CHAPTER 3

Configuring the Infrastructure

This chapter describes how to configure IDMZ infrastructure in the CPwE architecture based on the design considerations of the previous chapters. It covers the configuration of the network infrastructure, network services, data transfer, remote access services and network and application security, all from an IDMZ perspective. The included configurations have been validated during the testing effort.

This chapter includes the following major topics:

Configuring IDMZ Network Infrastructure

This section describes validated configurations for the network infrastructure that establishes the IDMZ within the CPwE architecture, such as firewalls and switches.

Industrial Zone Firewall Configuration

The following firewall configuration steps are covered in this section:

- Configuration of the IDMZ firewall in active/standby mode
- Configuration of the IDMZ network interface on the firewall

Active/Standby Firewall Configuration

Note This guide assumes that the user has already performed the initial setup and hardening of the Cisco Firepower 2100. For more details on these configurations, refer to:

- https://www.cisco.com/c/en/us/support/security/firepower-2100-series/series.html#~tab-documents

The following steps describe the initial configuration of the active and standby IDMZ firewalls:

Step 1 Configure interfaces for the Industrial and Enterprise Zones (see Figure 3-1):

a. In Cisco FMC, select **Devices > Device Management** and click **Edit** for your FTD device. The **Interfaces** page is selected by default.

b. Click **Add Interfaces > Ether Channel Interface**.

c. On the **General** tab, set the **Ether Channel ID** to a number between 1 and 48.

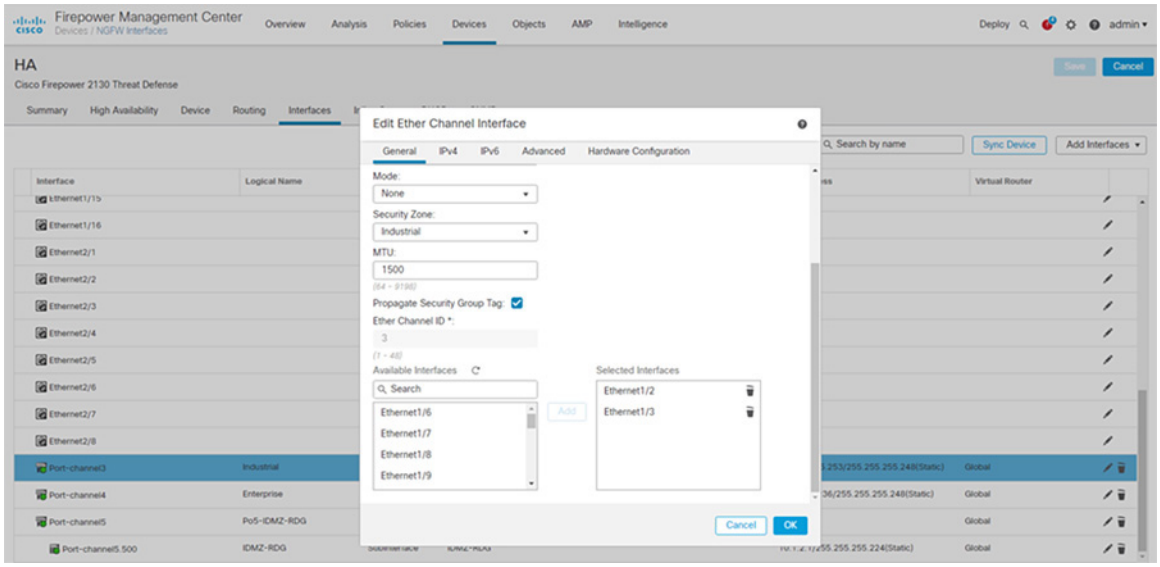
d. In the **Available Interfaces** area, click an interface and then click **Add** to move it to the **Selected Interfaces** area. Repeat for all interfaces you want to make members.

Note Make sure all interfaces are the same type and speed. The first interface you add determines the type and speed of the EtherChannel. Any non-matching interfaces you add will be put into a suspended state. The FMC does not prevent you from adding non-matching interfaces.

e. Click **OK**.

f. Click **Save**. Make sure to **Deploy** changes when configuration is complete.

Figure 3-1 FMC EtherChannel Interface Configuration



Step 2 Configure EIGRP as the dynamic routing protocol (see Figure 3-2):

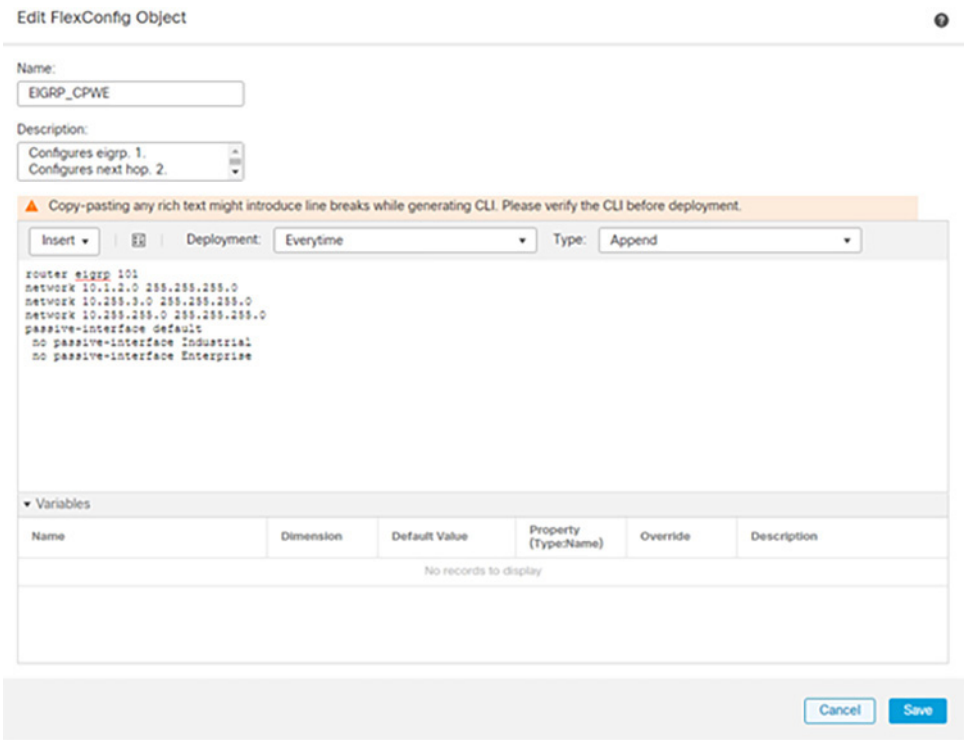
Note FlexConfig is used to allow you to implement features that are not yet directly supported through FMC policies and settings. FlexConfig can be a useful tool when migrating from ASA to FTD and there are compatible features you are using (and continuing to use) that FMC does not directly support.

a. In FMC, select **Objects > Object Management** and navigate to **FlexConfig > FlexConfig Object**.

b. Click **Add FlexConfig Object**.

c. Give a meaningful name to the object, and insert the desired EIGRP configuration for the FTD (see Figure 3-2 for an example).

Figure 3-2 FMC EIGRP FlexConfig Object



d. Continuing in FMC, select **Devices > FlexConfig** and click **New Policy**.

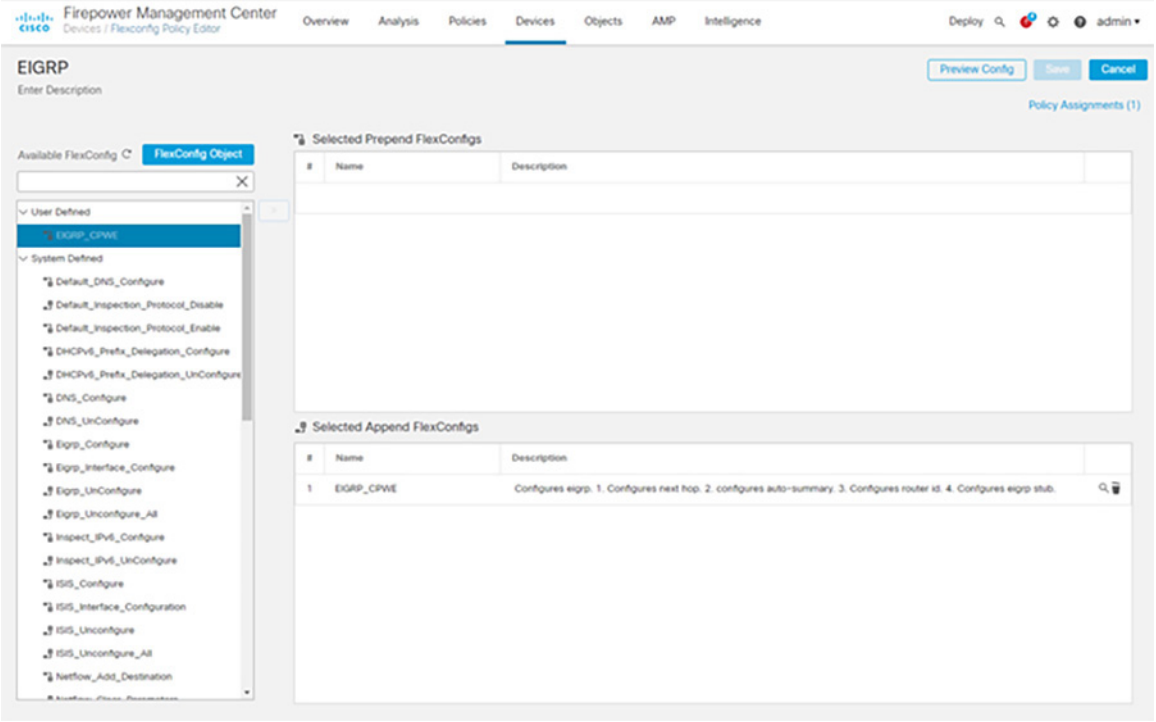
e. Give a meaningful name to the policy and in the **Available Devices** area, click an interface and then click **Add to Policy** to move it to the **Selected Devices** area. Repeat for all devices you want to make this policy to apply.

f. Click **Save**.

g. In the **Available FlexConfig** tab, under **User Defined**, select the FlexConfig object for EIGRP and click > to move it to the **Selected Append FlexConfigs** area.

h. Click **Save and Deploy** changes to the FTD.

Figure 3-3 FMC EIGRP Configuration with FlexConnect



Step 3 Configure active/standby failover mode on each firewall and the failover link between the two (see Figure 3-4):

a. In FMC, navigate to **Devices > Device Management**.

b. From the **Add** drop-down menu, choose **High Availability**.

c. Enter a display **Name** for the high availability pair.

d. Under **Device Type**, choose **Firepower Threat Defense**.

e. Choose the **Primary Peer** device for the high availability pair.

f. Choose the **Secondary Peer** device for the high availability pair.

g. Click **Continue**.

h. Under **High Availability Link**, choose an Interface with enough bandwidth to reserve for failover communications.

Note Only interfaces that do not have a logical name and do not belong to a security zone,will be listed in the Interface drop-down menu in the Add High Availability Pair dialog.

i. Type any identifying **Logical Name**.

j. Type a **Primary IP** address for the failover link on the active unit. This address should be on an unused subnet. This subnet can be 31-bits (255.255.255.254 or /31) with only two IP addresses.

Note 169.254.1.0/24 and fd00:0:0:*::/64 are internally used subnets and cannot be used for the failover or state links.

k. Optionally, choose **Use IPv6 Address**.

l. Type a **Secondary IP** address for the failover link on the standby unit. This IP address must be in the same subnet as the primary IP address.

m. If IPv4 addresses are used, type a **Subnet Mask** that applies to both the primary and secondary IP addresses.

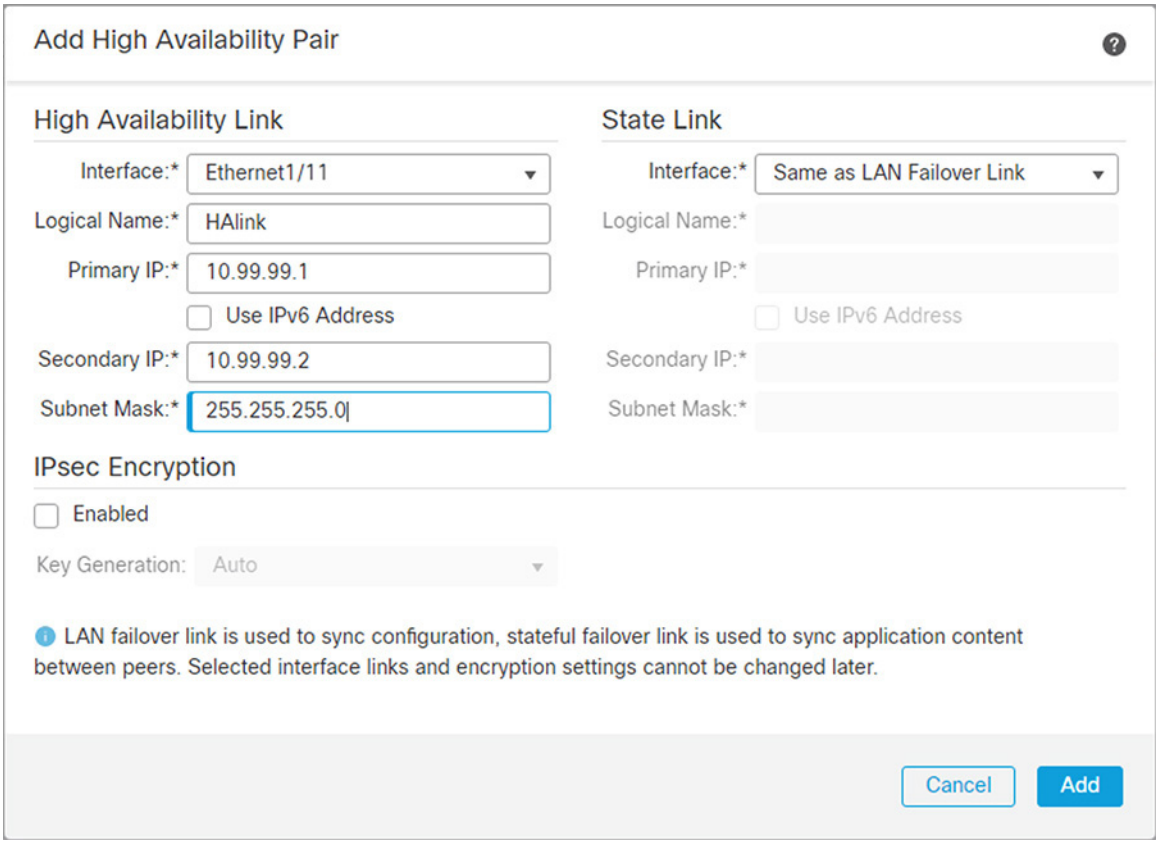
n. Optionally, under **Stateful Failover Link**, choose the same **Interface**, or choose a different interface and enter the high availability configuration information. This subnet can be 31-bits (255.255.255.254 or /31) with only two IP addresses.

Note 169.254.1.0/24 and fd00:0:0:*::/64 are internally used subnets and cannot be used for the failover or state links.

o. Optionally, choose **Enabled** and choose the **Key Generation** method for IPsec Encryption between the failover links.

p. Click **Add**. This process takes a few minutes as the process synchronizes system data.

Figure 3-4 FMC Failover Configuration



Step 4 Configure explicit **Deny All** rules between all zones (see Figure 3-5):

a. In FMC, navigate to **Policies > Access Control**.

b. Click **New Policy**.

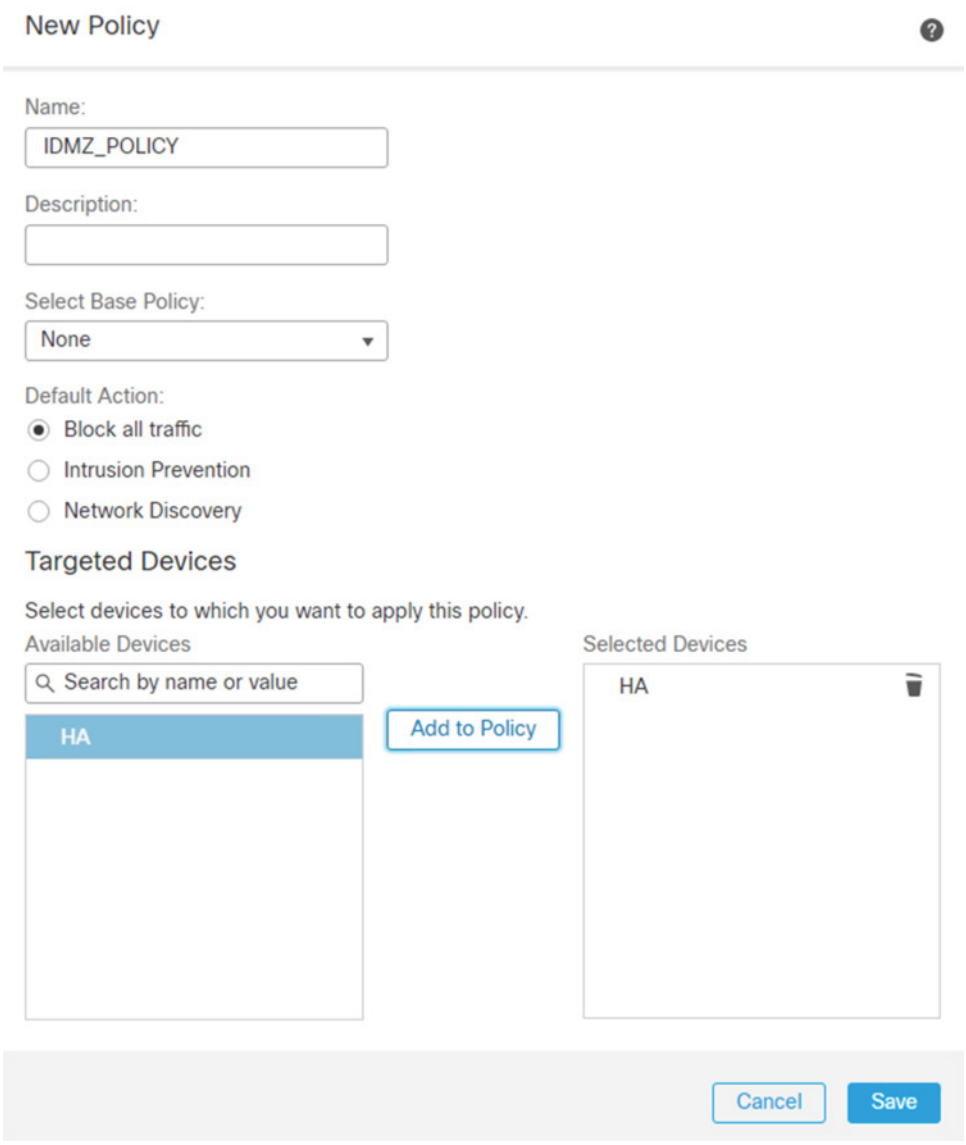
c. Enter a unique **Name** and, optionally, a **Description**.

d. Specify the initial **Default Action**. Our intention is to **Block all traffic** which creates a policy with the **Access Control: Block All Traffic** default action.

e. Choose the **Available Devices** where you want to deploy the policy, then click **Add to Policy** to add the selected devices.

f. Click **Save**.

Figure 3-5 FMC Access Rules Configuration



Note Later sections in this chapter describe the configuration of firewall rules and policies for specific network applications and services.

IDMZ Network Interface Configuration

The following steps describe the configuration of the firewall interfaces for the IDMZ network. In the recommended architecture, the IDMZ network is segmented into several VLANs, each corresponding to a specific service in the IDMZ.

Step 1 Configure separate sub-interfaces for each network or application service hosted in the IDMZ (see Figure 3-6):

Note Before starting this procedure, confirm that the IDMZ-facing interface does not have an IP address, name, or security level configured. Otherwise, these configurations will be removed when the first sub-interface associated with that interface is created.

a. In FMC, navigate to **Devices > Device Management** and **Edit** the device in which this VLAN applies.

b. In the **Interfaces** tab, click **Add Interfaces > Sub Interface**.

c. Give a meaningful **Name** to the sub interface.

d. Assign a **Security Zone** for the sub interface.

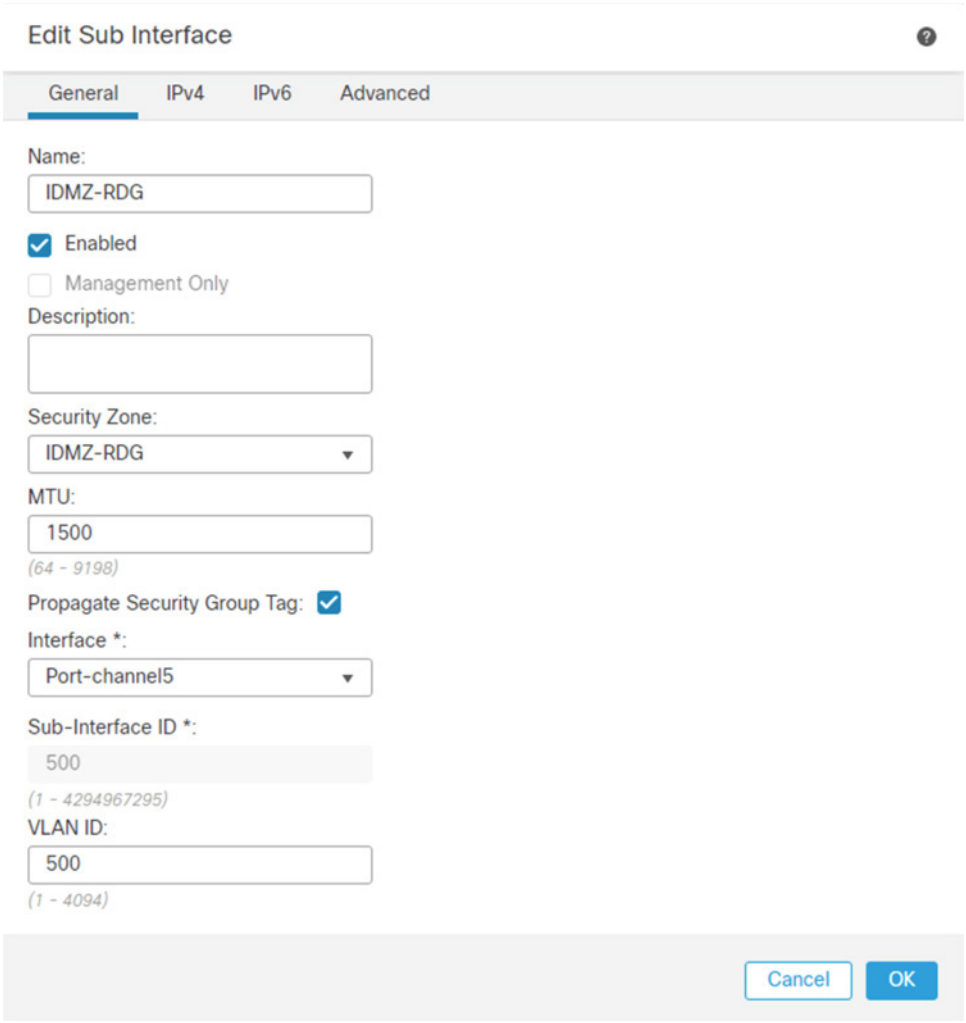
e. Assign the **Interface** to which the sub interface belongs.

f. Assign the **VLAN ID** for the sub interface.

g. Click **OK** to add the sub interface and then Save changes to the device.

h. Define explicit **Deny All** rules for each sub-interface as described in the previous section to confirm isolation of each IDMZ service.

