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Quick Start Guide for Onboarding Industrial Routers to Cisco Secure Equipment Access

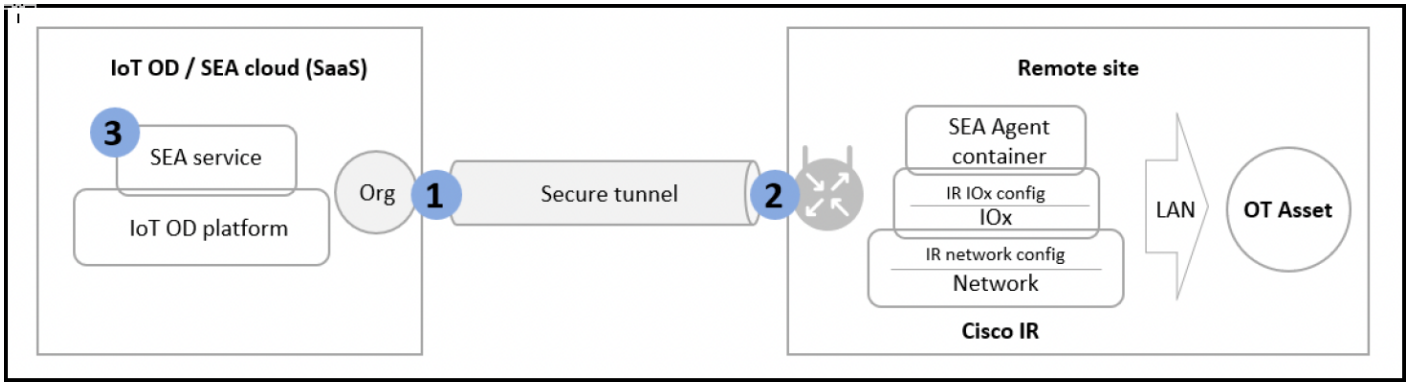
Objective

This guide helps new SEA administrators onboard their first Cisco industrial router (IR) to Cisco IoT Operations Dashboard. It also guides them in configuring the first remote session through the Secure Equipment Access (SEA) service. Upon completion, SEA administrators will be able to remotely access the required asset from an Internet-enabled device. This self-contained quick start guide provides the shortest and most efficient path to achieving the objective. For more details and advanced concepts, refer to the Cisco IoT Operations Dashboard documentation.

Introduction

The Cisco Secure Equipment Access (SEA) service is a hybrid-cloud solution with control and management handled by the Cisco IoT Operations Dashboard. The on-premises component runs on a supported industrial network device deployed at a remote site with the target operational technology (OT) asset. The SEA service aims to provide customers and partners with remote access to specific industrial IoT resources for maintenance operations.

Figure 1: SEA Components



Prerequisites

- You must have a valid IoT OD organization (cloud tenant). If you don't have one, send a request to mailto:iotod-account-request@cisco.com.
- You must have an Application Manager admin and SEA System admin roles in the organization. For details, see SEA roles and permissions.
- The IR routers must run Cisco IOS XE version 17.15.1 or later.
- The IR routers have an active Internet connetion to us.ciscoiot.com or eu.ciscoiot.com, depending on the IoT OD cluster used.

High Level Workflow

1. Application Manager Service Configurations: Onboard the required IR device through the Application Manager service on IoT OD.
2. IR Router Configurations: Configure the IR device to establish a secure tunnel to the IoT OD for application management.
3. Remote Access Configurations: Install the SEA agent on the IR device and configure a remote session through SEA for the target OT asset.

Application Manager Service Configurations

The Application Manager is one of the many services in the Cisco IoT Operations Dashboard. Perform the following tasks in the Application Manager service.

Create a Device Profile

A device profile is a set of common settings such as user credentials that can be linked to multiple devices. When you onboard a device, Cisco IoT OD uses the user credentials configured in the device profile to establish a connection.

