



Enterprise Campus Architecture Comparative Assessment:

Cisco Digital Network Architecture

HPE-Aruba Mobile First Campus

Huawei Agile Campus Solution



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1 - Executive Summary

Enterprise campus networks continue to evolve to meet the business needs of users, devices and things. The architectural design behind these networks becomes the forefront of integrating business demands with effective communication technology. A poor design can have serious consequences on user experience and management.

Cisco Systems, Inc. engaged Miercom to independently assess Cisco's next generation enterprise campus architecture, Digital Network Architecture (DNA), alongside the latest competitive offerings of Hewlett Packard Enterprise (HPE-Aruba) and Huawei Technologies for positive impact on end users, applications and administration for three key areas:

- **Network Automation:** How easily can new network devices and services be designed and provisioned?
- **Network Segmentation:** How well can the network be segmented for diverse users and devices, all while maintaining security?
- **Network Assurance:** Can network problems be addressed with automatic features, such as self-monitoring, troubleshooting and remediating insight?

Key Findings and Conclusions

- **Unified Resource Management.** Cisco's DNA Center effectively consolidates and manages wired and wireless network resources, far exceeding the capabilities of HPE-Aruba and Huawei.
- **Simplified Operations.** Cisco offers automation for the end-to-end network which saves time, resources and money for IT operations, as opposed to HPE and Huawei which involves multiple steps and touchpoints.
- **Granular policies for user, devices & IoT.** Cisco's SD-Access offers security based on group-based policies and virtual networks which delivers segmentation without compromise.
- **Insightful Resolution.** DNA Center offers impressive assessments of problems like DHCP issues and RF issues with understandable descriptions, root cause analysis, proactive insight and guided remediation.
- **Intuitive Diagnostic Tools.** Cisco provides proactive, leading-edge visual tools, like Path Trace and Intelligent Capture, to help administrators eliminate issues.

Based on our review and findings, the Cisco Digital Network Architecture (DNA) far outpaces the competitive solutions from HPE-Aruba and Huawei. We proudly award Cisco DNA the **Miercom Performance Verified** certification.

Robert Smithers

CEO

Miercom



2 - About the Products Reviewed

Networks are defined by the users. The user demands dictate how the network is setup, accessed, secured and optimized. As the complexity of these demands increases, network administrators must rely on well-designed architectures to achieve expected management, protection and quality of communication services.

A campus network architecture transcends traditional pieces of the network, like routers and Access Points (APs). This high-level infrastructure unifies advanced technologies with basic network requirements in real-time for evolving business requirements to avoid piecemeal integration that incurs downtime and cost.

In this study we acquired and assembled the wired and wireless components of three network-equipment competitors—Cisco, HPE-Aruba and Huawei. Each vendor's network consisted of functional layers: the access, core and services layers.

Cisco Digital Network Architecture (DNA)

All the latest Cisco products have been built "DNA-ready". This adoption of DNA also extends to earlier Cisco devices and, to varying degrees, even non-Cisco equipment.

Cisco uses the term "intent-based" to describe DNA's goals. This means the software is structured to accept and execute many low-level processes, to address the customer's intent. Examples include: adding a segmented guest network or identifying traffic bottlenecks without requiring hours of rigid commands on multiple touchpoints (applications and platforms). DNA makes network deployment, management, monitoring and troubleshooting easier and quicker. This directly equates to reduced maintenance, downtime and costs.

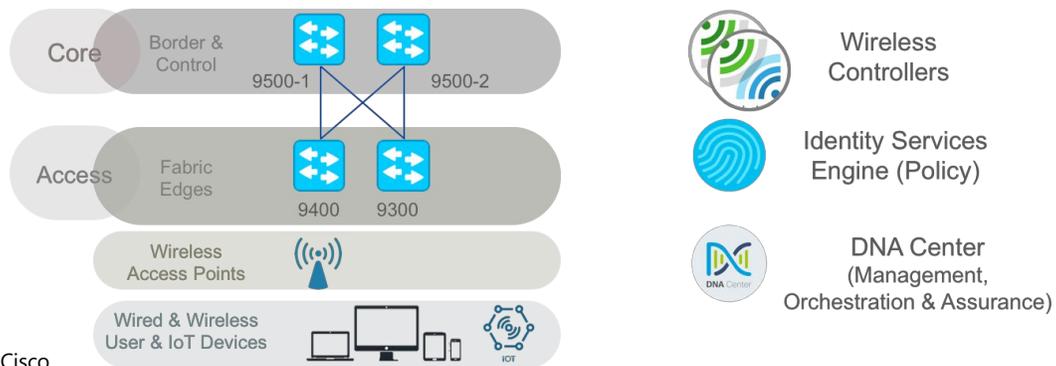
The Cisco DNA test bed featured DNA-ready equipment, including the new Catalyst 9500 at the network core. The access layer consisted of Catalyst 9300 and 9400 switches. Wireless Access was enabled using Cisco 8540/ 5520 Wireless LAN Controller and 4800/3800 Wireless APs. At the heart of the network, was the DNA Center – a suite of automation and analytics software which includes applications such as design, policy, provisioning and assurance.

Augmenting the DNA Center at the services level is Cisco Identity Services Engine (ISE), which streamlines security policy management and provides security context information about devices and users. This policy management and security system shares data on users, devices, threats and vulnerabilities. The ISE configurations are abstracted from ISE to DNA Center, so that the administrator rarely must leave the DNA Center dashboard.

SD-Access provides policy-based automation from the edge to the cloud with secure segmentation for users and things. The SD-Access architecture is supported by fabric technology implemented for the campus, which enables the use of virtual networks (overlay networks) running on a physical network (underlay network) in order to create alternative topologies to connect devices.

The underlay is comprised of the physical network devices, such as routers, switches, and wireless LAN controllers (WLCs) plus a traditional Layer 3 routing protocol. The overlay is the logical, virtualized topology built on top of the physical underlay.

The SD-Access architecture is implemented via Cisco DNA Center.



Source: Cisco

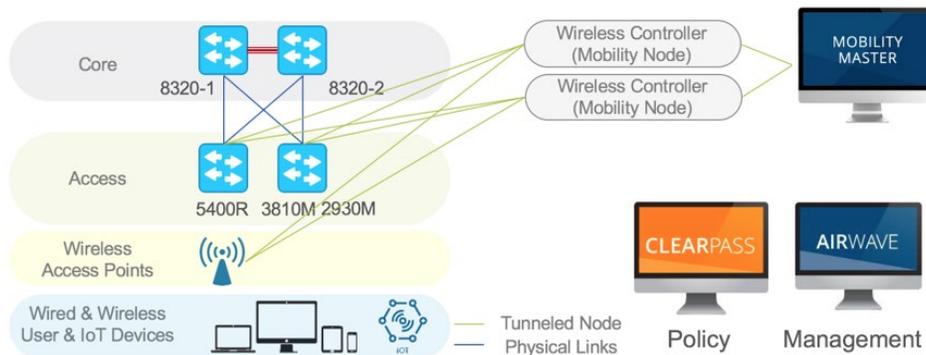
Fabric edge: The SD-Access fabric edge nodes are the equivalent of an access layer switches in a traditional campus design which interface with wired hosts (laptops, IoT devices etc.), wireless access points or other fabric extension switches.

Border node: The fabric border nodes serve as the gateway between the SD-Access fabric domain and the network outside of the fabric. The fabric border node is responsible for encapsulation-decapsulation for network virtualization interworking and SGT propagation from the fabric to the rest of the network.

Control plane node: The SD-Access fabric control plane node is based on the LISP Map-Server (MS) and Map-Resolver (MR) functionality combined on the same node or also distributed on separate nodes. The control plane node enables those functions together to create the Host tracking database

HPE-Aruba Mobile First Campus Solution

HPE expanded into the wireless realm with the 2015 acquisition of Aruba Networks and its impressive repertoire of Wi-Fi equipment, such as APs, controllers and wireless management applications. Additionally, HPE has adopted Aruba's AirWave management, ClearPass policy management and Mobility Master for wireless configuration. HPE-Aruba also offers four distinct assurance platforms: Clarity (part of AirWave), Network Analytics Engine (part of ArubaOS-CX), NetInsights (acquisition Rasa Networks) and Cape Networks (acquisition, Sensor overlay).



Source: Miercom

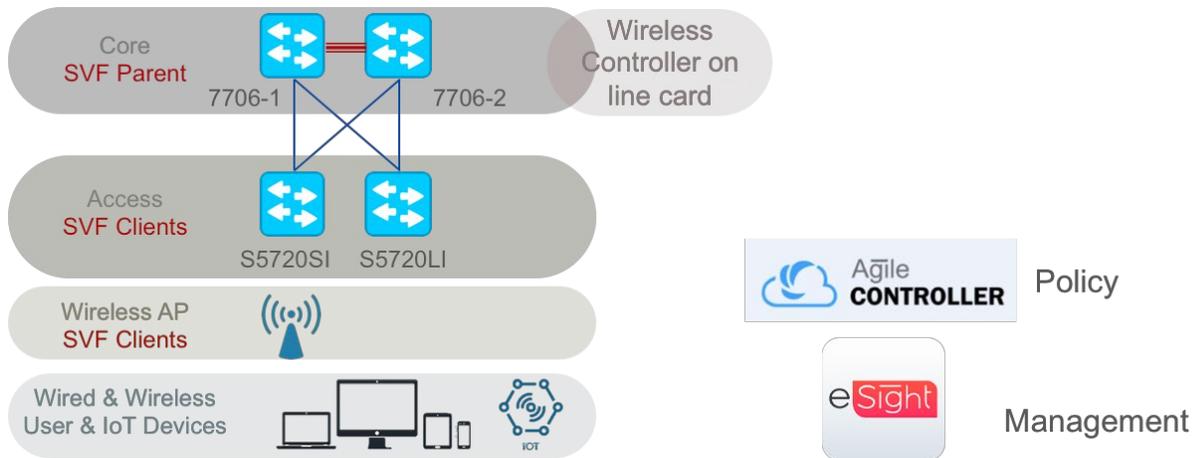
HPE offers another high-level management package, the Intelligent Management Center (IMC), which is oriented towards core and wired data centers – not campuses, and without wireless support. We selected AirWave as the most appropriate application for this comparative analysis. AirWave is designed with mobility in mind, proactively monitoring devices, users and applications for health and performance.

Our HPE test bed also included the former Aruba application – ClearPass, a policy manager platform for Network Access Control (NAC), secure device onboarding and guest access. We also deployed Mobility Master, a wireless-oriented package also from Aruba, which addresses configuration and deployment, operations, and Wi-Fi client load balancing.

Huawei Agile Campus Network Solution

Huawei eSight is a software suite for unified enterprise control. This network management package is the centerpiece of the Huawei campus architecture and is used for planning, operating and maintaining the complex infrastructure.

Another key ingredient in the Huawei architecture is the Agile Controller, which handles all manner of network-layer operations – SDN, VLAN, and for our purposes, policy management.



