



Fast-Track WLAN Deployment Using Cisco Catalyst Center

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Cisco CCIE #4923

Key Concepts

- + Introduction to Intent-Based Networking (IBN)
- + Cisco Catalyst Center Web-UI Navigation
- + Comparing the Design, Provision, and Assurance stages of Cisco Catalyst Center
- + Brownfield vs. Greenfield Deployment Strategy
- + Creating & Provisioning WLANs

MAJOR TOPICS

- + Catalyst Center Overview & Terminology
- + Steps Involved in WLAN Planning
- + Usage & Limitations of Brownfield Integration
- + Using Plug-and-Play for Catalyst 9800 discovery
- + Introduction to CLI Templates
- + Overview of Catalyst Center Assurance Dashboards



LEARNING OUTCOMES

- + Gain Familiarity with Cisco Catalyst Center (CCC) Web-UI Navigation
- + Explain Minimum WLAN Design Requirements
- + Exposure to Catalyst 9800 WLC Discovery and Onboarding techniques
- + Learn the Differences between Site Assignment & Provisioning

Recognition



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-
- + Familiarity with Cisco Catalyst 9800 operation
 - + Experience with WPA2 & WPA3
 - + Understanding of DHCP
 - + Familiarity with Basics of IOS-XE CLI

PREREQUISITES



LET'S GO!

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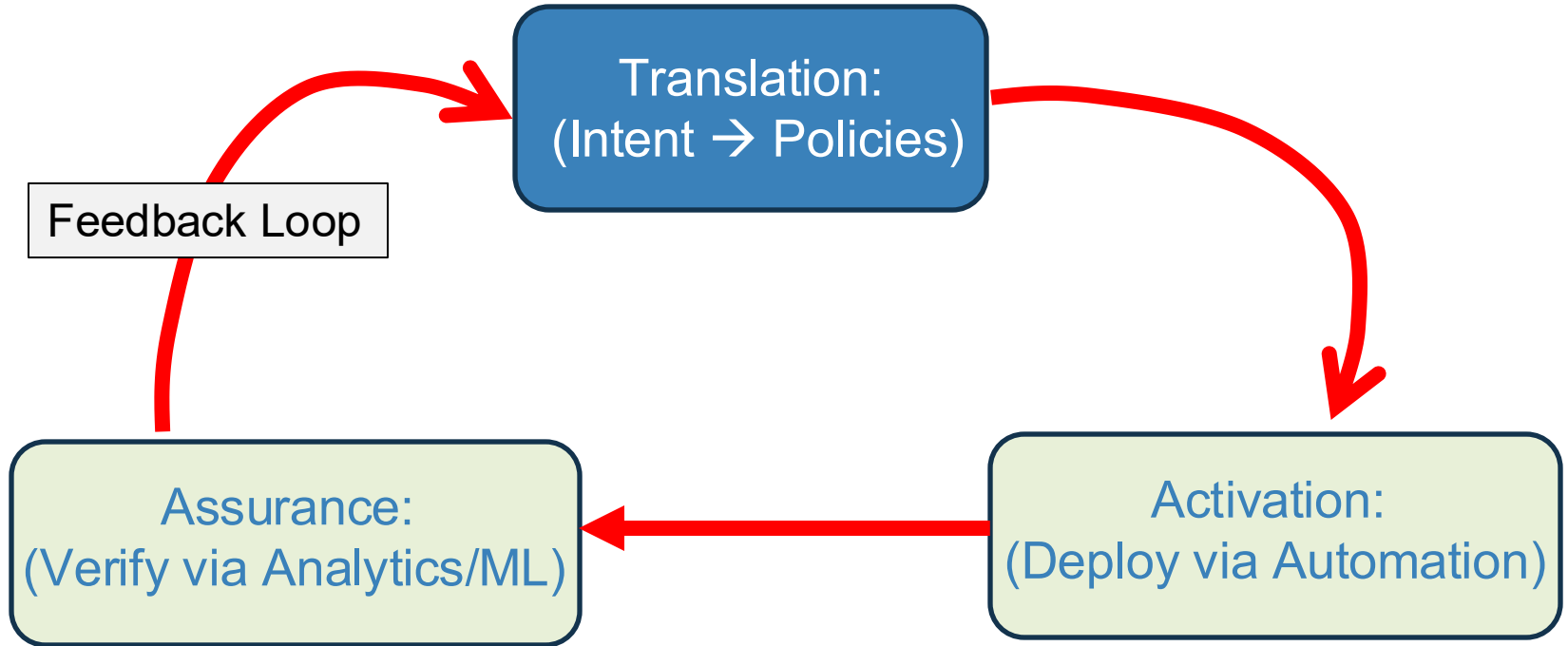


