校園智慧網路 – Aruba Wi-Fi 6E AP

Aruba ESP

AI-POWERED MOBILE INNOVATIONS FOR

THE EDGE

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Aruba, a Hewlett Packard Enterprise company

Agenda (大綱)

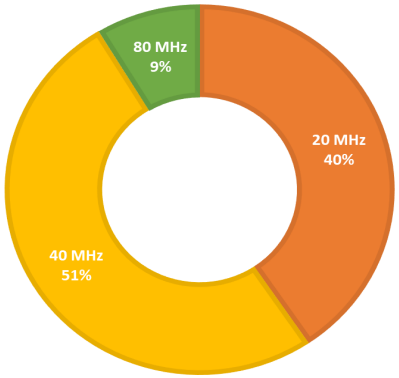
1. 無線網路於頻段上之發展 (802.11ax, Wi-Fi 6E)
2. 智慧校園網路 - Aruba ESP, AI-powered Innovations for the Edge

aruba
a Hewlett Packard Enterprise company

無線網路於頻段上之發展 (802.11ax, WiFi 6)

What is Wi-Fi 6E?

TODAY'S WIRELESS NETWORKS ARE LIMITED BY AVAILABLE SPECTRUM

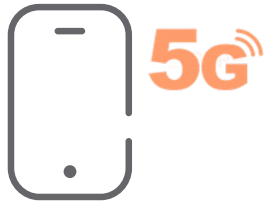


91% CHANNELS
DEPLOYED ARE <80 MHZ

Source: HPE, customer study

6.2B CLIENT DEVICES
WILL BE IN USE THIS YEAR

Source: Gartner

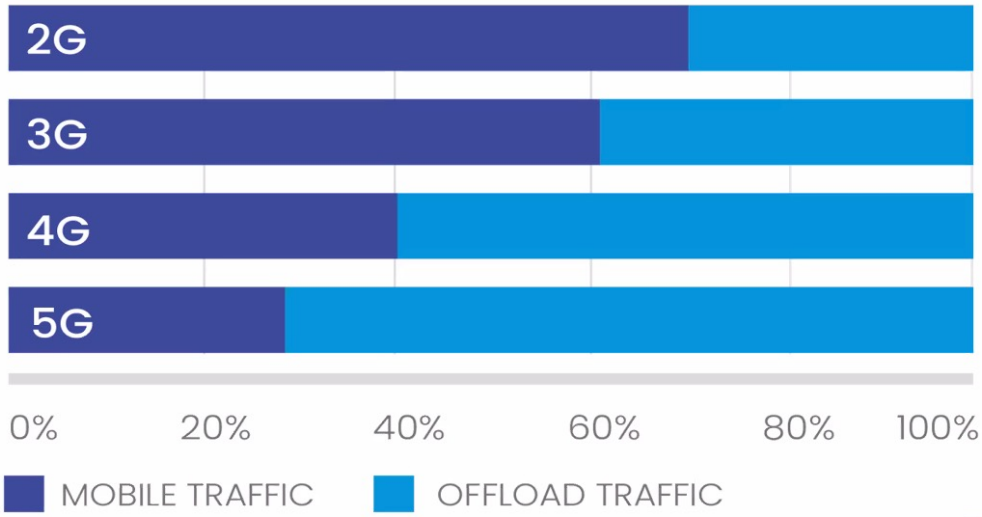


63% TRAFFIC
FROM MOBILE IS OFFLOADED TO WI-FI

Source: Wi-Fi Alliance

Why 6 GHz?
5G Cannot Succeed Without Wi-Fi

- Without the ability to offload traffic to Wi-Fi, 4G/5G networks would be more expensive. Mobile operators would need to invest more in network densification
- Many “core” 4G/5G use cases depend on Wi-Fi for value creation. These include:
  - Fixed wireless access (FWA)
  - Mobile AR/VR for consumer & enterprise
  - Mobile gigabit hotspot
  - Smart home
  - 4K movie casting from smartphones to smart TVs
  - Home health monitoring devices & wearables



Wi-Fi 6E = Wi-Fi 6 in the 6 GHz Band

New Features In 6 GHz

- Native Wi-Fi 6 Transmissions
  - High-Efficiency (HE) PHY/MAC structure
  - Native HE beacons
- 3 methods for In-Band AP Discovery
  - Fast Initial Link Setup (FILS) Discovery announcements
  - Unsolicited Probe Responses
  - Active scans on preferred scanning channels
- Security Enhancements
  - WPA3 Enterprise / Personal required
  - Protected Management Frames (PMF) required
  - Enhanced Open required

Enhancements In 5 GHz & 2.4 GHz

- 2 methods for Out-of-Band AP Discovery
  - Reduced Neighbor Reports (RNR)
  - Multiple-BSSID Beacons
- Security Enhancements
  - Expanded requirements for recent WFA standards

Wi-Fi 6E Features – Out-of-Band Discovery

Option 1 - Reduced Neighbor Report (RNR)

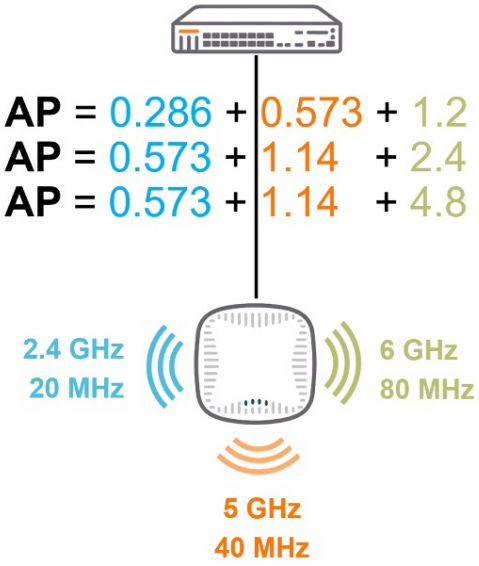
- WFA Optimized Connectivity (OCE) feature
- Lists adjacent radios in same housing
- Broadcast both bands in beacon
- Or supplied in Probe Response
- RNR support ClientMatch from day one

Option 2 - Multiple BSSID Beacon

- Agile Multiband (MBO) feature
- Lists virtual APs on same AP
- Broadcast both bands in beacon
- Or supplied in Probe Response
- Old feature, support is now mandatory

Dimensioning the Enterprise Edge for Wi-Fi 6E

				80 MHz		160 MHz
2x2 AP =	0.286	+ 0.573	+ 1.2 =	**2.1 Gbps**	=	**3.3 Gbps**
4x4 AP =	0.573	+ 1.14	+ 2.4 =	**4.1 Gbps**	=	**6.5 Gbps**
8x8 AP =	0.573	+ 1.14	+ 4.8 =	**6.5 Gbps**	=	**11.3 Gbps**

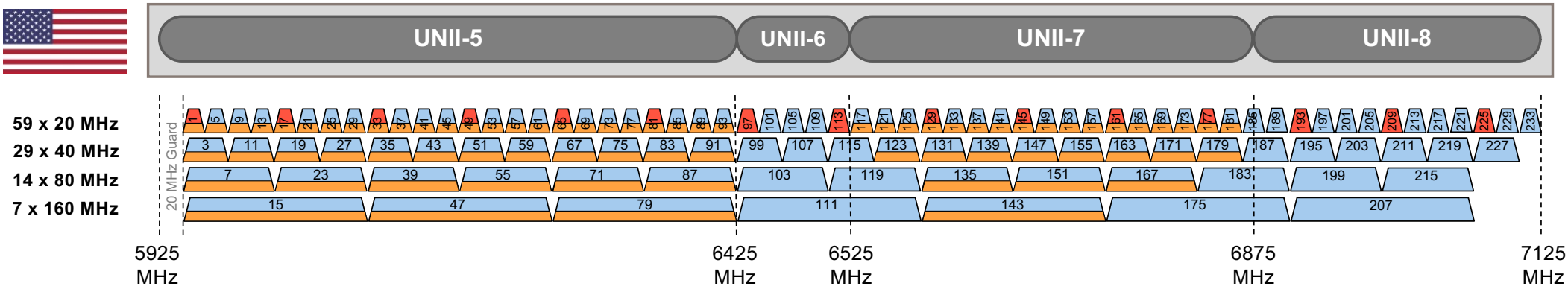


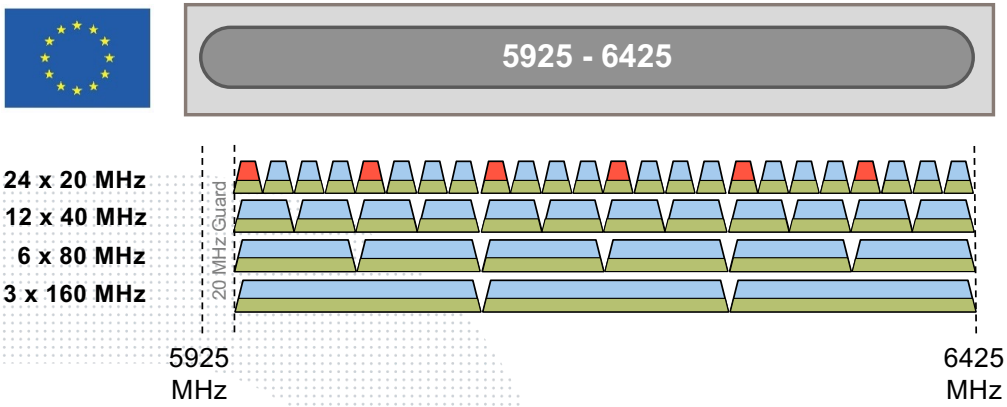
Spatial Streams	20 MHz
1SS	143 Mbps
2SS	**286 Mbps**
3SS	430 Mbps
4SS	**573 Mbps**

Spatial Streams	40 MHz
1SS	286 Mbps
2SS	**573 Mbps**
3SS	860 Mbps
4SS	**1.14 Gbps**

Spatial Streams	80 MHz	160 MHz
1SS	600 Mbps	1.2 Gbps
2SS	**1.2 Gbps**	**2.4 Gbps**
4SS	**2.4 Gbps**	**4.8 Gbps**
6SS	3.6 Gbps	7.2 Gbps
8SS	**4.8 Gbps**	**9.6 Gbps**

6 GHz Channels in United States & Europe/CEPT





= Low Power Indoor (LPI) Only

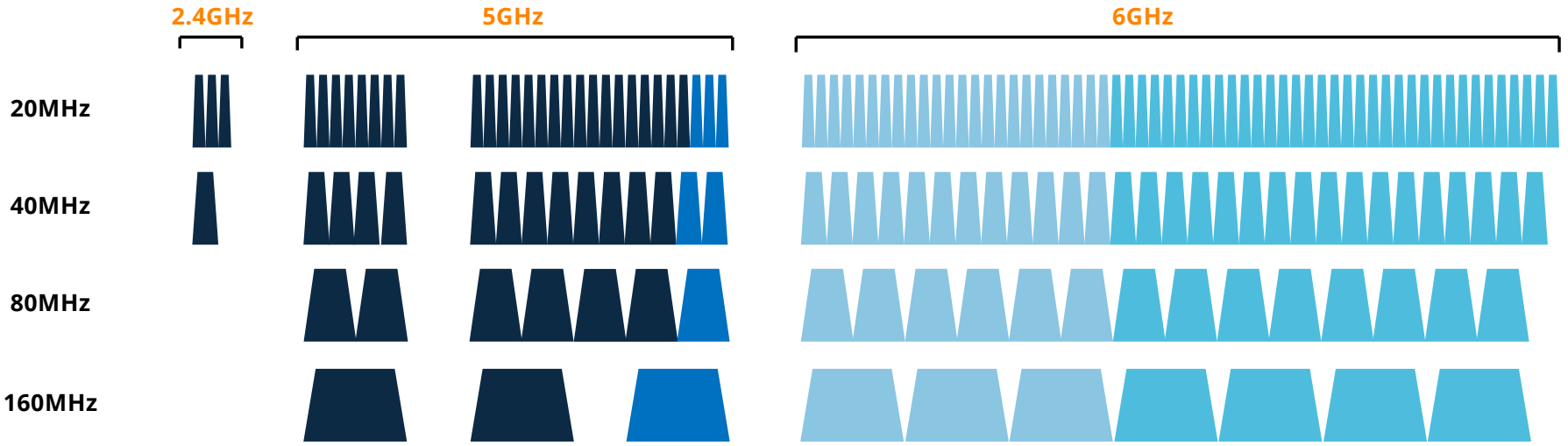
= LPI & Automatic Frequency Coordination (AFC)

= LPI & Very Lower Power (VLP)

= Preferred Scanning Channels (PSC)

WI-FI 6E = WI-FI 6 IN THE 6 GHZ BAND

AMERICAS, SAUDI ARABIA, S KOREA



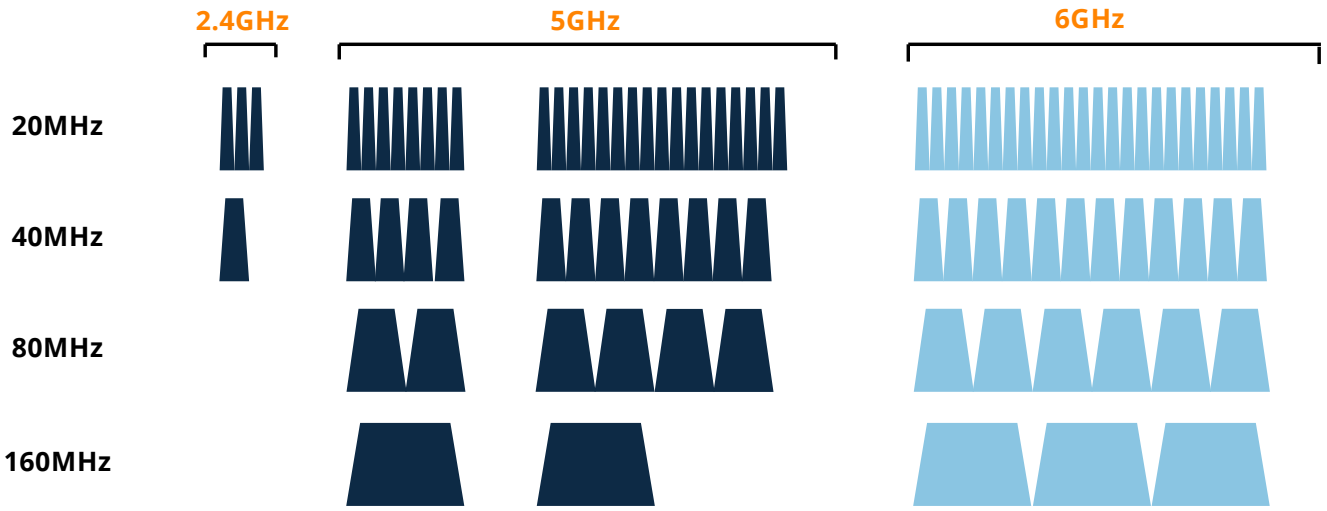
– More than 2x the amount of unlicensed spectrum

– Seven wider channels for amazing performance and reduced airtime

– 6 GHz is greenfield (no need for backwards compatibility)

WI-FI 6E = WI-FI 6 IN THE 6 GHZ BAND

EU, UK, & UAE BAND ALLOCATIONS

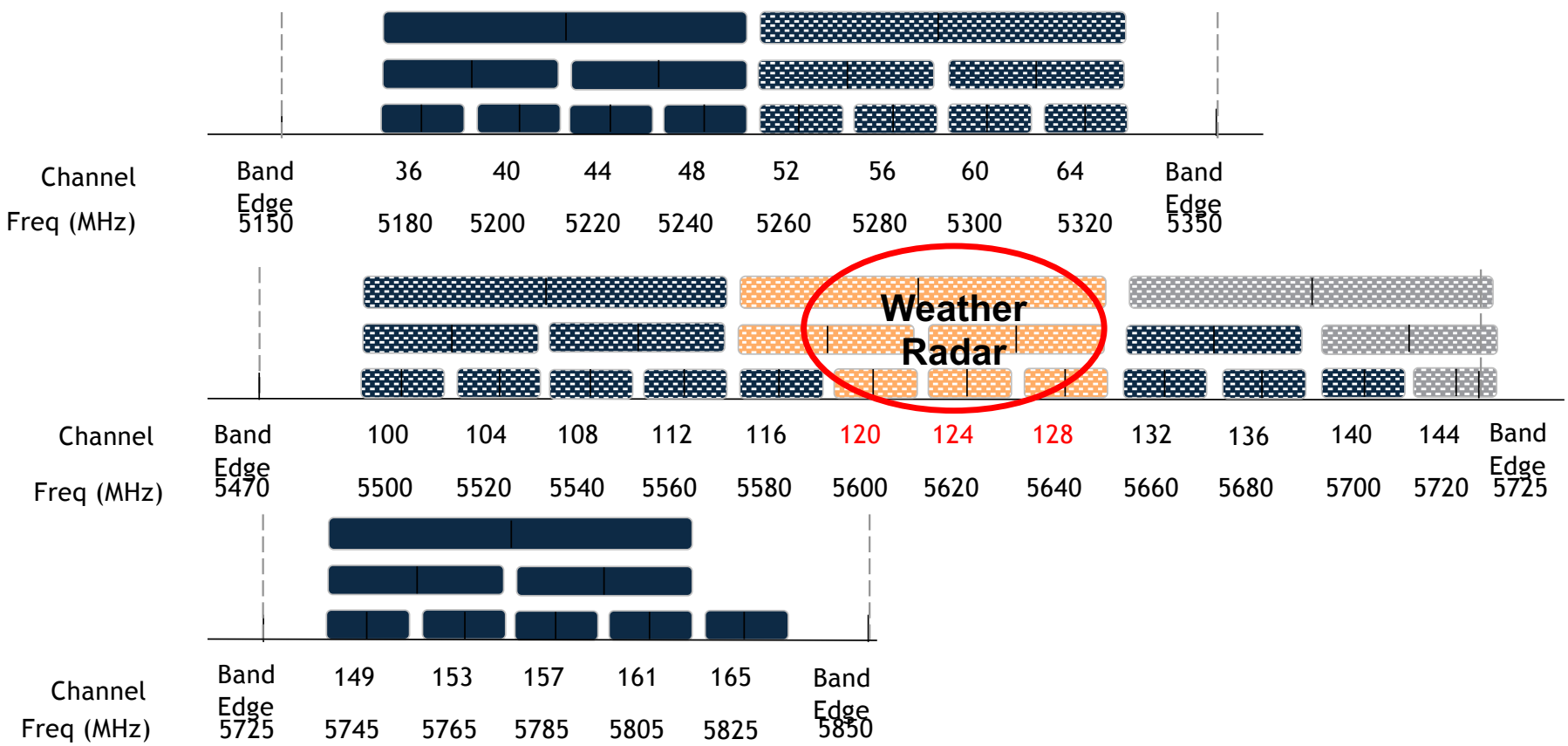


– More than 2x unlicensed spectrum

– Wider channels for amazing performance and reduced airtime

– 6 GHz is greenfield (no need for backwards compatibility)

802.11ac, 802.11ax Channels (5GHz FCC Channels)



UNII I and UNII II
2x 80 MHz
4x 40 MHz
8x 20 MHz

UNII II extended
3x 80 MHz
6x 40 MHz
12x 20 MHz

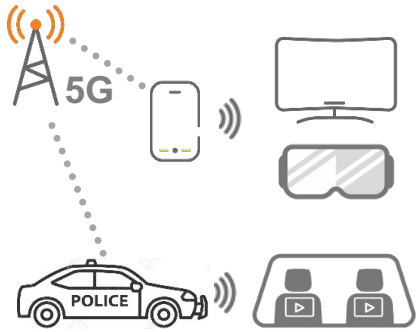
US UNII III
1x 80 MHz
2x 40 MHz
5x 20 MHz

Device Classes in 6 GHz

Low Power Indoor (LPI) AP
- Fixed indoor only
- Up to 63X lower energy
- No antenna connectors
- No weatherproofing
- Wired power

Standard Power (SP) AP
- Fixed indoor / outdoor
- Controlled by AFC database
- Automated geolocation
- Pointing angle restriction

Very Low Power (VLP) AP
- Mobile indoor / outdoor
- 160X lower energy



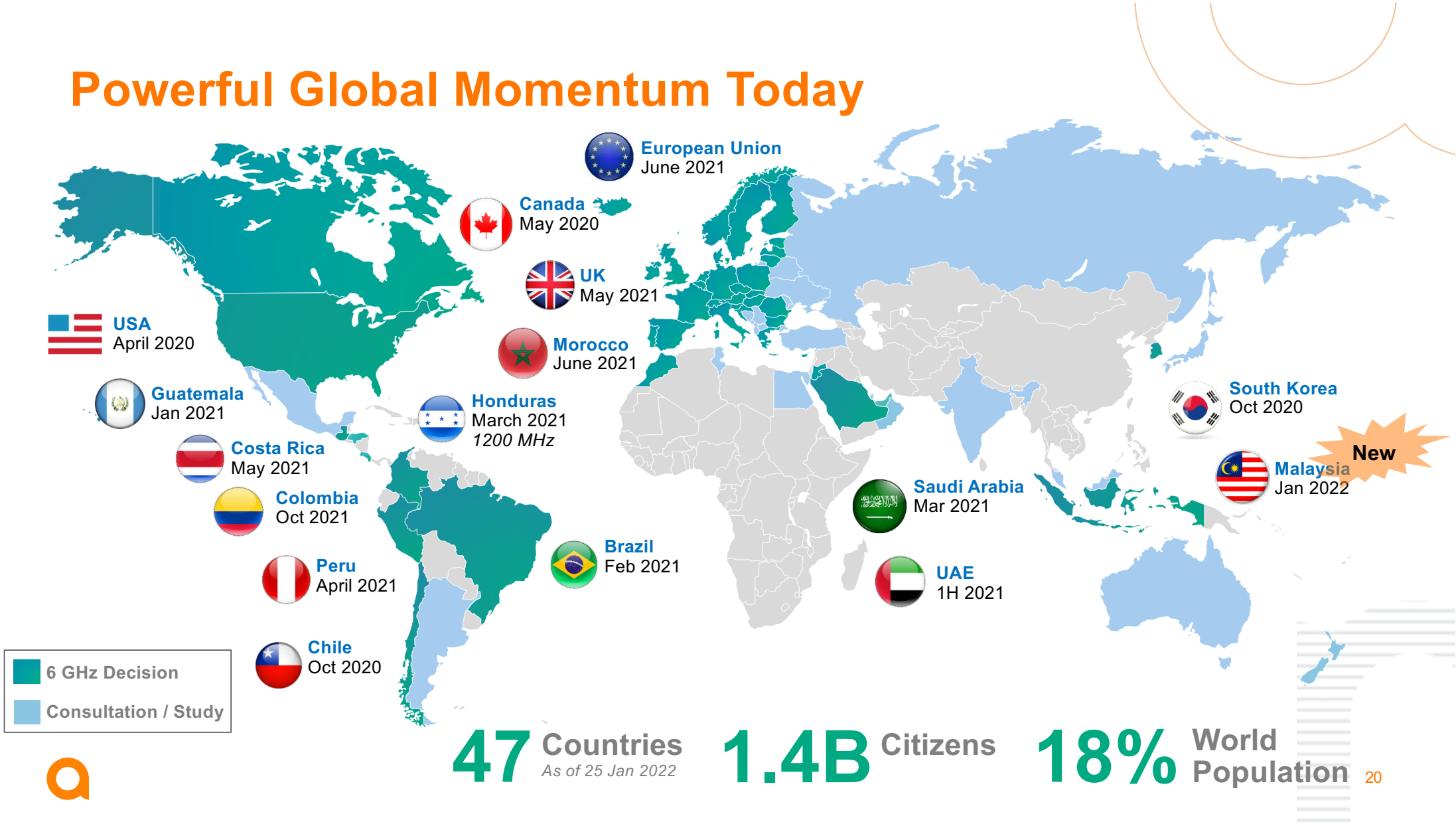
~2 Gbps throughput with sub-ms latency at 3m

Subordinate Indoor Device
- Same rules as LPI AP, ***plus***:
- Under AP control
- No direct Internet connection

Mobile Client
- Indoor / outdoor
- 4X less power than connected AP

Fixed Outdoor Device
- Same rules as SP AP, ***plus***:
- Attached to structure

Powerful Global Momentum Today



47 Countries
As of 25 Jan 2022

1.4B Citizens

18% World Population

WiFi 6E Country status

Country/Market	Status	Est. Date for Acceptance
Korea	• Adopted full 1.2GHz. Rules published South Korea 6GHz	Oct 20
Malaysia	• Adopted Lower 500MHz channels. Malaysia 6GHz	Jan 22
Australia	• Planning to make lower 500 MHz available soon. Considering Upper 700 MHz channels before 2023.	Target Apr/May 22
New Zealand	• Planning to make lower 500 MHz available soon.	Target May/June 22
Japan	• MIC is working toward decision for lower 500 MHz for April 2022. • MIC will study upper 700 MHz and standard power in April 2022, the decision is likely to be made after WRC-2023. • MIC requested ARIB to consolidate industry requirement. Considering full 1.2GHz channels	April 22
Taiwan	• MOTC opened to consultation on 6GHz band	
Singapore	• IMDA spectrum team in discussion. Looking to open up the lower 500MHz channels	
Thailand	• NBTC staff shared roadmap for lower 500 MHz – consultation + decision in Q4 2022. Decision will be in two phases. • Upper 700MHz decision will be post WRC-23.	Q4 22
China	• Looking to license the bands for 5G	
Hong Kong S.A.R.	• OFCA consulted unlicensed lower 500 MHz in November 2021.	April/May 22
India	• C-DOT supports 1200MHz unlicensed study, 700MHz licensed study	