Source: Miercom

Huawei's Super Virtual Fabric (SVF) is one of the many components of the Agile Campus 5.0 solution. Huawei requires SVF for Unified Management of wired and wireless networks. SVF uses a Parent switch for management and configuration for the SVF system. SVF Clients (wired and wireless APs) are connected to the parent. Traffic is sent to a Parent Switch for wired and wireless forwarding. When configuring SVF, Huawei recommends configuring parent switches in a CSS pair (Cluster Switching System). Configuring CSS was only available via CLI on the S7706. This was a 9-step operation and consisted of a reboot of the S7706 chassis to form the CSS. Miercom followed Huawei's Recommended SVF configuration via the [configuration assistant](#).

Products and Software Under Test

	Cisco	HPE-Aruba	Huawei
Core Switches	9500 (16.8.1)	8320 (10.01)	7700 (V200R010)
Access Switches (Modular)	9400 (16.8.1)	5400R (16.6)	7700 (V200R010)
Access Switches (Fixed)	9300/ 3850 (16.8.1)	3810M/ 2930M (16.6)	S5720SI/ S5720LI (V200R011)
Wireless Controller	8540/ 5520 (8.8)	Mobility Master/ 7280/ 7210 (8.3)	X2/ AC6605 (V200R010)
Access Point	3802/ 4800	335/ 345	7050DE
Policy	ISE 2.4	ClearPass 6.7	Agile Controller 1.0 V100R003
Management	DNA Center 1.2	AirWave 8.2	eSight V300R008

3 - Network Automation

Typical network design and deployment is a very complex and time-consuming process. It becomes increasingly complicated as enterprises include wired and wireless user devices, newly introduced Internet-of-Things (IoT) devices, advanced services (e.g. guest, host mobility), operations and maintenance. Today, network administrators need automation and orchestration platforms to support end-to-end networking devices (e.g. switching, wireless, routing, SD-Access, SD-WAN). To assess how network automation works per each vendor's architecture, we verified following two test cases:

- Part 1: Network Design
- Part 2: Out-of-box Switch and Access Point Deployment

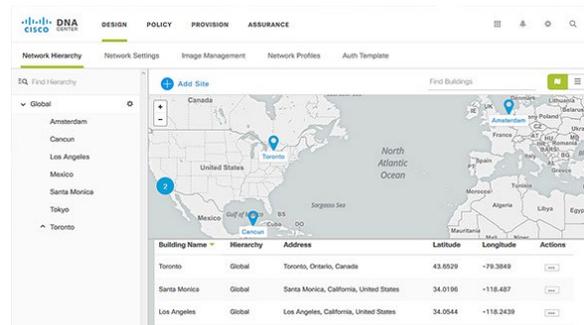
Part 1: Network Design

In this test case, we evaluated how each of the vendor offers the network design capabilities before device deployment. Accurate network design is very crucial, saving lot of time and money by avoiding any future misconfiguration or errors.

Cisco

In our testing, only Cisco offered a single, unified dashboard for designing an entire campus network with switching, wireless and routing using DNA Center. Network design started with the site creation for multiple locations/branches, and it zoomed into building and floor level, with floor plan maps. All shared network services (e.g. DHCP, AAA, SNMP, device credentials) can be configured globally or per location, which automatically trickled down to hierarchy-based sub-groups. Even common network parameters, like wireless SSID for employees, guest access, authentication methods and configuration templates were defined based on a hierarchy.

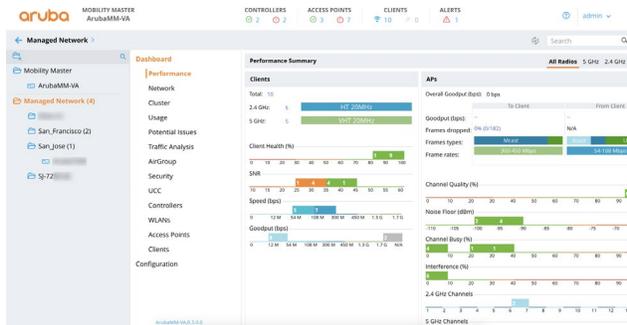
Cisco showed excellent design automation using DNA Center workflows and a hierarchical deployment model, which truly turns business intent into the automated network configuration. An automation scenario we verified was deploying wireless SSIDs across multiple sites and multiple wireless controllers, based on a hierarchy, with just few clicks on DNA Center dashboard. We never touched multiple wireless controllers for configuration changes. DNA Center took care of creating various SSIDs, respective interfaces and AP groups automatically, abstracting and automating the configurations behind-the-scenes.



Source: Miercom

HPE-Aruba

Aruba offers the hierarchical model of network design using Aruba Mobility Master, but it is only for wireless networks. All switch network designing is done traditionally using configuration templates, for individual or batches of switches using AirWave Management platform. Automation is not supported. This leads to two separate touchpoints for designing wired and wireless networks. Moreover, routing support can be only added using FlexNetwork routers and IMC Management platform, creating another touchpoint.



Aruba Mobility Master

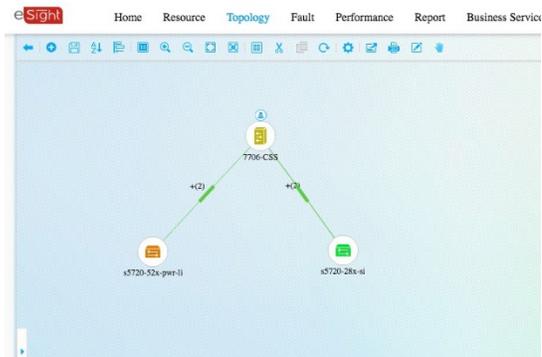


Aruba AirWave

Source: Miercom

Huawei

Huawei's Agile Campus solution does not offer any hierarchical model for network design and deployment. Huawei still relies on the traditional way of network design, which is neither time-saving nor agile. Huawei relies on multiple ways to configure network deployments. For example, SVF (Super Virtual Fabric) can be configured through CLI, Easy Operations (switch dashboard) and eSight NMS. Huawei supports a limited design capability and automation using eSight maps/topology view; it is only for traditional networks and offers no fabric support.



Source: Miercom

Network Design Summary

	Cisco	HPE-Aruba	Huawei
<i>Site Creation/ hierarchy/ Maps</i>	Yes	Requires both Mobility Master and AirWave	No support for hierarchy, Maps requires eSight
<i>Shared services config</i>	DHCP, AAA, DNS, SNMP, CLI credentials	AAA, SNMP	DHCP, SNMP, CLI credentials
<i>Image Management</i>	Direct cloud download for images and patches for wireless, switches and routers	Manual upload using AirWave	Manual upload using Easy Operations (SVF parent) or eSight
<i>Network Profile</i>	Wireless, Switches, Routing, Authentication methods	Wireless Only	Wireless and Wired using Easy Operations (SVF parent) or eSight
<i>Guest</i>	Built-in auth. and portal customization	Requires access to ClearPass or any other external server	Requires access to Agile or any other external server

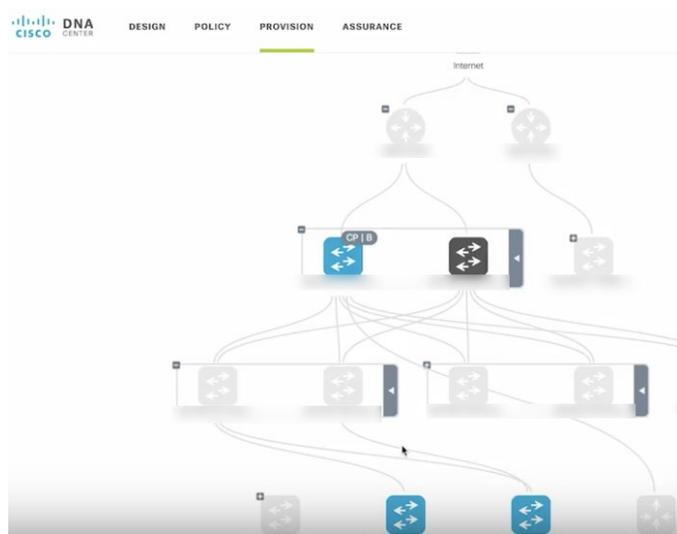
Part 2: Out-of-the-Box Switch and Access Point Deployment

In this test case, a customer wants to incorporate new network devices and services, and then provision a new area for network access. The following criteria was applied to each vendor:

1. How easy is it to bring up a new switch and AP out-of-the-box?
2. How easy is it to setup the underlay and overlay networks? (An **overlay** network is a virtual network built on top of an underlying network infrastructure – the **underlay** network. The **underlay** provides a service to the overlay.)
3. How simple or difficult is it to provision advanced network services like wireless for employees and guest access?

Cisco

All the above processes are executed completely from the DNA Center main screen. From the top options (Design, Policy, Provision, Assurance), the Provision Application is selected. Activation and configuration of the new devices, once appropriately connected, is straightforward and quick. Cisco DNA Center used the seed device (switch) to discover all the connected network devices using CDP (Cisco Discovery Protocol), and then onboarded those devices on the network, automatically creating a topology. Adding these devices to Software-Defined Access (SD-Access) fabric was simple



two-click operation. DNA Center onboarded the devices and provided them with prescriptive configuration according to Cisco design best practices. DNA Center also automatically pulled the required software images and patches directly from Cisco.com and made them available for the joining devices.

Cisco automatically configured switchports, based on the connected device, using switchport macros triggered by DNA Center in the background, without user intervention. Shown right is an example an automatically pushed configuration by DNA Center for a connected wireless AP. DNA Center automation saved a significant amount of time in manual configuration and avoided any syntax or user error while configuring this on potentially hundreds of AP switchports.

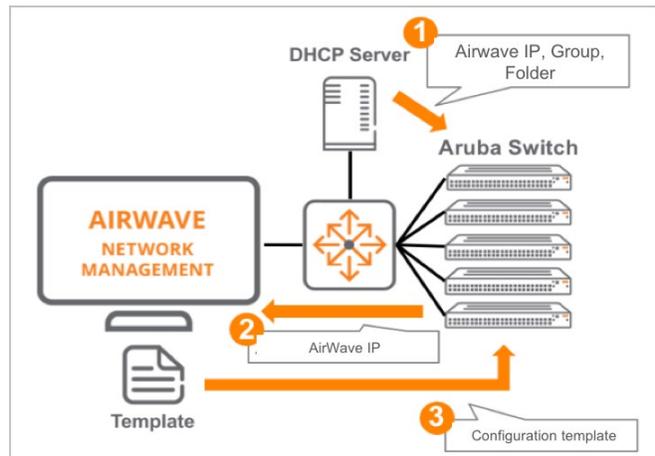
```
interface TenGigabitEthernet1/0/24
switchport access vlan 1025
switchport mode access
switchport block unicast
switchport port-security violation protect
switchport port-security aging time 1
switchport port-security aging type inactivity
load-interval 30
storm-control broadcast level pps 1k
storm-control multicast level pps 2k
storm-control action trap
macro description CISCO_WIRELESS_LIGHTWEIGHT_AP_EVENT
no macro auto processing
auto qos trust dscp
spanning-tree portfast
spanning-tree bpduguard enable
service-policy input AutoQos-4.0-Trust-Dscp-Input-Policy
service-policy output AutoQos-4.0-Output-Policy
ip dhcp snooping limit rate 15
```

Source: Miercom

Cisco DNA Center directly communicated with ISE to add devices to ISE network devices database and made them ready for policy implementation.

