Zero-Touch Provisioning

To address network provisioning challenges, Cisco introduces a zero-touch provisioning model. This module describes the Zero-Touch Provisioning feature.

Note The Zero-Touch Provisioning feature is enabled automatically; no configuration is required.

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Restrictions for Zero-Touch Provisioning

- Zero-touch provisioning is not supported on Cisco Catalyst 9200L SKUs.
- In the Cisco Catalyst 9800-L Wireless Controller, if both the service port as well as one of the data ports are enabled and connected, the AutoInstall feature will use the service port by default.
- The Cisco Catalyst 9800-L Wireless Controller does not support virtual port group (VPG) and Network Address Translation (NAT). Hence, applications or scripts cannot communicate from the Guest Shell to the network through data port. On the Cisco Catalyst 9800-L Wireless Controller, the ZTP scripts downloaded through the data port or the service port will not be able to communicate externally.

  Guestshell is a virtualized Linux-based environment, designed to run custom Linux applications, including Python for automated control and management of Cisco devices. It also includes the automated provisioning (day zero-provisioning) of systems.

Information About Zero-Touch Provisioning

This section provides information about the DHCP server configuration, DHCPv6 support, Secure ZTP, bootstrapping information, and so on.

Zero-Touch Provisioning Overview

Zero-touch provisioning (ZTP) provides open bootstrap interfaces to automate network device provisioning in heterogeneous network environments.

When a device that supports ZTP starts up, and does not find the startup configuration (during initial installation), the device enters the zero-touch provisioning mode. The device searches for a DHCP server, bootstraps itself with its interface IP address, gateway, and Domain Name System (DNS) server IP address, and enables Guest Shell. The device then obtains the IP address or URL of an HTTP or a TFTP server, and downloads the Python script from an HTTP or a TFTP server to configure the device.

Guest Shell provides the environment for the Python script to run. Guest Shell runs the downloaded Python script and applies an initial configuration to the device.

After initial provisioning is complete, Guest Shell remains enabled. For more information, see the Guest Shell chapter.

Note If ZTP fails, the device falls back on AutoInstall to load the configuration file. For more information, see Using AutoInstall and Setup.

DHCP Server Configuration for Zero-Touch Provisioning

In ZTP, a DHCP server must be running on the same network as the new device that is being provisioned. ZTP is supported on both management ports and in-band ports.

When the new device is switched on, it retrieves the IP address information of the HTTP or TFTP server where the Python script resides, and the folder path of the Python script from the DHCP server. For more information on Python Scripts, see the *Python API* and *Python CLI Module* chapters.

The DHCP server responds to DHCP discovery events with the following options:

- Option 150: (Optional) Contains a list of IP addresses that point to the HTTP or TFTP server in the management network that hosts the Python scripts to be run.
- Option 67: Contains the Python script file path in the HTTP/TFTP server.

After receiving these DHCP options, the device connects to the HTTP or TFTP server, and downloads the Python script. At this point, because the device does not have a route to reach the HTTP or TFTP server, it uses the default route provided by the DHCP server.

DHCPv6 Support

In Cisco IOS XE Fuji 16.9.1, DHCP Version 6 support is added to the Zero-Touch Provisioning feature. DHCPv6 is enabled by default, and will work on any device that boots without a startup configuration.

Note DHCPv6 is only supported on Catalyst 9300 and 9500 Series Switches.

DHCPv6 is supported by both TFTP and HTTP download of Python scripts. If this download fails, the device reverts to the initial or factory settings (without any configuration). For both DHCPv4 and DHCPv6 to work, the correct HTTP or TFTP file path must be available in the DHCP configuration.

There can be scenarios where the same interface can have both IPv4 and IPv6 addresses, or two different interfaces in a network—one can receive IPv4 traffic and the other, IPv6 traffic. We recommend that you use either the DHCPv4 or DHCPv6 option in your deployment.

The following is a sample DHCPv4: {/etc/dhcp/dhcpd.conf:}

```
host <hostname> {
  hardware ethernet xx:xx:xx:xx:xx:xx;
  option dhcp-client-identifier "xxxxxxxxxxxxxx";
  option host-name "<hostname>".
  option log-servers x.x.x.x;
  fixed-address x.x.x.x;
  if option vendor-class-identifier = "..." {
    option vendor-class-identifier "...";
    if exists user-class and option user-class = "iPXE" {
      filename "http://x.x.x.x/…/<image>";
    } else {
      filename "http://x.x.x.x/…/<script-name>";
    }
  }
}
```

The following is a sample ISC DHCPv6 server configuration:

```
 option dhcp6.bootfile-url  "http://[2001:DB8::21]/sample_day0_script.py";
```

Secure ZTP

As per RFC 8572, Secure ZTP is a technique to securely provision a device, while it is booting in a factory default state. The provisioning updates the boot image, commits an initial configuration, and runs customer-specific scripts.

The existing ZTP can download a configuration script from an HTTP or a TFTP server, and run it on the device, but it does not securely provision a device.

To securely provision a device, the following requirements must be met:

- The management system must validate that it is provisioning a valid device.
- The device must validate that it is being deployed in the correct network.
- The device must validate that the provisioning data has not been tampered with.
- Provisioning must use a secure transport protocol for data communication.

The Secure ZTP feature is enabled by default, and it cannot be disabled. The feature coexists with the classic ZTP. Based on the response that comes from the DHCP server, either ZTP or Secure ZTP is enabled. Option 67 triggers ZTP, and Option 143 or 136 triggers Secure ZTP.

To use Secure ZTP, users must get an ownership voucher from a Cisco Manufacturer Authorized Signing Authority (MASA) server.

Note Secure ZTP supports only Python scripts.

Secure ZTP Workflow

This section describes the Secure ZTP workflow:

1. When a device that supports the Secure ZTP boots up and does not find the startup configuration, it enters the ZTP mode, and triggers the Plug-n-Play (PnP) agent.
2. The PnP agent locates a DHCP server, obtains an IP address from the server, and checks the response for Options 143 (DHCPv4) or 136 (DHCPv6). If either of these options is available, Secure ZTP is started.

Note The DHCP server must already be configured.

3. The device starts a recursive algorithm of iterating over the bootstrapping servers, trying to get valid bootstrapping data.

   The algorithm is recursive because a bootstrapping server can return redirect data, in which case, new bootstrapping servers are added to the top of the list. The algorithm stops when either the bootstrapping data is received and successfully applied, or when the list of servers is exhausted after not receiving any bootstrapping data.

Note A bootstrapping server is a RESTCONF server, and the data transport protocol is HTTPS.

4. The server validates and provisions the device. The device presents its Cisco Secure Unique Device Identifier (SUDI) certificate to the bootstrapping server during TLS handshake.

   The device can accept the server certificate either by verifying it against a server-trust anchor that the device learned previously, or without verification.
5. The device requests bootstrapping data from the server through a RESTCONF POST request by using the ietf-sztp-bootstrap-server:get-bootstrapping-data RPC.

   The bootstrapping server can provide either redirect or onboarding data in the response message. The onboarding information that is received from the bootstrapping server will be signed data.
6. The device checks the headers of the CMS structures that contain the bootstrapping artifacts to decide whether decrypting is required, and the format (JSON or XML) of the data used. If required, decryption is performed by using the device's private SUDI key.
7. The device uses its trust anchor (the Cisco root certificate) to validate the ownership voucher. The ownership voucher must be signed by the IOSXE_SZTP private key. The IOSXE_SZTP certificate is signed by a Cisco root, but the trust chain for the voucher must use the IOSXE_SZTP key: any other certificate signed by the Cisco root will fail.

   Note that only the ownership voucher is validated against the device trust anchor. All other bootstrapping artifacts are validated with the customer's pinned-domain-certificate that is found in the ownership voucher.

8. If the onboarding information includes a requirement for a specific OS version, the device checks the running OS version. In case of a mismatch, the device downloads and installs the specific version.

   After the OS installation is complete, the device reboots and the Secure ZTP process restarts.

9. The device starts the Guest Shell after the onboarding information is downloaded from the bootstrap server.

   Guest Shell is used to run customer-specific scripts, and to apply the downloaded configuration. The configuration can be in Cisco IOS CLI format or in the form of NETCONF edit-config requests. The Guest Shell is shut down after bootstrapping is completed.

10. The device sends progress messages to the server if the server is trusted.

Secure ZTP Transport Protocol

Secure ZTP uses HTTPS as the transport protocol when communicating with the RESTCONF bootstrapping servers.

When establishing a connection, the device provides its Cisco Secure Unique Device Identifier (SUDI) certificate during the TLS handshake. The certificate serves as an authentication token. No other authentication is supported. The SUDI certificate validates the device on the server side.

The bootstrapping server provides its own certificate during the TLS handshake to the device. If the device has the server-trust anchor corresponding to this server, the device performs an X.509 certificate validation of the server certificate against the server-trust anchor. (The device can get the server-trust anchor from the redirect server.)

If the device does have a server-trust anchor, but the X.509 certificate is not validated successfully, the device must discard the server-trust anchor, accept the connection, and mark the server as not trusted.

If the device does not have a server-trust anchor, it accepts the server certificate, but marks it as not trusted.

According to the RESTCONF protocol, a device must first initiate the root-resource discovery, before it can proceed with RPC requests. The following is a sample root-discovery request:

```
GET /.well-known/host-meta HTTP/1.1
Host: example.com
Accept: application/xrd+xml
```

The following is a sample root-discovery response:

```
HTTP/1.1 200 OK
Content-Type: application/xrd+xml
Content-Length: nnn
<XRD xmlns='http://docs.oasis-open.org/ns/xri/xrd-1.0'>
    <Link rel='restconf' href='/restconf_root'/>
</XRD>
```

The value in the HREF attribute is used in the follow-up requests to the RESTCONF server, for example, when

```
href='/restconf_root'
```

is received, the header for the get-bootstrapping-data RPC is

```
POST /restconf_root/operations/ietf-sztp-bootstrap-server:
get-bootstrapping-data HTTP/1.1
```

The device receives a plain XML file, and the fields in the file are Base64 encoded. The device runs Base64 decoding before extracting the information and attempting to recognize its structure. The decoded structure format can either be JSON or XML.

DHCP Options for Secure ZTP

DHCP redirect Options 136 (DHCPv6) and 143 (DHCPv4) are supported for Secure ZTP. These options are used to provision a client with one or more Uniform Resource Identifiers (URIs) for bootstrap servers.

A device in the Zero-Touch Provisioning mode carries out a DHCP discovery to find a DHCP server, and to receive the IP address and other information. When the DHCP client receives Options 136 and 143, the Secure ZTP procedures are started, and the Secure ZTP handling functions are invoked. If the Secure ZTP handling functions fail, the handling procedure is repeated indefinitely, until it is either successful, or is interrupted by the user.

Bootstrapping Servers

A bootstrap server is a RESTCONF server that uses the HTTPS data transport protocol. A bootstrap server can be a redirect server or an onboarding server.

