Cisco Smart+Connected Solutions with Signify Interact Office Wired

Implementation Guide

March 2019

Contents

Cisco Smart+Connected Solutions with Signify Interact Office Wired Implementation Guide

The Cisco Smart+Connected Solutions with Signify Interact Office Wired system is an over-the-top (OTT) connected lighting system that uses Cisco's PoE switching products and the Signify Envision IP protocol to control networks of IP luminaires directly and to provide indoor lighting services on the enterprise network.

This document provides implementation and configuration details for the Cisco Smart+Connected Solutions with Signify Interact Office Wired system for the Signify network, as depicted in Figure 2.

Navigator

This document covers the following:

Audience and Scope

The audience of this guide comprises, but is not limited to, system architects, network/compute design engineers, systems engineers, field consultants, Cisco Advanced Services specialists, and customers. This document also provides high-level Signify Lighting use case implementation for the use cases defined in the design section for Signify Commissioning Engineers.

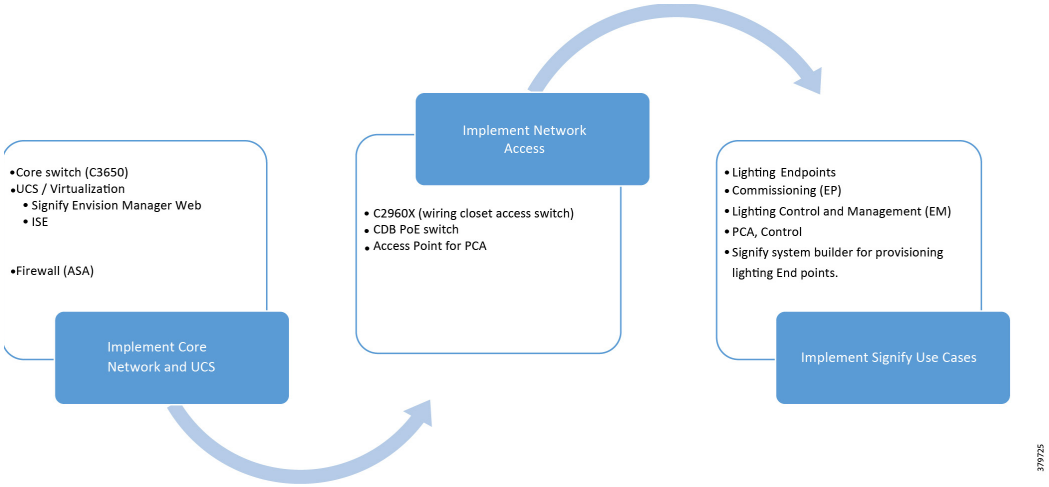
Detailed Signify Lighting use case implementation is beyond the scope of this document and it is the responsibility of Signify Commissioning Engineers to use appropriate Signify documentation that is referenced in this document.

Readers should be familiar with IPv4 and IPv6 dual stack networking concepts and protocols, Networking Layer 4 through Layer 7 services and Cisco Catalyst Series Switches, Cisco Unified Computing System (UCS), and VMware hypervisors.

Implementation Workflow

This section provides the high-level implementation flow for deploying the standalone Cisco Smart+Connected Solutions with Signify Interact Office Wired system described in System Overview, page 3. It is recommended to follow the implementation flow as shown in Figure 1.

Figure 1 Standalone Signify Lighting System Implementation Workflow



System Overview

This chapter, which provides an overview of the Cisco Smart+Connected Solutions with Signify Interact Office Wired system implementation, includes the following major topics:

Network Topology

This section describes the Cisco Smart+Connected Solutions with Signify Interact Office Wired deployment model physical connectivity as shown in Figure 2 and logical representation of the topology as shown in Figure 3.

Figure 2 Standalone Signify Lighting Network Star Topology–Physical Connectivity

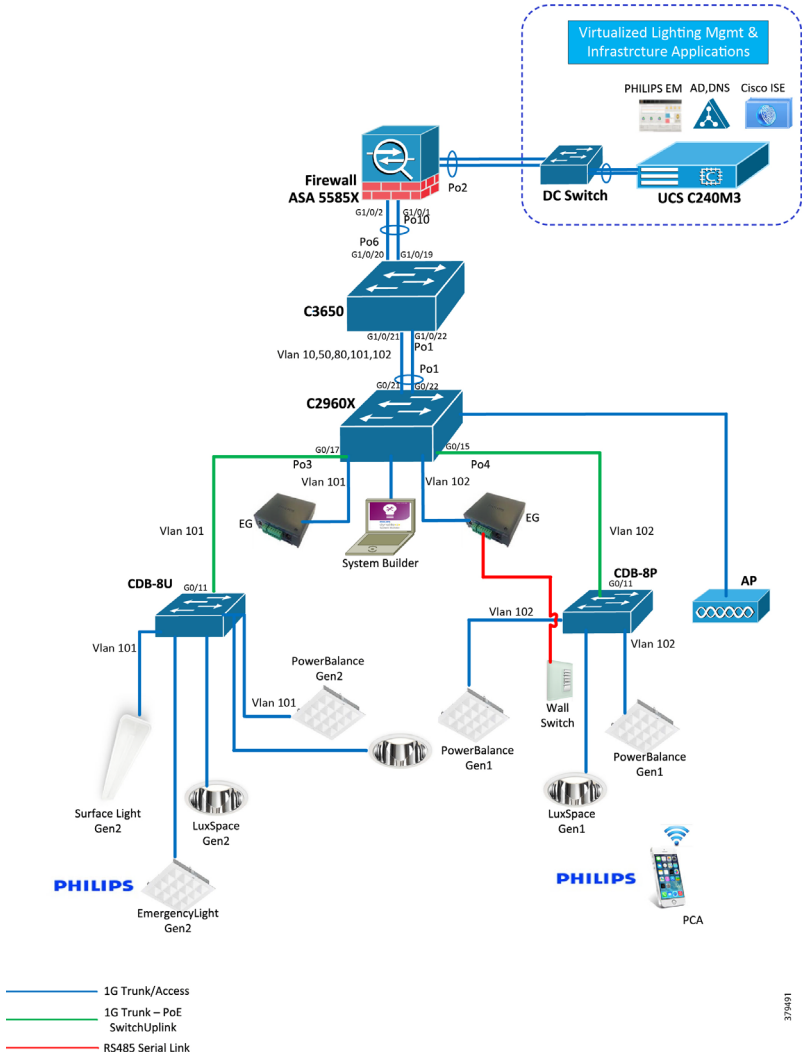


Figure 3 Standalone Signify Lighting Network Star Topology–Logical Topology

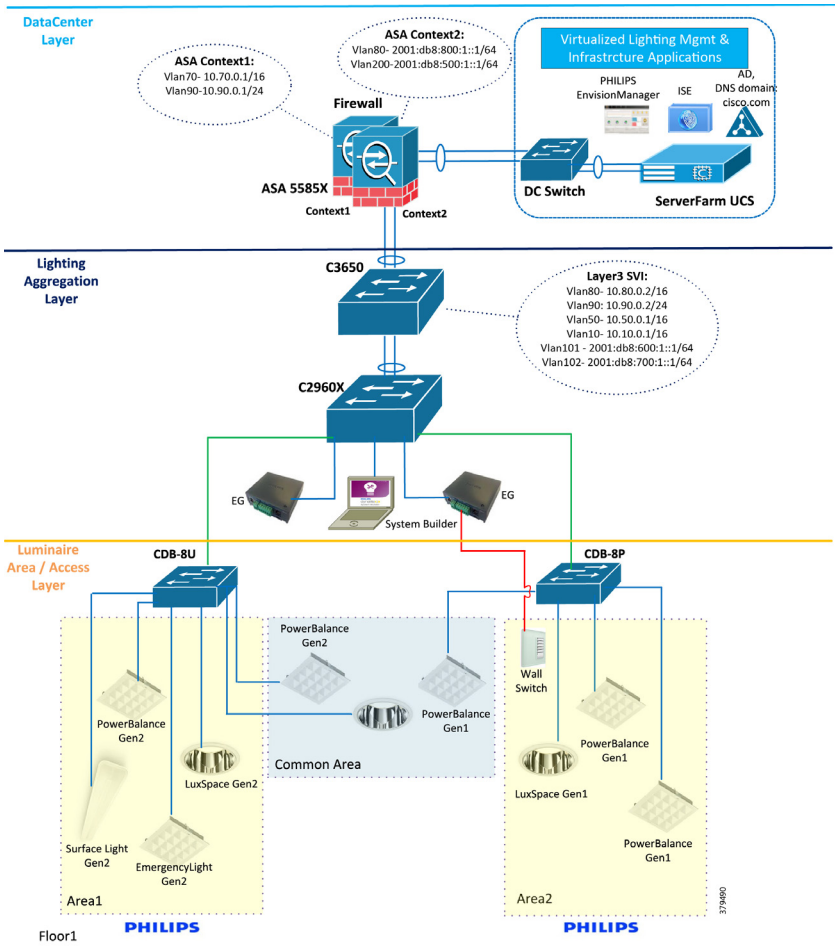
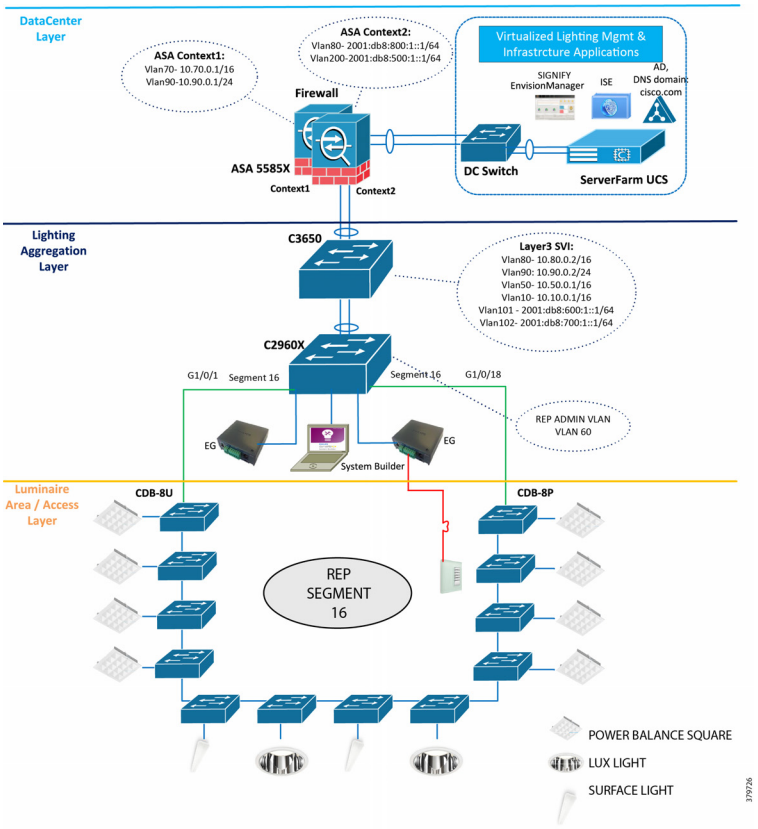


Figure 4 Standalone Signify Lighting Network–Ring Topology



System Components

The components validated within this system consist of a mix of Cisco products (Table 1) and Signify products (Table 2).

Table 1 Cisco Components

Cisco Product	Software Release	Description
Cisco Catalyst Digital Building (CDB)	15.2(6)E2	CDB-8U model provides up to 480W PoE power, 8 ports to connect to 8 luminaires; each require up to 60W PoE power.
Cisco Catalyst 2960X	15.2(3)E2	Wiring closet access switch
Cisco Catalyst 3650	16.09.01	Router in wiring closet
Cisco ASA Firewall	9.3.3	Firewall to protect server farm

Table 2 Signify Components

Vendor Product	Release	Description
Signify PowerBalance Recessed	PoE LC Gen 1 FW v5.24	PoE Luminaire
Signify PowerBalance Gen2	PoE LC v10.96	PoE Luminaire
Signify Envision Gateway	3.44	Area Controller

Table 2 Signify Components (continued)

Vendor Product	Release	Description
Signify Envision Manager Web	1.5.031.20182404.000.1212	Central Lighting management application
Signify System Builder	3.15.16.4660	Luminaires commissioning application
Signify Personal Control Application (PCA)	v1.4.4	PCA Application Android

Table 3 provides the list of third party infrastructure components used in the system.

