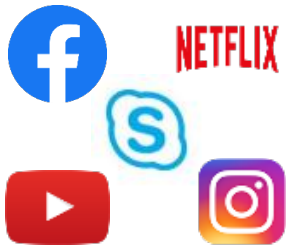
aruba
a Hewlett Packard Enterprise company

安全連線，信心無限
打造Wi-Fi 6 世代的校園智慧網路

Roy Lin

資深技術經理

Today’s environments are changing



DIVERSITY OF APPLICATIONS

GROWTH IN DEVICES

Aruba WLAN with 11ax AP

GROWING USER EXPECTATIONS

IOT CONNECTIVITY

Why WiFi 6 11ax

Buy New Model or …..

Aruba WiFi 6 AP Price

AP315
USD:1045

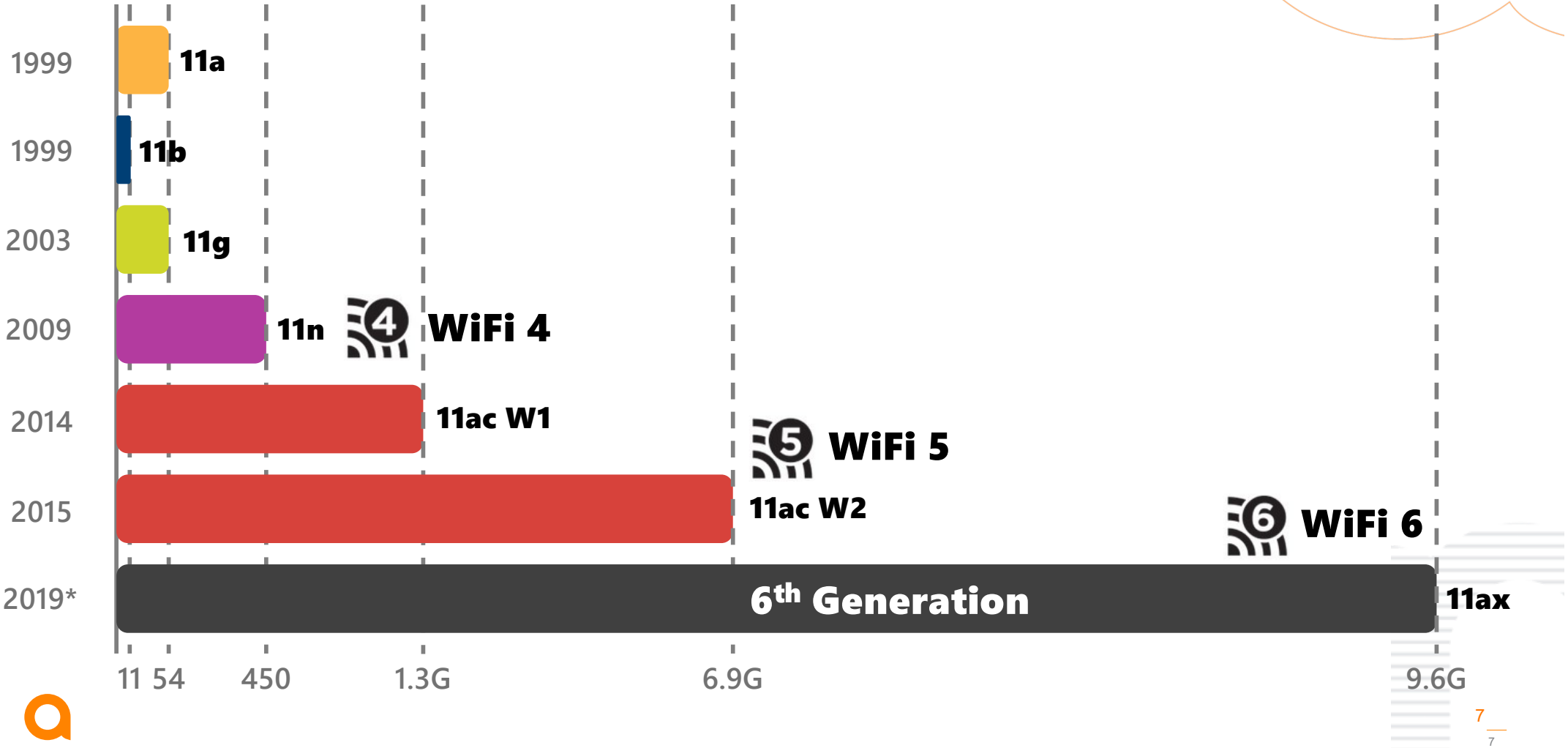
AP515
USD:1095

AP335
USD:1780

AP535
USD:1570

What 11ax improvement compare with 11ac

Evolution of wireless LAN



802.11ax important features – 增強了什麼

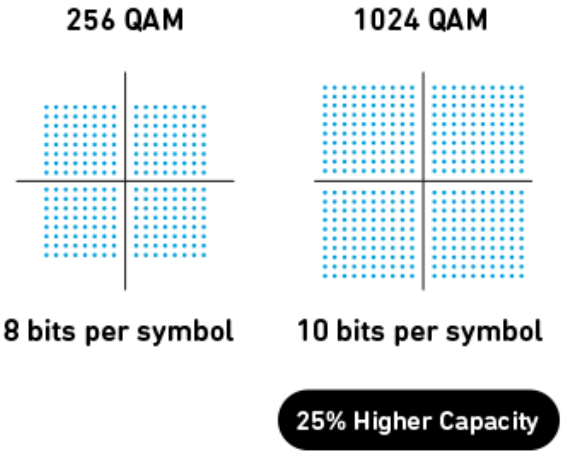
– Increase average throughput per device by at least 4x in a dense deployment

Feature	Benefit	Improvements over 802.11ac**
High-order modulation 1024 QAM	Higher data rates under good conditions	25% over 802.11ac
New OFDM symbol	Increases efficiency by reducing guard interval and pilot tone overhead	20% higher data rates over 802.11ac
OFDMA downlink & uplink	More clients, lower latency. More efficient for low data rates, short packets.	~ 3x system capacity for short packets or many clients
MU-MIMO downlink and uplink for up to 8 clients	More efficient in grouping clients, reducing sounding and ack overhead	~ 2x capacity over 802.11ac
Spatial re-use (BSS color)	Better performance for overlapping, dense APs (beneficial for congested venues)	~ 2x capacity over 802.11ac
Target Wait Time	Extended sleep mode for longer battery life	~ 3-10x battery life
20 MHz – only client option	Simpler, longer-battery-life IoT devices	Lower cost chips
Special preamble for long links	Enhanced outdoor pt-pt distances	~ 2x more range for a given data rate

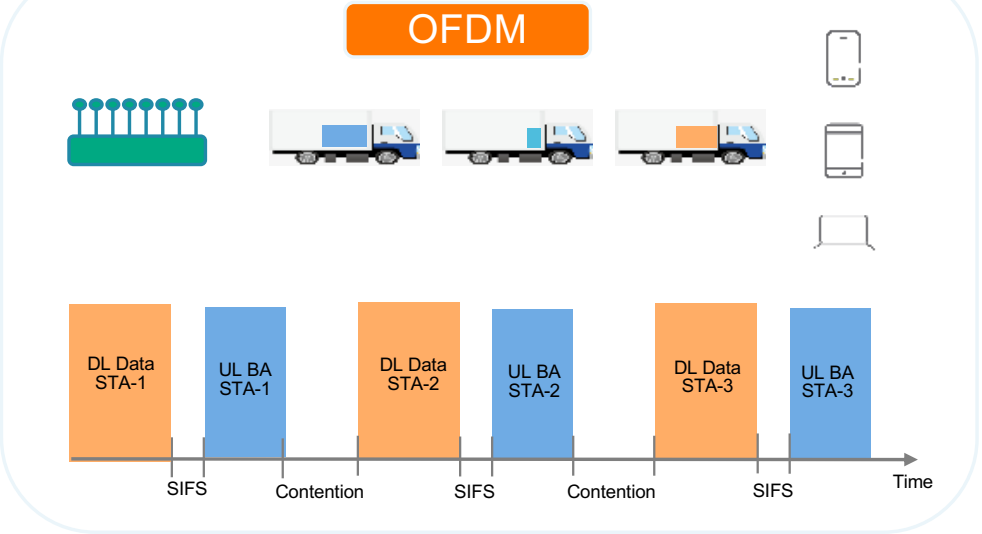
** estimates

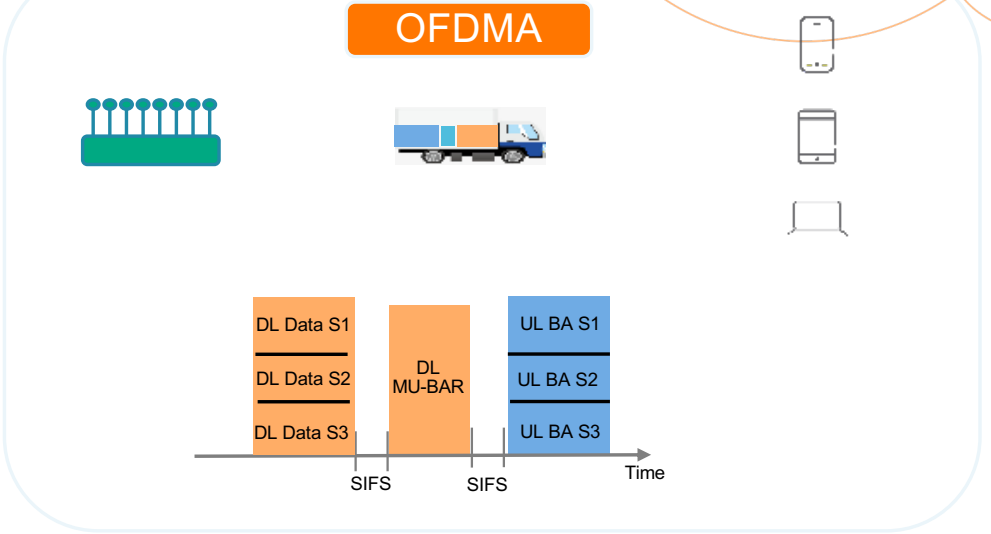
802.11ax Data Rate – improve 25%

	802.11ac	802.11ax
Bands	5GHz	2.4GHz/5GHz
Highest Modulation	256-QAM	1024-QAM
Data Rate	87.6Mbps (20MHz,1SS) 433Mbps (80MHz,1SS) 6933Mbps(160Mhz,8SS) But 1.7Gbps only (4SS)	143.4Mbps (20MHz,1SS) 600.4Mbps (80MHz,1SS) 9607.8Mbps(160Mhz,8SS)



