



# 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)

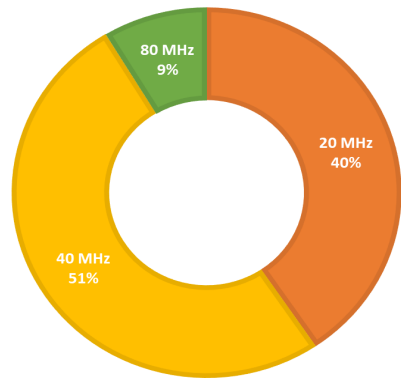




# What is Wi-Fi 6E?



# 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**

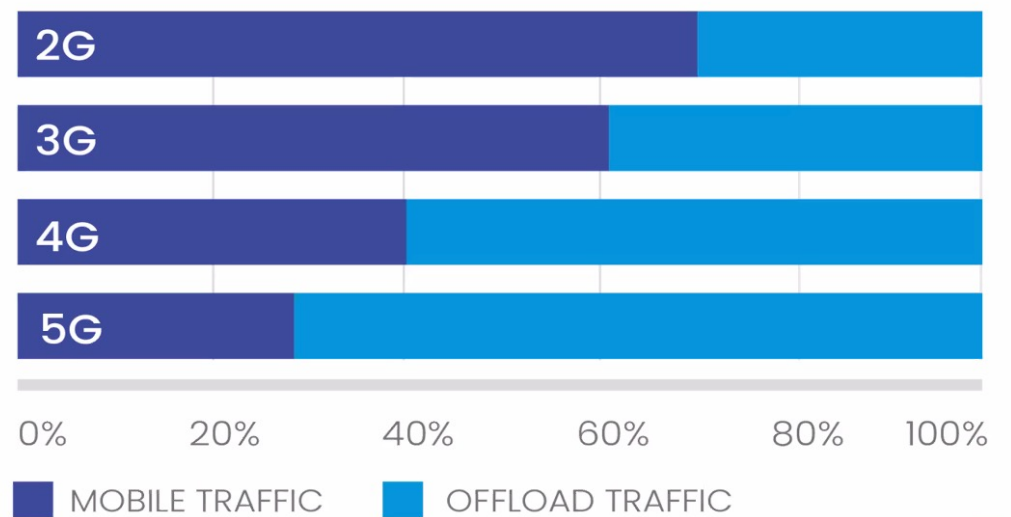
Source: Wi-Fi Alliance



# 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

$$\begin{array}{r}
 \text{2x2 AP} = 0.286 + 0.573 + 1.2 = \text{2.1 Gbps} \\
 \text{4x4 AP} = 0.573 + 1.14 + 2.4 = \text{4.1 Gbps} \\
 \text{8x8 AP} = 0.573 + 1.14 + 4.8 = \text{6.5 Gbps}
 \end{array}$$

	<u>80 MHz</u>	<u>160 MHz</u>
<b>2.1 Gbps</b>	=	<b>3.3 Gbps</b>
<b>4.1 Gbps</b>	=	<b>6.5 Gbps</b>
<b>6.5 Gbps</b>	=	<b>11.3 Gbps</b>

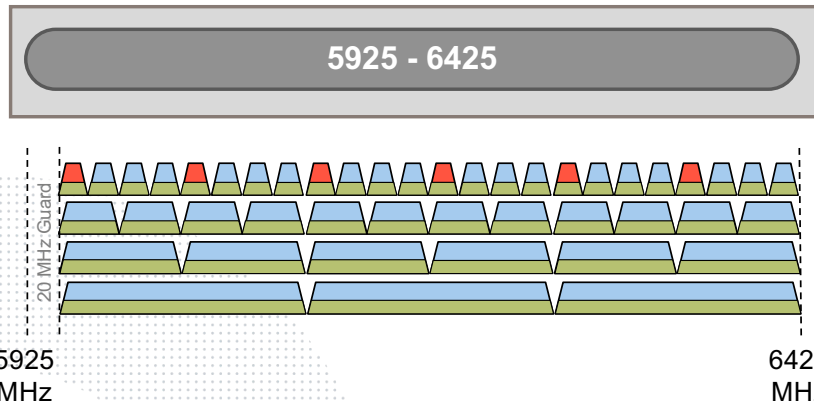
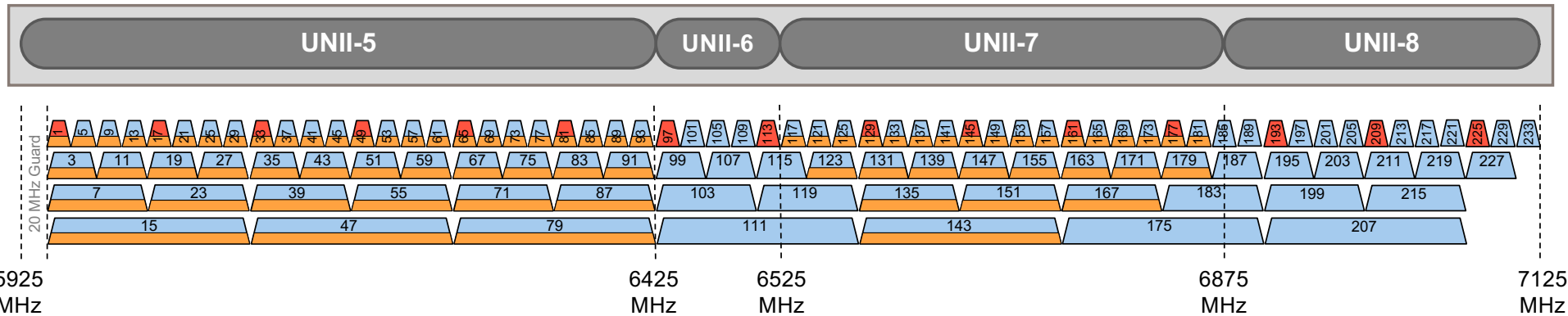
Spatial Streams	20 MHz
1SS	143 Mbps
<b>2SS</b>	<b>286 Mbps</b>
3SS	430 Mbps
<b>4SS</b>	<b>573 Mbps</b>

Spatial Streams	40 MHz
1SS	286 Mbps
<b>2SS</b>	<b>573 Mbps</b>
3SS	860 Mbps
<b>4SS</b>	<b>1.14 Gbps</b>

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



# 6 GHz Channels in United States & Europe/CEPT



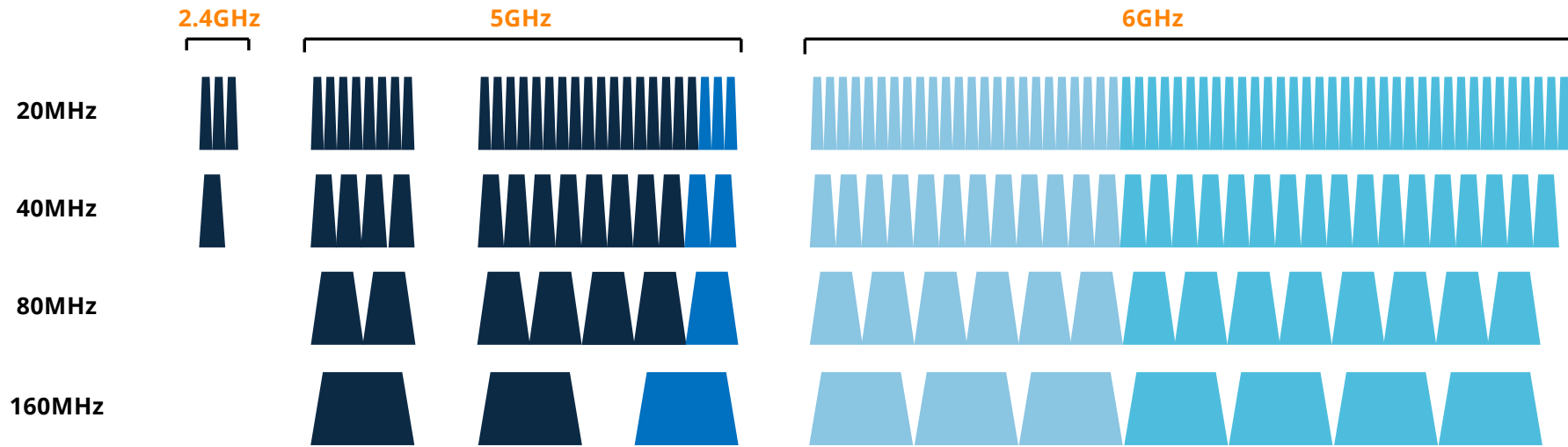
- = Low Power Indoor (LPI) Only
- = LPI & Automatic Frequency Coordination (AFC)
- = LPI & Very Lower Power (VLP)
- = Preferred Scanning Channels (PSC)





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

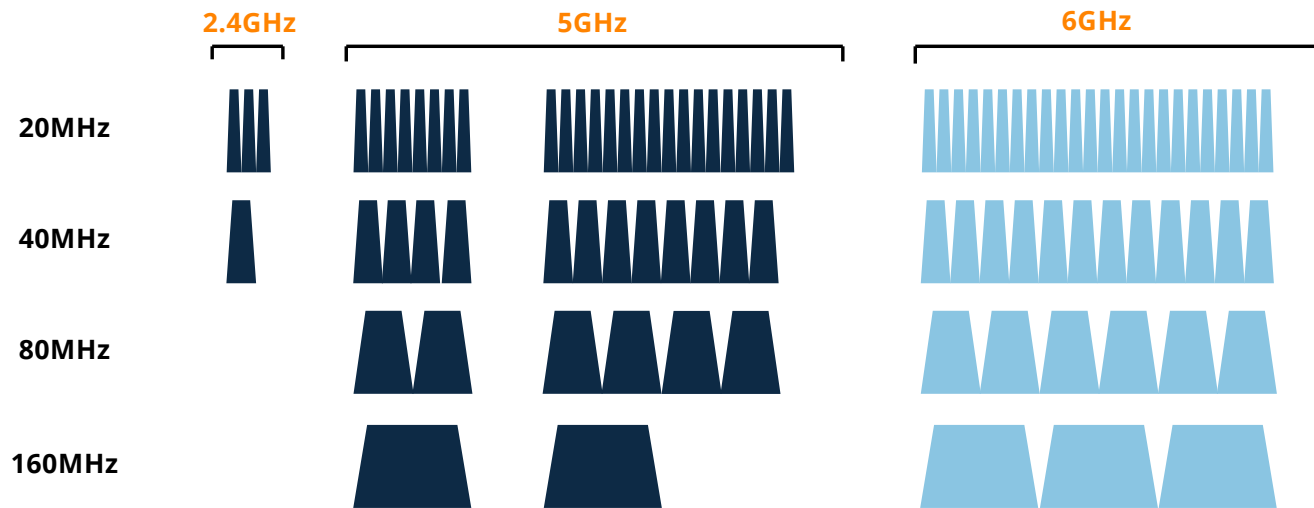
AMERICAS, SAUDI ARABIA, S KOREA



- 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)

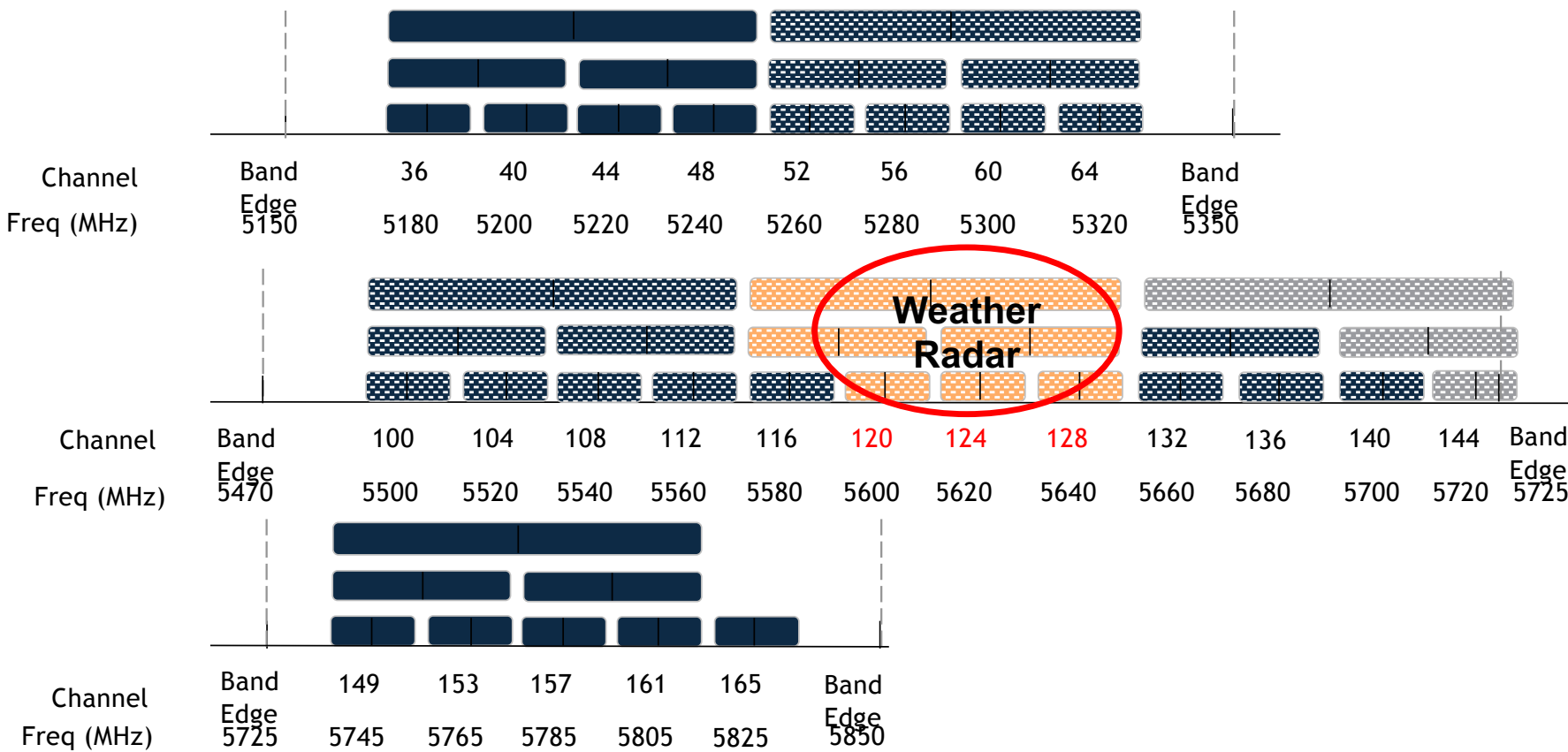
# WI-FI 6E = WI-FI 6 IN THE 6 GHZ BAND

## 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

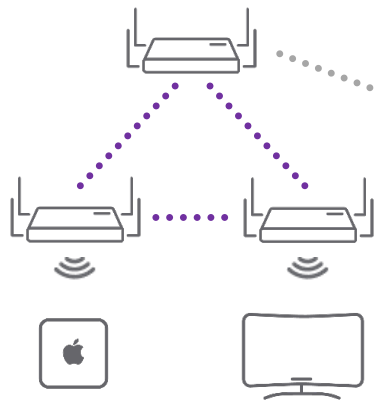




# Device Classes in 6 GHz

## Low Power Indoor (LPI) AP

- Fixed indoor only
- Up to 63X lower energy
- No antenna connectors
- No weatherproofing
- Wired power

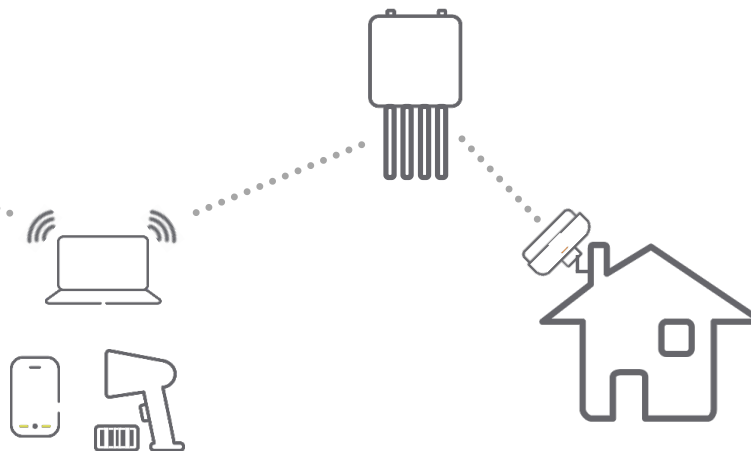


## Subordinate Indoor Device

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

## Standard Power (SP) AP

- Fixed indoor / outdoor
- Controlled by AFC database
- Automated geolocation
- Pointing angle restriction