Figure 3-6 FMC Sub-interface Configuration



Industrial Zone Core Network Configuration

The following steps describe the configuration of the redundant network infrastructure between the Industrial Zone core network and the IDMZ firewall. The redundant core consisted of a pair of Cisco Catalyst 6500 switches in the VSS configuration.

Step 1 Enable Cisco StackWise Virtual on both switches and reload and configure Cisco StackWise Virtual link.

Note For information on VSS and detailed steps on performing this conversion process, refer to:

- https://www.cisco.com/c/en/us/td/docs/switches/lan/catalyst9500/software/release/16-9/configuration_guide/ha/b_169_ha_9500_cg/configuring_cisco_stackwise_virtual.html

Typical CLI output resulting from this conversion is shown below.

```
!
stackwise-virtual
 domain 1switch virtual domain 100 switch mode virtual

!

interface TwentyFiveGigE1/0/1
 stackwise-virtual link 1
interface TwentyFiveGigE1/0/2
 stackwise-virtual link 1
interface TwentyFiveGigE2/0/1
 stackwise-virtual link 1
interface TwentyFiveGigE2/0/2
 stackwise-virtual link 1
```

Step 2 Configure redundant EtherChannels between the VSS switch pair and the active and standby firewalls.

a. Configure two EtherChannel interfaces on the VSS switch pair, one for each firewall connection, using the commands below:

```
!
interface Port-channel11
 description TO FIREWALL - FPR2130
 switchport access vlan 210
 switchport mode access
!
interface Port-channel12
 description TO FIREWALL - FPR2130
 switchport access vlan 210
 switchport mode access
interface Port-channel1 description To Primary FTD switchport
switchport trunk encapsulation dot1q switchport trunk allowed vlan <VLAN-LIST>
switchport mode trunk
!
interface Port-channel2 description To Secondary FTD switchport
switchport trunk encapsulation dot1q switchport trunk allowed vlan <VLAN-LIST>
switchport mode trunk
!
```

b. Configure the members of both EtherChannel interfaces on the VSS switch pair using the commands below:

```
interface TwentyFiveGigE1/0/9
 description FPR-1 eth1/2
 switchport access vlan 210
 switchport mode access
 channel-group 12 mode active
!
interface TwentyFiveGigE1/0/10
 description FPR-2 eth1/3
 switchport access vlan 210
 switchport mode access
 channel-group 11 mode active
!
interface TwentyFiveGigE2/0/9
 description FPR-2 eth1/2
 switchport access vlan 210
 switchport mode access
 channel-group 11 mode active
!
interface TwentyFiveGigE2/0/10
 description FPR-1 eth1/3
 switchport access vlan 210
 switchport mode access
 channel-group 12 mode active!
```

```
!
```

IDMZ Server Network Configuration

The following steps describe the configuration of the redundant network infrastructure between the IDMZ switch and the IDMZ firewall.

Step 1 Configure EtherChannels between the IDMZ switch and the active and standby firewalls.

a. Configure trunked EtherChannel interfaces on the IDMZ switch using the commands below:

```
!
interface Port-channel5
 description To Active Firewall
 switchport trunk encapsulation dot1q
 switchport trunk allowed vlan <VLAN-LIST>
 switchport mode trunk
!
interface Port-channel6
 description To Standby Firewall
 switchport trunk encapsulation dot1q
 switchport trunk allowed vlan <VLAN-LIST>
 switchport mode trunk
!
```

b. Configure the members of the EtherChannel interface on the IDMZ switch using the commands below:

```
!
interface GigabitEthernet1/0/1
 description To Primary FTD
 switchport trunk encapsulation dot1q
 switchport trunk allowed vlan <VLAN-LIST>
 switchport mode trunk
 channel-group 5 mode active
!
interface GigabitEthernet1/0/2
 description To Secondary FTD
 switchport trunk encapsulation dot1q
 switchport trunk allowed vlan <VLAN-LIST>
 switchport mode trunk
 channel-group 6 mode active
!
interface GigabitEthernet2/0/1
 description To Primary FTD
 switchport trunk encapsulation dot1q
 switchport trunk allowed vlan <VLAN-LIST>
 switchport mode trunk
 channel-group 5 mode active
!
interface GigabitEthernet2/0/2
 description To Secondary FTD
 switchport trunk encapsulation dot1q
 switchport trunk allowed vlan <VLAN-LIST>
 switchport mode trunk
 channel-group 6 mode active
```

Step 2 Configure the IDMZ switch with VLANs for each service that will be hosted in the IDMZ, according to best practices for IDMZ segmentation. Assign switch ports to appropriate VLANs.

Configuring Network Services

This section describes validated configurations for the network services that are allowed to traverse the IDMZ in order to provide necessary functions in both the Industrial and Enterprise Zones:

- Active Directory replication between Industrial and Enterprise Domain Controllers
- Time synchronization using NTP
- AAA Services
- Industrial and Enterprise ISE node synchronization traffic
- Tunneling of WLAN traffic between Industrial and Enterprise WLCs

Active Directory Configuration

Note This section shows only what is needed to enable replication through the IDMZ. For more generalized AD configuration steps, refer to the *Deploying Identity Services within a Converged Plantwide Ethernet Architecture Design and Implementation Guide* at:

- http://www.cisco.com/c/en/us/td/docs/solutions/Verticals/CPwE/3-5-1/ISE/DIG/CPwE_ISE_CVD.html

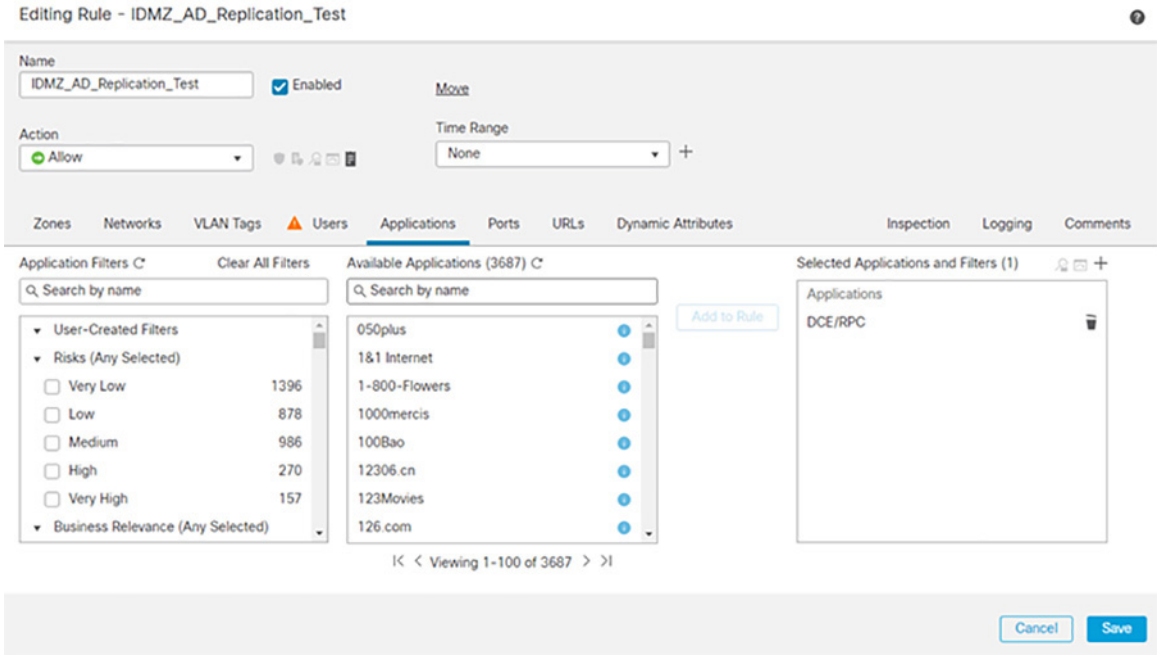
Firewall Rules for AD Replication

The following steps describe the configuration of firewall rules to allow replication of AD services across the IDMZ.

Step 1 Configure the firewall to allow RPC traffic between the Enterprise and Industrial AD data centers:

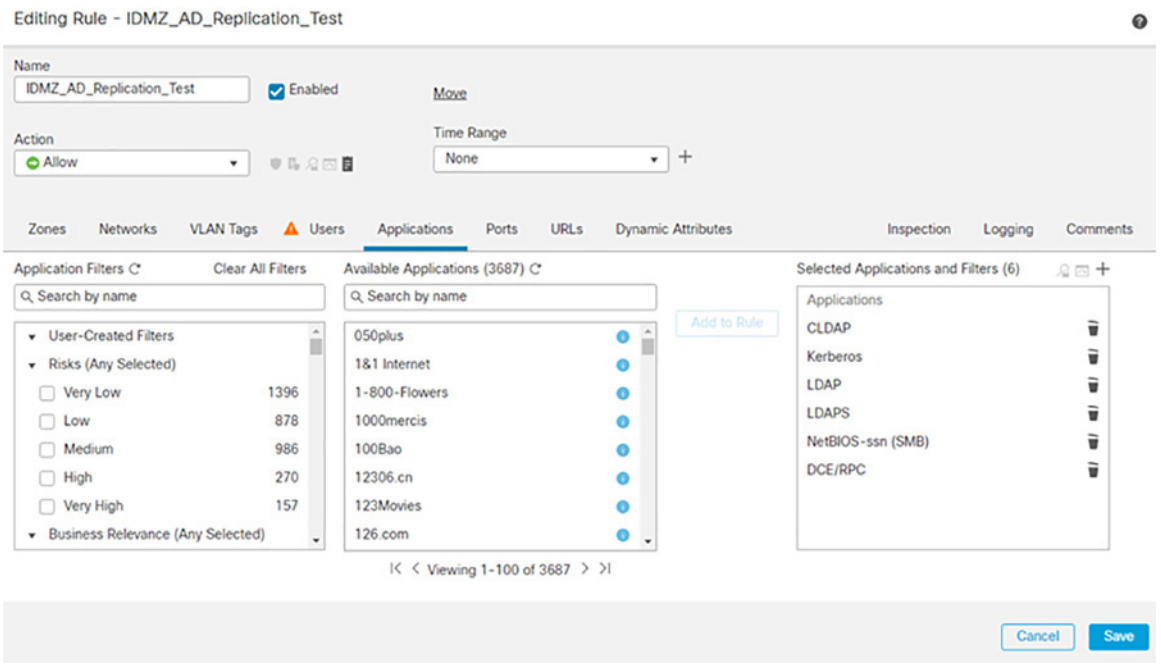
a. In FMC, navigate to **Policies > Access Control**.
b. **Edit** the rule assigned to the IDMZ firewall(s).
c. Click **+ Add Rule**.
d. In the **Zones** tab, click **Enterprise** as the **Source and Industrial** as the **Destination**.
e. In the **Networks** tab, enter the **Enterprise AD IP Address** object in the **Source Network** and the **Industrial AD IP Address** object in the **Destination Network**.
f. In the **Applications** tab, search for **DCE/RPC** and click **Add to Rule**.
g. In the **Logging** tab, click **Log at Beginning of Connection** to log connection events to FMC.
h. Repeat the rule in the reverse direction (Industrial to Enterprise)

Figure 3-7 IDMZ AD Replication Access Control Rule



Step 2 Configure the firewall to allow additional protocols for replication (Table 3-1). These protocols can be found in the **Applications** tab during policy creation.

Figure 3-8 Adding Additional Protocols for AD Replication



The access rules for AD replication are summarized in Table 3-1..

Table 3-1 Access Rules—AD Replication

Firewall Interface	Source	Destination	Permitted protocols
Industrial	Industrial DC	Enterprise DC	RPC (TCP/UDP port 135) LDAP (TCP/UDP port 389) LDAP SSL (TCP port 636) CLDAP (UDP port 389) Kerberos (TCP/UDP port 88) SMB (TCP/UDP port 445)
Enterprise	Enterprise DC	Industrial DC	

Firewall Rules for AD Authentication in IDMZ

Certain firewall rules should be configured to allow hosts in the IDMZ to authenticate to the Enterprise AD. The examples of the IDMZ hosts are RD Gateway and Reverse Web Proxy servers, anti-virus, Windows Update and other services that are hosted in the IDMZ. These rules are listed in Table 3-2.

Table 3-2 Access Rules—AD Authentication

Firewall Interface	Source	Destination	Permitted protocols
IDMZ	IDMZ hosts that authenticate to AD	Enterprise DC	RPC (TCP/UDP port 135) LDAP (TCP/UDP port 389) LDAP SSL (TCP port 636) LDAP GC (TCP port 3268) LDAP GC SSL (TCP port 3269) Kerberos (TCP/UDP port 88) Kerberos password change (TCP/UDP port 464) SMB (TCP/UDP port 445)

NTP Configuration

This section describe configuration that is required to enable NTP in the CPwE IDMZ architecture.

NTP Synchronization for Network Devices

Network devices use NTP or sometimes SNTP to synchronize their clocks.

Note For best practices and sample configurations to enable NTP on network devices, refer to the product documentation at:

- http://www.cisco.com/c/en/us/support/docs/availability/high-availability/19643-ntpm.html

NTP Synchronization for Windows Servers

Microsoft Windows Servers use the Windows Time Service to synchronize their clocks. If a server is a domain member, it can receive time information directly from the DC. Otherwise, it can be configured to synchronize with a separate NTP server.

Note For more information and configuration guidelines, refer to *Windows Time Service Technical Reference* at:

- https://technet.microsoft.com/en-us/library/cc773061.aspx

NTP traffic should also be allowed between the Industrial and Enterprise DCs as part of the AD replication.

Firewall Rules for NTP Synchronization

The following steps describe the configuration of firewall rules to allow NTP traffic across the IDMZ (see Table 3-3):

Step 1 Configure the firewall to allow NTP synchronization between the Enterprise and Industrial Zone NTP servers, and between the Enterprise and Industrial DCs.

Step 2 Configure the firewall to allow synchronization (see Table 3-3) between IDMZ NTP clients (for example, Windows servers and IDMZ access/distribution switches) and the Enterprise Zone NTP server.

Table 3-3 Access Rules—NTP Synchronization

Firewall Interface	Source	Destination	Permitted Protocols
Industrial	Industrial NTP server	Enterprise NTP server	NTP (UDP port 123)
Industrial	Industrial DC	Enterprise DC	
IDMZ	NTP clients in IDMZ	Enterprise NTP server	

The access rules can be applied using Cisco FDM or FMC (see Figure 3-8 on page 3-12 in the Active Directory section as an example with FMC).

AAA Services Configuration

Some IDMZ network devices such as switches may need to communicate to the enterprise AAA servers to authenticate network administrators to allow remote login to the device. Table 3-4 lists the firewall rules that should be applied (depending on the AAA protocol in use):

Table 3-4 Access Rules—AAA Traffic

Firewall Interface	Source	Destination	Permitted Protocols
IDMZ	Network devices in the IDMZ	Enterprise AAA servers	RADIUS (UDP port 1812, 1813) TACACS+ (TCP port 49)

ISE Configuration

As part of a distributed ISE setup, the nodes must be able to securely communicate to synchronize their policy configurations and centralize logs. Since ISE nodes exist in both the Industrial and Enterprise Zones, the following steps describe the configuration of the IDMZ firewall rules for the distributed ISE services across the IDMZ (see Table 3-5).

Note For information about ISE deployment in the CPwE, refer to the *Deploying Identity Services within a Converged Plantwide Ethernet Architecture Design and Implementation Guide* at:

- http://www.cisco.com/c/en/us/td/docs/solutions/Verticals/CPwE/3-5-1/ISE/DIG/CPwE_ISE_CVD.html

Note For more information about ISE services and TCP/UDP ports that the distributed IES system may use, refer to:

- http://www.cisco.com/c/en/us/td/docs/security/ise/1-4/installation_guide/b_ise_InstallationGuide14/b_ise_InstallationGuide14_appendix_01010.html

Step 1 Configure the firewall to allow the ISE PSN in the Industrial Zone to synchronize its configuration with the PSN/PAN in the Enterprise Zone using HTTPS and JGroups protocols.

Step 2 Configure the firewall to allow the ISE PSN in the Industrial Zone to send its logs to the ISE MNT in the Enterprise Zone.

Table 3-5 Access Rules—ISE Synchronization and Logging

Firewall Interface	Source	Destination	Permitted Protocols
Industrial	Industrial ISE PSN node	Enterprise ISE PSN/PAN node	HTTPS (TCP port 443) JGroups (TCP port 12001)
Enterprise	Enterprise ISE PSN/PAN node	Industrial ISE PSN node	HTTPS (TCP port 443) JGroups (TCP port 12001)
Industrial	Industrial ISE PSN node	Enterprise ISE MNT node	HTTPS (TCP port 443) Secure Syslog (TCP port 6514) UDP port 20514 TCP port 1468

The access rules can be applied using Cisco FMC (see Figure 3-8 on page 3-12 in the Active Directory section as an example).

Cisco Smart Software Manager (SSM) On-Prem Configuration

The following example will present a scenario and show the configuration steps to manage smart licensing in the Industrial Zone using an on-premise licensing server.

Note For details on the configuration of Cisco SSM On-Prem, refer to *Cisco Smart Software Manager On-Prem Installation Guide* at:

- https://www.cisco.com/web/software/286285517/147683/Smart_Software_Manager_On-Prem_7_Installation_Guide.pdf

Installing the Virtual Appliance

Step 1 Install the virtual appliance on ESXI:

a. Download the SSM iso file.

b. Log in to the VMWare vSphere web user interface console.

c. From the side menu, right-click **Virtual Machine** and then choose **Create/Register VM**.

d. Choose Create a New Virtual Machine.

e. Enter the **name** of the VM.

f. In the **Guest OS Family** drop-down menu, choose **Linux**.

g. In the **Guest OS Version** drop-down menu, choose **Other Linux (64-bit)**.

h. Under **CPUs**, select the following settings: **2** or **4 Cores**.

i. Under **Memory**, configure the **supported memory size** (8 gigabytes are recommended) for your deployment.

j. Under **New Hard Disk**, configure 200 gigabytes (recommended).

k. Under **Network**, allocate at least **1 virtual network interface** card.

l. Under **SCSI Controller**, select **LSI Logic Parallel**.

m. Under **New CD/DVD Drive**, select **Datastore ISO file**.

n. Mount the ISO file for Cisco SSM.

o. Once finished, power on the virtual appliance.

Step 2 Create an account on Cisco SSM:

a. Open the Cisco SSM On-Prem Administration workspace using the URL: https://<ip_address>:8443/admin.

b. When the login screen appears, login using these credentials: admin/CiscoAdmin!2345.

Note For security reasons, you will be required to immediately change the admin password or disable the account after you create a new local account to be used for administration.

Step 3 Configure the Host Common Name:

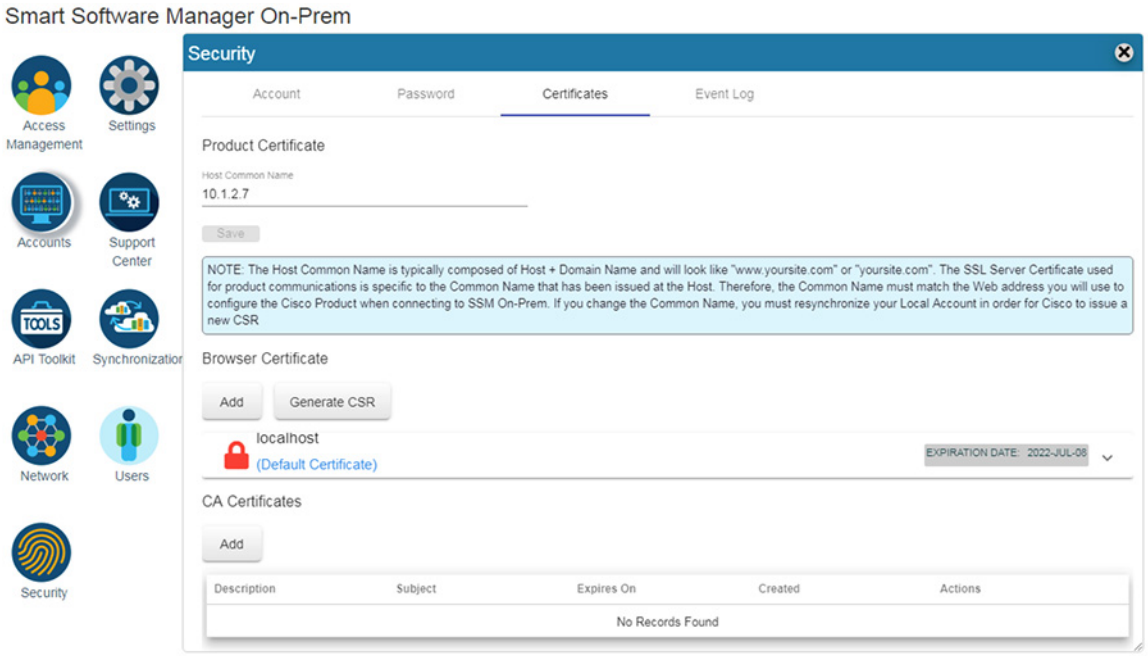
The SSM ON-PREM-URL is the Common Name (CN) for the product. The CN is set in the Administration Workspace within the Security Widget, and is entered in the form of a Fully Qualified Domain Name (FQDN), hostname, or IP address of the SSM On-Prem. The CN must match what is used on the product as part of the call home configuration.

a. In Cisco SSM, open the **Security** Widget.

b. In the **Certificates** tab, enter the **Host Common Name** (IP Address).

c. Click **Save**.

Figure 3-9 Adding Certificates to Cisco SSM On-Prem



Step 4 Configure NTP settings.

Currently, you can set the time manually or allow it to synchronize with NTP. The time zone for your SSM On-Prem system can also be set with UTC+0 which allows for all the timestamps to be displayed in UTC time. UTC+offset enables the timestamp to be displayed in the system's local time.

a. In Cisco SSM, open the **Settings** Widget and select the **Time Settings** tab.

b. Select **Time Zone** from the drop-down menu.

