



## Cisco Identity Services Engine Network Component Compatibility, Release 3.1

### Overview 2

Validated Security Product Integrations (over pxGrid) 22

Validated Cisco Digital Network Architecture Center Release 25

Validated Cisco Prime Infrastructure Release 25

Validated Cisco Firepower Management Center Release 25

Validated Cisco Stealthwatch Management Release 25

Validated Cisco WAN Service Administrator Release 25

Support for Threat Centric NAC 25

Additional References 25

Communications, Services, and Additional Information 26

Revised: May 8, 2024

# Overview

Cisco ISE supports protocol standards like RADIUS, its associated RFC Standards, and TACACS+. For more information, see the [ISE Community Resources](#).

Cisco ISE supports interoperability with any Cisco or non-Cisco RADIUS client network access device (NAD) that implements common RADIUS behavior for standards-based authentication.

Cisco ISE interoperates fully with third-party TACACS+ client devices that adhere to the governing protocols. Support for TACACS+ functions depends on the device-specific implementation.

## RADIUS

Cisco ISE interoperates fully with third-party RADIUS devices that adhere to the standard protocols. Support for RADIUS functions depends on the device-specific implementation.

Certain advanced use cases, such as those that involve posture assessment, profiling, and web authentication, are not consistently available with non-Cisco devices or may provide limited functionality. We recommend that you validate all network devices and their software for hardware capabilities or bugs in a particular software release.

If the network device does not support both dynamic and static URL redirects, Cisco ISE provides an Auth VLAN configuration by which URL redirect is simulated. For more information, see "Third-Party Network Device Support in Cisco ISE" section in Chapter "Secure Wired Access" in the [Cisco Identity Services Engine Administrator Guide](#).

## TACACS+

Cisco ISE interoperates fully with third-party TACACS+ client devices that adhere to the governing protocols. Support for TACACS+ functions depends on the device-specific implementation.

For information on enabling specific functions of Cisco ISE on network switches, see the "Switch and Wireless LAN Controller Configuration Required to Support Cisco ISE Functions" chapter in [Cisco Identity Services Engine Administrator Guide](#).

### ISE Community Resource

#### [Does ISE Support My Network Access Device?](#)

For information about third-party NAD profiles, see [ISE Third-Party NAD Profiles and Configs](#).

For information on how to configure TACACS+ for Nexus devices, see [Cisco ISE Device Administration Prescriptive Deployment Guide](#).



#### Note

- Some switch models and IOS versions may have reached the end-of-life date and interoperability may not be supported by Cisco TAC.
- You must use the latest version of NetFlow for the Cisco ISE profiling service. If you use NetFlow Version 5, you can use it only on the primary NAD at the access layer.

For Wireless LAN Controllers, note the following:

- MAC authentication bypass (MAB) supports MAC filtering with RADIUS lookup.

- Support for session ID and COA with MAC filtering provides MAB-like functionality.
- DNS-based ACL feature is supported for WLC 8.0 and above. Not all Access Points support DNS-based ACL. See the *Cisco Access Points Release Notes* for more details.

For information about the devices that are validated with Cisco ISE, see [Network Device Capabilities Validated with Cisco Identity Services Engine](#).

## Supported Protocol Standards, RFCs, and IETF Drafts

Cisco ISE conforms to the following protocol standards, Requests for Comments (RFCs), and IETF drafts:

- **Supported IEEE Standards**

- [IEEE802.1X-Std-2001](#)
- [IEEE802.1X-Std-2004](#)

- **Supported IETF RFC**

- [RFC2138 - RADIUS](#)
- [RFC2246 - TLSv1.0](#)
- [RFC2548 - Microsoft Vendor-specific RADIUS Attributes](#)
- [RFC2759 - Microsoft PPP CHAP Extensions, Version 2](#)
- [RFC2865 - RADIUS](#)
- [RFC2866 - RADIUS Accounting](#)
- [RFC2867 - RADIUS Accounting Modifications for Tunnel Protocol Support](#)
- [RFC2868 - RADIUS Attributes for Tunnel Protocol Support](#)
- [RFC2869 - RADIUS Extensions](#)
- [RFC3579 - RADIUS Support For EAP](#)
- [RFC3580 - IEEE 802.1X RADIUS Usage Guidelines](#)
- [RFC3748 - EAP](#)
- [RFC4017 - EAP Method Requirements for Wireless LANs](#)
- [RFC4851 - EAP-FAST](#)
- [RFC5176 - Dynamic Authorization Extensions to RADIUS](#)
- [RFC5216 - EAP-TLS Authentication Protocol](#)
- [RFC5281 - Extensible Authentication Protocol Tunneled Transport Layer Security Authenticated Protocol Version 0 \(EAP-TTLSv0\)](#)
- [RFC5422 - Dynamic Provisioning Using Flexible Authentication via Secure Tunneling Extensible Authentication Protocol \(EAP-FAST\)](#)
- [RFC5425 - Transport Layer Security \(TLS\) Transport Mapping for Syslog](#)

- [RFC6587 - Transmission of Syslog Messages over TCP](#)
- [RFC7360 - Datagram Transport Layer Security \(DTLS\) as a Transport Layer for RADIUS](#)

The following RFCs are partially supported:

- [RFC2548 - Microsoft Vendor-specific RADIUS Attributes](#)
  - [RFC2882 - Network Access Servers Requirements: Extended RADIUS Practices](#)
  - [RFC7030 - Enrollment over Secure Transport \(EST\) \(supported as part of BYOD flow\)](#)
  - [RFC7170 - Tunnel Extensible Authentication Protocol \(TEAP\) Version 1](#)
- **Supported IETF Drafts**
    - [IETF Draft - PEAP Version 0](#)
    - [IETF Draft - PEAP Version 1](#)
    - [IETF Draft - PEAP Version 2](#)
    - [IETF Draft - Microsoft EAP CHAP Extensions Version 2](#)

## AAA Attributes for RADIUS Proxy Service

For RADIUS proxy service, the following authentication, authorization, and accounting (AAA) attributes must be included in the RADIUS communication:

- Calling-Station-ID (IP or MAC\_ADDRESS)
- RADIUS::NAS\_IP\_Address
- RADIUS::NAS\_Identifier

## AAA Attributes for Third-Party VPN Concentrators

For VPN concentrators to integrate with Cisco ISE, the following authentication, authorization, and accounting (AAA) attributes should be included in the RADIUS communication:

- Calling-Station-ID (tracks individual client by MAC or IP address)
- User-Name (tracks remote client by login name)
- NAS-Port-Type (helps to determine connection type as VPN)
- RADIUS Accounting Start (triggers official start of session)
- RADIUS Accounting Stop (triggers official end of session and releases ISE license)
- RADIUS Accounting Interim Update on IP address change (for example, SSL VPN connection transitions from Web-based to a full-tunnel client)



---

**Note** For VPN devices, the RADIUS Accounting messages must have the Framed-IP-Address attribute set to the client's VPN-assigned IP address to track the endpoint while on a trusted network.