## Mobile Client

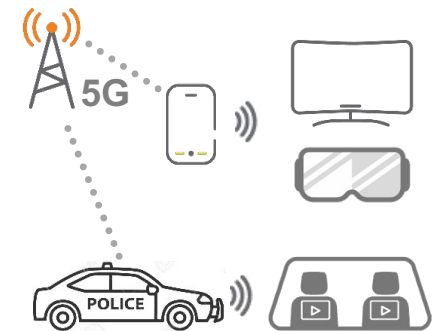
- Indoor / outdoor
- 4X less power than connected AP

## Fixed Outdoor Device

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

## Very Low Power (VLP) AP

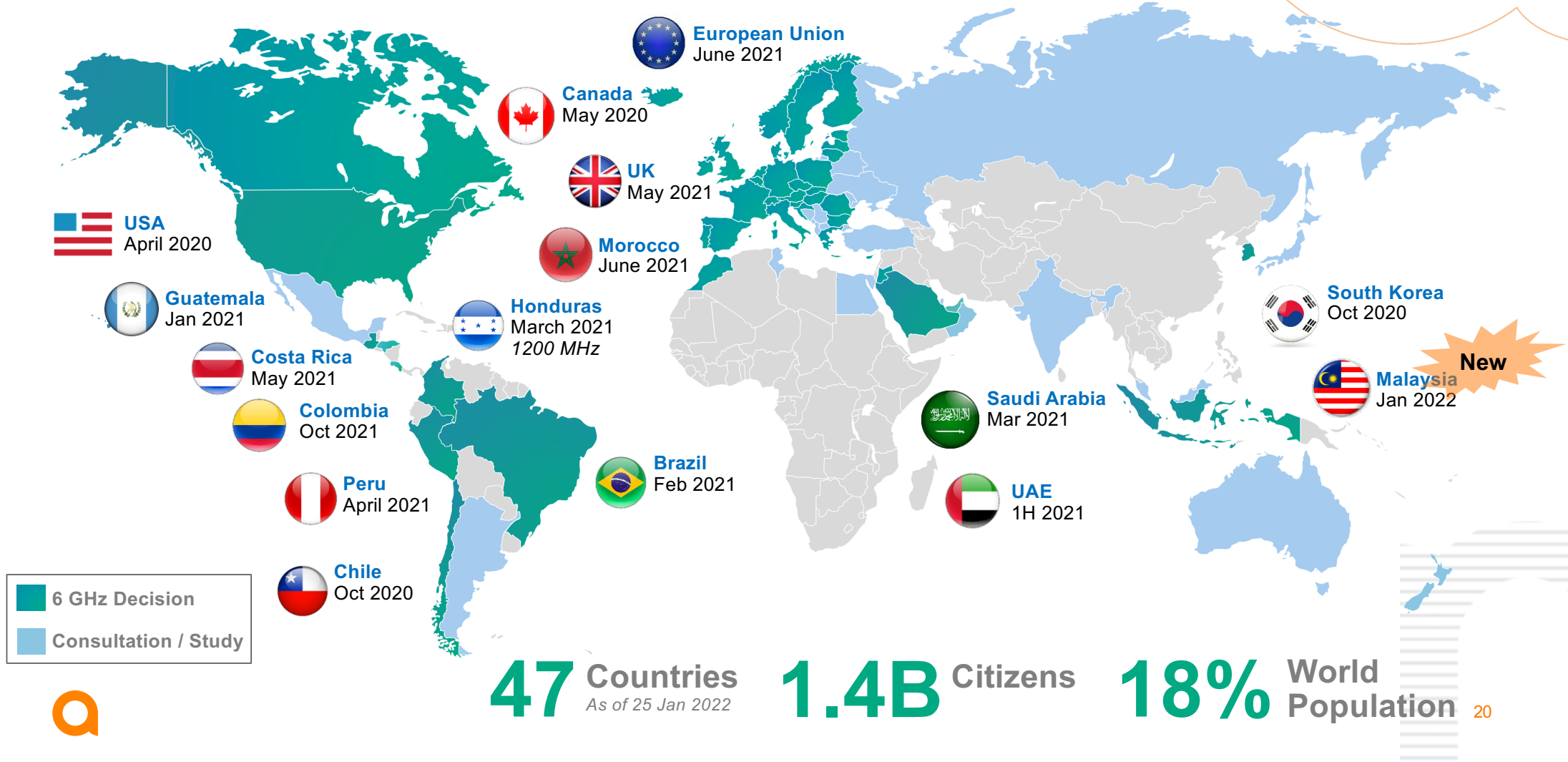
- Mobile indoor / outdoor
- 160X lower energy



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

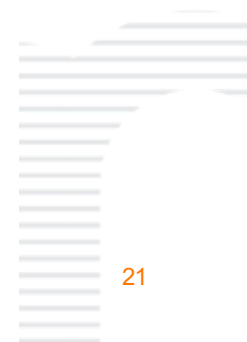


# Powerful Global Momentum Today



# WiFi 6E Country status

Country/Market	Status	Est. Date for Acceptance
Korea	<ul style="list-style-type: none"> <li>Adopted full 1.2GHz. Rules published <a href="#">South Korea 6GHz</a></li> </ul>	Oct 20
Malaysia	<ul style="list-style-type: none"> <li>Adopted Lower 500MHz channels. <a href="#">Malaysia 6GHz</a></li> </ul>	Jan 22
Australia	<ul style="list-style-type: none"> <li>Planning to make lower 500 MHz available soon. Considering Upper 700 MHz channels before 2023.</li> </ul>	Target Apr/May 22
New Zealand	<ul style="list-style-type: none"> <li>Planning to make lower 500 MHz available soon.</li> </ul>	Target May/June 22
Japan	<ul style="list-style-type: none"> <li>MIC is working toward decision for lower 500 MHz for April 2022.</li> <li>MIC will study upper 700 MHz and standard power in April 2022, the decision is likely to be made after WRC-2023.</li> <li>MIC requested ARIB to consolidate industry requirement. Considering full 1.2GHz channels</li> </ul>	April 22
Taiwan	<ul style="list-style-type: none"> <li>MOTC opened to <a href="#">consultation on 6GHz band</a></li> </ul>	
Singapore	<ul style="list-style-type: none"> <li>IMDA spectrum team in discussion. Looking to open up the lower 500MHz channels</li> </ul>	
Thailand	<ul style="list-style-type: none"> <li>NBTC staff shared roadmap for lower 500 MHz – consultation + decision in Q4 2022. Decision will be in two phases.</li> <li>Upper 700MHz decision will be post WRC-23.</li> </ul>	Q4 22
China	<ul style="list-style-type: none"> <li>Looking to license the bands for 5G</li> </ul>	
Hong Kong S.A.R.	<ul style="list-style-type: none"> <li>OFCA consulted unlicensed lower 500 MHz in November 2021.</li> </ul>	April/May 22
India	<ul style="list-style-type: none"> <li>C-DOT supports 1200MHz unlicensed study, 700MHz licensed study</li> </ul>	



The background features a dark blue field with a pattern of small, light-colored dots that form a large, abstract shape. In the top-left corner, there is a solid red quarter-circle. The text "Aruba's Wi-Fi 6E Solution" is centered in white, bold font.

# 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

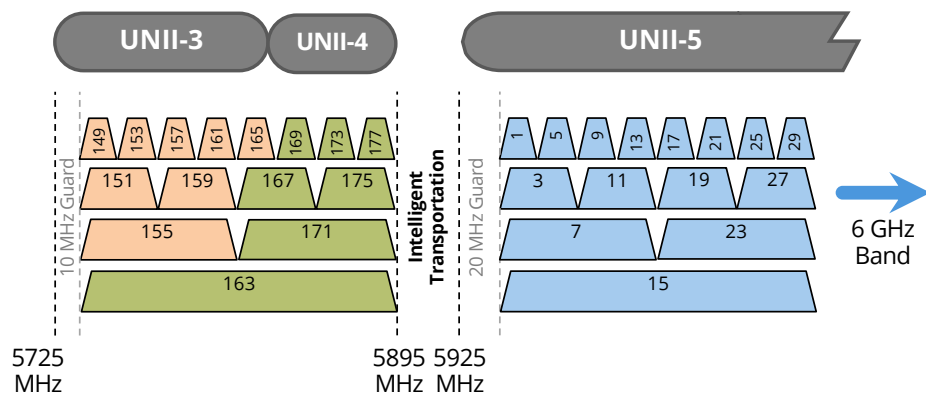





- **Three 4x4 MIMO radios** (2.4GHz + 5GHz + 6GHz) with **Ultra Tri-Band (UTB)**
- 802.11ax: UL&DL OFDMA, 1024-QAM modulation
  - **Peak data rate: 7.8 Gbps**
    - 4.8Gbps (6GHz, HE160/2SS)
    - 2.4Gbps (5GHz, HE80/2SS)
    - 574Mbps (2.4GHz, HE20/2SS)
  - Up to **1024 associated clients per radio**
- **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

New 5-6 GHz Boundary Plan



-  = Existing 5 GHz UNII-3 Channels
-  = New 5 GHz UNII-3/4 Channels
-  = New 6 GHz UNII-5 Channels

**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

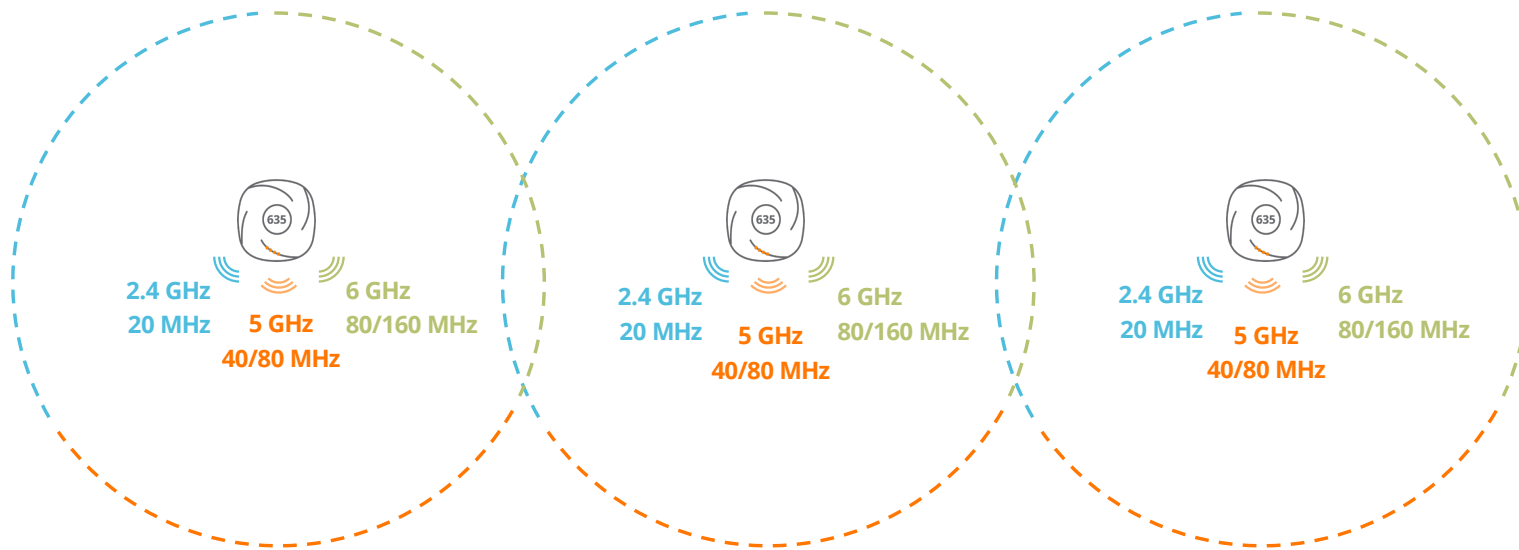
**RESULT:**  
Less interference and unrestricted channel selection for better spectrum utilization



# 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

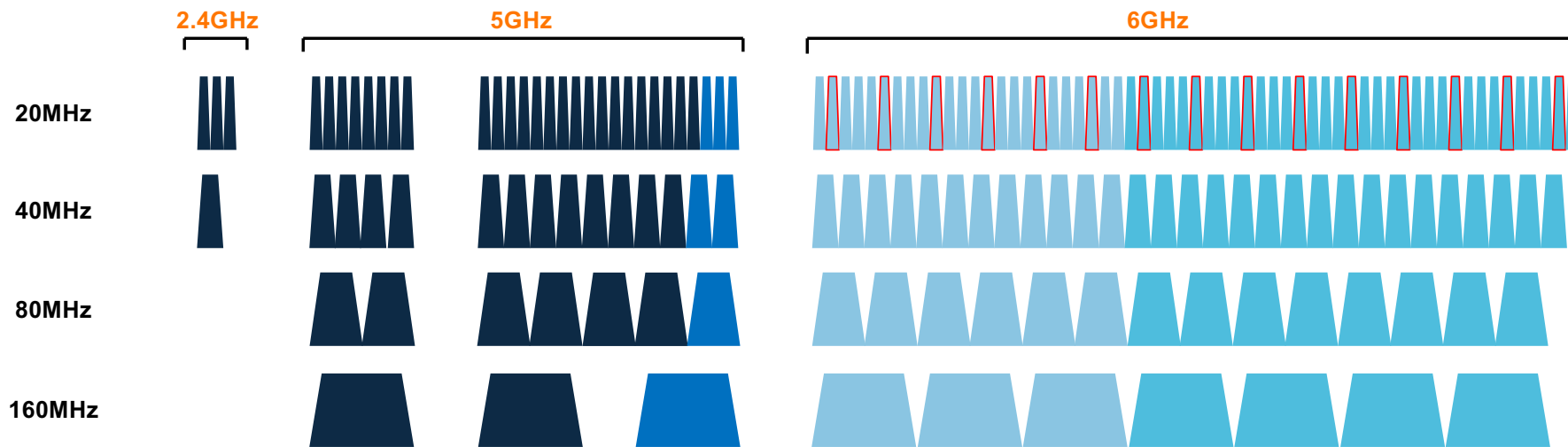


**AP-515**  
200 x 200  
810g



# 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 data rate: 2.4Gbps (2.9Gbps with 4096-QAM)
- 5GHz radio: 2x2 MIMO, 20/40/80MHz, 802.11a/n/ac/ax. Peak data rate: 1.2Gbps
- 2.4GHz radio: 2x2 MIMO, 20/40MHz, 802.11b/g/n/ax. Peak data rate: 287Mbps (574Mbps @ 40MHz)
- Aggregate peak data rate: **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)

