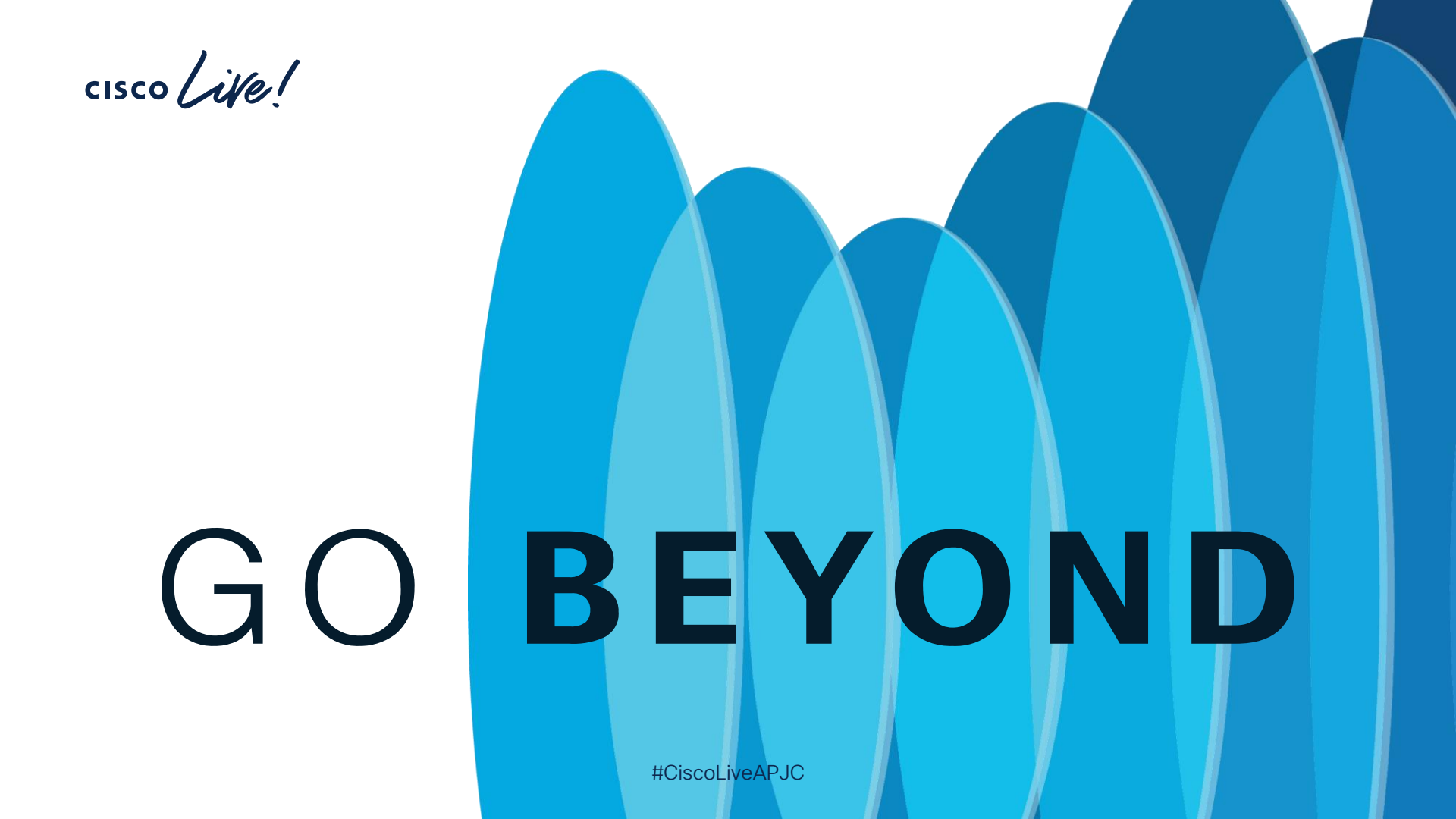
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The Inner Workings of Cisco Catalyst Center Lan Automation

Rahul Kaitharath
Software Engineering Technical Leader
CCIE R&S, DC

LTRENS-2195

Cisco Webex App

https://ciscolive.ciscoevents.com/ciscolivebot/#LTRENS-2195

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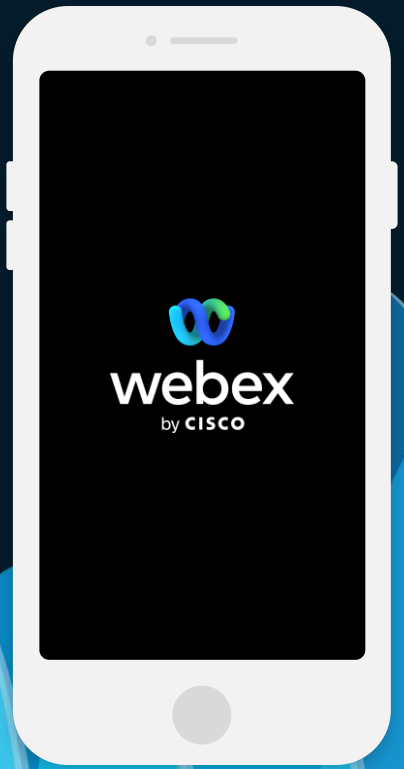

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Agenda

- Introduction
- Lan Automation Overview
- Lan Automation Workflow
- Troubleshooting Lan Automation
- Lan Automation – RoadMap
- Conclusion

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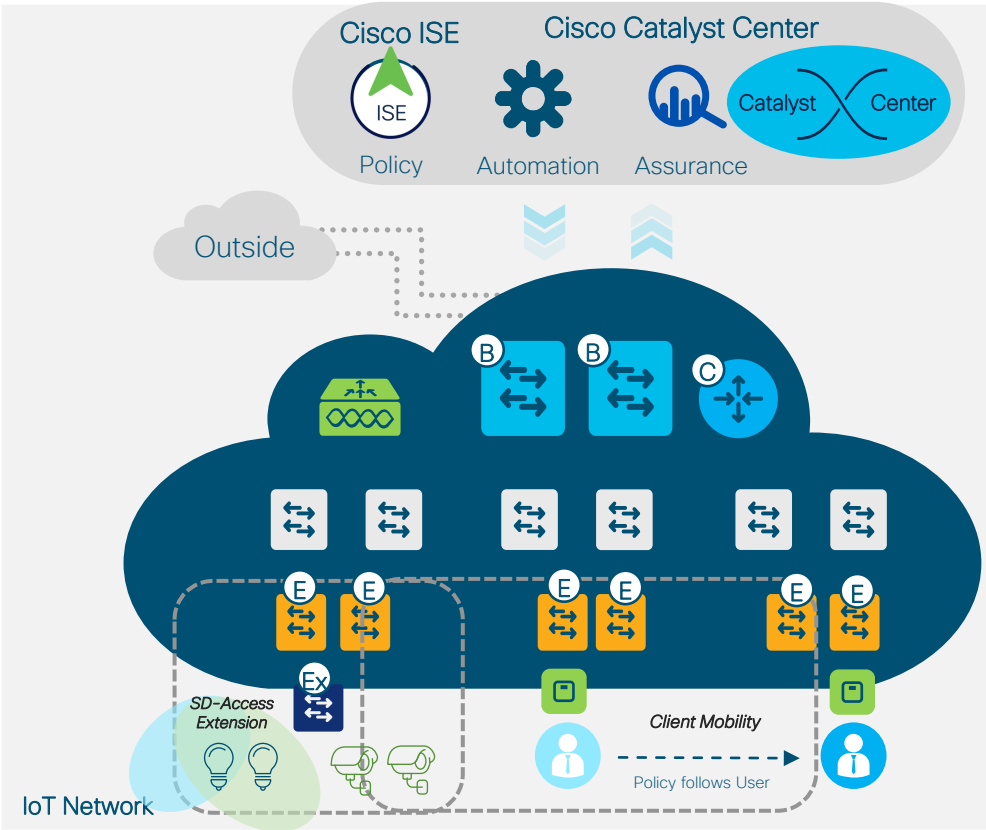
Cisco Software Defined Access

