

# ARUBA WLANS 101 AND DESIGN FUNDAMENTALS

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# About Me

- **Sr. Mobility Solutions Architect**  
**Wireless Practice Lead**
- **Boston, MA**
- **Airheads Community: cappalli**
- **Favorite product? ClearPass**



 @tcappy0707

about.me/timcappalli



- **Mobility controller architecture**
- **Aruba Instant architecture**
- **RAP-NG / IAP-VPN**
- **Management platforms**
  - Aruba Central
  - AirWave
- **Discussion & Questions**

- **Mobility Controller: Master-local**
- **Mobility Controller: All masters**
- **Instant**
- **Instant: RAP-NG**
- **Hybrid! (all of the above, mix and match)**

# Mobility Controller Architecture

# Mobility Controller Family

## 7200 SERIES

256 APs  
4,096 IPsec

512 APs  
16,384 IPsec

1,024 APs  
24,576 IPsec

2,048 APs  
32,768 IPsec





# Mobility Controller Family

## CLOUD SERVICES CONTROLLERS

16 APs  
Can be powered via PoE



64 APs



32 APs  
10 PoE+



# Mobility Controller Family

## CLOUD SERVICES CONTROLLERS

32 APs, 24 PoE+, 2x10G



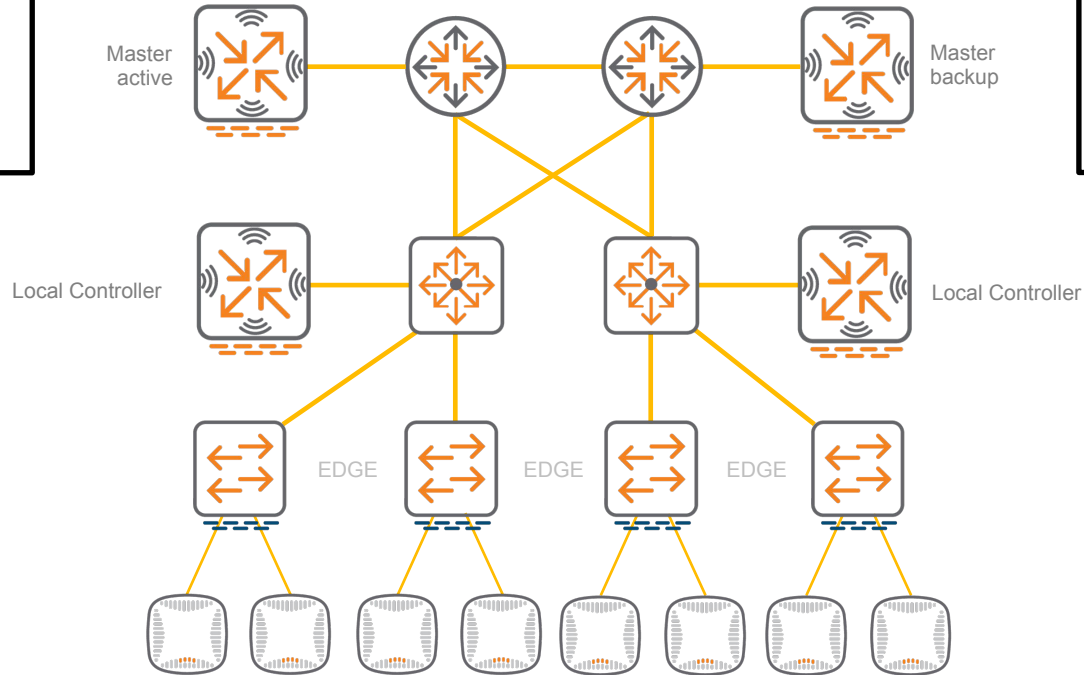


# Campus physical topology

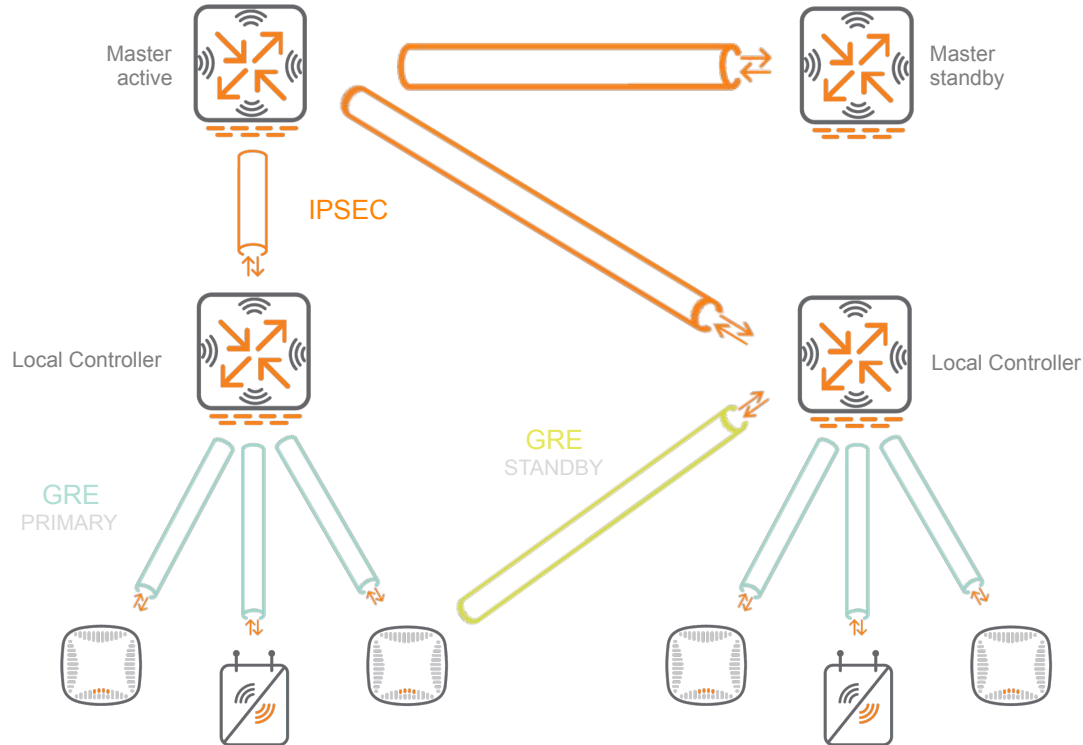
Datacenter



Datacenter

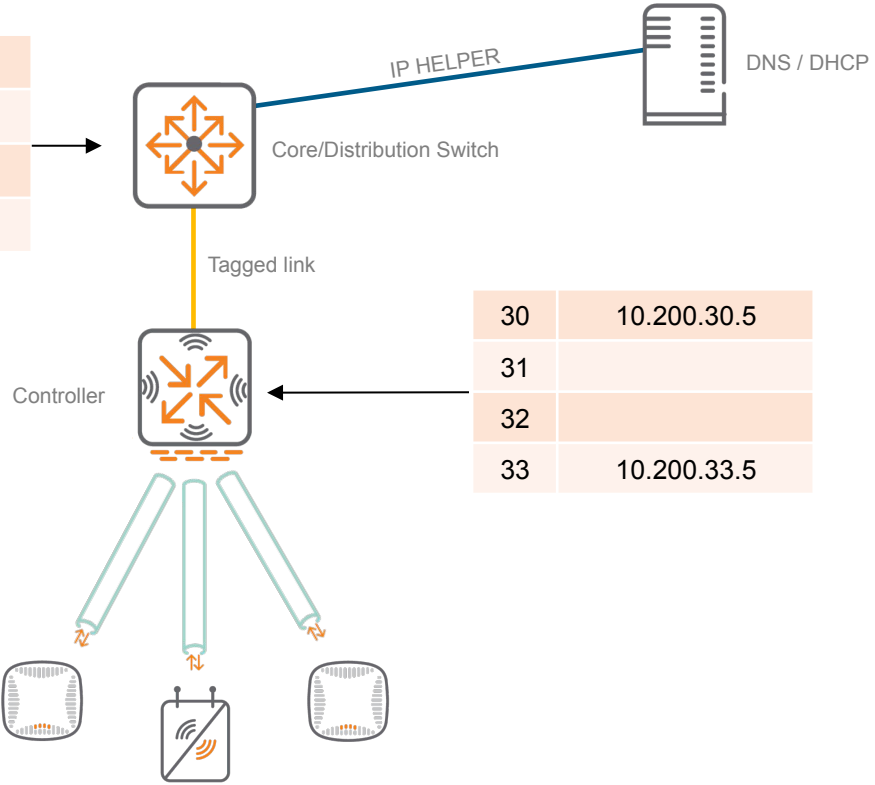


# Campus logical topology

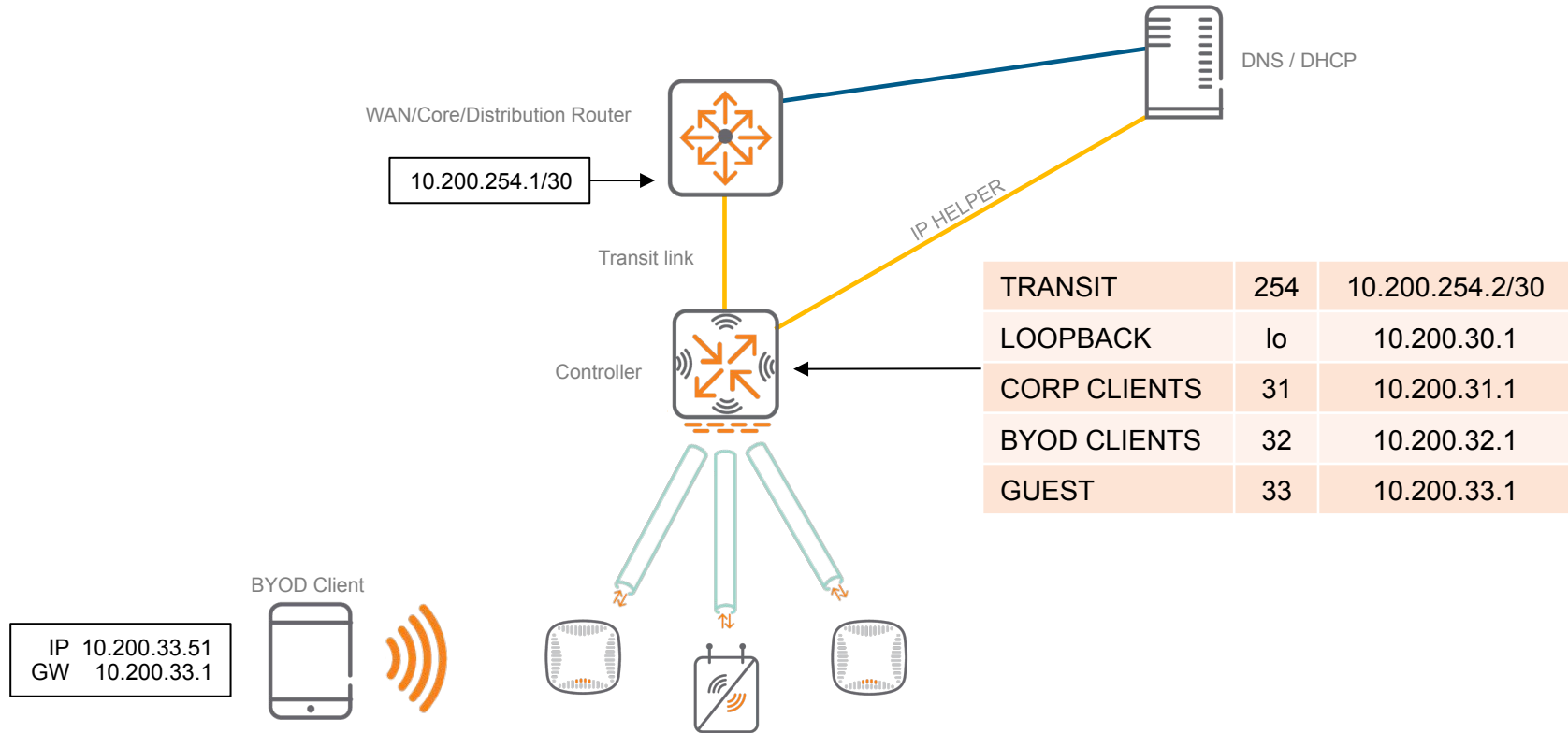


# L2 Deployment

MGMT	30	10.200.30.1
CORP CLIENTS	31	10.200.31.1
BYOD CLIENTS	32	10.200.32.1
GUEST	33	10.200.33.1



# L3 Deployment



- **Policy configuration**
- **Wireless security (WIPS / RFProtect)**
- **AP white lists (CAPs w/ CPsec and RAPs)**
- **Initial AP configuration**
- **Authentication and roles**

- **AP and session termination**
  - Terminates AP tunnels
