

An OT Network Engineer's Guide for MESH, WGB and URWB

CISCO Live !

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Industrial IoT Solutions Engineer

Cisco Webex App

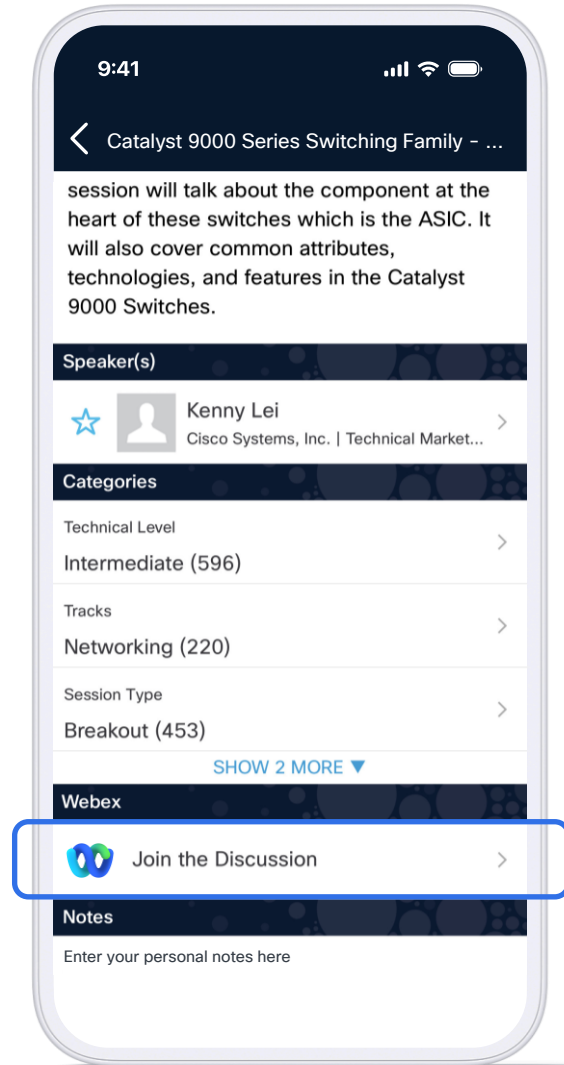
Questions?

Use Cisco Webex App to chat with the speaker after the session

How

- 1 Find this session in the Cisco Live Mobile App
- 2 Click “Join the Discussion”
- 3 Install the Webex App or go directly to the Webex space
- 4 Enter messages/questions in the Webex space

Webex spaces will be moderated by the speaker until 14 November 2025.

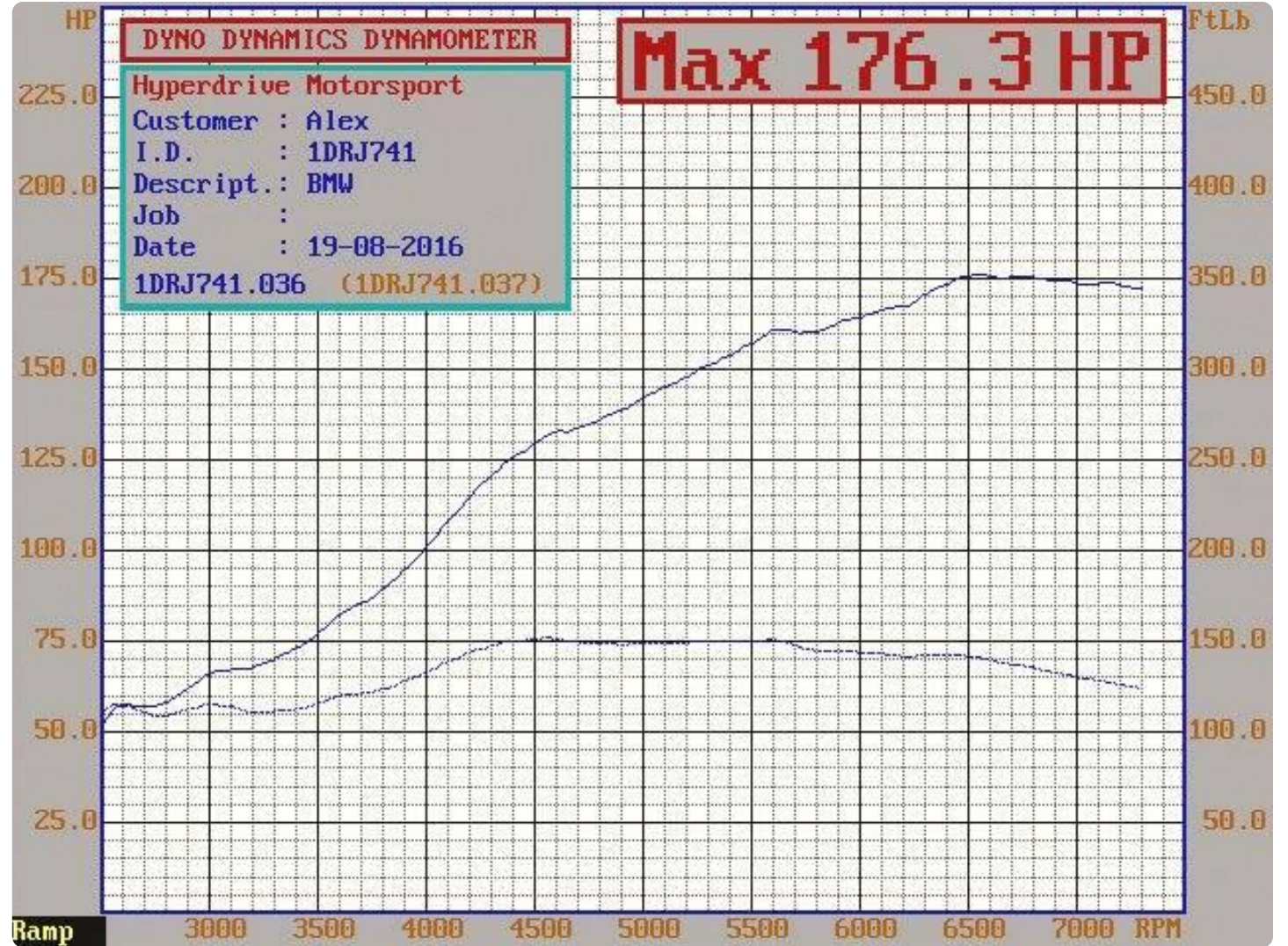


<https://cislive.ciscoevents.com/cislivebot/BRKIOT-2027>

Mature Technologies



Lessons in Compromise



Technology Transition



Extending IT to operational environments



- Warehouses
- Distribution Center
- Parking Lots
- Airport
- Port

- Factories
- Utility Substations
- Roadways

- Oil & Gas Refinery
- Mines

Consistent Network Architecture

Agenda

- 01 Why do we use Mesh & WGB
- 02 Another way? URWB and WLC's
- 03 Demonstration
- 04 Mesh & WGB updates
- 05 Field test results