The Foundation for Cisco's Intent-Based Network



One Automated Network Fabric

Single fabric for Wired and Wireless with full automation

Identity-Based Policy and Segmentation

Policy definition decoupled from VLAN and IP address

AI-Driven Insights and Telemetry

Analytics and visibility into User and Application experience

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Cisco Catalyst Center
Device Onboarding options

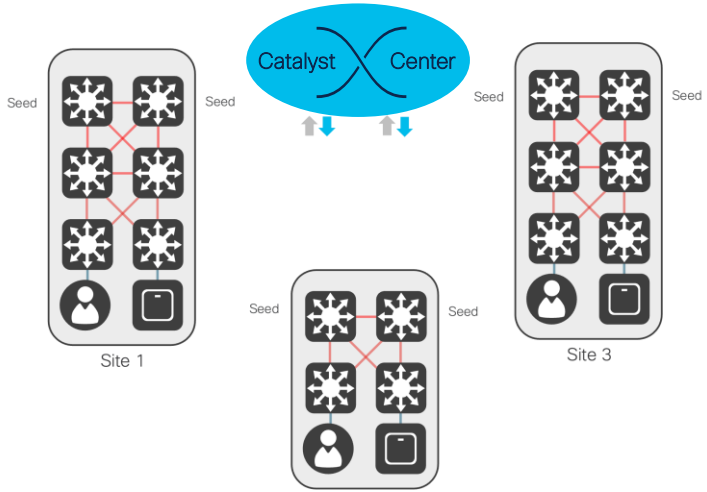
Manual | Semi-Automated Underlay

Device-by-Device onboarding and configuration either manually or through Cisco Plug-and-Play.

Automated Underlay(Lan Automation)

Turnkey solution to onboard multiple switches with image management and best-practices configuration.

Underlay multicast to optimise overlay subnet multicast/broadcast distribution



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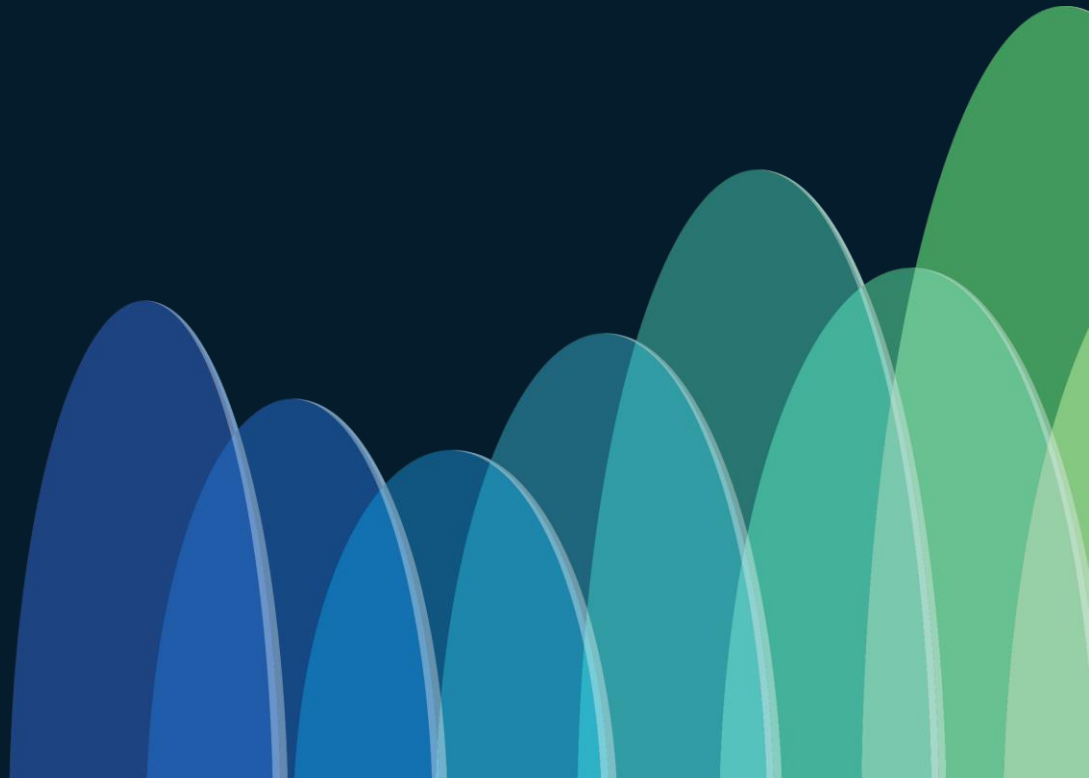
Lan Automation Overview



