

# Cisco DNA Digital Network Architecture

- “Cisco DNA enables you to streamline operations and facilitate IT and business innovation.
- **Intent-based networking (IBN)** built on **Cisco DNA** takes a **software-delivered** approach to **automating** and **assuring** services across your WAN and your campus and branch networks.”

# Cisco DNA Digital Network Architecture

- 3 of the main building blocks of Cisco DNA and Software Defined Architecture are:
  - DNA Center
  - SD-Access
  - SD-WAN

# DNA Center



- DNA Center is a Cisco SDN controller which is designed to manage enterprise environments – campus, branch and WAN
- (As opposed to the APIC which manages data center environments with Nexus switches)
- You can think of DNA Center as an upgrade to the APIC-EM (Application Policy Infrastructure Controller – Enterprise Module)

# DNA Center Appliance



- The DNA Center Appliance runs on Cisco UCS server hardware
- The underlying operating system is Linux
- It can be clustered for redundancy



# IBN Intent Based Networking (IBN)



- Intent Based Networking transforms a traditional manual network into a controller led network that translates the business needs into policies that can be automated and applied consistently across the network.
- The goal is to continuously monitor and adjust network performance to help assure desired business outcomes.

# IBN Intent Based Networking Example 1

Example 1: a QoS policy roll-out

- The Intent: The network policy is first defined, for example providing guaranteed service to voice and video across network locations

# IBN Intent Based Networking Example 1

## Traditional Networking:

- The network team researches and plans the implementation, then configures each network device individually.
- Different network device models require different commands.
- This method is very time consuming and liable to mistakes

# IBN Intent Based Networking Example 1

## Intent Based Networking:

- The network team creates an Application Policy in DNA Center specifying voice and video as business relevant applications.
- DNA Center automatically configures the best practice QoS settings on the network devices.
- This can reduce total deployment time from months to minutes



# IBN Intent Based Networking Example 1

## Application Policies

Application Policy Name\*

Site Scope 0 Sites LAN Queuing Profiles CVD\_QUEUING\_PROFILE SP Profiles 0 Profiles Host Tracking  Off

EQ

### Business Relevant (16)

- Authentication-Services  
39 applications
- Backup-And-Storage  
14 applications
- Collaboration-Apps  
42 applications
- Database-Apps  
33 applications
- Desktop-Virtualization-Apps  
18 applications
- Email  
29 applications
- Enterprise-Ipc  
20 applications

### Default (6)

- File-Sharing  
32 applications
- General-Browsing  
9 applications
- General-Media  
12 applications
- General-Misc  
485 applications
- Software-Updates  
15 applications
- Tunneling  
20 applications

Custom-Apps  
1 applications

### Business Irrelevant (6)

- Consumer-Browsing  
223 applications
- Consumer-File-Sharing  
38 applications
- Consumer-Gaming  
15 applications
- Consumer-Media  
98 applications
- Consumer-Misc  
9 applications
- Consumer-Social-Networking  
13 applications

### Unassigned Application Sets (1)

- Custom-Apps  
1 applications

# IBN Intent Based Networking Example 2

## Example 2: Securing traffic flows in the campus

- The Intent: Users in DeptA and DeptB must have connectivity to other users in their own department, and to the company servers. They must not have connectivity to users in the other department