---

## System Requirements

For an uninterrupted Cisco ISE configuration, ensure that the following system requirements are fulfilled.

For more details on hardware platforms and installation for this Cisco ISE release, see the [Cisco Identity Services Engine Hardware Installation Guide](#).

For information on the SSM On-Prem server releases that support smart licensing, see the topic Configure Smart Software Manager On-Prem for Smart Licensing in the Chapter "Licensing", in the [Cisco ISE Administrator Guide](#) for your release.

## Supported Hardware

Cisco ISE, Release 3.1, can be installed on the following platforms:

**Table 1: Supported Platforms**

| Hardware Platform           | Configuration  |
|-----------------------------|--|
| Cisco SNS-3595-K9 (large)   | For appliance hardware specifications, see the <a href="#">Cisco Secure Network Server Appliance Hardware Installation Guide</a> . |
| Cisco SNS-3615-K9 (small)   |  |
| Cisco SNS-3655-K9 (medium)  |  |
| Cisco SNS-3695-K9 (large)   |  |
| Cisco SNS-3715-K9 (small)*  |  |
| Cisco SNS-3755-K9 (medium)* |  |
| Cisco SNS-3795-K9 (large)*  |  |

After installation, you can configure Cisco ISE with specific component personas such as Administration, Monitoring, or pxGrid on the platforms that are listed in the above table. In addition to these personas, Cisco ISE contains other types of personas within Policy Service, such as Profiling Service, Session Services, Threat-Centric NAC Service, SXP Service for TrustSec, TACACS+ Device Admin Service, and Passive Identity Service.



---

**Caution**

- \*Cisco ISE 3.1 Patch 6 and above versions support Cisco SNS 3700 series appliances.
  - Cisco ISE 3.1 and later releases do not support Cisco Secured Network Server (SNS) 3515 appliance.
  - Cisco SNS 3400 Series appliances are not supported in Cisco ISE, Release 2.4, and later.
  - Memory allocation of less than 16 GB is not supported for VM appliance configurations. In the event of a Cisco ISE behavior issue, all the users will be required to change the allocated memory to at least 16 GB before opening a case with the [Cisco Technical Assistance Center](#).
  - Legacy Access Control Server (ACS) and Network Access Control (NAC) appliances (including the Cisco ISE 3300 Series) are not supported in Cisco ISE, Release 2.0, and later.
- 

## Supported Virtual Environments

Cisco ISE supports the following virtual environment platforms:

- VMware version 9 for ESXi 6.5
- VMware version 14 for ESXi 6.7 and later

For Cisco ISE Release 3.0 and later releases, we recommend that you update to VMware ESXi 7.0.3 or later releases.

You can deploy Cisco ISE on VMware cloud solutions on the following public cloud platforms:

- VMware cloud in Amazon Web Services (AWS): Host Cisco ISE on a software-defined data centre provided by VMware Cloud on AWS.
- Azure VMware Solution: Azure VMware Solution runs VMware workloads natively on Microsoft Azure. You can host Cisco ISE as a VMware virtual machine.
- Google Cloud VMware Engine: Google Cloud VMware Engine runs software defined data centre by VMware on the Google Cloud. You can host Cisco ISE as a VMware virtual machine on the software defined data centre provided by the VMware Engine.



---

**Note**

From Cisco ISE 3.1, you can use the VMware migration feature to migrate virtual machine (VM) instances (running any persona) between hosts. Cisco ISE supports both hot and cold migration. Hot migration is also called live migration or vMotion. Cisco ISE need not be shut down or powered off during the hot migration. You can migrate the Cisco ISE VM without any interruption in its availability.

---

- Microsoft Hyper-V on Microsoft Windows Server 2012 R2 and later
- KVM on QEMU 2.12.0-99



---

**Note**

Cisco ISE cannot be installed on OpenStack.

---

- Nutanix AHV 20201105.2096

You can deploy Cisco ISE natively on the following public cloud platforms:

- Amazon Web Services (AWS)

For information about the virtual machine requirements, see the [Cisco Identity Services Engine Installation Guide](#) for your version of Cisco ISE.

## Federal Information Processing Standard (FIPS) Mode Support

Cisco ISE uses embedded Federal Information Processing Standard (FIPS) 140-2-validated cryptographic module, Cisco FIPS Object Module Version 7.2 (Certificate #3790). For details about the FIPS compliance claims, see [Global Government Certifications](#).

When FIPS mode is enabled on Cisco ISE, consider the following:

- All non-FIPS-compliant cipher suites will be disabled.
- Certificates and private keys must use only FIPS-compliant hash and encryption algorithms.
- RSA private keys must be 2048 bits or greater.
- Elliptical Curve Digital Signature Algorithm (ECDSA) private keys must be 224 bits or greater.
- Diffie–Hellman Ephemeral (DHE) ciphers work with Diffie–Hellman (DH) parameters of 2048 bits or greater.
- SHA1 is not allowed to generate ISE local server certificates.
- The anonymous PAC provisioning option in EAP-FAST is disabled.
- The local SSH server operates in FIPS mode.
- The following protocols are not supported in FIPS mode for RADIUS:
  - EAP-MD5
  - PAP
  - CHAP
  - MS-CHAPv1
  - MS-CHAPv2
  - LEAP

## Supported Browsers

Cisco ISE 3.1 is supported on the following browsers:

- Mozilla Firefox 114 and earlier versions from version 82
- Mozilla Firefox ESR 102.4 and earlier versions
- Google Chrome 116 and earlier versions from version 86
- Microsoft Edge, the latest version and one version earlier than the latest version