Table 3 Third Party System Components

Product	Purpose	Version
Virtualization Software for UCS	Hypervisor	VMware ESXi 6.0.0-2494585
Virtual Machine on UCS	Signify Envision Manager	Windows Server 2012 R2 Standard
iPhone 6	Signify PCA	Apple iOS11.1
Nexus 6	Signify PCA	Android 7.1.1

IP Addressing

This section summarizes the VLAN and IPv4 DHCP address pools in the system.

VLANs

Table 4 shows the Layer 2 and Layer 3 VLAN IP addressing of the system.

Table 4 Layer 2 VLAN IP Addressing

VLAN	Purpose	Network/Mask
10	VLAN for wireless clients in the data network	10.10.0.0/16
50	Management VLAN for the network	10.50.0.0/16
60	REP Administrative VLAN	10.60.0.0/16
70	IPv4 Data Center Network VLAN for Signify Envision Manager Web IT network interface and other servers (ACS, AD/DNS)	10.70.0.0/16
80	IPv6 traffic VLAN between C3650 switch and ASA	2001:db8:800:1::/64
90	IPv4 data network VLAN between C3650 switch and ASA	10.90.0.0/16
101	Signify luminaires (Spur1) IPv6 VLAN	2001:db8:600:1::/64
102	Signify luminaires (Spur2) IPv6 VLAN	2001:db8:700:1::/64
200	Signify Envision Manager Web Lighting Network IPv6 Interface VLAN	2001:db8:500:1::/64

Note: The VLANs and subnet mask shown in Table 4 are only examples that are used in the standalone Cisco Smart+Connected Solutions with Signify Interact Office Wired system deployment validation. VLAN numbering and mask may vary based on your actual deployment; follow best practices as recommended by enterprise IT network engineers.

Dynamic Host Configuration Protocol

Dynamic Host Configuration Protocol (DHCP) for the Signify luminaires IPv6 addressing is not needed since Signify uses Stateless Address Auto Configuration (SLAAC). In SLAAC, a router periodically advertises an IPv6 address prefix. Signify luminaires and Envision Gateway will get the IPv6 address that is built based on that prefix and device MAC address.

The IPv4 DHCP pools are created, as shown in Table 5, on the C3650 for management and wireless clients to enable PCA access to Signify Envision Manager Web.

Table 5 IPv4 DHCP Address Pools in the System

Pool Network	Excluded IP Range	Purpose
10.50.0.0/16	10.50.0.1 - 10.50.0.30	Management Network Pool
10.60.0.0/16	10.60.0.1 - 10.60.0.30	REP Admin VLAN Network Pool

Note: The DHCP pools and IP range shown in Table 5 are example pools used in the system for validation. Signify Personal Control Application (PCA) will be leveraging corporate IT wireless network. Follow the DHCP pool and IP range creation for appropriate VLANs during the deployment based on Enterprise IT network deployment when integrating a lighting network to an enterprise IT network.

Lighting Aggregation and Network Access

This chapter, which covers the implementation of networking Layer 2, Layer 3, and security features required for a Greenfield standalone lighting network deployment as specified in the *Design Guide*, includes the following major topics:

Lighting Aggregation Switch

VLAN numbering, IP addressing, and other configurations used in this chapter are the example configurations, as shown in the lighting network topology in Figure 3. However, the VLAN numbering and IP addressing scheme may vary based on network planning in your deployment.

The Catalyst 3650 switch is the lighting network aggregation switch providing IPv6 lighting network router prefix and network Layer 3 routing functionalities for the lighting network. The following sections cover the implementation of Layer 2, Layer 3, and security features as required on the C3650 switch.

Layer 2 and Layer 3 Configuration

This section defines the implementation of VLANs and Layer 3 logical interfaces on the C3650 switch.

1. Configure VLANs, which must be created along with ports assignment on the 3650 switch:

```
CL-3650(config)#vlan 50,70,80,101,102
```

2. Create Layer 3 switched virtual interface (SVI) for the VLANs 50, 80, 90, 101, and 102. The configuration below shows SVIs for the VLAN on the C3650 switch:

```
interface Vlan50
ip address 10.50.0.10 255.255.0.0
!
interface Vlan80

ipv6 address 2001:db8:800:1::2/64
ipv6 enable
!
interface Vlan90
ip address 10.90.0.2 255.255.255.0
!
interface Vlan101 no ip address
ipv6 address 2001:db8:600:1::1/64
ipv6 enable
!
interface Vlan102 no ip address
ipv6 address 2001:db8:700:1::1/64
ipv6 enable
```

3. Enable IPv6 unicast routing features on the 3650 switch using the following command:

```
CL-3650(config)#ipv6 unicast-routing
```

Note: Steps 2 and 3 above enable IPv6 routing and router IPv6 prefix advertisements for the IPv6 SLAAC address assignment to Signify Envision gateways and luminaires in a VLAN.

4. Create port channel interfaces on the 3650 to 2960X, the UCS Server, and the Cisco Adaptive Security Appliance (ASA) firewall in the network as shown below:

```
interface Port-channel1
description Etherchannel link to C2960X
switch switchport trunk allowed vlan 50,80,101,102
switchport mode trunk
!
interface Port-channel2
description Etherchannel Link to UCS
switchport trunk allowed vlan 70,200
switchport mode trunk
!
interface Port-channel6
description Etherchannel Link to ASA5585 Firewall
switchport trunk allowed vlan 70,80,90,200
switchport mode trunk
```

5. Enable EtherChannel on the appropriate physical switch ports connected to the 2960X, UCS server, and ASA. The following configuration shows the port channel assignment to switch physical ports:

Physical Links to 2960X Switch

```
interface GigabitEthernet1/0/21
description Link to 2960X switch
switchport trunk allowed vlan 50,80,101,102
switchport mode trunk
channel-group 1 mode active

interface GigabitEthernet1/0/22
description Link to 2960X switch
switchport trunk allowed vlan 50,80,101,102
switchport mode trunk
channel-group 1 mode active
```

Physical Links to UCS Server

```
interface GigabitEthernet1/0/1
description Link to UCS Server
switchport trunk allowed vlan 70,101,200
switchport mode trunk
channel-group 2 mode on
!
interface GigabitEthernet1/0/2
description Link to UCS Server
switchport trunk allowed vlan 70,101,200
switchport mode trunk
channel-group 2 mode on
```

Physical Links to ASA5585 Firewall Switch

```
interface GigabitEthernet1/0/19
description Link to ASA
switchport trunk allowed vlan 70,80,90,200
switchport mode trunk
channel-group 6 mode active
!
interface GigabitEthernet1/0/20
description Link to ASA
switchport trunk allowed vlan 70,80,90,200
switchport mode trunk
channel-group 6 mode active
!
```

6. Add IPv4 and IPv6 traffic static routes to the ASA with the VLAN80 default gateway as the VLAN80 bridges the lighting and IT network traffic between the ASA and the 3650. The following commands add static routes to the Data Center IPv4 and IPv6 destination networks on the 3650 switch:

```
ip route 10.70.0.0 255.255.255.0 10.90.0.1
!
ipv6 route 2001:db8:500:1::/64 2001:db8:800:1::1
ipv6 route ::/0 Null0
```

7. Enable rapid per-vlan spanning tree:

```
!
spanning-tree mode rapid-pvst
!
```

Security

This section defines the implementation of security features on the C3650 switch.

Disabling Telnet

Since Telnet is not secure, it should be disabled for accessing the device. The following commands disable Telnet and enable only Secure Shell (SSH) access to the 3650 switch.

```
line vty 0 4
transport input ssh
line vty 5 15
transport input ssh
!
```

SNMP Monitoring

Simple Network Management Protocol (SNMP) facilitates the exchange of management information among network devices. System administrators can remotely manage network performance, find and solve network problems, and plan for network growth by using SNMP. The SNMP agent gathers data from the MIB, which is the repository for information about device parameters and network data. The SNMP agent also can send traps (notifications) of certain events, to the SNMP manager.

SNMP v3 is used for monitoring the switches in the lighting network via traps upon switch ports status change and security violations. Enable and configure the SNMP v3 traps on switch to track ports up/down and security violations, as shown below:

```
snmp-server view <view_name> iso included
snmp-server group <Group_name> v3 priv read <read view name> write <write view name>
snmp-server user <Username> <Group_name> v3 auth <md5/sha> <authorization password>
priv <encryption type> <privacy password>
snmp-server host <IP address of an NMS host> traps version 3 priv <username> udp-port 162
snmp-server enable traps <trap_type>

snmp-server view view1 iso included
snmp-server group GRP v3 priv read view1 write view1
snmp-server user USR GRP v3 auth md5 1234567 priv aes 128 1234567 snmp-server host 10.70.0.154
version 3 priv nasingh3
```

For example:

```
snmp-server host 10.70.0.154 traps version 3 priv nasingh3 udp-port 162
snmp-server enable traps snmp
snmp-server enable traps port-security
snmp-server enable traps port-security trap-rate 0
```

Note: The IP address of the network management station (NMS) host is the IP address of the network management tool supporting SNMP v3 that is being used for monitoring the system.

Wiring Closet Access Switch (C2960X)

This section covers wiring closet access switch C2960X Layer 2, Layer 3 networking, and security configurations.

For Star Topology

Layer 2 and Layer 3 Configuration

This section defines the implementation of VLANs and Layer 3 logical interfaces on the C2960X switch.

1. Configure VLANs, which must be created along with ports assignment on the 2960 switch. The following is an example VLAN creation configuration in this system:

```
switch(config)#vlan 50,101,102
```

2. Create Layer 3 SVI for the VLANs as required. The following is an example configuration of SVIs for the VLAN on the C2960 switch.

```
interface Vlan50
ip address 10.50.0.11 255.255.0.0
!
```

3. Create port channel interfaces on the 2960 to 3650 in the network. The following is an example port channel configuration for the network topology shown in Figure 3 above:

```
!
interface Port-channel1
description Connected to 3650-L3 switch
switchport trunk allowed vlan 50,101,102
switchport mode trunk
!
```

4. Enable EtherChannel on the appropriate physical switch ports connected to the 3650 switch. The following configuration shows the port channel assignment to switch physical ports:

Physical Links to C3650 Switch

```
interface GigabitEthernet1/0/21
descriptiondDescription Connected to 3650-L3 switch
switchport trunk allowed vlan 50,101,102
switchport mode trunk
channel-group 1 mode active
!
interface GigabitEthernet1/0/22
description Connected to 3650-L3
switch
switchport trunk allowed vlan 50,101,102
switchport mode trunk
channel-group 1 mode active
```

5. Add IPv4 default gateway on the switch as shown below:

```
ip default-gateway 10.50.0.10
!
```

6. Configure interfaces on the C2960X switch connected to CDB-1 and CDB-2 PoE switches, as shown below:

```
!
interface GigabitEthernet1/0/15
description CDB-2
switchport trunk allowed vlan 50,101,102
switchport mode trunk
end
!
interface GigabitEthernet1/0/17
description CDB-1
switchport trunk allowed vlan 50,101,102
switchport mode trunk
end
```

7. Configure interfaces on the C2960X connected to the Envision Gateway in appropriate access VLANs. For example, Envision Gateways shown in the network topology in Figure 3 are in VLAN 101 or VLAN 102 configured, as shown below:

```
!
interface GigabitEthernet1/0/3
description Connected to PhilipsSignify_Spur1_Vlan101_EG
switchport access vlan 101
switchport mode access
!
interface GigabitEthernet1/0/4
description Connected to PhilipsSignify_Spur2_Vlan102_EG
switchport access vlan 102
switchport mode access
```

8. Enable rapid per-vlan spanning tree.

```
!
spanning-tree mode rapid-pvst
```

Security

This section defines the implementation for disabling Telnet and enabling SNMP features on the C3650.