# IBN Intent Based Networking Example 2

## Traditional Networking:

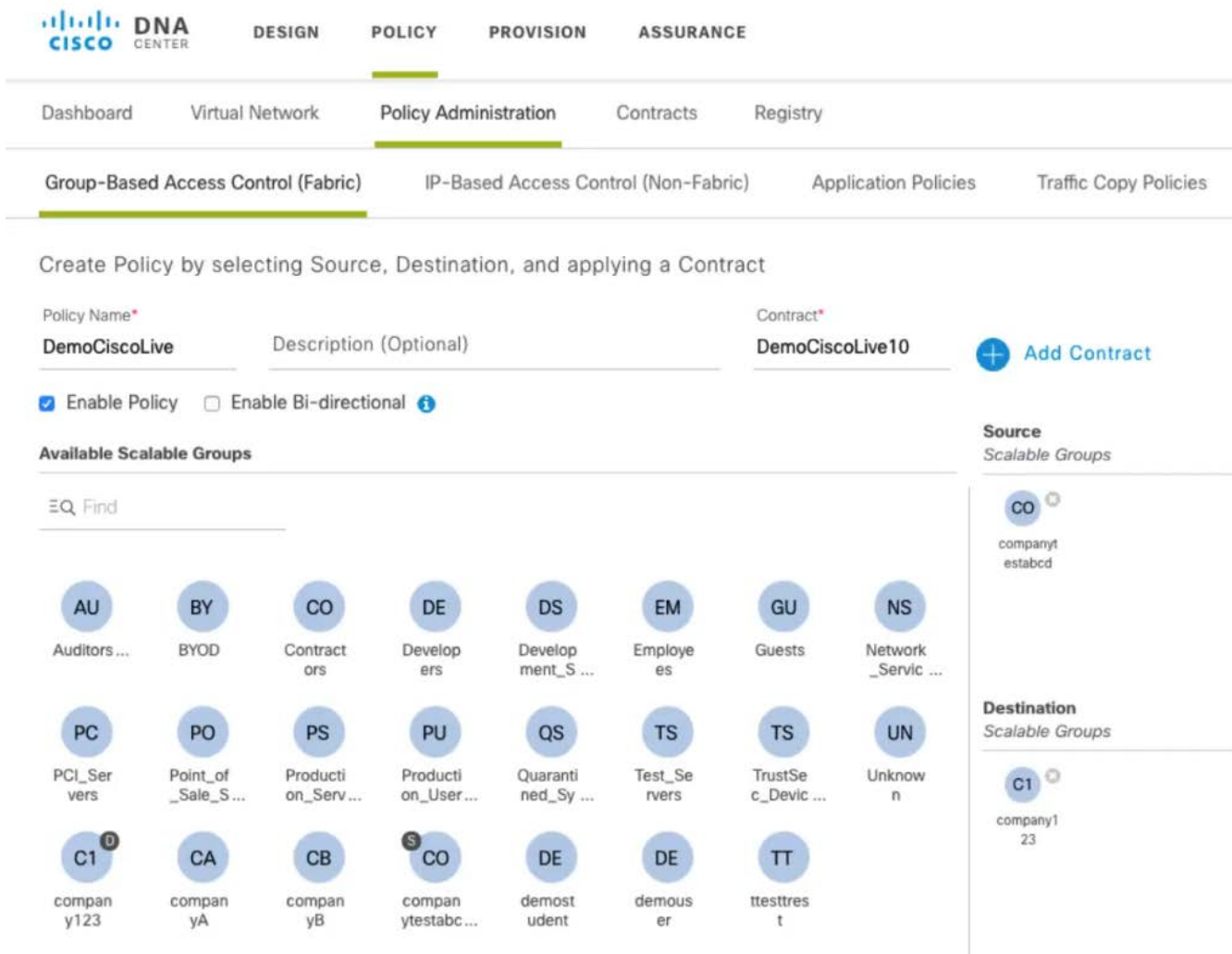
- The network team plans the VLAN, IP subnet and ACL implementation, then configures each switch individually.
- Users are expected to stay plugged in to the same access port. They are assigned a VLAN and IP Address based on their physical location
- This method is very time consuming, liable to mistakes, and does not support mobility

# IBN Intent Based Networking Example 2

## Intent Based Networking:

- The network team creates a Group-Based Access Control Policy in DNA Center which specifies the allowed traffic flows
- Users log in from and can move to any physical location on campus
- They are authenticated by Cisco ISE Identity Services Engine and assigned a Security Group Tag controlling their access

# IBN Intent Based Networking Example 2



The screenshot shows the Cisco DNA Center interface for Policy Administration. The top navigation bar includes 'DESIGN', 'POLICY', 'PROVISION', and 'ASSURANCE'. The 'POLICY' section is active, with sub-menus for 'Dashboard', 'Virtual Network', 'Policy Administration', 'Contracts', and 'Registry'. Under 'Policy Administration', there are options for 'Group-Based Access Control (Fabric)', 'IP-Based Access Control (Non-Fabric)', 'Application Policies', and 'Traffic Copy Policies'. The 'Group-Based Access Control (Fabric)' option is selected.