---

**Note** Currently, you cannot access the Cisco ISE GUI on mobile devices.

---

## Validated External Identity Sources



**Note** The supported Active Directory versions are the same for both Cisco ISE and Cisco ISE-PIC.

**Table 2: Validated External Identity Sources**

| External Identity Source  | Version  |
|---|--|
| <b>Active Directory</b>   |  |
| Microsoft Windows Active Directory 2012                               | Windows Server 2012  |
| Microsoft Windows Active Directory 2012 R2<br><a href="#">1</a>       | Windows Server 2012 R2   |
| Microsoft Windows Active Directory 2016                               | Windows Server 2016  |
| Microsoft Windows Active Directory 2019                               | Windows Server 2019  |
| Microsoft Windows Active Directory 2022                               | Windows Server 2022 with Patch<br>Windows10.0-KB5025230-x64-V1.006.msu |
| <b>LDAP Servers</b>   |  |
| SunONE LDAP Directory Server  | Version 5.2  |
| OpenLDAP Directory Server   | Version 2.4.23   |
| Any LDAP v3 compliant server  | Any version that is LDAP v3 compliant                                  |
| AD as LDAP  | Windows Server 2022 with Patch<br>Windows10.0-KB5025230-x64-V1.006.msu |
| <b>Token Servers</b>  |  |
| RSA ACE/Server  | 6.x series   |
| RSA Authentication Manager  | 7.x and 8.x series   |
| Any RADIUS RFC 2865-compliant token server                            | Any version that is RFC 2865 compliant                                 |
| <b>Security Assertion Markup Language (SAML) Single Sign-On (SSO)</b> |  |
| Microsoft Azure MFA   | Latest   |
| Oracle Access Manager (OAM)   | Version 11.1.2.2.0   |
| Oracle Identity Federation (OIF)                                      | Version 11.1.1.2.0   |
| PingFederate Server   | Version 6.10.0.4   |
| PingOne Cloud   | Latest   |



| External Identity Source                                 | Version  |
|--|--|
| Secure Auth  | 8.1.1  |
| Any SAMLv2-compliant Identity Provider                   | Any Identity Provider version that is SAMLv2 compliant |
| <b>Open Database Connectivity (ODBC) Identity Source</b> |  |
| Microsoft SQL Server                                     | Microsoft SQL Server 2012<br>Microsoft SQL Server 2022 |
| Oracle   | Enterprise Edition Release 12.1.0.2.0                  |
| PostgreSQL   | 9.0  |
| Sybase   | 16.0   |
| MySQL  | 6.3  |
| <b>Social Login (for Guest User Accounts)</b>            |  |
| Facebook   | Latest   |

<sup>1</sup> Cisco ISE supports all the legacy features in Microsoft Windows Active Directory 2012 R2. However, the new features in Microsoft Windows Active Directory 2012 R2, such as Protective User Groups, are not supported.

See the [Cisco Identity Services Engine Administrator Guide](#) for more information.

## Supported Unified Endpoint Management and Mobile Device Management Servers

Supported MDM servers include products from the following vendors:

- Absolute
- Blackberry - BES
- Blackberry - Good Secure EMM
- Cisco Meraki Systems Manager
- Citrix XenMobile 10.x (On-prem)
- Globo
- IBM MaaS360
- Ivanti (previously MobileIron UEM), core and cloud UEM services

For the use case of handling random and changing MAC Addresses in Cisco ISE 3.1, you must integrate MobileIron Core 11.3.0.0 Build 24 and later releases to receive GUID values.




---

**Note** Some versions of MobileIron do not work with Cisco ISE. MobileIron is aware of this problem, and have a fix. Contact MobileIron for more information.

---

- JAMF Casper Suite

- Microsoft Endpoint Configuration Manager
- Microsoft Endpoint Manager Intune
- Mosyle
- SAP Afaria
- Sophos
- SOTI MobiControl
- Symantec
- Tangoe
- VMware Workspace ONE (earlier known as AirWatch)
- 42Gears

For the configurations that you must perform in your endpoint management servers to integrate the servers with Cisco ISE, see [Integrate UEM and MDM Servers With Cisco ISE](#).

#### **ISE Community Resource**

[How To: Meraki EMM / MDM Integration with ISE](#)

### **Supported Antivirus and Antimalware Products**

For information about the antivirus and antimalware products supported by the Cisco ISE posture agent, see [Cisco AnyConnect ISE Posture Support Charts](#).

### **Supported Ciphers**

In a clean or fresh install of Cisco ISE, SHA1 ciphers are disabled by default. However, if you upgrade from an existing version of Cisco ISE, the SHA1 ciphers retain the options from the earlier version. You can view and change the SHA1 ciphers settings using the **Allow SHA1 Ciphers** field (**Administration** > **System** > **Settings** > **Security Settings**).




---

**Note** This does not apply to the Admin portal. When running in Federal Information Processing Standard Mode (FIPS), an upgrade does not remove SHA1 ciphers from the Admin portal.

---

Cisco ISE supports TLS versions 1.0, 1.1, and 1.2.

Cisco ISE supports RSA and ECDSA server certificates. The following elliptic curves are supported:

- secp256r1
- secp384r1
- secp521r1




---

**Note** Cisco ISE does not support intermediate certificates having SHA256withECDSA signature algorithm for any of the elliptical curves due to the limitations in the current implementation of OpenJDK 1.8.

---

The following table lists the supported Cipher Suites:

| Cipher Suite                  | When Cisco ISE is configured as an EAP server<br>When Cisco ISE is configured as a RADIUS DTLS server   | When Cisco ISE downloads CRL from HTTPS or a secure LDAP server<br>When Cisco ISE is configured as a secure syslog client or a secure LDAP client<br>When Cisco ISE is configured as a RADIUS DTLS client for CoA |
|-------------------------------|---|---|
| TLS 1.0 support               | When TLS 1.0 is allowed<br>(DTLS server supports only DTLS 1.2)<br><br>Allow TLS 1.0 option is disabled by default in Cisco ISE 2.3 and above. TLS 1.0 is not supported for TLS based EAP authentication methods (EAP-TLS, EAP-FAST/TLS) and 802.1X supplicants when this option is disabled. If you want to use the TLS based EAP authentication methods in TLS 1.0, check the Allow TLS 1.0 check box in the <b>Security Settings</b> window. In the Cisco ISE GUI, click the <b>Menu</b> icon (☰) and choose <b>Administration &gt; System &gt; Settings &gt; Protocols &gt; Security Settings</b> . | When TLS 1.0 is allowed<br>(DTLS client supports only DTLS 1.2)   |
| TLS 1.1 support               | When TLS 1.1 is allowed   | When TLS 1.1 is allowed   |
| ECC DSA ciphers               |   |   |
| ECDHE-ECDSA-AES256-GCM-SHA384 | Yes   | Yes   |
| ECDHE-ECDSA-AES128-GCM-SHA256 | Yes   | Yes   |
| ECDHE-ECDSA-AES256-SHA384     | Yes   | Yes   |
| ECDHE-ECDSA-AES128-SHA256     | Yes   | Yes   |
| ECDHE-ECDSA-AES256-SHA        | When SHA-1 is allowed   | When SHA-1 is allowed   |
| ECDHE-ECDSA-AES128-SHA        | When SHA-1 is allowed   | When SHA-1 is allowed   |
| ECC RSA ciphers               |   |   |
| ECDHE-RSA-AES256-GCM-SHA384   | When ECDHE-RSA is allowed   | When ECDHE-RSA is allowed   |
| ECDHE-RSA-AES128-GCM-SHA256   | When ECDHE-RSA is allowed   | When ECDHE-RSA is allowed   |
| ECDHE-RSA-AES256-SHA384       | When ECDHE-RSA is allowed   | When ECDHE-RSA is allowed   |
| ECDHE-RSA-AES128-SHA256       | When ECDHE-RSA is allowed   | When ECDHE-RSA is allowed   |

