Automation and Management with Catalyst Center APIs

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1 Introduction and lab objectives

2 Catalyst Center deep dive

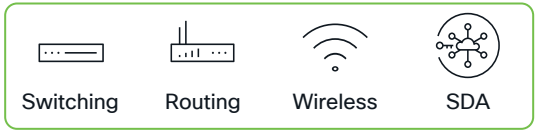
3 Lab introduction

4 CatC APIs 100-200 level with Postman collections

5 CatC APIs 300-400 level using jupyter notebooks and python

Catalyst Center Headless Deployments

The complexity to operate large networks



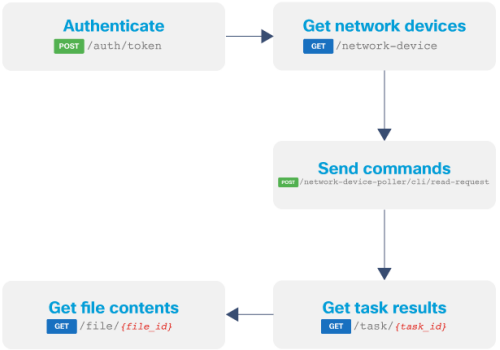

```
!
Router# show running-config
Building configuration...


Current configuration : 5980 bytes
!
! Last configuration change at 13:56:48 PST Fri Nov 3 2017 by admin
!
version 16.6
service timestamps debug datetime msec
service timestamps log datetime msec
service call-home
platform qfp utilization monitor load 80
no platform punt-keepalive disable-kernel-core
platform shell
!
hostname Router
!
boot-start-marker
boot system tftp /auto/tftp-sjc-users5/c1100-universalk9_ias.16.06.02.SPA.bin 223.255.254.254
boot-end-marker
!
!
vrf definition VRF-example
 description VRF-example
!
no logging console
!
aaa new-model
!
!
!
aaa login success-track-conf-time 1
!
!
!
!
aaa session-id common
```

```yaml
- name: Check the running-config against master config
  cisco.ios.ios_config:
    diff_against: intended
    intended_config: "{{ lookup('file', 'master.cfg') }}"

- name: Check the startup-config against the running-config
  cisco.ios.ios_config:
    diff_against: startup
    diff_ignore_lines:
      - ntp clock .*

- name: Save running to startup when modified
  cisco.ios.ios_config:
    save_when: modified
```



The complexity to operate large networks

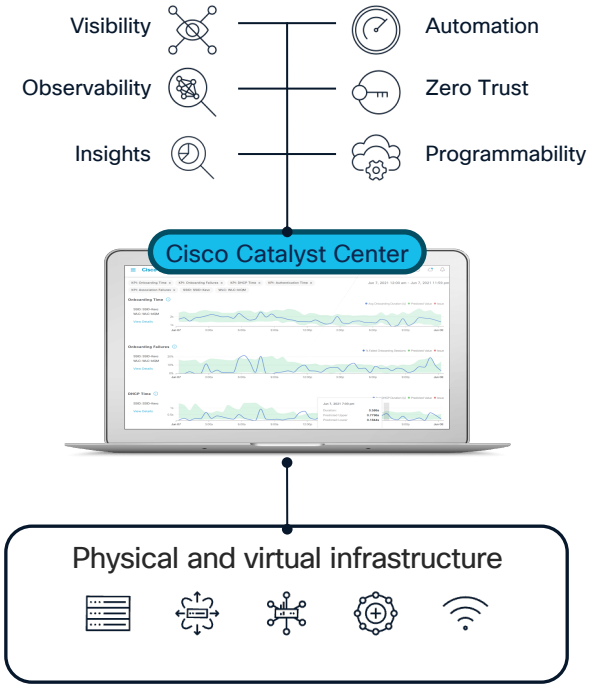
Pros and Cons

	IOS XE CLI	IOS XE Ansible Collection	Cisco Catalyst Center APIs
Day 0	✔✔✔✔✔ Fine configuration Prone to human errors	✔✔✔✔✔ IaC, CI/CD pipelines Requires more expertise	✔✔✔✔✔ API Platform Single tenant
Day 1	✔✔✔✔ Data rich Requires additional infra	✔✔✔ Leverage community Prone to errors	✔✔✔✔✔ Extensive integration Requires more coding
Day 2	✔✔✔✔ Information rich Complex to troubleshoot	✔✔ Leverage community Not ready for Day 2	✔✔✔✔✔ Event management Requires more coding
Complexity [1]	Very complex	Mid complexity	Low complexity
IDEAL Team size [2]	10-15 engineers	5-7 engineers	3-5 engineers

REALITY CHECK: We operate with reduced teams

Catalyst Center simplifies network operations

Enabling IT admin to deliver business outcomes, smarter and faster at scale



Small teams' productivity increase through automation

NetOps — Increase Scale

- Providing customers with business resiliency, continuity, and quick time to value
- Enabling customers to achieve Compliance of network with config policies
- Automation to simplify the creation and maintenance of customers networks

SecOps — Improved Security

- AI-driven security to classify endpoints and enforce security policies for a complete zero trust workplace solution
- Automate end point visibility, classification, and grouping