Below the navigation, a instruction reads: "Create Policy by selecting Source, Destination, and applying a Contract".

The form fields are as follows:

- Policy Name\***: DemoCiscoLive
- Description (Optional)**: (empty)
- Contract\***: DemoCiscoLive10
- Buttons**: + Add Contract
- Enable Policy**:  (checked)
- Enable Bi-directional**:  (unchecked)

**Available Scalable Groups**

EQ Find

AU	BY	CO	DE	DS	EM	GU	NS
Auditors ...	BYOD	Contract ors	Develop ers	Develop ment_S ...	Emplo yees	Guests	Network _Servic ...
PC	PO	PS	PU	QS	TS	TS	UN
PCI_Ser vers	Point_of _Sale_S ...	Producti on_Serv ...	Producti on_User ...	Quaranti ned_Sy ...	Test_Se rvers	TrustSe c_Devic ...	Unknow n
C1	CA	CB	CO	DE	DE	TT	
compan y123	compan yA	compan yB	compan ytestabc...	demost udent	demous er	ttestres t	

**Source Scalable Groups**

- CO: companyt estabcd

**Destination Scalable Groups**

- C1: company1 23

# DNA Center Dashboard – Config and Ops



DESIGN

POLICY

PROVISION

ASSURANCE



## Network Configuration and Operations

### Design

Model your entire network, from sites and buildings to devices and links, both physical and virtual, across campus, branch, WAN and cloud.

- [Add site locations on the network](#)
- [Designate golden images for device families](#)
- [Create wireless profiles of SSIDs](#)

### Policy

Use policies to automate and simplify network management, reducing cost and risk while speeding rollout of new and enhanced services.

- [Segment your network as Virtual Networks](#)
- [Create scalable groups to describe your critical assets](#)
- [Define segmentation policies to meet your policy goals](#)

### Provision

Provide new services to users with ease, speed and security across your enterprise network, regardless of network size and complexity.

- [Discover Devices](#)
- [Manage Unclaimed Devices](#)
- [Set up fabric across sites](#)

### Assurance










Use proactive monitoring and insights from the network, devices, and applications to predict problems faster and ensure that policy and configuration changes achieve the business intent and the user experience you want.

- [Assurance Health](#)
- [Assurance Issues](#)

# DNA Center Dashboard - Tools



## Tools

 <b>Discovery</b> Automate addition of devices to controller inventory	 <b>Inventory</b> Add, update or delete devices that are managed by the controller	 <b>Topology</b> Visualize how devices are interconnected and how they communicate	 <b>Image Repository</b> Download and manage physical and virtual software images automatically
 <b>Command Runner</b> Allows you to run diagnostic CLIs against one or more devices	 <b>License Manager</b> Visualize and manage license usage	 <b>Template Editor</b> An interactive editor to author CLI templates	 <b>Network Plug and Play</b> <i>BETA</i> A simple and secure approach to provision networks with a near zero touch experience
 <b>Telemetry</b> Telemetry Design and Provision			

?

Make a Wish

# Design – Network Hierarchy



DESIGN POLICY PROVISION ASSURANCE



Network Hierarchy Network Settings Image Repository Network Profiles Auth Template