Why Do We Use Mesh & WGB?

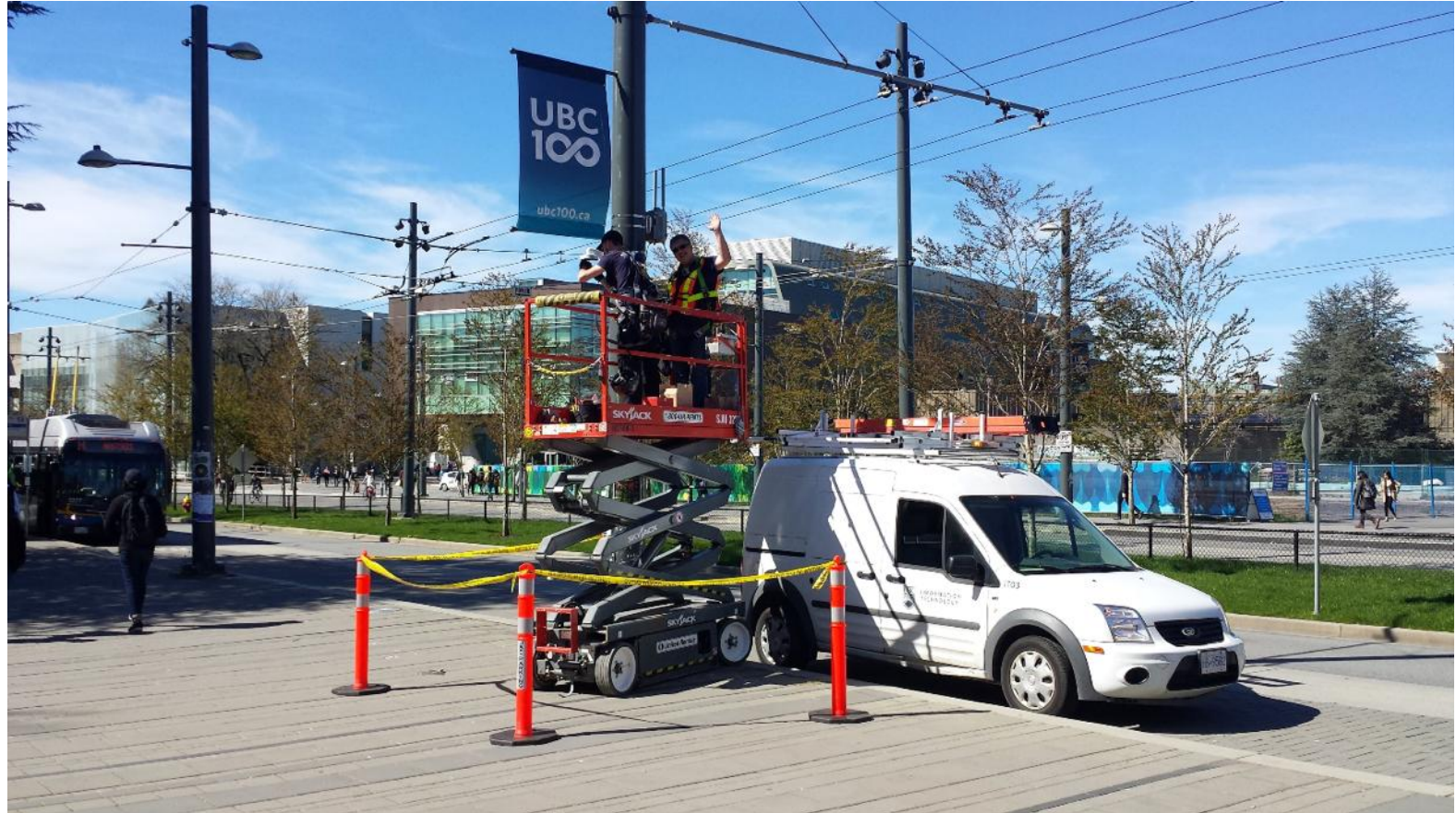
Business Demands Drive Expansion

- Need connectivity or services to somewhere or on some thing
- Can't run fibre, too impractical or expensive
- Same case for copper, although we've also got added distance constraints as well
- But ... we have wireless right?