Aruba's Wi-Fi 6E Solution

630 Series Campus Access Point

Mid-range Wi-Fi 6E 802.11ax Platform, 2x2 Tri Radio

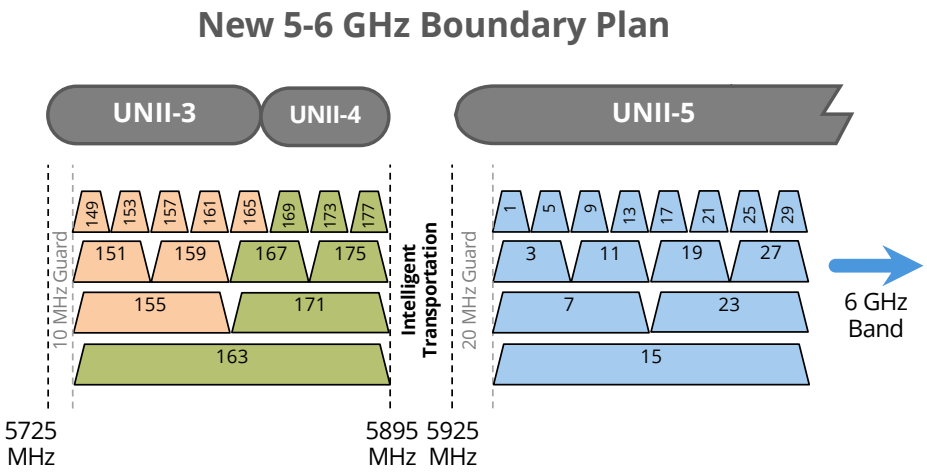
- **Three 2x2 MIMO radios** (2.4GHz + 5GHz + 6GHz) with **Ultra Tri-Band (UTB)**
- 802.11ax: UL&DL OFDMA, 1024-QAM modulation
  - **Peak data rate: 3.9 Gbps**
    - 2.4Gbps (6GHz, HE160/2SS)
    - 1.2Gbps (5GHz, HE80/2SS)
    - 287Mbps (2.4GHz, HE20/2SS)
  - Up to **512 associated clients per radio**
- **Dual 2.5 Gbps Copper Ethernet**
- **Bluetooth** 5.0 & 802.15.4 (**ZigBee**) radios for IOT
- Power: 12Vdc or POE, max power draw: **24W**
- Physical: 220mm x 220mm x 50mm, 1300g

650 Series Campus Access Point

Flagship Wi-Fi 6E 802.11ax Platform, 4x4 Tri Radio

- **Three 4x4 MIMO radios** (2.4GHz + 5GHz + 6GHz) with **Ultra Tri-Band (UTB)**
- 802.11ax: UL&DL OFDMA, 1024-QAM modulation
  - **Peak data rate: 7.8 Gbps**
    - 4.8Gbps (6GHz, HE160/2SS)
    - 2.4Gbps (5GHz, HE80/2SS)
    - 574Mbps (2.4GHz, HE20/2SS)
  - Up to **1024 associated clients per radio**
- **Dual 5 Gbps Copper Ethernet**
- **Bluetooth** 5.0 & 802.15.4 (**ZigBee**) radios for IOT
- Power: 12Vdc or POE, max power draw: **41W**
- Physical: 260mm x 260mm x 60mm, 1800g

ARUBA'S ULTRA TRI-BAND FILTERING



CHALLENGE:

The 5 GHz and 6GHz are separated by just 50 MHz, which may cause interference

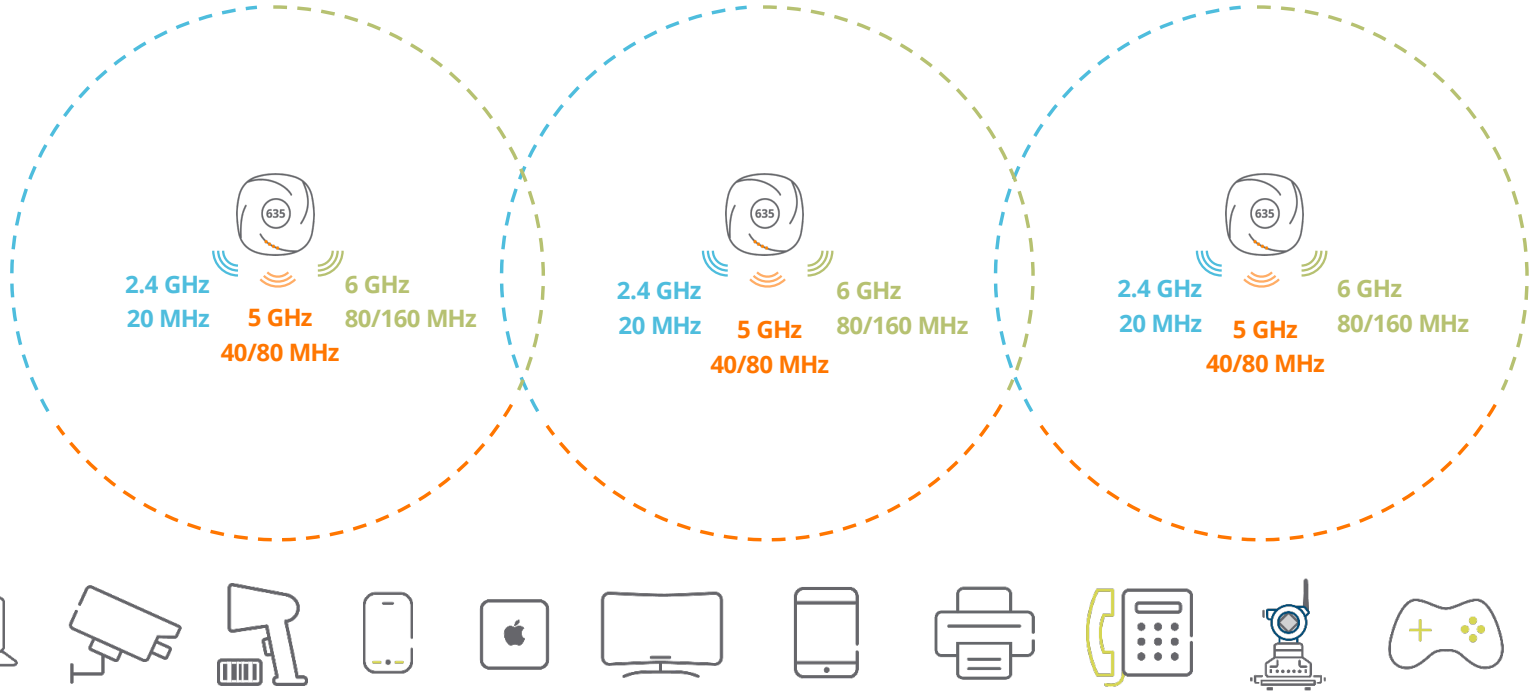
SOLUTION:

Aruba's ultra tri-band capability delivers dynamic filtering

RESULT:

Less interference and unrestricted channel selection for better spectrum utilization

WI-FI 6E DEPLOYMENT
RESILIENT, SECURE, OPTIMIZED
TRI-BAND ACCESS POINTS WITH OVERLAPPING COVERAGE LAYERS IN 2.4 GHZ, 5 GHZ, AND 6 GHZ



Relative Size and Weight

AP-555
260 x 260
1570g

AP-655
260 x 260
1800g

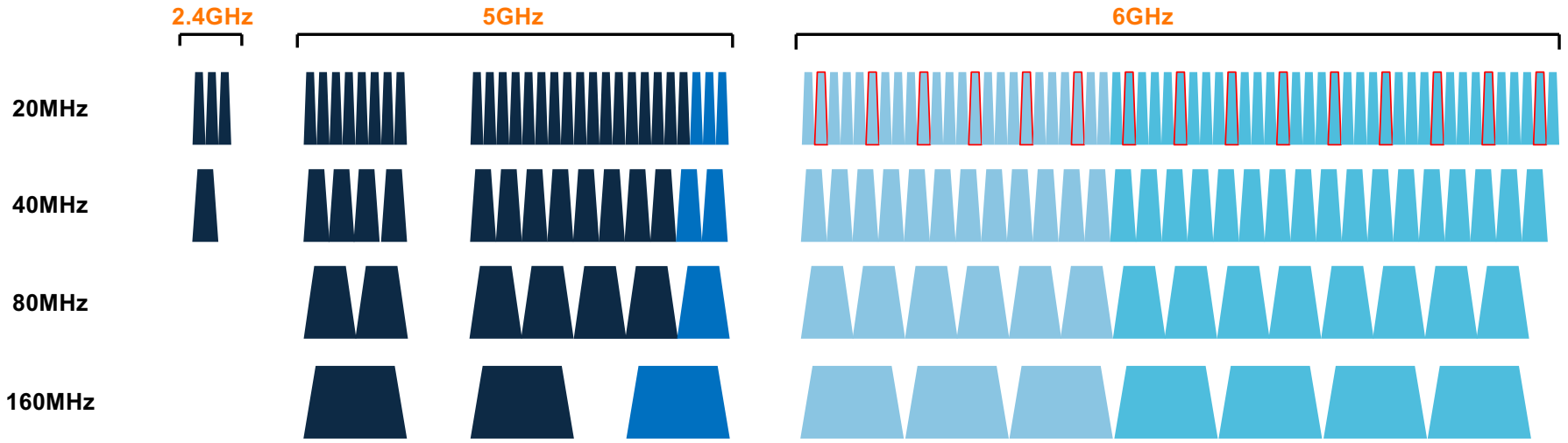
AP-535
240 x 240
1270g

AP-635
220 x 220
1300g

AP-515
200 x 200
810g

Product Introduction – 6xx Series Campus Access Points

Future-proofing Wi-Fi for years to come



– More than 2x the amount of unlicensed spectrum to avoid network congestion and boost performance

– An opportunity to use wider channels for higher throughput performance and reduced airtime

– 6GHz offers a green field scenario for 802.11ax (no need for backwards compatibility)

630 Series Campus Access Points

High-level Summary

– First Enterprise Wi-Fi 6E Access Point, announced May 25, 2021
  – Adding 6GHz support in a tri-radio AP to more than double the AP performance and total wireless network capacity
  – Bringing Wi-Fi 6 to the 6GHz band, and taking advantage of a much-needed boost in spectrum and capacity
  – AP-635 will be Wi-Fi 6 certified to ensure full backwards compatibility, full interoperability with legacy and Wi-Fi 6/6E client devices, and meeting (and exceeding) the industry baseline for 6/6E features and performance
  – AP-635 incorporates many existing and new Aruba AP innovations

– Over time, we'll add more platforms to the Wi-Fi 6E AP portfolio
  – Initially focusing on indoor (LPI class) products, which implies:
    – Indoor deployments only
    – No connectorized antennas
    – Moderate RF transmit power levels (good enough for typical indoor enterprise)

650 Series Campus Access Points

High-level Summary

- With the mid-range AP-635, we announced the first 6E Enterprise AP on 5/25/21, and are now adding a flagship model
  - Thee 4x4 radios versus 2x2 on AP-635, two 5Gbps Ethernet ports with SmartPOE versus dual 2.5Gbps
  - Adding 6GHz support in a tri-radio AP more than doubles the AP performance and total wireless network capacity
  - Bringing Wi-Fi 6 to the 6GHz band, and taking advantage of a much-needed boost in spectrum and capacity
  - AP-655 will be Wi-Fi 6 certified to ensure full backwards compatibility, full interoperability with legacy and Wi-Fi 6/6E client devices, and meeting (and exceeding) the industry baseline for 6/6E features and performance
  - AP-655 incorporates many existing and new Aruba AP innovations

- We'll continue to add models to our Wi-Fi 6E AP portfolio
  - Initially focusing on indoor (LPI class) products, which implies:
    - Indoor deployments only
    - No connectorized antennas
    - Moderate RF transmit power levels (good enough for typical indoor enterprise)

Product Introduction – 630 Series Campus Access Points

Some key specifications

– Wi-Fi Radio Specifications
  – 6GHz radio: 2x2 MIMO, 20/40/80/160MHz, 802.11ax. Peak datarate: 2.4Gbps (2.9Gbps with 4096-QAM)
  – 5GHz radio: 2x2 MIMO, 20/40/80MHz, 802.11a/n/ac/ax. Peak datarate: 1.2Gbps
  – 2.4GHz radio: 2x2 MIMO, 20/40MHz, 802.b/g/n/ax. Peak datarate: 287Mbps (574Mbps @ 40MHz)
  – Aggregate peak datarate: 3.9Gbps
  – Up to 512 associated clients per radio (hard limit; 100 limit for active clients recommended)
  – Max number of 802.11ax OFDMA Resource Units: 8
  – Up to 16 BSSIDs per radio (4 only for 6GHz initially)
  – Transmit power up to 18dBm, receive sensitivity down to -92dBm (conducted per chain)
  – All mandatory features for WFA certification (as well as some optional ones) are supported
  – No MU-MIMO (limited/no added value on 2x2 radios)

– Ethernet: two 2.5Gbps Smart Rate ports (E0, E1)
  – Both support POE

Product Introduction – 650 Series Campus Access Points

Some key specifications

– Wi-Fi Radio Specifications
  – 6GHz radio: 4x4 MIMO, 20/40/80/160MHz, 802.11ax. Peak datarate: 4.8Gbps
  – 5GHz radio: 4x4 MIMO, 20/40/80MHz, 802.11a/n/ac/ax. Peak datarate: 2.4Gbps
  – 2.4GHz radio: 4x4 MIMO, 20/40MHz, 802.b/g/n/ax. Peak datarate: 574Mbps (1,147Mbps @ 40MHz)
  – Aggregate peak datarate: 7.8Gbps
  – Up to 1024 associated clients per radio (hard limit; 150 limit for active clients recommended)
  – Max number of 802.11ax OFDMA Resource Units: 37
  – Up to 16 BSSIDs per radio (4 only for 6GHz initially*)
  – Transmit power up to 18dBm, receive sensitivity down to -92dBm (conducted per chain)
    – Excludes MIMO/MRC gain (3dB), antenna gain
  – All mandatory features for WFA certification (as well as some optional ones) are supported
  – Both down- and uplink MU-MIMO

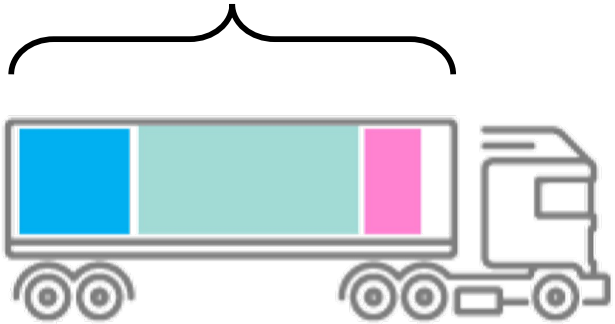
– Ethernet: two 5Gbps Smart Rate ports (E0, E1)
  – Both support POE

OFDMA

What Is In 802.11ax?

802.11ax

Channel width is divided into sub-channels



Resource Units (RUs)

Smallest is RU-26

9 x RU-26 in 20MHz

Up to 9 recipients!

Product Introduction – 6xx Series Campus Access Points

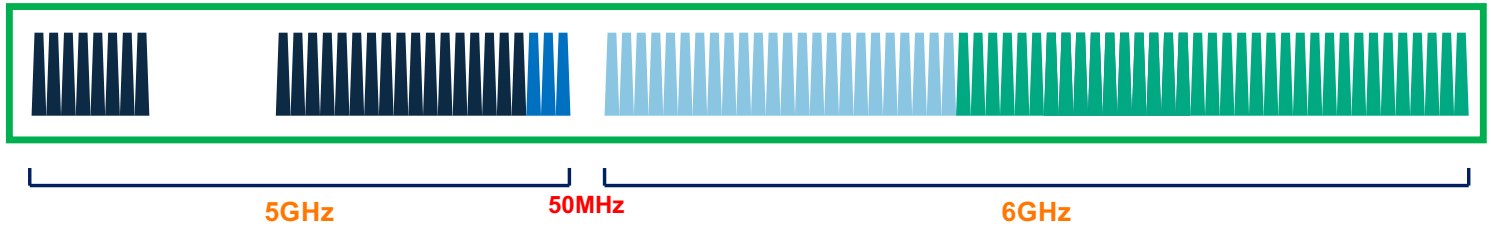
Some key specifications

- Other Platform Specifications
  - Integrated BLE5.0 & 802.15.4 (Zigbee) radio, for locationing, IOT
  - USB 2.0 host interface (5W max)
  - Console port (proprietary, micro-B USB)
  - Reset / LED control button
  - Kensington lock slot
  - Thermal shutdown function
  - Status LEDs: system (1x) and radio (3x)
- Innovative RF filtering functions
  - Advanced Cellular Coexistence (ACC) delivers robust performance in the presence of strong out-of-band interference
  - Advanced IOT Coexistence (AIC) allows for concurrent operation of Wi-Fi and BLE/Zigbee in 2.4GHz without performance degradation
  - Ultra Tri-Band (UTB) enables unrestricted 5GHz and 6GHz channel configuration without performance degradation

Product Introduction – 6xx Series Campus Access Points

What is Ultra Tri-Band (UTB)

- The 5GHz and 6GHz bands are separated by a gap of just 50MHz (in the US*; 95MHz WW)
- Traditional filters to protect the 5GHz or 6GHz band do not effectively block energy from channels in the other band close to the gap (need at least 200MHz separation)
- Steeper filters cannot cover the full band and will block off more than 2/3 of the in-band channels
- To avoid this issue, the higher 5GHz channels (in U-NII-3 & -4) and/or the lower 6GHz ones (in U-NII-5) may not be useable on many products. Or if those channels are used, both throughput and range performance will be severely degraded
  - Typical implementations will sacrifice the lower eight 6GHz channels. For Europe, that's a third of the band!
- Aruba's patent-pending ultra tri-band feature dynamically applies a mix of different filter solutions to address the issue
  - Result: no channel selection restrictions, no performance degradation



Platform Comparison Matrix

	AP-635	AP-655	AP-535
6GHz radio	HE160 2x2 1024-QAM (MCS11)	HE160 4x4 1024-QAM (MCS11)	Not applicable
5GHz radio	HE80 2x2 1024-QAM (MCS11)	HE80 4x4, HE160 (80+80) 2x2 1024-QAM (MCS11)	HE80 4x4, HE160 2x2 1024-QAM (MCS11)
2.4GHz radio	HE20 2x2 (HE40)* 1024-QAM (MCS11)	HE20 4x4 (HE40)* 1024-QAM (MCS11)	HE20 4x4 (HE40)* 1024-QAM (MCS11)
Peak datarates (6GHz, 5GHz, 2.4GHz)	2.4Gbps / 1.2Gbps / 574Mbps	4.8Gbps / 2.4Gbps / 1,147Mbps	2.4Gbps / 1147Mbps
Peak datarates (typical)	2.4Gbps / 1.2Gbps / 287Mbps	4.8Gbps / 2.4Gbps / 574Mbps	2.4Gbps / 574Mbps
Aggregate peak datarate	3.9Gbps	7.8Gbps	3.0Gbps
Max number of clients per radio	512 (100)	1024 (150)	1024 (100)
DL/UL-OFDMA	Yes	Yes	Yes
Max no. of RUs (HE80) per radio	8 (37 for 6GHz)	37	37
DL-MU-MIMO	No	Yes	Yes
UL-MU-MIMO	No	Yes	Yes
Wired ports	2x 2.5Gbps	2x 5Gbps	2x 5Gbps
Peak POE power (excl. USB)	23.8W	40.3W	26.4W
POE-PD (typical)	Class 4 Dual (failover)	Class 6 Dual (Smart POE)	Class 4 Dual (failover/combine)
Size & weight	220 x 220 x 50 (mm) 1300g	260 x 260 x 60 (mm) 1800g	240 x 240 x 53 (mm) 1270g

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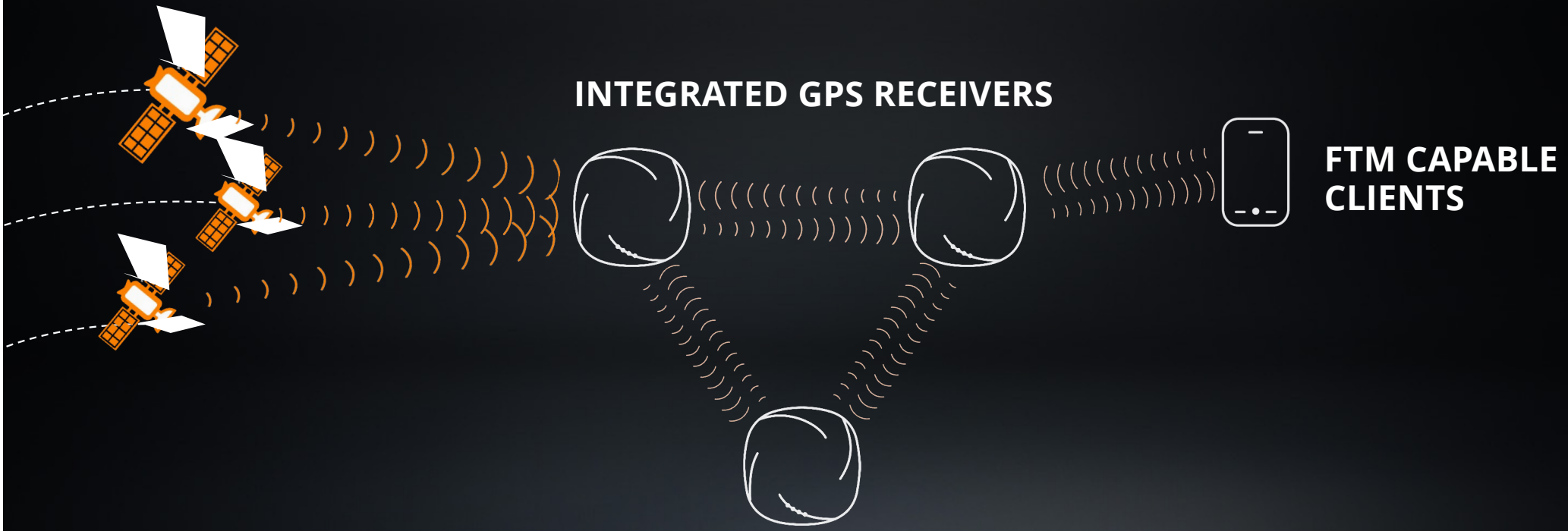
a Hewlett Packard Enterprise company