  - User traffic processed and forwarded
- **RFPprotect enforcement and blacklisting**
- **ARM**
- **Mobility**
- **QoS**



- **Controller scaling table (VRD)**
- **The important numbers**
  - AP capacity
  - User/device capacity << important!
  - Tunnel capacity
- **WMS scaling for master controller**
  - Master controller may need to be larger than the locals depending on the environment

- **Platform**
  - 7000 series (7005/7010/7024/7030) should only be used as local controllers\*
  - 7200 series should be master for multiple 7000 locals
- **Failover capacity**

# Campus Forwarding Modes

- **Tunnel**
- **Bridge**
- **Decrypt-tunnel**
  
- **Configured per virtual-ap and per ethernet interface**
- **Choose based on network topology and requirements**

- **All traffic is tunneled back to controller**
- **User VLANs live in controller**
- **Wired network is a high-speed overlay network**
- **User traffic passes through stateful firewall and deep packet inspection engine (\*on 7 series controllers)**

- **User traffic bridged out to local network**
- **User VLANs live in edge network**
- **Authentication traffic tunneled to controller**
- **Control plane security (cpsec) required**
- **Captive portal authentication is not supported**

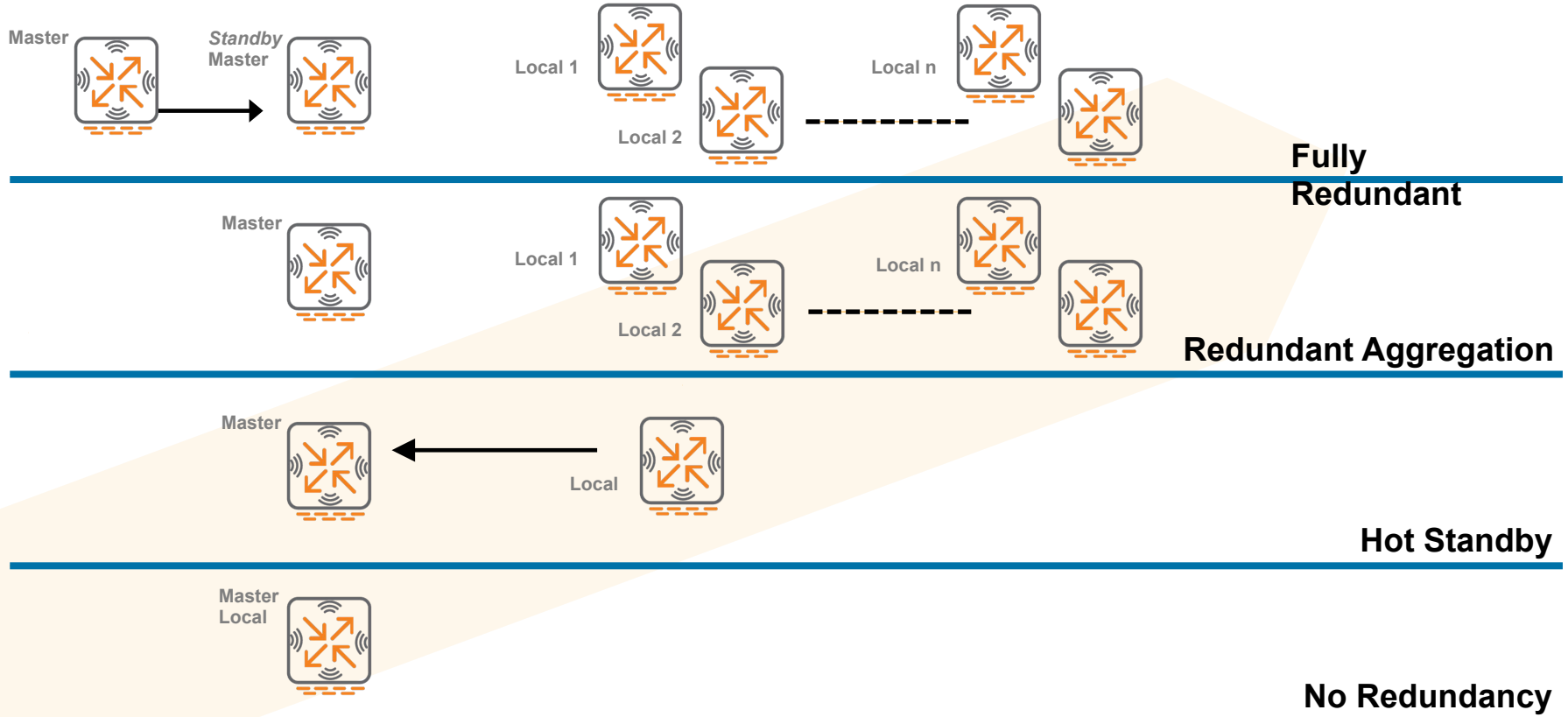
# Decrypt-tunnel (d-tunnel)

- **User VLANs live in controller**
- **AP decrypts traffic and strips 802.11 headers**
- **AP adds 802.3 headers and frame is encapsulated in GRE tunnel to controller**
- **Controller applies firewall policies to traffic**
- **Solves double-encryption issues when using a VPN**
- **Control plane security (cpsec) required**