Disabling Telnet

Since Telnet is not secure, it should be disabled for accessing the device. The following commands disable Telnet and only enable SSH access to the 3650 switch.

```
 line vty 0 4
transport input ssh
line vty 5 15
transport input ssh
```

SNMP Monitoring

SNMP facilitates the exchange of management information among the network devices. The system administrator can remotely manage the network performance, find and solve network problems, and plan for network growth by using the SNMP. The SNMP agent gathers data from the MIB, which is the repository for information about device parameter and network data. The SNMP agent also sends traps (notifications) of certain events, to the SNMP Manager.

SNMP v3 is used for monitoring the switches in the Lighting network via traps on switch port status change and security violations. Enable and configure SNMP traps on the port to monitor port change status and violations on the device.

```
Snmp-server view <view name> iso included
Snmp-server group <Group name> v3 priv read <read view name> write <write view name
snmp-server user <Username> <Group name> v3 auth <md5/sha>
<authorization password> priv <encryption type> <privacy password>
Snmp-server host <IP address of the NMS Host> traps version 3 priv <username> udp-port 162
Snmp-server enable traps <trap type>
```

For example:

```
Snmp-server view view1 iso included
Snmp-server group <GRP> v3 priv read view1 write view1
snmp-server user USR GRP v3 auth md5 12345676 priv aes 128 1234567
Snmp-server host 10.70.0.174 traps version 3 priv machocka udp-port 162
Snmp-server enable traps snmp
```

Note: The IP address of the NMS host is the address of the network management tool supporting SNMP v3 that is being used for monitoring the system.

Access Lists

Configure and apply the following access-list on the interfaces connecting to the Envision Gateway:

```
ipv6 access-list e-gateway
permit ipv6 any FF12::/16
permit ipv6 any host FF02::2
permit ipv6 any FE80::/10
permit ipv6 FE80::/10 any
permit tcp any eq 50000 any
permit tcp any eq 50001 any
permit tcp any eq 50002 any
permit udp any eq 52145 any
```

Note: FF12::/16 range is the ipv6 multicast address used by the Signify Envision Gateway for spur connection.

```
interface GigabitEthernet1/0/3
ipv6 traffic-filter e-gateway in
```

Spanning Tree Security

Enable spanning tree BPDU Guard and PortFast on all interfaces connecting to the Envision Gateways.

```
!
interface GigabitEthernet1/0/3
switchport access vlan 101
spanning-tree portfast
spanning-tree bpduguard enable
!
```

For Ring Network Topology

Note: This section is optional and required only when the REP ring network topology is implemented in the deployment solutions.

Configurations Required for REP Ring on C2960

This section defines the implementation of VLANs and Layer 2 interfaces on the C2960X switch for the REP Ring Network topology.

Refer to Figure 4 for the topology.

1. Configure VLANs, which must be created along with port assignments on the 2960 switch. The following is an example VLAN creation configuration in this system:

```
switch(config)#vlan 50,90,101,102
```

2. Create the Layer 3 SVI for the VLANs as required. The following is an example configuration of SVIs for the VLAN on the C2960 switch:

```
    interface Vlan50
ip address 10.50.0.11 255.255.0.0
!
```

3. Create REP Admin VLAN on the C2960 switch:

```
Config terminal
Interface Vlan60
No shut
Exit
Rep admin vlan 60
```

4. Configure interfaces on the C2960X switches edge port connected to the CDB switches in the REP ring:

```
interface GigabitEthernet1/0/21
Description Connected to CDB switch
switchport trunk allowed vlan 50,60,90,101,102
switchport mode trunk
rep segment 16 edge primary
rep stcn segment 16
rep lsl-age-timer 2000
!
interface GigabitEthernet1/0/22
Description Connected to CDB switch
switchport trunk allowed vlan 50,60,90,101,102
switchport mode trunk
rep segment 16 edge
secondary
rep stcn segment 16
rep lsl-age-timer 2000
```

5. Disable spanning tree for VLANs, which are used in the REP network topology:

```
Conf t
No spanning-tree vlan 1,50,60,90,101,102
```

Cisco PoE Switch for Signify Luminaires (CDB)

This section covers the Cisco Catalyst Digital Building PoE switch Layer 2 and security configurations.

Layer 2 and Layer 3 Configuration

This section defines the implementation of VLANs and Layer 3 logical interfaces on the CDB-8U switch.

1. Configure VLANs, which must be created along with ports assignment on the CDB switch:

```
CDB-1(config)#vlan 50,90, 101,102
```

2. Create Layer 3 SVI for the VLAN 50 and assign an IP address using DHCP:

```
interface Vlan50

ip address dhcp
!
```

3. Add the IPv4 default gateway on the switch:

```
ip default-gateway 10.50.0.10
!
```

4. Configure interfaces on the CDB-8U connected to C2960:

```
!

interface GigabitEthernet0/11

switchport trunk allowed vlan 50,90, 101,102
switchport mode trunk
!
```

5. Configure interfaces on the CDB-8U connected to the Signify luminaires, as shown below in VLAN 101 or 102:

```
!
interface range GigabitEthernet0/1 - 8
switchport access vlan  101
switchport mode access
switchport nonegotiate
power inline port poe-ha
power inline port 2-event
!
```

   The switch CLI command power inline port POE-HA enables Perpetual PoE and Fast PoE features on switch ports. The command power inline port 2-event enables 2-event classification on switch ports for Signify luminaires, to provide power up to 30W.

6. Enable rapid per-vlan spanning tree.

```
!
spanning-tree mode rapid-pvst
```

   Note: The following steps to enable MAC Authentication Bypass (MAB) are valid only if Cisco ISE is used for MAB-based device authentication MUD_URI visibility in the Cisco Identity Services Engine (ISE). The following steps can be ignored if you do not use ISE in your deployment. However, it is recommended to use ISE for device authentication and profiling for enhanced system network security.

7. Enable Policy Map for MAB:

```
!

policy-map type control subscriber MAB_Policy
event session-started match-all
10 class always do-until-failure
10 authenticate using mab
```

8. Enable MAB in interfaces where PoELC lights are connected:

```
Interface Fastethernet 1/0/1
    Mab
    service-policy type control Subscriber MAB policy
```

Note: It is recommended to enable MAB in switch ports for luminaires and network security. However, it can be disabled by using " no mab" under the interface configuration.

Note: By default, all the configuration required for Fast PoE, access session, and 2-event classifications are enabled in CDB.

Security

The following sections cover security configurations on the CDB switch for Signify luminaires.

Disabling Telnet

Since it is not secure, Telnet should be disabled for accessing the device:

```
line vty 0 4
transport input ssh
line vty 5 15
transport input ssh
```

Spanning Tree Security

Enable spanning tree BPDU Guard and PortFast on all interfaces connecting to the luminaires as shown below:

```
!
interface GigabitEthernet0/3
switchport access vlan 101
spanning-tree portfast
spanning-tree bpduguard enable
!
```

SNMP Monitoring

Enable and configure the following SNMP v3 traps on switch to track ports up/down and security violations:

```
snmp-server view <view_name> iso included
snmp-server group <Group_name> v3 priv read <read view name> write <write view name>
snmp-server user <Username> <Group_name> v3 auth <md5/sha> <authorization password>
priv <encryption type> <privacy password>
snmp-server host <IP address of an NMS host> traps version 3 priv <username> udp-port 162
snmp-server enable traps <trap_type>
```

For example:

```
snmp-server view view1 iso included
snmp-server group GRP v3 priv read view1 write view1
snmp-server user USR GRP v3 auth md5 1234567 priv aes 128 1234567
snmp-server host 10.70.0.154 version 3 priv nasingh3
snmp-server host 10.70.0.154 traps version 3 priv nasingh3 udp-port 162
snmp-server enable traps snmp
snmp-server enable traps port-security
snmp-server enable traps port-security trap-rate 0
```

Access Lists

Configure and apply the following access list on all the ports connecting to the luminaires:

```
!
ipv6 access-list light
permit ipv6 FE80::/10 any
permit ipv6 any FE80::/10
permit ipv6 any FF12::/16
permit ipv6 any host FF02::2

!
!
interface GigabitEthernet0/3
ipv6 traffic-filter light in
!
```

For Ring Network Topology

Note: This section is optional and required only when REP ring network topology is implemented in the deployment solutions.

Configurations required for REP Ring on CDB

This section defines the implementation of VLANs on the CDB switch for the REP ring network topology.

1. Configure VLANs, which must be created along with ports assignment on the 2960 switch. The following is an example VLAN creation configuration in this system:

   ```
   switch(config)#vlan 50,90,101,102
   ```

2. Create Layer 3 SVI for the VLANs as required. The following is an example configuration of SVIs for the VLAN on the C2960 switch:

   ```
   interface Vlan50
   ip address dhcp
   !
   ```

3. Create the REP Admin VLAN on the CDB switch:

   ```
   Config terminal
   Interface Vlan60
   No shut
   Exit
   Rep admin vlan 60
   ```

4. Configure interfaces on the C2960X switch's edge port connected to CDB switches in the REP ring:

```
interface GigabitEthernet1/0/1
Description Connected to 2960 switch
switchport trunk allowed vlan 50,60,90,101,102
switchport mode trunk
rep segment 16
rep stcn segment 16
rep lsl-age-timer 2000
!
interface GigabitEthernet1/0/2
Description Connected to CDB neighbor switch
switchport trunk allowed vlan 50,60,90,101,102
switchport mode trunk
rep segment 16 edge
rep stcn segment 16
rep lsl-age-timer 2000
```

5. Configure VLAN 90 to reach to ISE via ASA:

```
CDB-1# conf t
       interface vlan 90
    ip address 10.90.0.x 255.255.255.0
        exit
    ip default-gateway 10.90.0.1
```

6. Disable spanning tree for VLANs that are used in the REP network topology on CDB switches in the ring topology:

```
Conf t
No spanning-tree vlan 1,50,60,90,101,102
```

Note: All the above configurations are required in all the CDB switches participating in the REP ring topology.

Firewall

This chapter, which covers firewall configuration on the ASA in the data center layer for Signify Envision Manager Web security, includes the following major topic:

- Firewall (Cisco ASA 5585), page 19

Firewall (Cisco ASA 5585)

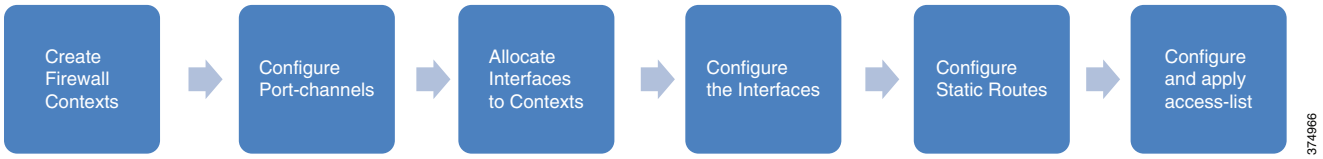
In the Cisco Smart+Connected Solutions with Signify Interact Office Wired solution, ASA acts as a firewall and protects the applications in the data center. Traffic coming into the data center from the network, along with traffic from lighting network, should pass through the ASA firewall.

The ASA is configured to operate as follows:

- Firewall Mode: Routed
- Context: Multiple

Several tasks are required to complete ASA configuration. The work flow is shown in Figure 5.

Figure 5 ASA Configuration Flow



Creating Contexts

Two firewall contexts are created to separate the Lighting Network traffic from the Data Network traffic:

1. Enable mode multi-context on the ASA firewall:

```
ciscoasa(config)# mode multiple
```

2. Create a new ASA context for the Lighting Network traffic:

```
!
context LightingManagement
config-url disk0:/lightmanagement.cfg
!
```

Port Channel to Network

1. ASA is configured with a port channel having two member links to C3650 switch. The port channel includes the two 1 Gig interfaces available on the ASA 5585X. It is configured from the system context and no name or security-level is assigned.

```
interface Port-channel10 description ##To-C3650## lacp max-bundle 8

!
interface GigabitEthernet0/1 channel-group 10 mode active

!
interface GigabitEthernet0/2 channel-group 10 mode active
```

2. VLAN subinterfaces provide access to different components in the network, such as the data center, management network, and Envision Manager Server. Subinterfaces based on VLANs are configured on the port channel from the system context.