A redirect server sends a list of bootstrapping servers to a device. The device can attempt bootstrapping from any server in the list. Each server entry has a server address, a server port, and a trust anchor (X.509 certificate) that verifies the server's certificate presented during the TLS handshake. The trust anchor is accepted only if the redirect information is signed, or if the current redirect server is trusted. Otherwise, all the trust anchors received from the redirect server are discarded.

An onboarding server is a server that sends the actual bootstrapping data. The bootstrapping data contains the following types of information:

- Required updated image that the device must run: The required version, URLs for downloading the image, and information about how to validate the downloaded image.
- Preconfiguration script: A Python script that must be run before the initial device configuration is applied.
- Configuration: The initial device configuration. This configuration can be in the Cisco IOS CLI format of a NETCONF edit-config format.
- Postconfiguration script: A Python script that must be run after the initial device configuration is applied.

A bootstrapping server can be trusted or untrusted. A trusted server can send bootstrapping data that is not necessarily signed. A trusted server can be demoted into an untrusted server if the server certificate it sends during the TLS handshake fails to validate the server-trust anchor on the device.

Bootstrapping Data

Bootstrapping data refers to a collection of data that a device obtains during the bootstrapping process.

Bootstrapping data (both redirect and onboarding information) can be signed or unsigned. An ownership voucher, owner certificate, and conveyed information must be present in signed bootstrapping data.

Signed data is trusted. If the signed data is redirect information, trust anchors for the bootstrap servers that are being redirected to are saved for future TLS handshakes. Signed onboarding information is trusted and is applied to the device.

When a bootstrap server provides signed data, the data is considered trusted. However; this does not make the server trusted. If the server is considered untrusted before receiving the data, it remains untrusted, and the server does not receive progress reports.

Unsigned data do not need to present the ownership voucher and the owner certificate artifacts; infact, these are discarded, if present. Unsigned data is accepted only if it is redirect data or is received from a trusted server. Receiving unsigned data from an untrusted onboarding server is considered an error, and the device continues to the next server on its list.

Ownership Voucher

Assigning ownership is important to bootstrapping mechanisms. The ownership voucher is defined in Section 5.3 of RFC 8366. The primary purpose of a voucher is to securely assign a pledge to an owner. The voucher provides the pledge with details of the entity, which the pledge should consider as its owner.

The ownership voucher has a Cryptographic Message Syntax (CMS) structure, is Distinguished Encoding Rules-encoded (DER-encoded), and encloses YANG-modeled data.

This is a sample ownership voucher:

```
yang-data voucher-artifact:
+---- voucher
+---- created-on                     yang:date-and-time
+---- expires-on?                    yang:date-and-time
+---- assertion                      enumeration
+---- serial-number                  string
+---- idevid-issuer?                 binary
+---- pinned-domain-cert             binary
+---- domain-cert-revocation-checks? boolean
+---- nonce?                         binary
+---- last-renewal-date?             yang:date-and-time
```

The CMS structure is signed using a private key that corresponds to the device's trust anchor. The device carries the public key (the trust anchor), which is the only thing it needs to verify the signature on the voucher. The private key is used by the Cisco MASA server when creating the voucher. The private key is securely stored in the Cisco Software Image Management (SWIM) server.

The device uses its trust anchor to extract the actual ownership voucher from the CMS structure. The signature on the ownership voucher is verified by using the public key enclosed in the device's trust anchor. This verification may require additional intermediate X.509 certificates, in which case, these must be attached to the ownership voucher.

After the signature on the ownership voucher is verified, the YANG-modeled data fields are extracted. If the *created-on* field is present, the device verifies whether the voucher was created in the past. If the *expires-on* field is present, the device verifies whether the voucher is expired or not. If these fields are not present, the voucher is rejected.

The device then verifies the required *serial-number* data field. The serial number of the device is learned by the server from the device's SUDI certificate sent to the server during the TLS handshake. The serial number helps the server to send the right configuration data to the right device.

When all the checks are successful, the device extracts the data field *pinned-domain-cert*, which is the main payload of the ownership voucher. The pinned domain certificate must be Base64 encoded. The device performs a Base64 decoding before handling the certificate. The decoded certificate is an X.509 certificate in DER format.

If an error occurs during validation, the ownership voucher is not verified, and the bootstrapping data is considered invalid.

Owner Certificate

The owner certificate is an X.509 certificate that binds an owner's identity to a public key, which a device can use to validate a signature in the conveyed information.

After verifying the ownership voucher, the device uses the pinned domain certificate extracted from the ownership voucher to validate the owner certificate.

The data field in the bootstrapping data that represents the owner certificate is Base64 encoded. The device then performs a Base64 decoding. The output of this decoding is a degenerate CMS structure, is DER-encoded, and is of the content type signedData. (Degenerate structure is a format that is commonly used to distribute X.509 certificates. These structures do not contain any signatures, but can have attached intermediate certificates.) The owner certificate is an x509 certificate, and the owner certificate artifact is a degenerate CMS structure that carries the x509 certificate.

Conveyed Information

The conveyed information artifact encodes the essential bootstrapping data for a device. This artifact is used to encode the redirect and onboarding information types.

The final step in validating the signed information is the verification of the signed-CMS structure that contains the conveyed information. The data field for the conveyed information is Base64 encoded. The device first performs Base64 decoding.

The device then verifies the signature using the certificates from the owner certificate's CMS structure and the pinned domain certificate as the trust anchor.

Image Update Support

When the bootstrapping data requires a specific OS version, the device checks the version of the software that it is currently running. In case of a mismatch, even if the running version is newer, the device uses the URL provided in the bootstrapping data, and downloads the specified image. No modifications are done to the URL, and no additional authentication information is added by the device. If several URLs are specified in the bootstrapping data, the device will loop over the list of URLs until the first successful attempt or until the list is exhausted.

After an image is downloaded, if the *image-verification* data is included in the bootstrapping information, the device uses the specified algorithm to calculate the hash of the image and compares the result with the hash string included in the bootstrapping data. If multiple algorithms or hashes are provided in the bootstrapping data, the device picks the first-supported algorithm in the list to calculate and compare the hash.

After the image is verified, the image is installed, and the device reboots. State information is not stored before the reboot. When the device boots up, it enters the Secure ZTP process again and repeats all the steps till the image updating. Because the device is running the correct image, it does not need an image update, and the device will proceed with applying the on-boarding information.

Progress Reporting

The device sends progress reports to the bootstrapping server. RFC 8572 provides more information on progress reporting.

When a bootstrapping server is trusted, it receives appropriate POST-request messages with the *ietf-sztp-bootstrap-server:report-progress* RPC.

There are two types of progress report messages—mandatory and optional. The mandatory reports indicate the start or termination of the bootstrapping process and include the following types of reports:

- bootstrap-initiated
- bootstrap-error
- bootstrap-complete
- boot-image-installed-rebooting
- config-error
- parsing-error
- pre-script-error
- post-script-error

The rest of progress report messages are optional. Optional progress report messages are only sent to the server if the bootstrapping data has set the *reporting-level* parameter to *verbose*.

This is a sample report-progress request from the device to the server:

```
POST /restconf/operations/ietf-sztp-bootstrap-server:report-progress/HTTP/1.1
HOST: example.com
Content-Type: application/yang.data+xml

<input xmlns="urn:ietf:params:xml:ns:yang:ietf-sztp-bootstrap-server">
<progress-type>bootstrap-error</progress-type>
<message>Failed to decode data</message>
</input>
```

This is a sample *No content* response from the server:

```
HTTP/1.1 204 No Content
Date: Sat, 31 May 2021 17:02:40 GMT
Server: example-server
```

Sample Zero-Touch Provisioning Configurations

Sample DHCP Server Configuration on a Management Port Using TFTP Copy

The following is a sample DHCP server configuration using TFTP copy when the DHCP server is connected through the management port on a device:

```
Device> enable
Device# configure terminal
Device(config)# ip dhcp excluded-address 10.1.1.1
Device(config)# ip dhcp excluded-address vrf Mgmt-vrf 10.1.1.1 10.1.1.10
Device(config)# ip dhcp pool pnp_device_pool
Device(config-dhcp)# vrf Mgmt-vrf
Device(config-dhcp)# network 10.1.1.0 255.255.255.0
Device(config-dhcp)# default-router 10.1.1.1
Device(config-dhcp)# option 150 ip 203.0.113.254
Device(config-dhcp)# option 67 ascii /sample_python_dir/python_script.py
Device(config-dhcp)# exit
Device(config)# interface gigabitethernet 1/0/2
```

```
Device(config-if)# no ip dhcp client request tftp-server-address
Device(config-if)# end
```

Sample DHCP Server Configuration on a Management Port Using HTTP Copy

The following is a sample DHCP server configuration using HTTP copy when the DHCP server is connected through the management port on a device:

```
Device> enable
Device# configure terminal
Device(config)# ip dhcp pool pnp_device_pool
Device(config-dhcp)# vrf Mgmt-vrf
Device(config-dhcp)# network 10.1.1.0 255.255.255.0
Device(config-dhcp)# default-router 10.1.1.1
Device(config-dhcp)# option 67 ascii http://198.51.100.1:8000/sample_python_2.py
Device(config-dhcp)# end
```

Sample DHCP Server Configuration on an In-Band Port Using TFTP Copy

The following is a sample DHCP server configuration using TFTP copy when the DHCP server is connected through the in-band port on a device:

```
Device> enable
Device# configure terminal
Device(config)# ip dhcp excluded-address 10.1.1.1
Device(config)# ip dhcp pool pnp_device_pool
Device(config-dhcp)# network 10.1.1.0 255.255.255.0
Device(config-dhcp)# default-router 10.1.1.1
Device(config-dhcp)# option 150 ip 203.0.113.254
Device(config-dhcp)# option 67 ascii /sample_python_dir/python_script.py
Device(config-dhcp)# exit
Device(config)# interface gigabitethernet 1/0/2
Device(config-if)# no ip dhcp client request tftp-server-address
Device(config-if)# end
```

Sample DHCP Server Configuration on an In-Band Port Using HTTP Copy

The following is a sample DHCP server configuration using HTTP copy when the DHCP server is connected through the in-band port on a device:

```
Device> enable
Device# configure terminal
Device(config)# ip dhcp excluded-address 10.1.1.1
Device(config)# ip dhcp pool pnp_device_pool
Device(config-dhcp)# network 10.1.1.0 255.255.255.0
Device(config-dhcp)# default-router 10.1.1.1
Device(config-dhcp)# option 67 ascii http://192.0.2.1:8000/sample_python_2.py
Device(config-dhcp)# end
```

Sample DHCP Server Configuration on a Linux Ubuntu Device

The following sample DHCP server configuration shows that the server is either connected to the management port or the in-band port in a device, and that a Python script is copied from a TFTP server.

```
root@ubuntu-server:/etc/dhcp# more dhcpd.conf
subnet 10.1.1.0 netmask 255.255.255.0 {
range 10.1.1.2  10.1.1.255;
      host 3850 {
          fixed-address                      10.1.1.246 ;
          hardware ethernet                  CC:D8:C1:85:6F:00;
          option bootfile-name !<opt 67>     " /python_dir/python_script.py";
         option tftp-server-name !<opt 150>  "203.0.113.254";
      }
  }
```

The following sample DHCP configuration shows that a Python script is copied from an HTTP server to the device:

```
Day0_with_mgmt_port_http
------------------------
subnet 192.168.1.0 netmask 255.255.255.0 {
 range 192.168.1.2 192.168.1.255;
      host C2-3850 {
          fixed-address                   192.168.1.246 ;
          hardware ethernet               CC:D8:C1:85:6F:00;
          option bootfile-name            "http://192.168.1.46/sample_python_2.py";
      }
  }
```

After the DHCP server starts running, you must start the management network-connected device. The rest of the configuration is automatic.