DevOps — Improved Service Delivery

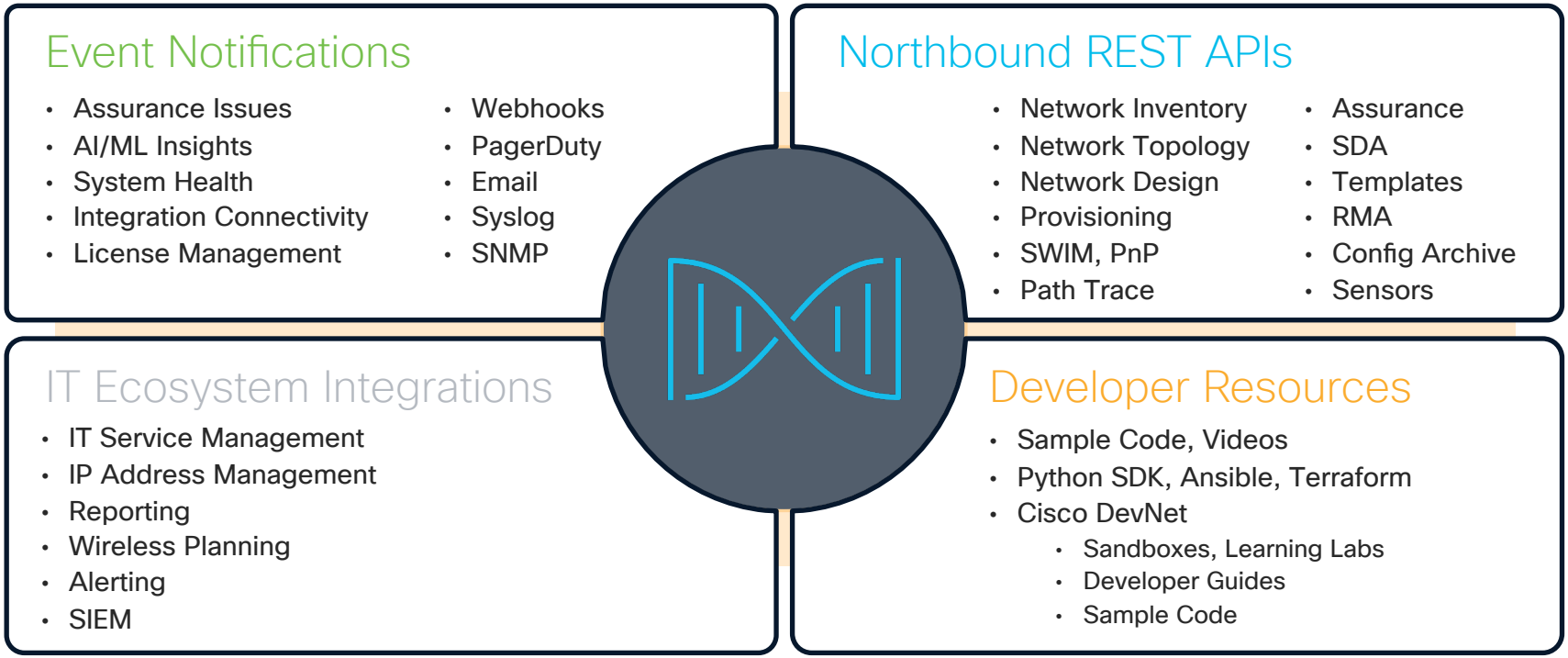
- Mature APIs, SDKs, and closed-loop integrations to simplify and streamline ecosystem integration
- Faster service delivery using API-based automation workflows
- Early issue detection and integration with 3rd party platforms through enhanced notification channels

AIOps — Improved Performance Insights

- Reduced proactive problem resolution through faster Root Cause Analysis
- AI-driven visibility, observability, insights, and troubleshooting to ensure the health your customers applications, infrastructure and user experience