HPE-Aruba

HPE-Aruba's AirWave network management platform is used for Zero Touch Provisioning (ZTP) to successfully deploy the new switch and AP. ZTP relies on the traditional method of DHCP Option 43 to discover the AirWave server, making the process of adding a switch and AP manual and requiring multiple touchpoints. This also requires pre-loaded configuration templates for every unique device to accomplish complete network provisioning. This old way of provisioning is prone to user errors and consumes significant amount of time and money.



Source: HPE-Aruba

Moreover, HPE-Aruba does not have direct hooks into ClearPass for automatic network device configuration. Unlike Cisco, we had to manually add and configure all the networking devices in the ClearPass to start using ClearPass policy.

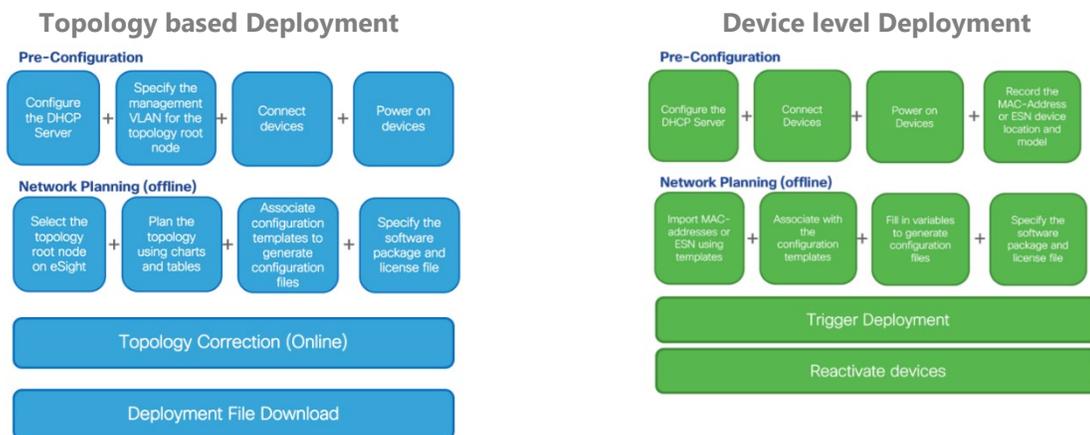
Huawei

Huawei's eSight, like HPE-Aruba's AirWave, is one of several touchpoints the customer uses to manually perform the proper connection and configuration of a new switch and AP.

Huawei's eSight is a management platform with multiple modules which requires different licenses for various features such as MPLS, Wireless, Network Infrastructure, Network Traffic Analytics, Wireless Management and more. Huawei uses a ZTP module within the eSight tool.

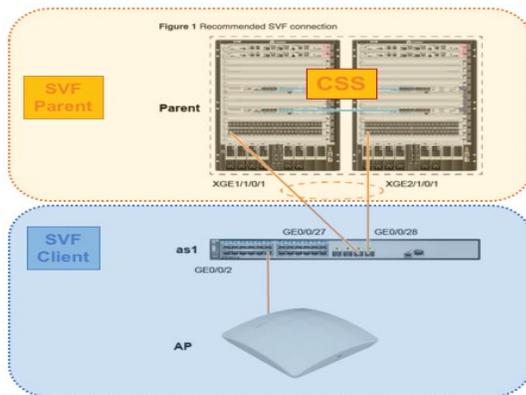
Huawei eSight Zero-Touch Provisioning

Huawei offers two modes for ZTP with their eSight NMS: device-level, and topology based.



Source: Huawei

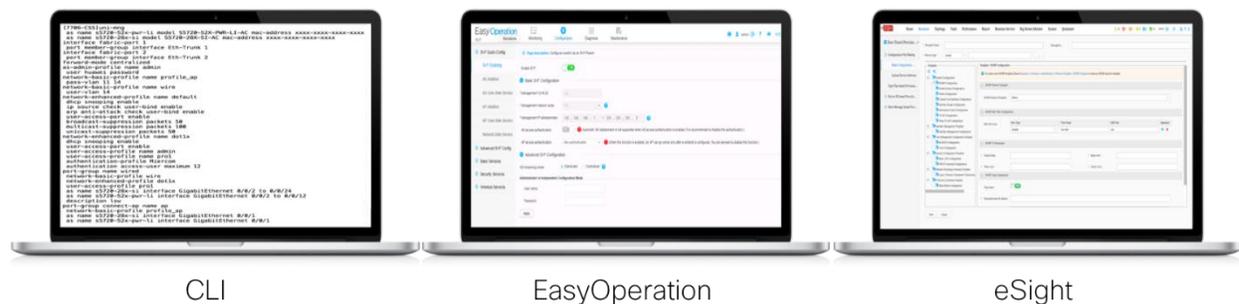
The topology method is used when there are multiple switches for a greenfield or batch deployment. The device level method applies to expanding a brownfield campus where a few wired switches need to be deployed by manually entering MAC addresses or ESN (Electronic Serial Number).



Steps required for Building the Huawei Agile Campus

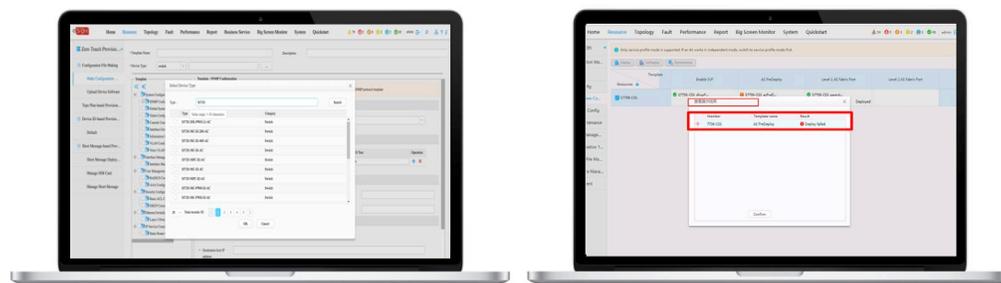
A collection of dashboards such as CLI, Easy Operation, and eSight operations were required to build the Agile Campus 5.0 architecture. ZTP was performed through eSight. Huawei offers three ways to configure the campus into a Super Virtual Fabric. After enabling SVF, STP mode is set to RSTP.

Source: Miercom



Source: Huawei

eSight appeared to have an older look and feel, not a current user experience for an Intent-Driven Network. Miercom encountered an error when using the eSights template-based operation for SVF. Operating eSight is sometimes difficult, as these errors may appear in non-English language.



Source: Huawei

Similar to HPE-Aruba, Huawei does not offer any direct hooks into the Agile Controller platform to automatically add network devices for policy; the administrator is forced to go through various dashboards to complete the configuration. This old way of provisioning is prone to user errors and consumes significant amount of time and money.

Steps Required to build an Enterprise Network

Cisco	HPE	Huawei
<ul style="list-style-type: none"> • Cisco DNA Center runs the Plug-n-Play service for LAN Automation for all the new devices • Create hierarchy for sites, buildings, etc. • Use the seed device to start network automation to find all the connected devices in your network using Cisco Discovery Protocol (CDP) neighbor discovery • DNA Center automatically onboards all the connected Cisco devices and configures them with certificates, credentials, basic configurations based on the site-specific network settings and automatically creates topology 	<ul style="list-style-type: none"> • Aruba AirWave runs ZTP feature • Create groups and folders for the onboarding devices (no hierarchy option) • Create configuration template for every device or group of devices • Configure DHCP Option 43 on the DHCP server with AirWave's IP address, Device Group, Folder name, etc. (If you have multiple AirWave servers, take caution to configure the right server) • Connect out-of-box devices (switches, AP, etc.) to network • Accept all the new devices on AirWave • For Wireless, Aruba Mobility Master can be used to create hierarchy-based configuration 	<ul style="list-style-type: none"> • ZTP eSight (Seed Device) Device-level based deployment • Configured S7706 Pair as CSS Cluster (Total of 9 steps) • Create Multi-Action Detection configuration on CSS device • Enable Parent SVF Functionality (This can be done via CLI, Easy Operation, or eSight. If eSight is selected, SNMP, SSH/Telnet Configuration is required on the Parent switch and eSight.) • When using eSight, the network administrator will use templates to enable SVF Parent, VLANs, IP Pools • Configure SVF Template for access layer switches; this requires knowledge of the switch name, switch part number, MAC-address of switch, and adding to whitelist • Configure Fabric Port ID, Fabric Ethernet Trunk ID, Ethernet Trunk Member, Interface selection, Connection type • After the templates are configured, eSight pushes the templates to the Parent Switch • Create Port Groups for Access Switches and APs • Create User interface (VLAN) for Access switch • Deploy SVF Port Config • Create Manage of Access switches and AP parameters • Physically cable the access layer switch to the parent SVF switch, and connect AP(s) to access layer switch • Configure WLAN service on SVF Parent

Network Automation Summary

Cisco DNA Center abstracted the complexities involved in the deployment of networks and offered a single, unified dashboard to design and deploy end-to-end network. DNA Center gracefully handled all the complicated tasks and best practices behind-the-scenes, helping Miercom translating business intent into reliable network automation.

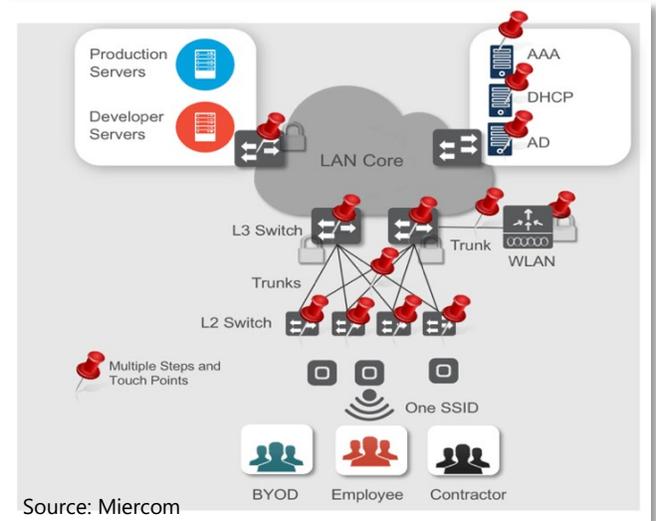
HPE-Aruba and Huawei forced Miercom to use multiple dashboards to design and deploy networks. Sometimes there were different platforms for switching and wireless networks. Their lack of a granular hierarchy-based model made provisioning and configuration time-consuming. HPE-Aruba and Huawei lack network automation and its inherent simplicity. Their traditional way of deploying enterprise networks is prone to user errors, lacks best practices and most importantly costs more money in CAPEX and OPEX.