|  |   |                                     |
|--|---|-------------------------------------|
| ECDHE-RSA-AES256-SHA                                     | When ECDHE-RSA/SHA-1 is allowed   | When ECDHE-RSA/SHA-1 is allowed     |
| ECDHE-RSA-AES128-SHA                                     | When ECDHE-RSA/SHA-1 is allowed   | When ECDHE-RSA/SHA-1 is allowed     |
| DHE RSA ciphers  |   |                                     |
| DHE-RSA-AES256-SHA256                                    | No  | Yes                                 |
| DHE-RSA-AES128-SHA256                                    | No  | Yes                                 |
| DHE-RSA-AES256-SHA                                       | No  | When SHA-1 is allowed               |
| DHE-RSA-AES128-SHA                                       | No  | When SHA-1 is allowed               |
| RSA ciphers  |   |                                     |
| AES256-SHA256  | Yes   | Yes                                 |
| AES128-SHA256  | Yes   | Yes                                 |
| AES256-SHA   | When SHA-1 is allowed   | When SHA-1 is allowed               |
| AES128-SHA   | When SHA-1 is allowed   | When SHA-1 is allowed               |
| 3DES ciphers   |   |                                     |
| DES-CBC3-SHA   | When 3DES/SHA-1 is allowed  | When 3DES/DSS and SHA-1 are enabled |
| DSS ciphers  |   |                                     |
| DHE-DSS-AES256-SHA                                       | No  | When 3DES/DSS and SHA-1 are enabled |
| DHE-DSS-AES128-SHA                                       | No  | When 3DES/DSS and SHA-1 are enabled |
| EDH-DSS-DES-CBC3-SHA                                     | No  | When 3DES/DSS and SHA-1 are enabled |
| Weak RC4 ciphers   |   |                                     |
| RC4-SHA  | When "Allow weak ciphers" option is enabled in the Allowed Protocols page and when SHA-1 is allowed | No                                  |
| RC4-MD5  | When "Allow weak ciphers" option is enabled in the Allowed Protocols page                           | No                                  |
| EAP-FAST anonymous provisioning only:<br>ADH-AES-128-SHA | Yes   | No                                  |
| Peer certificate restrictions                            |   |                                     |

|                           |  |   |
|---------------------------|--|---|
| Validate KeyUsage         | <p>Client certificate should have KeyUsage=Key Agreement and ExtendedKeyUsage=Client Authentication for the following ciphers:</p> <ul style="list-style-type: none"> <li>• ECDHE-ECDSA-AES128-GCM-SHA256</li> <li>• ECDHE-ECDSA-AES256-GCM-SHA384</li> <li>• ECDHE-ECDSA-AES128-SHA256</li> <li>• ECDHE-ECDSA-AES256-SHA384</li> </ul>  |   |
| Validate ExtendedKeyUsage | <p>Client certificate should have KeyUsage=Key Encipherment and ExtendedKeyUsage=Client Authentication for the following ciphers:</p> <ul style="list-style-type: none"> <li>• AES256-SHA256</li> <li>• AES128-SHA256</li> <li>• AES256-SHA</li> <li>• AES128-SHA</li> <li>• DHE-RSA-AES128-SHA</li> <li>• DHE-RSA-AES256-SHA</li> <li>• DHE-RSA-AES128-SHA256</li> <li>• DHE-RSA-AES256-SHA256</li> <li>• ECDHE-RSA-AES256-GCM-SHA384</li> <li>• ECDHE-RSA-AES128-GCM-SHA256</li> <li>• ECDHE-RSA-AES256-SHA384</li> <li>• ECDHE-RSA-AES128-SHA256</li> <li>• ECDHE-RSA-AES256-SHA</li> <li>• ECDHE-RSA-AES128-SHA</li> <li>• EDH-RSA-DES-CBC3-SHA</li> <li>• DES-CBC3-SHA</li> <li>• RC4-SHA</li> <li>• RC4-MD5</li> </ul> | Server certificate should have ExtendedKeyUsage=Server Authentication |

### Validated OpenSSL Version

Cisco ISE 3.1 is validated with OpenSSL 1.1.1k.

### Validated Client Machine Operating Systems, Supplicants, and Agents

This section lists the validated client machine operating systems, browsers, and agent versions for each client machine type. For all devices, you must also have cookies enabled in the web browser. Cisco AnyConnect-ISE Posture Support Charts are available at: <https://www.cisco.com/c/en/us/support/security/identity-services-engine/products-device-support-tables-list.html>

The following client machine types have been validated for Bring Your Own Device (BYOD) and Posture workflows:

- Apple iOS
- Apple macOS
- Google Android
- Google Chromebook

- Linux
- Microsoft Windows

Cisco ISE 2.7 Patch 8 and above, Cisco ISE 3.0 Patch 7 and above, Cisco ISE 3.1 Patch 5 and above, Cisco ISE 3.2 Patch 1 and above, and Cisco ISE 3.3 and above releases support both AnyConnect and Cisco Secure Client for Windows, macOS, and Linux operating systems.

All standard 802.1X supplicants can be used with Cisco ISE, Release 2.4 and above standard and advanced features as long as they support the standard authentication protocols supported by Cisco ISE. For the VLAN change authorization feature to work in a wireless deployment, the supplicant must support IP address refresh on VLAN change.

Posture and Bring Your Own Device (BYOD) flows are supported by the General Availability releases of the operating systems that are listed in the Cisco ISE UI, based on the latest Posture Feed Update. The Posture and BYOD flows may also work in the Beta macOS releases that are listed in the Cisco ISE UI. For example, if **macOS 12 Beta (all)** is listed in the Cisco ISE UI, Posture and BYOD flows may work on macOS 12 Beta endpoints. Support is provided on a best-effort basis as beta operating system releases often undergo significant changes between the initial and General Availability releases.