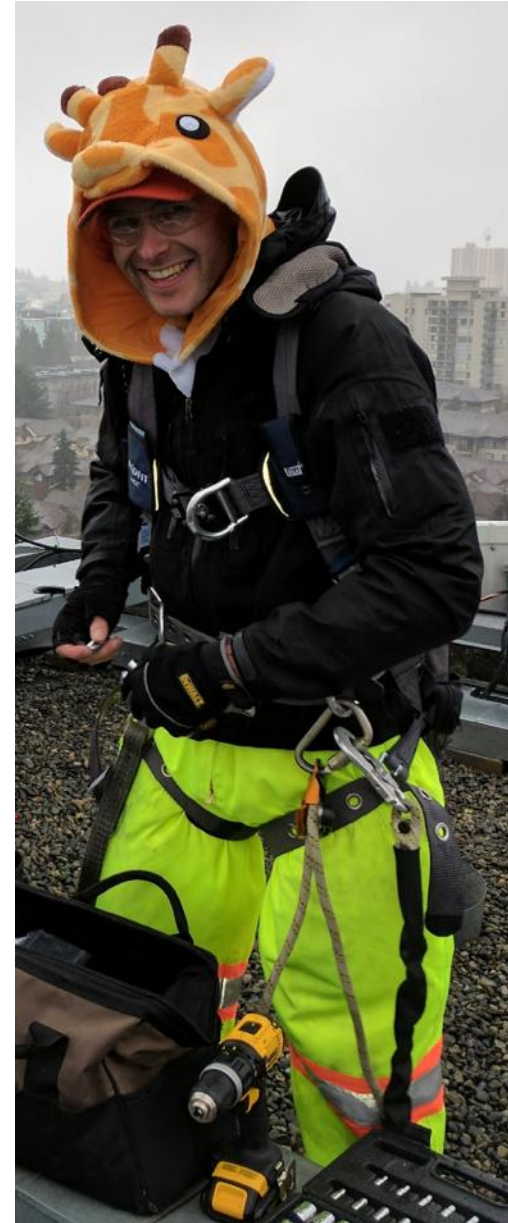
Safety Considerations

- Eliminate use of ladders where possible and practical.
- Make sure to isolate work area, especially in public spaces where “stuff” dropping can be of concern.
- Working teams proficient and certified with any machinery used to achieve the job safely.

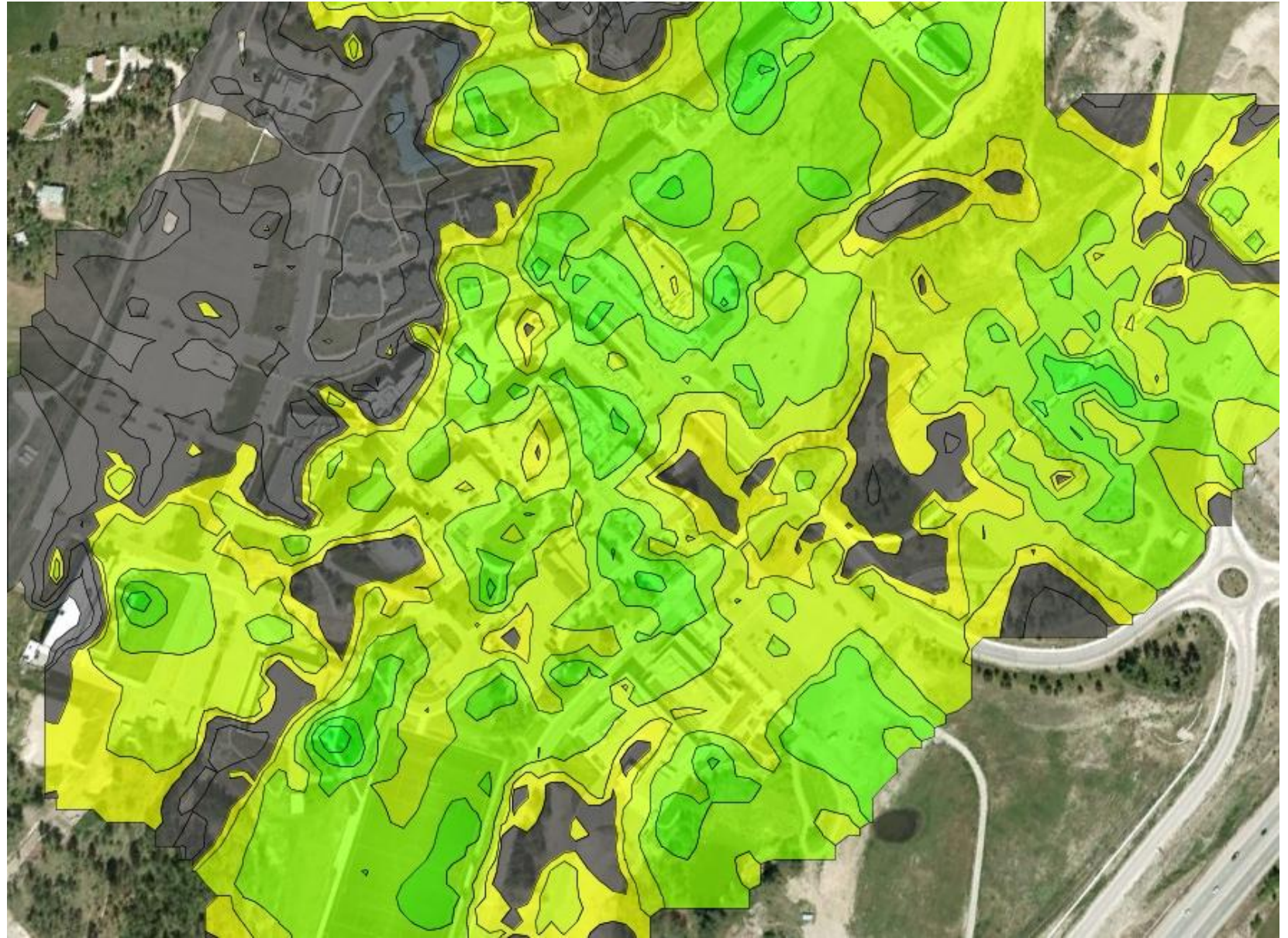


Safety Considerations

- Working teams familiar with hazardous location requirements
 - Explosive areas
 - Stored potential energy
 - Radiation, including RF!!!
 - Autonomous vehicles
 - Confined areas & noxious gasses
- Staff familiarity with all aspects of a solution
 - From Layer 1 – Cables, connectors, tools
 - To Layer 7 – Application characteristics



RF Bleed Considerations



Why do I need an Outdoor AP?