Overview of the Cisco Catalyst Center

Intent-Based Networking

- + IBN transforms traditional, manual networks into controller-led systems.
- + It captures business intent and translates it into network policies.
- + Policies are applied and automated consistently across the network.
- + The goal is to align network behavior with desired business outcomes.

The IBN Closed-Loop Lifecycle





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Catalyst Center Terminology (Part-1)

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Terminology Introduction

- + Telemetry
- + Dashboard
- + Assurance
- + Hierarchy
- + Inventory
- + Onboarding



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Catalyst Center Terminology (Part-2)

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Terminology Continued

- + Discovery vs Claiming
- + Workflows
- + Modes
 - + Assurance-Only
 - + Managed
- + Provisioning



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Catalyst Center Web UI Overview

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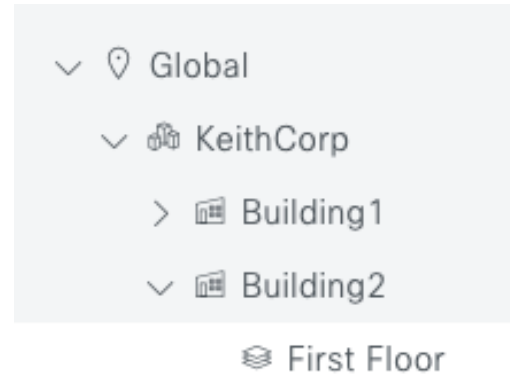
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Advanced Planning: Setting the Stage for Catalyst Center WLANs

Catalyst Center Advanced Planning

- + Names to be assigned to Areas, Buildings and Floors
- + IP addresses for various critical server services such as AAA, NTP, DNS and DHCP
- + Common credentials that will be applied across devices for CCC management



Wireless Planning

- + SSID names, security settings and RF characteristics

<input type="checkbox"/>	Network Name (SSID) ▾	WLAN Profile Name	Policy Profile Name	SSID Type	L2 Security
<input type="checkbox"/>	Marketing	Marketing... (1)	Marketing... (1)	Enterprise	wpa2_wpa3_persona
<input type="checkbox"/>	Payroll	Payroll_pr... (1)	Payroll_pr... (1)	Enterprise	wpa2_wpa3_persona

- + Common configuration settings to be applied during provisioning via CLI Templates
- + IP address allocation for Wireless Management Interface(s)

Additional Wireless Planning

- + Interface assignment (SVI and VLAN) for Wireless Management interfaces
- + VLAN assignments for SSIDs

<input type="checkbox"/>	Interface Name ▲	VLAN ID	Wireless Profiles
<input type="checkbox"/>	management	-	
<input type="checkbox"/>	Marketing	3	KeithCorp-Net-Profile
<input type="checkbox"/>	Payroll	2	KeithCorp-Net-Profile



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A high-angle, close-up photograph of a person wearing glasses, looking down at a laptop keyboard. The scene is illuminated with a strong blue light, creating a professional and technical atmosphere. The person's hands are visible on the keyboard. A thin orange horizontal line is positioned near the top of the frame, and a vertical orange bar is on the left side.

Creating a Network Hierarchy

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Why Create a Network Hierarchy

- + The network hierarchy is foundational to leveraging Catalyst Center features.
- + Without a hierarchy, most Catalyst Center functions are unavailable.
- + The default hierarchy begins with a Global level.
- + Subsequent hierarchy levels include:
 - + Area (e.g., regions like "Keith Corp North Carolina")
 - + Building (e.g., Building 1)
 - + Floor (e.g., Floor 1 with uploaded floor plans)

Configuring Sites and Visualizing Locations

- + Each building can be geolocated with either:
 - + A street address or
 - + GPS coordinates (manually extracted from Google Maps)
- + Uploaded floor plans support multiple formats: PDF, PNG, DXF, etc.
- + Environmental attributes (e.g., ceiling height, wall types) can be specified for RF modeling.
- + Once a WLC and APs are onboarded and assigned, APs can be dragged onto floor plans.

