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Inside Cisco IT: Deploying SD-WAN and SDA

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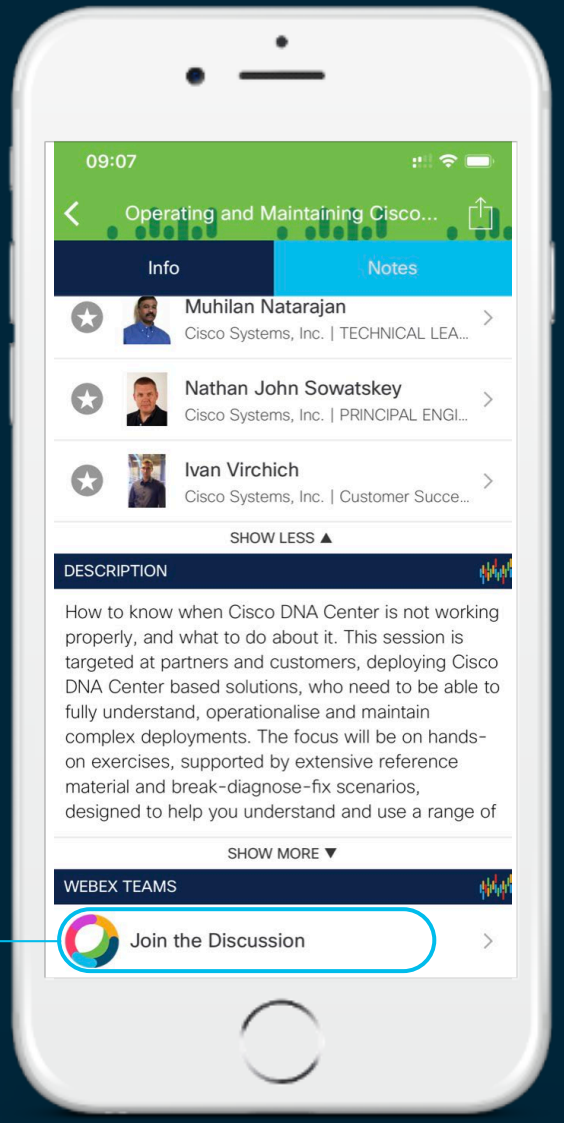
Cisco Webex Teams

Questions?

Use Cisco Webex Teams to chat with the speaker after the session

How

1. Find this session in the Cisco Events Mobile App
2. Click “Join the Discussion”
3. Install Webex Teams or go directly to the team space
4. Enter messages/questions in the team space



Related Sessions

- Cisco on Cisco Booth & Mini Theatre in Cisco Showcase
  - World of Solutions – Open Daily
- Inside Cisco IT: Cisco Multicloud Backbone - securely inter-connecting clouds (BRKCOC-2294)
  - Today @ 2:45pm
- Inside Cisco IT: Enterprise Wireless Design and Assurance with Cisco IT (BRKCOC-2257)
  - Check the recording online!

Agenda

- Part 1 – Cisco IT Global Network Overview
- Part 2 – Technical Deep dive
  - SDA with Cisco DNA Center
  - SD-WAN
  - Integration
- Part 3 – Automating & Deploying Cisco DNA
  - Development Lifecycle & Version Control
  - What does a deployment involve?
  - Cisco IT Automation & ZTD Micro Service

Part 1 – Cisco IT Network Overview

Cisco at a Glance

7,198
Routers

8,693
LAN Switches

11,909
Unified Computing System Servers

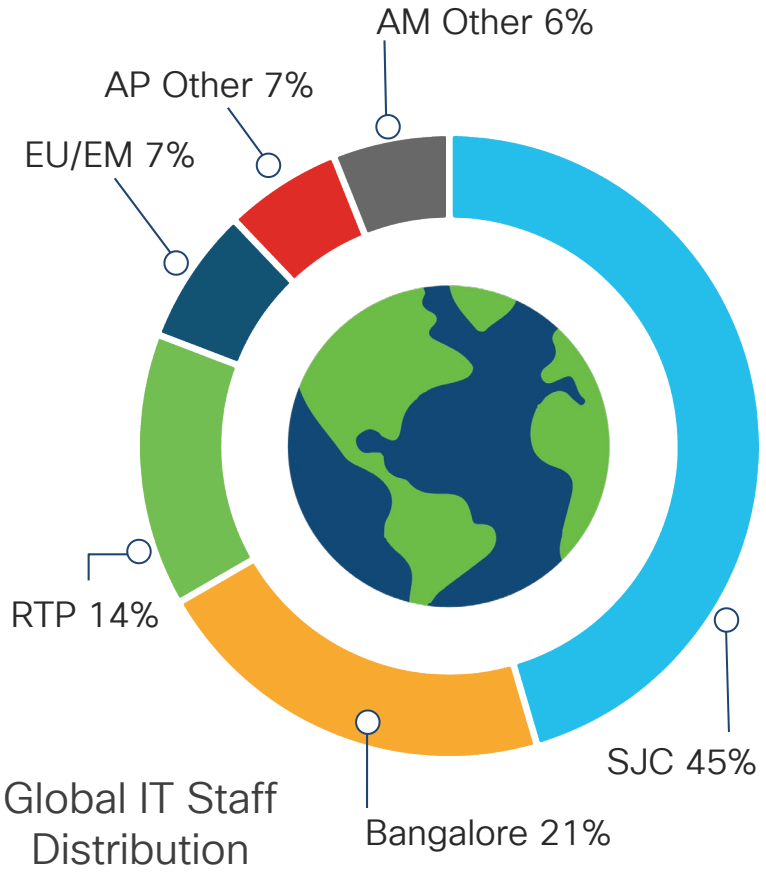
7.6
Billion DNS requests per day

74,726
Employees

137,414
Connected Stakeholders

96
Countries

506
Offices



93
Services

48,811
Virtual Machines

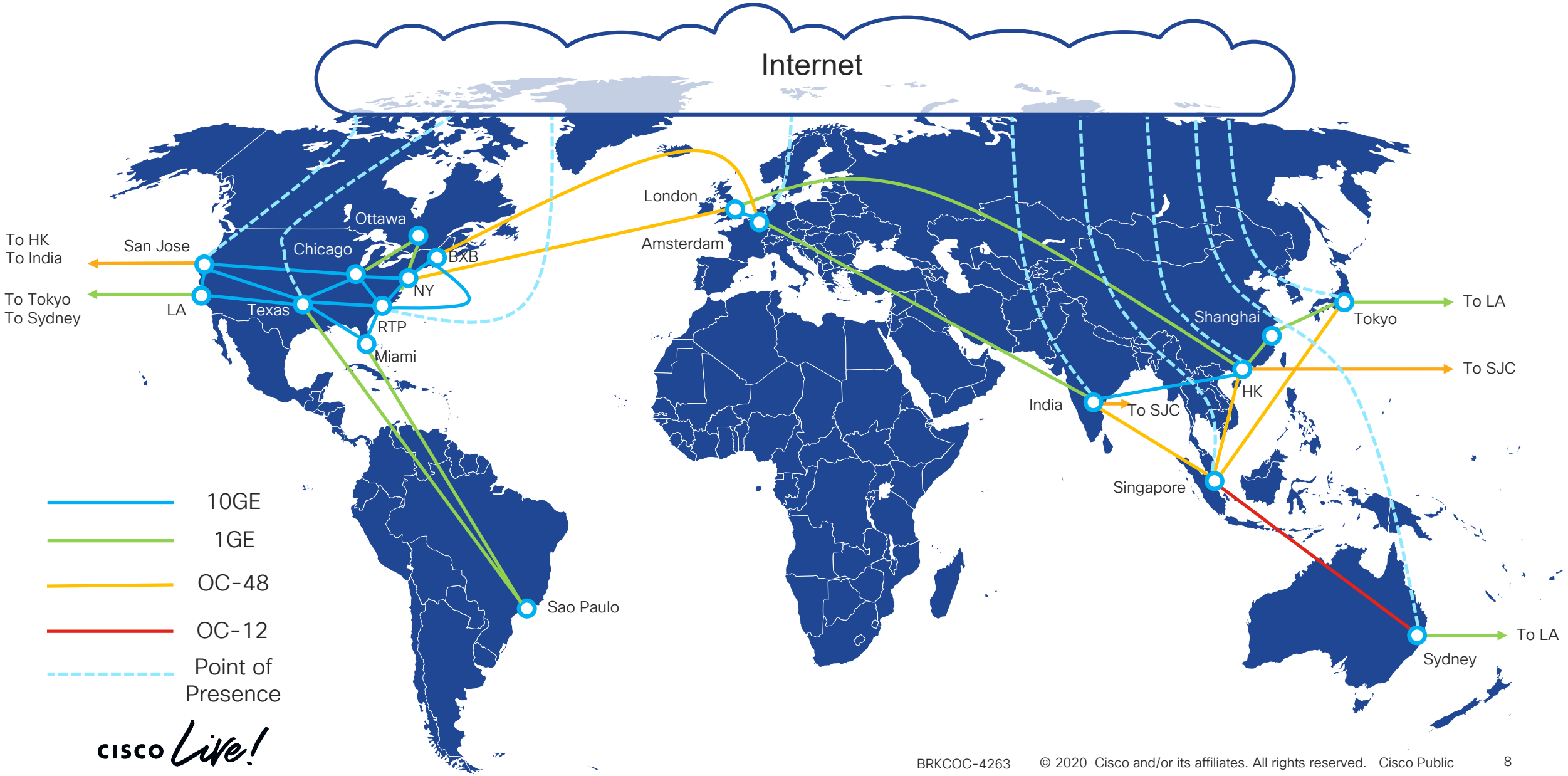
~458k
Managed End Devices

91PB
Overall Usable Storage

26.9MW
Data Center Capacity

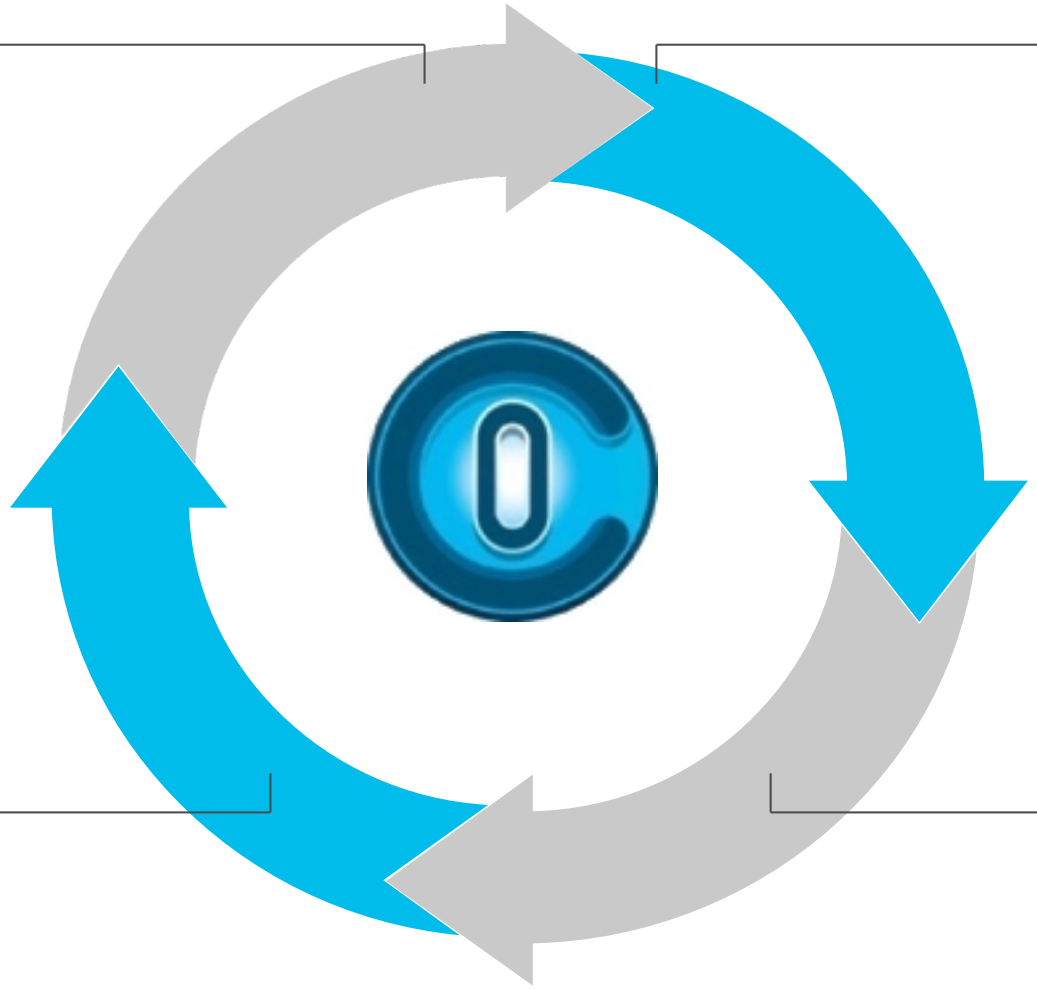
6.39M
Internet Threats Blocked Per Day (WSA w/AMP)

Tier 1 WAN & Internet PoPs



Cisco IT is Customer Zero

BU Development
The BU will work to implement fixes and critical feature enhancements to the product.



New Release
Cisco IT is an early adopter of new releases, putting them into pre-prod infrastructure rapidly.

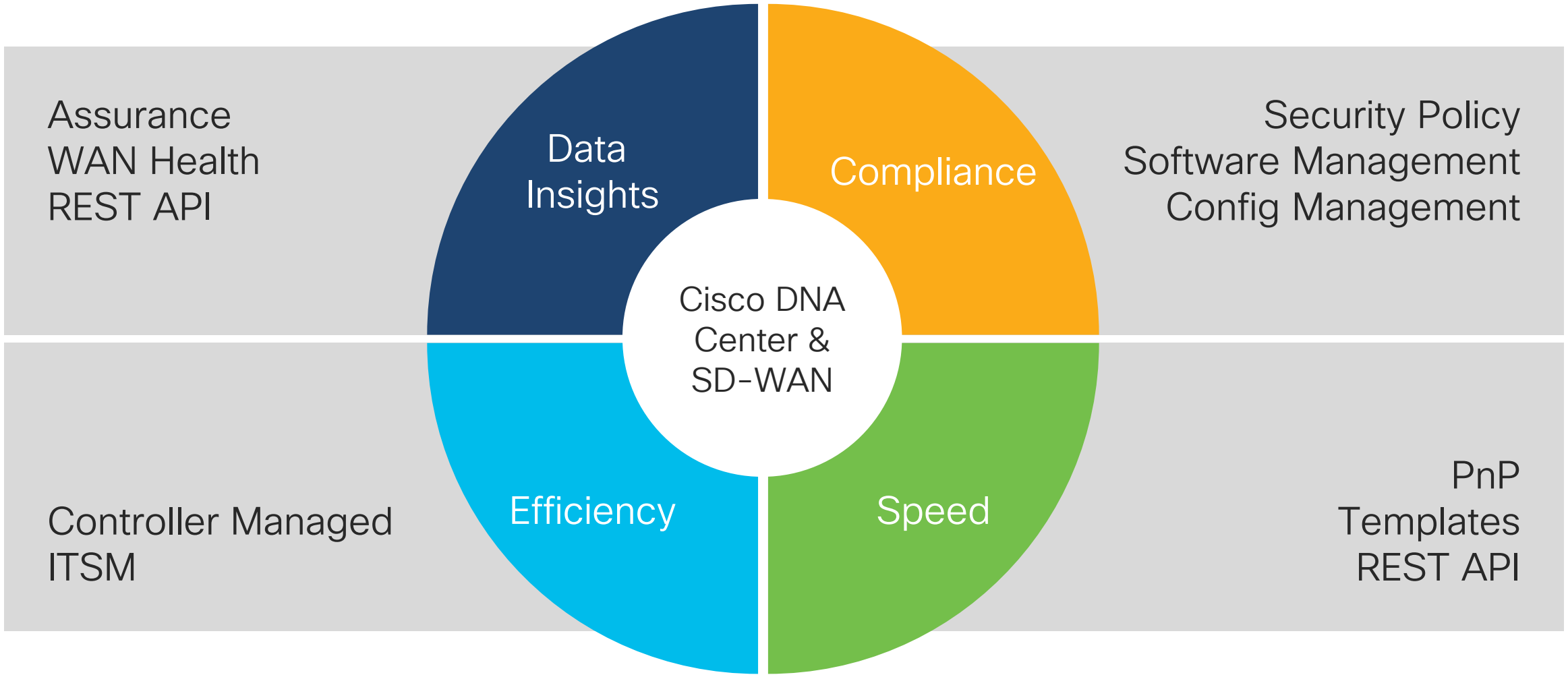
Feedback
We provide feedback to the engineering BU, and request enhancements.

Test
Cisco IT tests the release for defects. and the new features in environments that match the production network.

Question!

What are we doing with Cisco DNA to assist us?