OFDMA vs OFDM





Full channel bandwidth used by one user at a time

Fixed overhead, ie. Contention, padding

Not efficient for small packets application & dense environment

Orthogonal Frequency Division Multiplexing

One channel frequency is subdivided and can be fully used by multiple user at the same time

Efficient channel usage

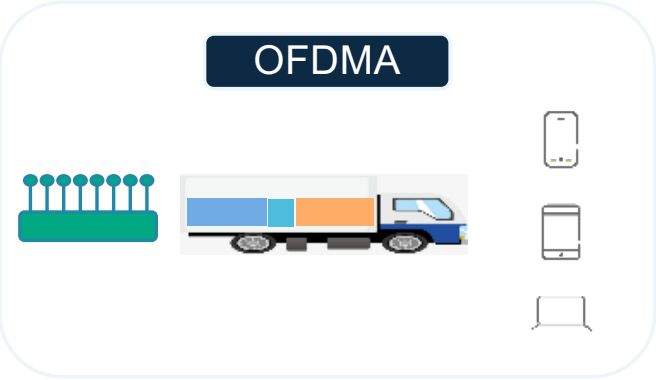
Increase overall efficiency and throughput

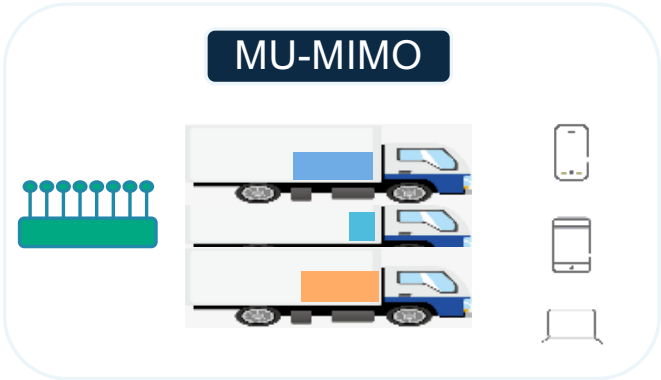
Orthogonal Frequency Division Multiple Access

10

OFDMA and MU-MIMO

- Both are complementary
- Utilized based on the type of applications being served





OFDMA	MU-MIMO
OFDMA increases efficiency and capacity	MU-MIMO increases capacity
OFDMA reduces latency	MU-MIMO results in higher speed and throughput per user
Ideal for low bandwidth and small packets applications	Ideal for higher bandwidth applications

UL OFDMA & UL MU-MIMO

Uplink Resource Scheduling

Contention based resource allocation (11ac)

- Un coordinated resource management
- Devices all compete and try to get resource till they succeed
- Works well in single AP scenario

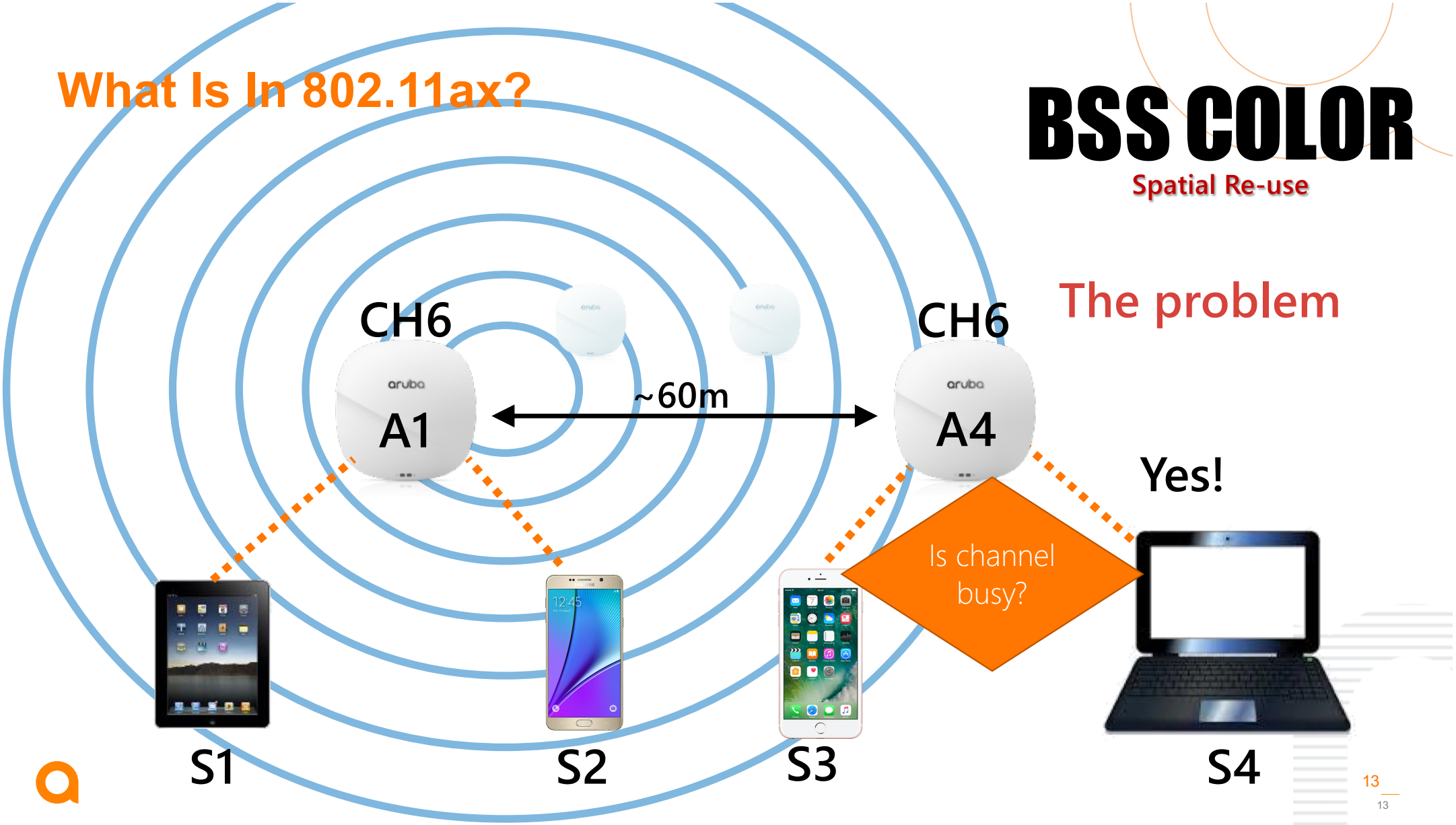
Scheduling based resource allocation (11ax)

- Up link resource allocation managed by AP
- A must for dense scenarios
- Increased capacity and better user experience

What Is In 802.11ax?

BSS COLOR

Spatial Re-use



What Is In 802.11ax?

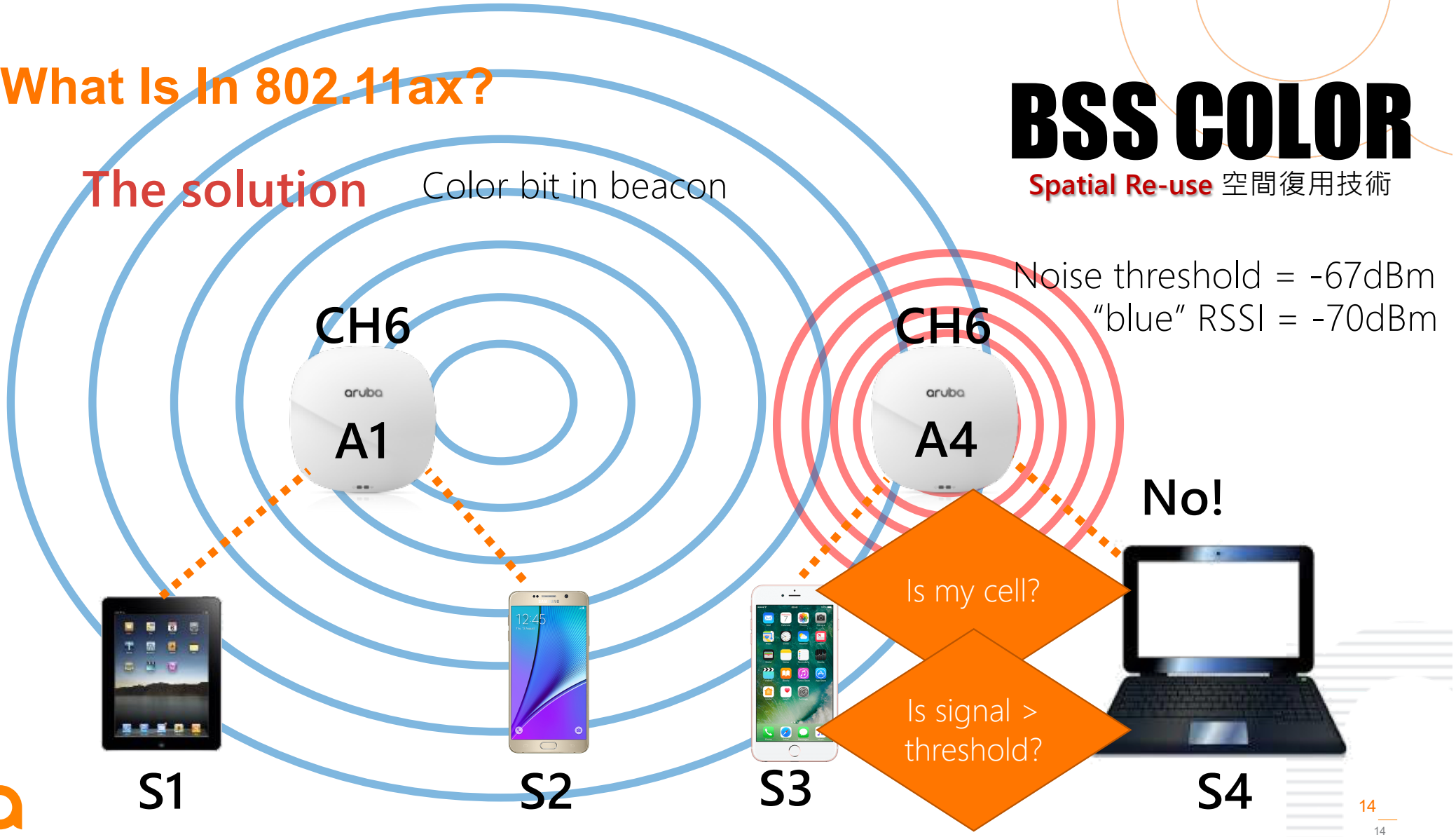
The solution

Color bit in beacon

BSS COLOR

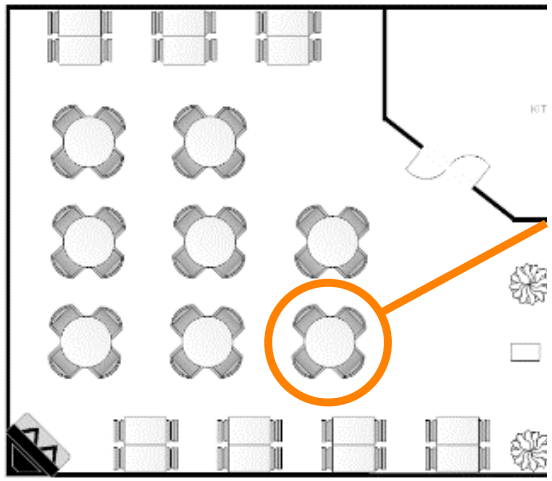
Spatial Re-use 空間復用技術

Noise threshold = -67dBm
"blue" RSSI = -70dBm



BSS Color

Spatial Re-use



Spatial Re-use

Every table represents an AP with several clients connected

This environment is equivalent to all APs operating in the same channel.