Bringing the Power of GPS Indoors

Introducing Aruba's Self-Locating Access Points

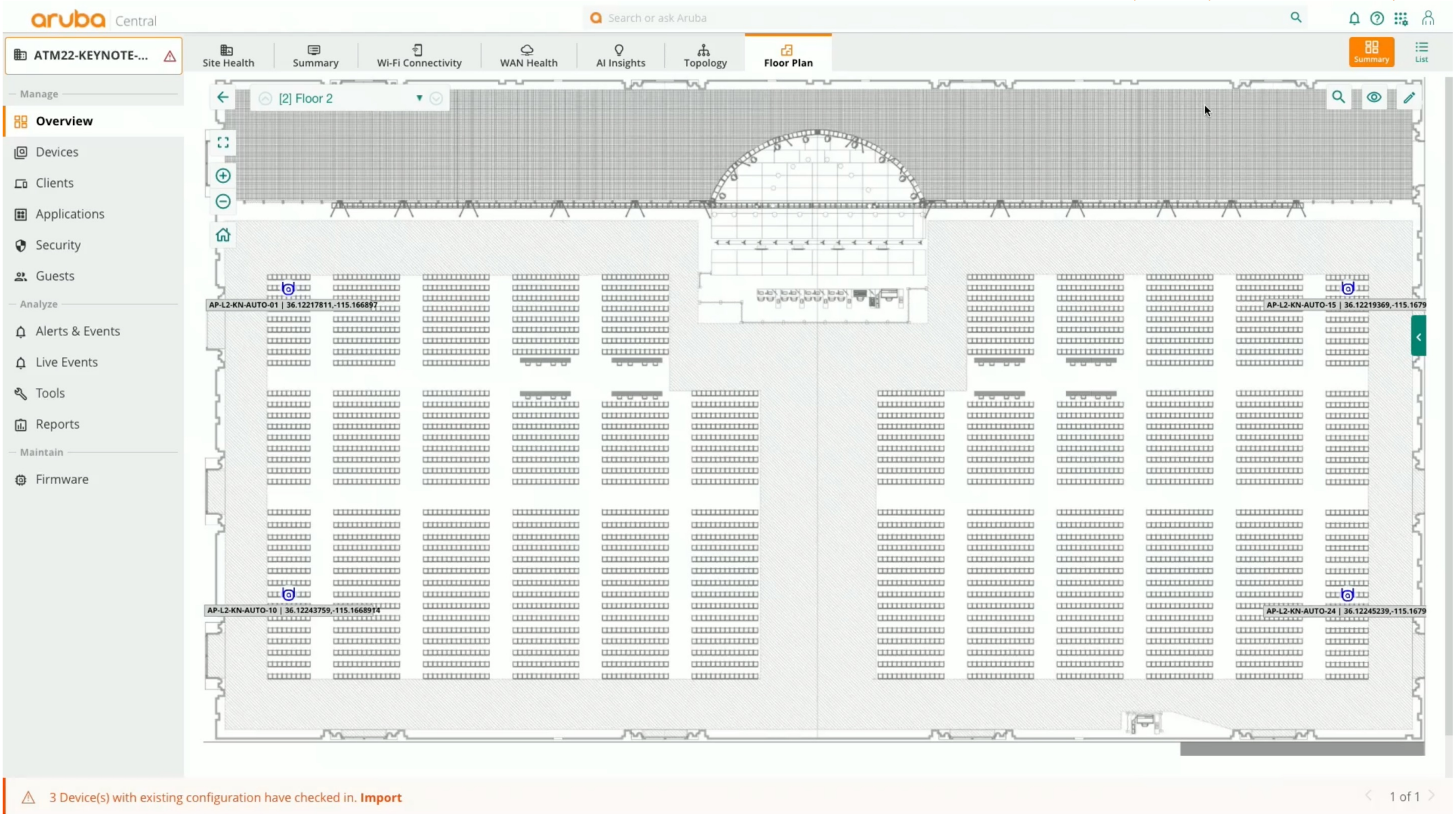
INTRODUCING OPEN LOCATE

WORLD'S FIRST SELF-LOCATING WIRELESS NETWORK



WI-FI CERTIFIED LOCATION

802.11mc / Fine Time Measurement (FTM)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WAN Health
AI Insights
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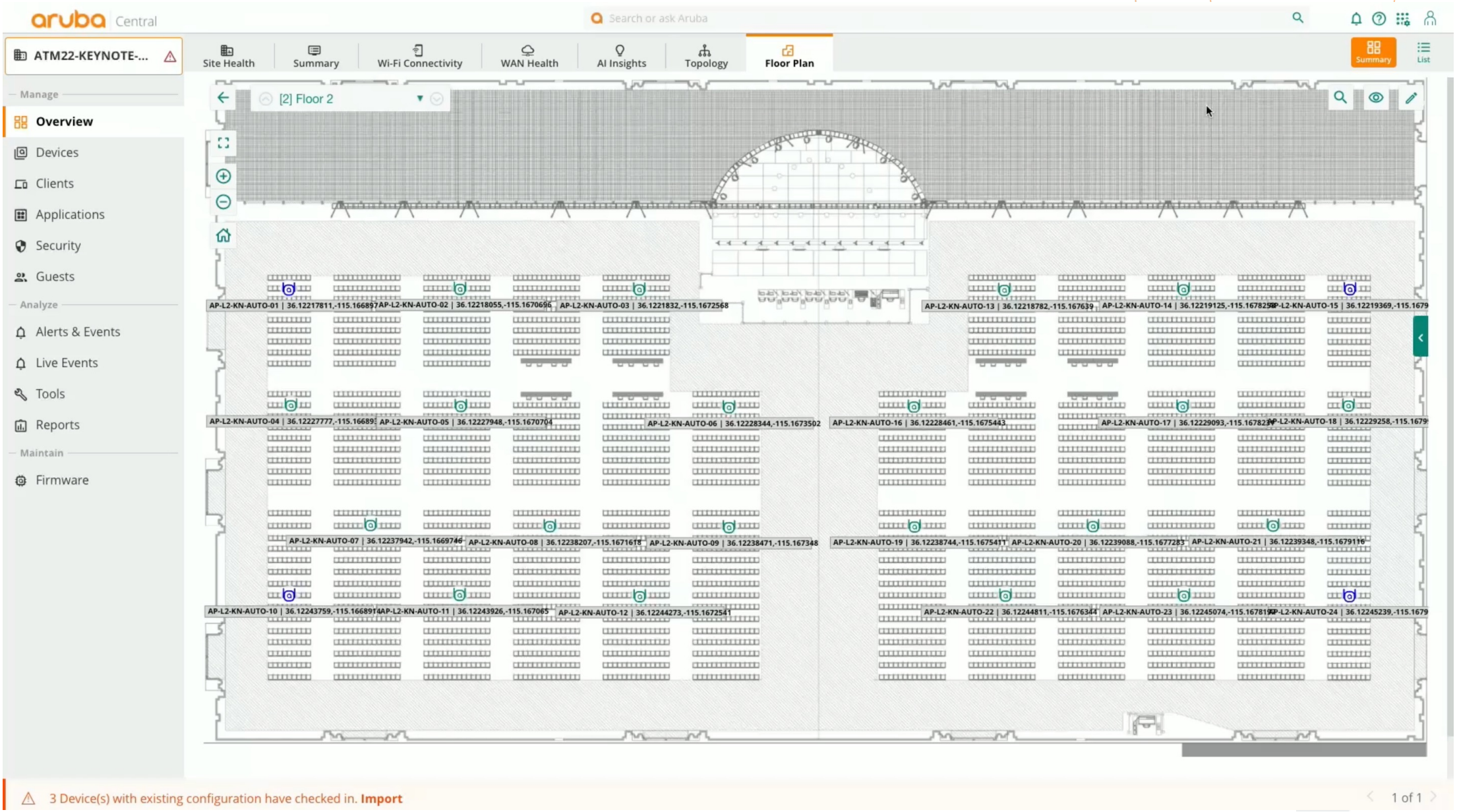
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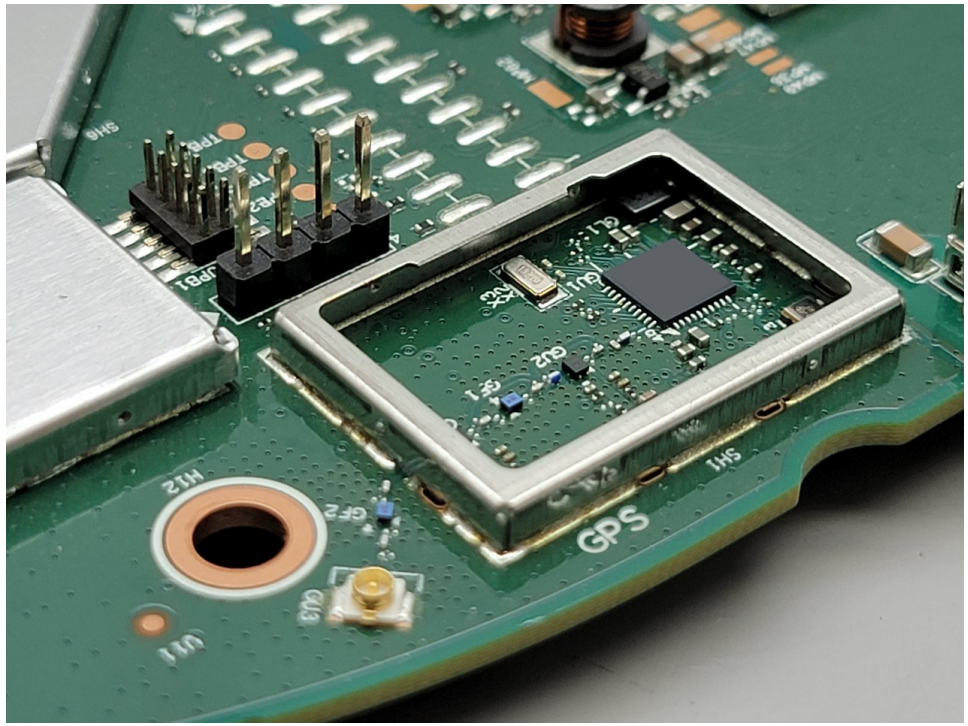
AP-L2-KN-AUTO-05 | 36.12227948,-115.1670704
AP-L2-KN-AUTO-06 | 36.12228344,-115.1673502
AP-L2-KN-AUTO-16 | 36.12228461,-115.1675443
AP-L2-KN-AUTO-17 | 36.12229093,-115.167823
AP-L2-KN-AUTO-18 | 36.12229258,-115.1679
AP-L2-KN-AUTO-07 | 36.12237942,-115.1669746
AP-L2-KN-AUTO-08 | 36.12238207,-115.1671618
AP-L2-KN-AUTO-09 | 36.12238471,-115.167348
AP-L2-KN-AUTO-19 | 36.12238744,-115.1675411
AP-L2-KN-AUTO-20 | 36.12239088,-115.1677283
AP-L2-KN-AUTO-21 | 36.12239348,-115.1679116
AP-L2-KN-AUTO-10 | 36.12243759,-115.166891
AP-L2-KN-AUTO-11 | 36.12243926,-115.167065
AP-L2-KN-AUTO-12 | 36.12244273,-115.167254
AP-L2-KN-AUTO-22 | 36.12244811,-115.167634
AP-L2-KN-AUTO-23 | 36.12245074,-115.167819
AP-L2-KN-AUTO-24 | 36.12245239,-115.1679
3 Device(s) with existing configuration have checked in. Import
1 of 1

High-Sensitivity GPS Receiver
in Every Aruba Wi-Fi 6E Access Point

- Optimized for indoor, stationary operation
- Roots AP locations in absolute universal reference frame of WGS84 coordinates
- Establishes world's largest GPS reference network, capable of generating high quality assistance, calibrating additional sensors, and improving AP and client location determination in three dimensions



Aruba's Vision for the Future of Indoor Location

Our Aims

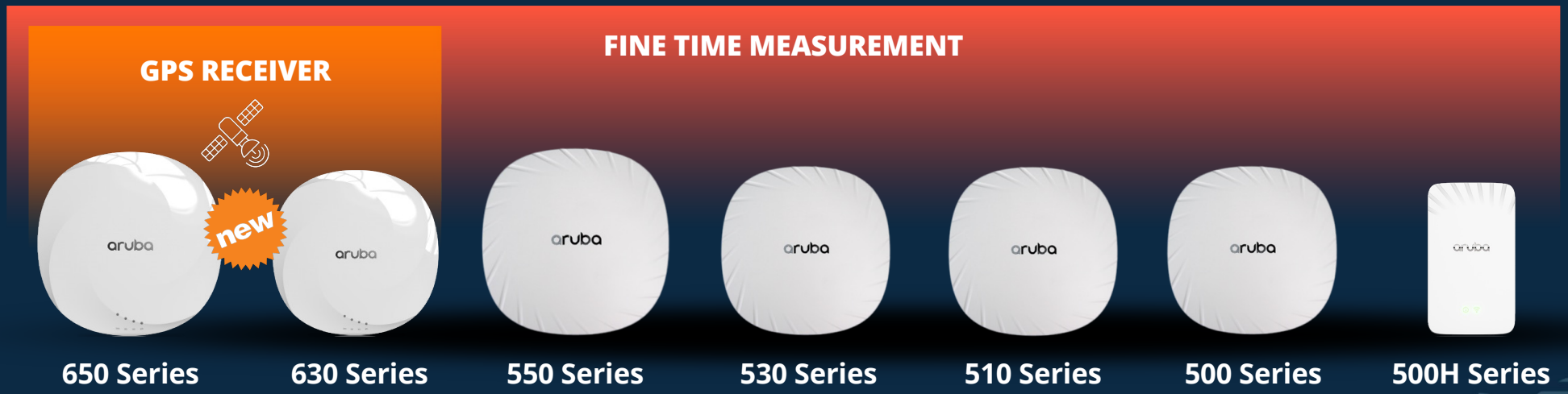
- Locate every AP in the enterprise Wi-Fi footprint
  - Automatically, without any manual survey or customer intervention
  - Accurately – on par with the highest quality client ranging methods
  - In a universal reference frame (lat/long), with no dependencies on local customer maps or floorplans
  - Scalable across our entire global installed base of Wi-Fi
- Make this information freely and readily available in all network tools and applications and throughout the ecosystem over standardized interfaces
- Enable all Wi-Fi 6E APs, indoors or out, to operate at Standard Power
- Create a global reference network for geolocation and other sensor calibration and assistance data

First Steps

- Embedded GPS receiver in every Aruba Wi-Fi 6E AP
- WFA Wi-Fi Location (FTM) support across the Aruba portfolio
- Open Locate initiative to make this information universally available and freely accessible throughout the networking ecosystem
- Users can use Google/Apple maps to navigate indoors – no need to install site-specific apps or switch from indoors/outdoor apps

OPEN LOCATE-READY ACCESS POINTS
WI-FI 6E AND WI-FI 6 PORTFOLIO

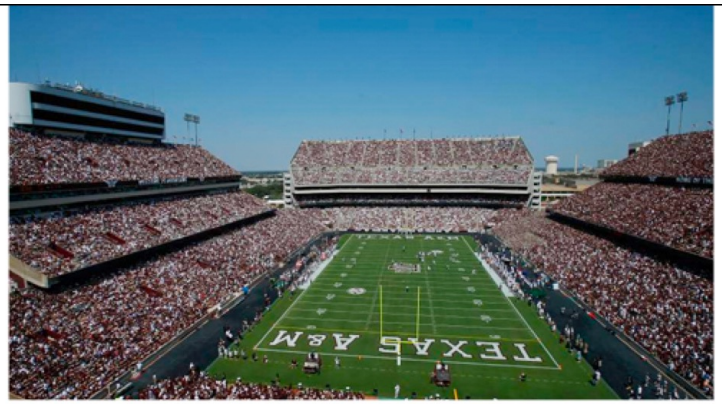
PREPARE FOR DIGITAL ACCELERATION WITH ARUBA WI-FI 6E & WI-FI 6



aruba
a Hewlett Packard Enterprise company

智慧校園網路
Aruba ESP Architecture

AI-powered Innovations for the Edge



Building Environments for Student Success

ARUBA ESP
ARCHITECTURE

Aruba Edge Services Platform Architecture

AI-POWERED EDGE SERVICES PLATFORM

REMOTE

BRANCH OFFICE

CAMPUS

DATA CENTER

ARUBA CENTRAL

SERVICES

Onboarding

Provisioning

Orchestration

Artificial Intelligence

Location

Management

DYNAMIC SEGMENTATION

POLICY

PEF

UNDERLAY

CONNECTIVITY

Wi-Fi6

ARUBA CX

GATEWAY

Edge Services Platform ARCHITECTURE

CONVERT EDGE DATA INTO BUSINESS OUTCOMES

ARUBA CENTRAL

3 ANALYZE AND ACT

AI-Powered features identify issues before they impact business and help IT resolve issues more quickly — **AIOPS**

2 PROTECT

Applying principles of Zero Trust Security and SASE to increase protection levels while simplifying operations — **Zero Trust Security**

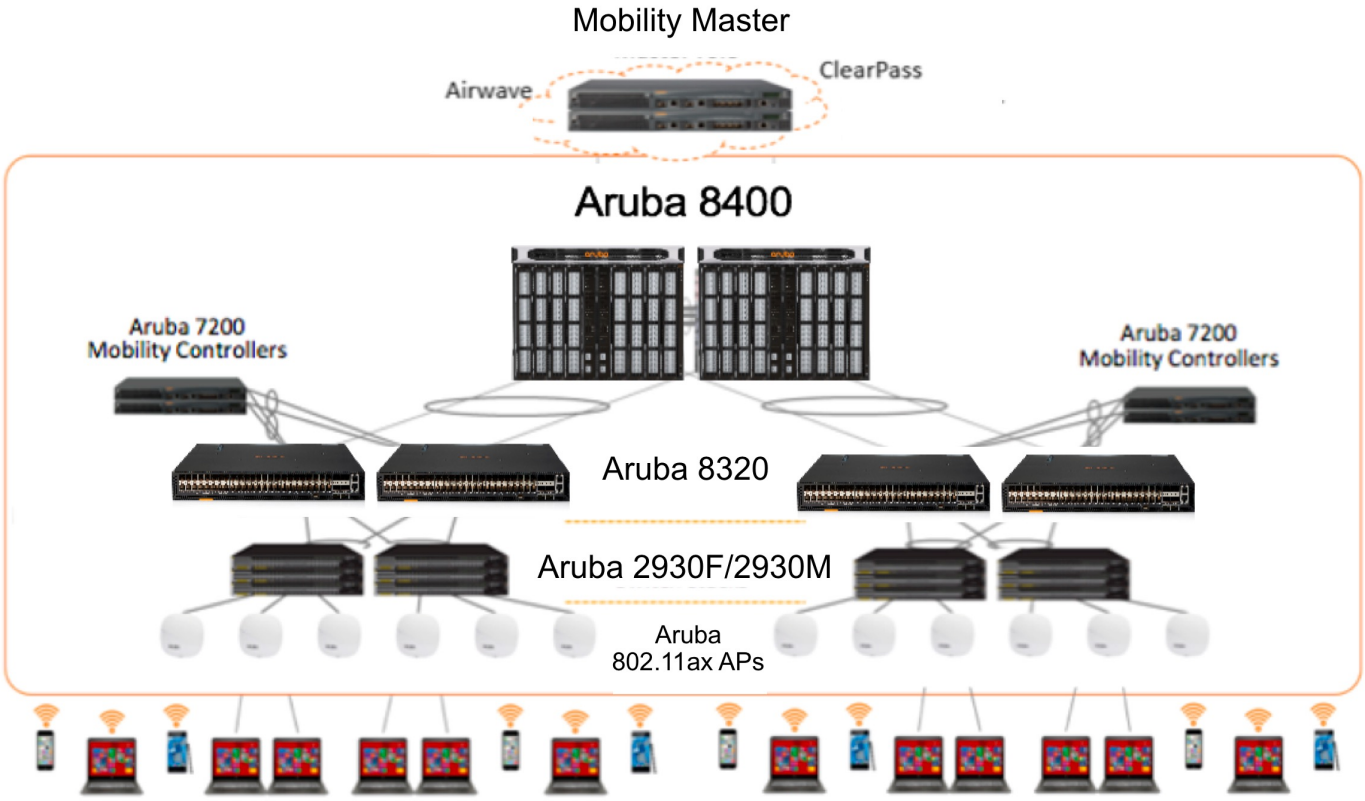
1 CONNECT

Unify network operations across all domains and locations — **UNIFIED INFRASTRUCTURE**

Network-as-a-Service

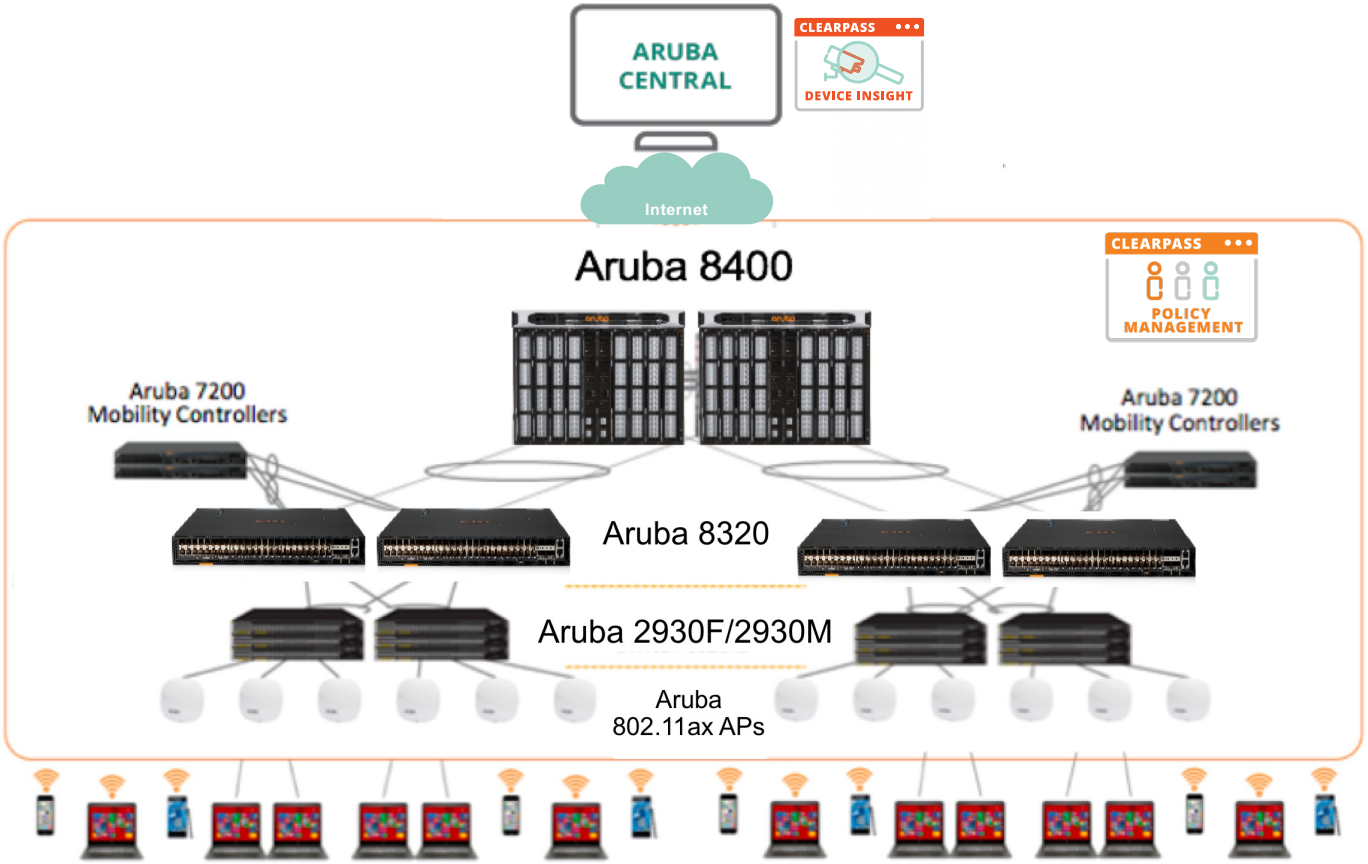
Aruba Edge Services Platform Architecture

On Premise



- Assured User Experience
- Optimized for Mobile Apps
- App, Device, User Aware
- Unified Policy Enforcement

Aruba Edge Services Platform Architecture

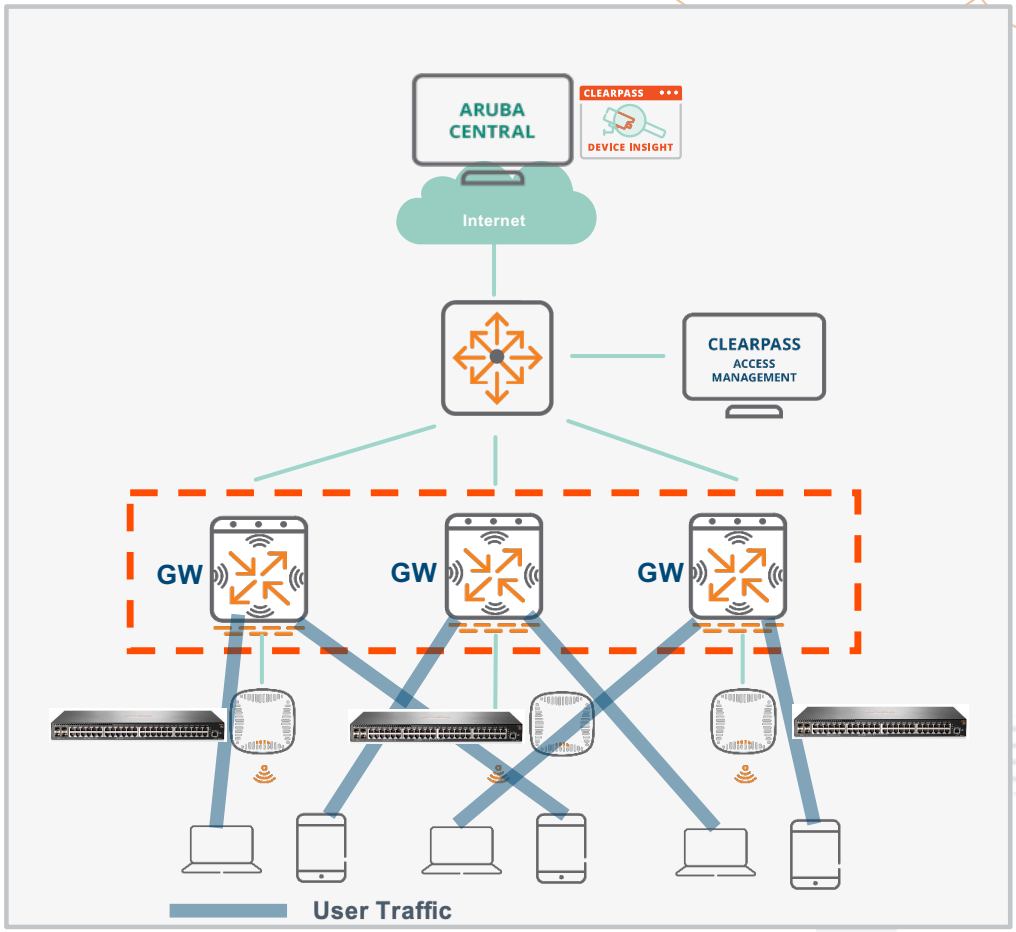


- Assured User Experience
- Optimized for Mobile Apps
- App, Device, User Aware
- Unified Policy Enforcement