Cisco IT Drivers & Technologies



Cisco IT DNA-C Highlights

76

Sites inside Cisco DNA-Center

3

Regions

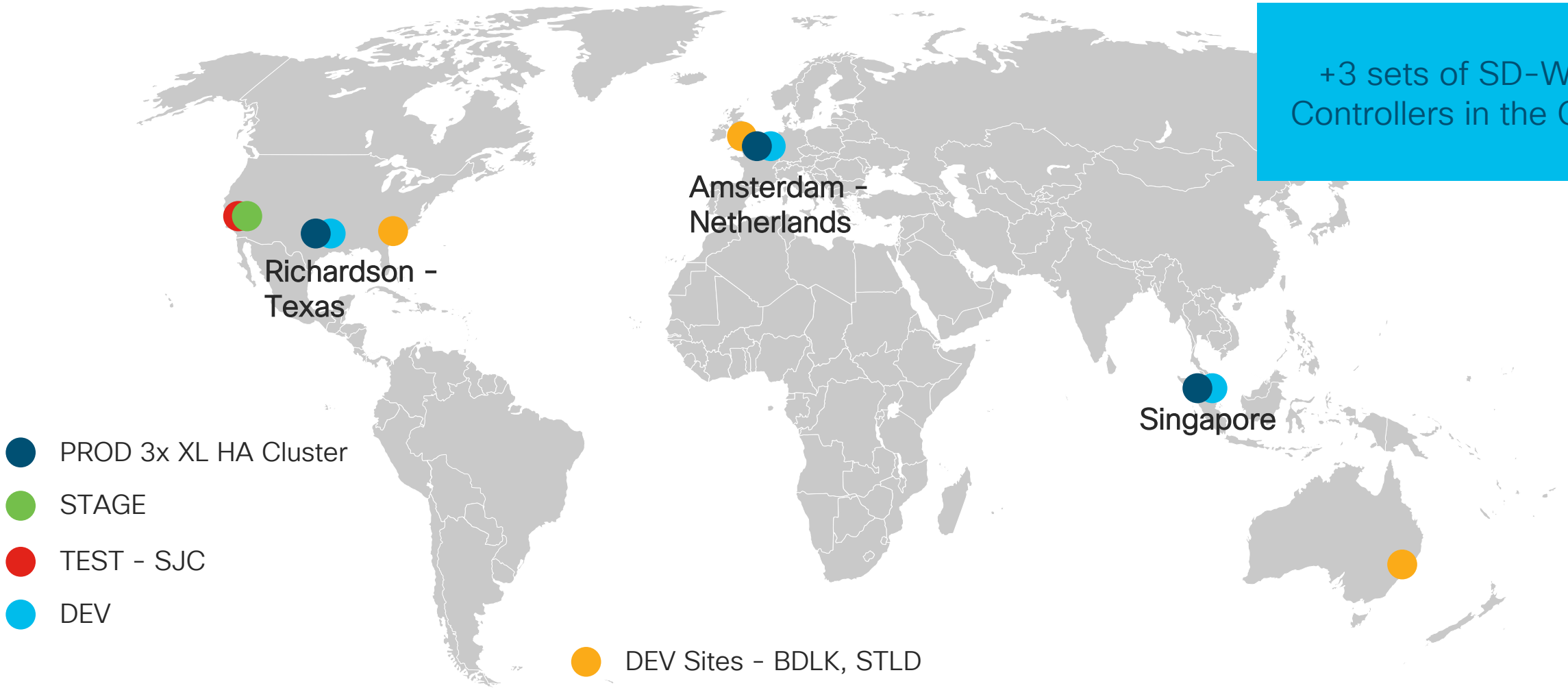
15’000+

Clients (last 7 days)

1708

Network Devices

Cisco Controller Locations

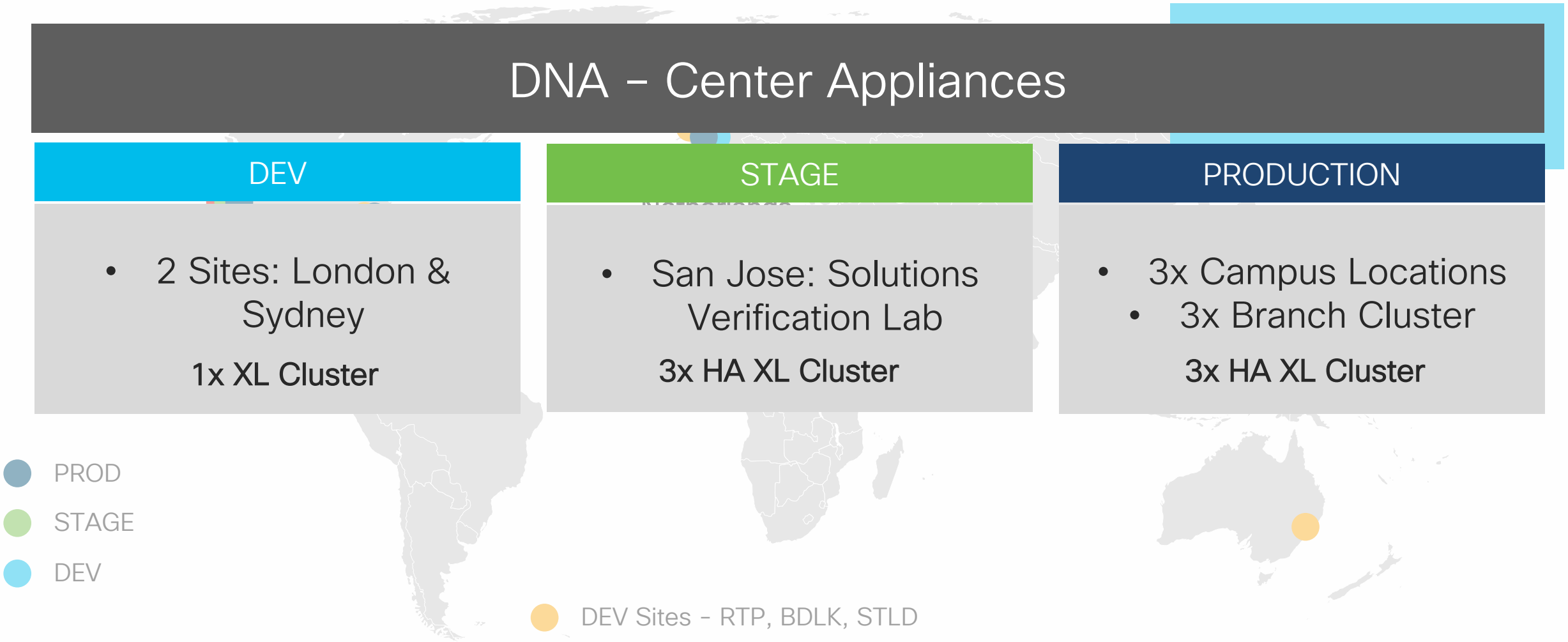


+3 sets of SD-WAN Controllers in the Cloud

Cisco Controller Locations

DNA – Center Appliances

DEV	STAGE	PRODUCTION
• 2 Sites: London & Sydney **1x XL Cluster**	• San Jose: Solutions Verification Lab **3x HA XL Cluster**	• 3x Campus Locations • 3x Branch Cluster **3x HA XL Cluster**



DNA-Center Dashboard

DNAC Topology

Dev Environment

Name	Devices Count	Category	Reservation Status	Reserve Topology	Wait in Queue
svlidc1	8	IDC Core (Aggregation Hub)	Available	Reserve	0
svlgold11	17	Gold	Available	Reserve	0
svlsilv11	8	Silver	Available	Reserve	0

Test Environment

Name	Devices Count	Category	Reservation Status	Reserve Topology	Wait in Queue
svlidc2	8	IDC Core (Aggregation Hub)	Available	Reserve	0
svlsilv21	8	Silver	Available	Reserve	0

Stage Environment

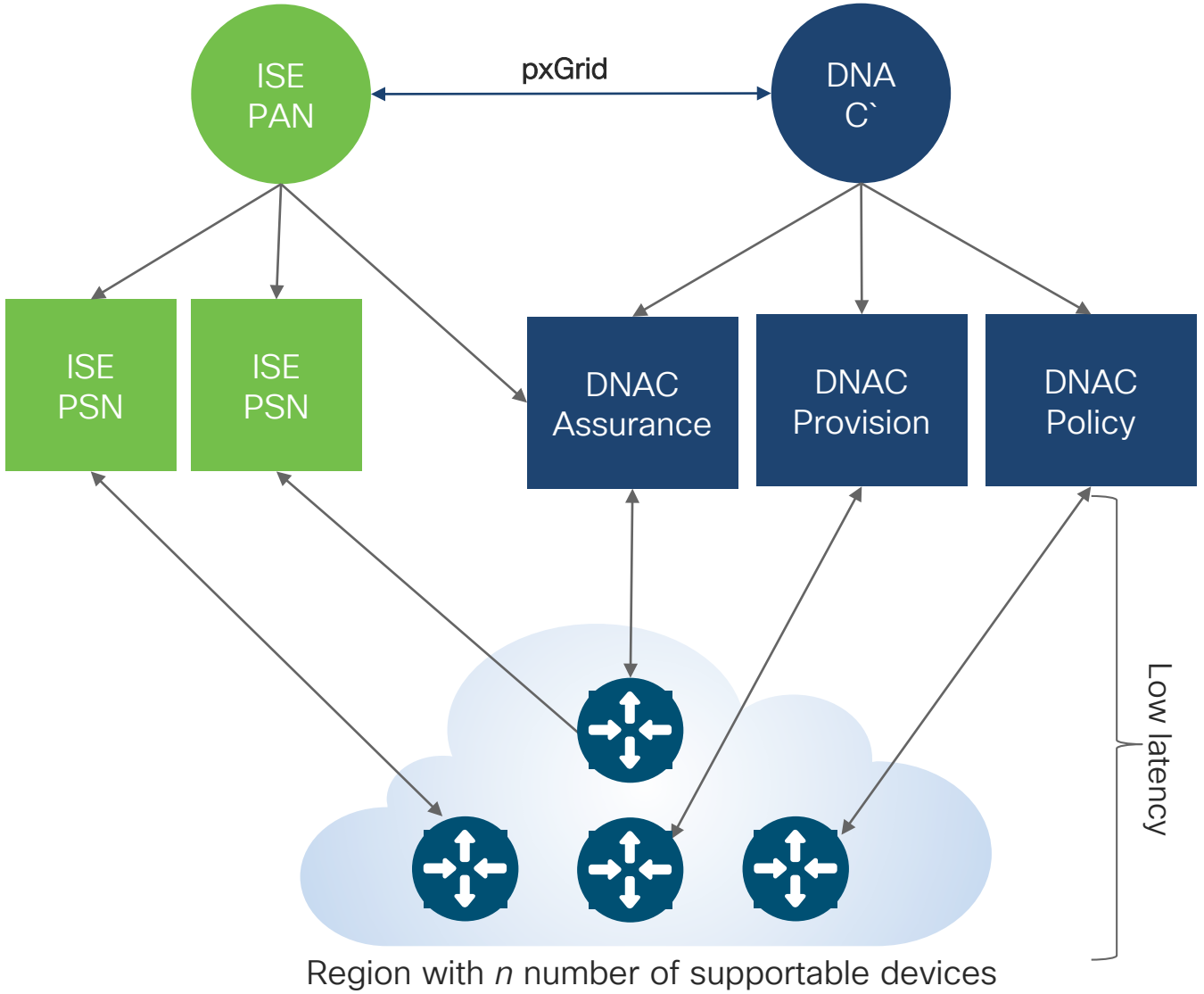
Name	Devices Count	Category	Reservation Status	Reserve Topology	Wait in Queue
svlidc3	8	IDC Core (Aggregation Hub)	Available	Reserve	0
svlgold31	17	Gold	Available	Reserve	0
svlplat31	17	Platinum	Available	Reserve	0
svlsilv31	6	Silver	Available	Reserve	0

Part 2 Technical Deep Dive

The SDA Foundation – ISE

Cisco DNA-Center – ISE Architecture

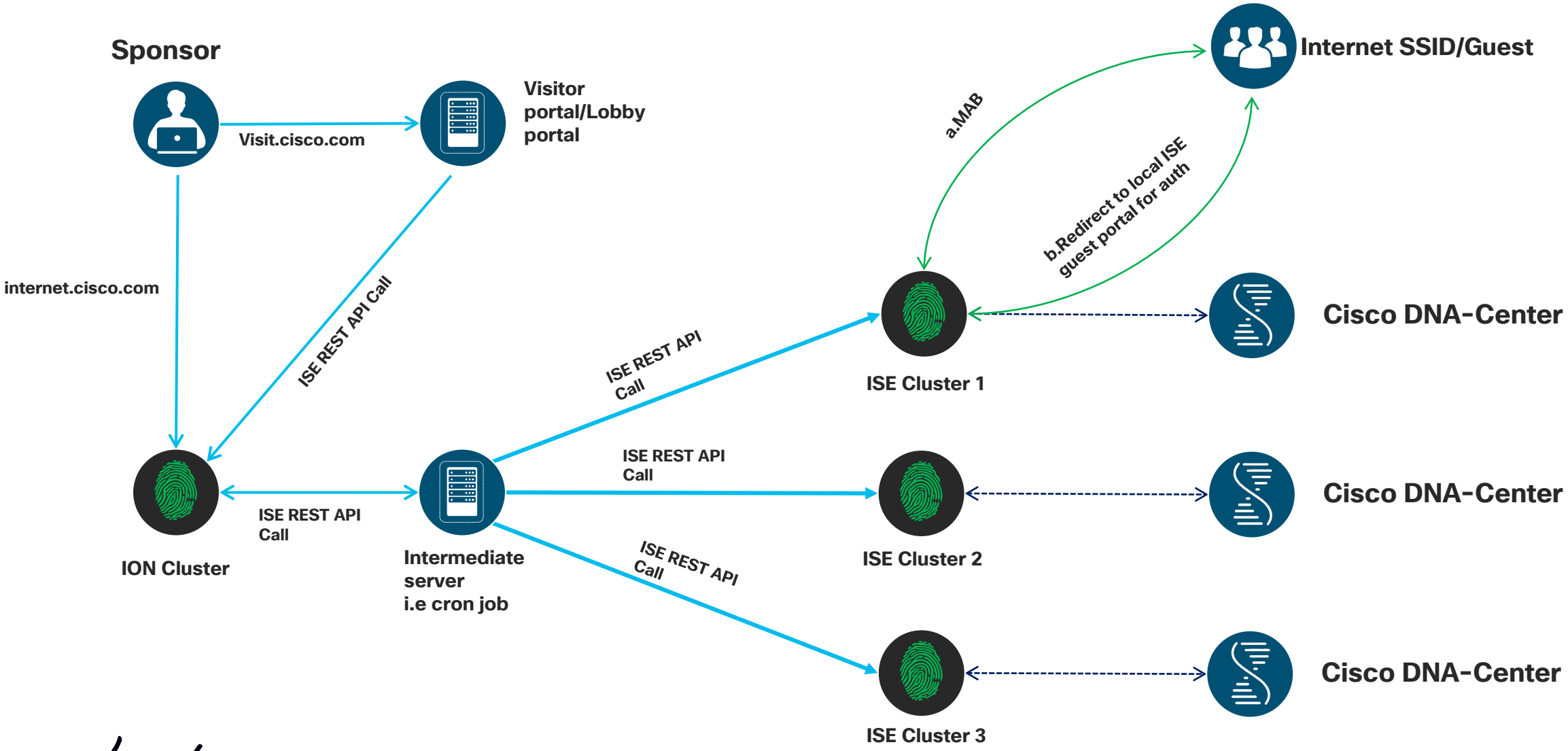
Create DNAC+ISE deployments
Which maps ISE PSN + DNAC components to pools of devices



Question!

How does Cisco IT have this setup for Guest?

Cisco DNA-Center – ISE Architecture



Question!

Why do we like segmentation?

Policy Based Management

Wired and Wireless experience

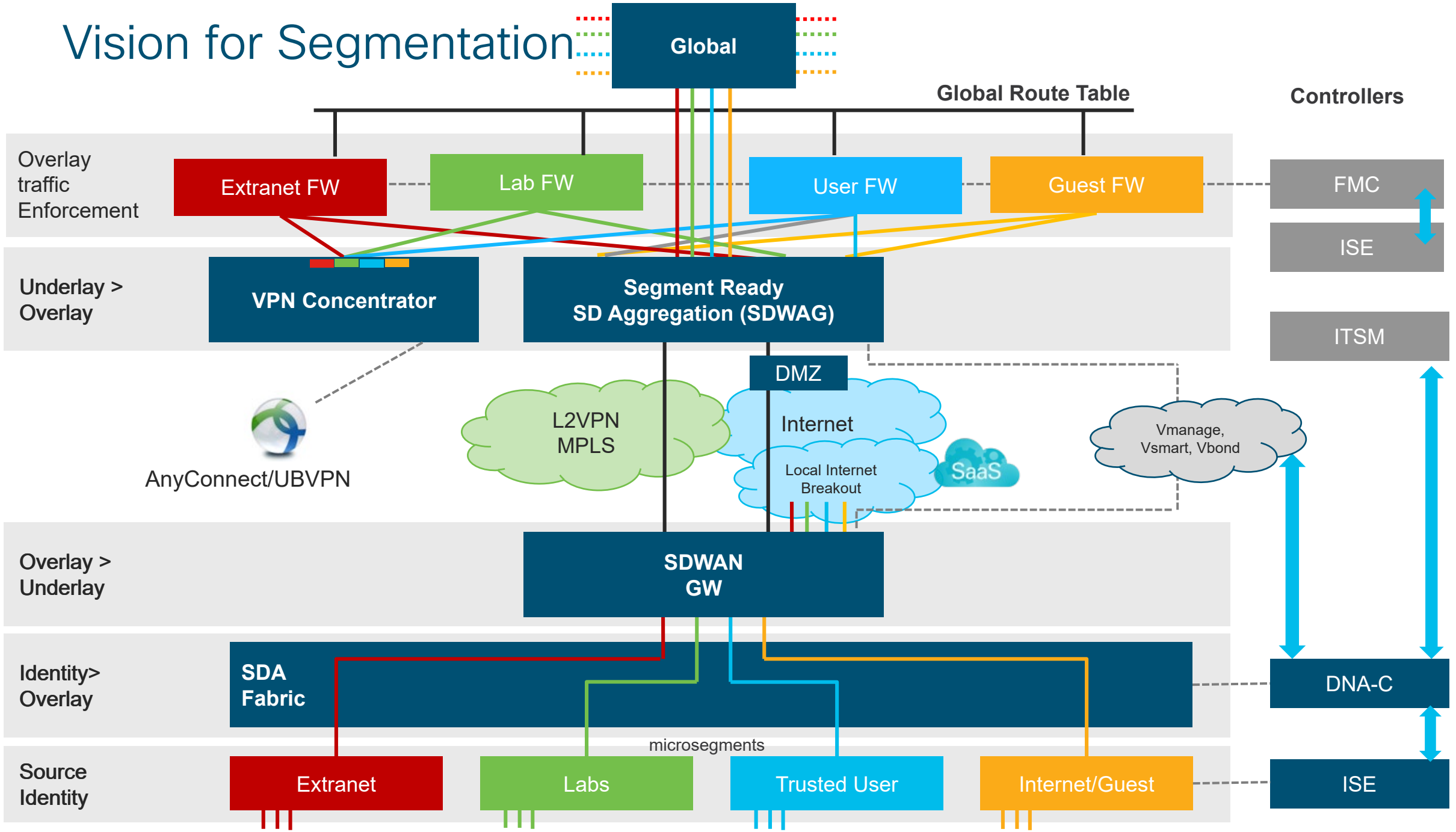
Guest Services

Centralized control of user access

Segmentation Use Cases

- **Advantages of segmentation:**
  - Primarily for **boosting performance** and **improving security**, and
  - Include benefits such as *containing network problems*, *enabling better compliance with industry regulations*, *avoiding exposure to unnecessary security risks*, and *controlling visitor access*.
- **Segregation in *traditional* and *basic* networks** has been achieved by a combination of firewalls and VLANs (Virtual Local Area Networks).
- **Software-Defined Networking (SDN)** can enable creation and management of micro-segmented networks in more complex, dynamic and hybrid networks.
- **Proper segregating** of a network essentially **minimizes the level of access** to sensitive information for those apps, servers, and people who don't need it, while enabling access for those that do.
- Meanwhile it becomes **more difficult for a cyber-attacker** to locate and gain access to an organization's most sensitive information.