   The VLAN and subinterface configuration for server network access:

   ```
   interface Port-channel10.200 vlan 200
   ```

   VLAN and subinterface configuration for data center access on the firewall:

   ```
   interface Port-channel10.70 vlan 70
   ```

   VLAN and subinterface configuration for data network access on the firewall:

   ```
   interface Port-channel10.90 vlan 90
   ```

   VLAN and subinterface configuration for the lighting network on the firewall:

   ```
   interface Port-channel10.80 vlan 80
   ```

Allocating Interfaces to Firewall Contexts

The port channel subinterfaces created in the previous section are assigned to the firewall contexts, as shown below. This segregates the lighting network traffic from the data network traffic into different security contexts on the firewall.

```
context admin
allocate-interface Management0/0 allocate-interface Port-channel10.70 allocate-interface
Port-channel10.90
!
context LightingManagement
allocate-interface Port-channel10.80 allocate-interface Port-channel10.200
!
```

Interface Configuration

Within each of the security contexts, the interfaces are configured with names, security levels, and IP addresses. Table 6 summarizes the interface configuration used along with the zones each interface is part of in the contexts.

Table 6 Admin Context

Zone	Interface	Security Level	Description
Data Network	port channel.90	0	Used to connect to the Data Network
Data Center	port channel.70	100	Used to connect to the Data Center

```
!
interface Port-channel10.70 nameif datacenter
security-level 100
ip address 10.70.0.1 255.255.0.0
!
interface Port-channel10.90 nameif datanetwork security-level 0
ip address 10.90.0.1 255.255.255.0
!
```

The firewall security level can be configured between 0 and 100; 0 is the least secure zone and 100 is the most secure zone. See Table 7.

Table 7 Light Management Context

Zone	Interface	Security Level	Description
Data Network	port channel.80	0	Used to connect to the Lighting Network
Server	port channel.200	100	Used to connect to the Envision Manager Server

```
!
interface Port-channel10.80 nameif lightnetwork security-level 0
no ip address
ipv6 address 2001:db8:800:1::1/64
ipv6 enable
ipv6 nd suppress-ra
!
interface Port-channel10.200 nameif server
security-level 100
no ip address
ipv6 address 2001:db8:500:1::1/64
ipv6 enable
!
```

Note: On port channel 10.80 in ASA, we enable router advertisement suppression.

Static Routes

The following static routes are configured on the ASA contexts:

Light Management Context

```
ipv6 route lightnetwork 2001:db8:600:1::/64 2001:db8:800:1::2
ipv6 route lightnetwork 2001:db8:700:1::/64 2001:db8:800:1::2
```

Admin Context

```
route datanetwork 10.10.0.0 255.255.255.0 10.90.0.2 1
route datanetwork 10.50.0.0 255.255.255.0 10.90.0.2 1
```

Access Control Lists and Access Control List Entries

By default, ASA denies all traffic moving from a lower security level to a higher security level. Access control lists (ACLs) are configured to enable required traffic between interfaces. The access list entries (ACEs) follow.

ACE to allow traffic from the Envision Gateway to the Envision Manager in Lighting Management context:

```
access-list light_to_server extended permit tcp 2001:db8:700:1::/64 eq 50000 2001:db8:500:1::/64
access-list light_to_server extended permit tcp 2001:db8:600:1::/64 eq 50000 2001:db8:500:1::/64
```

Apply the access-list on the lighting network interface:

```
access-group light_to_server in interface lightnetwork
```

ISE enabling HTTP and HTTPS access to Envision Manager in admin context:

```
access-list datanetwork_to_datacenter extended permit tcp any 10.70.0.0 255.255.255.0 eq https
access-list datanetwork_to_datacenter extended permit tcp any 10.70.0.0 255.255.255.0 eq www
```

ACE allowing management network reachability to ISE in the Data Center through admin context:

```
access-list datanetwork_to_datacenter extended permit tcp 10.50.0.0 255.255.255.0 host 10.70.0.152
eq radius
```

Apply the access-list on the data network interface:

```
access-group datanetwork_to_datacenter in interface datanetwork
```

UCS and Virtualization

This chapter includes the following major topics:

Note: The Cisco Unified Computing System (UCS) C-Series server platform discussed in this chapter is used in the deployment of all data center applications (for example, Signify Envision Manager and applications like Cisco ISE) through server virtualization. However, any UCS server series or desktop server can be chosen for deployment based on the application's hardware requirements matching the server hardware resources.

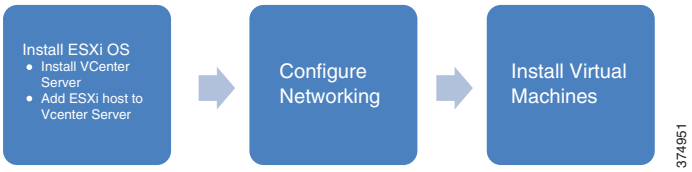
UCS and Virtualization Infrastructure

This section describes how to deploy a Cisco UCS C220 M5 server to provide the virtualized infrastructure required to deploy virtual machines (VMs), for example, the Signify Envision Manager Web, ISE, and CA server. Where applicable, refer to the following Cisco and VMware documentation for details:

- *Cisco UCS C220 M5 Rack Server Installation Guide*:
  - https://www.cisco.com/c/en/us/td/docs/unified_computing/ucs/c/hw/C220M5/install/C220M5/C220M5_chapter_01.html
- *Cisco UCS C-Series Servers Integrated Management Controller GUI Configuration Guide, Release 4.0*:
  - https://www.cisco.com/c/en/us/td/docs/unified_computing/ucs/c/sw/cli/config/guide/4_0/b_Cisco_UCS_C-Series_CLI_Configuration_Guide_40.html
- *vSphere Installation and Setup*:
  - https://docs.vmware.com/en/VMware-vSphere/6.0/com.vmware.vsphere.install.doc/GUID-7C9A1E23-7FCD-4295-9CB1-C932F2423C63.html

Figure 6 shows the virtualization configuration flow.

Figure 6 Flow Diagram for Virtualization Configuration



ESXi Installation and Configuration

To install and configure ESXi on a UCS C220 server, refer to the Installing & Setting Up ESXi sections in the *vSphere Installation and Setup Guide*.

Refer to the detailed vCenter server installation steps in the " Installing vCenter server" section of the *vSphere Installation and Setup Guide* at the following URL:

- https://docs.vmware.com/en/VMware-vSphere/6.0/com.vmware.vsphere.install.doc/GUID-7C9A1E23-7FCD-4295-9CB1-C932F2423C63.html

Note: We recommend immediately completing all licensing through the vCenter management application during the ESXi installation process.

ESXi Networking

This section covers the ESXi networking configuration for UCS C-Series server platform for the data center applications like Signify Envision Manager, and Cisco ISE as shown in Figure 6 above.

Note: The VMware vSwitch configurations for the UCS platform discussed in this section are example networking configurations for the Signify Envision Manager Web and other applications deployment for the topology shown in Figure 6. The data center networking switches and configurations may vary based on the Enterprise IT network data center deployment. Where applicable, follow the deployment procedures used for the enterprise data center deployment.

Refer to the following Vmware vSphere networking configuration to configure virtual machines ESXi networking on the UCS ESXi host:

- https://docs.vmware.com/en/VMware-vSphere/6.0/com.vmware.vsphere.install.doc/GUID-7C9A1E23-7FCD-4295-9CB1-C932F2423C63.html

Note: Make sure to create two port groups for Signify Envision Manager Web application VML: one for the IPv4 network (example: DC_Vlan70) and the other for the Lighting IPv6 network.

VM Installation (ISE, Signify Envision Manager Web)

The following sections describe procedures involved in deploying the virtual machines for ACS and a Window Server 2012 server for AD/DNS services.

Configuring Network Device Authentication (ISE) (Optional)

This section covers how to deploy Cisco ISE 2.0 on the UCS server platform in the data center for network devices authentication (RADIUS) and security.

Installation of Cisco Identity Services Engine

The prerequisites and the necessary information to install ISE can be found at the following URL:

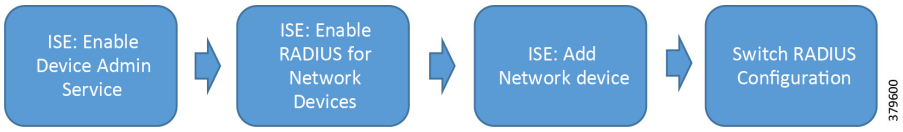
- https://www.cisco.com/c/en/us/td/docs/security/ise/2-4/install_guide/b_ise_InstallationGuide24/b_ise_InstallationGuide24_chapter_00.html

This document describes different deployment scenarios with ISE. One should choose deployment scenario according to the use case needs.

Configuring Cisco Identity Services Engine

ISE 2.0 is used for providing device authentication and authorization in the network via RADIUS. ISE is deployed in a VM and assigned an IP address in the VLAN 70 residing behind the firewall. The firewall ports need to be opened for RADIUS communication from the VLAN 90 to ISE.

Figure 7 AAA Configuration Flow



Note: The deployment of ISE in the solution is optional for the MUD-URI feature. However, it is recommended to use ISE for devices authentication and enhanced network security.

The following configurations are required to implement MUD-URI visibility in ISE.

Switch AAA Configuration

Perform the following steps on each switch in the network (for example, Cisco Catalyst 3650 and Cisco CDB and Cisco Catalyst 3650 switches in the deployment, as shown in Figure 3) to configure AAA.

1. On the switches, configure ISE as the RADIUS server:

   ISE is the name of the RADIUS defined. Any user-defined name can be used. The RADIUS server "ISE" defined is added to the AAA group-server.

   ```
   aaa new-model
   aaa group server radius ise-group
    server name ISE
   radius server ISE
    address ipv4 10.70.0.100 auth-port 1645 acct-port 1646
    key cisco
   ```

2. Create a local user with full privilege for fall back with the username command as shown here:

   ```
   username administrator password 0 C1sco
   username cisco password 0 cisco
   ```

3. Configure login authentication and exec and console authorization using the following commands, which show the different authentication groups that could be created.

   ```
   aaa authentication login default group ise-group local
   aaa authentication login CDB-1console none
   aaa authentication login telnetConsole local
   aaa authentication enable default enable
   aaa authentication dot1x default group radius
   aaa authorization network default group radius
   aaa accounting update periodic 15
   aaa accounting exec default start-stop group ise-group
   ```

4. Use the Telnet Console method on Virtual Teletype (VTY) authentication and authorization:

   With this step, the different authentication groups that have been created should be attached to the respective login type.