Image Source:
<https://bboxblog.files.wordpress.com/2014/10/ipratings2-copy.jpg>

SOLID OBJECT		MOISTURE	
1	Protected against a solid object greater than 50mm such as a hand.	1	Protected against vertical falling drops of water. Limited ingress permitted.
2	Protected against a solid object greater than 12.5mm such as a finger.	2	Protected against vertical falling drops of water with enclosure tilted up to 15 degrees from the vertical. Limited ingress permitted.
3	Protected against a solid object greater than 2.5mm such as a screwdriver.	3	Protected against sprays of water up to 60 degrees from the vertical. Limited ingress permitted.
4	Protected against a solid object greater than 1mm such as a wire.	4	Protected against water splashes from all directions. Limited ingress permitted.
5	Dust protected. Limited ingress of dust permitted. Will not interfere with operation of the equipment.	5	Protected against jets of water. Limited ingress permitted.
6	Dust tight. No ingress of dust.	6	Protected against powerful jets of water. Limited ingress permitted.
		7	Watertight against the effects of immersion in water between 15cm and 1m for 30 minutes.
		8	Watertight against the effects of immersion in water under pressure for long periods.

IP65
 |
 Ingress protection

Environmental Testing



Hardware Installation Guides

- A hardware deployment guide is published that accompanies each product Cisco makes.
- These guides are specifically helpful in understanding the various mounting brackets and installation options for each product.
- Grounding, lightning protection, antenna configurations and weatherproofing are also covered.



Another Way?

**Ultra-Reliable Wireless
Backhaul and WLC's!**

What if I told you we could do something better than WGB?



Devices could seamlessly roam between wireless APs with zero packet loss, with less latency and jitter



Both ends of the connection are managed in the WLC (and other platforms in the future)



Critical wireless devices could have a redundant connection to two separate APs



The same solution is also capable of point-to-point, point-to-multipoint, and mesh links

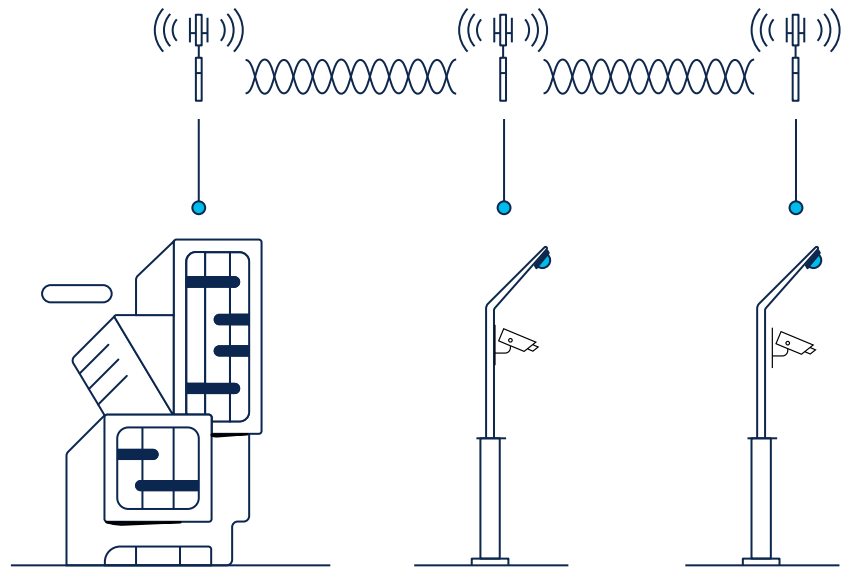
These problems can't be solved today with Wi-Fi alone.

Enter Cisco URWB.

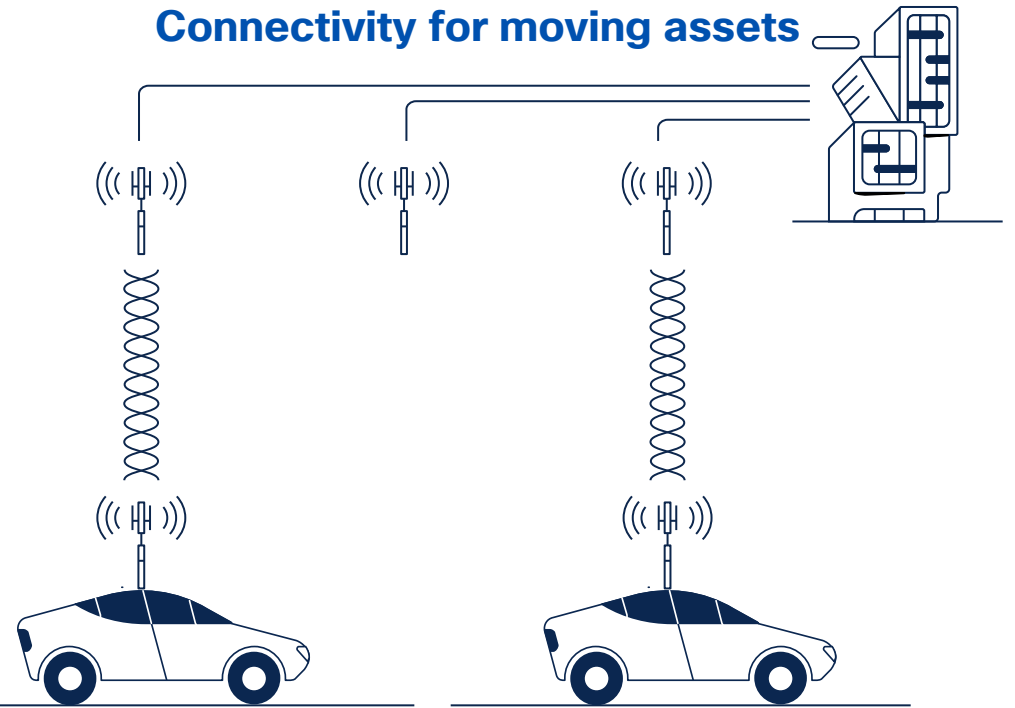
What is URWB?