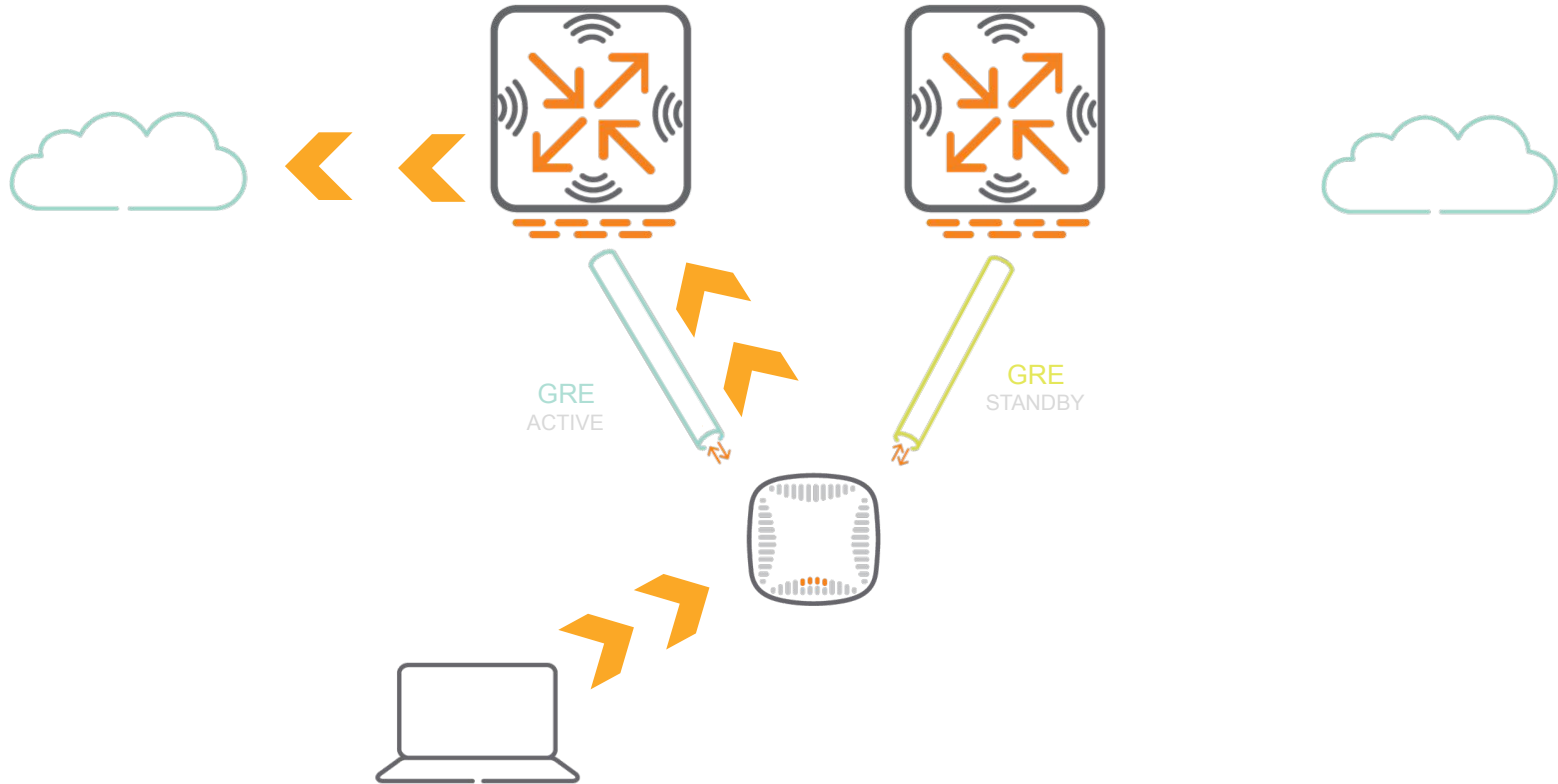


# Campus Redundancy

# Master-Local Redundancy

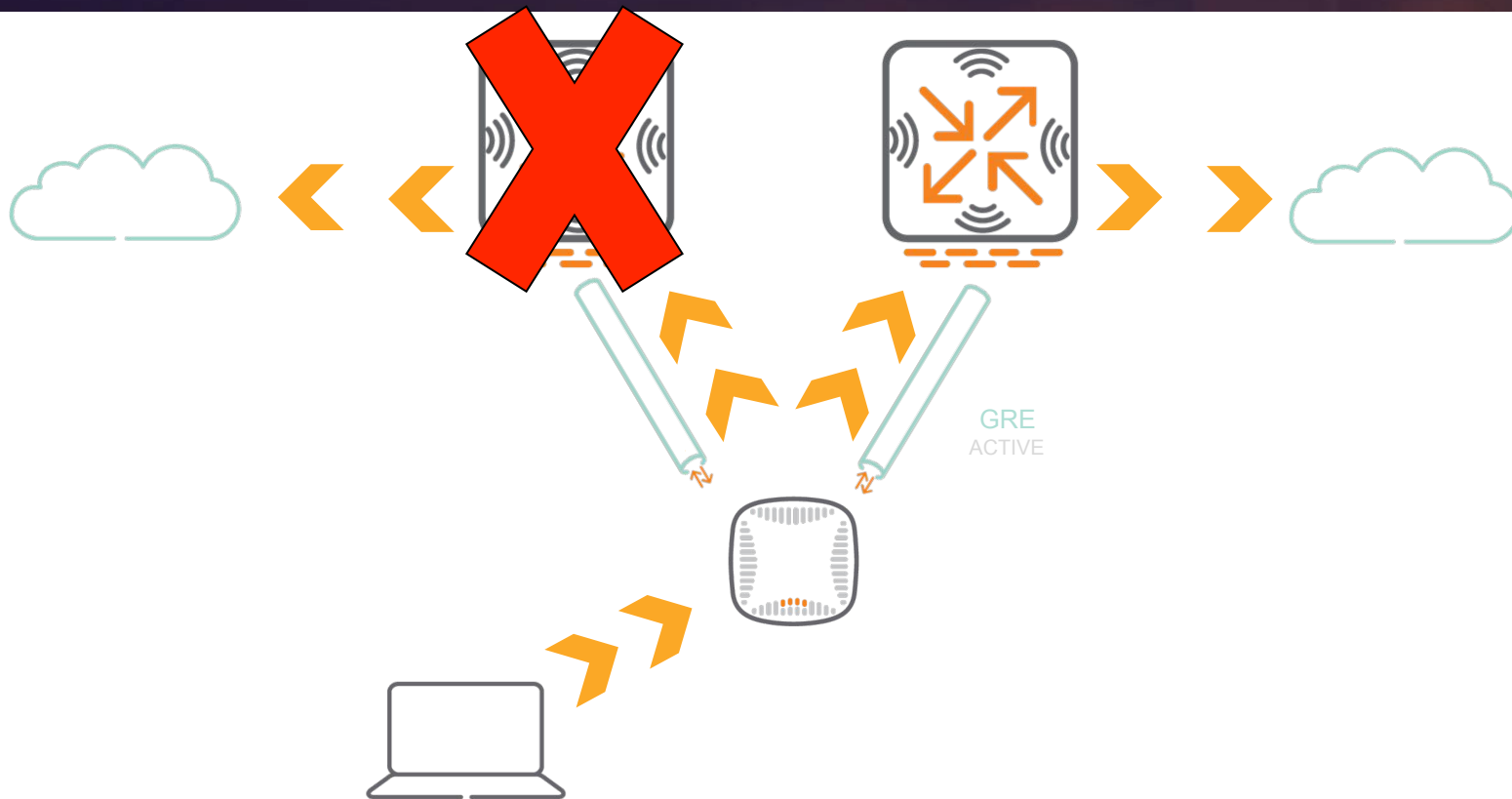


# HA: AP Fast Failover



AOS 6.3+

# HA: AP Fast Failover



- **DUAL:** Primary for some APs, standby for others
- **ACTIVE:** Controller does not terminate standby tunnels for other controllers
- **STANDBY:** Controller only terminates standby tunnels

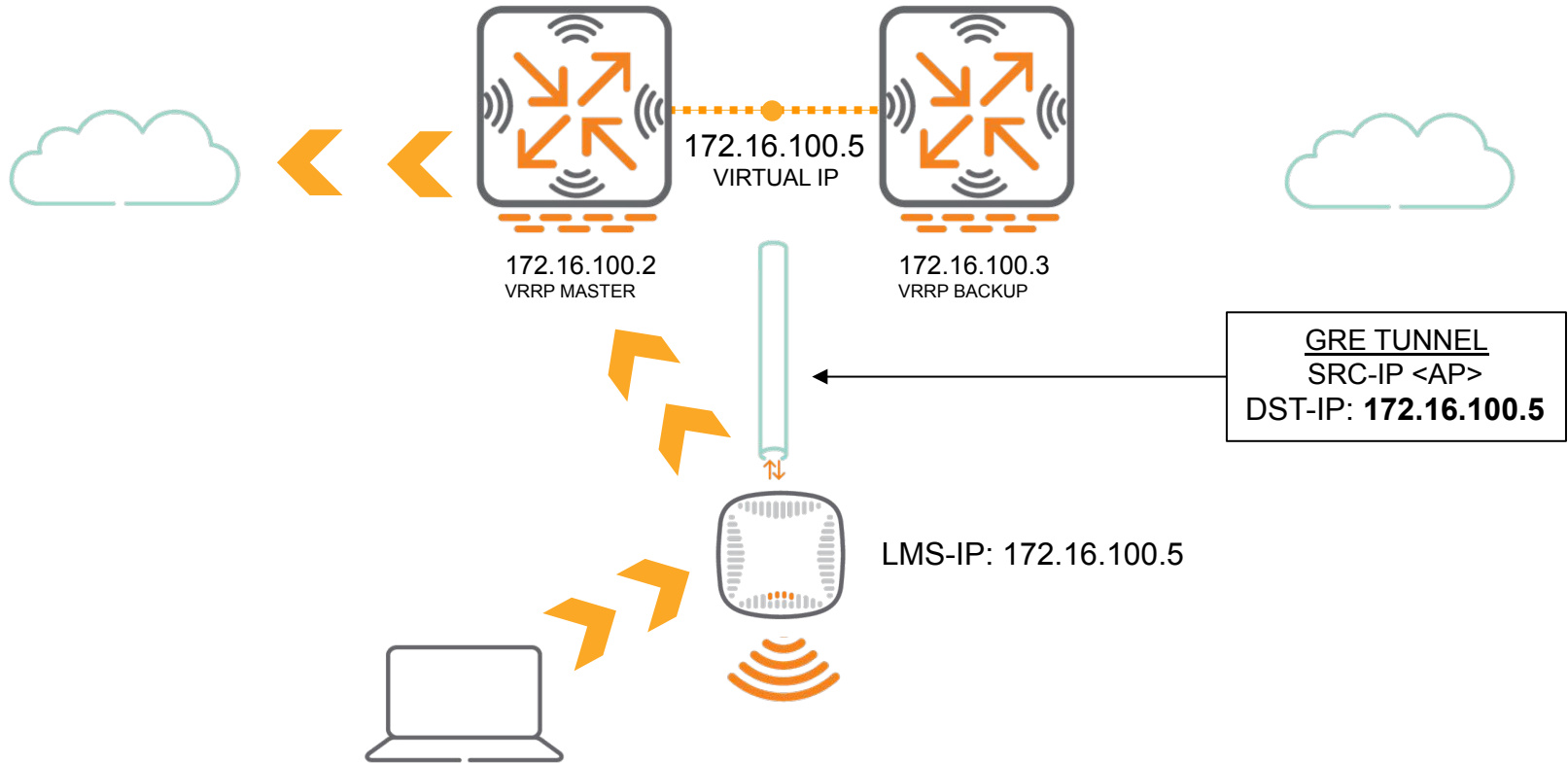
# AP FF: N+1 Oversubscription

Controller Platform	Ratio	Max GRE tunnels
7000-series (70-05/10/24/30)	1:1	--
7210	4:1	16K
7220	4:1	32K
7240	4:1	64K
M3 & 3600	2:1	16K