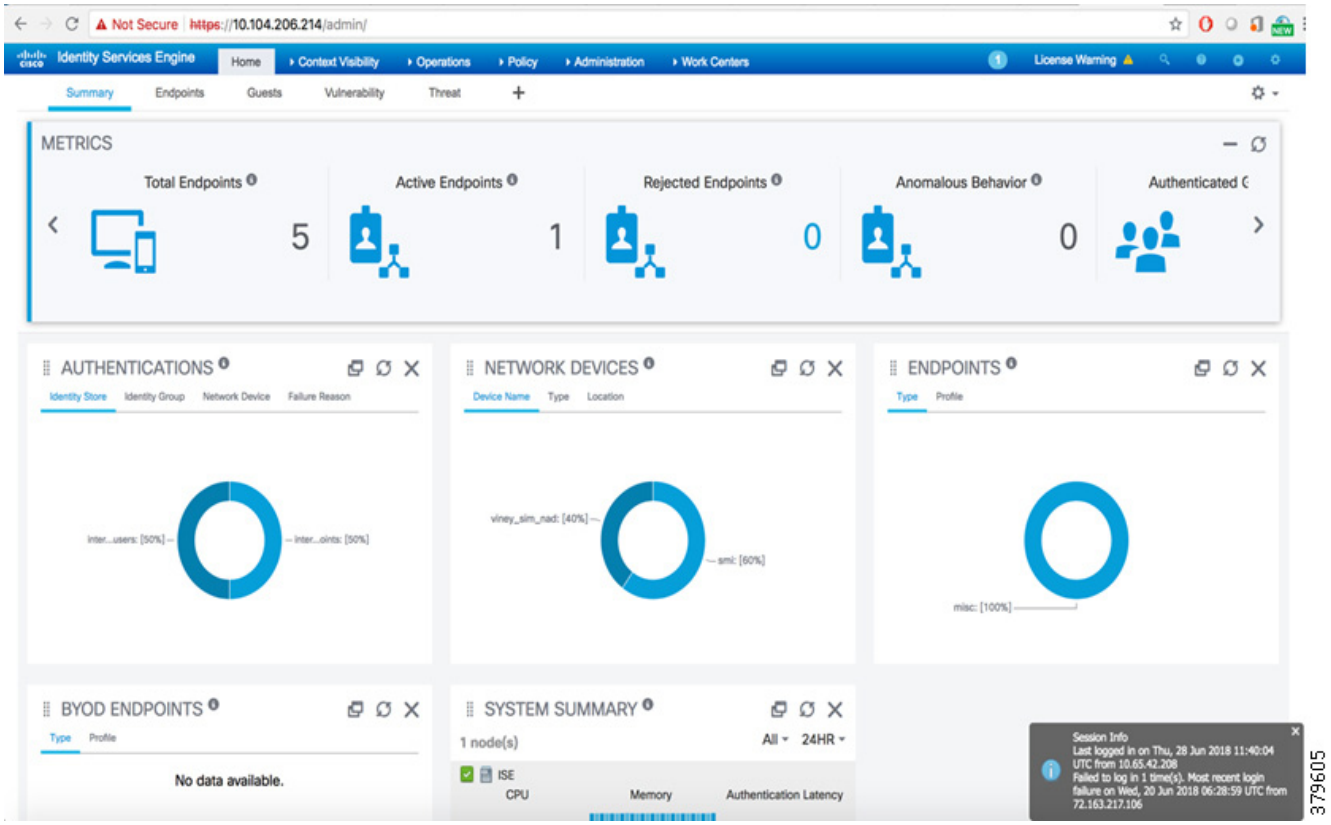
   ```
   line con 0
   login authentication CDB-1console
   stopbits 1
   speed 115200
       line vty 0 4
       login authentication telnetConsole
       line vty 5
       login authentication telnetConsole
   ```

ISE Configuration

Perform the following steps on the ISE server for enabling RADIUS-based device authentication and authorization:

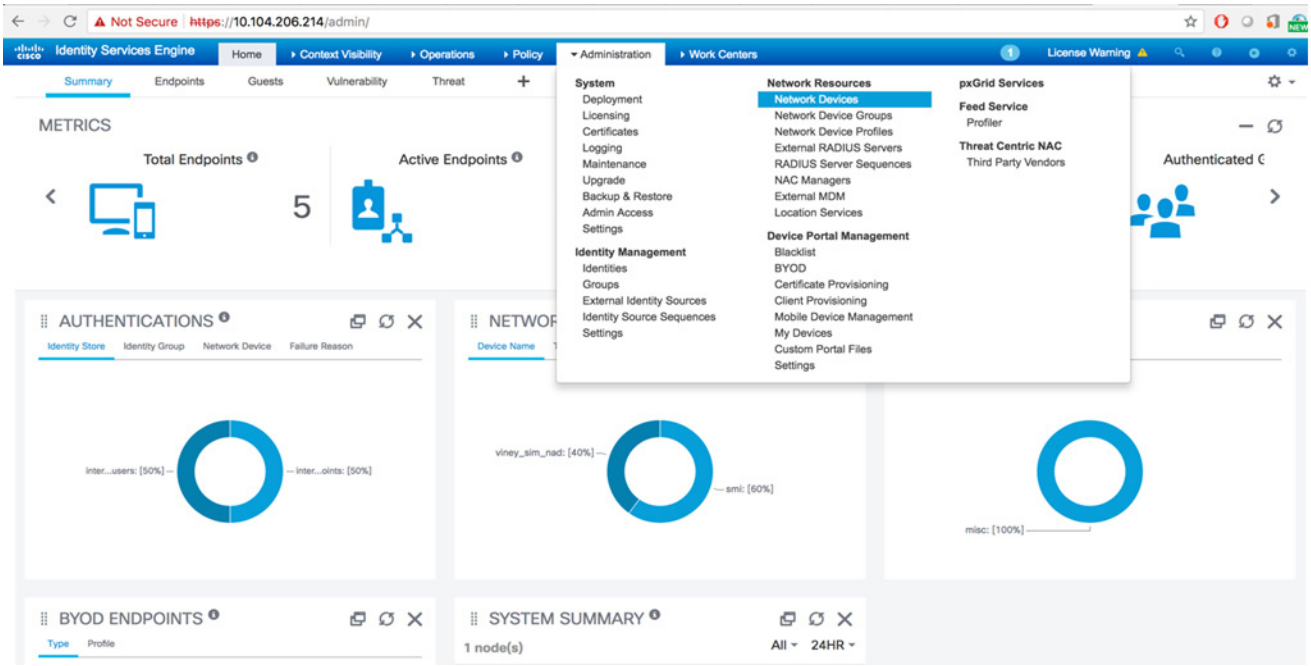
1. Log in to ISE. Figure 8 shows ISE summary after successful login.

Figure 8 ISE Login Success Page



2. Add the 3850 standalone switch or the stack as a network device to ISE. To add Network Device, select **Network Devices** from **Administration > Network Resources**, as shown in Figure 9.