Aruba Edge Services Platform Architecture

Gateway Clustering

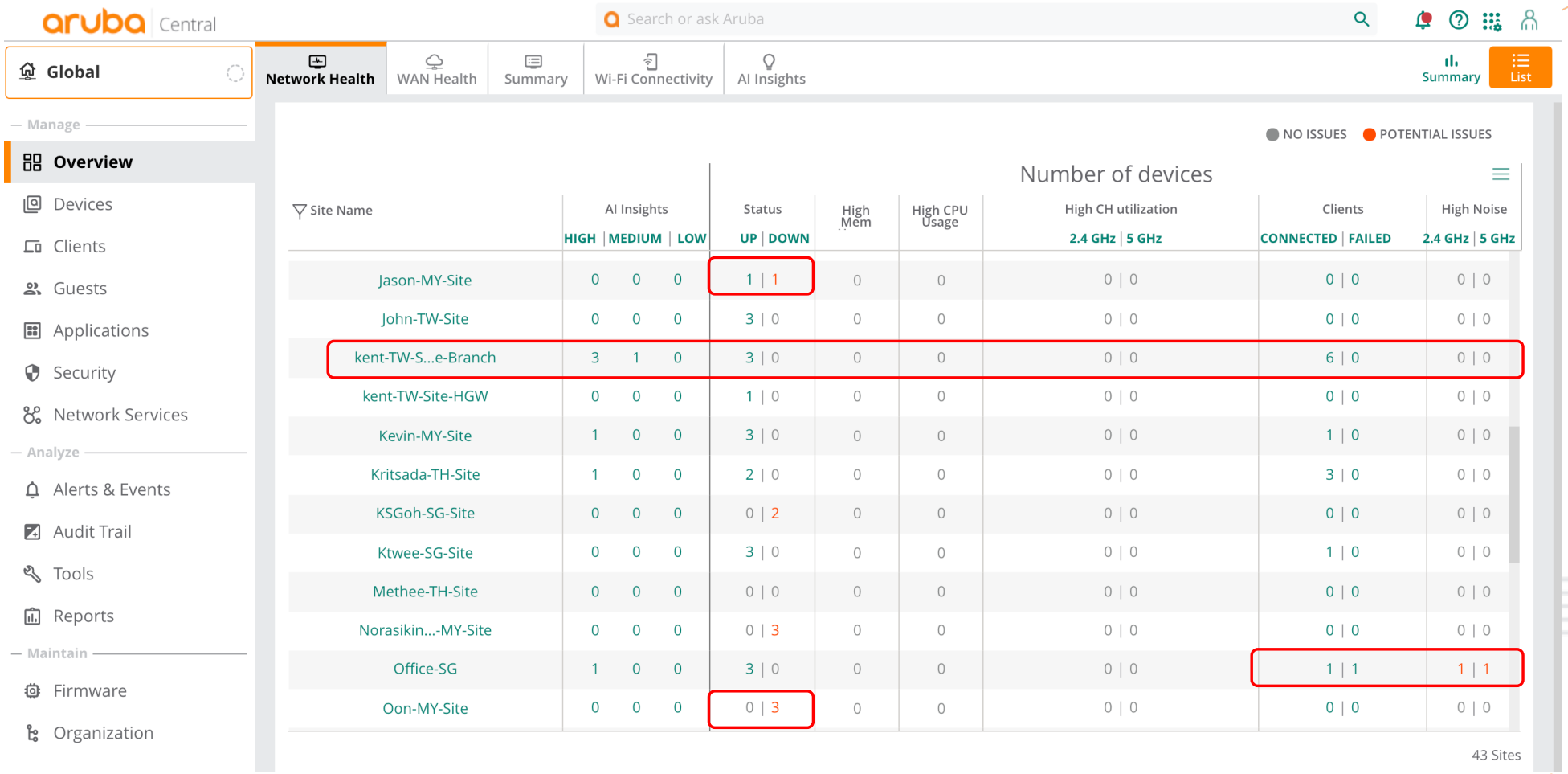
1. **Stateful Client Failover**
   User traffic uninterrupted upon controller failure
2. **Seamless Campus Roaming**
   Clients stay anchored to a single Mobility Controller when roaming across controllers
3. **Client Load Balancing**
   Users automatically load balanced across cluster members
4. **AP Load Balancing**
   APs are automatically load balanced across cluster members



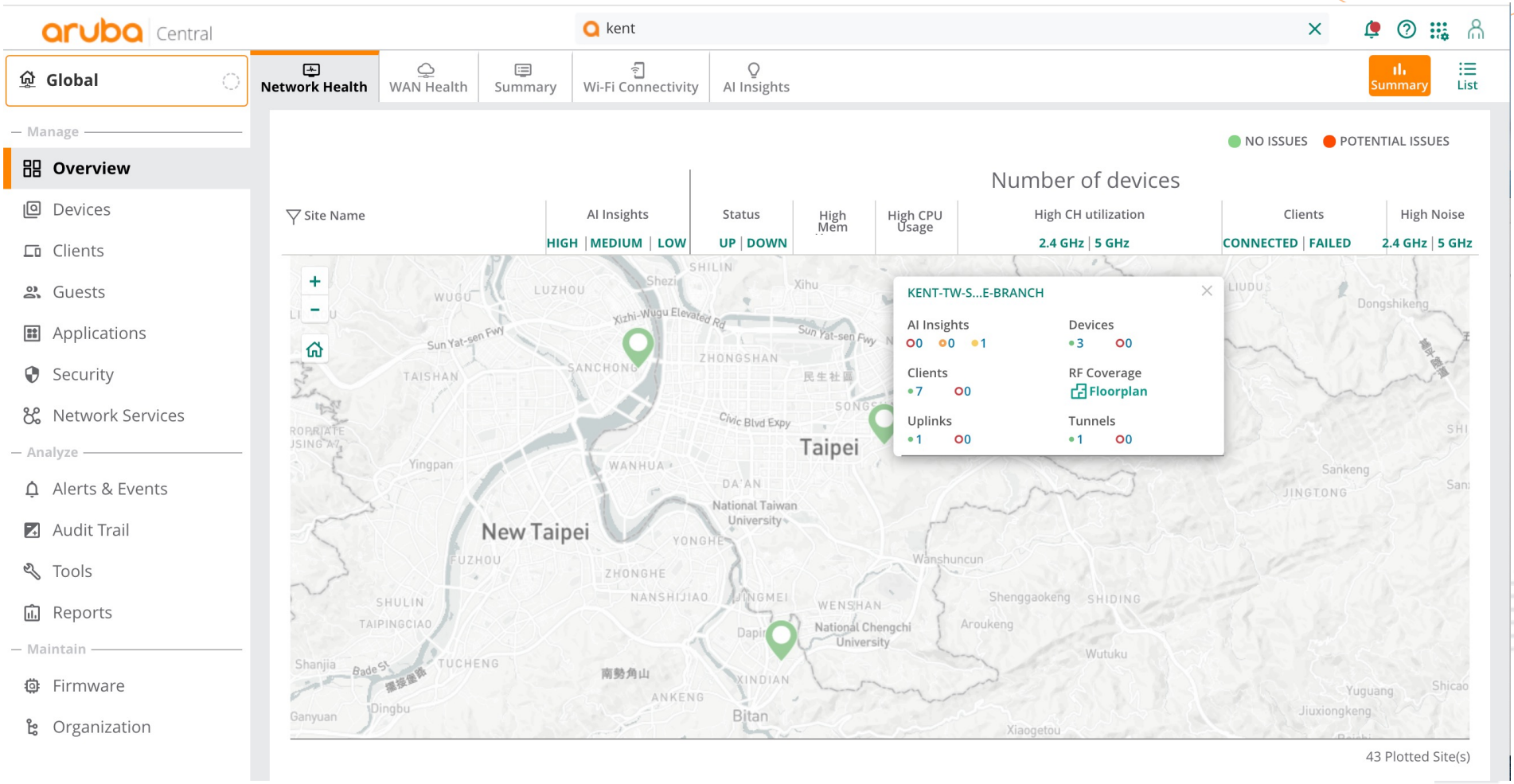
Unified Infrastructure

Aruba Central: Single Pane of Glass

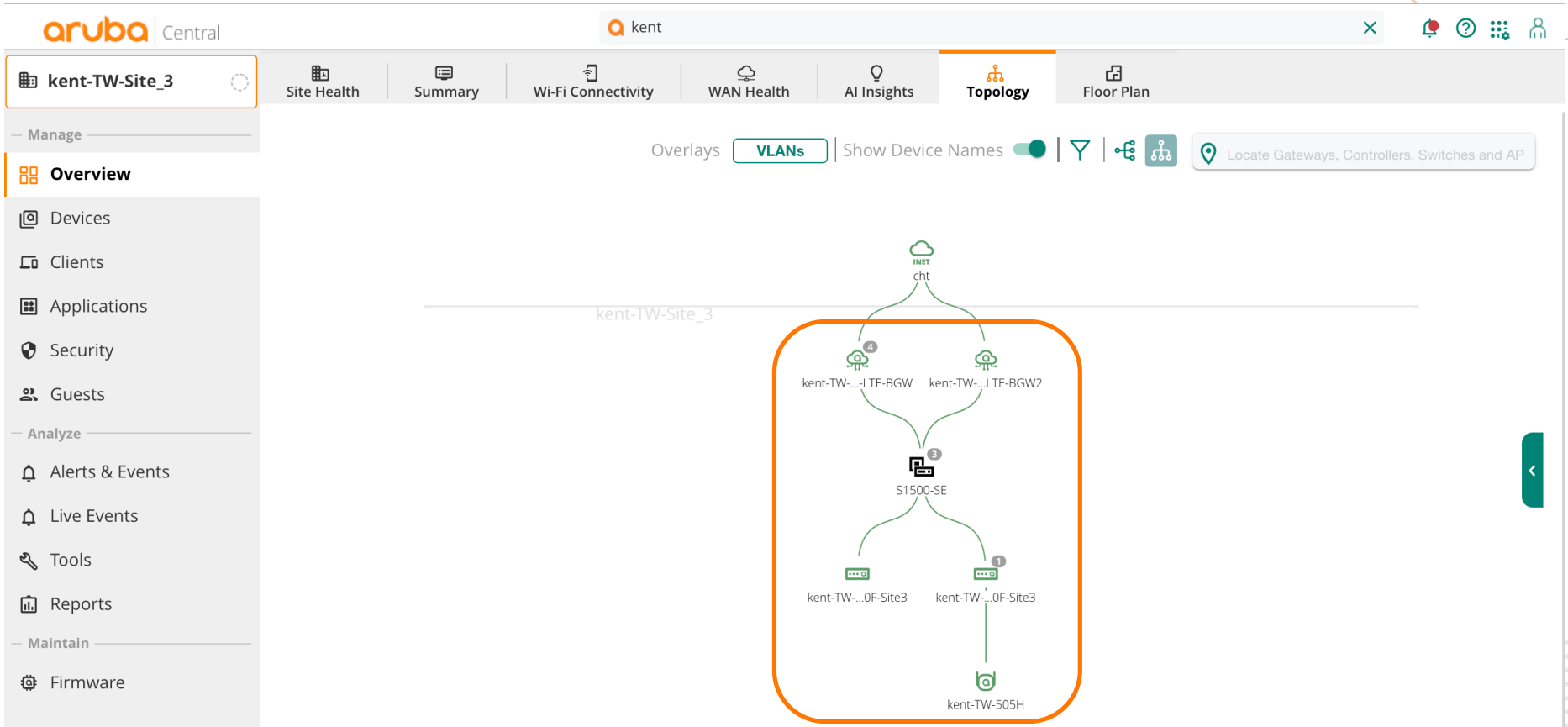
Network Health at all Sites



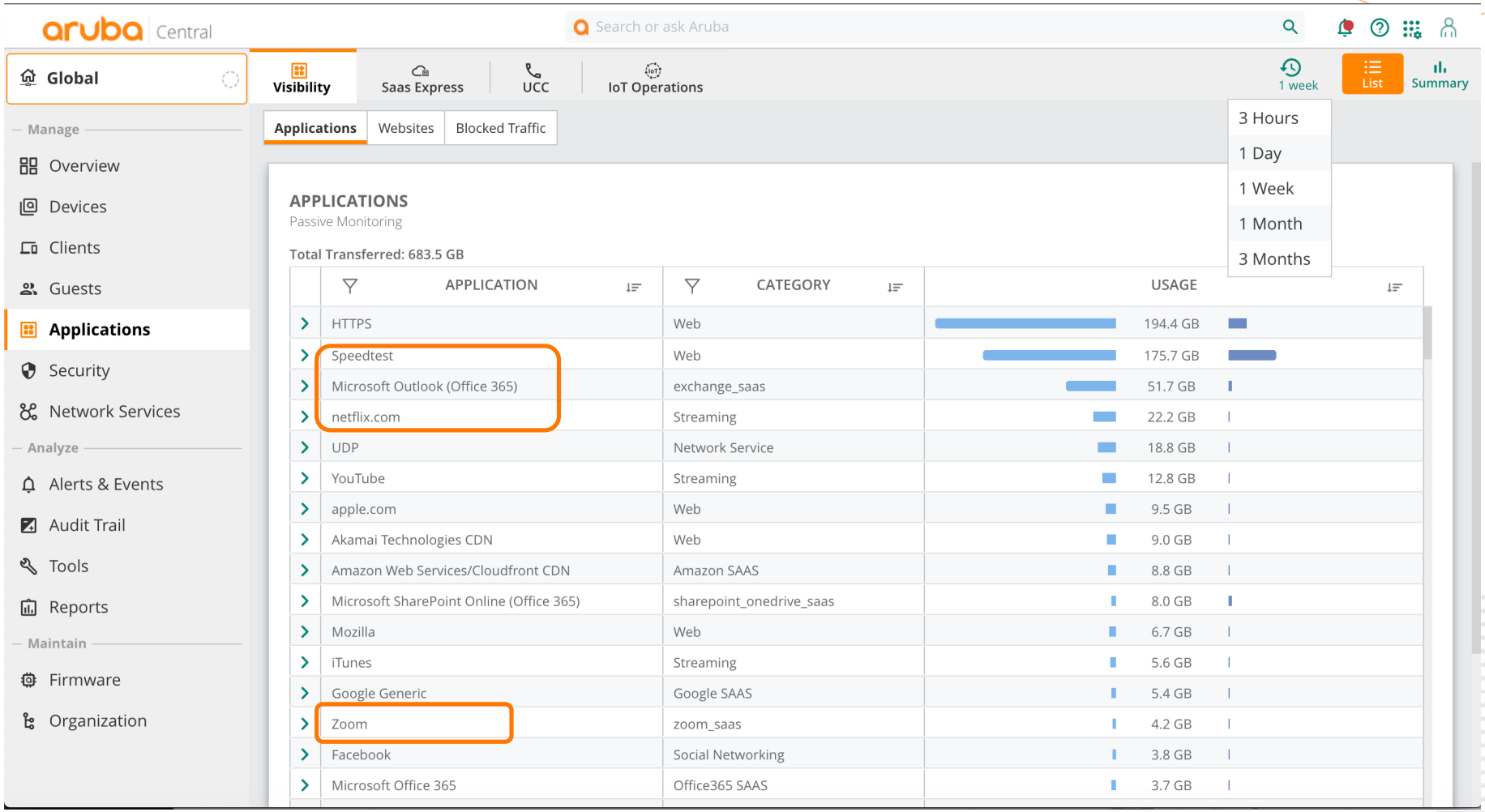
Network Health at all Sites



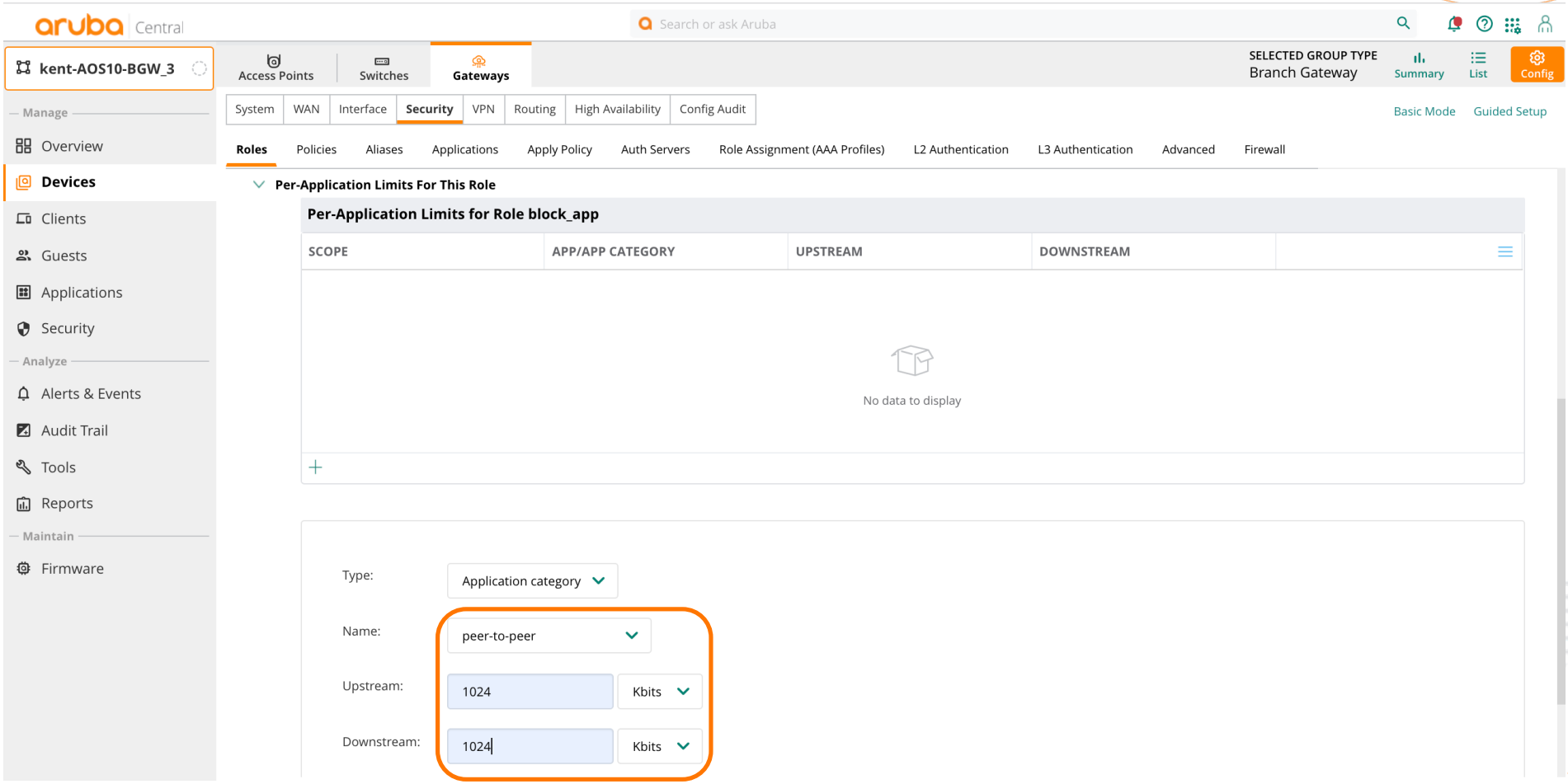
Topology View by site



Application Monitoring and Control (AppRF)

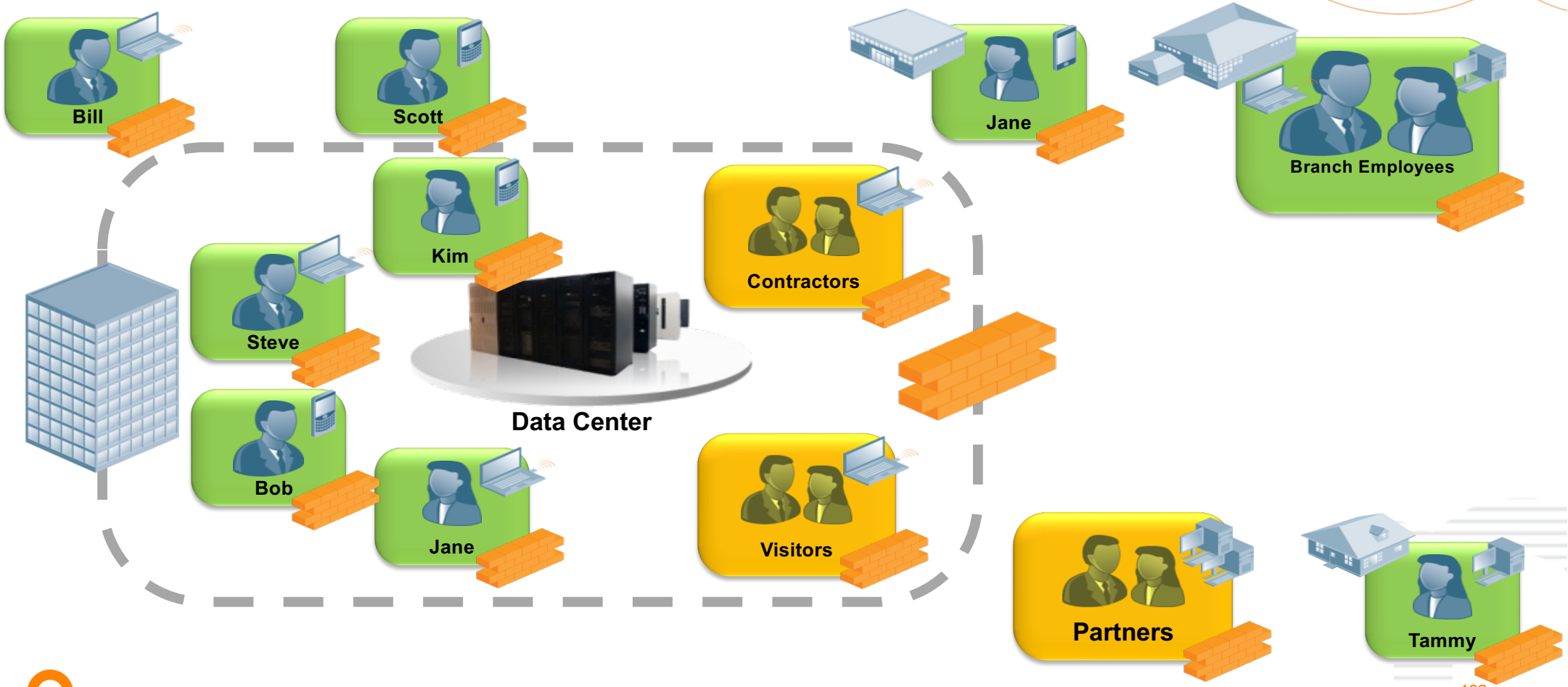


Application Monitoring and Control (AppRF)