Wireless Assignments and Inheritance Behavior

- + WLCs should be assigned at the building level.
- + APs are assigned at the floor level and must match the floors declared under the WLC.
 - + Failure to do this will result in errors when placing APs.
- + Settings (e.g., credentials, SSIDs, network profiles) can be:
 - + Defined at any level of the hierarchy.
 - + Inherited by lower levels unless overridden locally.
- + Overrides at lower levels replace conflicting inherited values.



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Setting Up Essential Network Server & Credential Settings

Introduction to Catalyst Center Network Settings

- + Purpose of the Design Phase
 - + Prepopulate Catalyst Center with hierarchical data for onboarding/provisioning.
 - + Configuration begins at the global level, cascading down to buildings and floors.
- + Network Settings Overview
 - + Found in the Design section under the hamburger menu.
 - + We'll Focus on:
 - + Server settings (AAA, DHCP, DNS).
 - + Device credentials.

Server and Credential Configuration

- + Server Credential Configuration
 - + Add AAA (e.g., RADIUS, TACACS+), DHCP, and DNS servers.
 - + Configuration cascades downward unless overridden at a lower level.
 - + Example: DNS 8.8.8.8 added globally can be replaced per building/floor.
- + Saving Changes
 - + Settings must be saved before switching tabs or changes are lost.

Credential Types & Levels

- + Credentials can be:
 - + Assigned at global/building/floor level.
 - + Stored at System Level (credentials are available but unassigned to any level in the site hierarchy).
- + Assigned credentials at lower-levels (i.e. Floor) override higher-level credentials. (i.e. Area)

SNMP Credential Caveats

- + Device Discovery Tool
 - + Works with SNMPv2c or SNMPv3 credentials.
 - + Shouldn't use both
 - + Designed for brownfield environments with existing configs.
- + Plug-and-Play (PnP)
 - + For zero-config devices.
 - + Device sends a PnP hello → Catalyst Center receives it.
 - + Requires SNMPv3 credentials; SNMPv2c may fail.



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Designing Wireless Settings

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Understanding Catalyst Center's Role

- + Cisco Catalyst Center = Management , Automation, and Assurance platform
- + Three core functional areas for WLAN implementation:
 - + Design: Define networks, sites, and wireless settings
 - + Policy: Intent-based segmentation and profiles
 - + Provision: Push config to infrastructure
- + Catalyst 9800 WLCs can be managed by CCC via Intent-based workflows or CLI templates
- + CLI Templates fill gaps not covered in GUI workflows

Relationship of Interfaces to SSIDs

- + SSIDs must be assigned to a named VLAN interface during creation
 - + “Interface” = a named entity mapping to a VLAN (SVI or not)
- + If no VLAN interface is pre-defined, only the Management Interface is selectable for the SSID
- + Best Practice: Always predefine interface mappings before SSID creation

VLAN Interface vs SVI Behavior

- + Create an interface under:
 - + Design → Network Settings → Wireless → Interfaces
 - + Only creates an interface mapping, not necessarily a Layer-3 SVI
- + To form an SVI, assign:
 - + IP address and subnet mask under Interface settings
- + No IP? → Becomes a Layer-2 VLAN, useful when:
 - + You want bridging, not routing
 - + Catalyst 9800 simply hands off client traffic upstream
- + Cisco recommends Layer 2 bridging for many WLAN deployments to avoid routing on WLC

VLAN Groups for SSID Scalability

- + VLAN Groups = collection of VLAN Interfaces
- + Useful for:
 - + Spreading clients across multiple VLANs while using one SSID
 - + Reducing broadcast domain size
 - + Enhancing scalability and performance
- + Clients are dynamically assigned to VLANs in the group
- + Helps distribute load and align traffic with appropriate upstream routers

