security incidents and their outcomes. Requirements addressed
- Auditing—Implement mechanisms to record and examine activity in systems that contain or use ePHI as required by HIPAA Technical safeguards.
  - §164.312(b) Audit controls. Implement hardware, software, and/or procedural mechanisms that record and examine activity in information systems that contain or use electronic protected health information. Requirements addressed include: Auditing.
  - §164.308(a)(5)(ii)(C) Log-in Monitoring. Procedures for monitoring log-in attempts and reporting discrepancies. Requirements addressed include: Access Control and Auditing.

Sample Configuration

The RSA enVision Internal Database is used (as part of its local Windows Active Directory). For validation, RSA enVision was linked to the centralized user database (Active Directory) using LDAP. Within RSA enVision, individual user IDs are assigned. Roles are defined and based on group membership.

RSA enVision management interfaces implement role-based access control that can be used to restrict access to privileged user IDs, as shown in Figure 5-91.

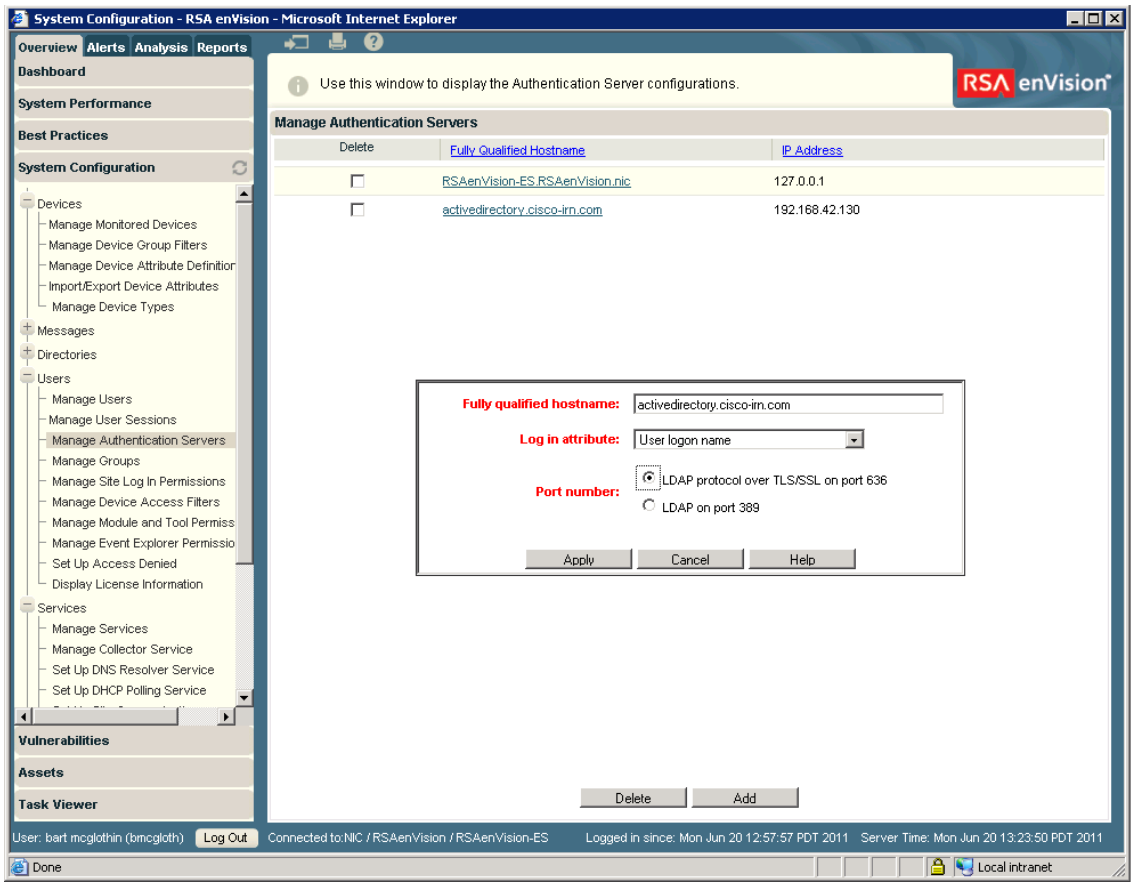
Figure 5-91 RSA enVision User Profile



RSA enVision's access control system defaults to deny access.

RSA enVision is configurable to use its local Active Directory database, or an external database via LDAP, as shown in Figure 5-92.

Figure 5-92 RSA enVision Authentication Servers



RSA enVision is designed to track and monitor all administrative user access and events. To address the Incident Response and Auditing HIPAA safeguards identified above, it performs the role of a central logging repository. RSA enVision collects syslog and SNMP information from all devices to ensure the integrity and correlation of events.

RSA enVision delivers mirrored, unfiltered data to its Internet Protocol Database, which provides the ability to retain data in its original format. Further, “write once, read many” capabilities help ensure that the mirrored copy remains intact, even if the original data is compromised. RSA enVision-captured event logs are stored on a hardened operating system and protected using an integrity check mechanism.

To secure authentication information and management of the RSA enVision server, addressing Safeguard 164.308(a)(1)(i) Security Management, the management console is accessible only via HTTPS.

As a best practice, NTP is used to synchronize clocks among network devices. Time synchronization for this windows server is specified through the Domain Policy because the RSA enVision appliance is itself a Domain Controller. The server synchronizes its clock to know time sources using NTP as specified in the initial appliance setup. This synchronization allows events to be correlated when system logs are created and when other time-specific events occur. All devices in the network used NTP to synchronize their clocks. The NTP servers were hosted at the data center site. The Cisco Lab uses two NTP servers that are synchronized to external reference sources. All systems and devices in the lab are pointed to these two servers.

Clock synchronization is a requirement for common industry security frameworks such as the HiTrust Common Security Framework (CSF), ISO 27002, and NIST Security Publications, as well as other industry-based standards.

HIPAA Standards Failed

No HIPAA standards were failed.

HIPAA Implementation Specifications Failed

No HIPAA implementation specifications were failed.

HyTrust Appliance

Vblock Infrastructure Platforms from VCE allow organizations to take advantage of the architectural, operational, and financial benefits of virtualization in their PHI infrastructure. HyTrust Appliance (HTA) complements Vblock capabilities by providing:

- Access control for virtual infrastructure including least privilege, separation of duties, and two-factor authentication
- Granular and exhaustive logging and auditing
- Segmentation of infrastructure to support virtualized applications

Virtualized technologies create additional security requirements to ensure that the virtualized environment security controls are appropriate for the data sensitivity. This requirement is consistent with additional risks introduced by mobility and the fast-paced change rate of virtualized assets that can now be reconfigured, relocated, and duplicated by remote administrators. These capabilities combined with poor access control create a significant risk. Hypervisor logs geared toward software maintenance and troubleshooting are obviously useful, but not in the context of a compliance audit.

HyTrust Appliance systematically addresses the three broad areas of IT control objectives (access and user administration, change and configuration, and operations), by proactively enforcing policies for all administrative access, regardless of access method: Secure Shell (SSH) to host, VMware vSphere client to host, or VMware vCenter or any of the programmatic access. HyTrust Appliance provides two-factor authentication and role-based access control, logical segmentation of shared infrastructure, root password vaulting, and audit-quality logs of every attempted access.

Table 5-19 PHI HIPAA Assessment Summary—HyTrust Appliance

Models Assessed	
HyTrust version 2.2.1.14064	
HIPAA Safeguards Addressed	
Administrative	**Standards/Implementation Specifications**
164.308	(a)(1)(i) Security Management Process
	(a)(3)(ii)(A) Authorization/Supervision
	(a)(4)(ii)(B) Access Authorization
	(a)(5)(ii)(C) Log-in Monitoring
	(a)(6)(ii) Response and Reporting
Technical	**Standards/Implementation Specifications**
164.312	(a)(1) Access Control
	(b) Audit Controls
HIPAA Standards Failed	
No HIPAA standards were failed.	

Table 5-19 PHI HIPAA Assessment Summary—HyTrust Appliance

HIPAA Implementation Specifications Failed
No HIPAA implementation specifications were failed.

Primary PHI Function

The primary function of HyTrust Appliance is to provide an automated control and audit facility for the virtual infrastructure and cloud stack.

Design Considerations

Define rules and deploy policy to activate protection for the virtual infrastructure.

Administrators can define custom rules that restrict entitlement based on specific virtual infrastructure objects that users need to access and manage. Rules that define entitlement can be based on pre-defined roles or administrators can use custom user-defined roles.

The HyTrust appliance provides complete logging of administrator actions by proxying VMware vCenter client connections to the vSphere management server, and clients that try to connect directly to ESX/ESXi hosts. This logging includes the source IP address of the clients, permitted actions and actions that are blocked because the client may not have sufficient privileges.

HIPAA Assessment Detail—HIPAA Safeguards Passed

The HyTrust Appliance allows for management of user access (authorization) to systems containing ePHI. Additionally, the HyTrust Appliance can prevent unauthorized devices from accessing systems containing ePHI and protect access from unauthorized locations.

The HyTrust Appliance logs can be used to identify unauthorized attempts to connect to systems containing PHI to help meet the supervision requirements.

All of the sample configurations of the HyTrust Appliance shown below were used to meet the following list of satisfied controls:

- Access Control—Restrict access to ePHI data as required by HIPAA Administrative and Technical safeguards
  - §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.308(a)(3)(ii)(A) Authorization/Supervision. Implement procedures for the authorization and/or supervision of workforce members who work with ePHI or in locations where it might be accessed. Requirements addressed include: Auditing.
  - §164.308(a)(4)(ii)(B) Access authorization. Implement policies and procedures for granting access to electronic protected health information, for example, through access to a workstation, transaction, program, process, or other mechanism. Requirements addressed include: Access Control and Auditing.
  - §164.312(a)(1) Access Control. Implement technical policies and procedures for electronic information systems that maintain ePHI to allow access only to those persons or software programs that have been granted access rights as specified in §164.308(a)(4).
- Incident response—Implement security incident response as required by HIPAA Administrative safeguards.

  - §164.308(a)(6)(ii) Response and Reporting. Identify and respond to suspected or known security incidents; mitigate, to the extent practicable, harmful effects of security incidents that are known to the covered entity or business associate; and document security incidents and their outcomes. Requirements addressed include: Incident Response and Auditing.

- Auditing—Implement mechanisms to record and examine activity in systems that contain or use ePHI as required by HIPAA Technical safeguards.
  - §164.308(a)(5)(ii)(C) Log-in Monitoring. Procedures for monitoring log-in attempts and reporting discrepancies. Requirements addressed include: Access Control and Auditing.
  - §164.312(b) Audit controls. Implement hardware, software, and/or procedural mechanisms that record and examine activity in information systems that contain or use electronic protected health information. Requirements addressed include: Auditing.

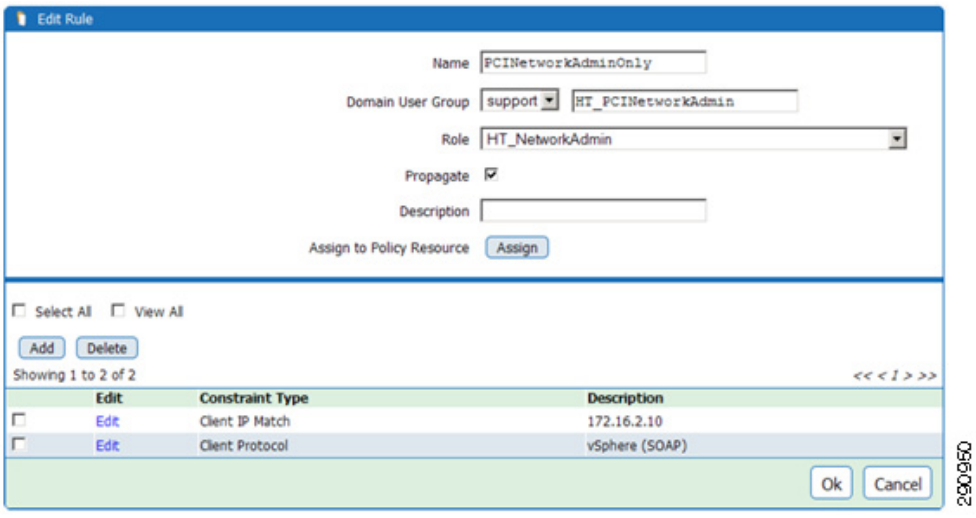
Sample Configuration

The Hytrust Appliance is designed to track and monitor all administrative user access and events, thereby addressing all of the safeguards listed under Access Control above. By integrating HyTrust Appliance authentication with Microsoft Active Directory, user accounts and passwords are not managed on the HyTrust Appliance; instead, when authentication is requested by the user, the HyTrust Appliance performs the actual authentication request against Active Directory. Complex AD environments with multiple domains are supported for authentication. Individual user IDs and roles are based on group membership.

The HyTrust Appliance implements a sophisticated policy-driven access control system that makes an authorization decision for every attempted operation in the Vblock environment. The authorization decision is based on the user ID as obtained from the vSphere session, the user function as derived from the user's assigned role in Active Directory, logical infrastructure segmentation, least privilege role defined for this activity, and object-level policy active for that user.

In the reference implementation, a policy was created that restricted virtual systems to operating only on the PHI portion of the infrastructure and enforced separation of duties between the network administrators and application owners. (See Figure 5-93.)

Figure 5-93 Edit Rule Screen



Policy and privilege definition was performed by a separate group of authorized users, typically security professionals.

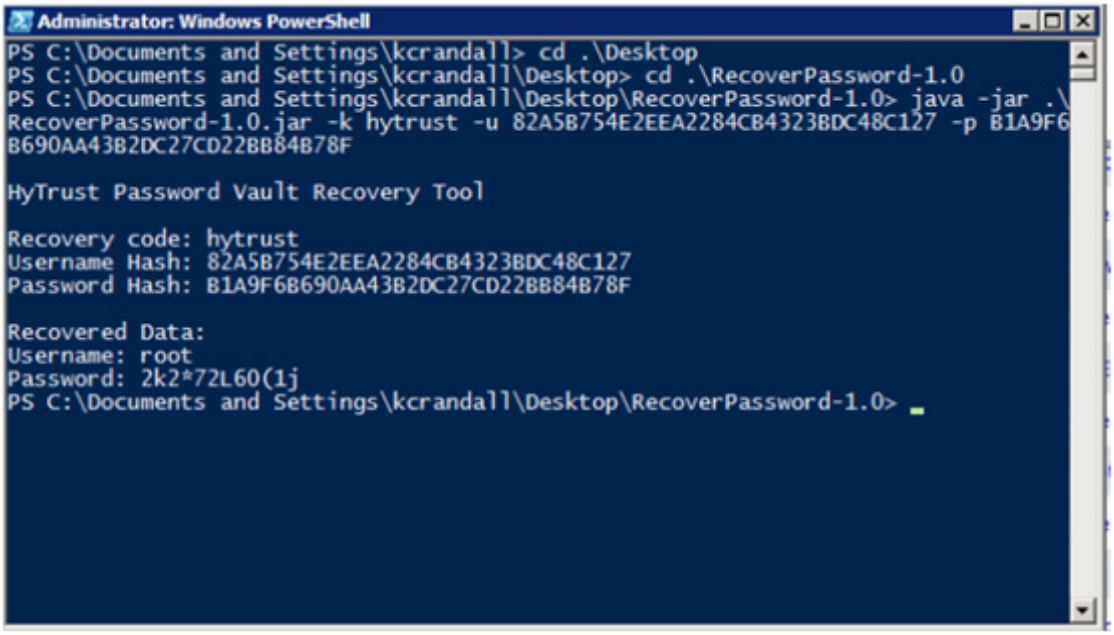
The HyTrust Appliance implements default “deny all” access policy. Many of the users that gain access to Vblock infrastructure by the means of HyTrust Appliance proxying their operations do not have privileges to log into the HyTrust Appliance management console.

RSA two-factor authentication is supported, where the user enters the AD password (something they know) in conjunction with an RSA physical token (something they have).

The HyTrust Appliance enables RSA two-factor authentication to work with any methods of access to VMware vSphere or Cisco Nexus 1000V Vblock infrastructure.

The HyTrust Appliance enforces the use of one-time root passwords for all VMware ESX hosts in the environment. Unique random machine-generated passwords of 12 characters in length are set up for each host and rotated every five days (see Figure 5-94). If requested by a privileged user, a different one-time use password was generated and remained valid for a fixed time duration not to exceed 24 hours.

Figure 5-94 Using Root Passwords

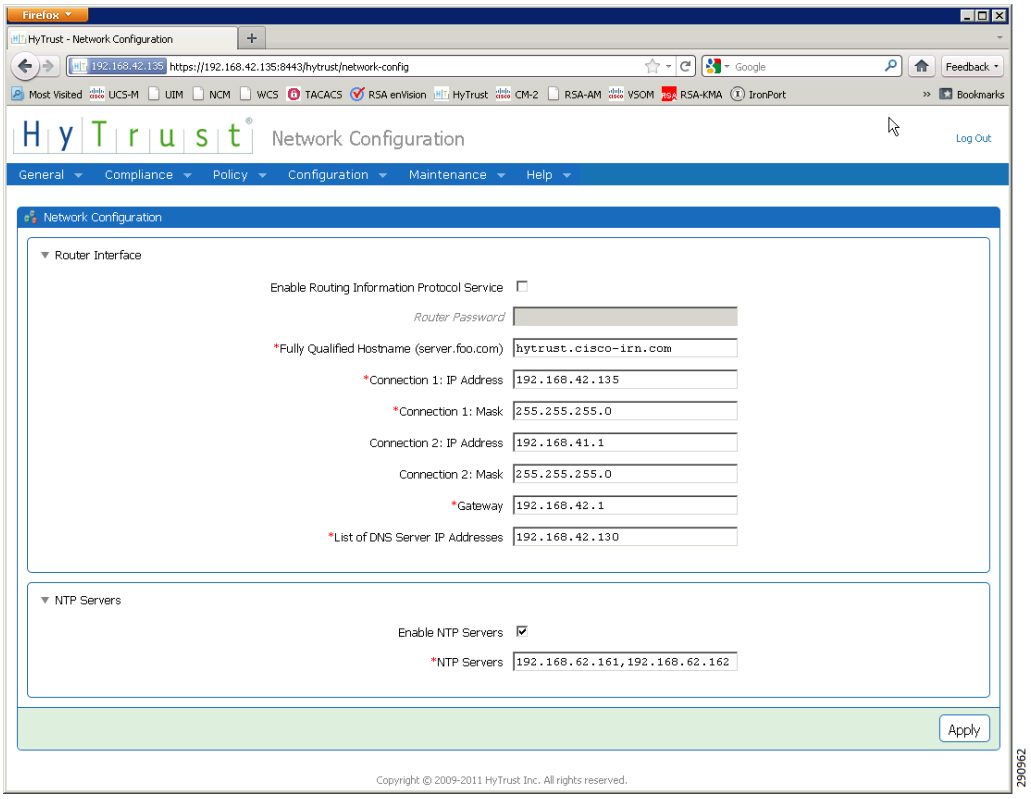


To secure authentication information and management of the HyTrust and VMware vSphere hosts, addressing Safeguard 164.308(a)(1)(i) Security Management, the HyTrust Appliance configures the virtualization platform (VMware ESX server) to disable unsecure protocols. In addition, the HyTrust Appliance proxies non-console management access and redirects attempts to connect via the HTTP management protocol to HTTPS-based connections. In the reference implementation, the configuration of VMware ESX 4.0 servers was performed in accordance with the HyTrust default configuration template. Specifically, the following controls are set:

```
ssh_config: Protocol = 2
sshd_config:
Protocol = 2
X11Forwarding = yes
IgnoreRhosts = yes
RhostsAuthentication = no
RhostsRSAAuthentication = no
HostbasedAuthentication =no
PermitRootLogin = no
PermitEmptyPasswords = no
Banner = /etc/issue.net if not set
```

As a best practice, NTP is used to synchronize clocks among network devices. This synchronization allows events to be correlated when system logs are created and when other time-specific events occur. All devices in the network used NTP to synchronize their clocks. The NTP servers were hosted at the data center site. The Cisco Lab uses two NTP servers that are synchronized to external reference sources. All systems and devices in the lab are pointed to these two servers. The HyTrust Appliance uses NTP by specifying the NTP server in the IP settings. (See Figure 5-95.)

Figure 5-95 Specifying the NTP Server



Clock synchronization is a requirement for common industry security frameworks such as the HiTrust Common Security Framework (CSF), ISO 27002, and NIST Security Publications, as well as other industry-based standards.

HIPAA Standards Failed

No HIPAA standards were failed.

HIPAA Implementation Specifications Failed

No HIPAA implementation specifications were failed.

Infrastructure

Routing

Router—Clinic

The primary HIPAA function of the Cisco Integrated Services Router (ISR) is the segmentation of ePHI scope and enforcement of that new scope boundary. The ISR is the component that is used as the main routing and security platform of the clinic. It can securely scale to the requirements of the business because it has integrated firewall, VPN, and IPS/IDS capabilities. WAN options include traditional terrestrial paths using T1, T3, Ethernet, and so on; wireless options include 3G/4G/Wi-Fi modules connecting clinics over public paths for higher availability.

The Cisco ISR consolidates voice, data, and security into a single platform with local and centralized management services. It delivers scalable rich media, service virtualization, and energy efficiency ideal for deployments requiring business continuity, WAN flexibility, and superior collaboration capabilities. The Cisco ISR uses field-upgradeable motherboards, with services such as security, mobility, WAN optimization, unified communications, video, and customized applications.

Table 5-20 PHI HIPAA Assessment Summary—Cisco ISR

Models Assessed	
CISCO891W version c890-universalk9-mz.151-3.T.bin	
CISCO1941W-A/K9 version c1900-universalk9-mz.SPA.151-3.T.bin	
CISCO2921/K9 version c2900-universalk9-mz.SPA.151-3.T.bin	
CISCO2951/K9 version c2951-universalk9-mz.SPA.151-3.T.bin	
CISCO3945-SPE150/K9 version c3900-universalk9-mz.SPA.151-3.T.bin	
HIPAA Safeguards Addressed	
Administrative	**Standards/Implementation Specifications**
164.308	(a)(1)(i) Security Management Process
	(a)(3)(i) Authorization/Supervision
	(a)(4)(i) Access Authorization
	(a)(5)(i) Log-in Monitoring
	(a)(6)(i) Response and Reporting
Technical	**Standards/Implementation Specifications**
164.312	(a)(1) Access Control
	(b) Audit Controls
	(e)(2)(ii) Encryption
HIPAA Standards Failed	
No HIPAA standards were failed.	
HIPAA Implementation Specifications Failed	
No HIPAA implementation specifications were failed.	

Primary PHI Function

The primary function of the Cisco ISR is the segmentation of HIPAA scope and enforcement of that new scope boundary.

It has five primary functions/capabilities in relation to HIPAA.

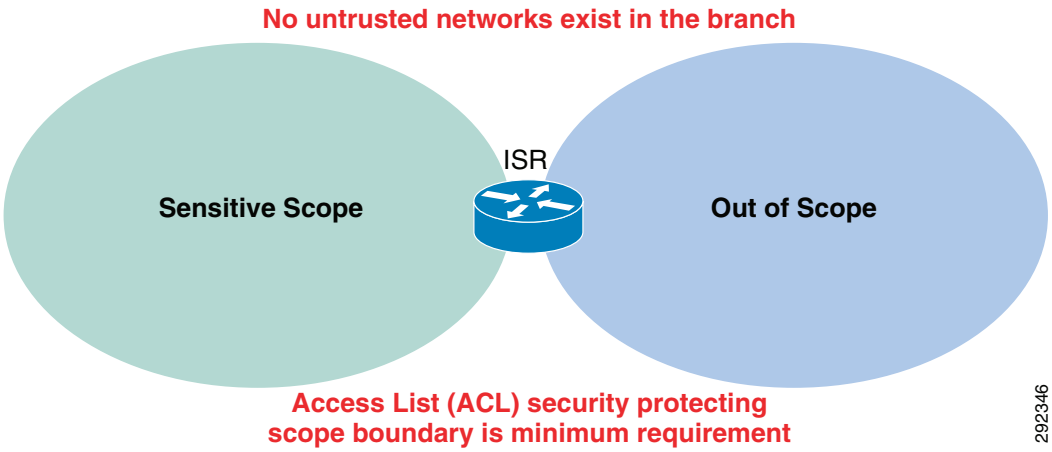
1. As a router, directing traffic between networks

   A router in its simplest form routes between networks. By segmenting a network into sub-networks, an organization can isolate sensitive information from non-sensitive information. The Cisco ISR can segment and route sensitive traffic separately from non-sensitive traffic to reduce the overall scope of a company's ePHI data environment. Depending on risk vectors within the clinic, different levels of enforcement might be required at the segmented scope boundary level. (See items 2, 3 and 4 following.)

2. As a router with ACLs, restricting traffic between the ePHI data environment and other areas of the network

   A router with ACLs can be used to enforce segmented traffic only if the ACLs are used to filter and segment private networks of the organization. They may not be used to filter untrusted networks. For example, many organizations have a central chokepoint in their data center that is the connection to the Internet (an untrusted network). As long as the organization has only untrusted network connections outside of the clinic, (the data center, in this case), then an organization may use router access lists to protect its scope from its own private internal networks. As soon as the clinic connects to untrusted networks directly, items 3 and 4 below become relevant. (See Figure 5-96.)

Figure 5-96 ACLs Segment Traffic



3. As a stateful firewall, restricting traffic between the ePHI data environment and other areas of the network

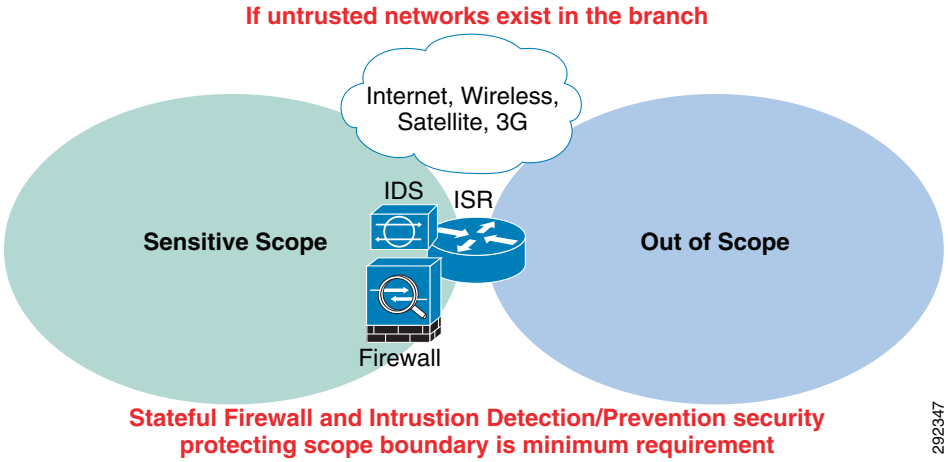
   As soon as any untrusted network is introduced at the clinic level, stateful firewalling needs to be implemented. The following are examples of untrusted networks:

   - The Internet
   - Wireless
   - Satellite
   - 3G/4G cellular backup

Step 8 As an intrusion prevention system, inspecting all traffic going to and from the ePHI data environment.