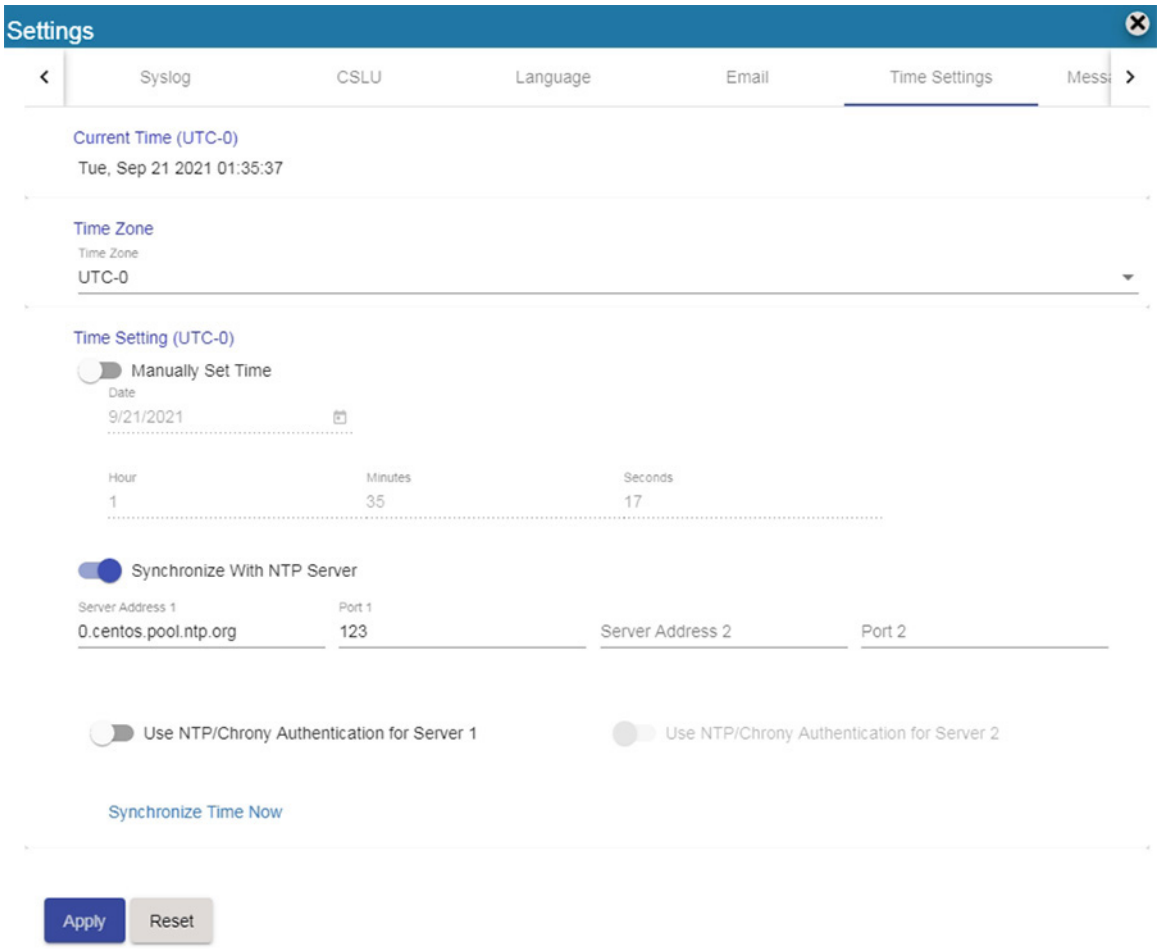
c. Turn on **Synchronize with NTP server**.

d. Enter the **NTP server address**.

e. Click **Synchronize now**.

f. Click **Apply**.

Figure 3-10 Cisco SSM On-prem NTP Settings



Step 5 Register On-Prem appliance with Cisco SSM Cloud.

It is necessary to register with Cisco Smart Software Manager (https://software.cisco.com) to use the Smart Software Manager On-Prem. To complete this process, ensure you meet the following requirements:

- Access to a Smart Account.
- A valid CCO User ID and Password to access the Smart Account.
- Either Smart Account or Virtual Account access to a Cisco Smart Account.
- Either an eligible existing or new Cisco Virtual Account.

With these requirements met, you will be able to proceed with the registration process by completing these steps to register (request) a local account.

a. In Cisco SSM, open the **Accounts** widget.

b. Click **New Account**.

c. Enter the required information:

  – Local Account Name

  – Cisco Smart Account

  – Cisco Virtual Account

- Email (for notification)

d. Click **Submit**.

e. The Account request then is listed on the **Account Requests** tab in the **Accounts** widget.

Step 6 Approving the request:

a. In Cisco SSM, open the **Accounts** widget.

b. In the **Account Requests** tab, select **Approve** under the **Actions** drop-down menu.

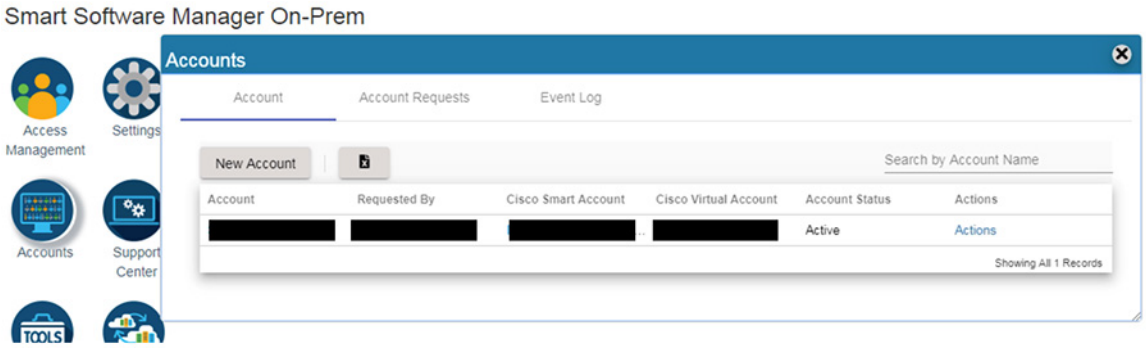
c. Click **Next**.

d. When prompted, enter your **CCO ID credentials** to allow Cisco Smart Account/Virtual Account access on the Cisco SSM.

e. Click **Submit**.

f. Verify that the local Account is listed as **Active** under the **Accounts** tab.

Figure 3-11 Account Management in Cisco SSM On-prem



Step 7 Synchronization with the Cloud.

Online synchronization assumes there is an Internet connection to Cisco Smart Software Manager from SSM On-Prem. On each local Account, you can choose to perform either a Standard Synchronization Now action or Full Synchronization Now action. Manual synchronization is used when the customer network is not connected to the Internet. For details on that deployment see Smart Software Manager On-Prem Installation Guide.

a. In **Cisco SSM**, click the **Synchronization** Widget.

b. On the local **Account**, under **Actions**, select **Standard Syncronization Now** or **Full Synchronization Now**.

c. Enter your **Cisco Smart Account** credentials.

d. Click **OK**.

Configuring Firewall Rules for Cisco SSM On-Prem

The following steps describe the configuration of firewall rules for the Cisco SSM On-Prem to allow Industrial Clients to get licensed behind the IDMZ.

Note If using a web proxy in the IDMZ a rule should already exist in the firewall for the web proxy to forward all HTTPS towards the enterprise zone.

Step 1 Configure the firewall to allow Cisco SSM On-Prem to synchronize with the Cloud and for clients to access Management portal from Enterprise zone (see Table 3-6).

Table 3-6 Required Access Rules—Cisco SSM On-Prem to Cisco SSM Cloud—1

Firewall Interface	Source	Destination	Permitted Protocols
IDMZ	Cisco SSM On-Prem	Cisco SSM Cloud	HTTPS (port 443)
Enterprise	Enterprise Client	Cisco SSM On-Prem	HTTPS (port 443)

Step 2 Configure firewall to allow Industrial Clients to register with Cisco SSM On-Prem (see Table 3-7).

Table 3-7 Required Access Rules—Cisco SSM On-Prem to Cisco SSM Cloud—2

Firewall Interface	Source	Destination	Permitted Protocols
Industrial	Industrial Client software	Cisco SSM On-Prem	HTTPS port 443)

WSUS Configuration

This section describe configuration that is required to enable WSUS in the CPwE IDMZ architecture.

Deploying WSUS

For information and configuration guidelines for planning and deploying WSUS refer to:

- https://docs.microsoft.com/en-us/windows-server/administration/windows-server-update-services/deploy/deploy-windows-server-update-services

In this design guide, the WSUS server in the IDMZ was set to automatically collect updates from Microsoft Update and for Industrial zone updates to be installed manually.

Firewall Rules for WSUS

To get updates from Microsoft Update, the WSUS server uses port 443 for the HTTPS protocol. It is assumed for this design guide that all traffic traversing port 80/443 will do so through a web proxy and therefore no additional firewall rules need to be deployed for the outbound interface.

For clients connecting from the Industrial zone to the WSUS, the following is required:

Step 1 Configure the firewall to allow Windows clients to pull updates from the WSUS (see Table 3-8).

Table 3-8 Required Access Rules—Windows Clients to WSUS Server

Firewall Interface	Source	Destination	Permitted Protocols
Industrial	Industrial Client software	Cisco SSM On-Prem	HTTPS port 443)

Configuring Data Transfer through IDMZ

This section describes validated configurations that allow essential data to traverse the IDMZ between the Enterprise and Industrial Zones as described in System Design Considerations.

The following configuration steps are covered in this section:

- PI-to-PI Interface configuration and firewall rules for FactoryTalk Historian data transfer
- Firewall rules for secure managed file transfer using SolarWinds Serv-U solution as an example

FactoryTalk Historian Data Transfer Configuration

This section provides necessary steps to enable FactoryTalk Historian data transfer across the IDMZ.

Note For general information about FactoryTalk Historian installation and configuration, refer to:

- http://literature.rockwellautomation.com/idc/groups/literature/documents/in/hse-in025_-en-e.pdf

PI to PI Interface Configuration

An overview of PI-to-PI installation and configuration steps is provided here.

Note For complete information, refer to the following documents:

- *FactoryTalk Historian to Historian Interface Installation and Configuration Guide*:
  - http://literature.rockwellautomation.com/idc/groups/literature/documents/in/h2h-in001_-en-e.pdf
- *FactoryTalk Historian to Historian Interface User Guide*:
  - http://literature.rockwellautomation.com/idc/groups/literature/documents/um/h2h-um001_-en-e.pdf

Step 1 Install the FactoryTalk Services platform on the PI to PI server in the IDMZ.

Step 2 Install FactoryTalk Historian To Historian Interface (PI-to-PI Interface) on the PI-to-PI server in the IDMZ.

Step 3 Obtain a PI-to-PI license activation file and activate the interface using FactoryTalk Activation Manager. Assign the license activation to the target server using the FactoryTalk Administration Console.

Step 4 Create a PI-to-PI Interface Instance in the Interface Configuration Utility (ICU).

a. Go to **Start > All Programs > Rockwell Software > FactoryTalk Historian SE > Interface Configuration Utility**. The ICU dialog box appears.

b. Select **Interface > New Windows Interface Instance** from EXE. Click **Browse** to locate the executable file for the PI-to-PI Interface, for example *C:\Program Files (x86)\Rockwell Software\FactoryTalk Historian\PIPC\Interfaces\FTPItoPI\FTPItoPI.exe*.

c. Under Host PI Server/Collective, select the **Enterprise Zone Historian server.** Complete the following information and then click **Add**.

Under:	Type:
Point Source	FTSS
Interface ID	1
Service ID	1

d. Under Scan Classes, create one scan class at a 15 second frequency.

e. In the PI-to-PI sub menu, go to the **Required** tab, and type the **Source host**, which is the Industrial Zone FactoryTalk Historian SE server. It may be either a DNS name or an IP address.

f. In the **Service** tab, click **Create**.

Step 5 Create a **Test Target Point** on the Enterprise FactoryTalk Historian server.

a. Go to **Start > All Programs > Rockwell Software > FactoryTalk Historian SE > System Management Tools**. The System Management Tools dialog box appears.

b. Under **Collectives and Servers**, select the **Enterprise Zone FactoryTalk Historian server**.

c. Under **System Management Tools**, select **Points > Point Builder**. Click the toolbar icon to create anew point.

d. In the **General** tab, complete the following information:

Under:	Type:
Name	MyTempTag
Point Source	FTSS
Exdesc	STAG=BA.Temp.1

e. In the Classic tab, complete the following information:

Under:	Type:
Location1	1 (This is the interface ID as specified in the ICU)
Location4	1

f. Save the point.

Step 6 In order for the PI-to-PI Interface to be allowed to interact with either one of the FactoryTalk Historian Servers, a trust has to be created for its executable. Configure an application trust for FTPITOPI.exe with the PIadmin user on the Enterprise FactoryTalk Historian server.

a. On the **Enterprise FactoryTalk Historian SE Server**, go to **Start > All Programs > Rockwell Software > FactoryTalk Historian SE > System Management Tools**. The System Management Tools dialog box appears.

b. Under **Collectives and Servers**, select the **Enterprise Zone FactoryTalk Historian server**.

c. Under **System Management Tools**, select **Security > Mappings & Trust.** Go to the Trusts tab. Click **New Trust** in the toolbar and then click **Advanced**.

d. In the **Add New Trust** dialog box, provide the following information:

Item name	Description
Trust Name	PI_to_PI_Trust
IP Address	IP address of the server with the PI to PI interface installed
Netmask	255.255.255.255
Application Information	Ftpitopi.exe
PI Identity	In the PI User dialog box, select PIAdmin

Step 7 Configure an application trust for FTPITOPI.exe with the PIadmin user on the Industrial Zone FactoryTalk Historian server. The steps are same as for the Enterprise server above.

Step 8 Start and verify the PI-to-PI Interface:

a. Go to **Start > All Programs > Rockwell Software > FactoryTalk Historian SE > Interface Configuration Utility**. The ICU dialog box appears.

b. Under **Interface**, select the interface you have just created. On the toolbar, click **Start**. The status of the interface at the bottom of the dialog box should change to Running.

c. To verify that the PI-to-PI Interface is working properly, you need to check whether the current values of the tag at the Industrial Zone and Enterprise Zone FactoryTalk Historian servers match each other. This can be done using System Management Tools by selecting **Data > Current Values** and searching for the tag.

Firewall Rules for FactoryTalk Historian Data Transfer

The following steps describe the configuration of firewall rules to allow FactoryTalk Historian data across the IDMZ using a PI-to-PI Interface (see Table 3-9).

Step 1 Configure firewall to allow incoming connections from the Industrial Zone Historian to the PI-to-PI server using PI Server Client protocol (TCP port 5450) and RPC (TCP port 135).

Step 2 Configure firewall to allow incoming connections from the Enterprise Zone Historian to the PI-to-PI server on the same ports.

Step 3 Configure firewall to allow incoming connections from the PI-to-PI server to both Historians.

Table 3-9 Access Rules—Historian Data Transfer

Firewall Interface	Source	Destination	Permitted protocols
Industrial	Industrial Zone Historian	PI to PI server	PI Server Client Access (TCP port 5450) RPC (TCP port 135)
Enterprise	Enterprise Zone Historian	PI to PI server	
IDMZ	PI to PI server	Industrial Zone Historian Enterprise Zone Historian	

In addition to Steps 1-3, the PI-to-PI server needs to authenticate to the DC through the firewall, therefore it should be included in the list of IDMZ hosts that are allowed to do so (see Active Directory Configuration sections).

Secure File Transfer Configuration

To facilitate secure file transfer (SFT) between the Enterprise and Industrial Zones via the IDMZ, many implementations are available to choose from.

In the context of the IDMZ, a client based in the Industrial Zone can upload to and download files from the SFT Server (located in the Enterprise Zone) via the Gateway (located in the IDMZ). As per IDMZ best practices, no direct connections are opened between the Industrial and Enterprise Zones, and no data resides permanently in the IDMZ. In a similar manner, an enterprise client can upload to and download files from the Industrial SFT Server via the IDMZ Gateway.

The following steps describe the configuration of firewall rules to allow SFT services across the IDMZ, using FTP as the mode of transport (see Table 3-10 and Table 3-11):

Step 1 Configure the firewall to allow incoming client connections from the Industrial Zone clients to the IDMZ-based gateway server. The clients use the FTP protocol, which can be configured in an application rule.

Step 2 Configure the firewall to allow incoming client connections from Enterprise Zone clients to the IDMZ-based gateway server. The clients use the FTP protocol.

Note If using SFTP for file transfer, the connection must be decrypted so the file contents can be checked. For information on doing decryption using Cisco FTD. See Understanding Traffic Decryption at: https://www.cisco.com/c/en/us/td/docs/security/firepower/70/configuration/guide/fpmc-config-guide-v70/understanding_traffic_decryption.html

Table 3-10 Access Rules—Managed File Transfer Industrial to Enterprise

Firewall Interface	Source	Destination	Permitted Protocols
Industrial	Any (or specific clients in Industrial Zone)	SFT Gateway in IDMZ	FTP, SFTP

Table 3-11 Access Rules—Managed File Transfer (Serv-U) Enterprise to Industrial

Firewall Interface	Source	Destination	Permitted Protocols
Enterprise	Any (or specific clients in Enterprise Zone)	MFT Gateway in IDMZ	FTP, SFTP

The access rules can be applied using Cisco FMC web interface (see Figure 3-8 on page 3-12 in the Active Directory section as an example).

Step 3 Connect to the AMP Cloud.

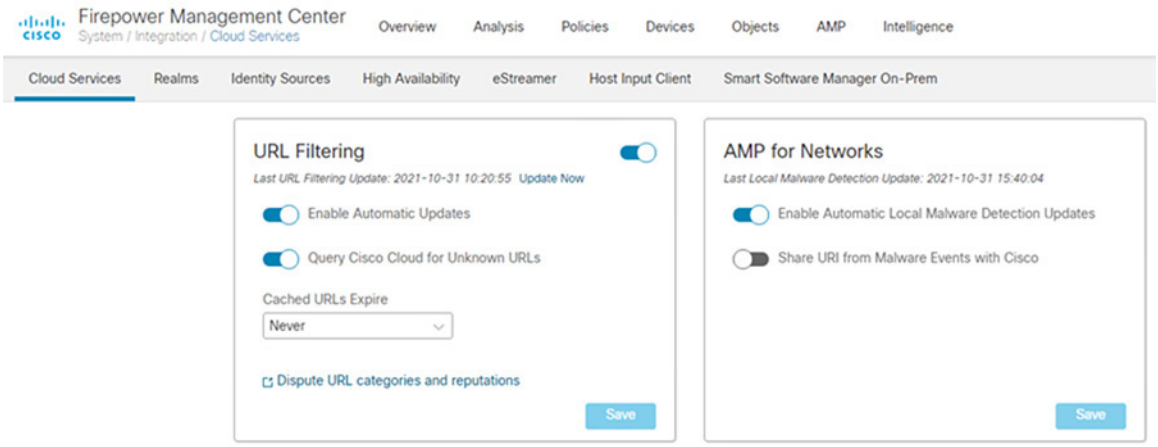
a. In FMC, navigate to **System > Integration**.

b. Click **Cloud Services**.

c. Select **Enable Automatic Local Malware Detection Updates** to stay up to date with the latest signatures updates.

d. Configure the firewall to allow outgoing connections from the IDMZ to the cloud. By default, Firepower uses port 443/HTTPS to communicate with the AMP public cloud to obtain file disposition date. Note: If using a web proxy in the IDMZ, forward all traffic through the web proxy.

Figure 3-12 FMC URL Filtering Updates



Step 4 Create a File Policy:

a. In FMC, navigate to **Policies > Access Control > Malware & File**.

b. Click **New File Policy**.

c. Give a **Name** and optional **Description**. Click **Save**.

d. Click + **Add Rule**.

e. In the **Action** drop down list, choose **Block Files**.

f. Under **File Type Categories**, click all categories you wish to block and click **Add**.

Note Note: The order of precedence of file-rule action is:

- Block Files
- Block Malware
- Malware Cloud Lookup
- Detect Files

g. Click **Save**.

h. Click + **Add Rule**.

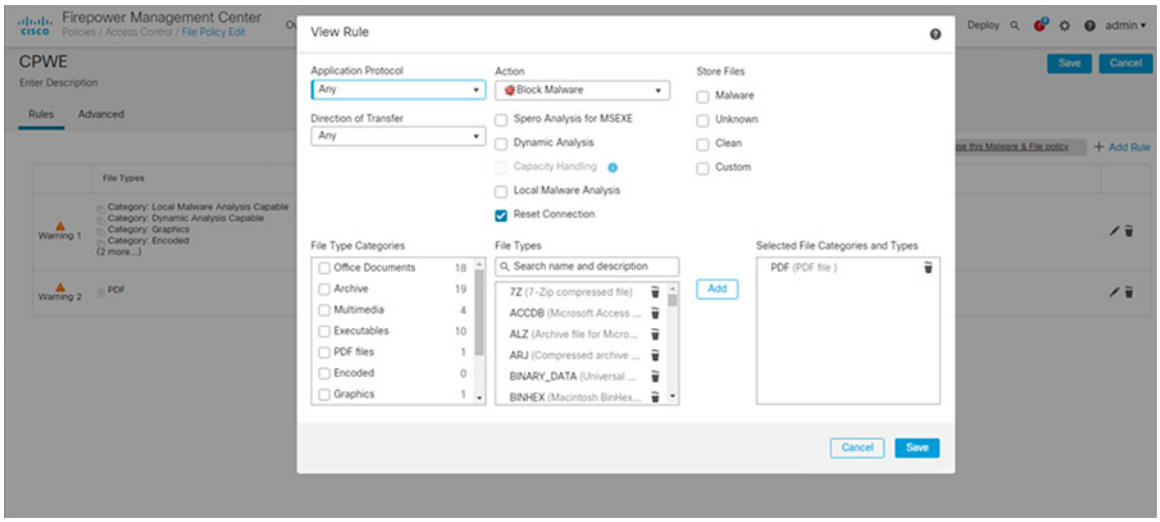
i. In the **Action** drop down list, choose **Block Malware**.

Note Block Malware rules allow you to calculate the SHA-256 hash value of specific file types, query the AMP cloud to determine if files traversing your network contain malware, then block files that represent threats.

j. Under **File Type Categories**, click all categories you wish to allow into the Industrial zone and click **Add**.

k. Click **Save**.

Figure 3-13 FMC File Policy



Step 5 Add File Policy to Access Control Rule:

a. In FMC, navigate to **Policies > Access Control**.

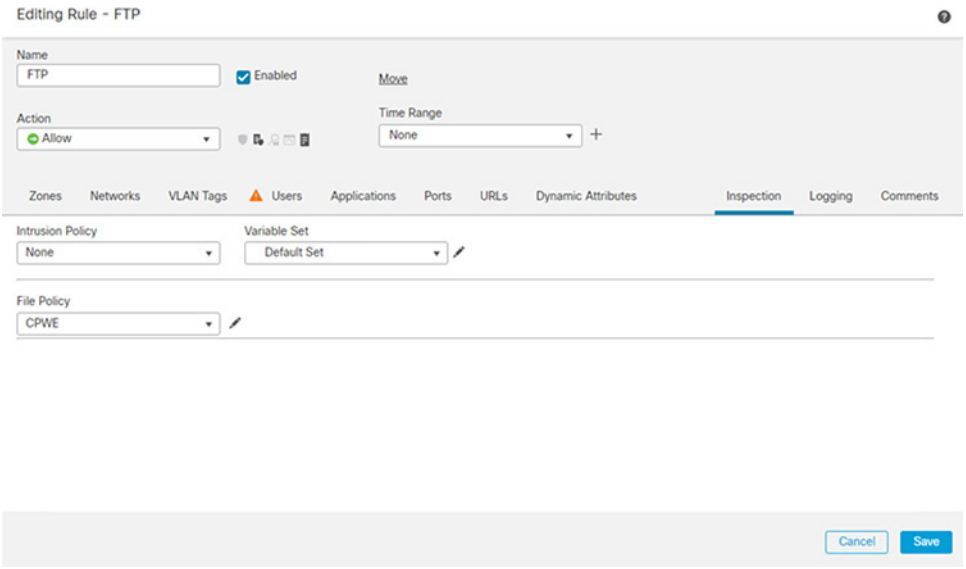
b. Edit the access control rule created earlier for allowing FTP.

c. Go to the Inspection tab, and in the **File Policy** drop down menu, choose the File Policy created in Step 4.

d. Click **Save**.

e. **Save** the policy and **Deploy** changes.

Figure 3-14 Editing Access Rule in FMC for FTP



Configuring Remote Access Services

This section describes validated configurations that allow remote users securely access desktop applications that are hosted in the Industrial Zone via the IDMZ.