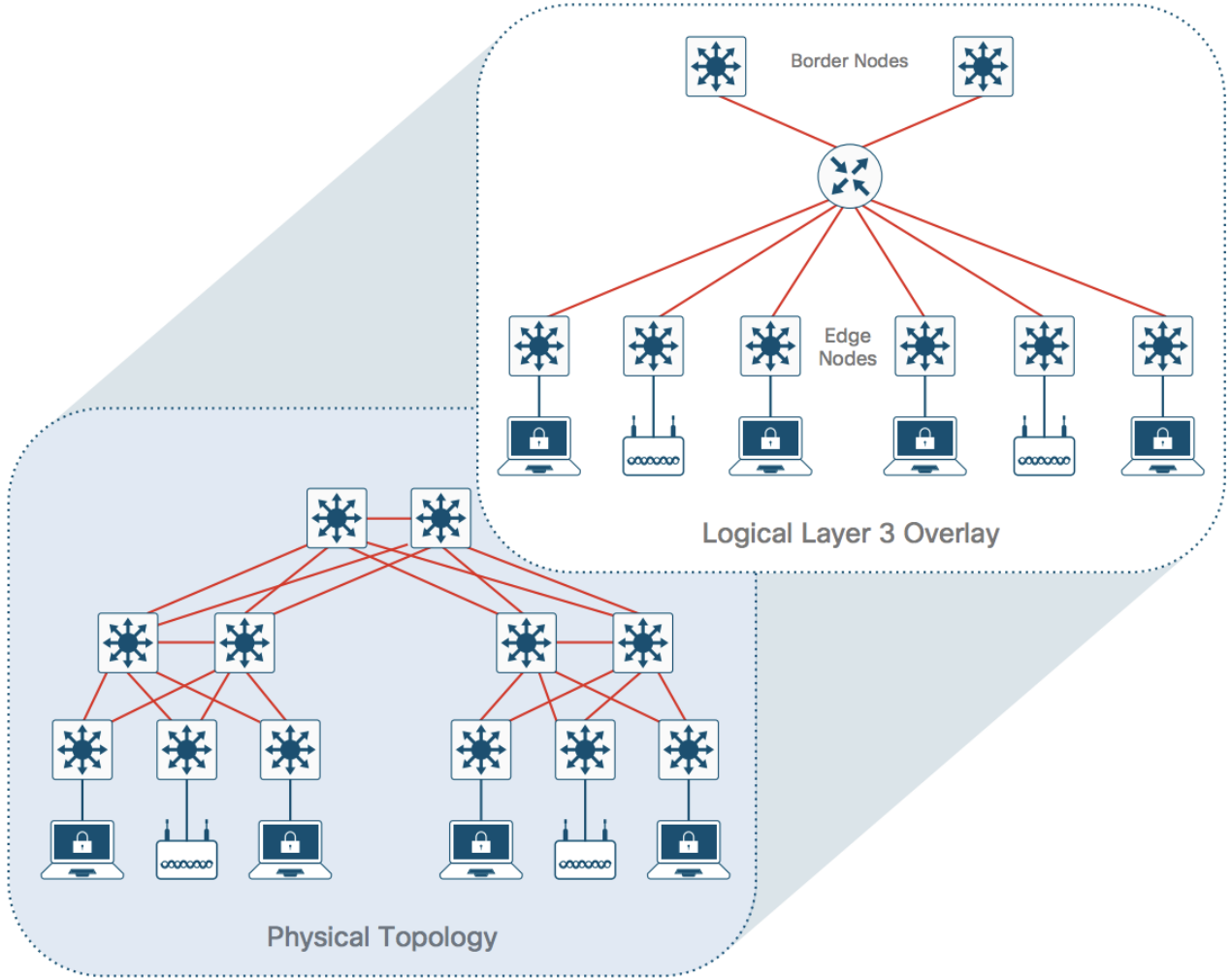
Vision for Segmentation



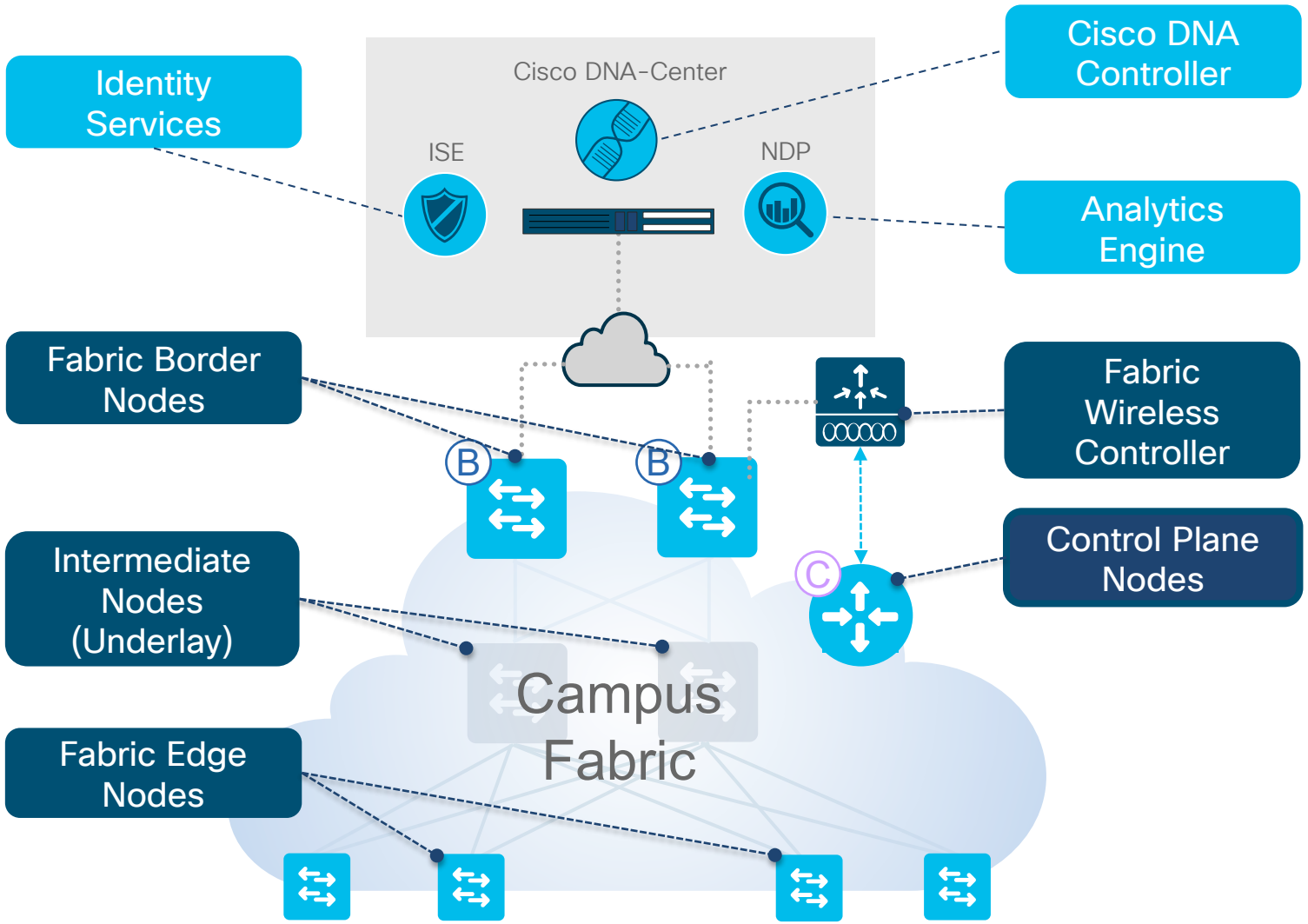
SD-Access

The Basics: Underlay and Overlay

1. Underlay is essentially the physical topology
2. For SDA deployment, it will require L3 Routed Access
3. Overlay abstracts IP-based activity from physical to provide Virtual Networks
4. Allows traffic/user segmentation and dynamic endpoint placement, independent of underlay schema



The Basics: What is SD-Access?



- **Cisco DNA Controller** – Enterprise SDN Controller (e.g. Cisco DNA Center) provides GUI management and abstraction via Apps that share context
- **Identity Services** – External ID System(s) (e.g. ISE) are leveraged for dynamic Endpoint to Group mapping and Policy definition
- **Analytics Engine** – External Data Collector(s) (e.g. NDP) are leveraged to analyze Endpoint to App flows and monitor fabric status

- **Control Plane (CP) Nodes** – Map System that manages Endpoint to Device relationships
- **Fabric Border Nodes** – A Fabric device (e.g. Core) that connects External L3 network(s) to the SDA Fabric
- **Fabric Edge Nodes** – A Fabric device (e.g. Access or Distribution) that connects Wired Endpoints to the SDA Fabric
- **Fabric Wireless Controller** – A Fabric device (WLC) that connects Wireless Endpoints to the SDA Fabric

The Basics: Virtual Networks and Secure Group Tags

Virtual Networks (VN)

Based on VRFs, enables one virtual network to be isolated from another, providing endpoint segmentation

Macro Segmentation

Scalable Group Tags (SGT)

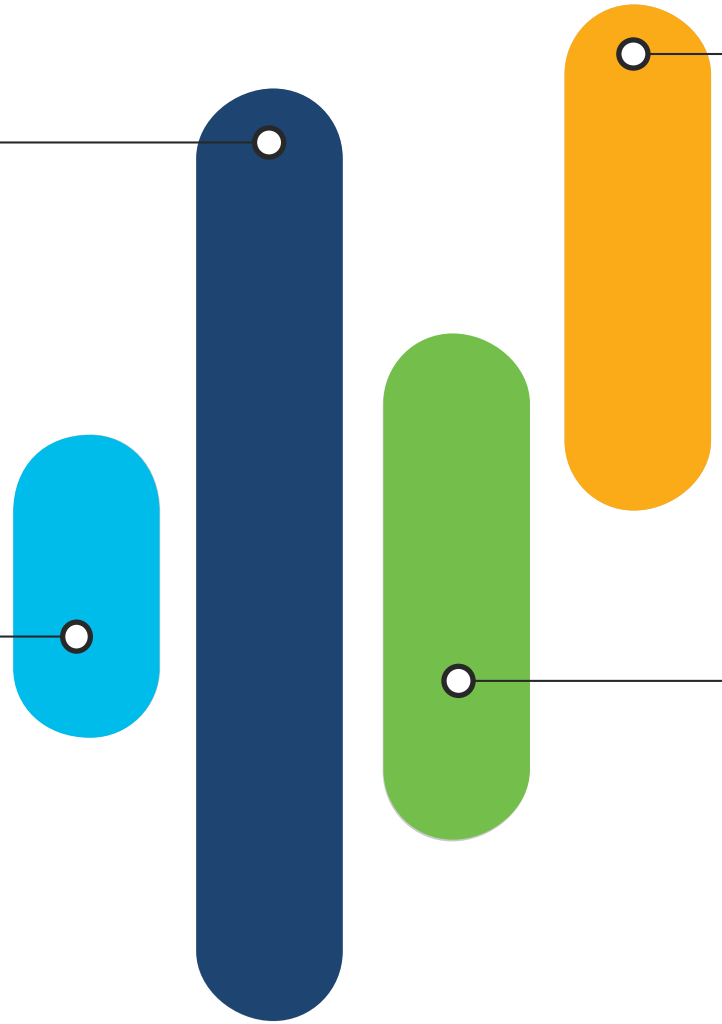
16-bit group identifier, used within a Virtual Network, and carried using the VXLAN header, East to West segmentation

Micro Segmentation

Question!

What does Cisco IT's current architecture and hardware look like?

Locking Down your ‘DNA Ready’ Infrastructure



WLAN

AIR CT5520 / 3504

Catalyst 9800

HA-SSO Mode (Topology Dependent)

LAN

Catalyst 9K Platform

9500 at Backbone/Border

9300 / 9400 at Edge/Access

Controllers

Cisco DNA Center

Identity Services Engine

vManage

WAN

SD-WAN

ISR4451 Spoke

ASR1K Hub

Cisco IT – Current Code Snapshot

Catalyst 9K	16.12.2s
ISR4451	16.12.2r IOS-XE SD-WAN
Wireless	8.10.105.0 (AireOS) & 16.12.2s (9800)
Cisco DNA-Center	1.3.1.4
Identity Services Engine	2.6 Patch 1
vManage	19.2.1

Our DNA-Ready Topology and Catalogue

Private Line (2nd SP)
MPLS / Private Line
Internet (DIA)
Landlord Internet

Business requirement

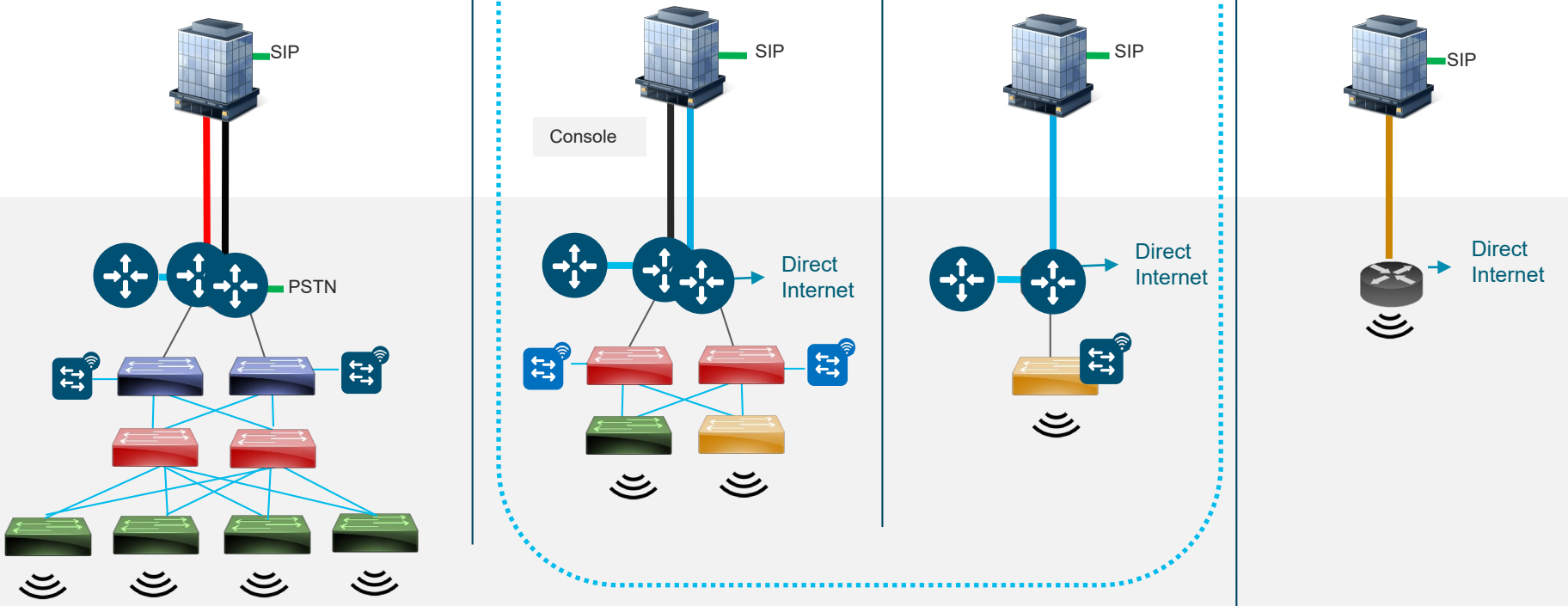
Platinum
TAC/24x7 Contact Center/CCIE Lab/IT DC/CBC/Campus

Gold
Regional TAC/Regional head office/Eng. DC/Innovation center

Silver
Non-critical business functions/Occasional customer visit

Bronze
Light weight/Service office space

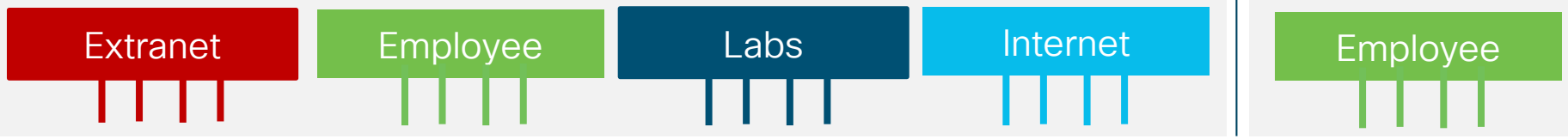
Current Target



9500
9404/7
9300
4451
WLC3504
9800
4800
Meraki

Macro-Segments(VN)