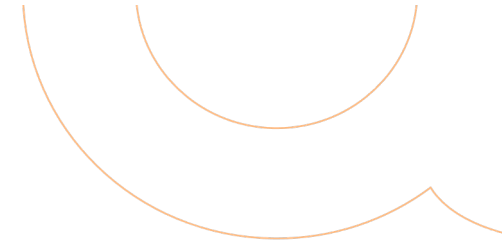
- Both support POE



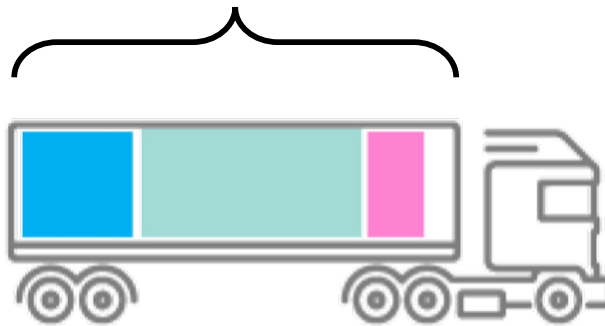
# OFDMA

## 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

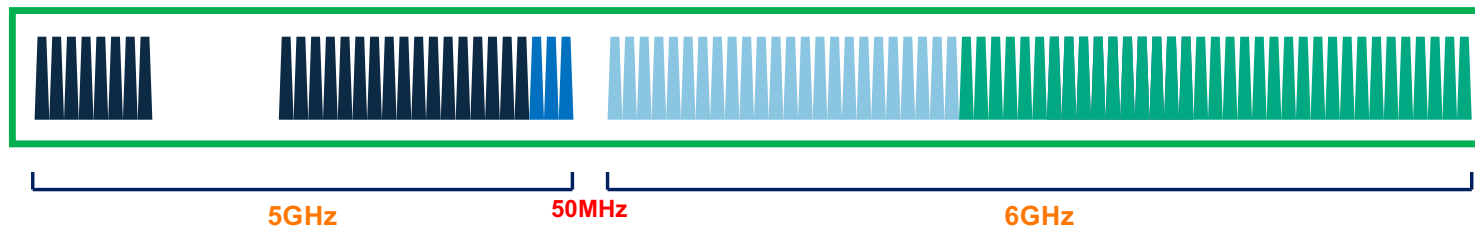
- **Advanced Cellular Coexistence (ACC)** delivers robust performance in the presence of strong out-of-band interference
- **Advanced IOT Coexistence (AIC)** allows for concurrent operation of Wi-Fi and BLE/Zigbee in 2.4GHz without performance degradation
- **Ultra Tri-Band (UTB)** enables unrestricted 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
<b>6GHz radio</b>	HE160 2x2 1024-QAM (MCS11)	HE160 4x4 1024-QAM (MCS11)	Not applicable
<b>5GHz radio</b>	HE80 2x2 1024-QAM (MCS11)	HE80 4x4, HE160 (80+80) 2x2 1024-QAM (MCS11)	HE80 4x4, HE160 2x2 1024-QAM (MCS11)
<b>2.4GHz radio</b>	HE20 2x2 (HE40)* 1024-QAM (MCS11)	HE20 4x4 (HE40)* 1024-QAM (MCS11)	HE20 4x4 (HE40)* 1024-QAM (MCS11)
<b>Peak datarates (6GHz, 5GHz, 2.4GHz)</b>	2.4Gbps / 1.2Gbps / 574Mbps	4.8Gbps / 2.4Gbps / 1,147Mbps	2.4Gbps / 1147Mbps
<b>Peak datarates (typical)</b>	2.4Gbps / 1.2Gbps / 287Mbps	4.8Gbps / 2.4Gbps / 574Mbps	2.4Gbps / 574Mbps
<b>Aggregate peak datarate</b>	<b>3.9Gbps</b>	<b>7.8Gbps</b>	<b>3.0Gbps</b>
<b>Max number of clients per radio</b>	512 (100)	1024 (150)	1024 (100)
<b>DL/UL-OFDMA</b>	Yes	Yes	Yes
<b>Max no. of RUs (HE80) per radio</b>	<b>8 (37 for 6GHz)</b>	<b>37</b>	<b>37</b>
<b>DL-MU-MIMO</b>	No	Yes	Yes
<b>UL-MU-MIMO</b>	No	Yes	Yes
<b>Wired ports</b>	<b>2x 2.5Gbps</b>	<b>2x 5Gbps</b>	<b>2x 5Gbps</b>
<b>Peak POE power (excl. USB)</b>	23.8W	40.3W	26.4W
<b>POE-PD (typical)</b>	<b>Class 4 Dual (failover)</b>	<b>Class 6 Dual (Smart POE)</b>	<b>Class 4 Dual (failover/combine)</b>
<b>Size &amp; weight</b>	220 x 220 x 50 (mm) 1300g	260 x 260 x 60 (mm) 1800g	240 x 240 x 53 (mm) 1270g





**aruba**

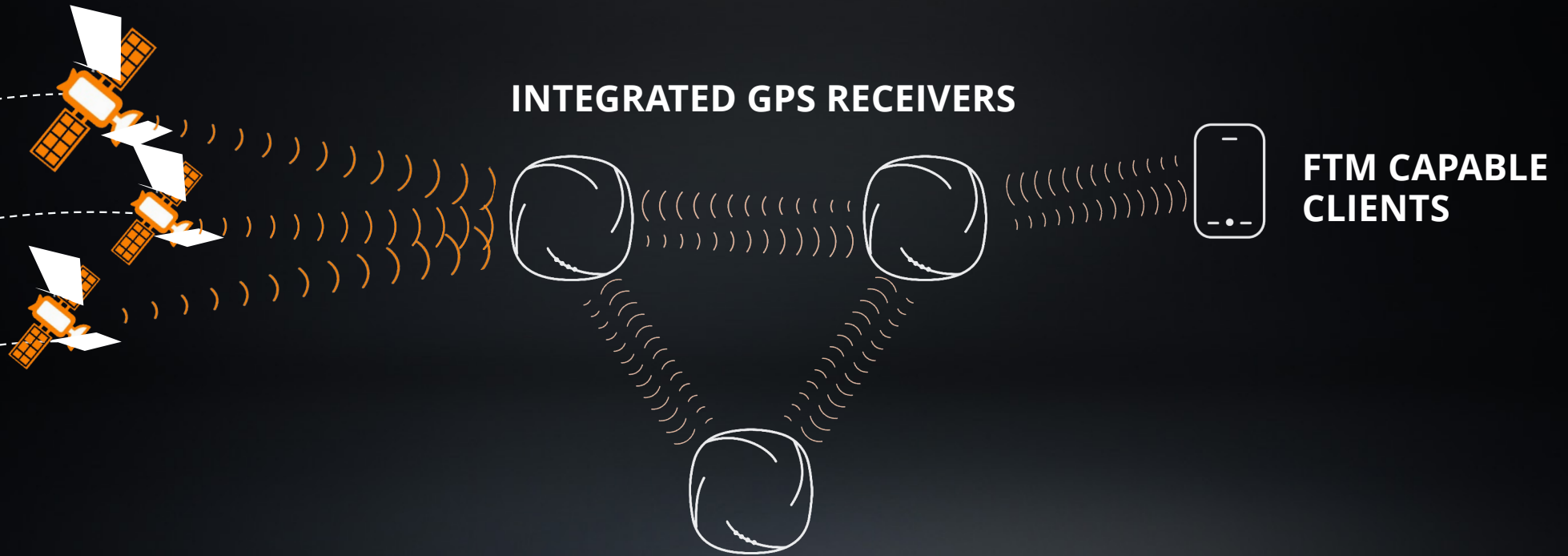
a Hewlett Packard  
Enterprise company

# *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)

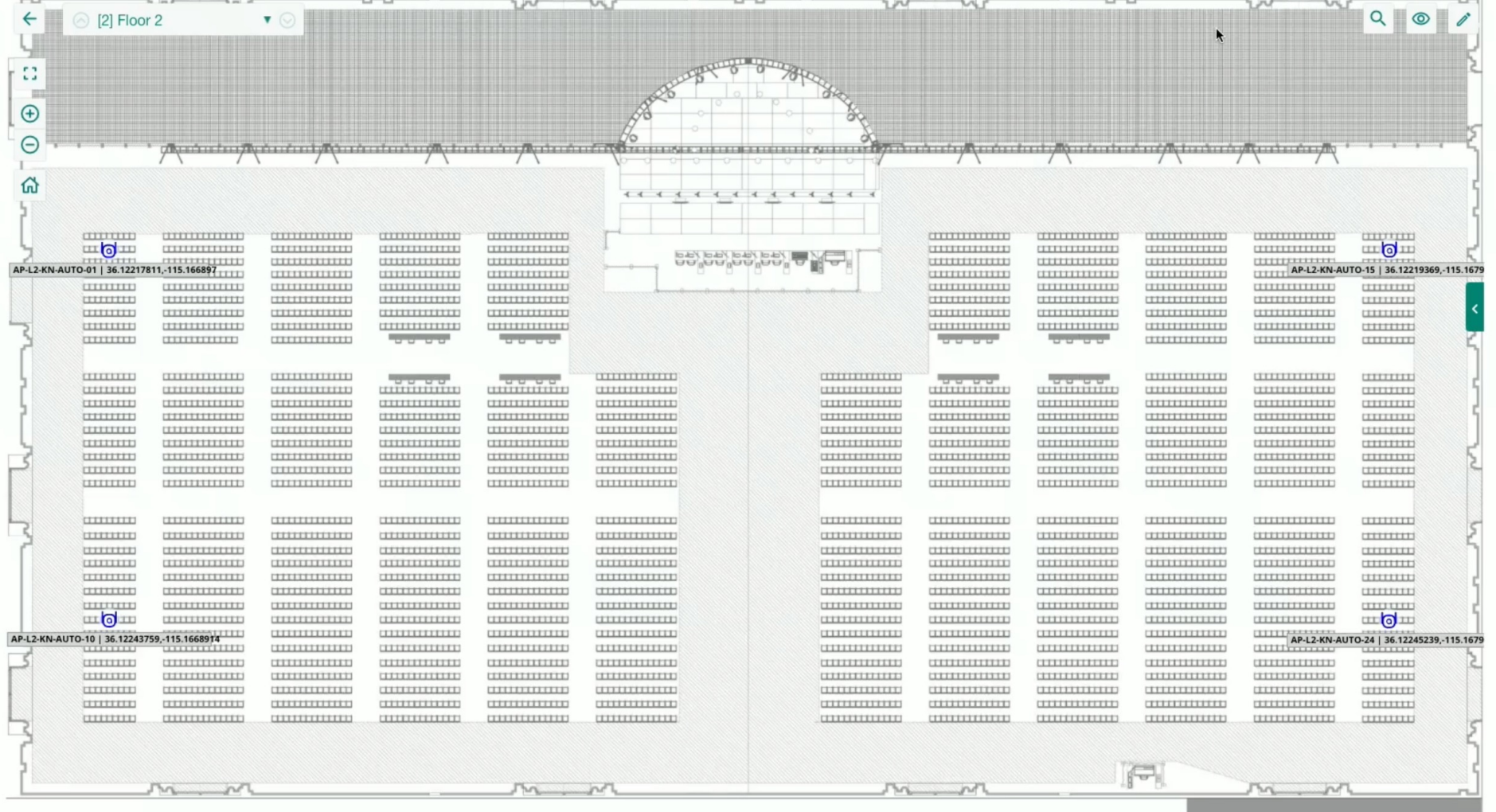




— Manage —

Overview

- 📷 Devices
- 👤 Clients
- 🏢 Applications
- 🛡️ Security
- 👥 Guests
- Analyze —
- 🔔 Alerts & Events
- 🔔 Live Events
- 🔧 Tools
- 📄 Reports
- Maintain —
- ⚙️ Firmware



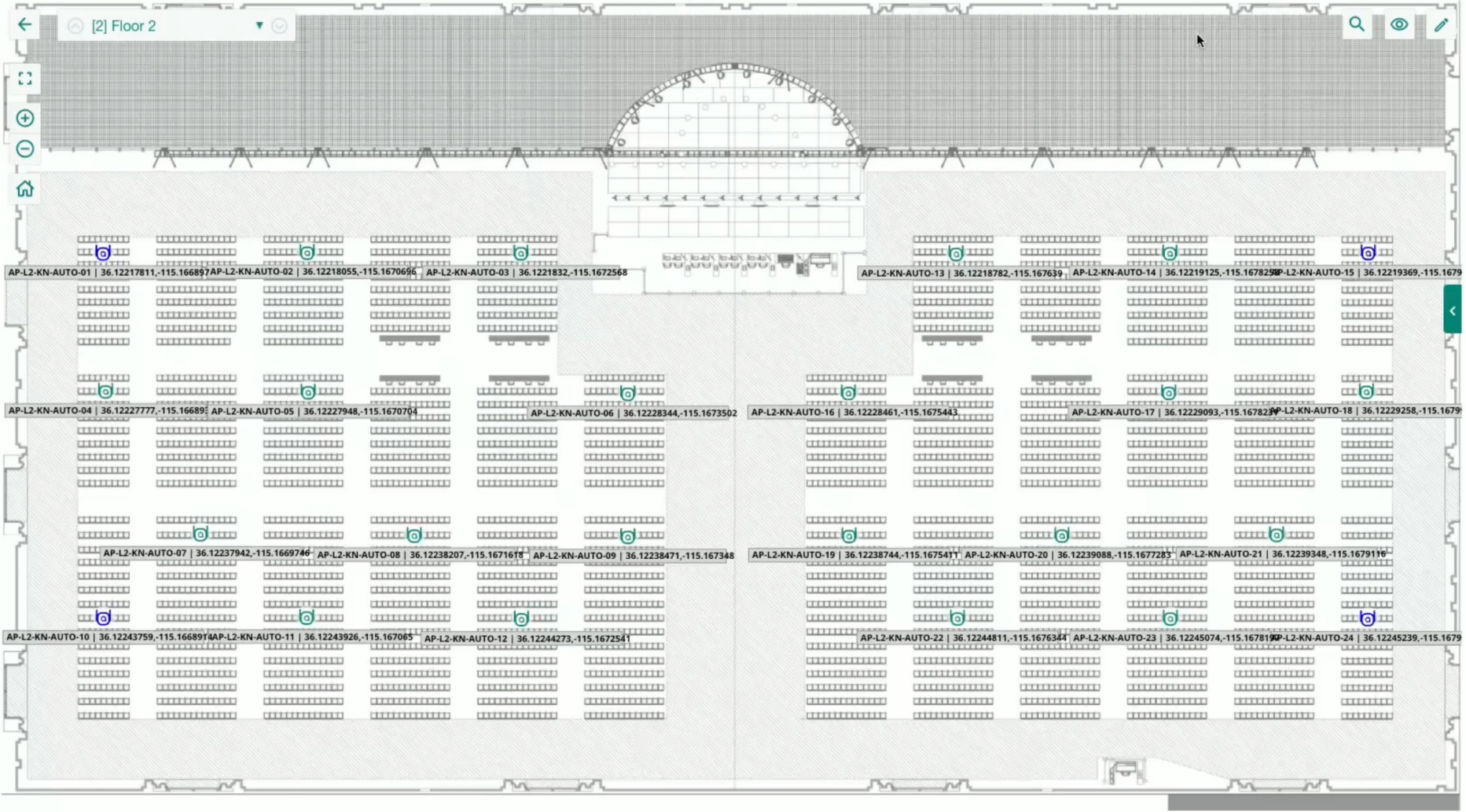
⚠️ 3 Device(s) with existing configuration have checked in. **Import**



— Manage —

Overview

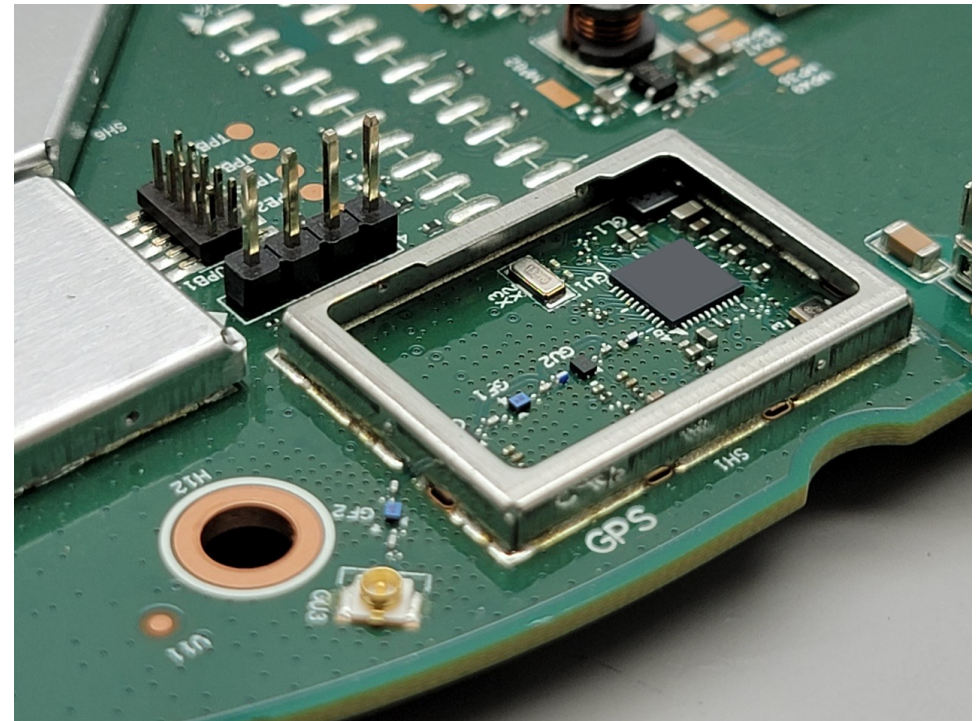
- Devices
- Clients
- Applications
- Security
- Guests
- Analyze
  - Alerts & Events
  - Live Events
  - Tools
  - Reports
- Maintain
  - Firmware