Cisco DNA Center extends its support to the Cisco-Meraki Cloud Networking solution, Cisco-Viptela's SD-WAN solution and to third parties using SDKs and APIs.

Cisco	HPE-Aruba	Huawei
 Automated Process  Duration: 1-2 hours Single touch point DNA Center	 Manual Process  Duration: 5-6 hours Multiple touch point AirWave, Mobility Master	 Manual Process  Duration: 1-2 days Multiple touch point CLI, Easy Operations, eSight

4 - Network Segmentation

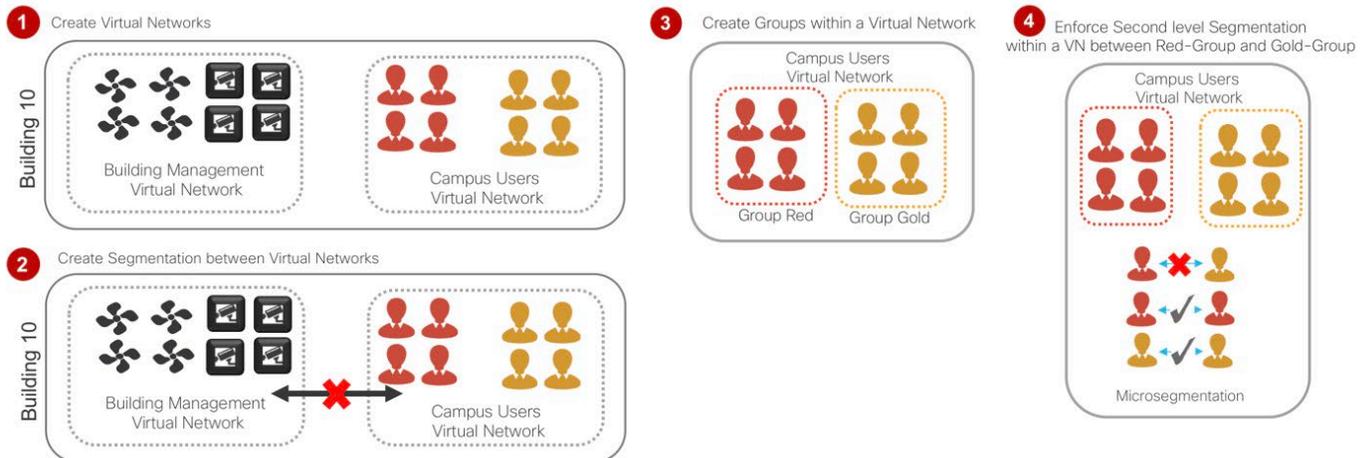
Network segmentation refers to the subdividing of a network into logical partitions for reasons such as: to segregate Guest access in a WLAN or to create a highly secure VLAN for a specific set of endpoints to prevent malicious East-West traffic within the network. The figure (shown right) depicts multiple configuration touchpoints to deploy segmentation.



Applying Policies

In this test case, Miercom tested the capability to segment at the network level using virtual networks and at the micro segmentation level with group-based policies. Miercom also compared the network administrator experience using a single dashboard using the following test cases:

1. Create Virtual Networks
2. Create Segmentation between Virtual Networks
3. Create Groups within a Virtual Network
4. Create Intra-Virtual Network Segmentation



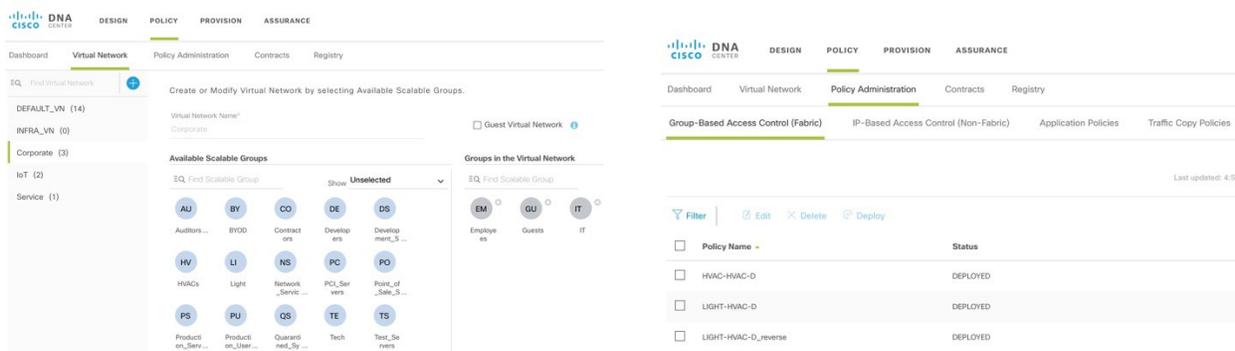
Source: Miercom

Cisco

Miercom used Cisco's DNA Center Policy Application to create virtual networks. DNA Center is a system for centralized deployment and policy management of devices within a campus network. The DNA Center acts as a software-defined controller pushing down configurations and policy to every node across the enterprise.

Cisco's SD-Access provides embedded multi-level segmentation. Under the covers, SD-Access allows for creation of multiple Virtual Networks using Virtual Routing and Forwarding (VRF) definitions and micro segmentation using Scalable Group Tags. Access policies are enabled in hardware on each individual edge switch to provide an unprecedented level of granularity in routing and access control for wired and wireless users and devices.

Cisco's DNA Center allowed creation of virtual networks and management of scalable groups from a single dashboard.



Source: Miercom

This test case showcased the simplicity of how a customer can leverage DNA Center to build a complete security policy. With SD-Access we were able to provide macro segmentation using virtual networks and at the micro segmentation level with scalable groups.

DNA Center was the single dashboard used to build virtual networks, assign groups to virtual networks, define and implement security policy, and define new security contracts.

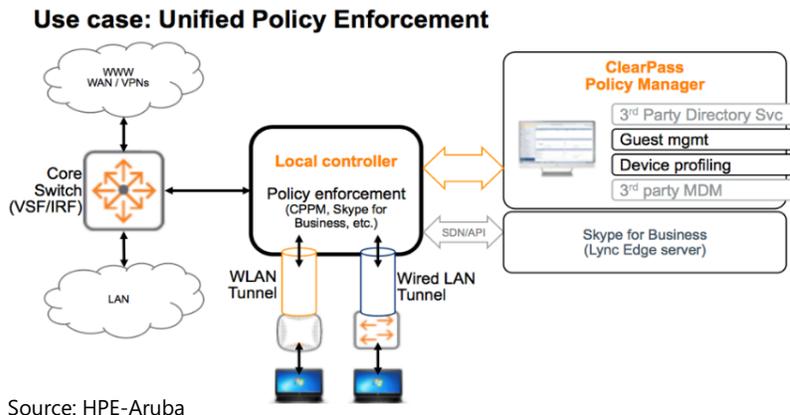
Miercom executed security policies and contracts via simple drag-and-drop method in DNA Center.

Cisco's implementation for policy is not tied to IP address or location, but rather uses identity of users, devices, or things. This provides host mobility with consistent policy without having to reconfigure the various touchpoints for VLANs, subnets, and Access Control Lists (ACLs).

Because of this, Cisco demonstrated the ability to add, remove, and modify virtual networks and group-based policies, independent of network devices or location of user.

HPE-Aruba

For the segmentation test cases, HPE-Aruba requires a feature called Tunnel-Node (TN). This feature converts an Aruba switch to behave like an AP. User traffic from the switch is redirected to the Aruba WLC for unified policy enforcement. Aruba also recommends TN for application visibility and stateful firewall. Tunneling is configured as a per-port or per-user mode, but both are mutually exclusive.



Aruba uses TN in conjunction with its ClearPass Policy Manager (CPPM). The switch is manually configured for AAA, VLANs, user policies, port configuration for 802.1x and MAC-Auth, and IP connectivity to the Mobility Controller. The Mobility Controller is configured as the TN server. ClearPass is used as the RADIUS policy server. The main purpose of Tunneled Node is to use the controller as a unified policy enforcement point for traffic from both wired and wireless clients.

Under the hood, Aruba uses GRE tunnels from the access switch to the Aruba Mobility Controller to segment traffic. The figure below depicts the ClearPass Configuration and CLI of the ArubaOS Switch required for segmentation. For example:

Service	Authentication	Authorization	Roles	Posture	Enforcement	Audit	Profiler
Accounting Proxy Summary							
Type:	802.1X Wired						
Name:	Wired-Test-1						
Description:	802.1X Wired Access Service						
Monitor Mode:	<input type="checkbox"/> Enable to monitor network access without enforcement						
More Options:	<input checked="" type="checkbox"/> Authorization <input checked="" type="checkbox"/> Posture Compliance <input checked="" type="checkbox"/> Audit End-hosts <input checked="" type="checkbox"/> Profile Endpoints <input checked="" type="checkbox"/> Accounting Proxy						
Service Rule							
Matches <input type="radio"/> ANY or <input checked="" type="radio"/> ALL of the following conditions:							
Type	Name	Operator	Value				
1. RADIUS:IETF	NAS-Port-Type	EQUALS	Ethernet (15)				
2. RADIUS:IETF	Service-Type	BELONGS_TO	Login-User (1), Framed-User (2), Authenticate-Only (8)				
3. Click to add...							

```

class ipv4 "IP-ANY-ANY"
  match ip 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255
  exit

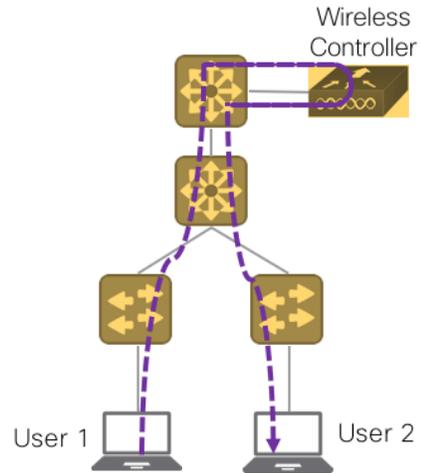
policy user "PERMIT-ALL"
  class ipv4 "IP-ANY-ANY" action permit
  exit

aaa authorization user-role name "IoT-Lights"
  policy "PERMIT-ALL"
  reauth-period 28800
  vlan-name "IOT_Lights_vlan1"
  exit
  
```

Source: Miercom

The HPE-Aruba switches employ traditional segmentation, which uses static ACLs and similar access-policy controls. The security policy is based on IP addresses and the network topology, and there is separate policy management for wired and wireless networks. Maintaining these policies is complex, time-consuming and prone to error.