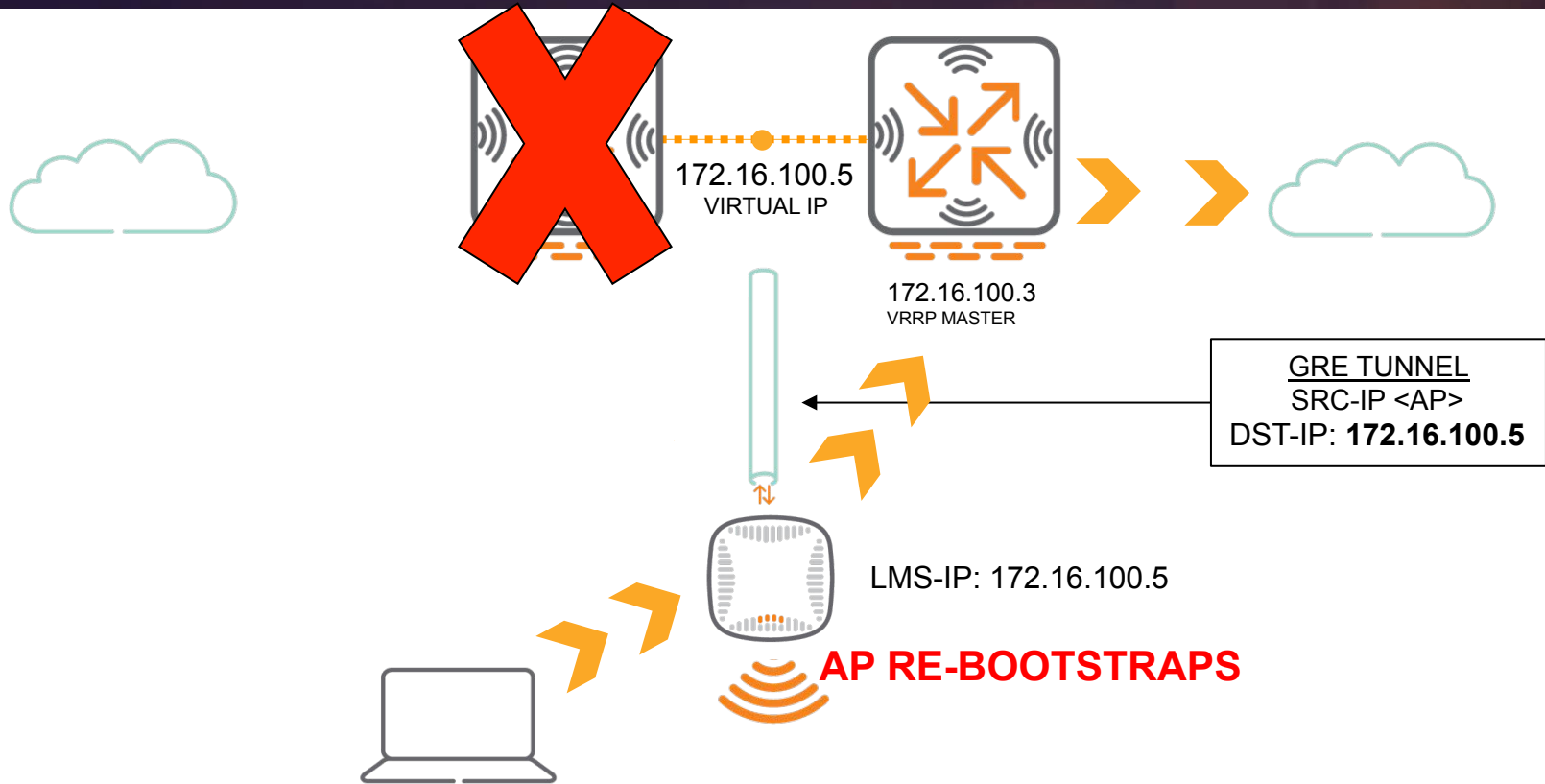
AOS 6.4+



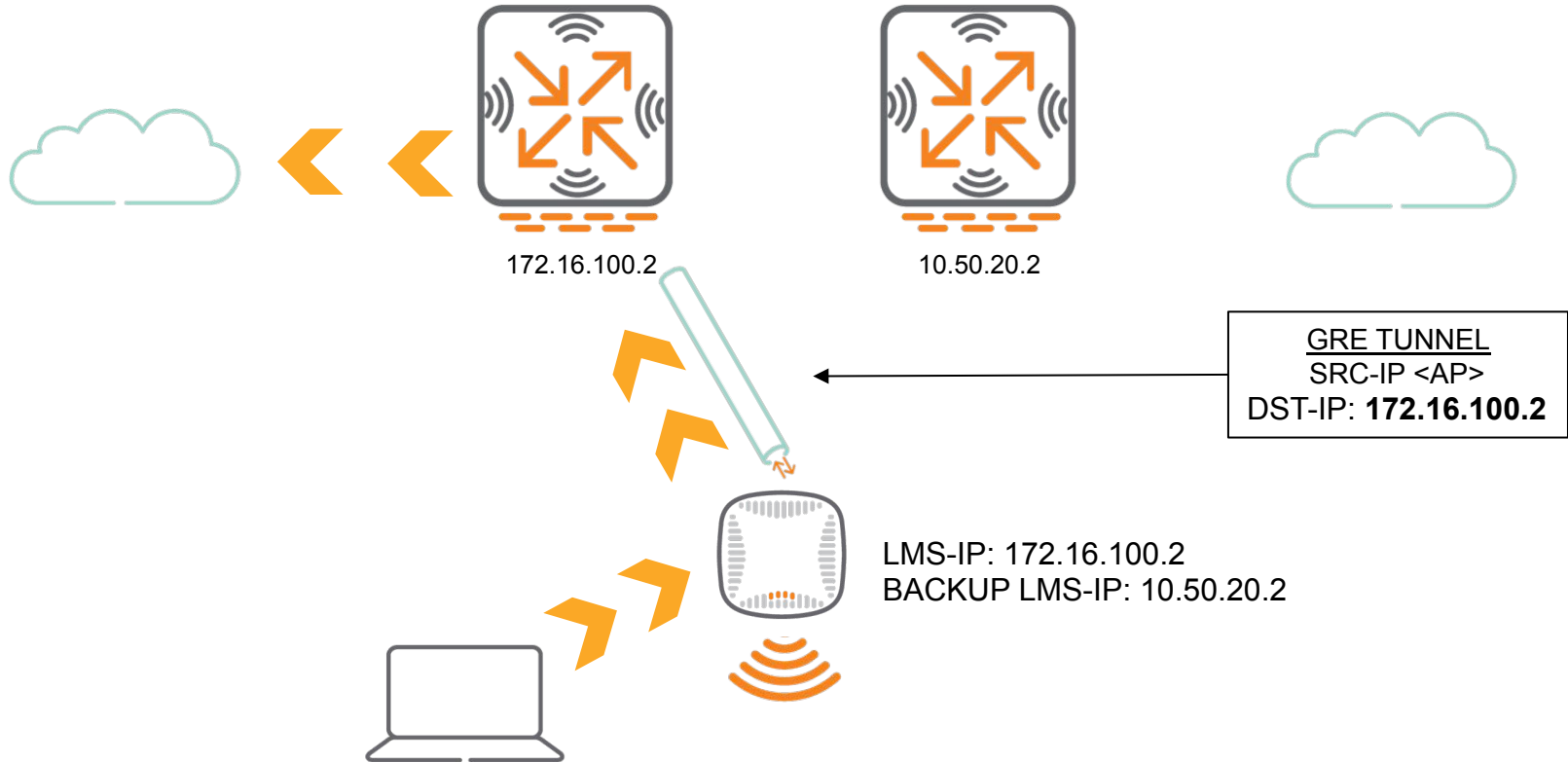
# VRRP Failover (L2)



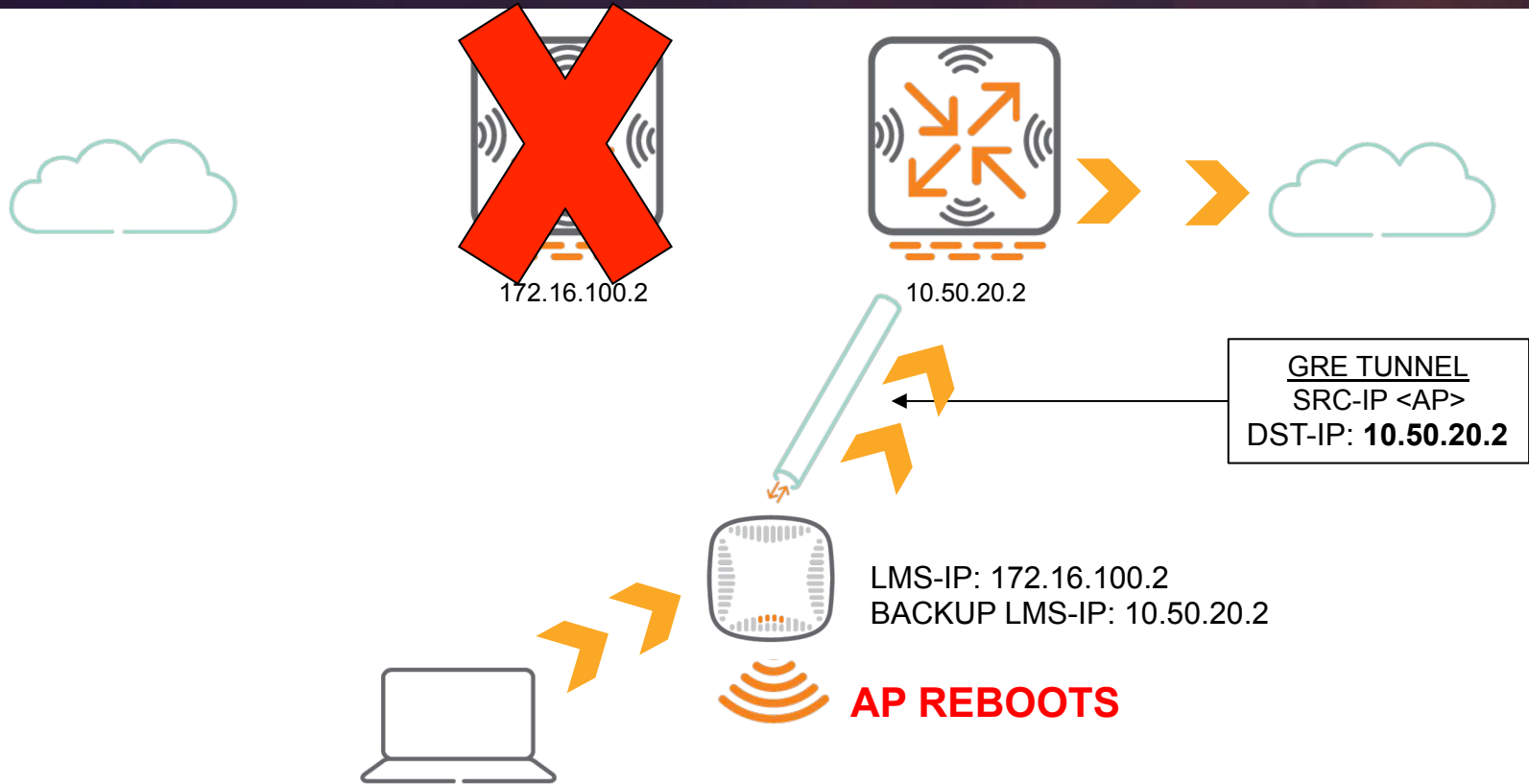
# VRRP Failover (L2)