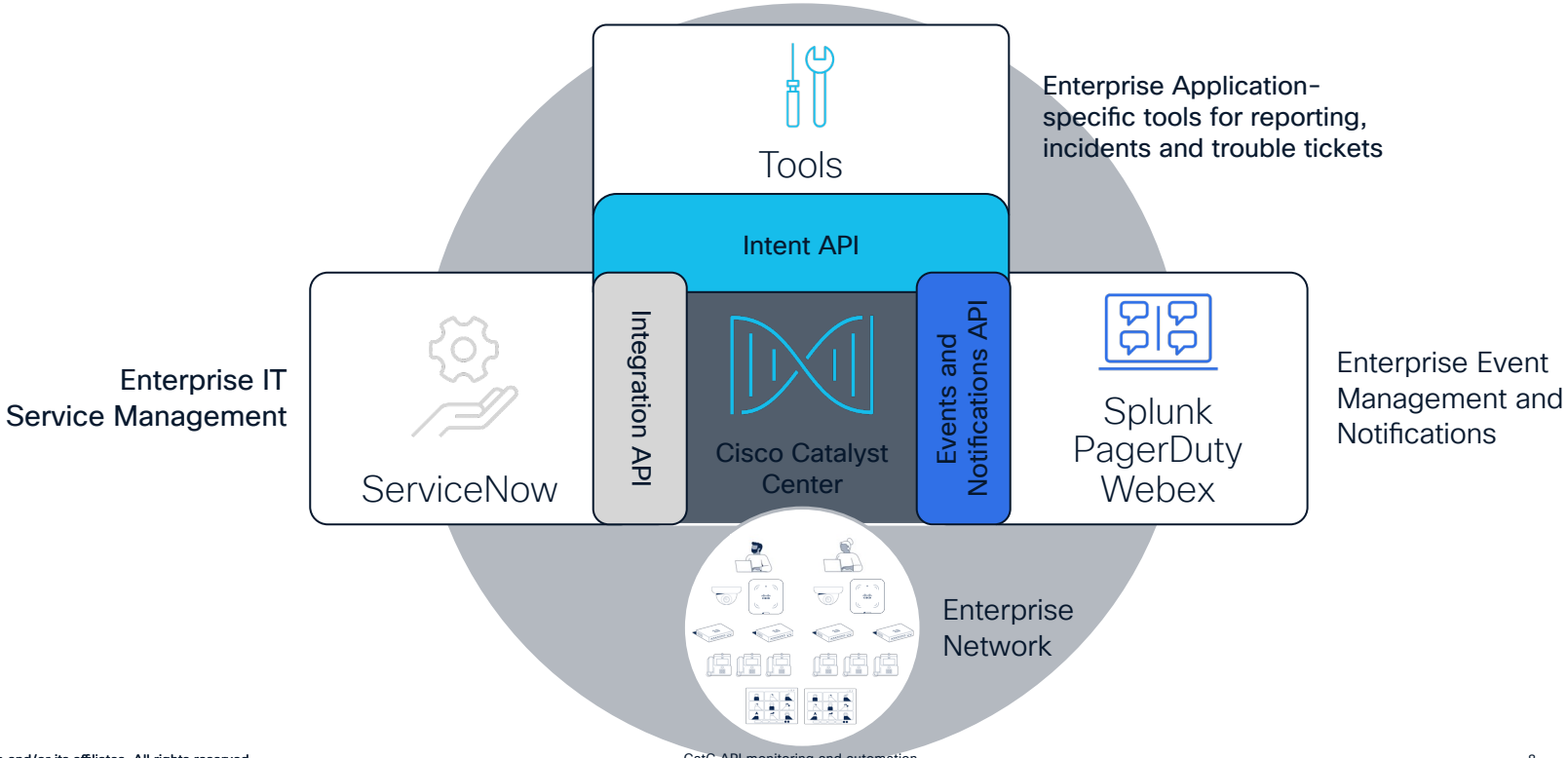
Catalyst Center as a platform

Powered for headless integration



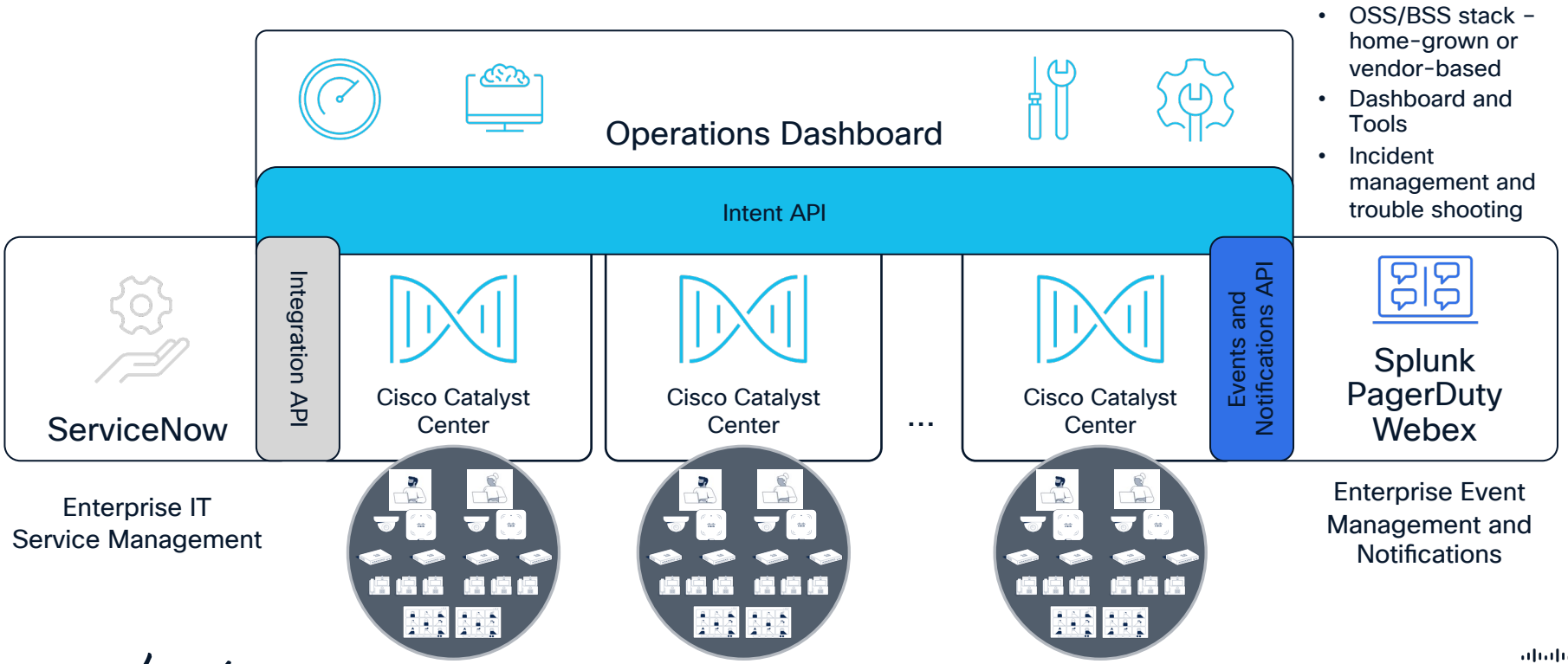
Cisco Catalyst Center enterprise architecture

Align to ITIL framework



Cisco Catalyst Center architecture

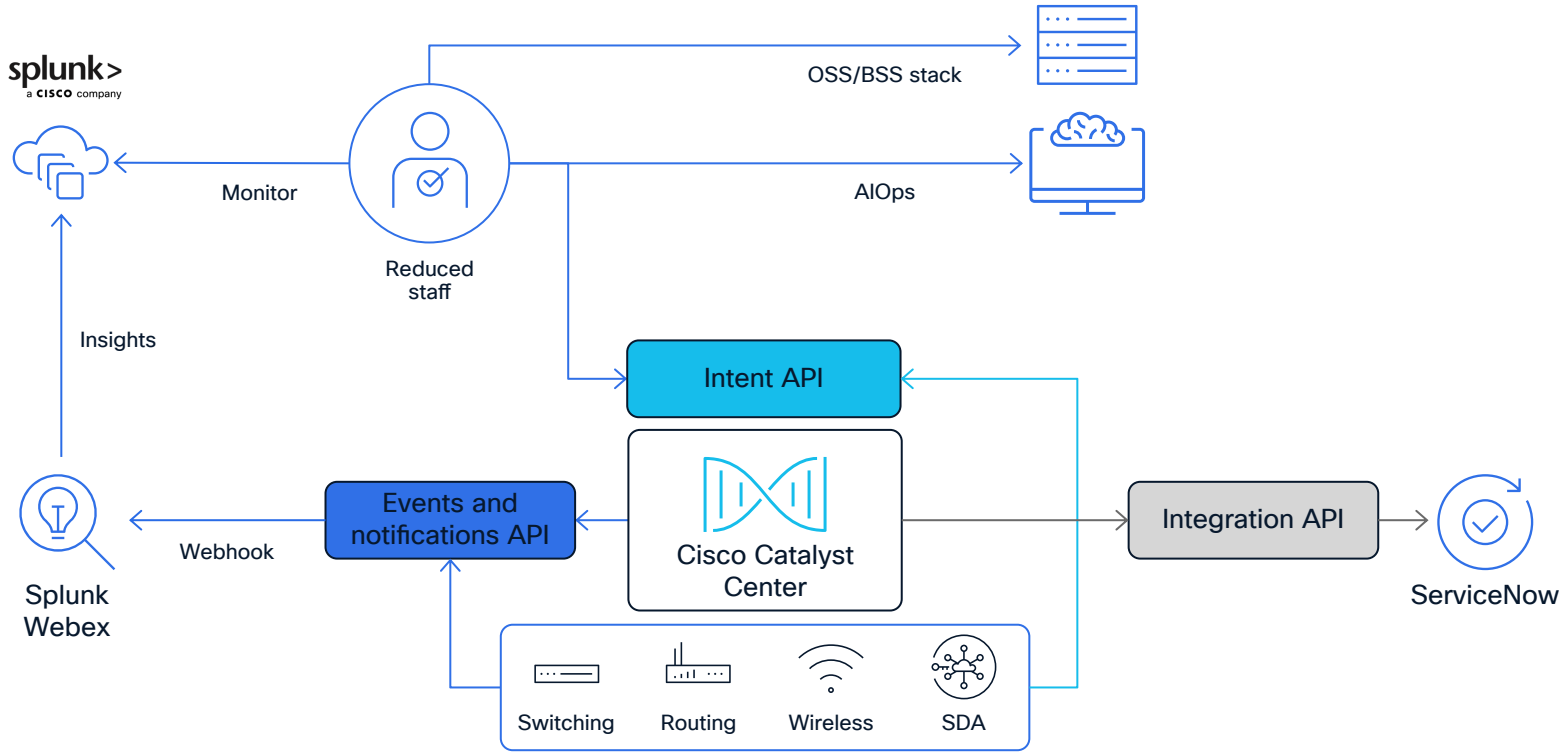
Headless operations: operate Catalyst Center at scale