Best Practices Summary

- + Define VLAN Interfaces before SSID creation
- + Avoid mapping SSIDs to Management Interface
- + Use CLI templates configuration settings not possible with intent-based workflows
- + Understand difference between:
 - + Creating only a named VLAN Interface vs.
 - + SVI (with IP) for Layer 3 routing
- + Use bridging mode (L2) when the WLC should not route client traffic



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Using the Discovery Tool for Brownfield Onboarding

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Introduction to Brownfield Onboarding with Catalyst Center

- + Definition: Brownfield onboarding involves integrating Catalyst Center with a pre-existing, functioning Cisco 9800 wireless network.
- + Goal: Use Catalyst Center only for assurance, not for automation or config changes.
- + Cisco TAC Recommendation: Avoid automating preconfigured devices — it can cause instability.
- + **Discovery Tool Purpose:** Identify and onboard existing Catalyst 9800(s) into Catalyst Center inventory for assurance.

Minimum Requirements

- + Nodes discovered by Catalyst Center using the Discovery Tool should have a minimum configuration already in place:
 - + Local username and password (privilege 15)
 - + AAA authentication and authorization (default local)
 - + IP address on at least one reachable interface
 - + IP route providing reachability to Catalyst Center
 - + Wireless Management Interface
 - + SNMP
 - + NETCONF-YANG

Running the Discovery Tool – Step-by-Step

- + Navigation: Tools > Discovery Tool > Add Discovery Job.
- + Discovery Method: Use IP address range (even a single IP is valid).
- + Can also utilize CDP or LLDP with a seed IP address
- + Protocols Used:
 - + ICMP (reachability check)
 - + SNMP (telemetry)
 - + SSH (CLI access)
 - + Netconf/YANG (data modeling)

Running the Discovery Tool – Step-by-Step

- + Discovery requires addition of various credentials that match existing config on node
- + Credential Setup:
 - + CLI for SSH access
 - + SNMP (v2c or v3)
 - + Netconf-YANG (can change to individually defined TCP port if desired)
- + Can use job-specific or global credentials
- + Can re-use credentials already configured within Design → Network Settings

Completing Discovery and Interpreting Results

- + Execution: Choose to run now or schedule later.
- + Device Assignment: Can auto-assign to site or remain in global inventory.
- + Success Indicators:
 - + Green checks next to ICMP, SNMP, CLI, Netconf
 - + Device and connected AP(s) appear in inventory
- + Discovery by Proxy: APs joined to WLC are auto-discovered by Catalyst Center.



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Site Assignment vs Provisioning



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Site Assignment vs. Provisioning – Key Concepts

+ Site Assignment

- + Assigns a device to a site in Catalyst Center's hierarchy (e.g., building, floor).
- + Enables collection of Assurance and Telemetry data only.
- + No configuration changes are pushed to the device.

+ Provisioning

- + Pushes actual configuration settings (e.g., SSIDs, VLANs) from Catalyst Center to the device.
- + Needed to enforce intent-based configuration created in Catalyst Center.
- + Higher risk when used on brownfield (already-configured) devices.

What Happens During Site Assignment

- + Device is added to the proper site (e.g., MyCorp → NC → Building 1).
- + Only monitoring and visibility are enabled:
 - + Health status
 - + Telemetry
 - + Wireless client info
- + No change to device configuration (e.g., SSIDs, VLANs remain untouched).
- + Shows up as “Managed” in Catalyst Center—but this means monitored, not configured.

Limitations of Site Assignment

- + Existing WLANs and Policy-Profiles are read-only in Catalyst Center.
- + Catalyst Center does not display all 9800 configuration details.
- + Cannot delete or modify legacy SSIDs
- + No visibility into some configuration items like Policy-Tag names.
- + Useful only for Assurance, not for active configuration.