Find Hierarchy

+ Add Site

Find Buildings



- Global
- Asia
- Australia
- Germany
- USA

Building Name	Hierarchy	Address	Latitude	Longitude	Actions
SYD CircQay	Global>Australia>Sydney	Circular Quay, Sydney, New South Wales 2000, Australia	-33.861458	151.211859	...
SIN Downtown	Global>Asia>Singapore	Singapore	1.351616	103.808053	...
Perth Downtown	Global>Australia>Perth	Perth, Western Australia, Australia	-31.952700	115.860500	...
Japan Bulding	Global>Asia>Japan	Japan	36.386493	138.592230	...
Downtown Office	Global>USA>New York	Broadway, Manhattan, New York, New York 10019, United States	40.764067	-73.982935	...
Cisco FRA	Global>Germany>Frankfurt	Ludwig-Erhard-Stra??e, Eschborn, Hessen 65760, Germany	50.144871	8.554709	...
Cisco BER	Global>Germany>Berlin	Kurf??rstendamm, Berlin, Berlin 10707, Germany	52.500268	13.310529	...
Building 13	Global>USA>San Jose	Cisco Way, San Jose, California 95134, United States	37.409598	-121.928828	...

Show 10 entries

Showing 1 - 8 of 8

Previous 1 Next

Feedback



# Design – Network Settings



**CISCO DNA CENTER**   DESIGN   POLICY   PROVISION   ASSURANCE

Network Hierarchy   **Network Settings**   Image Repository   Network Profiles   Auth Template

Find Hierarchy

Global  
  ^ Asia  
  ^ Australia  
  ^ Germany  
  ^ USA

**Network**   Device Credentials   IP Address Pools   SP Profiles   Wireless

Setup network properties like AAA, NTP, Syslog, Trap and Netflow using the "Add Servers" link. Once devices are discovered, DNA Center will deploy using these settings.   [Network Telemetry](#) | [+ Add Servers](#)

**SNMP Server** ⓘ

SNMP  
172.20.2.46   +

**NTP Server**

ⓘ NTP  
172.20.2.55   +

**Time Zone** ⓘ

Time Zone  
MET (MET)   v

**Message of the day** ⓘ

Message of the day

DNACenter-Global Banner

Drag corner to expand the field

[Feedback](#)

[Reset](#)   [Save](#)

# Tools - Discovery



**CISCO DNA CENTER** Discovery 🔍 ⌵ ⚙️ ☰

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**Discoveries** +

🔍 Search by Discovered Device IP

- ✓ **WLC** Range 172.20.30.12-172.20... 2
- ✓ **9300** Range 172.20.195.245-172.2... 1
- ✓ **Other** Range 172.20.1.113-172.20... 4
- ✓ **1701** Range 172.20.30.53-172.20... 0
- ✓ **Rack2** Range 172.20.2.0-172.20.2.2... 16
- ✓ **SDA** Range 172.20.195.240-172.2... 5

**Rack2** Delete Clone Edit Start

**Complete** 16

DISCOVERY DETAILS

CDP LEVEL None	PROTOCOL ORDER ssh	RETRY COUNT 3	TIMEOUT 5
IP RANGE 172.20.2.0-172.20.2.255	IP FILTER LIST None	PREFERRED MANAGEMENT IP Use LoopBack	

CREDENTIALS

GLOBAL JOB SPECIFIC

CLI	SNMP V2C READ	SNMP V2C WRITE
apic	discoverro	discoverrw
apicem		
SNMP V3	HTTP(S) READ	HTTP(S) WRITE

**Devices** 📌 →

LIST CHART

Filter ✓ SUCCESS ⚡ UNREACHABLE ✗ FAILURE ⚪ NOT TRIED ? UNAVAILABLE

IP Address	Device Name	Status	ICMP	SNMP	CLI	HTTP(S)	NETCONF
172.20.2.184		🚫	🚫	✓	✗	⚪	⚪
10.100.32.1	CSR1kv-DC2.fra-lab.net	✓	✓	✓	✓	⚪	⚪
10.100.32.2	CSR1kv-DC1.fra-lab.net	✓	✓	✓	✓	⚪	⚪
172.20.2.253	RTR-3.fra-lab.net	✓	✓	✓	✓	⚪	⚪
172.20.2.254	RTR-4.fra-lab.net	✓	✓	✓	✓	⚪	⚪
172.20.2.250	CI6504_1.fra-lab.net	✓	✓	✓	✓	⚪	⚪
172.20.2.249	CI6504_2.fra-lab.net	✓	✓	✓	✓	⚪	⚪
172.20.195.240	CI3850-SDA-1.fra-lab.net	✓	✓	✓	✓	⚪	⚪
172.20.2.240	L3Rack2-1.fra-lab.net	✓	✓	✓	✓	⚪	⚪
172.20.2.255	L3-Rack2-2.fra-lab.net	✓	✓	✓	✓	⚪	⚪