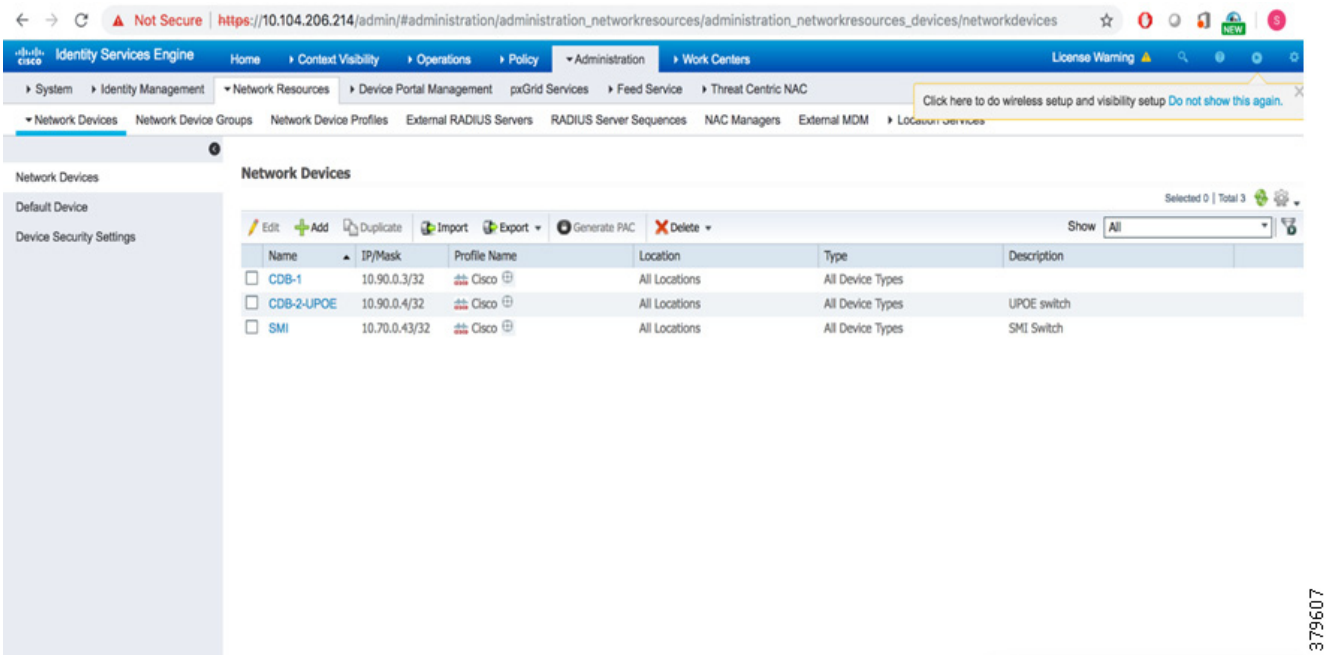
Figure 9 Select Network Devices in ISE



379609

3. On selecting **Network Devices**, the page should display devices (if any) that were added, as shown in Figure 10.

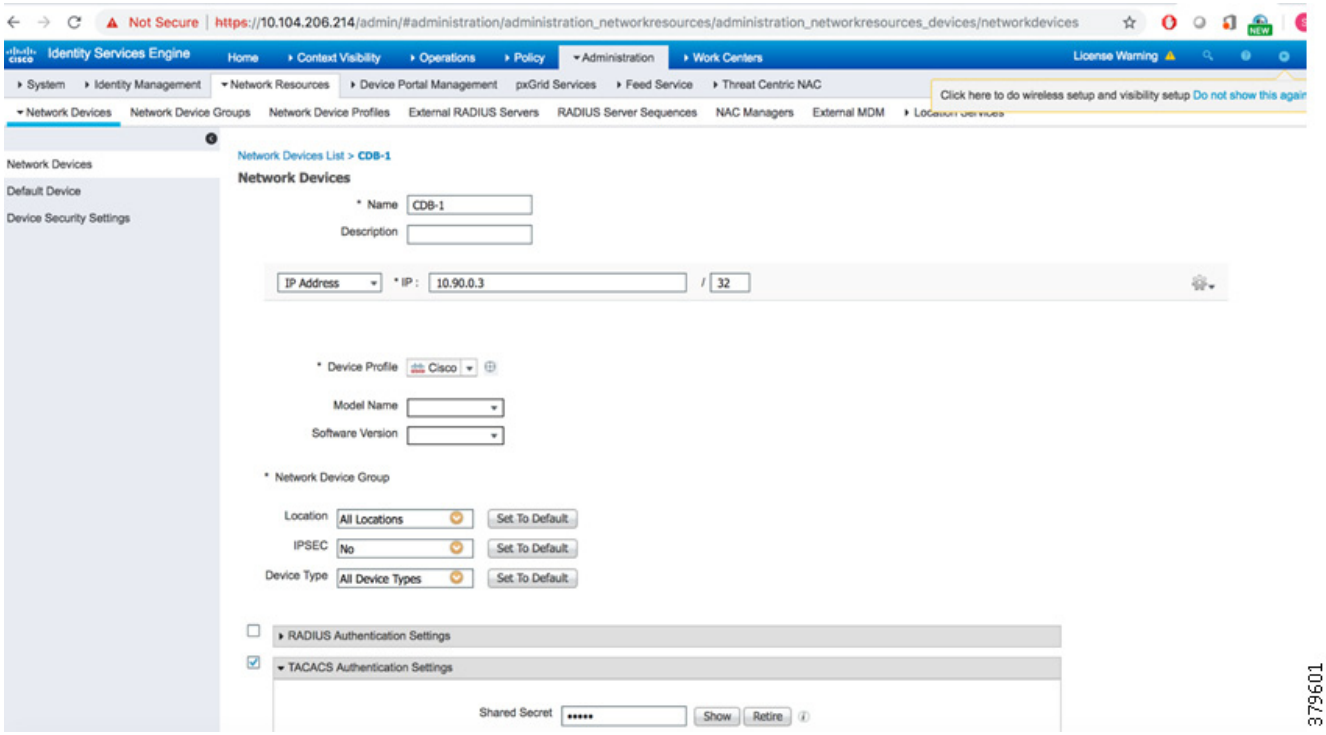
Figure 10 Network Devices in ISE



379607

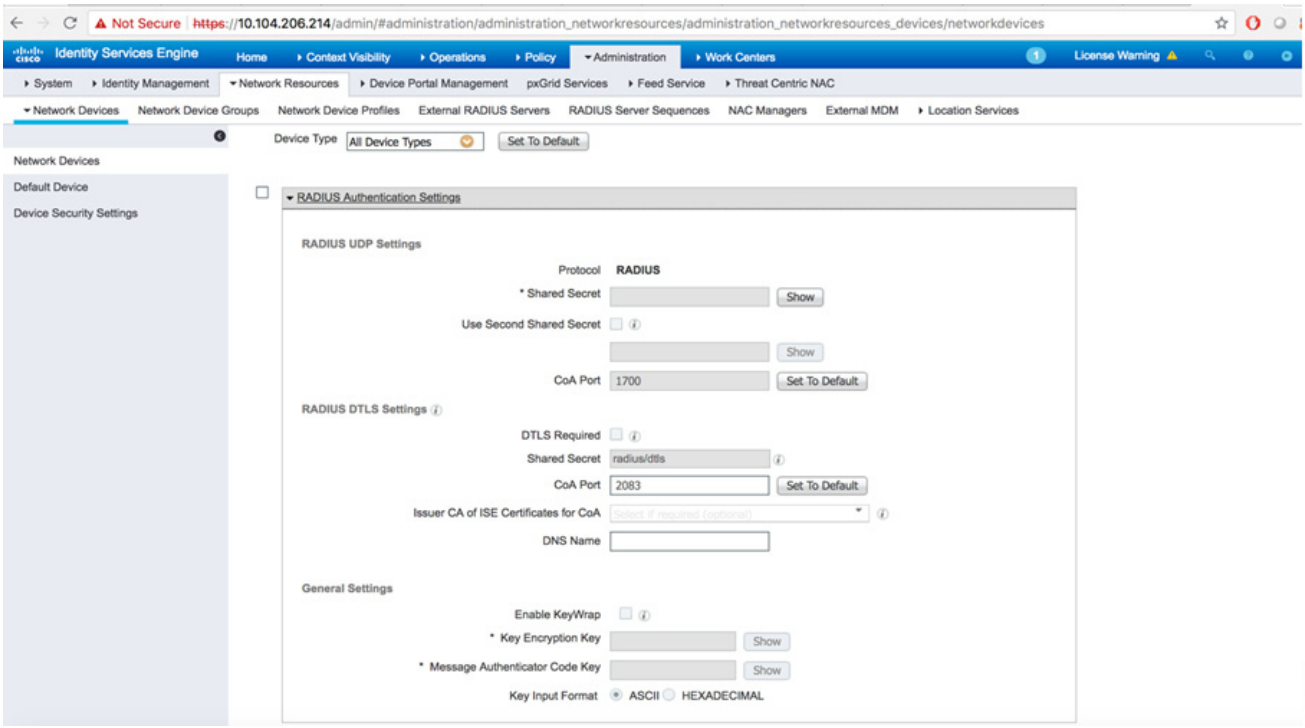
4. To add network device to the list, click **Add**, enter the device name and the correct IP address. The IP address of the network device should be reachable from ISE. See Figure 11.

Figure 11 Adding a Network Device in ISE



5. After adding a network device, select the RADIUS authentication settings and then enter the pre-shared key that is common to the network device, as shown in Figure 12. This pre-shared key should be same as the key added in the AAA configuration of the network device.

Figure 12 RADIUS Authentication Settings



6. To create an identity (user), go to **Administration > Identity Management > Identities > Users**. Add the Name and the login password, as shown in Figure 13 and Figure 14. These credentials will be used to log in to the network device from ISE.

Figure 13 Adding a User Identity in Identity Management

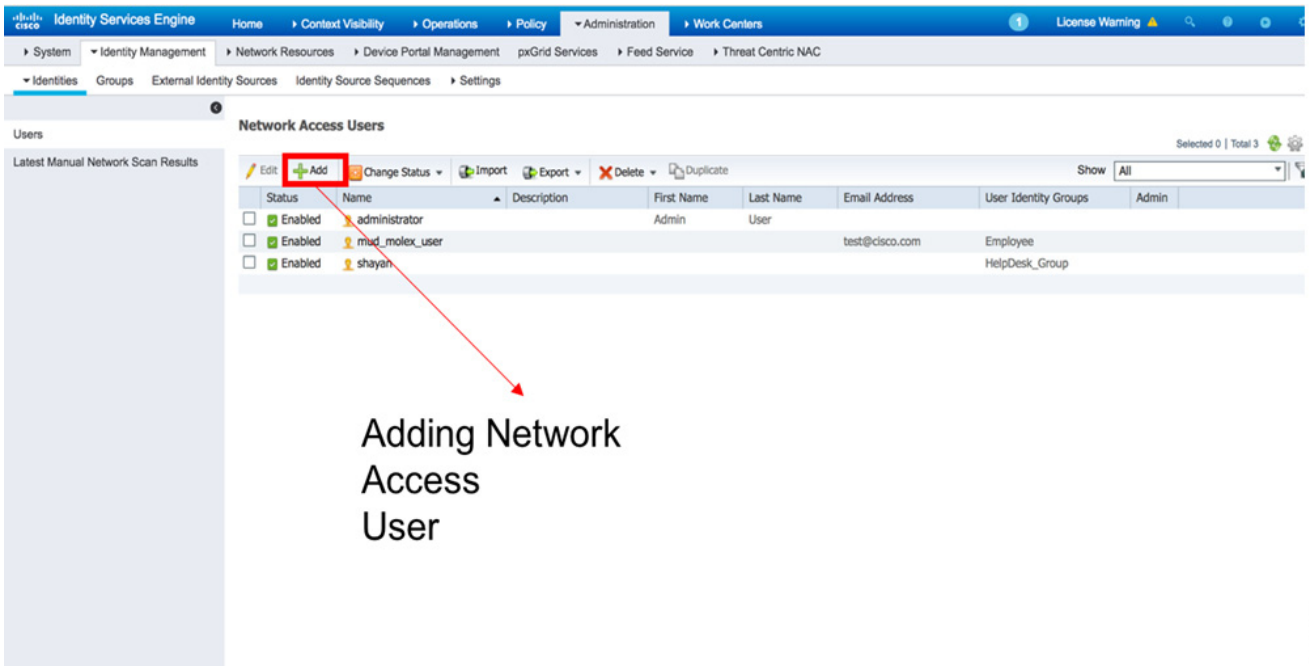
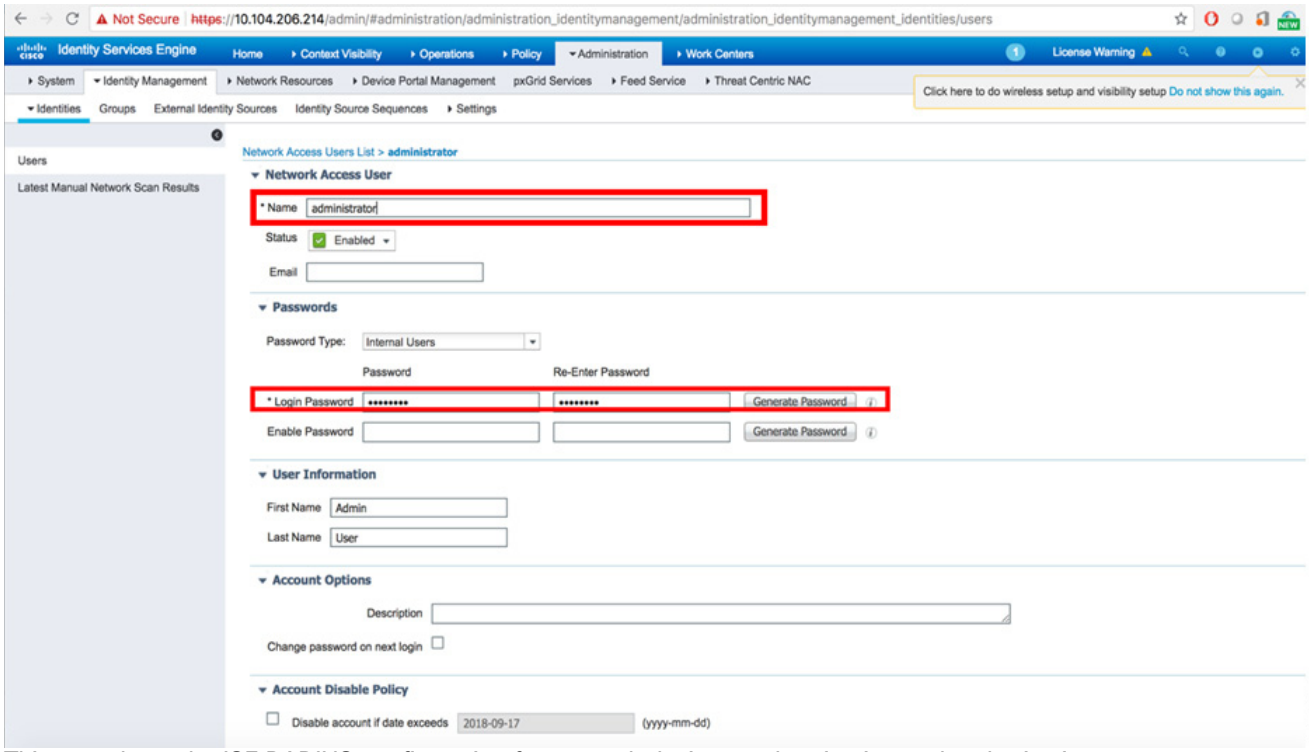


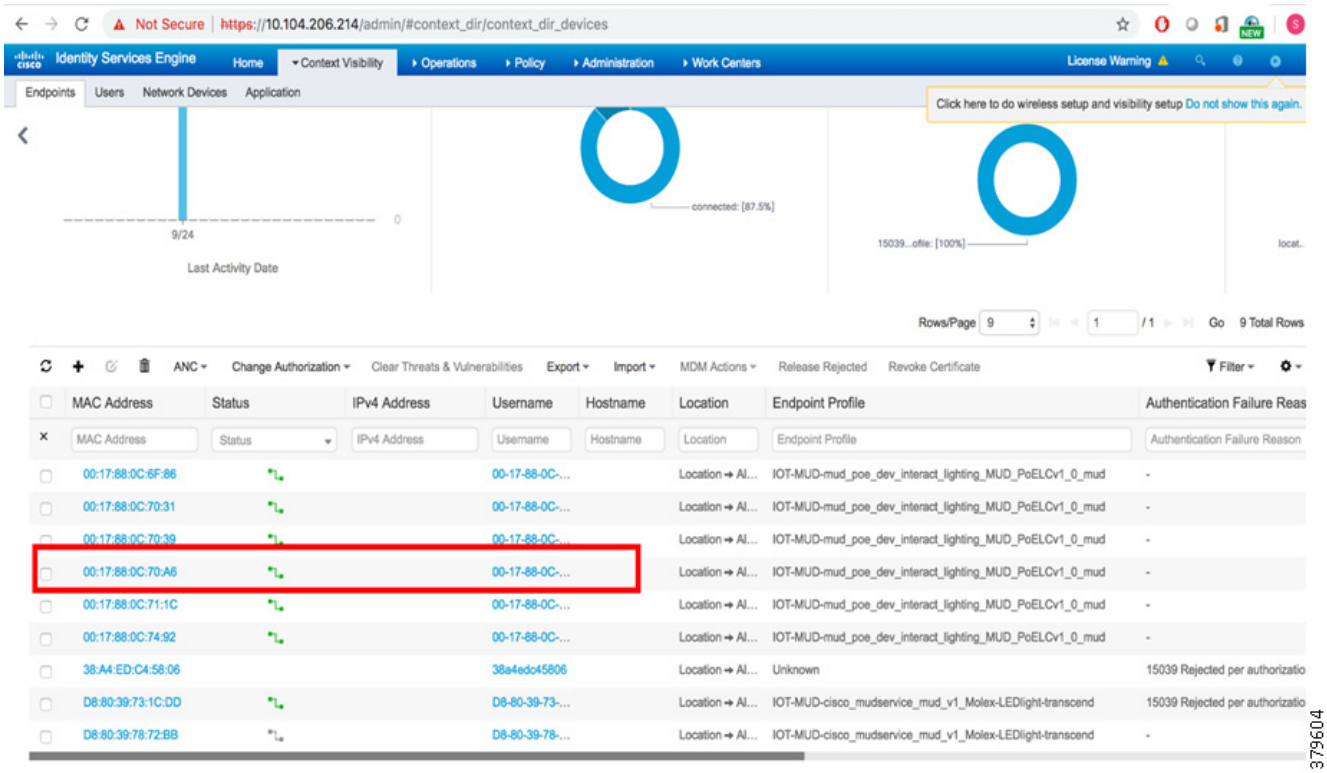
Figure 14 Creating a New User in Identity Management



This completes the ISE RADIUS configuration for network devices authentication and authorization.