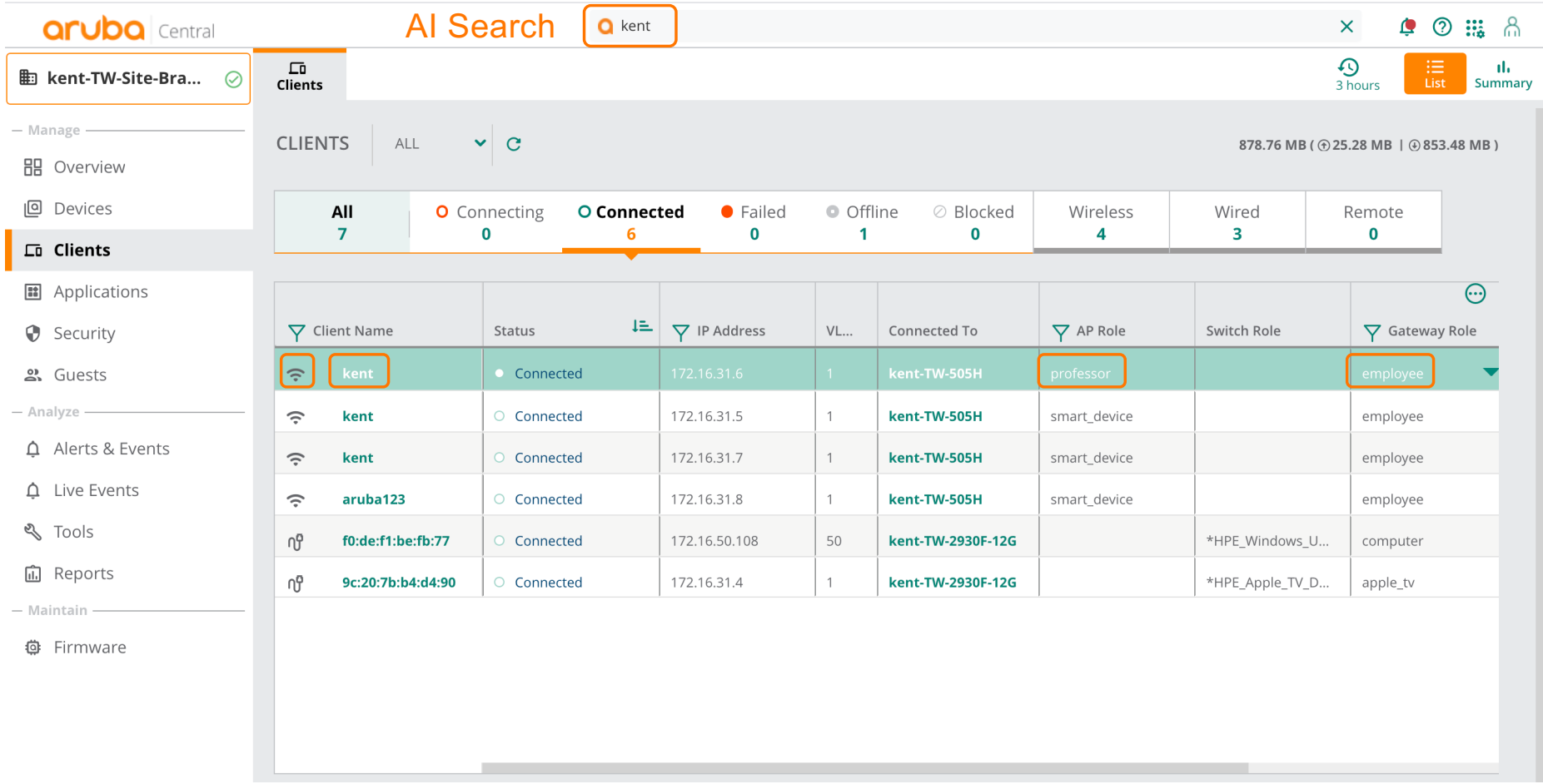


Context-Aware Policies & Enforcement

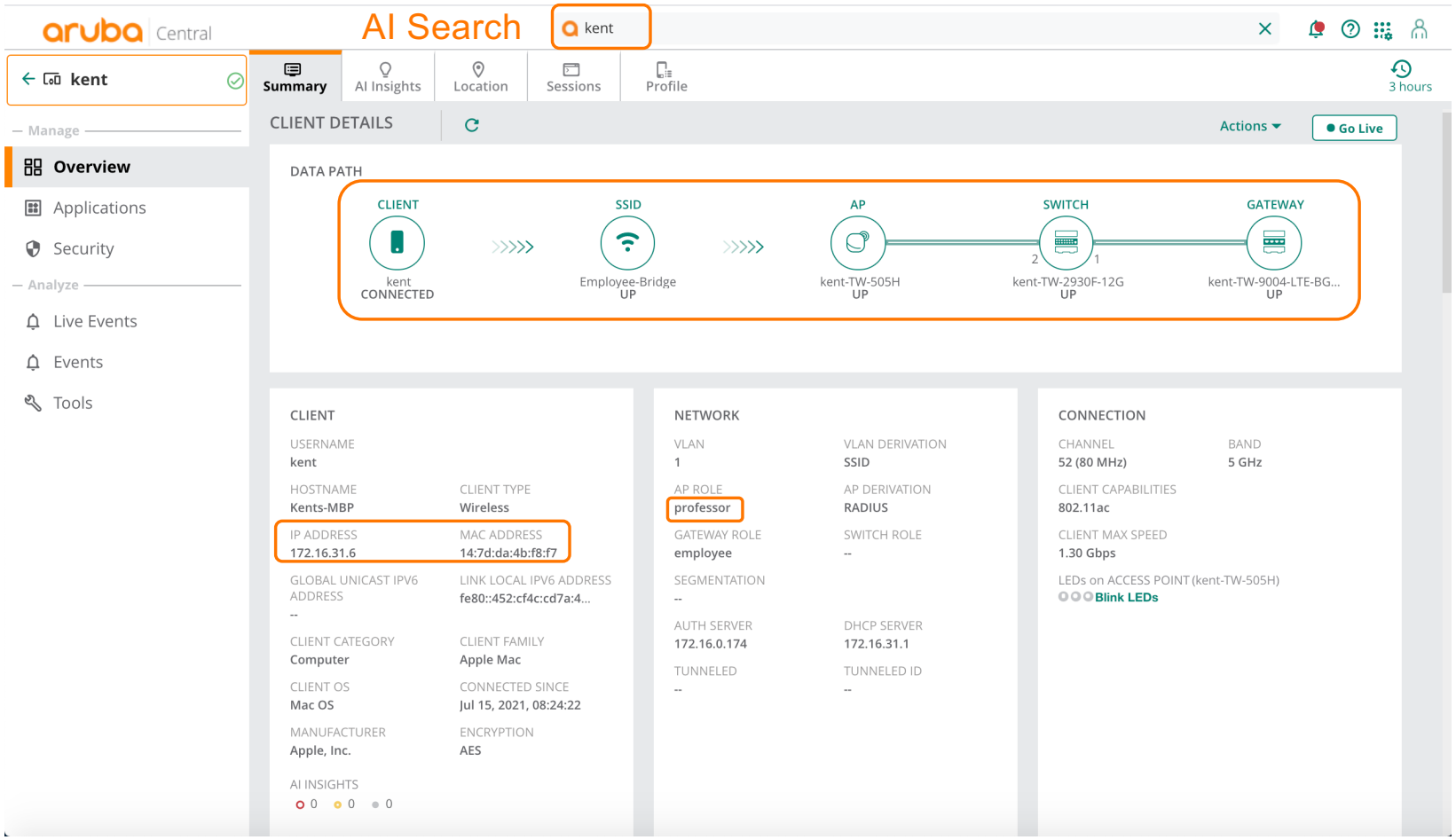
-Stateful Firewall



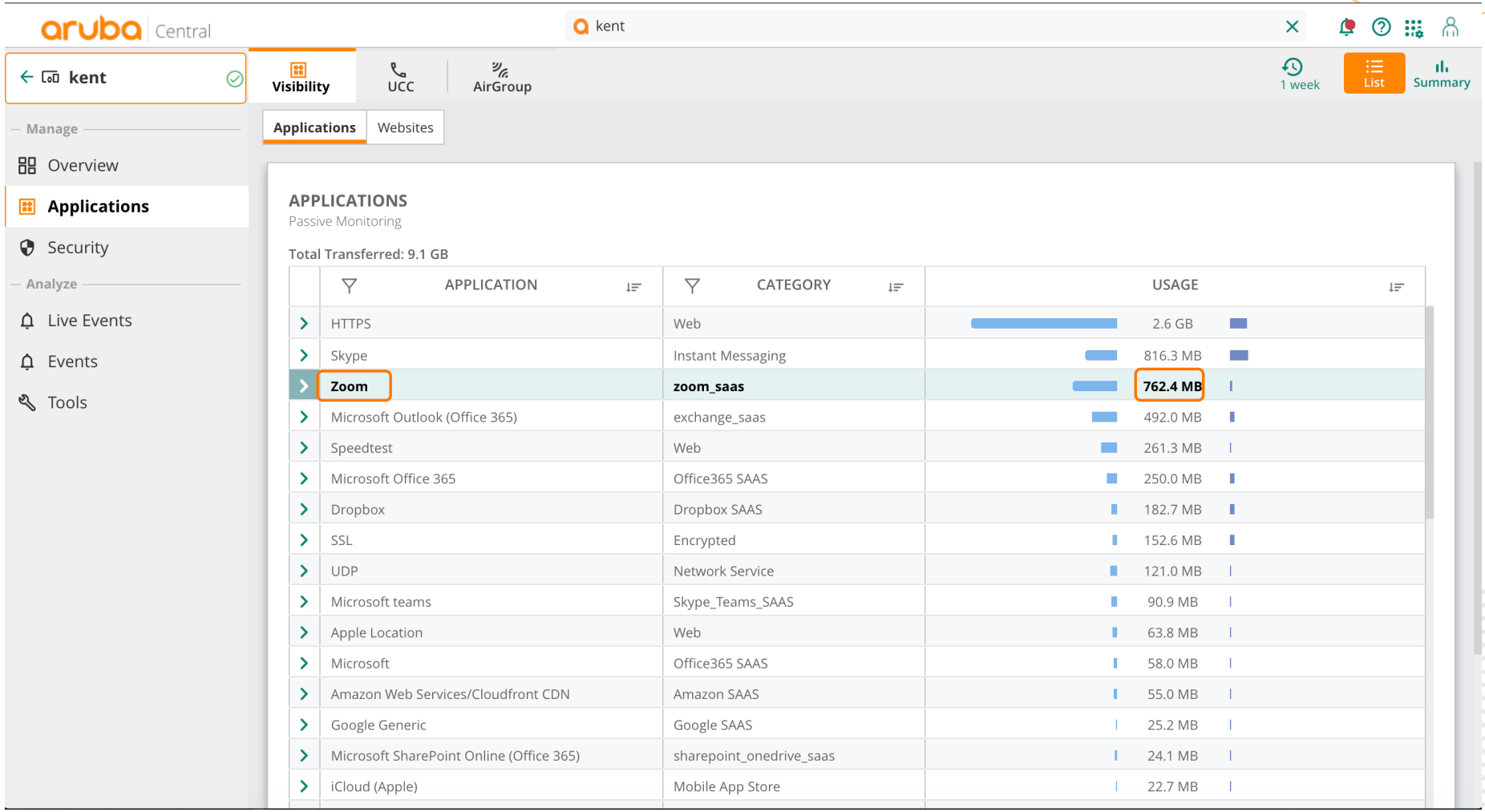
Client Visibility



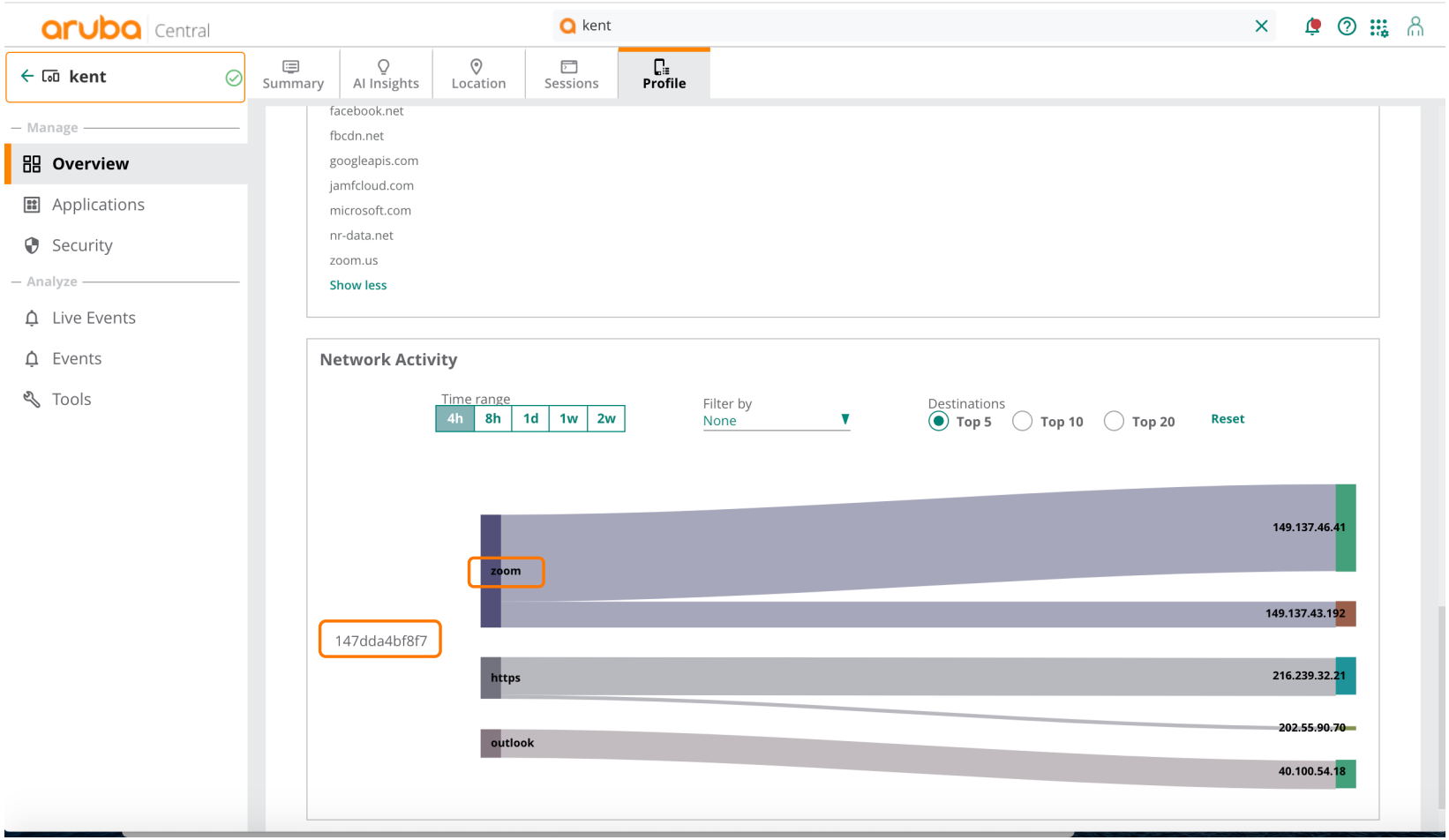
Client Visibility



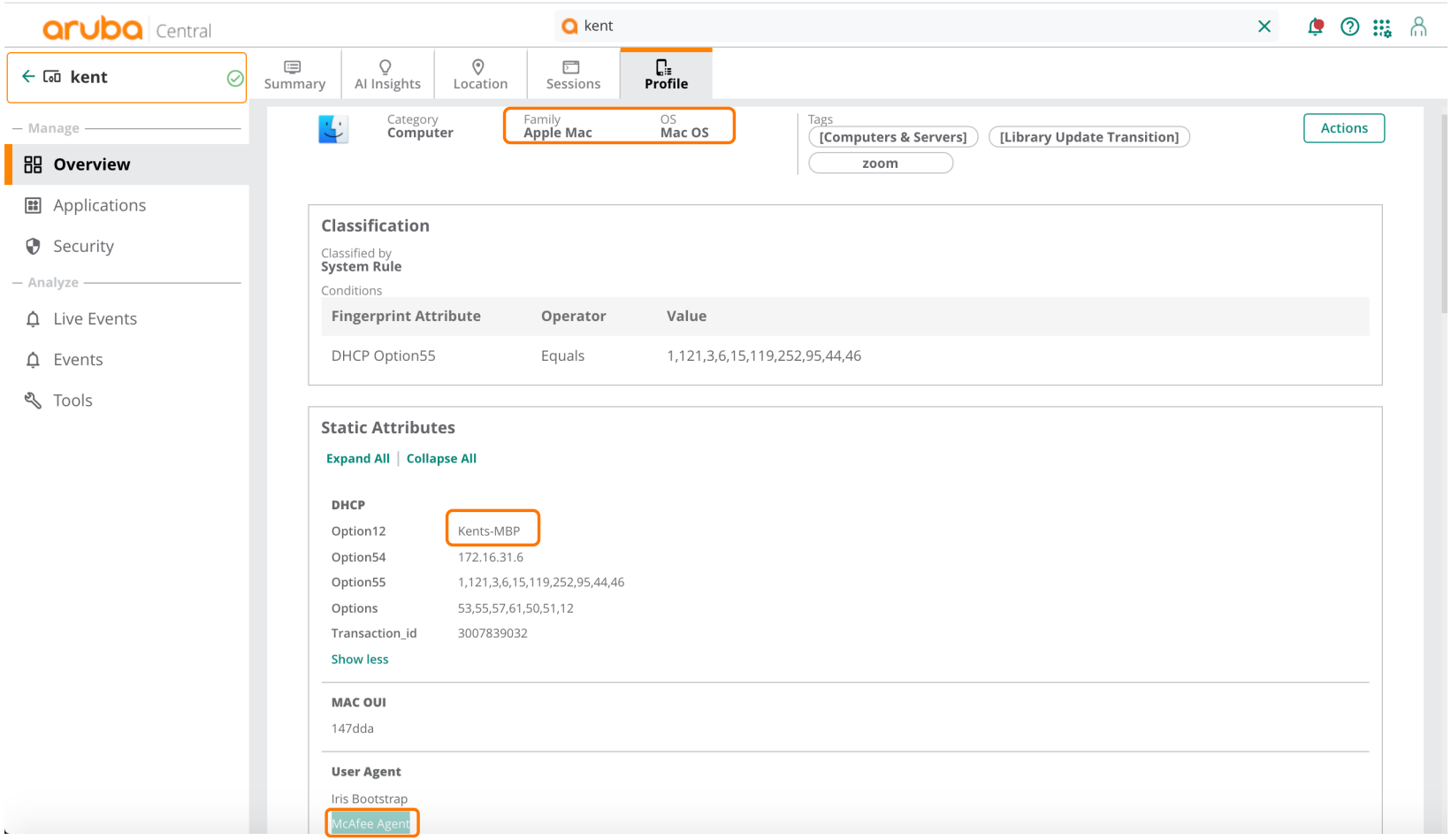
Client Visibility - Application



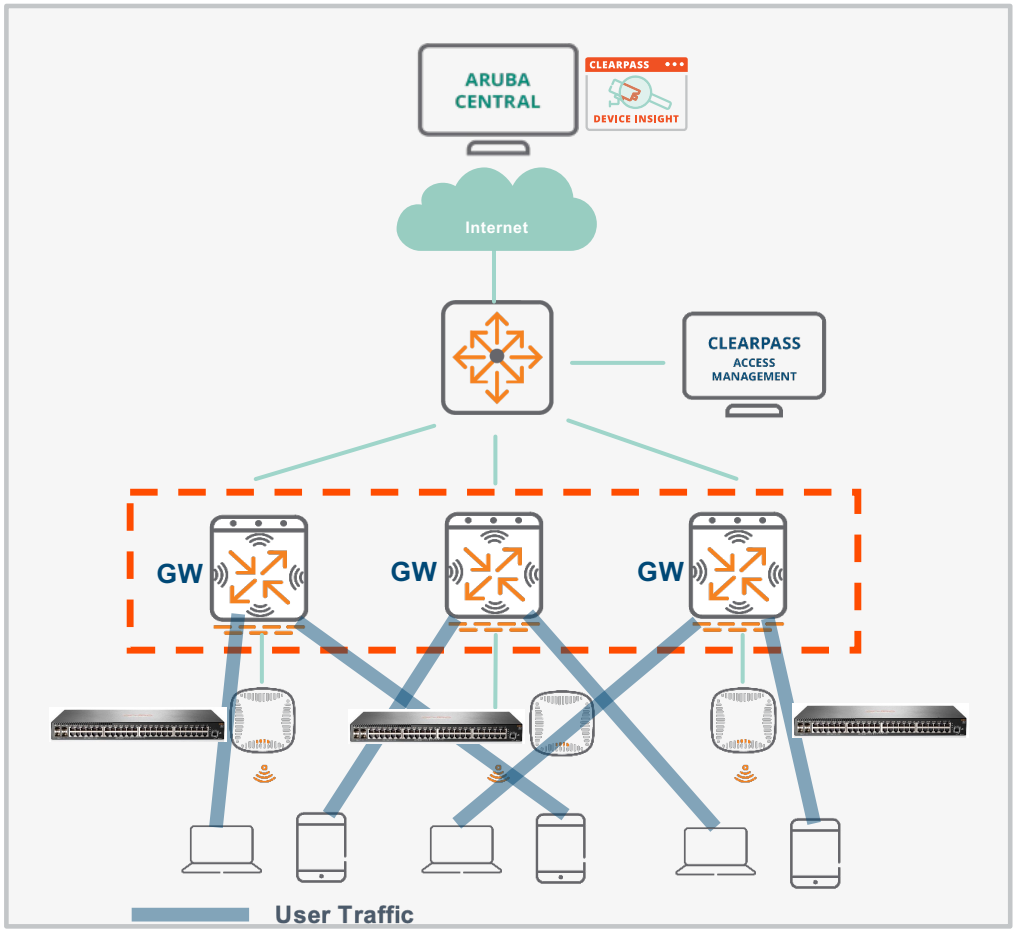
Client Visibility - CPDI



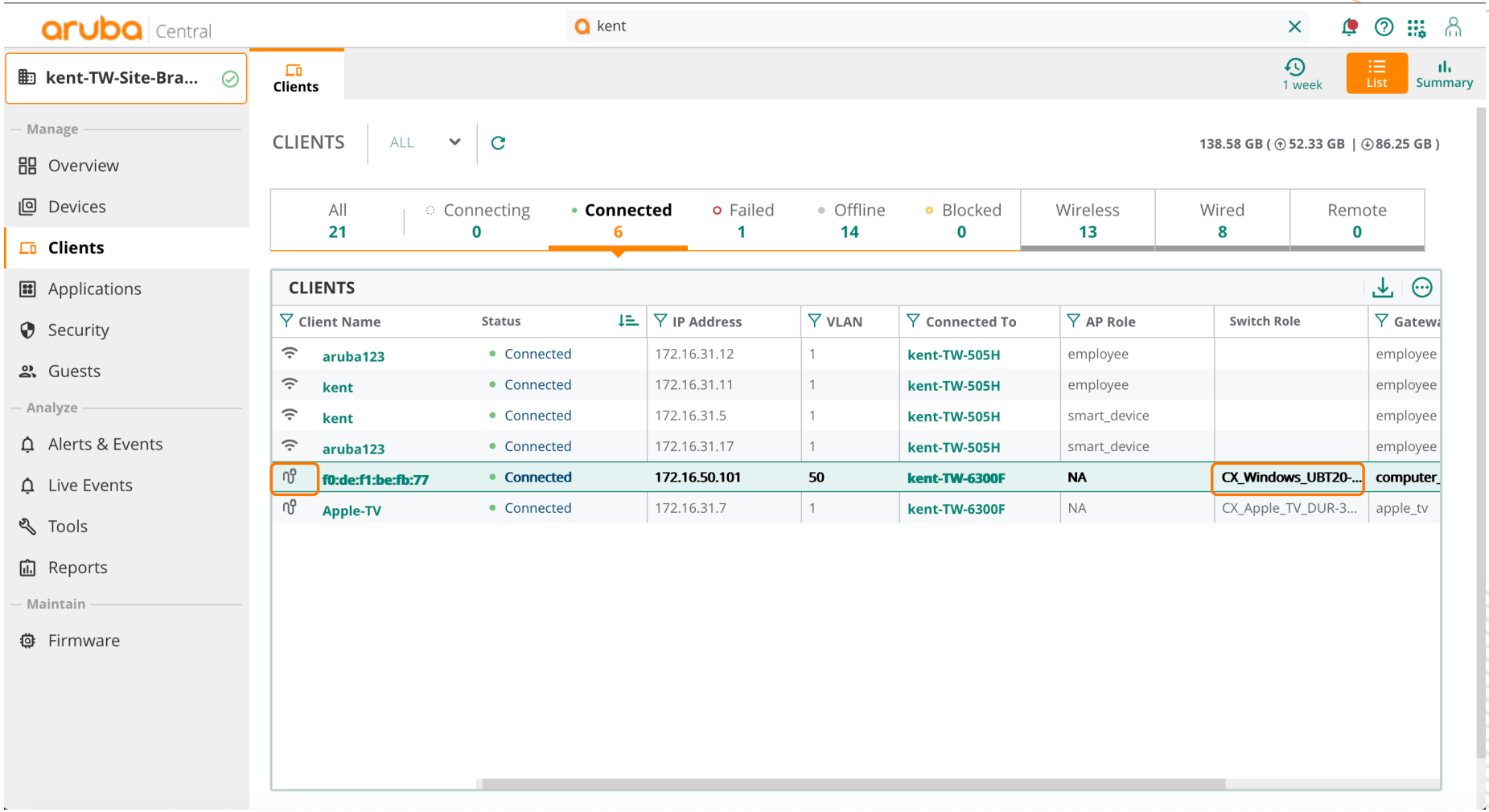
Client Visibility - CPDI



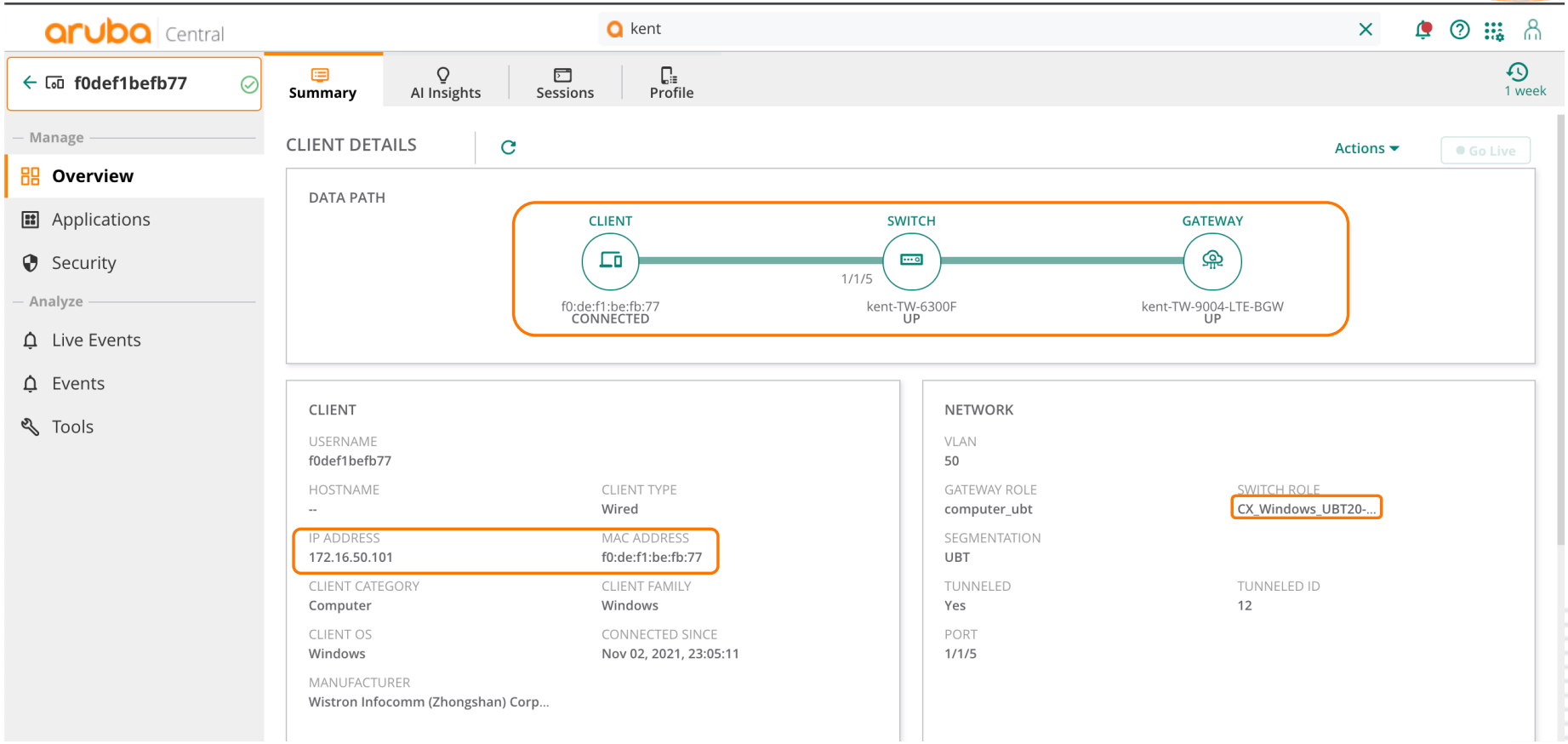
Always-On Architecture, Secure End to End Wired and Wireless