Show 25 Showing 1 to 25 of 45 Page 1 of 2

# Tools - Inventory



## Inventory



Last updated: 11:25 am [Refresh](#) [Import](#) [Export Credentials](#) [Export Data](#) [Add](#)

[Filter](#) | [Actions](#)

EQ Find

<input type="checkbox"/>	Device Name	IP Address	MAC Address	IOS/Firmware	Platform	Serial Number	Config	Device Role	Location	
<input type="checkbox"/>	<a href="#">AP2802_1</a>	172.20.199.13	00:f2:8b:26:ef:30	8.5.110.0	AIR-AP2802I-E-K9	RDPP1B2K182	N/A	ACCESS	EG	
<input type="checkbox"/>	<a href="#">AP3802I_1</a>	172.20.199.21	00:81:c4:41:2a:a0	8.5.110.0	AIR-AP3802I-E-K9	FCW2024NYTA	N/A	UNKNOWN	EG	
<input type="checkbox"/>	<a href="#">AP3802I_2-Sensor</a>	172.20.199.14	00:2a:10:1b:c9:20	8.5.110.0	AIR-AP3802I-E-K9	FCW2024NWVM	N/A	ACCESS	EG	
<input type="checkbox"/>	<a href="#">CI2960S_1.fra-lab.net</a>	172.20.2.146	6c:9c:ed:f5:e2:80	15.2(2)E	WS-C2960S-48TS-L	FOC1540Y05Q	<a href="#">View</a>	ACCESS	10G	
<input type="checkbox"/>	<a href="#">CI2960S_2.fra-lab.net</a>	172.20.2.154	d4:d7:48:7e:1d:80	15.2(2a)E1	WS-C2960S-24PS-L	FOC1543Y3FJ	<a href="#">View</a>	ACCESS	10G	
<input type="checkbox"/>	<a href="#">CI2960SF_1.fra-lab.net</a>	172.20.2.138	20:3a:07:b1:ff:00	15.2(2)E	WS-C2960S-F48TS-L	FOC1634W12V	<a href="#">View</a>	ACCESS	10G	
<input type="checkbox"/>	<a href="#">CI3650_1.fra-lab.net</a>	172.20.2.247	c0:67:af:ee:0a:00	16.3.3	WS-C3650-48PD-E	FDO1736Q02G	<a href="#">View</a>	DISTRIBUTION	10G	
<input type="checkbox"/>	<a href="#">CI3650-SDA1.fra-lab.net</a>	172.20.195.241	d8:b1:90:25:03:80	16.6.2s	WS-C3650-48TD-E	FDO1921E2HJ	<a href="#">View</a>	ACCESS	EG	
<input type="checkbox"/>	<a href="#">CI3650-SDA2.fra-lab.net</a>	172.20.195.242	d8:b1:90:04:4d:00	16.6.2s	WS-C3650-48TD-E	FDO1921E2JW	<a href="#">View</a>	ACCESS	EG	
<input type="checkbox"/>	<a href="#">CI3650-SDA3.fra-lab.net</a>	172.20.195.243	d8:b1:90:3a:9f:00	16.6.2s	WS-C3650-48TD-E	FDO1921E24W	<a href="#">View</a>	ACCESS	EG	