1. In the Cisco IoT Operations Dashboard, navigate to **Application Manager** service.
2. Go to **Device Profiles** and click **Create Device Profile**. The **Create Device Profile** page appears.
3. On the **Create Device Profile** page:
   a. Enter a profile name in the **Device Profile Name** field.
   b. (Optional) Enter a description in the **Device Profile Description** field.
   c. Click **Next**.
4. In the **Configure credentials** area, enter a user name and password in the respective fields for the device profile configuration.

Note

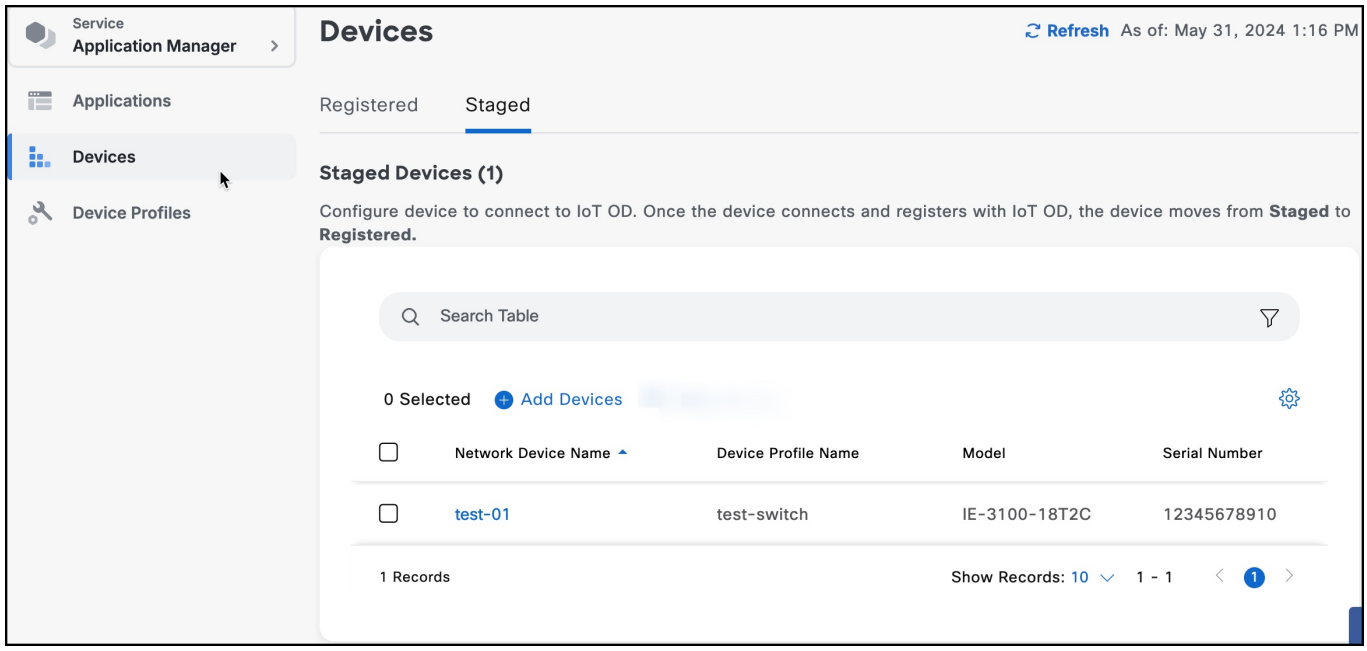
Use privilege level 15 user credentials

5. Click **Next**. The created profile appears for your review.
6. After confirming the device profile details, click **Create Device Profile**. The created device profile is listed on the **Device Profiles** page.

