X.509v3 Certificates for SSH Authentication

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The X.509v3 Certificates for secure shell (SSH) Authentication feature uses the X.509v3 digital certificates in server and user authentication at the SSH server side.

Prerequisites for Digital Certificates for SSH Authentication

The Digital Certificates for SSH Authentication feature introduces the **ip ssh server algorithm authentication** command to replace the **ip ssh server authenticate user** command. If you use the **ip ssh server authenticate user** command, the following deprecation message is displayed.

```
Warning: SSH command accepted but this CLI will be deprecated soon. Please move to new CLI
 "ip ssh server algorithm authentication". Please configure "default ip ssh server
authenticate user" to make CLI ineffective.
```

Use the **default ip ssh server authenticate user** command to remove the **ip ssh server authenticate user** command from effect. The IOS secure shell (SSH) server then starts using the **ip ssh server algorithm authentication** command.

Restrictions for X.509v3 Certificates for SSH Authentication

The following restrictions are applicable for X.509v3 Certificate for SSH Authentication:

- The X.509v3 Certificates for SSH Authentication feature implementation is applicable only on the IOS secure shell (SSH) server side.
- IOS SSH server supports only the x509v3-ssh-rsa algorithm based certificate for server and user authentication on the IOS SSH server side.

The X.509v3 Certificate for SSH Authentication fails in the following conditions:

- When root certification authority is configured as a trustpoint on the device.
- When a client passes a certificate chain that leads to a self-signed root certificate authority that includes a client certificate, sub-ca certificate, and self-signed root certificate authority.
- When a sub-ca certification is configured as a trustpoint on the device but not included as a trustpoint on the user certificate.

Information About X.509v3 Certificates for SSH Authentication

The following section provides information about digital certificates, and server and user authentication.

Digital Certificates

The validity of the authentication depends upon the strength of the linkage between the public signing key and the identity of the signer. Digital certificates in the X.509v3 format (RFC5280) are used to provide identity management. A chain of signatures by a trusted root certification authority and its intermediate certificate authorities binds a given public signing key to a given digital identity.

Public key infrastructure (PKI) trustpoint helps manage the digital certificates. The association between the certificate and the trustpoint helps track the certificate. The trustpoint contains information about the certificate authority (CA), different identity parameters, and the digital certificate. Multiple trustpoints can be created to associate with different certificates.

Server and User Authentication using X.509v3

For server authentication, the IOS secure shell (SSH) server sends its own certificate to the SSH client for verification. This server certificate is associated with the trustpoint configured in the server certificate profile (ssh-server-cert-profile-server configuration mode).

For user authentication, the SSH client sends the user's certificate to the IOS SSH server for verification. The SSH server validates the incoming user certificate using public key infrastructure (PKI) trustpoints configured in the server certificate profile (ssh-server-cert-profile-user configuration mode).

By default, certificate-based authentication is enabled for server and user at the IOS SSH server end.

How to Configure X.509v3 Certificates for SSH Authentication

The following section provides information about how to configure X.509v3 Certificates for SSH Authentication.

Configuring IOS SSH Server to Use Digital Certificates for Sever Authentication

The following section provides information about Configuring IOS SSH Server to Use Digital Certificates for Sever Authentication.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**ip ssh server algorithm hostkey** {**x509v3-ssh-rsa** [**ssh-rsa**] | **ssh-rsa** [**x509v3-ssh-rsa**]} **Example:** `Device(config)# ip ssh server algorithm hostkey x509v3-ssh-rsa`	Defines the order of host key algorithms. Only the configured algorithm is negotiated with the secure shell (SSH) client. **Note** The IOS SSH server must have at least one configured host key algorithm: • ssh-rsa – public key based authentication • x509v3-ssh-rsa – certificate-based authentication
Step 4	**ip ssh server certificate profile** **Example:** `Device(config)# ip ssh server certificate profile`	Configures server certificate profile and user certificate profile and enters SSH certificate profile configuration mode.
Step 5	**server** **Example:** `Device(ssh-server-cert-profile)# server`	Configures server certificate profile and enters SSH server certificate profile server configuration mode.
Step 6	**trustpoint sign** *PKI-trustpoint-name* **Example:** `Device(ssh-server-cert-profile-server)# trustpoint sign trust1`	Attaches the public key infrastructure (PKI) trustpoint to the server certificate profile. The SSH server uses the certificate associated with this PKI trustpoint for server authentication.
Step 7	**ocsp-response include** **Example:** `Device(ssh-server-cert-profile-server)# ocsp-response include`	(Optional) Sends the Online Certificate Status Protocol (OCSP) response or OCSP stapling along with the server certificate. **Note** By default the “no” form of this command is configured and no OCSP response is sent along with the server certificate.

	Command or Action	Purpose
Step 8	**end** **Example:** `Device(ssh-server-cert-profile-server)# end`	Exits SSH server certificate profile server configuration mode and enters privileged EXEC mode.