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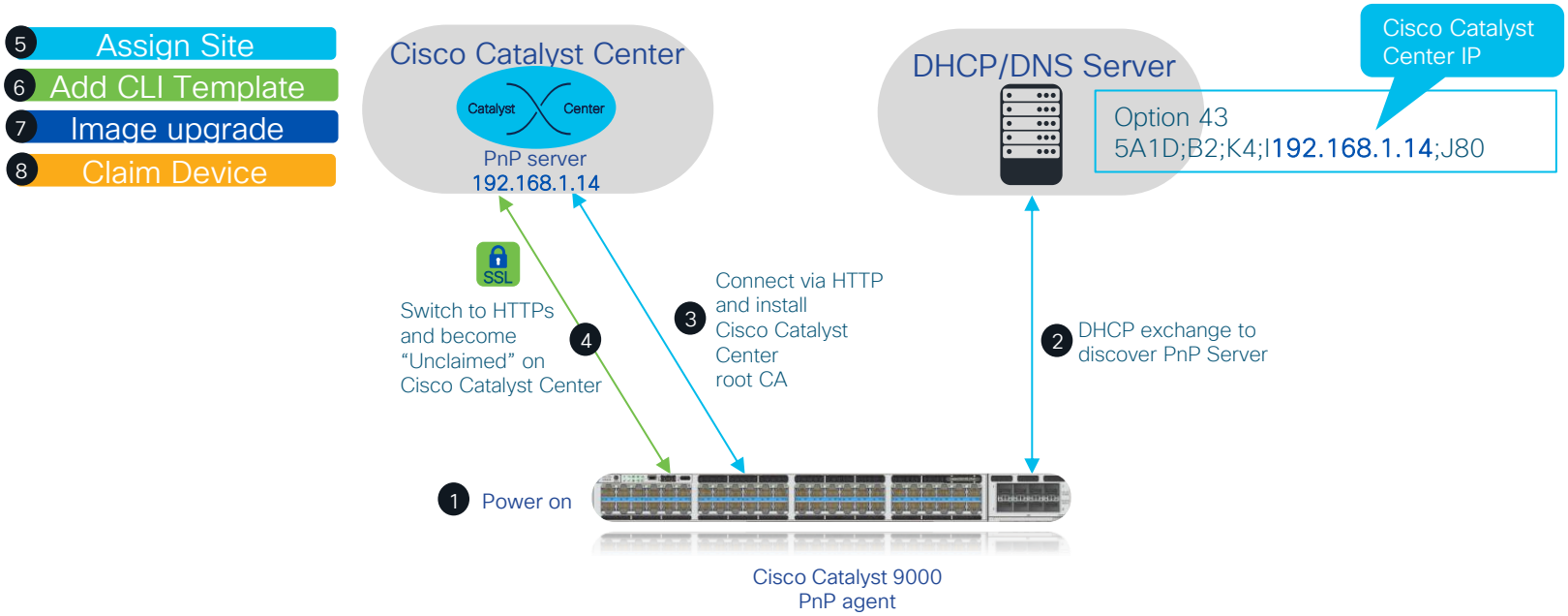
Cisco Plug and Play



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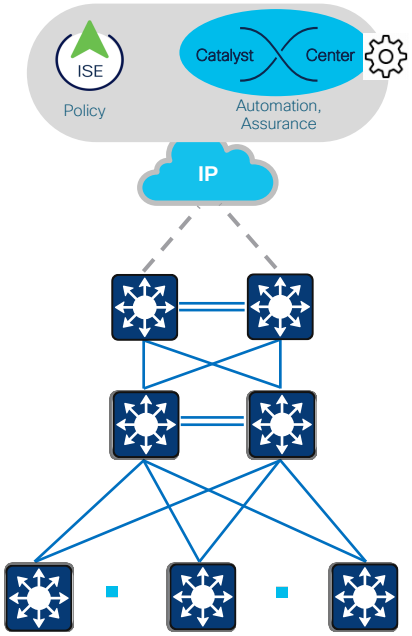
What is Lan Automation



Traditional Networks

Layer 3
Layer 2

Lan Automation

- Simplifies network operations
- Frees IT staff from time-consuming, repetitive network configuration tasks
- Creates a standard, error-free underlay network

Lan Automation Benefits

- Zero-touch provisioning
- End-to-end topology
- Resilience
- Security
- Compliance

Seed
PnP Agent
Layer 3
Layer 2
LAN Automation Boundary

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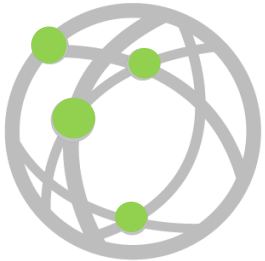
Lan Automation Overview
Simplified Procedure

Cisco Lan Automation Workflow – 4 Step Process

Planning

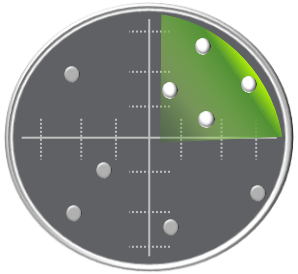
- Lan Automation Roles
- Supported Switches
- Site/IP Pool Planning

Design



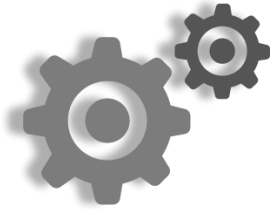
- Build Network Hierarchy
- Global network services
- Design IP Address Pools

Discover



- Discover Network devices
- Physical Topology
- Network Readiness

Provision



- Dynamic automation
- Optimised routing design
- Resilient underlay settings

SD-Access Ready Network

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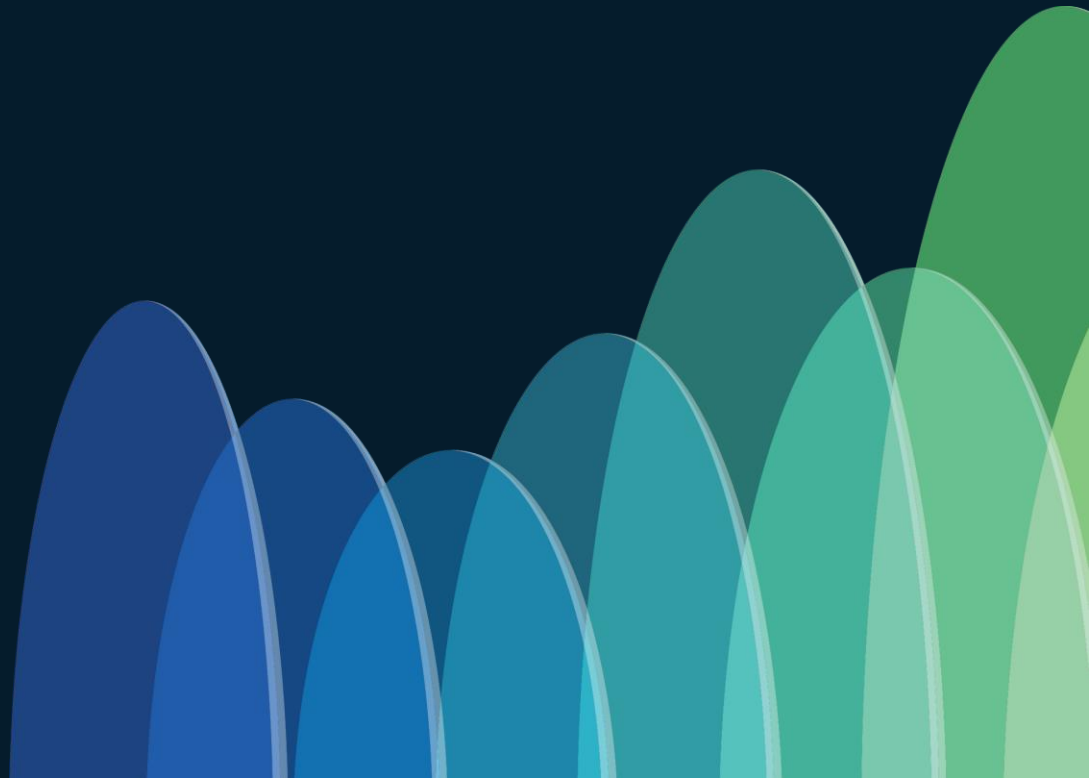
Lan Automation Workflow