Reliable fiber-like wireless connectivity, anywhere

Connectivity where fiber isn't available or is too costly



Connectivity for moving assets



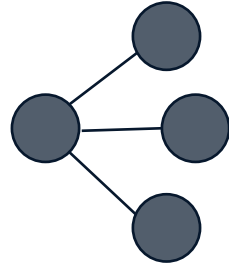
Proven · Deploys like Wi-Fi · Full control of your network · Unlicensed spectrum

Supports highly flexible wireless architectures

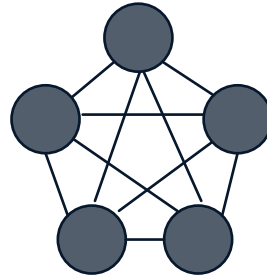
Point to Point



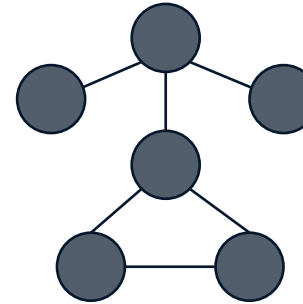
Point to Multipoint



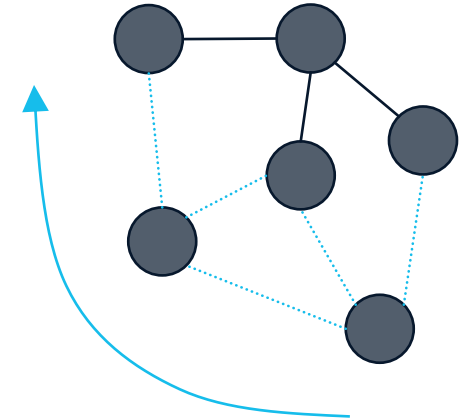
Mesh



Mixed



Mobility



Ultra-Reliable Wireless Backhaul to connect fixed and mobile assets for Ports OTS, T2G, Entertainment, Mining, Smart Cities

The R isn't Silent

URWB \neq UWB

UWB is for **location** awesomeness

URWB is for **reliability** awesomeness

Common URWB Use Cases



Manufacturing / AGV



Connected Rail




Intersections and Highways




Mining

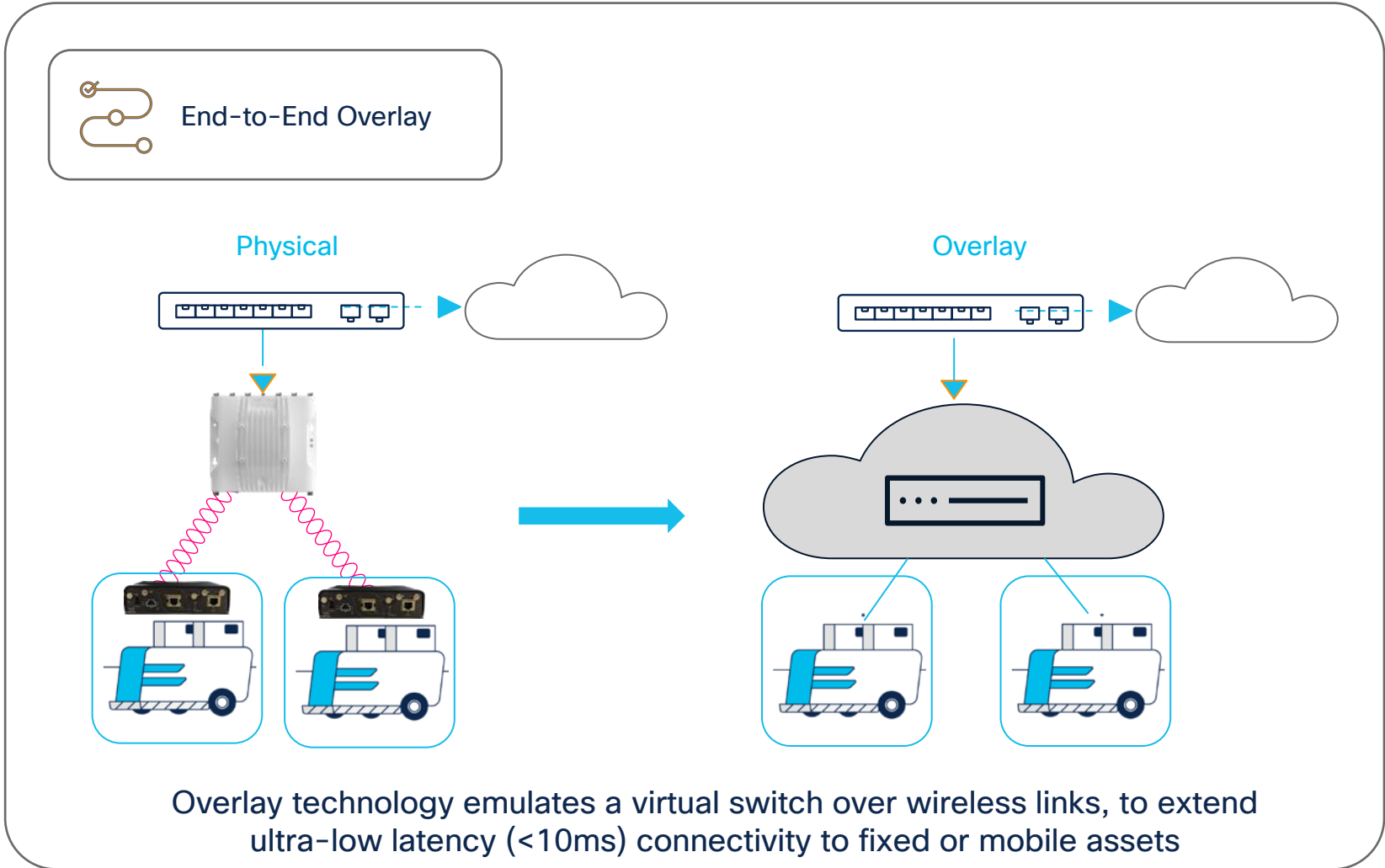
What Makes URWB Ultra-Reliable?