HIPAA Safeguard 164.308(a)(1)(i) requires policies and procedures to detect security violations. IDS is used to address wherever ePHI is present in the organization to detect for anomalous behavior of the sensitive area. (See Figure 5-97.)

Figure 5-97 Using Firewall and IDS/IPS



The Cisco ISR can be used to address segmentation challenges and enforce scope boundaries depending on the levels required by the organization. Each of these features can be enabled by using a license key. This feature is particularly useful for organizations because it does not require a visit to every clinic to enable the firewall/IPS/IDS capability. If these capabilities are not used within the Cisco ISR, an external component(s) can be used to address this level of scope enforcement.

4. As a VPN system, encrypting all traffic going to and from the clinic across open and public networks.

   The Cisco ISR can be used to address the need to encrypt the transmission of ePHI data across open, public networks such as 3G/4G/Wi-fi, and satellite technologies using SSL and IPSec technologies.

Design Considerations

- The security features of the Cisco ISR routers in the clinic designs are configured using Cisco Security Manager. When adopting this as the primary method of router configuration, Cisco does not recommend making changes directly to the command-line interface (CLI) of the router. Unpredictable results can occur when central and local management are used concurrently.
- The general configuration of the Cisco ISR routers in the clinic designs are maintained with Cisco Prime LMS.
- Firewall rule sets must adhere to a “least amount of access necessary” policy. Rules must be defined by specific source/destination addressing and TCP/UDP ports required for the ePHI data environment (for example, hospitals) networks.
- Enable inspection rules and/or zones on the Cisco ISR router so that the firewall maintains state (none are enabled by default).
- Redundant Cisco IOS firewalls do not have the capability to maintain state between the routers. During a failure, client communication sessions need to be re-established through the alternate router. If high availability with statefulness is a requirement, Cisco ASA firewalls should be used.

- Access into a clinic router from the WAN needs to be protected by a clinic-located firewall filter if the WAN technology is considered untrusted/public (for example, Internet DSL or cable network, public 3G or 4G, satellite). In the Cisco Solution lab, a private MPLS WAN is simulated, and filtering of the clinic traffic occurs on the WAN link of all in-scope locations.
- Disable the HTTP server service on the router and enable the HTTP secure server.
- Disable use of Telnet and enable use of only SSH version 2.
- Configure the **session-timeout** and **exec-timeout** commands to 15 minutes or less on the console, VTY, and line interfaces on the router. Disable the AUX interface.
- Configure appropriate banner messages on login, incoming, and exec modes of the router. The login banner warning should not reveal the identity of the company that owns or manages the router. The incoming and executive banners should state that these areas are considered private and that unauthorized access will result in prosecution to the full extent of the law.
- Configure the primary login authentication of the router to be directed to the Cisco Secure ACS. Individual user account profiles need to be created. Configure secondary or tertiary authentication local to the router itself in the event of a WAN or Cisco Secure ACS failure.
- Use the **no service password-recovery** command in conjunction with the **service password encryption** command to prevent password theft by physical compromise of the router.
- Change default passwords and community strings to appropriate complexity.
- Configure logs to be sent to a centralized syslog server, such as RSA enVision.
- Configure NTP to coordinate all logging.
- Disable un-necessary services (for example, Bootp, Pad, ipv6).
- Shutdown unused interfaces.

Each of the clinic designs was implemented using guidance from the following:

- Cisco Enterprise Branch Security Design Guide—
http://www.cisco.com/en/US/docs/solutions/Enterprise/Branch/E_B_SDC1.html
- Branch/WAN Design Zone—
http://www.cisco.com/en/US/netsol/ns816/networking_solutions_design_guidances_list.html

Additional information for router hardening can be found at the following URLs:

- Cisco Guide to Harden Cisco IOS Devices—
http://www.cisco.com/en/US/tech/tk648/tk361/technologies_tech_note09186a0080120f48.shtml
- Cisco IOS Security Configuration Guide, Release 12.4—
http://www.cisco.com/en/US/docs/ios/security/configuration/guide/12_4/sec_12_4_book.html
- Cisco Enterprise Branch Security Design Guide—
http://www.cisco.com/en/US/docs/solutions/Enterprise/clinic/E_B_SDC1.html
- Branch/WAN Design Zone—
http://www.cisco.com/en/US/netsol/ns816/networking_solutions_design_guidances_list.html
- Additional information for router hardening can be found at the following URLs:
- Cisco Guide to Harden Cisco IOS Devices—
http://www.cisco.com/en/US/tech/tk648/tk361/technologies_tech_note09186a0080120f48.shtml
- Cisco IOS Security Configuration Guide, Release 12.4—
http://www.cisco.com/en/US/docs/ios/security/configuration/guide/12_4/sec_12_4_book.html

HIPAA Assessment Detail—HIPAA Safeguards Addressed

All of the sample configurations of the ISR shown below were used to meet the following list of satisfied controls:

- Access Control—Restrict access to ePHI data as required by HIPAA Administrative and Technical safeguards
  - §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.308(a)(3)(ii)(A) Authorization/Supervision. Implement procedures for the authorization and/or supervision of workforce members who work with ePHI or in locations where it might be accessed. Requirements addressed include: Auditing.
  - §164.308(a)(4)(ii)(B) Access authorization. Implement policies and procedures for granting access to electronic protected health information, for example, through access to a workstation, transaction, program, process, or other mechanism. Requirements addressed include: Access Control and Auditing
  - §164.308(a)(5)(ii)(C) Log-in Monitoring. Procedures for monitoring log-in attempts and reporting discrepancies. Requirements addressed include: Access Control and Auditing.
  - §164.312(a)(1) Access Control. Implement technical policies and procedures for electronic information systems that maintain ePHI to allow access only to those persons or software programs that have been granted access rights as specified in §164.308(a)(4).
  - §164.312(e)(2)(ii) Encryption. Implement a mechanism to encrypt electronic protected health information whenever deemed appropriate.
- Incident response—Implement security incident response as required by HIPAA Administrative Safeguards.
  - §164.308(a)(6)(ii) Response and Reporting. Identify and respond to suspected or known security incidents; mitigate, to the extent practicable, harmful effects of security incidents that are known to the covered entity or business associate; and document security incidents and their outcomes. Requirements addressed include: Incident Response and Auditing.
- Auditing—Implement mechanisms to record and examine activity in systems that contain or use ePHI as required by HIPAA Technical safeguards.
  - §164.312(b) Audit controls. Implement hardware, software, and/or procedural mechanisms that record and examine activity in information systems that contain or use electronic protected health information. Requirements addressed include: Auditing.

Sample Configuration

Cisco ISR routers are designed to track and monitor all administrative user access and events, thereby addressing all of the safeguards listed under Access Control above. User access throughout the solution uses a centralized user database in the Active Directory, which is linked through authentication servers via LDAP, RADIUS, and TACACS+ services, enabling verification of users and administrators of devices and endpoints. These services are located in the data center. Individual user IDs are assigned, and roles are based on group membership. The following configurations enable central Authentication, Accounting and Authorization:

```
aaa new-model
aaa authentication login CiscoACS group tacacs+ local
aaa authentication enable default group tacacs+ enable
aaa authorization exec default group tacacs+ if-authenticated
aaa accounting update newinfo
aaa accounting exec default
```

```
 action-type start-stop
 group tacacs+
!
aaa accounting commands 15 default
 action-type start-stop
 group tacacs+
!
aaa accounting system default
 action-type start-stop
 group tacacs+
aaa session-id common
ip tacacs source-interface Loopback0
tacacs-server host 192.168.42.131
tacacs-server directed-request
tacacs-server domain-stripping
tacacs-server key 7 <removed>
```

Local user accounts are configured in the event that the centralized authentication server cannot be reached. These accounts must be manually updated to maintain compliance requirements regarding password rotation and expiration.

```
username bart privilege 15 secret 5 <removed>
username emc-ncm privilege 15 secret 5 <removed>
username bmcgloth privilege 15 secret 5 <removed>
username csmadmin privilege 15 secret 5 <removed>
```

These AAA authentication groups are assigned to the administrative interfaces where users connect:

```
ip http authentication aaa login-authentication CiscoACS

line con 0
 login authentication CiscoACS

line vty 0 4
 login authentication CiscoACS

line vty 5 15
 login authentication CiscoACS
```

HIPAA Safeguard 164.312(a)(2)(ii) requires the enabling of automatic logoff options. Cisco ISR routers support session timeout. It is a best practice to set the session timeout to 15 minutes, as shown below.

```
ip http timeout-policy idle 900

line con 0
 session-timeout 15 output
 exec-timeout 15 0
line vty 0 4
 session-timeout 15 output
 exec-timeout 15 0
line vty 5 15
 session-timeout 15 output
 exec-timeout 15 0
```

Note If only the session timeout command is specified, the session timeout interval is based solely on detected input from the user. If the session timeout command is specified with the output keyword, the interval is based on both input and output traffic. You can specify a session timeout on each port. The session-timeout command behaves slightly differently on virtual (vty) terminals than on physical console, auxiliary (aux), and terminal (tty) lines. When a timeout occurs on a vty, the user session returns to the EXEC prompt. When a timeout occurs on physical lines, the user session is logged out and the

line returned to the idle state. You can use a combination of the exec-timeout and session-timeout line configuration commands, set to approximately the same values, to get the same behavior from virtual lines that the session-timeout command causes on physical lines.

To secure authentication information and management of the ISR router, addressing Safeguard 164.308(a)(1)(i) Security Management, the ISR management interfaces were configured to support HTTPS access, and SSH. Before crypto keys can be generated, hostname and domain name must be entered:

```
hostname R-A2-Small-1
ip domain name cisco-irn.com
```

Generate keys with 1024 or larger bit key generation, *not* the default 512:

```
Crypto key generate rsa 1024
```

Configure the SSH server to use the more secure protocol version SSHv2:

```
ip ssh version 2
```

Configure the HTTP server to use HTTPS, and only more secure ciphers:

```
no ip http server
ip http secure-server
ip http secure-ciphersuite 3des-ede-cbc-sha
```

Cisco ISR routers use firewalling and intrusion detection capabilities to address Safeguard 164.308(a)(1)(i) Security Management by segmenting ePHI networks from other networks and monitoring activity across these networks.

To segment ePHI information, Cisco zone-based firewalls are configured with source and destination zones to control traffic passing from one zone to another. Each of these zone pairs receives a service policy, which is the mechanism that identifies permitted traffic, while all other traffic is dropped and logged.

```
zone-pair security CSM_S_POS-W-S_POS_1 source S_POS-W destination S_POS
 service-policy type inspect CSM_ZBF_POLICY_MAP_18
```

Cisco zone-based firewalls are configurable to perform stateful inspection by use of the inspect statement in the associated class map, policy map, and zone pair service policy statements.

```
class-map type inspect match-all CSM_ZBF_CLASS_MAP_9
 match access-group name CSM_ZBF_CMAP_ACL_9
 match protocol tcp

policy-map type inspect CSM_ZBF_POLICY_MAP_7
 class type inspect CSM_ZBF_CLASS_MAP_9
  inspect Inspect-1
 class type inspect CSM_ZBF_CLASS_MAP_10
  inspect Inspect-1
 class type inspect CSM_ZBF_CLASS_MAP_11
  inspect Inspect-1
 class class-default
  drop log
```

In the clinic, VLANs are used to segment traffic based on function and security requirements. Each of these VLANs are assigned to an appropriate security zone using the zone-based firewall feature of the router.

```
interface GigabitEthernet0/0.11
  description POS
  zone-member security S_POS
interface GigabitEthernet0/0.13
```

```
 description VOICE
 zone-member security S_Voice
```

Cisco routers are capable of performing intrusion detection. Each of the reference designs includes networks where intrusion detection capabilities are required. IPS signature updates and configurations are managed centrally through Cisco Security Manager, which implements the following configuration statements to enable the IPS inspection capability in the routers:

```
ip ips config location flash0: retries 1 timeout 1
ip ips notify SDEE
ip ips name CISCO-IPS
!
ip ips signature-category
 category all
  retired true
 category ios_ips default
  retired false
!
interface GigabitEthernet0/0
 description WAN
 ip ips CISCO-IPS in
 ip ips Store-IPS out
interface GigabitEthernet0/1.11
 description POS
 ip ips CISCO-IPS in
 ip ips CISCO-IPS out
interface GigabitEthernet0/1.15
 description WIRELESS-POS
 ip ips CISCO-IPS in
 ip ips CISCO-IPS out
```

To address the Incident Response and Auditing HIPAA safeguards identified above, Cisco ISR routers can be configured to send log data to the RSA enVision log management platform. Cisco routers track individual administrator actions through several mechanisms including AAA, logging, and system events by implementing the following configuration statements:

```
logging trap debugging
logging 192.168.42.124
logging buffered 50000

login on-failure log
login on-success log

archive
 log config
  logging enable
  notify syslog contenttype plaintext
  hidekeys
```

And SNMP:

```
snmp-server user remoteuser remoteuser remote 192.168.42.124 v3 access  88
snmp-server user remoteuser remoteuser v3
snmp-server group remoteuser v3 noauth
snmp-server trap-source Loopback0
snmp-server enable traps snmp authentication linkdown linkup coldstart warmstart
snmp-server enable traps envmon fan shutdown supply temperature status
snmp-server enable traps flash insertion removal
snmp-server enable traps energywise
snmp-server enable traps config-copy
snmp-server enable traps config
snmp-server enable traps config-ctid
snmp-server enable traps entity
```

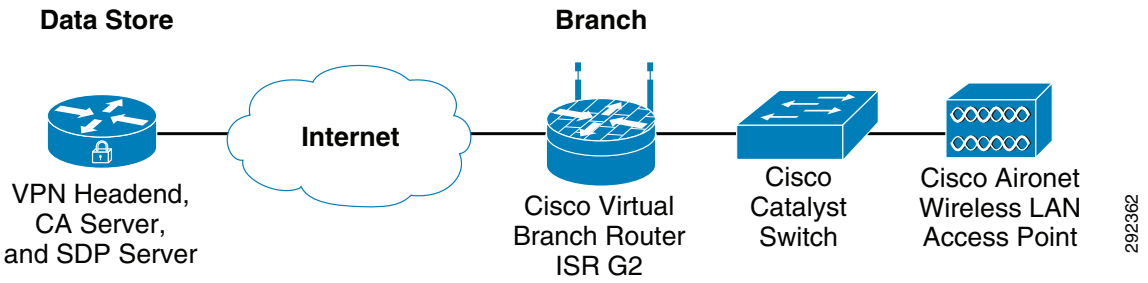
```
snmp-server enable traps hsrp
snmp-server enable traps cpu threshold
snmp-server enable traps rsvp
snmp-server enable traps syslog
snmp-server enable traps vtp
snmp-server enable traps ipsla
snmp-server host 192.168.42.124 remoteuser
```

Public WAN link connections include technologies such as DSL, cable, satellite, Wi-Fi, and 3G/4G networks. These are public networks and Safeguard §164.312(e)(2)(ii) Encryption specifies that electronic protected health information is to be encrypted. A VPN is required to securely tunnel traffic between the clinic and the enterprise network across these mediums.

Cisco Virtual Office provides reference designs for building a VPN solution to connect clinics to data centers using these technologies. For more information about Cisco VPN solutions, see: http://www.cisco.com/en/US/prod/collateral/iosswrel/ps6537/ps6586/ps6660/ps6808/prod_white_paper0900aecd8051bf3b_ns855_Networking_Solutions_White_Paper.html.

The following example describes equipment located at the clinic and the data center headend router. The clinic router is referred to as the spoke router, and the data center router as the hub. Figure 5-98 shows a simplified Cisco VPN topology.

Figure 5-98 Cisco VPN Topology



Cisco VPN technology connects the clinics to the data center over the Internet. As a result, a secure, encrypted tunnel is used to secure sensitive information such as ePHI data. Cisco VPN technologies offer a choice to protect the data in transit and provide a secure access to the clinics' networks, including Easy VPN and Dynamic Multipoint VPN (DMVPN).

This example shows DMVPN as the VPN technology. DMVPN uses IPSec-encrypted GRE tunnels, with dynamic routing. Two simultaneously active DMVPN tunnels are built from each clinic to different hub routers, providing instant failover. If the primary tunnel fails, routing converges to use the secondary tunnel, and all sessions are kept alive. In addition, with DMVPN, clinic routers can dynamically build spoke-to-spoke tunnels between each other to exchange data, without having to tunnel the traffic back to the hub, thus alleviating the load on the headend.

Following are sample DMVPN spoke and hub configurations. Enhanced Interior Gateway Routing Protocol (EIGRP) is used as the routing protocol inside the DMVPN network. Split-tunneling is used and only traffic on the POS and employee VLANs going to the servers on the 10.0.0.0 network at the headquarters is sent through the DMVPN tunnel, while any other traffic is sent straight to the Internet. Note that, if split-tunneling is not required, a default route (to 0.0.0.0) can be advertised from the hubs to the spokes, instead of specific subnets.

891 Clinic Router

```
!! Configure the IP addresses on the VLAN interfaces
interface vlan 10
  description POS VLAN
```

```
  ip address 172.16.10.1 255.255.255.0
  no autostate
interface vlan 20
  description employee VLAN
  ip address 172.16.20.1 255.255.255.0
  no autostate
interface vlan 30
  description guest VLAN
  ip address 172.16.30.1 255.255.255.0
  no autostate
!! Configure the ISAKMP and IPSec policies
crypto isakmp policy 1
  encryption aes 256

crypto isakmp keepalive 35 5
crypto isakmp nat keepalive 10
crypto ipsec transform-set t1 esp-aes 256 esp-sha-hmac
 mode transport

crypto ipsec profile cvs
 set transform-set t1
ip multicast-routing
!! Configure the DMVPN tunnel
interface Tunnel0
  bandwidth 1000
  ip address 192.168.1.3 255.255.255.0
  no ip redirects
  ip mtu 1400
  ip hello-interval eigrp 99 30
  ip hold-time eigrp 99 90
  ip pim sparse-dense-mode
  ip nhrp map multicast <Primary-hub-public-IP>
  ip nhrp map 192.168.1.1 <Primary-hub-public-IP>
  ip nhrp nhs 192.168.1.1
  ip nhrp map multicast <Secondary-hub-public-IP>
  ip nhrp map 192.168.1.2 <Secondary-hub-public-IP>
  ip nhrp nhs 192.168.1.2
  ip nhrp authentication <password>
  ip nhrp network-id 12345
  ip nhrp holdtime 300
  ip nhrp registration no-unique
  ip nhrp shortcut
  ip nhrp redirect
  ip tcp adjust-mss 1360
  load-interval 30
  delay 1000
  qos pre-classify
  tunnel source GigabitEthernet0
  tunnel mode gre multipoint
  tunnel key 12345
  tunnel protection ipsec profile cvs


!! Configure the DMVPN routing protocol. Only permit the POS and employee LAN !!
subnets to be advertised to the hubs
ip access-list standard dmvpn_acl
  permit 172.16.10.0 0.0.0.255
  permit 172.16.20.0 0.0.0.255

router eigrp 99
  no auto-summary
  network 192.168.1.3 0.0.0.0
  network 172.16.10.1 0.0.0.0
  network 172.16.20.1 0.0.0.0
```

```
  distribute-list dmvpn_acl out
```

3945E Hub Router

```
!! Configure the ISAKMP and IPSec policies

crypto isakmp policy 1
  encryption aes 256

crypto isakmp keepalive 35 5
crypto isakmp nat keepalive 10

crypto ipsec transform-set t1 esp-aes 256 esp-sha-hmac
  mode transport require

crypto ipsec profile cvs
  set transform-set t1

!! Enable multicast routing

ip multicast-routing

!! Configure the DMVPN tunnel. Use the same bandwidth metric for both primary !! and
secondary hubs, but a lower delay metric on the primary hub

interface Tunnel0

  bandwidth 2000
  ip address 192.168.1.1 255.255.255.0
  no ip redirects
  ip mtu 1400
  ip pim sparse-dense-mode
  ip nhrp authentication <password>
  ip nhrp map multicast dynamic
  ip nhrp network-id 12345
  ip nhrp redirect
  ip tcp adjust-mss 1360
  no ip split-horizon eigrp 99
  delay 1000
  qos pre-classify
  tunnel source <Outside_Interface >
  tunnel mode gre multipoint
  tunnel key 12345
  tunnel protection ipsec profile cvs

!! Configure the DMVPN routing protocol. Only the 10.0.0.0 network is        !!
advertised to the spokes in this example (split-tunneling)

router eigrp 99
  no auto-summary
  network 192.168.1.1 0.0.0.0
  redistribute static route-map split_in
ip access-list standard split_in
  permit 10.0.0.0

route-map split_in permit 10
  match ip address split_in
```

As a best practice, NTP is used to synchronize clocks among network devices. This synchronization allows events to be correlated when system logs are created and when other time-specific events occur. All devices in the network used NTP to synchronize their clocks. The NTP servers were hosted at the

data center site. The Cisco Lab uses two NTP servers that are synchronized to external reference sources. All systems and devices in the lab are pointed to these two servers. Cisco routers use NTP to meet these requirements by implementing the following configuration statements:

```
ntp server 192.168.62.161 prefer
ntp server 192.168.62.162

clock timezone PST -8 0
clock summer-time PDT recurring

service timestamps debug datetime localtime show-timezone
service timestamps log datetime msec localtime show-timezone
```

Clock synchronization is a requirement for common industry security frameworks such as the HiTrust Common Security Framework (CSF), ISO 27002, and NIST Security Publications, as well as other industry-based standards.

HIPAA Standards Failed

No HIPAA standards were failed.

HIPAA Implementation Specifications Failed

No HIPAA implementation specifications were failed.

Routers—Data Center

The primary function of data center routers from a HIPAA perspective is routing between ePHI networks and out-of scope networks and enforcing that boundary with firewall services. Data center routers function as WAN aggregation routers or connecting to larger networks such as the Internet. Therefore, performance and scalability are equally important as securely passing data. For this reason, and unlike the routers in the clinic, security functions are typically separated physically into distinct appliances. The Cisco ASR routers were used for the Internet edge and clinic WAN edge portions of the network within the solution testing.

Table 5-21 PHI HIPAA Assessment Summary—Cisco ASR

Models Assessed	
ASR-1002 (RP1) version asr1000rp1-adventerprisek9.03.02.01.S.151-1.S1.bin	
HIPAA Safeguards Addressed	
Administrative	**Standards/Implementation Specifications**
164.308	(a)(1)(i) Security Management Process
	(a)(3)(i) Authorization/Supervision
	(a)(4)(i) Access Authorization
	(a)(5)(i) Log-in Monitoring
	(a)(6)(i) Response and Reporting
Technical	**Standards/Implementation Specifications**
164.312	(a)(i) Access Control
	(b) Audit Controls
HIPAA Standards Failed	

Table 5-21 PHI HIPAA Assessment Summary—Cisco ASR (continued)

No HIPAA standards were failed.
HIPAA Implementation Specifications Failed
No HIPAA implementation specifications were failed.

Primary ePHI Function

The primary function of the data center routers is the segmentation of ePHI scope and enforcement of that new scope boundary. The data center router has four primary functions/capabilities in relation to HIPAA:

1. As a router, directing traffic between networks

   A router in its simplest form routes between networks. By segmenting a network into sub-networks, an organization can isolate sensitive information from non-sensitive information. Data center routers can segment and route sensitive traffic separately from non-sensitive traffic to reduce the overall scope of a company's HIPAA ePHI environment. Depending on risk vectors, different levels of enforcement might be required at the segmented scope boundary level. (See items 2, 3, and 4 following.)

2. As a router with ACLs, restricting traffic between the ePHI networks and other areas of the network

   A router with ACLs can be used to enforce segmented traffic only if the ACLs are used to filter and segment private networks of the organization. They may not be used to filter untrusted networks. For example, if a data center router is used to segment sensitive ePHI networks from other internal networks, an organization may use router access lists to protect its scope. As soon as this segment connects to untrusted networks directly, item number 3 becomes relevant.

3. As a stateful firewall, restricting traffic between the ePHI environment and other untrusted areas.

   As soon as any untrusted network is introduced to the connections of the data center router, firewalling must be deployed. The following are examples of untrusted networks:

   - Internet
   - Wireless
   - Satellite
   - Cellular backup

4. As an intrusion prevention system, inspecting all traffic going to and from the ePHI environment. HIPAA Safeguard 164.308(a)(1)(i) requires policies and procedures to detect security violations. IDS is used to address wherever ePHI is present in the organization to detect for anomalous behavior of the sensitive area.

Design Considerations

- Configuration was done manually on the router CLI, and backup of configuration and monitoring of configuration for changes and non-compliance were done through Cisco Prime LMS (alternatively, CiscoWorks Resource Manager Essentials, a component of Cisco LMS, can be used as well).
- Disable the HTTP server service on the router and enable the HTTP secure server.
- Configure the **session-timeout** and **exec-timeout** commands to 15 minutes or less on the console, VTY, and line interfaces on the router. Disable the AUX interface.