Tunneled Node. HPE-Aruba creates an architecture to unify policy for wired and wireless clients, using a common controller, as shown in the graphic. Wired traffic between hosts are not optimized, and all traffic passes to and from the Aruba Mobility controller.



Source: Miercom

Miercom configured the tunnel-node feature as per Aruba’s recommendation. Using ClearPass or switch configuration, only traffic from a specific user/device role is sent to the mobility controller.

Validation of client traffic was performed prior to injecting traffic from the Spirent test tool. The following screenshots show figures from the Spirent Test Center and smartphone screen pinging the gateway. The Spirent Test Center was configured to simulate wired clients. Uni-directional traffic streams were configured for IMIX traffic distribution. Simultaneously, a smartphone was used as a wireless client associating to the TN-SSID. Pings were generated from the wireless client. Before enabling Aruba’s Tunneled-node feature, there was no performance impact, and the phone pinged the gateway

Before enabling Tunneled-Node:

Validation of Wired and Wireless connectivity through the Aruba network.

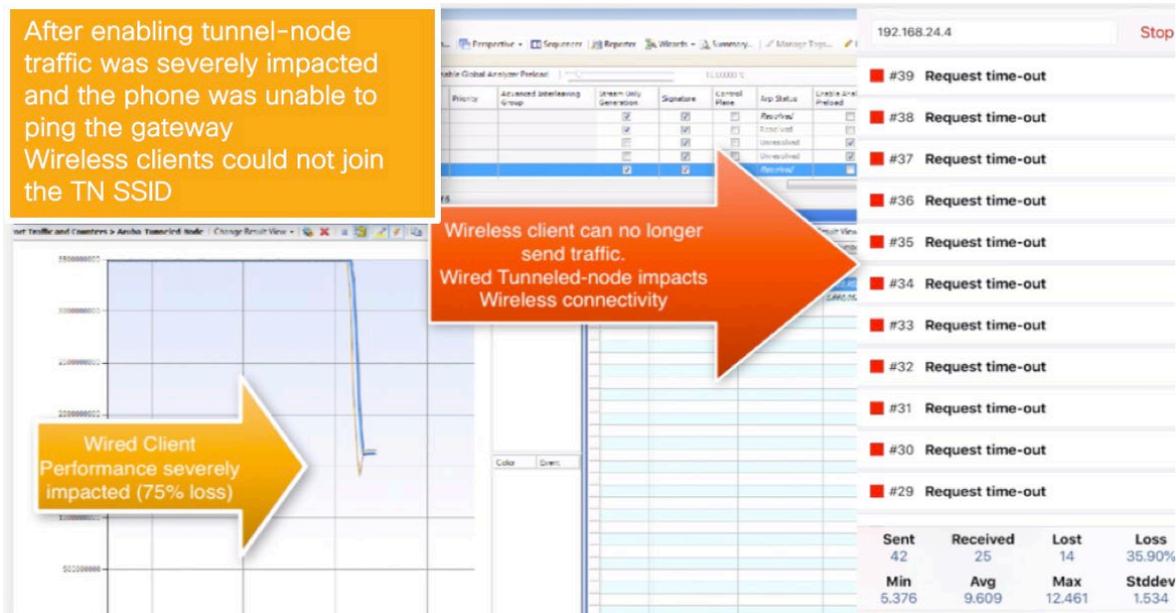
Spirent Test Center simulating wired clients, and iPhone connecting to the TN-SSID and pinging the gateway

Seq	IP	Bytes	TTL	Time (ms)
#4	192.168.24.4	128	TTL=128	9.255
#3	192.168.24.4	128	TTL=128	9.660
#2	192.168.24.4	128	TTL=128	9.334
#1	192.168.24.4	128	TTL=128	5.376
#0	192.168.24.4	128	TTL=128	11.210

Wireless Client (Tunneled-Node) Pinging

Source: Miercom

After enabling Tunneled-node: The figure below highlights the performance impact to the wired client. The Aruba MC was impacted by the volume of traffic and was unable to respond to the pings sent by the wireless client.



Source: Miercom

Additional wireless clients were unable to associate to the TN-SSID, and the ArubaOS-Switch reported the controller as unreachable via the [show tunneled-node-server state] output

```

Tunneled Node Port State
Active Controller IP Address :
Port  State
-----
1      Port down
2      Port down
3      Port down
4      Port down
5      Port down
6      Port down
7      Controller not reachable ←
8      Port down
9      Port down
10     Port down
49     Controller not reachable ←
    
```

Source: Miercom

This test proved Aruba’s Tunneled-node incurs a severe impact to the client performance. The Aruba mobility controller was a critical chokepoint and ultimately a bottleneck due to its limited data plane, and once overloaded, became non-operational.

TN consumes and wastes bandwidth across the backbone network, resulting in overprovisioning of uplinks. The wireless controller becomes a bottleneck due to its limited data plane, and once overloaded, it becomes non-operational.

To prevent this from occurring, the Aruba solution would require a customer to purchase and deploy additional Aruba Mobility controllers to support unified policy for wired and wireless clients.

Aruba's implementation for segmentation is tied to an IP address. Traditional ACLs and VLANs are still required for configuration. For converged wired and wireless, TN is the only offering from Aruba. TN exhibits the following limitations:

- Performance bottleneck
- Higher number of Aruba Mobility controller appliances required for wired and wireless along with additional device licenses
- Requires high-capacity uplinks to carry wired traffic to the Aruba Mobility controller

Huawei

The Agile Controller functions as the authentication server and uses RADIUS interfaces to authenticate users by interacting with Huawei devices. It also functions as the policy server and delivers Free Mobility policies to the switches and firewalls through XMPP interfaces.

Huawei uses the Free Mobility function to provide and obtain group-based policies regardless of user location and IP address but requires multiple touchpoints for all campus network layers.

The figure below depicts the matrix when configuring a Free-Mobility policy.

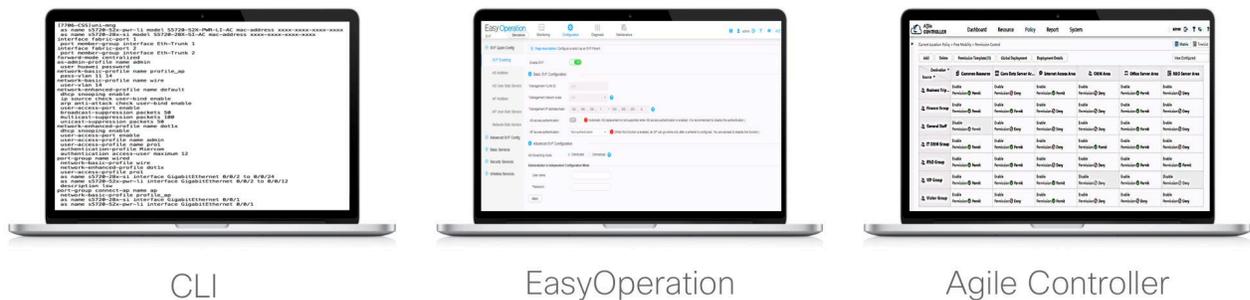
The screenshot shows the Agile Controller web interface. The breadcrumb trail is: Current Location: Policy > Free Mobility > Policy Configuration > Permission Control. The interface is divided into several sections:

- Left Sidebar:** Contains navigation options: Free Mobility, Policy Configuration, Permission Control (selected), QoS Policy, and Security Object Configuration.
- Top Navigation:** Dashboard, Monitor, Resource, Policy (selected), Report, System.
- Main Content Area:**
 - Sub-sections: Common Policy, Local Policy, Policy List.
 - Selected Policy: SJ.
 - Table with columns: Source_T, Destination_T, Email_Server, Service_resource, Video_Server.

Source_T	Destination_T	Email_Server	Service_resource	Video_Server
Employee_Group		Enable Default Permissions : ✔ Per... Application Control : ✘	Enable Default Permissions : ✔ Per... Application Control : ✘	
Guest_Group		Enable Default Permissions : ✔ Per... Application Control : ✘	Enable Default Permissions : ✔ Per... Application Control : ✘	
VIP_GROUP		Enable Default Permissions : ✔ Per... Application Control : ✘	Enable Default Permissions : ✔ Per... Application Control : ✘	

Source: Miercom

Huawei Dashboards required for Network Segmentation:



Source: Huawei

Huawei offers group-based policies by maintaining a database of users and their current IP addresses, coupled with location. Policies configured on the Agile controller are implemented using traditional means of configuration through VLANs and ACLs. This adds complexity when configuring segmentation on the network.

Huawei’s policy enforcement using Free Mobility is only supported on their high-end Ethernet Networking Processor-based (ENP-based) switches.

If there is a customer requirement for user-to-user access control, Layer 2 isolation must be deployed on Huawei’s access switches to divert all traffic to authentication point switches. User isolation for wireless services needs to be configured in the Virtual AP profile. These are manual configuration steps performed by the network administrator.

Cisco SDA	HPE	Huawei
<p>Ensure ISE and DNA Center are communicating over pxGrid.</p> <ul style="list-style-type: none"> • Assign Scalable Groups (SGTs) to Virtual Networks (VNs) • Define access policies between SGTs based on either source, destination or application 	<ul style="list-style-type: none"> • Configure all the devices (switches and WLC) to communicate with ClearPass (using CLI or AirWave) • Define user roles on ClearPass • Define ACL rules • Configure tunneled node on switches • Configure individual switch ports for host/ IoT 	<p>Manually configured on each Access and Aggregation Layer Switch:</p> <ul style="list-style-type: none"> • Configure L2 VLAN (Global, Interface), L2 Protocol Transparent Transmission <p>Core Layer</p> <ul style="list-style-type: none"> • Configure IP Address for VLAN and IP Pool of Gateway • Configure DHCP/DNS, RADIUS Server, Authentication Templates, Domain, accounting scheme, authentication profiles for 802.1 + MAC-Auth • Configure XMPP and connection to Agile Controller for Group-Based Policy • Configure Wired 802.1x, MAC-Auth, Web-Auth and Wireless Portal Authentication • Configure CAPWAP Source interface, WLAN Controller/AP <p>Agile Controller Server</p> <ul style="list-style-type: none"> • Configure authentication Device (Switch), MAC Account of AP, account for 802.1x and Portal Authentication • Configure authentication and authorization process • Configure Security Groups (Static) and Security Groups (Dynamic) • Configure policy of Free Mobility

Network Segmentation Summary

- Aruba and Huawei did not pass all test cases. Aruba does not offer a unified method of virtualization services for wired and wireless beyond VLANs. Both Aruba and Huawei required multiple dashboards and manual operations during each of the test cases.
- Cisco DNA Center is a system for centralized deployment and policy management of devices within a campus network. It reduces security operations while increasing the organization's security footprint .
- With Cisco, policy enforcement was immediately applied at the edge switch where unknown devices connect. Both Aruba and Huawei push the policy enforcement up the stack, such as the wireless controller (Aruba) or the SVF parent (Huawei). The policy enforcement point for Cisco is distributed, hence scalable, while with Aruba and Huawei are centralized.