⚠️ 3 Device(s) with existing configuration have checked in. **Import**

# 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

GPS RECEIVER



new



FINE TIME MEASUREMENT

650 Series

630 Series

550 Series

530 Series

510 Series

500 Series

500H Series



# 智慧校園網路 Aruba ESP Architecture

AI-powered Innovations for the Edge





# Building Environments for **Student Success**

## ARUBA ESP **ARCHITECTURE**



CONFIDENTIAL



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# 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



CLEARPASS  
ACCESS  
MANAGEMENT

### UNDERLAY

#### CONNECTIVITY



Wi-Fi6



ARUBA CX



GATEWAY



# Edge Services Platform ARCHITECTURE

## CONVERT EDGE DATA INTO BUSINESS OUTCOMES



REMOTE



BRANCH OFFICE



CLOUD



CAMPUS



DATA CENTER

**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**

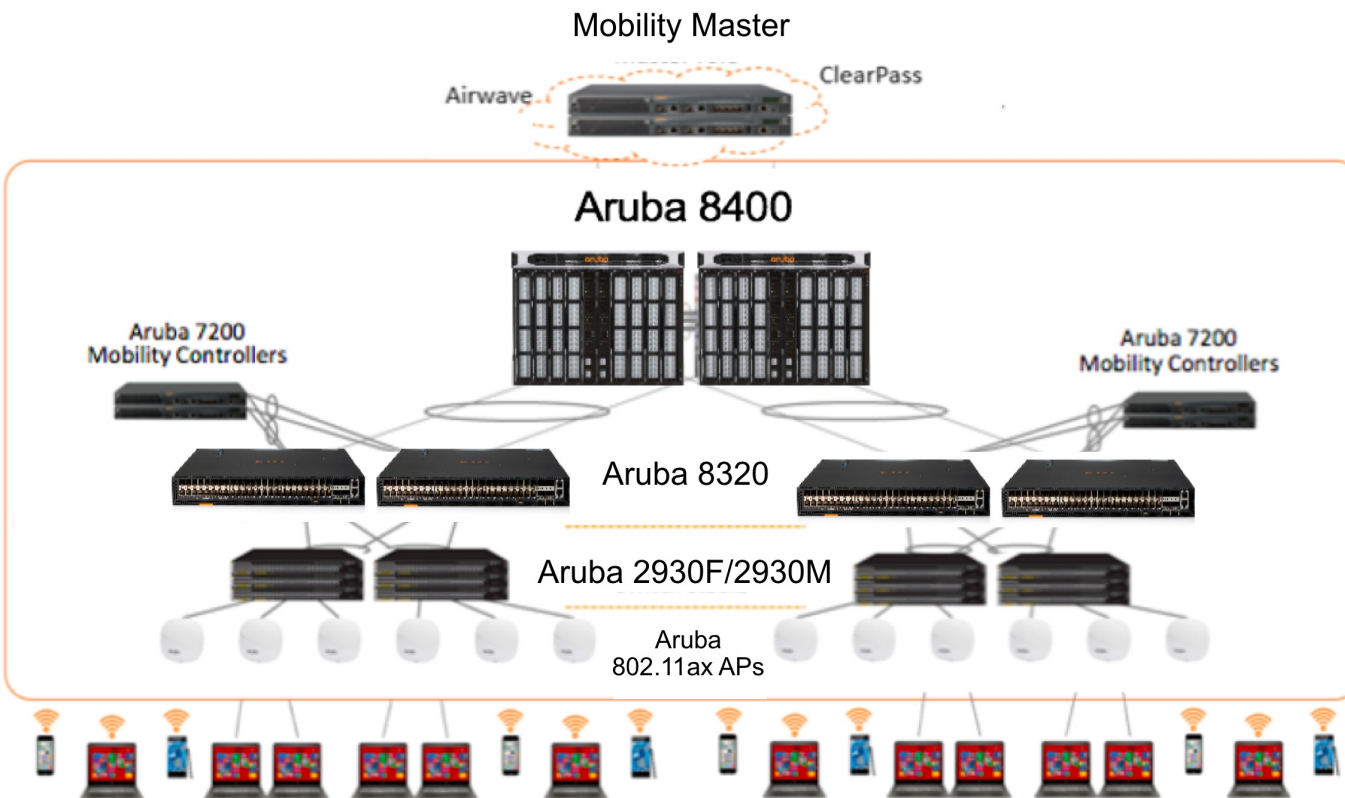
**Network-as-a-Service**





# Aruba Edge Services Platform Architecture

On Premise

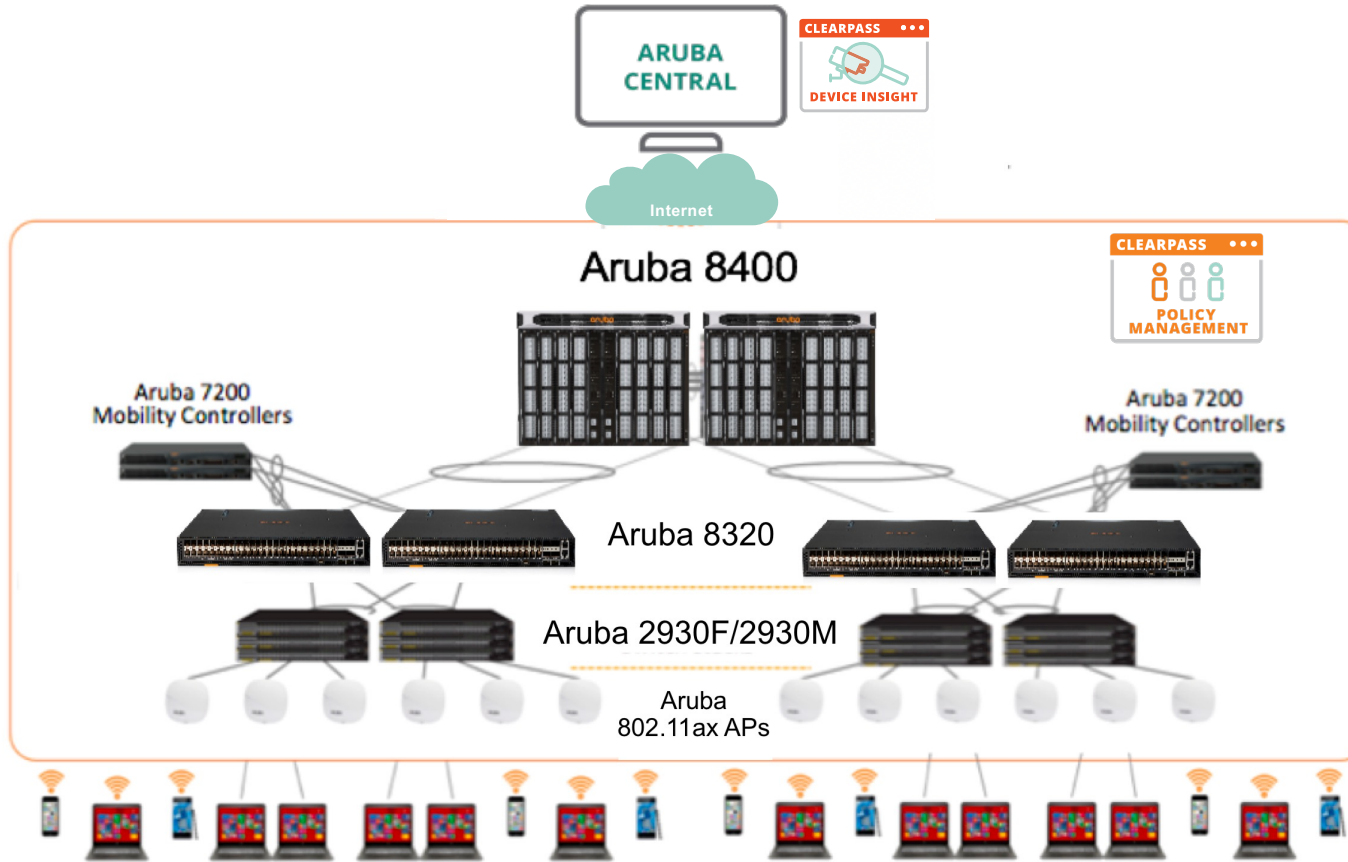


- Assured User Experience
- Optimized for Mobile Apps
- App, Device, User Aware
- Unified Policy Enforcement





# 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

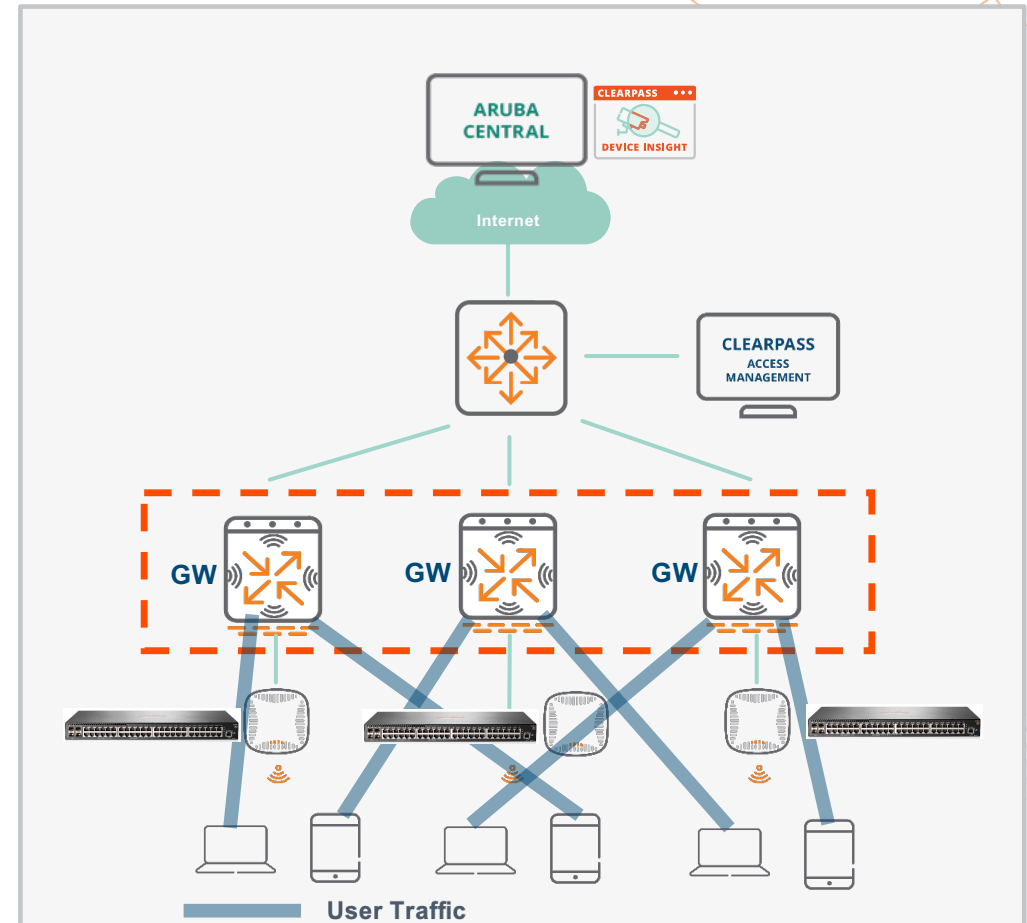
### Client Load Balancing

Users automatically load balanced across cluster members

4

### AP Load Balancing

APs are automatically load balanced across cluster members





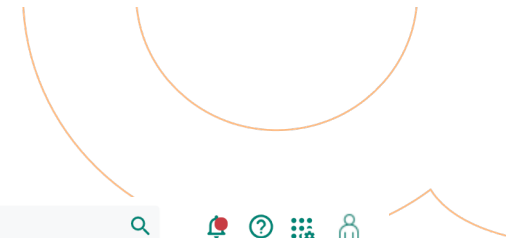
# Unified Infrastructure

Aruba Central: Single Pane of Glass

aruba

a Hewlett Packard  
Enterprise company

# Network Health at all Sites



aruba Central

Search or ask Aruba

Global

Network Health | WAN Health | Summary | Wi-Fi Connectivity | AI Insights

Summary | List

— Manage —

Overview

- Devices
- Clients
- Guests
- Applications
- Security
- Network Services

— Analyze —

- Alerts & Events
- Audit Trail
- Tools
- Reports

— Maintain —

- Firmware
- Organization

NO ISSUES POTENTIAL ISSUES

Number of devices

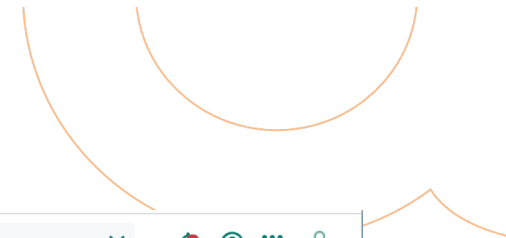
Site Name	AI Insights			Status		High Mem	High CPU Usage	High CH utilization		Clients		High Noise	
	HIGH	MEDIUM	LOW	UP	DOWN			2.4 GHz	5 GHz	CONNECTED	FAILED	2.4 GHz	5 GHz
Jason-MY-Site	0	0	0	1	1	0	0	0	0	0	0	0	0
John-TW-Site	0	0	0	3	0	0	0	0	0	0	0	0	0
kent-TW-S...e-Branch	3	1	0	3	0	0	0	0	0	6	0	0	0
kent-TW-Site-HGW	0	0	0	1	0	0	0	0	0	0	0	0	0
Kevin-MY-Site	1	0	0	3	0	0	0	0	0	1	0	0	0
Kritsada-TH-Site	1	0	0	2	0	0	0	0	0	3	0	0	0
KSGoh-SG-Site	0	0	0	0	2	0	0	0	0	0	0	0	0
Ktwee-SG-Site	0	0	0	3	0	0	0	0	0	1	0	0	0
Methee-TH-Site	0	0	0	0	0	0	0	0	0	0	0	0	0
Norasikin...-MY-Site	0	0	0	0	3	0	0	0	0	0	0	0	0
Office-SG	1	0	0	3	0	0	0	0	0	1	1	1	1
Oon-MY-Site	0	0	0	0	3	0	0	0	0	0	0	0	0

43 Sites





# Network Health at all Sites



aruba Central kent

Global Network Health WAN Health Summary Wi-Fi Connectivity AI Insights

Summary List

Manage

Overview

- Devices
- Clients
- Guests
- Applications
- Security
- Network Services

Analyze

- Alerts & Events
- Audit Trail
- Tools
- Reports

Maintain

- Firmware
- Organization

Number of devices

NO ISSUES POTENTIAL ISSUES

Site Name	AI Insights	Status	High Mem	High CPU Usage	High CH utilization	Clients	High Noise
	HIGH   MEDIUM   LOW	UP   DOWN			2.4 GHz   5 GHz	CONNECTED   FAILED	2.4 GHz   5 GHz
KENT-TW-S...E-BRANCH	0 0 1	0 0	3 0	7 0	1 0	0 0	

43 Plotted Site(s)





# Topology View by site

aruba Central

Search: kent

Site Health | Summary | Wi-Fi Connectivity | WAN Health | AI Insights | **Topology** | Floor Plan

Manage: kent-TW-Site\_3

Overlays: **VLANs** | Show Device Names:  |  |  |  |  | Locate Gateways, Controllers, Switches and AP

Overview

- Devices
- Clients
- Applications
- Security
- Guests

Analyze

- Alerts & Events
- Live Events
- Tools
- Reports

Maintain

- Firmware

Network Diagram:

- INET cloud (inet cht)
- Two LTE-BGW devices: kent-TW-...-LTE-BGW and kent-TW-...-LTE-BGW2
- Central switch: S1500-SE
- Two OF-Site3 devices: kent-TW-...-OF-Site3 and kent-TW-...-OF-Site3
- Device: kent-TW-505H



# Application Monitoring and Control (AppRF)

The screenshot displays the Aruba Central interface for Application Monitoring. The main content area shows a table of applications with columns for Application, Category, and Usage. The 'Speedtest' and 'Zoom' rows are highlighted with orange boxes. A time filter dropdown is open on the right, showing options for 3 Hours, 1 Day, 1 Week, 1 Month, and 3 Months.