- You are at a table with your friends
- You can hear others speaking (from other tables) – **same channel**
- If the noise level is not high, you can talk – **signal* < threshold**
- If it is too noisy, you can't talk – **signal > threshold**

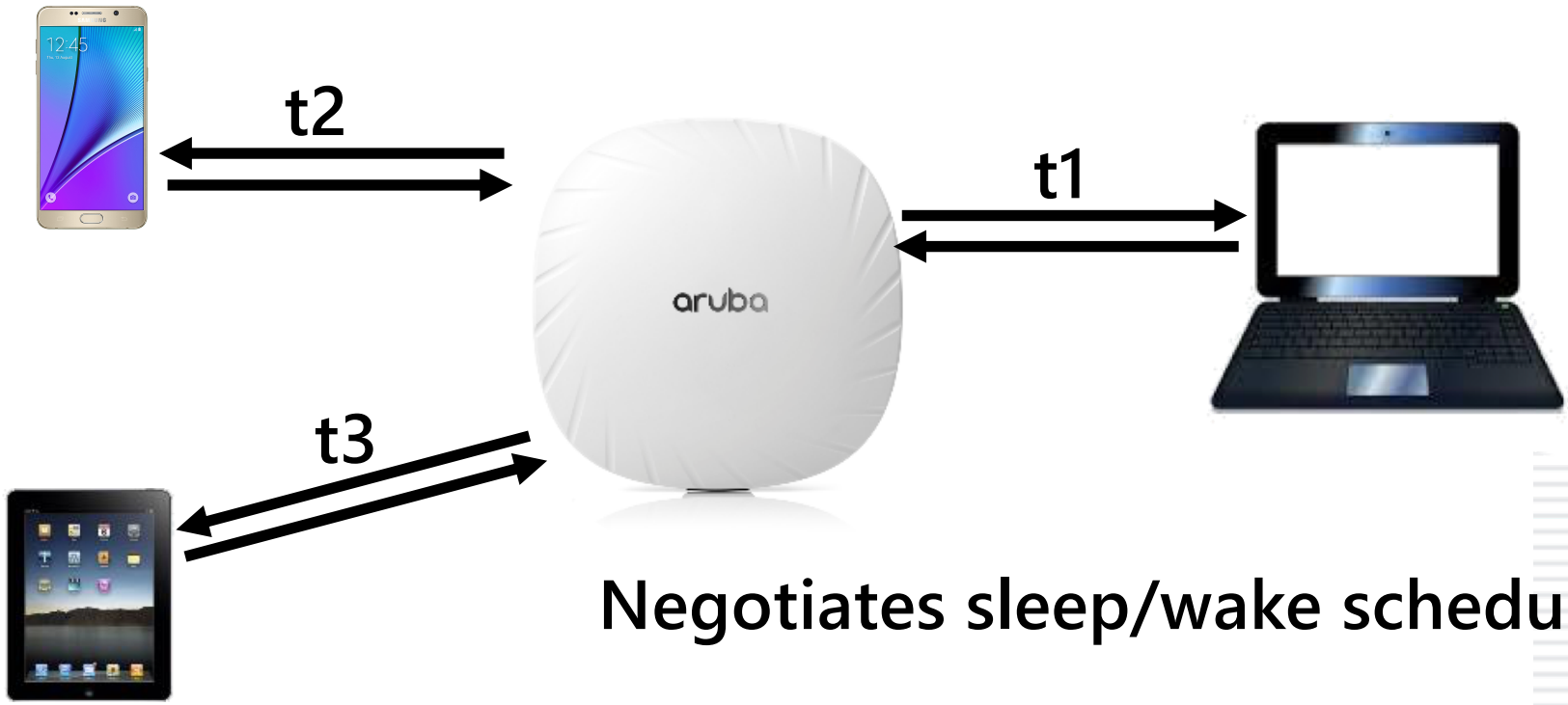
Signal* - signal from other tables (that is **not your "color"**)

What Is In 802.11ax?

TARGET WAKE TIME

Longer Battery Life

Borrowed from 802.11ah



Negotiates sleep/wake schedule

Aruba 在 WiFi 6 獨到之處

WI-FI 6 CERTIFIED
COMPLETE INDOOR PORTFOLIO

Wi Fi 6™ CERTIFIED

RELIABILITY
TRUST
INTEROPERABILITY

ARUBA 500 SERIES

ARUBA 510 SERIES

ARUBA 530 SERIES

ARUBA 550 SERIES

CLOUD OR ON-PREMISES

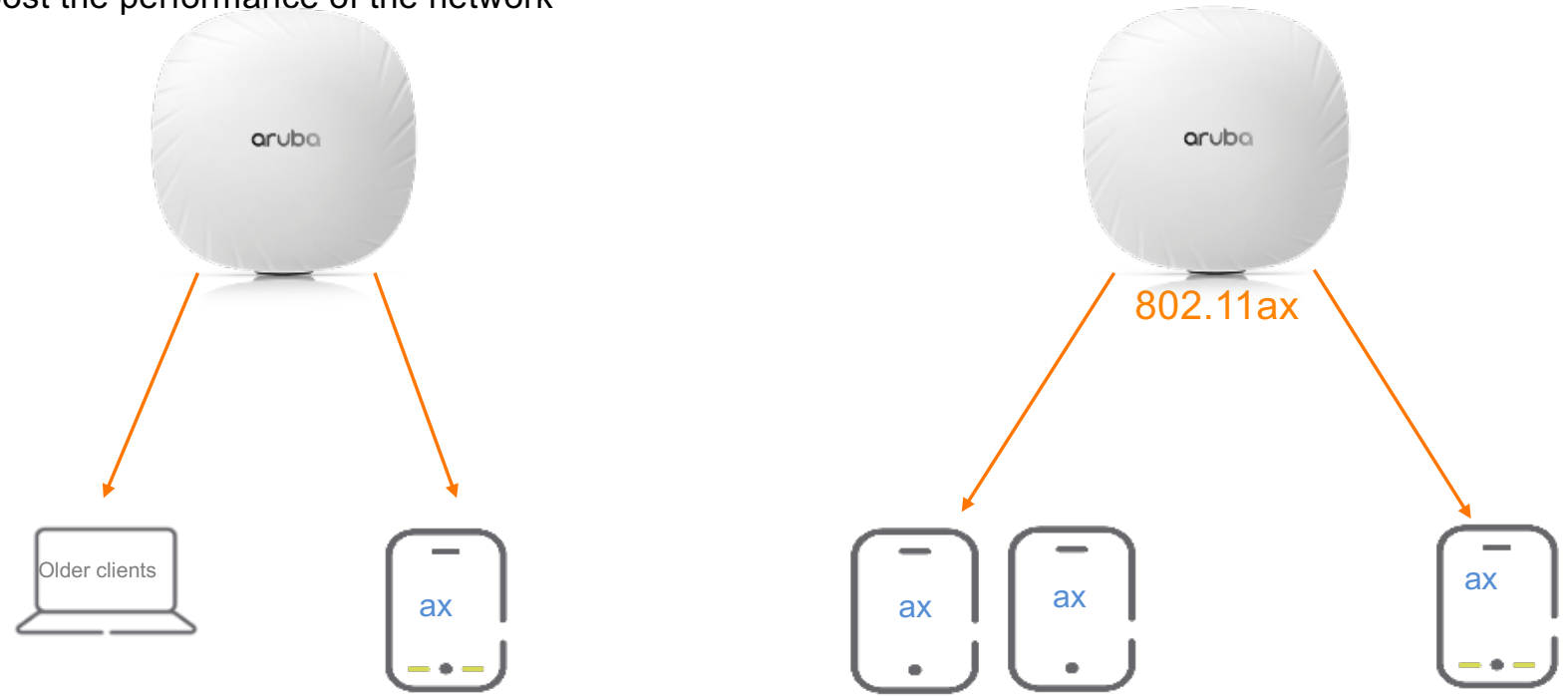
AI POWERED

SLA-GRADE ASSURANCE

ARUBA AIR PASS READY

Improve Wi-Fi experience for clients with multi-user and Wi-Fi 6 aware ClientMatch

– By moving all ax clients to the ax APs we can utilize multi user capabilities (OFDMA or MU-MIMO) efficiently to boost the performance of the network



ClientMatch

Intelligent adaptive RF and Intelligent traffic control

Good user experience

AirMatch

- Enhanced user experience while roaming in large dense environments
- **AI-powered** self-optimizing RF planning - enhancement to ARM
- Provides channel, channel bandwidth and power planning

AppRF

- Automatically identifying traffic using DPI
- Prioritizing traffic per user ,device and application
- Use cases: prioritize Skype for Business for employees but deprioritize for contractors

Aruba Wi-Fi 6 also includes advanced security capabilities

Wi-Fi CERTIFIED WPA3

- Passwords are harder to crack with SAE (Simultaneous Authentication of Equals)
- WPA3-Enterprise simplifies configuration and enhances encryption (Suite B /256-bit encryption)

Wi-Fi CERTIFIED Enhanced Open

- All wireless traffic gets encrypted to protect user data in open networks like coffee shops or airports

Aruba Air Slice

- Improve user experience by optimizing radio resources to deliver application assurance, guaranteed bit rate, and bounded latency with intelligent scheduling.