Note that when you update your Operating System (OS) to a new version, you may experience a delay (of a few hours or a day) in support and refection of the updated OS version in the Posture Feed Server.

## Apple iOS

This client machine type has been validated for BYOD and posture workflows.

While Apple iOS devices use Protected Extensible Authentication Protocol (PEAP) with Cisco ISE or 802.1x, the public certificate includes a CRL distribution point that the iOS device needs to verify but it cannot do it without network access. Click “confirm/accept” on the iOS device to authenticate to the network.

The following Apple iOS versions have been validated with Cisco ISE:

- Apple iOS 17.x
- Apple iOS 16.x
- Apple iOS 15.x
- Apple iOS 14.x
- Apple iOS 13.x
- Apple iOS 12.x
- Apple iOS 11.x

**Note**

- If you are using Apple iOS 12.2 or later version, you must manually install the downloaded Certificate/Profile. To do this, choose **Settings > General > Profile** in the Apple iOS device and Click **Install**. After the first profile installation, choose **Settings > General > About > Certificate Trust Settings > Enable Full Trust For Root Certificate** for the installed profile.
- If you are using Apple iOS 12.2 or later version, RSA key size must be 2048 bits or higher. Otherwise, you might see an error while installing the BYOD profile.
- If you are using Apple iOS 13 or a later version, regenerate the self-signed certificate for portal role by adding the <<FQDN>> as **DNS Name** in the **SAN** field.
- If you are using Apple iOS 13 or a later version, ensure that **SHA-256** (or greater) is selected as the signature algorithm.

## Apple macOS

This client machine type has been validated for BYOD and posture workflows.

**Table 3: Apple macOS**

| Client Machine Operating System | AnyConnect          |
|---------------------------------|---------------------|
| Apple macOS 14.x                | 4.10.05111 or later |
| Apple macOS 13.x                | 4.10.05111 or later |
| Apple macOS 12.6                | 4.10.05111 or later |
| Apple macOS 12.5                | 4.10.04071 or later |
| Apple macOS 11.6                | 4.9.04043 or later  |
| Apple macOS 10.15               | 4.8.01090 or later  |
| Apple macOS 10.14               | 4.8.01090 or later  |
| Apple macOS 10.13               | 4.8.01090 or later  |

Cisco ISE does work with earlier release of AnyConnect 4.x. However, only newer AnyConnect releases support newer features.

**Note**

For Apple macOS 11, you must use Cisco AnyConnect 4.9.04043 or above and MAC OSX compliance module 4.3.1466.4353 or above.

If you are using Apple macOS 11, you might see a prompt to install the profiles manually when you are installing the Cisco Network Setup Assistant. In this case, you must do the following:

1. Navigate to the Downloads folder.
2. Double-click the cisco802dot1xconfiguration.mobileconfig file.
3. Choose **System > Preferences**.

4. Click **Profiles**.
5. Install the profiles.
6. Click **OK** in the prompt that is displayed in the Cisco Network Setup Assistant to proceed with installation.



---

**Note** The Supplicant Provisioning Wizard bundle for MAC OSX version 3.1.0.1 is common for all Cisco ISE releases. It has been verified with Cisco ISE 2.4 patch 12, Cisco ISE 2.6 patch 8, Cisco ISE 2.7 patch 3, and Cisco ISE 3.0 patch 2.

---

For information about the Windows and MAC OSX anti-malware, patch management, disk encryption, and firewall products that are supported by the Cisco ISE Posture Agent, see the [Cisco AnyConnect-ISE Posture Support Charts](#).



- 
- Note**
- All browsers have capped the reported Apple macOS version to 10.15.7 and increased user privacy.
  - During provisioning we won't be able to identify Apple macOS 11 endpoints. This leads to an issue with CP policy matching in Posture and BYOD flows when client is running Apple macOS 11. As a workaround, proceed with Posture and BYOD flows for Apple macOS 11 as Map CP policy as macOS All.
  - During classification we won't be able to identify Apple macOS 11 endpoints. This leads to an issue with profiling policy matching when client is running Apple macOS 11.
- 

From Cisco ISE Release 3.0, you can use the Agentless Posture feature with all the supported Apple macOS releases. See the topic "Agentless Posture" in the Chapter "Compliance" in the [Cisco ISE Administrators Guide](#) for your Cisco ISE release.

## Google Android

This client machine type has been validated for BYOD and posture workflows.


Cisco ISE may not support certain Android OS version and device combinations due to the open access-nature of Android implementation on certain devices.

The following Google Android versions have been validated with Cisco ISE:

- Google Android 14.x
- Google Android 13.x
- Google Android 12.x
- Google Android 11.x
- Google Android 10.x
- Google Android 9.x
- Google Android 8.x
- Google Android 7.x

Ensure that the Location service is enabled on the Android 9.x and 10.x devices before starting the supplicant provisioning wizard (SPW).



Android no longer uses Common Name (CN). The Hostname must be in the subjectAltName (SAN) extension, or trust fails. If you are using self-signed certificates, regenerate Cisco ISE self-signed certificate by selecting Domain Name or IP Address option from the SAN drop-down list for Portals. To view this window, click the **Menu** icon () and choose **Administration > System > Certificates > System Certificates**.

If you are using Android 9.x, you must update the posture feed in Cisco ISE to get the NSA for Android 9.

## Google Chromebook

This client machine type has been validated for BYOD and posture workflows.

Google Chromebook is a managed device and does not support the Posture service. See the *Cisco Identity Services Engine Administration Guide* for more information.

**Table 4: Google Chromebook**

| Client Machine Operating System | Web Browser                       | Cisco ISE             |
|---------------------------------|-----------------------------------|-----------------------|
| Google Chromebook               | Google Chrome version 49 or later | Cisco ISE 2.4 Patch 8 |

Cisco ISE BYOD or Guest portal may fail to launch in Chrome Operating System 73 even though the URL is redirected successfully. To launch the portals in Chrome Operating System 73, follow the steps below:

1. Generate a new self-signed certificate from ISE GUI by filling the Subject Alternative Name field. Both DNS and IP Address must be filled.
2. Export and copy the certificate to the end client (chrome book).
3. Choose **Settings > Advanced > Privacy and Security > Manage certificates > Authorities**.
4. Import the certificate.
5. Open the browser and try to redirect the portal.

In Chromebook 76 and later, if you are configuring EAP-TLS settings using an internal CA for EAP, upload the CA certificate chain with SAN fields to the Google Admin Console **Device Management > Network > Certificates**. Once the CA chain is uploaded, the Cisco ISE generated certificate with SAN fields is mapped under **Chromebook Authorities** section to consider your Cisco ISE certificate as trusted.