 End-to-End Overlay

 Ultra-fast failover
Carrier-grade availability

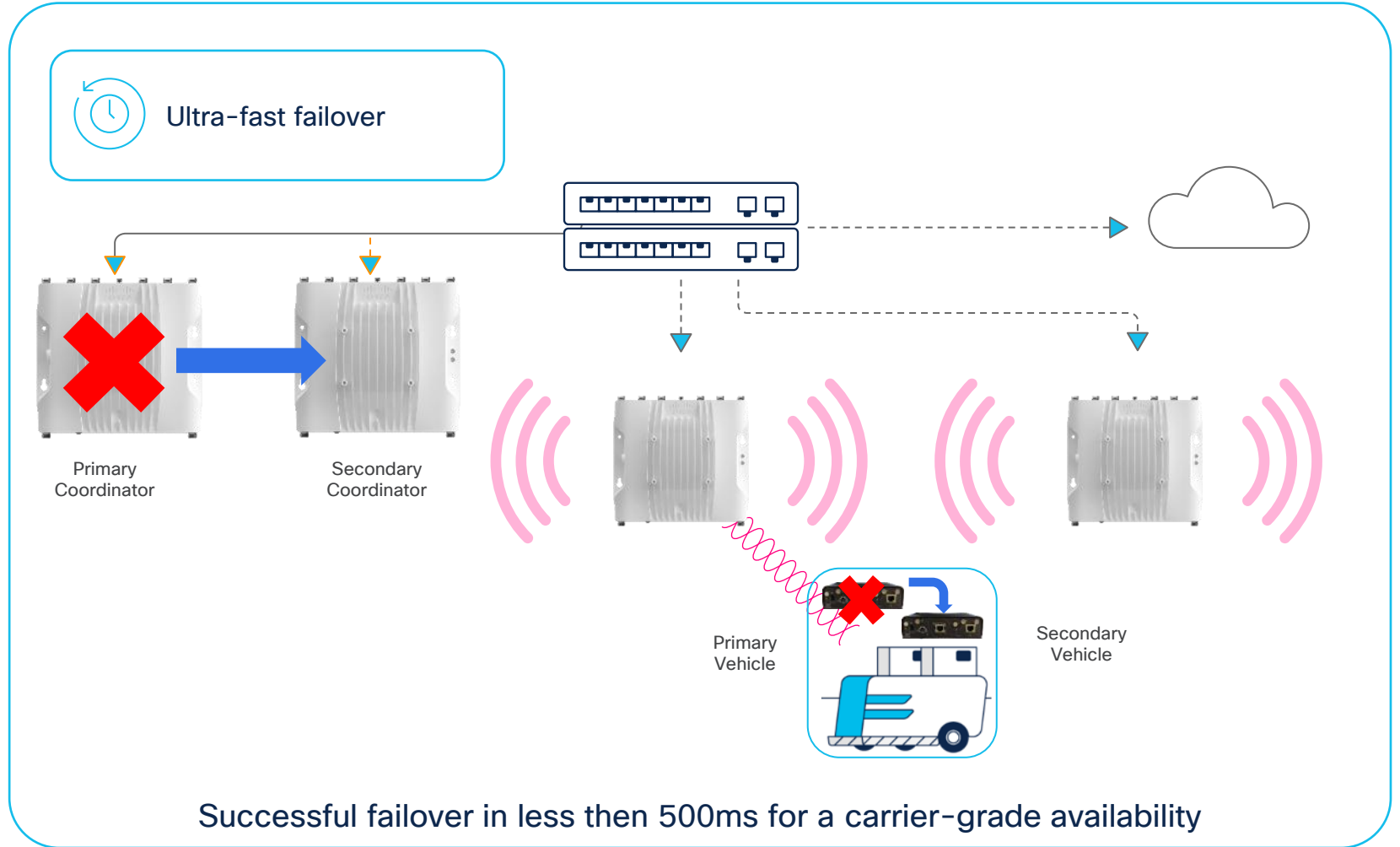
 Make-before-break
handoff

 Multipath operations
(MPO)

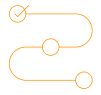


What Makes URWB Ultra-Reliable?

- End-to-End Overlay
- Ultra-fast failover
Carrier-grade availability
- Make-before-break handoff
- Multipath operations (MPO)



What Makes URWB Ultra-Reliable?



End-to-End Overlay



Ultra-fast failover
Carrier-grade availability



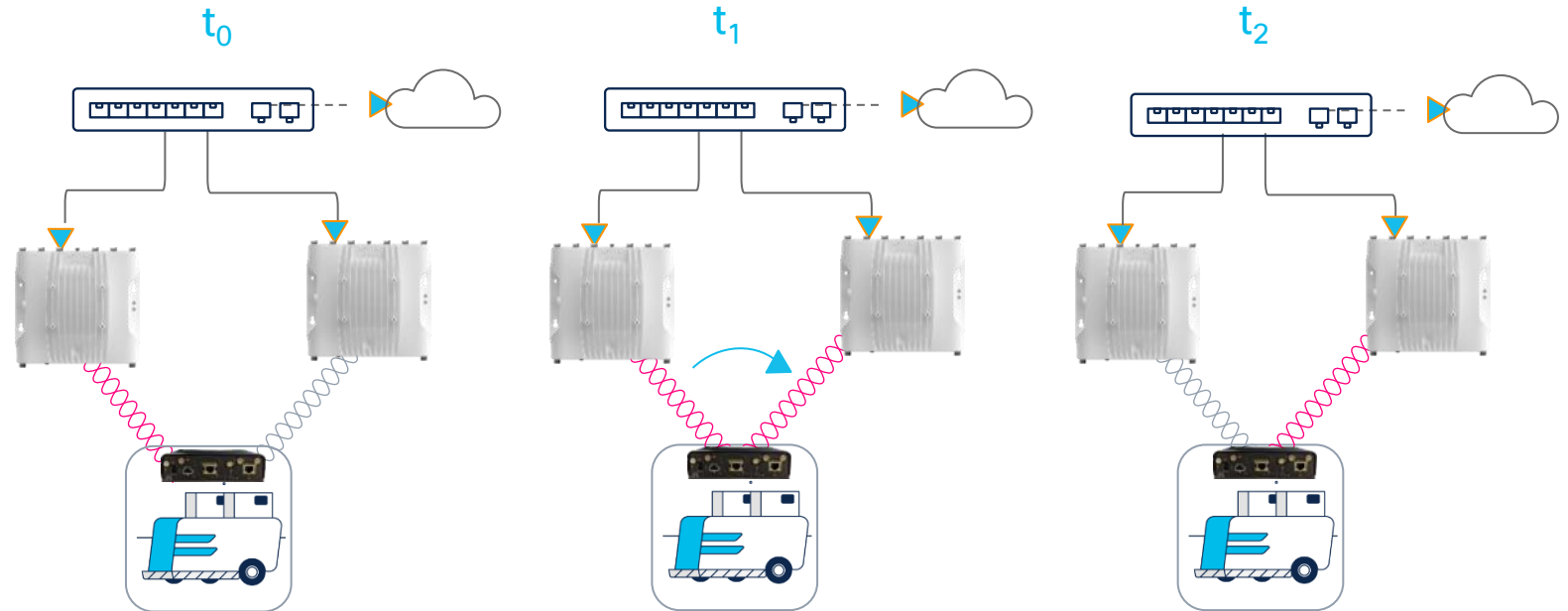
Make-before-break
handoff



Multipath operations
(MPO)