Provisioning Conflicts & Post-Provisioning Limitations

- + Provisioning brownfield 9800s may fail
 - + Caused by config conflicts between CCC and existing 9800 setup
 - + Common example: A VLAN name mismatch exists between CCC and 9800 (e.g., “VLAN003” vs. “marketing”)
- + After provisioning:
 - + Catalyst Center can view most brownfield config (e.g., SSIDs, Policy Tags)
 - + But cannot modify or delete this legacy configuration
- + Even provisioned WLCs retain read-only legacy elements, limiting automation value





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Assigning Access Points

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AP Discovery in Brownfield Environments

- + Avoid discovering all WLCs at once — creates confusion.
 - + Discover one WLC at a time.
 - + Easier to track which APs belong to which controller.
- + A challenging Example:
 - + Two WLCs with same hostname.
 - + Multiple APs at Global inventory level only
 - + Difficult to distinguish AP relationships to WLCs.
- + Tip:
 - + Use View 360 to determine which APs belong to which WLC.

Assigning APs to Floors and Floor Plans

- + Identify AP MAC address from View 360.
- + In Inventory:
 - + Select one or more APs
 - + Actions → Assign device(s) to site.
 - + Select the correct:
 - + Building
 - + Floor
- + In Design > Network Hierarchy:
 - + Go to the “Floor” level where you assigned APs
 - + Use Add/Edit Devices to drag AP to floor plan.

Provisioning APs and RF Profiles

+ Process:

- + From Inventory, select AP → Actions > Provision.
- + Select an RF Profile:
 - + Default: Typical
 - + Options: Low, High, or Custom Clone
- + AP is configured with SSIDs (e.g., Payroll, Marketing).
- + Push configuration and track progress in Tasks window.

+ Result:

- + AP becomes fully operational and managed.

Summary: End-to-End AP Assignment

- + Steps Recap:
 - + Discover the WLC (one at a time).
 - + Assign WLC to building site.
 - + Identify and assign APs to matching floors.
 - + Place APs on the visual floor plan.
 - + Provision APs with desired RF settings and SSIDs.
- + Outcome:
 - + Full wireless assurance and visual heat map data.
 - + Simplified AP management in Catalyst Center.



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Per-Device Configuration

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Per Device Configuration in Cisco Catalyst Center

- + Used to manage individual Cisco 9800 WLCs directly within Catalyst Center.
- + Bypasses intent-based workflows for more granular control.
- + Ideal when:
 - + Custom configurations are required.
 - + Working with brownfield deployments.
- + Not a replacement for the standard workflow, but a fallback for unique use cases.

Why Not Always Use Intent-Based Workflows?

- + Catalyst Center is optimized for intent-based networking:
 - + Centralized configuration.
 - + No CLI knowledge needed.
- + Great for switches and large-scale environments.
- + Limitation: Intent workflows only cover ~60–70% of WLC config needs.
- + Per Device Configuration (PDC) fills this gap by enabling:
 - + VLAN trunking specifics
 - + QoS
 - + Wireless configuration not available with intent workflows

PDC on Unprovisioned vs. Provisioned Devices

- + Unprovisioned 9800 WLCs:
 - + PDC fully unlocks configurability
 - + Can edit existing wireless LANs, policy profiles, hostname, and more
 - + Behaves like direct access to the controller's native GUI
- + Provisioned 9800 WLCs:
 - + PDC causes configuration lockout
 - + Cannot edit anything via PDC or intent-based workflows
 - + Becomes view-only (assurance data only)
- + Recommendation: Only enable PDC on unprovisioned devices to avoid losing management capabilities



Key Takeaways and Best Practices

- + Do:
 - + Use PDC for unprovisioned WLCs needing custom configurations.
 - + Resync device after enabling PDC.
 - + Understand that PDC disables intent-based provisioning.
- + Don't:
 - + Apply PDC to already provisioned devices.
 - + Expect to edit anything on pre-provisioned 9800s afterward.



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Hands-Free Discovery Using DHCP & PnP

Overview of Plug-and-Play with Cisco 9800

- + PnP allows a zero-touch onboarding of Cisco 9800 controllers via Cisco Catalyst Center.
 - + Useful for new deployments where no manual CLI configuration is desired.
 - + Requires DHCP server setup to deliver onboarding parameters.
 - + Catalyst Center and Cisco 9800 both support PnP, though it's more complex than traditional onboarding.
- + Ideal for greenfield environments with new, unconfigured controllers.