# Backup-LMS (L3)



# Backup-LMS (L3)

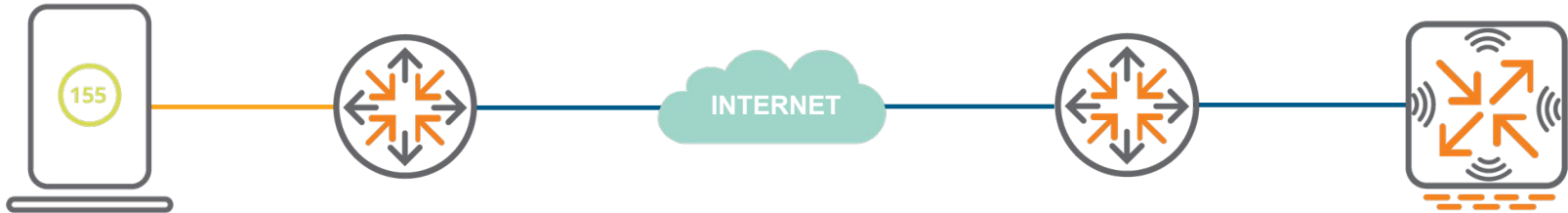


# Remote AP (RAP)

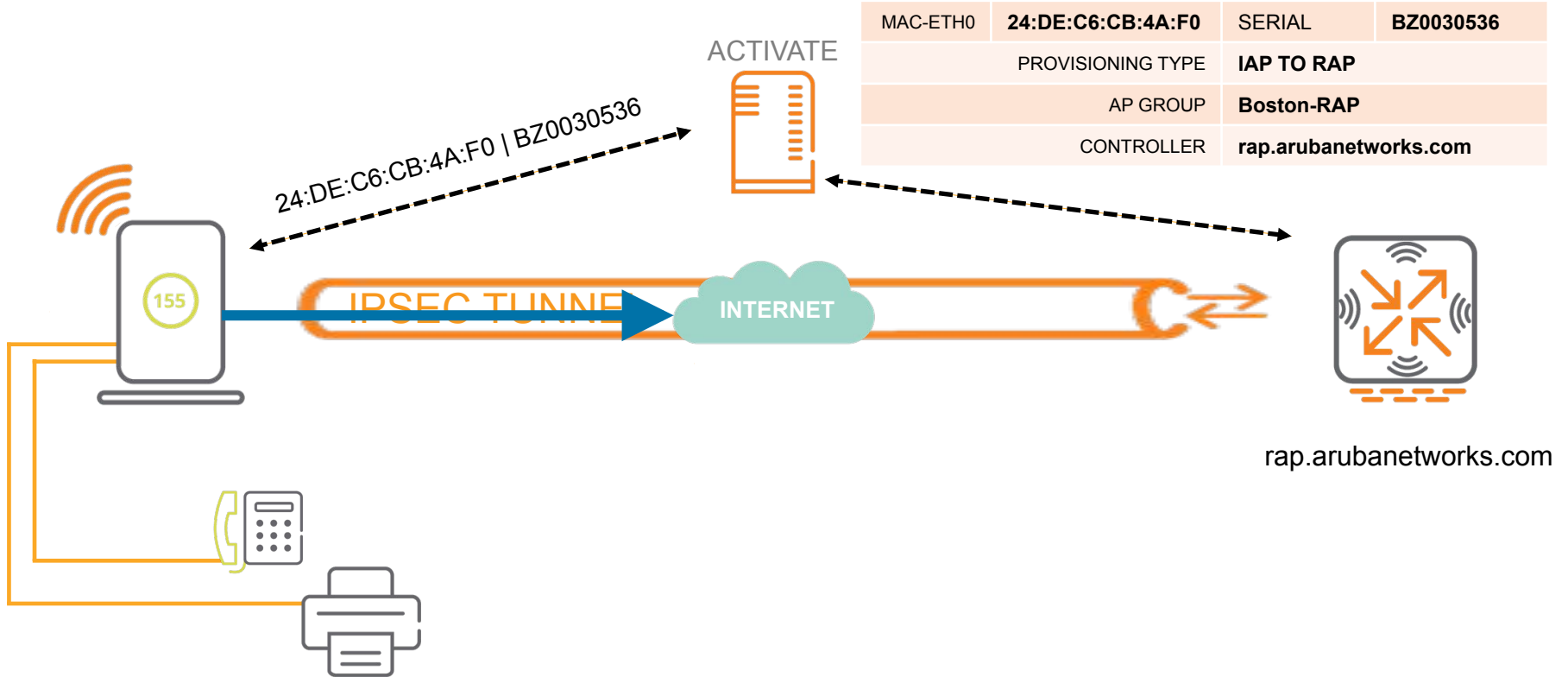


- **Purpose-built RAPs and campus APs**
- **Certificate-based provisioning**
- **Secure wired and wireless remote access**
- **RAPs are Instant out of the box**
- **Aruba Activate**

# Remote AP



# Remote AP - Logical





# RAP Forwarding Modes

- **Tunnel**
- **Bridge**
- **Decrypt-tunnel**
- **Split-tunnel**

- **Tunnels certain traffic back to controller via IPSec tunnel (defined in user roles)**
- **Allows non-corporate traffic to be bridged out locally saving bandwidth.**
- **RAP handles encryption, decryption and firewall enforcement locally**

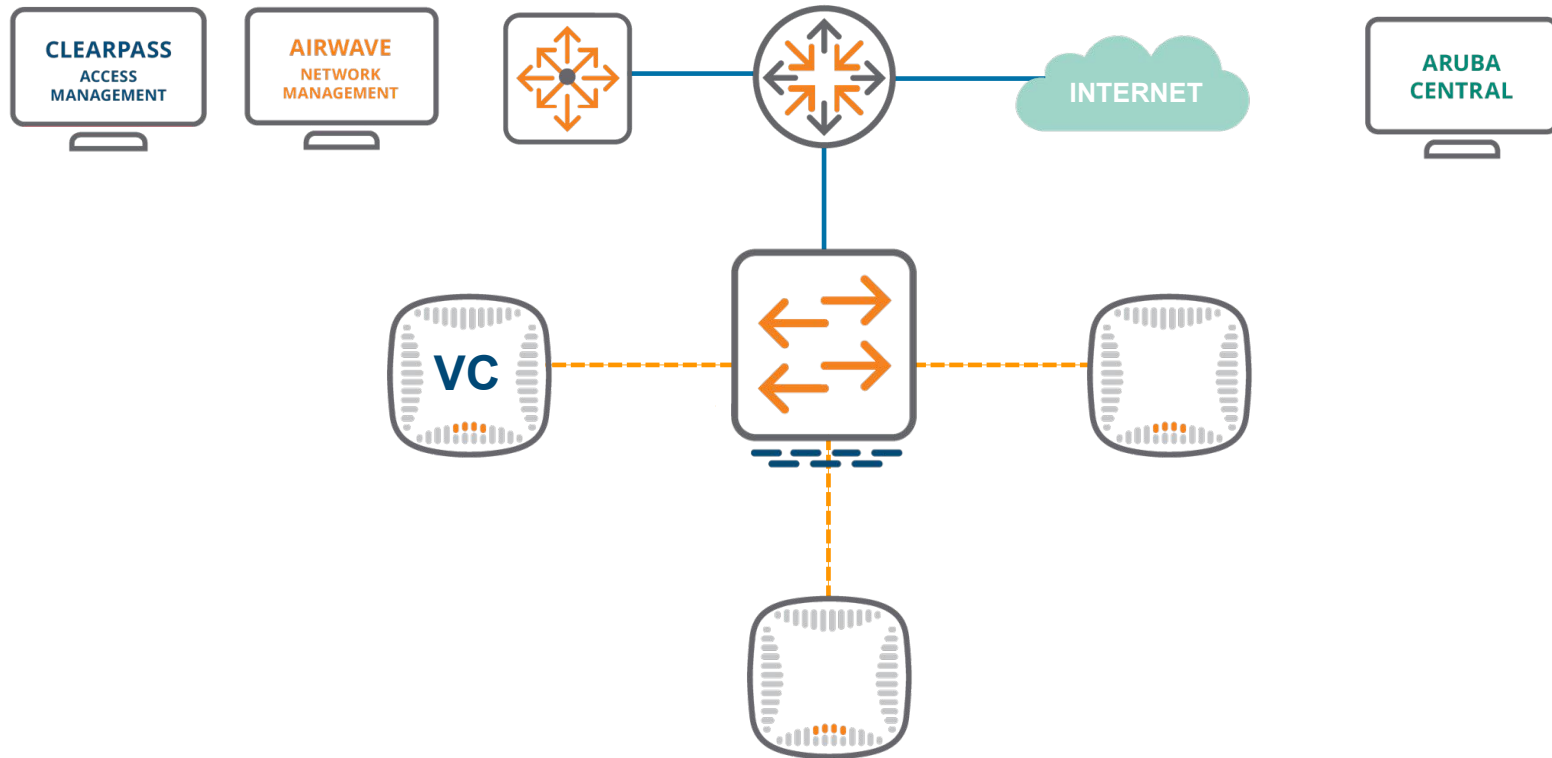
- **Roaming**
- **ARM features**
- **Requires controller licenses**
- **Limited visibility**

# Aruba Instant Architecture

- **AP model begins with the letter I**
  - IAP-225, IAP-215, IAP-205, etc
- **Instant APs can be converted to controller-based APs**
- **No feature licensing with local management**
- **Manage locally, via AirWave, or Aruba Central (cloud)**
- **Dynamic provisioning via Aruba Activate (free)**

- **Cooperate locally at L2**
- **Multiple uplink options (Ethernet, 4G/LTE, WiFi)**
- **ARM, ClientMatch, AppRF, AirGroup, L3 Mobility**
- **IAP-VPN/RAP-NG for distributed environments**