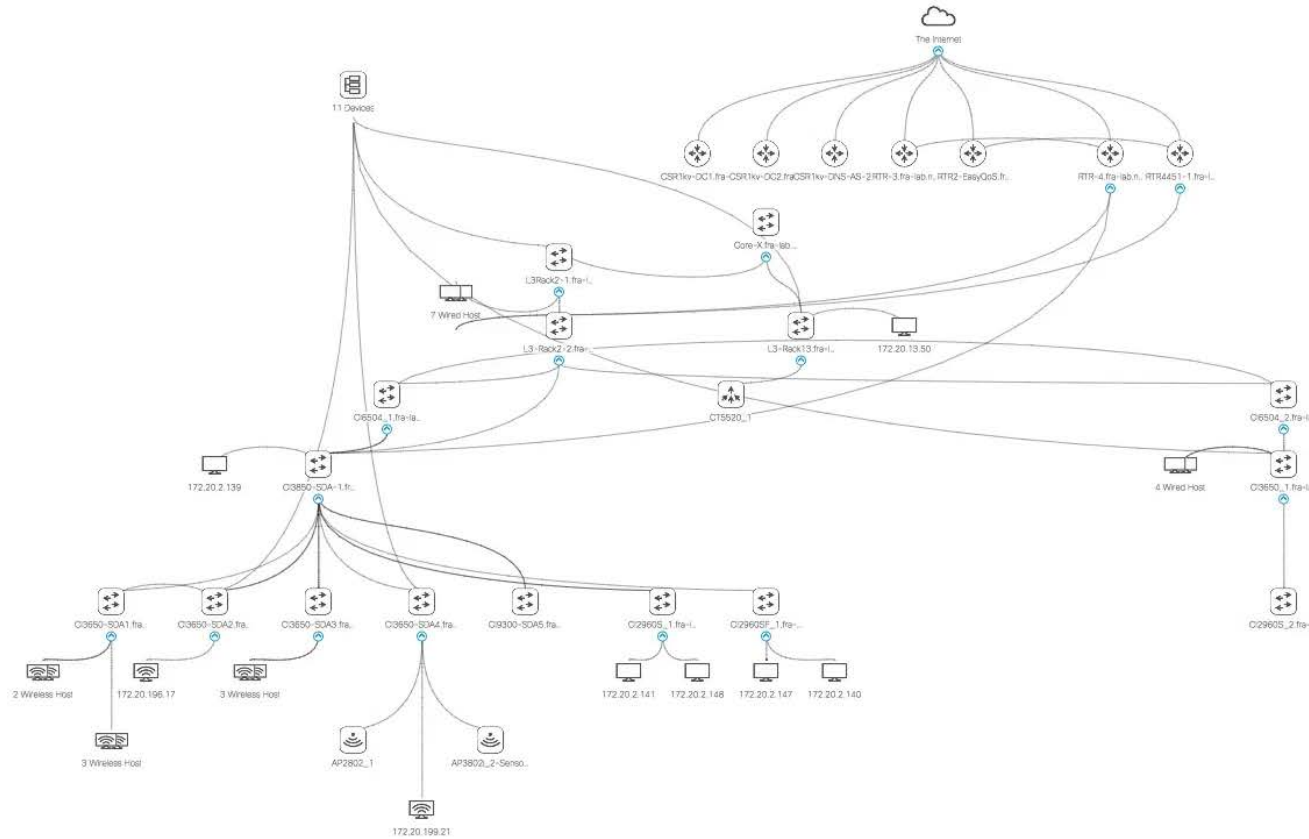
Feedback

Show 50 entries

Showing 1 - 28 of 28

Previous 1 Next

# Tools - Topology



# SWIM Software and Image Management



## Image Repository



[+ Import Image/SMU](#) | [Upgrade Devices](#) | [Show Tasks](#) | [Take a tour](#)