- Configure appropriate banner messages on login, incoming, and exec modes of the router. The login banner warning should not reveal the identity of the company that owns or manages the router. The incoming and executive banners should state that these areas are considered private and that unauthorized access will result in prosecution to the full extent of the law.
- Configure the primary login authentication of the router to be directed to the Cisco Secure ACS. Individual user account profiles need to be created. Configure secondary or tertiary authentication local to the router itself in the event of a WAN or Cisco Secure ACS failure.
- Use the **no service password-recovery** command in conjunction with the **service password encryption** command to prevent password theft by physical compromise of the router.
- Enable anti-spoofing on all interfaces.
- Routers in the data center were implemented using guidance from the following:
  - Enterprise Data Center Design guide based on a Data Center 3.0 Architecture—http://www.cisco.com/en/US/netsol/ns743/networking_solutions_program_home.html
  - Enterprise Internet Edge Design Guide—http://www.cisco.com/en/US/docs/solutions/Enterprise/Security/IE_DG.html
- For the Internet edge routers, use the access list below on the interface that is facing the Internet. This access list explicitly filters traffic destined for the infrastructure address space. Deployment of edge infrastructure access lists requires that you clearly define your infrastructure space and the required/authorized protocols that access this space. The access list is applied at the ingress to your network on all externally facing connections, such as peering connections, customer connections, and so forth.

```
!
ip access-list extended COARSE-FILTER-INTERNET-IN
 remark ---------------------------------------
 remark ---Block Private Networks---
 deny   ip 10.0.0.0 0.255.255.255 any log
 deny   ip 172.16.0.0 0.15.255.255 any log
 deny   ip 192.168.0.0 0.0.255.255 any log
 remark -
 remark ---Block Autoconfiguration Networks---
 deny   ip 169.254.0.0 0.0.255.255 any log
 remark -
 remark ---Block Loopback Networks---
 deny   ip 127.0.0.0 0.0.255.255 any log
 remark -
 remark ---Block Multicast Networks---
 deny   ip 224.0.0.0 15.255.255.255 any log
 remark -
 remark ---Block Your assigned IP's at edge---
 deny   ip <YOUR_CIDR_BLOCK> any log
 remark -
 remark ---Allow remaining public internet traffic---
 permit ip any any
!
```

Note The **log** keyword can be used to provide additional details about source and destinations for a given protocol. Although this keyword provides valuable insight into the details of access list hits, excessive hits to an access list entry that uses the **log** keyword increase CPU utilization. The performance impact associated with logging varies by platform.

HIPAA Assessment Detail—HIPAA Safeguards Addressed

All of the sample configurations of the Cisco ASR shown below were used to meet the following list of satisfied controls:

- Access Control—Restrict access to ePHI data as required by HIPAA Administrative and Technical safeguards
  - §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.308(a)(3)(ii)(A) Authorization/Supervision. Implement procedures for the authorization and/or supervision of workforce members who work with ePHI or in locations where it might be accessed. Requirements addressed include: Auditing.
  - §164.308(a)(4)(ii)(B) Access authorization. Implement policies and procedures for granting access to electronic protected health information, for example, through access to a workstation, transaction, program, process, or other mechanism. Requirements addressed include: Access Control and Auditing
  - §164.308(a)(5)(ii)(C) Log-in Monitoring. Procedures for monitoring log-in attempts and reporting discrepancies. Requirements addressed include: Access Control and Auditing.
  - §164.312(a)(1) Access Control. Implement technical policies and procedures for electronic information systems that maintain ePHI to allow access only to those persons or software programs that have been granted access rights as specified in §164.308(a)(4).
- Incident response—Implement security incident response as required by HIPAA Administrative safeguards.
  - §164.308(a)(6)(ii) Response and Reporting. Identify and respond to suspected or known security incidents; mitigate, to the extent practicable, harmful effects of security incidents that are known to the covered entity or business associate; and document security incidents and their outcomes. Requirements addressed include: Incident Response and Auditing.
- Auditing—Implement mechanisms to record and examine activity in systems that contain or use ePHI as required by HIPAA Technical safeguards.
  - §164.312(b) Audit controls. Implement hardware, software, and/or procedural mechanisms that record and examine activity in information systems that contain or use electronic protected health information. Requirements addressed include: Auditing.

Sample Configuration

Cisco ASR routers are designed to track and monitor all administrative user access and events, thereby addressing all of the safeguards listed under Access Control above. User access throughout the solution uses a centralized user database in the Active Directory, which is linked through authentication servers via LDAP, RADIUS, and TACACS+ services, enabling verification of users and administrators of devices and endpoints. These services are located in the data center. Individual user IDs are assigned, and roles are based on group membership. The following configurations enable central Authentication, Accounting and Authorization:

```
aaa new-model
aaa authentication login CiscoACS group tacacs+ local
aaa authentication enable default group tacacs+ enable
aaa authorization exec default group tacacs+ if-authenticated
aaa accounting update newinfo
aaa accounting exec default start-stop group tacacs+
aaa accounting commands 15 default start-stop group tacacs+
aaa accounting system default start-stop group tacacs+
aaa session-id common
```

```
tacacs-server host 192.168.42.131
tacacs-server directed-request
tacacs-server key 7 <removed>
```

Local user accounts are configured in the event that the centralized authentication server cannot be reached. These accounts must be manually updated to maintain compliance requirements regarding password rotation and expiration.

```
username bart privilege 15 secret 5 <removed>
username bmcgloth privilege 15 secret 4 <removed>
username csmadmin privilege 15 secret 4 <removed>
```

These AAA authentication groups are assigned to the administrative interfaces where users connect:

```
ip http authentication aaa login-authentication CiscoACS

line con 0
 login authentication CiscoACS

line vty 0 4
 login authentication CiscoACS

line vty 5 15
 login authentication CiscoACS
```

HIPAA Safeguard 164.312(a)(2)(ii) requires the enabling of automatic logoff options. Cisco ASR Routers support session timeout. It is a best practice to set the session timeout to 15 minutes, as shown below.

```
ip http timeout-policy idle 60 life 86400 requests 10000
line con 0
session-timeout 15 output
exec-timeout 15 0
line vty 0 4
session-timeout 15 output
exec-timeout 15 0
line vty 5 15
session-timeout 15 output
exec-timeout 15 0
```

Note If only the session timeout command is specified, the session timeout interval is based solely on detected input from the user. If the session timeout command is specified with the output keyword, the interval is based on both input and output traffic. You can specify a session timeout on each port. The session-timeout command behaves slightly differently on virtual (vty) terminals than on physical console, auxiliary (aux), and terminal (tty) lines. When a timeout occurs on a vty, the user session returns to the EXEC prompt. When a timeout occurs on physical lines, the user session is logged out and the line returned to the idle state. You can use a combination of the exec-timeout and session-timeout line configuration commands, set to approximately the same values, to get the same behavior from virtual lines that the session-timeout command causes on physical lines.

To secure authentication information and management of the ASR router, addressing Safeguard 164.308(a)(1)(i) Security Management, the ASR management interfaces were configured to support HTTPS access, and SSH. Before crypto keys can be generated hostname and domain name must be entered:

```
hostname RWAN-1
ip domain name cisco-irn.com
```

Generate keys with 1024 or larger bit key generation, *not* the default 512.

```
Crypto key generate rsa 1024
```

Configure the SSH server to use the more secure protocol version SSHv2.

```
ip ssh version 2
```

Configure the HTTP server to use HTTPS, and only more secure ciphers:

```
no ip http server
ip http secure-server
ip http secure-ciphersuite 3des-ede-cbc-sha
```

Configure the use of Secure Copy in place of TFTP:

```
ip scp server enable
```

To address the Incident Response and Auditing HIPAA safeguards identified above, Cisco ASR Routers can be configured to send log data to the RSA enVision log management platform. Cisco routers track individual administrator actions through several mechanisms including AAA, logging, and system events by implementing the following configuration statements:

```
logging trap debugging
logging 192.168.42.124
logging buffered 50000

login on-failure log
login on-success log

archive
 log config
  logging enable
  notify syslog contenttype plaintext
  hidekeys
```

And SNMP:

```
snmp-server engineID remote 192.168.42.124 0000000000
snmp-server user remoteuser remoteuser remote 192.168.42.124 v3 access  88
snmp-server user remoteuser remoteuser v3
snmp-server group remoteuser v3 noauth
snmp-server trap-source Loopback0snmp-server enable traps snmp authentication linkdown
linkup coldstart warmstart
snmp-server enable traps envmon fan shutdown supply temperature status
snmp-server enable traps flash insertion removal
snmp-server enable traps energywise
snmp-server enable traps config-copy
snmp-server enable traps config
snmp-server enable traps config-ctid
snmp-server enable traps entity
snmp-server enable traps hsrp
snmp-server enable traps cpu threshold
snmp-server enable traps rsvp
snmp-server enable traps syslog
snmp-server enable traps vtp
snmp-server enable traps ipsla
snmp-server host 192.168.42.124 remoteuser
```

As a best practice, NTP is used to synchronize clocks among network devices. This synchronization allows events to be correlated when system logs are created and when other time-specific events occur. All devices in the network used NTP to synchronize their clocks. The NTP servers were hosted at the

data center site. The Cisco Lab uses two NTP servers that are synchronized to external reference sources. All systems and devices in the lab are pointed to these two servers. Cisco routers use NTP to meet these requirements by implementing the following configuration statements:

```
ntp server 192.168.62.161 prefer
ntp server 192.168.62.162

clock timezone PST -8 0
clock summer-time PSTDST recurring

service timestamps debug datetime localtime show-timezone
service timestamps log datetime msec localtime show-timezone
```

Clock synchronization is a requirement for common industry security frameworks such as the HiTrust Common Security Framework (CSF), ISO 27002, and NIST Security Publications, as well as other industry-based standards.

HIPAA Standards Failed

No HIPAA standards were failed.

HIPAA Implementation Specifications Failed

No HIPAA implementation specifications were failed.

Switching

Switches—Clinic

Cisco branch switches provide connectivity for wired endpoints and the ability to segment them onto their own sensitive scope networks. Virtual local area networks (VLANs) are used to put sensitive ePHI applications and devices onto their own network and segregate them from devices that are on non-sensitive networks.

- Cisco branch switches are stackable, expandable switches that can be used for wired device port density in branch wiring closets. Access switches offer a variety of modular and fixed configuration options, and feature operational efficiency with StackPower, FlexStack, and NetFlow to increase visibility and control
- Core/distribution—Highly redundant, powerful core switches allow for the most demanding business requirements of the healthcare organization. Modular functionality provides the ability to insert security technology as the needs of the business expand into new areas.

Table 5-22 PHI HIPAA Assessment Summary—Cisco Clinic Switches

Models Assessed	
WS-C3560E-PS-24 c3560e-universalk9-mz.122-35.SE5.bin WS-C2960PD-8TT-L c2960-lanbasek9-mz.122-55.SE1.bin WS-C2960G-8TC-L c2960-lanbasek9-mz.122-50.SE4.bin WS-C2960-8TC-L c2960-lanbasek9-mz.122-50.SE4.bin WS-C2960S-48FPS-L c2960s-universalk9-mz.122-53.SE1.bin WS-C3750X-48PF-S c3750e-universalk9-mz.122-53.SE2.bin WS-C2960CPD-8PT-L c2960c405-universalk9-mz.122-55.0.43.SK.bin WS-4507+R SUP-7 cat4500e-universalk9.SPA.03.01.00.SG.150-1.XO.bin WS-C3560X-48PF-S c3560e-universalk9-mz.122-53.SE2.bin WS-C3560CPD-8PT-L c3560c405ex-universalk9-mz.122-55.0.44.SK.bin	
HIPAA Safeguards Addressed	
Administrative	**Standards/Implementation Specifications**
164.308	(a)(1)(i) Security Management Process
	(a)(3)(i) Authorization/Supervision
	(a)(4)(i) Access Authorization
	(a)(5)(i) Log-in Monitoring
	(a)(6)(i) Security Incident Procedures
	(a)(6)(ii) Response and Reporting
Technical	**Standards/Implementation Specifications**
164.312	(a)(1) Access Control
	(b) Audit Controls
	(c)(1) Data Integrity
	(e)(i) Transmission Security
	(e)(2)(i) Integrity Controls.
	(e)(2)(ii) Encryption
HIPAA Standards Failed	
No HIPAA standards were failed.	
HIPAA Implementation Specifications Failed	
No HIPAA implementation specifications were failed.	

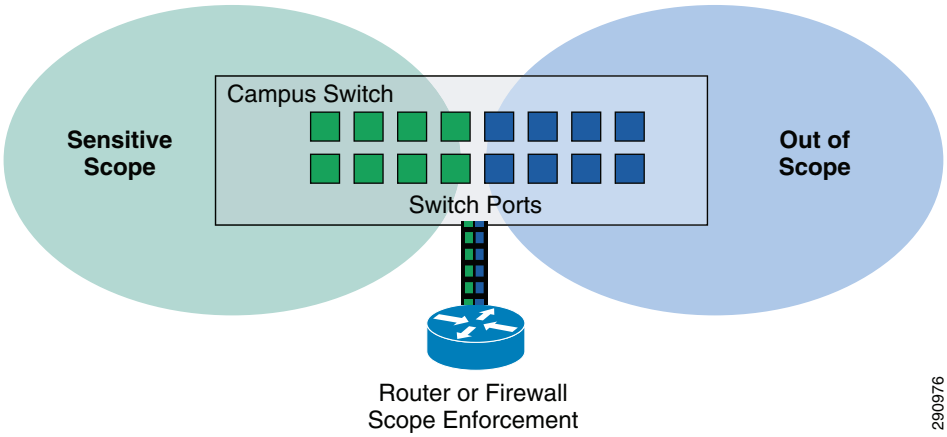
Primary PHI Function

The primary HIPAA compliance feature of clinic switches is to provide secure wired port access.

Clinic switches also provide compliance via segmentation of sensitive networks from out-of-scope networks. Switches extend that Layer 3 boundary to Layer 2. Using VLANs, Cisco clinic switches allow organizations to put their networks into separate VLANs (scopes) from other non-sensitive data (out-of-scope).

Figure 5-99 shows an example of switch segmentation.

Figure 5-99 Cisco Branch Switch Segmentation



Although the enforcement of these boundaries would be handled by either a router or firewall, the switch provides the port density and access required to connect the devices from the clinic floor.

Design Considerations

- The configurations of the Cisco Catalyst switches in the clinic architectures are maintained within Cisco Prime LMS (alternatively CiscoWorks Resource Manager Essentials, a component of C-LMS, can be used as well).
- The use of VLANs on the Cisco Catalyst switch enables the organization to provide same-box wired access to its devices while maintaining segregated addressing schemes.
- Disable the HTTP server on the switch and enable the HTTP secure server.
- Using the stacking capability of Cisco Catalyst switches improves high availability designs while simplifying configuration and support.
- Cisco SmartPorts simplifies connecting the right device to the right VLAN.
- Network Admission Control (NAC) protects the network from rogue devices being connected.
- Cisco compact switches can easily add more securely managed ports where needed (for example, Cash Wrap and customer service desk), and some models can use PoE.
- Set the **session** and **exec timeout** commands to 15 minutes or less.
- Configure appropriate banner messages on login, incoming, and exec modes of the switch. The login banner warning should not reveal the identity of the company that owns or manages the switch. The incoming and executive banners should state that these areas are considered private and that unauthorized access will result in prosecution to the full extent of the law.
- Configure the primary login authentication of the switch to be directed to the Cisco Secure ACS. Individual user account profiles need to be created. Configure secondary or tertiary authentication local to the switch itself in the event of a WAN or Cisco Secure ACS failure.
- Use the **no service password-recovery** command in conjunction with the **service password encryption** command to prevent password theft by physical compromise of the switch.

HIPAA Assessment Detail—HIPAA Safeguards Addressed

All of the sample configurations of the Cisco clinic switches shown below were used to meet the following list of satisfied controls:

- Access Control—Restrict access to ePHI data as required by HIPAA Administrative and Technical safeguards
  - §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.308(a)(3)(ii)(A) Authorization/Supervision. Implement procedures for the authorization and/or supervision of workforce members who work with ePHI or in locations where it might be accessed. Requirements addressed include: Auditing.
  - §164.308(a)(4)(ii)(B) Access authorization. Implement policies and procedures for granting access to electronic protected health information, for example, through access to a workstation, transaction, program, process, or other mechanism. Requirements addressed include: Access Control and Auditing.
- Auditing—Implement mechanisms to record and examine activity in systems that contain or use ePHI as required by HIPAA Technical safeguards.
  - §164.312(b) Audit controls. Implement hardware, software, and/or procedural mechanisms that record and examine activity in information systems that contain or use electronic protected health information. Requirements addressed include: Auditing.
  - §164.308(a)(5)(ii)(C) Log-in Monitoring. Procedures for monitoring log-in attempts and reporting discrepancies. Requirements addressed include: Access Control and Auditing.
- Integrity—Protect electronic protected health information from improper alteration or destruction as required by HIPAA Technical safeguards.
  - §164.312(c)(1) Data Integrity. Implement policies and procedures to protect health information from improper alteration or destruction.
  - §164.312(e)(1) Transmission Security. Implement technical security measures to guard against unauthorized access to ePHI that is being transmitted over an electronic communications network. Requirements addressed include: Encryption and Integrity.
  - §164.312(e)(2)(i) Integrity Controls. Implement security measures to ensure that ePHI is not improperly modified without detection until disposed of. Requirements addressed include: Integrity.
  - §164.312(e)(2)(ii) Encryption. Implement a mechanism to encrypt ePHI whenever deemed appropriate. Requirements addressed include: Encryption.
- Incident response—Implement security incident response as required by HIPAA Administrative safeguards.
  - §164.308(a)(6)(i) Security Incident Procedures. Implement policies and procedures to address security incidents.
  - §164.308(a)(6)(ii) Response and Reporting. Identify and respond to suspected or known security incidents; mitigate, to the extent practicable, harmful effects of security incidents that are known to the covered entity or business associate; and document security incidents and their outcomes. Requirements addressed include: Incident Response and Auditing.

Sample Configuration

Cisco switches are designed to track and monitor all administrative user access and events, thereby addressing all of the safeguards listed under Access Control above. User access throughout the solution uses a centralized user database in the Active Directory, which is linked through authentication servers via LDAP, RADIUS, and TACACS+ services, enabling verification of users and administrators of devices and endpoints. These services are located in the data center. Individual user IDs are assigned, and roles are based on group membership.

```
aaa new-model
aaa authentication login CiscoACS group tacacs+ local
aaa authentication enable default group tacacs+ enable
aaa authorization exec default group tacacs+ if-authenticated
aaa accounting update newinfo
aaa accounting exec default start-stop group tacacs+
aaa accounting commands 15 default start-stop group tacacs+
aaa accounting system default start-stop group tacacs+
aaa session-id common
tacacs-server host 192.168.42.131
tacacs-server directed-request
tacacs-server domain-stripping
tacacs-server key 7 <removed>
```

Local individual user accounts are configured in the event that the centralized authentication server cannot be reached. These accounts must be manually updated to maintain compliance requirements regarding password rotation and expiration.

```
username bart privilege 15 secret 5 <removed>
username emc-ncm privilege 15 secret 5 <removed>
username bmcgloth privilege 15 secret 5 <removed>
username csmadmin privilege 15 secret 5 <removed>
```

These AAA authentication groups are assigned to the administrative interfaces where users connect.

```
ip http authentication aaa login-authentication CiscoACS

line con 0
 login authentication CiscoACS

line vty 0 4
 login authentication CiscoACS

line vty 5 15
 login authentication CiscoACS
```

HIPAA Safeguard 164.312(a)(2)(ii) requires the enabling of automatic logoff options. Cisco Clinic switches supports session timeout. It is a best practice to set the session timeout to 15 minutes, as shown below.

```
ip http timeout-policy idle 900

line con 0
 session-timeout 15 output
 exec-timeout 15 0
line vty 0 4
 session-timeout 15 output
 exec-timeout 15 0
line vty 5 15
 session-timeout 15 output
 exec-timeout 15 0
```

To secure authentication information and management of the clinic switch, addressing Safeguard 164.308(a)(1)(i) Security Management, the clinic switch management interfaces were configured to support HTTPS access, and SSH. Before crypto keys can be generated hostname and domain name must be entered:

```
hostname S-A2-MED-1/2
ip domain name cisco-irn.com
```

Generate keys with 1024 or larger bit key generation, *not* the default 512.

```
Crypto key generate rsa 1024
```

Configure the SSH server to use the more secure protocol version SSHv2:

```
ip ssh version 2
```

Configure the HTTP server to use HTTPS, and only more secure ciphers:

```
no ip http server
ip http secure-server
ip http secure-ciphersuite 3des-ede-cbc-sha
```

Configure the use of Secure Copy in place of TFTP:

```
ip scp server enable
```

Cisco switches are able to track and monitor all administrative user access, events such as port up/down, as well as device authentication events when using 802.1x. See Cisco ISE for more information regarding port authentication.

To address the Incident Response and Auditing HIPAA safeguards identified above, Cisco Switches can be configured to send log data to the RSA enVision log management platform. Cisco switches track individual administrator actions through several mechanisms including AAA, logging, and system events by implementing the following configuration statements:

```
logging trap debugging
logging 192.168.42.124
logging buffered 50000

login on-failure log
login on-success log


archive
 log config
  logging enable
  notify syslog contenttype plaintext
  hidekeys
```

And SNMP:

```
snmp-server user remoteuser remoteuser remote 192.168.42.124 v3 access  88
snmp-server user remoteuser remoteuser v3
snmp-server group remoteuser v3 noauth
snmp-server trap-source Loopback0
snmp-server enable traps snmp authentication linkdown linkup coldstart warmstart
snmp-server enable traps config-copy
snmp-server enable traps config
snmp-server enable traps config-ctid
snmp-server enable traps dot1x auth-fail-vlan guest-vlan no-auth-fail-vlan
no-guest-vlan
snmp-server enable traps energywise
snmp-server enable traps entity
snmp-server enable traps hsrp
snmp-server enable traps power-ethernet group 1-4
snmp-server enable traps power-ethernet police
snmp-server enable traps cpu threshold
snmp-server enable traps rtr
snmp-server enable traps bridge newroot topologychange
snmp-server enable traps syslog
snmp-server enable traps vtp
snmp-server enable traps vlancreate
snmp-server enable traps vlandelete
snmp-server enable traps flash insertion removal
snmp-server enable traps port-security
snmp-server enable traps envmon fan shutdown supply temperature status
```

```
snmp-server enable traps errdisable
snmp-server enable traps mac-notification change move threshold
snmp-server enable traps vlan-membership
snmp-server host 192.168.42.124 remoteuser
```

As a best practice, NTP is used to synchronize clocks among network devices. This synchronization allows events to be correlated when system logs are created and when other time-specific events occur. All devices in the network used NTP to synchronize their clocks. The NTP servers were hosted at the data center site. The Cisco Lab uses two NTP servers that are synchronized to external reference sources. All systems and devices in the lab are pointed to these two servers. Cisco switches use NTP to meet these requirements by implementing the following configuration statements:

```
ntp server 192.168.62.161 prefer
ntp server 192.168.62.162

clock timezone PST -8 0
clock summer-time PSTDST recurring

service timestamps debug datetime localtime show-timezone
service timestamps log datetime msec localtime show-timezone
```

Clock synchronization is a requirement for common industry security frameworks such as the HiTrust Common Security Framework (CSF), ISO 27002, and NIST Security Publications, as well as other industry-based standards.

HIPAA Standards Failed

No HIPAA standards were failed.

HIPAA Implementation Specifications Failed

No HIPAA implementation specifications were failed.

Cisco Catalyst Switches—Data Center

The Cisco Catalyst family of data center switches are designed to securely switch data from servers to high speed trunks, maintaining the integrity of segmented scopes of compliance. They provide scalable inter-switch connectivity, high port density for wired endpoints, and the ability to segment them into sensitive scope networks. VLANs are used to put sensitive ePHI applications and devices onto their own network and segregate them from devices that are on non-sensitive networks. Data center Cisco Catalyst switches are highly redundant, capable of delivering high performance switching, with feature options depending on the needs of the business.

Modular functionality provides the ability to insert security technology to enforce compliance needs.

- Security services include access control, firewall, and intrusion prevention.
- Wireless services can be aggregated into these switches for central policy control of unified wireless access points.
- Application services include quality of service (QoS), content filtering, and load balancing.

Table 5-23 PHI HIPAA Assessment Summary—Cisco Data Center Switches

Models Assessed
Cisco Catalyst6509-Sup720-3BXL version s72033-adventerprisek9_wan-mz.122-33.SXJ.bin WS-C3750-48P version c3750-ipbasek9-mz.122-55.SE1.bin

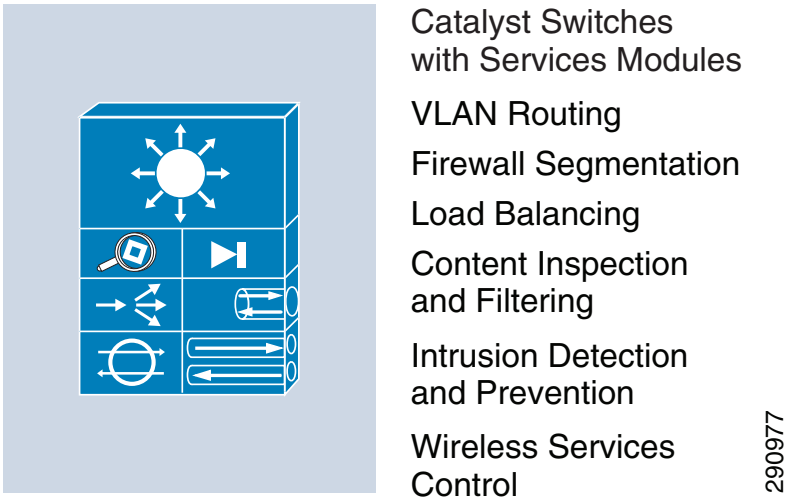
Table 5-23 PHI HIPAA Assessment Summary—Cisco Data Center Switches

HIPAA Safeguards Addressed	
Administrative	**Standards/Implementation Specifications**
164.308	(a)(1)(i) Security Management Process
	(a)(3)(i) Authorization/Supervision
	(a)(4)(i) Access Authorization
	(a)(5)(i) Log-in Monitoring
	(a)(6)(i) Security Incident Procedures
	(a)(6)(ii) Response and Reporting
Technical	**Standards/Implementation Specifications**
164.312	(a)(1) Access Control
	(b) Audit Controls
	(c)(1) Data Integrity
	(e)(i) Transmission Security
	(e)(2)(i) Integrity Controls.
	(e)(2)(ii) Encryption
HIPAA Standards Failed	
No HIPAA standards were failed.	
HIPAA Implementation Specifications Failed	
No HIPAA implementation specifications were failed.	

Primary PHI Function

Securing the infrastructure is a key PHI compliance feature of Cisco Catalyst data center switches. Cisco Catalyst switches have firewall/IDS modules for perimeter security. (See Figure 5-100.)