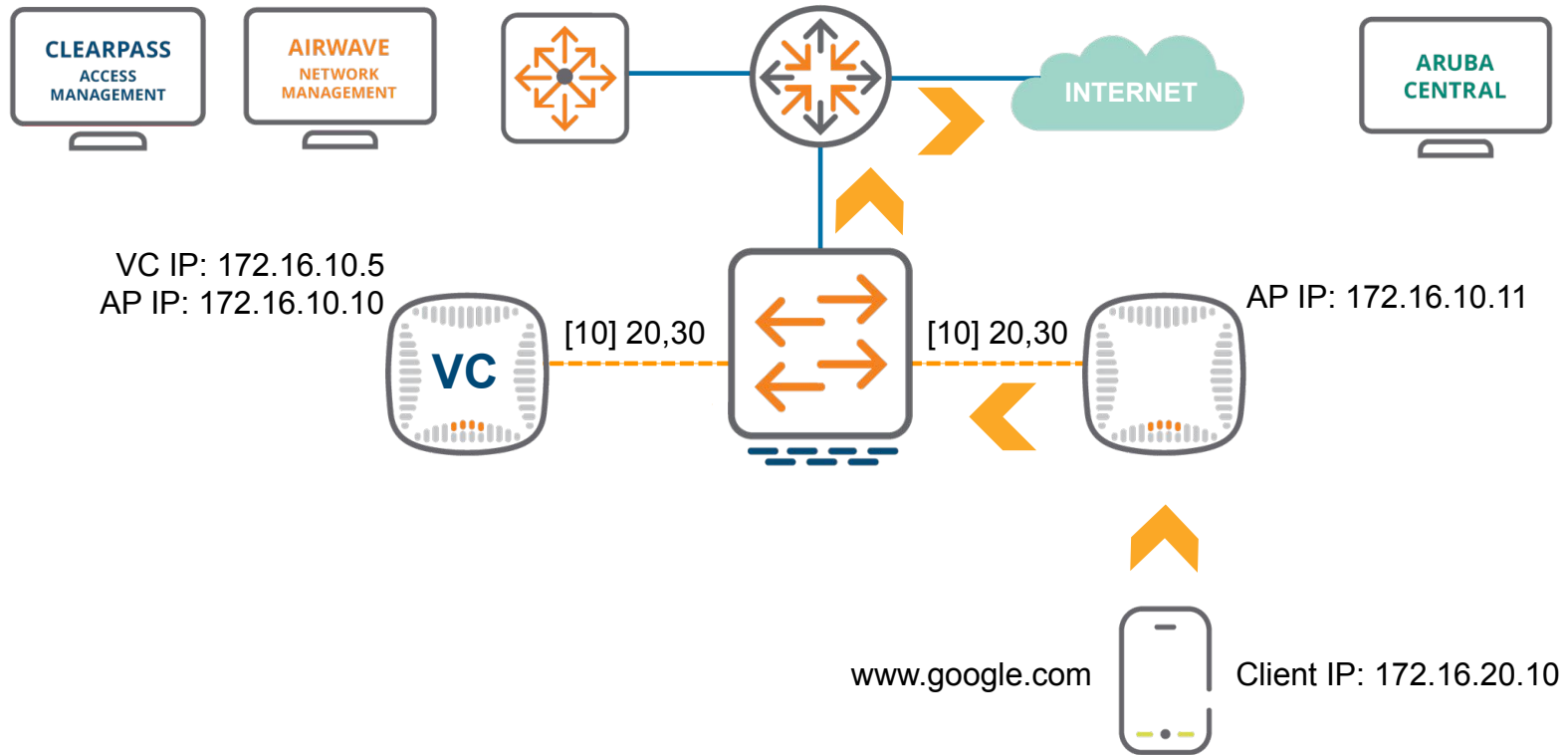
# Instant topology



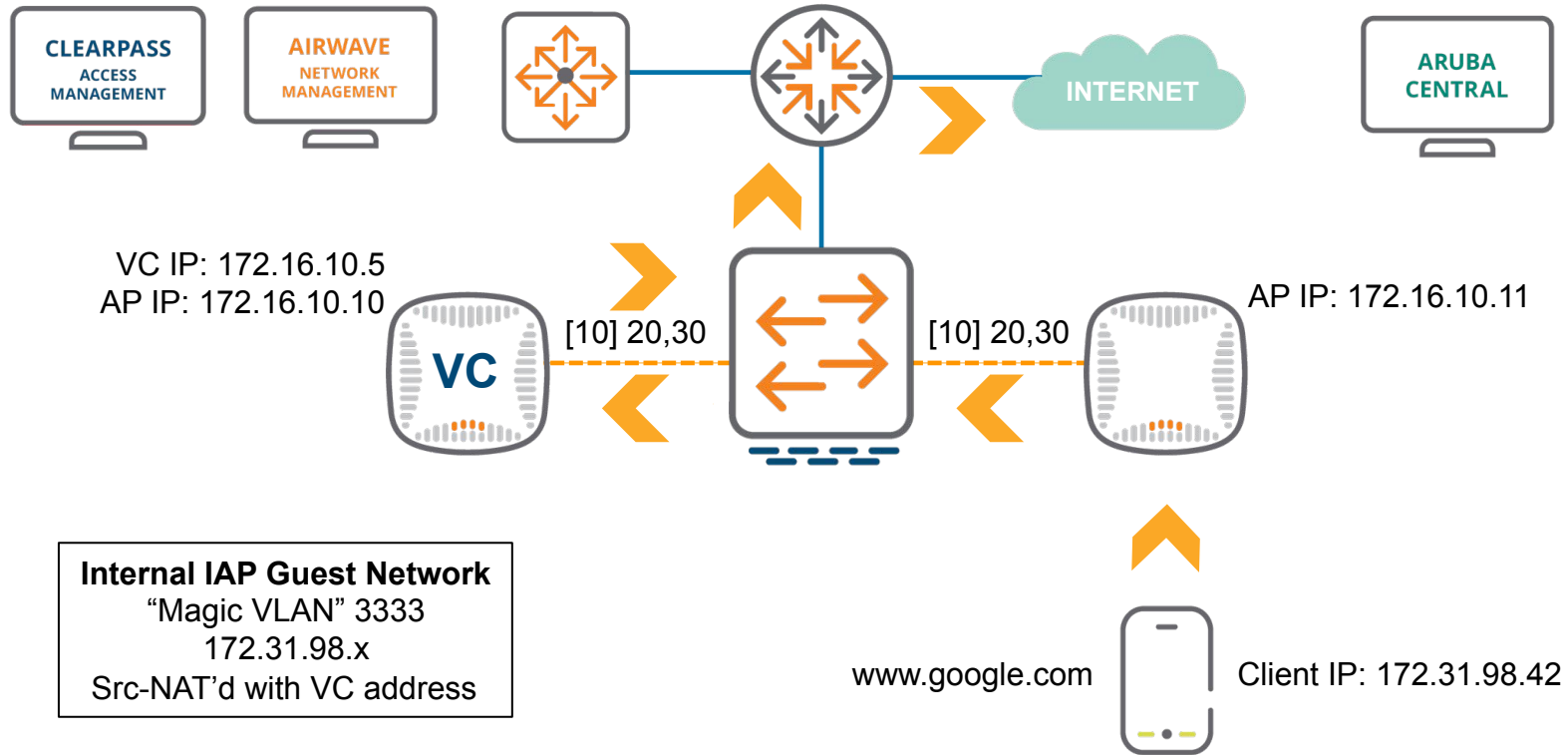
- **Traffic destined for tunnels goes through VC**
- **NAT'd traffic (guest) goes through VC**
- **Regular user traffic firewalled, processed and switched out at AP**



# Instant traffic flow

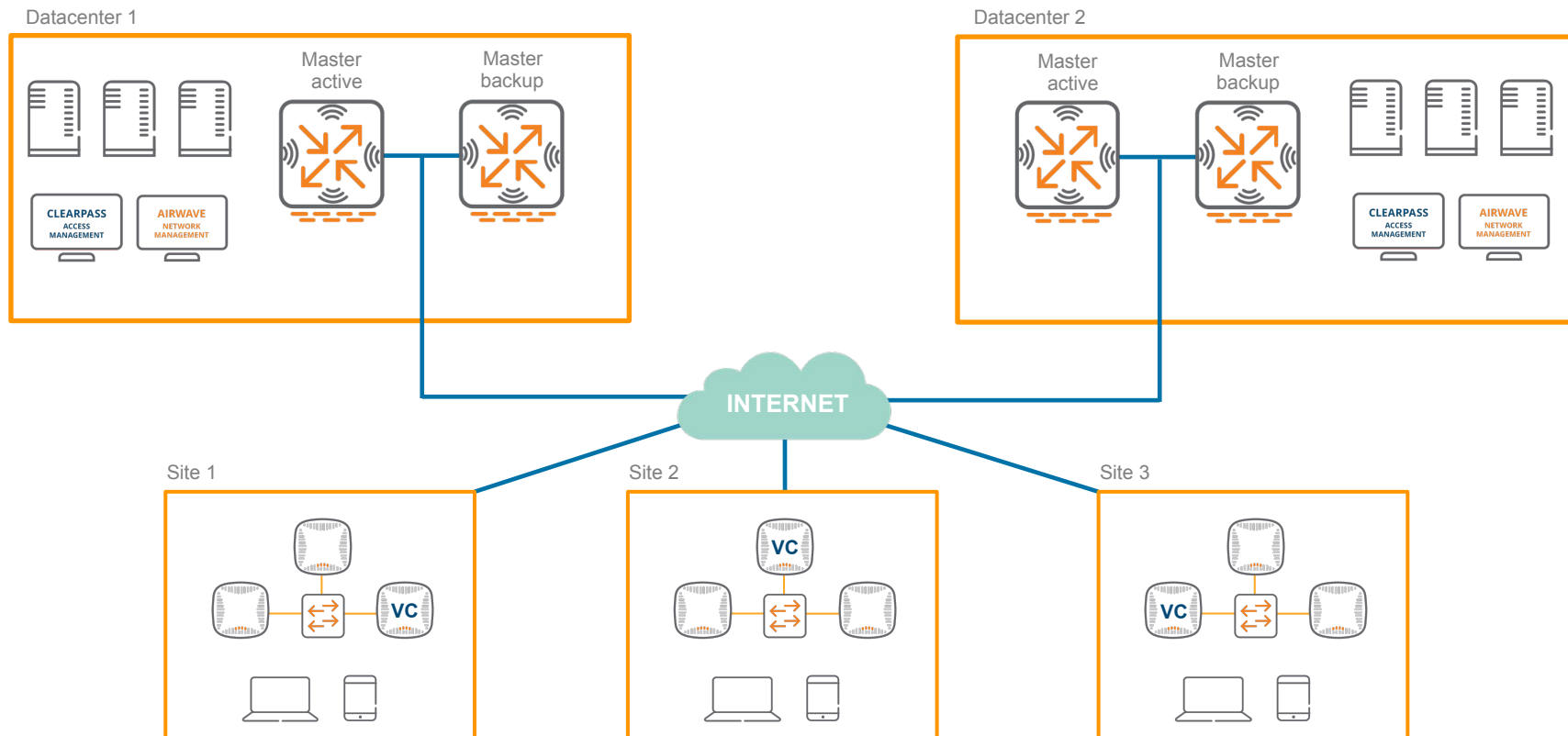


# Instant traffic flow – Guest/NAT



# RAP-NG / IAP-VPN

# RAP-NG / IAP-VPN Topology



- **Local RF coordination**
- **Roaming**
- **Isolated broadcast domains for each cluster**
- **Authentication survivability**
- **MAS integration**

- **Local**
- **Centralized L2**
- **Distributed L2**
- **Centralized L3**
- **Distributed L3**

# DHCP modes

DHCP MODE	SUBNET	DHCP	CLIENT GW	CORP TRAFFIC	LCL/INTERNET
<b>Local</b>	Local	Master AP	Master AP	Src-NAT IPSec tunnel	Src-NAT Master AP IP
<b>Centralized L2</b>	CORP	Datacenter	Datacenter	Tagged & switched to datacenter via tunnel	Src-NAT Master AP IP
<b>Distributed L2</b>	CORP	Master AP	Datacenter	Tagged & switched to datacenter via tunnel	Src-NAT Master AP IP
<b>Centralized L3</b>	CORP	Datacenter	Master AP	Routed to datacenter inside IPSec tunnel	Src-NAT Master AP IP
<b>Distributed L3</b>	CORP	Master AP	Master AP	Routed to datacenter inside IPSec tunnel	Src-NAT Master AP IP