- OSS/BSS stack – home-grown or vendor-based
- Dashboard and Tools
- Incident management and trouble shooting

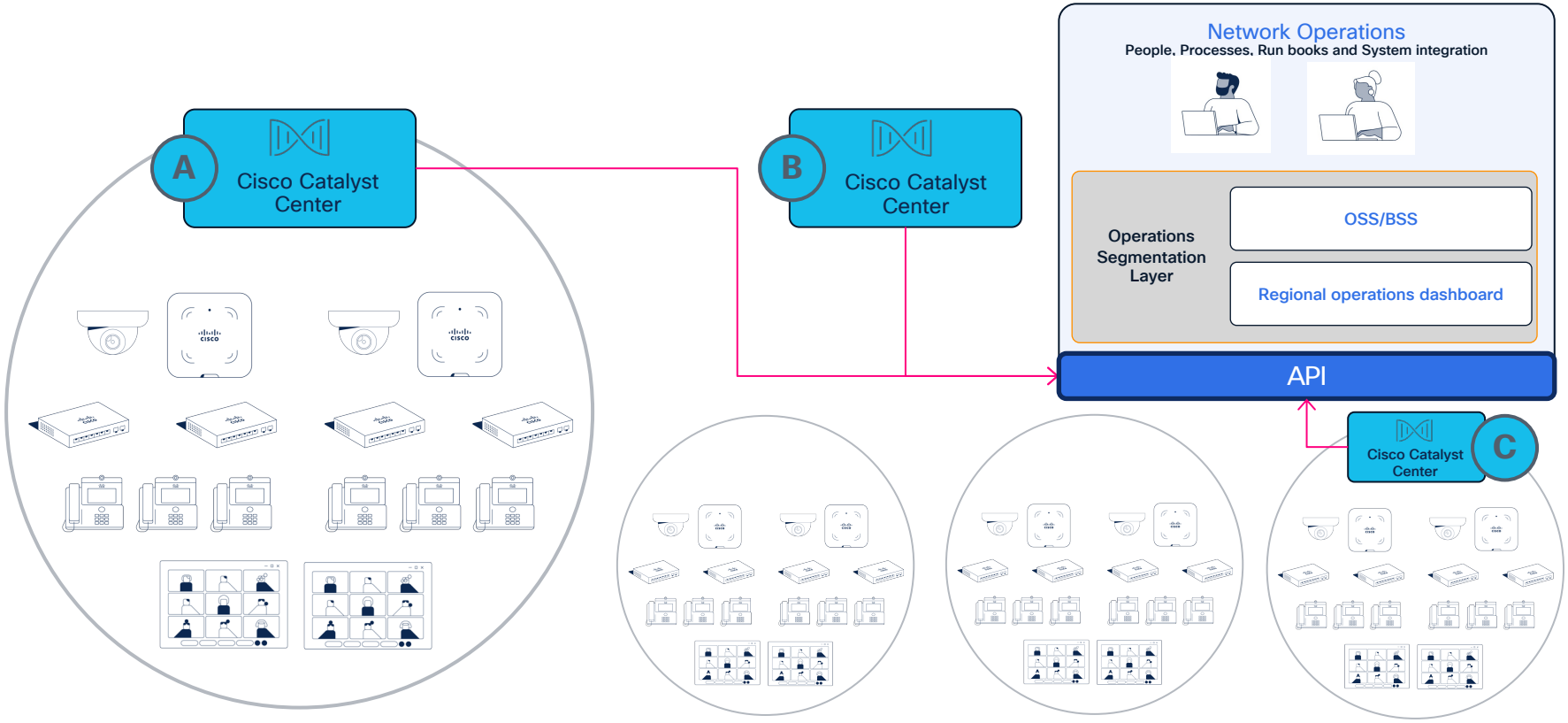
A high-level view

Catalyst Center headless deployment example



Catalyst Center APIs

What a headless scenario looks like



Cisco Catalyst Center API platform

Event and Notifications API

Provides a notification handler when specific events are triggered, such as Network Assurance and Automation (SWIM) events.

Enables external systems to take actions in response to an event: execute a software upgrade action in response to an out of compliance notification of network devices

Notifications may also be triggered by internal Catalyst Center events. For example, Assurance events can be customised for IT Service Management incidents.

Intent API

The Intent API is a REST API that exposes specific capabilities of the Cisco Catalyst Center platform.

Provides policy-based abstraction of business intent, allowing focus on an outcome rather than struggling with individual mechanisms steps.

The RESTful Cisco Catalyst Center Intent API uses HTTPS verbs (GET, POST, PUT, and DELETE) with JSON structures to discover and control the network.