Figure 5-100 Cisco Catalyst Data Center Switches



The primary function of the Cisco Catalyst data center switches is segmentation of scope and enforcement of that new scope boundary. These switches have five primary functions/capabilities in relation to HIPAA:

- Using VLANs, Cisco Catalyst switches allow an organization to put its ePHI networks into separate VLANs (scopes) from other non-sensitive data (out of scope).
- The Layer 3 Cisco Catalyst switch acts as a router, directing traffic between networks. By segmenting a network into sub-networks, an organization can isolate sensitive information from non-sensitive information. The Cisco Catalyst switch can perform the ability to segment and route sensitive traffic from non-sensitive and reduce the overall scope of a company's ePHI data environment. Depending on risk vectors, different levels of enforcement are required at the segmented scope boundary level. See the following bullets for details.
- The Layer 3 Cisco Catalyst switch acts as a router with ACLs, restricting traffic between the ePHI data environment and other areas of the network. A Cisco Catalyst switch with ACLs can be used to enforce segmented traffic if the ACLs are used only to filter and segment private networks of the organization. ACLs may not be used to segment untrusted networks.
- The Cisco Catalyst switch with a firewall service module restricts traffic between the ePHI data environment and other areas of the network. As soon as any untrusted network is introduced, firewalling must be deployed.
- The Layer 3 Cisco Catalyst switch with an intrusion prevention module inspects all traffic going to and from the ePHI data environment. HIPAA Safeguard 164.308(a)(1)(i) requires policies and procedures to detect security violations. IDS is used to address wherever ePHI is present in the organization to detect for anomalous behavior of the sensitive area.

Design Considerations

- The configurations of the Cisco Catalyst switches in the data center and Internet edge architectures are maintained within Cisco Prime LMS (alternatively CiscoWorks Resource Manager Essentials, a component of C-LMS, can be used as well).
- The use of VLANs on the Cisco Catalyst switch enables the organization to provide same-box wired access to its devices while maintaining segregated addressing schemes.
- Using the stacking capability of Cisco Catalyst switches improves high availability designs while simplifying configuration and support.
- Disable the HTTP server on the switch and enable the HTTP secure server.
- Set the **session** and **exec timeout** commands to 15 minutes or less.
- Configure appropriate banner messages on login, incoming, and exec modes of the switch. The login banner warning should not reveal the identity of the company that owns or manages the switch. The incoming and executive banners should state that these areas are considered private and that unauthorized access will result in prosecution to the full extent of the law.
- Configure the primary login authentication of the switch to be directed to the Cisco Secure ACS. Individual user account profiles need to be created. Configure secondary or tertiary authentication local to the switch itself in the event of a WAN or Cisco Secure ACS failure.
- Use the **no service password-recovery** command in conjunction with the **service password encryption** command to prevent password theft by physical compromise of the switch.

HIPAA Assessment Detail—HIPAA Safeguards Addressed

All of the sample configurations of the Cisco Catalyst data center switches shown below were used to meet the following list of satisfied controls:

- Access Control—Restrict access to ePHI data as required by HIPAA Administrative and Technical safeguards
  - §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.308(a)(3)(ii)(A) Authorization/Supervision. Implement procedures for the authorization and/or supervision of workforce members who work with ePHI or in locations where it might be accessed. Requirements addressed include: Auditing.
  - §164.308(a)(4)(ii)(B) Access authorization. Implement policies and procedures for granting access to electronic protected health information, for example, through access to a workstation, transaction, program, process, or other mechanism. Requirements addressed include: Access Control and Auditing.
- Auditing—Implement mechanisms to record and examine activity in systems that contain or use ePHI as required by HIPAA Technical safeguards.
  - §164.312(b) Audit controls. Implement hardware, software, and/or procedural mechanisms that record and examine activity in information systems that contain or use electronic protected health information. Requirements addressed include: Auditing.
  - §164.308(a)(5)(ii)(C) Log-in Monitoring. Procedures for monitoring log-in attempts and reporting discrepancies. Requirements addressed include: Access Control and Auditing.
- Integrity—Protect electronic protected health information from improper alteration or destruction as required by HIPAA Technical safeguards.
  - §164.312(c)(1) Data Integrity. Implement policies and procedures to protect health information from improper alteration or destruction.
  - §164.312(e)(1) Transmission Security. Implement technical security measures to guard against unauthorized access to ePHI that is being transmitted over an electronic communications network. Requirements addressed include: Encryption and Integrity.
  - §164.312(e)(2)(i) Integrity Controls. Implement security measures to ensure that ePHI is not improperly modified without detection until disposed of. Requirements addressed include: Integrity.
  - §164.312(e)(2)(ii) Encryption. Implement a mechanism to encrypt ePHI whenever deemed appropriate. Requirements addressed include: Encryption.
- Incident response—Implement security incident response as required by HIPAA Administrative safeguards.
  - §164.308(a)(6)(i) Security Incident Procedures. Implement policies and procedures to address security incidents.
  - §164.308(a)(6)(ii) Response and Reporting. Identify and respond to suspected or known security incidents; mitigate, to the extent practicable, harmful effects of security incidents that are known to the covered entity or business associate; and document security incidents and their outcomes. Requirements addressed include: Incident Response and Auditing.

Sample Configuration

Cisco switches are designed to track and monitor all administrative user access and events, thereby addressing all of the safeguards listed under Access Control above. User access throughout the solution uses a centralized user database in the Active Directory, which is linked through authentication servers via LDAP, RADIUS, and TACACS+ services, enabling verification of users and administrators of devices and endpoints. These services are located in the data center. Individual user IDs are assigned, and roles are based on group membership.

```
aaa new-model
aaa authentication login CiscoACS group tacacs+ local
aaa authentication enable default group tacacs+ enable
aaa authorization exec default group tacacs+ if-authenticated
aaa accounting update newinfo
aaa accounting exec default start-stop group tacacs+
aaa accounting commands 15 default start-stop group tacacs+
aaa accounting system default start-stop group tacacs+
aaa session-id common
tacacs-server host 192.168.42.131
tacacs-server directed-request
tacacs-server domain-stripping
tacacs-server key 7 <removed>
```

Local individual user accounts are configured in the event that the centralized authentication server cannot be reached. These accounts must be manually updated to maintain compliance requirements regarding password rotation and expiration.

```
username bart privilege 15 secret 5 <removed>
username emc-ncm privilege 15 secret 5 <removed>
username bmcgloth privilege 15 secret 5 <removed>
username csmadmin privilege 15 secret 5 <removed>
```

These AAA authentication groups are assigned to the administrative interfaces where users connect.

```
ip http authentication aaa login-authentication CiscoACS

line con 0
 login authentication CiscoACS

line vty 0 4
 login authentication CiscoACS

line vty 5 15
 login authentication CiscoACS
```

HIPAA Safeguard 164.312(a)(2)(ii) requires the enabling of automatic logoff options. Cisco data center switches support session timeout. It is a best practice to set the session timeout to 15 minutes, as shown below.

```
ip http timeout-policy idle 900

line con 0
 session-timeout 15 output
 exec-timeout 15 0
line vty 0 4
 session-timeout 15 output
 exec-timeout 15 0
line vty 5 15
 session-timeout 15 output
 exec-timeout 15 0
```

To secure authentication information and management of the Cisco data center switches, addressing Safeguard 164.308(a)(1)(i) Security Management, the Cisco data center switches management interfaces were configured to support HTTPS access, and SSH. Before crypto keys can be generated hostname and domain name must be entered:

```
hostname S-A2-MED-1/2
ip domain name cisco-irn.com
```

Generate keys with 1024 or larger bit key generation, *not* the default 512.

```
Crypto key generate rsa 1024
```

Configure the SSH server to use the more secure protocol version SSHv2:

```
ip ssh version 2

Configure the HTTP server to use HTTPS, and only more secure ciphers:
no ip http server
ip http secure-server
ip http secure-ciphersuite 3des-ede-cbc-sha
```

Configure the use of Secure Copy in place of TFTP

```
ip scp server enable
```

Cisco switches are able to track and monitor all administrative user access, events such as port up/down, as well as device authentication events when using 802.1x. See Cisco ISE for more information regarding port authentication.

To address the Incident Response and Auditing HIPAA safeguards identified above, Cisco Switches can be configured to send log data to the RSA enVision log management platform. Cisco switches track individual administrator actions through several mechanisms including AAA, logging, and system events by implementing the following configuration statements:

```
logging trap debugging
logging 192.168.42.124
logging buffered 50000

login on-failure log
login on-success log


archive
 log config
  logging enable
  notify syslog contenttype plaintext
  hidekeys
```

And SNMP:

```
snmp-server user remoteuser remoteuser remote 192.168.42.124 v3 access  88
snmp-server user remoteuser remoteuser v3
snmp-server group remoteuser v3 noauth
snmp-server trap-source Loopback0
snmp-server enable traps snmp authentication linkdown linkup coldstart warmstart
snmp-server enable traps config-copy
snmp-server enable traps config
snmp-server enable traps config-ctid
snmp-server enable traps dot1x auth-fail-vlan guest-vlan no-auth-fail-vlan
no-guest-vlan
snmp-server enable traps energywise
snmp-server enable traps entity
snmp-server enable traps hsrp
snmp-server enable traps power-ethernet group 1-4
snmp-server enable traps power-ethernet police
snmp-server enable traps cpu threshold
snmp-server enable traps rtr
snmp-server enable traps bridge newroot topologychange
snmp-server enable traps syslog
snmp-server enable traps vtp
snmp-server enable traps vlancreate
snmp-server enable traps vlandelete
snmp-server enable traps flash insertion removal
snmp-server enable traps port-security
snmp-server enable traps envmon fan shutdown supply temperature status
snmp-server enable traps errdisable
```

```
snmp-server enable traps mac-notification change move threshold
snmp-server enable traps vlan-membership
snmp-server host 192.168.42.124 remoteuser
```

As a best practice, NTP is used to synchronize clocks among network devices. This synchronization allows events to be correlated when system logs are created and when other time-specific events occur. All devices in the network used NTP to synchronize their clocks. The NTP servers were hosted at the data center site. The Cisco Lab uses two NTP servers that are synchronized to external reference sources. All systems and devices in the lab are pointed to these two servers. Cisco switches use NTP to meet these requirements by implementing the following configuration statements:

```
ntp server 192.168.62.161 prefer
ntp server 192.168.62.162

clock timezone PST -8 0
clock summer-time PSTDST recurring

service timestamps debug datetime localtime show-timezone
service timestamps log datetime msec localtime show-timezone
```

Clock synchronization is a requirement for common industry security frameworks such as the HiTrust Common Security Framework (CSF), ISO 27002, and NIST Security Publications, as well as other industry-based standards.

HIPAA Standards Failed

No HIPAA standards were failed.

HIPAA Implementation Specifications Failed

No HIPAA implementation specifications were failed.

Cisco Nexus 1000V Switch—Data Center

The Cisco Nexus 1000V Series Switch provides connectivity for virtual servers with the ability to segment them onto their own sensitive scope networks. VLANs are used to put sensitive PHI applications and devices onto their own network and segregate them from devices that are on non-sensitive networks.

The Cisco Nexus 1000V Series Switch provides advanced networking functions and a common network management model in a virtualized server environment. The Cisco Nexus 1000V Series Switch replaces the virtual switching functionality of the VMware vCenter data center container of servers. Each server in the data center container is represented as a line card in the Cisco Nexus 1000V Series Virtual Supervisor Module (VSM) and is managed as if it were a line card in a physical Cisco switch.

Key benefits of the Nexus 1000V include the following:

- Policy-based virtual machine (VM) connectivity
- Mobile VM security and network policy
- Non-disruptive operational model for your server virtualization, and networking teams

Table 5-24 PHI HIPAA Assessment Summary—Cisco Nexus 1000V Switch

Models Assessed
Cisco Nexus 1000V version 4.2(1)SV1(4)

Table 5-24 PHI HIPAA Assessment Summary—Cisco Nexus 1000V Switch

HIPAA Safeguards Addressed	
Administrative	**Standards/Implementation Specifications**
164.308	(a)(1)(i) Security Management Process
	(a)(3)(i) Authorization/Supervision
	(a)(4)(ii)(A) Isolating Healthcare Clearinghouse Functions
	(a)(4)(i) Access Authorization
	(a)(5)(i) Log-in Monitoring
	(a)(6)(i) Security Incident Procedures
Technical	**Standards/Implementation Specifications**
164.312	(a)(i) Access Control
	(b) Audit Controls
HIPAA Standards Failed	
No HIPAA standards were failed.	
HIPAA Implementation Specifications Failed	
No HIPAA implementation specifications were failed.	

Primary PHI Function

The primary HIPAA compliance feature of Cisco Nexus switches is secure aggregation and access layer connectivity.

- Using VLANs, Cisco Nexus switches allow an organization to put its ePHI network into separate VLANs (scopes) from other non-sensitive data (out of scope).
- The Layer 3 Cisco Nexus switch acts as a router, directing traffic between networks. By segmenting a network into sub-networks, an organization can isolate sensitive information from non-sensitive information. The Cisco Nexus switch can segment and route sensitive traffic separately from non-sensitive traffic to reduce the overall scope of a company's ePHI data environment. Depending on risk vectors, various levels of enforcement are required at the segmented scope boundary level.
- The Layer 3 Cisco Nexus switch acts as a router with ACLs, restricting traffic between the ePHI data environment and other areas of the network. A Cisco Nexus switch with ACLs can be used to enforce segmented traffic if the ACLs are used only to filter and segment private networks of the organization. ACLs may not be used to segment untrusted networks.
- The Cisco Nexus switch uses *virtualization contexts*, which are essentially virtualized switches. Each virtualized context has its own configuration and management interfaces that can be used to segregate not only data but administration as well.

Design Considerations

The Cisco Nexus 1000V Series Switch includes the Cisco Integrated Security features that are found on Cisco physical switches to prevent a variety of attack scenarios. For example, a rogue virtual machine can spoof its MAC and IP addresses so that it appears to be an existing production virtual machine, send a rogue Address Resolution Protocol (ARP) transaction mimicking the way that VMware vMotion announces the location of a migrated virtual machine, and divert traffic from the production virtual machine to the rogue virtual machine. With Cisco Integrated Security features, this type of attack can

easily be prevented with simple networking policy. Because server virtualization is being used for desktop and server workloads, it is critical that this type of security feature be deployed for the proper operation of a virtualized environment.

The Cisco Nexus 1000V Series implementation has two primary components:

- Virtual Supervisor Module (VSM)
- Virtual Ethernet module (VEM)

The Cisco Nexus 1000V VSM is installed as an appliance server on either a standalone Cisco UCS server (Cisco Nexus 1010) or as a virtual appliance on VMware ESXi server running on a blade of the Cisco UCS system.

HIPAA Assessment Detail—HIPAA Safeguards Addressed

All of the sample configurations of the Cisco Nexus 1000V Series Switch shown below were used to meet the following list of satisfied controls:

- Access Control—Restrict access to ePHI data as required by HIPAA Administrative and Technical safeguards
- §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
- §164.308(a)(3)(ii)(A) Authorization/Supervision. Implement procedures for the authorization and/or supervision of workforce members who work with ePHI or in locations where it might be accessed. Requirements addressed include: Auditing.
- §164.308(a)(4)(ii)(A) Isolating healthcare clearinghouse function. If a healthcare clearinghouse is part of a larger organization, the clearinghouse must implement policies and procedures that protect the electronic protected health information of the clearinghouse from unauthorized access by the larger organization. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.308(a)(4)(ii)(B) Access authorization. Implement policies and procedures for granting access to electronic protected health information, for example, through access to a workstation, transaction, program, process, or other mechanism. Requirements addressed include: Access Control and Auditing.
  - §164.308(a)(5)(ii)(C) Log-in Monitoring. Procedures for monitoring log-in attempts and reporting discrepancies. Requirements addressed include: Access Control and Auditing.
  - §164.312(a)(1) Access Control. Implement technical policies and procedures for electronic information systems that maintain ePHI to allow access only to those persons or software programs that have been granted access rights as specified in §164.308(a)(4).
- Incident response—Implement security incident response as required by HIPAA Administrative safeguards.
  - §164.308(a)(6)(ii) Response and Reporting. Identify and respond to suspected or known security incidents; mitigate, to the extent practicable, harmful effects of security incidents that are known to the covered entity or business associate; and document security incidents and their outcomes. Requirements addressed include: Incident Response and Auditing.
- Auditing—Implement mechanisms to record and examine activity in systems that contain or use ePHI as required by HIPAA Technical Safeguards.
  - §164.312(b) Audit controls. Implement hardware, software, and/or procedural mechanisms that record and examine activity in information systems that contain or use electronic protected health information. Requirements addressed include: Auditing.

Sample Configuration

Cisco Nexus 1000V is designed to track and monitor all administrative user access and events, thereby addressing all of the safeguards listed under Access Control above. User access throughout the solution uses a centralized user database in the Active Directory, which is linked through authentication servers via LDAP, RADIUS, and TACACS+ services, enabling verification of users and administrators of devices and endpoints. These services are located in the data center. Individual user IDs are assigned, and roles are based on group membership.

To enable central authentication, you first have to enable the TACACS+ feature on the Cisco Nexus 1000V:

```
config t
feature tacacs+
```

The following commands show how to configure the TACACS+ server:

```
tacacs-server key 7 password
tacacs-server host 192.168.42.131
aaa group server tacacs+ CiscoACS
    server 192.168.42.131
    use-vrf management
    source-interface mgmt0
aaa group server tacacs+ tacacs
aaa authentication login default group CiscoACS
aaa authentication login console group CiscoACS
```

Number *7* in the key command specifies an encrypted string (key) to follow.

Local individual user accounts are configured in the event that the centralized authentication server cannot be reached. These accounts must be manually updated to maintain compliance requirements regarding password rotation and expiration as specified in established policies for passwords. Configure the local user with encrypted passwords for fallback authentication:

```
username janoff password 5 <removed>  role network-admin
username bart password 5 <removed>  role network-operator
```

Both roles used in the **username** commands are pre-defined roles in the Cisco Nexus 1000V. The network admin role has access to all commands on the switch, whereas the network operator role has access to all read commands on the switch.

To address the Incident Response and Auditing HIPAA safeguards identified above, Cisco Nexus 1000V can be configured to send its log data to the RSA enVision log management platform. Cisco Nexus switches track individual administrator actions through several mechanisms including AAA, logging, and system events by implementing the following configuration statements:

```
logging server 192.178.42.124 6 facility syslog
aaa accounting default group CiscoACS
```

HIPAA Safeguard 164.312(a)(2)(ii) requires the enabling of automatic logoff options. Cisco Nexus 1000V supports session timeout, it is a best practice to set session timeout to 15 minutes, as shown below.

```
line vty
  exec-timeout 15
line console
  exec-timeout 15
```

NTP is used to synchronize clocks among network devices. This synchronization allows events to be correlated when system logs are created and when other time-specific events occur. All devices in the network used NTP to synchronize their clocks. The NTP servers were hosted at the data center site. The

Cisco Lab uses two NTP servers that are synchronized to external reference sources. All systems and devices in the lab are pointed to these two servers. Cisco Nexus switches use NTP to meet these requirements by implementing the following configuration statements.

```
enable NTP
ntp server 192.168.62.161 use-vrf management
ntp server 192.168.62.162 use-vrf management
clock timezone PST -8 0
clock summer-time PST 1 Sun April 02:00 5 Sun Oct 02:00 60
```

Clock synchronization is a requirement for common industry security frameworks such as the HiTrust Common Security Framework (CSF), ISO 27002, and NIST Security Publications, as well as other industry-based standards.

HIPAA Standards Failed

No HIPAA standards were failed.

HIPAA Implementation Specifications Failed

No HIPAA implementation specifications were failed.

Cisco Nexus Switches—Data Center

The Cisco Nexus family of data center switches is designed to securely switch data from healthcare application servers to high speed trunks of the core, maintaining the integrity of segmented scopes of compliance. They provide scalable inter-switch connectivity and high port density for wired endpoints. VLANs are used to put sensitive applications and devices onto their own network and segregate them from devices on non-sensitive networks.

Cisco Nexus switches are ideal for enterprise-class server and aggregation layer deployments. These multipurpose, multilayer switches can be deployed across a diverse set of traditional, virtualized, unified, and high-performance computing environments. They enable diverse transports over Ethernet (including Layer 2, Layer 3, and storage traffic) on one common platform. Nexus switches help transform your data center, with a standards-based, multipurpose, multiprotocol, Ethernet-based fabric.

Table 5-25 PHI HIPAA Assessment Summary—Cisco Nexus Data Center Switches

Models Assessed	
Cisco Nexus5020 Chassis (“40x10GE/Supervisor”) version n5000-uk9.5.0.3.N1.1b.bin Cisco 7010 Chassis (“Supervisor module-1X”) version n7000-s1-dk9.5.1.2.bin	
HIPAA Safeguards Addressed	
Administrative	**Standards/Implementation Specifications**
164.308	(a)(1)(i) Security Management Process
	(a)(3)(i) Authorization/Supervision
	(a)(4)(ii)(A) Isolating Healthcare Clearinghouse Functions
	(a)(4)(i) Access Authorization
	(a)(5)(i) Log-in Monitoring
	(a)(6)(i) Security Incident Procedures
Technical	**Standards/Implementation Specifications**

Table 5-25 PHI HIPAA Assessment Summary—Cisco Nexus Data Center Switches

164.312	(a)(i) Access Control
	(b) Audit Controls
HIPAA Standards Failed	
No HIPAA standards were failed.	
HIPAA Implementation Specifications Failed	
No HIPAA implementation specifications were failed.	

Primary PHI Function

The primary HIPAA compliance feature of Cisco Nexus data center switches is secure aggregation and access layer connectivity.

- Using VLANs, Cisco Nexus switches allow an organization to put its ePHI network into separate VLANs (scopes) from other non-sensitive data (out of scope).
- The Layer 3 Cisco Nexus switch acts as a router, directing traffic between networks. By segmenting a network into sub-networks, an organization can isolate sensitive information from non-sensitive information. The Cisco Nexus switch can segment and route sensitive traffic separately from non-sensitive traffic to reduce the overall scope of a company's ePHI data environment. Depending on risk vectors, various levels of enforcement are required at the segmented scope boundary level.
- The Layer 3 Cisco Nexus switch acts as a router with ACLs, restricting traffic between the ePHI data environment and other areas of the network. A Cisco Nexus switch with ACLs can be used to enforce segmented traffic if the ACLs are used only to filter and segment private networks of the organization. ACLs may not be used to segment untrusted networks.
- The Cisco Nexus switch uses virtualization contexts, which are essentially virtualized switches. Each virtualized context has its own configuration and management interfaces that can be used to segregate not only data but administration as well.

Design Considerations

- Configuration was done manually on the router CLI, and backup of configuration and monitoring of configuration for changes and non-compliance were done through the Cisco Prime LMS (alternatively CiscoWorks Resource Manager Essentials, a component of C-LMS, can be used as well).
- Configure appropriate banner messages on login, incoming, and EXEC modes of the router. The login banner warning should not reveal the identity of the company that owns or manages the router. The incoming and executive banners should state that these areas are considered private and that unauthorized access will result in prosecution to the full extent of the law.
- Configure the primary login authentication of the router to be directed to the Cisco Secure ACS. Individual user account profiles need to be created. Configure secondary or tertiary authentication local to the router itself in the event of a WAN or Cisco Secure ACS failure.
- Nexus switches in the data center were implemented using guidance from the Enterprise Data Center Design guide based on a Data Center 3.0 Architecture:
  http://www.cisco.com/en/US/netsol/ns743/networking_solutions_program_home.html

  Enterprise Internet Edge Design Guide:
  http://www.cisco.com/en/US/docs/solutions/Enterprise/Security/IE_DG.html

- The Cisco Nexus 7010 and the Cisco Nexus 5000 were used for the aggregation block portions of the lab validation network.

HIPAA Assessment Detail—HIPAA Safeguards Addressed.

All of the sample configurations of the Cisco Nexus data center switches shown below were used to meet the following list of satisfied controls:

- Access Control—Restrict access to ePHI data as required by HIPAA Administrative and Technical safeguards
  - §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.308(a)(3)(ii)(A) Authorization/Supervision. Implement procedures for the authorization and/or supervision of workforce members who work with ePHI or in locations where it might be accessed. Requirements addressed include: Auditing.
  - §164.308(a)(4)(ii)(A) Isolating healthcare clearinghouse function. If a health care clearinghouse is part of a larger organization, the clearinghouse must implement policies and procedures that protect the electronic protected health information of the clearinghouse from unauthorized access by the larger organization. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.308(a)(4)(ii)(B) Access authorization. Implement policies and procedures for granting access to electronic protected health information, for example, through access to a workstation, transaction, program, process, or other mechanism. Requirements addressed include: Access Control and Auditing.
  - §164.308(a)(5)(ii)(C) Log-in Monitoring. Procedures for monitoring log-in attempts and reporting discrepancies. Requirements addressed include: Access Control and Auditing.
  - §164.312(a)(1) Access Control. Implement technical policies and procedures for electronic information systems that maintain ePHI to allow access only to those persons or software programs that have been granted access rights as specified in §164.308(a)(4).
- Incident response—Implement security incident response as required by HIPAA Administrative safeguards.
  - §164.308(a)(6)(ii) Response and Reporting. Identify and respond to suspected or known security incidents; mitigate, to the extent practicable, harmful effects of security incidents that are known to the covered entity or business associate; and document security incidents and their outcomes. Requirements addressed include: Incident Response and Auditing.
- Auditing—Implement mechanisms to record and examine activity in systems that contain or use ePHI as required by HIPAA Technical safeguards.
  - §164.312(b) Audit controls. Implement hardware, software, and/or procedural mechanisms that record and examine activity in information systems that contain or use electronic protected health information. Requirements addressed include: Auditing.

Sample Configuration

Cisco Nexus switches are designed to track and monitor all administrative user access and events, thereby addressing all of the safeguards listed under Access Control above. User access throughout the solution uses a centralized user database in the Active Directory, which is linked through authentication servers via LDAP, RADIUS, and TACACS+ services, enabling verification of users and administrators of devices and endpoints. These services are located in the data center. Individual user IDs are assigned, and roles are based on group membership.

To enable central authentication, you first have to enable the TACACS+ feature on the Cisco Nexus 1000V:

```
config t
feature tacacs+
```

The following commands show how to configure the TACACS+ server:

```
tacacs-server key 7 "<removed>"
tacacs-server host 192.168.42.131
aaa group server tacacs+ CiscoACS
    server 192.168.42.131
    use-vrf management
    source-interface mgmt0
aaa group server tacacs+ tacacs
aaa authentication login default group CiscoACS
aaa authentication login console group CiscoACS
```

Number *7* in the key command specifies an encrypted string (key) to follow.

Local individual user accounts are configured in the event that the centralized authentication server cannot be reached. These accounts must be manually updated to maintain compliance requirements regarding password rotation and expiration as specified in established policies for passwords. Configure the local user with encrypted passwords for fallback authentication:

```
username janoff password 5 <removed>  role network-admin
username bart password 5 <removed>  role network-operator
```

Both roles used in the **username** commands are pre-defined roles in the Cisco Nexus 1000V. The network admin role has access to all commands on the switch, whereas the network operator role has access to all read commands on the switch.