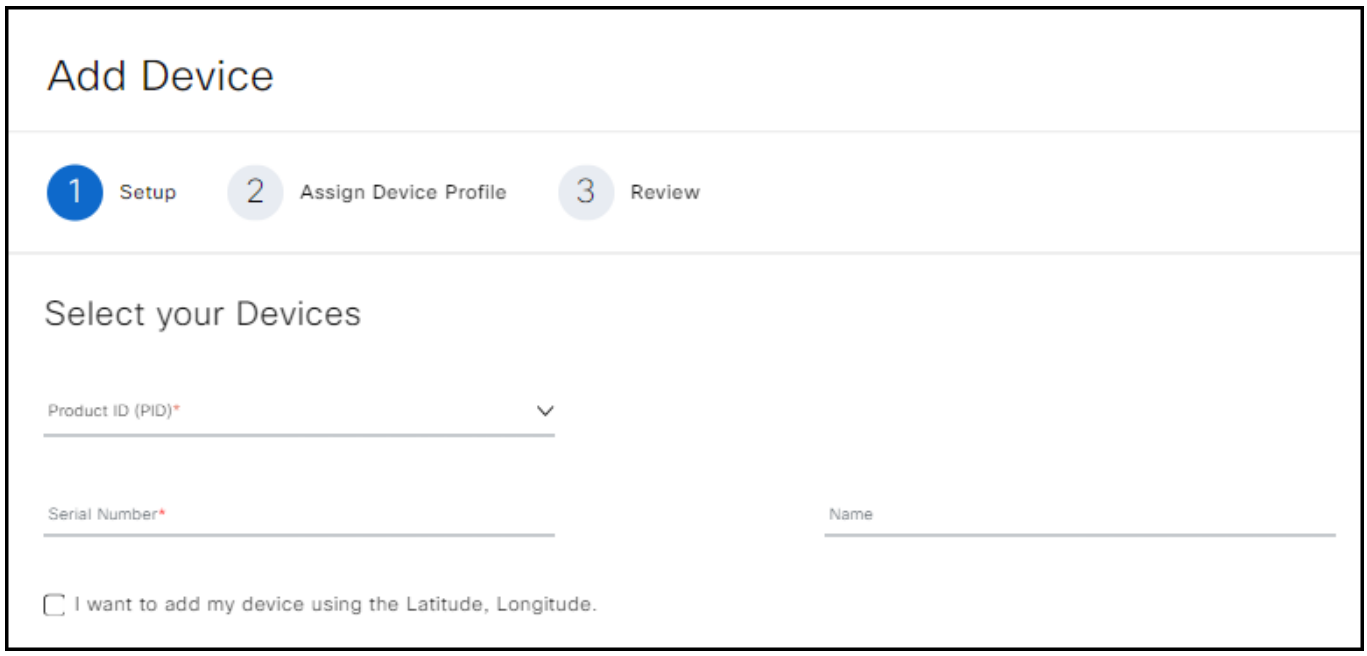
Add IR Routers to App Manager Service

After you create a device profile, you can add IR routers to the Application Manager service by using this procedure.

1. In the Cisco IoT Operations Dashboard, navigate to **Application Manager** service.
2. Choose **Devices** > **Staged** tab.



3. Click **Add Devices**. The **Select Add Device Method** window appears.
4. On the window, select **Single Device** to open the **Add Device** page.
5. On the **Add Device** page, enter the product ID, serial number, and a name in the respective fields.