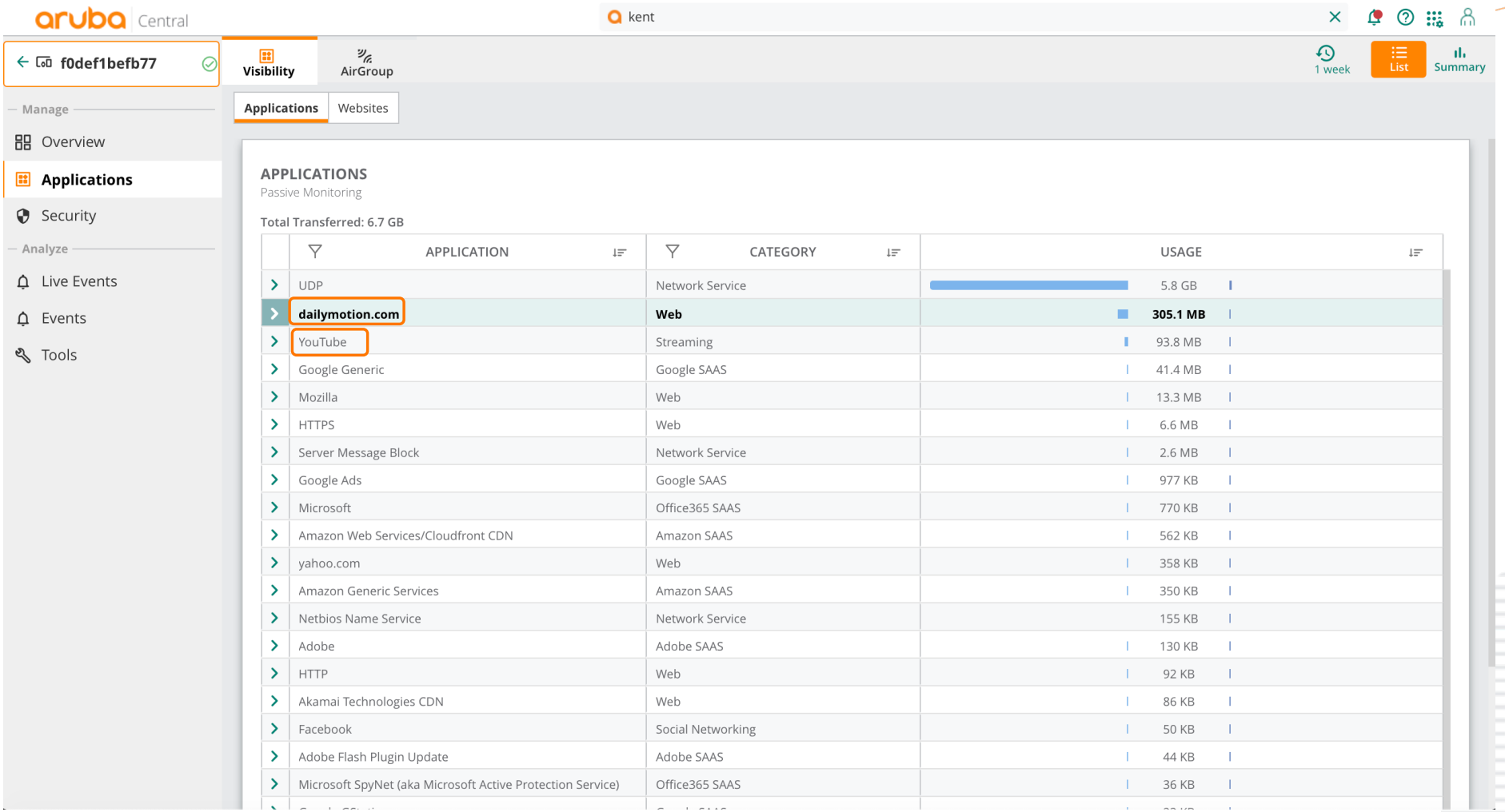
Wired Client Visibility



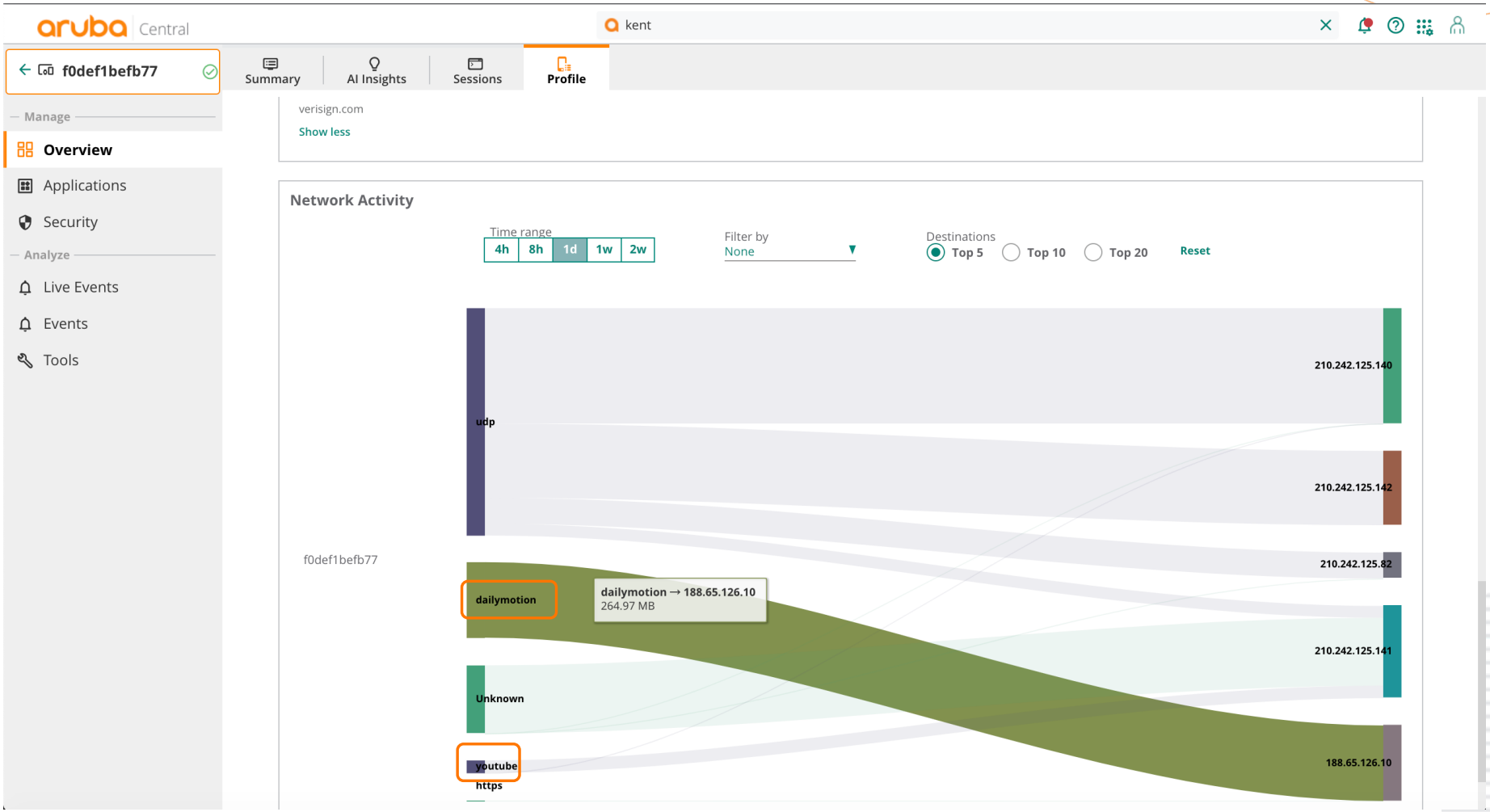
Wired Client Visibility



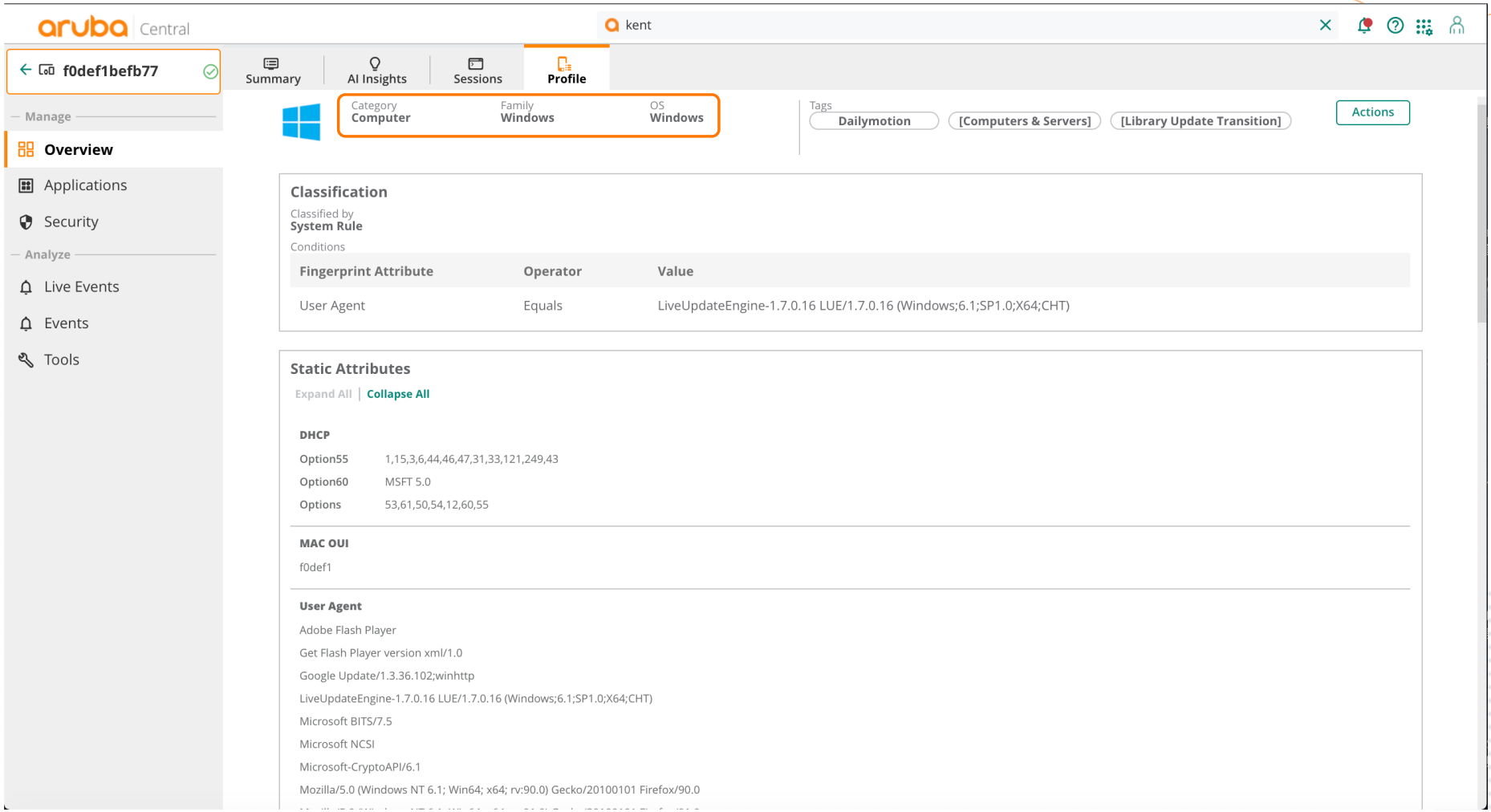
Wired Client Visibility - Application



Wired Client Visibility - CPDI



Wired Client Visibility - CPDI



ClearPass Device Insight (CPDI)
IoT Discovered and Profiled

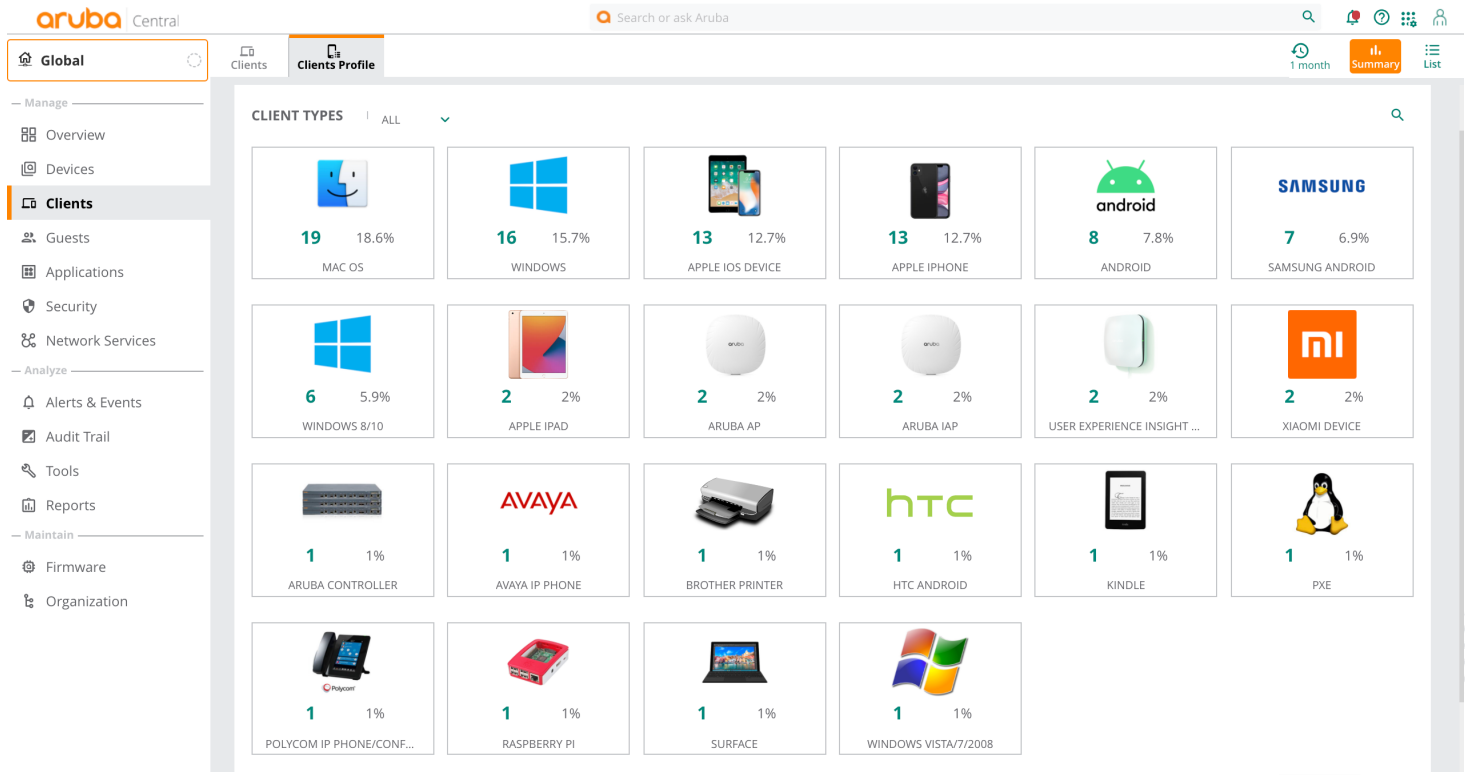
DEEP PACKET INSPECTION (DPI)