Aruba Policy Enforcement Firewall

- Deliver role-based access control and Layer 7 deep packet inspection to provide

Aruba is the FIRST to get WPA3 Certification!

Need for Application Aware QOS

Growing User Density and Stringent QOS Demands For Applications

- How to identify flows that needs to be prioritized ?
- How to identify various QOS requirements (latency, jitter, bandwidth, sleep duty cycles) for these applications ?
- How to prioritize these applications in order to meet the performance SLA ?

Air Slice for SLA-grade application assurance

Air Slice 透過智能調度功能提供確保應用程式, 保證頻寬與有限的延遲

Non-Wi-Fi 6 clients can also benefit from priority queuing

11ax AP供電 有需要更換PoE Switch ？

Aruba 11ax可沿用既有802.3af/at PoE switch

- **AP-50x**
  - 802.3af POE (class 3): supported unrestricted with IPM
  - 802.3at POE (class 4): unrestricted

- **AP-51x (POE on E0 only)**
  - 802.3af POE (class 3): not supported without IPM, unrestricted with IPM
  - 802.3at POE (class 4): unrestricted (reduced USB power budget)
  - 802.3bt POE (class 5): unrestricted

- **AP-53x (POE on E0 and/or E1)**
  - 802.3af POE (class 3): not supported
  - 802.3at POE (class 4): some restrictions (USB, second Ethernet disabled), unrestricted with IPM
  - 802.3bt POE (class 5): unrestricted
  - Dual 802.3at POE *(Smart POE):* unrestricted

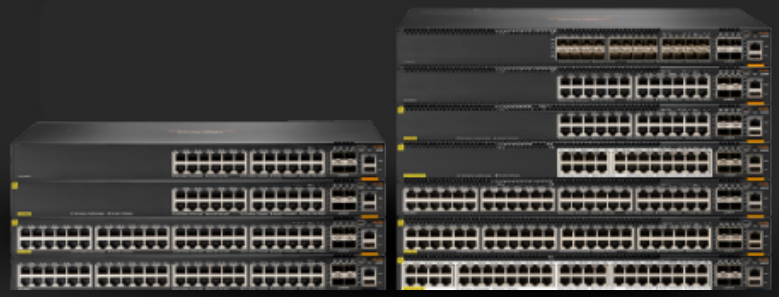
- **AP-555 (POE on E0 and/or E1)**
  - 802.3af POE (class 3): not supported
  - 802.3at POE (class 4): serious restrictions (same capabilities as AP-53x on 802.3at POE)
  - 802.3bt POE (class 5): unrestricted
  - Dual 802.3at POE *(Smart POE)*: unrestricted

Aruba OS-CX Switch

ARUBA CX 6300

符合未來效能，擴充，與需求的解決方案

7	4	1
款模組式雙電源	固定電源	作業系統



880G
Capacity

10 member
Stacking

2880W
60W PoE

符合未來擴充: 1/10G to 25/50G uplinks for scale and investment protection

彈性擴充: VSF stacking for ease of management and collapsed architectures

支持Wi-Fi 6效能: 1/2.5/5G Smart Rate on all ports and 60W always-on PoE

Always-On PoE

Enable APs, healthcare devices, sensors, and IoT devices to be powered on 100% of the time

HIGH POWER ALWAYS-ON POE AND SMART RATE

Wi-FI 6 Ready	No rip and replace of switches or cables	Continuous Power

打造校園智慧網路

The Aruba Architecture and Why Aruba

CHALLENGES AT THE EDGE

TECHNOLOGY SILOS HINDER AGILITY

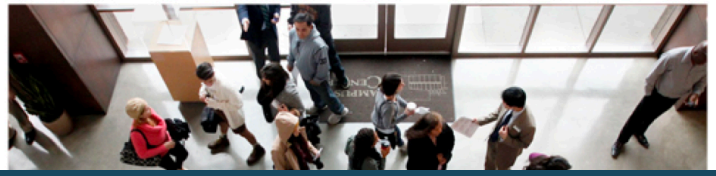
Fragmented management of switching, wireless, security, and WAN edge platforms cause significant challenges in provisioning, monitoring, and troubleshooting

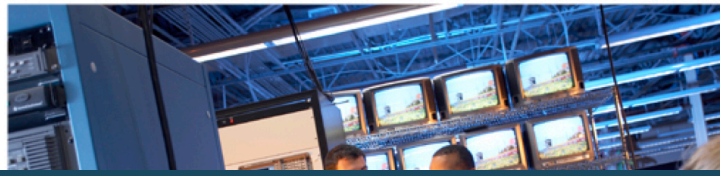
SECURITY THREATS INCREASE NETWORK COMPLEXITY

The security landscape is rapidly changing due to personal devices and IOT becoming commonplace attack vectors

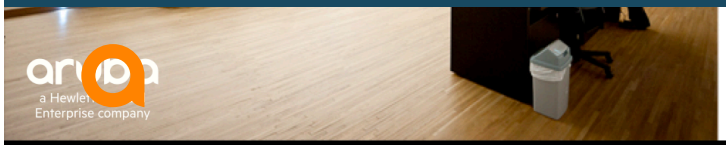
MANUAL OPERATION AND POOR VISIBILITY CREATE FRAGILE NETWORKS

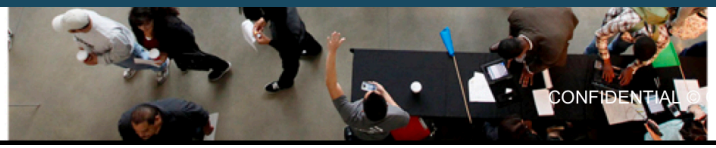
Manual actions are slow and will likely lead to human error. Lack of data makes troubleshooting and issue resolution painful

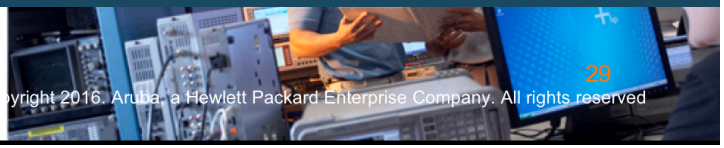




Networks Must Do More







打造網路「智」動化高可取用性的創新網路

簡化並保護使用者及IoT裝置的網路分段安全性

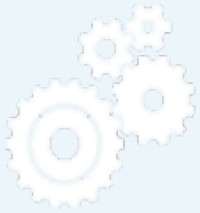
Profiling & Colorless port Dynamic Segmentation

整合3rd-party FW/IPS 資安防護聯動

External Server Interface and Adaptive Trust

VSX雙控制平面 Controller Clustering

High Availability, simply and avoid service interrupt when upgrade



更智慧的自動化、AI 故障排除和管理

Automation , troubleshooting and Integration

802.1X + MAC Auth + Profiling(辨識)

=>Access control is determined when device is plugged in

Dynamic Segmentation

Device Discovery and Profiling

Wired, Wireless, IOT

Custom Fingerprinting

Precision Access Privileges

Identity and context-based rules

Relationship between device, apps, services, and infrastructure

Wired, Wi-Fi, VPN

AAA and non-AAA options

Integration w/ network and security infrastructure

Attack Response

Event-triggered actions

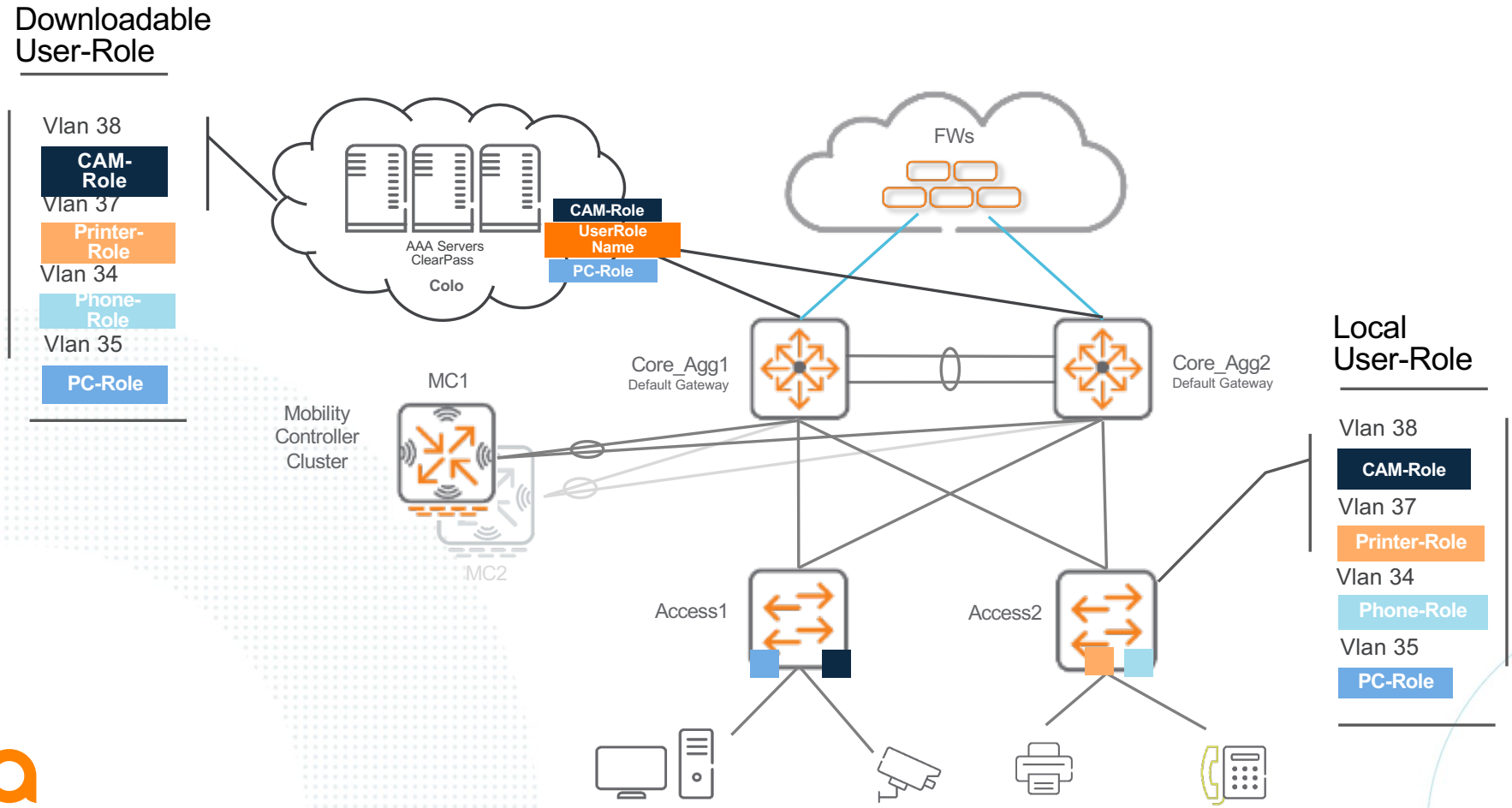
3rd party integration for end to end visibility and control