Physical Virtual

[Filter](#) | [Refresh](#) Last updated: 11:59 am

Family	Image Name	Using Image	Version	Golden Image	Device Role	Action
Cisco 2811VE Integrated Services Router	<a href="#">c2800nm-advsecurityk9-mz.124-24.T7.bin</a>	1	12.4(24)T7 SMU (N/A)	★	<a href="#">Edit</a>	<a href="#">Delete</a>
Cisco 2911 Integrated Services Router G2	<a href="#">c2900-universalk9-mz.SPA.155-3.M4a.bin</a>	1	15.5(3)M4a SMU (N/A)	★	<a href="#">Edit</a>	<a href="#">Delete</a>
Cisco 2921 Integrated Services Router G2	<a href="#">c2900-universalk9-mz.SPA.155-3.M4a.bin</a>	1	15.5(3)M4a SMU (N/A)	★	<a href="#">Edit</a>	<a href="#">Delete</a>
Cisco 3750 Stackable Switches	<a href="#">c3750e-universalk9-mz.152-4.E1.bin</a>	1	15.2(4)E1 SMU (N/A)	★	<a href="#">Edit</a>	<a href="#">Delete</a>
Cisco 4451 Series Integrated Services Router	<a href="#">isr4400-universalk9.03.16.03.S.155-3.S3-ext.SPA.bin</a>	1	15.5(3)S3 SMU (0)	★	<a href="#">Edit</a>	<a href="#">Delete</a>
Cisco 5508 Wireless LAN Controller	<a href="#">AIR-CT5500-K9-8-5-110-0.aes</a>	0	8.5.110.0 SMU (N/A)	★	<a href="#">Edit</a> <a href="#">ALL</a> ★	<a href="#">Delete</a>
Cisco 5520 Series Wireless Controllers	<a href="#">AIR-CT5520-K9-8-5-110-0.aes</a>	1	8.5.110.0 SMU (N/A)	★	<a href="#">Edit</a> <a href="#">ALL</a> ★	<a href="#">Delete</a>
Cisco Catalyst 29xx Stack-able Ethernet Switch	<a href="#">c2960s-universalk9-mz.152-2a.E1.bin</a>	1	15.2.2aE1 SMU (N/A)	★	<a href="#">Edit</a>	<a href="#">Delete</a>
Cisco Catalyst 36xx stack-able ethernet switch	<a href="#">cat3k_caa-universalk9.16.06.02s.SPA.bin</a>	4	16.6.2s SMU (N/A)	★	<a href="#">Edit</a> <a href="#">ALL</a> ★	<a href="#">Delete</a>
Cisco Catalyst 3850 48P 10/100/1000 PoE+ Ports Layer 2/Layer 3 Eth...	<a href="#">cat3k_caa-universalk9.16.06.02.SPA.bin</a>	0	16.6.2 SMU (N/A)	★	<a href="#">Edit</a> <a href="#">ALL</a> ★	<a href="#">Delete</a>

Feedback

# DNA Center Features – Network Plug and Play

- Network Plug and Play allows routers, switches and wireless access points to be deployed in remote offices with zero touch configuration
- The device is physically installed in the remote office and connected to the network

# DNA Center Features – Network Plug and Play

- It discovers DNA Center through various methods including DHCP option 43 or DNS '*pnpserver.domain-name.com*'
- It then registers with and downloads its configuration from DNA Center
- This ensures consistent configuration of remote office devices with no need for a network engineer onsite

# Assurance



- Assurance guarantees that the infrastructure is doing what you intended it to do
- DNA Center receives information from all the network devices and ISE etc.
- DNA Center's correlation engine can identify 150+ different types of network and client issues
- DNA Center reports the problem and provides recommended remediation actions



# Assurance

## Overall Health

Jan 17, 2018 2:39 pm

Show   Last 24 hours ▾   All Domains ▾   Actions ▾

### Overall Health Summary 📌 Jan 17, 2018 2:25 pm

#### NETWORK

90%

Healthy Devices

— Last 24 Hours

[View Network Health](#)

#### NETWORK DEVICES

Core	0%	Healthy Devices
Access	88%	Healthy Devices
Distribution	86%	Healthy Devices
Router	100%	Healthy Devices
Wireless	100%	Healthy Devices

#### CLIENT

89%

Healthy Clients

— Last 24 Hours

[View Client Health](#)

#### CLIENTS

Wireless	100%	Healthy Clients
Wired	88%	Healthy Clients

### Top 10 Issues (5) Jan 16, 2018 2:25:00 to Jan 17, 2018 2:25:00

#### Connectivity

OSPF Adjacency Failed on Device " 172.20.2.254" Interface GigabitEthernet0/1 with Neighbor 172.20.2.253  
Total occurrences: 24