The following configuration steps are covered in this section:

- SSL VPN Configuration
  - Client-based SSL VPN (Cisco AnyConnect) to the Enterprise firewall
- Microsoft RD Gateway configuration
- ThinManager RD Gateway Configuration
- DUO SFT Authentication

SSL VPN Configuration

This section provides configuration steps for the firewall to implement SSL VPN access for remote users.

https://www.cisco.com/c/en/us/td/docs/security/firepower/670/configuration/guide/fpmc-config-guide-v67/firepower_threat_defense_remote_access_vpns.html

Note Additional information about VPN configuration on the FTD can be found in *Remote Access VPNs for Firepower Threat Defense* at:

- https://www.cisco.com/c/en/us/td/docs/security/firepower/670/configuration/guide/fpmc-config-guide-v67/firepower_threat_defense_remote_access_vpns.html

Client-based SSL VPN Configuration

The following steps describe the configuration of client-based (Cisco AnyConnect) SSL VPN on the **Enterprise edge firewall** to allow remote access from the Internet.

Step 1 Load the AnyConnect client images to the FMC (images are downloaded from Cisco):

a. In FMC, navigate to **Objects > Object Management**.

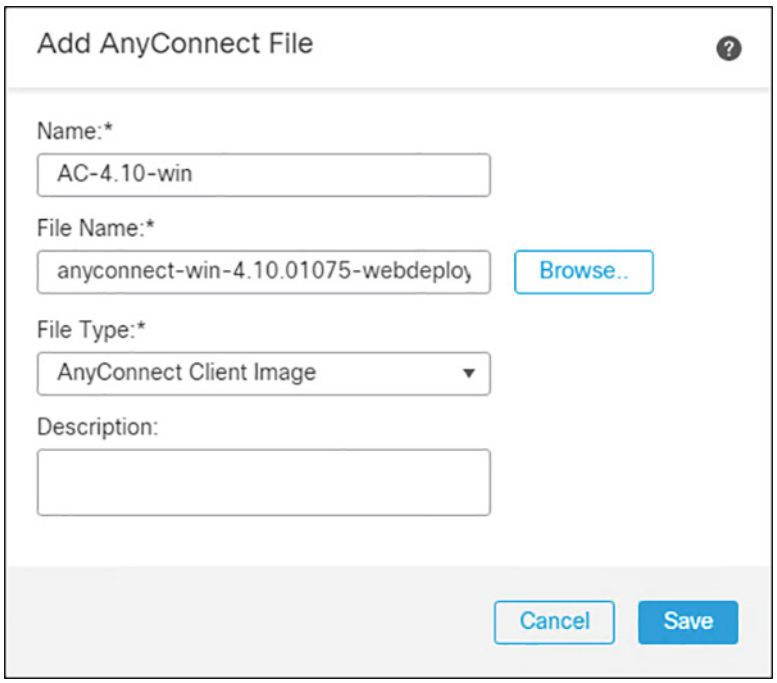
b. Click on **VPN > AnyConnect File**.

c. Click **Add AnyConnect File**.

d. Give a meaningful name to the AnyConnect File, add the headend package using the **Browse** button, and on the **File Type** drop down menu click **AnyConnect Client Image**.

e. Repeat for all packages that have been downloaded (Windows, Mac, etc.).

Figure 3-15 Loading AnyConnec Files in FMC



Step 2 Add Duo Authentication Proxy as RADIUS Server in FMC:

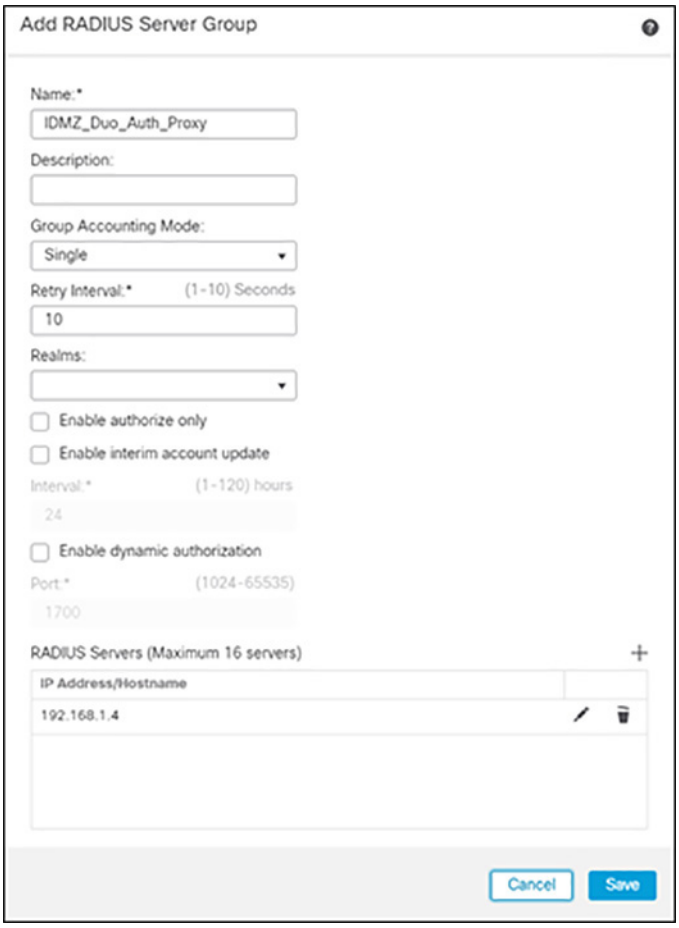
a. In FMC, navigate to **Objects > Object Management > AAA Server > RADIUS Server Group**.

b. Click **Add RADIUS Server Group**.

c. Give a meaningful name to the server group and add the **IP Address/Hostname** where the Duo Authentication Proxy resides.

d. Click **Save**.

Figure 3-16 Add RADIUS Server to FMC



Step 3 Create VPN Address Pool:

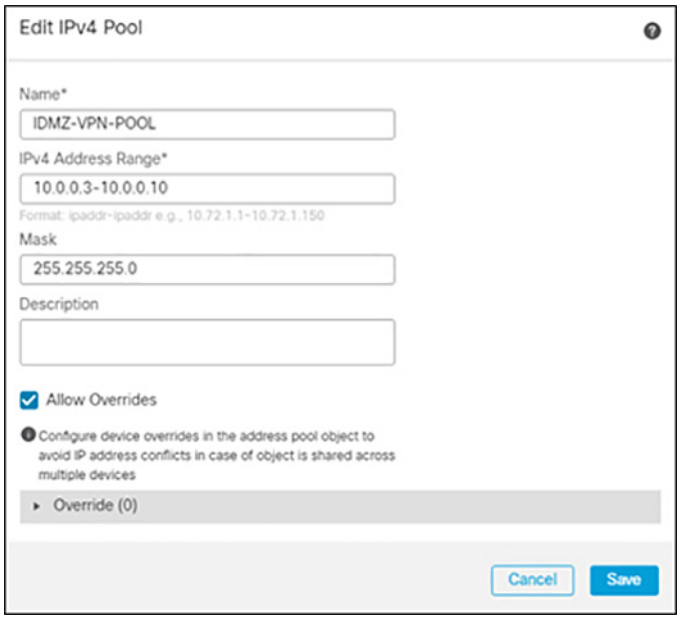
a. In FMC, navigate to **Objects > Object Management > Address Pools > IPv4 Pools**.

b. Click **Add IPv4 Pools**.

c. Give a meaningful name to the address pool and add the **IPv4 Address Range** you wish to assign to VPN users.

d. Click **Save**.

Figure 3-17 Editing IPv4 address pool for remotes access VPN



Step 4 Add a VPN Split Tunnel List:

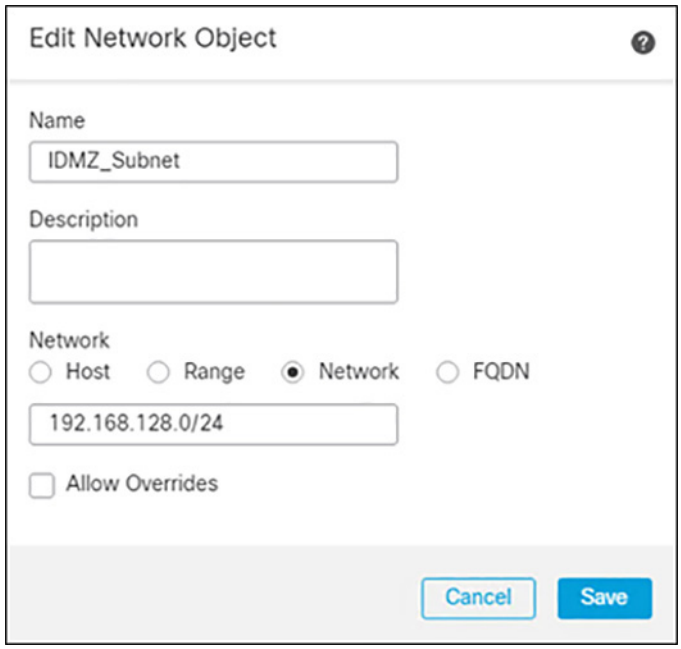
a. In FMC, navigate to **Objects > Object Management > Network**.

b. In the **Add Network** drop down, click **Add Object**.

c. Add the **Network** subnet that you would like roaming users to reach through the tunnel. In this design guide, roaming users will only use the VPN tunnel to access private subnets.

d. Repeat for each subnet or host that you would like to be reachable by roaming users.

Figure 3-18 Configuring Network Range for Split Tunnel Configuration



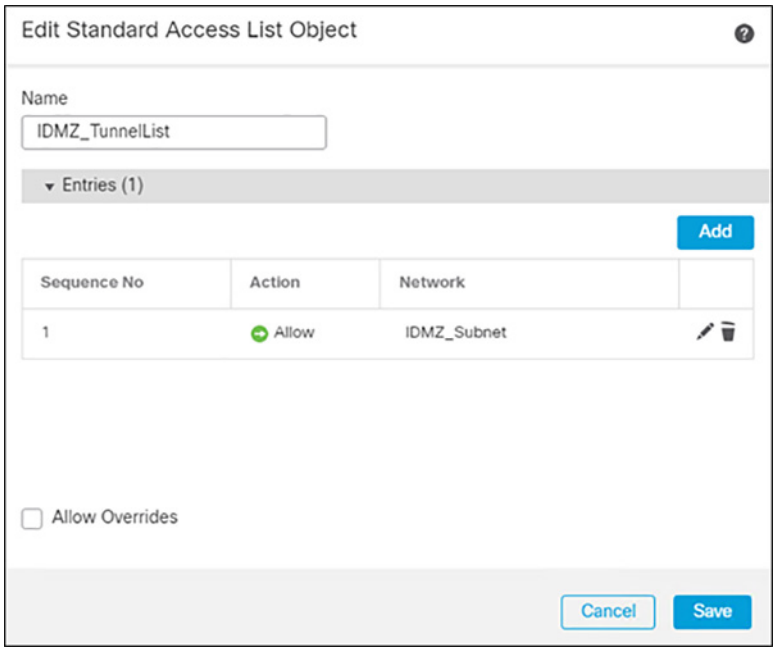
a. Navigate to **Objects > Object Management > Access List > Standard**.

b. Click **Add Standard Access List**.

c. Give a meaningful name to the split tunnel and add the network object(s) from the previous steps.

d. Click **Save**.

Figure 3-19 Editing Access List for VPN Access



Step 5 Complete the AnyConnect VPN wizard:

a. In FMC, navigate to **Devices > VPN > Remote Access**.

b. Click **Add**.

c. Add a meaningful name and click the **FTD(s)** that this policy will apply. Click **Next**.

d. Under **Authentication Server**, choose the **Duo Authentication Proxy** that was configured in a previous step.

e. Add the **IPv4 Address Pool** that was created for VPN users.

f. Under **Group Policy**, click +.

g. Give a meaningful name to the policy.

h. In the **General > DNS/WINS** tab, add the DNS server for the internal network. Note: If this network object does not already exist in FMC, it can be added using the + button.

i. In the **General > Split Tunneling** tab, click **IPv4 Split Tunneling** drop down and choose **Tunnel networks specified below**. Repeat for IPv6 if applicable.

j. Under **Standard Access List**, choose the Split Tunneling list that was created in a previous step. This will ensure that only the traffic that has been specified will use the tunnel.

k. Under **DNS Request Split Tunneling**, click **DNS Requests** drop down and choose **Send only specified domains over tunnel**.

l. Enter the domain list for the internal network. All other DNS requests will be sent to Umbrella (when configured).

m. Click **Next** on the Remote Access VPN wizard.

n. Select the AnyConnect Client images that were uploaded in a previous step. Click **Next**.

o. On the **Interface group/Security Zone** drop-down menu, choose the FTD interface that users will access for VPN connections.

p. In the **Certificate Enrollment** drop-down menu, choose the device certificate that will be used to authenticate the VPN gateway. Note: This design guide used a self-signed certificate that was created using the + button.

q. Click **Next**.

r. Validate the policy information and click **Finish**.

s. Click **Deploy** to send remote access policy to the FTD.

Note While out of scope for this guide, it is recommended to create access control rules on the firewall to limit access to VPN users. This can be achieved by using the IPv4 address pool reserved for VPN users and creating an allow list of services they should be able to reach on the network.

Microsoft Remote Desktop Gateway Configuration

The following example will present a scenario and show the configuration steps to achieve the requirements. It is assumed that the user has completed the initial setup of the RD Gateway role server in the IDMZ.

Note For details on the configuration of the RD Gateway feature on the Microsoft Windows Server, refer to *Deploying Remote Desktop Gateway Step-by-Step Guide* at:

- https://docs.microsoft.com/en-us/windows-server/remote/remote-desktop-services/rds-build-and-deploy

Defining User Groups and Remote Access Rules

In our scenario, we have the following actors shown in Table 3-12 that will be assigned to the following Active Directory User Groups:

Table 3-12 Users and User Groups

User	User Group	Role
Oscar Operator	Operators	Monitors production equipment to support the IACS process
Martha Maintenance	Maintenance	Maintains Industrial Zone assets related directly to production systems
Ed Engineer	Engineers	Defines, configures, maintains Industrial Zone assets related directly to production systems
Alice Admin	Production Administrators	Defines, configures, maintains Industrial Zone software assets that contain common enterprise software such as Antivirus, OS patches, etc.
Beth Oemone	OEM 1	Trusted Partner: a non-employee resource that is working for the company that needs access to certain assets.
Bob Oemtwo	OEM 2	
Maintenance, Engineers, Production Administrators, OEM1, OEM2	IDMZ RDG Users	This group contains all user groups that can have access to Industrial Zone resources via RD Gateway

We will now define the Industrial Zone assets each AD user group will be allowed to access through the RD Gateway. Duo Authentication for Remote Desktop Gateway adds two-factor authentication to your RemoteApp Access logons and blocks any connections to your Remote Desktop Gateway server(s) from users who have not completed two-factor authentication when all connection requests are proxied through a Remote Desktop Gateway. Users automatically receive a 2FA prompt in the form of a push request in Duo Mobile or a phone call when logging in. This configuration does not support passcodes or inline self-enrollment.

Installing Duo's RD Gateway plugin disables Remote Desktop Connection Authorization Policies (RD CAP) and Resource Authorization Policies (RD RAP). The CAPs and RAPs become inaccessible from the Remote Desktop Gateway Manager and previously configured policy settings are ignored by Remote Desktop Gateway. If operational requirements mandate continued use of RD CAPs/RAPs, you may want to consider installing Duo for Windows Logon at your RDS session hosts instead.

With this in mind, the remainder of the document will focus on the use of RD CAPs/RAPs. For prerequisites, installation instructions and troubleshooting tips for MFA with the RD gateway, see Duo Authentication for Microsoft Remote Desktop Gateway on Windows 2012 or later.

Now that we have defined the computer groups, users, user groups and what each group is authorized to access through the RD Gateway, we will show the configuration steps to meet these requirements.

It is worthwhile mentioning that FactoryTalk Security is discussed in this guide as a means to secure Rockwell Automation applications. Application security can also be achieved by limiting the applications available to each user or user group(s) desktop.

Configuring Active Directory

Before we configure the RD Gateway, we want to leverage the AD users and groups we have planned in the previous section so configuring these users within AD is our first step. The section assumes the reader has some familiarity with AD and how to create users, user groups and computer groups.

Note For more detailed information on the Microsoft AD functionality, refer to *Active Directory Users and Computers* at:

- https://docs.microsoft.com/en-us/previous-versions/windows/it-pro/windows-server-2008-R2-and-2008/cc754217(v=ws.11)?redirectedfrom=MSDN

Step 1 Create AD users and groups as described in Table 17 using the Active Directory Users and Computers management console.

a. Create AD users groups (Operators, Engineers, Maintenance, OEM1, OEM2 and ProdAdmins).

b. Create AD users and assign to the corresponding groups.

c. Create an AD group that will be allowed to access Industrial Zone assets. In our example it will be named IDMZ RD Gateway Users.

d. Add user groups from Step 1 (Engineers, Maintenance, OEM1, OEM2 and ProdAdmins) to the IDMZ RD Gateway Users group.

   – Note that the Operators group will not be added since our policy does not allow remote access for operators.

Step 2 Create computer groups as described in Table 3-12.

a. Create IDMZ RD Gateway Remote Hosts computer group.

b. Add the IACS Terminal Server (TERM01) to the IDMZ RD Gateway Remote Hosts group.

c. Create IACS Hosts computer group that will contain Industrial Zone assets for remote access.

d. Add the appropriate servers to the IACS Hosts group per Table 3-12. The exact list of servers for remote access will depend on the environment and business needs.

Configuring RD Gateway Policies

After defining remote access rules and creating corresponding users, user groups and computer groups in the AD, the administrator should configure the RD Gateway policies (CAPs and RAPs) to match the rules.

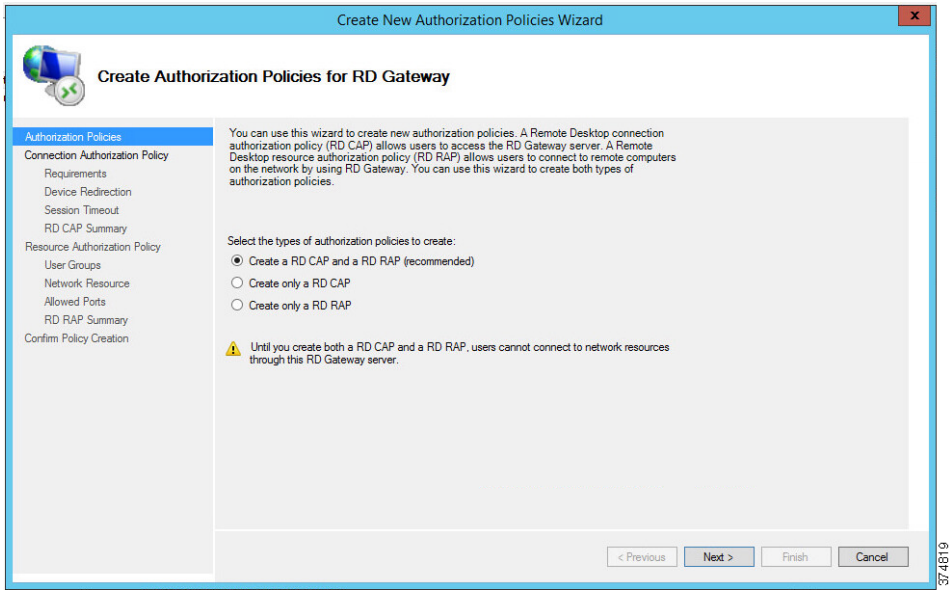
In our example, we will configure two CAPs and RAPs to support the scenario in Table 3-12.

- A CAP and RAP will exist to allow users to connect to the terminal server in the Industrial Zone.
- A CAP and RAP will also exist to allow Production Administrators and Engineers to access all the IACS servers.

Step 1 Configure IDMZ RDG Remote Host CAP using the RDG Manager. The IDMZ RDG Remote Host scenario will allow the authorized users to access the terminal server in the Industrial Zone.

a. From the **RDG Manager**, the **Policies** folder and select **Create New Authorization Policies**. In the dialog box (see Figure 3-20), select **Create RD CAP** and a **RD RAP** (recommended) and then click **Next**.

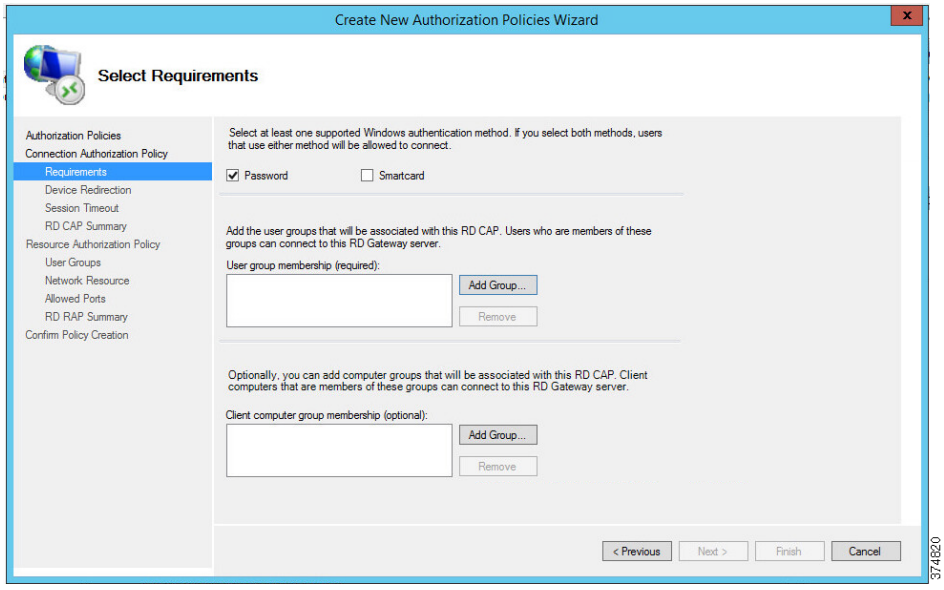
Figure 3-20 RDG Policy Wizard



b. Name the CAP as **IDMZ RDG CAP** and then click **Next** to proceed to the Requirements page.

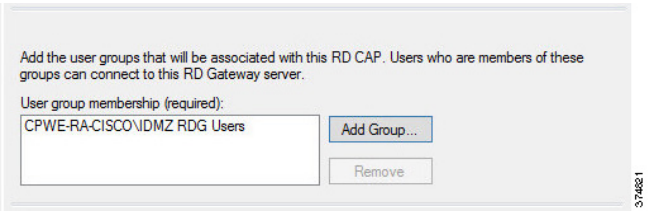
c. Each CAP allows the administrator to select a Password, a Smartcard or both as an authentication method. In our example, we are allowing the user to use a password (see Figure 3-21).

Figure 3-21 CAP Requirements - Authentication Method



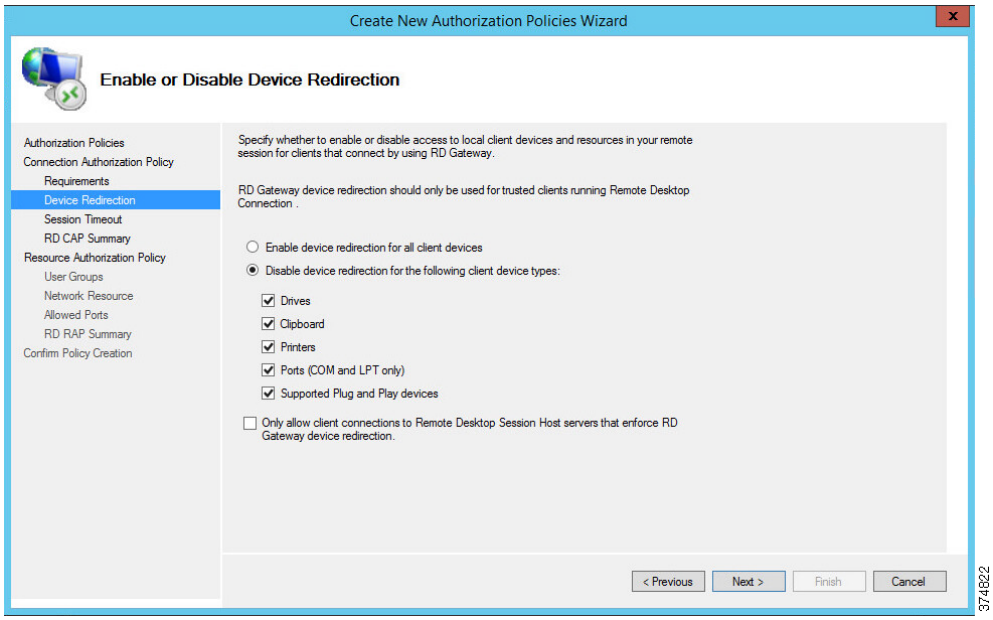
d. With the Password option selected, we will now add user groups that will be associated with this CAP. Click **Add Group** in the **User Group Membership** section. In the **Selection Group** dialog box, find and select **IDMZ RDG Users** group to associate it with the RDG CAP (see Figure 3-22). Click **Next**.