End device , IOT visibility – Aruba ClearPass End-Point Profiler

User-Roles And Colorless Port

Dynamic Segmentation

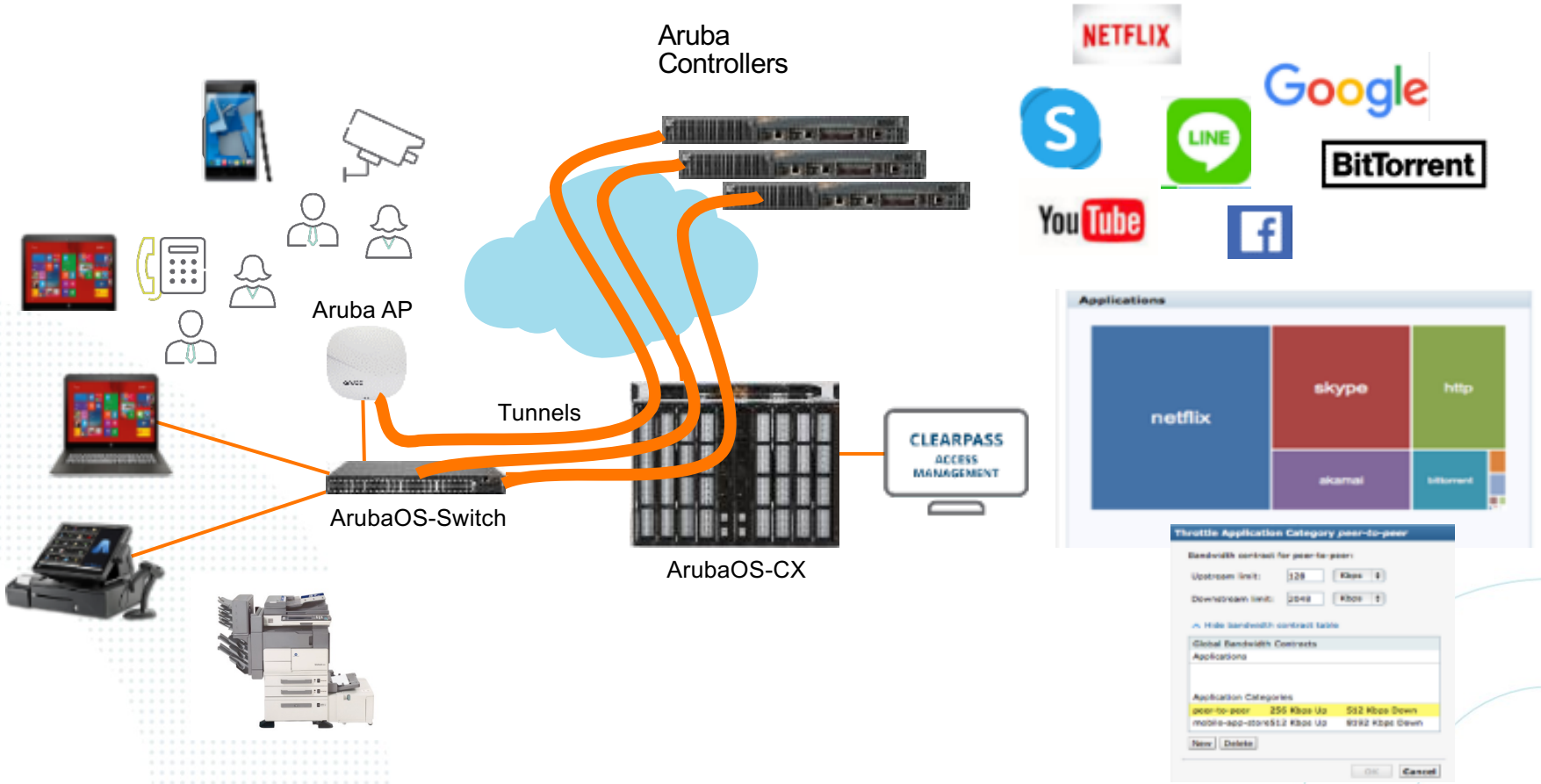
DUR Edge switch無需設定



Dynamic Segmentation

User-Based Tunneling – 有線無用戶流量可視性與控管

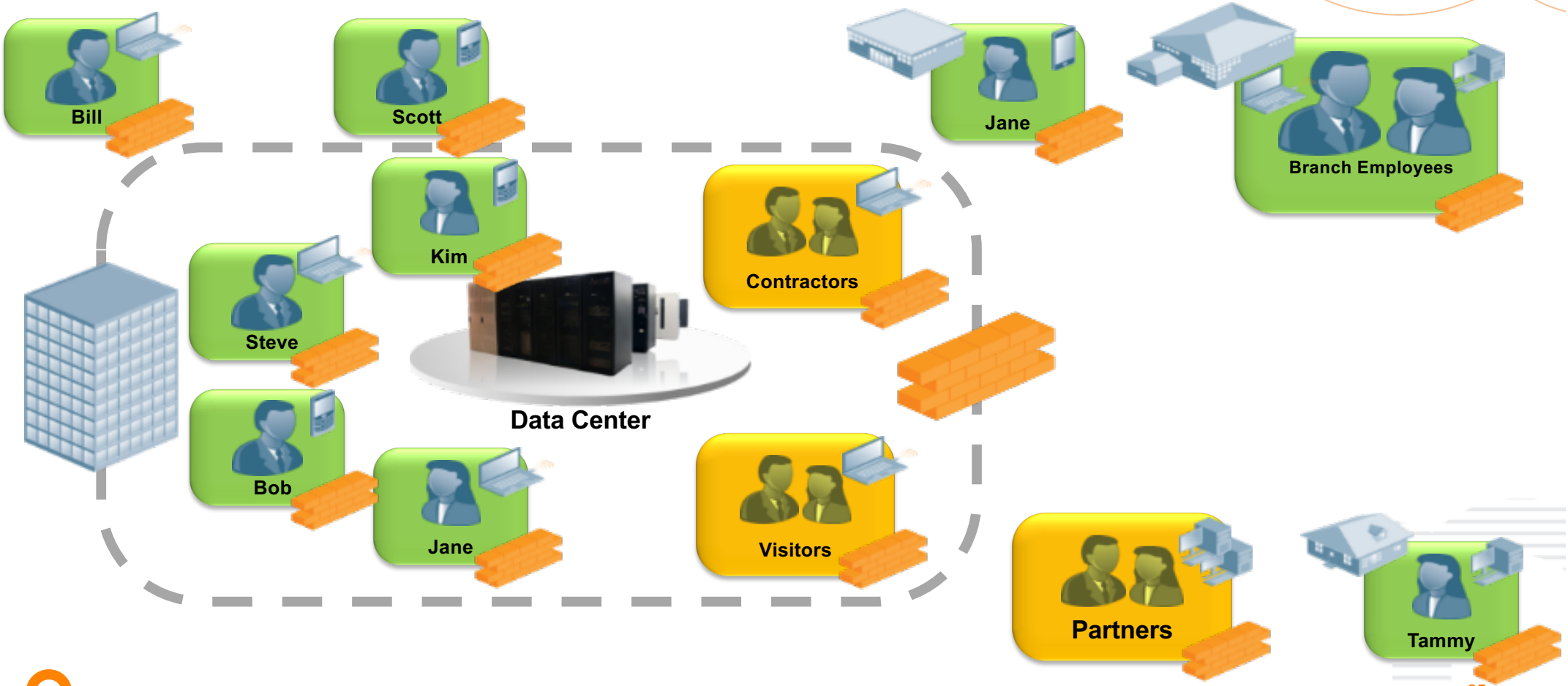
有線與無線單一策略



Context-Aware Policies & Enforcement

-Per User/Device FW

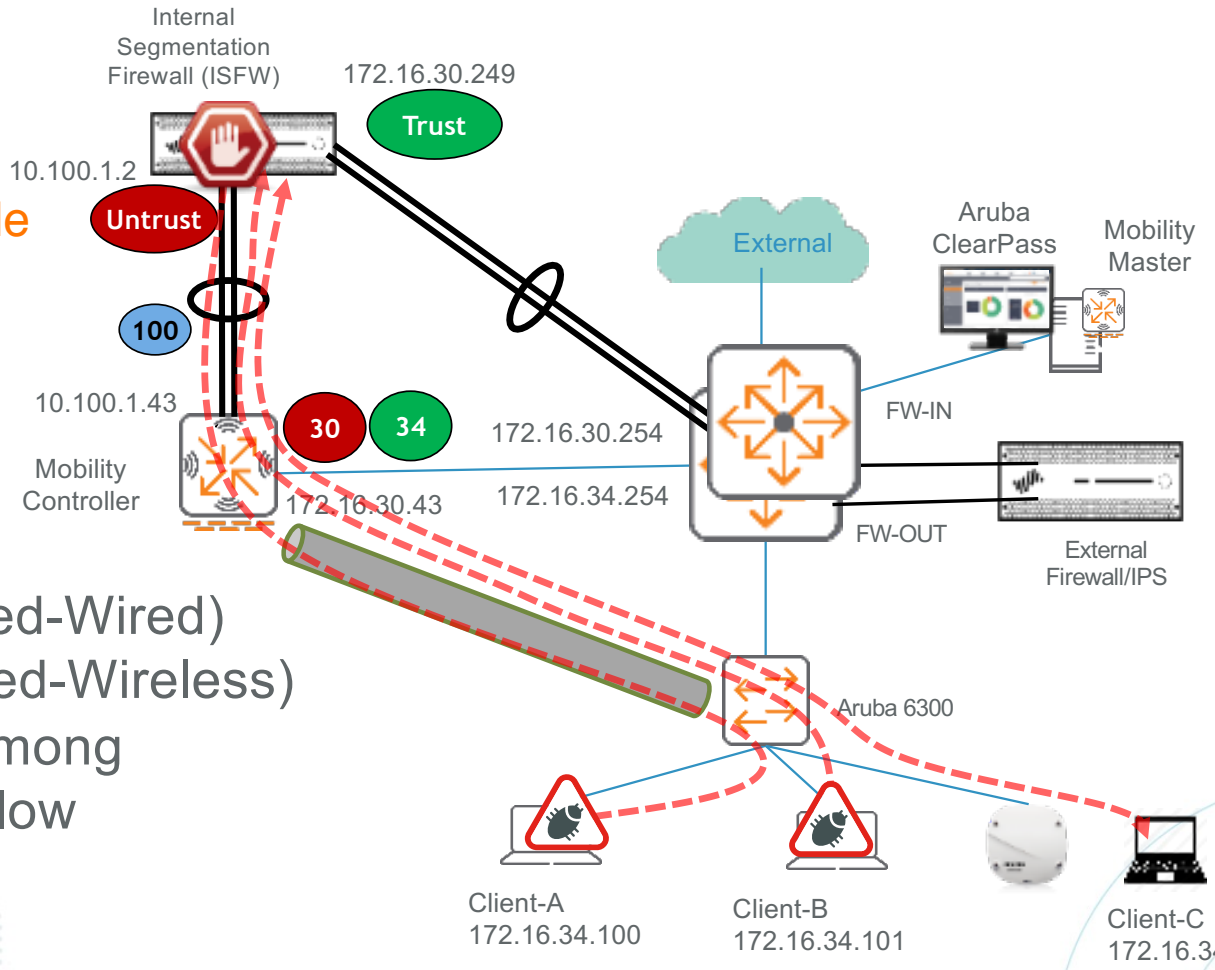
Dynamic Segmentation



Firewall integration – Aruba External Service Interface

清洗流量

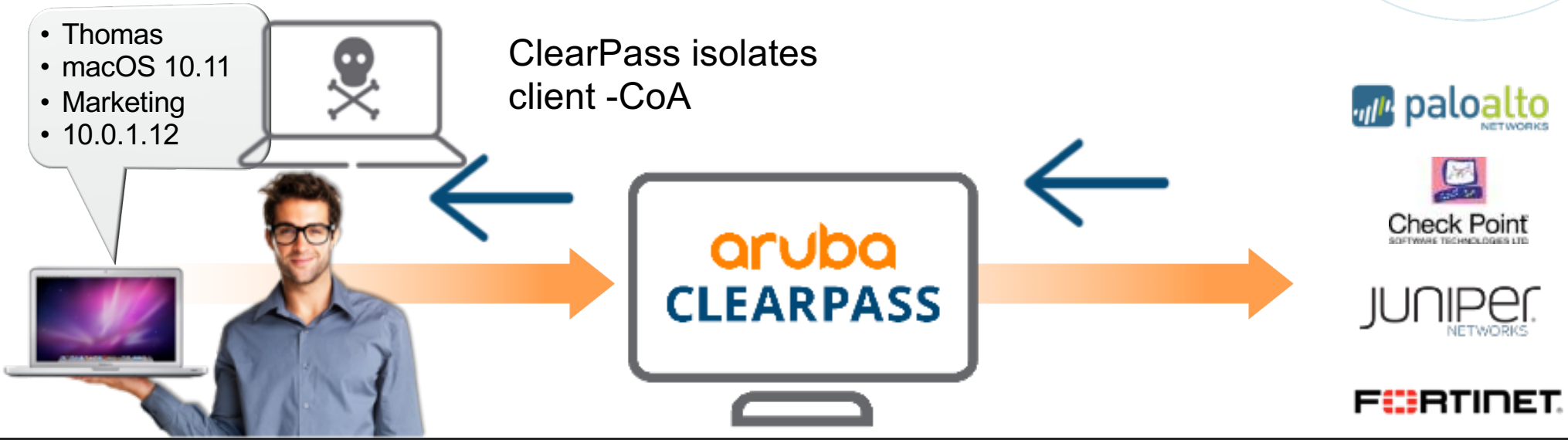
Redirection Policies and Role Based on Access Control



- Client-A & Client-B (Wired-Wired)
- Client-A & Client-C (Wired-Wireless)
- Block malicious traffic among tunneled clients while allow legitimate traffic.

資安聯防

Adaptive Trust Context Sharing – 區域聯防隔離受感染用戶



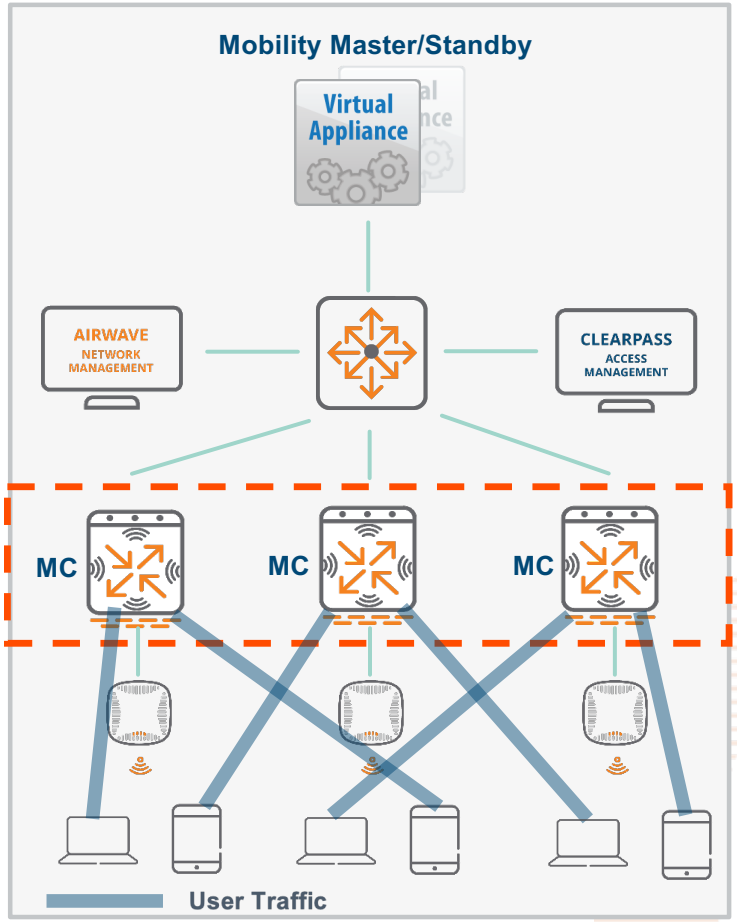
No agents/clients required

Adaptive Trust Defense based on real-time threat detection

Solution:
Stable Air - Controller Clustering

Controller 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



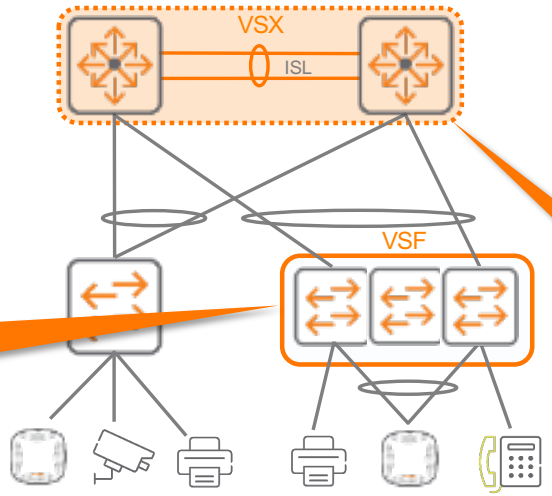
AOS-CX Switch Virtualization Solutions

VSX 雙控制平面

VSF for Access / VSX for Agg-Core

VSF - 6300

- Single control plane with database on master maintaining configuration for all members
- Single data plane
- Operational simplicity – one configuration for the stack