DHCP Role in Plug-and-Play

- + PnP server IP address can be discovered via DHCP or DNS
- + DHCP must provide Option 43 with PnP server info
- + Option 43 format example:

```
ip dhcp pool 9800-Subnet
network 10.199.101.0 255.255.255.0
default-router 10.199.101.254
dns-server 1.1.1.1
option 43 ascii "5A1D;B2;K4;172.31.1.215;"
```

- + 9800 PnP agent uses this string to identify and contact Catalyst Center.

Preparing the Cisco 9800 for PnP

- + PnP designed for devices with blank configurations (no “Startup-Config file”)
- + For pre-configured devices, use *pnpa service reset* to revert a configured 9800 to factory defaults.
- + During boot:
 - + DHCP Discover messages are periodically sent.
 - + Device ignores DHCP offers until the System Configuration Dialog times out.
- + Do not type anything at the CLI during this process — it will cancel PnP

Claiming and Onboarding in Catalyst Center

- + After DHCP/PnP, device appears under Provision → Plug and Play as Unclaimed.
- + Steps:
 - + Claim the device.
 - + Assign it to a Site (automatically triggers provisioning).
 - + Provide wireless management interface details (required).
- + Optional steps:
 - + Assign a golden image.
 - + Apply a CLI template.
- + Once provisioned, Catalyst Center uses the management IP for SNMP, NETCONF, and telemetry.



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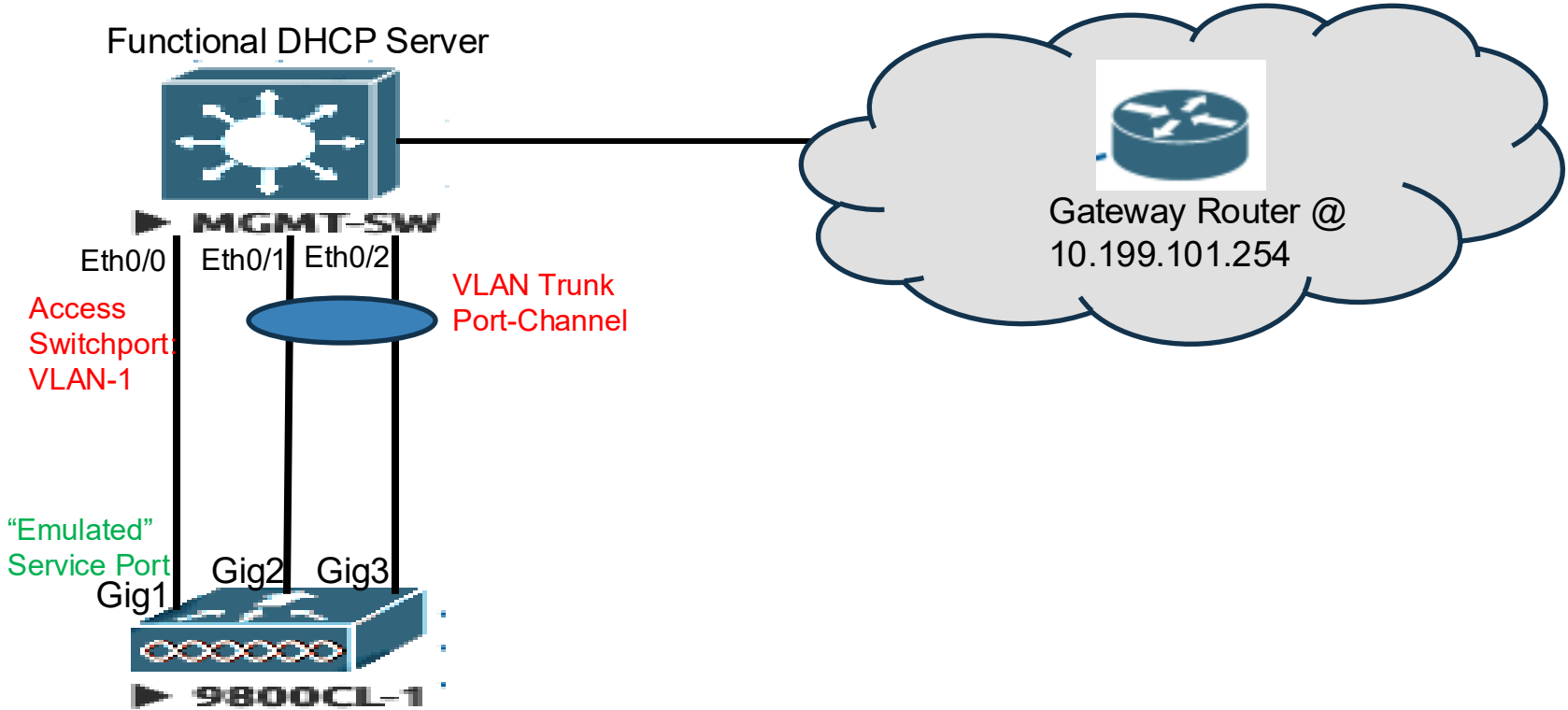