- **For basic VPN connectivity (single role), a single PEFNG license is required**
- **To use different roles for individual IAP clusters, the PEFV license is required for each controller**






atmosphere2015

HOW TOMORROW MOVES

# Aruba Activate

# Aruba Activate

88 (87) of 87 Devices Move to Folder | Refresh CLI | Refresh Device(s) | More

Serial	MAC Addr	Status	Part	Folder	Firmware	Node	Last Seen	IP Address	Controller	AP/Device	Ship.	PO Number
...	08:00:00:00:00:00	Shipped	SAP-100-US	default	6.3.1.4-6.3.0.3_45022	18P-S08	2/10/2015 3:04 PM	...	34	08:00:00:00:00:00	...	...
...	08:00:00:00:00:00	Shipped	SAP-115-US	default	6.3.1.4-6.3.0.3_46401	18P-4C	2/10/2015 3:02 PM	...	...	08:00:00:00:00:00	...	...
...	08:00:00:00:00:00	Shipped	SAP-80-US	default	6.3.1.4-6.3.0.3_46401	18P-4C	2/20/2015 3:00 PM	...	...	08:00:00:00:00:00	...	...
...	08:00:00:00:00:00	Shipped	SAP-85-US	default	6.3.1.4-6.3.0.3_46401	18P-S08	2/20/2015 3:00 PM	...	...	08:00:00:00:00:00	...	...
...	08:00:00:00:00:00	Shipped	SAP-105-US	Home Labs	6.3.1.4-6.3.0.3_41648	18P-4C	2/20/2015 3:00 PM	...	...	08:00:00:00:00:00	...	...
...	08:00:00:00:00:00	Shipped	SAP-105-US	default	6.3.0.0-6.2.0.0_36000	18P-4C	2/10/2015 3:00 PM	...	...	08:00:00:00:00:00	...	...
...	08:00:00:00:00:00	Shipped	SAP-105-US	default	6.2.0.0-6.2.0.0_37020	18P-4C	2/10/2015 3:00 PM	...	...	08:00:00:00:00:00	...	...
...	08:00:00:00:00:00	Shipped	SAP-115-US	default	6.3.1.4-6.3.0.3_45022	18P-S08	2/20/2015 3:00 PM	...	...	08:00:00:00:00:00	...	...
...	08:00:00:00:00:00	Shipped	SAP-115-US	default	6.3.1.4-6.3.0.3_45022	18P-S08	2/20/2015 3:00 PM	...	...	08:00:00:00:00:00	...	...
...	08:00:00:00:00:00	Shipped	SAP-115-US	default	6.3.1.4-6.3.0.3_45022	18P-S08	2/20/2015 3:00 PM	...	...	08:00:00:00:00:00	...	...
...	08:00:00:00:00:00	Shipped	SAP-115-US	default	6.3.1.4-6.3.0.3_45022	18P-S08	2/20/2015 3:00 PM	...	...	08:00:00:00:00:00	...	...
...	08:00:00:00:00:00	Shipped	SAP-115-US	default	6.3.1.4-6.3.0.3_45022	18P-S08	2/20/2015 3:00 PM	...	...	08:00:00:00:00:00	...	...
...	08:00:00:00:00:00	Shipped	SAP-115-US	default	6.3.1.4-6.3.0.3_45022	18P-S08	2/20/2015 3:00 PM	...	...	08:00:00:00:00:00	...	...
...	08:00:00:00:00:00	Shipped	SAP-115-US	default	6.3.1.4-6.3.0.3_45022	18P-S08	2/20/2015 3:00 PM	...	...	08:00:00:00:00:00	...	...
...	08:00:00:00:00:00	Shipped	SAP-115-US	default	6.3.1.4-6.3.0.3_45022	18P-S08	2/20/2015 3:00 PM	...	...	08:00:00:00:00:00	...	...
...	08:00:00:00:00:00	Shipped	SAP-115-US	default	6.3.1.4-6.3.0.3_45022	18P-S08	2/20/2015 3:00 PM	...	...	08:00:00:00:00:00	...	...
...	08:00:00:00:00:00	Shipped	SAP-115-US	default	6.3.1.4-6.3.0.3_45022	18P-S08	2/20/2015 3:00 PM	...	...	08:00:00:00:00:00	...	...

### Device Summary

**Device Detail**

Total Devices: 87

AP: 28


Controller: 7

LAN: 43

RAI: 1


NAD: 8

**Devices by Part Number**



- AP-200
- Other
- SAP-115-US
- SAP-120-US
- SAP-100-US
- SAP-105-US
- SAP-110-US
- SAP-115-US
- SAP-120-US
- SAP-125-US
- SAP-130-US
- SAP-135-US
- SAP-140-US
- SAP-145-US
- SAP-150-US
- SAP-155-US
- SAP-160-US
- SAP-165-US
- SAP-170-US
- SAP-175-US
- SAP-180-US
- SAP-185-US
- SAP-190-US
- SAP-195-US
- SAP-200-US
- SAP-205-US
- SAP-210-US
- SAP-215-US
- SAP-220-US
- SAP-225-US
- SAP-230-US
- SAP-235-US
- SAP-240-US
- SAP-245-US
- SAP-250-US
- SAP-255-US
- SAP-260-US
- SAP-265-US
- SAP-270-US
- SAP-275-US
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- SAP-300-US
- SAP-305-US
- SAP-310-US
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- SAP-320-US
- SAP-325-US
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- SAP-335-US
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- SAP-345-US
- SAP-350-US
- SAP-355-US
- SAP-360-US
- SAP-365-US
- SAP-370-US
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- SAP-410-US
- SAP-415-US
- SAP-420-US
- SAP-425-US
- SAP-430-US
- SAP-435-US
- SAP-440-US
- SAP-445-US
- SAP-450-US
- SAP-455-US
- SAP-460-US
- SAP-465-US
- SAP-470-US
- SAP-475-US
- SAP-480-US
- SAP-485-US
- SAP-490-US
- SAP-495-US
- SAP-500-US
- SAP-505-US
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- SAP-800-US
- SAP-805-US
- SAP-810-US
- SAP-815-US
- SAP-820-US
- SAP-825-US
- SAP-830-US
- SAP-835-US
- SAP-840-US
- SAP-845-US
- SAP-850-US
- SAP-855-US
- SAP-860-US
- SAP-865-US
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- SAP-930-US
- SAP-935-US
- SAP-940-US
- SAP-945-US
- SAP-950-US
- SAP-955-US
- SAP-960-US
- SAP-965-US
- SAP-970-US
- SAP-975-US
- SAP-980-US
- SAP-985-US
- SAP-990-US
- SAP-995-US
- SAP-1000-US

**Devices by Firmware**



- Other
- 6.3.1.4-6.3.0.3\_41
- 6.3.1.4-6.3.0.3\_40
- unknown
- 6.4.1.0
- 6.3.1.4-6.3.0.3\_39
- 6.3.1.4-6.3.0.3\_40
- 6.3.0.0-6.2.0.0\_37
- 6.3.1.4-6.3.0.3\_40
- 6.3.1.4-6.3.0.3\_40

**Order Detail**

Standard Direct: 25

Evaluation: 11

88A Adv-Eval: 2

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52

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# MANAGEMENT

# Aruba Central

- **Cloud management for Instant and MAS**
- **ZTP with Aruba Activate**
- **Firmware management**
- **Reporting**
- **Responsive UI (adaptive to any display)\***
- **AppRF management and visibility\***
- **Cloud captive portal w/ social\***

\* Central 2.0 – Coming Soon

The screenshot displays the Aruba Central web interface. On the left is a navigation sidebar with the Aruba logo and a list of groups: "All Groups (3)", "dMaup0", "SE LMG(2)", and "Tiv-Cole(1)". The "Monitoring" section is expanded, showing a sub-menu with "Overview" (selected), "Access Points", "Switches", "Clients", "WIDS", "Event Log", "Notifications", "Wireless Configuration", "Switch Configuration", "Guest Management", "Reports", "Maintenance", and "Documentation". The main content area is titled "Overview" and features a "Quick Links" button. Below this is a summary table:

ACCESS POINTS	SWITCHES	CLIENTS	ALERT
2 ↑ 0 ↓ 2	2 ↑ 2 ↓ 0	WIFI: 0 WIRE: 0	0/20

Below the table is a map view with tabs for "ACCESS POINTS" and "SWITCHES". The map shows a street grid with a blue location pin and a red location pin. At the bottom of the map are zoom controls: "100", "50", "100", "150", "175".



The dashboard displays the 'Clients' section under 'Monitoring'. It includes a sidebar with navigation options, a summary of total clients (58) and flagged clients (0), a throughput line graph, a table for flagged wireless clients, and a donut chart for device types.

**Monitoring**

- Overview
- Access Points
- Switches
- Clients**
- WIDS
- Event Log
- Notifications
- Wireless Configuration
- Switch Configuration
- Guest Management
- Reports
- Maintenance
- Documentation