APPLICATION	CATEGORY	USAGE
HTTPS	Web	194.4 GB
Speedtest	Web	175.7 GB
Microsoft Outlook (Office 365)	exchange_saas	51.7 GB
netflix.com	Streaming	22.2 GB
UDP	Network Service	18.8 GB
YouTube	Streaming	12.8 GB
apple.com	Web	9.5 GB
Akamai Technologies CDN	Web	9.0 GB
Amazon Web Services/Cloudfront CDN	Amazon SAAS	8.8 GB
Microsoft SharePoint Online (Office 365)	sharepoint_onedrive_saas	8.0 GB
Mozilla	Web	6.7 GB
iTunes	Streaming	5.6 GB
Google Generic	Google SAAS	5.4 GB
Zoom	zoom_saas	4.2 GB
Facebook	Social Networking	3.8 GB
Microsoft Office 365	Office365 SAAS	3.7 GB



# Application Monitoring and Control (AppRF)

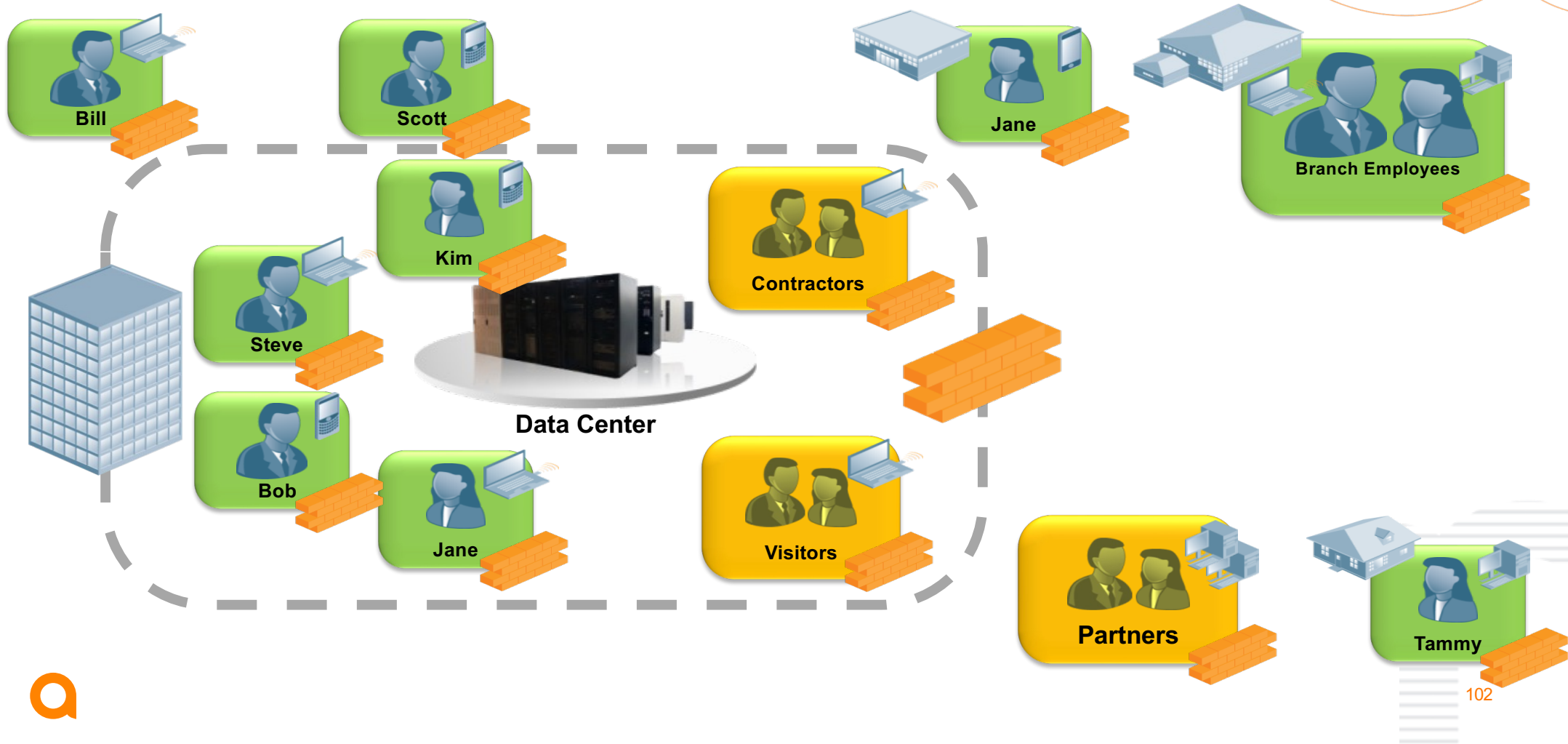
The screenshot displays the Aruba Central web interface for configuring Application Monitoring and Control (AppRF) for a specific role. The interface is organized into several sections:

- Header:** Includes the Aruba Central logo, a search bar, and navigation icons for search, notifications, and user profile.
- Navigation:** A left sidebar contains menu items such as Overview, Devices, Clients, Guests, Applications, Security, Alerts & Events, Audit Trail, Tools, Reports, and Firmware.
- Context:** The top navigation bar shows the selected group type as "Branch Gateway" and the current device as "kent-AOS10-BGW\_3".
- Configuration Area:** The "Security" tab is active, showing various sub-sections like Roles, Policies, and Aliases. The "Roles" section is expanded to show "Per-Application Limits For This Role".
- Table:** A table titled "Per-Application Limits for Role block\_app" is shown, with columns for SCOPE, APP/APP CATEGORY, UPSTREAM, and DOWNSTREAM. The table is currently empty, displaying "No data to display".
- Form:** Below the table, a configuration form is visible. The "Name" field is set to "peer-to-peer" and is highlighted with an orange box. The "Upstream" and "Downstream" fields are both set to "1024" Kbits.

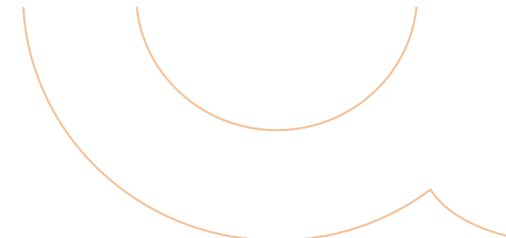


# Context-Aware Policies & Enforcement

## -Stateful Firewall



# Client Visibility



aruba Central AI Search

**kent-TW-Site-Bra...** 3 hours List Summary

— Manage —

- Overview
- Devices
- Clients**
- Applications
- Security
- Guests

— Analyze —

- Alerts & Events
- Live Events
- Tools
- Reports

— Maintain —

- Firmware

**CLIENTS** | ALL 878.76 MB (⊕25.28 MB | ⊖853.48 MB)

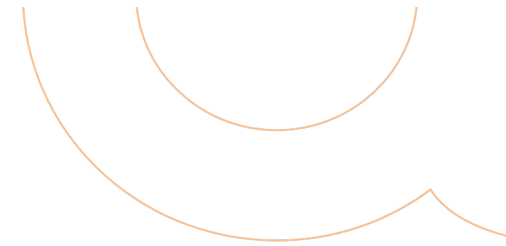
All 7
Connecting 0
**Connected 6**
Failed 0
Offline 1
Blocked 0
Wireless 4
Wired 3
Remote 0

Client Name	Status	IP Address	VL...	Connected To	AP Role	Switch Role	Gateway Role
<b>kent</b>	● Connected	172.16.31.6	1	kent-TW-505H	<b>professor</b>		<b>employee</b>
<b>kent</b>	○ Connected	172.16.31.5	1	kent-TW-505H	smart_device		employee
<b>kent</b>	○ Connected	172.16.31.7	1	kent-TW-505H	smart_device		employee
<b>aruba123</b>	○ Connected	172.16.31.8	1	kent-TW-505H	smart_device		employee
<b>f0:de:f1:be:fb:77</b>	○ Connected	172.16.50.108	50	kent-TW-2930F-12G		*HPE_Windows_U...	computer
<b>9c:20:7b:b4:d4:90</b>	○ Connected	172.16.31.4	1	kent-TW-2930F-12G		*HPE_Apple_TV_D...	apple_tv





# Client Visibility



aruba Central **AI Search** kent

Summary AI Insights Location Sessions Profile

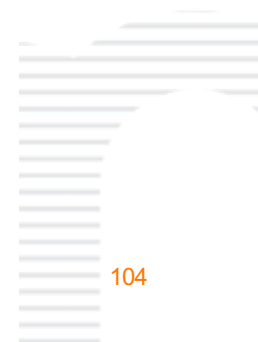
CLIENT DETAILS **Go Live**

DATA PATH

```

    graph LR
      CLIENT[kent CONNECTED] --> SSID[Employee-Bridge UP]
      SSID --> AP[kent-TW-505H UP]
      AP --- SWITCH[kent-TW-2930F-12G UP]
      SWITCH --- GATEWAY[kent-TW-9004-LTE-BG... UP]
  
```

CLIENT		NETWORK		CONNECTION	
USERNAME	kent	VLAN	1	CHANNEL	52 (80 MHz)
HOSTNAME	Kents-MBP	AP ROLE	professor	BAND	5 GHz
CLIENT TYPE	Wireless	GATEWAY ROLE	employee	CLIENT CAPABILITIES	802.11ac
IP ADDRESS	172.16.31.6	SEGMENTATION	--	CLIENT MAX SPEED	1.30 Gbps
MAC ADDRESS	14:7d:da:4b:f8:f7	AUTH SERVER	172.16.0.174	LEDs on ACCESS POINT (kent-TW-505H)	●●● Blink LEDs
GLOBAL UNICAST IPV6 ADDRESS	--	DHCP SERVER	172.16.31.1		
LINK LOCAL IPV6 ADDRESS	fe80::452:cf4c:cd7a:4...	TUNNELED	--		
CLIENT CATEGORY	Computer				
CLIENT FAMILY	Apple Mac				
CLIENT OS	Mac OS				
CONNECTED SINCE	Jul 15, 2021, 08:24:22				
MANUFACTURER	Apple, Inc.				
ENCRYPTION	AES				
AI INSIGHTS	0 0 0				



# Client Visibility - Application

aruba Central kent

Visibility UCC AirGroup

1 week List Summary

Manage

- Overview
- Applications**
- Security

Analyze

- Live Events
- Events
- Tools

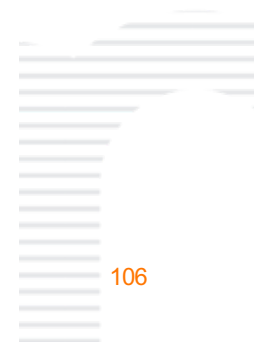
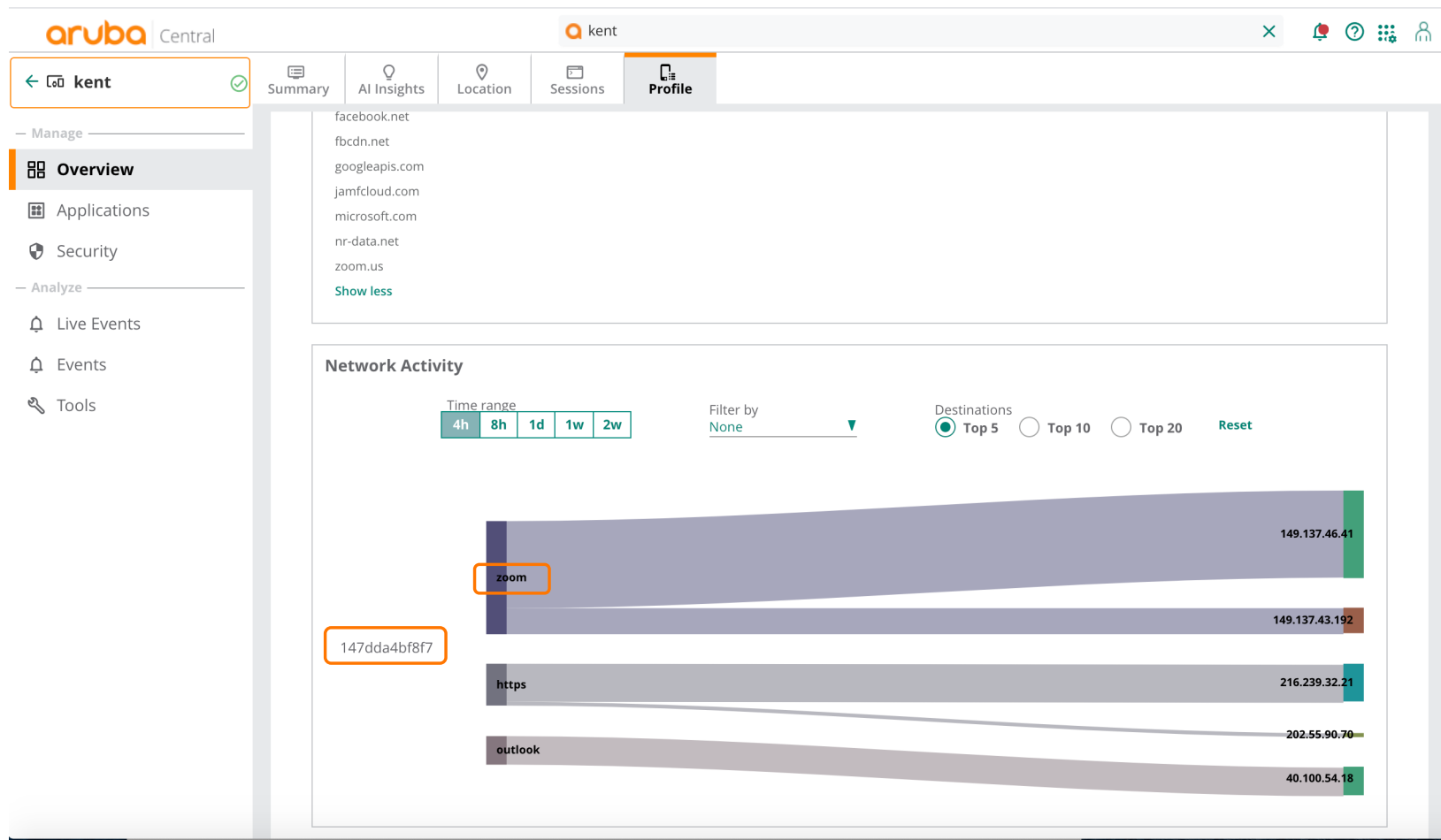
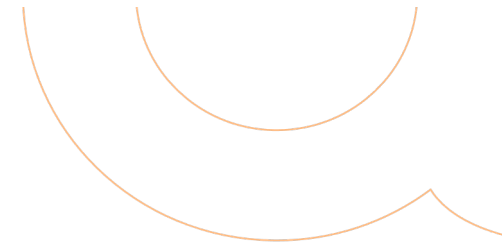
**APPLICATIONS**  
Passive Monitoring

Total Transferred: 9.1 GB

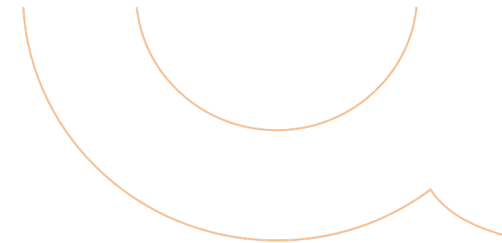
	APPLICATION		CATEGORY		USAGE	
>	HTTPS		Web		2.6 GB	
>	Skype		Instant Messaging		816.3 MB	
>	<b>Zoom</b>		<b>zoom_saas</b>		<b>762.4 MB</b>	
>	Microsoft Outlook (Office 365)		exchange_saas		492.0 MB	
>	Speedtest		Web		261.3 MB	
>	Microsoft Office 365		Office365 SAAS		250.0 MB	
>	Dropbox		Dropbox SAAS		182.7 MB	
>	SSL		Encrypted		152.6 MB	
>	UDP		Network Service		121.0 MB	
>	Microsoft teams		Skype_Teams_SAAS		90.9 MB	
>	Apple Location		Web		63.8 MB	
>	Microsoft		Office365 SAAS		58.0 MB	
>	Amazon Web Services/Cloudfront CDN		Amazon SAAS		55.0 MB	
>	Google Generic		Google SAAS		25.2 MB	
>	Microsoft SharePoint Online (Office 365)		sharepoint_onedrive_saas		24.1 MB	
>	iCloud (Apple)		Mobile App Store		22.7 MB	