An Overview of CLI Templates

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The Topology





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CLI Templates Use Case

- + CLI templates fill gaps when certain configurations **cannot be done via the GUI workflows**.
- + They are crucial during the **Plug-and-Play (PnP) onboarding process**, or for post-provisioning configuration.

Template Organization

- + Templates are organized into projects.
- + If the CLI template is to be used during PnP onboarding, it must reside in the “*Onboarding Configuration*” project.
- + Templates in other projects won't be available for PnP use.

Creating a CLI Template

- + Navigate to Design > CLI Templates
- + Choose to add a new template
- + Select:
 - + Project: Onboarding Configuration
 - + Template Type: Regular or Composite (Composite lets you bundle several templates)
 - + Template Language: Jinja or Velocity (Jinja is more Pythonic and preferred)
 - + Software Type: Must select IOS-XE (not “Cisco Controller”) for application against Cisco 9800 WLCs
 - + Device Details: Must match your hardware, e.g., “Wireless Controller for Cloud”

Writing the Template

- + Use standard IOS-XE commands.
- + Optionally, insert variables (e.g., `{{ my_hostname }}`, `{{ channel_id }}`) for dynamic values.
- + Variables can be configured for:
 - + Default values
 - + Data type (string, integer, IP, etc.)
 - + Required/optional status

Template Commit and Association

- + Save and commit the template after editing.
- + Must be **attached to a Network Profile**.
- + Network Profile must be assigned to the site/building during device claim for the template to be applied.
- + Will be attached as a DayN Template type
- + Within Network Profile, must be attached as an “Onboarding Template” for PnP use.

Plug-and-Play Process Walkthrough

- + Claim the device
- + Assign to a site
- + Select the template (must appear under “Onboarding Templates” in the network profile)
- + Provide required variables (e.g., hostname, channel ID)
- + Preview the configuration
- + Submit the claim



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Provisioned...or NOT Provisioned?

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Understanding the Problem – Managed ≠ Provisioned

- + Common complaint: “I can’t configure my device in Catalyst Center.”
- + Confusion between "Managed" and "Provisioned" status
- + “Managed” means telemetry only, not configuration
- + Configuration requires full device provisioning

How to Check If a Device Is Provisioned

- + Hover over the “Success” status in the provisioning column
- + Look for “**Device Provisioning**” in the popup
- + If only “Device Controllability and Telemetry” appears
→ **Not provisioned**
- + Only provisioned devices support intent-based workflows

Misleading Signs & Site Assignment

- + Assigning a device to a site \neq provisioning it
- + PnP (Plug-and-Play) may partially provision devices
- + Sync messages like “Provision in progress” can be misleading
- + Site assignment may appear locked even when not fully provisioned

Quick Tests to Confirm Provisioning Status

- + Hover over status → Look for “Device Provisioning”
- + Try to assign device to another site:
 - + If grayed out → possibly provisioned
 - + If not grayed out → definitely not provisioned
- + Device must be discovered and then provisioned
- + Site assignment is only one part of the process



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Essentials of Wireless Assurance in Catalyst Center

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Fast-Track WLAN Deployment Using Cisco Catalyst Center - Summary

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Key Concepts - Recap

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Learning Outcomes Recap

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- + Exposure to Catalyst 9800 WLC Discovery and Onboarding techniques
- + Learn the Differences between Site Assignment & Provisioning

Next Steps

- + Install your own Cisco Catalyst Center in AWS
- + Gain your own hands-on experience with CCC and Catalyst 9800 integration
- + Explore advanced WLAN topics

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