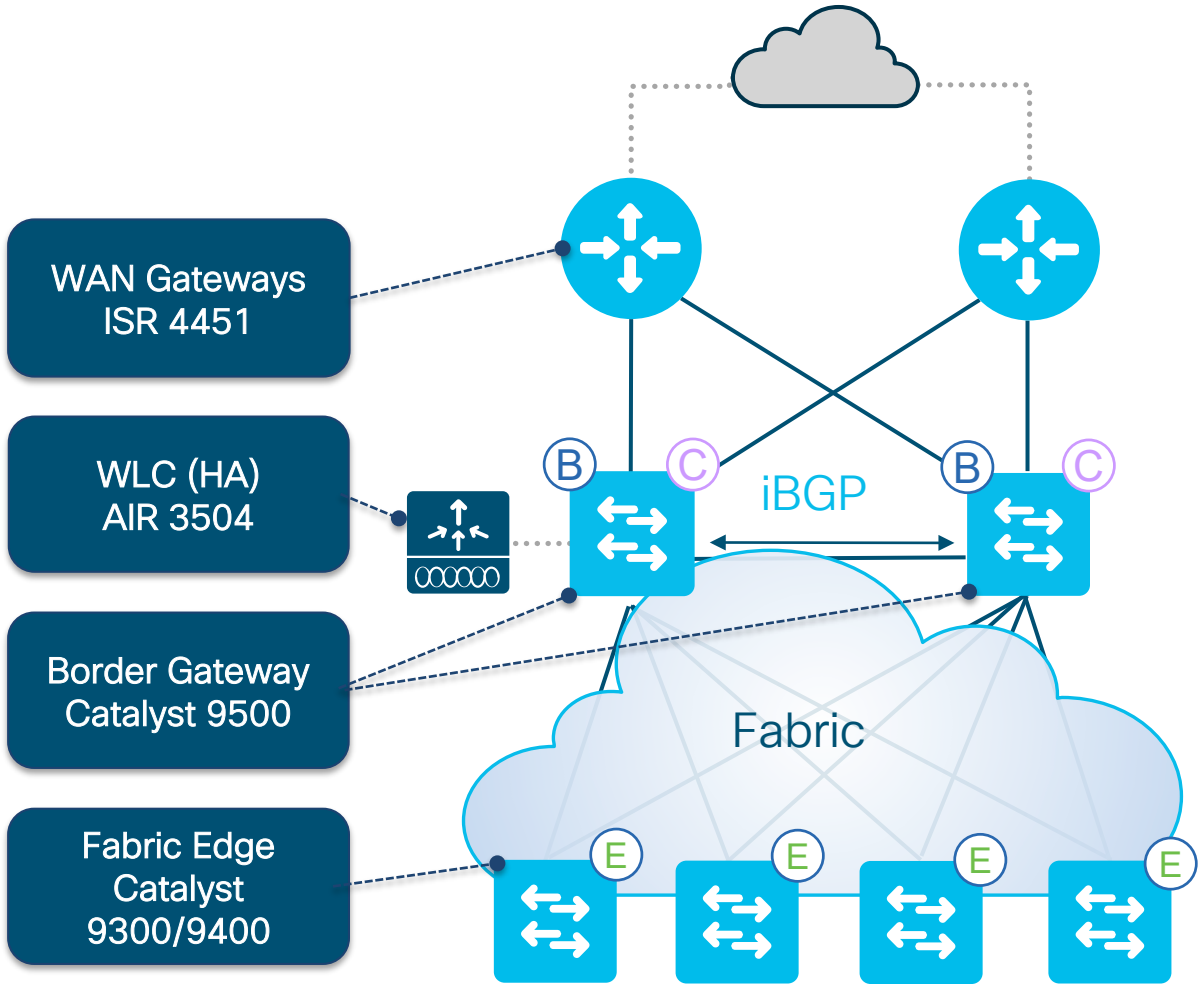
Overlay Segments



Micro-Segments(SGT)

Mapping Topologies to SDA

Our Outcome (Gold)



Post SDA

eBGP

LISP

VXLAN

BGP houses the **Virtual Networks** under **bgp address-family ipv4 vrf xx**. LISP is based on **Endpoint ID (EID)** to **Router Locator (RLOC)** mapping system, whilst VXLANs encapsulate IP/UDP-based traffic, meaning it can forward to any IP-based network (legacy or current).

DNA Center Use Cases

DNA 0 PnP install (6 devices)

Manual
Auto

Manual

1. Console to device
2. Upload new image
3. Copy to redundant supervisor
4. Reload switch
5. Upload config
6. Save config > operational
7. Repeat for 6 devices

Time to complete operation: **480 mins (Day's work)**

DNA-C Automation

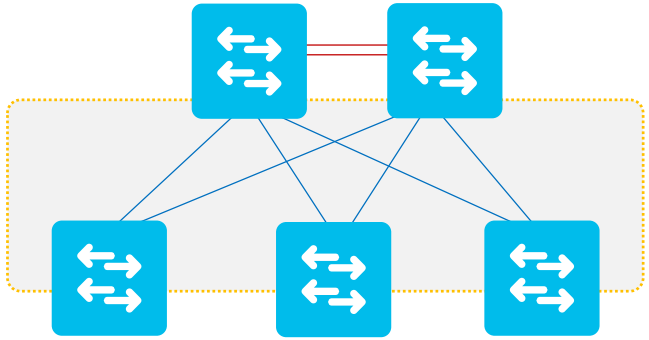
1. Device connects to DNA-C
2. Admin claims devices
3. Image is copied to devices & redundant supervisors
4. Switch reloads and reconnects to DNA-C
5. DNA-C upload latest configuration templates to devices
6. Save config > operational

Time to complete operation: **45 mins**

LAN Automation

LAN Automation builds a prescriptive, best-practice underlay for the SD-Access network using IS-IS routing.

2 Tier – Collapsed Core Design



Layer	Role	Switch
Distribution	Seed	Catalyst 9500
Access	PnP Agent	Catalyst 9300

Seed Device (Border Nodes)

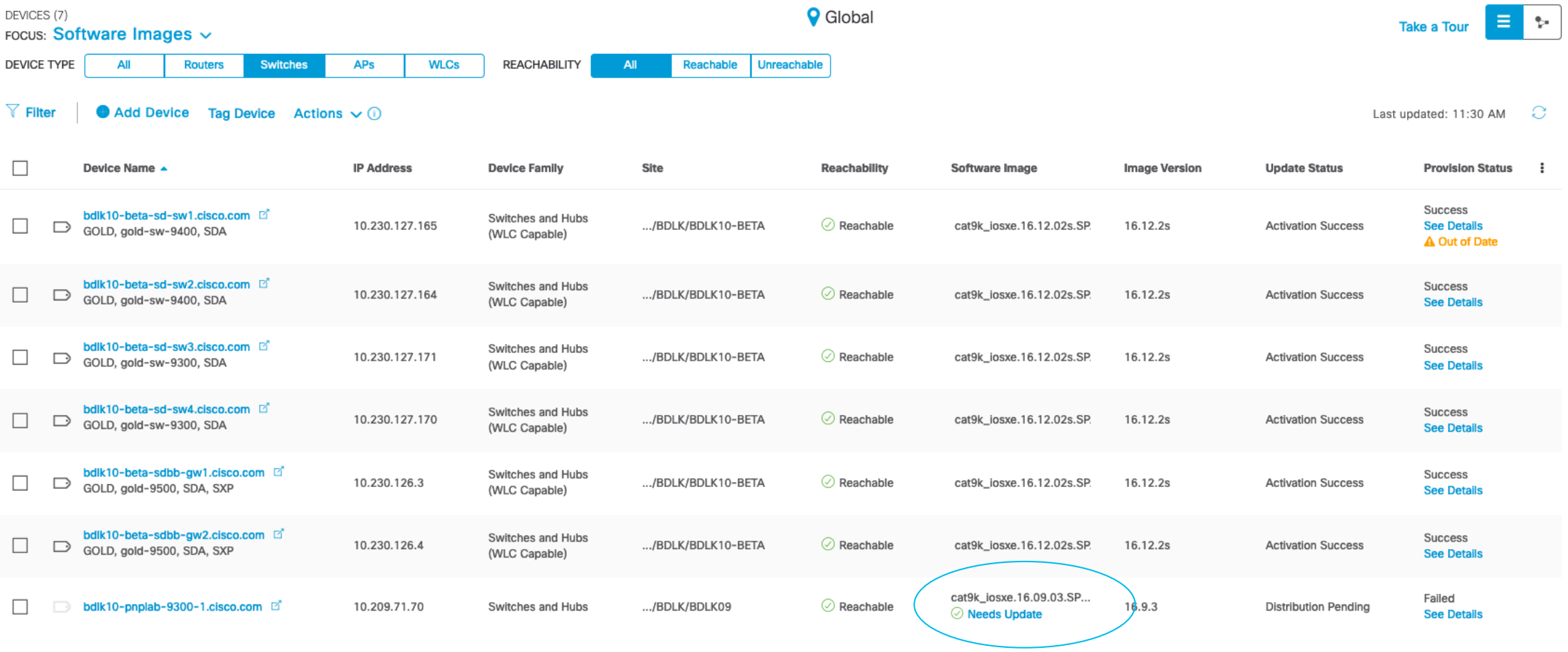
- DNA-C needs IP connectivity & SSH access to seed devices, hence some initial configuration is required

PnP Agent (Edge Nodes)

- Fresh out-of-the-box switches that are running factory default config. *Needs to be sitting at initial configuration prompt in order for the PnP Agent to be running:*

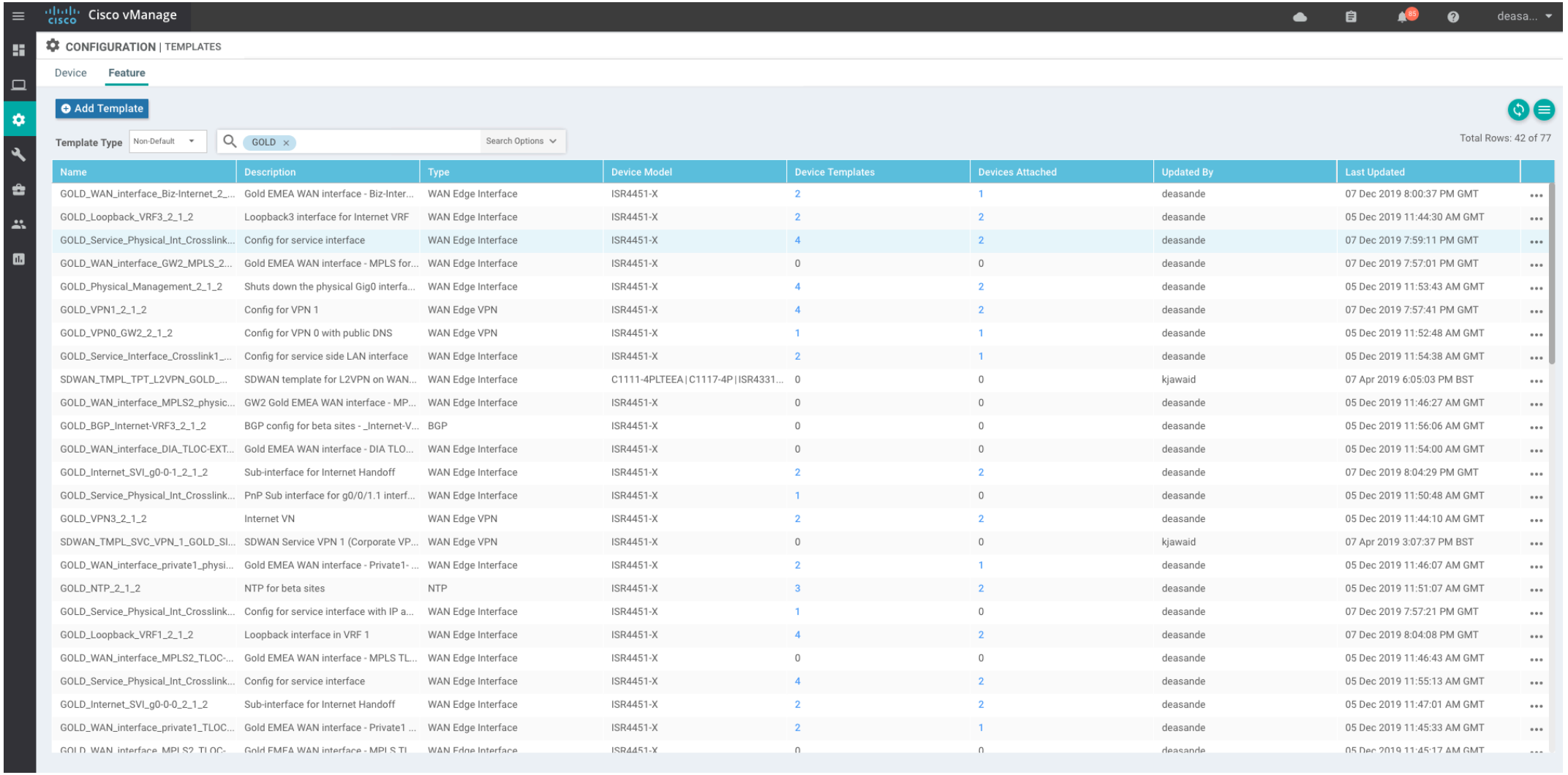
```
%INIT: waited 0 seconds for NVRAM to be available

         --- System Configuration Dialog ---

Would you like to enter the initial configuration dialog? [yes/no]:
```