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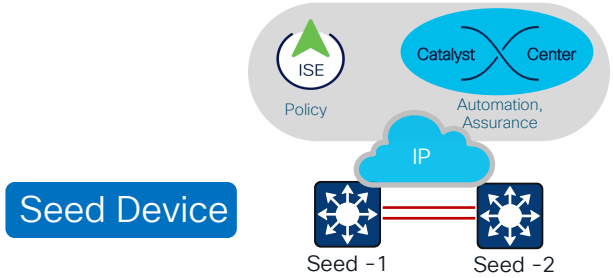
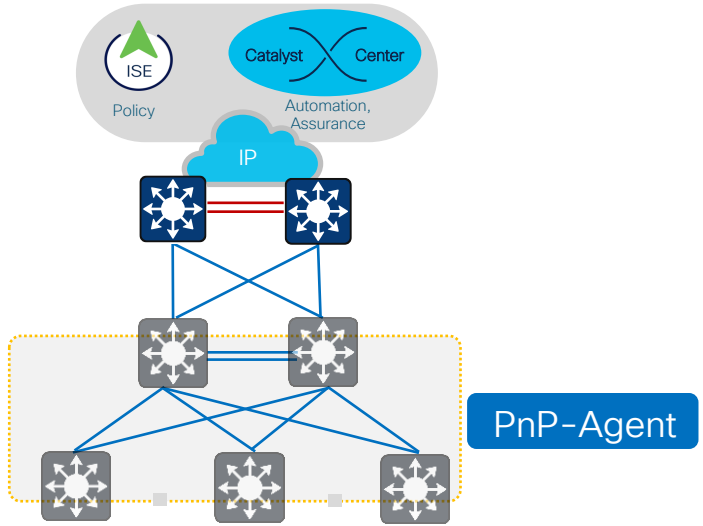
Lan Automation – Planning
Understanding Device Roles





Seed Device

Intermediate system(s) between Core and new network block

Key system to discover, automate and on-board new Catalyst switches in network

Device can be automated using Cisco PnP or configured Manually

Only one Seed is required, Device discovery happens only on the primary seed device interfaces

Peer Seed(Seed-2) can be Lan automated.

PnP-Agent Device

Catalyst switch* with factory-default settings and waiting at startup-wizard state

Interconnect between Seed and another PnP-Agent device in the network

License Auto Upgrade – Catalyst Center release 2.3.5 onwards

Seed
PnP Agent
Layer 3
Layer 2
LAN Automation Boundary

* - C9K or C3850

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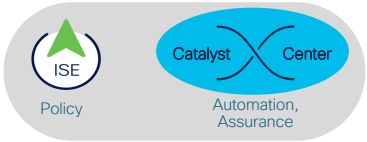
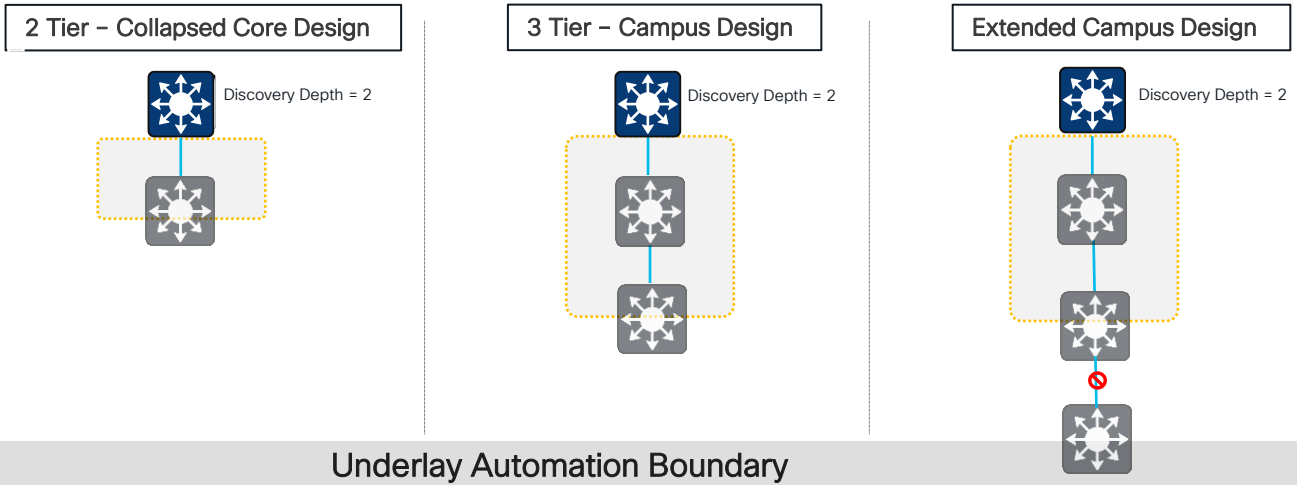
*Catalyst Center: 2.3.7.x

Lan Automation – Planning

Automation Boundary





Underlay Automation Boundary

Maximum Automation boundary(**Discovery Depth**) from Seed Device: 1 to 5 (Default: 2)*

Supporting common hierarchical and structured Enterprise network designs

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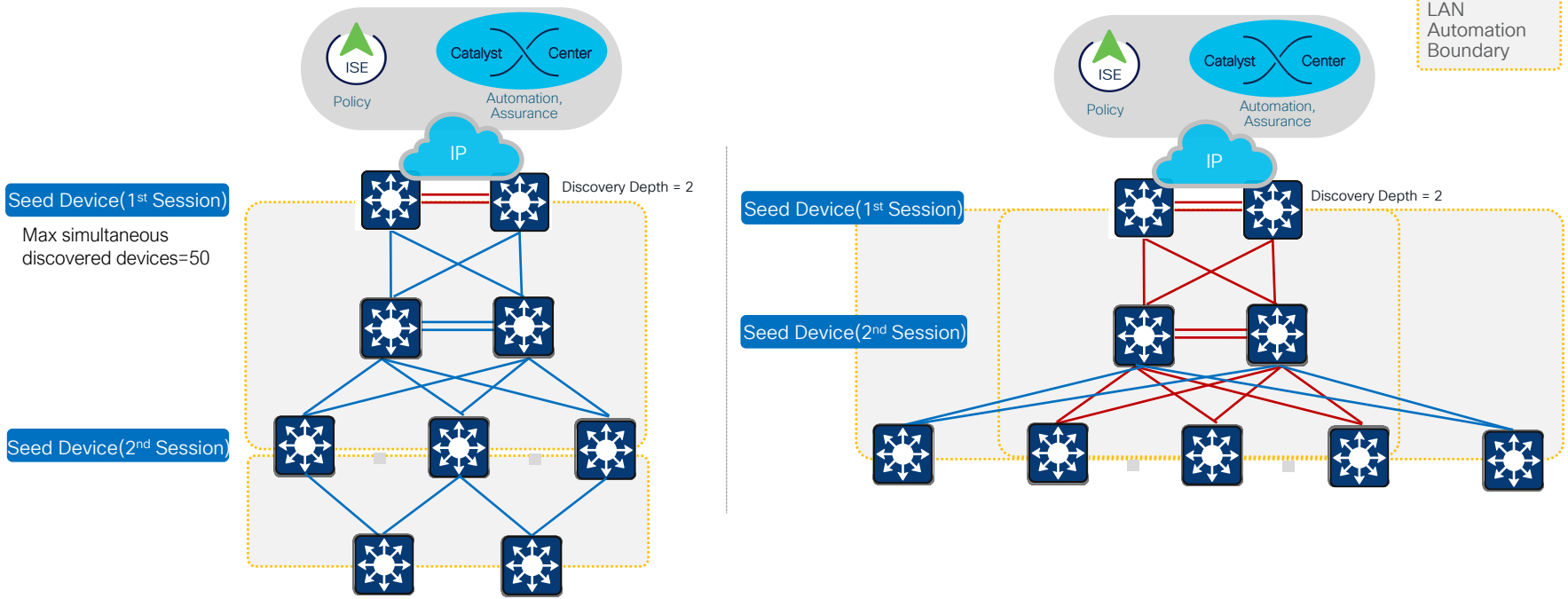
Lan Automation – Planning
Multistep for Large Topologies