STATIC + BEHAVIORAL ATTRIBUTES

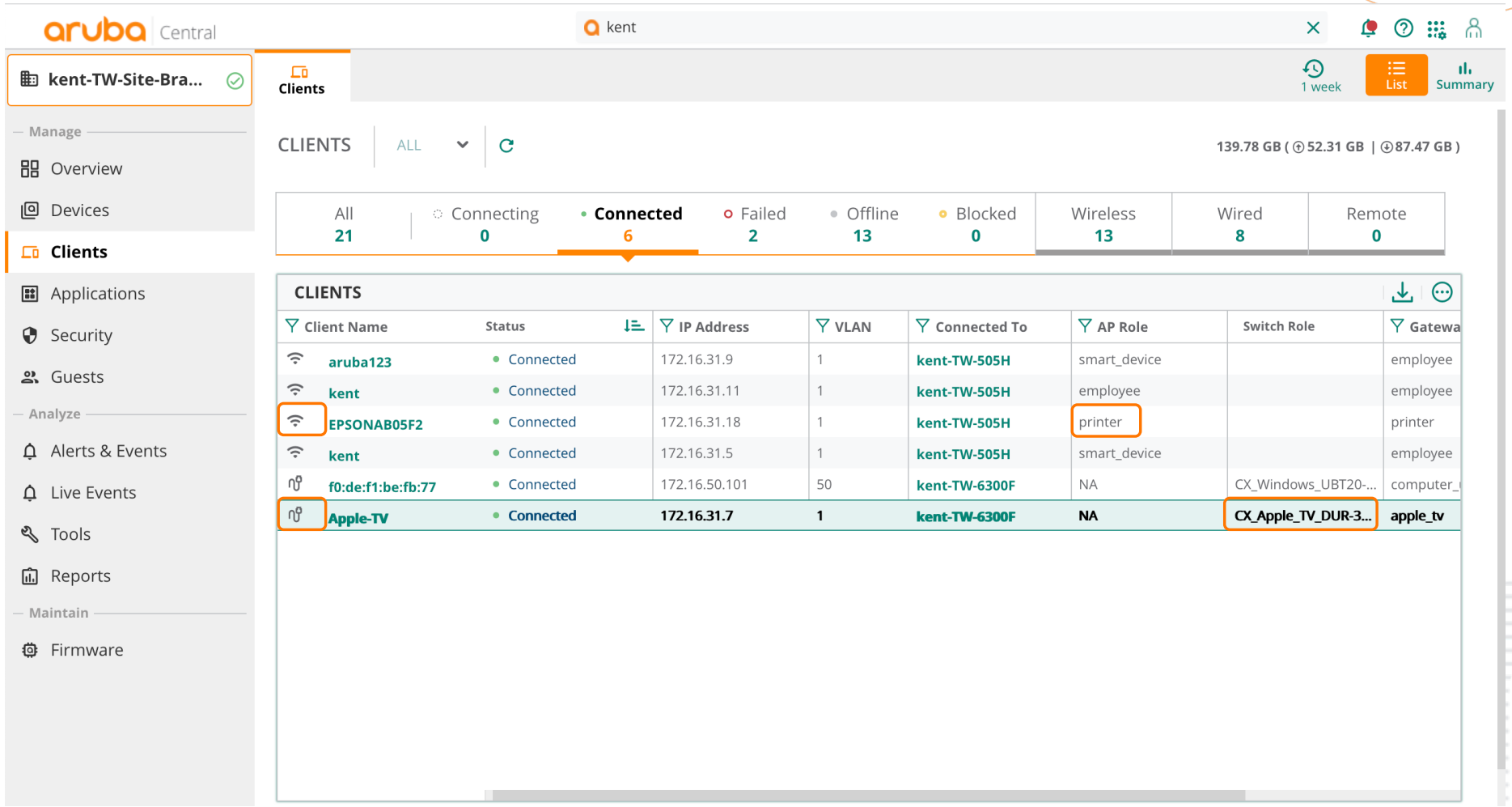
APPLICATIONS
WEB SITES
PORTS
PROTOCOLS

MACHINE LEARNING

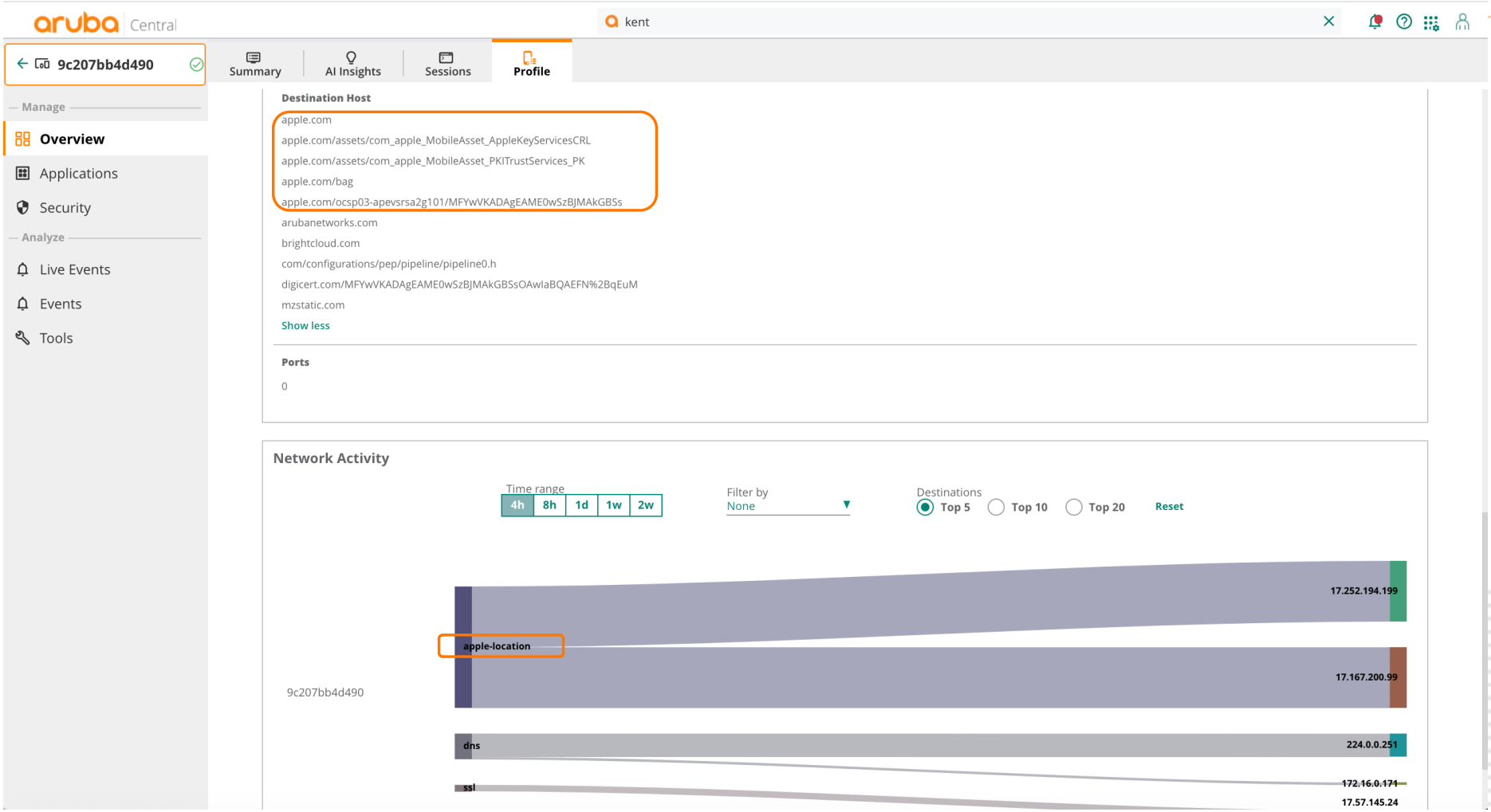
CROWD-SOURCING



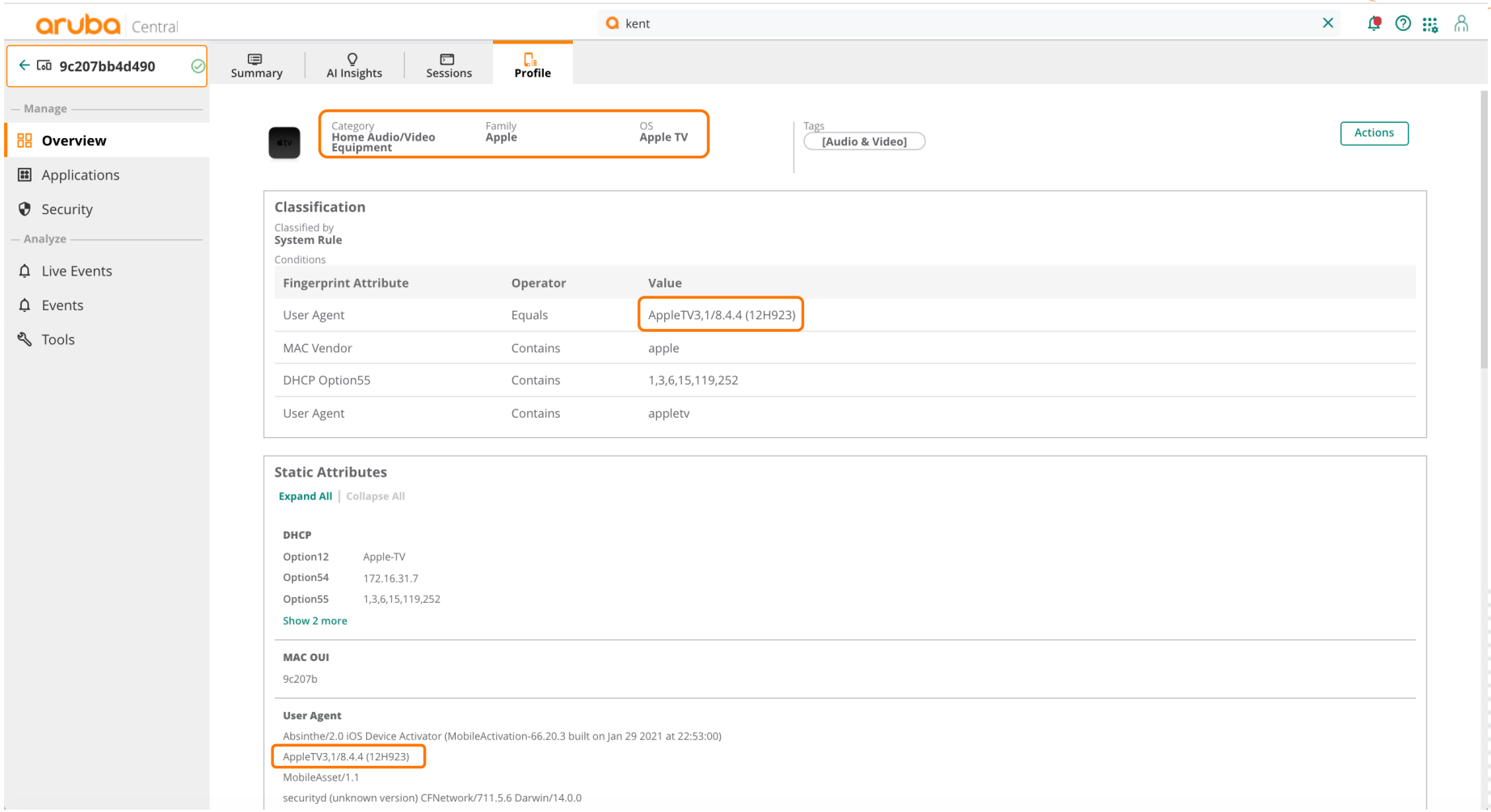
IoT Devices


aruba Central
kent
kent-TW-Site-Bra...
Clients
1 week
List
Summary
Manage
Overview
Devices
Clients
Applications
Security
Guests
Analyze
Alerts & Events
Live Events
Tools
Reports
Maintain
Firmware
CLIENTS
ALL
139.78 GB (52.31 GB | 87.47 GB)
All 21
Connecting 0
Connected 6
Failed 2
Offline 13
Blocked 0
Wireless 13
Wired 8
Remote 0
CLIENTS
Client Name
Status
IP Address
VLAN
Connected To
AP Role
Switch Role
Gatewa
aruba123 Connected 172.16.31.9 1 kent-TW-505H smart_device employee
kent Connected 172.16.31.11 1 kent-TW-505H employee employee
EPSONAB05F2 Connected 172.16.31.18 1 kent-TW-505H printer printer
kent Connected 172.16.31.5 1 kent-TW-505H smart_device employee
f0:de:f1:be:fb:77 Connected 172.16.50.101 50 kent-TW-6300F NA CX_Windows_UBT20-... computer_
Apple-TV Connected 172.16.31.7 1 kent-TW-6300F NA CX_Apple_TV_DUR-3... apple_tv

Wired IoT Devices - CPDI



Wired IoT Devices - CPDI

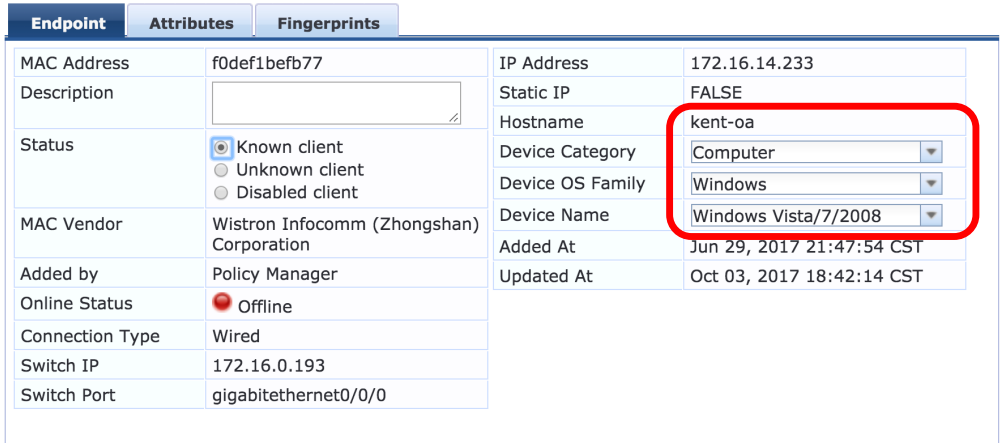


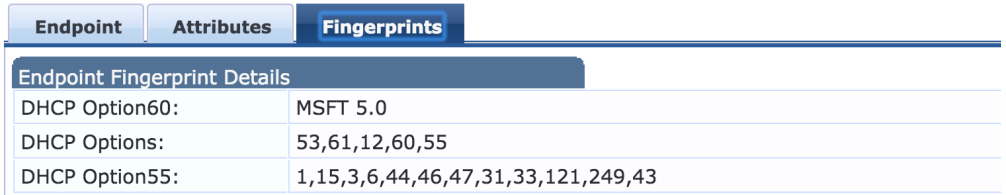
ClearPass Profiling

– Device is know and has been profiled

– Assign Role

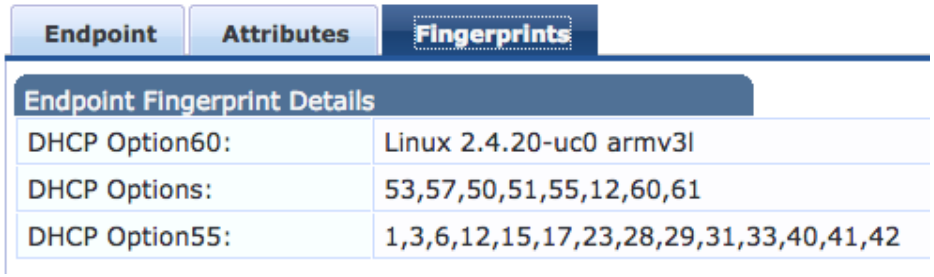
– Enforce Access controls

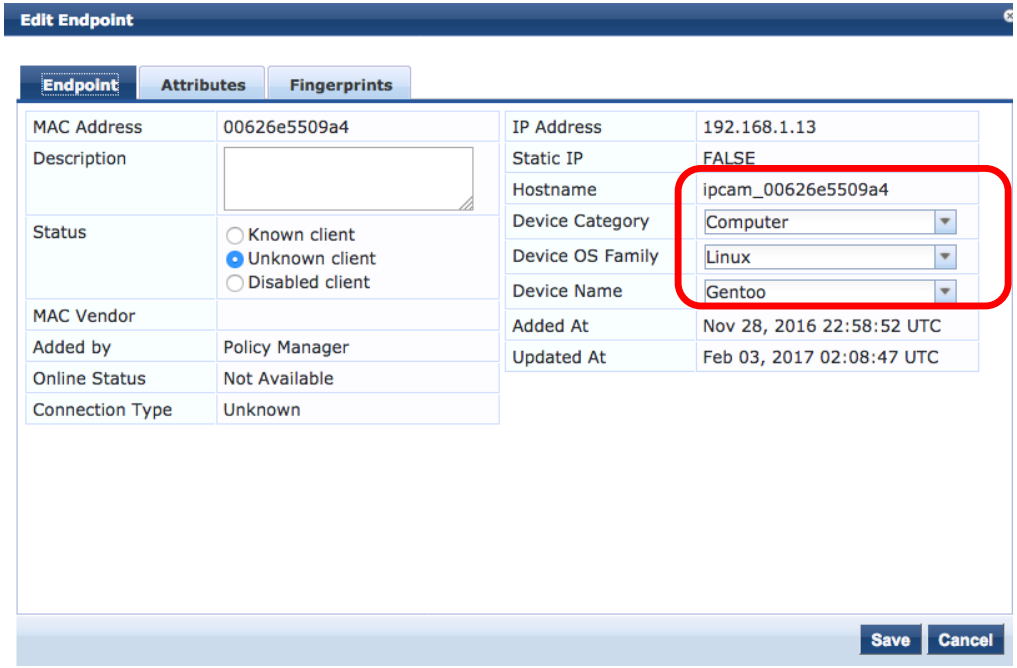




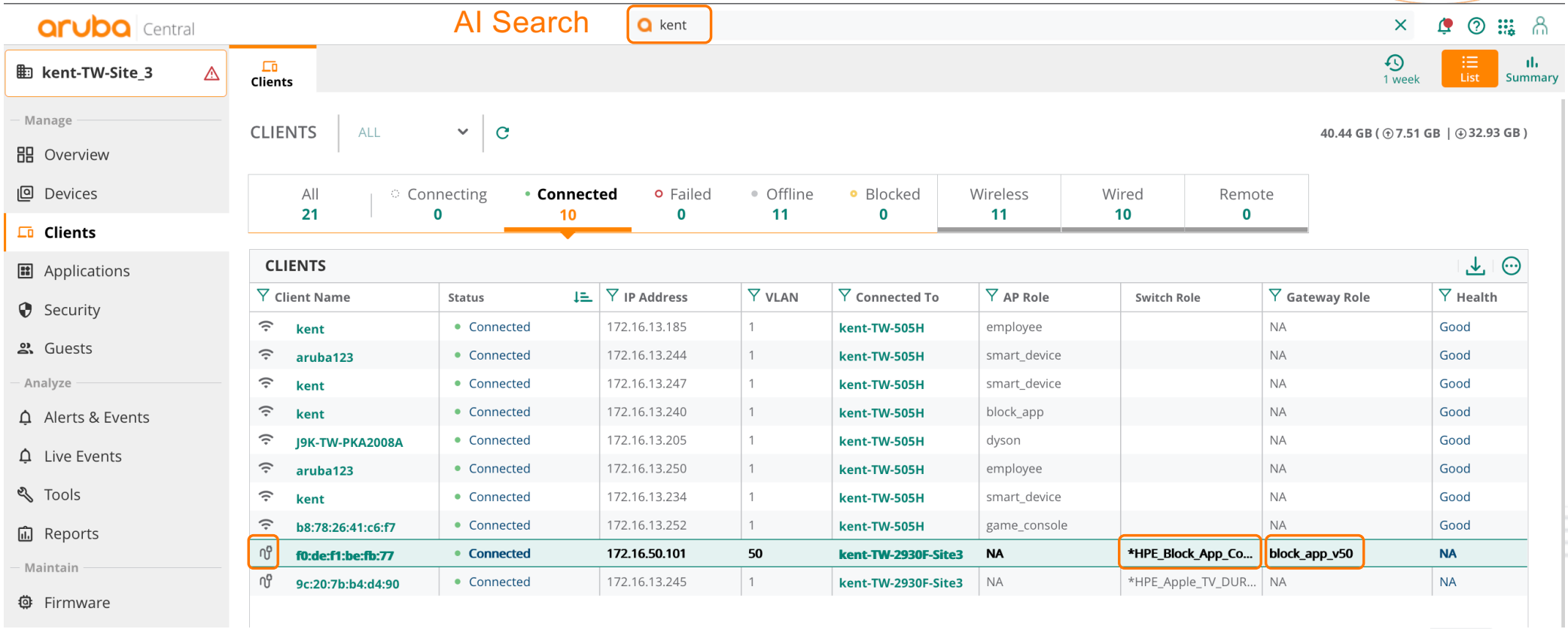
ClearPass Profiling

- New device detected
- Profiled
  - Profile matches defined role based access
- Inform Admin / Security
  - Text
  - Phone
  - Email
  - Pager
- Assign Role (IP_CAM)

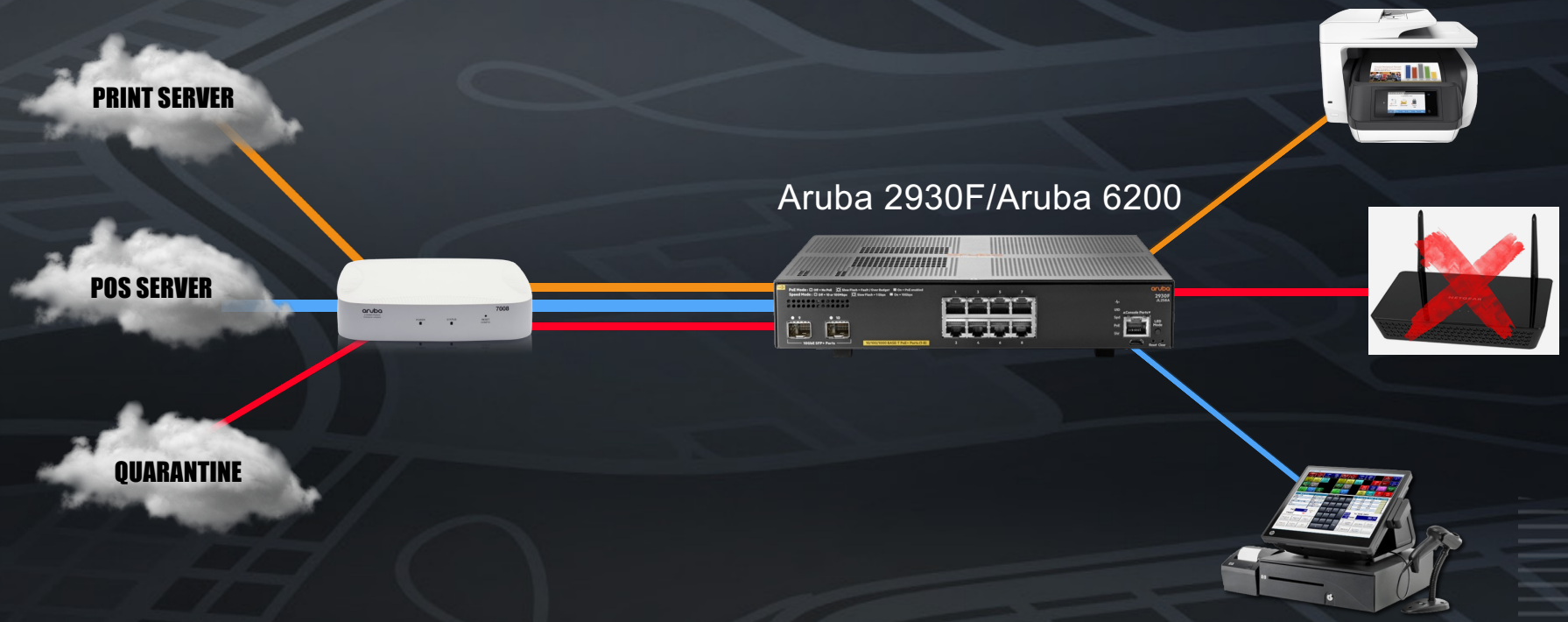




Dynamic Segmentation
- CoA (Change of Authorization)

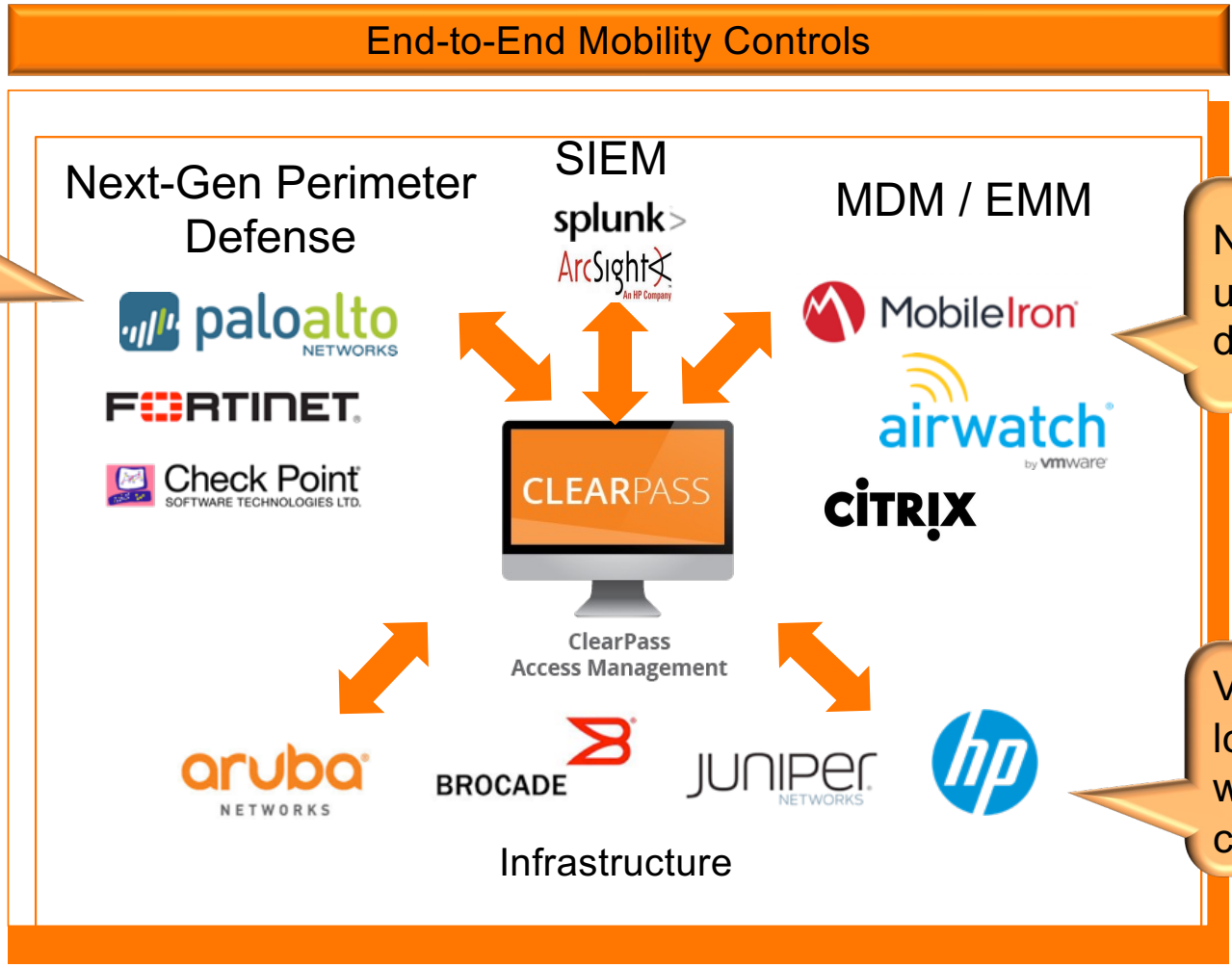


Secure Everywhere on Wired (using ArubaOS-Switch)
全面阻擋 私接 IoT 設備

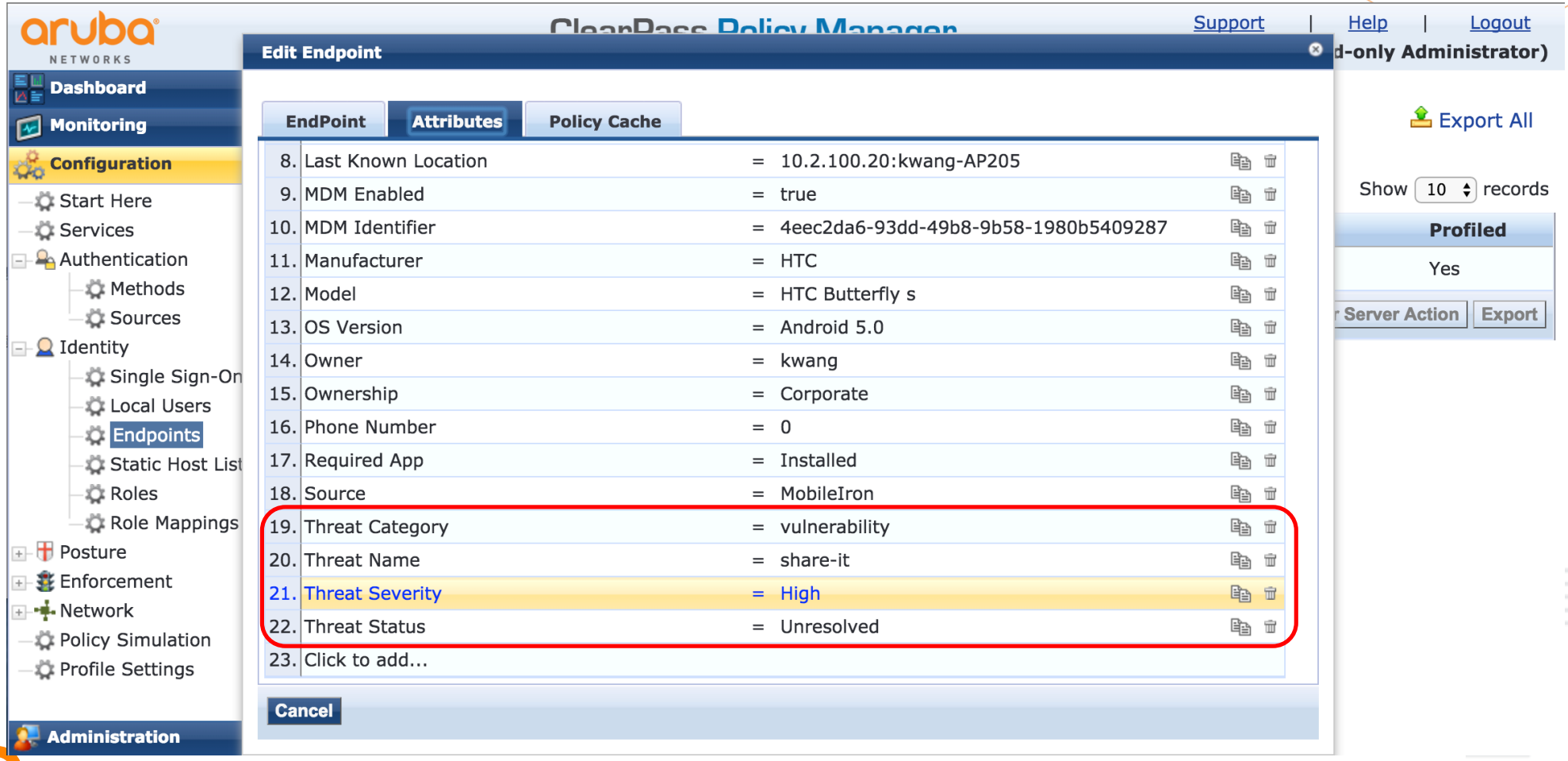


Time for New Defense Model – Adaptive Trust

- ✓ Multivendor integration
- ✓ Context sharing
- ✓ Open API

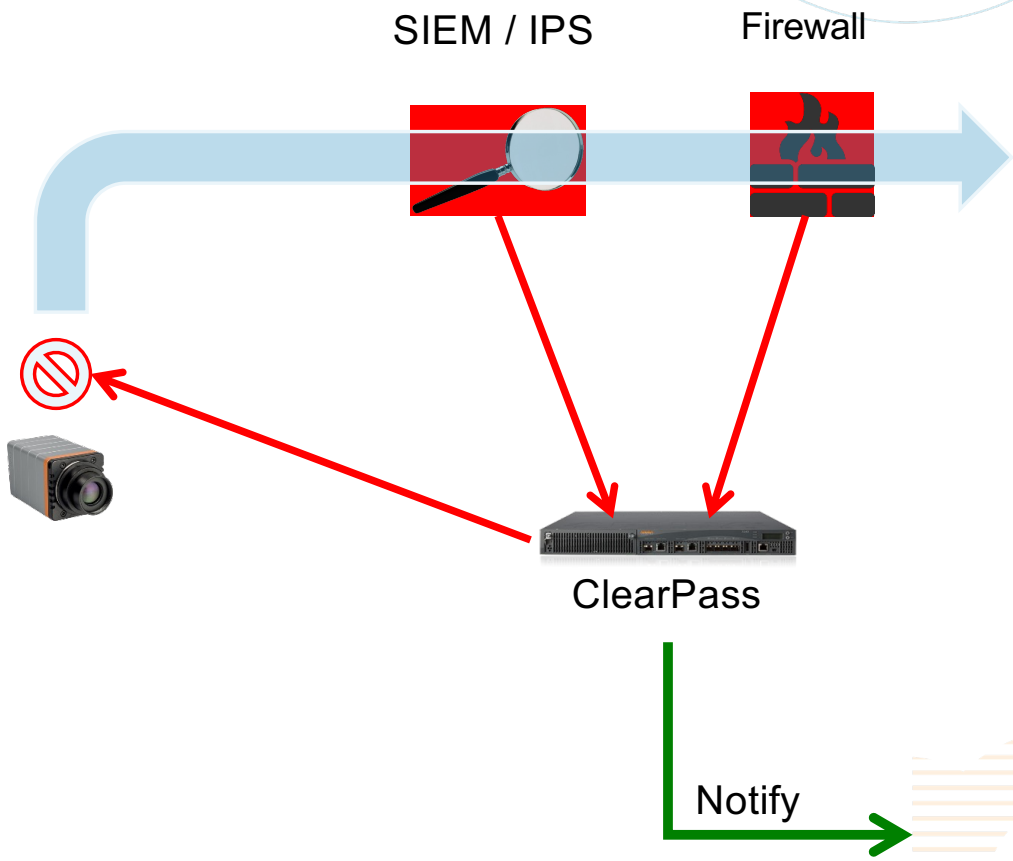


Context Stores in ClearPass



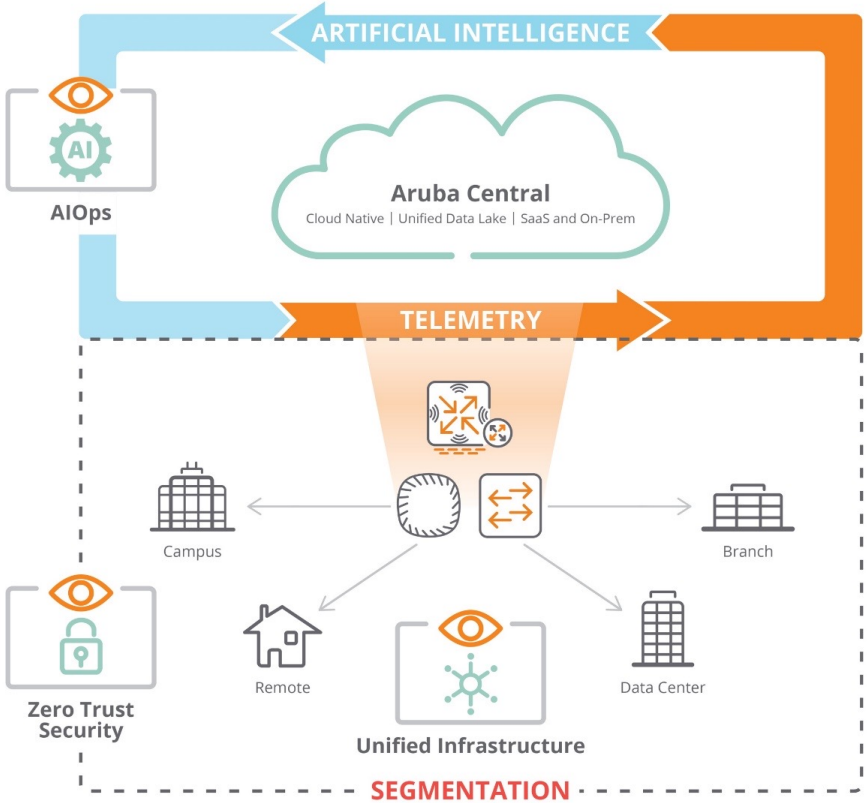
Continuing Visibility & Control

- Input from Threat monitoring / detection device triggers action
  - Quarantine device
  - Restrict access
  - Restrict bandwidth
- Alert Net Management / Security
  - Text
  - Phone
  - Email
  - Pager