Sample DHCPv6 Server Configuration on a Management Port Using TFTP Copy

The following is a sample configuration using TFTP copy when the DHCPv6 server is connected through the management port on a device:

```
Device> enable
Device# configure terminal
Device(config)# ipv6 dhcp pool ztp
Device(config-dhcpv6)# address prefix 2001:DB8::1/64
Device(config-dhcpv6)# domain-name cisco.com
Device(config-dhcpv6)# bootfile-url tftp://[2001:db8::46]/sample_day0_script.py
Device(config-dhcpv6)# exit
Device(config)# interface vlan 20
Device(config-if)# ipv6 dhcp server ztp
Device(config-if)# end
```

Sample Python Provisioning Script

The following is a sample Python script that can be used from either an HTTP server or a TFTP server:

```
print "\n\n *** Sample ZTP Day0 Python Script *** \n\n"

# Importing cli module
import cli


print "\n\n *** Executing show platform  *** \n\n"
cli_command = "show platform"
cli.executep(cli_command)

print "\n\n *** Executing show version *** \n\n"
cli_command = "show version"
cli.executep(cli_command)

print "\n\n *** Configuring a Loopback Interface *** \n\n"
cli.configurep(["interface loop 100", "ip address 10.10.10.10 255.255.255.255", "end"])


print "\n\n *** Executing show ip interface brief  *** \n\n"
cli_command = "sh ip int brief"
cli.executep(cli_command)

print "\n\n *** ZTP Day0 Python Script Execution Complete *** \n\n"
```

Boot Log for Cisco 4000 Series Integrated Services Routers

The following sample Zero-Touch Provisioning boot log displays that Guest Shell is successfully enabled, the Python script is downloaded to the Guest Shell, and the Guest Shell is running the downloaded Python script and configuring the device for day zero.

```
% failed to initialize nvram
! <This message indicates that the startup configuration
is absent on the device. This is the first indication that the Day Zero work flow is
going to start.>

This product contains cryptographic features and is subject to United
States and local country laws governing import, export, transfer and
use. Delivery of Cisco cryptographic products does not imply
third-party authority to import, export, distribute or use encryption.
Importers, exporters, distributors and users are responsible for
compliance with U.S. and local country laws. By using this product you
agree to comply with applicable laws and regulations. If you are unable
to comply with U.S. and local laws, return this product immediately.

A summary of U.S. laws governing Cisco cryptographic products may be found at:
http://www.cisco.com/wwl/export/crypto/tool/stqrg.html

If you require further assistance please contact us by sending email to
export@cisco.com.

cisco ISR4451-X/K9 (2RU) processor with 7941237K/6147K bytes of memory.
Processor board ID FJC1950D091
4 Gigabit Ethernet interfaces
```

```
32768K bytes of non-volatile configuration memory.
16777216K bytes of physical memory.
7341807K bytes of flash memory at bootflash:.
0K bytes of WebUI ODM Files at webui:.

%INIT: waited 0 seconds for NVRAM to be available


         --- System Configuration Dialog ---

Would you like to enter the initial configuration dialog? [yes/no]: %
!!<DO NOT TOUCH. This is Zero-Touch Provisioning>>
Generating 2048 bit RSA keys, keys will be non-exportable...
[OK] (elapsed time was 1 seconds)
The process for the command is not responding or is otherwise unavailable
The process for the command is not responding or is otherwise unavailable
The process for the command is not responding or is otherwise unavailable
The process for the command is not responding or is otherwise unavailable
The process for the command is not responding or is otherwise unavailable
The process for the command is not responding or is otherwise unavailable
The process for the command is not responding or is otherwise unavailable
The process for the command is not responding or is otherwise unavailable
The process for the command is not responding or is otherwise unavailable
The process for the command is not responding or is otherwise unavailable
Guestshell enabled successfully


 *** Sample ZTP Day0 Python Script ***


 *** Configuring a Loopback Interface ***


Line 1 SUCCESS: interface loop 100
Line 2 SUCCESS: ip address 10.10.10.10 255.255.255.255
Line 3 SUCCESS: end


 *** Executing show ip interface brief  ***


Interface              IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0/0   unassigned      YES unset  down                  down
GigabitEthernet0/0/1   unassigned      YES unset  down                  down
GigabitEthernet0/0/2   unassigned      YES unset  down                  down
GigabitEthernet0/0/3   192.168.1.246   YES DHCP   up                    up
GigabitEthernet0       192.168.1.246   YES DHCP   up                    up
Loopback100            10.10.10.10     YES TFTP   up                    up


 *** ZTP Day0 Python Script Execution Complete ***



Press RETURN to get started!
```

The day zero provisioning is complete, and the Cisco IOS prompt is accessible.

Boot Log for Cisco Catalyst 9000 Series Switches

The following sections display sample Zero-Touch Provisioning boot logs. These logs shows that Guest Shell is successfully enabled, the Python script is downloaded to the Guest Shell, and the Guest Shell executes the downloaded Python script and configures the device for Day Zero.

=

```
% Checking backup nvram
% No config present. Using default config

FIPS: Flash Key Check : Begin
FIPS: Flash Key Check : End, Not Found, FIPS Mode Not Enabled

! <This message indicates that the startup configuration
is absent on the device. This is the first indication that the Day Zero work flow is
going to start.>
```

Cisco IOS XE Everest 16.6.x to Cisco IOS XE Fuji 16.8.x

The following example shows the sample boot logs before the .py script is run:

```
Press RETURN to get started!

The process for the command is not responding or is otherwise unavailable
The process for the command is not responding or is otherwise unavailable
The process for the command is not responding or is otherwise unavailable
The process for the command is not responding or is otherwise unavailable
The process for the command is not responding or is otherwise unavailable


 *** Sample ZTP Day0 Python Script ***

...

 *** ZTP Day0 Python Script Execution Complete ***
```