If you are using a third-party CA, you do not have to import CA chain to Google Admin Console. Choose **Settings > Advanced > Privacy and Security > Manage certificates > Server certificate Authority** and select **Use any default Certificate Authority** from the drop-down list.

## Linux

This client machine type has been validated for BYOD and posture workflows.

**Table 5: Linux**

| Client Machine Operating System | Cisco AnyConnect |
|---------------------------------|------------------|
|                                 |                  |

|  |   |
|--|---|
| <b>Red Hat Enterprise Linux (RHEL)</b>     | Cisco AnyConnect Release 4.10 MR2[4.10.02086] and later |
| RHEL 7.5 and later                         |   |
| RHEL 8.1 and later                         |   |
| RHEL 9.x                                   |   |
| <b>SUSE Linux Enterprise Server (SLES)</b> |   |
| SLES 12.3 and later                        |   |
| SLES 15.x                                  |   |
| <b>Ubuntu</b>                              |   |
| Ubuntu 18.04                               |   |
| Ubuntu 20.04                               |   |
| Ubuntu 22.04                               |   |
| Ubuntu 23.04                               |   |

## Microsoft Windows


**Table 6: Microsoft Windows**

| Client Machine Operating System  | Suplicants (802.1X)  | Cisco Temporal Agent | AnyConnect <sup>2</sup> |
|--|--|----------------------|-------------------------|
| <b>Microsoft Windows 11</b>  |  |                      |                         |
| <ul style="list-style-type: none"> <li>• Windows 23H2</li> <li>• Windows 22H2</li> <li>• Windows 11 Enterprise</li> <li>• Windows 11 Pro</li> <li>• Windows 11 Education</li> <li>• Windows 11 Home</li> </ul> | <ul style="list-style-type: none"> <li>• Microsoft Windows 802.1x Client</li> <li>• AnyConnect Network Access Manager</li> </ul> | 4.10.04065 or later  | 4.10.04065 or later     |
| <b>Microsoft Windows 10</b>  |  |                      |                         |

| Client Machine Operating System  | Supplicants (802.1X)  | Cisco Temporal Agent | AnyConnect <sup>2</sup> |
|--|---|----------------------|-------------------------|
| <ul style="list-style-type: none"> <li>• Windows 22H2</li> <li>• Windows 21H2</li> <li>• Windows 21H1</li> <li>• Windows 20H2</li> <li>• Windows 20H1</li> <li>• Windows 19H2</li> <li>• Windows 19H1</li> <li>• Windows 10 Enterprise</li> <li>• Windows 10 Enterprise N</li> <li>• Windows 10 Enterprise E</li> <li>• Windows 10 Enterprise LTSB</li> <li>• Windows 10 Enterprise N LTSB</li> <li>• Windows 10 Pro</li> <li>• Windows 10 Pro N</li> <li>• Windows 10 Pro E</li> <li>• Windows 10 Education</li> <li>• Windows 10 Home</li> <li>• Windows 10 Home Chinese</li> <li>• Windows 10.0 SLP (Single Language Pack)</li> </ul> | <ul style="list-style-type: none"> <li>• Microsoft Windows 10 802.1X Client</li> <li>• AnyConnect Network Access Manager</li> </ul> | 4.5 or later         | 4.8.01090 or later      |

<sup>2</sup> If you have AnyConnect Network Access Manager (NAM) installed, NAM takes precedence over Windows native supplicant as the 802.1X supplicant and it does not support the BYOD flow. You must disable NAM completely or on a specific interface. See the Cisco AnyConnect Secure Mobility Client Administration Guide for more information.

To enable wireless redirection in Firefox 70 for BYOD, Guest, and Client Provisioning portals:

1. In the Cisco ISE GUI, click the **Menu** icon () and choose **Administration > System > Settings > Security Settings**.
2. Check the **Allow SHA1 ciphers** check box. SHA1 ciphers are disabled by default.
3. In your Firefox browser, choose **Options > Privacy & Settings > View Certificates > Servers > Add Exception**.
4. Add `https://<FQDN>:8443/` as exception.
5. Click **Add Certificate** and then refresh your Firefox browser.

From Cisco ISE Release 3.0, you can use the Agentless Posture feature with all the supported Microsoft releases. See the topic "Agentless Posture" in the Chapter "Compliance" in the *Cisco ISE Administrators Guide* for your Cisco ISE release.

## Validated Operating Systems and Browsers for Sponsor, Guest, and My Devices Portals

These Cisco ISE portals support the following operating system and browser combinations. These portals require that you have cookies enabled in your web browser.

**Table 7: Validated Operating Systems and Browsers**

| Supported Operating System <sup>3</sup>                                 | Browser Versions  |
|---|---|
| Google Android <sup>4</sup> 14.x, 13.x, 12.x, 11.x, 10.x, 9.x, 8.x, 7.x | <ul style="list-style-type: none"> <li>• Native browser</li> <li>• Mozilla Firefox</li> <li>• Google Chrome</li> </ul>    |
| Apple iOS 17.x, 16.x, 15.x, 14.x, 13.x, 12.x, 11.x                      | <ul style="list-style-type: none"> <li>• Safari</li> </ul>  |
| Apple macOS 14.x, 13, 12.6, 12.5, 11.6, 10.15, 10.14, 10.13             | <ul style="list-style-type: none"> <li>• Mozilla Firefox</li> <li>• Safari</li> <li>• Google Chrome</li> </ul>            |
| Microsoft Windows 10  | <ul style="list-style-type: none"> <li>• Microsoft IE 11.x</li> <li>• Mozilla Firefox</li> <li>• Google Chrome</li> </ul> |


<sup>3</sup> The latest two officially-released browser versions are supported for all operating systems except Microsoft Windows; refer to Table 14 for the supported Internet Explorer versions.

<sup>4</sup> Cisco ISE may not support certain Android OS version and device combinations due to the open access-nature of Android implementation on certain devices.

## Validated Devices for On-Boarding and Certificate Provisioning

Cisco Wireless LAN Controller (WLC) 7.2 or later support is required for the BYOD feature. See the [Release Notes for the Cisco Identity Services Engine](#) for any known issues or caveats.