Figure 3-22 CAP Requirements—User Group



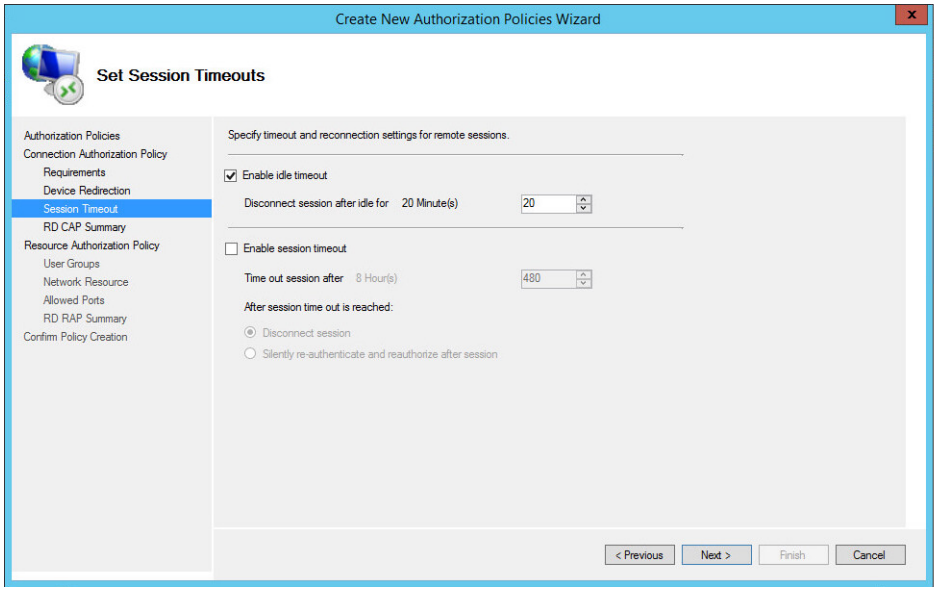
e. The CAP also allows the administrator to enable or disable device redirection. Device redirection controls access to devices and resources on a client computer in RDP sessions. For instance, Drives redirection specifies whether to prevent the mapping of client drives in an RDP session. For our example, we will disable device redirection to bolster security (see Figure 3-23). After disabling device redirection, click **Next** to continue.

Figure 3-23 CAP - Device Redirection



f. The CAP allows the administrator to specify idle timeout and automatic session disconnection. In our example, we have chosen to disconnect if the session has been idle for 20 minutes. Your security policy will dictate the idle timeout and session timeout parameters. After the timeout parameters have been entered, click **Next** to continue.

Figure 3-24 CAP—Idle and Session Timeouts



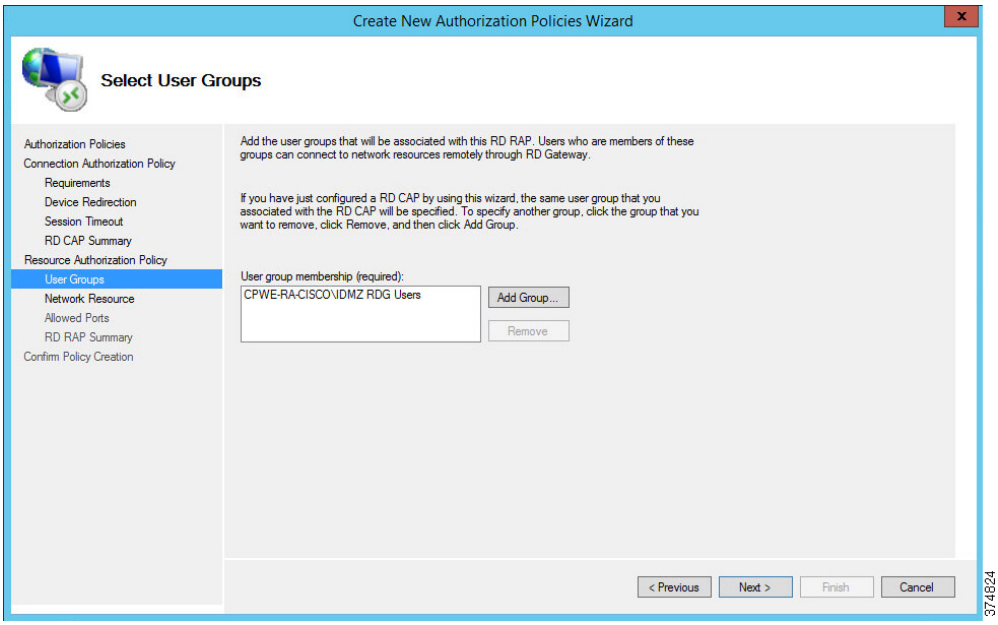
g. Once the CAP configuration steps are completed, the administrator can review the entire details of the configuration before submitting the content.

Step 2 Configure IDMZ RDG Remote Host RAP using the RDG Manager. The RAP will specify what resources the authorized remote users can access in the Industrial Zone.

a. In Step 1, we completed our CAP configuration. We will now continue the wizard to configure a Resource Authorization Policy. Name the RAP as **IDMZ RDG RAP** and then click **Next**.

b. The RAP allows the administrator to specify the user groups that can have access to the Industrial Zone resources. We specified the IDMZ RDG Users group in the CAP so the RAP is prepopulated with the same group (see Figure 3-25). This group will be allowed to access the terminal server in the next step. Click **Next** to continue.

Figure 3-25 RAP—User Groups



c. The Network Resource page allows the administrator to specify the network resources that the IDMZ RDG Users can access. Previously, we defined a computer group named IDMZ RDG Remote Hosts that included our terminal server TERM01. Click Browse, find and select IDMZ RDG Remote Hosts computer group to add to this RAP (see Figure 3-26 and Figure 3-27).

Figure 3-26 RAP—Network Resources

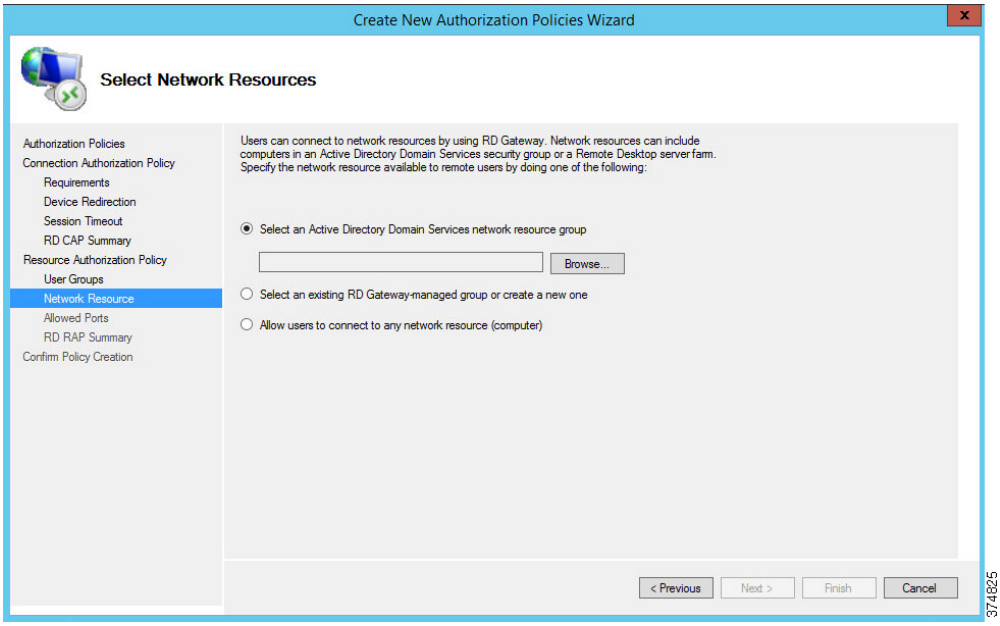
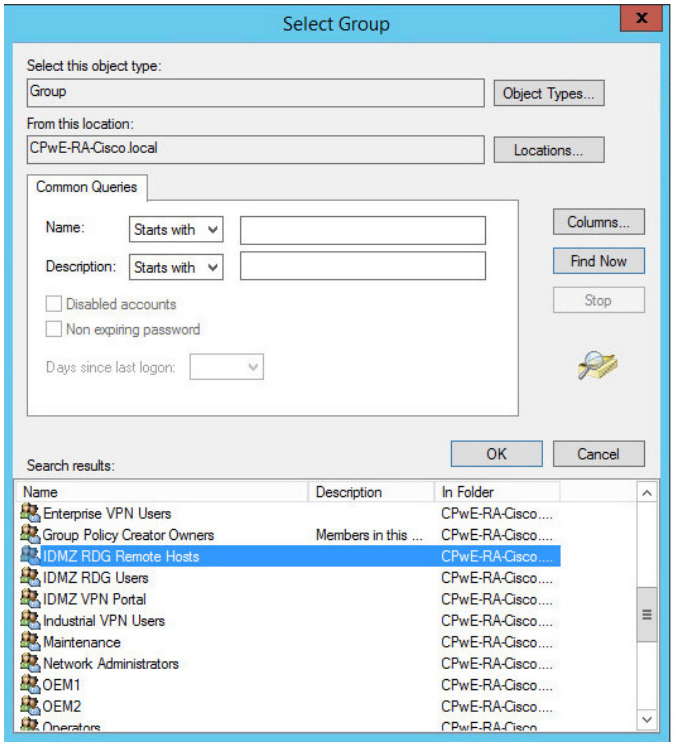
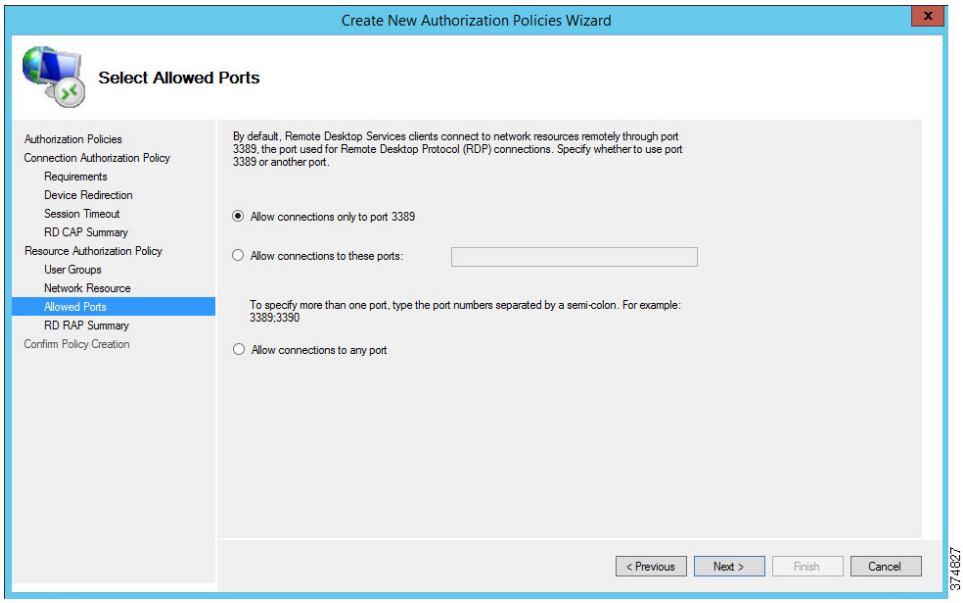


Figure 3-27 RDG Remote Hosts Computer Group



d. By default, the RDG connects to IACS resources on port 3389 (RDP). For this example, we have not changed the default connection port number (see Figure 3-28). If a different port or group of ports is selected, make sure that the firewall rules reflect that. Click **Next**.

Figure 3-28 RAP—Allowed Ports



e. The CAP and RAP configuration is now complete. In Steps 1 and 2, we defined policies for remote access to the terminal server in the Industrial Zone via RD Gateway.

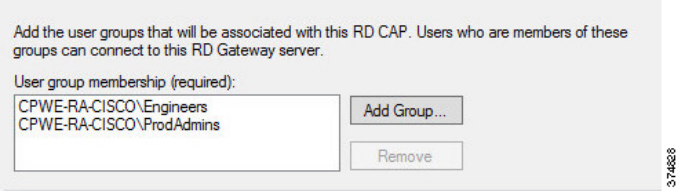
Step 3 Configure IACS Remote Host CAP using the RD Gateway Manager. The IACS Remote Host scenario will allow the production administrators and engineers to access the Industrial Zone servers in the IACS Hosts group (Table 19). Configuration of this CAP is similar to Step 1.

a. Start the wizard to create a new CAP and a RAP. In our example, the CAP will be named **RDG IACS Remote Hosts CAP**.

b. Select the authentication method (password or smartcard) depending on the security policy.

c. Add user groups that will be associated with this CAP. In our example, **Engineers and ProdAdmins** groups will be selected.

Figure 3-29 Remote Host CAP User Groups



d. Configure Device Redirection policy to control access to devices and resources on a client computer in remote desktop sessions. For our example, we will disable device redirection to bolster security.

e. Specify idle and session timeout parameters.

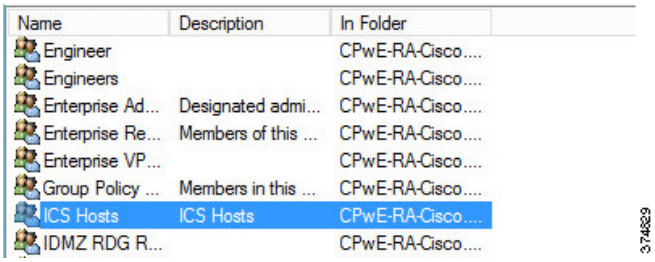
Step 4 Configure IACS Remote Host RAP using the RDG Manager after the CAP is created. Configuration of this CAP is similar to Step 2.

a. Name the policy (**RDG IACS Remote Hosts RAP** is used in our example).

b. Same user groups that we associated in the CAP should be prepopulated in the RAP. In our example, Engineers and ProdAdmins groups will have access to the Industrial Zone resources.

c. Specify the network resources that Engineers and ProdAdmins groups can access. Previously, we defined a computer group named IACS Hosts that included our Industrial Zone servers and computers. This group will be added to the RAP.

Figure 3-30 ICS Hosts Computer Group



d. Accept the default RDP port 3389. This completes the RAP configuration.

Verifying the RD Gateway Policies

In order to verify the functionality of the RD Gateway, the appropriate SSL certificates must be installed on the computers that will be used in conjunction with the RD Gateway. CPwE IDMZ does not cover PKI in depth nor does it recommend how to properly implement or manage PKI. For test purposes, firewalls and other devices used self-signed certificates as PKI management was beyond the scope of this CPwE DIG.

Configuring Firewall Rules for RD Gateway

The following steps describe the configuration of firewall rules for the Microsoft RD Gateway to allow secure RDP sessions from Enterprise clients to Industrial servers:

Step 1 Configure the firewall to allow RDP sessions to traverse the IDMZ via the RD Gateway (see Table 3-13).

Table 3-13 Access Rules—Remote Desktop Gateway

Firewall Interface	Source	Destination	Permitted Protocols
Enterprise	Any	RDG server in the IDMZ	HTTPS (TCP port 443)
IDMZ	RD Gateway server in the IDMZ	Industrial servers and/or workstations accessible via RDG	RDP (TCP port 3389)

Step 2 Configure the firewall to allow RD Gateway to authenticate to the Enterprise DC (see AD configuration section for details). Normally the RD Gateway would be part of the firewall object for IDMZ hosts that authenticate to the DC.

ThinManager Remote Desktop Gateway Configuration

Configuring Firewall Rules for ThinManager with RD Gateway

The following steps describe the configuration of firewall rules for the Microsoft RD Gateway to allow secure RDP sessions from Enterprise thin clients to Industrial servers:

Step 1 Configure the firewall to allow RDP sessions from thin clients to traverse the IDMZ via the RD Gateway (see Table 3-14).

Table 3-14 Required Access Rules—Thin Clients with Remote Desktop Gateway

Firewall Interface	Source	Destination	Permitted Protocols
Enterprise	Thin client IP addresses	RDG server in the IDMZ	HTTPS (TCP port 443)
IDMZ	RD Gateway server in the IDMZ	Industrial servers and/or workstations accessible via RDG	RDP (TCP port 3389)

Table 3-15 Optional Access Rules—ThinManager with Remote Desktop Gateway

Firewall Interface	Source	Destination	Permitted Protocols	Purpose
Enterprise	ThinManager Server IP addresses	Remote Desktop Server	RPC/DCOM (TCP 135)	Host Monitoring of Remote Desktop Server
Enterprise	ThinManager Server IP addresses	Remote Desktop Server	ICMP	Enforce Primary Display Client Feature
Industrial	ThinManager Server IP addresses	Remote Desktop Server	ICMP	Enforce Primary Display Client Feature

Note Table 3-15 citing optional access rules for ThinManager with Remote Desktop Gateway does not have an IDMZ brokered connection and requires direct access through the IDMZ. This may not be acceptable based on risk tolerance and user policies.

Step 2 Configure the firewall to allow RD Gateway to authenticate to the Enterprise DC (see AD configuration section for details). Normally the RD Gateway would be part of the firewall object for IDMZ hosts that authenticate to the DC.

ThinManager Configuration for Use with RDG

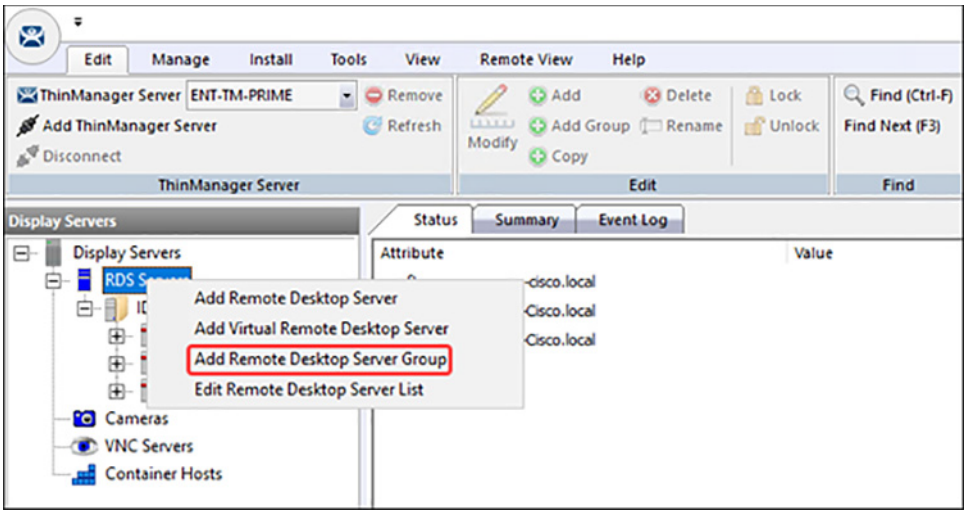
Access to an RD Gateway is configured in the Display Server and Display Client in ThinManager with the assumption that a device on the industrial or enterprise network might need to access resources across the network security boundary such as the IDMZ. The below sections regarding Remote Desktop Gateway and ThinManager explain how to use the Microsoft RD Gateway with ThinManager and thin clients. These steps assume the following:

- RD Gateway setup is completed as per the previous sections.
- ThinManager Remote Desktop Display Servers and Display Clients have basic ThinManager configurations complete.

Configure the Remote Desktop Server Group

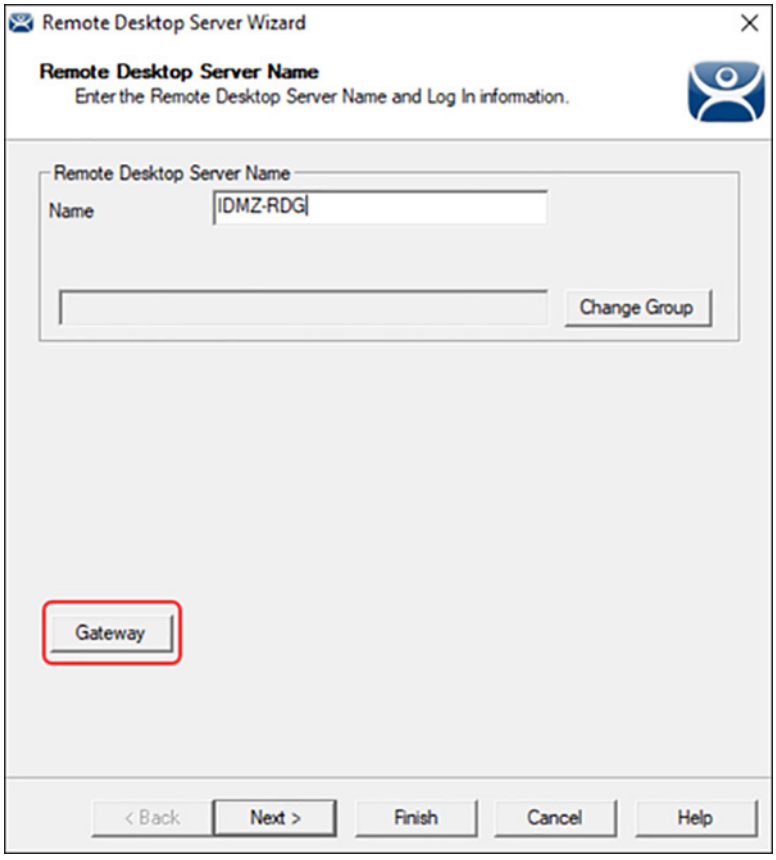
Step 1 Create **Remote Desktop Server Group** by navigating to **Display Servers** in ThinManager, right clicking on **RDS Servers** and selecting **Add Remote Desktop Server Group**.

Figure 3-31 Add Remote Desktop Server Group



Step 2 Enter a name for the **Remote Desktop Server Group** in the **Name** field and select the **Gateway** button to open the RDP Gateway window.