Jan 17, 2018 1:43 pm

#### Connectivity

OSPF Adjacency Failed on Device " 172.20.2.244" Interface GigabitEthernet0/0/2 with Neighbor 172.20.2.252  
Total occurrences: 30

Jan 17, 2018 11:49 am

#### Onboarding

Wireless clients failed to connect (Site: Global/Germany/Frankfurt/Cisco FRA/EG) - DHCP Timeout  
Total occurrences: 28

Jan 17, 2018 10:00 am

#### Connectivity

Feedback

# Assurance



Health Dashboards

### NETWORK

# 90%

Healthy Devices

[View Network Health](#)

### Top 10 Issues (5) Jan 16, 2018

Connectivity  
OSPF Adjacency Failed on Device  
Total occurrences: 24

Connectivity  
OSPF Adjacency Failed on Device  
Total occurrences: 30

Onboarding  
Wireless clients failed to connect  
Total occurrences: 28

Connectivity  
OSPF Adjacency Failed on Device  
Total occurrences: 9

Connectivity  
Interface Virtual-Access1 State Ch  
Total occurrences: 3

## OSPF Adjacency Failed on Device " 172.20.2.244" Interface GigabitEthernet0/0/2 with Neighbor 172.20.2.252

Status: Open

Last Occurred: Jan 17, 2018 11:49 AM



### Suggested Actions (6)

1 Ping the neighbor IP to verify connectivity.

ping neighbor IP  
ping 172.20.2.252

Running

2 Check OSPF neighbors.

Run

3 If the Neighbor is in "Init" state. Check if there is authentication configured using "show run | sec OSPF". Authentication type and keys should match on both routers

Run

4 If the Neighbor is in "Exstart" state. Check if the MTU settings are same on the interface connecting the routers.

Run

5 Check interface GigabitEthernet0/0/2 for configuration errors

Run

Feedback

# Assurance – Network Time Travel



- Administrators can drill down into the health status of network devices and clients
- You can see the current status and also view historical information
- This is useful to troubleshoot intermittent problems or issues which occurred in the past

# Assurance – Network Time Travel



Health ▾ Dashboards ▾ Issues Manage ▾

## Client 360

Last 24 hours ▾ All Domains ▾

10<sub>no</sub> daphine.blake

10 📱 Daphine-PC



Issues and Trends Onboarding Path Trace Application Experience Detail Information

### Issues (12)

Application Network Latency for Application 'ssh' is Above the Threshold Value of 362ms. Total occurrences: 12	01/23 10:15am
Application Network Latency for Application 'cifs' is Above the Threshold Value of 412ms. Total occurrences: 35	01/23 10:15am
Application Network Latency for Application 'espn-browsing' is Above the Threshold Value of 262ms. Total occurrences: 37	01/23 10:15am
Application	

Feedback

# DNA Center Features – Path Trace

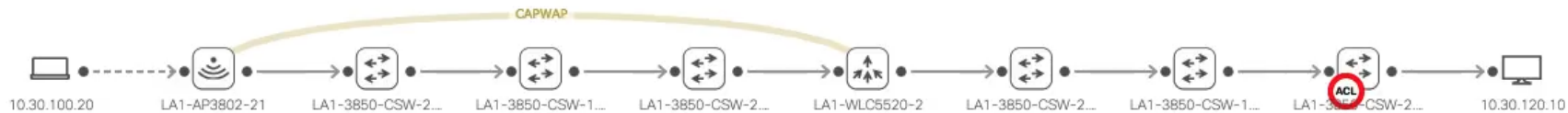


- An engineer can use Path Trace to query DNA Center for the path that traffic takes over the network
- This aids troubleshooting

## ✓ Path Trace

To find the location of an issue, perform a path trace between two nodes in your network – a source device and a destination device.

10.30.100.20 (port: not specified) → 10.30.120.10 (port: 9100) [protocol: tcp] Jan 23, 2018 11:14 am



Run New Path Trace

# API Support

- Everything that can be done through the DNA Center GUI can also be done via a northbound REST API
- DNA Center also supports 'east' and 'west' bound APIs for integration with other services such as reporting and analytics servers