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Lan Automation – Planning

Pre-Requisites

- **Seed Device:** Interface to PnP Agents should be defaulted
- Seed devices are reachable to Catalyst center, discovered and assigned to Site Hierarchy.
- PnP Agents are FACTORY DEFAULTED, running ADVANTAGE license and booted in INSTALL Mode
- Minimum Lan Automation IP Pool /29

Constraints

- No Automation of StackWise Virtual (SVL) switch. SVL switch can only be used as a seed device.
- No support for stack renumbering.
- For platform support, see Supported Switches for Each Role at Different Layers.
- Not supported on Switch dedicated management port

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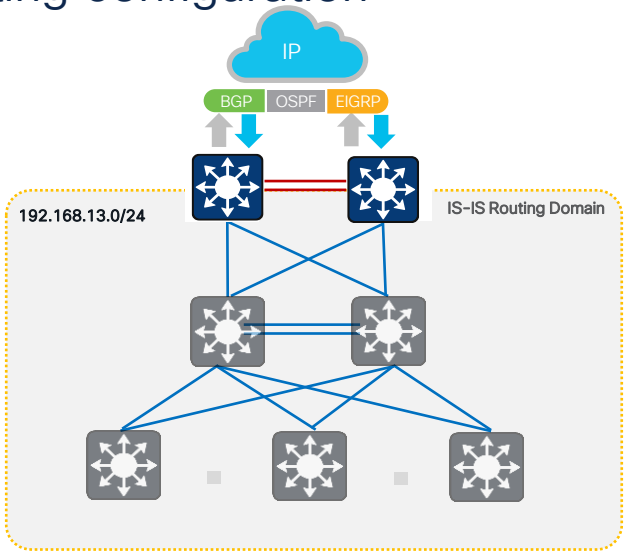
Lan Automation – Planning
Seed Switches IP Routing configuration

Seed Device
Manual Configuration for discovery

- Loopback IP *
- Login Credentials
- SNMP Commands
- MTU *
- Line VTY Commands
- IP Routing
- Northbound
  - Routing Protocol
  - Interface configs
- Netconf-yang
- Domain Name
- SSH



BGP

```
router isis
  redistribute BGP <as_number> route-map <name>
!
ip route 192.168.13.0 255.255.255.0 Null0 250 *
!
router bgp <as_number>
Network 192.168.13.0 *
```

OSPF

```
router isis
  redistribute ospf <id> metric <count>
!
router ospf <id>
  redistribute connected route-map <name>
  summary-address 192.168.13.0 255.255.255.0
```

EIGRP

```
router isis
  redistribute eigrp <id> metric <count>
!
interface <id>
  description CONNECTED TO CORE
  ip summary-address eigrp <AS> 192.168.13.0 255.255.255.0
```

Automated IS-IS Routing Configuration

Optional if IS-IS routing protocol in Core

Automates IS-IS routing process configurations on Seed and each PnP-Agent systems. No manual configuration required.

Programs default-route injection on **SELECTED** Seed Device for global network reachability

* - Configured as part of Seed Provisioning

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Lan Automation – Planning
IP Pool Planning

IP Pool Type and Usage

Roles	Mandatory	Pool Type	Usage
Main/Principal IP Pool	Yes	LAN	Temp DHCP Pool* Loopback(/32) P2P L3 Links(/31)* Multicast
Link Overlapping IP Pool	No	LAN	Temp DHCP Pool P2P L3 Links(/31)

IP Pool Allocation Logic

Allocation Logic	TEMP Pool	Rest of the Pool
Less than /21	/23(512 IPs)	Loopback(/32) P2P L3 Links(/31)* Multicast
/24	/26(64 IPs)	Loopback(/32) P2P L3 Links(/31)* Multicast

IP Pool Usage Example

Allocated Pool	Total Devices to Automate	No of Uplinks	TEMP DHCP Range	Loopback Range	P2P Range	Total IP's
Main/Principal IP Pool 192.168.13.0/24	10	2 (one each to Primary and Secondary Seed)	First /26 (192.168.13.1 to 63)	Next /27 (192.168.13.65 to 94)	Remaining IPs (192.168.13.96 to 254)	10 – Temp DHCP(Released upon completion) 10 – Loopback 40 – P2P Uplinks

* – Link Overlapping IP Pool not provided

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Lan Automation – Design
Configuration Summary

Optional	Integrate Cisco Catalyst Center and Cisco ISE
Step-1	Build Network Hierarchy based on geographic locations
Step-2	Configure Network Services – Global | Area | Site level
Step-3	Configure Network Address Range – Global | Area | Site level
Step-4	Configure LAN IP Pool from Parent – Global | Area | Site level

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Lan Automation – Discovery
Configuration Summary