Figure 3-32 RDP Gateway Window



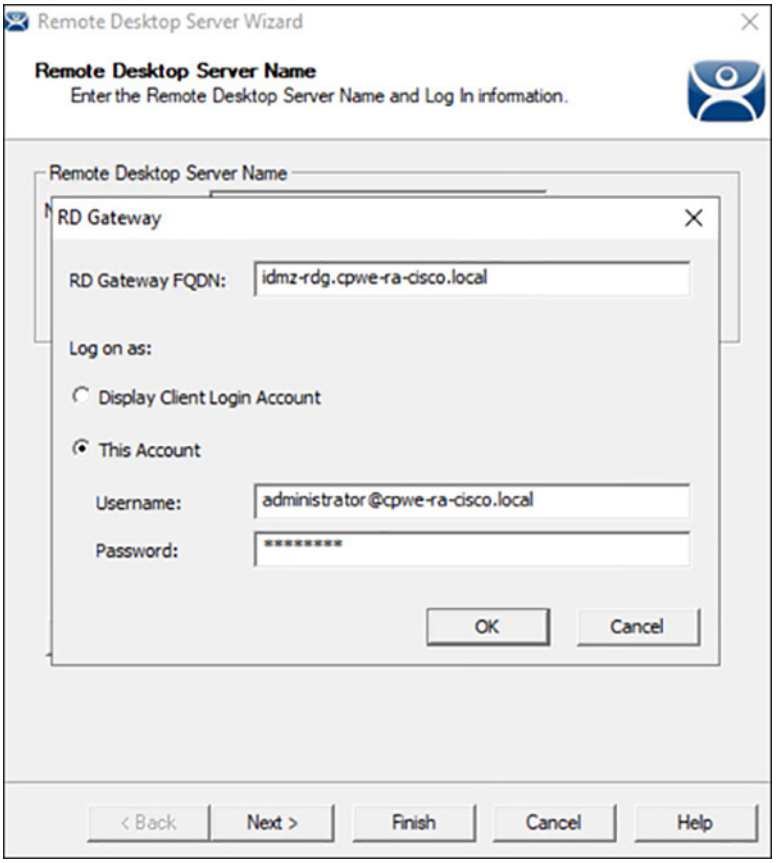
Step 3 Enter the **Fully Qualified Domain Name** (FQDN) of the RD Gateway in the Gateway Name field.

Step 4 Enter an administrative account and password in the Username and Password fields, if desired. The administrative account should be entered in the User Principal Name (UPN) format.

- If credentials are provided all the terminals will use those credentials to log into the RD Gateway.
- If left blank the terminal with use the terminal username and password to log into the RD Gateway.

Step 5 Select the **OK** button to accept.

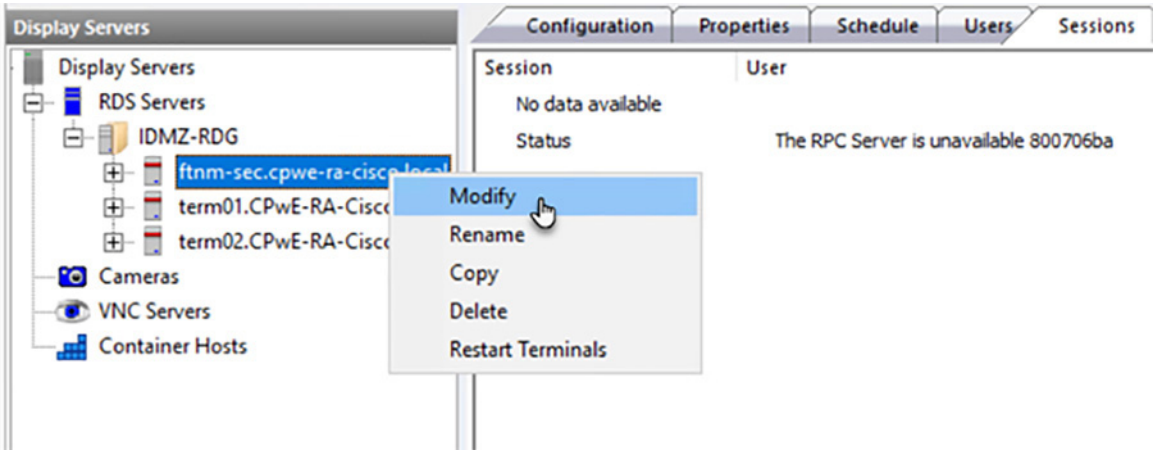
Figure 3-33 RD Gateway



The Remote Desktop Server Group will be empty and will need member servers. These are added from the Remote Desktop Server wizard of each server. Add the Remote Desktop Servers to the Remote Desktop Server Group.

Step 6 On the **Display Server** branch of the ThinManager tree, right click on a RDS Server icon, and select **Modify** to open the Remote Desktop Server wizard.

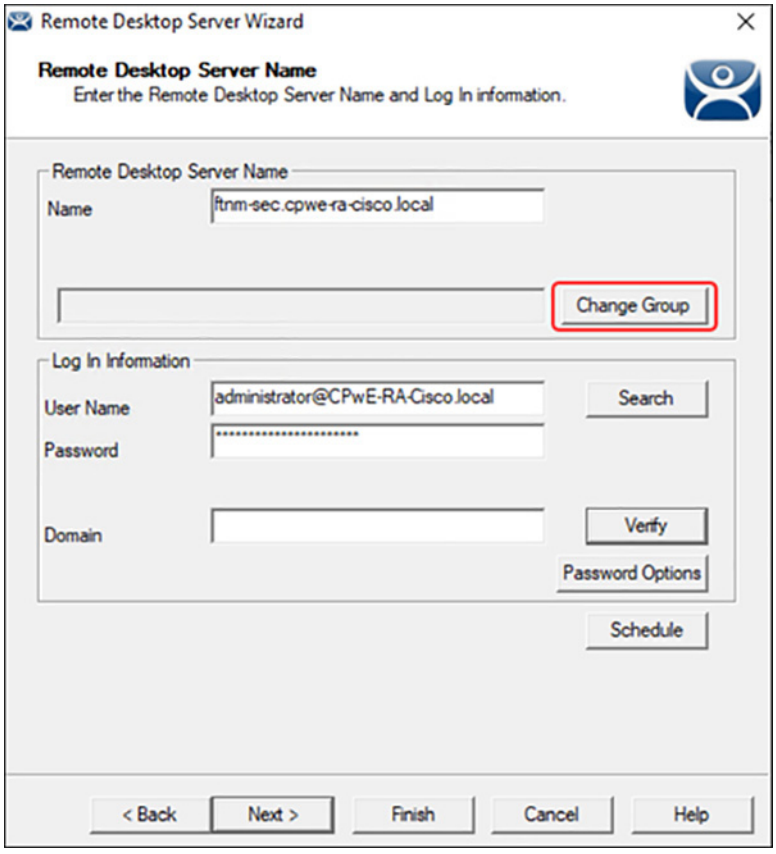
Figure 3-34 Remote Desktop Server Wizard



Note Servers will show a red status and the RPC Server error shown above if the optional access rules in Table 3-15 are not configured

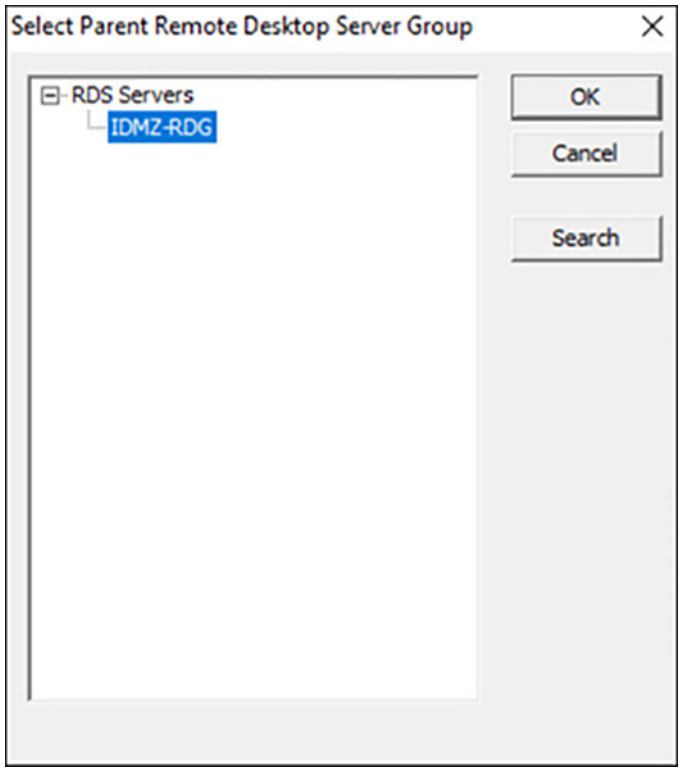
Step 7 Select the **Change Group** button to open the Select Parent Remote Desktop Server Group window.

Figure 3-35 Select Parent Remote Desktop Server Group Window



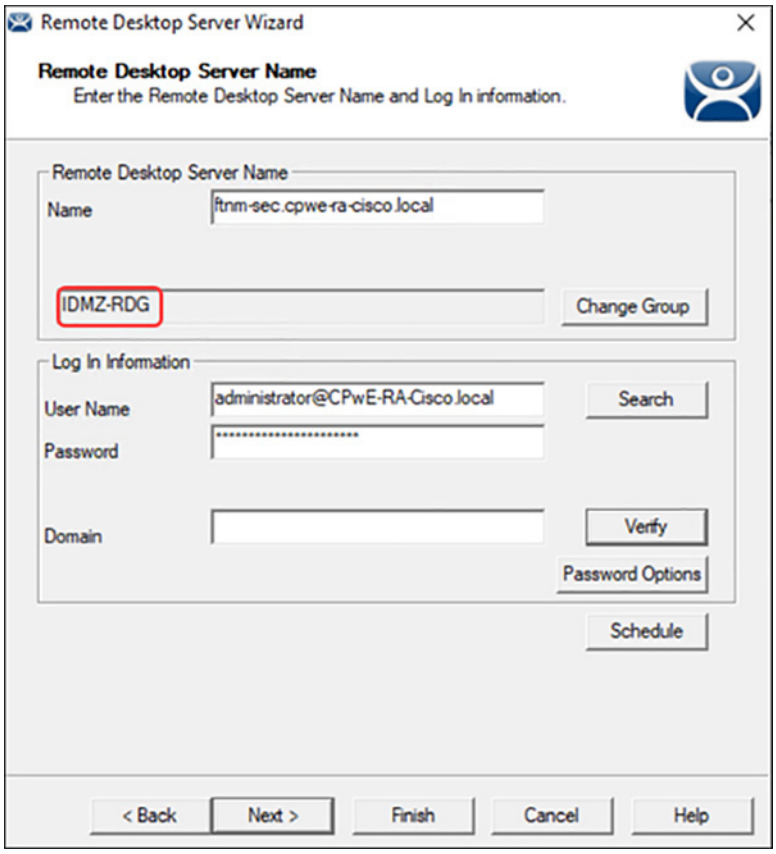
Step 8 On the **Parent Remote Desktop Server Group** window select the **Remote Desktop Server Group** and select the **OK** button.

Figure 3-36 Select Parent Remote Desktop Server Group



Step 9 This will put the **Remote Desktop Server** into the **Remote Desktop Server Group** once you select the **Finish** button to close the wizard. The new status will show in the Group field.

Figure 3-37 Group Field



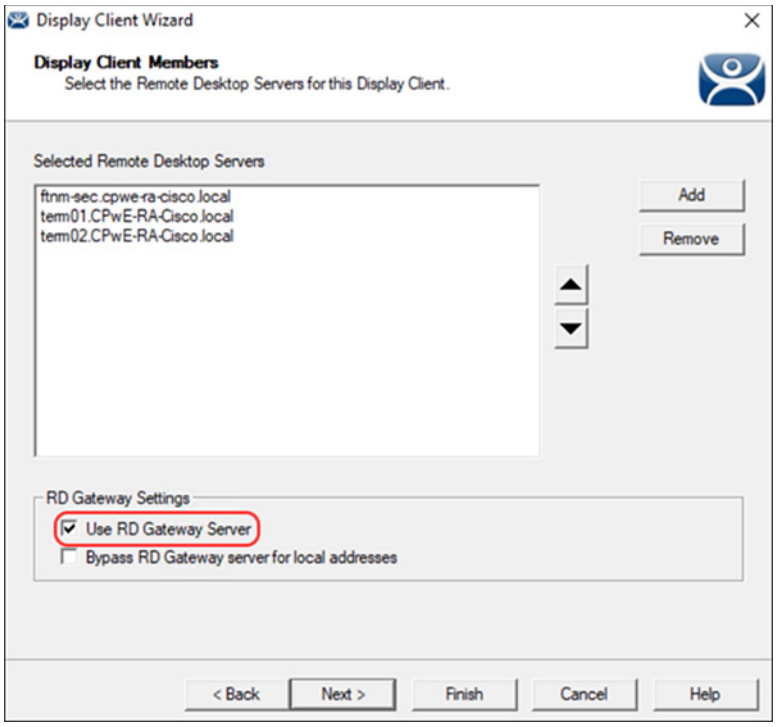
Step 10 Once the Remote Desktop Server wizard is closed the ThinManager tree will reflect the changes to the membership in the tree.

Configure the Display Client

Access to the RD Gateway is assigned in the Display Client wizard:

Step 1 Open the Display Client branch of the ThinManager tree, right click on the **Remote Desktop Server** icon, and select **Add Display Client** to open the Display Client wizard.

Figure 3-38 Display Client Wizard



The RD Gateway settings are on the Display Client Members page of the Display Client wizard. Assign the Remote Desktop Servers by selecting the Remote Desktop Server Group. There are two RD Gateway settings:

- **Use RD Gateway**—This checkbox, if selected, prompts the Display Client to use the Microsoft RD Gateway
- **Bypass RD Gateway server for local address**—This checkbox, if selected, allows the Display Client to use a Remote Desktop Server without going through the RD Gateway if the terminal and Remote Desktop Server are on the same subnet.
- Leaving both unchecked will create a display client without access to the RD Gateway or the other network or subnet.

Step 2 Once the desired RD Gateway Settings have been configured click **Finish**.

Note For more information on ThinManager configuration see ThinManager Manuals and Guides at:

- https://thinmanager.com/support/manuals/

Configuring Application Security

This section contains guidelines for configuring application security in the CPwE IDMZ, specifically FactoryTalk Security and Microsoft Windows hardening.

FactoryTalk Security Configuration

FactoryTalk Security is not a separate product - it is fully integrated into the FactoryTalk Directory - you will not find it on the Start menu, or in the Add or Remove Programs list in Control Panel.

The FactoryTalk Administration Console is your tool for working with FactoryTalk Security. Using this tool, you can:

- Browse your FactoryTalk system and view the applications, servers, and devices within it
- Create system-wide security settings, and security settings that affect all instances of FactoryTalk-enabled products
- Secure the FactoryTalk Network Directory or FactoryTalk Local Directory
- Secure resources in your FactoryTalk system, including applications and data
- Secure hardware networks and devices

In order to better describe how to configure FactoryTalk Security, we will walk through a scenario and configure FactoryTalk Security to meet the scenario's requirements. In this small example, we will configure the “Deny Privileges” shown in Table 3-16 for users of Studio 5000® software:

Table 3-16 FactoryTalk Security Authorization Example

User Group	Studio 5000 Deny Privileges List
Operators	Deny All Studio 5000 Privileges
Maintenance	Deny Controller: Secure, Firmware: Update
Engineer	No Restrictions
Production Administrator	No Restrictions
OEM 1	Deny Controller: Secure, Firmware: Update, Tag: Force
OEM 2	Deny Controller: Secure, Firmware: Update, Tag: Force

The following section will show how to configure FactoryTalk Security to accomplish these requirements. This example will be configuring a ControlLogix controller named CLX_C.

FactoryTalk Security User Groups Configuration

You can add two different types of user accounts to your FactoryTalk system:

- **FactoryTalk User or Group Accounts**—These accounts are separate from the user's Microsoft Windows account. This allows you to specify the account’s identity (for example, the user name), set up how the account operates (for example, whether the password expires), and specify the groups the account belongs to.
- **Windows-linked User or Group Accounts**—These accounts are managed and authenticated by the Windows operating system, but linked into the FactoryTalk Security services. A Windows-linked user account is added to the FactoryTalk system from a Windows domain or workgroup. You cannot change any Windows-linked account information, but you can change the groups the user belongs to. Adding Windows linked accounts to FactoryTalk means you maintain only one identity for users while still having separate Windows and FactoryTalk security parameters.

The Windows-linked user group Windows Administrators account is added to the FactoryTalk Administrators group, giving all Windows Administrators accounts on a local computer full access to the FactoryTalk Network Directory.

Note You can remove the default level of access for Windows Administrators after installation. Typically, different groups are responsible for managing FactoryTalk and Windows security parameters.

The Windows-linked user group Authenticated Users is added to the FactoryTalk Network Directory and FactoryTalk Local Directory if you install the FactoryTalk Services Platform on a new computer. You can remove this level of access after installation.

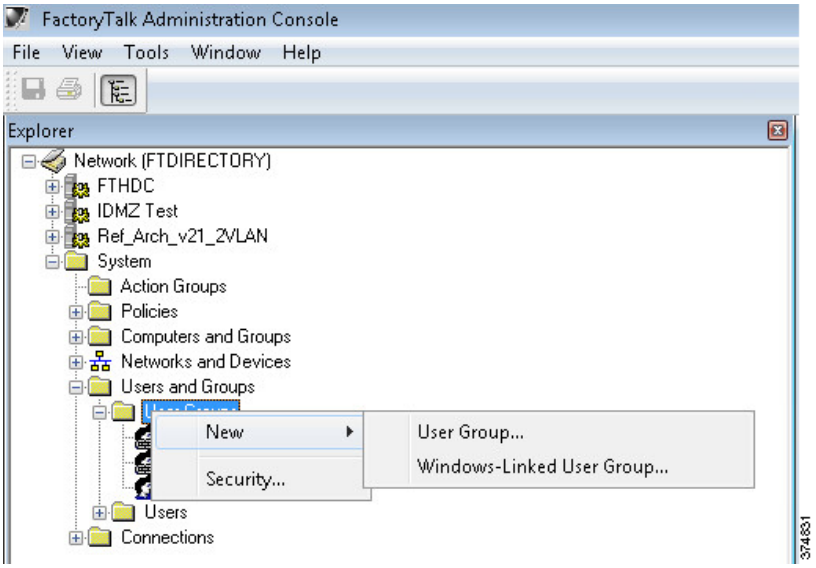
In our example, we are going to add the Windows users groups Operators, Engineers, Maintenance, Production Administrators, OEM1 and OEM2 (Table 3-12).

Step 1 Add Windows-linked users groups to the FactoryTalk Network Directory.

a. Open the FactoryTalk Administration Console: **Start > All Programs > Rockwell Software > FactoryTalk Administration Console** and then log on to the **FactoryTalk Network Directory**.

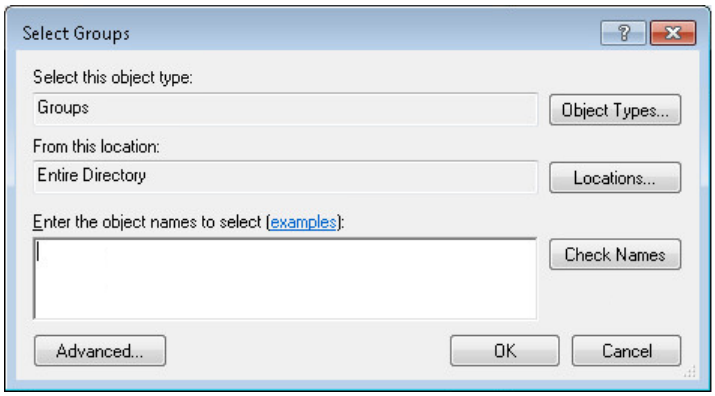
b. Right-click **User Groups** and select **Windows Linked User Group** (see Figure 3-39).

Figure 3-39 FactoryTalk Administration Console—Add User Group



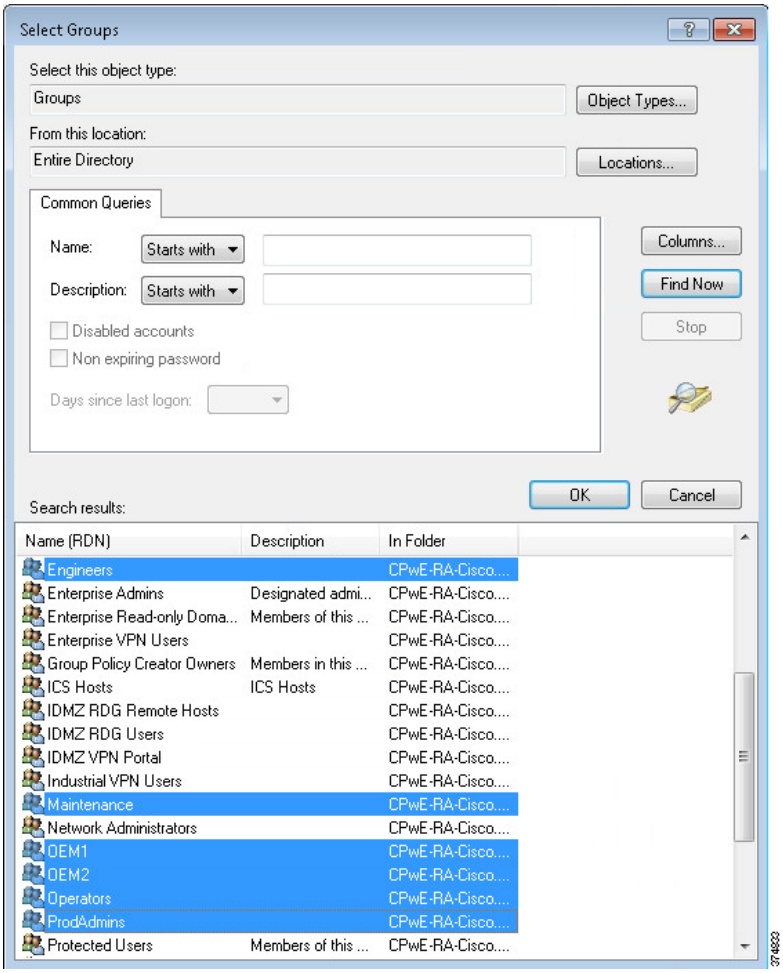
c. In the New Windows Linked User Group dialog box, click **Add > Locations > Entire Directory > OK**. The **Select Groups** dialog box will reappear with the **From this location** field changed from the local computer name to the entire directory (see Figure 3-40).

Figure 3-40 Select Groups—Location



d. Click **Advanced > Find Now** to search all of the User Group within the domain. Select Engineers, Maintenance, Operators, OEM1, OEM2 and ProdAdmins groups (see Figure 3-41). Click **OK**.

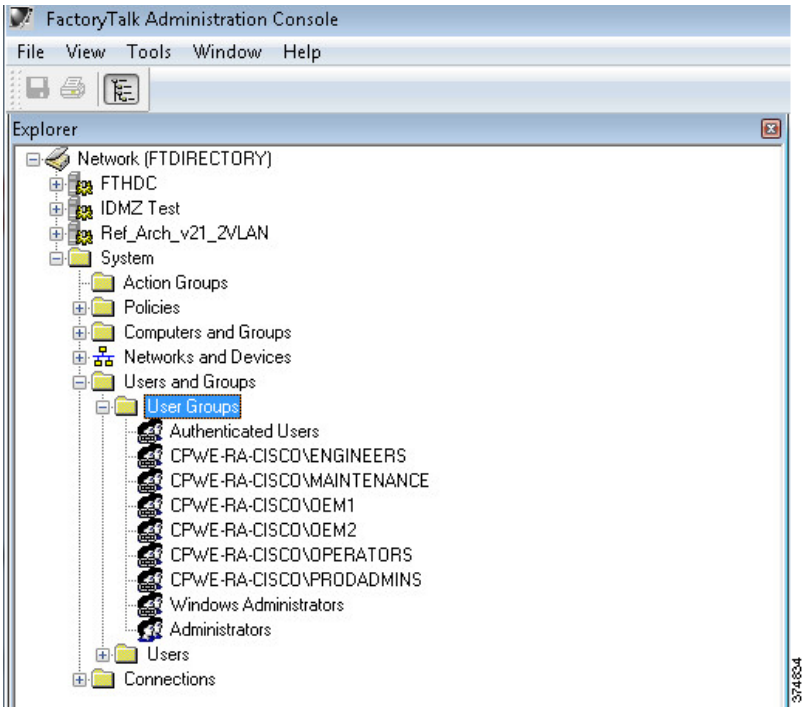
Figure 3-41 Select Groups—Advanced



e. Verify that the correct groups were added and click **OK**. The FactoryTalk New Windows-Linked User Group dialog box will show the domain users that are to be added. Click **OK** to complete the configuration.

f. Once the user groups are added, you will see them listed under the User Groups folder in the FactoryTalk Administration Console.