# Client Visibility - CPDI



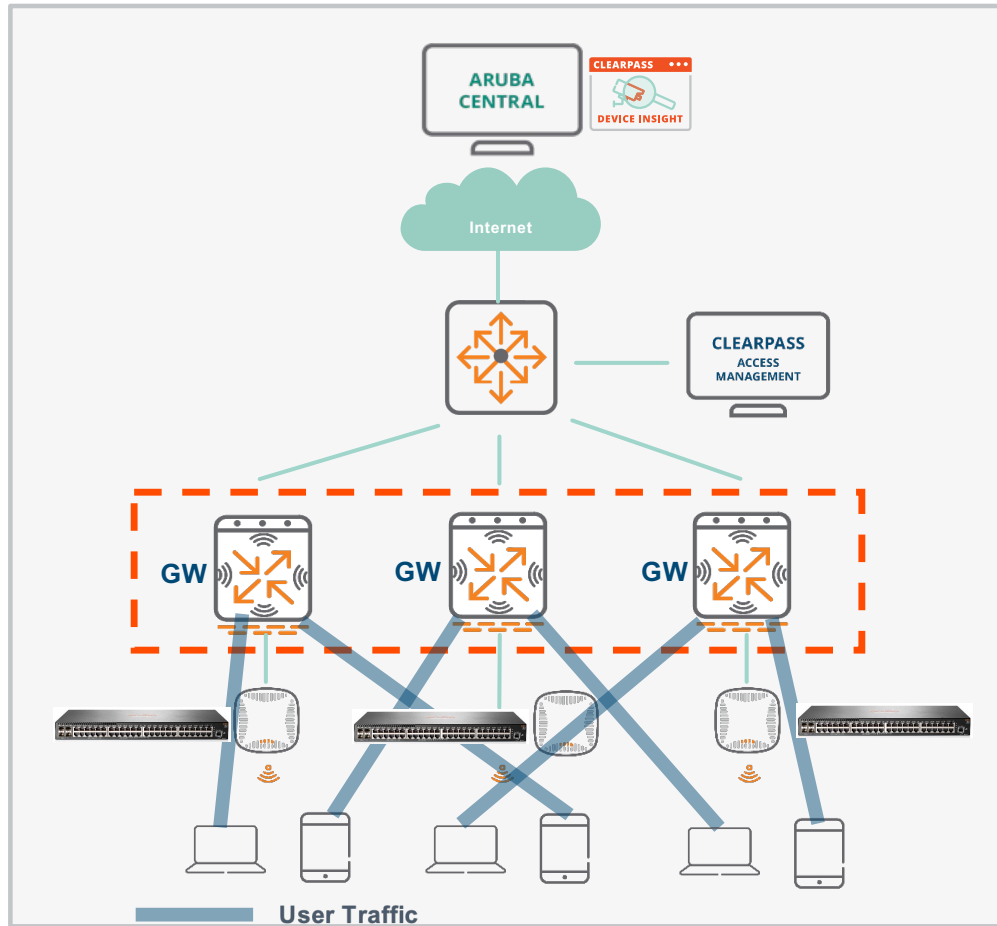
# Client Visibility - CPDI



The screenshot displays the Aruba Central interface for a client named 'kent'. The breadcrumb navigation shows 'kent' with a checkmark. The main navigation bar includes 'Summary', 'AI Insights', 'Location', 'Sessions', and 'Profile' (which is selected). The client's category is 'Computer', with sub-categories 'Family Apple Mac' and 'OS Mac OS' highlighted. Tags include '[Computers & Servers]' and '[Library Update Transition]'. The 'Classification' section shows it is classified by a 'System Rule' with conditions: 'DHCP Option55' equals '1,121,3,6,15,119,252,95,44,46'. The 'Static Attributes' section is expanded to show DHCP details: Option12 is 'Kents-MBP', Option54 is '172.16.31.6', Option55 is '1,121,3,6,15,119,252,95,44,46', Options are '53,55,57,61,50,51,12', and Transaction\_id is '3007839032'. Under 'MAC OUI', the value is '147dda'. Under 'User Agent', the value is 'McAfee Agent'.



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





# Wired Client Visibility

aruba Central kent

Client Name Status IP Address VLAN Connected To AP Role Switch Role Gateway

Client Name	Status	IP Address	VLAN	Connected To	AP Role	Switch Role	Gateway
aruba123	Connected	172.16.31.12	1	kent-TW-505H	employee		employee
kent	Connected	172.16.31.11	1	kent-TW-505H	employee		employee
kent	Connected	172.16.31.5	1	kent-TW-505H	smart_device		employee
aruba123	Connected	172.16.31.17	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

109

# Wired Client Visibility

The screenshot displays the Aruba Central interface for a specific client. The breadcrumb navigation shows the client's MAC address, `f0def1befb77`. The main content area is titled "CLIENT DETAILS" and features a "DATA PATH" diagram and two summary panels: "CLIENT" and "NETWORK".

**DATA PATH:** A diagram showing the connection path from the CLIENT to the SWITCH and then to the GATEWAY. The CLIENT is identified by MAC address `f0:de:f1:be:fb:77` and is in a "CONNECTED" state. The SWITCH is `kent-TW-6300F` and is "UP". The GATEWAY is `kent-TW-9004-LTE-BGW` and is also "UP".

**CLIENT Summary:**

CLIENT	
USERNAME	<code>f0def1befb77</code>
HOSTNAME	--
CLIENT TYPE	Wired
IP ADDRESS	<code>172.16.50.101</code>
MAC ADDRESS	<code>f0:de:f1:be:fb:77</code>
CLIENT CATEGORY	Computer
CLIENT FAMILY	Windows
CLIENT OS	Windows
CONNECTED SINCE	Nov 02, 2021, 23:05:11
MANUFACTURER	Wistron Infocomm (Zhongshan) Corp...

**NETWORK Summary:**

NETWORK	
VLAN	50
GATEWAY ROLE	computer_ubt
SWITCH ROLE	CX_Windows_UBT20...
SEGMENTATION	UBT
TUNNELED	Yes
TUNNELED ID	12
PORT	1/1/5



# Wired Client Visibility - Application



aruba Central kent

← f0def1befb77 1 week List Summary

Visibility AirGroup

Applications Websites

Manage

- Overview
- Applications**
- Security

Analyze

- Live Events
- Events
- Tools

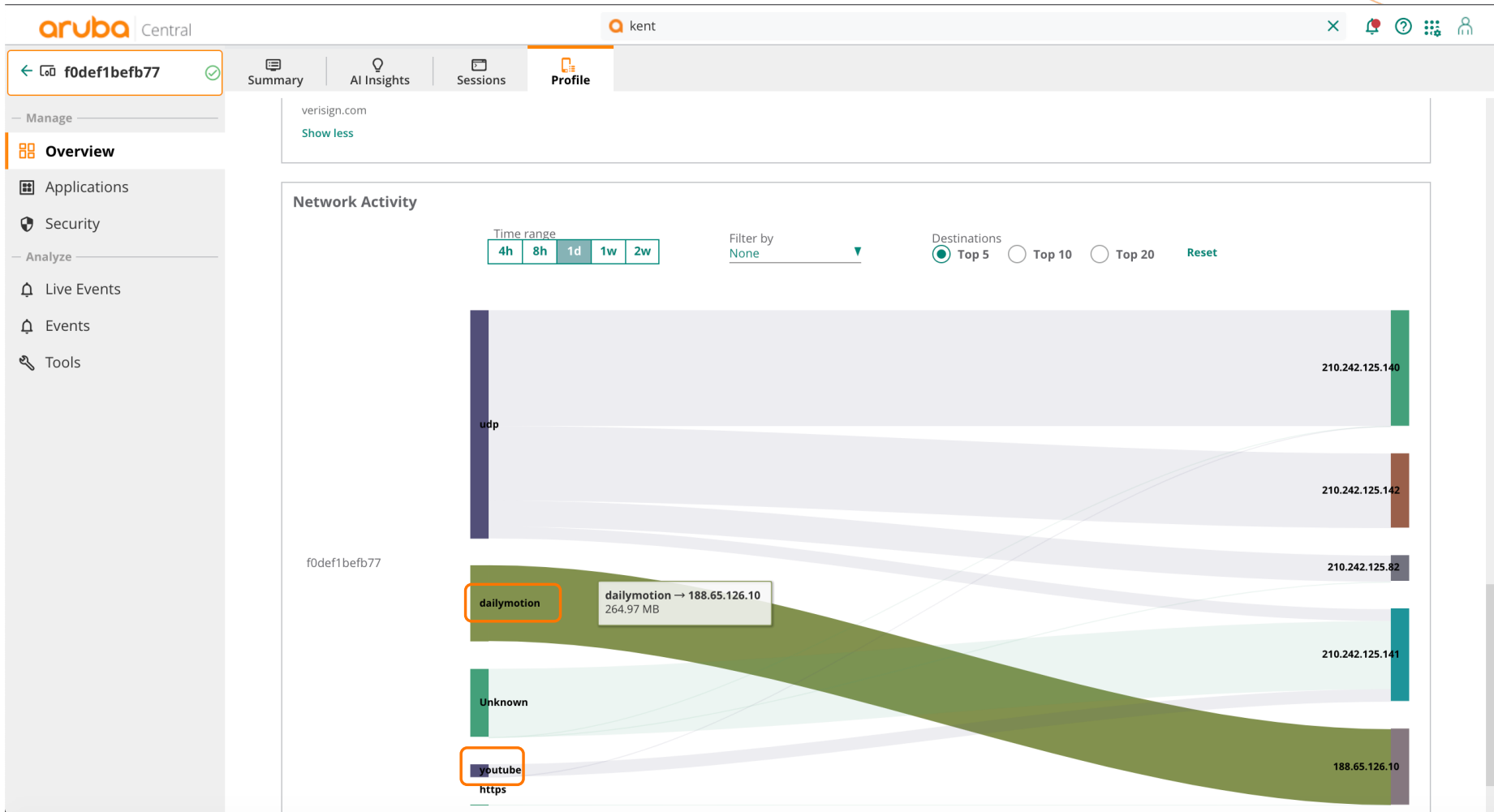
**APPLICATIONS**  
Passive Monitoring

Total Transferred: 6.7 GB

	APPLICATION		CATEGORY		USAGE	
>	UDP		Network Service		5.8 GB	
>	<b>dailymotion.com</b>		<b>Web</b>		<b>305.1 MB</b>	
>	YouTube		Streaming		93.8 MB	
>	Google Generic		Google SAAS		41.4 MB	
>	Mozilla		Web		13.3 MB	
>	HTTPS		Web		6.6 MB	
>	Server Message Block		Network Service		2.6 MB	
>	Google Ads		Google SAAS		977 KB	
>	Microsoft		Office365 SAAS		770 KB	
>	Amazon Web Services/Cloudfront CDN		Amazon SAAS		562 KB	
>	yahoo.com		Web		358 KB	
>	Amazon Generic Services		Amazon SAAS		350 KB	
>	Netbios Name Service		Network Service		155 KB	
>	Adobe		Adobe SAAS		130 KB	
>	HTTP		Web		92 KB	
>	Akamai Technologies CDN		Web		86 KB	
>	Facebook		Social Networking		50 KB	
>	Adobe Flash Plugin Update		Adobe SAAS		44 KB	
>	Microsoft SpyNet (aka Microsoft Active Protection Service)		Office365 SAAS		36 KB	



# Wired Client Visibility - CPDI



# Wired Client Visibility - CPDI

The screenshot displays the Aruba Central interface for a client profile. The client's MAC address, `f0def1befb77`, is highlighted in the search bar. The interface is divided into several sections:

- Navigation:** A sidebar on the left contains 'Overview', 'Applications', 'Security', 'Analyze', 'Live Events', 'Events', and 'Tools'.
- Top Bar:** Includes the Aruba Central logo, a search bar with the client ID, and tabs for 'Summary', 'AI Insights', 'Sessions', and 'Profile'.
- Client Identification:** A box shows the client's 'Category' as 'Computer', 'Family' as 'Windows', and 'OS' as 'Windows'. It also lists tags: 'Dailymotion', '[Computers & Servers]', and '[Library Update Transition]'. An 'Actions' button is present.
- Classification:** A section titled 'Classification' indicates it is 'Classified by System Rule'. Below this is a table of conditions:

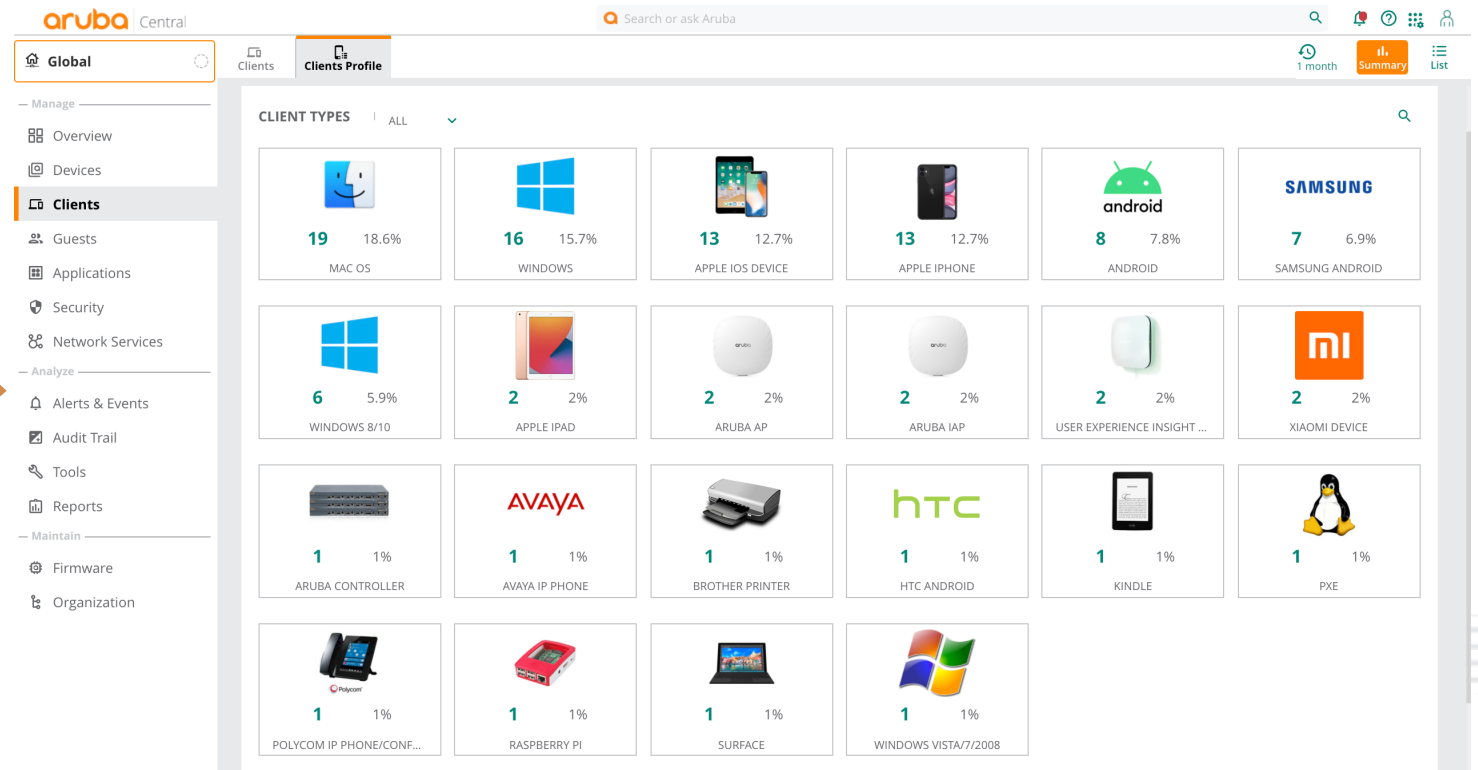
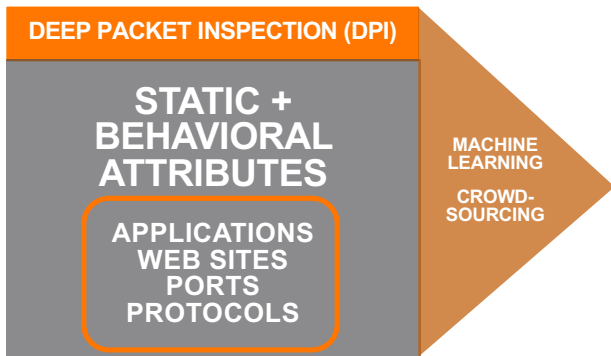
Fingerprint Attribute	Operator	Value
User Agent	Equals	LiveUpdateEngine-1.7.0.16 LUE/1.7.0.16 (Windows;6.1;SP1.0;X64;CHT)

- Static Attributes:** A section titled 'Static Attributes' with expand/collapse options. It lists DHCP options (Option55, Option60, Options) and the MAC OUI (`f0def1`).
- User Agent:** A list of user agent strings including 'Adobe Flash Player', 'Get Flash Player version xml/1.0', 'Google Update/1.3.36.102;winhttp', 'LiveUpdateEngine-1.7.0.16 LUE/1.7.0.16 (Windows;6.1;SP1.0;X64;CHT)', 'Microsoft BITS/7.5', 'Microsoft NCSI', 'Microsoft-CryptoAPI/6.1', and 'Mozilla/5.0 (Windows NT 6.1; Win64; x64; rv:90.0) Gecko/20100101 Firefox/90.0'.