Step-1 Build Discovery Profile to discovery both Seed Devices

Step-2 Assign Discovered devices to Site

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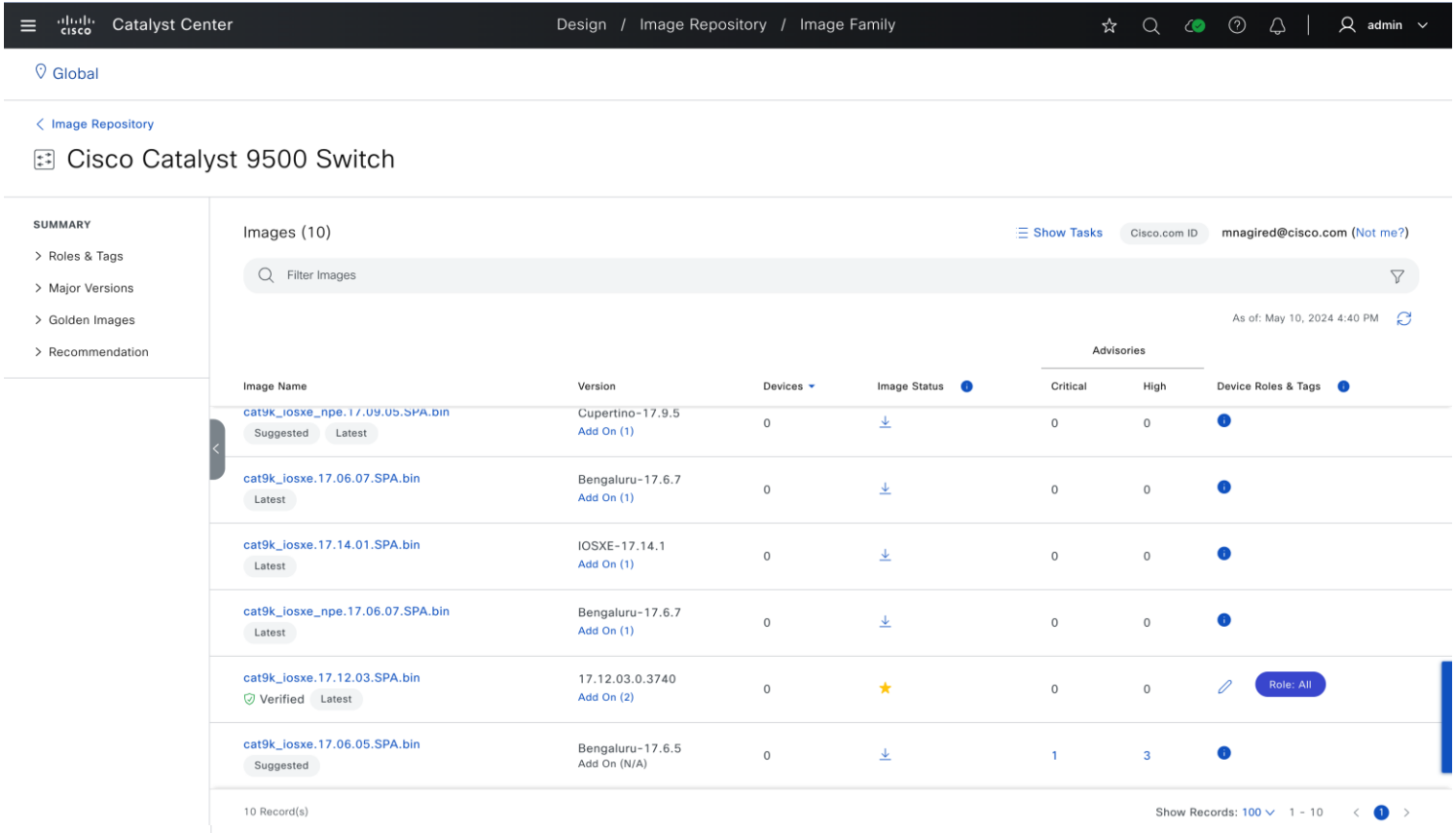
Lan Automation – Provision

Golden Image Download



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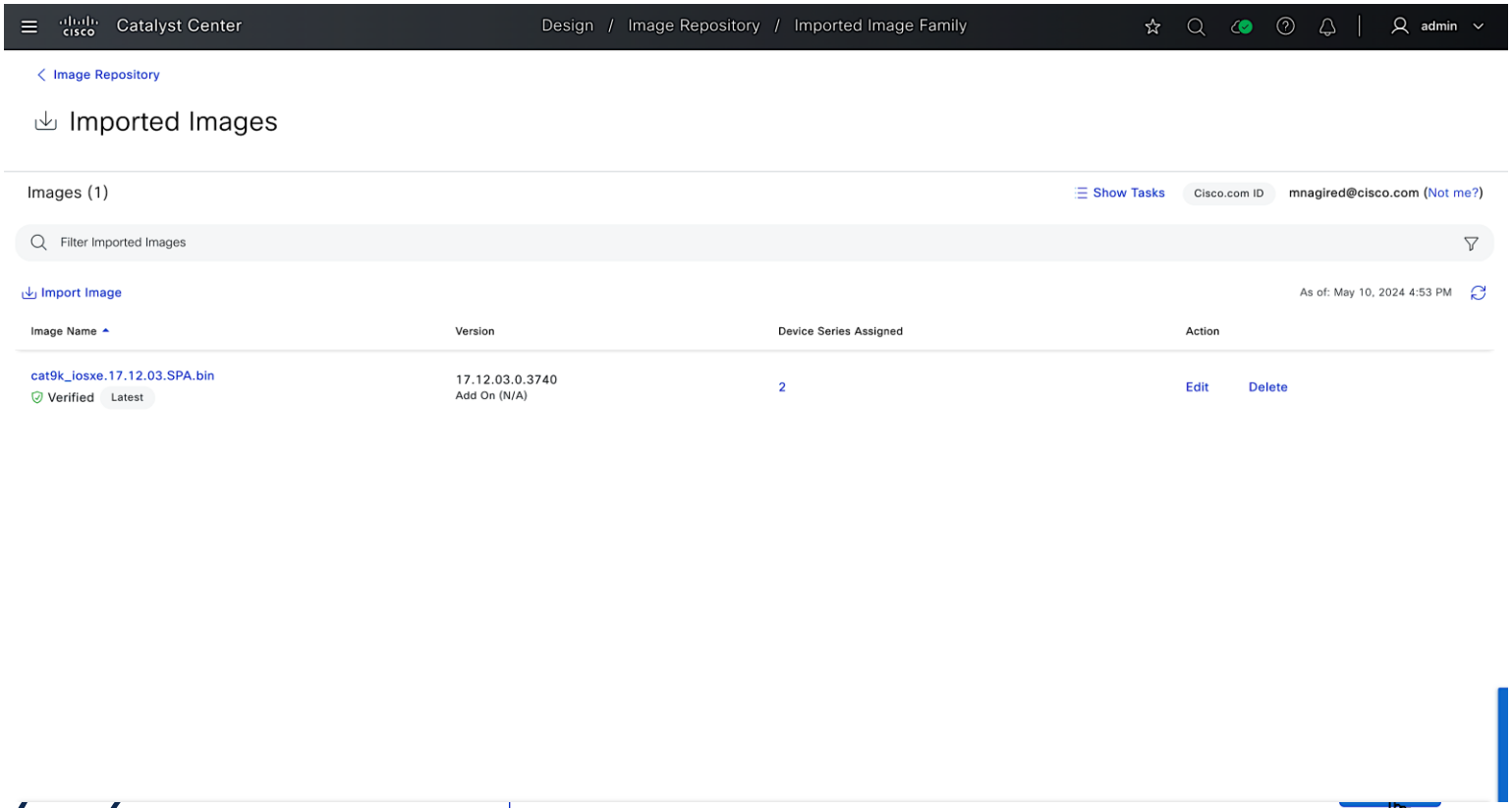
Lan Automation – Provision
Golden Image Selection for PnP Agent Devices



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Lan Automation – Provision

Switch Factory default

Restore the switch configurations to factory default using the following commands:

- For Cisco IOS XE 16.11 and earlier, use:

  [CLI config mode]

  ```
  no pnp profile pnp-zero-touch
  no crypto pki certificate pool
  crypto key zeroize  (remove any other crypto certs)
  config-register 0x2102 or 0x0102  (if not already)
  do write
  end
  ```