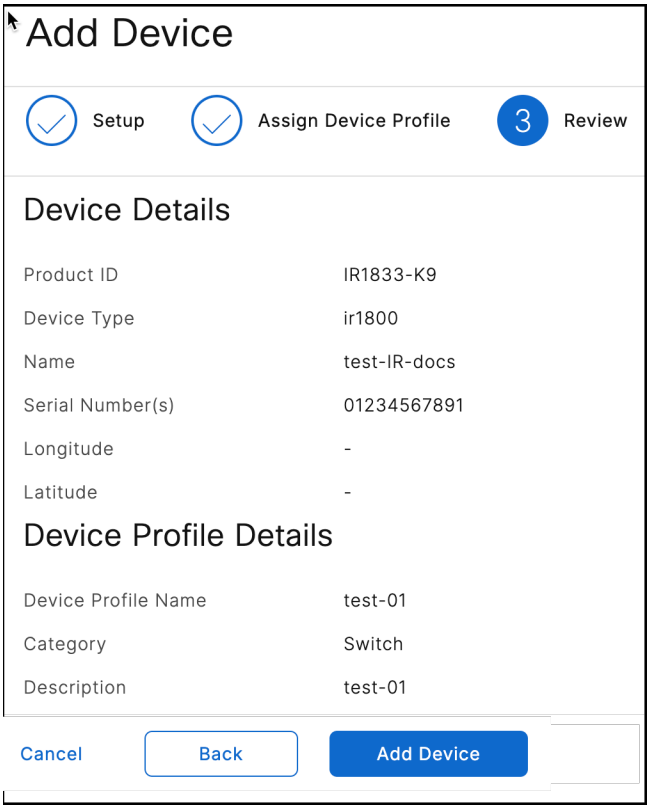


Note

Use the following command on the console of your device to display the product ID and the serial mumber:

Router# **show license udi**

6. Click **Next**.
7. On the **Select Device Profile for Assignment** page, choose a device profile from the list and click **Next**.
8. Review the configuration information on the **Review** page.



9. Click **Add Device**.

   The new device is listed under **Staged Devices**, indicating it is added through the Application Manager service but not registered with the Cisco IoT Operations Dashboard yet.

IR Router Configurations

To prepare and configure the IR device for Cisco IoT Operations Dashboard, you must perform various tasks using the device's CLI.

Prerequisites for Configuring IR Routers

- **For IR1101 devices**: Ensure that the device has IOx container keys programmed:

  Verification

  1. Run the command: `Router#show software authenticity keys | i Name`
  2. Check for lines with "Product Name: Cisco Services Containers"

  If missing:

- **Pre-January 2020 devices:** Disable signature verification or upgrade the device.

  IR1100 devices shipped after January 1, 2020, should have the container keys programmed.

  Note

  If the device doesn't have container keys programmed and signature verification enabled, SEA installation will fail with a signature verification error.

- Ensure that the IR router is added to Cisco IoT OD Application Manager.

Configuration workflow

1. Prepare the device
2. Configure and Enable IOx, on page 5
3. Configure the IR Router to Connect to IoT OD, on page 6
4. Verify the Configuration on the Device, on page 8
5. Verify the Device Status on the IoT Operations Dashboard, on page 8

Prepare the IR Device

1. Attach the necessary networking cables.
2. Power up the device.

Configure and Enable IOx

IOx is a container hosting platform that runs on Cisco IOS XE. It's used to install and execute several services that Cisco IoT Operations Dashboard can deliver such as Secure Equipment Access (SEA), Cisco Cyber Vision (CCV), and Edge Intelligence (EI).

Follow these steps to configure and enable IOx on your IR router:

1. Configure the VirtualPortGroup0 (VPG) Interface , DHCP Pool, and NAT Rules on the device for IOx Network.

   a. **Configure the VPG Interface**. The virtual interface that connects IOx applications to IOS XE is called VirtualPortGroup0. The IOx applications will need IP connectivity through the virtual interface, which includes receiving an IP address. An example configuration is given in the next line. You can change the IP address to suit your requirements. Enter these configuration commands on the router console, in the config mode.

   ```
   ! Example
     conf t
     interface VirtualPortGroup0
     description IOx Interface
     ip address 192.168.16.1 255.255.255.0
     ip nat inside
     ipv6 enable
     end
   ```

   b. **Configure the DHCP pool**. When the IOx applications start, they will request an IP address via DHCP. Therefore, you need to configure a DHCP pool for IOx applications. An example configuration of IP pool and DNS server is given in the next

line. You can customize this configuration to suit your requirements. Ensure that the default router IP address is the same as the IP address previously configured for the `VirtualPortGroup0` interface.

```
! Example
  conf t
  ip dhcp pool ioxpool
  network 192.168.16.0 255.255.255.0
  default-router 192.168.16.1
  dns-server 192.168.16.1 8.8.8.8
  end
```

c. **Configure NAT**. IOx Apps use private IP addresses obtained from DHCP. They need Network Address Translation (NAT) to access the internet. Add NAT Rules for the DHCP pool to enable IOx App traffic to access the internet.