# ClearPass Device Insight (CPDI) IoT Discovered and Profiled



# IoT Devices

aruba Central kent

**Clients** 1 week **List** Summary

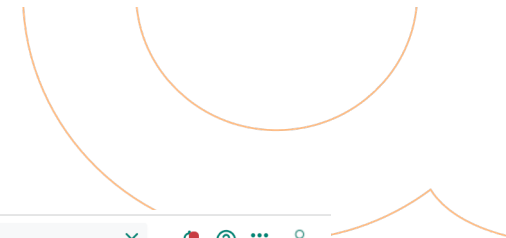
CLIENTS | ALL | 139.78 GB (52.31 GB | 87.47 GB)

All 21 | Connecting 0 | **Connected 6** | Failed 2 | Offline 13 | Blocked 0 | Wireless 13 | Wired 8 | Remote 0

Client Name	Status	IP Address	VLAN	Connected To	AP Role	Switch Role	Gateway
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



The screenshot displays the Aruba Central interface for a specific device (ID: 9c207bb4d490). The interface is divided into several sections:

- Header:** Shows the Aruba Central logo, the user 'kent', and navigation icons for home, notifications, settings, and user profile.
- Navigation:** A sidebar on the left contains menu items: Overview (selected), Applications, Security, Analyze, Live Events, Events, and Tools.
- Summary:** A top navigation bar with tabs for Summary, AI Insights, Sessions, and Profile.
- Destination Hosts:** A list of hosts connected to the device, with 'apple.com' and its various subdomains highlighted by an orange box. The list includes:
  - apple.com
  - apple.com/assets/com\_apple\_MobileAsset\_AppleKeyServicesCRL
  - apple.com/assets/com\_apple\_MobileAsset\_PKITrustServices\_PK
  - apple.com/bag
  - apple.com/ocsp03-apevrsa2g101/MFYwVKADAgEAME0wSzBJMAkGB5s
  - arubanetworks.com
  - brightcloud.com
  - com/configurations/pep/pipeline/pipeline0.h
  - digicert.com/MFYwVKADAgEAME0wSzBJMAkGB5sOAwiaBQAEFN%2BqEuM
  - mzstatic.com
- Ports:** Shows '0' ports.
- Network Activity:** A horizontal bar chart showing traffic volume over time for various destinations. The chart is filtered for 'Top 5' destinations. The data points are:
  - 17.252.194.199 (highest volume)
  - apple-location (highlighted with an orange box)
  - 17.167.200.99
  - dns (224.0.0.251)
  - ssl (172.16.0.174 and 17.57.145.24)



# Wired IoT Devices - CPDI

aruba Central kent

← 9c207bb4d490 ✓

Summary AI Insights Sessions Profile

Category: Home Audio/Video Equipment Family: Apple OS: Apple TV Tags: [Audio & Video] Actions

### Classification

Classified by System Rule

Conditions

Fingerprint Attribute	Operator	Value
User Agent	Equals	AppleTV3,1/8.4.4 (12H923)
MAC Vendor	Contains	apple
DHCP Option55	Contains	1,3,6,15,119,252
User Agent	Contains	appletv

### Static Attributes

Expand All | Collapse All

#### DHCP

Option12	Apple-TV
Option54	172.16.31.7
Option55	1,3,6,15,119,252

Show 2 more

#### MAC OUI

9c207b

#### User Agent

Absinthe/2.0 iOS Device Activator (MobileActivation-66.20.3 built on Jan 29 2021 at 22:53:00)

AppleTV3,1/8.4.4 (12H923)

MobileAsset/1.1

securityd (unknown version) CFNetwork/711.5.6 Darwin/14.0.0



# ClearPass Profiling

- Device is known and has been profiled
- Assign Role
- Enforce Access controls

Endpoint	Attributes	Fingerprints	
MAC Address	f0def1befb77	IP Address	172.16.14.233
Description		Static IP	FALSE
Status	<input checked="" type="radio"/> Known client <input type="radio"/> Unknown client <input type="radio"/> Disabled client	Hostname	kent-oa
MAC Vendor	Wistron Infocomm (Zhongshan) Corporation	Device Category	Computer
Added by	Policy Manager	Device OS Family	Windows
Online Status	<input checked="" type="radio"/> Offline	Device Name	Windows Vista/7/2008
Connection Type	Wired	Added At	Jun 29, 2017 21:47:54 CST
Switch IP	172.16.0.193	Updated At	Oct 03, 2017 18:42:14 CST
Switch Port	gigabitethernet0/0/0		

Endpoint	Attributes	Fingerprints
Endpoint Fingerprint Details		
DHCP Option60:	MSFT 5.0	
DHCP Options:	53,61,12,60,55	
DHCP Option55:	1,15,3,6,44,46,47,31,33,121,249,43	





# ClearPass Profiling

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

Endpoint	Attributes	Fingerprints
<b>Endpoint Fingerprint Details</b>		
DHCP Option60:	Linux 2.4.20-uc0 armv3l	
DHCP Options:	53,57,50,51,55,12,60,61	
DHCP Option55:	1,3,6,12,15,17,23,28,29,31,33,40,41,42	

**Edit Endpoint**

Endpoint	Attributes	Fingerprints	
MAC Address	00626e5509a4	IP Address	192.168.1.13
Description		Static IP	FALSE
Status	<input type="radio"/> Known client <input checked="" type="radio"/> Unknown client <input type="radio"/> Disabled client	Hostname	ipcam_00626e5509a4
MAC Vendor		Device Category	Computer
Added by	Policy Manager	Device OS Family	Linux
Online Status	Not Available	Device Name	Gentoo
Connection Type	Unknown	Added At	Nov 28, 2016 22:58:52 UTC
		Updated At	Feb 03, 2017 02:08:47 UTC

Save Cancel



# Dynamic Segmentation - CoA (Change of Authorization)

aruba Central AI Search

kent-TW-Site\_3 ⚠

Manage

- Overview
- Devices
- Clients**
- Applications
- Security
- Guests

Analyze

- Alerts & Events
- Live Events
- Tools
- Reports

Maintain

- Firmware

1 week List Summary

40.44 GB (⊕ 7.51 GB | ⊖ 32.93 GB)

CLIENTS | ALL | ↕ | ↻

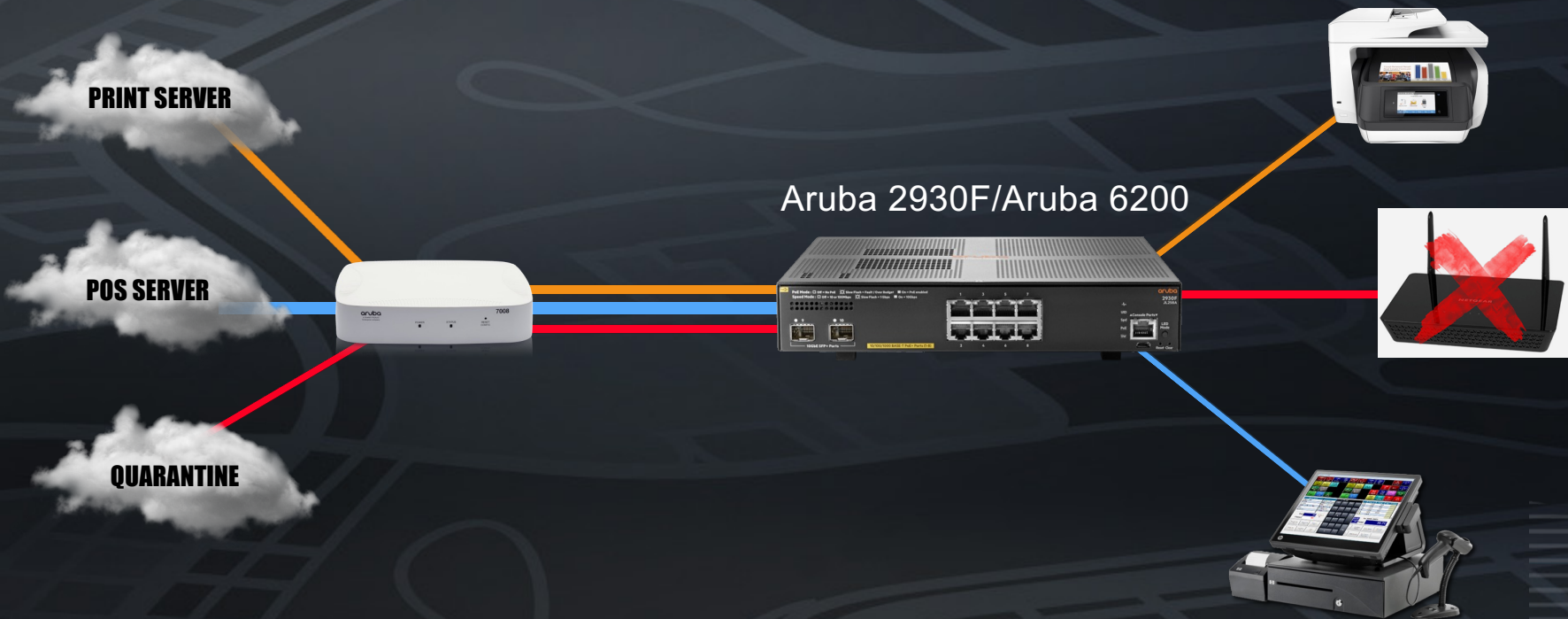
All	Connecting	<b>Connected</b>	Failed	Offline	Blocked	Wireless	Wired	Remote
21	0	10	0	11	0	11	10	0

Client Name	Status	IP Address	VLAN	Connected To	AP Role	Switch Role	Gateway Role	Health
kent	Connected	172.16.13.185	1	kent-TW-505H	employee		NA	Good
aruba123	Connected	172.16.13.244	1	kent-TW-505H	smart_device		NA	Good
kent	Connected	172.16.13.247	1	kent-TW-505H	smart_device		NA	Good
kent	Connected	172.16.13.240	1	kent-TW-505H	block_app		NA	Good
J9K-TW-PKA2008A	Connected	172.16.13.205	1	kent-TW-505H	dyson		NA	Good
aruba123	Connected	172.16.13.250	1	kent-TW-505H	employee		NA	Good
kent	Connected	172.16.13.234	1	kent-TW-505H	smart_device		NA	Good
b8:78:26:41:c6:f7	Connected	172.16.13.252	1	kent-TW-505H	game_console		NA	Good
<b>f0:de:f1:be:fb:77</b>	Connected	<b>172.16.50.101</b>	<b>50</b>	<b>kent-TW-2930F-Site3</b>	<b>NA</b>	<b>*HPE_Block_App_Co...</b>	<b>block_app_v50</b>	<b>NA</b>
9c:20:7b:b4:d4:90	Connected	172.16.13.245	1	kent-TW-2930F-Site3	NA	*HPE_Apple_TV_DUR...	NA	NA