- 
- Note** To get the latest Cisco-supported client Operating System versions, check the posture update information. To do this:
1. In the Cisco ISE GUI, click the **Menu** icon () and choose **Administration > System > Settings > Posture > Updates**.
  2. Click **Update Now**.
-

**Table 8: BYOD On-Boarding and Certificate Provisioning - Validated Devices and Operating Systems**

| Device  | Operating System  | Single SSID      | Dual SSID (open > PEAP (no cert) or open > TLS) | Onboard Method                             |
|---|---|------------------|---|--|
| Apple iDevice                                     | Apple iOS 17.x, 16.x, 15.x, 14.x, 13.x, 12.x, 11.x<br>Apple iPad OS 13.x                                | Yes              | Yes <sup>5</sup>                                | Apple profile configurations (native)      |
| Google Android                                    | 14.x, 13.x, 12.x, 11.x, 10.x, 9.x, 8.x, 7.x   | Yes <sup>6</sup> | Yes   | Cisco Network Setup Assistant <sup>7</sup> |
| Barnes & Noble Nook (Android) HD/HD+ <sup>8</sup> | —   | —                | —   | —  |
| Windows   | Windows 10<br>Microsoft Windows 10 Version 2004 (OS build 19041.1) and higher is required for EAP TEAP. | Yes <sup>9</sup> | Yes   | 2.2.1.53 or later                          |
| Windows   | Mobile 8, Mobile RT, Surface 8, and Surface RT  | No               | No  | —  |
| Apple macOS                                       | Apple macOS 14.x, 13, 12.6, 12.5, 11.6, 10.15, 10.14, 10.13   | Yes              | Yes   | 2.2.1.43 or later                          |

<sup>5</sup> Connect to secure SSID after provisioning.

<sup>6</sup> You cannot modify the system-created SSIDs using the Cisco supplicant provisioning wizard (SPW), if you are using Android version 6.0 or above. When the SPW prompts you to forget the network, you must choose this option and press the Back button to continue the provisioning flow.

<sup>7</sup> You must use Native Supplicant Protocol 3.1.7 for Android 11 and earlier versions. You must use Native Supplicant Protocol 3.1.9 for Android 12 and later versions.

<sup>8</sup> Barnes & Noble Nook (Android) works when it has Google Play Store 2.1.0 installed.

<sup>9</sup> While configuring the wireless properties for the connection (**Security > Auth Method > Settings > Validate Server Certificate**), uncheck the valid server certificate option. If you check this option, ensure that you select the correct root certificate.

## Validated Security Product Integrations (over pxGrid)

**Table 9: Validated Security Product Integrations (over pxGrid)**

| Product                           | Cisco ISE 3.1   | Cisco ISE 3.0 | Cisco ISE 2.7   | Cisco ISE 2.6  |
|-----------------------------------|---|---------------|---|--|
| Cisco Firepower Management Center | <p>Firepower Threat Defense with Cisco Firepower Management Center 7.0.1</p> <p>Firepower Threat Defense with Firepower Device Management 7.0.1</p> <p>Firepower Threat Defense with Cisco Firepower Management Center 7.1</p> <p>Firepower Threat Defense with Firepower Device Management 7.1</p> <p>Firepower Threat Defense with Cisco Firepower Management Center 7.2</p> <p>Firepower Threat Defense with Firepower Device Management 7.2</p> |               | <p>Firepower Threat Defense with Cisco Firepower Management Center 6.6.7</p> <p>Firepower Threat Defense with Firepower Device Management 6.6.7</p> <p>Firepower Threat Defense with Cisco Firepower Management Center 7.0</p> <p>Firepower Threat Defense with Firepower Device Management 7.0</p> | <p>Firepower Threat Defense with Cisco Firepower Management Center 6.4</p> |

| Product | Cisco ISE 3.1 | Cisco ISE 3.0  | Cisco ISE 2.7 | Cisco ISE 2.6 |
|---------|---------------|--|---------------|---------------|
|         |               | <p>Firepower Threat Defense with Cisco Firepower Management Center 6.6.5</p> <p>Firepower Threat Defense with Firepower Device Management 6.6.5</p> <p>Firepower Threat Defense with Cisco Firepower Management Center 6.6.7</p> <p>Firepower Threat Defense with Firepower Device Management 6.6.7</p> <p>Firepower Threat Defense with Cisco Firepower Management Center 7.0</p> <p>Firepower Threat Defense with Firepower Device Management 7.0</p> <p>Firepower Threat Defense with Cisco Firepower Management Center 7.0.1</p> <p>Firepower Threat Defense with Firepower Device Management 7.0.1</p> <p>Firepower Threat Defense with Cisco Firepower Management Center 7.0.2</p> <p>Firepower Threat Defense with Firepower Device Management 7.0.2</p> <p>Firepower Threat Defense with Cisco Firepower Management Center 7.1</p> <p>Firepower Threat</p> |               |               |

| Product                       | Cisco ISE 3.1  | Cisco ISE 3.0  | Cisco ISE 2.7  | Cisco ISE 2.6                     |
|-------------------------------|--|--|--|-----------------------------------|
|                               |  | Defense with Firepower Device Management 7.1<br>Firepower Threat Defense with Cisco Firepower Management Center 7.2<br>Firepower Threat Defense with Firepower Device Management 7.2   |  |                                   |
| Cisco Stealthwatch Management | —  | Cisco Stealthwatch Management 7.3.1<br>Cisco Stealthwatch Management 7.3.2<br>Cisco Stealthwatch Management 7.4  | Cisco Stealthwatch Management 7.3.0<br>Cisco Stealthwatch Management 7.3.1<br>Cisco Stealthwatch Management 7.3.2<br>Cisco Stealthwatch Management 7.4   | Cisco Stealthwatch Management 6.9 |
| Cisco Web Security Appliance  | Cisco Web Security Appliance 11.5.1<br>Cisco Web Security Appliance 12.5.4<br>Cisco Web Security Appliance 14.0.2<br>Cisco Web Security Appliance 14.5.0 | Cisco Web Security Appliance 11.5.1<br>Cisco Web Security Appliance 12.0.5<br>Cisco Web Security Appliance 12.5.3<br>Cisco Web Security Appliance 12.5.4<br>Cisco Web Security Appliance 14.0.2<br>Cisco Web Security Appliance 14.5.0 | Cisco Web Security Appliance 11.5.1<br>Cisco Web Security Appliance 11.8.3<br>Cisco Web Security Appliance 12.0.3<br>Cisco Web Security Appliance 12.5.3<br>Cisco Web Security Appliance 12.5.4<br>Cisco Web Security Appliance 14.0.0<br>Cisco Web Security Appliance 14.0.2<br>Cisco Web Security Appliance 14.5.0 | —                                 |



**Note** From Cisco ISE Release 3.1, all pxGrid connections must be based on pxGrid 2.0. pxGrid 1.0-based (XMPP-based) integrations will cease to work on Cisco ISE from Release 3.1 onwards.

pxGrid Version 2.0, which is based on WebSockets, was introduced in Cisco ISE Release 2.4. We recommend that you plan and upgrade your other systems to pxGrid 2.0-compliant versions in order to prevent potential disruptions, if any, to integrations.