To address the Incident Response and Auditing HIPAA Safeguards identified above, Cisco Nexus 1000v can be configured to send its log data to the RSA enVision log management platform. Cisco Nexus switches track individual administrator actions through several mechanisms including AAA, logging, and system events by implementing the following configuration statements:

```
logging server 192.178.42.124 6 facility syslog
!
! --- for implementations using VRF's ----
!
logging server 192.168.42.124 6 use-vrf servers1

aaa accounting default group CiscoACS
```

HIPAA Safeguard 164.312(a)(2)(ii) requires the enabling of automatic logoff options. Cisco Nexus 1000V supports session timeout, it is a best practice to set session time-out to 15 minutes, as shown below.

```
line vty
  exec-timeout 15
line console
  exec-timeout 15
```

NTP is used to synchronize clocks among network devices. This synchronization allows events to be correlated when system logs are created and when other time-specific events occur. All devices in the network used NTP to synchronize their clocks. The NTP servers were hosted at the data center site. The Cisco Lab uses two NTP servers that are synchronized to external reference sources. All systems and devices in the lab are pointed to these two servers. Cisco Nexus switches use NTP to meet these requirements by implementing the following configuration statements.

```
! NTP can only be configured in the default VDC
!
```

```
enable NTP
ntp server 192.168.62.161 use-vrf management
ntp server 192.168.62.162 use-vrf management
clock timezone PST -8 0
clock summer-time PST 1 Sun April 02:00 5 Sun Oct 02:00 60
```

Clock synchronization is a requirement for common industry security frameworks such as the HiTrust Common Security Framework (CSF), ISO 27002, and NIST Security Publications, as well as other industry-based standards.

HIPAA Standards Failed

No HIPAA standards were failed.

HIPAA Implementation Specifications Failed

No HIPAA implementation specifications were failed.

Wireless

Cisco Wireless technologies provide connectivity for mobile clients within the clinic. They are designed to securely connect traditional business functions such as guest access, without increasing risk. In addition to expanding business functionality, Cisco wireless technology seamlessly provides the capability to detect rogues.

Cisco Aironet access points are designed to provide industry-leading performance to enable highly secure and reliable wireless connections for both indoor and outdoor environments. Cisco offers a broad portfolio of access points targeted to specific business needs and topologies.

Cisco wireless controllers help reduce the overall operational expenses of Cisco Unified Wireless Networks by simplifying network deployment, operations, and management. They extend policy and security from the wired network to the wireless edge.

Cisco Wireless Control System (WCS) delivers full visibility and control of Cisco Aironet access points, Cisco Wireless LAN Controllers (WLC) and the Cisco Mobility Services Engine (MSE) with built-in support for Cisco adaptive wireless intrusion prevention systems (wIPS) and Cisco context-aware services. This robust platform helps you reduce total cost of ownership and maintain a business-ready wireless network.

Table 5-26 PHI HIPAA Assessment Summary—Cisco Wireless Products

Models Assessed	
AIR-CT5508-12-K9 version 7.0.114.112 MSE3550 version 7.0.200.125 Cisco WCS Manager version 7.0.171.107 AIR-CAP1042N AIR-CAP3502i AIR-CAP3502E AIR-LAP1262N	
HIPAA Safeguards Addressed	
Administrative	**Standards/Implementation Specifications**
164.308	(a)(1)(i) Security Management Process
	(a)(3)(i) Authorization/Supervision

Table 5-26 PHI HIPAA Assessment Summary—Cisco Wireless Products (continued)

	(a)(4)(i) Access Authorization
	(a)(5)(i) Log-in Monitoring
	(a)(6)(i) Security Incident Procedures
	(a)(6)(i) Response and Reporting
Technical	**Standards/Implementation Specifications**
164.312	(a)(i) Access Control
	(a)(2)(i) Unique User Identification
	(a)(2)(ii) Emergency Access procedures
	(a)(2)(ii) Automatic Logoff
	(a)(ii)(iv) Encryption and Decryption
	(b) Audit Controls
	(c)(1) Data Integrity
	(d) Person or Entity Authentication
	(e)(i) Transmission Security
	(e)(2)(i) Integrity Controls
	(e)(2)(ii) Encryption
HIPAA Standards Failed	
No HIPAA standards were failed.	
HIPAA Implementation Specifications Failed	
No HIPAA implementation specifications were failed.	

Primary PHI Function

The primary ePHI function of Cisco Unified Wireless is secure connectivity and authentication of wireless clients as well as rogue device detection.

Design Considerations

Wireless technology in the PHI environment is a growing concern for organizations in the healthcare field. Implementing wireless requires that appropriate security controls are in place to prevent, detect and respond to security violations. A hacker might infiltrate a PHI environment and install a rogue wireless device (for example, access point, wireless-enabled printer, or radio-enabled USB stick). This would allow a hacker remote access into the PHI environment (from the parking lot, for example) that is hard to detect. There are several methods for detecting rogue devices. Cisco Unified Wireless offers the benefit of continuous rogue detection while simultaneously passing normal wireless traffic.

Wireless technology is an untrusted network connection. Appropriate security must be is in place for wireless technology in the ePHI environment. Organizations must ensure that controls are in place to prevent unauthorized access. Appropriate controls include a firewall to segment and protect the PHI data environment and intrusion detection services to identify potential intrusion attempts to the secured network. Stateful firewalls must be configured to limit traffic to and from the wireless environment (all enabled services, protocols, and ports must have documented justification for business purposes). All other access should be denied.

When implementing wireless in an ePHI environment, encryption must be configured to adequately protect ePHI transmitted over the wireless medium. Today the minimum level of encryption deemed acceptable by auditors is WPA2.

Cisco recommends using the Unified Wireless (controller-based) architecture for enterprise wireless deployments because of the Cisco ongoing wireless strategy. The autonomous Cisco IOS access points are not being enhanced. Future security and user enhancements will be developed on the controller-based architecture.

For WCS servers running software versions prior to 4.1, Cisco recommends a combination of documented password policies, manual audit procedures, and firewall segmentation for WCS servers within the data center.

- Configure unique SSIDs
- Disable broadcast of the SSIDs

HIPAA Assessment Detail—HIPAA Safeguards Addressed

All of the sample configurations of the Cisco Wireless technologies shown below were used to meet the following list of satisfied controls:

- Access Control—Restrict access to ePHI data as required by HIPAA Administrative and Technical safeguards
  - §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.308(a)(4)(ii)(A) Isolating healthcare clearinghouse function. If a healthcare clearinghouse is part of a larger organization, the clearinghouse must implement policies and procedures that protect the electronic protected health information of the clearinghouse from unauthorized access by the larger organization. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.308(a)(4)(ii)(B) Access authorization. Implement policies and procedures for granting access to electronic protected health information, for example, through access to a workstation, transaction, program, process, or other mechanism. Requirements addressed include: Access Control and Auditing.
  - §164.308(a)(4)(ii)(C) Access Establishment and Modification. Implement policies and procedures that, based upon the covered entity's or the business associate's access authorization policies, establish, document, review, and modify a user's right of access to a workstation, transaction, program, or process. Requirements addressed include: Access Control, Incident Response, and Auditing.
  - §164.312(a)(1) Access Control. Implement technical policies and procedures for electronic information systems that maintain ePHI to allow access only to those persons or software programs that have been granted access rights as specified in §164.308(a)(4).
  - §164.312(d) Person or entity authentication. Implement procedures to verify that a person or entity seeking access to electronic protected health information is the one claimed. Requirements addressed include: Access Control and Auditing.
  - §164.308(a)(5)(ii)(D) Password Management. Procedures for creating, changing, and safeguarding passwords. Requirements addressed include: Access Control and Auditing.
- Integrity—Protect electronic protected health information from improper alteration or destruction as required by HIPAA Technical safeguards.

  - §164.312(c)(1) Data Integrity. Implement policies and procedures to protect health information from improper alteration or destruction.
  - §164.308(a)(4)(ii)(C) Access Establishment and Modification. Implement policies and procedures that, based upon the covered entity's or the business associate's access authorization policies, establish, document, review, and modify a user's right of access to a workstation, transaction, program, or process. Requirements addressed include: Access Control, Incident Response, and Auditing.
  - §164.308(a)(5)(ii)(C) Log-in Monitoring. Procedures for monitoring log-in attempts and reporting discrepancies. Requirements addressed include: Access Control and Auditing.
  - §164.312(a)(2)(ii) Emergency Access Procedure. Establish (and implement as needed) procedures for obtaining necessary ePHI during an emergency.
  - §164.312(e)(1) Transmission Security. Implement technical security measures to guard against unauthorized access to ePHI that is being transmitted over an electronic communications network. Requirements addressed include: Encryption and Integrity.
  - §164.308(e)(2)(i) Integrity Controls. Implement security measures to ensure that ePHI is not improperly modified without detection until disposed of. Requirements addressed include: Integrity.
  - §164.308(e)(2)(ii) Encryption. Implement a mechanism to encrypt ePHI whenever deemed appropriate. Requirements addressed include: Encryption.

- Incident response—Implement security incident response as required by HIPAA Administrative safeguards.
  - §164.308(a)(6)(ii) Response and Reporting. Identify and respond to suspected or known security incidents; mitigate, to the extent practicable, harmful effects of security incidents that are known to the covered entity or business associate; and document security incidents and their outcomes. Requirements addressed include: Incident Response and Auditing.
  - §164.312(a)(2)(i) Unique User Identification. Assign a unique name and/or number for identifying and tracking user identity. Requirements addressed include: Access Control and Auditing.
  - §164.312(a)(2)(ii) Automatic logoff. Implement electronic procedures that terminate an electronic session after a predetermined time of inactivity. Requirements addressed include: Access Control and Auditing.
- Encryption—Implement mechanisms to encrypt and decrypt ePHI.
  - §164.312(a)(ii)(iv) Encryption and Decryption. Implement a mechanism to encrypt and decrypt electronic protected health information. Requirements addressed include: Encryption and Integrity.
- Auditing—Implement mechanisms to record and examine activity in systems that contain or use ePHI as required by HIPAA Technical safeguards.
  - §164.312(b) Audit controls. Implement hardware, software, and/or procedural mechanisms that record and examine activity in information systems that contain or use electronic protected health information. Requirements addressed include: Auditing.
  - §164.308(a)(5)(ii)(C) Log-in Monitoring. Procedures for monitoring log-in attempts and reporting discrepancies. Requirements addressed include: Access Control and Auditing.
  - §164.312(d) Person or entity authentication. Implement procedures to verify that a person or entity seeking access to electronic protected health information is the one claimed. Requirements addressed include: Access Control and Auditing.

Sample Configuration

Cisco WCS is designed to track and monitor all administrative user access and events, thereby addressing all of the safeguards listed under Access Control above. User access throughout the solution uses a centralized user database in the Active Directory, which is linked through authentication servers via LDAP, RADIUS, and TACACS+ services, enabling verification of users and administrators of devices and endpoints. These services are located in the data center. Individual user IDs are assigned, and roles are based on group membership.

Cisco Unified Wireless allows the network administrator to set user IDs that can be monitored and restricted with respect to access and other privileges when necessary.

For network security, the Cisco solution uses profiles for appropriate access where a user is assigned to the profile, and user access can be restricted as shown in Figure 5-101 and Figure 5-102.

Figure 5-101 Local Management Users Screen

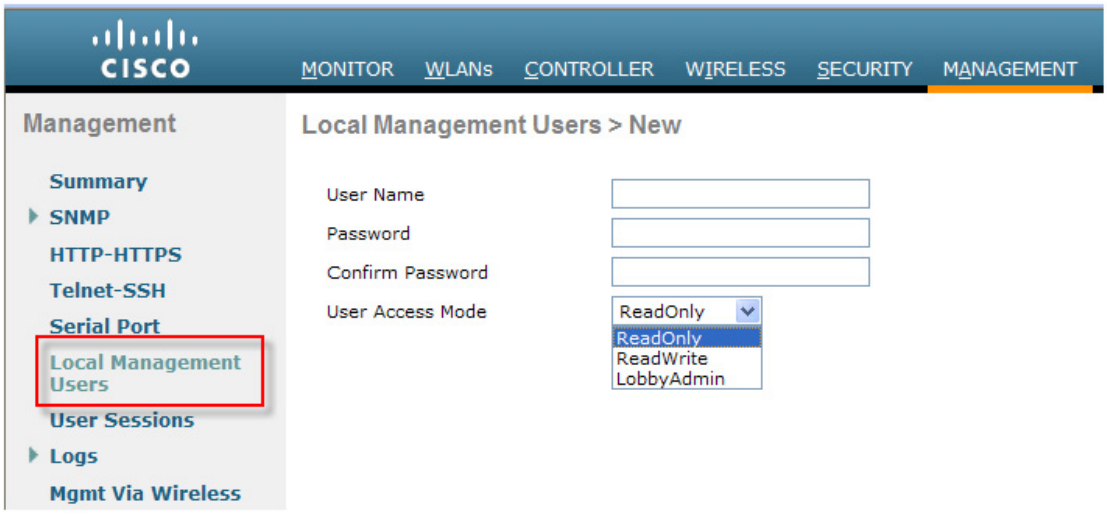
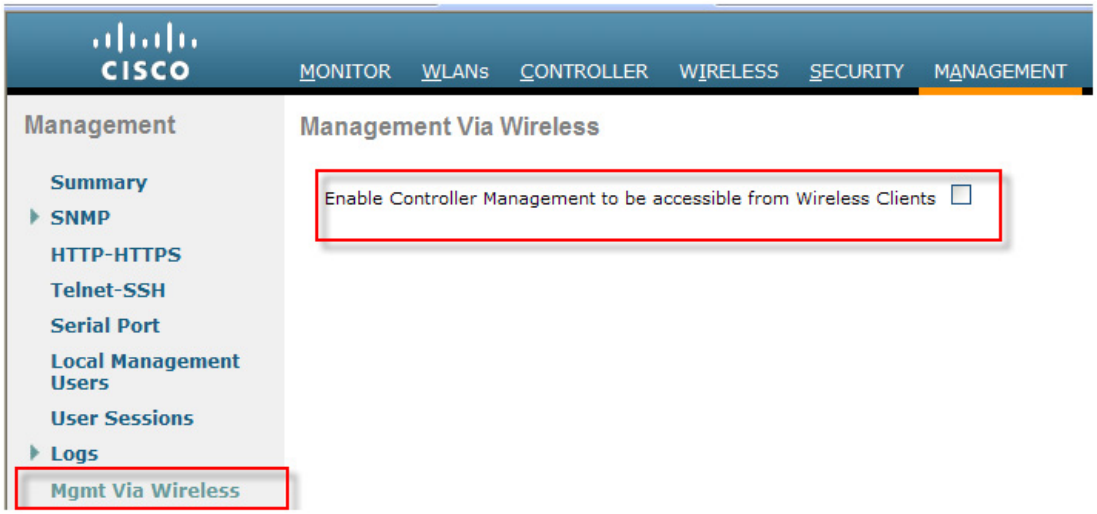
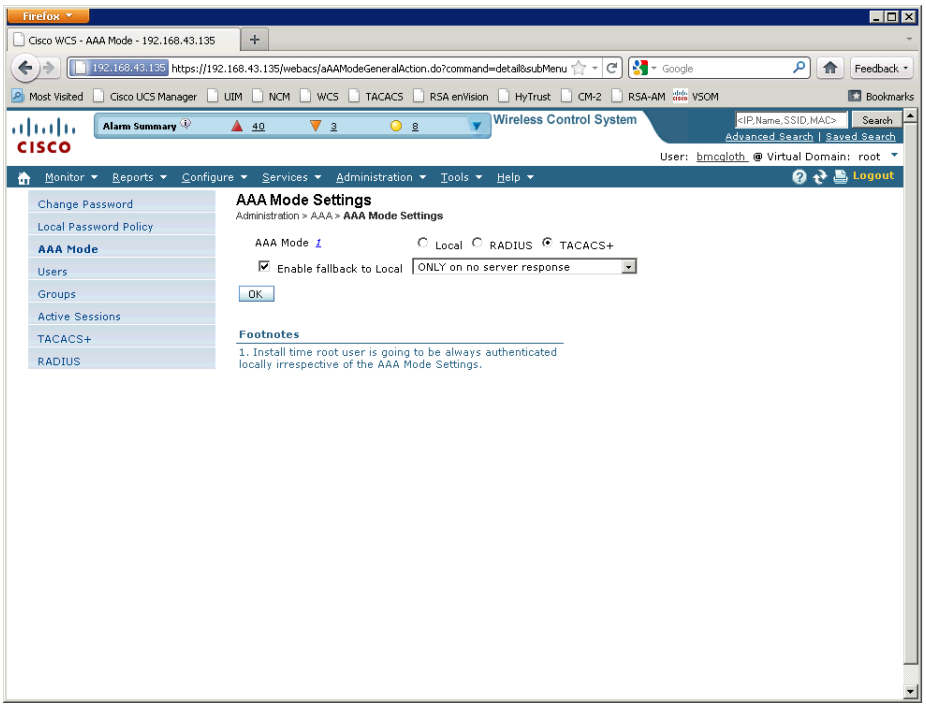


Figure 5-102 Management Via Wireless Screen



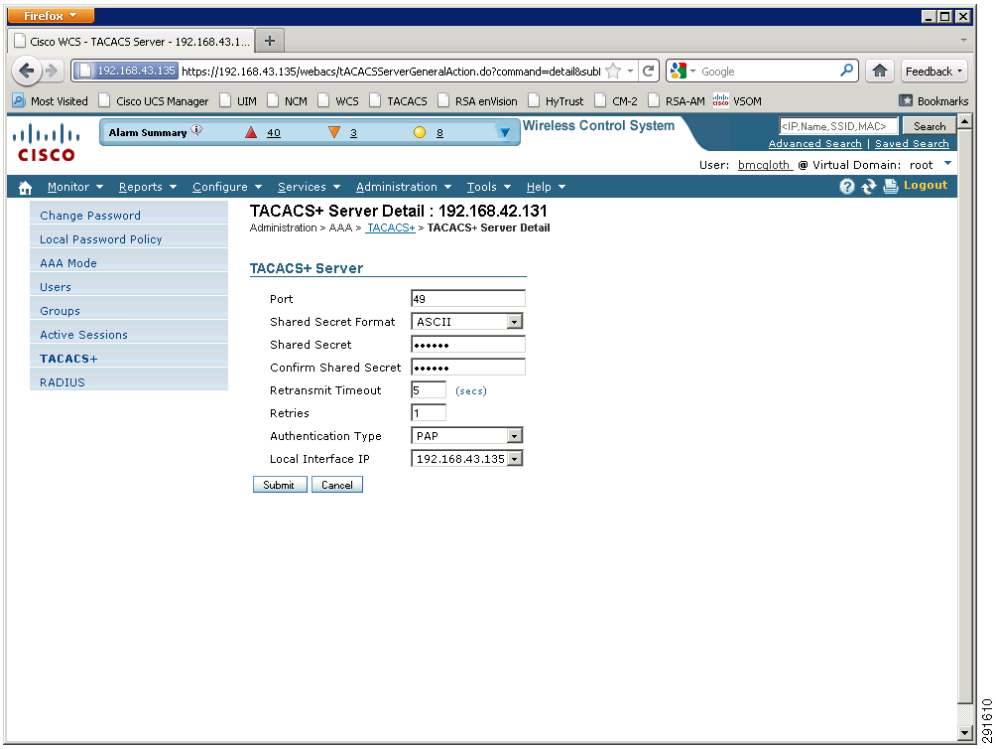
Cisco WCS is configured to use TACACS+ for authentication of administrators, as shown in Figure 5-103.

Figure 5-103 WCS Manager AAA Authentication Mode



The authentication servers for TACACS+ in WCS Manager are configured as shown in Figure 5-104.

Figure 5-104 WCS Manager TACACS+ Server Configuration

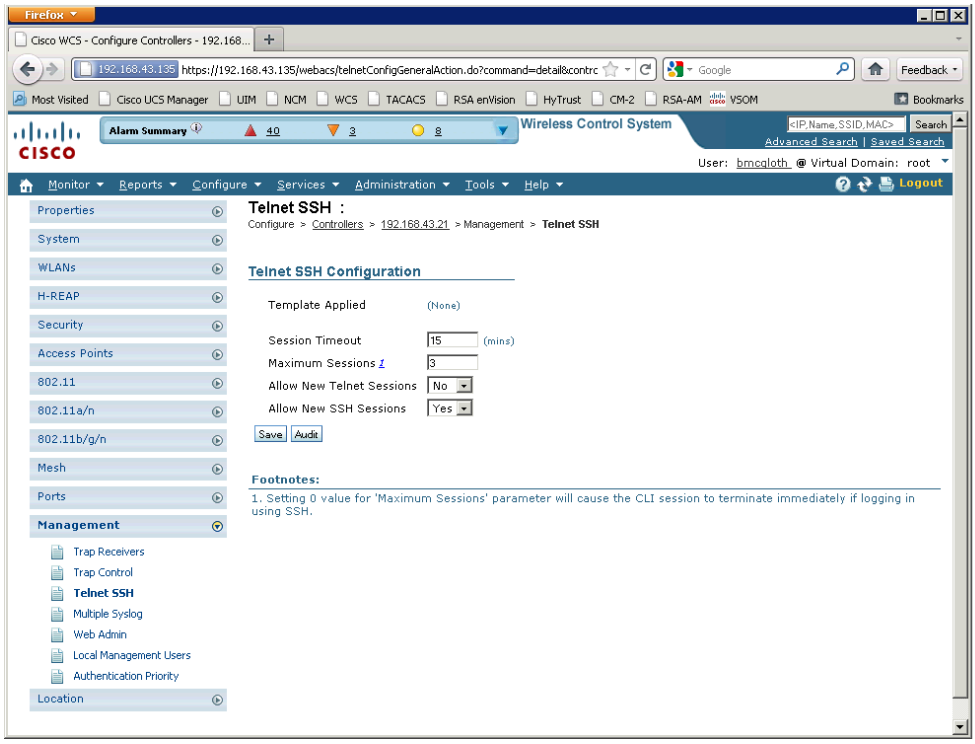


The citations in this section were addressed with the sample configuration at the end of this section.

Local individual user accounts are configured in the event that the centralized authentication server cannot be reached. These accounts must be manually updated to maintain compliance requirements regarding password rotation and expiration as specified in established policies for passwords. Local user accounts on Cisco WCS Manager and controllers require a password.

HIPAA Safeguard 164.312(a)(2)(ii) requires the enabling of Automatic logoff options. Cisco WCS supports session policies under the management tab. It is a best practice to change the session timeout to 15 minutes, as shown in Figure 5-105.

Figure 5-105 Controller Secure Management for SSH



The Cisco WLAN performs 24-hour scanning to immediately detect and contain unauthorized and rogue wireless devices addressing safeguard 164.308(a)(1)(i) Security Management. Threats to network security can occur in between regularly scheduled scans, creating the need to continuously scan and to use automatic alerts and containment mechanisms. Similarly, physical and/or port scanning on the wired network is not enough. Cisco Wireless LAN Controllers include wIPS and wIDS that find and stop rogue wireless devices and attacks. WCS is a single point of management for WLAN devices, the mobility services engine, and mobility services. Cisco context-aware location services in the Cisco 3300 Series Mobility Services Engine (MSE) can locate multiple rogue devices. Cisco enhanced local mode (ELM) access points offer monitor mode wIPS on local mode access points for additional protection without a separate overlay network. Cisco CleanAir technology allows the detection and location of rogue devices on nonstandard Wi-Fi channels. (See Figure 5-106 and Figure 5-107.)