Aruba Edge Services Platform - AIOps

Automating and Protecting the Intelligent Edge

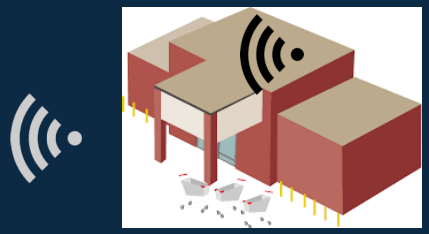


CONTINOUSLY MONITOR AND OPTIMZE

AI INSIGHTS

Problem

Passerby traffic dragging down network performance

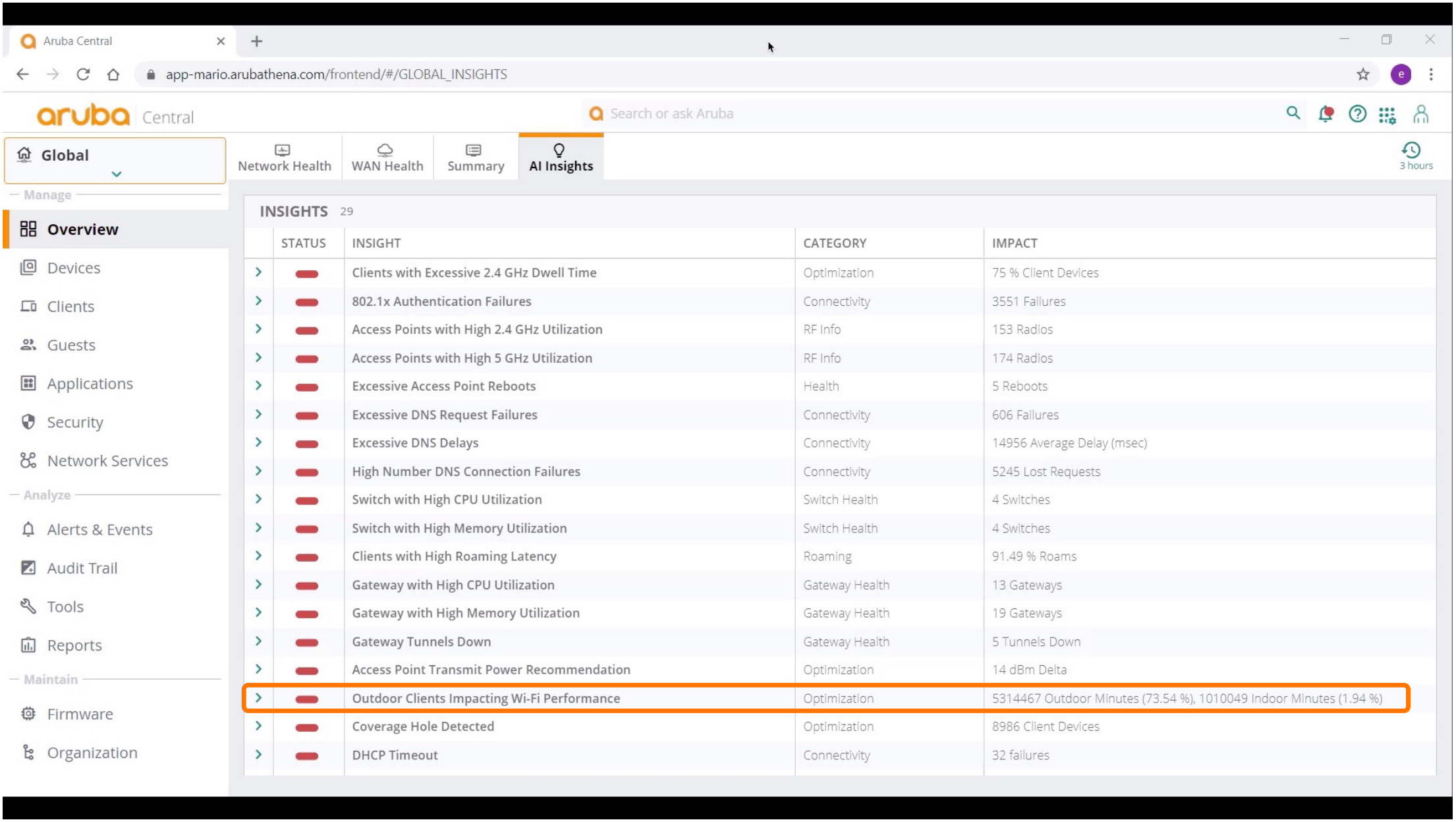


Solution

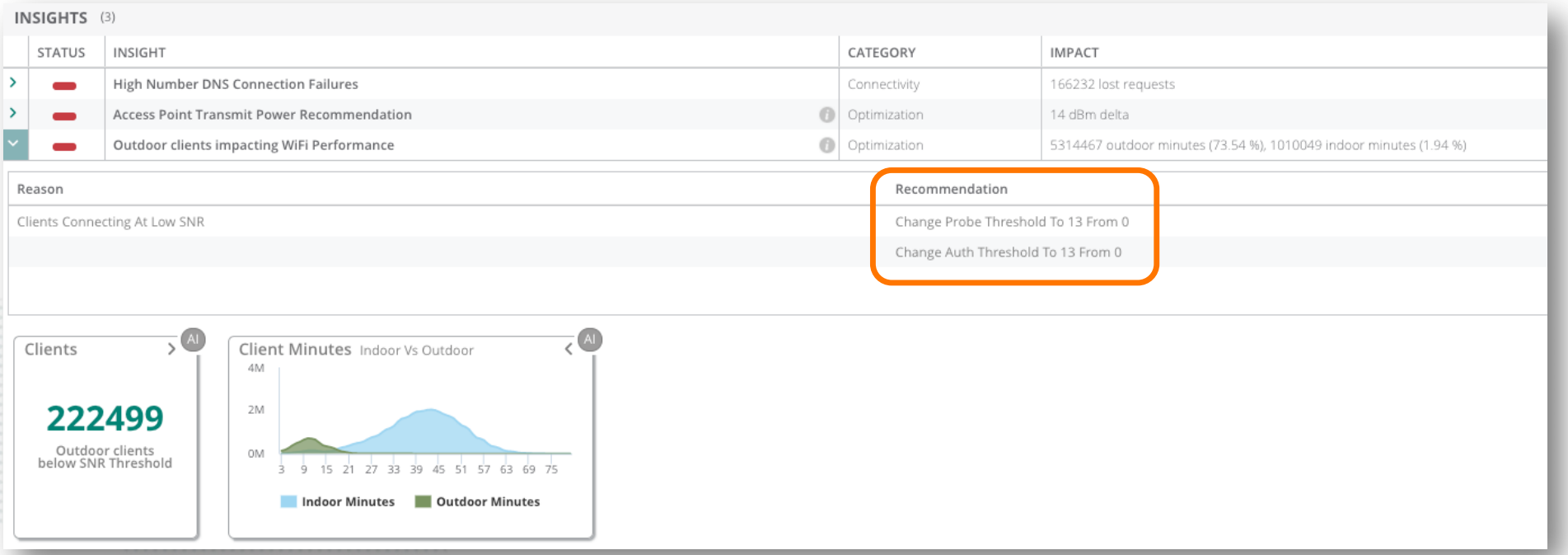
Aruba AI Insights recommended setting changes to reduce passerby traffic by 95% while maintaining inside traffic

Result

25% improvement in network performance with no additional hardware


Aruba Central
app-mario.arubathena.com/frontend/#/GLOBAL_INSIGHTS
aruba Central
Search or ask Aruba
Global
Network Health
WAN Health
Summary
AI Insights
3 hours
Manage
Overview
Devices
Clients
Guests
Applications
Security
Network Services
Analyze
Alerts & Events
Audit Trail
Tools
Reports
Maintain
Firmware
Organization
INSIGHTS 29
STATUS
INSIGHT
CATEGORY
IMPACT
Clients with Excessive 2.4 GHz Dwell Time
Optimization
75 % Client Devices
802.1x Authentication Failures
Connectivity
3551 Failures
Access Points with High 2.4 GHz Utilization
RF Info
153 Radios
Access Points with High 5 GHz Utilization
RF Info
174 Radios
Excessive Access Point Reboots
Health
5 Reboots
Excessive DNS Request Failures
Connectivity
606 Failures
Excessive DNS Delays
Connectivity
14956 Average Delay (msec)
High Number DNS Connection Failures
Connectivity
5245 Lost Requests
Switch with High CPU Utilization
Switch Health
4 Switches
Switch with High Memory Utilization
Switch Health
4 Switches
Clients with High Roaming Latency
Roaming
91.49 % Roams
Gateway with High CPU Utilization
Gateway Health
13 Gateways
Gateway with High Memory Utilization
Gateway Health
19 Gateways
Gateway Tunnels Down
Gateway Health
5 Tunnels Down
Access Point Transmit Power Recommendation
Optimization
14 dBm Delta
Outdoor Clients Impacting Wi-Fi Performance
Optimization
5314467 Outdoor Minutes (73.54 %), 1010049 Indoor Minutes (1.94 %)
Coverage Hole Detected
Optimization
8986 Client Devices
DHCP Timeout
Connectivity
32 failures

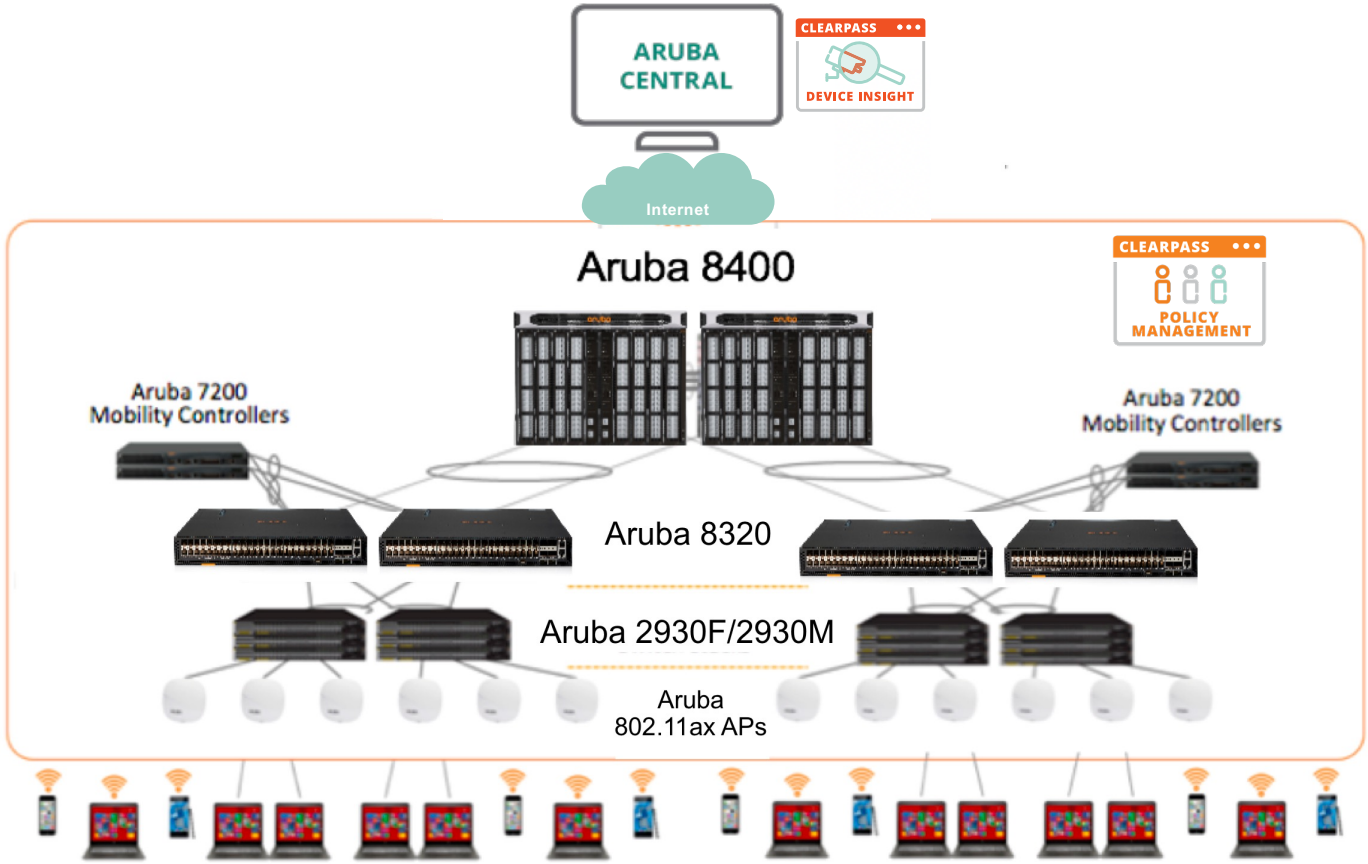
Outdoor clients impacting Wi-Fi performance

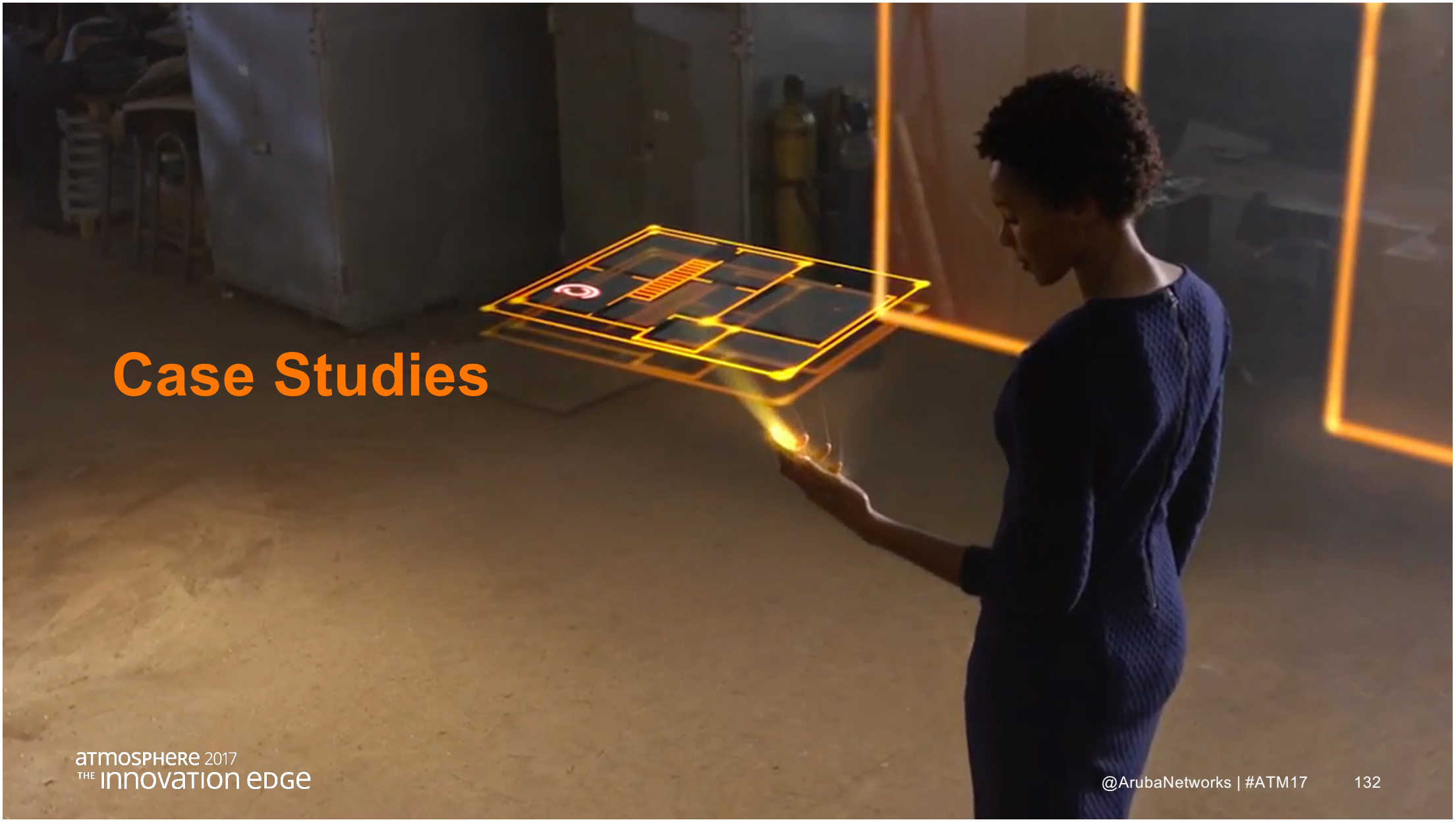


- Passerby (outdoor) clients connect at low rates to APs and degrade indoor performance
- AI Insights models the difference between indoor and outdoor clients using multiple factors
- AI Insights provides visibility and develops configuration recommendations to prevent passerby clients from connecting to the network.

Aruba Edge Services Platform Architecture

Ready for Mobile, IoT and Future




Case Studies

Why Higher Education Institutions chose Aruba

DOANE UNIVERSITY

"We wouldn't want to put all of our APs in the cloud and manage them with one system, then have to troubleshoot our switches on another platform. Being able to **manage everything from a single pane of glass using Aruba Central saves us valuable time and resources**." - ***Ryan Dorshorst, Director of IT***

UNIVERSITY OF CAMBRIDGE

Our Aruba solution has proven easy, reliable and intuitive to manage. Given our limited IT resources, we would not have been able to achieve what **we've achieved without a solution like Aruba.** - ***John Holgate, Head of Network***

RMIT UNIVERSITY

We chose Aruba because it is **the leader in its field**… we worked closely with team to deliver a wired and wireless network infrastructure to support **anytime, anywhere learning.** - ***Stephen Castellas, Senior Manager of Global Networks***

As the connectivity provider for a demanding community that never sleeps, users expect our wireless and wired networks **to work seamlessly,** like turning on the lights. We're **exceedingly happy** with our Aruba environment for enabling us to make that happen every day - ***Kirt Guinn, Director of Telecommunications and Enterprise Infrastructure***

Student residence hall experiences with Aruba's Wi-Fi gave us the confidence to deploy across campus. Our new wireless network provides **exceptional experiences and is critical** to continuing our distinction as a center of educational and research excellence on the global stage - ***Ben Price, Associate CIO of Administrative and Residential IT***

UC SANTA BARBARA

"Standardizing on a **centrally managed Wi-Fi solution** for the entire University system has **significantly improved security controls and responses while enhancing performance, capacity, and stability** for our ever-growing user base. We're addressing complex problems and delivering solutions that work." - ***Louis Hammond, Service Owner of Voice and Data Network Services***

UNIVERSITY OF MINNESOTA

James Cook University

ArubaOS Benefits :

- Leveraged existing **virtualized environment**
- **New UI and hierarchical** configuration
  - **Manage geographically dispersed network**
  - Design and **deploy a solution in 1hr vs 24hrs** for a new site
- Clustering **reduces downtime risk**
- AirMatch ensures student devices get **optimal Wi-Fi**

JCU Background and challenge :

- 25,000 students-1200 APs in dorm rooms with peak device at 8000
- Required improved network management, high availability and greater agility for responding to evolving needs

Levi's Stadium: Wi-Fi for the Record Books

Palo Alto Unified School District (PAUSD)

ArubaOS 8 Benefits :

- Enabled unifying all of PAUSD's 18 sites w/ separate networks onto **a single network** leveraging the hierarchical Configuration
- **Visualize and manage** the entire system as a single unified Wi-Fi network - Creating a multitude of efficiencies
- **Min downtime** with Live upgrade and in-service updates
- Better control of shared devices with AirGroup
- Less complaints- better user experience

PAUSD Background and challenge :

- Ranked among the top U.S. public school districts, 12,500-student- 800 teachers will scale upto 50K devices
- Sought a high-performance Wi-Fi solution with streamlined management. operate with minimal overhead
- The biggest pain point was to create a single network across our 18 campuses

Palo Alto
Unified School District

Case Study: Ohio State University (Over 85k Users)

Reason for upgrade

- Over 400 buildings (25 million square feet) on approximately 1,700 acres.
- Replace hundreds of different departmental and dormitory networks, comprised of thick APs and other legacy equipment, with a secure, unified pervasive wireless network.

Solution

- Consist of over 11,000 access points distributed across three core router points of presence.
- Initial deployment of 1,700 APs was deployed in 3 weeks!
- Will provide ubiquitous wireless access to over 85,000 students, faculty and staff.

Why Aruba

- Central policy and network management
- Remote diagnostics and troubleshooting
- Mobile computing and Internet-based collaborative learning programs

"We needed a single mobile network that worked everywhere on campus."

Bob Corbin
Director of Telecommunications & Networking
The Ohio State University

Innovative Customers

Education is Aruba's largest vertical for a reason

2500+ Universities deploy Aruba WLAN

6 of 8 Ivy League schools leverage Aruba solutions

2021 Gartner® Magic Quadrant™ for Wired and Wireless LAN Infrastructure

HPE Aruba Positioned as a Leader in the Gartner Magic Quadrant for Wired and Wireless LAN Infrastructure

aruba

a Hewlett Packard Enterprise company

Aruba's 16th Time In The Leaders Quadrant[1]

Figure 1. Magic Quadrant for Enterprise Wired and Wireless LAN Infrastructure

Source: Gartner (November 2021)

Source: Gartner Magic Quadrant for the Wired and Wireless LAN Access Infrastructure
November 2021, Mike Toussaint, Christian Canales, Tim Zimmerman
ID Number: G00739263

1 Aruba's 16 years of placement includes HPE (Aruba) in the Magic Quadrant for the Wired & Wireless LAN Access Infrastructure from 2015-2021 (7 years), Aruba Networks in the same Magic Quadrant from 2012-2014 (3 years) and in the Magic Quadrant for Wireless LAN Access Infrastructure from 2006-2011 (6 years).

Thank You

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