Integration API

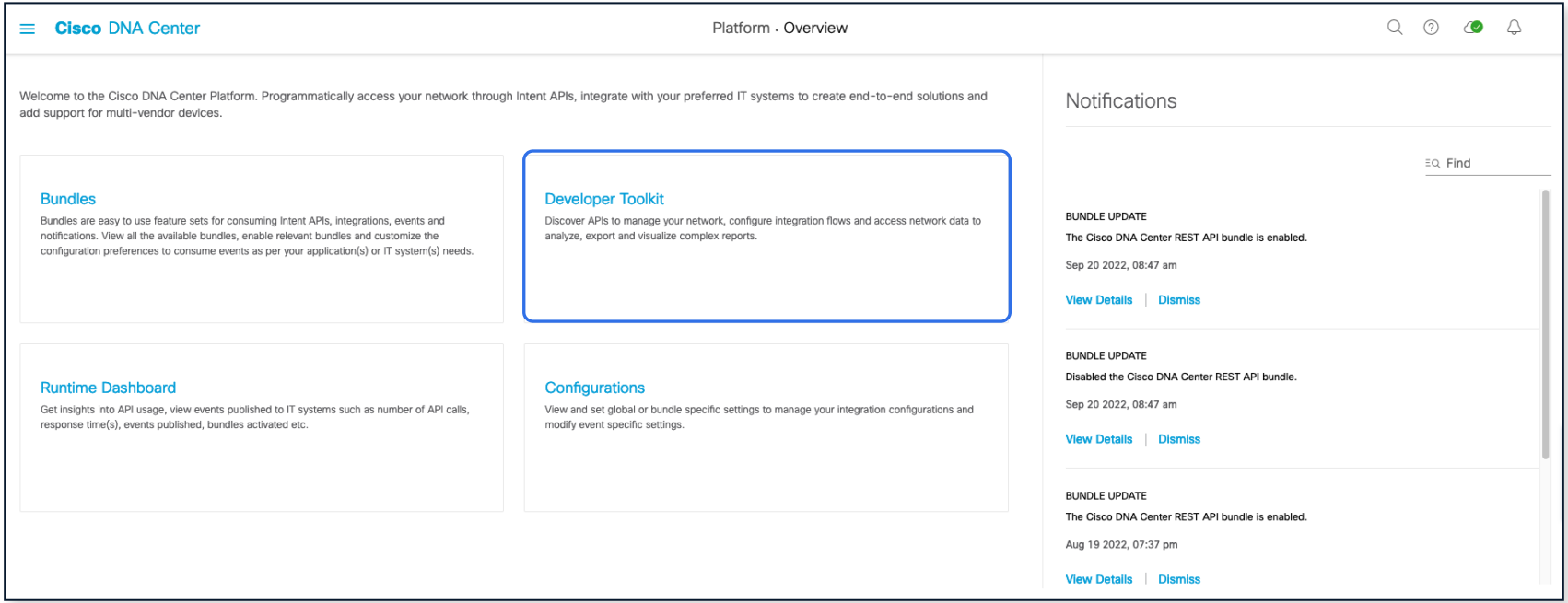
Provides mechanisms for integrating Network Assurance end-to-end workflows and data with third-party IT Service Management (ITSM) solutions.

ITSM integration minimises handoffs, reduces duplication of issues, and optimizes processes such as approval- and pre-approval chains,

Cisco Catalyst Center also Integrates with Reporting and Analytics capabilities for capacity planning, asset management, compliance control, and auditing.

Cisco Catalyst Center

Platform overview



Options for CatC Labs

- DevNet Catalyst Center Sandboxes:
  - https://developer.cisco.com/docs/dna-center/sandboxes/#cisco-catalyst-center-sandbox
- dCloud
  - Cisco Enterprise Networks Hardware Sandbox v4.1 (This lab)

CatC API documentation

- In CatC in the Platform overview
- In DevNet
  - https://developer.cisco.com/docs/dna-center/cisco-dna-center-2-3-7-api-overview/

CatC API way to consume

- Postman collections (the easiest)
- Programming languages:
  - Python (the most popular)
  - Ansible
- Catalyst Center SDKs
  - Prebuild libraries for REST API Calls
  - Offers all methods and error handling
  - https://dnacentersdk.readthedocs.io/en/latest/
  - https://github.com/cisco-en-programmability/dnacentersdk