The following example shows how to configure the device for Day Zero provisioning:

```
Initializing Hardware...

System Bootstrap, Version 17.2.1r[FC1], RELEASE SOFTWARE (P)
Compiled Thu 02/20/2020 23:47:51.50 by rel

Current ROMMON image : Primary
Last reset cause     : SoftwareReload
C9300-48UXM platform with 8388608 Kbytes of main memory

Preparing to autoboot. [Press Ctrl-C to interrupt]  0
boot: attempting to boot from [flash:cat9k_iosxe.16.06.05.SPA.bin]
boot: reading file cat9k_iosxe.16.06.05.SPA.bin
########################################################################################################


Both links down, not waiting for other switches
Switch number is 1
```

```
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Version 16.6.5, RELEASE SOFTWARE (fc3)
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Compiled Mon 10-Dec-18 12:52 by mcpre



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or the applicable URL provided on the flyer accompanying the IOS-XE
software.


% Checking backup nvram
% No config present. Using default config


FIPS: Flash Key Check : Begin
FIPS: Flash Key Check : End, Not Found, FIPS Mode Not Enabled

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If you require further assistance please contact us by sending email to
export@cisco.com.

cisco C9300-48UXM (X86) processor with 1392780K/6147K bytes of memory.
Processor board ID FCW2144L045
2048K bytes of non-volatile configuration memory.
8388608K bytes of physical memory.
1638400K bytes of Crash Files at crashinfo:.
11264000K bytes of Flash at flash:.
0K bytes of WebUI ODM Files at webui:.
```

```
Base Ethernet MAC Address          : ec:1d:8b:0a:68:00
Motherboard Assembly Number        : 73-17959-06
Motherboard Serial Number          : FOC21418FPQ
Model Revision Number              : B0
Motherboard Revision Number        : A0
Model Number                       : C9300-48UXM
System Serial Number               : FCW2144L045


%INIT: waited 0 seconds for NVRAM to be available

SETUP: new interface Vlan1 placed in "shutdown" state


Press RETURN to get started!


*Sep  4 20:35:07.330: %SMART_LIC-6-AGENT_READY: Smart Agent for Licensing is initialized
*Sep  4 20:35:07.493: %IOSXE_RP_NV-3-NV_ACCESS_FAIL: Initial read of NVRAM contents failed
*Sep  4 20:35:07.551: %IOSXE_RP_NV-3-BACKUP_NV_ACCESS_FAIL: Initial read of backup NVRAM
contents failed
*Sep  4 20:35:10.932: dev_pluggable_optics_selftest attribute table internally inconsistent
 @ 0x1D4

*Sep  4 20:35:13.406: %CRYPTO-4-AUDITWARN: Encryption audit check could not be performed
*Sep  4 20:35:13.480: %SPANTREE-5-EXTENDED_SYSID: Extended SysId enabled for type vlan
*Sep  4 20:35:13.715: %LINK-3-UPDOWN: Interface Lsmpi18/3, changed state to up
*Sep  4 20:35:13.724: %LINK-3-UPDOWN: Interface EOBC18/1, changed state to up
*Sep  4 20:35:13.724: %LINEPROTO-5-UPDOWN: Line protocol on Interface LI-Null0, changed
state to up
*Sep  4 20:35:13.724: %LINK-3-UPDOWN: Interface GigabitEthernet0/0, changed state to down
*Sep  4 20:35:13.725: %LINK-3-UPDOWN: Interface LIIN18/2, changed state to up
*Sep  4 20:35:13.749: WCM-PKI-SHIM: buffer allocation failed for SUDI support check
*Sep  4 20:35:13.749: PKI/SSL unable to send Sudi support to WCM
*Sep  4 20:35:14.622: %IOSXE_MGMTVRF-6-CREATE_SUCCESS_INFO: Management vrf Mgmt-vrf created
 with ID 1,
    ipv4 table-id 0x1, ipv6 table-id 0x1E000001
*Sep  4 20:34:42.022: %STACKMGR-6-STACK_LINK_CHANGE: Switch 1 R0/0: stack_mgr:  Stack port
 1 on Switch 1 is nocable
*Sep  4 20:34:42.022: %STACKMGR-6-STACK_LINK_CHANGE: Switch 1 R0/0: stack_mgr:  Stack port
 2 on Switch 1 is down
*Sep  4 20:34:42.022: %STACKMGR-6-STACK_LINK_CHANGE: Switch 1 R0/0: stack_mgr:  Stack port
 2 on Switch 1 is nocable
*Sep  4 20:34:42.022: %STACKMGR-6-SWITCH_ADDED: Switch 1 R0/0: stack_mgr:  Switch 1 has
been added to the stack.
*Sep  4 20:34:42.022: %STACKMGR-6-SWITCH_ADDED: Switch 1 R0/0: stack_mgr:  Switch 1 has
been added to the stack.
*Sep  4 20:34:42.022: %STACKMGR-6-SWITCH_ADDED: Switch 1 R0/0: stack_mgr:  Switch 1 has
been added to the stack.
*Sep  4 20:34:42.022: %STACKMGR-6-ACTIVE_ELECTED: Switch 1 R0/0: stack_mgr:  Switch 1 has
been elected ACTIVE.
*Sep  4 20:35:14.728: %LINEPROTO-5-UPDOWN: Line protocol on Interface Lsmpi18/3, changed
state to up
*Sep  4 20:35:14.728: %LINEPROTO-5-UPDOWN: Line protocol on Interface EOBC18/1, changed
state to up
*Sep  4 20:35:15.506: %HMANRP-6-HMAN_IOS_CHANNEL_INFO: HMAN-IOS channel event for switch
1: EMP_RELAY: Channel UP!
*Sep  4 20:35:15.510: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed state
 to down
*Sep  4 20:35:34.501: %LINK-5-CHANGED: Interface Vlan1, changed state to administratively
down
*Sep  4 20:35:34.717: %SYS-5-RESTART: System restarted --
Cisco IOS Software [Everest], Catalyst L3 Switch Software (CAT9K_IOSXE), Version 16.6.5,
RELEASE SOFTWARE (fc3)
```

```
Technical Support: http://www.cisco.com/techsupport
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*Sep  4 20:35:34.796: %LINK-3-UPDOWN: Interface GigabitEthernet0/0, changed state to up
*Sep  4 20:35:35.266: %SYS-6-BOOTTIME: Time taken to reboot after reload =  283 seconds
*Sep  4 20:35:35.796: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0,
changed state to up
*Sep  4 20:35:36.607: %LINK-3-UPDOWN: Interface GigabitEthernet1/1/1, changed state to down
*Sep  4 20:35:36.607: %LINK-3-UPDOWN: Interface GigabitEthernet1/1/2, changed state to down
*Sep  4 20:35:36.607: %LINK-3-UPDOWN: Interface GigabitEthernet1/1/3, changed state to down
*Sep  4 20:35:36.608: %LINK-3-UPDOWN: Interface GigabitEthernet1/1/4, changed state to down
*Sep  4 20:35:36.608: %LINK-3-UPDOWN: Interface TenGigabitEthernet1/1/1, changed state to
down
*Sep  4 20:35:36.608: %LINK-3-UPDOWN: Interface TenGigabitEthernet1/1/2, changed state to
down
*Sep  4 20:35:36.608: %LINK-3-UPDOWN: Interface TenGigabitEthernet1/1/3, changed state to
down
*Sep  4 20:35:36.608: %LINK-3-UPDOWN: Interface TenGigabitEthernet1/1/4, changed state to
down
*Sep  4 20:35:36.608: %LINK-3-UPDOWN: Interface TenGigabitEthernet1/1/5, changed state to
down
*Sep  4 20:35:36.609: %LINK-3-UPDOWN: Interface TenGigabitEthernet1/1/6, changed state to
down
*Sep  4 20:35:36.609: %LINK-3-UPDOWN: Interface TenGigabitEthernet1/1/7, changed state to
down
*Sep  4 20:35:36.609: %LINK-3-UPDOWN: Interface TenGigabitEthernet1/1/8, changed state to
down
*Sep  4 20:35:36.609: %LINK-3-UPDOWN: Interface FortyGigabitEthernet1/1/1, changed state
to down
*Sep  4 20:35:36.609: %LINK-3-UPDOWN: Interface FortyGigabitEthernet1/1/2, changed state
to down
*Sep  4 20:35:37.607: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/1/1,
 changed state to down
*Sep  4 20:35:37.608: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/1/2,
 changed state to down
*Sep  4 20:35:37.608: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/1/3,
 changed state to down
*Sep  4 20:35:37.609: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/1/4,
 changed state to down
*Sep  4 20:35:37.609: %LINEPROTO-5-UPDOWN: Line protocol on Interface TenGigabitEthernet1/1/1,
 changed state to down
*Sep  4 20:35:37.609: %LINEPROTO-5-UPDOWN: Line protocol on Interface TenGigabitEthernet1/1/2,
 changed state to down
*Sep  4 20:35:37.609: %LINEPROTO-5-UPDOWN: Line protocol on Interface TenGigabitEthernet1/1/3,
 changed state to down
*Sep  4 20:35:37.609: %LINEPROTO-5-UPDOWN: Line protocol on Interface TenGigabitEthernet1/1/4,
 changed state to down
*Sep  4 20:35:37.609: %LINEPROTO-5-UPDOWN: Line protocol on Interface TenGigabitEthernet1/1/5,
 changed state to down
*Sep  4 20:35:37.609: %LINEPROTO-5-UPDOWN: Line protocol on Interface TenGigabitEthernet1/1/6,
 changed state to down
*Sep  4 20:35:43.511: AUTOINSTALL: Obtain tftp server address (opt 150) 159.14.27.2
*Sep  4 20:35:43.511: PNPA: Setting autoinstall complete to true for 159.14.27.2
*Sep  4 20:35:57.673: %PLATFORM_PM-6-FRULINK_INSERTED: 8x10G uplink module inserted in the
 switch 1 slot 1
*Sep  4 20:36:19.562: [IOX DEBUG] Guestshell start API is being invoked

*Sep  4 20:36:19.562: [IOX DEBUG] provided idb is mgmt interface

*Sep  4 20:36:19.562: [IOX DEBUG] Setting up guestshell to use mgmt-intf

*Sep  4 20:36:19.562: [IOX DEBUG] Setting up chasfs for iox related activity

*Sep  4 20:36:19.562: [IOX DEBUG] Setting up for iox pre-clean activity if needed
```

```
*Sep  4 20:36:19.562: [IOX DEBUG] Waiting for iox pre-clean setup to take affect

*Sep  4 20:36:19.562: [IOX DEBUG] Waited for 1 sec(s) for iox pre-clean setup to take affect

*Sep  4 20:36:19.562: [IOX DEBUG] Auto-configuring iox feature

*Sep  4 20:36:19.563: [IOX DEBUG] Waiting for CAF and ioxman to be up, in that order

*Sep  4 20:36:20.076: %UICFGEXP-6-SERVER_NOTIFIED_START: Switch 1 R0/0: psd:  Server iox
has been notified to start
*Sep  4 20:36:23.564: [IOX DEBUG] Waiting for another 5 secs

*Sep  4 20:36:28.564: [IOX DEBUG] Waiting for another 5 secs
The process for the command is not responding or is otherwise unavailable

*Sep  4 20:36:33.564: [IOX DEBUG] Waiting for another 5 secs
The process for the command is not responding or is otherwise unavailable

*Sep  4 20:36:34.564: [IOX DEBUG] Waited for 16 sec(s) for CAF and ioxman to come up

*Sep  4 20:36:34.564: [IOX DEBUG] Validating if CAF and ioxman are running

*Sep  4 20:36:34.564: [IOX DEBUG] CAF and ioxman are up and running

*Sep  4 20:36:34.564: [IOX DEBUG] Building the simple mgmt-intf enable command string

*Sep  4 20:36:34.564: [IOX DEBUG] Enable command is: request platform software iox-manager

    app-hosting guestshell enable

*Sep  4 20:36:34.564: [IOX DEBUG] Issuing guestshell enable command and waiting for it to
be up
The process for the command is not responding or is otherwise unavailable
The process for the command is not responding or is otherwise unavailable
The process for the command is not responding or is otherwise unavailable
The process for the command is not responding or is otherwise unavailable

*Sep  4 20:36:38.578: [IOX DEBUG] Waiting for another 5 secs
The process for the command is not responding or is otherwise unavailable

*Sep  4 20:36:39.416: %LINK-3-UPDOWN: Interface TenGigabitEthernet1/0/48, changed state to
 up
*Sep  4 20:36:40.416: %LINEPROTO-5-UPDOWN: Line protocol on Interface
TenGigabitEthernet1/0/48,
    changed state to upThe process for the command is not responding or is otherwise
unavailable
The process for the command is not responding or is otherwise unavailable
The process for the command is not responding or is otherwise unavailable

*Sep  4 20:36:43.586: [IOX DEBUG] Waiting for another 5 secs
Guestshell enabled successfully

*Sep  4 20:37:45.321: [IOX DEBUG] Checking for guestshell mount path

*Sep  4 20:37:45.321: [IOX DEBUG] Validating if guestshell is ready for use

*Sep  4 20:37:45.321: [IOX DEBUG] Guestshell enabled successfully


 *** Sample ZTP Day0 Python Script ***
```

```
 *** Executing show platform  ***


Switch  Ports    Model               Serial No.   MAC address     Hw Ver.       Sw Ver.
------  -----   ---------            -----------  --------------  -------       --------
 1       62     C9300-48UXM          FCW2144L045  ec1d.8b0a.6800  V01           16.6.5

Switch/Stack Mac Address : ec1d.8b0a.6800 - Local Mac Address
Mac persistency wait time: Indefinite
                                     Current
Switch#   Role        Priority      State
-----------------------------------------
*1       Active          1          Ready


 *** Executing show version ***


Cisco IOS XE Software, Version 16.06.05
Cisco IOS Software [Everest], Catalyst L3 Switch Software (CAT9K_IOSXE), Version 16.6.5,
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or the applicable URL provided on the flyer accompanying the IOS-XE
software.
ROM: IOS-XE ROMMON
BOOTLDR: System Bootstrap, Version 17.2.1r[FC1], RELEASE SOFTWARE (P)
Switch uptime is 2 minutes
Uptime for this control processor is 4 minutes
System returned to ROM by Reload Command
System image file is "flash:cat9k_iosxe.16.06.05.SPA.bin"
Last reload reason: Reload Command
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Technology Package License Information:
------------------------------------------------------------------
Technology-package                  Technology-package
Current             Type            Next reboot
------------------------------------------------------------------
network-advantage   Permanent       network-advantage
cisco C9300-48UXM (X86) processor with 1392780K/6147K bytes of memory.
Processor board ID FCW2144L045
36 Ethernet interfaces
1 Virtual Ethernet interface
4 Gigabit Ethernet interfaces
```

```
20 Ten Gigabit Ethernet interfaces
2 Forty Gigabit Ethernet interfaces
2048K bytes of non-volatile configuration memory.
8388608K bytes of physical memory.
1638400K bytes of Crash Files at crashinfo:.
11264000K bytes of Flash at flash:.
0K bytes of WebUI ODM Files at webui:.
Base Ethernet MAC Address          : ec:1d:8b:0a:68:00
Motherboard Assembly Number        : 73-17959-06
Motherboard Serial Number          : FOC21418FPQ
Model Revision Number              : B0
Motherboard Revision Number        : A0
Model Number                       : C9300-48UXM
System Serial Number               : FCW2144L045
Switch Ports Model              SW Version        SW Image              Mode
------ ----- -----              ----------        ----------            ----
*    1 62    C9300-48UXM        16.6.5            CAT9K_IOSXE           BUNDLE
Configuration register is 0x102


 *** Configuring a Loopback Interface ***


Line 1 SUCCESS: interface loop 100
Line 2 SUCCESS: ip address 10.10.10.10 255.255.255.255
Line 3 SUCCESS: end


 *** Executing show ip interface brief  ***


Interface              IP-Address      OK? Method Status                Protocol
Vlan1                  unassigned      YES unset  administratively down down
GigabitEthernet0/0     10.127.128.3    YES DHCP   up                    up
Tw1/0/1                unassigned      YES unset  down                  down
Tw1/0/2                unassigned      YES unset  down                  down
Tw1/0/3                unassigned      YES unset  down                  down
Tw1/0/4                unassigned      YES unset  down                  down
Tw1/0/5                unassigned      YES unset  down                  down
Tw1/0/6                unassigned      YES unset  down                  down
Tw1/0/7                unassigned      YES unset  down                  down
Tw1/0/8                unassigned      YES unset  down                  down
Tw1/0/9                unassigned      YES unset  down                  down
Tw1/0/10               unassigned      YES unset  down                  down
Tw1/0/11               unassigned      YES unset  down                  down
Tw1/0/12               unassigned      YES unset  down                  down
Tw1/0/13               unassigned      YES unset  down                  down
Tw1/0/14               unassigned      YES unset  down                  down
Tw1/0/15               unassigned      YES unset  down                  down
Tw1/0/16               unassigned      YES unset  down                  down
Tw1/0/17               unassigned      YES unset  down                  down
Tw1/0/18               unassigned      YES unset  down                  down
Tw1/0/19               unassigned      YES unset  down                  down
Tw1/0/20               unassigned      YES unset  down                  down
Tw1/0/21               unassigned      YES unset  down                  down
Tw1/0/22               unassigned      YES unset  down                  down
Tw1/0/23               unassigned      YES unset  down                  down
Tw1/0/24               unassigned      YES unset  down                  down
Tw1/0/25               unassigned      YES unset  down                  down
Tw1/0/26               unassigned      YES unset  down                  down
Tw1/0/27               unassigned      YES unset  down                  down
Tw1/0/28               unassigned      YES unset  down                  down
Tw1/0/29               unassigned      YES unset  down                  down
Tw1/0/30               unassigned      YES unset  down                  down
```

```
Tw1/0/31               unassigned      YES unset  down                  down
Tw1/0/32               unassigned      YES unset  down                  down
Tw1/0/33               unassigned      YES unset  down                  down
Tw1/0/34               unassigned      YES unset  down                  down
Tw1/0/35               unassigned      YES unset  down                  down
Tw1/0/36               unassigned      YES unset  down                  down
Te1/0/37               unassigned      YES unset  down                  down
Te1/0/38               unassigned      YES unset  down                  down
Te1/0/39               unassigned      YES unset  down                  down
Te1/0/40               unassigned      YES unset  down                  down
Te1/0/41               unassigned      YES unset  down                  down
Te1/0/42               unassigned      YES unset  down                  down
Te1/0/43               unassigned      YES unset  down                  down
Te1/0/44               unassigned      YES unset  down                  down
Te1/0/45               unassigned      YES unset  down                  down
Te1/0/46               unassigned      YES unset  down                  down
Te1/0/47               unassigned      YES unset  down                  down
Te1/0/48               unassigned      YES unset  up                    up
GigabitEthernet1/1/1   unassigned      YES unset  down                  down
GigabitEthernet1/1/2   unassigned      YES unset  down                  down
GigabitEthernet1/1/3   unassigned      YES unset  down                  down
GigabitEthernet1/1/4   unassigned      YES unset  down                  down
Te1/1/1                unassigned      YES unset  down                  down
Te1/1/2                unassigned      YES unset  down                  down
Te1/1/3                unassigned      YES unset  down                  down
Te1/1/4                unassigned      YES unset  down                  down
Te1/1/5                unassigned      YES unset  down                  down
Te1/1/6                unassigned      YES unset  down                  down
Te1/1/7                unassigned      YES unset  down                  down
Te1/1/8                unassigned      YES unset  down                  down
Fo1/1/1                unassigned      YES unset  down                  down
Fo1/1/2                unassigned      YES unset  down                  down
Loopback100            10.10.10.10     YES TFTP   up                    up


 *** Configuring username, password, SSH  ***


Line 1 SUCCESS: username cisco privilege 15 password cisco
Line 2 SUCCESS: ip domain name domain
Line 3 SUCCESS: line vty 0 15
Line 4 SUCCESS: login local
Line 5 SUCCESS: transport input all
Line 6 SUCCESS: end


 *** ZTP Day0 Python Script Execution Complete ***
```