Figure 3-42 FactoryTalk Administration Console—User Groups Created



Studio 5000 Product Policies Configuration

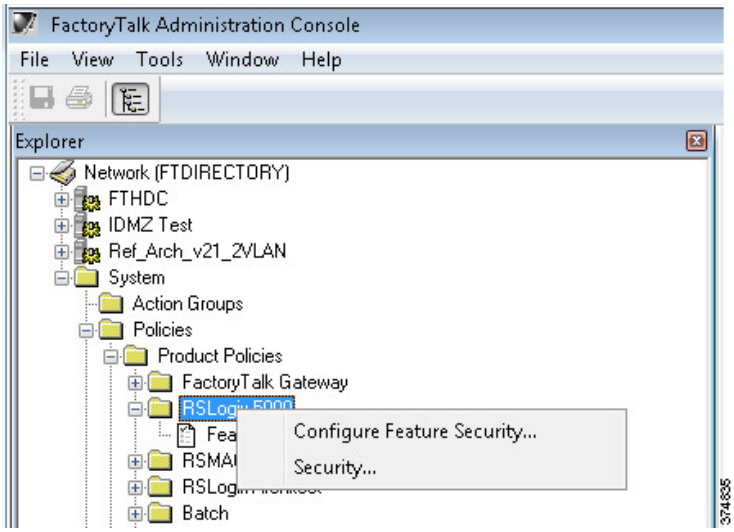
FactoryTalk Security allows the security administrator fine granularity of actions that can be secured for Studio 5000, FactoryTalk View SE and other Rockwell Automation products. In our example, we will start by configuring the Studio 5000 product policies, in particular who can secure and unsecure a controller.

- A **policy** is a setting that applies across the entire FactoryTalk IACS system. For example, all FactoryTalk products that share a single FactoryTalk Directory use the same audit policy setting that records a user's failure to access a secured object or feature because the user has insufficient security permissions. If you disable this policy, none of the FactoryTalk products in your system will record failed attempts to access secured objects or features.
- A **product policy** secures either a system-wide feature or system-wide configuration data that is specific to a particular product. Each FactoryTalk product provides its own set of product-specific policies, which means that the product policies available on your system vary, depending on which FactoryTalk products you have installed.

Step 1 Configure Studio 5000 policies to align with the User Groups requirements in Table 3-12 on page 3-33.

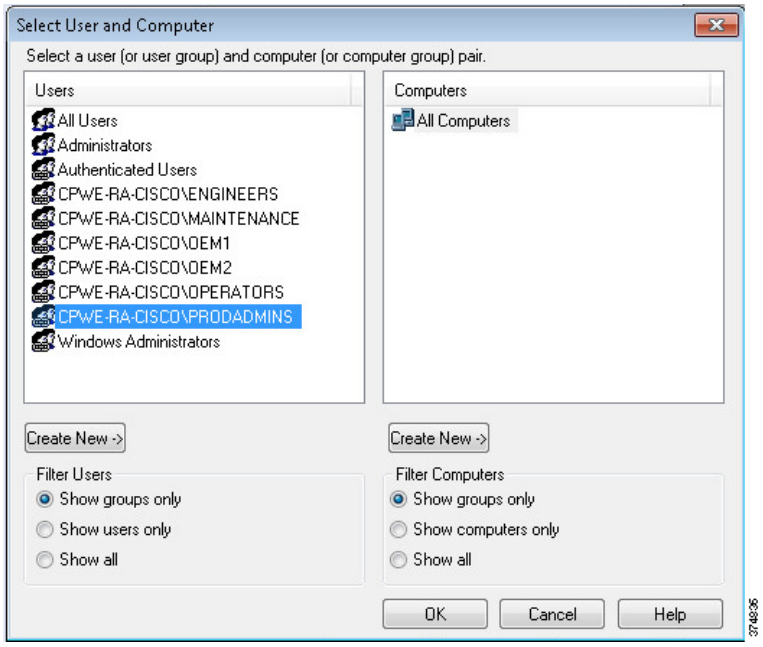
a. Under **System > Policies > Product Policies**, right-click **RSLogix 5000** and select **Configure Feature Security** (see Figure 3-43).

Figure 3-43 FactoryTalk Administration Console—Product Policies



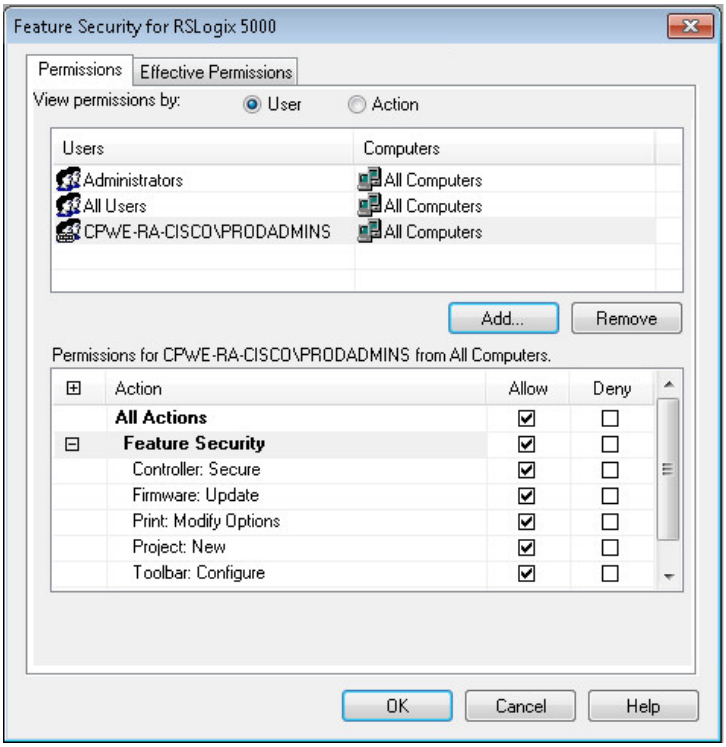
b. First we need to add the User Groups and then assign permissions. On the **Feature Security** dialog box, select **Add** to display the list of available user groups. Remember that we have added Windows-linked users in a previous step so they will be included in the list of users. Select **PRODADMINS** and click **OK** (see Figure 3-44).

Figure 3-44 Feature Security—Select User Group



c. The PRODADMINS group is now added to the user list in the Feature Security dialog box. We will now assign Studio 5000 product policy permissions to this group. We want to allow the Production Administrators unrestricted security access, so we select **Allow** on all Studio 5000 actions (see Figure 3-45).

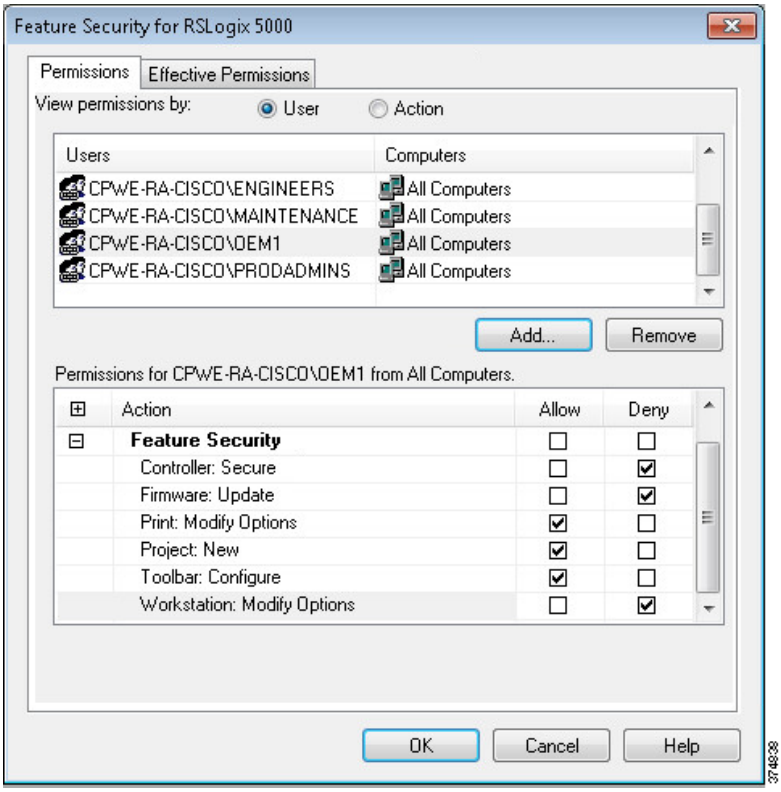
Figure 3-45 Feature Security—Allow All



d. Repeat the same step for each user group according to Table 3-12 on page 3-33. In our example, the Maintenance group should not be allowed to update the firmware. We can select **Deny** for Firmware: Update action to achieve this requirement.

e. We also wanted to stricter control over the OEM1 and OEM2 group. We can simply select **Deny** for additional actions to meet our requirements (see Figure 3-46).

Figure 3-46 Feature Security—Deny



f. Once permissions for all groups have been configured and applied, a Security Settings warning dialog will appear. It reminds that Deny entries take precedence over Allow entries if a user is a member of two groups.

Controller Security Configuration

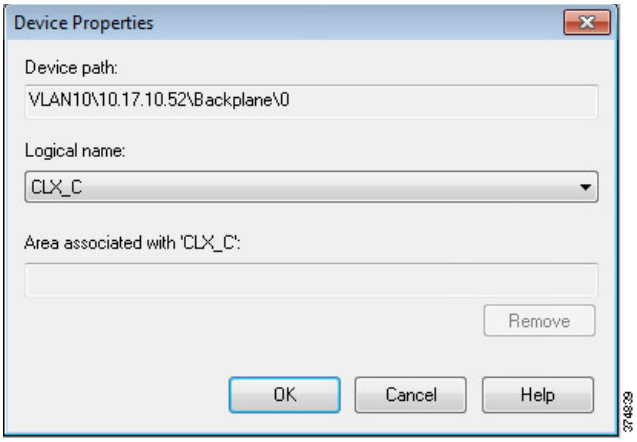
Now that we have created FactoryTalk user groups and assigned Studio 5000 product policies, it is time to set the granular security permissions for each group specific to a controller. Actions such as Tag: Force or Tag: Create can be secured through FactoryTalk Security.

Step 1 **Add a logical name to the controller**. It is recommended that security settings be applied to the controller's logical name. The logical name is the same as the name shown on the controller properties dialog. Security settings for a logical name apply to the offline project as well as when the project is downloaded to the controller.

a. To set the logical name in the FactoryTalk Administration Console, expand the **Networks and Devices** topology and navigate to the controller. In our example, the controller is named CLX_C. Right-click the controller and select **Properties**.

b. Select the **Logical** name that coincides with your controller's name. If the name does not appear in the **Networks and Devices** tree, you need to manually update the path information for the controller.

Figure 3-47 Controller Properties—Logical Name



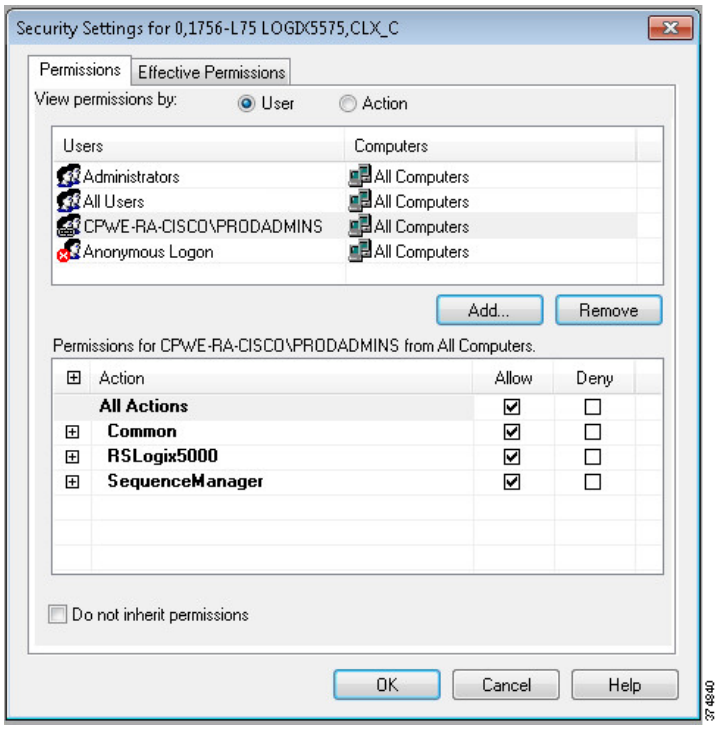
Step 2 **Assign Studio 5000 permissions to the controller based on the user group**. In our example, we will assign all Studio 5000 permissions on the CLX_C controller to the Production Administrators group (PRODADMIN) while setting a Deny permission to the Tag: Force to the OEM1 group.

a. Select the controller in the **Network and Devices** branch of the FactoryTalk Administration console. In our example, this is **CLX_C**. Right-click and select **Security**.

b. The **Security Settings** screen allows the security administrator to add users and user groups and assign permissions to each. Click **Add** to find and select the **Production Administrators (PRODADMINS)** user group.

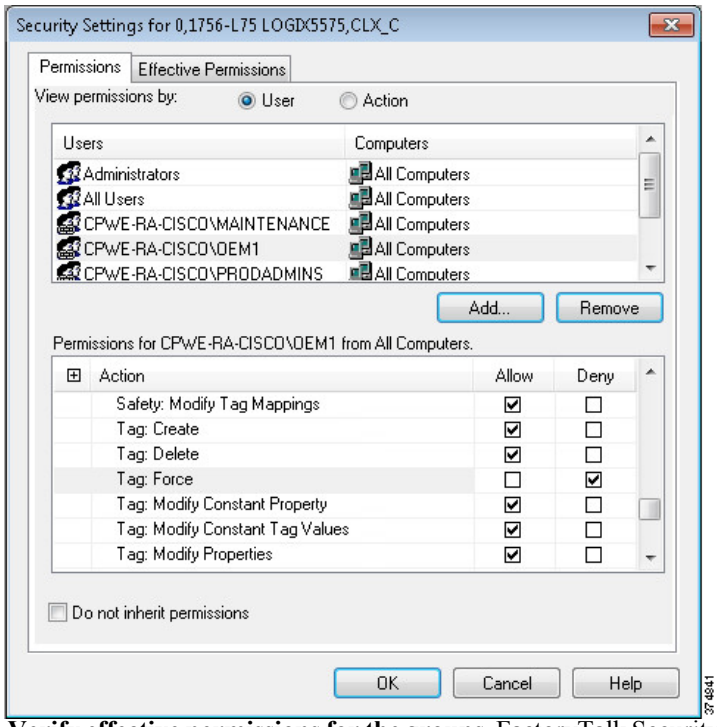
c. The **Security Settings** screen will now show the PRODADMINS group. We want to allow all actions to the CLX_C controller for this group so select **Allow** in the **All Actions** row (see Figure 3-48).

Figure 3-48 Controller Permissions—Allow All



d. Now we will deny the **Tag: Force** permission for the OEM1 group. From the **Security Settings** screen, click **Add** and select the **OEM1 group** to add to the configuration list. Expand the **RSLogix 5000** permission set and select **Deny** for the **Tag: Force** action (see Figure 3-49).

Figure 3-49 Controller Permissions—Deny

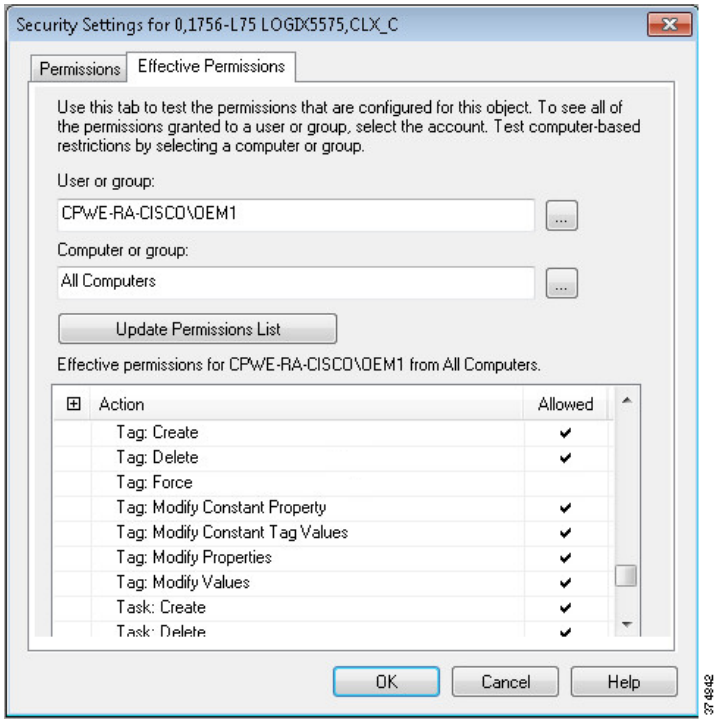


Step 3 **Verify effective permissions for the groups**. FactoryTalk Security is very flexible and allows users and user groups to inherit security permissions. Because of this flexibility, tools exist to check the effective permission for each user, user group and device. In this step, we will check the effective permissions of the OEM1 group to verify they are not allowed to “Tag: Force” on the CLX_C controller.

a. Select the controller in the **Network and Devices** branch of the FactoryTalk Administration console. Right-click and select **Security**.

b. Once the **Security Settings** dialog box opens, select the **Effective Permissions** tab. Browse to the desired user group (in our example, OEM1). The Effective Permissions will be shown for the OEM1 group. In our example, we see that **Tag: Force** action is not allowed (see Figure 3-50).

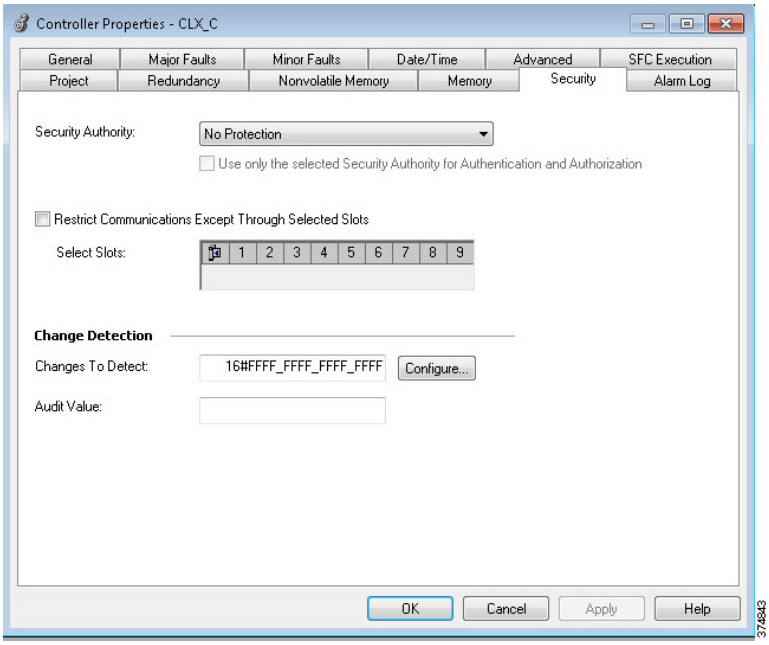
Figure 3-50 Controller Security—Effective Permissions



Step 4 **Apply FactoryTalk Security to the controller in Studio 5000**.

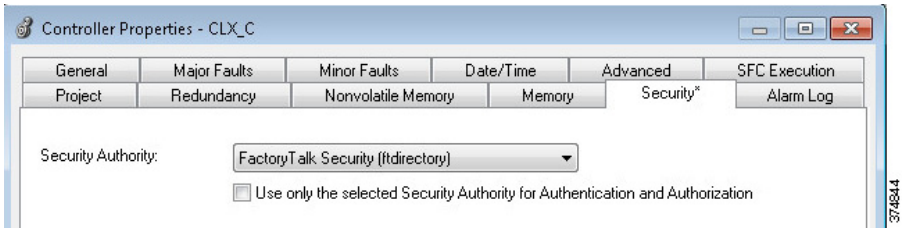
a. Open the CLX_C project with Studio 5000. Right-click the **Controller** folder and select **Properties**. Within the Controller Properties screen, select the **Security** tab. You will notice that the **Security Authority** will be set to **No Protection** (see Figure 3-51).

Figure 3-51 Controller Properties—No Protection



b. Change the Security Authority option to **FactoryTalk Security** (see Figure 3-52) and click **OK**. The Logix Designer warning dialog box is displayed. Select **Yes** to secure the controller.

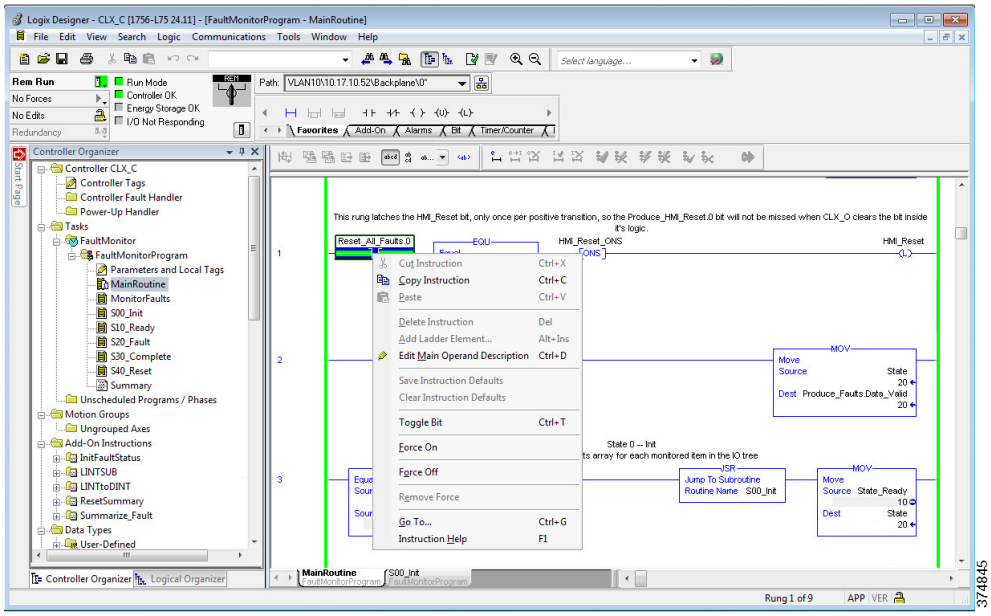
Figure 3-52 Controller Properties—FactoryTalk Security



Step 5 **Test the FactoryTalk Security configuration on the controller**.