Lab introduction

Lab description

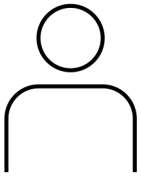
Prerequisites

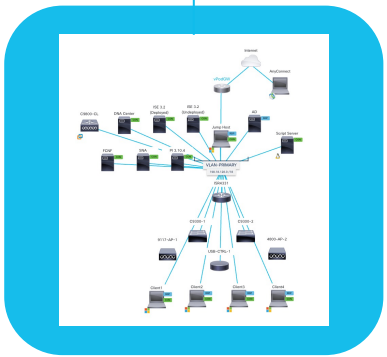
Laptop with Cisco Anyconnect client

Internet

Jump windows host

User preferable with Postman account

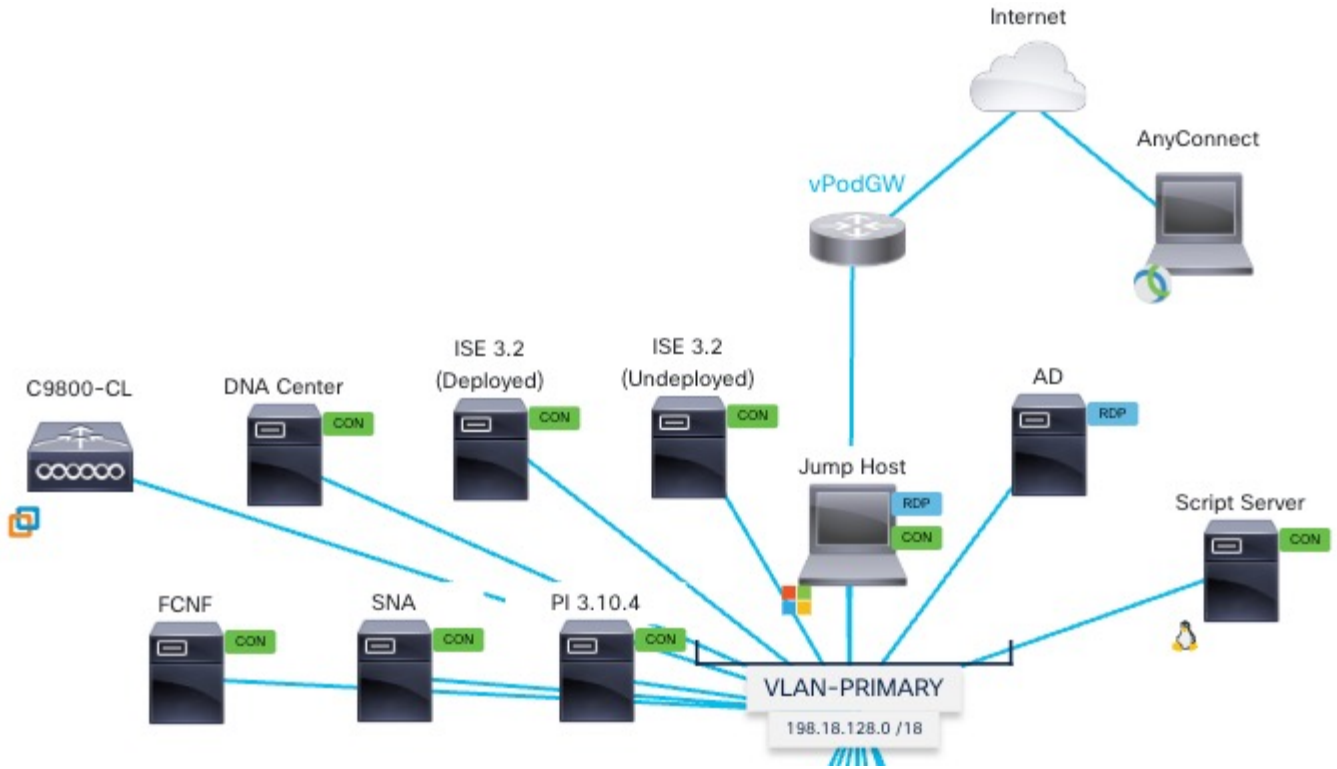




Sandbox

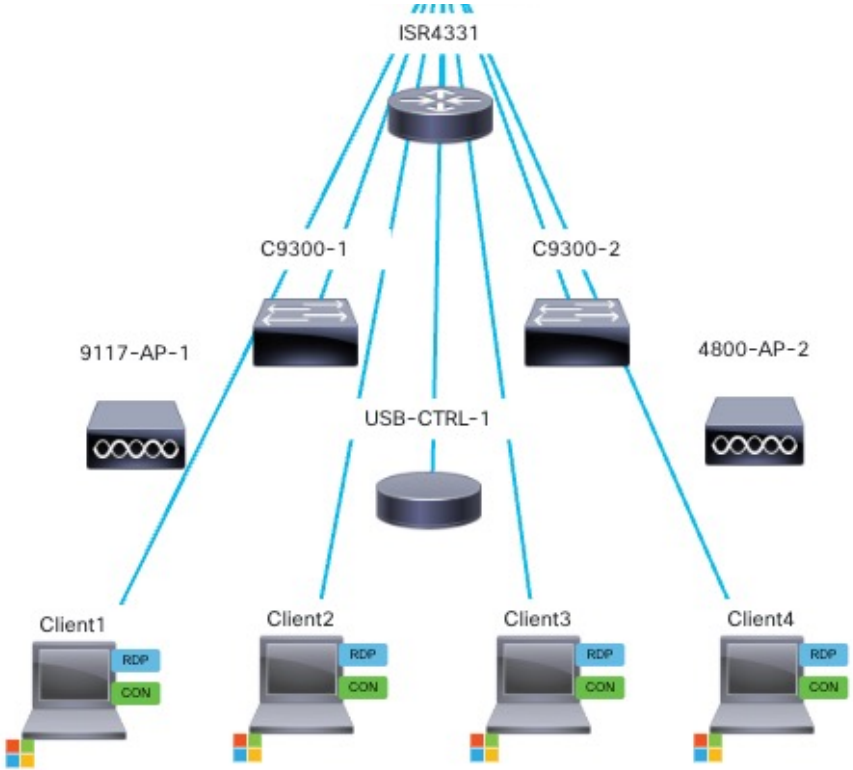
Cisco Enterprise Networks Sandbox v4.1

Jump host and servers including CatC



Cisco Enterprise Networks Sandbox v4.1

Network devices and clients



What is in this environment?

Virtual Machines

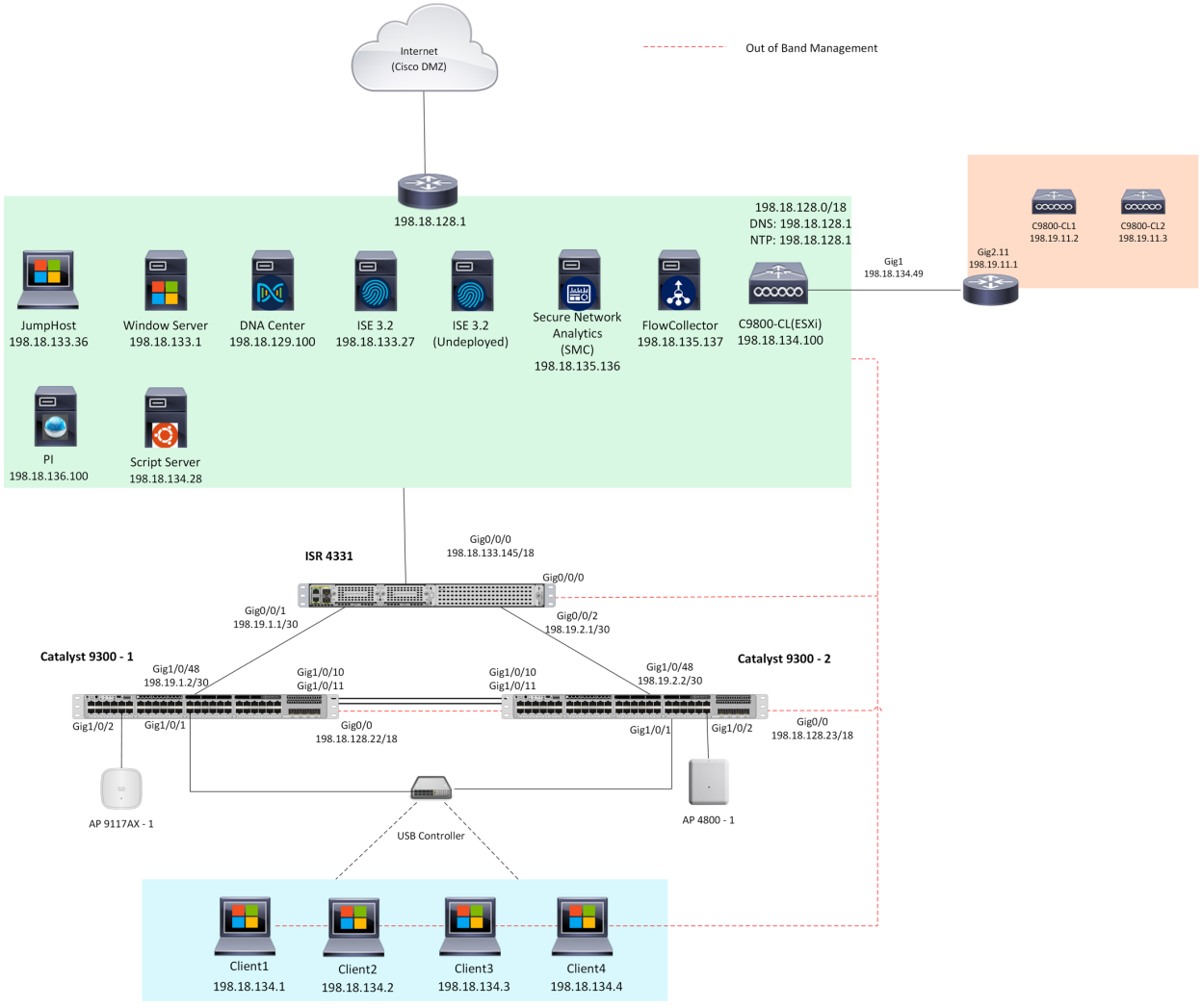
- DNA Center 2.3.5.5
- Identity Services Engine (ISE) 3.2 Patch 5 – (Deployed)
- Identity Services Engine (ISE) 3.2 – (Undeployed)
- Secure Network Analytics (Stealthwatch) 7.4.2
- FlowCollector 7.4.2
- Cisco Prime Infrastructure 3.10.4
- Wireless LAN Controllers – C9800 running IOS-XE 17.12.3 code
- Windows 10 Jump Host – Contains links to common URLs needed to view and configure the environment. Can also be used to TFTP files to/from the hardware devices. Can be used to pull files from Box.
- Ubuntu 20.04.3 – Can be used as a script server and for programing tools.
- Windows Server 2019 – Can be configured to provide identity, DHCP, DNS, etc.
- Windows 10 Clients – Used to simulate network clients participating in the environment. Can be used to test segmentation, host onboarding, policy implementation, etc.