SWIM



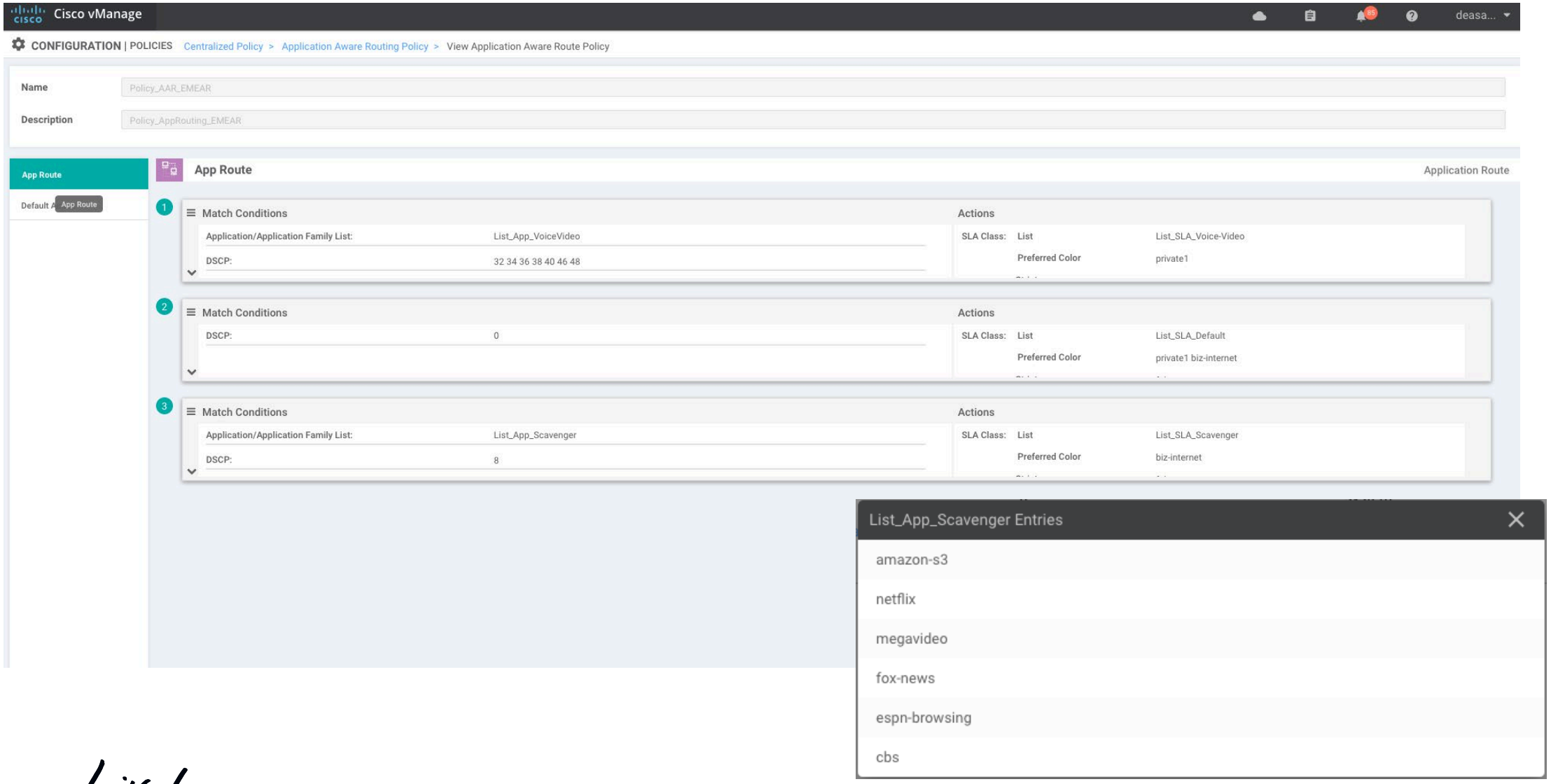
SD-WAN Use Cases

Config Management – Feature Templates



Name	Description	Type	Device Model	Device Templates	Devices Attached	Updated By	Last Updated
GOLD_WAN_interface_Biz-Internet_2_...	Gold EMEA WAN interface - Biz-Inter...	WAN Edge Interface	ISR4451-X	2	1	deasande	07 Dec 2019 8:00:37 PM GMT
GOLD_Loopback_VRF3_2_1_2	Loopback3 interface for Internet VRF	WAN Edge Interface	ISR4451-X	2	2	deasande	05 Dec 2019 11:44:30 AM GMT
GOLD_Service_Physical_Int_Crosslink...	Config for service interface	WAN Edge Interface	ISR4451-X	4	2	deasande	07 Dec 2019 7:59:11 PM GMT
GOLD_WAN_interface_GW2_MPLS_2...	Gold EMEA WAN interface - MPLS for...	WAN Edge Interface	ISR4451-X	0	0	deasande	07 Dec 2019 7:57:01 PM GMT
GOLD_Physical_Management_2_1_2	Shuts down the physical Gig0 interfa...	WAN Edge Interface	ISR4451-X	4	2	deasande	05 Dec 2019 11:53:43 AM GMT
GOLD_VPN1_2_1_2	Config for VPN 1	WAN Edge VPN	ISR4451-X	4	2	deasande	07 Dec 2019 7:57:41 PM GMT
GOLD_VPN0_GW2_2_1_2	Config for VPN 0 with public DNS	WAN Edge VPN	ISR4451-X	1	1	deasande	05 Dec 2019 11:52:48 AM GMT
GOLD_Service_Interface_Crosslink1_...	Config for service side LAN interface	WAN Edge Interface	ISR4451-X	2	1	deasande	05 Dec 2019 11:54:38 AM GMT
SDWAN_TMPL_TPT_L2VPN_GOLD_...	SDWAN template for L2VPN on WAN...	WAN Edge Interface	C1111-4PLTEEA | C1117-4P | ISR4331...	0	0	kjawaid	07 Apr 2019 6:05:03 PM BST
GOLD_WAN_interface_MPLS2_physic...	GW2 Gold EMEA WAN interface - MP...	WAN Edge Interface	ISR4451-X	0	0	deasande	05 Dec 2019 11:46:27 AM GMT
GOLD_BGP_Internet-VRF3_2_1_2	BGP config for beta sites - _Internet-V...	BGP	ISR4451-X	0	0	deasande	05 Dec 2019 11:56:06 AM GMT
GOLD_WAN_interface_DIA_TLOC-EXT...	Gold EMEA WAN interface - DIA TLO...	WAN Edge Interface	ISR4451-X	0	0	deasande	05 Dec 2019 11:54:00 AM GMT
GOLD_Internet_SVI_g0-0-1_2_1_2	Sub-interface for Internet Handoff	WAN Edge Interface	ISR4451-X	2	2	deasande	07 Dec 2019 8:04:29 PM GMT
GOLD_Service_Physical_Int_Crosslink...	PnP Sub interface for g0/0/1.1 interf...	WAN Edge Interface	ISR4451-X	1	0	deasande	05 Dec 2019 11:50:48 AM GMT
GOLD_VPN3_2_1_2	Internet VN	WAN Edge VPN	ISR4451-X	2	2	deasande	05 Dec 2019 11:44:10 AM GMT
SDWAN_TMPL_SVC_VPN_1_GOLD_SI...	SDWAN Service VPN 1 (Corporate VP...	WAN Edge VPN	ISR4451-X	0	0	kjawaid	07 Apr 2019 3:07:37 PM BST
GOLD_WAN_interface_private1_physi...	Gold EMEA WAN interface - Private1- ...	WAN Edge Interface	ISR4451-X	2	1	deasande	05 Dec 2019 11:46:07 AM GMT
GOLD_NTP_2_1_2	NTP for beta sites	NTP	ISR4451-X	3	2	deasande	05 Dec 2019 11:51:07 AM GMT
GOLD_Service_Physical_Int_Crosslink...	Config for service interface with IP a...	WAN Edge Interface	ISR4451-X	1	0	deasande	07 Dec 2019 7:57:21 PM GMT
GOLD_Loopback_VRF1_2_1_2	Loopback interface in VRF 1	WAN Edge Interface	ISR4451-X	4	2	deasande	07 Dec 2019 8:04:08 PM GMT
GOLD_WAN_interface_MPLS2_TLOC-...	Gold EMEA WAN interface - MPLS TL...	WAN Edge Interface	ISR4451-X	0	0	deasande	05 Dec 2019 11:46:43 AM GMT
GOLD_Service_Physical_Int_Crosslink...	Config for service interface	WAN Edge Interface	ISR4451-X	4	2	deasande	05 Dec 2019 11:55:13 AM GMT
GOLD_Internet_SVI_g0-0-0_2_1_2	Sub-interface for Internet Handoff	WAN Edge Interface	ISR4451-X	2	2	deasande	05 Dec 2019 11:47:01 AM GMT
GOLD_WAN_interface_private1_TLOC...	Gold EMEA WAN interface - Private1 ...	WAN Edge Interface	ISR4451-X	2	1	deasande	05 Dec 2019 11:45:33 AM GMT
GOLD_WAN_interface_MPLS2_TLOC-...	Gold EMEA WAN interface - MPLS TL...	WAN Edge Interface	ISR4451-X	0	0	deasande	05 Dec 2019 11:45:17 AM GMT

Centralised Policy



Question!

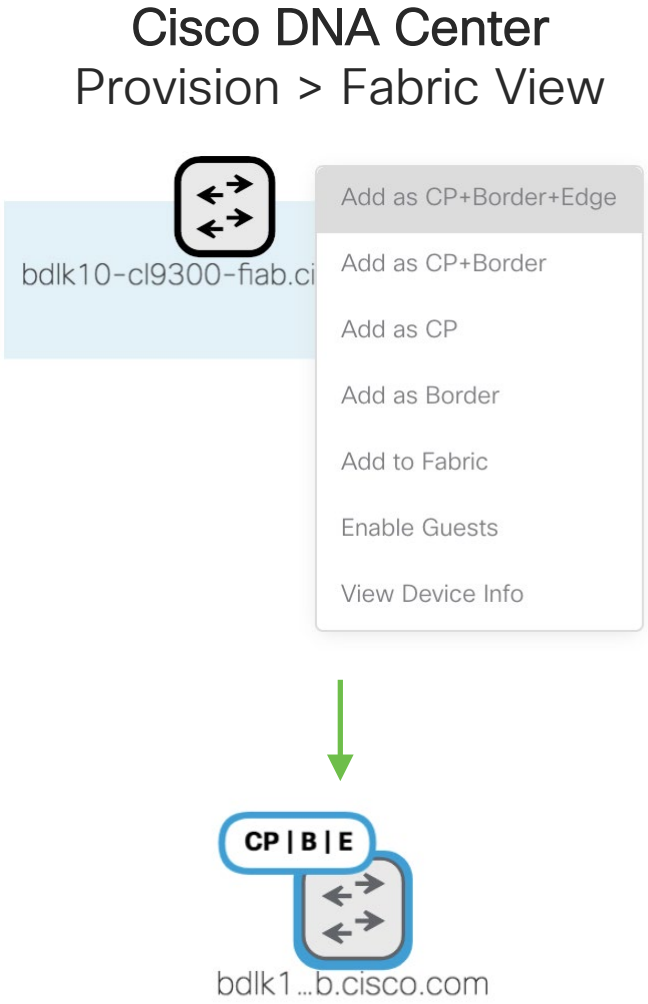
What about a full end-to-end Use Case?

The Fabric-in-a-Box Use Case Story (Silver Topology)

Mapping Topologies to SDA

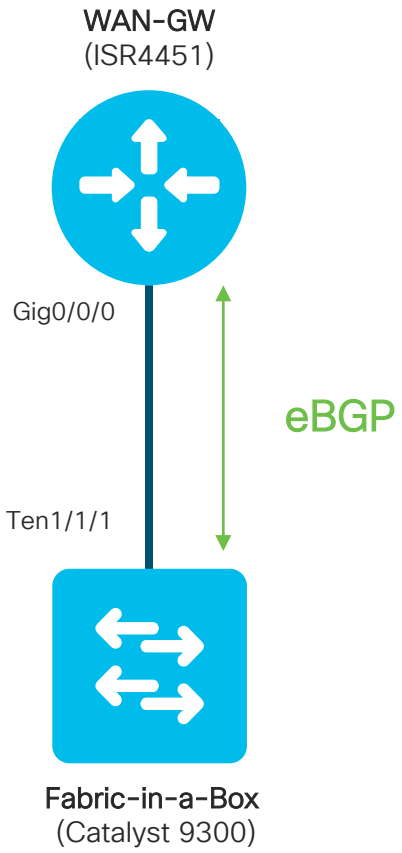
Fabric-in-a-Box (FIAB) – Silver Topology

1. Device can be the Edge (E), Border (B), and Control Plane (CP) node simultaneously
2. Enable Embedded Wireless for collapsed solution on Catalyst 9300 (stack for redundancy)
3. However - No other additional fabric devices are required or permitted
4. As per our topologies, this fits into Silver Site Design (DIA only)



The Fabric-in-a-Box Use Case

FIAB SDA Turn-Up - Basic Underlay Configuration (Pre-SDA)



WAN Gateway (ISR4451)

```
interface Loopback0
 ip address x.x.x.x 255.255.255.255
!
interface GigabitEthernet0/0/1
 description to 9300 Fabric-in-a-Box
 no ip address
 negotiation auto
!
interface GigabitEthernet0/0/1.2011
encapsulation dot1Q 2011
 ip address x.x.x.x 255.255.255.252
!
router bgp 65111
 bgp router-id Loopback0
 bgp log-neighbor-changes
 neighbor x.x.x.x remote-as 65112 <- eBGP to 9300
 !
 address-family ipv4
  network x.x.x.x mask 255.255.255.252 <- p2p to 9300
  neighbor x.x.x.x activate
  neighbor x.x.x.x default-originate
  default-information originate
 exit-address-family
 !
```

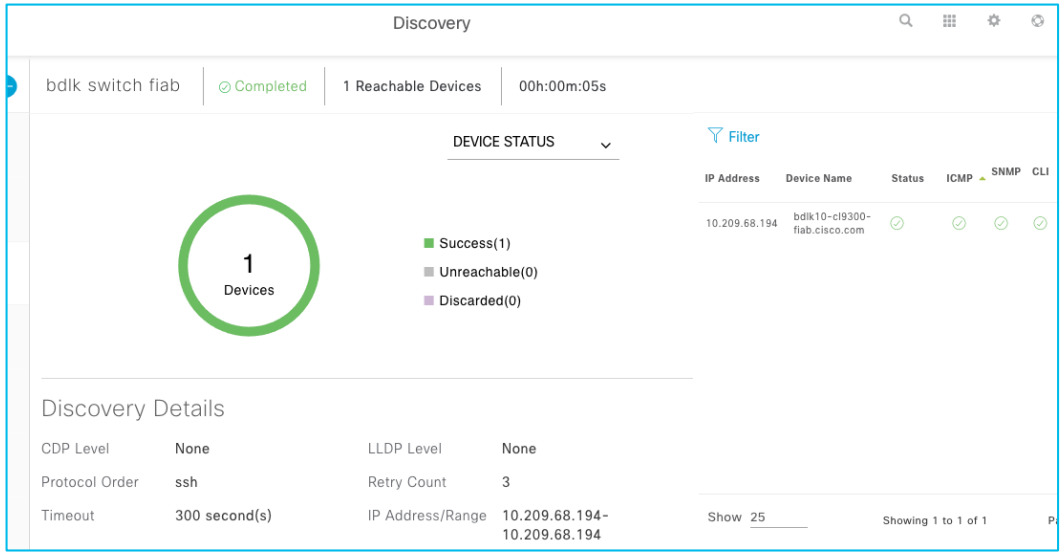
Fabric-in-a-Box (Catalyst 9300 – Post PnP)

```
interface Loopback0
 ip address x.x.x.x 255.255.255.255
!
interface TenGigabitEthernet1/1/1 <- physical link to WAN
 description to cEdge ISR4451
 switchport trunk allowed 2011
 switchport mode trunk
!
interface Vlan2011 <- underlay SVI
 ip address x.x.x.x 255.255.255.252
!
router bgp 65112
 bgp router-id interface Loopback0
 bgp log-neighbor-changes
 neighbor x.x.x.x remote-as 65111 <- eBGP to WAN
 !
 address-family ipv4
  network x.x.x.x mask 255.255.255.252 <- p2p to WAN
  network x.x.x.x mask 255.255.255.255
  redistribute connected
  neighbor x.x.x.x activate
 exit-address-family
!
```