Cisco	HPE-Aruba	Huawei
 Automated Process  Duration: 1 hour Single touch point DNA Center	 Manual Process  Duration: 1 day Multiple touch point AirWave, ClearPass, Mobility Master	 Manual Process  Duration: 2 days Multiple touch point CLI, Easy Operations, Agile Controller

5 - Network Assurance

Cisco offers wired and wireless Network Assurance as a part DNA Center. Aruba, on the other hand, has four separate solutions that offer network assurance. For this analysis, we decided to focus on on-premises solutions only. Aruba NetInsight is a cloud-based solution that provides network assurance such as baselines, root causes and suggestions. Cape Networks, now acquired by Aruba, offers network assurance through their hardware sensors. The Network Analytics Engine provides the network health for the ArubaOS-CX switches. Aruba Clarity comes with Aruba Airwave as an optional module and is free of cost. Since Clarity is Aruba's most popular network assurance solution and readily available, we decided to test it. Huawei recently launched their network assurance solution called CampusInsight 2.0. Huawei eSight also offers basic network and client statistics for network troubleshooting. We decided to test Huawei eSight since CampusInsight 2.0 was not available during the period of testing.

To determine how well each architecture isolates, analyzes and resolves network issues, we applied test cases which reveal what insight, if any, is offered by each vendor's software for reporting wired and wireless client experience.

We created an assortment of failure scenarios to assess the individual vendor's software's ability to respond effectively. These included: DHCP server exhausts its IP-address pool exhaustion; Radio Frequency (RF) issues; proactive tests; and troubleshooting with Path Trace.

DHCP Issues

We created conditions so that the wireless clients connecting to the AP could not get the IP address due to an exhausted DHCP IP addresses pool. The client, IP address issue, was confirmed by checking the client's association on the wireless controller showing that the client was connected to the wireless network although could not acquire an IP address

through DHCP. Then the IP address pool was restored on the DHCP server and the clients received an IP address from the server.

Cisco

The Cisco DNA Center information gives a description of the problem, details what parts of the network are impacted and provides additional information and possible solutions to the problem. It also shows in the graph the excessive onboarding times of the clients.

Wireless client took a long time to connect (SSID: CAssure, AP: 3800-5, Band: 5.0 GHz) - Excessive time to get an IP Address

Status: Open Last Occurred: Jul 25, 2018 1:25

Description

This client is taking longer than expected time to connect to "CAssure" SSID due to excessive time in getting an IPv4 address.

- Onboarding took 37.4 seconds (expected time should be less than 10.0 seconds).
- Association took 0 seconds (expected time should be less than 2.0 seconds).
- Authentication and Key Exchange took less than a second (expected time should be less than 3.0 seconds).
- IP Addressing took 37.4 seconds (expected time should be less than 5.0 seconds).

The client is taking longer to get an IP address. The client was connecting to "CAssure" SSID on 5.0 GHz radio on "3800-5" AP in "GlobalFloorRE022/Floor 1". The AP was connected to "req02-5520" WLC.

Impact of Last Occurrence

Location:

- 1 Building
- 2 Wireless Clients

Suggested Actions (2)

- 1 Verify whether the 10.99.0.1 DHCP server is responsive. The client may not be getting DHCP responses in time because of DHCP server or network issues.
- 2 Verify whether the wireless client (which is the DHCP client) is responsive. The client may not be processing the DHCP server responses on time.

Average Onboarding Times (DHCP Server: 10.99.0.1)

Jul 24, 2018 1:25 pm to Jul 25, 2018 1:25 pm

Show: DHCP Addressing

Source: Miercom

The Cisco DNA Center event viewer shows the chronology of the successful client onboarding process.

Event Viewer EQ Find

Filter

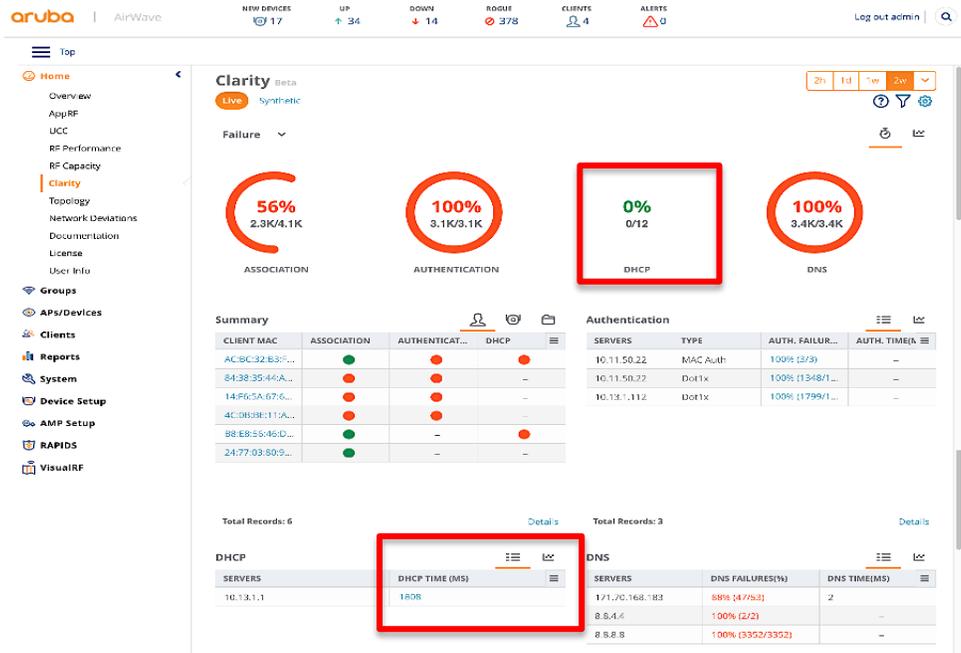
Jul 25, 2018

Onboarding	AP:3800-4 WLC:req02-5520 WLAN:CAss...	2:24:54.591 PM - 2:24:54.658 PM
Run		2:24:54.658 PM
DHCP	IP Learn DHCP	2:24:54.658 PM
Mobility	MM Handoff Timeout	2:24:54.599 PM
KeyExchange		2:24:54.599 PM
Association Done		2:24:54.591 PM
Association Start	Client Association with AP	2:24:54.591 PM
Delete	WLC:req02-5520	2:24:50.820 PM - 2:24:50.820 PM
Onboarding	AP:3800-4 WLC:req02-5520 WLAN:CAss...	2:18:04.778 PM - 2:18:04.937 PM

Source: Miercom

HPE-Aruba

The Aruba AirWave Clarity dashboard shows the failure percentage of basic network metrics such as association, authentication, DHCP and DNS. It also shows the average time for a client to get an IP address from the DHCP server. A threshold of each metric can be set to show pass/fail. The dashboard depicts the network summary from the client and access point perspective.



Source: Miercom

The client details window does show some added information such as timeline of the duration for the client to get an IP address once DHCP is restored to full operation. However, it lacks information on the impacted location, the number of clients affected, and guided remediations.

Huawei

The Huawei eSight doesn't provide any dashboard to show network assurance statistics such as association, authentication DHCP, DNS failure rate or average time. However, the Huawei eSight WLAN Fault Diagnosis screen, in the Terminal Check section, can be used to make fault diagnosis on the client to see the cause of the fault and the suggestion to fix it. It does not go any deeper into the cause of this disassociation.

Diagnose Result

Terminal Check

FaultCause: The STA disassociates with the network. [2018-07-25 16:30:26]

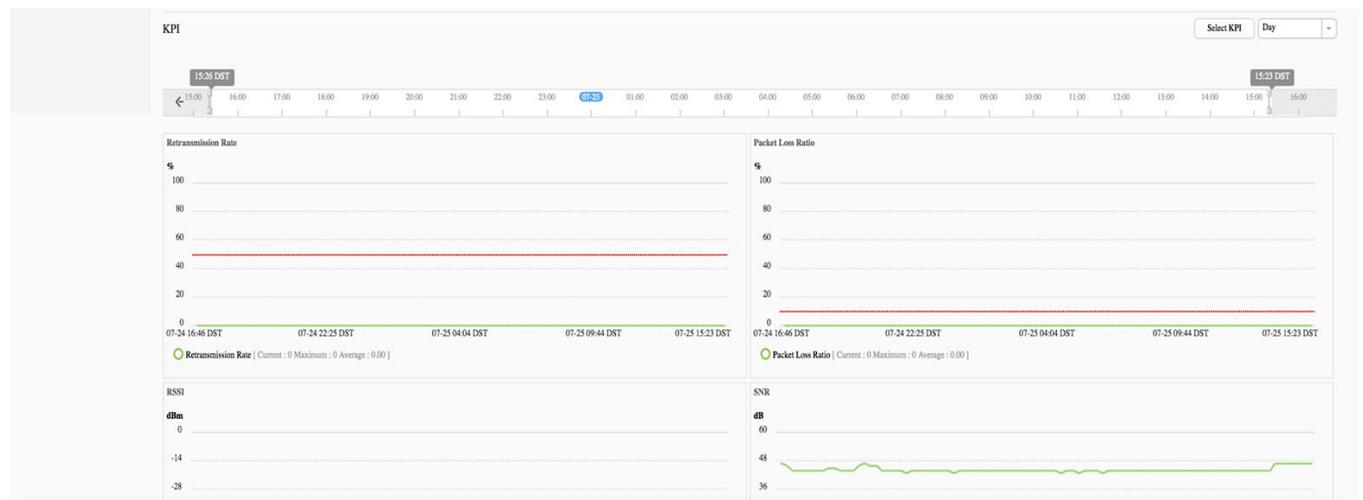
FaultSuggestion: Check whether the user actively goes offline or whether the terminal is faulty.

Source: Miercom

Huawei eSight does offer several additional windows of information, but these collectively provide little additional information that helps in troubleshooting. One such window is the "Client Detail". Client Detail provides additional detail including:

- Topology of the last path accessed from the client, through to the AP Controller
- Basic client information such as naming and addressing, various access times and performance information
- Retransmission rate and packet loss information

The screenshot below shows the client traffic information portion of the client page.



Source: Miercom

RF (Radio Frequency) Issues

In this test case, we created a scenario where a client is forced to join the 2.4-GHz radio instead of 5-GHz radio in a dual-band WLAN. We artificially reduced the transmit power on the 5-GHz radio of the AP and then positioned the client away from the AP. This is a typical scenario in a wireless network where a client joins 2.4-GHz band due to the lack of a 5-GHz signal and suffers from performance issues.

Cisco

As shown below, Cisco DNA Center identifies the cause of the client running on the 2.4-GHz radio rather than the greater bandwidth of 5-GHz. DNA Center describes the problem in detail, including identifying the AP that is providing the poorer connection. In addition, DNA Center offers four suggestions for resolving and remedying the situation.

The screenshot displays a Cisco DNA Center alert titled "Insufficient 5GHz Coverage - Dual Band capable client prefers 2.4GHz over 5GHz". The alert status is "Open".