  [CLI exec mode]

  ```
  delete /force nvram:*.cer
  delete /force stby-nvram:*.cer (if a stack)
  delete /force flash:pnp-reset-config.cfg
  write erase
  reload (enter no if asked to save)
  ```

- For Cisco IOS XE 16.12.x or later, use:

  [CLI exec mode]

  ```
  pnp service reset no-prompt
  ```


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Lan Automation – Provision
Configuration Summary

Pre-Req	IP Pool Subnet Reachability from Catalyst Center Unplug Management port Ensure Seed Ports are layer 2/defaulted Ensure PnP Devices are not present in the Inventory
Step-1	Start Underlay Network discovery and automation
Step-2	Stop Underlay Network discovery and automation
Step-3	Provision Global Network services
Step-4	Designate System role to build structure network topology

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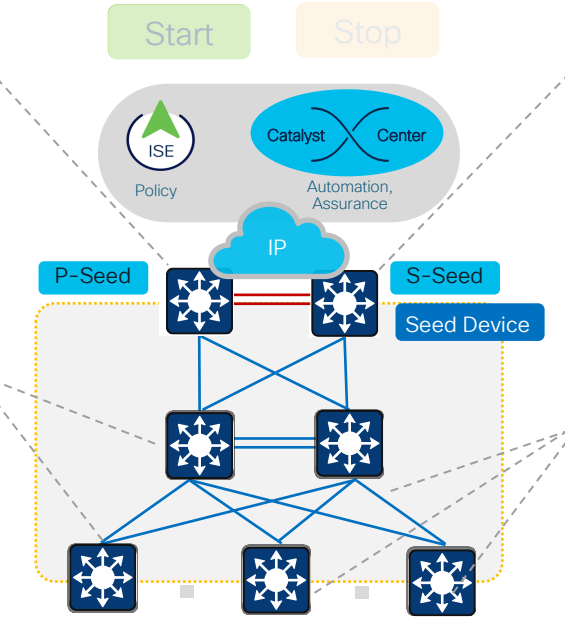
Lan Automation – Provision

- Loopback0
- MTU(9100)
- Routing Protocol: ISIS
  - ISIS Type: Level 2*
  - Default Info Originate
- **BGP Advertisement**
- **DHCP Pool**
- Interface vlan 1
- Loopback 60000**
- RP_address**
- Multicast Routing**
- PIM**
- MSDP*

- **No DHCP Pool**
- No Interface vlan 1
- P2P Links
- Disable CTS Enforcement***



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- **No DHCP Pool**
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- P2P Links
- Disable CTS Enforcement***

- Certificates
- Loopback0
- Routing Protocol: ISIS
  - ISIS Type: Level 2*
- SSH
- IP Routing
- VTP- Transparent
- Rapid-pvst
- Error disable Recovery
  - SNMP
- MTU 9100
- BFD
- Local Credentials
- Hostname
- RP_address**
- Multicast Routing**
- PIM**

- No Interface vlan 1
- P2P Links
- Disable CTS Enforcement***

- Certificates
- Loopback0
- Routing Protocol: ISIS
  - ISIS Type: Level 2*
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- PIM**

- No Interface vlan 1
- P2P Links
- Disable CTS Enforcement***

* Starting Catalyst Center 2.3.3
** With Underlay Multicast Enabled
*** Starting Catalyst Center 2.3.7.5

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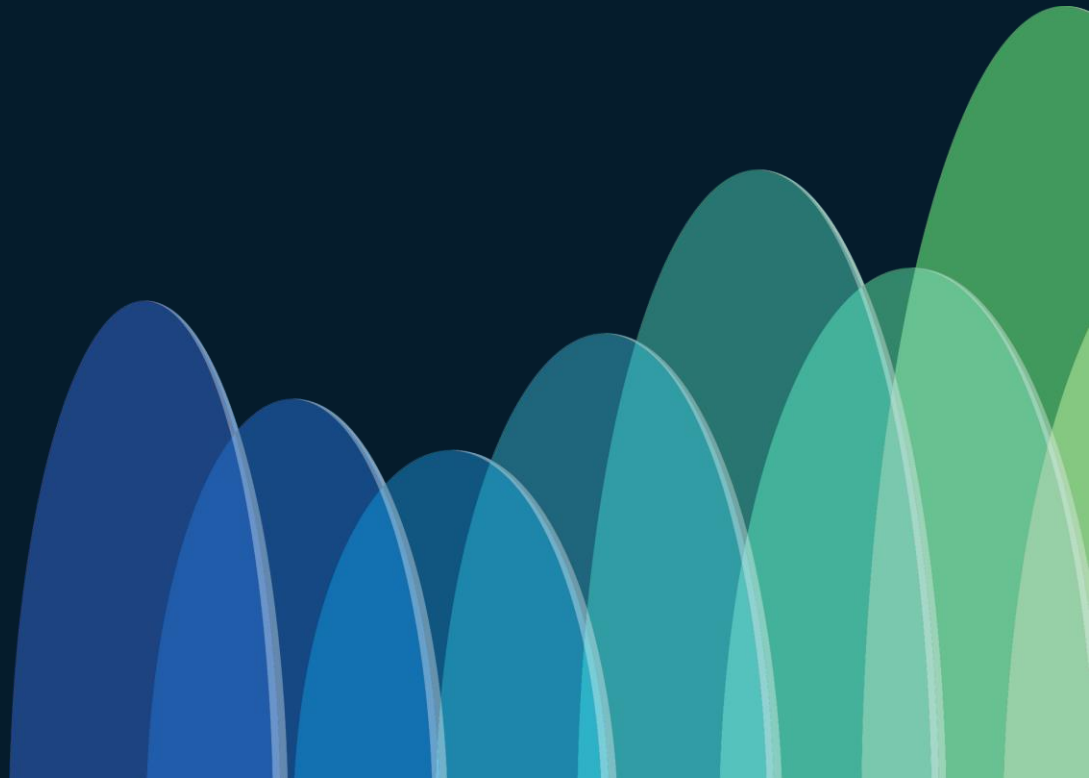
Troubleshooting Lan Automation



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Trouble Shooting Lan Automation

- IP Pool Subnet reachability from Cisco Catalyst Center
- Static Route addition for LAN Pool
- Un-plug the management port
- Seed ports must be Layer 2
- Device being discovered (PNP-agent) should not be present in Inventory
- Device being discovered should (PNP-agent) not be present in PnP database
- Correct License Level configured in the PNP agent.
- Ensure PNP-agent is in INSTALL mode for image upgrade to take place during Lan automation