- Ideal for campus access use cases
- Up to 10 members per stack



VSX 8320/8325/6400/8400

- Dual control plane
- Dual management plane with “opt-in” configuration synchronization
- Live Upgrade
- Ideal for high density access, aggregation, core
- 2 members

VSX Live Upgrade no Service interrupt

VSX 雙控制平面

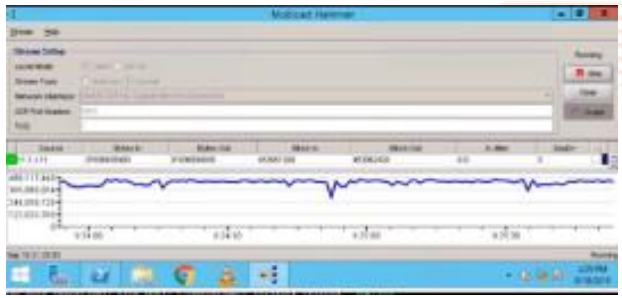
- LACP traffic draining feature is specifically implemented to support VSX update-software.
- The objective is to minimize downtime close to zero by avoiding in-flight traffic loss when the device is rebooting and links drop.
- As for protocol graceful-shutdown, this mechanism starts between image download and reboot.
- No configuration is required as automatically part of the VSX Live Upgrade orchestration.

Without LACP traffic draining

TOTAL IMPACT of VSX Live Upgrade
=
Secondary failover impact
+
Secondary failback impact
+
Primary failover impact
+
Primary failback impact
=
< 300ms

With LACP traffic draining

TOTAL IMPACT of VSX Live Upgrade
=
~~Secondary failover impact~~
+
Secondary failback impact
+
~~Primary failover impact~~
+
Primary failback impact
=
< 100ms



Network Analytics Engine, 網路的AI智慧自動查修與Root Cause分析

AI智能與查修

當用戶報案故障

- 產生IT Ticket

IT 開始進入痛苦root-cause查修過程

- 服務Impact範圍，時間，比對log，分析log，查看設備
- .....