Figure 5-106 Security—AP Policies Screen

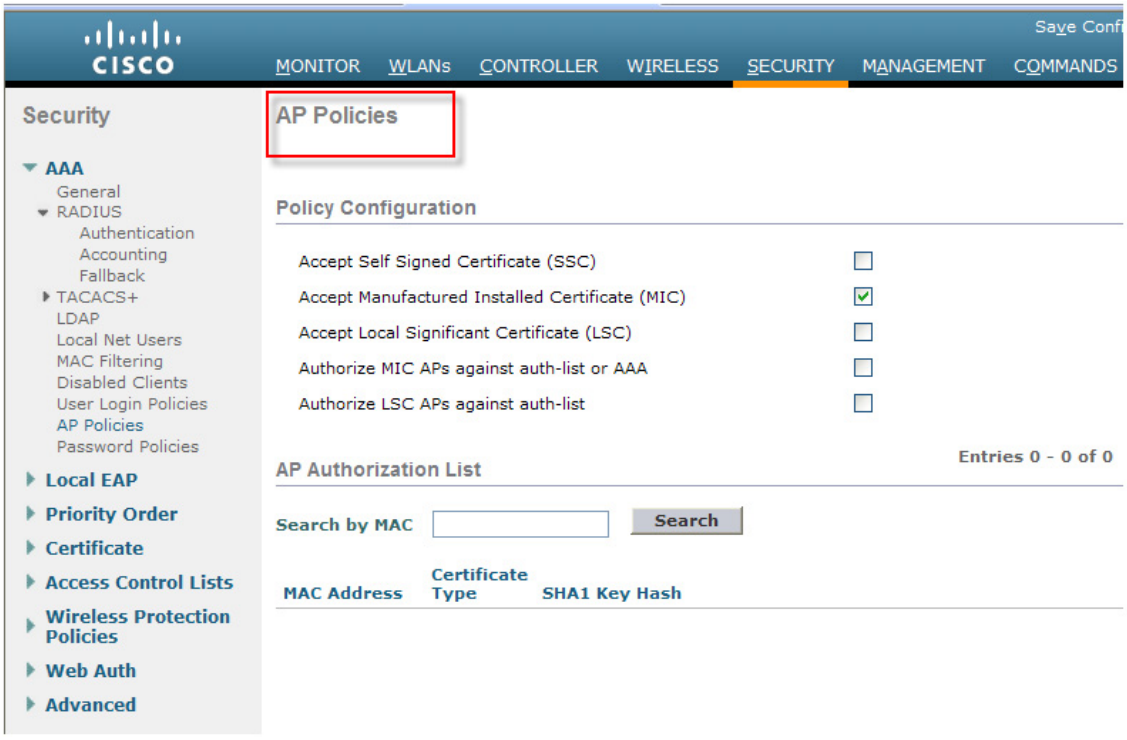
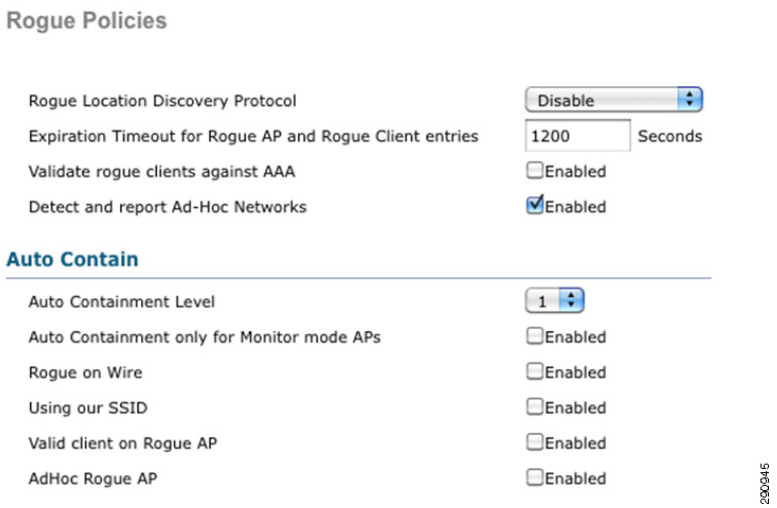
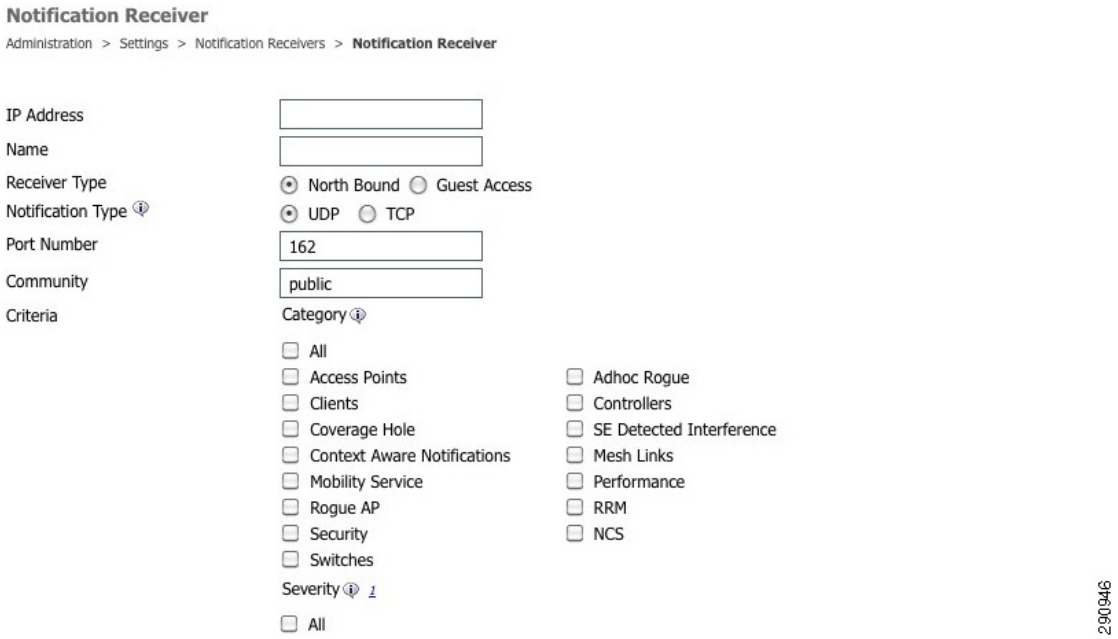


Figure 5-107 Rogue Policies Screen



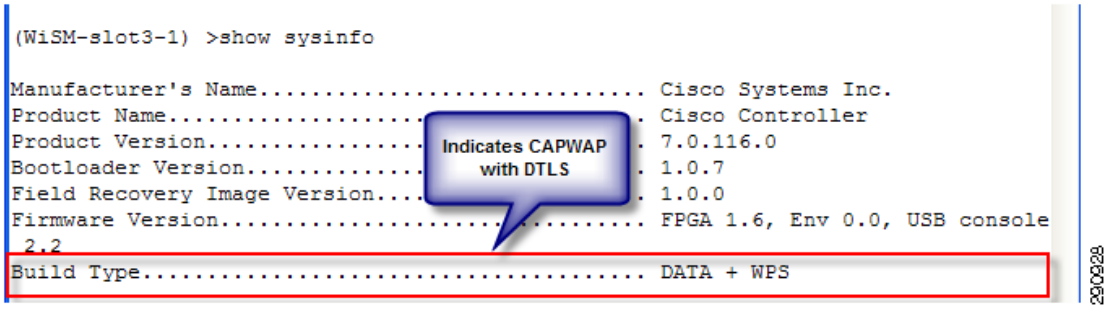
Cisco WCS has the ability to forward alerts to e-mail addresses. The system can forward all or selected alerts to multiple receivers. (See Figure 5-108.)

Figure 5-108 Notification Receiver Screen



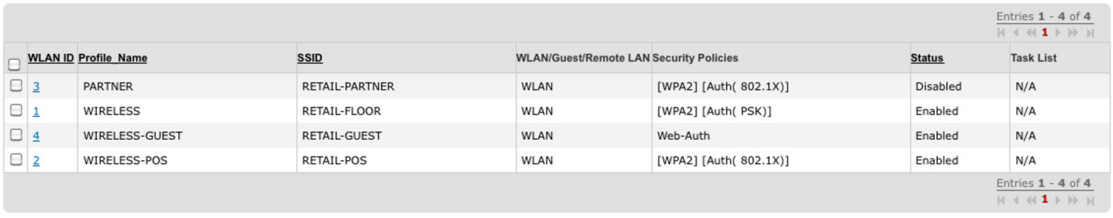
Cisco offers Control and Provisioning of Wireless Access Points (CAPWAP)-compliant DTLS encryption to provide full-line-rate encryption between access points and controllers across remote WAN/LAN links (see Figure 5-109). The Cisco Unified Wireless Network defaults to the highest CipherSuite available on the network. Furthermore, fallback on less secure SSL versions (that is, SSLv2 and SSLv1) can also be disabled, thus always forcing use of SSLv3. The Cisco Unified Wireless Network provides 256-bit encryption and provides automated vulnerability scanning in the WCS to identify WLANs using suboptimal encryption/authentication configurations.

Figure 5-109 CAPWAP with DTLS



Cisco supports both WPA and WPA2 and provides automated vulnerability scanning in the WCS to identify WLANs using suboptimal encryption. Cisco does not advertise the organization's name in the Service Set ID (SSID) broadcast. Cisco also disables SSID broadcast by default for non-guest networks. Cisco supports WPA2 Personal mode with a minimum 13-character random pass-phrase and Advanced Encryption Standard (AES) encryption, and provides automated vulnerability scanning in the WCS to identify WLANs using suboptimal encryption/authentication configurations. (See Figure 5-110.)

Figure 5-110 WLAN Information



Entries 1 - 4 of 4

	WLAN ID	Profile_Name	SSID	WLAN/Guest/Remote LAN	Security Policies	Status	Task List
☐	3	PARTNER	RETAIL-PARTNER	WLAN	[WPA2] [Auth(802.1X)]	Disabled	N/A
☐	1	WIRELESS	RETAIL-FLOOR	WLAN	[WPA2] [Auth(PSK)]	Enabled	N/A
☐	4	WIRELESS-GUEST	RETAIL-GUEST	WLAN	Web-Auth	Enabled	N/A
☐	2	WIRELESS-POS	RETAIL-POS	WLAN	[WPA2] [Auth(802.1X)]	Enabled	N/A

Entries 1 - 4 of 4

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The citations in this section were addressed with the sample configuration at the end of this section.

To address the Incident Response and Auditing HIPAA Safeguards identified above, the Cisco Unified Wireless system is designed to track and monitor all administrative user access and events. Cisco Unified Wireless tracks individual administrator actions through several mechanisms including AAA, logging, and system events.

Figure 5-111 shows the configuration of local logging settings, and Figure 5-112 shows the syslog server configuration used to send logs to RSA enVision.

Figure 5-111 Local Logging Configuration

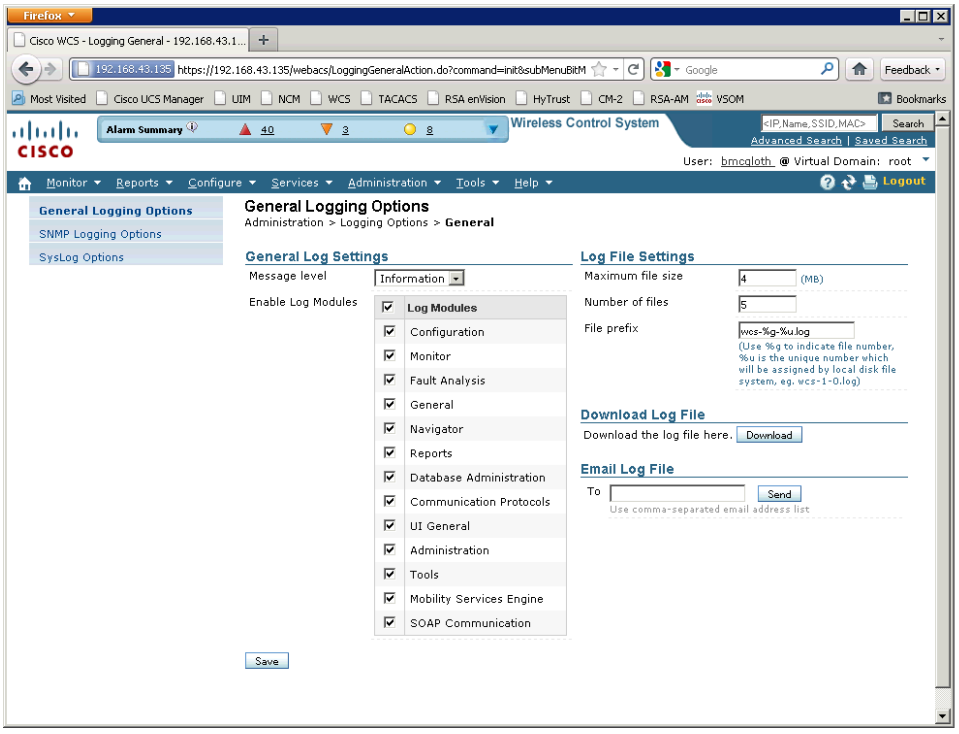

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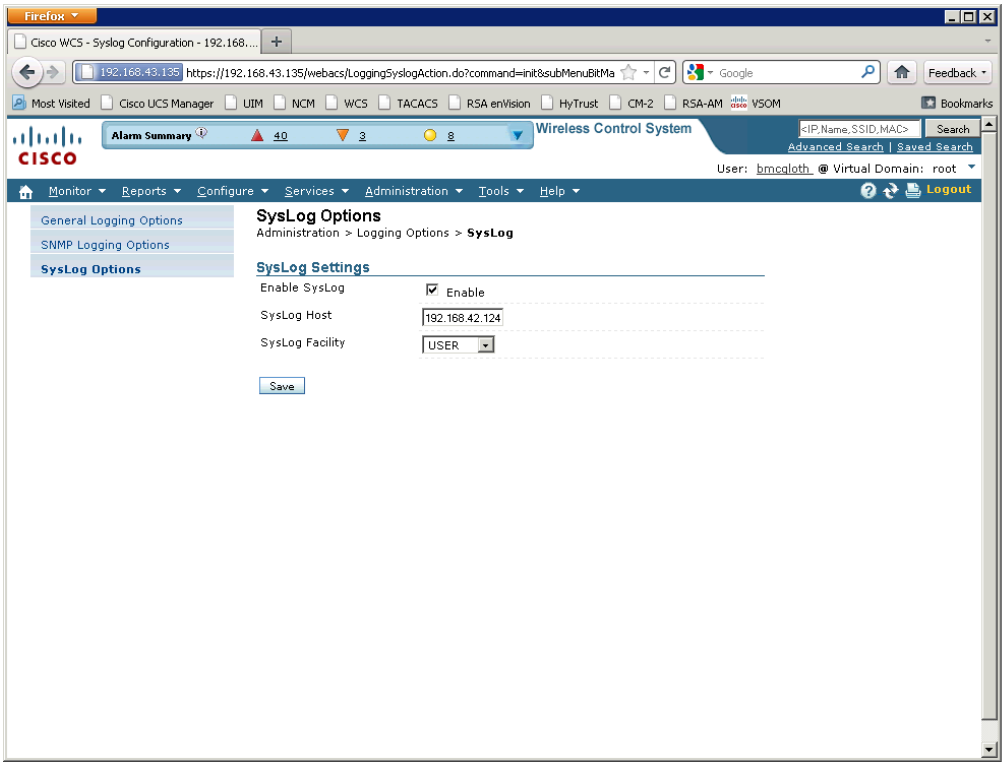
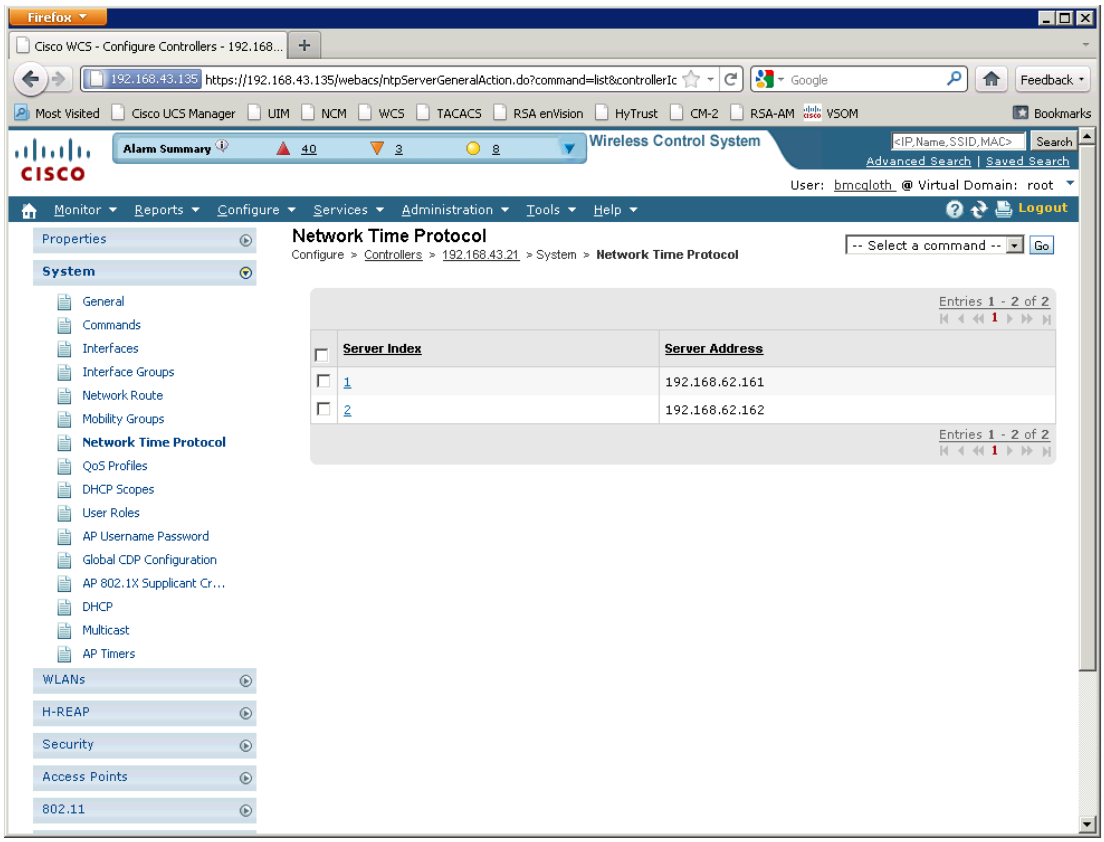
Figure 5-112 WCS Manager Syslog Configuration



As a best practice, NTP is used to synchronize clocks among network devices. This synchronization allows events to be correlated when system logs are created and when other time-specific events occur. All devices in the network used NTP to synchronize their clocks. The NTP servers were hosted at the data center site. The Cisco Lab uses two NTP servers that are synchronized to external reference sources. All systems and devices in the lab are pointed to these two servers.

A Network Time Protocol server can be configured within the Cisco WCS and Controllers to meet this requirement for all wireless devices, as shown in Figure 5-113.

Figure 5-113 NTP Servers Screen for Controllers



HIPAA Standards Failed

No HIPAA standards were failed.

HIPAA Implementation Specifications Failed

No HIPAA implementation specifications were failed.

Storage

Cisco MDS Storage Switches

Cisco MDS storage switches provide the central switching infrastructure connecting servers to storage. They provide the added capability to encrypt all information “on the fly” between these systems for specified targets; specifically, the EMC storage array and Cisco UCS servers in the solution.

The Cisco MDS 9000 Series Multilayer SAN Switches can help lower the total cost of ownership of the most demanding storage environments. By combining robust and flexible hardware architecture with multiple layers of network and storage management intelligence, the Cisco MDS 9000 Series helps you build highly available, scalable storage networks with advanced security and unified management.

Table 5-27 PHI HIPAA Assessment Summary—Cisco MDS Storage Switches

Models Assessed	
MDS 9506 (“Supervisor/Fabric-2”) version m9500-sf2ek9-mzg.5.0.1a.bin.S4 MDS 9506 (“Supervisor/Fabric-2”) version m9500-sf2ek9-mz.5.0.4.bin	
HIPAA Safeguards Addressed	
Administrative	**Standards/Implementation Specifications**
164.308	(a)(1)(i) Security Management Process
	(a)(4)(i) Access Authorization
	(a)(5)(i) Log-in Monitoring
	(a)(6)(i) Security Incident Procedures
Technical	**Standards/Implementation Specifications**
164.312	(a)(i) Access Control
	(a)(2)(iv) Encryption and Decryption
	(b) Audit Controls
	(c)(1) Data Integrity
HIPAA Standards Failed	
No HIPAA standards were failed.	
HIPAA Implementation Specifications Failed	
No HIPAA implementation specifications were failed.	

Primary PHI Function

The primary function of Cisco MDS storage switches is to securely encrypt ePHI data at rest as it passes from server to storage. This safeguard was met using the MDS configuration to implement encryption for ePHI data in storage to prevent unauthorized access and prevent unauthorized modification to the ePHI data. Logs can be used to monitor access attempts to ePHI data in storage.

Design Considerations

Cisco MDS 9000 Family security features such as VSANs, advanced zoning, fabric binding, port security, Fiber Channel Security Protocol (FC-SP) authentication, and role-based access control (RBAC) with SNMPv3 and SSH make the Cisco MDS 9000 Family an excellent platform for enforcing this requirement. SSH RBAC in particular, if used in conjunction with VSANs, is especially designed to support tight partitioning of the physical infrastructure.

The MDS 9500s were configured for zoning and LUN masking to secure the logical partitioning of disk used for storing ePHI data. Only host machines in the data center that require access to that logical disk partition were allowed access. Configuration of the VSANs, host UUIDs, and mappings was partially performed using EMC Unified Infrastructure Manager as directed by the Vblock architecture by VCE. Vblock requires specific software versions and pre-configurations to be completed as specified in the Vblock preparation guide.

More information of Vblock designs can be found at the following URL:
http://www.vceportal.com/solutions/68580567.html#

Information in installing and configuring Cisco MDS can be found at the following URL:
http://www.cisco.com/en/US/products/hw/ps4159/ps4358/tsd_products_support_series_home.html

HIPAA Assessment Detail—HIPAA Safeguards Passed

All of the sample configurations of the Cisco MDS storage switches shown below were used to meet the following list of satisfied controls:

- Access Control—Restrict access to ePHI data as required by HIPAA Administrative and Technical safeguards
  - §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.308(a)(4)(ii)(B) Access authorization. Implement policies and procedures for granting access to electronic protected health information, for example, through access to a workstation, transaction, program, process, or other mechanism. Requirements addressed include: Access Control and Auditing.
  - §164.312(a)(1) Access Control. Implement technical policies and procedures for electronic information systems that maintain ePHI to allow access only to those persons or software programs that have been granted access rights as specified in §164.308(a)(4).
- Incident response—Implement security incident response as required by HIPAA Administrative safeguards.
  - §164.308(a)(6)(ii) Response and Reporting. Identify and respond to suspected or known security incidents; mitigate, to the extent practicable, harmful effects of security incidents that are known to the covered entity or business associate; and document security incidents and their outcomes. Requirements addressed include: Incident Response and Auditing.
- Auditing—Implement mechanisms to record and examine activity in systems that contain or use ePHI as required by HIPAA Technical safeguards.
  - §164.308(a)(5)(ii)(C) Log-in Monitoring. Procedures for monitoring log-in attempts and reporting discrepancies. Requirements addressed include: Access Control and Auditing.
  - §164.312(b) Audit controls. Implement hardware, software, and/or procedural mechanisms that record and examine activity in information systems that contain or use electronic protected health information. Requirements addressed include: Auditing.
- Integrity—Protect electronic protected health information from improper alteration or destruction as required by HIPAA Technical safeguards.
  - §164.312(c)(1) Data Integrity. Implement policies and procedures to protect health information from improper alteration or destruction.

Sample Configuration

Cisco MDS storage switches are designed to track and monitor all administrative user access and events, thereby addressing all of the safeguards listed under Access Control above. User access throughout the solution uses a centralized user database in the Active Directory, which is linked through authentication servers via LDAP, RADIUS, and TACACS+ services, enabling verification of users and administrators of devices and endpoints. These services are located in the data center. Individual user IDs are assigned, and roles are based on group membership.

The following configurations demonstrate how to configure the Cisco MDS for TACACS+ authentication to a central server.

```
Feature tacacs+

tacacs-server key 7 "<removed>"
tacacs-server host 192.168.42.131
aaa group server tacacs+ CiscoACS
```

```
    server 192.168.42.131

aaa authentication login default group CiscoACS
aaa authentication login console group CiscoACS
aaa authorization ssh-certificate default group CiscoACS
aaa accounting default group CiscoACS
aaa authentication login error-enable
```

Note To configure LDAP authentication in NX-OS version 5.0 or higher, enable LDAP (**feature ldap**) and follow configuration steps in the *Cisco MDS 9000 Family NX-OS Security Configuration Guide.*

Assignment of privileges to individuals based on job classification and function is accomplished with the following configuration:

```
Feature privilege
        change admin user ID:
        username admin password <password> role network-admin (password will be
encrypted when displayed)
        create network operator type user ID:
        username <assigned name> password <password> role network-operator (password
will be encrypted when displayed)
        create default user ID:
        role name default-role
            description This is a system defined role and applies to all users.
            rule 5 permit show feature environment
            rule 4 permit show feature hardware
            rule 3 permit show feature module
            rule 2 permit show feature snmp
            rule 1 permit show feature system
        username <assigned name> password <password> role default-role (password will
be encrypted when displayed)
        create custom user ID:
        role name <name>
            description User defined permissions define here:
            rule 1 permit show interface
            .
            .
            Rune 256 permit show module
        username <assigned name> password <password> role <name> (password will be
encrypted when displayed)
```

Local individual user accounts are configured in the event that the centralized authentication server cannot be reached. These accounts must be manually updated to maintain compliance requirements regarding password rotation and expiration as specified in established policies for passwords.

```
username bmcgloth password 5 <removed>   role network-admin
username bart password 5 <removed>   role network-admin
```

HIPAA Safeguard 164.312(a)(2)(ii) requires the enabling of automatic logoff options. Cisco MDS supports session timeout configuration in the CLI. It is a best practice to set the session timeout to 15 minutes, as shown below.

```
line vty
  exec-timeout 15
line console
  exec-timeout 15
```

To secure authentication information and management of the Cisco MDS Switch, addressing Safeguard 164.308(a)(1)(i) Security Management, the management intercedes are configured to support only encrypted access using the following configurations:

```
Configure terminal
feature ssh
ssh key dsa or ssh key rsa <768-2048>
no feature telnet
no feature http-server
```

And access to the management interface is restricted with an access list.

Secure access to the management port as follows:

```
ip access-list 23 permit ip 127.0.0.1 0.0.0.0 <mgmt port ip address> 0.0.0.0
ip access-list 23 permit ip <ip address of mgmt workstation> 0.0.0.0 <mgmt port ip
address> 0.0.0.0
ip access-list 23 permit ip <ip address of snmp workstation> 0.0.0.0 <mgmt port ip
address> 0.0.0.0
ip access-list 23 permit ip <ip address of AAA server> 0.0.0.0 <mgmt port ip address>
0.0.0.0
ip access-list 23 permit ip <ip address of NTP workstation> 0.0.0.0 <mgmt port ip
address> 0.0.0.0
ip access-list 23 deny ip any any log-deny
interface mgmt0
ip address <ip address> <mask>
ip access-group 23 in
```

To address the Incident Response and Auditing HIPAA safeguards identified above, the Cisco MDS 9000 Family implements the Cisco Data Center Network Manager (DCNM), which continuously monitors the SAN and allows you to establish criteria and thresholds to generate real-time alarms and call-home functions. Syslog and SNMP traps offers detailed entries and can be redirected to the RSA enVision log server to consolidate IT infrastructure monitoring information. Note that the log never contains application data. Cisco MDS is designed to track and monitor all administrative user access and events.

Logs stored locally are buffered and require operator level privileges to be viewed. External logging and SNMP traps are enabled by implementing the following configuration statements:

```
logging server 192.168.42.124 6
snmp-server host 192.168.41.101 traps version 2c public  udp-port 2162
snmp-server host 192.168.42.121 traps version 3 auth public
```

A central logging repository, RSA enVision, collects syslog and SNMP information from all devices to ensure the integrity and correlation of events.

As a best practice, NTP is used to synchronize clocks among network devices. This synchronization allows events to be correlated when system logs are created and when other time-specific events occur. All devices in the network used NTP to synchronize their clocks. The NTP servers were hosted at the data center site. The Cisco Lab uses two NTP servers that are synchronized to external reference sources. All systems and devices in the lab are pointed to these two servers. Cisco MDS use NTP to meet these requirements by implementing the following configuration statements:

```
clock timezone PST -8 0
clock summer-time PST 1 Sun April 02:00 5 Sun Oct 02:00 60
ntp server 192.168.62.161
ntp server 192.168.62.162
```

Clock synchronization is a requirement for common industry security frameworks such as the HiTrust Common Security Framework (CSF), ISO 27002, and NIST Security Publications, as well as other industry-based standards.

HIPAA Standards Failed

No HIPAA standards were failed.

HIPAA Implementation Specifications Failed

No HIPAA implementation specifications were failed.

Security

Cisco ASA Firewalls

The Cisco Adaptive Security Appliance (ASA) is designed to provide secure segmentation within a network. The stateful firewall and modular intrusion detection modules enable the healthcare entity to securely connect public networks to the PHI environment. The ASA also enables secure connectivity from remote locations via encrypted tunnels using its VPN technology.