Description: This dual band capable client is consistently connecting to 2.4GHz instead of 5 GHz. At client location, better 5 GHz signal is not available. This client is on "CAssure" SSID, "3800-4" AP, which is connected to "req02-5520" WLC.

Impact of Last Occurrence: Jul 22, 2018 06:16 PM to 06:46 PM

Location:

- 1 Building

Clients:

- 1 Wireless Client

Connection History: Jul 22, 2018 10:46 am to Jul 22, 2018 6:46 pm

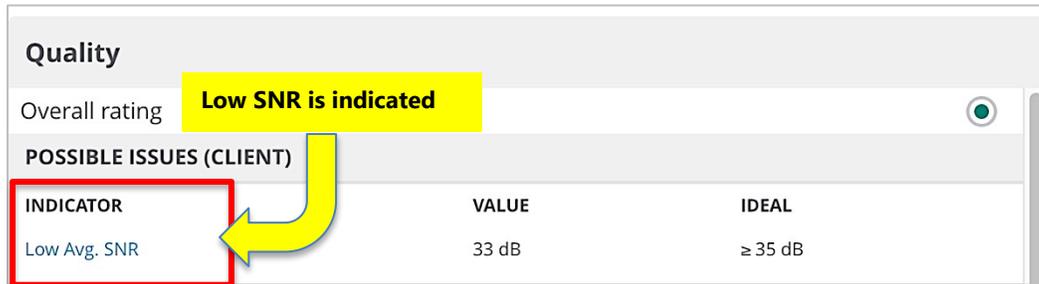
Suggested Actions (4):

- 1 Verify if obstacles prevent the 5GHz signal from reaching the client.
- 2 Verify the levels for the 5 GHz and 2.4 GHz power levels on "3800-4" AP.
- 3 (If applicable) verify that the external antenna provides enough coverage for 5 GHz at the client location.
- 4 Consider enabling Optimized Roaming on "CAssure" SSID.

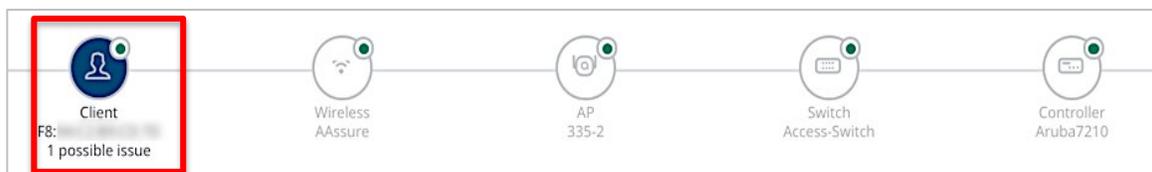
Source: Miercom

HPE-Aruba

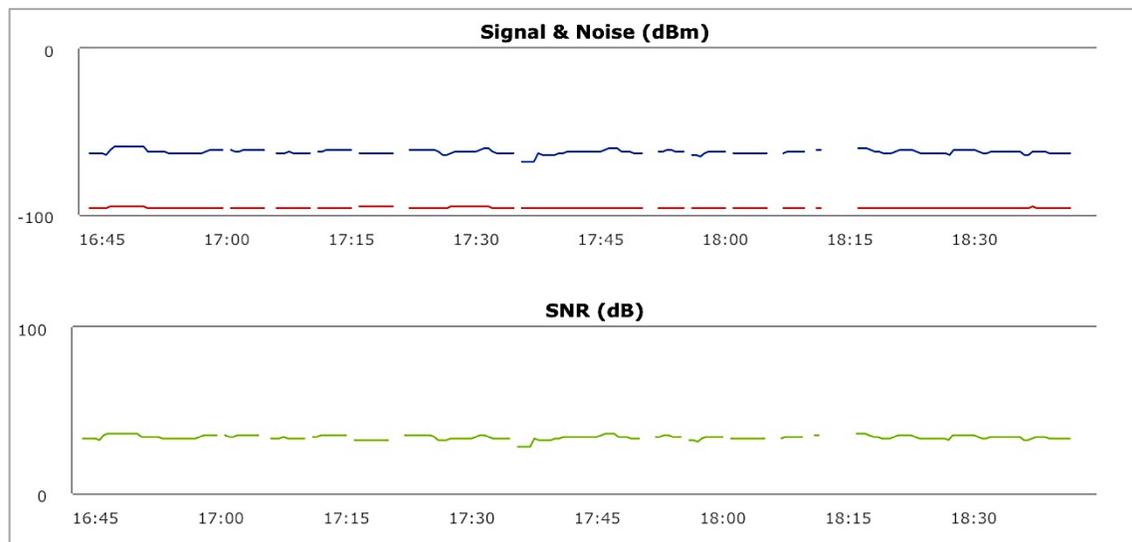
The HPE-Aruba package notices that the Signal to Noise Ratio (SNR) is low and presents an alert that identifies the low average SNR. This is accompanied by a graph that separately plots the signal to noise levels.



Source: Miercom



Source: Miercom



Source: Miercom

While HPE-Aruba provides client alerts based on average SNR, there are no suggested actions and the extent of the impact is not indicated.

The HPE-Aruba configuration of the SNR threshold, as well as authorization errors and overall station health, for alerts, is straightforward.

Huawei

Huawei doesn't have a view that identifies this RF issue (a client and an AP underperforming at 2.4-GHz). But the Huawei package can single out clients with low RSSI (Received Signal Strength Indication) – which could then be researched, using other tools, to eventually find the AP with a bad 5-GHz radio. The Huawei "Low-RSSI" screen is shown below.

Top N Clients With Low RSSI Update time: 2018-07-25 18:44

MAC address	User name	RSSI (dBm)
08 [redacted]	08 [redacted]	-60
34 [redacted]	34 [redacted]	-56
60 [redacted]	ah [redacted]	-52
70 [redacted]	c1 [redacted]	-48
3c [redacted]	3c [redacted]	-37

Source: Miercom

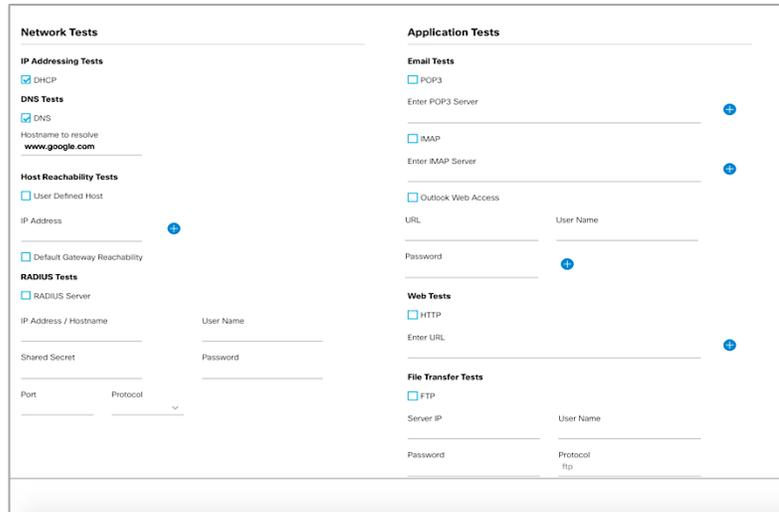
Proactive Testing

A sensor is a network device, such as an AP, which conducts synthetic tests, driven by configurable parameters, rather than based on actual traffic.

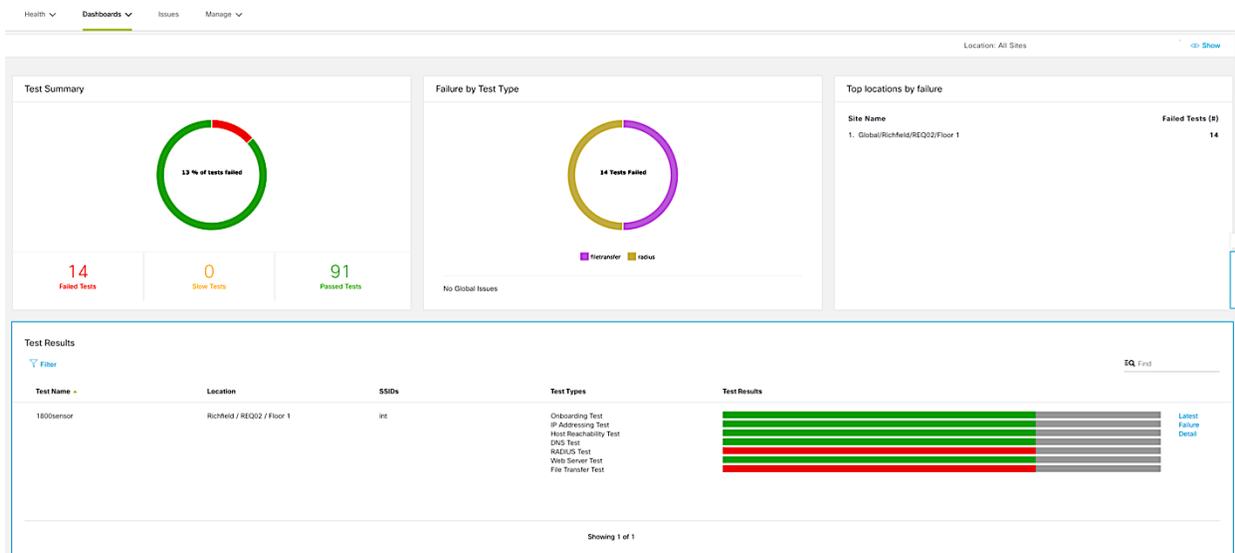
Cisco

Cisco has over fifteen available proactive tests, accessible under the DNA Center "Assurance" tab and under "Manage," via the "Sensor Driven Tests" window. This allows network administrators to select from the various test types to be run manually or automatically on a selected schedule.

Test results are compiled over time to yield a historical view of network stability. The Test Summary window tracks the failure percentage and which tests failed.



Source: Miercom



Source: Miercom

In this case, seven tests were run and two failed as shown by two red lines. This summary is also capable of recording sets of tests run together repeatedly over time.

HPE-Aruba

HPE-Aruba Clarity only offers a battery of seven sensor, or synthetic tests – executable tests of various network functions. This window is offered to configure the synthetic tests.

Synthetic Tests

Basic Info | DNS | Ping | Page Load | Traceroute | iPerf3

Select a Profile:

Profile Name (alphanumeric only)*:

SSID*:

Authentication:

Selected Client (s):

Band:

Selected Target(s):

Key*:

Source: Miercom

Huawei

Huawei has no proactively run set of tests.

Troubleshooting via Path Trace

Path Trace is a software diagnostic tool similar to traceroute, a standardized process that has long been used for uncovering network problems. Traceroute has traditionally been launched via CLI. Path Trace, and traceroute, perform a connectivity test between specified network nodes and show all intermediate nodes along the path in the result.