Make-before-break
handoff



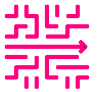
Make-before-break handoff ensures connectivity is established with a new AP before dropping connectivity from the previous AP

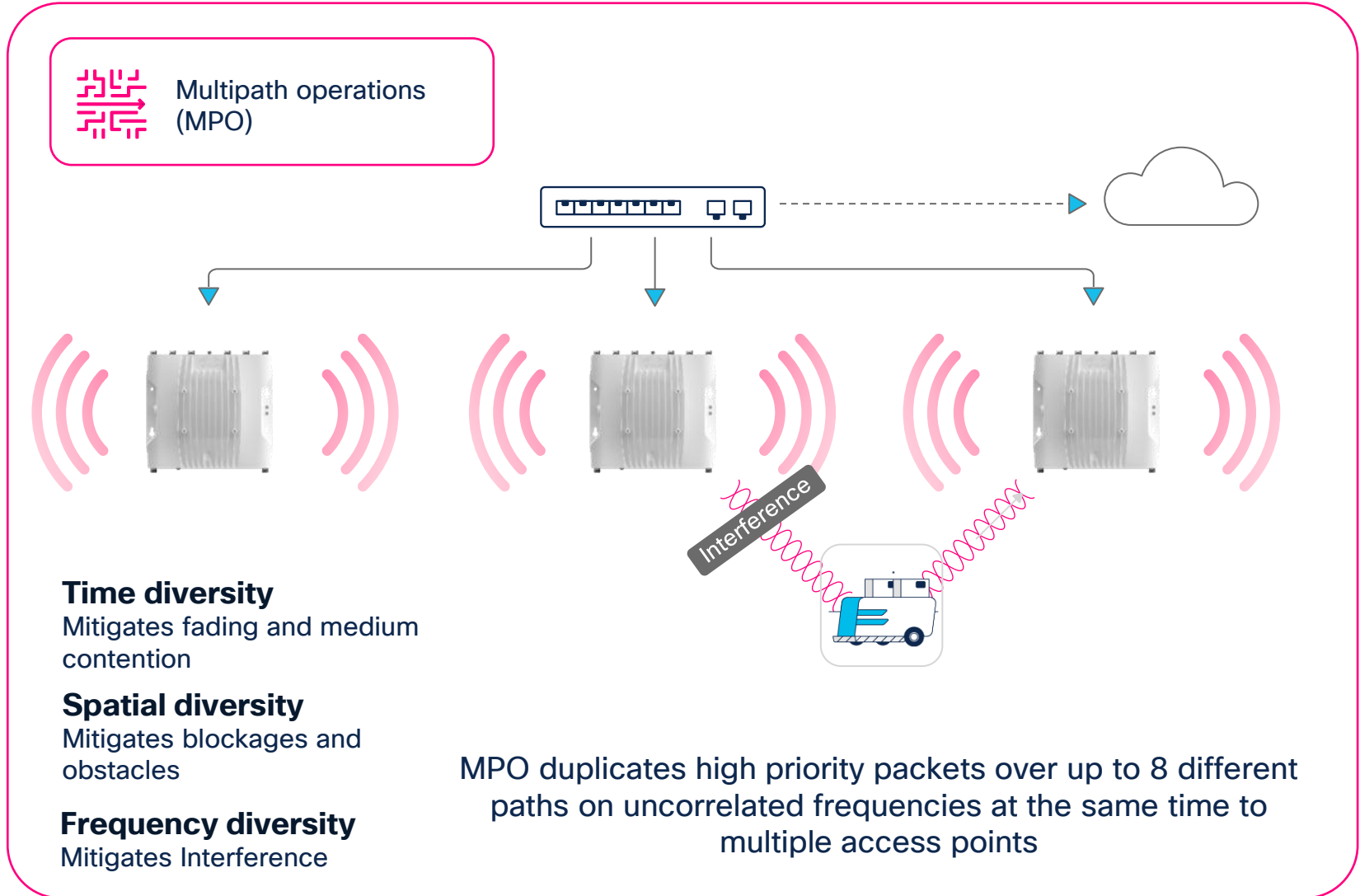
What Makes URWB Ultra-Reliable?

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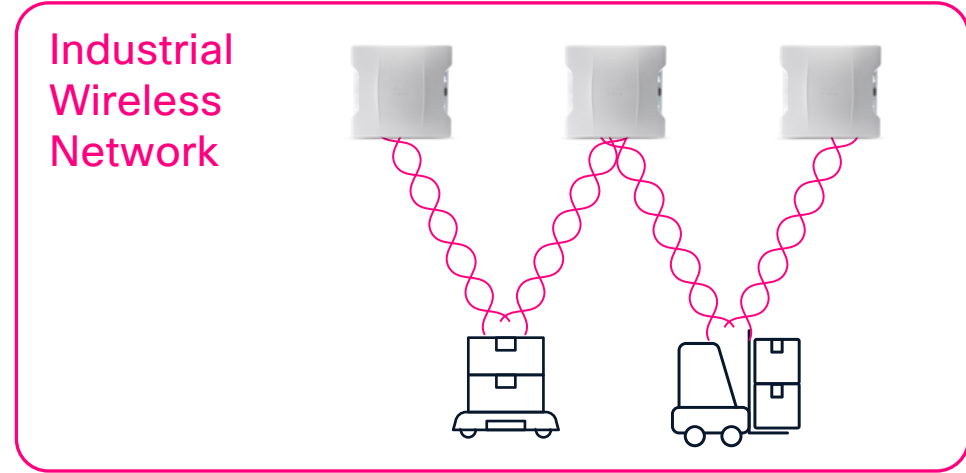