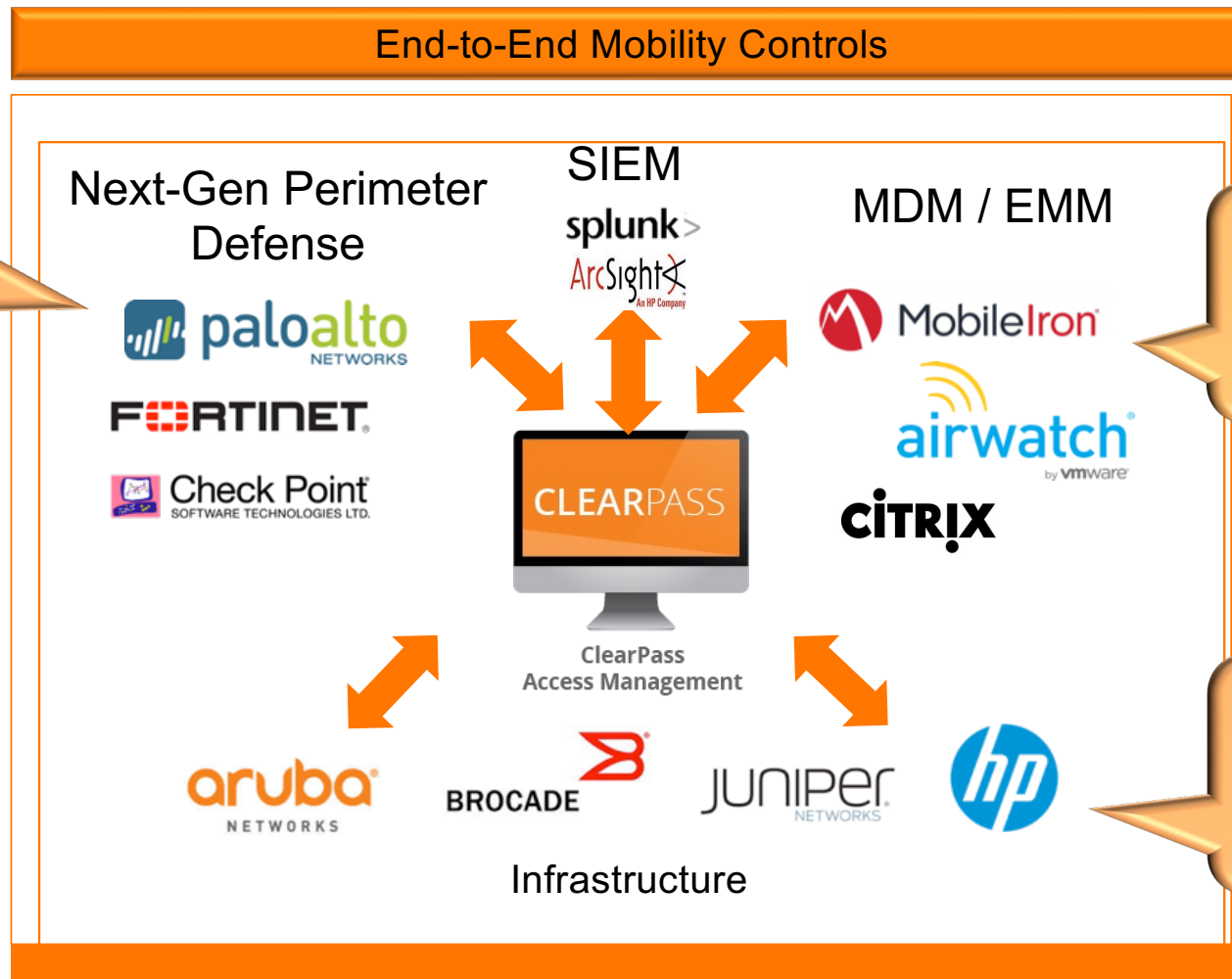


# Secure Everywhere on Wired (using ArubaOS-Switch)

## 全面阻擋 私接 IoT 設備



# Time for New Defense Model – Adaptive Trust



Granular traffic control with user and device data

Network controls using real-time device data

Visibility into location and time with granular controls

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

# Context Stores in ClearPass

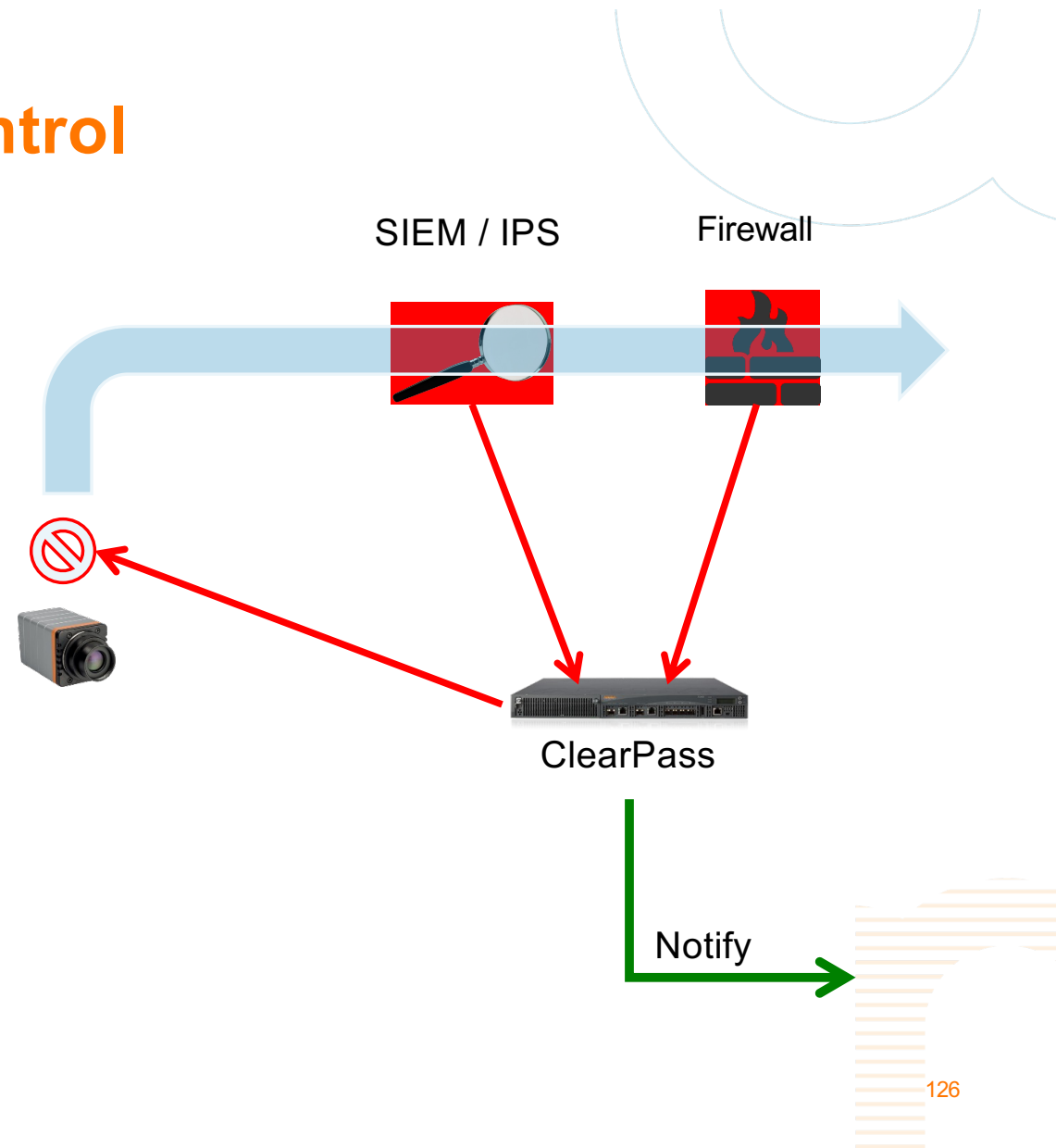
The screenshot shows the 'Edit Endpoint' window in the ClearPass Policy Manager. The window title is 'Edit Endpoint' and it includes a close button. The top navigation bar shows 'aruba NETWORKS', 'ClearPass Policy Manager', and links for 'Support', 'Help', and 'Logout'. The user is identified as 'd-only Administrator'. The left sidebar contains navigation options: Dashboard, Monitoring, Configuration (selected), and Administration. Under Configuration, there are sub-items: Start Here, Services, Authentication (Methods, Sources), Identity (Single Sign-On, Local Users, Endpoints (selected), Static Host List, Roles, Role Mappings), Posture, Enforcement, and Network (Policy Simulation, Profile Settings). The main content area has three tabs: 'EndPoint', 'Attributes' (selected), and 'Policy Cache'. Below the tabs is a table with 23 rows. The 21st row, 'Threat Severity', is highlighted in yellow and circled in red. The table also includes 'Export All', 'Show 10 records', 'Profiled Yes', 'Server Action', and 'Export' buttons on the right side.

EndPoint	Attributes	Policy Cache
8.	Last Known Location	= 10.2.100.20:kwang-AP205
9.	MDM Enabled	= true
10.	MDM Identifier	= 4eec2da6-93dd-49b8-9b58-1980b5409287
11.	Manufacturer	= HTC
12.	Model	= HTC Butterfly s
13.	OS Version	= Android 5.0
14.	Owner	= kwang
15.	Ownership	= Corporate
16.	Phone Number	= 0
17.	Required App	= Installed
18.	Source	= MobileIron
19.	Threat Category	= vulnerability
20.	Threat Name	= share-it
21.	Threat Severity	= High
22.	Threat Status	= Unresolved
23.	Click to add...	



# Continuing Visibility & Control

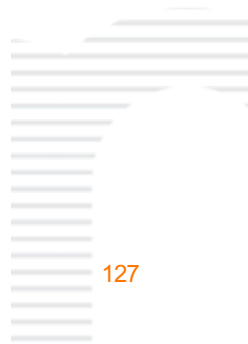
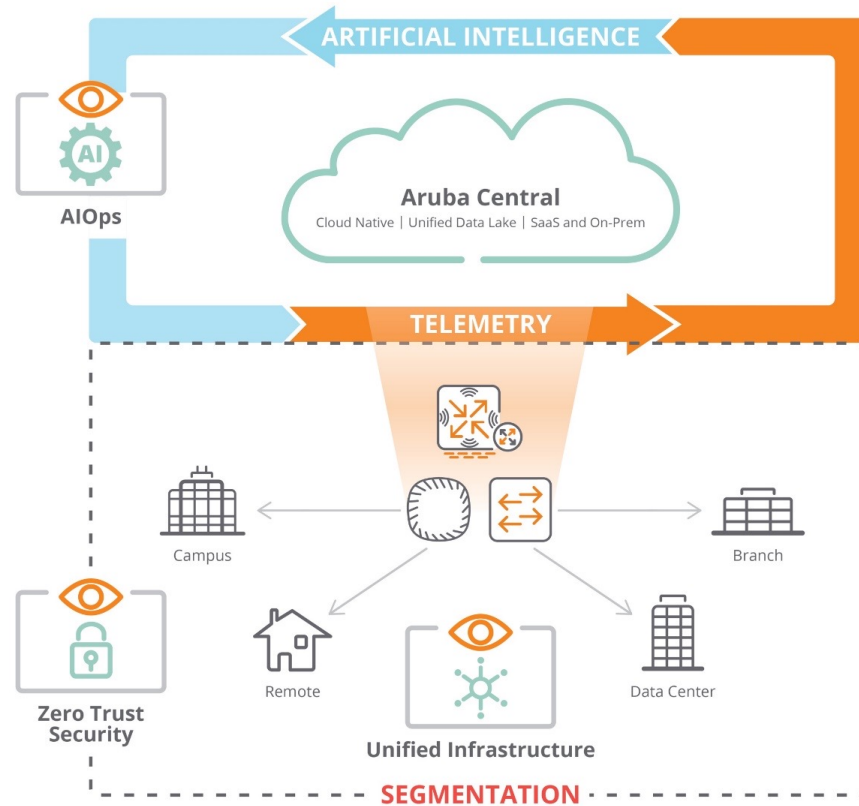
- Input from Threat monitoring / detection device triggers action
  - Quarantine device
  - Restrict access
  - Restrict bandwidth
- Alert Net Management / Security
  - Text
  - Phone
  - Email
  - Pager





# Aruba Edge Services Platform - AIOps

Automating and Protecting the Intelligent Edge



# CONTINUOUSLY MONITOR AND OPTIMIZE

## 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 Confidential. For Internal Use Only.

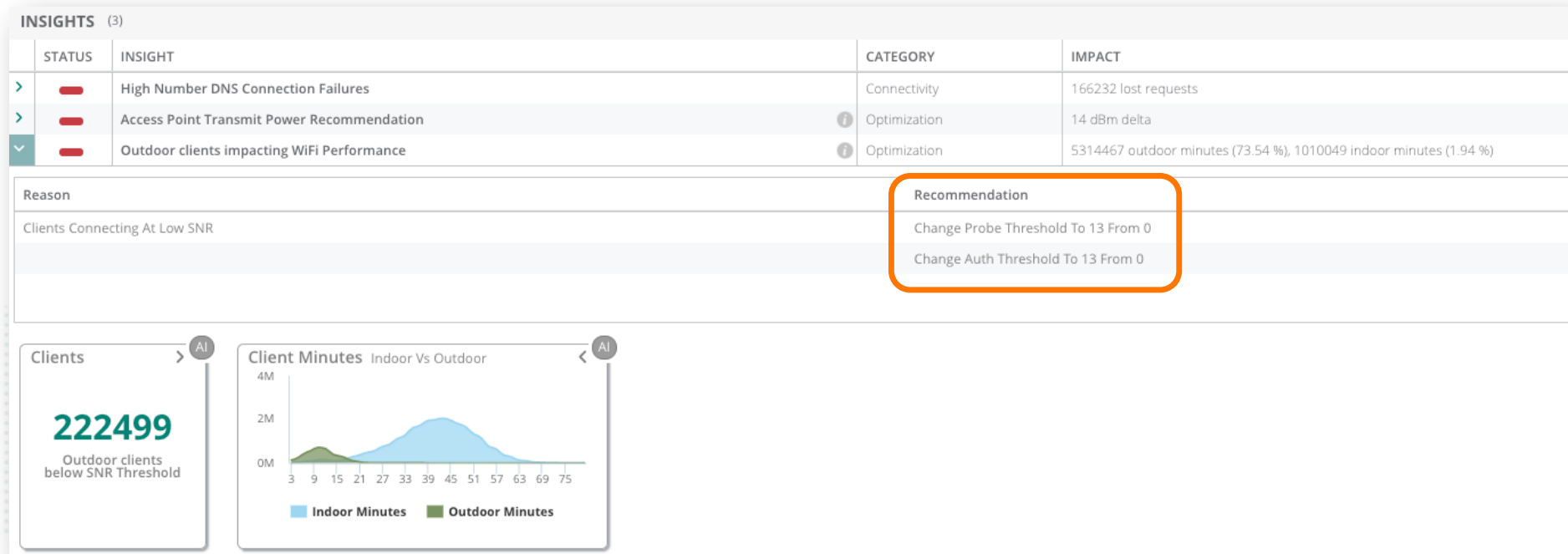


- Global
- Manage
- Overview
- Devices
- Clients
- Guests
- Applications
- Security
- Network Services
- Analyze
- Alerts & Events
- Audit Trail
- Tools
- Reports
- Maintain
- Firmware
- Organization

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
>	🔴	<b>Outdoor Clients Impacting Wi-Fi Performance</b>	Optimization	<b>5314467 Outdoor Minutes (73.54 %), 1010049 Indoor Minutes (1.94 %)</b>
>	🔴	Coverage Hole Detected	Optimization	8986 Client Devices
>	🔴	DHCP Timeout	Connectivity	32 failures

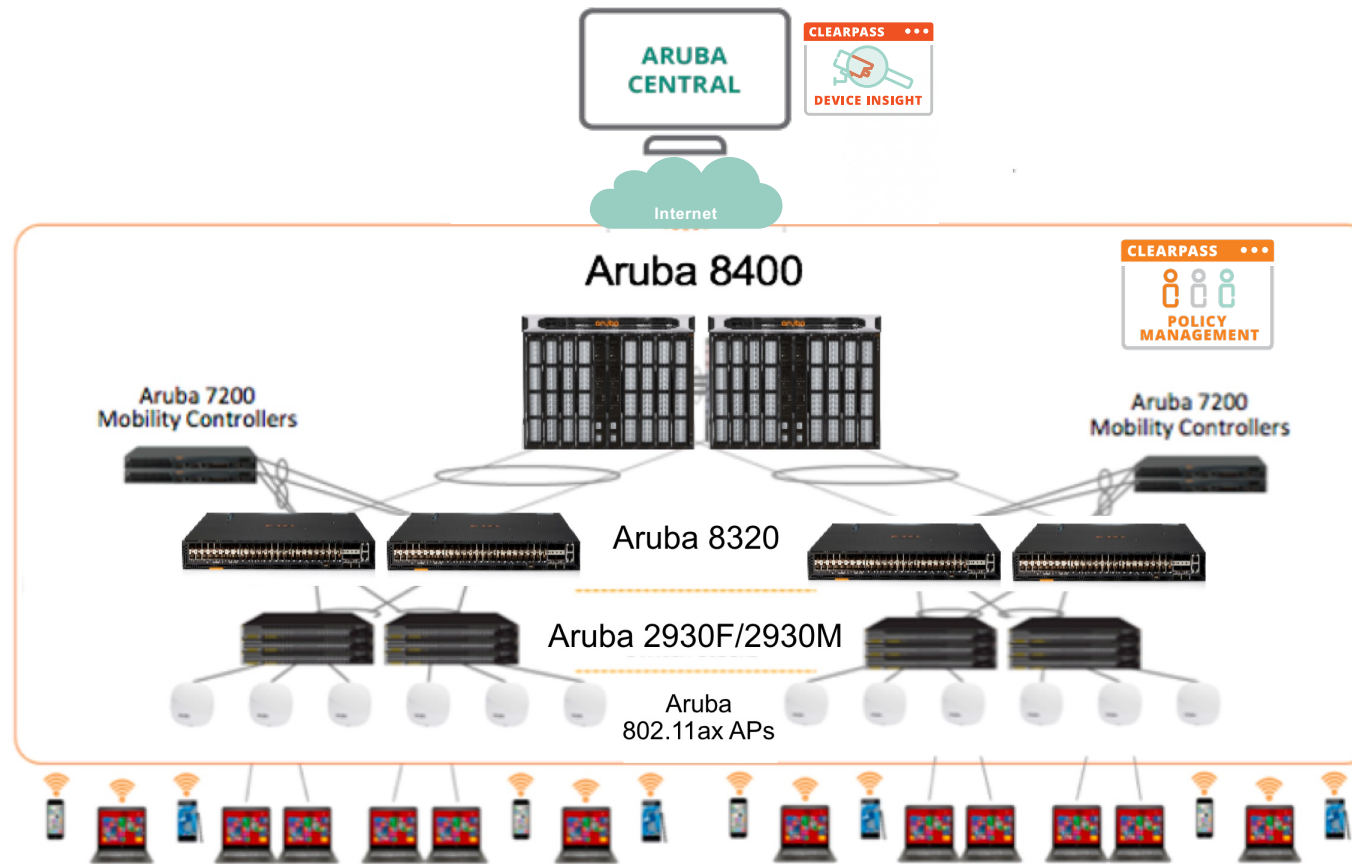
# Outdoor clients impacting Wi-Fi performance



- 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



"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*



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*



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*

"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*



UC SANTA BARBARA



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

29,429

Unique Wi-Fi Users

4.5 TB

Offloaded!





# 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 16<sup>th</sup> Time In The Leaders Quadrant<sup>1</sup>

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

<sup>1</sup> 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).

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a Hewlett Packard  
Enterprise company

**Thank You**