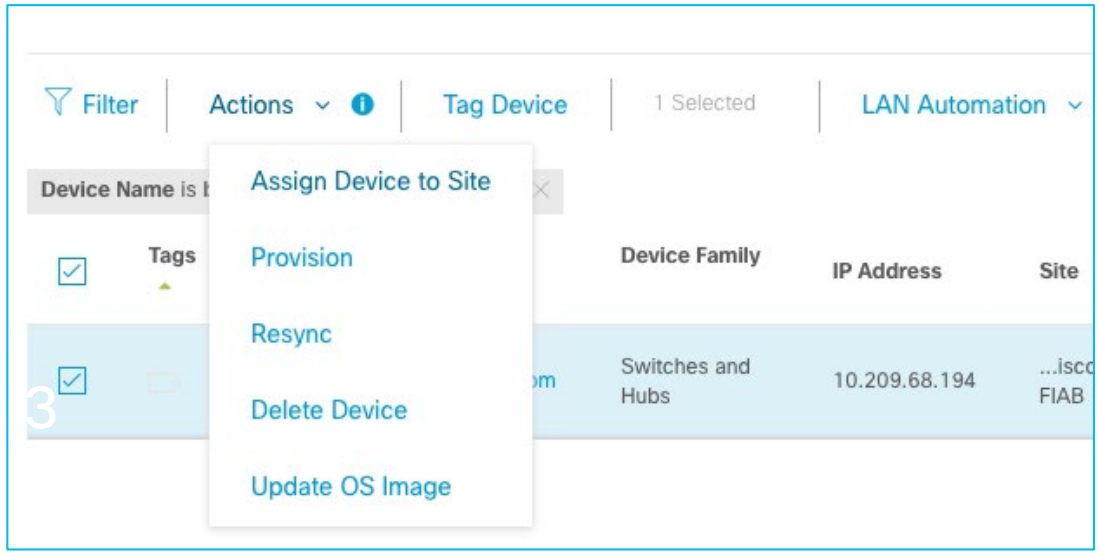
The Fabric-in-a-Box Use Case

FIAB SDA Turn-Up - Discovery and Assignment

1 Discover device



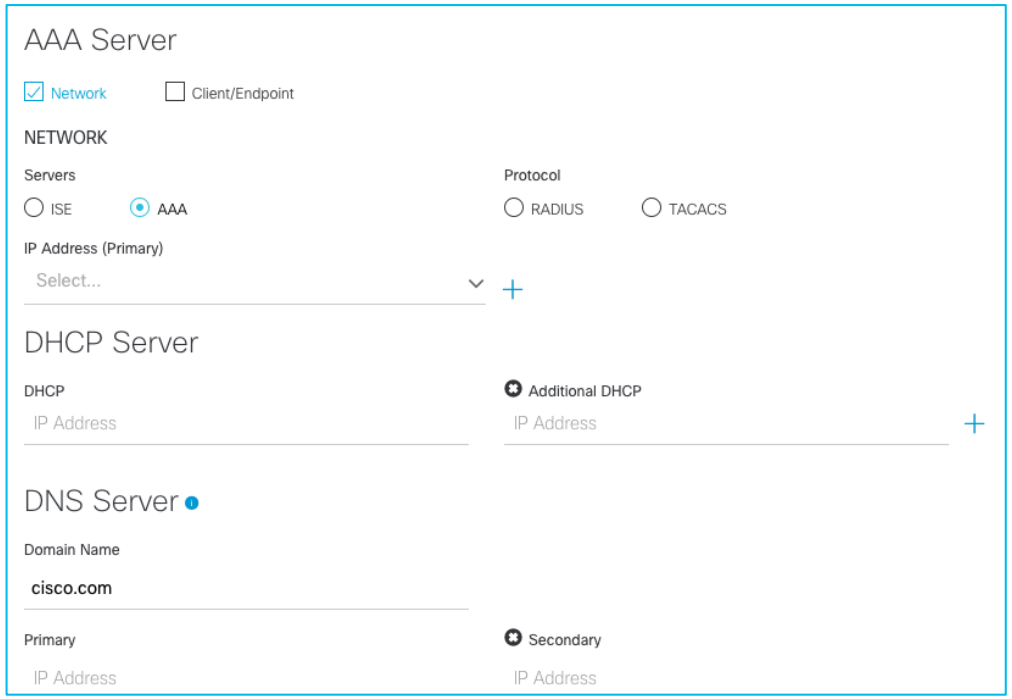
2 Provision and Assign Device to Site



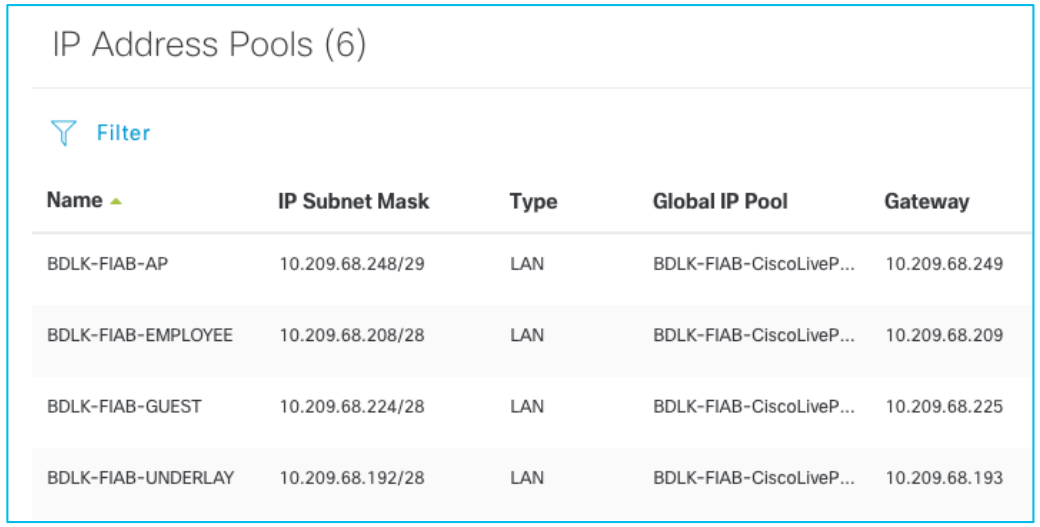
The Fabric-in-a-Box Use Case

FIAB SDA Turn-Up - Define your Network Settings

3 Define Network Settings



4 Define Addressing Schema

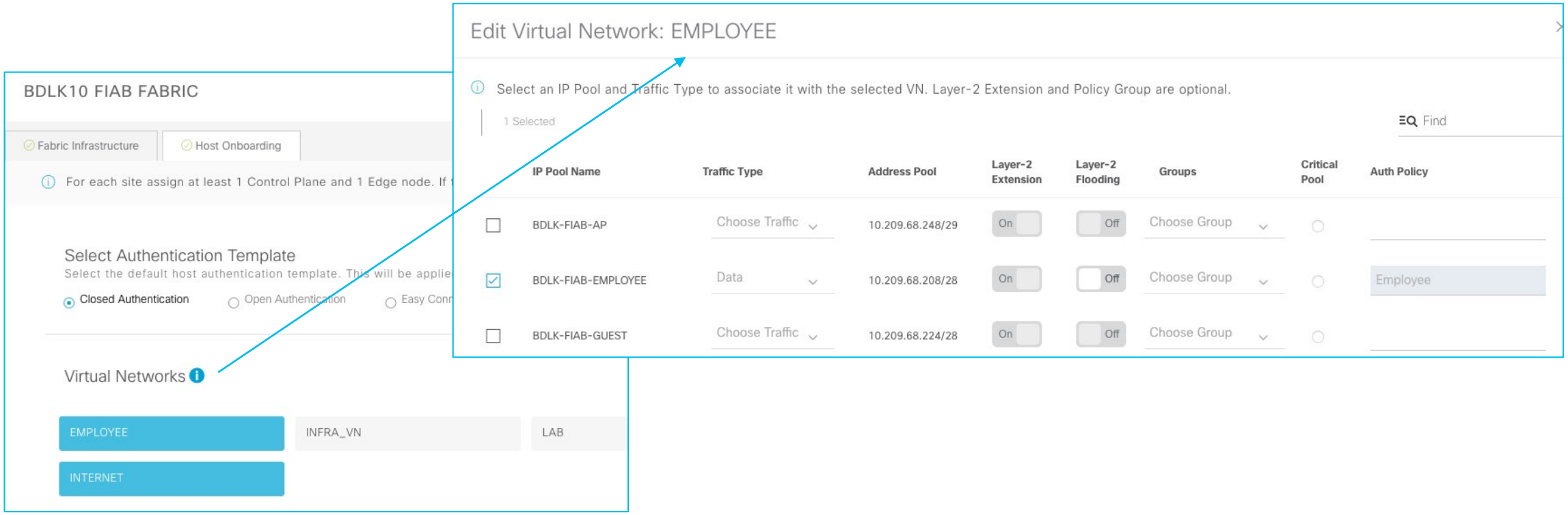


Name	IP Subnet Mask	Type	Global IP Pool	Gateway
BDLK-FIAB-AP	10.209.68.248/29	LAN	BDLK-FIAB-CiscoLiveP...	10.209.68.249
BDLK-FIAB-EMPLOYEE	10.209.68.208/28	LAN	BDLK-FIAB-CiscoLiveP...	10.209.68.209
BDLK-FIAB-GUEST	10.209.68.224/28	LAN	BDLK-FIAB-CiscoLiveP...	10.209.68.225
BDLK-FIAB-UNDERLAY	10.209.68.192/28	LAN	BDLK-FIAB-CiscoLiveP...	10.209.68.193

The Fabric-in-a-Box Use Case

FIAB SDA Turn-Up - Host Onboarding Pre-SDA Push

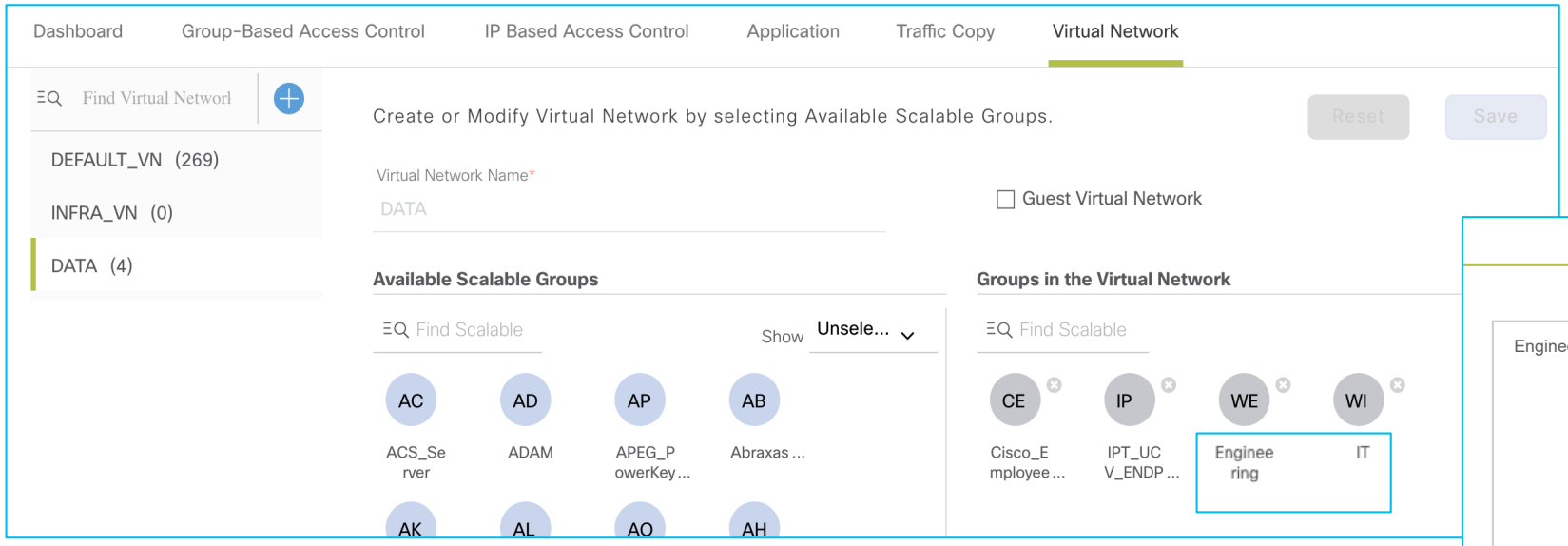
5 Define Host Onboarding

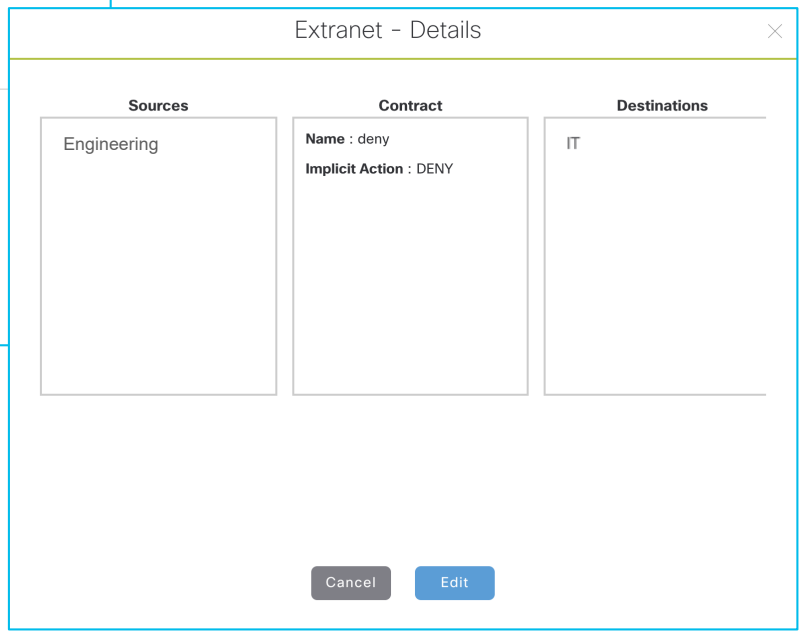


The Fabric-in-a-Box Use Case

FIAB SDA Turn-Up - Scalable Group Tag/Contract Creation

6 Define SGTs (If req.)

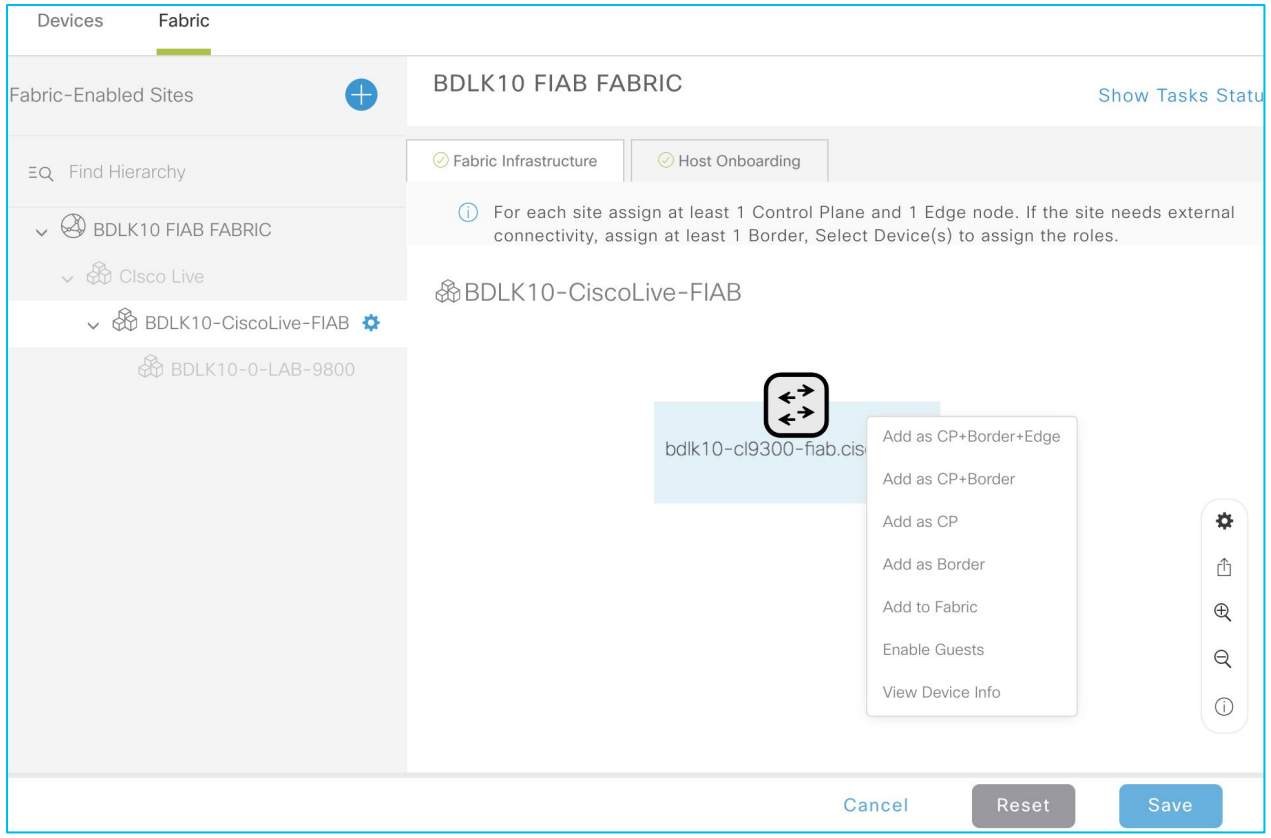




The Fabric-in-a-Box Use Case

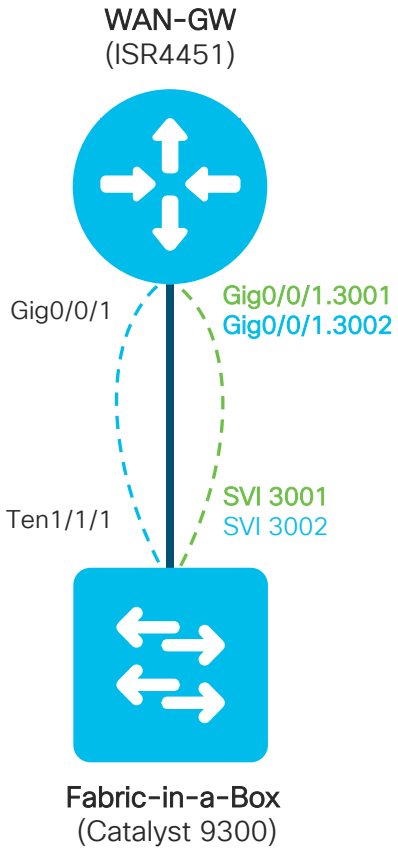
FIAB SDA Turn-Up – Fabric Push

6 Select CP, Border, and Edge Roles / Save to Complete



The Fabric-in-a-Box Use Case

FIAB SDA Turn-Up – A Look Under The Hood Post Push (Post-SDA)



Fabric-in-a-Box (Catalyst 9300)

BGP Configuration Snippet for EMPLOYEE/INTERNET

```
...
 address-family ipv4
  bgp aggregate-timer 0
  network x.x.x.x mask 255.255.255.255
  redistribute connected
  redistribute lisp metric 10
  neighbor x.x.x.x activate
 exit-address-family
 !
 address-family ipv4 vrf EMPLOYEE
  bgp aggregate-timer 0
  network x.x.x.x mask 255.255.255.255
  network x.x.x.x mask 255.255.255.240
  aggregate-address x.x.x.x 255.255.255.240 summary-only
  redistribute lisp metric 10
  neighbor x.x.x.x remote-as 65111
  neighbor x.x.x.x update-source Vlan3001
  neighbor x.x.x.x activate
  neighbor x.x.x.x weight 65535
 exit-address-family
 !
 address-family ipv4 vrf INTERNET
  bgp aggregate-timer 0
  network x.x.x.x mask 255.255.255.240
  aggregate-address x.x.x.x 255.255.255.240 summary-only
  redistribute lisp metric 10
  neighbor x.x.x.x remote-as 65111
  neighbor x.x.x.x update-source Vlan3002
  neighbor x.x.x.x activate
  neighbor x.x.x.x weight 65535
 exit-address-family
```

Fabric-in-a-Box (Catalyst 9300)

LISP Configuration Snippet for EMPLOYEE

```
...
instance-id 4099
 remote-rloc-probe on-route-change
 dynamic-eid Employee
  database-mapping x.x.x.x/28 locator-set rloc_xxx
  exit-dynamic-eid
 !
 service ipv4
  eid-table vrf EMPLOYEE
  map-cache 0.0.0.0/0 map-request
  route-export site-registrations
  distance site-registrations 250
  map-cache site-registration
  exit-service-ipv4
 !
 exit-instance-id
!
 instance-id 8190
 remote-rloc-probe on-route-change
 service ethernet
  eid-table vlan 1023
  database-mapping mac locator-set rloc_xxx
  exit-service-ethernet
 !
 exit-instance-id
```

The Fabric-in-a-Box Use-Case

FIAB SDA Turn-Up – How to Verify Macro/Micro Verifications

IT User

```
bdlk10-cl9300-fiab#show access-session interface tenGigabitEthernet 1/0/1 det
           Interface:  TenGigabitEthernet1/0/1
             IIF-ID:  0x16ADC532
         MAC Address:  0050.56bd.e6ee
        IPv6 Address:  fe80::2c14:3033:54e7:b2b8
        IPv4 Address:  x.x.x.x
           User-Name:  host/JAMIE-0855A
              Status:  Authorized
              Domain:  DATA
     Oper host mode:  multi-auth
    Oper control dir:  both
     Session timeout:  N/A
   Common Session ID:  C644D10A000000C970B267B1
    Acct Session ID:  0x0000c37f
             Handle:  0xff00002c
     Current Policy:  PMAP_DefaultWiredDot1xClosedAuth_1X_MAB

Server Policies:
          Vlan Group:  Vlan: 1023
           SGT Value:  16
```