   In the example below, assume that the connection to the internet will be through Cellular 0/1/0. Make sure to change or adjust the interface if it is not Cellular 0/1/0. For example, it could be GigabitEthernet 0/0/0 or Cellular 0/3/0.

```
! Example of a NAT rule for using Cellular0/1/0 as an uplink:
  conf t
  interface Cellular0/1/0
  ip nat outside
  ip access-list extended NAT_ACL
  10 permit ip 192.168.16.0 0.0.0.255 any
  route-map RM_WAN_ACL2 permit 10
  match ip address NAT_ACL
  match interface Cellular0/1/0
  ip nat inside source route-map RM_WAN_ACL2 interface Cellular0/1/0 overload
  end
```

2. Enable IOx.

```
conf t
iox
end
```

3. Verify that IOx is running correctly by running this command in exec mode:

```
show iox-service
! Example 1: When IOx is up and running, both the "IOx service (CAF)" and "dockerd" will be running.
Router#sh iox-service
IOx Infrastructure Summary:
---------------------------
IOx service (CAF)          : Running
IOx service (HA)           : Not Supported
IOx service (IOxman)       : Running
IOx service (Sec storage)  : Running
Libvirtd 5.5.0             : Running
Dockerd v19.03.13-ce       : Running
```

Configure the IR Router to Connect to IoT OD

To establish a connection with the Cisco IoT Operations Dashboard, you must run a set of IOS commands on the device's CLI. To manage the IOx Apps, the Cisco IoT Operations Dashboard requires a valid user configured with level 15 credentials on the switch in IOS XE.

1. Create a privilege 15 user by applying the following configuration. The credentials should match the values configured in the Device Profile on the Cisco IoT Operations Dashboard:

```
conf t
username <DEVICE PROFILE USERNAME> privilege 15 algorithm-type scrypt secret <DEVICE PROFILE PASSWORD>
end
```

2. Configure the authentication-related settings and WSMA settings.

```
conf t
aaa new-model
aaa authentication login default local
aaa authorization exec default local
ip http server
ip http authentication local
ip http secure-server
wsma agent exec
profile exec
wsma profile listener exec
transport http path /wsma/exec
cgna gzip
end
```

3. Configure the IDA transport profile: Enable a secure TLS connection using WebSocket to Cisco IoT Operations Dashboard using TLS with port TCP 443.

   For the US Cluster:

```
conf t
ida transport-profile wst
 callhome-url wss://device-us.ciscoiot.com/wst/cgna
 active
end
```

   For the EU Cluster:

```
conf t
ida transport-profile wst
 callhome-url wss://device-eu.ciscoiot.com/wst/cgna
 active
end
```

4. Configure the CGNA registration profile.

```
conf t
  cgna profile cg-nms-register
   transport-profile wst
   add-command show version | format flash:/managed/odm/cg-nms.odm
   add-command show inventory | format flash:/managed/odm/cg-nms.odm
   interval 3
   active
   url https://localhost/cgna/ios/registration
   gzip
  end
```

Note

Once the configuration is done, the device connects to IoT OD and triggers the registration process.

5. (Optional) Enable DNS on the router if it's not already acquired through the DHCP server.

   This is important if the router is configured with a static IP and a static default gateway, and no DNS server is explicitly specified. In this example, we use a Cisco DNS. You can use any DNS server.

```
conf t
ip name-server 208.67.222.222
end
```

Verify the Configuration on the Device

Use the following commands to verify that the device is configured correctly to connect to IoT OD.

Router# **show ida transport-profile-state all**

```
! Verify that IDA status is connected for the "wst" transport profile
 ! Notice the line "IDA Status: Connected" in the show command output below for the "wst" transport profile.
 Router#sh ida transport-profile-state all
 Transport Profile 1:
 Profile Name: wst
 Activated at: Fri Jun  7 07:26:42 2024
 Reconnect Interval: 30 seconds
 keepalive timer Interval: 50 seconds
 Source interface: [not configured]
 callhome-url: wss://device-us.ciscoiot.com/wst/cgna
 Local TrustPoint: CISCO_IDEVID_SUDI
 Remote TrustPoint: [not configured]
 Execution-url: http://192.168.16.1
 Proxy-Addr: [not configured]
 IDA Status: Connected
 State: Wait for activation
 Last successful response at Fri Jun  7 08:25:29 2024
 Last failed response:
 Last failed reason:
```

Verify the Device Status on the IoT Operations Dashboard

Once IoT OD receives a registration request from a device and validates its configuration, the device automatically moves from the **Devices > Staged** status to **Registered** status in your IoT OD Organization.