Cisco

Cisco's Path Trace tool shows the topology between any two nodes in the network, wired and wireless. It doesn't generate packet like traceroute/ping. Instead, it depends on device inventory database and models to trace the actual path. The resulting display shows each node along the physical path, as well as the logical network path such as a CAPWAP (Control and Provisioning of Wireless Access Points) tunnel between two nodes, and the connection across a wireless AP.

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.

10.99.0.121 (port: not specified) → 10.99.0.121 (port: not specified) [protocol: not specified] Jul 25, 2018 3:41 pm



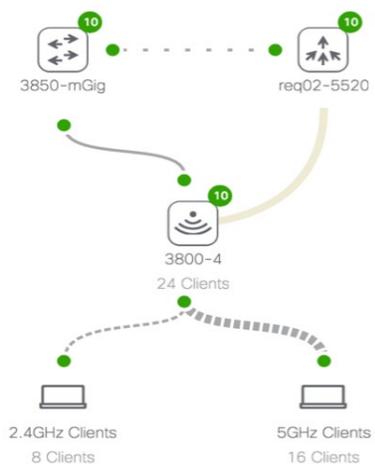
[Run New Path Trace](#)

Source: Miercom

The Cisco Path Trace utility allows for full visibility of the wired network, logically as well as physically. We found the Cisco topology view, as part of its Path Trace, to show comprehensive detail which proved useful in pinpointing network issues such as bottlenecks and delays.

Path trace also shows health of each device and ACLs applied on the switch.

The Cisco DNA Center also shows the network view from the device perspective. The physical neighbor topology in the Device 360 window displays the neighbors connected to the devices. The screenshot, shown right, shows the physical and logical connection of the AP, switch, controller, and the clients connected on both radios.



Source: Miercom

HPE-Aruba

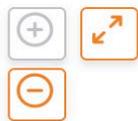
HPE-Aruba doesn't offer an option to run a patch trace. However, it gives a view of the physical connection but not the logical connection in the client detail window. The HPE display is basic but nevertheless informative and useful.



Source: Miercom

The Aruba Airwave topology window shows the topology of the network devices. It also shows the health of the network devices but doesn't give information on the clients connected the devices. The screenshot below shows the topology view of Aruba Airwave.

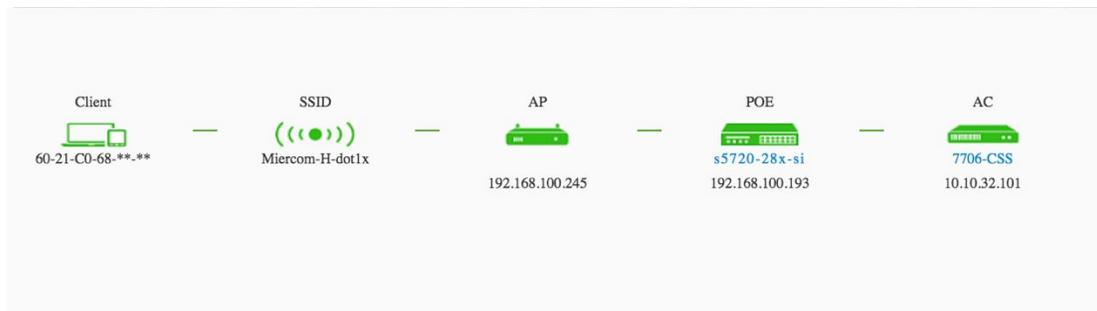
Topology



Source: Miercom

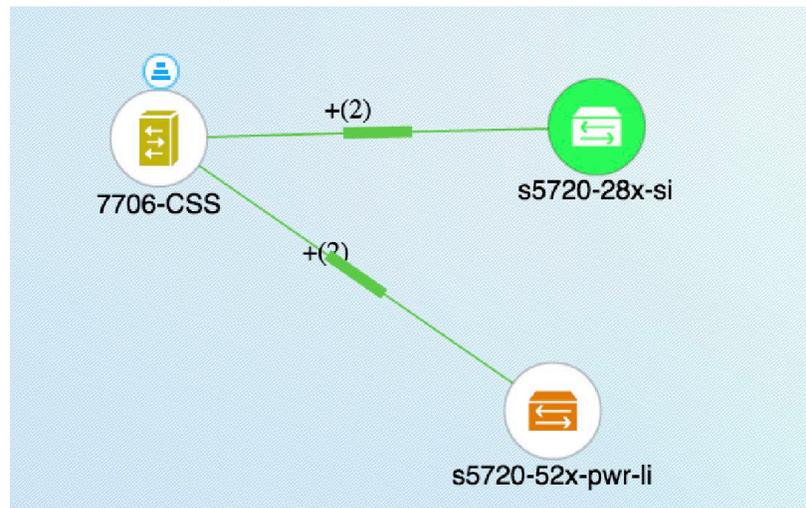
Huawei

Huawei has the path trace capability, but it only shows the physical connection layout. It also displays the IP addresses of the nodes in the physical connection.



Source: Miercom

The Huawei topology tab shows the physical connection of the network devices with CPU usage and memory usage.



Source: Miercom

DNA Center Assurance- Additional Features

There are other DNA Center Assurance features that were not part of the testing because the equivalent features from the competitor solutions were missing. Nevertheless, we summarize these features for the remainder of this section since they play a prominent role in assisting network administrators to proactively monitor and troubleshoot the network.

iOS Wi-Fi Analytics

The Cisco and Apple partnership brings iOS Wi-Fi Analytics feature to DNA Center Assurance. The feature allows Apple clients to report the client view of the network that includes the list of the APs it can see along with the signal value and channel. It also shows the reasons for the client disconnection to make troubleshooting easier for the network administrator. For example, if a client got disconnected from the network due to its software-related reason, the network administrator can deduce that it is not a network-related problem but a client-related problem. The DNA Center gathers the client-related information and displays in the client 360 view shown in the figure below.

The screenshot displays the 'iOS Analytics' section of the DNA Center Assurance interface. It is divided into two main panels: 'Neighbor APs (4)' and 'Client Disassociation Details (2)'. Both panels include a 'Filter' option and an 'Export' button.

Neighbor APs (4) Table:

BSSID	AP Name	Channel	RSSI (dBm)	Location
00:00:00:00:00:00	18151	6	-34	Global/Richfield/REQ02/Floor 1
00:00:00:00:00:00	2800-02	11	-63	Global/Richfield/REQ02/Floor 1
00:00:00:00:00:00	3800-4	6	-68	Global/Richfield/REQ02/Floor 1
00:00:00:00:00:00	3800-4	124	-64	Global/Richfield/REQ02/Floor 1

Client Disassociation Details (2) Table:

Time	Disassociation Reason	Disassociated AP	Session Duration	AP Location
Monday, September 24, 2018 5:02 PM	Device Idle	3800-4		Floor 1
Monday, September 24, 2018 4:44 PM	Device Idle	2800-02		Floor 1

Below the tables, there is a 'Show 10 entries' dropdown and a 'Showing 1 - 4 of 4' indicator. At the bottom of the interface, there is a diagram showing a mobile device connected to four Wi-Fi access points with signal strength indicators: -68dBm, -63dBm, -34dBm, and -64dBm.

Source: Miercom

Application Experience

The DNA Center Application Experience feature allows the network administrator to monitor the health of the applications running on the client devices. A health score is given to the applications based on packet loss and latency metrics. Furthermore, it also segregates the application from business relevant with business irrelevant so that a network administrator can focus on the critical application for diagnosing. The application health can be monitored globally from the main dashboard or per-client basis in the Client 360 view window.

Network Assurance Summary

- Aruba Clarity offers some fundamental assurance capabilities but lacks in providing a multitude of client-based analytics including iOS analytics, wired and wireless client analytics, and patch trace. Huawei eSight also offers some client statistics and can also do a traceroute, but unlike Cisco DNA Assurance it only shows the physical topology with no useful metrics such as ACL, device health.
- Cisco DNA Center Assurance can continuously monitor the health of the network by running comprehensive synthetic tests. Aruba Clarity has the same capability but only offers half of the synthetic test compared to Cisco. Huawei eSight only relies on health diagnostic of the client and doesn't offer any synthetic tests. Cisco DNA Center Intelligent Capture can detect the issues in real-time by providing automatic packet captures and displaying the captures on the DNA Center. Aruba and Huawei don't have any native packet capture capability.
- Aruba Clarity displays the issues created in the DHCP and RF issue tests but doesn't provide any suggestion to mitigate the issue. Huawei eSight could only detect the client's RF issue, but like Aruba, there are no suggested actions. Cisco DNA Center offers a Client 360 view that shows the client issues over a timeline and provides guided remediations to resolve the issue.

Cisco DNA	HPE	Huawei
<ul style="list-style-type: none"> • DHCP Problem: Offers detailed problem description, graphical representation and solution • RF Issues: Identifies reduced bandwidth and offers solutions • Proactive Testing: Offers 15 tests to be run automatically, manually or by schedule; historical stability view and test summary • Troubleshooting: Shows topology with health of each node and full logical and physical network visibility to show bottlenecks 	<ul style="list-style-type: none"> • DHCP Problem: No clear indication of problem, no offered solutions • RF Issues: Notices low signal strength, offers topology of affected configuration but no remediation • Proactive Testing: Offers 7 tests and visual table of results • Troubleshooting: Doesn't offer path trace but shows hardware topology with the health of devices. 	<ul style="list-style-type: none"> • DHCP Problem: Does not offer any dashboard to show DHCP related issue • RF Issues: Notices low signal strength but offers no resolution • Proactive Testing: No sensor tests offered • Troubleshooting: Offers Path Trace capability but only shows the physical connection in the client page.

DNA Summary

Cisco automation offers comprehensive network automation capabilities, extending beyond basic day-zero configuration and helps the administrator convert business intent to an automated network configuration. This saves customers a huge amount of time, resources and money. HPE and Huawei continue to use manual and rigid, template-based provisioning for wired and wireless networks.

Cisco SD-Access offers ease of policy creation and deployment with micro and macro segmentation using a simple drag-and-drop mechanism. HPE and Huawei fail to offer multi-level segmentation and still rely on traditional ACL-based network segmentation – adding complexity and additional operational cost.

Cisco provides a unified assurance platform for wired, wireless and routing with predictive troubleshooting, faster remediation and unique features, like Intelligent Capture. HPE and Huawei offer various assurance platforms for different places in the network.

Cisco DNA Center offers a single-pane-of-glass dashboard. HPE and Huawei's lack of integration forces the network administrator to use multiple dashboards and tools for network deployment, management, monitoring and troubleshooting.

About "Miercom Performance Verified" Testing

This report was sponsored by Cisco Systems, Inc. The data was obtained completely and independently by Miercom engineers and lab-test staff as part of our Performance Verified assessment. Testing such as this is based on a methodology that is jointly co-developed with the sponsoring vendor. The test cases are designed to focus on specific claims of the sponsoring vendor, and either validate or repudiate those claims. The results are presented in a report such as this one, independently published by Miercom.

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