### Clients

TOTAL CLIENTS: 58

FLAGGED: 0

THRU (3H) 2H 1D 1W 1Y

#### THROUGHPUT

48 Mbit  
0 Mbit  
-48 Mbit

11:30 11:45 12:00 12:15 12:30

Up  
Down

#### FLAGGED WIRELESS CLIENTS

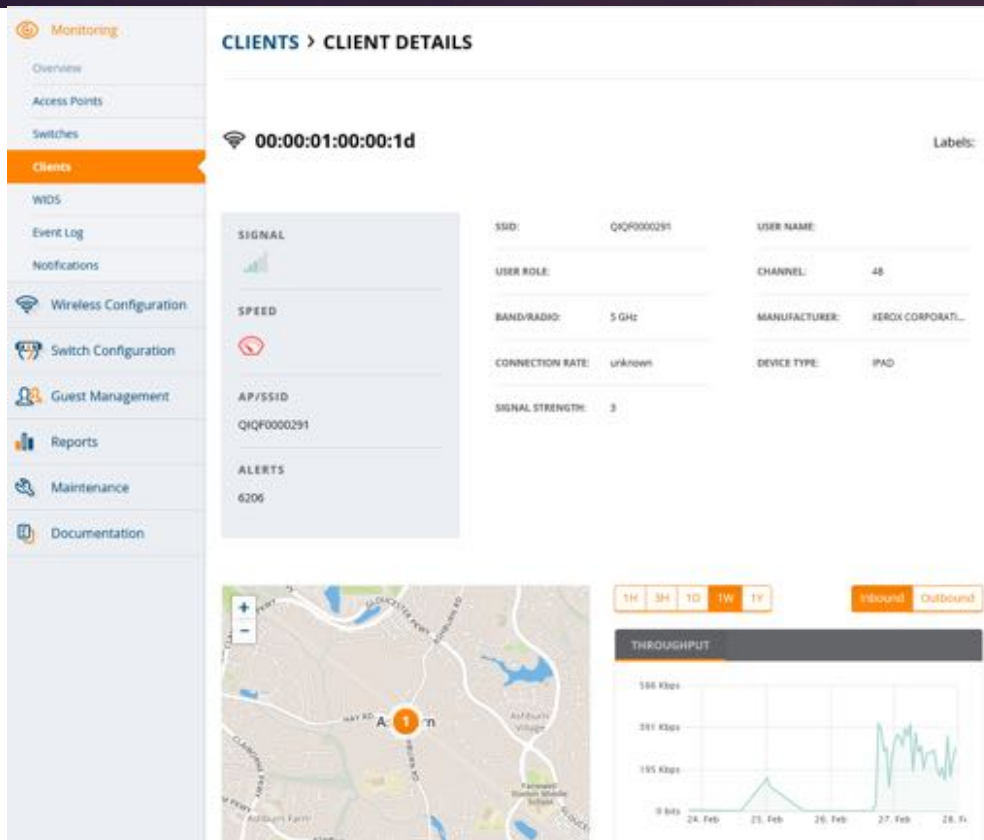
Display ▾

MAC ADDRESS	IP ADDRESS	SIGNAL	SPEED
-------------	------------	--------	-------

#### DEVICE TYPE

- Unknown
- Linux
- iPAD
- WINDOW XP
- Win7





The screenshot displays the 'CLIENTS > CLIENT DETAILS' page in the Aruba Central interface. On the left is a navigation sidebar with categories like Monitoring, Wireless Configuration, and Guest Management. The 'Clients' item is highlighted. The main content area shows client information for a device with MAC address 00:00:01:00:00:1d. It includes signal strength, speed, and AP/SSID details. A table lists technical specifications such as SSID, user role, band/radio, connection rate, signal strength, user name, channel, manufacturer, and device type. At the bottom, there is a map showing the client's location and a throughput graph for inbound and outbound traffic over a period of several days.

### CLIENTS > CLIENT DETAILS

00:00:01:00:00:1d Labels:

Category	Value
SIGNAL	
SPEED	
AP/SSID	QIQF000291
ALERTS	6206

SSID:	QIQF000291	USER NAME:	
USER ROLE:		CHANNEL:	48
BAND/RADIO:	5 GHz	MANUFACTURER:	XEROX CORPORAT...
CONNECTION RATE:	unknown	DEVICE TYPE:	IPAD
SIGNAL STRENGTH:	3		

**THROUGHPUT**

1M 3H 1D 1W 1Y Inbound Outbound

588 Kbps  
294 Kbps  
195 Kbps  
0 Kbps

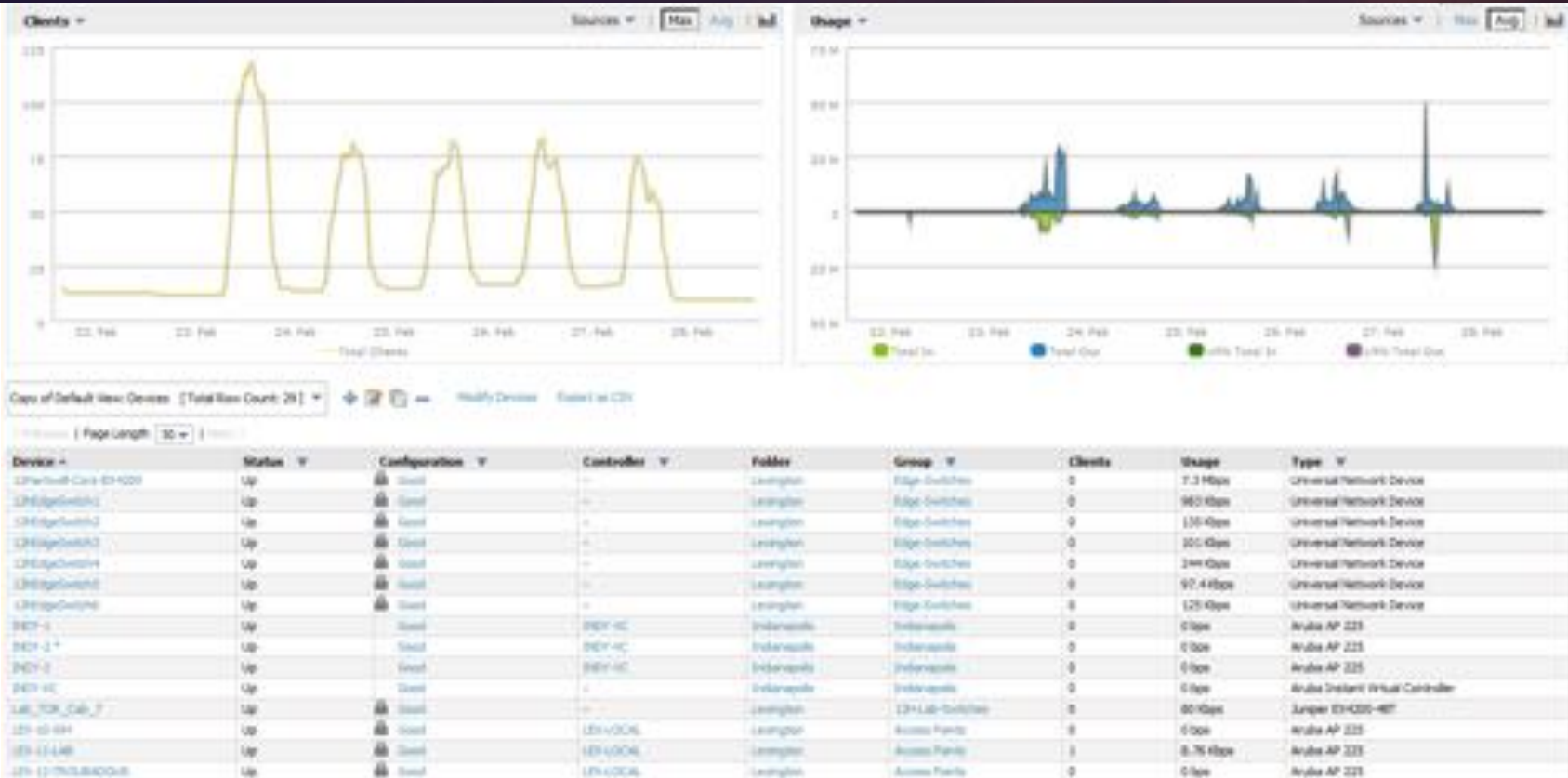
24. Feb. 25. Feb. 26. Feb. 27. Feb. 28. Fe.

The screenshot shows the Aruba Central web interface for configuring a splash page. The top navigation bar includes the Aruba Networks logo, a search bar, and utility icons. A left-hand sidebar contains a menu with categories like Monitoring, Wireless Configuration, Switch Configuration, Guest Management, and a highlighted 'Splash Page' section. The main content area is titled 'Create a Splash Page' and features a progress bar with 'Configuration' and 'Customization' steps. Below this, three preview thumbnails of splash page designs are shown, each with a 'SIGN IN' button and a 'REGISTER' button. At the bottom, there are input fields for 'BACKGROUND COLOR' (set to #000000), 'PRIMARY COLOR' (set to #ff9900), and 'FONT COLOR' (set to #ffffff).

# AirWave

- **On-premise solution (VM or physical)**
- **Management, monitoring and reporting of Aruba controllers, Instant clusters, and MAS**
- **Multi-vendor**
- **In a hybrid controller-Instant environment, AirWave recommended**
- **Single pane of glass**

# Single pane of glass



# Instant GUI config

The screenshot shows the Aruba Instant GUI configuration interface for a new wireless network. The page is titled "New Wireless Network" and is divided into several sections:

- General:** Includes fields for "Type" (Wireless selected), "Name (SSID)" (CAMPALLI), "Primary usage" (Employee selected), "Broadcast/Multicast" settings (Broadcast filtering: Disabled, DTN Interval: 1 beam, Multicast transmission optimization: Disabled, Dynamic multicast optimization: Disabled, DMG channel utilization threshold: 90%), and "Transmit Rates" (2.4GHz: 1, 54, mbps).
- Bandwidth Limits:** Includes checkboxes for "Airtime", "Each user", and "Each radio".
- Microservices:** Includes "Content filtering" (Enabled selected), "Band" (40), "Inactivity timeout" (1000 sec), "Hide SSID" (checkbox), "Max clients threshold" (54), and "Local probe request threshold" (0).

# Discussion & Questions



Home > Community > Address Configuration > IP Addressing > Validated Reference Design Guides

## Validated Reference Design Guides

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### Search the Knowledge Base



Knowledge Base



Options



View 19 Results & Support Cases

#### IP and Routing Optimization for Aruba 802.11ac Networks

Labels: Configuration, IP Addressing, Troubleshooting  
By: [Aruba](#)

Views: 0

Score: 0

#### ArubaOS DHCP Fingerprinting

Labels: DHCP, IP Addressing, Troubleshooting  
By: [Aruba](#)

Views: 1

Score: 0

#### Guest Access with ArubaOS

Labels: Configuration, IP Addressing, Troubleshooting  
By: [Aruba](#)

Views: 0

Score: 0

### Search Airheads



Knowledge Base



### Couldn't find your answer?

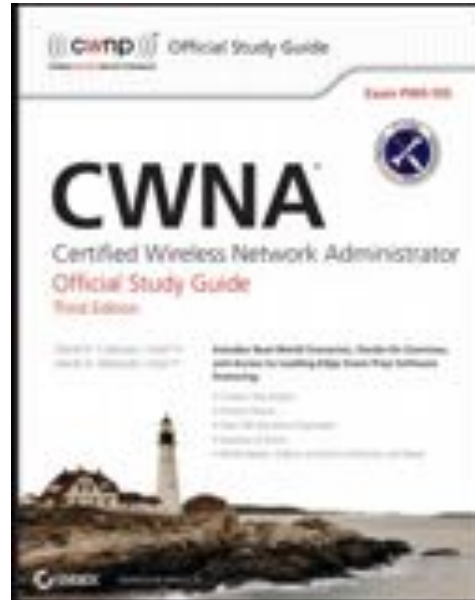
Ask the Community

### Is this a frequent problem?



# Other resources

In-depth Wireless Architecture  
[cwnp.com](http://cwnp.com)



A nighttime photograph of a city skyline, likely Las Vegas, with numerous illuminated buildings and a dense crowd of lights in the foreground. The sky is a deep twilight blue and purple. Two thin, diagonal lines, one white and one yellow, cross the image. The text 'THANK YOU' is centered in the upper right quadrant in a large, white, sans-serif font.

# THANK YOU

The background of the slide is a panoramic view of a city at night, likely Las Vegas, with numerous illuminated buildings and a prominent tower. The sky is a mix of dark blue and orange-red, suggesting a sunset or sunrise. The title 'atmosphere 2015' is written in a large, teal, lowercase sans-serif font across the top half of the image.

# atmosphere 2015

HOW TOMORROW MOVES