ENG User

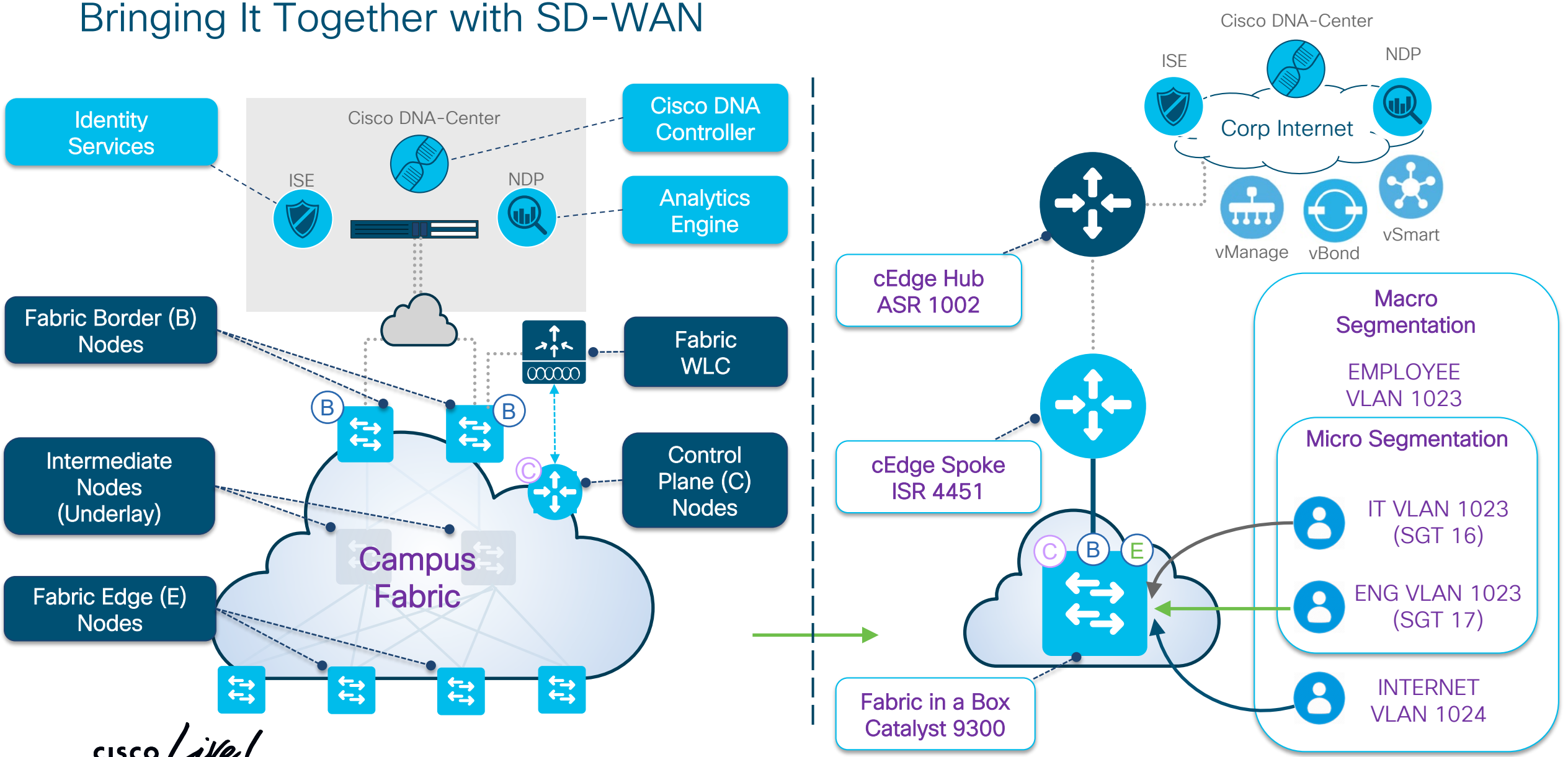
```
bdlk10-cl9300-fiab#show access-session interface tenGigabitEthernet 1/0/2 det
           Interface:  TenGigabitEthernet1/0/2
             IIF-ID:  0x171F0D4F
         MAC Address:  0050.56bd.e2ca
        IPv6 Address:  fe80::650d:fdb1:5929:b1af
        IPv4 Address:  x.x.x.x
           User-Name:  host/CALLUM-0843A
              Status:  Authorized
              Domain:  DATA
     Oper host mode:  multi-auth
    Oper control dir:  both
     Session timeout:  N/A
   Common Session ID:  C644D10A000000CB70B3BD09
    Acct Session ID:  0x0000035e
             Handle:  0x3900002e
     Current Policy:  PMAP_DefaultWiredDot1xClosedAuth_1X_MAB

Server Policies:
          Vlan Group:  Vlan: 1023
           SGT Value:  17
```

Question!

What about the (SD-)WAN?

The Fabric-in-a-Box Use Case

Bringing It Together with SD-WAN



What did we learn on SDA <> SDWAN Hand-off?

Key Configurations

Hand-off at the cEdge 4451 Side (SDWAN)

```
bdlk10-cl4331-fiab#show run int gi0/0/1
interface GigabitEthernet0/0/1
 description to bdlk10-cl9300-fiab te1/1/1
 mtu 9100
 no ip address
 negotiation auto
```

```
bdlk10-cl4431-fiab#show run int g0/0/1.3001
interface GigabitEthernet0/0/1.3001
 description Employee-VRF
 encapsulation dot1Q 3001
 vrf forwarding 1
 ip address x.x.x.x 255.255.255.252
 ip mtu 1496
```

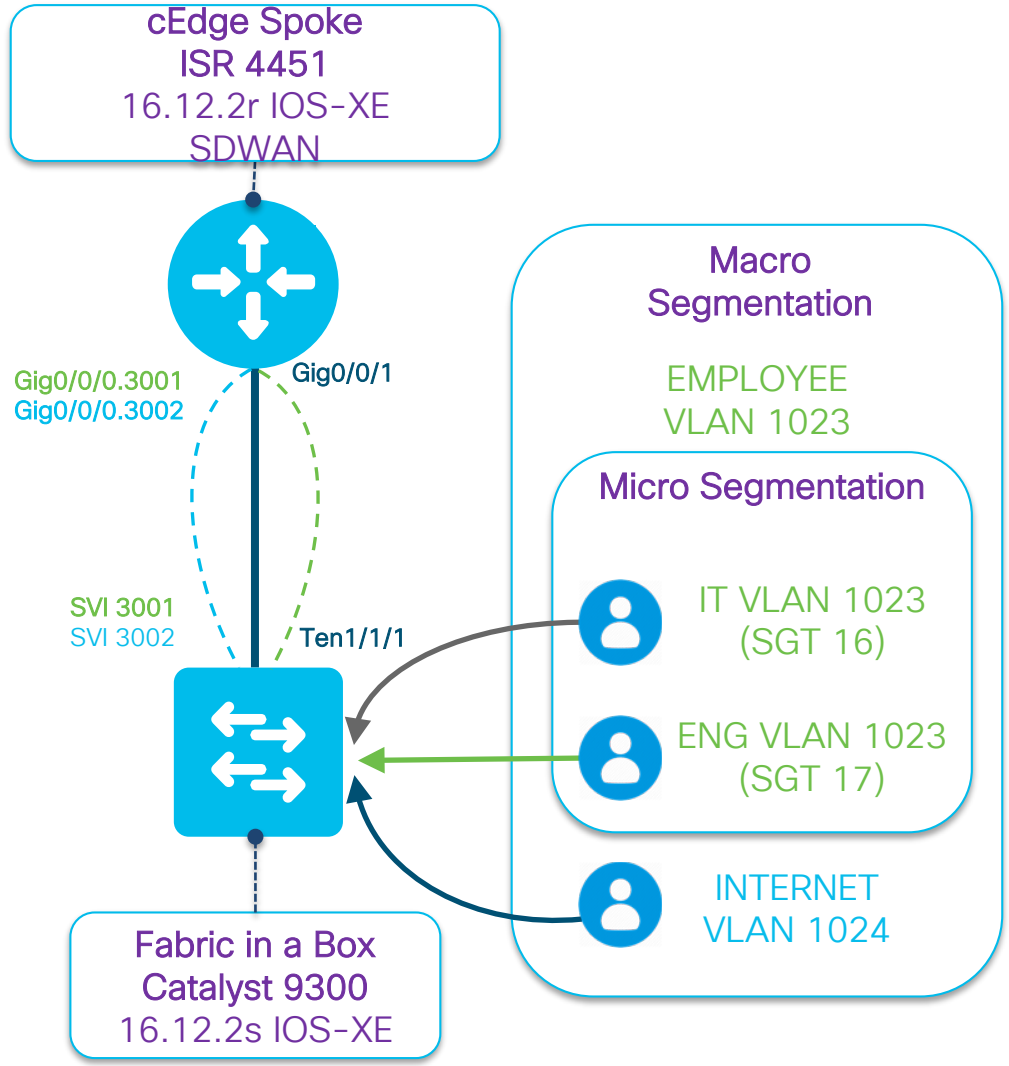
```
bdlk10-cl4331-fiab#show run int g0/0/1.3002
interface GigabitEthernet0/0/1.3002
 description Internet/Guest-VRF
 encapsulation dot1Q 3002
 vrf forwarding 3
 ip address x.x.x.x 255.255.255.252
 ip mtu 1496
```

Hand-off at the FIAB 9300 Side (SDA)

```
bdlk10-cl9300-fiab#show run int te1/1/1
interface TenGigabitEthernet1/1/1
 description bldk10-cl4331-fiab gig0/0/1
 switchport trunk allowed vlan 1,2011,3001,3002
 switchport mode trunk
```

```
bdlk10-cl9300-fiab#show run int vlan 3001
interface Vlan3001
 description vrf interface to External router
 vrf forwarding EMPLOYEE
 ip address x.x.x.x 255.255.255.252
 no ip redirects
 ip route-cache same-interface
```

```
bdlk10-cl9300-fiab#show run int vlan 3002
interface Vlan3002
 description vrf interface to External router
 vrf forwarding INTERNET
 ip address x.x.x.x 255.255.255.252
 no ip redirects
 ip route-cache same-interface
```



What did we learn on SDA <> SDWAN Hand-off?

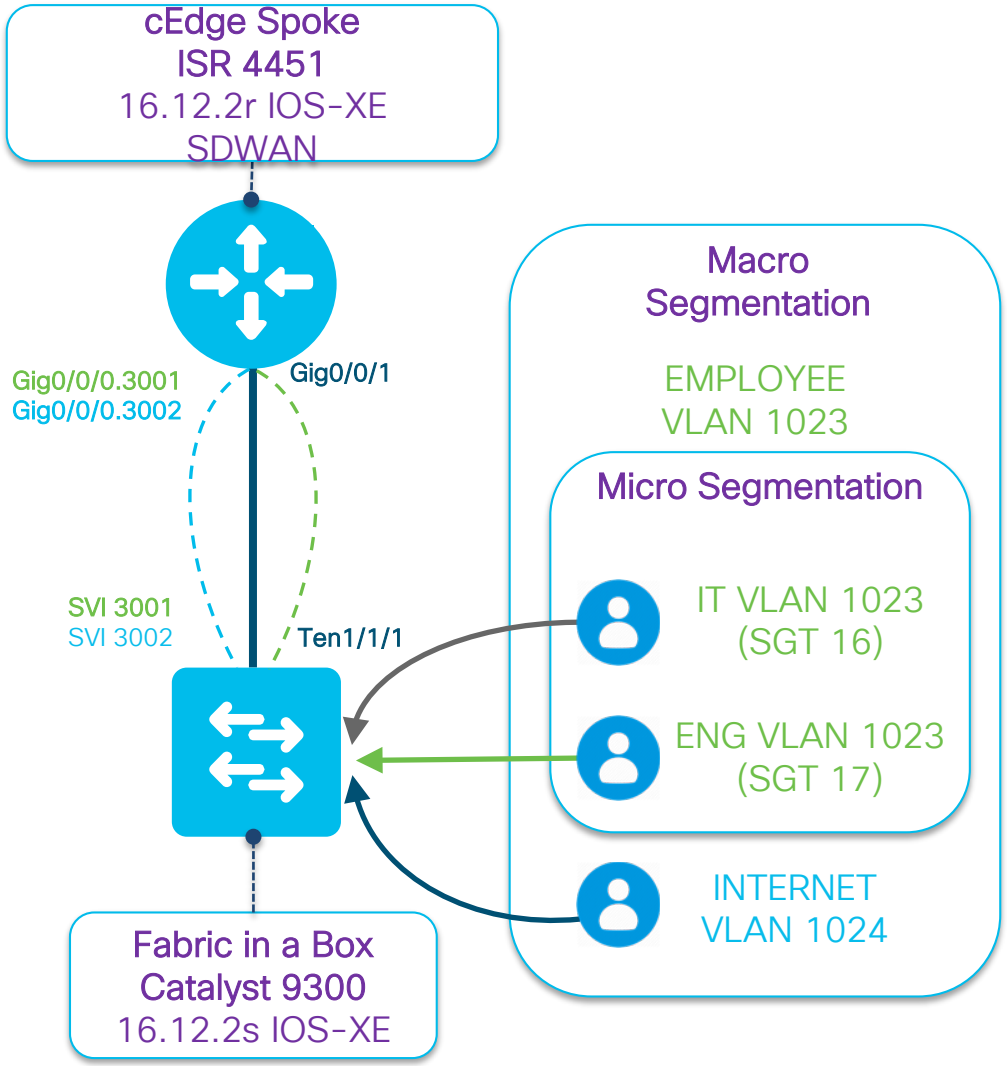
Key Configurations Cont.

cEdge 4451 Side (SDWAN) (vManage Templates)

```
router bgp 65111
 ...
!
 address-family ipv4
  network x.x.x.x mask 255.255.255.252
  redistribute eigrp 109
  neighbor x.x.x.x activate
  neighbor x.x.x.x default-originate
  default-information originate
 exit-address-family
 !
 address-family ipv4 vrf 1
  redistribute omp metric 1000
  neighbor 10.209.69.129 remote-as 65112
  neighbor 10.209.69.129 activate
  neighbor 10.209.69.129 default-originate
 exit-address-family
 !
 address-family ipv4 vrf 3
  redistribute omp metric 1000
  neighbor 10.209.69.133 remote-as 65112
  neighbor 10.209.69.133 activate
  neighbor 10.209.69.133 default-originate
 exit-address-family
```

cEdge 4451 Side (SDWAN)

```
sdwan
 interface GigabitEthernet0/0/0 (ISP)
  tunnel-interface
   encapsulation ipsec
   color private1
   no allow-service bgp
   allow-service dhcp
   allow-service dns
   allow-service icmp
   no allow-service sshd
   no allow-service netconf
   no allow-service ntp
   no allow-service ospf
   no allow-service stun
   allow-service https
!
omp
  no shutdown
  graceful-restart
  address-family ipv4 vrf 1
   advertise bgp
  !
  address-family ipv4 vrf 3
   advertise bgp
  !
  address-family ipv4
   advertise bgp
   advertise connected
   advertise static
```



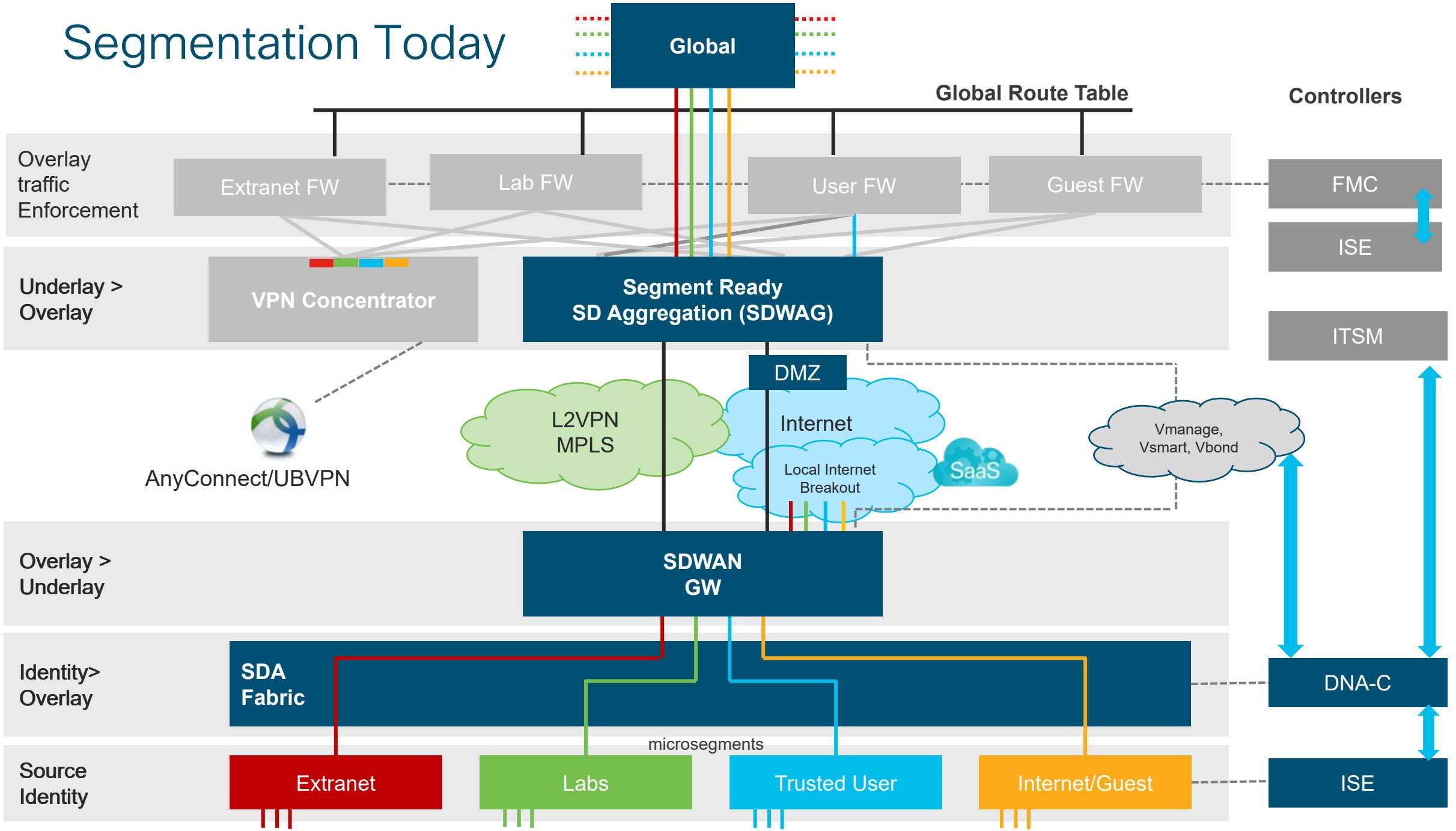
Part 3- Automation & Deployment

What's our progress?

Development	2 Beta Locations with full fabric
Hardware	147 Locations with DNA Ready hardware installed.
Segmentation	4 SD-WAN Hubs Segmentation ready
Full Fabric	2 Silver and 4 Gold Sites running full fabric – Many more to come!