Cisco IOS XE Fuji 16.9.x to Cisco IOS XE Gibraltar 16.11.x

The following example shows the sample boot logs before the .py script is run:

```
--- System Configuration Dialog ---

Would you like to enter the initial configuration dialog? [yes/no]: The process for the
command is not
responding or is otherwise unavailable
The process for the command is not responding or is otherwise unavailable
The process for the command is not responding or is otherwise unavailable
The process for the command is not responding or is otherwise unavailable
The process for the command is not responding or is otherwise unavailable
The process for the command is not responding or is otherwise unavailable
```

```
guestshell installed successfully
Current state is: DEPLOYED
guestshell activated successfully
Current state is: ACTIVATED
guestshell started successfully
Current state is: RUNNING
Guestshell enabled successfully
```

The following example shows how to configure the device for Day Zero provisioning:

```
Both links down, not waiting for other switches
Switch number is 1

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responsibility to monitor your usage of any such term Software feature to
ensure that your systems and networks are prepared for a shutdown of the
Software feature.


% Checking backup nvram
% No config present. Using default config
```

```
FIPS: Flash Key Check : Key Not Found, FIPS Mode Not Enabled
cisco C9300-48UXM (X86) processor with 1419044K/6147K bytes of memory.
Processor board ID FCW2144L045
2048K bytes of non-volatile configuration memory.
8388608K bytes of physical memory.
1638400K bytes of Crash Files at crashinfo:.
11264000K bytes of Flash at flash:.
0K bytes of WebUI ODM Files at webui:.

Base Ethernet MAC Address          : ec:1d:8b:0a:68:00
Motherboard Assembly Number        : 73-17959-06
Motherboard Serial Number          : FOC21418FPQ
Model Revision Number              : B0
Motherboard Revision Number        : A0
Model Number                       : C9300-48UXM
System Serial Number               : FCW2144L045


%INIT: waited 0 seconds for NVRAM to be available


         --- System Configuration Dialog ---

Would you like to enter the initial configuration dialog? [yes/no]: The process for the
command is not
    responding or is otherwise unavailable
The process for the command is not responding or is otherwise unavailable
The process for the command is not responding or is otherwise unavailable
The process for the command is not responding or is otherwise unavailable
The process for the command is not responding or is otherwise unavailable
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The process for the command is not responding or is otherwise unavailable
The process for the command is not responding or is otherwise unavailable
The process for the command is not responding or is otherwise unavailable
```

```
The process for the command is not responding or is otherwise unavailable
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The process for the command is not responding or is otherwise unavailable
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The process for the command is not responding or is otherwise unavailable
The process for the command is not responding or is otherwise unavailable
The process for the command is not responding or is otherwise unavailable
The process for the command is not responding or is otherwise unavailable
The process for the command is not responding or is otherwise unavailable
The process for the command is not responding or is otherwise unavailable
guestshell installed successfully
Current state is: DEPLOYED
guestshell activated successfully
Current state is: ACTIVATED
guestshell started successfully
Current state is: RUNNING
Guestshell enabled successfully


HTTP server statistics:
Accepted connections total: 0

 *** Sample ZTP Day0 Python Script ***



 *** Executing show platform  ***


Switch  Ports    Model              Serial No.   MAC address     Hw Ver.       Sw Ver.
------  -----   ---------           -----------  --------------  -------       --------
 1       64     C9300-48UXM         FCW2144L045  ec1d.8b0a.6800  V01           16.9.4

Switch/Stack Mac Address : ec1d.8b0a.6800 - Local Mac Address
Mac persistency wait time: Indefinite
                                     Current
Switch#   Role        Priority      State
-----------------------------------------
*1       Active          1          Ready


 *** Executing show version ***


Cisco IOS XE Software, Version 16.09.04
Cisco IOS Software [Fuji], Catalyst L3 Switch Software (CAT9K_IOSXE), Version 16.9.4, RELEASE
 SOFTWARE (fc2)
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```

```
documentation or "License Notice" file accompanying the IOS-XE software,
or the applicable URL provided on the flyer accompanying the IOS-XE
software.
ROM: IOS-XE ROMMON
BOOTLDR: System Bootstrap, Version 17.2.1r[FC1], RELEASE SOFTWARE (P)
Switch uptime is 4 minutes
Uptime for this control processor is 5 minutes
System returned to ROM by Reload Command
System image file is "flash:cat9k_iosxe.16.09.04.SPA.bin"
Last reload reason: Reload Command
This product contains cryptographic features and is subject to United
States and local country laws governing import, export, transfer and
use. Delivery of Cisco cryptographic products does not imply
third-party authority to import, export, distribute or use encryption.
Importers, exporters, distributors and users are responsible for
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to comply with U.S. and local laws, return this product immediately.
A summary of U.S. laws governing Cisco cryptographic products may be found at:
http://www.cisco.com/wwl/export/crypto/tool/stqrg.html
If you require further assistance please contact us by sending email to
export@cisco.com.
Technology Package License Information:
------------------------------------------------------------------------------
Technology-package                                      Technology-package
Current                       Type                        Next reboot
------------------------------------------------------------------------------
network-advantage       Smart License                   network-advantage
None                    Subscription Smart License      None
Smart Licensing Status: UNREGISTERED/EVAL EXPIRED
cisco C9300-48UXM (X86) processor with 1419044K/6147K bytes of memory.
Processor board ID FCW2144L045
36 Ethernet interfaces
1 Virtual Ethernet interface
4 Gigabit Ethernet interfaces
20 Ten Gigabit Ethernet interfaces
2 TwentyFive Gigabit Ethernet interfaces
2 Forty Gigabit Ethernet interfaces
2048K bytes of non-volatile configuration memory.
8388608K bytes of physical memory.
1638400K bytes of Crash Files at crashinfo:.
11264000K bytes of Flash at flash:.
0K bytes of WebUI ODM Files at webui:.
Base Ethernet MAC Address          : ec:1d:8b:0a:68:00
Motherboard Assembly Number        : 73-17959-06
Motherboard Serial Number          : FOC21418FPQ
Model Revision Number              : B0
Motherboard Revision Number        : A0
Model Number                       : C9300-48UXM
System Serial Number               : FCW2144L045
Switch Ports Model              SW Version        SW Image              Mode
------ ----- -----              ----------        ----------            ----
*    1 64    C9300-48UXM        16.9.4            CAT9K_IOSXE           BUNDLE
Configuration register is 0x102