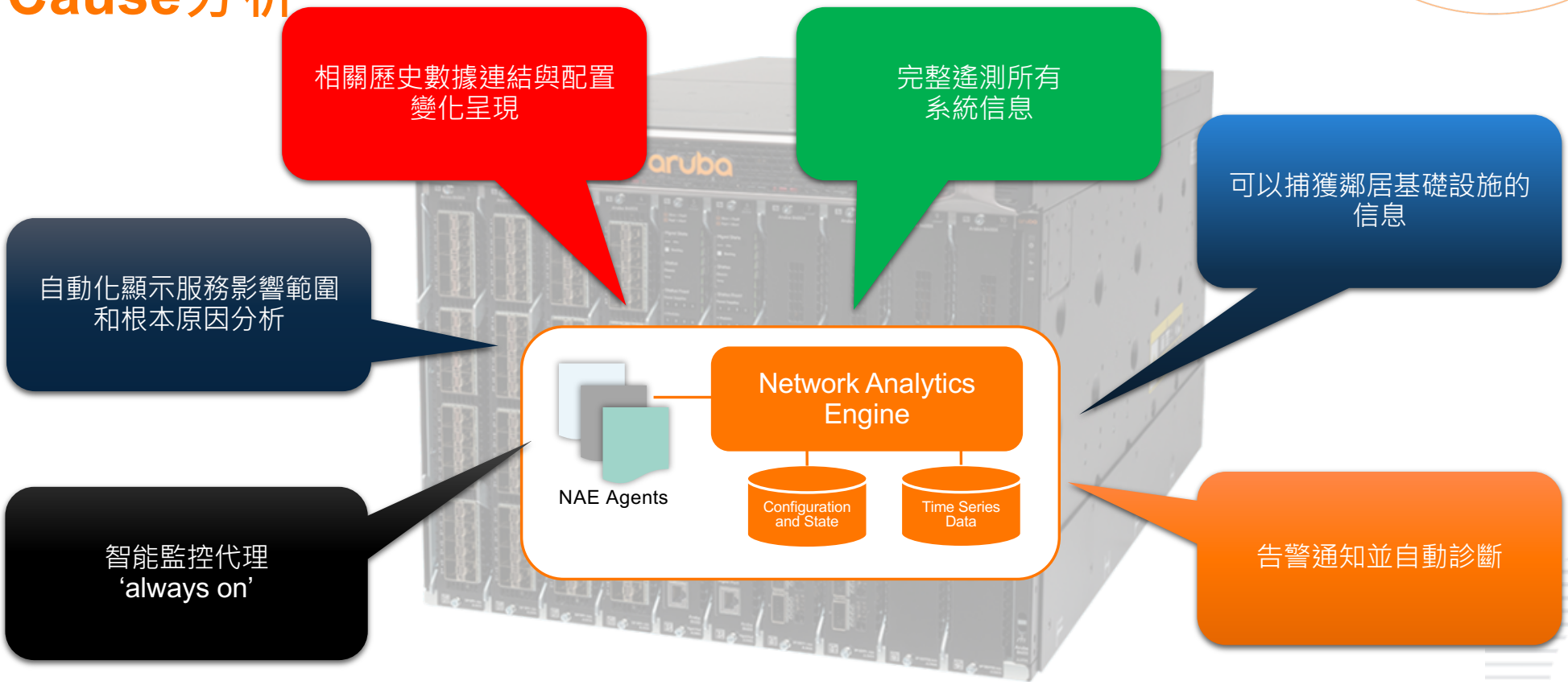
將問題解決

持續監控

- 避免問題再次發生

Network Analytics Engine, 網路的AI智慧自動查修與Root Cause分析

AI智能與查修



'就如同有一個資深技術工程師7/24持續不間斷監控與查修'

Scenario : PM11:30 switch Uplink xx port斷線5分鐘後回復

AI智能與查修

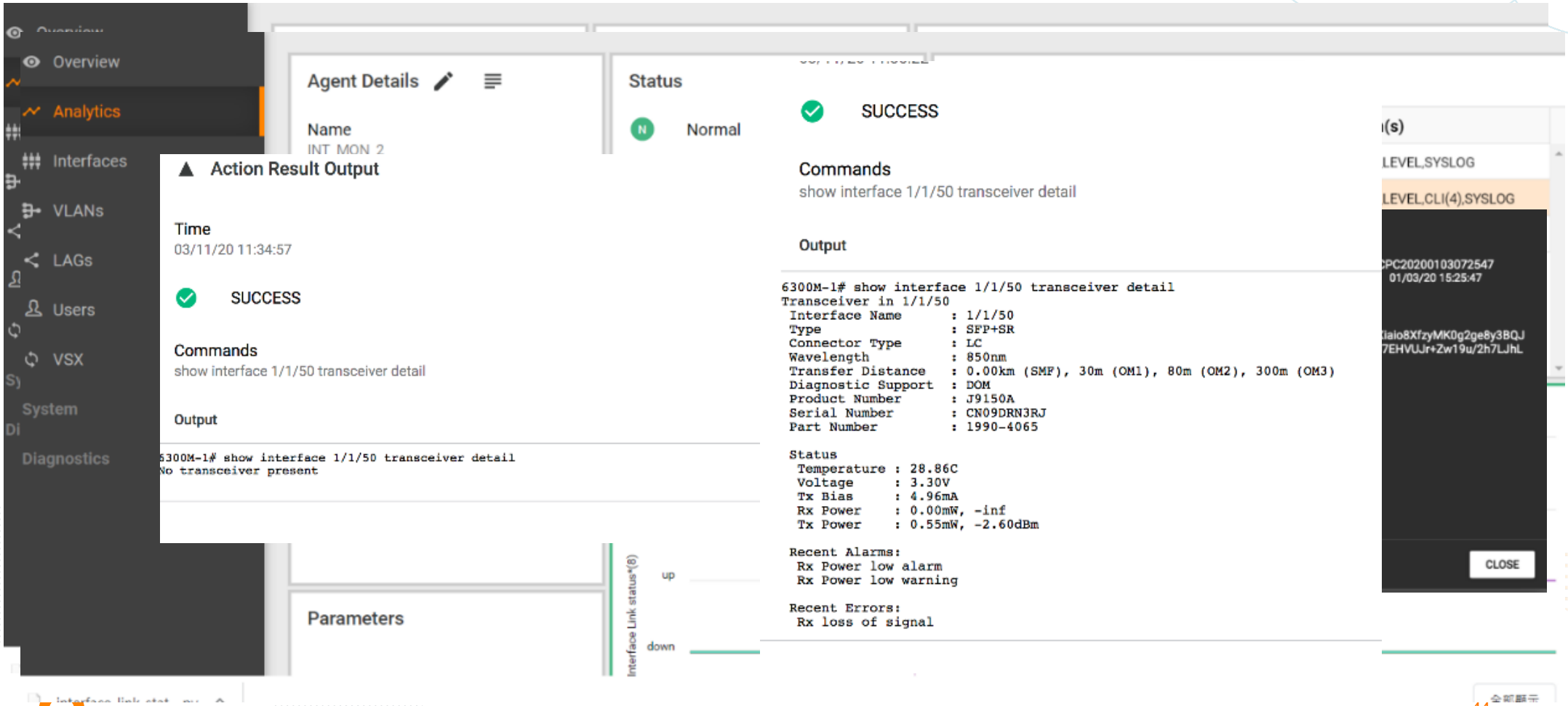
- 查Syslog, 2020/01/13 pm 11:30 switch XX port down, line protocol down
- 查Switch XX port與對接Switch XX port的配置，因為已經回復所以配置應該沒變
- 當時有人改配置？若有TACACS的話，恭喜你可以查有無配置變更
- 查Switch XX port transceiver 送收dB值，因為已經回復，所以送收DB值都正常

所以結論：請廠商來測光纖線吧！！！但.....

若測線OK, 那就先換Transceiver吧！若再發生那應該是Switch的Port壞掉吧

AI智能與查修

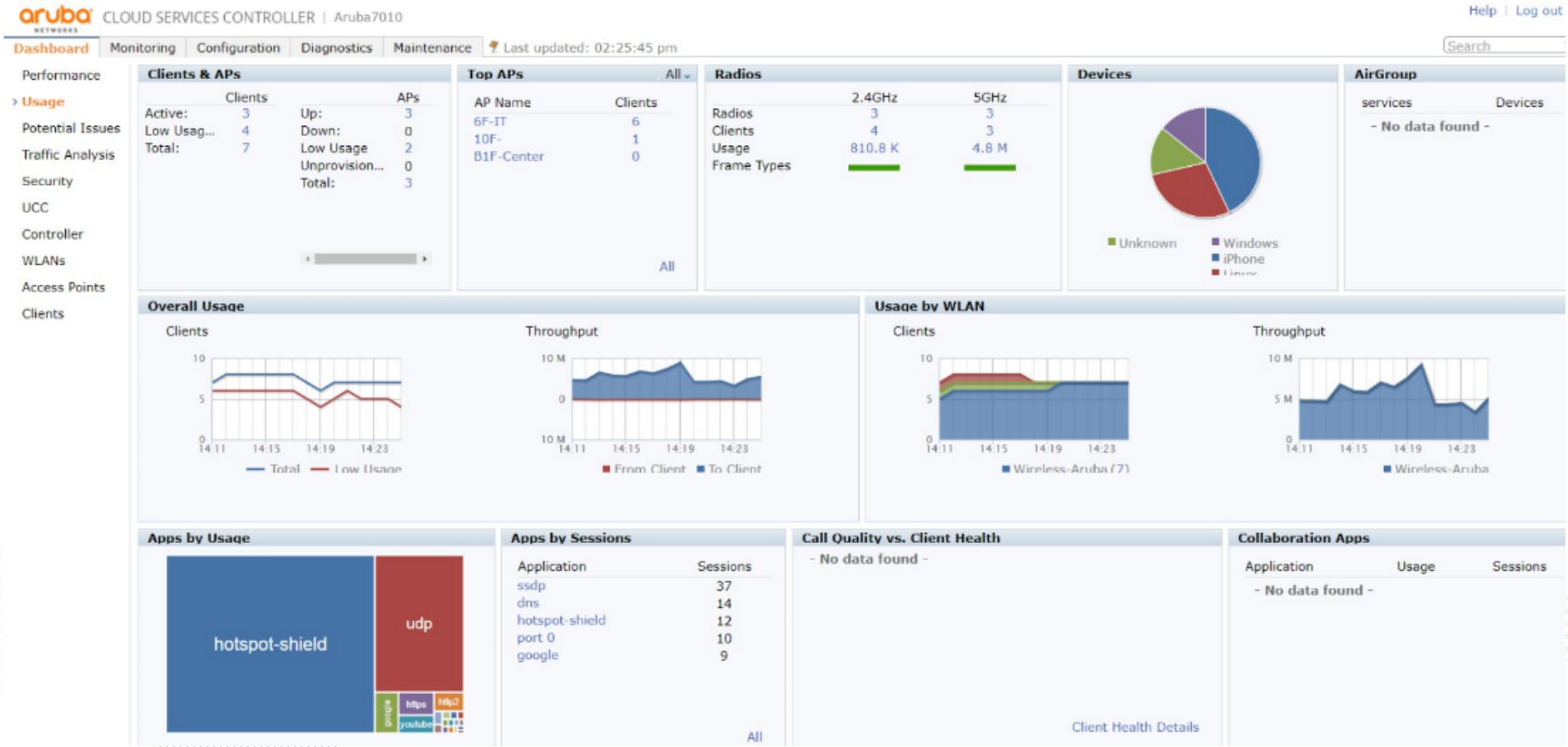
Scenario：PM11:30 switch xx port斷線10分鐘後回復