The Cisco ASA delivers superior scalability, a broad span of technology and solutions, and effective, always-on security designed to meet the needs of a wide array of deployments. By integrating the world's most proven firewall; a comprehensive, highly effective intrusion prevention system (IPS) with Cisco Global Correlation and guaranteed coverage; high-performance VPN and always-on remote access, the Cisco ASA helps organizations provide secure, high performance connectivity and protects critical assets for maximum productivity.

The Cisco ASA 5500 Series includes the Cisco ASA 5505, 5510, 5512-X, 5515-X, 5520, 5525-X, 5540, 5545-X, 5550, 5555-X, 5580, and 5585-X Adaptive Security Appliances-purpose-built, high-performance security solutions that take advantage of Cisco expertise in developing industry-leading, award-winning security and VPN solutions. Through Cisco Multi-Processor Forwarding (MPF), the Cisco ASA 5500 Series brings a new level of security and policy control to applications and networks. MPF enables highly customizable, flow-specific security policies that have been tailored to application requirements. The performance and extensibility of the Cisco ASA 5500 Series is enhanced through user-installable security service modules (SSMs) and virtual modules. This adaptable architecture enables businesses to rapidly deploy security services when and where they are needed, such as tailoring inspection techniques to specific application and user needs or adding additional intrusion prevention and content security services such as those delivered by the Adaptive Inspection and Prevention (AIP) and Content Security and Control (CSC) SSMs. Furthermore, the modular hardware architecture of the Cisco ASA 5500 Series, along with the powerful MPF, provides the flexibility to meet future network and security requirements, extending the investment protection provided by the Cisco ASA 5500 Series and allowing businesses to adapt their network defenses to new threats as they arise.

The Cisco ASA Services Module (ASASM) is an integrated module installed inside a Cisco Catalyst 6500 Series Switch or Cisco 7600 Internet Router. The Cisco ASASM allows any port on the Cisco Catalyst switch to operate as a firewall port and integrates firewall security inside the network infrastructure.

All Cisco ASA offer both IPsec and SSL/DTLS VPN solutions; Clientless and AnyConnect VPN features are licensed at various price points, on a per-seat and per-feature basis. By converging SSL and IPsec VPN services with comprehensive threat defense technologies, the Cisco ASA provides highly customizable, granular network access tailored to meet the requirements of diverse deployment environments, while providing advanced endpoint and network-level security.

Table 5-28 PHI HIPAA Assessment Summary—Cisco ASA

Models Assessed	
Cisco ASA5515-X w/vIPS Module version asa900-129-smp-k8.bin and IDS version 7.1(6)	
Cisco ASA5555-X w/vIPS module version asa900-129-smp-k8.bin and IPS version 7.1(6)E4	
Cisco ASA5585-S60-2A-K9 asa901-smp-k8.bin	
Cisco ASA Service Module WS-SVC-ASA-SM1 version asa851-smp-k8.bin	
HIPAA Safeguards Addressed	
Administrative	**Standards/Implementation Specifications**
164.308	(a)(1)(i) Security Management Process
	(a)(1)(ii)(D) Information System Activity Review
	(a)(3)(ii)(A) Authorization/Supervision
	(a)(4)(ii)(A) Isolating Healthcare Clearinghouse Function
	(a)(4)(ii)(B) Access Authorization
	(a)(4)(ii)(C) Access Est./Modification
	(a)(5)(ii)(C) Log-in Monitoring
	(a)(6)(ii) Response and Reporting
Technical	**Standards/Implementation Specifications**
164.312	(a)(1) Access Control
	(a)(2)(i) Unique User Identification
	(a)(2)(ii) Emergency Access procedures
	(a)(2)(ii) Automatic Logoff
	(a)(ii)(iv) Encryption and Decryption
	(b) Audit Controls
	(c)(1) Data Integrity
	(d) Person or Entity Authentication
	(e)(1) Transmission Security
	(e)(2)(i) Integrity Controls
	(e)(2)(ii) Encryption
HIPAA Standards Failed	
No HIPAA standards were failed.	
HIPAA Implementation Specifications Failed	
No HIPAA implementation specifications were failed.	

Primary PHI Function

The primary function of the Cisco ASA firewall in a healthcare network environment is to securely segment PHI data environments to prevent unauthorized access from public and business associate networks at clinics, hospitals, clearinghouses and to provide intrusion detection capabilities. Additionally, the firewall can provide the isolation necessary for organizations with clearing house functions to protect against unauthorized access to the clearing house from the larger organization.

Design Considerations

- Select the appropriate Cisco ASA model/SSM module for the traffic needs in the healthcare entity.
- Configure security policies, objects, and rules centrally with Cisco Security Manager to support segmentation of the LAN from Internet exposure, implement restrictions based on identity and authorization to access ePHI, and set up logging and monitoring alerts for central capture and auditing.
- Firewall rule sets must adhere to a "least amount of access necessary" policy. Rules must be defined by specific source/destination addressing and TCP/UDP ports.
- Allow only SSHv2 (and not Telnet or SSHv1) connection from network management station to Cisco ASA.
- Configure appropriate banner messages on login, incoming, and exec modes of the Cisco ASA. The login banner warning should not reveal the identity of the company that owns or manages the Cisco ASA. The incoming and executive banners should state that these areas are considered private and that unauthorized access will result in prosecution to the full extent of the law.
- Configure the primary login authentication of the Cisco ASA to be directed to the Cisco Secure ACS. Individual user account profiles need to be created. Configure secondary or tertiary authentication local to the Cisco ASA itself in the event of connectivity or Cisco Secure ACS failure.
- Change default passwords and community strings to appropriate complexity.
- Configure the **ip verify reverse path** command on all interfaces to provide anti-spoofing functionality.
- Configure the console timeout commands to 15 minutes or less on the console of the Cisco ASA.
- For Internet edge, disable **icmp permit** on the outside interface of Cisco ASA. If users need to access servers in the DMZ segment, make sure that external users can reach the servers using very specific protocol and ports.

HIPAA Assessment Detail—HIPAA Safeguards Addressed

HIPAA safeguards are spread across multiple categories. The ASA firewall helps healthcare-covered entities and business associates meet access control safeguards in the Administrative and Technical categories. The access control can be applied to both internal and external users that access ePHI data. Additionally, controls to protect the administrator accounts on the firewall have been implemented to protect the firewall from unauthorized modification if the authentication server fails. These local accounts represent only a subset of select individuals that would need access in the event central authentications services are unavailable.

All of the sample configurations of the ASA shown below were used to meet the following list of satisfied controls:

- Access Control—Restrict access to ePHI data as required by HIPAA Administrative and Technical safeguards
  - 164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - 164.308(a)(4)(ii)(A) Isolating healthcare clearinghouse function. If a health care clearinghouse is part of a larger organization, the clearinghouse must implement policies and procedures that protect the electronic protected health information of the clearinghouse from unauthorized access by the larger organization. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.

  - 164.308(a)(4)(ii)(B) Access authorization. Implement policies and procedures for granting access to electronic protected health information, for example, through access to a workstation, transaction, program, process, or other mechanism. Requirements addressed include: Access Control and Auditing.
  - 164.308(a)(4)(ii)(C) Access Establishment and Modification. Implement policies and procedures that, based upon the covered entity's or the business associate's access authorization policies, establish, document, review, and modify a user's right of access to a workstation, transaction, program, or process. Requirements addressed include: Access Control, Incident Response, and Auditing.
  - 164.312(a)(1) Access Control. Implement technical policies and procedures for electronic information systems that maintain ePHI to allow access only to those persons or software programs that have been granted access rights as specified in 164.308(a)(4).
  - 164.312(d) Person or entity authentication. Implement procedures to verify that a person or entity seeking access to electronic protected health information is the one claimed. Requirements addressed include: Access Control and Auditing.
  - 164.308(a)(5)(ii)(D) Password Management. Procedures for creating, changing, and safeguarding passwords. Requirements addressed include: Access Control and Auditing.
- Integrity—Protect electronic protected health information from improper alteration or destruction as required by HIPAA Technical safeguards.
  - 164.312(c)(1) Data Integrity. Implement policies and procedures to protect health information from improper alteration or destruction.
  - 164.308(a)(4)(ii)(C) Access Establishment and Modification. Implement policies and procedures that, based upon the covered entity's or the business associate's access authorization policies, establish, document, review, and modify a user's right of access to a workstation, transaction, program, or process. Requirements addressed include: Access Control, Incident Response, and Auditing.
  - 164.308(a)(5)(ii)(C) Log-in Monitoring. Procedures for monitoring log-in attempts and reporting discrepancies. Requirements addressed include: Access Control and Auditing.
  - 164.312(a)(2)(ii) Emergency Access Procedure. Establish (and implement as needed) procedures for obtaining necessary ePHI during an emergency.
  - 164.312(e)(1) Transmission Security. Implement technical security measures to guard against unauthorized access to ePHI that is being transmitted over an electronic communications network. Requirements addressed include: Encryption and Integrity.
  - 164.308(e)(2)(i) Integrity Controls. Implement security measures to ensure that ePHI is not improperly modified without detection until disposed of. Requirements addressed include: Integrity.
  - 164.308(e)(2)(ii) Encryption. Implement a mechanism to encrypt ePHI whenever deemed appropriate. Requirements addressed include: Encryption.
- Incident response—Implement security incident response as required by HIPAA Administrative safeguards.
  - 164.308(a)(6)(ii) Response and Reporting. Identify and respond to suspected or known security incidents; mitigate, to the extent practicable, harmful effects of security incidents that are known to the covered entity or business associate; and document security incidents and their outcomes. Requirements addressed include: Incident Response and Auditing.
  - 164.312(a)(2)(i) Unique User Identification. Assign a unique name and/or number for identifying and tracking user identity. Requirements addressed include: Access Control and Auditing.

  - 164.312(a)(2)(ii) Automatic logoff. Implement electronic procedures that terminate an electronic session after a predetermined time of inactivity. Requirements addressed include: Access Control and Auditing.

- Encryption—Implement mechanisms to encrypt and decrypt ePHI.
  - 164.312(a)(ii)(iv) Encryption and Decryption. Implement a mechanism to encrypt and decrypt electronic protected health information. Requirements addressed include: Encryption and Integrity.
- Auditing—Implement mechanisms to record and examine activity in systems that contain or use ePHI as required by HIPAA Technical safeguards.
  - 164.312(b) Audit controls. Implement hardware, software, and/or procedural mechanisms that record and examine activity in information systems that contain or use electronic protected health information. Requirements addressed include: Auditing.
  - 164.308(a)(5)(ii)(C) Log-in Monitoring. Procedures for monitoring log-in attempts and reporting discrepancies. Requirements addressed include: Access Control and Auditing.
  - 164.312(d) Person or entity authentication. Implement procedures to verify that a person or entity seeking access to electronic protected health information is the one claimed. Requirements addressed include: Access Control and Auditing.

Sample Configuration

Cisco ASA firewalls are designed to track and monitor all administrative user access and events, thereby addressing all of the safeguards listed under Access Control above. User access throughout the solution uses a centralized user database in the Active Directory, which is linked through authentication servers via LDAP, RADIUS, and TACACS+ services, enabling verification of users and administrators of devices and endpoints. These services are located in the data center. Individual user IDs are assigned, and roles are based on group membership.

Cisco ASA firewalls are configured to use a AAA model for user-based access. Users can be assigned to groups and based on privilege levels, have access to only the information they require for their job function. By default in Cisco ASA firewalls, no users are allowed access unless specifically configured and assigned appropriate passwords. The following configuration statements create an authentication group called *Oncology*, which is assigned to various interfaces. This group uses the TACACS+ protocol to communicate with the Cisco ACS server where individual user groups and roles are configured, limiting and logging access as appropriate.

```
aaa-server CiscoACS protocol tacacs+
aaa-server CiscoACS (inside) host 192.168.42.131
 key *****
user-identity default-domain LOCAL

aaa accounting ssh console CiscoACS
aaa accounting enable console CiscoACS
aaa accounting command privilege 15 CiscoACS
aaa authentication secure-http-client
aaa local authentication attempts max-fail 6
aaa authorization exec authentication-server
```

Local individual user accounts are configured in the event that the centralized authentication server cannot be reached. These accounts must be manually updated to maintain compliance requirements regarding password rotation and expiration as specified in established policies for passwords.

```
username csmadmin password <removed> encrypted privilege 15
username janoff password <removed> encrypted privilege 15
username bart password <removed> encrypted privilege 15
```

It is a best practice that these local accounts represent only a subset of key network or security device administrators that would need administrative access in the event central authentications services are unavailable. This should not be the complete list of users that require access to ePHI.

These AAA authentication groups are assigned to the administrative interfaces where users connect.

```
aaa authentication ssh console CiscoACS LOCAL
aaa authentication enable console CiscoACS LOCAL
aaa authentication http console CiscoACS LOCAL
```

Cisco ASA firewalls are configurable to restrict traffic through the use of object and service-based access lists, thereby addressing Safeguard 164.308(a)(4)(ii)(A), which requires isolating healthcare information. By default, the firewall does not forward any traffic unless explicitly permitted.

The following configuration example shows how objects identify hosts and services within the network and their use in an access list to permit approved traffic:

```
!
interface outside
nameif north
bridge-group 1
security-level 0
!
interface inside
nameif south
bridge-group 1
security-level 100
!
! ----Defining Objects and Object Groups----
!
object-group network EMC-NCM
description EMC Network Configuration Manager
network-object 192.168.42.122 255.255.255.255
object-group network CSManager
description Cisco Security Manager
network-object 192.168.42.133 255.255.255.255
object-group network RSA-enVision
description RSA EnVision Syslog collector and SIM
network-object 192.168.42.124 255.255.255.255
object-group network AdminStation3
network-object 192.168.42.138 255.255.255.255
object-group network Admin-Systems
group-object EMC-NCM
group-object AdminStation
group-object AdminStation2
group-object CSManager
group-object RSA-enVision
group-object AdminStation3
group-object AdminStation4-bart
!
object-group service CSM_INLINE_svc_rule_77309411635
description Generated by CS-Manager from service of FirewallRule# 3
(ASA-DC-1-vdc1_v1/mandatory)
service-object tcp destination eq ssh
service-object tcp destination eq https
group-object HTTPS-8443
!
object-group network CSM_INLINE_dst_rule_77309411635
description Generated by CS-Manager from dst of FirewallRule# 3
(ASA-DC-1-vdc1_v1/mandatory)
group-object DC-ALL
group-object Stores-ALL
group-object DC-DMZ
!
```

```
! ----One line of the larger access-list permitting traffic----
!
access-list CSM_FW_ACL_south extended permit object-group
CSM_INLINE_svc_rule_77309411635 object-group Admin-Systems object-group
CSM_INLINE_dst_rule_77309411635
!
! ----Applying the access-list to an interface----
!
access-group CSM_FW_ACL_south in interface south
```

Administration access to the firewall is further restricted through the use of network permit statements applied to the web and terminal interfaces. Isolating administrative access to this device enforces the perimeter of the ePHI scope of the infrastructure.

The following configuration shows the authorized management hosts for SSH and HTTPS administration, and none for Telnet.

```
http server enable
http 192.168.41.101 255.255.255.255 south
http 192.168.41.102 255.255.255.255 south
http 192.168.42.122 255.255.255.255 south
http 192.168.42.124 255.255.255.255 south
http 192.168.42.133 255.255.255.255 south
http 192.168.42.138 255.255.255.255 south
telnet timeout 5
ssh 192.168.41.101 255.255.255.255 south
ssh 192.168.41.102 255.255.255.255 south
ssh 192.168.42.122 255.255.255.255 south
ssh 192.168.42.124 255.255.255.255 south
ssh 192.168.42.133 255.255.255.255 south
ssh 192.168.42.138 255.255.255.255 south
```

It is a recommended practice to enable only management interface protocols that use strong encryption, to best protect the ePHI information and the identities and passwords of those who must have access. Cisco ASA firewalls support strong encryption for SSH and HTTPS. The following configurations are used to configure strong cryptography:

```
! ---Specify only Strong algorithms for SSL connections---
ssl encryption 3des-sha1 aes128-sha1 aes256-sha1
!
! ---Specify strong encryption version of SSH---
ssh version 2
!
```

SNMP versions 1 and 2(c) transmit data between the SNMP server and the SNMP agent in the clear. This makes your infrastructure and corresponding infrastructure devices vulnerable to attack and/or misuse. SNMP v3 adds authentication and privacy options to secure its communication between SNMP servers and SNMP agents.

Cisco ASA firewalls allow secure administration using SNMP version 3 with encryption and authentication using the priv security model.

SNMP groups provide an access control policy to which users are added. The user inherits the security model of the group.

SNMP users are assigned a username, a group to which they belong, authentication password, encryption password, and associated algorithms to use. Authentication algorithms are MD5 and SHA. Encryption algorithms are DES, 3DES, and AES (128,192,256).

```
snmp-server enable
snmp-server group V3Group v3 priv
snmp-server user ciscolms V3Group v3 auth sha <AUTHENTICATION-PASSWORD> priv aes 256
<ENCRYPTION-KEY>
```

```
snmp-server user csmadmin V3Group v3 auth sha <AUTHENTICATION-PASSWORD> priv aes 256
<ENCRYPTION-KEY>
```

VPNs enable secure communication between locations by encrypting and decrypting traffic addressing Safeguard 164.312(a)(ii)(iv).

The following configurations show the setup of the additional AAA RADIUS server and authentication group for SSL VPN access from external sources.

```
aaa-server partnerauth protocol radius
aaa-server partnerauth (inside) host 192.168.42.137
timeout 5
key *****
radius-common-pw *****
webvpn
enable outside
internal-password enable
smart-tunnel list AllExternalApplications All-Applications * platform windows
group-policy DfltGrpPolicy attributes
webvpn
url-list value page1
smart-tunnel enable AllExternalApplications
group-policy HEALTH-HIPAA internal
group-policy HEALTH-HIPAA attributes
vpn-tunnel-protocol ssl-clientless
!
tunnel-group DefaultRAGroup general-attributes
authentication-server-group partnerauth
tunnel-group DefaultWEBVPNGroup general-attributes
authentication-server-group partnerauth
tunnel-group ComplianceLab type remote-access
tunnel-group ComplianceLab general-attributes
authentication-server-group partnerauth LOCAL
default-group-policy HEALTH-HIPAA
```

Cisco ASA firewalls track individual administrator actions, which address all of the HIPAA Auditing safeguards summarized above, through several mechanisms including AAA, logging, and system events by implementing the following configuration statements:

```
logging enable
logging timestamp
logging trap informational
logging asdm informational
logging host south 192.168.42.124
```

An SNMP host is the server to which SNMP notifications and traps are sent. SNMP v3 hosts require the SNMP server IP address and SNMP username. Each SNMP host can have only one username associated with it. The user credentials on the NMS (CiscoPrime, EMC NCM, and so on) must match the SNMP username credentials.

```
snmp-server host south 192.168.42.134 version 3 ciscolms
snmp-server host south 192.168.42.139 version 3 ciscolms
snmp-server host south 192.168.42.133 version 3 csmadmin
```

Enable the SNMP traps (this will change depending on environment and business requirements). The following example enables all, but this could be limited to a subset of traps.

```
snmp-server enable traps all
snmp-server location Building SJC-17-1 Aisle 1 Rack 3
snmp-server contact EmployeeA
```

In addition to being able to set timeout limits for remote access VPNs, Safeguard 164.312(a)(2)(ii) Automatic Logoff, requires that the administrative sessions to the Cisco ASA firewalls be limited with the following configurations:

```
http server idle-timeout 15
ssh timeout 15
console timeout 15
```

As a best practice, NTP is used to synchronize clocks among network devices. This synchronization allows events to be correlated when system logs are created and when other time-specific events occur. All devices in the network used NTP to synchronize their clocks. Cisco ASA firewalls use NTP by implementing the following configuration statements:

```
ntp server 192.168.62.162 source south
ntp server 192.168.62.161 source south prefer
clock timezone PST -8
clock summer-time PDT recurring
```

Clock synchronization is a requirement for common industry security frameworks such as the HiTrust Common Security Framework (CSF), ISO 27002 and NIST Security Publications.

HIPAA Standards Failed

No HIPAA standards were failed.

HIPAA Implementation Specifications Failed

No HIPAA implementation specifications were failed.

Cisco Virtual Security Gateway

The Cisco Virtual Security Gateway (VSG) for Cisco Nexus 1000V Series Switches was used in the data center for setting a boundary between the sensitive scope of the organization's ePHI data environment and out-of-scope networks. It is a virtual firewall for Cisco Nexus 1000V Series Switches that delivers security and compliance for virtual computing environments. Cisco VSG uses virtual service data path (vPath) technology embedded in the Cisco Nexus 1000V Series Virtual Ethernet Module (VEM), offering transparent firewall insertion and efficient deployment. All the policy management for VSG is done via Virtual Network Management Center (VNMC). Cisco VSG provides the following:

- Zone-based security controls based on network as well as virtual machine attributes. This flexibility simplifies security policies, which are easy to troubleshoot and audit.
- Secure multi-tenant deployment, protecting tenant workloads on a shared compute infrastructure.
- Leverages vPath intelligence for efficient network-wide deployment and accelerated performance through fast-path off-load.
- IT security, network, and server teams to collaborate while enabling administrative segregation to meet regulatory and audit requirements and reduce administrative errors.

Table 5-29 PHI HIPAA Assessment Summary—Cisco Virtual Security Gateway

Models Assessed	
Nexus VSG version 4.2(1)VSG1(1)	
HIPAA Safeguards Addressed	
Administrative	**Standards/Implementation Specifications**

Table 5-29 PHI HIPAA Assessment Summary—Cisco Virtual Security Gateway (continued)

164.308	(a)(1)(i) Security Management Process
	(a)(1)(ii)(D) Information System Activity Review
	(a)(3)(i) Authorization/Supervision
	(a)(4)(ii)(A) Isolating health care clearinghouse function
	(a)(4)(i) Access Authorization
	(a)(4)(ii)(C) Access Est./Modification
	(a)(5)(i) Log-in Monitoring
	(a)(6)(i) Security Incident Procedures
	(a)(6)(i) Response and Reporting
Technical	**Standards/Implementation Specifications**
164.312	(a)(i) Access Control
	(a)(2)(i) Unique User Identification
	(a)(2)(ii) Emergency Access procedures
	(a)(2)(ii) Automatic Logoff
	(a)(ii)(iv) Encryption and Decryption
	(b) Audit Controls
	(c)(1) Data Integrity
	(d) Person or Entity Authentication
	(e)(i) Transmission Security
	(e)(2)(i) Integrity Controls
	(e)(2)(ii) Encryption
HIPAA Standards Failed	
No HIPAA standards were failed.	
HIPAA Implementation Specifications Failed	
No HIPAA implementation specifications were failed.	

Primary PHI Function

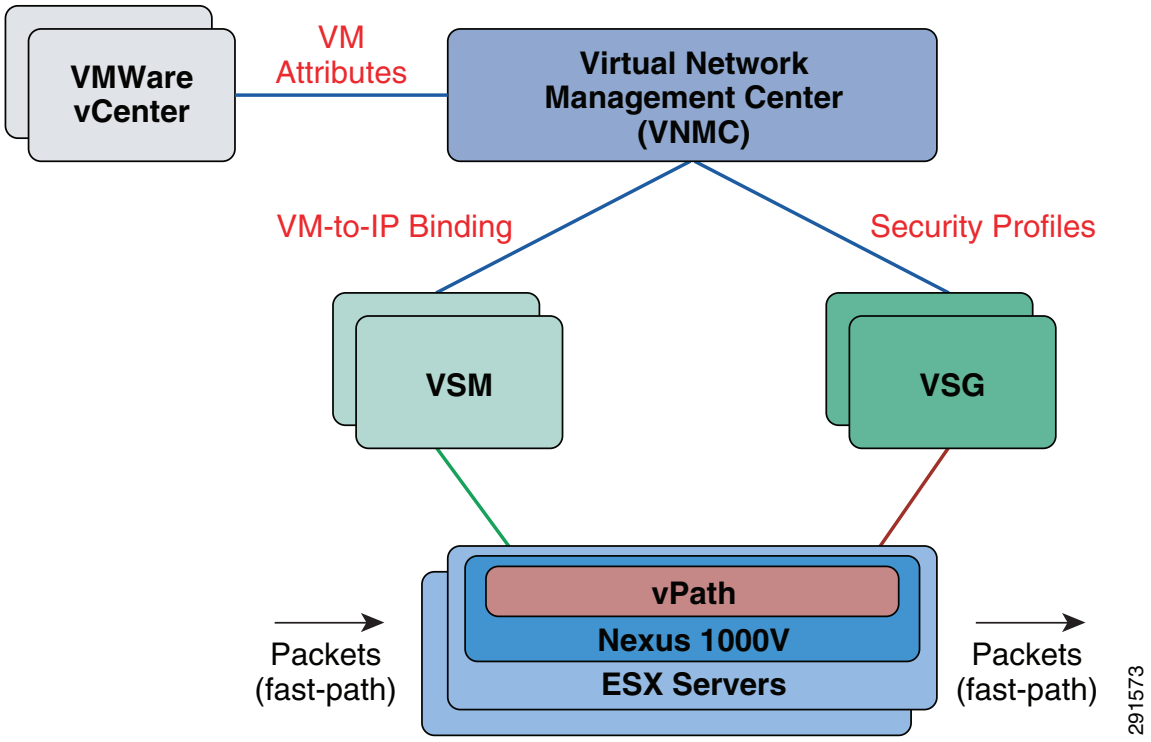
The primary function of the Cisco VSG is segmentation of PHI scope and enforcement of that new scope boundary. The Cisco VSG serves as a stateful firewall, restricting traffic between the cardholder data environment and other areas of the network.

Design Considerations

Cisco VSG integrates with Cisco Nexus 1000V Series Switches to enforce security policies for your virtualized environment. VNMC provides policy management for a multitenant environment. One or more VSGs are required per tenant. VSG uses the vPath intelligence in the Virtual Ethernet Module (VEM) of the Cisco Nexus 1000V Series to provide the security policy enforcement.

Cisco VSG is deployed as a virtual appliance in vCenter. The primary function of Cisco VSG is to protect against unauthorized access to the cardholder environment. (See Figure 5-114.)

Figure 5-114 Cisco Nexus VSG System Architecture



HIPAA Assessment Detail—HIPAA Safeguards Addressed

HIPAA safeguards are spread across multiple categories. The VSG firewall helps healthcare covered entities and business associates meet access control safeguards in the Administrative and Technical categories. The access control can be applied to both internal and external users that access ePHI data. Additionally, controls to protect the administrator accounts on the firewall have been implemented to protect the firewall from unauthorized modification if the authentication server fails. These local accounts represent only a subset of select individuals that would need access in the event central authentications services are unavailable.