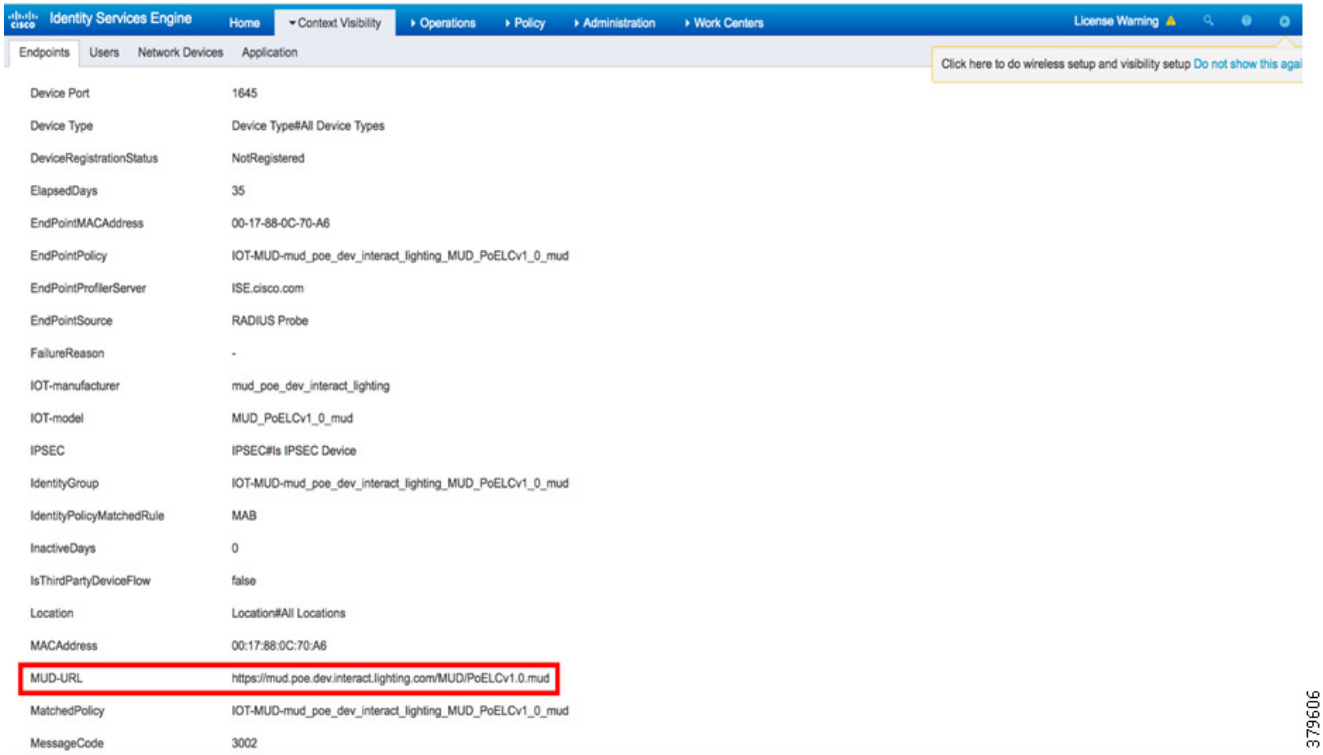
7. After performing the above steps, the endpoints can be seen at **Context Visibility > Endpoints** (Figure 15).

Figure 15 Endpoints List



8. On clicking one of the endpoints, scroll to the bottom of the **Attributes** tab and see the **mud-uri**. This is shown in Figure 16.

Figure 16 Mud-URI Visibility



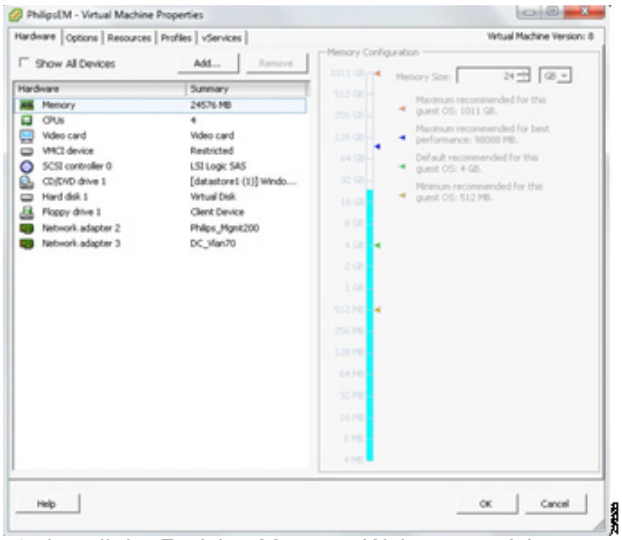
Signify Envision Manager Web

This section covers high-level installation steps for Signify Envision Manager on a VM on the UCS Server.

Note: The steps covered in this section are a high-level sequence of steps to install Signify Envision Manager Web. The *Signify EnvisionManagerWeb_Rel1-5-1_InstallationGuide_20180830_V3Fin*, which is supplied by Signify, must be used for detailed steps for Envision Manager Web installation. Refer to this guide for these steps.

1. Create a VM with the hardware and software requirements and configure two network adapters, as shown in Figure 17:

Figure 17 Network Adapter Configuration for the Envision Manager VM



2. Install the Envision Manager Web prerequisites.

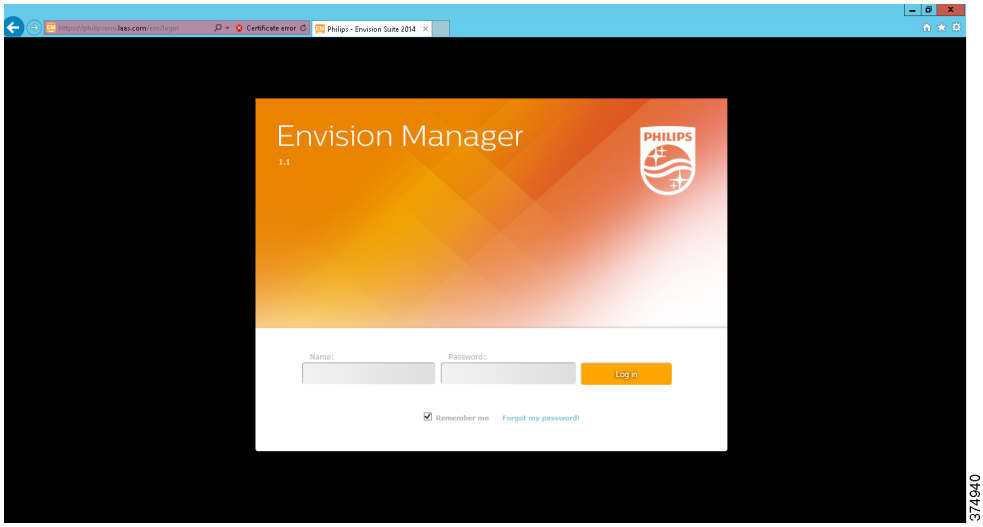
3. Install wEnvisionSuite.

Note: Make sure no other applications are running on the same machine using any port that is Signify referenced in Chapter 1.5.2 of the above mentioned installation guide. It is observed that if any other application server (for example, IIS) is running on the same Envision Manager machine with port clash (for example, port 80), the Envision Manager services do not start properly.

4. Launch the Envision Manager.

Figure 18 shows the Envision Manager Web UI after the Envision Manager installation using the URL: https://<FQDN of EM>/em/login.

Figure 18 Envision Manager Web User Interface



Note: It is **not recommended as mandatory** to upload a trusted Certificate Authority (CA) provided SSL certificate for the Envision Manager server for securely accessing the Envision Manager server using HTTPS. Make sure the SSL certificate is obtained as per the certificate requirements provided by Signify.

This completes the Signify Envision Manager Web installation.

Signify Lighting Use Cases

This chapter, which covers high-level steps for Signify lighting use cases, includes the following major topics:

Note: The detailed implementation steps for commissioning, control, and management of lighting use cases described in this chapter are beyond the scope of this document and should be implemented by Signify system experts with relevant Signify documents.

Commissioning of Luminaires

This section describes high-level summary of steps to be followed for commissioning of Signify luminaires. Where applicable, the steps described in this section should be implemented using the Connected Lighting PoE Commissioning Guide supplied by the Signify Commissioning/support engineer.

Refer to the *Connected Lighting PoE Commissioning Guide* for the detailed step-by-step procedure for commissioning Signify Luminaries and Area Controllers (Envision Gateways).

Luminaire Control and Management

This section covers the high-level implementation steps for lighting control and management use cases using Signify Envision Manager, Personal Control Application (PCA), and the wall switch.

The steps described in this section provide a high-level summary of steps for implementing a lighting control and management for areas as prepared in the job file during on-site commissioning.

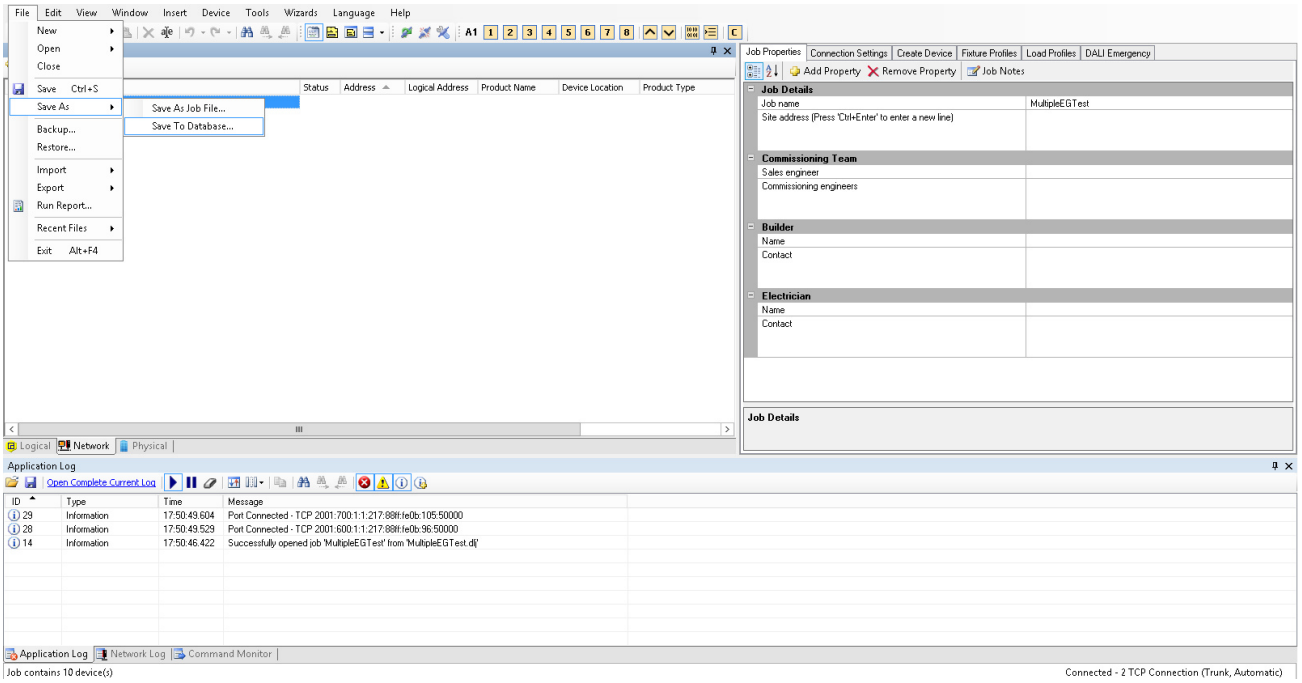
Refer to the *Signify wEnvisionSuite Installation Guide v1.1* and *wEnvisionManager User Guide v1.1* for detailed steps for implementation.