Aruba 無線網路- 看的到吃的到

整體網路使用狀況儀表板

AI智能與查修

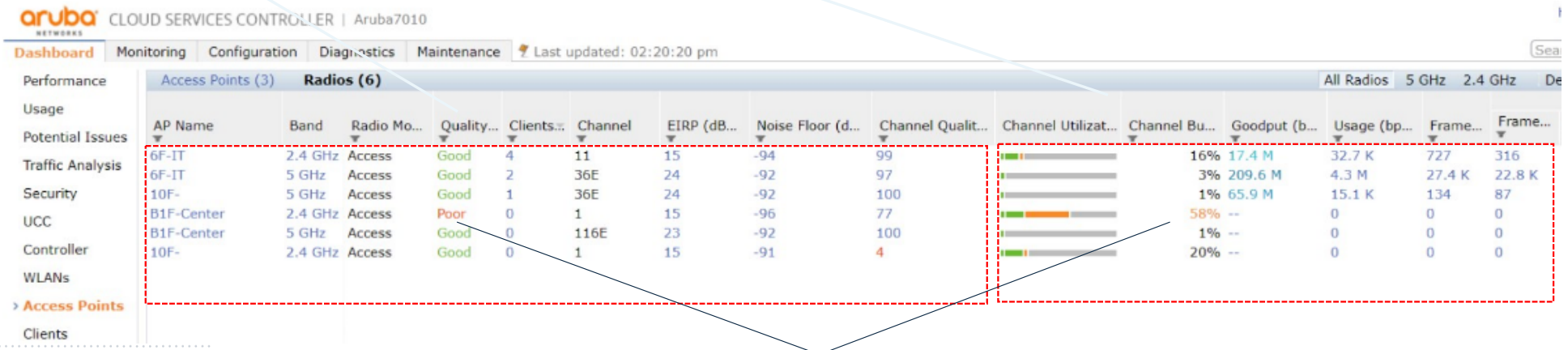


AI智能與查修

Aruba 無線網路看的到吃的到(快速即時性管理除錯)
設備資訊與運行狀況一目瞭然

AP基本資訊
- 名稱/頻帶/頻道
- 品質/連線用戶數
- 功率/雜訊

AP 使用率資訊
- 頻道使用率
- 頻道忙碌比例
- 流量資訊

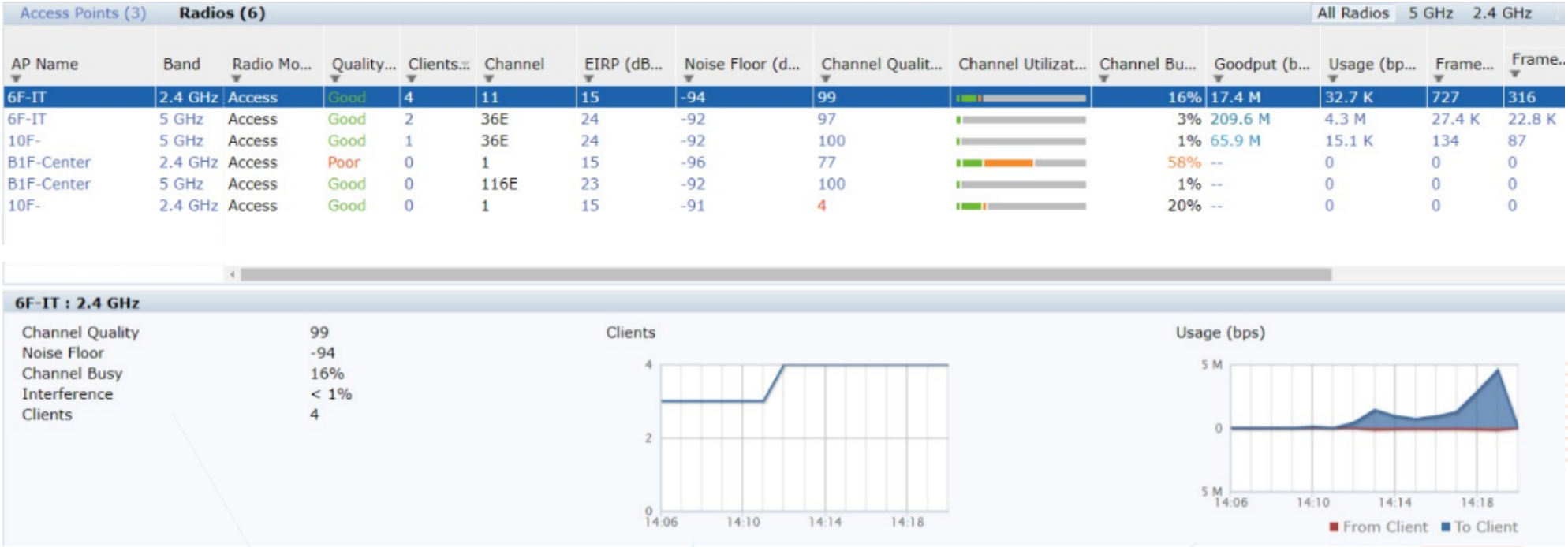


品質 Poor 原因：頻道使用率過高 (快速知道原因)
- 2.4GHz 可用頻道規範下只有 3 不互相干擾的可用頻道，很容易頻道忙碌
- 在正式使用環境下，透過Aruba ClientMatch™多顆AP頻道自動附載平衡Band Steering 技術自動解決此問題。(請參考：Aruba AP 優勢(四)： ClientMatch™)

Aruba 無線網路看的到吃的到(快速即時性管理除錯)

AI智能與查修

每顆AP詳細資訊呈現



無線網路品質

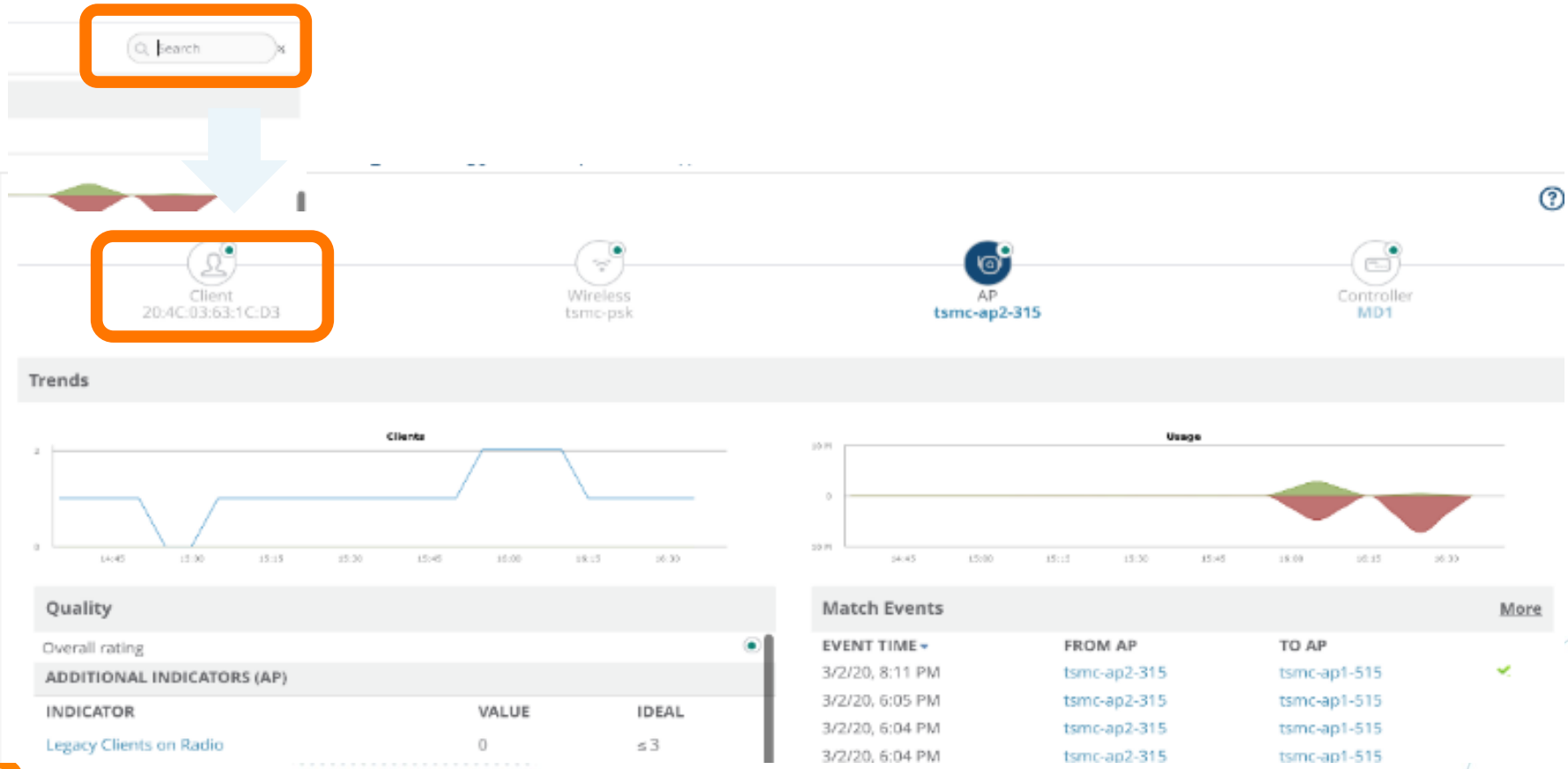
連線人數

使用頻寬

AI智能與查修

End-to-end performance monitoring

– AirWave and wireless client



Aruba's Wireless Advantage

1

Automated

AI-powered RF optimization
ZTP and open APIs
Configuration hierarchy
Live upgrades and seamless

2

Engaging

Improved user experience
Drive business with IoT
Enhanced app performance
Third-party and open

3

Secure

Policy Enforcement Firewall
Dynamic Segmentation
Enhanced wireless security

THANK YOU