All of the sample configurations of the VSG shown below were used to meet the following list of satisfied controls:

- Access Control—Restrict access to ePHI data as required by HIPAA Administrative and Technical safeguards
  - §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.308(a)(4)(ii)(A) Isolating healthcare clearinghouse function. If a healthcare clearinghouse is part of a larger organization, the clearinghouse must implement policies and procedures that protect the electronic protected health information of the clearinghouse from unauthorized access by the larger organization. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.308(a)(4)(ii)(B) Access authorization. Implement policies and procedures for granting access to electronic protected health information, for example, through access to a workstation, transaction, program, process, or other mechanism. Requirements addressed include: Access Control and Auditing.

  - §164.308(a)(4)(ii)(C) Access Establishment and Modification. Implement policies and procedures that, based upon the covered entity's or the business associate's access authorization policies, establish, document, review, and modify a user's right of access to a workstation, transaction, program, or process. Requirements addressed include: Access Control, Incident Response and Auditing.
  - §164.312(a)(1) Access Control. Implement technical policies and procedures for electronic information systems that maintain ePHI to allow access only to those persons or software programs that have been granted access rights as specified in §164.308(a)(4).
  - §164.312(d) Person or entity authentication. Implement procedures to verify that a person or entity seeking access to electronic protected health information is the one claimed. Requirements addressed include: Access Control and Auditing.
  - §164.308(a)(5)(ii)(D) Password Management. Procedures for creating, changing, and safeguarding passwords. Requirements addressed include: Access Control and Auditing.
- Integrity—Protect electronic protected health information from improper alteration or destruction as required by HIPAA Technical safeguards.
  - §164.312(c)(1) Data Integrity. Implement policies and procedures to protect health information from improper alteration or destruction.
  - §164.308(a)(4)(ii)(C) Access Establishment and Modification. Implement policies and procedures that, based upon the covered entity's or the business associate's access authorization policies, establish, document, review, and modify a user's right of access to a workstation, transaction, program, or process. Requirements addressed include: Access Control, Incident Response, and Auditing.
  - §164.308(a)(5)(ii)(C) Log-in Monitoring. Procedures for monitoring log-in attempts and reporting discrepancies. Requirements addressed include: Access Control and Auditing.
  - §164.312(a)(2)(ii) Emergency Access Procedure. Establish (and implement as needed) procedures for obtaining necessary ePHI during an emergency.
  - §164.312(e)(1) Transmission Security. Implement technical security measures to guard against unauthorized access to ePHI that is being transmitted over an electronic communications network. Requirements addressed include: Encryption and Integrity.
  - §164.308(e)(2)(i) Integrity Controls. Implement security measures to ensure that ePHI is not improperly modified without detection until disposed of. Requirements addressed include: Integrity.
  - §164.308(e)(2)(ii) Encryption. Implement a mechanism to encrypt ePHI whenever deemed appropriate. Requirements addressed include: Encryption.
- Incident response—Implement security incident response as required by HIPAA Administrative safeguards.
  - §164.308(a)(6)(ii) Response and Reporting. Identify and respond to suspected or known security incidents; mitigate, to the extent practicable, harmful effects of security incidents that are known to the covered entity or business associate; and document security incidents and their outcomes. Requirements addressed include: Incident Response and Auditing.
  - §164.312(a)(2)(i) Unique User Identification. Assign a unique name and/or number for identifying and tracking user identity. Requirements addressed include: Access Control and Auditing.
  - §164.312(a)(2)(ii) Automatic logoff. Implement electronic procedures that terminate an electronic session after a predetermined time of inactivity. Requirements addressed include: Access Control and Auditing.

- Encryption—Implement mechanisms to encrypt and decrypt ePHI.
  - §164.312(a)(ii)(iv) Encryption and Decryption. Implement a mechanism to encrypt and decrypt electronic protected health information. Requirements addressed include: Encryption and Integrity.
- Auditing—Implement mechanisms to record and examine activity in systems that contain or use ePHI as required by HIPAA Technical safeguards.
  - §164.312(b) Audit controls. Implement hardware, software, and/or procedural mechanisms that record and examine activity in information systems that contain or use electronic protected health information. Requirements addressed include: Auditing.
  - §164.308(a)(5)(ii)(C) Log-in Monitoring. Procedures for monitoring log-in attempts and reporting discrepancies. Requirements addressed include: Access Control and Auditing.
  - §164.312(d) Person or entity authentication. Implement procedures to verify that a person or entity seeking access to electronic protected health information is the one claimed. Requirements addressed include: Access Control and Auditing.

Sample Configuration

Cisco VSG firewalls are designed to track and monitor all administrative user access and events, thereby addressing all of the safeguards listed under Access Control above. User access throughout the solution uses a centralized user database in the Active Directory, which is linked through authentication servers via LDAP, RADIUS, and TACACS+ services, enabling verification of users and administrators of devices and endpoints. These services are located in the data center. Individual user IDs are assigned, and roles are based on group membership.

User roles in VNMC contain one or more privileges that define the operations allowed for the user who is assigned the role. A user can be assigned one or more roles. A user assigned multiple roles has the combined privileges of all assigned roles. For example, if Role1 has policy-related privileges, and Role2 has tenant-related privileges, users who are assigned to both Role1 and Role2 have policy and tenant related privileges.

The system contains the following default user roles:

- aaa—User has read and write access to users, roles, and AAA configuration. Read access to the rest of the system.
- admin—User has complete read-and-write access to the entire system and has all privileges. The default admin account is assigned this role by default, and it cannot be changed.
- network—User creates organizations, security policies, and device profiles.
- operations—User acknowledges faults and performs some basic operations such as logging configuration.
- read-only—User has read-only access to system configuration and operational status with no privileges to perform any operations.

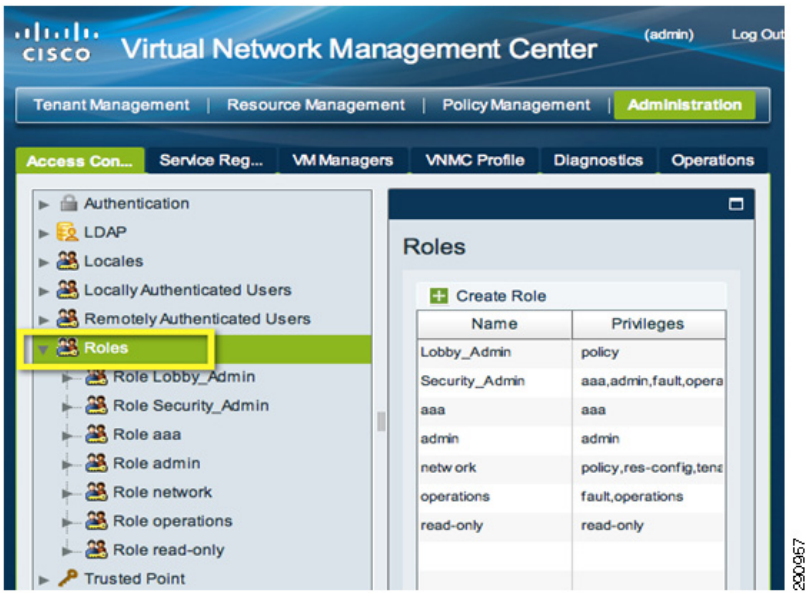
Roles can be created, modified to add new or remove existing privileges, or deleted. When a role is modified, the new privileges are applied to all users assigned to that role. Privilege assignment is not restricted to the privileges defined for the default roles. That is, you can use a custom set of privileges to create a unique role. For example, the default Network and Operations roles have different sets of privileges, but a new Network and Operations role can be created that combines the privileges of both roles.

To configure roles in VNMC, do the following:

1. Click the **Administration** tab, then click the **Access Control** sub-tab.

2. In the Navigation pane, select the **Roles** node. In the Work pane, click **Create Roles** (see Figure 5-115.)

Figure 5-115 Configuring Roles



In addition to roles, the user is also provided another dimension of privilege, which limits the user to tenant level visibility, called *locale*. Each locale defines one or more organizations (domains) to which the user is allowed access, and access would be limited to the organizations specified in the locale. To configure locales in VNMC, do the following:

1. Click the Administration tab, then click the Access Control sub-tab.
2. In the Navigation pane, select the Locales node.
3. In the Work pane, click the Create Locale link. (See Figure 5-116.)

Figure 5-116 Configuring Locales

CLI configuration of AAA services is as follows:

```
tacacs-server key 7 "<removed>"
tacacs-server host 192.168.42.131
aaa group server tacacs+ CiscoACS
    server 192.168.42.131
    use-vrf management
    source-interface mgmt0
aaa group server tacacs+ tacacs
!
aaa authentication login default group CiscoACS
aaa authentication login console group CiscoACS

HIPAA Safeguard 164.312(a)(2)(ii) requires the enabling of automatic logoff options.
Cisco VSG supports session timeout. It is a best practice to set session time-out to
15 minutes,
line vty
  exec-timeout 15
line console
  exec-timeout 15
```

It is a recommended practice to only enable management interface protocols which use strong encryption in order to best protect the ePHI information and the identities and passwords of those who must have access. Cisco VSG firewalls support strong encryption for SSH and HTTPS. Only SSH access is allowed for firewall console access over the network. The communication between Cisco VSG and Management Platform (VNMC) is all encrypted over SSL (443)

Cisco Nexus VSG can be configured to use secure protocols for all system functions. This includes SSH for remote management, SCP, and SFTP for file transfers. Insecure services can be disable or blocked using configuration statements and access lists.

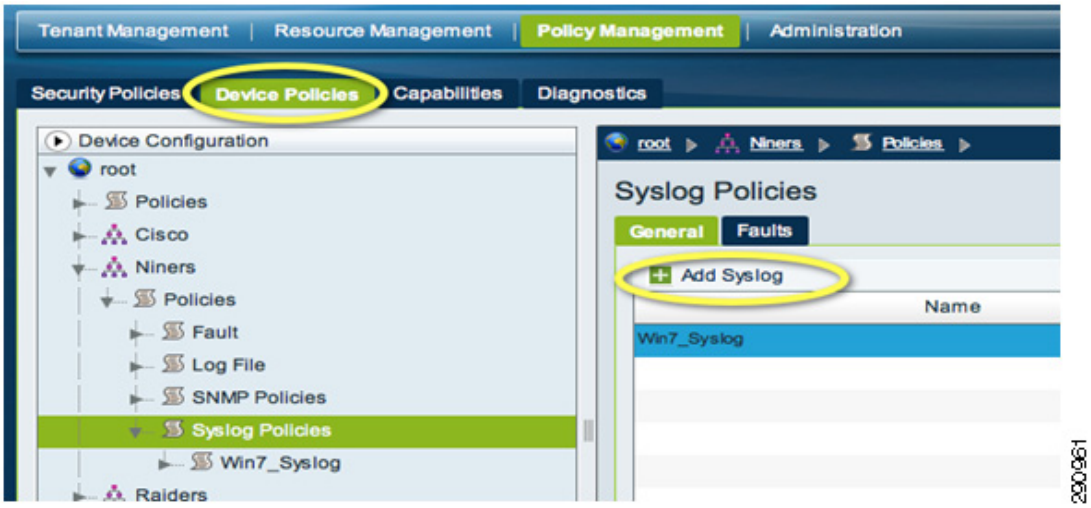
```
no feature telnet
no telnet server enable
feature ssh
```

Cisco Nexus VSG support administrative protocols with strong cryptography such as SSH version 2.

Cisco ASA firewalls track individual administrator actions, which address all of the HIPAA Auditing Safeguards summarized above, through several mechanisms including AAA, logging, and system events by implementing the following syslog server configurations for Cisco VSG to send all the logging information to a standard syslog server. This setting is available as part of the device profile.

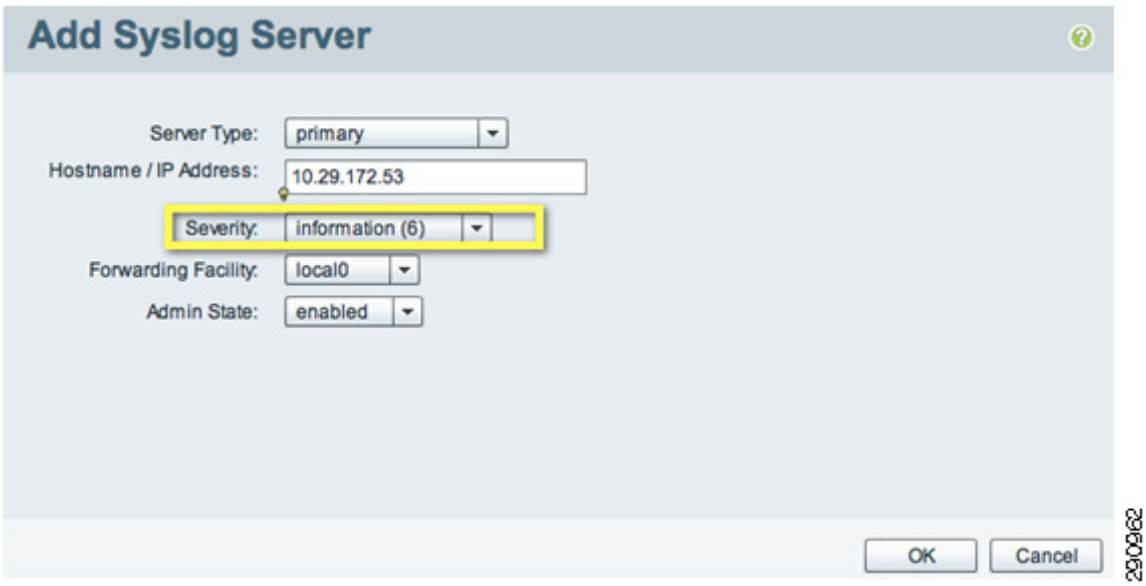
1. Navigate to Policy Management > Device Policies > Tenant> Policies > Syslog Policies. Add a syslog policy, as shown in Figure 5-117.

Figure 5-117 Configuring Syslog



2. The severity of the logging should be at level 6 to capture the firewall policy hit in the VSG. (See Figure 5-118).

Figure 5-118 Configuring Logging Severity



3. The syslog policy is attached to the Device Profile to enable the settings in the VSG.

   CLI configuration of logging services is as follows:

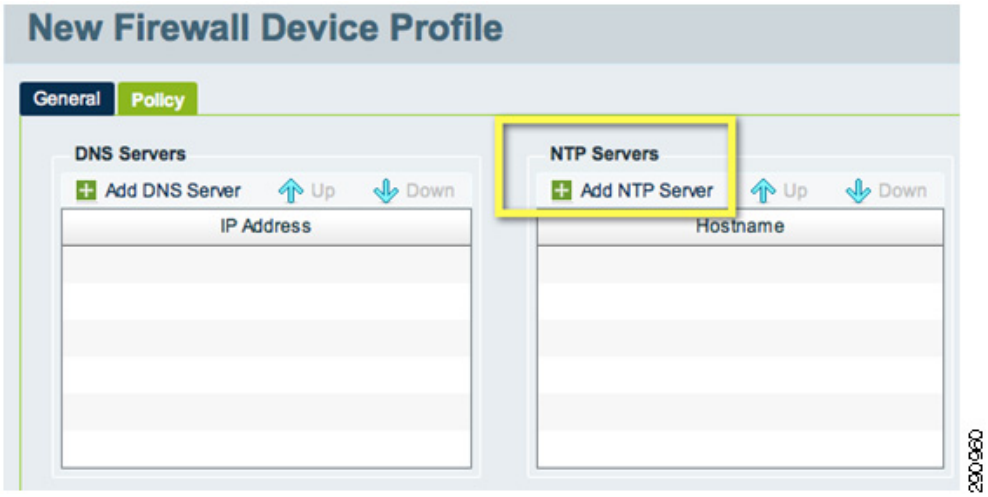
```
logging logfile messages 2
logging server 192.168.42.124 6 facility local0
logging monitor 2
```

As a best practice, NTP is used to synchronize clocks among network devices. This synchronization allows events to be correlated when system logs are created and when other time-specific events occur. All devices in the network used NTP to synchronize their clocks. The NTP servers were hosted at the data center site. The Cisco Lab uses two NTP servers that are synchronized to external reference sources. All systems and devices in the lab are pointed to these two servers.

NTP is configured in the Firewall Device Profile for the Cisco VSG VNMC. The setting is published via the device policy to Cisco VSG.

1. In the navigation pane, click the Policy Management tab, then the Device Policies sub-tab, and expand the Device Profile for a tenant.
2. Click a Profiles node to add a firewall device profile, and you see the option to add NTP server, as shown in Figure 5-119.

Figure 5-119 Configuring NTP



HIPAA Standards Failed

No HIPAA standards were failed.

HIPAA Implementation Specifications Failed

No HIPAA implementation specifications were failed.

Intrusion Detection

Cisco Catalyst 6500 Series Intrusion Detection System Services Module 2

The Cisco Catalyst 6500 Series Intrusion Detection System Services Module 2 (IDSM2) is an important intrusion prevention system (IPS) solution that protects switched environments by integrating full-featured IPS functions directly into the network infrastructure through the widely deployed Cisco Catalyst chassis. This integration allows the user to monitor traffic directly off the switch backplane.

The Cisco IDSM2 with Cisco IPS Sensor Software v6.0 helps users stop more threats through the use of the following elements:

- Multivector threat identification—Detailed inspection of Layer 2–7 traffic protects your network from policy violations, vulnerability exploitations, and anomalous activity.
- Accurate prevention technologies—The innovative Cisco Risk Rating feature and Meta Event Generator provide the ability to take preventive actions on a broader range of threats without the risk of dropping legitimate traffic.

When combined, these elements provide a comprehensive inline prevention solution, providing the ability to detect and stop the broadest range of malicious traffic before it affects business continuity.

Table 5-30 PHI HIPAA Assessment Summary—Cisco IDSM2

Models Assessed	
WS-SVC-IDSM-2 version 7.0(4)	
HIPAA Safeguards Addressed	
Administrative	**Standards/Implementation Specifications**
164.308	(a)(1)(i) Security Management Process
	(a)(3)(i) Authorization/Supervision
	(a)(4)(i) Access Authorization
	(a)(5)(ii)(B) Protection from Malicious Software
	(a)(5)(ii)(C) Log-in Monitoring
	(a)(6)(i) Security Incident Procedures
	(a)(6)(i) Response and Reporting
Technical	**Standards/Implementation Specifications**
164.312	(a)(i) Access Control
	(b) Audit Controls
HIPAA Standards Failed	
No HIPAA standards were failed.	
HIPAA Implementation Specifications Failed	
No HIPAA implementation specifications were failed.	

Primary PHI Function

The primary function of the Cisco IDSM2 is to monitor all traffic at the perimeter of the ePHI data environment as well as at critical points inside of the ePHI data environment, and alert personnel to suspected compromises.

Design Considerations

- Configure the Cisco IDSM2 to lock accounts so that users cannot keep trying to login after a certain number of failed attempts.
- Allow secure management of the Cisco IDSM2 only from specific host/hosts.
- Configure appropriate banner messages on login. The login banner warning should not reveal the identity of the company that owns or manages the Cisco IDSM2. The banners should state that these areas are considered private and that unauthorized access will result in prosecution to the full extent of the law.
- Change default passwords and community strings to appropriate complexity.

For more information, see the Installation Guide at the following URL:

http://www.cisco.com/en/US/docs/security/ips/6.0/configuration/guide/cli/cliInter.html

HIPAA Assessment Detail—HIPAA Safeguards Passed

All of the sample configurations of the IDSM shown below were used to meet the following list of satisfied controls:

- Access Control—Restrict access to ePHI data as required by HIPAA Administrative and Technical safeguards
  - §164.308(a)(1)(i) Security Management Process. Implement policies and procedures to prevent, detect, contain, and correct security violations. Requirements addressed include: Access Control, Integrity, Incident Response, and Auditing.
  - §164.308(a)(3)(ii)(A) Authorization/Supervision. Implement procedures for the authorization and/or supervision of workforce members who work with ePHI or in locations where it might be accessed. Requirements addressed include: Auditing.
  - §164.308(a)(4)(ii)(B) Access authorization. Implement policies and procedures for granting access to electronic protected health information, for example, through access to a workstation, transaction, program, process, or other mechanism. Requirements addressed include: Access Control and Auditing.
  - §164.308(a)(5)(ii)(B) Protection from malicious software. Procedures for guarding against, detecting, and reporting malicious software. Requirements addressed include: Incident Response and Auditing.
  - §164.308(a)(5)(ii)(C) Log-in Monitoring. Procedures for monitoring log-in attempts and reporting discrepancies. Requirements addressed include: Access Control and Auditing.
- Incident response—Implement security incident response as required by HIPAA Administrative safeguards.
  - §164.308(a)(6)(i) Security Incident Procedures. Implement policies and procedures to address security incidents. Requirements addressed include: Incident Response and Auditing.

  - §164.308(a)(6)(ii) Response and Reporting. Identify and respond to suspected or known security incidents; mitigate, to the extent practicable, harmful effects of security incidents that are known to the covered entity or business associate; and document security incidents and their outcomes. Requirements addressed include: Incident Response and Auditing.

- Auditing—Implement mechanisms to record and examine activity in systems that contain or use ePHI as required by HIPAA Technical safeguards.
  - §164.312(b) Audit controls. Implement hardware, software, and/or procedural mechanisms that record and examine activity in information systems that contain or use electronic protected health information. Requirements addressed include: Auditing.
  - §164.308(a)(5)(ii)(C) Log-in Monitoring. Procedures for monitoring log-in attempts and reporting discrepancies. Requirements addressed include: Access Control and Auditing.

Sample Configuration

Cisco IDSM modules are designed to track and monitor all administrative user access and events, thereby addressing all of the safeguards listed under Access Control above. User access throughout the solution uses a centralized user database in the Active Directory, which is linked through authentication servers via LDAP, RADIUS, and TACACS+ services, enabling verification of users and administrators of devices and endpoints. These services are located in the data center. Individual user IDs are assigned, and roles are based on group membership.

Cisco IDSM2 modules are configured to use a AAA model for user-based access. Users can be assigned to groups and based on privilege levels and have access to only the information they require for their job function. By default, no users are allowed access unless specifically configured and assigned appropriate passwords. The following configuration statements use the RADIUS protocol to communicate with the Cisco ACS server where individual user groups and roles are configured, limiting and logging access as appropriate.

```
! ------------------------------
service aaa
aaa radius
primary-server
server-address 192.168.42.131
shared-secret <removed>
exit
nas-id DMZ-IDS1
local-fallback enabled
console-authentication radius-and-local
default-user-role administrator
exit
exit
! ------------------------------
```

Cisco IDSM2 modules allow only administrative connections from authorized hosts/networks as specified in the device configuration. The following configuration shows the authorized management hosts for SSH and HTTPS administration, and disabling of Telnet.

```
! ------------------------------
service host
network-settings
host-ip 192.168.21.94/24,192.168.21.1
host-name DMZ-IDS2
telnet-option disabled
access-list 192.168.41.101/32
access-list 192.168.41.102/32
access-list 192.168.42.122/32
access-list 192.168.42.124/32
access-list 192.168.42.133/32
access-list 192.168.42.138/32
```

Local individual user accounts are configured in the event that the centralized authentication server cannot be reached. These accounts must be manually updated to maintain compliance requirements regarding password rotation and expiration as specified in established policies for passwords.

Cisco IDSM2 modules support the ability to specify a minimum password length for local accounts.

```
! ------------------------------
service authentication
password-strength
size 7-64
! ------------------------------
```

Cisco IDSM2 modules support the ability to specify alphanumeric passwords for local accounts.

```
! ------------------------------
service authentication
password-strength
digits-min 1
lowercase-min 1
other-min 1
! ------------------------------
```

Cisco IDSM2 modules support the ability to specify that old passwords should not be re-used for local accounts.

```
! ------------------------------
service authentication
password-strength
number-old-passwords 4
! ------------------------------
```

Cisco IDSM2 modules support the ability to specify that only a limited number of attempts can be made when authenticating for local accounts.

```
! ------------------------------
service authentication
attemptLimit 6
! ------------------------------
```

Cisco IDSM2 modules support the ability to lockout local accounts after the specified number of failed attempts, requiring an administrator to re-enable them. Locked accounts are indicated by parentheses when using the show users command:

```
sensor# show users all
CLI ID  User       Privilege
* 1349  bart       administrator
  5824 (pauljones) viewer
  9802  christian  operator
```

Cisco IDSM2 modules are capable of performing intrusion detection and prevention through the use of VLAN interfaces from the host Cisco Catalyst service chassis addressing safeguard 164.308(a)(1)(i) Security Management. IPS signature updates and configurations are managed centrally through Cisco Security Manager. The following configuration statements are necessary in the Cisco Catalyst service chassis to forward traffic via VLANs and enable the IDS inspection capability:

```
!
!
intrusion-detection module 2 management-port access-vlan 21
intrusion-detection module 2 data-port 1 trunk allowed-vlan 83,84
!
```

Cisco IDSM2 module interfaces are configured as follows to receive, inspect, and forward traffic across the assigned VLANs:

```
! ------------------------------
service interface
physical-interfaces GigabitEthernet0/7
subinterface-type inline-vlan-pair
subinterface 1
description INT1 vlans 83 and 84
vlan1 83
vlan2 84
exit
exit
exit
exit
! ------------------------------
```

To address the Incident Response and Auditing HIPAA Safeguards identified above, Cisco IDSM can be configured to send its log data to the RSA enVision log management platform. RSA enVision collects information from all devices to ensure the integrity and correlation of events.

Cisco IDSM2 modules are capable of sending system events to a centralized repository using SNMP traps. Logs stored locally are buffered and require operator level privileges on the device to be viewed. External logging is enabled by implementing the following configuration statements to send them to the RSA enVision server:

```
! ------------------------------
service notification
trap-destinations 192.168.42.124
trap-community-name RSAenVision
exit
enable-notifications true
trap-community-name RSAenVision
exit
! ------------------------------
```

As a best practice, NTP is used to synchronize clocks among network devices. This synchronization allows events to be correlated when system logs are created and when other time-specific events occur. All devices in the network used NTP to synchronize their clocks. The NTP server was hosted at the data center site. Cisco IDSM2 uses NTP to meet these requirements by implementing the following configuration statements:

```
time-zone-settings
offset -8
standard-time-zone-name PST
exit
ntp-option enabled-ntp-unauthenticated
ntp-server 192.168.62.161
exit
summertime-option recurring
summertime-zone-name PDT
```

Clock synchronization is a requirement for common industry security frameworks such as the HiTrust Common Security Framework (CSF), ISO 27002, and NIST Security Publications, as well as other industry-based standards.

HIPAA Standards Failed

No HIPAA standards were failed.

HIPAA Implementation Specifications Failed

No HIPAA implementation specifications were failed.