Data Correct Jan 2020

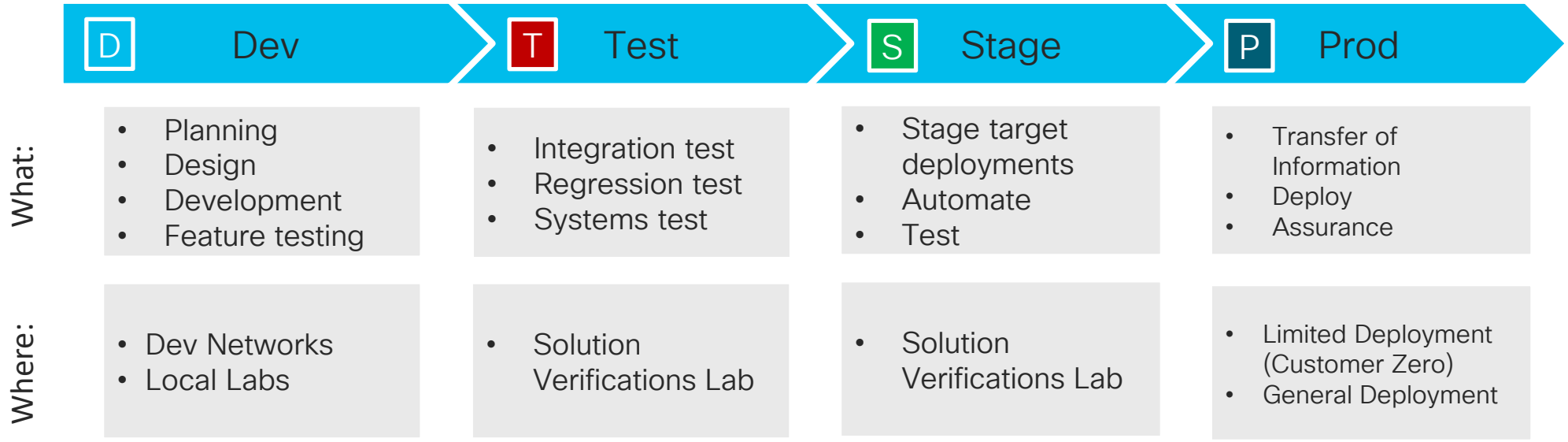
Segmentation Today



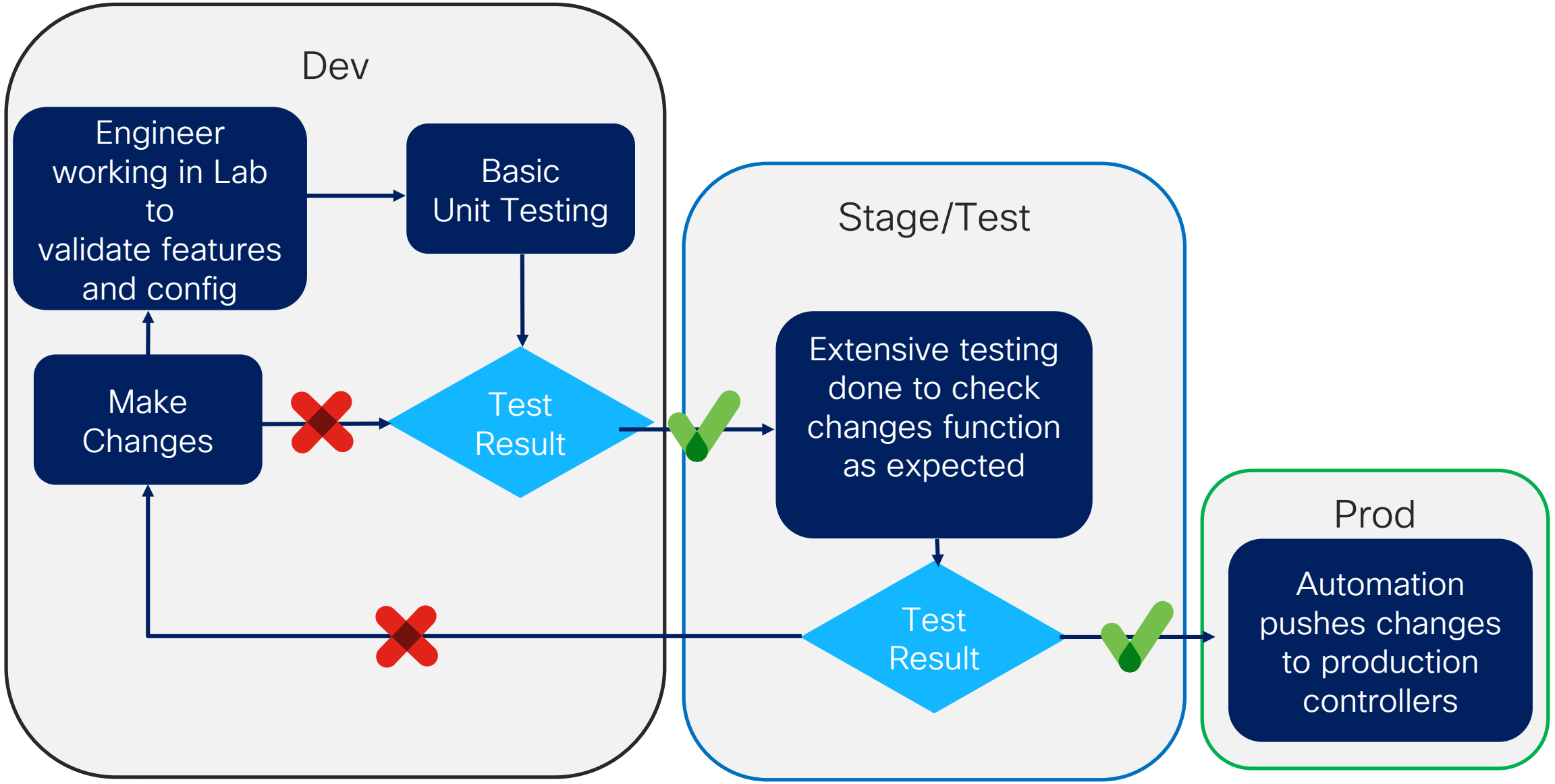
Development Lifecycle

The Requirement for A Deployment Lifecycle

Development through to Production



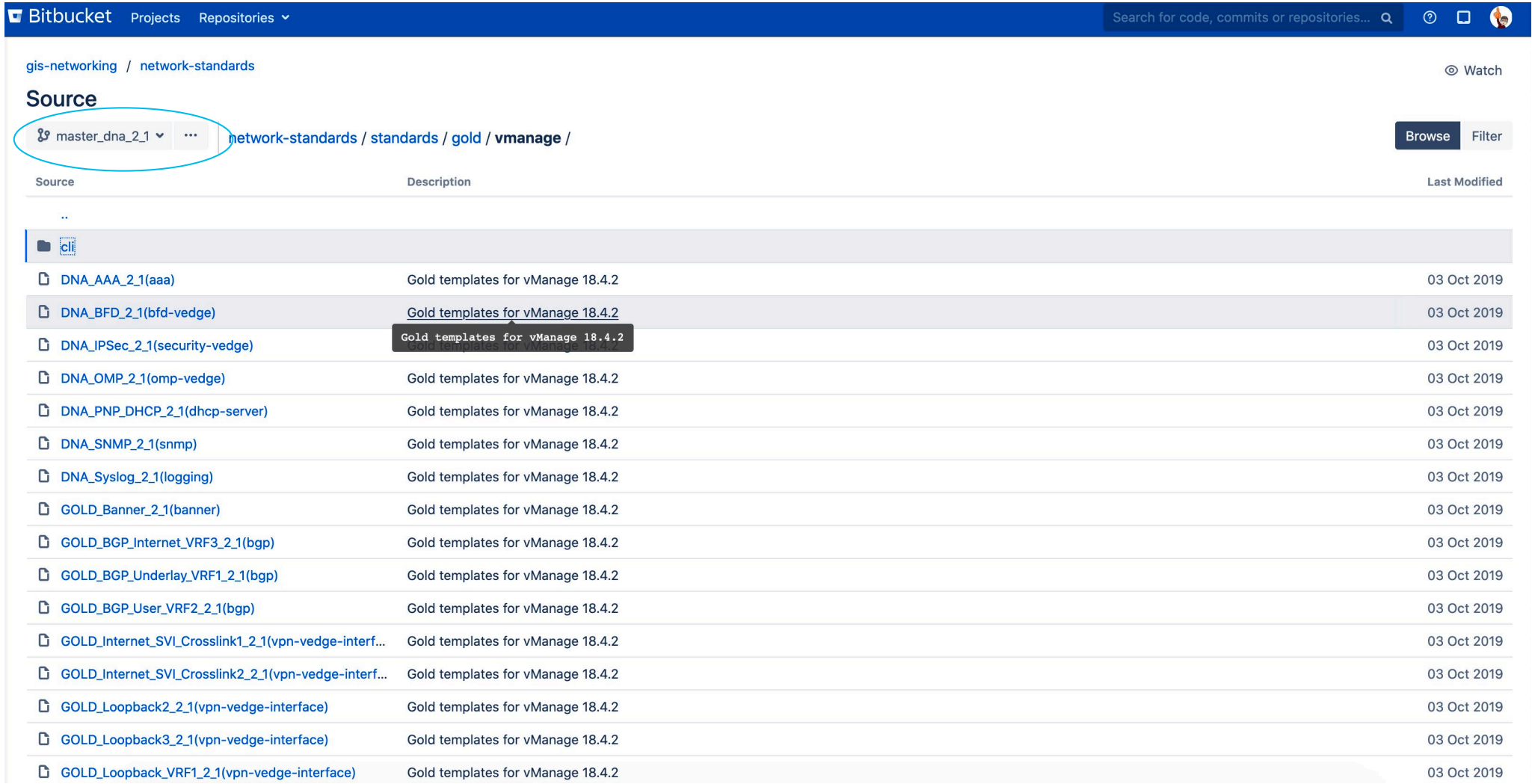
Cisco IT Development Lifecycle



CI/CD Workflow

- REST APIs are exposed by DNA-Center and vManage controllers for features like templates, policies, devices and sites management
- git, python+Flask, Jenkins and Docker are used to build micro-services with CI/CD pipeline
- Helps in building integrated solutions with different IT tools used for network operations

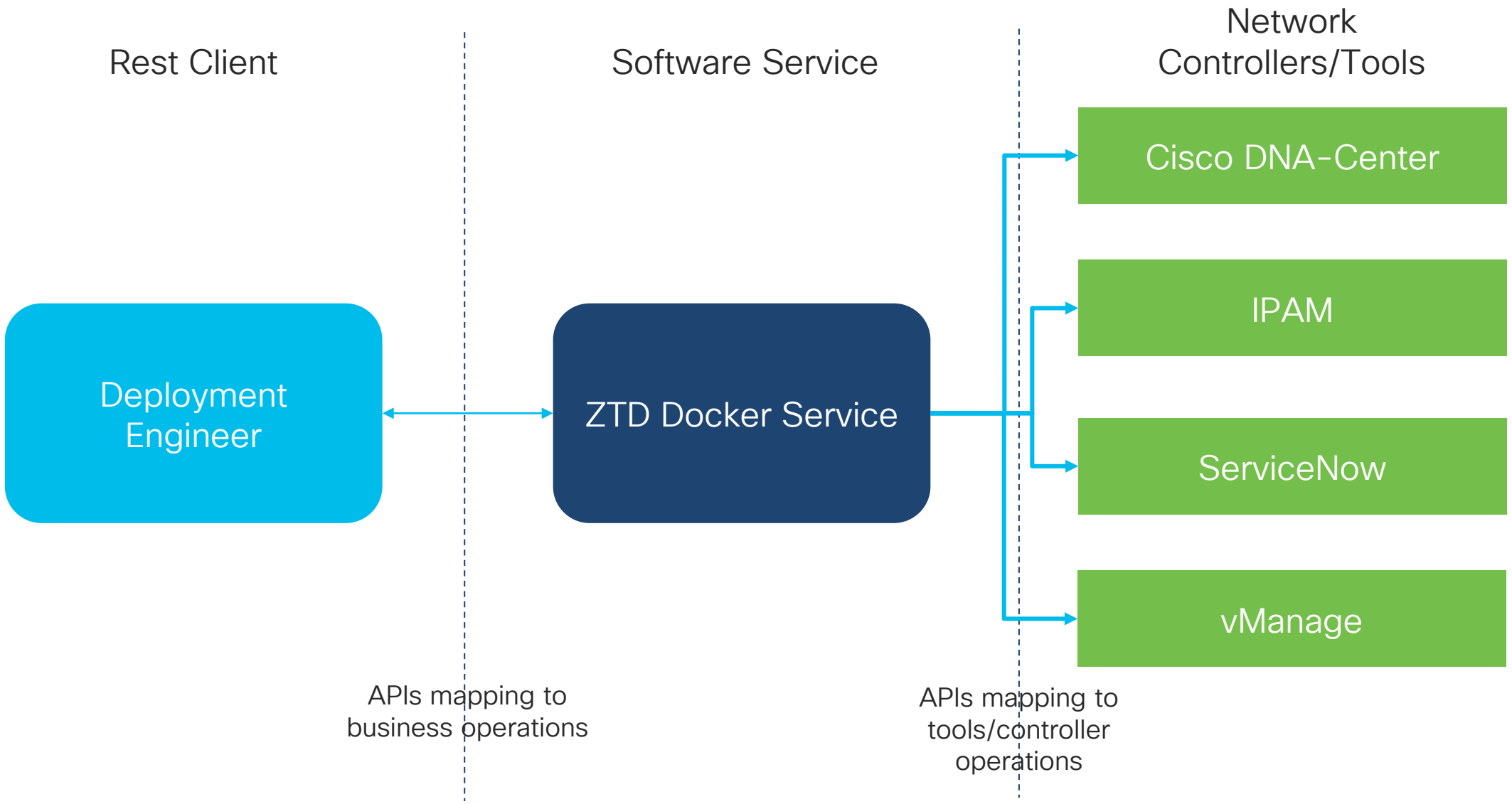
Configuration Management



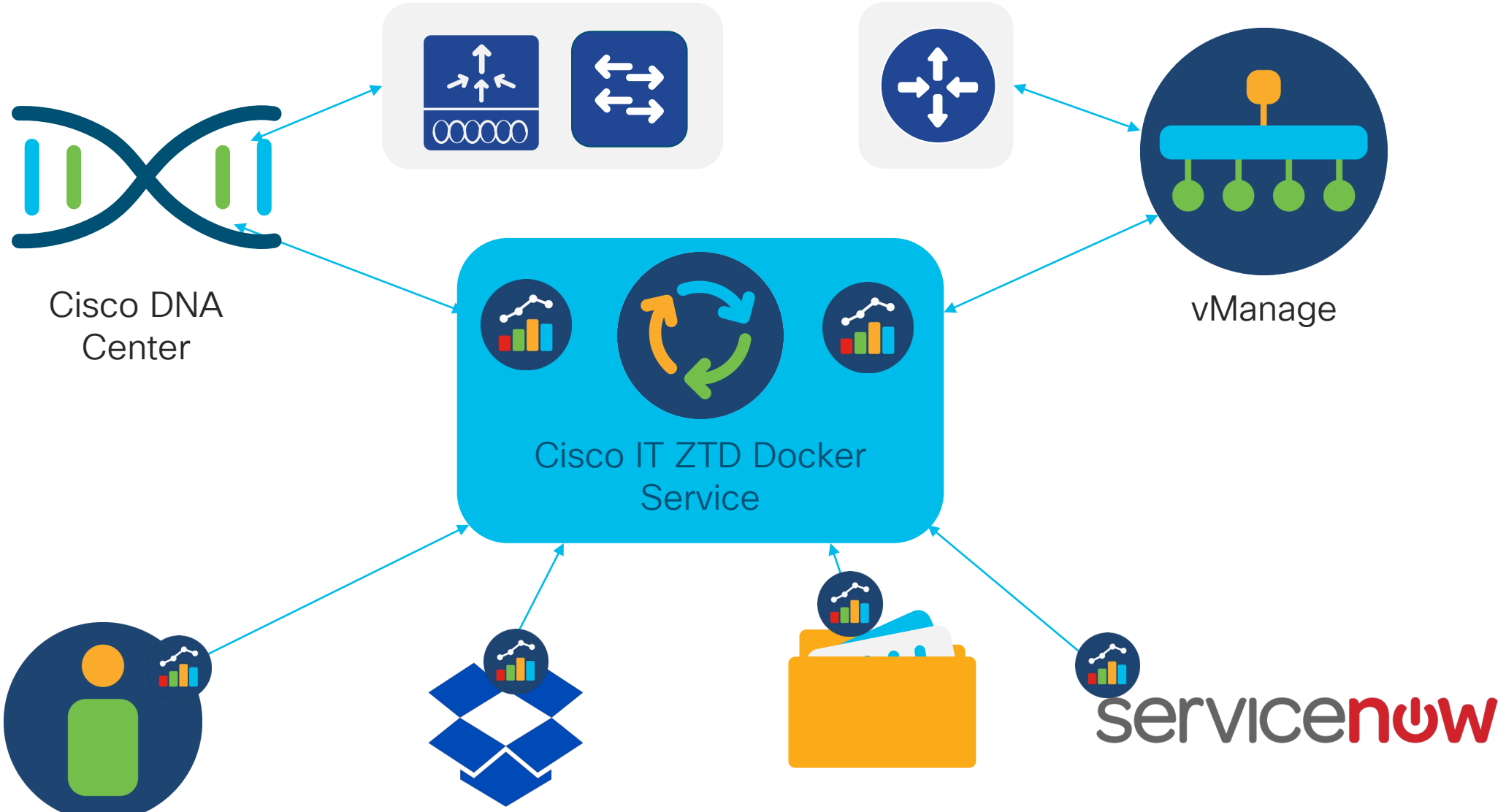
Question!

How do we use automation for our deployments?

ZTD Architecture



Service Integration



DEMO: Cisco IT ZTD Docker Service

What's next?

1. SD-WAN Only
2. 2.1.3 Fabric Deployments
3. Operationalize Assurance
4. Automation
5. Campus (Multi-Site)

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