Envision Manager Web

Signify Envision Manager Web has a simple graphical interface, which makes it easy for building and facility managers to control the entire lighting system and to perform complex functions.

1. Get a copy of the System Builder job file, which was prepared during commissioning, in the Signify Envision Manager server machine.
2. Open the saved Job File in using System Builder application on the Envision Manager server and save it to the database, as shown in Figure 19.

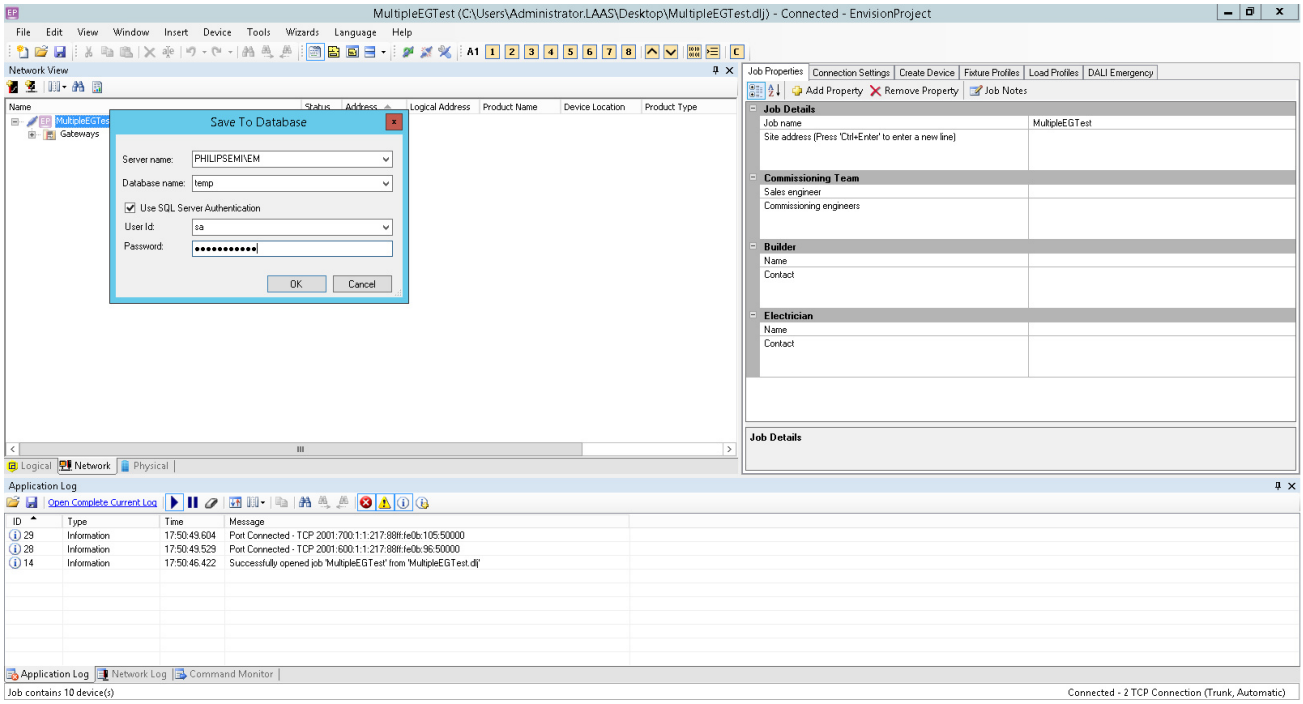
Figure 19 Saving Job File to Database



374937

3. Enter the appropriate database credentials, as shown in Figure 20.

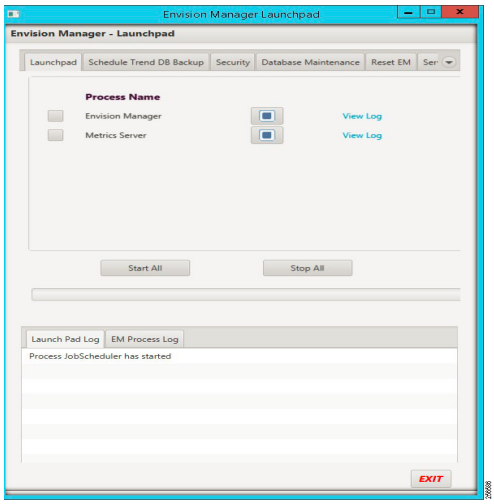
Figure 20 SQL Authentication for Saving Job File to Database



374938

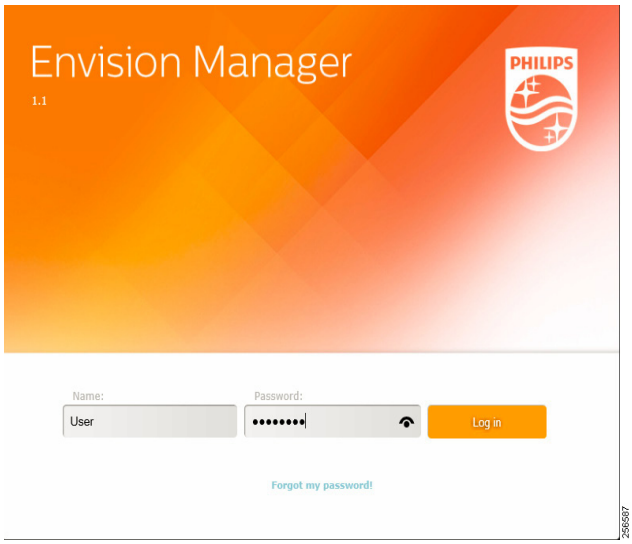
4. Launch the Envision Suite and start all the services, as shown in Figure 21.

Figure 21 Launching Envision Manager



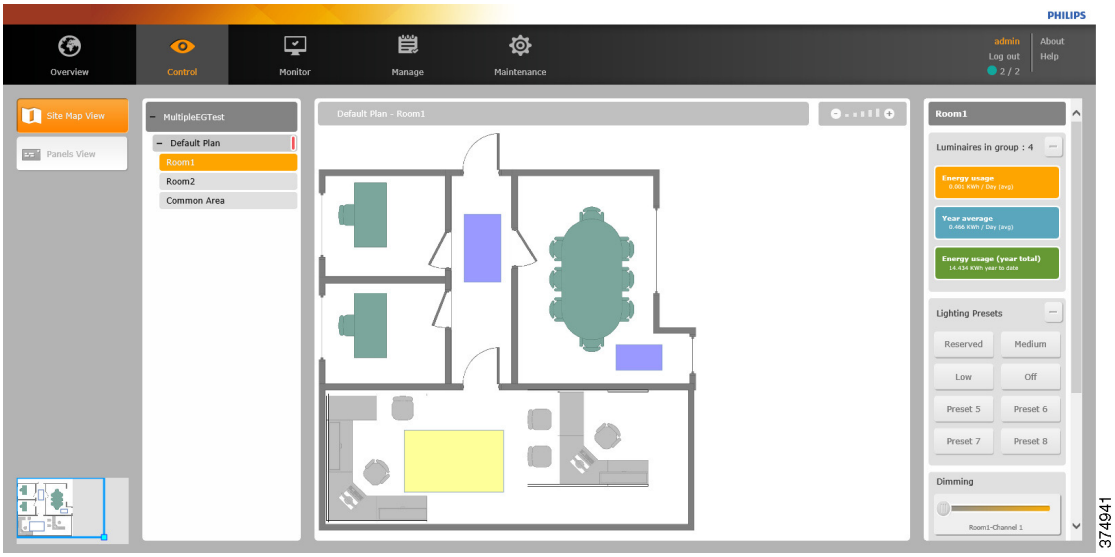
5. After the services restart, open the Google Chrome browser on Envision Manager web and then log on to the Envision Manager Web UI using the appropriate user's login credentials, as shown in Figure 22.

Figure 22 User Authentication for EM



6. Luminaire's control operations on Envision Manager can be performed as required by navigating to the **Control** tab and selecting the appropriate area and control action, as shown in Figure 23.

Figure 23 Controlling Luminaires in an Area using the Various Presets



Personal Control Application

This section covers Signify Personal Control Application (PCA) provisioning for luminaire control in an area.

Prerequisites

Ensure the following:

- You have the Apple iPhone or Android devices with the appropriate version of iOS and Android version as per Signify PCA requirements.
- Based on the Signify *EnvisionManagerWeb_Rel1-5-1_InstallationGuide_20180830_V3Fin.pdf* certificate requirements, you should have a valid SSL certificate issued by an official CA for Envision Manager server to which PCA is establishing a secure (HTTPS) connection. The certificate request should match the certificate requirements as specified by Signify.

  Note: It is observed that THE SSL certificate issued for the Envision Manager should be a trusted root certificate for the corresponding iOS. For example, the list of trusted root certificates for iOS8 can be found at the following link:

  – https://support.apple.com/en-us/HT204132
- You have uploaded the SSL certificate on the Envision Manager server by following the Signify *EnvisionManagerWeb_Rel1-5-1_InstallationGuide_20180830_V3Fin.pdf*.

Installation and Configuration

1. Install PCA by following the procedure as mentioned by the Apple Store or Android Play Store.
2. Steps for configuration and usage for PCA are available in the following Signify PCA user guides:
   – *ConnectedOffice_PCA_IOS_UG_20160902_V3Fin.pdf* or for Android
   – *ConnectedOffice_PCA_Android_UG_20160902_V3Fin.pdf*

Related Documentation

This appendix lists Cisco and Signify documentation referred to in this document.

Cisco Documentation

- *Cisco Smart+Connected Solutions with Signify Interact Office Wired: A Design Guide:*
  - https://docs.cisco.com/share/s/dID5vdxjTISQV1VrkB6a9Q
- *Cisco UCS C220M5 Installation*:
  - https://www.cisco.com/c/en/us/td/docs/unified_computing/ucs/c/hw/C220M5/install/C220M5/C220M5_chapter_01.html
- *Installation and Upgrade Guide for Cisco Identity Service Engine*:
  - https://www.cisco.com/c/en/us/td/docs/security/ise/2-3/install_guide/b_ise_InstallationGuide23/b_ise_InstallationGuide23_chapter_010.html
- Autonomous AP and Bridge Basic Configuration Template (Cisco Support Community):
  - https://supportforums.cisco.com/document/61936/autonomous-ap-and-bridge-basic-configuration-template
- Cisco SNMP Reference:
  - http://www.cisco.com/c/en/us/td/docs/ios/12_2/configfun/configuration/guide/ffun_c/fcf014.html

Signify Documentation

Table 8 provides the list of Signify documentation.

Table 8 Signify Documentation

Document Name	Application	Document Type	System Release
EnvisionManagerWeb_Rel1-5-1_InstallationGuide_20180830_V3Fin.pdf	Envision Manager	Installation Guide	1.5.1
EnvisionManagerWeb_Rel1-5-1_UserGuide_20180514_Fin.pdf	Envision Manager	User Guide	1.5.1
EnvisionManagerWeb_TechNote_Certificate_20180813_V6Fin.pdf	Envision Manager	Technical Note	1.5.1
CLSPoE_Rel1-5-1_SystemGuide_20180618_VAP.pdf	System Level	System Guide	1.5.1
ConnectedOffice_PCA_Android_UG_20160902_V3Fin.pdf	Personal Control Application (PCA)	User Guide	1.5.1
ConnectedOffice_PCA_IOS_UG_20160902_V3Fin.pdf	Personal Control Application (PCA)	User Guide	1.5.1

Glossary

Table 9 lists acronyms and initialisms used in this document.

Table 9 Acronyms and Initialisms

Term	Definition
ASA	Adaptive Security Appliance
CA	Certificate Authority
CDB	Cisco Catalyst Digital Building
DHCP	Dynamic Host Configuration Protocol
ISE	Cisco Identity Services Engine
MAB	MAC Authentication Bypass
MUD	Manufacturer Usage Description
NMS	network management station
OTT	Over-the-top
PCA	Signify Personal Control Application
SLAAC	Stateless Address Auto Configuration
SNMP	Simple Network Management Protocol
SSH	Secure Shell
SVI	switched virtual interface
UCS	Cisco Unified Computing System
VTY	Virtual teletype

Glossary