Configuring IOS SSH Server to Verify User's Digital Certificate for User Authentication

The following section provides information about configuring IOS SSH Server to Verify User's Digital Certificate for User Authentication.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**ip ssh server algorithm authentication** {**publickey** | **keyboard** | **password**} **Example:** `Device(config)# ip ssh server algorithm authentication publickey`	Defines the order of user authentication algorithms. Only the configured algorithm is negotiated with the secure shell (SSH) client. **Note** • The IOS SSH server must have at least one configured user authentication algorithm. • To use the certificate method for user authentication, the **publickey** keyword must be configured. • The **ip ssh server algorithm authentication** command replaces the **ip ssh server authenticate user** command.
Step 4	**ip ssh server algorithm publickey** {**x509v3-ssh-rsa** [**ssh-rsa**] | **ssh-rsa** [**x509v3-ssh-rsa**]}	Defines the order of public key algorithms. Only the configured algorithm is accepted by the SSH client for user authentication.

	Command or Action	Purpose
	Example: `Device(config)# ip ssh server algorithm publickey x509v3-ssh-rsa`	**Note** The IOS SSH client must have at least one configured public key algorithm: • ssh-rsa – public-key-based authentication • x509v3-ssh-rsa – certificate-based authentication
Step 5	**ip ssh server certificate profile** **Example:** `Device(config)#ip ssh server certificate profile`	Configures server certificate profile and user certificate profile and enters SSH certificate profile configuration mode.
Step 6	**user** **Example:** `Device(ssh-server-cert-profile)# user`	Configures user certificate profile and enters SSH server certificate profile user configuration mode.
Step 7	**trustpoint verify** *PKI-trustpoint-name* **Example:** `Device(ssh-server-cert-profile-user)#trustpoint verify trust2`	Configures the public key infrastructure (PKI) trustpoint that is used to verify the incoming user certificate. **Note** Configure multiple trustpoints by executing the same command multiple times. A maximum of 10 trustpoints can be configured.
Step 8	**ocsp-response required** **Example:** `Device(ssh-server-cert-profile-user)# ocsp-response required`	(Optional) Mandates the presence of the Online Certificate Status Protocol (OCSP) response with the incoming user certificate. **Note** By default the "no" form of this command is configured and the user certificate is accepted without an OCSP response.
Step 9	**end** **Example:** `Device(ssh-server-cert-profile-user)#end`	Exits SSH server certificate profile user configuration mode and enters privileged EXEC mode.

Verifying Configuration for Server and User Authentication Using Digital Certificates

The following section provides information about verifying configuration for Server and User Authentication Using Digital Certificates.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.

Step 2	**show ip ssh**
	Example:
	`Device# show ip ssh`
	`SSH Enabled - version 1.99`
	`Authentication methods:publickey,keyboard-interactive,password`
	`Authentication Publickey Algorithms:x509v3-ssh-rsa,ssh-rsa`
	`Hostkey Algorithms:x509v3-ssh-rsa,ssh-rsa`
	`Authentication timeout: 120 secs;`
	`Authentication retries: 3`
	`Minimum expected Diffie Hellman key size : 1024 bits`
		Displays the currently configured authentication methods. To confirm the use of certificate-based authentication, ensure that the x509v3-ssh-rsa algorithm is the configured host key algorithm.

Configuration Examples for X.509v3 Certificates for SSH Authentication

The following section provides examples for user and server authentication using digital certificates.

Example: Configuring IOS SSH Server to Use Digital Certificates for Server Authentication

This example shows how to configure IOS SSH Server to Use Digital Certificates for Server Authentication.

```
Device> enable
Device# configure terminal
Device(config)# ip ssh server algorithm hostkey x509v3-ssh-rsa
Device(config)# ip ssh server certificate profile
```

```
Device(ssh-server-cert-profile)# server
Device(ssh-server-cert-profile-server)# trustpoint sign trust1
Device(ssh-server-cert-profile-server)# exit
```

Example: Configuring IOS SSH Server to Verify User's Digital Certificate for User Authentication

This example shows how to configure IOS SSH Server to Verify User's Digital Certificate for User Authentication.

```
Device> enable
Device# configure terminal
Device(config)# ip ssh server algorithm authentication publickey
Device(config)# ip ssh server algorithm publickey x509v3-ssh-rsa
Device(config)# ip ssh server certificate profile
Device(ssh-server-cert-profile)# user
Device(ssh-server-cert-profile-user)# trustpoint verify trust2
Device(ssh-server-cert-profile-user)# end
```

Additional References for X.509v3 Certificates for SSH Authentication

Related Documents

Related Topic	Document Title
Security commands	• Cisco IOS Security Command Reference: Commands A to C • Cisco IOS Security Command Reference: Commands D to L • Cisco IOS Security Command Reference: Commands M to R • Cisco IOS Security Command Reference: Commands S to Z
SSH authentication	"Secure Shell-Configuring User Authentication Methods" chapter in *Secure Shell Configuration Guide*
Public key infrastructure (PKI) trustpoint	"Configuring and Managing a Cisco IOS Certificate Server for PKI Deployment" chapter in *Public Key Infrastructure Configuration Guide*

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for X.509v3 Certificates for SSH Authentication

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 1: Feature Information for X.509v3 Certificates for SSH Authentication

Feature Information	Release	Modification
X.509v3 Certificates for SSH Authentication	Cisco IOS XE Denali 16.1.x	The X.509v3 Certificates for SSH Authentication feature uses the X.509v3 digital certificates in server and user authentication at the secure shell (SSH) server side