What is in this environment?

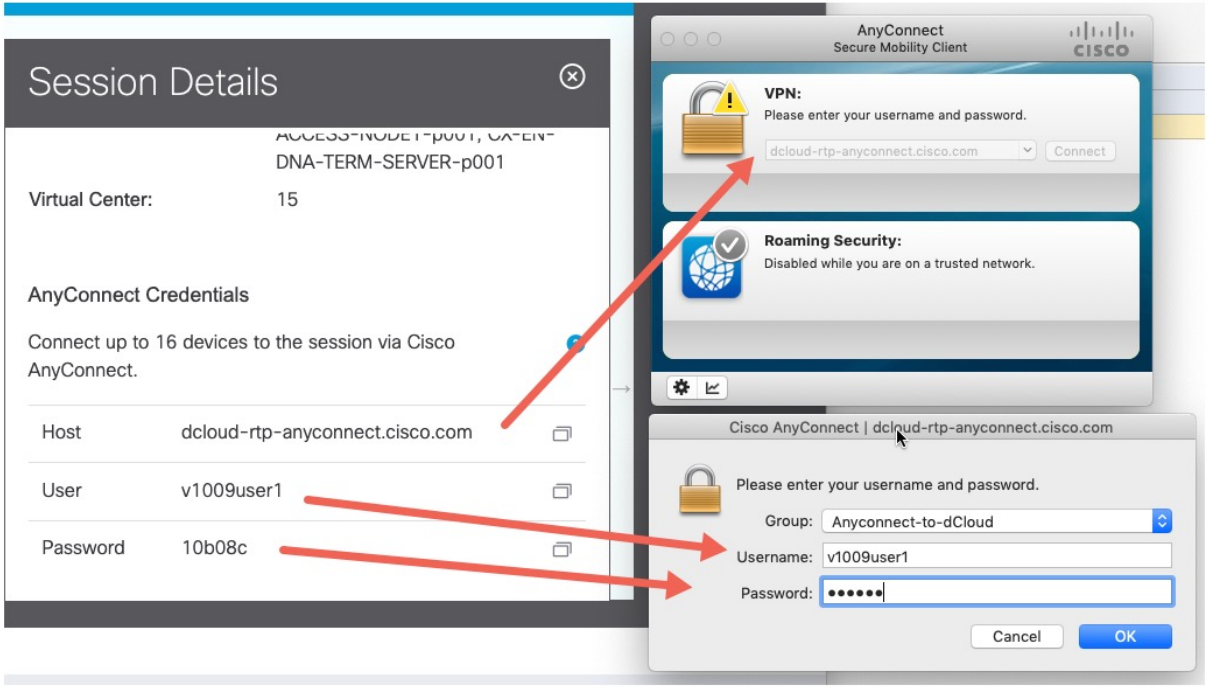
Hardware devices

- ISR 4331 Router – 17.09.02a IOS-XE Code
- Catalyst 9300 Switches – 17.09.02 IOS-XE Code with Embedded Wireless Controller (EWC) and ThousandEyes Enterprise Agent
- 9117 Access Point
- 4800 Access Points
- Silex Controllers (2 Wired NICs)

Topology



How to access your environment?