Troubleshoot Issues

- If IoT OD receives a registration attempt but encounters some issues, (e.g., incorrect credentials), the IR device remains in the **Devices > Staged** list with **Configure Failure** status until IoT OD receives a registration attempt with the correct credentials.
- If IoT OD does not receive any registration attempt, the IR device remains in the **Devices > Staged** list.

Remote Access Configurations

You can use SEA to remotely manage and interact with operational technology (OT) assets and network devices.

This topic explains the simplyfied procedure for installing an SEA agent on a network device and then configuring and connecting to a remote asset by using **Quick Wizard**.

Remote session configuration includes the following steps:

1. Install SEA agent on your IR router.
2. Configure remote sessions for the users.
3. Connect to a remote OT asset.

Install SEA Agent on IR Routers

Ensure the IR router is added to the IoT OD Application Manager service.

Step 1 Navigate to **Secure Equipment Access > Quick Wizard**.

The **Quick Wizard** page appears.

Step 2 Under **Install SEA Agent**, click **Start Configuration**.

All network devices added to the **App Manager Service** are listed under the **Select Network Device** area.

Step 3 Select the device on which you want to install the SEA agent, and click **Next**.

The **Advanced Configuration** page appears, displaying the default settings for the agent installation. By default, the SEA agent is installed on the native VLAN using DHCP without a proxy.

Step 4 (Optional) To customize the settings for agent installation, enter the required configuration details on the **Advanced Configuration** page, and click **Deploy**.

The SEA agent will be installed on the network device. You can verify its status on the **SEA Agent Connection** column on the **System Management** page. Wait for 5 to 10 minutes before checking the status.

Configure Remote Sessions

Ensure that the SEA agent is installed on the IR router that can reach the OT assets you want to manage.

SEA Users and Access Groups

SEA users are granted access through specific access groups. It is recommended that you create an access group and add both users and the configured remote session to the group. Only users in the group can remotely access OT assets.

High-Level Steps to Configure a Remote Session

1. Select a network device to be connected to the asset
2. Configure the asset
3. Configure an access method for remotely accessing the asset
4. Choose an access control group to which both the asset and the user belong
5. Verify that the connection is working

Step 1 Navigate to **Secure Equipment Access > Quick Wizard**.

The **Quick Wizard** page appears on the right.

Step 2 Under **Connect to Asset**, click **Start Configuration**.

All network devices added to the **App Manager Service** are listed under the **Select Network Device** area.

Step 3 Select an IR router from the list and then click **Next**.

The OT asset that you configure in the next step will be associated with this device.

Step 4 Configure connected asset. In the **Configure Connected Asset** area, enter the following details, and click **Next**:

a) **Asset Name**: Name of the assets to be added.
b) **IP Address**: IP address of the asset.
c) **Description**: A brief description about the asset.

Step 5 Configure access method.

a) Choose an access method from the **Choose Access Method** drop-down list.

An SEA user will access the asset by using the access method you choose here. The available options are RDP, SSH, Telnet, VNC, and Web App. Depending on the access method you select, additional fields are populated.

b) Choose an access control group from the **Assign to an Access Control Group** drop-down list and click **Finish**.

Only users who are added to the access control group can remotely access the assets within the group.

Step 6 Test the remote connection by clicking **Test Access Method**.

A new page appears confirming the connection to the asset.

Step 7 Click **Done**.

The remote session you configured will be displayed on the **Remote Sessions** page. An SEA user can log in to the Cisco IoT Operations Dashboard to access the session.