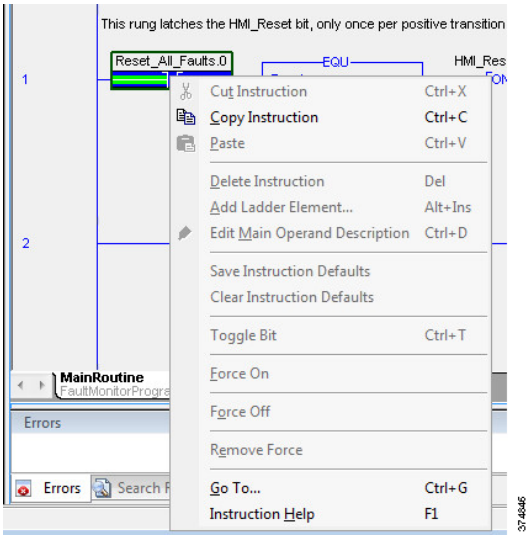
a. Log onto FactoryTalk Security as a **Production Administrator**. In the Studio 5000, when online with the controller. Right-click the tag. The Force On and Force Off actions are available for a tag (see Figure 3-53).

Figure 3-53 Force Tag Actions Available



Step 6 Log onto FactoryTalk Security as an **OEM1**. The Force On and Force Off actions are now disabled (see Figure 3-54).

Figure 3-54 Force Tag Actions Disabled



OS Hardening Configuration

This section provides a high-level overview of OS hardening configuration steps using Microsoft technologies outlined in Operating System Hardening, page 2-61.

Microsoft AppLocker Configuration

AppLocker uses the Application Identity service (AppIDSvc) for rule enforcement. For AppLocker rules to be enforced, this service must be set to start automatically in the Group Policy Object (GPO).

While the configuration options are unique to each customer and application, Rockwell Automation has provided a sample policy you can use as a guideline to help assist you to get started.

Note This sample policy can be downloaded from the following Knowledgebase article:

- https://rockwellautomation.custhelp.com/app/answers/detail/a_id/546989

For more information about AppLocker rules, see:

- http://technet.microsoft.com/en-us/library/dd759068.aspx

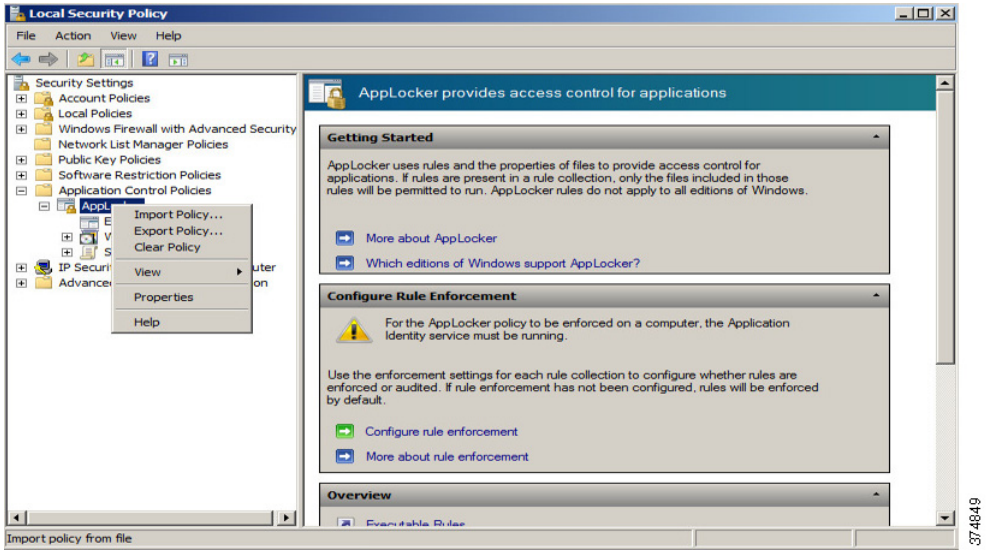
Note Before continuing, it is suggested to use audit-only mode to deploy the policy and understand its impact before enforcing it and rolling it out to a production environment.

Step 1 Import the Rockwell Automation example policy.

a. Open the **Local Group Policy Editor** by going to **Start > Run** and entering **gpedit.msc**.

b. Navigate to **Application Control Policies > AppLocker**. Right-click **AppLocker** and select **Import Policy** (see Figure 3-55).

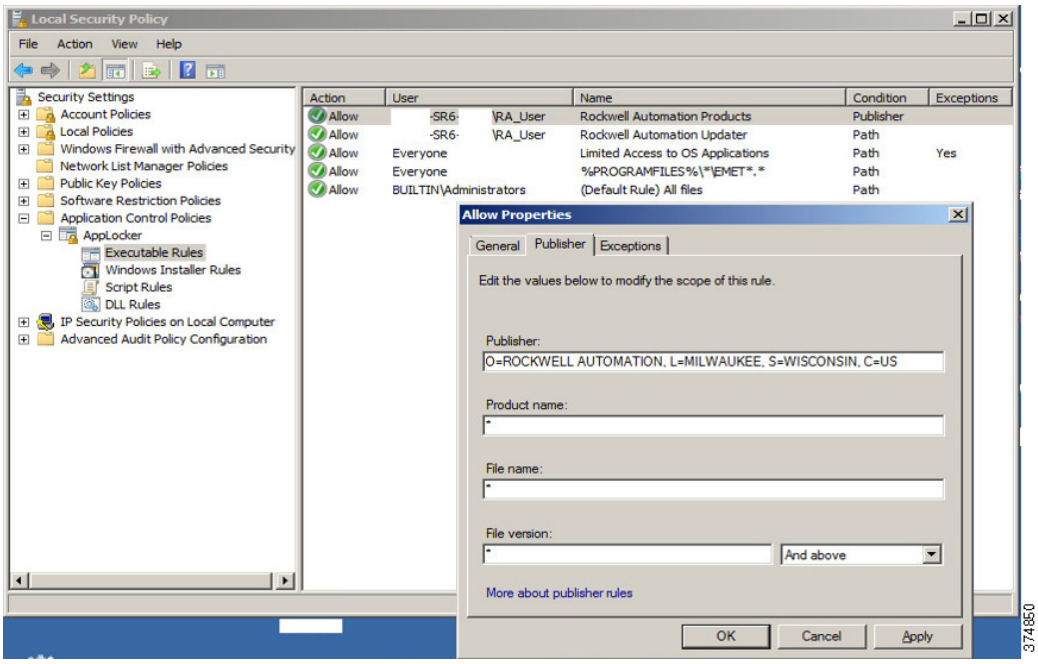
Figure 3-55 Group Policy Editor—Import AppLocker Example Policy



c. Navigate to the place where you downloaded the AppLocker_RAUser.xml file and import it. This will replace any existing policies with the example one.

d. Now within the AppLocker policy, rules can be observed and used to expand upon (see Figure 3-56).

Figure 3-56 Group Policy Editor—AppLocker Policy Details



Cisco Telemetry Broker Configuration

The following example will present a scenario and show the configuration steps to traverse network data across the IDMZ using the Cisco Telemetry Broker. It is assumed that the user has the necessary knowledge to configure network devices to send netflow and/or syslog to a given IP address.

Note For details on the configuration of the Cisco Telemetry Broker, refer to *Cisco Telemetry Broker Virtual Appliance Deployment and Configuration Guide* at:

- https://www.cisco.com/c/dam/en/us/td/docs/security/Telemetry_Broker/Deployment/TB_1_1_Virtual_Appliance_Deployment_and_Configuration_Guide_DV_3_0.pdf

Installing the Virtual Appliances

In our scenario, both the Manager node and Broker node were installed on the ESXI platform. For other supported platforms, see the guide linked above.

Step 1 Install the Manager Node:

a. Download the Manager Node OVA file.

b. Log in to the VMWare vSphere web user interface console.

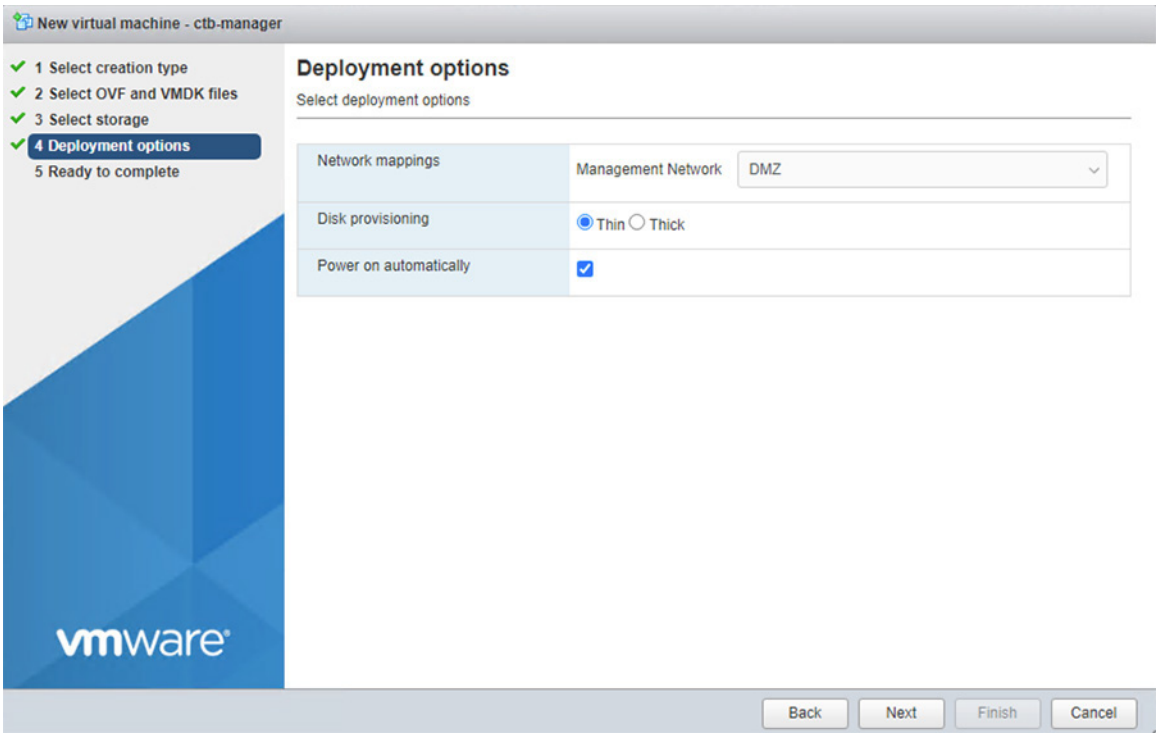
c. From the side menu, right-click **Virtual Machine** and then choose **Create/Register VM**.

d. Choose Deploy a virtual machine from an OVF or OVA file.

e. Enter the name of the OVA file.

f. Configure the settings as shown in Figure 3-57.

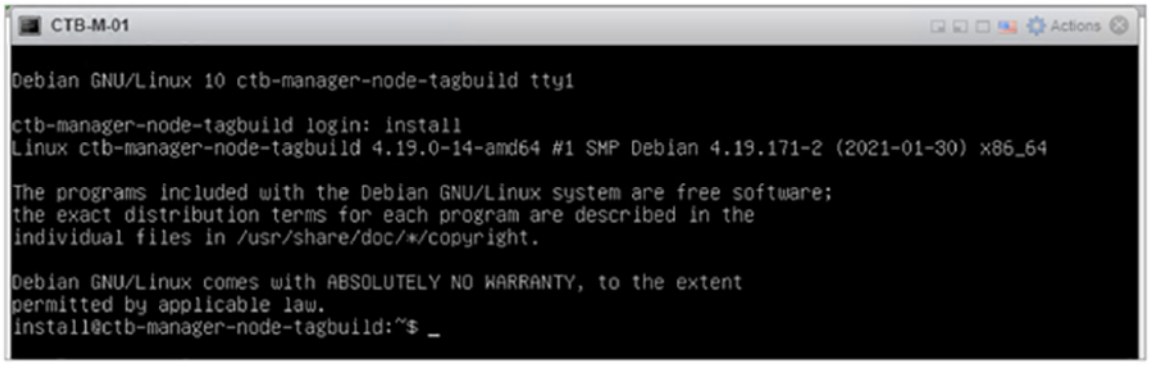
Figure 3-57 ESKI Deployment Options



g. Click **Finish**.

From the manager node virtual machine within the vmware user interface, open a web console and log in to the virtual machine (the username is install; there is no password).

Figure 3-58 CTB Manager Node CLI



Step 2 Run the **sudo ctb-install** command.

Enter the following information:

- Password for the admin user. The password must meet the following requirements:
  - Contain at least 8 characters
  - Contain at least 1 lowercase letter
  - Contain at least 1 uppercase letter

  - Contain at least 1 digit
  - Contains at least 1 of these special characters: @ # $ % ^ & * ! + ?
  - Cannot be a commonly used phrase or sequence
  - Cannot resemble any identifying attributes of the user (such as the username)
  - IPv4 address, subnet mask, and default gateway address for the Management Network interface
- Valid DNS nameserver IP address that is reachable from the virtual machine

If this is the first time you are logging in to the manager web interface, you must first create the first Superuser account before you install any broker nodes. We suggest assigning the username of **webadmin** so as not to confuse it with the admin user.

h. In a web browser, navigate to the following site to create it: https://<manager_ip_address>

i. To log out, type **exit**.

Step 3 Install the Broker Node:

a. Download the Broker Node OVA file.

b. Log in to the VMWare vSphere web user interface console.

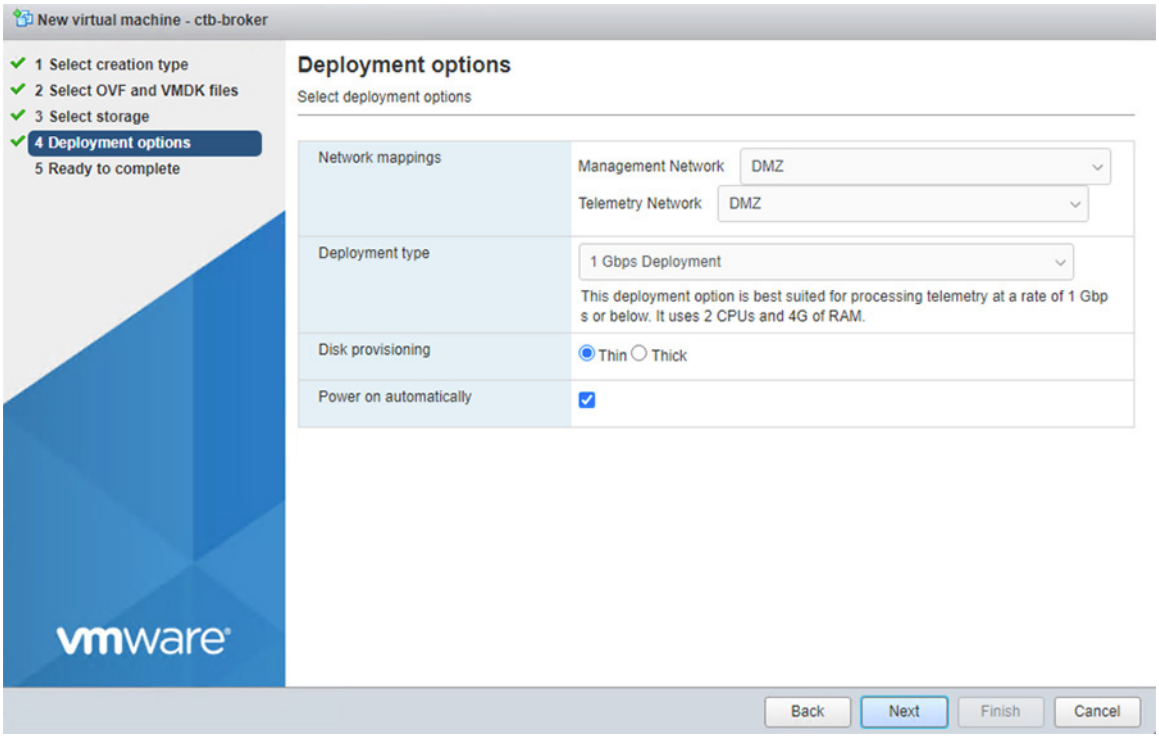
c. From the side menu, right-click **Virtual Machine** and then choose **Create/Register VM**.

d. Choose Deploy a virtual machine from an OVF or OVA file.

e. Enter the name of the OVA file.

f. Configure the settings as shown in Figure 3-59. Note: Deployment type will differ depending on network. For more information see Cisco Telemetry Broker.

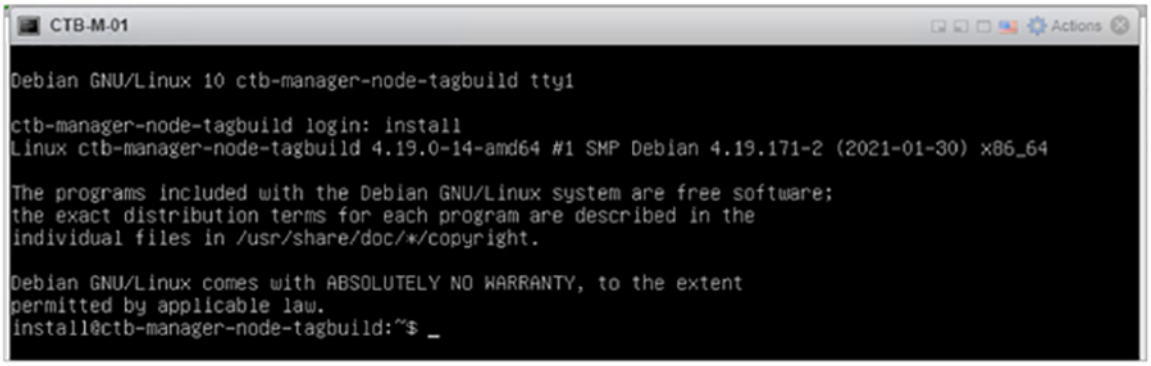
Figure 3-59 ESXI Deployment Options



g. Click **Finish**.

h. From the manager node virtual machine within the vmware user interface, open a web console and log in to the virtual machine (the username is install; there is no password).

Figure 3-60 CTB Broker Node CLI



i. Run the **sudo ctb-install** command.

Enter the following information:

- Password for the admin user. The password must meet the following requirements:
  - Contain at least 8 characters
  - Contain at least 1 lowercase letter
  - Contain at least 1 uppercase letter
  - Contain at least 1 digit
  - Contains at least 1 of these special characters: @ # $ % ^ & * ! + ?
  - Cannot be a commonly used phrase or sequence
  - Cannot resemble any identifying attributes of the user (such as the username)
  - IPv4 address, subnet mask, and default gateway address for the Management Network interface
- Valid DNS nameserver IP address that is reachable from the virtual machine

j. Run the **sudo ctb-manage** command.

Enter the following information:

- IP address of the manager node
- Username of the super user account you create in the manager node
- Password of the super user account you create in the manager node

k. To logout, type **exit**.

Step 4 Add the Broker node to the Manager Node.

In Cisco Telemetry Broker, click **Broker Nodes** from the main menu:

a. In the **Broker Nodes** table, click the applicable broker node.

b. In the **Telemetry Interface** section, click the **Edit** icon.

c. Configure the IP AddressPrefixLen, and Gateway address.

d. **Save** your changes.

e. Click **Destinations** from the main menu.

f. In the upper right corner of the page, click + **Add Destination**.

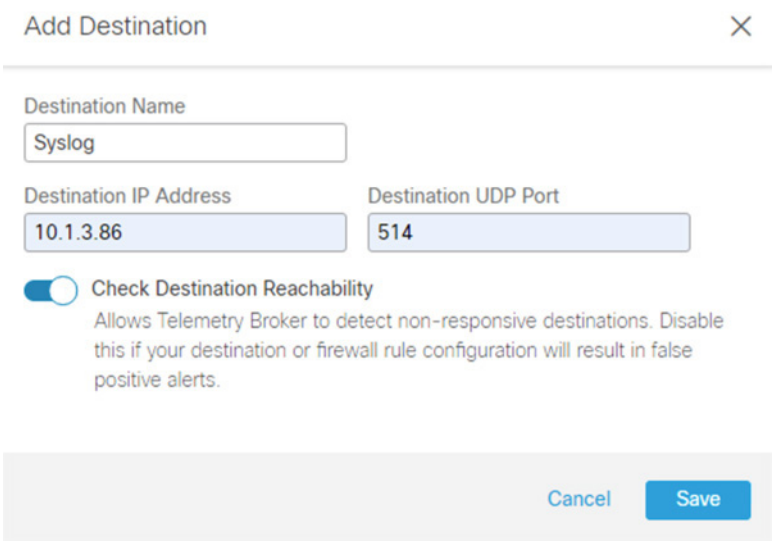
g. Enter a destination **Name**.

h. Enter a **Destination IP Address** and **Destination UDP Port** for this destination.

i. Enable **Check destination availability** if you want to establish an inactivity interval between the manager node and the destination. This allows you to identify when a destination is nonresponsive or not receiving telemetry.

j. Click **Save**.

Figure 3-61 Add Destination for Data Forwarding



Step 5 Create a forwarding rule in Cisco Telemetry Broker.

Note You must add at least one rule to the destination before it will receive telemetry.

a. In Cisco Telemetry Broker, click **Destinations** from the main menu.

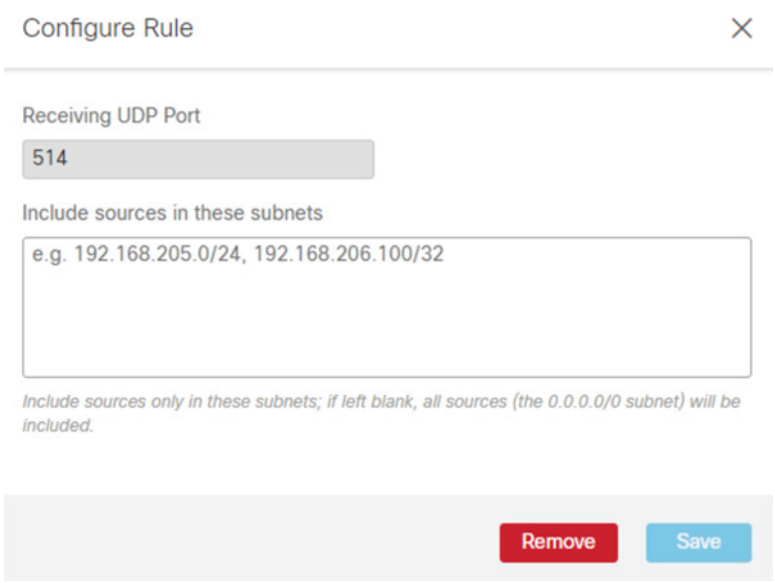
b. In the lower left corner of the applicable destination summary, click + **Add rule**.

c. Enter a **Receiving UDP Port**.

d. If you want to specify subnets over which this destination will receive certain traffic, add one or more **Subnets**.

e. Click **Save**.

Figure 3-62 Configure Rule in CTB



Configuring Firewall Rules for Cisco Telemetry Broker

The following steps describe the configuration of firewall rules for the Cisco Telemetry Broker to allow Industrial Clients to send UDP data outside of the network. Although the Cisco Telemetry Broker supports any UDP message, the tests done in this lab was for Netflow and Syslog message traversal.

Step 1 Configure the firewall to allow telemetry to traverse the IDMZ via the Cisco Telemetry Broker (see Table 3-17).

Table 3-17 Required Access Rules—Network Telemetry via Cisco Telemetry Broker

FirewallInterface	Source	Destination	Permitted Protocols
Industrial	Industrial Zone Switches	Cisco Telemetry Broker – Broker Node	Netflow (UDP port 2055)
Industrial	Industrial Zone Switches	Cisco Telemetry Broker – Broker Node	Syslog (UDP port 514)
IDMZ	Cisco Telemetry Broker – Broker Node	Netflow Collector	Netflow (UDP port 2055)
IDMZ	Cisco Telemetry Broker – Broker Node	Syslog Collector	Syslog (UDP port 514)