 *** Configuring a Loopback Interface ***


Line 1 SUCCESS: interface loop 100
Line 2 SUCCESS: ip address 10.10.10.10 255.255.255.255
Line 3 SUCCESS: end
```

```
 *** Executing show ip interface brief  ***


Any interface listed with OK? value "NO" does not have a valid configuration
Interface              IP-Address      OK? Method Status                Protocol
Vlan1                  unassigned      NO  unset  up                    up
GigabitEthernet0/0     10.127.128.5    YES DHCP   up                    up
Tw1/0/1                unassigned      YES unset  down                  down
Tw1/0/2                unassigned      YES unset  down                  down
Tw1/0/3                unassigned      YES unset  down                  down
Tw1/0/4                unassigned      YES unset  down                  down
Tw1/0/5                unassigned      YES unset  down                  down
Tw1/0/6                unassigned      YES unset  down                  down
Tw1/0/7                unassigned      YES unset  down                  down
Tw1/0/8                unassigned      YES unset  down                  down
Tw1/0/9                unassigned      YES unset  down                  down
Tw1/0/10               unassigned      YES unset  down                  down
Tw1/0/11               unassigned      YES unset  down                  down
Tw1/0/12               unassigned      YES unset  down                  down
Tw1/0/13               unassigned      YES unset  down                  down
Tw1/0/14               unassigned      YES unset  down                  down
Tw1/0/15               unassigned      YES unset  down                  down
Tw1/0/16               unassigned      YES unset  down                  down
Tw1/0/17               unassigned      YES unset  down                  down
Tw1/0/18               unassigned      YES unset  down                  down
Tw1/0/19               unassigned      YES unset  down                  down
Tw1/0/20               unassigned      YES unset  down                  down
Tw1/0/21               unassigned      YES unset  down                  down
Tw1/0/22               unassigned      YES unset  down                  down
Tw1/0/23               unassigned      YES unset  down                  down
Tw1/0/24               unassigned      YES unset  down                  down
Tw1/0/25               unassigned      YES unset  down                  down
Tw1/0/26               unassigned      YES unset  down                  down
Tw1/0/27               unassigned      YES unset  down                  down
Tw1/0/28               unassigned      YES unset  down                  down
Tw1/0/29               unassigned      YES unset  down                  down
Tw1/0/30               unassigned      YES unset  down                  down
Tw1/0/31               unassigned      YES unset  down                  down
Tw1/0/32               unassigned      YES unset  down                  down
Tw1/0/33               unassigned      YES unset  down                  down
Tw1/0/34               unassigned      YES unset  down                  down
Tw1/0/35               unassigned      YES unset  down                  down
Tw1/0/36               unassigned      YES unset  down                  down
Te1/0/37               unassigned      YES unset  down                  down
Te1/0/38               unassigned      YES unset  down                  down
Te1/0/39               unassigned      YES unset  down                  down
Te1/0/40               unassigned      YES unset  down                  down
Te1/0/41               unassigned      YES unset  down                  down
Te1/0/42               unassigned      YES unset  down                  down
Te1/0/43               unassigned      YES unset  down                  down
Te1/0/44               unassigned      YES unset  down                  down
Te1/0/45               unassigned      YES unset  down                  down
Te1/0/46               unassigned      YES unset  down                  down
Te1/0/47               unassigned      YES unset  down                  down
Te1/0/48               unassigned      YES unset  up                    up
GigabitEthernet1/1/1   unassigned      YES unset  down                  down
GigabitEthernet1/1/2   unassigned      YES unset  down                  down
GigabitEthernet1/1/3   unassigned      YES unset  down                  down
GigabitEthernet1/1/4   unassigned      YES unset  down                  down
Te1/1/1                unassigned      YES unset  down                  down
Te1/1/2                unassigned      YES unset  down                  down
Te1/1/3                unassigned      YES unset  down                  down
Te1/1/4                unassigned      YES unset  down                  down
Te1/1/5                unassigned      YES unset  down                  down
```

```
Te1/1/6                unassigned      YES unset  down                  down
Te1/1/7                unassigned      YES unset  down                  down
Te1/1/8                unassigned      YES unset  down                  down
Fo1/1/1                unassigned      YES unset  down                  down
Fo1/1/2                unassigned      YES unset  down                  down
TwentyFiveGigE1/1/1    unassigned      YES unset  down                  down
TwentyFiveGigE1/1/2    unassigned      YES unset  down                  down
Loopback100            10.10.10.10     YES TFTP   up                    up


 *** Configuring username, password, SSH  ***


Line 1 SUCCESS: username cisco privilege 15 password cisco
**CLI Line # 1:  WARNING: Command has been added to the configuration using a type 0 password.

    However, type 0 passwords will soon be deprecated. Migrate to a supported password type
Line 2 SUCCESS: ip domain name domain
Line 3 SUCCESS: line vty 0 15
Line 4 SUCCESS: login local
Line 5 SUCCESS: transport input all
Line 6 SUCCESS: end


 *** ZTP Day0 Python Script Execution Complete ***




Press RETURN to get started!
```

Cisco IOS XE Gibraltar 16.12.x to Cisco IOS XE Amsterdam 17.1.x

The following example shows the sample boot logs before the .py script is run:

```
--- System Configuration Dialog ---

Would you like to enter the initial configuration dialog? [yes/no]: day0guestshell installed
 successfully
Current state is: DEPLOYED
day0guestshell activated successfully
Current state is: ACTIVATED
day0guestshell started successfully
Current state is: RUNNING
Guestshell enabled successfully


 *** Sample ZTP Day0 Python Script ***

...

 *** ZTP Day0 Python Script Execution Complete ***


Guestshell destroyed successfully
```

The following example shows how to configure the device for Day Zero provisioning:

```
Both links down, not waiting for other switches
Switch number is 1

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           Cisco Systems, Inc.
           170 West Tasman Drive
           San Jose, California 95134-1706



Cisco IOS Software [Gibraltar], Catalyst L3 Switch Software (CAT9K_IOSXE), Version 16.12.3a,

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responsibility to monitor your usage of any such term Software feature to
ensure that your systems and networks are prepared for a shutdown of the
Software feature.


% Checking backup nvram
% No config present. Using default config

FIPS: Flash Key Check : Key Not Found, FIPS Mode Not Enabled

All TCP AO KDF Tests Pass
cisco C9300-48UXM (X86) processor with 1343703K/6147K bytes of memory.
Processor board ID FCW2144L045
2048K bytes of non-volatile configuration memory.
8388608K bytes of physical memory.
1638400K bytes of Crash Files at crashinfo:.
```

```
11264000K bytes of Flash at flash:.
0K bytes of WebUI ODM Files at webui:.

Base Ethernet MAC Address          : ec:1d:8b:0a:68:00
Motherboard Assembly Number        : 73-17959-06
Motherboard Serial Number          : FOC21418FPQ
Model Revision Number              : B0
Motherboard Revision Number        : A0
Model Number                       : C9300-48UXM
System Serial Number               : FCW2144L045


         --- System Configuration Dialog ---

Would you like to enter the initial configuration dialog? [yes/no]: day0guestshell installed
 successfully
Current state is: DEPLOYED
day0guestshell activated successfully
Current state is: ACTIVATED
day0guestshell started successfully
Current state is: RUNNING
Guestshell enabled successfully


HTTP server statistics:
Accepted connections total: 0

 *** Sample ZTP Day0 Python Script ***



 *** Executing show platform  ***


Switch  Ports    Model              Serial No.   MAC address     Hw Ver.       Sw Ver.
------  -----   ---------           ----------  --------------  -------       --------
 1       65     C9300-48UXM         FCW2144L045  ec1d.8b0a.6800  V01           16.12.3a

Switch/Stack Mac Address : ec1d.8b0a.6800 - Local Mac Address
Mac persistency wait time: Indefinite
                                    Current
Switch#   Role        Priority      State
-----------------------------------------
*1       Active          1          Ready


 *** Executing show version ***


Cisco IOS XE Software, Version 16.12.03a
Cisco IOS Software [Gibraltar], Catalyst L3 Switch Software (CAT9K_IOSXE), Version 16.12.3a,