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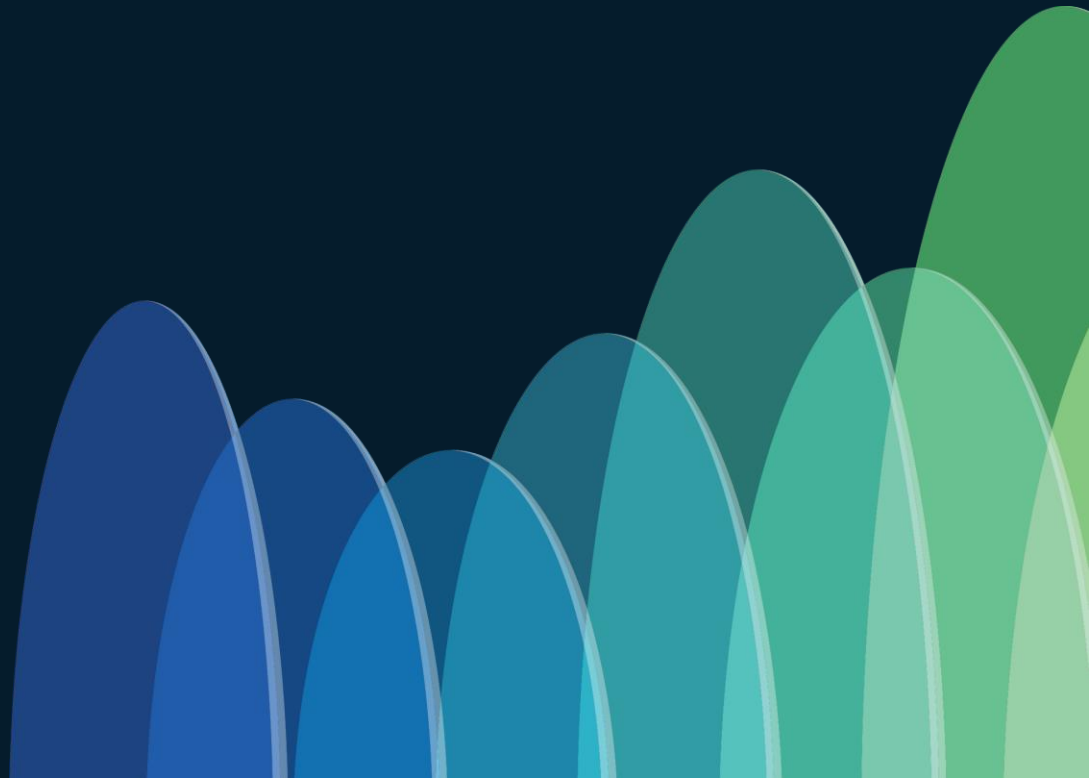
Lan Automation - RoadMap



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Lan Automation Enhancements

LAN Automation Enhancements 2.3.5.0

- Dedicated LAN Automation landing page
- 5 Simultaneous LAN Automation sessions with one session per site
- Day N Add or Delete L3 links

LAN Automation Enhancements 2.3.7.0

- Workflow now support /27,/28 and /29 LAN pools
- Deterministic of loopback IP addresses(Day 0 & Day N*)

LAN Automation Enhancements 2.3.7.5

- Discovery depth level for LAN automation(Default depth=2)
- Session Attributes
    - Session Timeout
    - Device Matching
        - Relaxed
        - Strict

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Demo

Complete Your Session Evaluations

Complete a minimum of 4 session surveys and the Overall Event Survey to claim a **Cisco Live T-Shirt**.

Complete your surveys in the **Cisco Live mobile app**.

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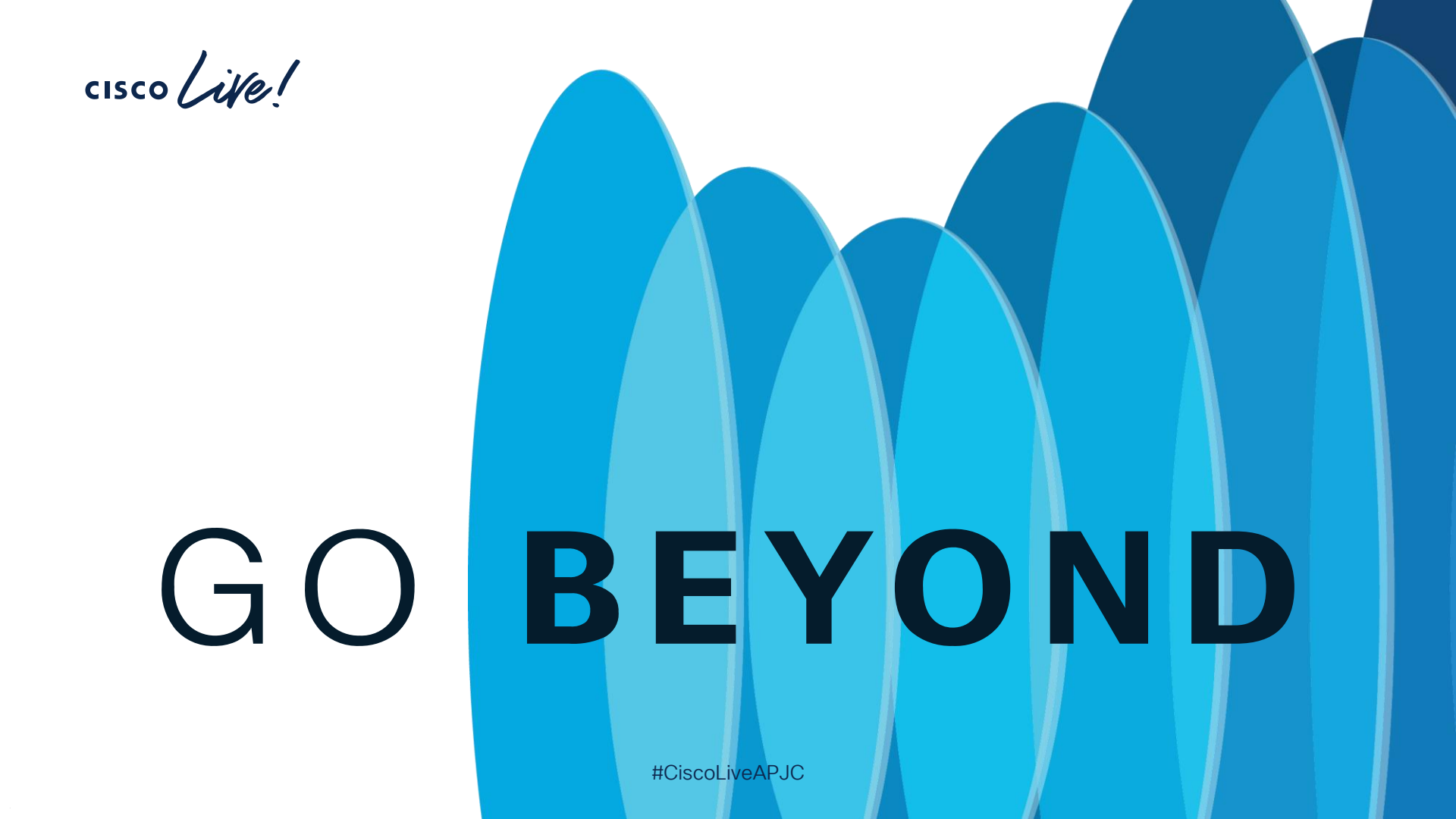
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