## Validated Cisco Digital Network Architecture Center Release

Cisco ISE can integrate with Cisco DNA Center. For information about configuring Cisco ISE to work with Cisco DNA Center, see the [Cisco DNA Center documentation](#).

For information about Cisco ISE compatibility with Cisco DNA Center, see [Cisco SD-Access Compatibility Matrix](#).

## Validated Cisco Prime Infrastructure Release

Cisco Prime Infrastructure, Release 3.6 or above can be integrated with Cisco ISE 2.6 or above to leverage the monitoring and reporting capabilities of Cisco ISE.

## Validated Cisco Firepower Management Center Release

Cisco Firepower Management Center, Release 6.4 or above can be integrated with Cisco ISE 2.6 or above.

## Validated Cisco Stealthwatch Management Release

Cisco Stealthwatch Management, Release 6.9 or above can be integrated with Cisco ISE 2.6 or above.

## Validated Cisco WAN Service Administrator Release

Cisco WAN Service Administrator, Release 11.5.1 or above can be integrated with Cisco ISE 2.7 or above.

## Support for Threat Centric NAC

Cisco ISE is validated with the following adapters:

- SourceFire FireAMP
- Cognitive Threat Analytics (CTA) adapter
- Rapid7 Nexpose
- Tenable Security Center
- Qualys (Only the Qualys Enterprise Edition is currently supported for TC-NAC flows)

## Additional References

The following link contains additional resources that you can use when working with Cisco ISE:

[https://www.cisco.com/c/en/us/td/docs/security/ise/end-user-documentation/Cisco\\_ISE\\_End\\_User\\_Documentation.html](https://www.cisco.com/c/en/us/td/docs/security/ise/end-user-documentation/Cisco_ISE_End_User_Documentation.html)

## Communications, Services, and Additional Information

- To receive timely, relevant information from Cisco, sign up at [Cisco Profile Manager](#).
- To get the business impact you're looking for with the technologies that matter, visit [Cisco Services](#).
- To submit a service request, visit [Cisco Support](#).
- To discover and browse secure, validated enterprise-class apps, products, solutions, and services, visit [Cisco DevNet](#).
- To obtain general networking, training, and certification titles, visit [Cisco Press](#).
- To find warranty information for a specific product or product family, access [Cisco Warranty Finder](#).

### Cisco Bug Search Tool

[Cisco Bug Search Tool](#) (BST) is a gateway to the Cisco bug-tracking system, which maintains a comprehensive list of defects and vulnerabilities in Cisco products and software. The BST provides you with detailed defect information about your products and software.

### Documentation Feedback

To provide feedback about Cisco technical documentation, use the feedback form available in the right pane of every online document.

THE SPECIFICATIONS AND INFORMATION REGARDING THE PRODUCTS IN THIS MANUAL ARE SUBJECT TO CHANGE WITHOUT NOTICE. ALL STATEMENTS, INFORMATION, AND RECOMMENDATIONS IN THIS MANUAL ARE BELIEVED TO BE ACCURATE BUT ARE PRESENTED WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED. USERS MUST TAKE FULL RESPONSIBILITY FOR THEIR APPLICATION OF ANY PRODUCTS.

THE SOFTWARE LICENSE AND LIMITED WARRANTY FOR THE ACCOMPANYING PRODUCT ARE SET FORTH IN THE INFORMATION PACKET THAT SHIPPED WITH THE PRODUCT AND ARE INCORPORATED HEREIN BY THIS REFERENCE. IF YOU ARE UNABLE TO LOCATE THE SOFTWARE LICENSE OR LIMITED WARRANTY, CONTACT YOUR CISCO REPRESENTATIVE FOR A COPY.

The Cisco implementation of TCP header compression is an adaptation of a program developed by the University of California, Berkeley (UCB) as part of UCB's public domain version of the UNIX operating system. All rights reserved. Copyright © 1981, Regents of the University of California.

NOTWITHSTANDING ANY OTHER WARRANTY HEREIN, ALL DOCUMENT FILES AND SOFTWARE OF THESE SUPPLIERS ARE PROVIDED "AS IS" WITH ALL FAULTS. CISCO AND THE ABOVE-NAMED SUPPLIERS DISCLAIM ALL WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, WITHOUT LIMITATION, THOSE OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NON-INFRINGEMENT OR ARISING FROM A COURSE OF DEALING, USAGE, OR TRADE PRACTICE.

IN NO EVENT SHALL CISCO OR ITS SUPPLIERS BE LIABLE FOR ANY INDIRECT, SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES, INCLUDING, WITHOUT LIMITATION, LOST PROFITS OR LOSS OR DAMAGE TO DATA ARISING OUT OF THE USE OR INABILITY TO USE THIS MANUAL, EVEN IF CISCO OR ITS SUPPLIERS HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

Any Internet Protocol (IP) addresses and phone numbers used in this document are not intended to be actual addresses and phone numbers. Any examples, command display output, network topology diagrams, and other figures included in the document are shown for illustrative purposes only. Any use of actual IP addresses or phone numbers in illustrative content is unintentional and coincidental.

All printed copies and duplicate soft copies of this document are considered uncontrolled. See the current online version for the latest version.

Cisco has more than 200 offices worldwide. Addresses and phone numbers are listed on the Cisco website at [www.cisco.com/go/offices](http://www.cisco.com/go/offices).

Cisco and the Cisco logo are trademarks or registered trademarks of Cisco and/or its affiliates in the U.S. and other countries. To view a list of Cisco trademarks, go to this URL: <https://www.cisco.com/c/en/us/about/legal/trademarks.html>. Third-party trademarks mentioned are the property of their respective owners. The use of the word partner does not imply a partnership relationship between Cisco and any other company. (1721R)

© 2021 Cisco Systems, Inc. All rights reserved.



**Americas Headquarters**  
Cisco Systems, Inc.  
San Jose, CA 95134-1706  
USA

**Asia Pacific Headquarters**  
CiscoSystems(USA)Pte.Ltd.  
Singapore

**Europe Headquarters**  
CiscoSystemsInternationalBV  
Amsterdam,TheNetherlands

Cisco has more than 200 offices worldwide. Addresses, phone numbers, and fax numbers are listed on the Cisco Website at [www.cisco.com/go/offices](http://www.cisco.com/go/offices).