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```

```
documentation or "License Notice" file accompanying the IOS-XE software,
or the applicable URL provided on the flyer accompanying the IOS-XE
software.
ROM: IOS-XE ROMMON
BOOTLDR: System Bootstrap, Version 17.2.1r[FC1], RELEASE SOFTWARE (P)
Switch uptime is 4 minutes
Uptime for this control processor is 9 minutes
System returned to ROM by Reload Command
System image file is "flash:cat9k_iosxe.16.12.03a.SPA.bin"
Last reload reason: Reload Command
This product contains cryptographic features and is subject to United
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http://www.cisco.com/wwl/export/crypto/tool/stqrg.html
If you require further assistance please contact us by sending email to
export@cisco.com.
Technology Package License Information:
------------------------------------------------------------------------------
Technology-package                                      Technology-package
Current                       Type                         Next reboot
------------------------------------------------------------------------------
network-advantage       Smart License                    network-advantage
None                    Subscription Smart License       None
AIR License Level: AIR DNA Advantage
Next reload AIR license Level: AIR DNA Advantage
Smart Licensing Status: UNREGISTERED/EVAL EXPIRED
cisco C9300-48UXM (X86) processor with 1343703K/6147K bytes of memory.
Processor board ID FCW2144L045
1 Virtual Ethernet interface
4 Gigabit Ethernet interfaces
36 2.5 Gigabit Ethernet interfaces
20 Ten Gigabit Ethernet interfaces
2 TwentyFive Gigabit Ethernet interfaces
2 Forty Gigabit Ethernet interfaces
2048K bytes of non-volatile configuration memory.
8388608K bytes of physical memory.
1638400K bytes of Crash Files at crashinfo:.
11264000K bytes of Flash at flash:.
0K bytes of WebUI ODM Files at webui:.
Base Ethernet MAC Address          : ec:1d:8b:0a:68:00
Motherboard Assembly Number        : 73-17959-06
Motherboard Serial Number          : FOC21418FPQ
Model Revision Number              : B0
Motherboard Revision Number        : A0
Model Number                       : C9300-48UXM
System Serial Number               : FCW2144L045
Switch Ports Model              SW Version        SW Image              Mode
------ ----- -----              ----------        ----------            ----
*    1 65    C9300-48UXM        16.12.3a          CAT9K_IOSXE           BUNDLE
Configuration register is 0x102


 *** Configuring a Loopback Interface ***


Line 1 SUCCESS: interface loop 100
Line 2 SUCCESS: ip address 10.10.10.10 255.255.255.255
Line 3 SUCCESS: end
```

```
*** Executing show ip interface brief  ***

Interface              IP-Address      OK? Method Status                Protocol
Vlan1                  unassigned      YES unset  up                    up
GigabitEthernet0/0     10.127.128.10   YES DHCP   up                    up
Tw1/0/1                unassigned      YES unset  down                  down
Tw1/0/2                unassigned      YES unset  down                  down
Tw1/0/3                unassigned      YES unset  down                  down
Tw1/0/4                unassigned      YES unset  down                  down
Tw1/0/5                unassigned      YES unset  down                  down
Tw1/0/6                unassigned      YES unset  down                  down
Tw1/0/7                unassigned      YES unset  down                  down
Tw1/0/8                unassigned      YES unset  down                  down
Tw1/0/9                unassigned      YES unset  down                  down
Tw1/0/10               unassigned      YES unset  down                  down
Tw1/0/11               unassigned      YES unset  down                  down
Tw1/0/12               unassigned      YES unset  down                  down
Tw1/0/13               unassigned      YES unset  down                  down
Tw1/0/14               unassigned      YES unset  down                  down
Tw1/0/15               unassigned      YES unset  down                  down
Tw1/0/16               unassigned      YES unset  down                  down
Tw1/0/17               unassigned      YES unset  down                  down
Tw1/0/18               unassigned      YES unset  down                  down
Tw1/0/19               unassigned      YES unset  down                  down
Tw1/0/20               unassigned      YES unset  down                  down
Tw1/0/21               unassigned      YES unset  down                  down
Tw1/0/22               unassigned      YES unset  down                  down
Tw1/0/23               unassigned      YES unset  down                  down
Tw1/0/24               unassigned      YES unset  down                  down
Tw1/0/25               unassigned      YES unset  down                  down
Tw1/0/26               unassigned      YES unset  down                  down
Tw1/0/27               unassigned      YES unset  down                  down
Tw1/0/28               unassigned      YES unset  down                  down
Tw1/0/29               unassigned      YES unset  down                  down
Tw1/0/30               unassigned      YES unset  down                  down
Tw1/0/31               unassigned      YES unset  down                  down
Tw1/0/32               unassigned      YES unset  down                  down
Tw1/0/33               unassigned      YES unset  down                  down
Tw1/0/34               unassigned      YES unset  down                  down
Tw1/0/35               unassigned      YES unset  down                  down
Tw1/0/36               unassigned      YES unset  down                  down
Te1/0/37               unassigned      YES unset  down                  down
Te1/0/38               unassigned      YES unset  down                  down
Te1/0/39               unassigned      YES unset  down                  down
Te1/0/40               unassigned      YES unset  down                  down
Te1/0/41               unassigned      YES unset  down                  down
Te1/0/42               unassigned      YES unset  down                  down
Te1/0/43               unassigned      YES unset  down                  down
Te1/0/44               unassigned      YES unset  down                  down
Te1/0/45               unassigned      YES unset  down                  down
Te1/0/46               unassigned      YES unset  down                  down
Te1/0/47               unassigned      YES unset  down                  down
Te1/0/48               unassigned      YES unset  up                    up
GigabitEthernet1/1/1   unassigned      YES unset  down                  down
GigabitEthernet1/1/2   unassigned      YES unset  down                  down
GigabitEthernet1/1/3   unassigned      YES unset  down                  down
GigabitEthernet1/1/4   unassigned      YES unset  down                  down
Te1/1/1                unassigned      YES unset  down                  down
Te1/1/2                unassigned      YES unset  down                  down
Te1/1/3                unassigned      YES unset  down                  down
Te1/1/4                unassigned      YES unset  down                  down
```

```
Te1/1/5                unassigned      YES unset  down                  down
Te1/1/6                unassigned      YES unset  down                  down
Te1/1/7                unassigned      YES unset  down                  down
Te1/1/8                unassigned      YES unset  down                  down
Fo1/1/1                unassigned      YES unset  down                  down
Fo1/1/2                unassigned      YES unset  down                  down
TwentyFiveGigE1/1/1    unassigned      YES unset  down                  down
TwentyFiveGigE1/1/2    unassigned      YES unset  down                  down
Ap1/0/1                unassigned      YES unset  up                    up
Loopback100            10.10.10.10     YES TFTP   up                    up


 *** Configuring username, password, SSH  ***


Line 1 SUCCESS: username cisco privilege 15 password cisco
**CLI Line # 1:  WARNING: Command has been added to the configuration using a type 0 password.

However, type 0 passwords will soon be deprecated. Migrate to a supported password type
Line 2 SUCCESS: ip domain name domain
Line 3 SUCCESS: line vty 0 15
Line 4 SUCCESS: login local
Line 5 SUCCESS: transport input all
Line 6 SUCCESS: end


 *** ZTP Day0 Python Script Execution Complete ***



Guestshell destroyed successfully



Press RETURN to get started!
```

Cisco IOS XE Amsterdam 17.2.x and Later Releases

This following example shows the sample boot logs before the .py script is run:

```
--- System Configuration Dialog ---

Would you like to enter the initial configuration dialog? [yes/no]:
Acquired IPv4 address 10.127.128.8 on Interface GigabitEthernet0/0
Received following DHCPv4 options:
        bootfile        : test.py
        tftp-server-ip  : 159.14.27.2

OK to enter CLI now...

pnp-discovery can be monitored without entering enable mode

Entering enable mode will stop pnp-discovery

Attempting bootfile tftp://159.14.27.2/test.py
day0guestshell activated successfully
Current state is: ACTIVATED
day0guestshell started successfully
Current state is: RUNNING
Guestshell enabled successfully
```

```
 *** Sample ZTP Day0 Python Script ***

...

 *** ZTP Day0 Python Script Execution Complete ***

Guestshell destroyed successfully
```

The following example shows how to configure the device for Day Zero provisioning:

```
Both links down, not waiting for other switches
Switch number is 1

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Software feature.


% Checking backup nvram
```

```
% No config present. Using default config

FIPS: Flash Key Check : Key Not Found, FIPS Mode Not Enabled

All TCP AO KDF Tests Pass
cisco C9300-48UXM (X86) processor with 1338934K/6147K bytes of memory.
Processor board ID FCW2144L045
2048K bytes of non-volatile configuration memory.
8388608K bytes of physical memory.
1638400K bytes of Crash Files at crashinfo:.
11264000K bytes of Flash at flash:.

Base Ethernet MAC Address          : ec:1d:8b:0a:68:00
Motherboard Assembly Number        : 73-17959-06
Motherboard Serial Number          : FOC21418FPQ
Model Revision Number              : B0
Motherboard Revision Number        : A0
Model Number                       : C9300-48UXM
System Serial Number               : FCW2144L045
CLEI Code Number                   :


No startup-config, starting autoinstall/pnp/ztp...

Autoinstall will terminate if any input is detected on console

Autoinstall trying DHCPv4 on GigabitEthernet0/0

Autoinstall trying DHCPv6 on GigabitEthernet0/0


         --- System Configuration Dialog ---

Would you like to enter the initial configuration dialog? [yes/no]:
Acquired IPv4 address 10.127.128.8 on Interface GigabitEthernet0/0
Received following DHCPv4 options:
        bootfile        : test.py
        tftp-server-ip  : 159.14.27.2

OK to enter CLI now...

pnp-discovery can be monitored without entering enable mode

Entering enable mode will stop pnp-discovery

Attempting bootfile tftp://159.14.27.2/test.py
day0guestshell activated successfully
Current state is: ACTIVATED
day0guestshell started successfully
Current state is: RUNNING
Guestshell enabled successfully


 *** Sample ZTP Day0 Python Script ***



 *** Executing show platform  ***

Switch  Ports    Model              Serial No.   MAC address     Hw Ver.       Sw Ver.
------  -----   ---------           -----------  --------------  -------       --------
 1       65     C9300-48UXM         FCW2144L045  ec1d.8b0a.6800  V01           17.02.01
```

```
Switch/Stack Mac Address : ec1d.8b0a.6800 - Local Mac Address
Mac persistency wait time: Indefinite
                                     Current
Switch#   Role        Priority      State
-----------------------------------------
*1       Active          1          Ready


 *** Executing show version ***


Cisco IOS XE Software, Version 17.02.01
Cisco IOS Software [Amsterdam], Catalyst L3 Switch Software (CAT9K_IOSXE), Version 17.2.1,
 RELEASE SOFTWARE (fc4)
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GPL code under the terms of GPL Version 2.0.  For more details, see the
documentation or "License Notice" file accompanying the IOS-XE software,
or the applicable URL provided on the flyer accompanying the IOS-XE
software.
ROM: IOS-XE ROMMON
BOOTLDR: System Bootstrap, Version 17.2.1r[FC1], RELEASE SOFTWARE (P)
Switch uptime is 2 minutes
Uptime for this control processor is 8 minutes
System returned to ROM by Reload Command
System image file is "flash:cat9k_iosxe.17.02.01.SPA.bin"
Last reload reason: Reload Command
This product contains cryptographic features and is subject to United
States and local country laws governing import, export, transfer and
use. Delivery of Cisco cryptographic products does not imply
third-party authority to import, export, distribute or use encryption.
Importers, exporters, distributors and users are responsible for
compliance with U.S. and local country laws. By using this product you
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http://www.cisco.com/wwl/export/crypto/tool/stqrg.html
If you require further assistance please contact us by sending email to
export@cisco.com.
Technology Package License Information:
------------------------------------------------------------------------------
Technology-package                                      Technology-package
Current                       Type                         Next reboot
------------------------------------------------------------------------------
network-advantage       Smart License                    network-advantage
None                    Subscription Smart License       None
AIR License Level: AIR DNA Advantage
Next reload AIR license Level: AIR DNA Advantage
Smart Licensing Status: UNREGISTERED/EVAL EXPIRED
cisco C9300-48UXM (X86) processor with 1338934K/6147K bytes of memory.
Processor board ID FCW2144L045
1 Virtual Ethernet interface
4 Gigabit Ethernet interfaces
36 2.5 Gigabit Ethernet interfaces
20 Ten Gigabit Ethernet interfaces
2 TwentyFive Gigabit Ethernet interfaces
2 Forty Gigabit Ethernet interfaces
```

```
2048K bytes of non-volatile configuration memory.
8388608K bytes of physical memory.
1638400K bytes of Crash Files at crashinfo:.
11264000K bytes of Flash at flash:.
Base Ethernet MAC Address          : ec:1d:8b:0a:68:00
Motherboard Assembly Number        : 73-17959-06
Motherboard Serial Number          : FOC21418FPQ
Model Revision Number              : B0
Motherboard Revision Number        : A0
Model Number                       : C9300-48UXM
System Serial Number               : FCW2144L045
CLEI Code Number                   :
Switch Ports Model              SW Version        SW Image              Mode
------ ----- -----              ----------        ----------            ----
*    1 65    C9300-48UXM        17.02.01          CAT9K_IOSXE           BUNDLE
Configuration register is 0x102


 *** Configuring a Loopback Interface ***


Line 1 SUCCESS: interface loop 100
Line 2 SUCCESS: ip address 10.10.10.10 255.255.255.255
Line 3 SUCCESS: end


 *** Executing show ip interface brief  ***


Interface              IP-Address      OK? Method Status                Protocol
Vlan1                  unassigned      YES unset  up                    up
GigabitEthernet0/0     10.127.128.8    YES DHCP   up                    up
Tw1/0/1                unassigned      YES unset  down                  down
Tw1/0/2                unassigned      YES unset  down                  down
Tw1/0/3                unassigned      YES unset  down                  down
Tw1/0/4                unassigned      YES unset  down                  down
Tw1/0/5                unassigned      YES unset  down                  down
Tw1/0/6                unassigned      YES unset  down                  down
Tw1/0/7                unassigned      YES unset  down                  down
Tw1/0/8                unassigned      YES unset  down                  down
Tw1/0/9                unassigned      YES unset  down                  down
Tw1/0/10               unassigned      YES unset  down                  down
Tw1/0/11               unassigned      YES unset  down                  down
Tw1/0/12               unassigned      YES unset  down                  down
Tw1/0/13               unassigned      YES unset  down                  down
Tw1/0/14               unassigned      YES unset  down                  down
Tw1/0/15               unassigned      YES unset  down                  down
Tw1/0/16               unassigned      YES unset  down                  down
Tw1/0/17               unassigned      YES unset  down                  down
Tw1/0/18               unassigned      YES unset  down                  down
Tw1/0/19               unassigned      YES unset  down                  down
Tw1/0/20               unassigned      YES unset  down                  down
Tw1/0/21               unassigned      YES unset  down                  down
Tw1/0/22               unassigned      YES unset  down                  down
Tw1/0/23               unassigned      YES unset  down                  down
Tw1/0/24               unassigned      YES unset  down                  down
Tw1/0/25               unassigned      YES unset  down                  down
Tw1/0/26               unassigned      YES unset  down                  down
Tw1/0/27               unassigned      YES unset  down                  down
Tw1/0/28               unassigned      YES unset  down                  down
Tw1/0/29               unassigned      YES unset  down                  down
Tw1/0/30               unassigned      YES unset  down                  down
Tw1/0/31               unassigned      YES unset  down                  down
Tw1/0/32               unassigned      YES unset  down                  down
```

```
Tw1/0/33               unassigned      YES unset  down                  down
Tw1/0/34               unassigned      YES unset  down                  down
Tw1/0/35               unassigned      YES unset  down                  down
Tw1/0/36               unassigned      YES unset  down                  down
Te1/0/37               unassigned      YES unset  down                  down
Te1/0/38               unassigned      YES unset  down                  down
Te1/0/39               unassigned      YES unset  down                  down
Te1/0/40               unassigned      YES unset  down                  down
Te1/0/41               unassigned      YES unset  down                  down
Te1/0/42               unassigned      YES unset  down                  down
Te1/0/43               unassigned      YES unset  down                  down
Te1/0/44               unassigned      YES unset  down                  down
Te1/0/45               unassigned      YES unset  down                  down
Te1/0/46               unassigned      YES unset  down                  down
Te1/0/47               unassigned      YES unset  down                  down
Te1/0/48               unassigned      YES unset  up                    up
GigabitEthernet1/1/1   unassigned      YES unset  down                  down
GigabitEthernet1/1/2   unassigned      YES unset  down                  down
GigabitEthernet1/1/3   unassigned      YES unset  down                  down
GigabitEthernet1/1/4   unassigned      YES unset  down                  down
Te1/1/1                unassigned      YES unset  down                  down
Te1/1/2                unassigned      YES unset  down                  down
Te1/1/3                unassigned      YES unset  down                  down
Te1/1/4                unassigned      YES unset  down                  down
Te1/1/5                unassigned      YES unset  down                  down
Te1/1/6                unassigned      YES unset  down                  down
Te1/1/7                unassigned      YES unset  down                  down
Te1/1/8                unassigned      YES unset  down                  down
Fo1/1/1                unassigned      YES unset  down                  down
Fo1/1/2                unassigned      YES unset  down                  down
TwentyFiveGigE1/1/1    unassigned      YES unset  down                  down
TwentyFiveGigE1/1/2    unassigned      YES unset  down                  down
Ap1/0/1                unassigned      YES unset  up                    up
Loopback100            10.10.10.10     YES TFTP   up                    up


 *** Configuring username, password, SSH  ***


Line 1 SUCCESS: username cisco privilege 15 password cisco
**CLI Line # 1:  WARNING: Command has been added to the configuration using a type 0 password.

However, type 0 passwords will soon be deprecated. Migrate to a supported password type
Line 2 SUCCESS: ip domain name domain
Line 3 SUCCESS: line vty 0 15
Line 4 SUCCESS: login local
Line 5 SUCCESS: transport input all
Line 6 SUCCESS: end


 *** ZTP Day0 Python Script Execution Complete ***



Guestshell destroyed successfully
Script execution success!



Press RETURN to get started!
```