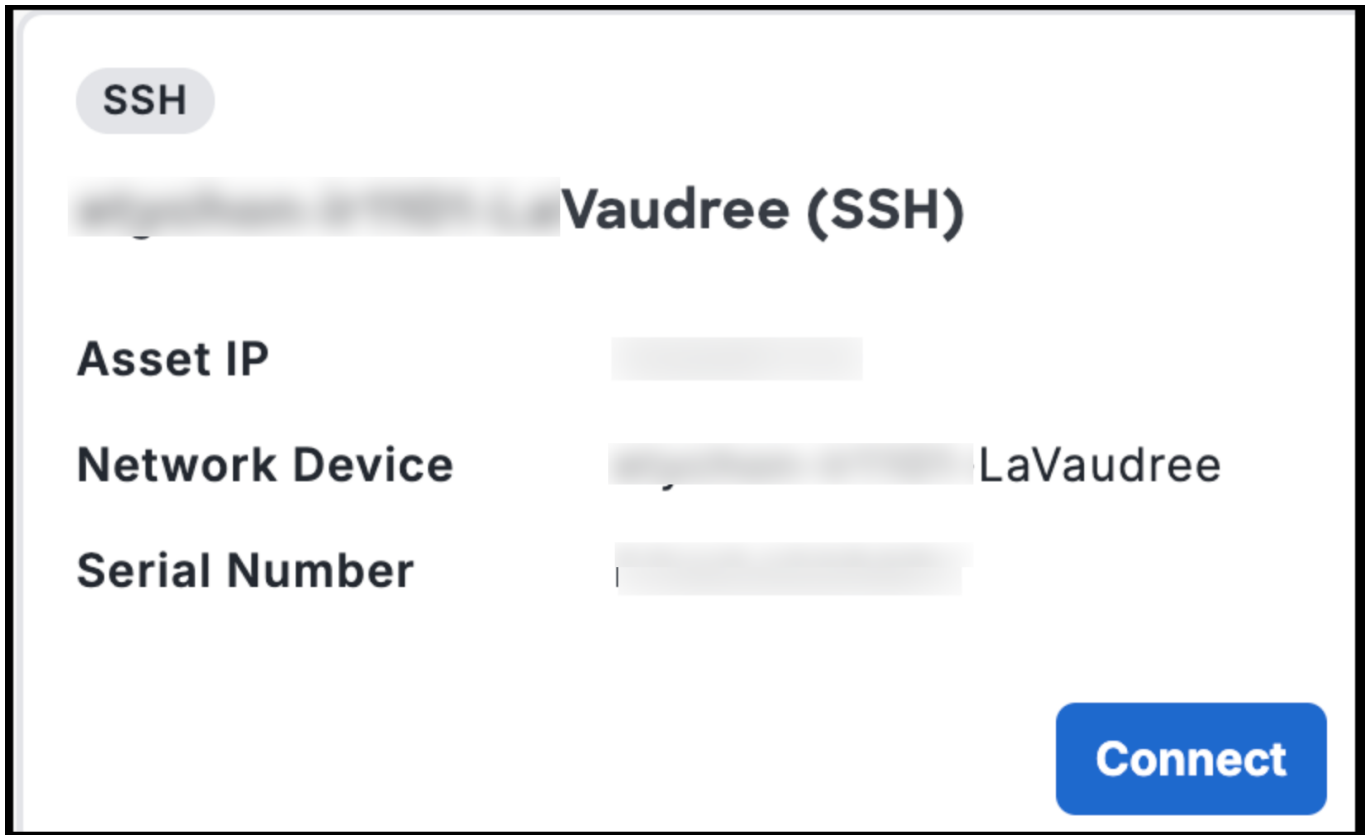
Connect to Remote Assets

After you configure remote sessions, SEA users can connect to remote OT assets.

1. Log in to the Cisco IoT Operations Dashboard as an SEA user.
2. Click **Secure Equipment Access > Remote Sessions**.

   All available sessions are displayed on the screen.
3. Go to the session of your choice and click **Connect**.

   The SEA user connects to the asset using the previously configured access method.


SSH
Vaudree (SSH)
Asset IP
Network Device
LaVaudree
Serial Number
Connect