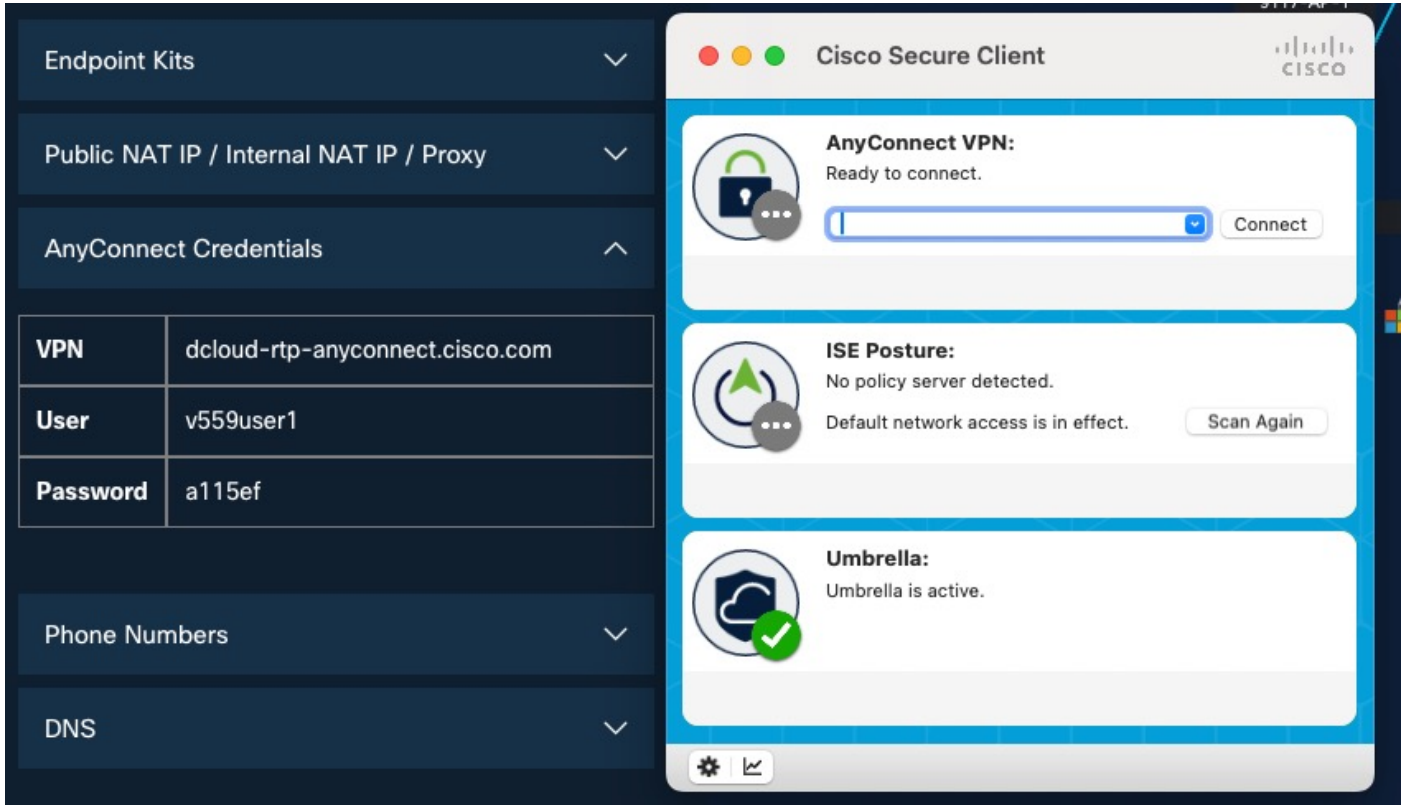


1. Connect to the demo with Cisco AnyConnect VPN. Find your AnyConnect information in the Session Details for your dCloud session.
2. Use your local browser to connect to URLs as outlined in the table in the Virtual Machines section that follows.
3. Use your local RDP client to connect to RDP-capable Virtual Machines as outlined in Virtual Machines section that follows.

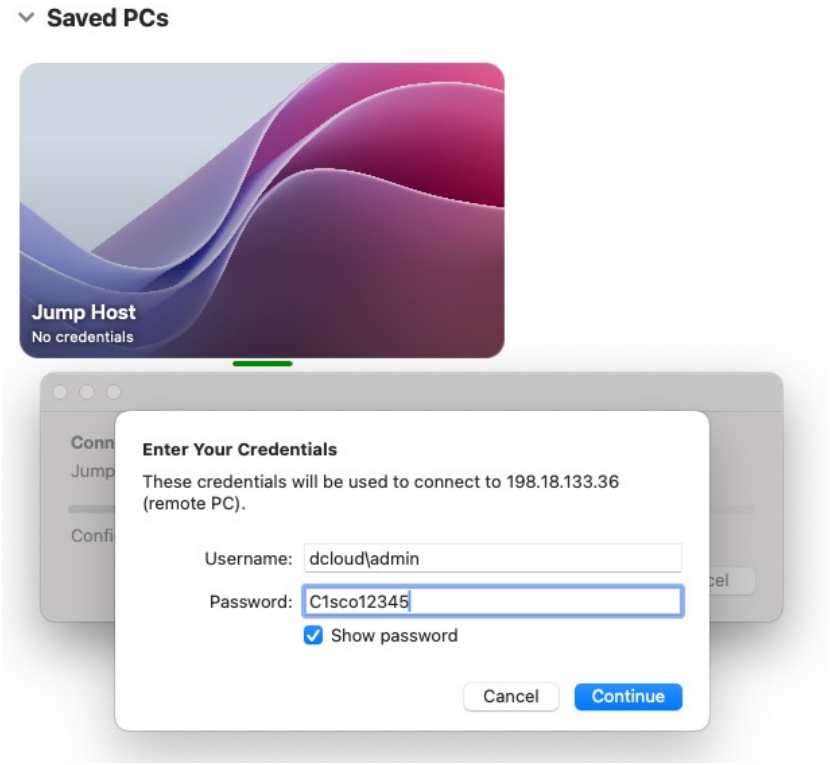
Virtual Machine Addressing and Credentials

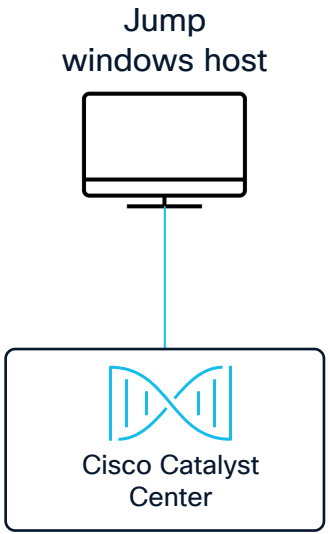
IP Address	Name	Username	Password	Preferred Access Method
Entry	ISE 3.0 Undeployed	Entry	Entry	VM Console via dCloud UIChrome or Firefox (once configured)
198.18.133.27	ISE 3.0 (Deployed)	admin	C1sco12345	Chrome or Firefox
198.18.129.100	DNA Center	admin	C1sco12345	Chrome or Firefox
198.18.135.136	Secure Network Analytics (Stealthwatch)	admin	C1sco12345	Chrome or Firefox
198.18.135.137	FlowCollector	admin	C1sco12345	Chrome or Firefox
198.19.11.2	C9800-CL1	admin	C1sco12345	Chrome or FirefoxSSH or Telnet
198.19.11.3	C9800-CL2	admin	C1sco12345	Chrome or FirefoxSSH or Telnet
198.18.134.49	ESXi-Router	admin	C1sco12345	SSH or Telnet
198.18.136.100	Cisco Prime Infrastructure	admin	C1sco12345	Chrome or Firefox
198.18.134.28	Script Server	root	C1sco12345	Chrome or FirefoxSSH
198.18.133.36	Jump Host	admin	C1sco12345	RDP
198.18.133.1	AD	admin	C1sco12345	RDP
198.18.134.1	Client1	admin	C1sco12345	RDP
198.18.134.2	Client2	admin	C1sco12345	RDP
198.18.134.3	Client3	admin	C1sco12345	RDP
198.18.134.4	Client4	admin	C1sco12345	RDP

Cisco Secure Client



RDC to jump host





Windows Jump Host