Additional References for Zero-Touch Provisioning

Standards and RFCs

Standard/RFC	Title
RFC 5652	*Cryptographic Message Syntax (CMS)*
RFC 8040	*RESTCONF Protocol*
RFC 8366	*A Voucher Artifact for Bootstrapping Protocols*
RFC 8572	*Secure Zero Touch Provisioning (SZTP)*

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.	https://www.cisco.com/c/en/us/support/index.html

Feature Information for Zero-Touch Provisioning

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 Zero-Touch Provisioning

Feature Name	Release	Feature Information
Zero-Touch Provisioning	Cisco IOS XE Everest 16.5.1a Cisco IOS XE Everest 16.5.1b Cisco IOS XE Fuji 16.7.1 Cisco IOS XE Fuji 16.8.2 Cisco IOS XE Gibraltar 16.12.1 Cisco IOS XE Amsterdam 17.2.1 Cisco IOS XE Amsterdam 17.3.1 Cisco IOS XE Cupertino 17.8.1	

Feature Name	Release	Feature Information
		To address network provisioning challenges, Cisco introduces a zero-touch provisioning model. In Cisco IOS XE Everest 16.5.1a, this feature was implemented on the following platforms: • Cisco Catalyst 3650 Series Switches • Cisco Catalyst 3850 Series Switches • Cisco Catalyst 9300 Series Switches • Cisco Catalyst 9500 Series Switches In Cisco IOS XE Everest 16.5.1b, this feature was implemented on the following platform: • Cisco 4000 Series Integrated Services Router models with a minimum of 8 GB RAM to support Guest Shell. In Cisco IOS XE Fuji 16.7.1, this feature was implemented on the following platform: • Cisco ASR 1000 Aggregation Services Routers (ASR1001-X, ASR1001-HX, ASR1002-X, ASR1002-HX) In Cisco IOS XE Fuji 16.8.2, this feature was implemented on the following platform: • Cisco ASR 1000 Series Aggregation Services Routers (ASR1004, ASR1006, ASR1006-X, ASR1009-X, ASR1013) In Cisco IOS XE Gibraltar 16.12.1, this feature was implemented on the following platforms: • Cisco Catalyst 9200 Series Switches **Note** This feature is not supported on C9200L SKUs. • Cisco Catalyst 9300L SKUs • Cisco Catalyst 9600 Series Switches • Cisco Catalyst 9800-40 Wireless Controllers • Cisco Catalyst 9800-80 Wireless Controllers

Feature Name	Release	Feature Information
		In Cisco IOS XE Amsterdam 17.2.1, this feature was implemented on the following platforms: • Cisco Cloud Services Router 1000V Series • Cisco C1100 Terminal Services Gateway (Supported only on C1100TGX-1N24P32A) In Cisco IOS XE Amsterdam 17.3.1, this feature was implemented on the following platforms: • Cisco Catalyst 8200 Series Edge Platforms • Cisco Catalyst 8300 Series Edge Platforms • Cisco Catalyst 8500 and 8500L Series Edge Platforms In Cisco IOS XE Bengaluru 17.4.1, this feature was implemented on the following platform: • Cisco Catalyst 8000V Edge Software In Cisco IOS XE Cupertino 17.8.1, this feature was implemented on the following platform: • Cisco Catalyst 9800-L Wireless Controller

Feature Name	Release	Feature Information
Zero-Touch Provisioning: HTTP Download	Cisco IOS XE Fuji 16.8.1 Cisco IOS XE Fuji 16.8.1a	Zero-Touch Provisioning supports HTTP and TFTP file download. In Cisco IOS XE Everest 16.8.1, this feature was implemented on the following platforms: • Cisco 4000 Series Integrated Services Routers • Cisco Catalyst 3650 Series Switches • Cisco Catalyst 3850 Series Switches • Cisco Catalyst 9300 Series Switches • Cisco Catalyst 9500 Series Switches In Cisco IOS XE Fuji 16.8.1a, this feature was implemented on Cisco Catalyst 9500-High Performance Series Switches.
DHCPv6 Support for Zero-Touch Provisioning	Cisco IOS XE Fuji 16.9.1 Cisco IOS XE Amsterdam 17.3.2a	In Cisco IOS XE Fuji 16.9.1, this feature was implemented on the following platforms: • Cisco Catalyst 9300 Series Switches • Cisco Catalyst 9500 Series Switches In Cisco IOS XE Amsterdam 17.3.2a, this feature was implemented on the following platforms: • Cisco Catalyst 9800-40 Wireless Controllers • Cisco Catalyst 9800-80 Wireless Controllers

Feature Name	Release	Feature Information
Side-Effect Synchronization of the Configuration Database	Cisco IOS XE Bengaluru 17.4.1	During configuration changes in the DMI, a partial synchronization of the changes that are triggered when a command or RPC is configured occurs. This is called the side-effect synchronization, and it reduces the synchronization time and NETCONF downtime. This feature was implemented on the following platforms: • Cisco ASR 1000 Aggregation Services Routers • Cisco Catalyst 8500 and 8500L Series Edge Platforms • Cisco Catalyst 9200 Series Switches • Cisco Catalyst 9300 Series Switches • Cisco Catalyst 9400 Series Switches • Cisco Catalyst 9500 Series Switches • Cisco Catalyst 9600 Series Switches
Zero-Touch Provisioning Through YANG Models	Cisco IOS XE Cupertino 17.7.1	ZTP is enabled through YANG models when NETCONF is enabled. This feature is supported on all platforms that support NETCONF-YANG.
Zero-Touch Provisioning Support on Data Port	Cisco IOS XE Cupertino 17.7.1	ZTP is supported on data port for both IPv4 and IPv6. This feature is implemented on the following platform: • Cisco Catalyst 9800-L Wireless Controller

Feature Name	Release	Feature Information
Secure Zero-Touch Provisioning	Cisco IOS XE Dublin 17.11.1	Secure ZTP provisions a device securely while booting in factory default state. This feature is implemented on the following platforms: • Cisco Catalyst 9300 and 9300L Series Switches • Cisco Catalyst 9400 Series Switches • Cisco Catalyst 9500 and 9500-High Performance Series Switches • Cisco Catalyst 9600 Series Switches