URWB is not Wi-Fi

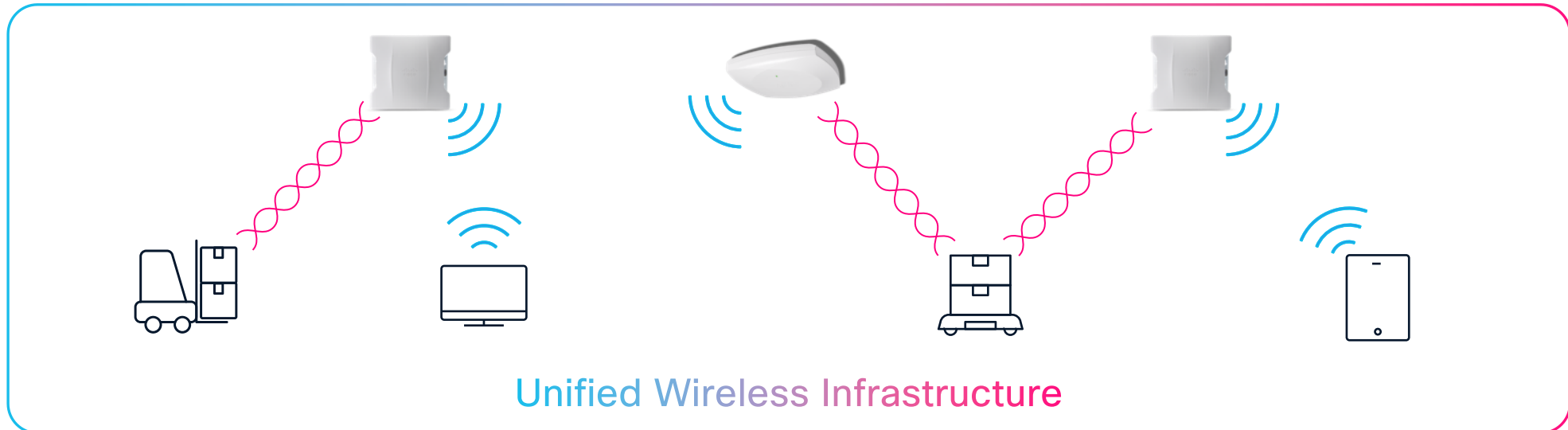
- Cisco URWB has always been a separate AP software image and only available on IW APs
- Customers have historically deployed and managed separate parallel AP infrastructures for URWB and Wi-Fi

Introducing Simultaneous Wi-Fi and URWB

Before



Now



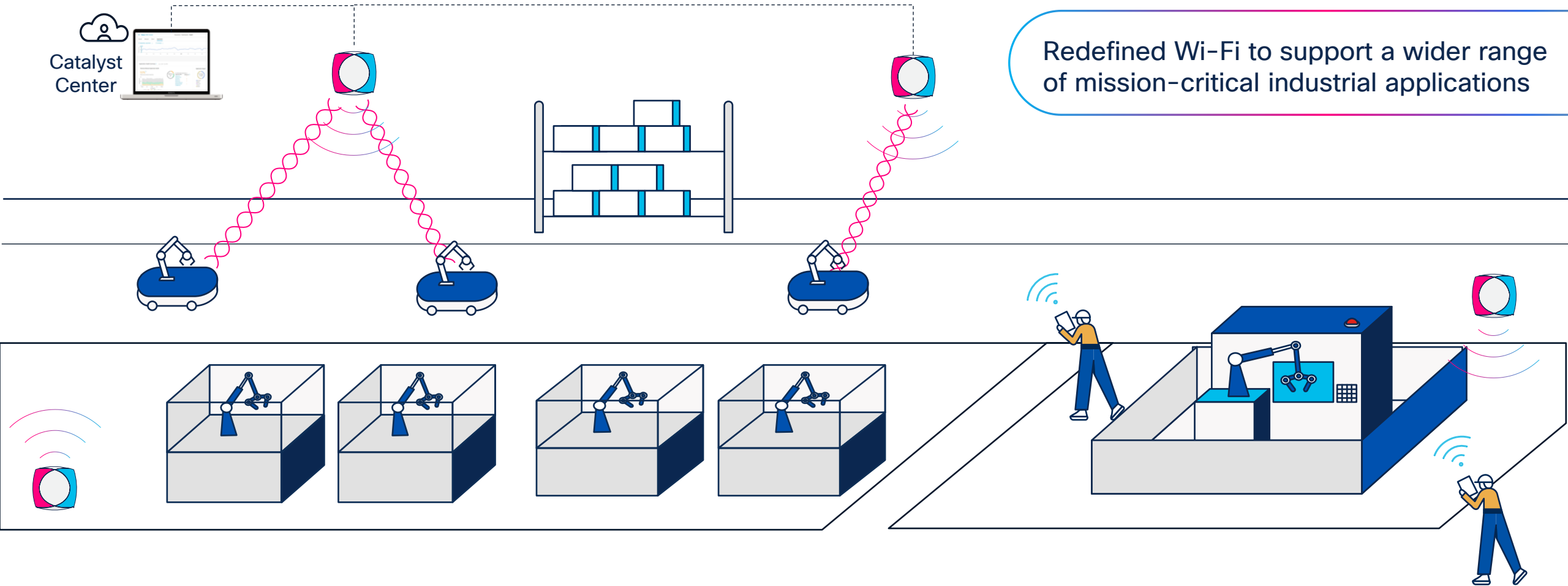
The Best of Both Worlds

URWB and Wi-Fi on the same AP, simultaneously

- Unified software image
 - No need to “dual-boot” separate URWB and Wi-Fi images
- Enablement is per radio/AP and is not a dedicated AP mode
 - URWB can be enabled on APs running Local and FlexConnect mode
- **All APs will be managed by WLC** (and other platforms in the future)
 - This means WGB use cases fulfilled by URWB will be centrally manageable
- Note: Standalone URWB architecture will continue to be available

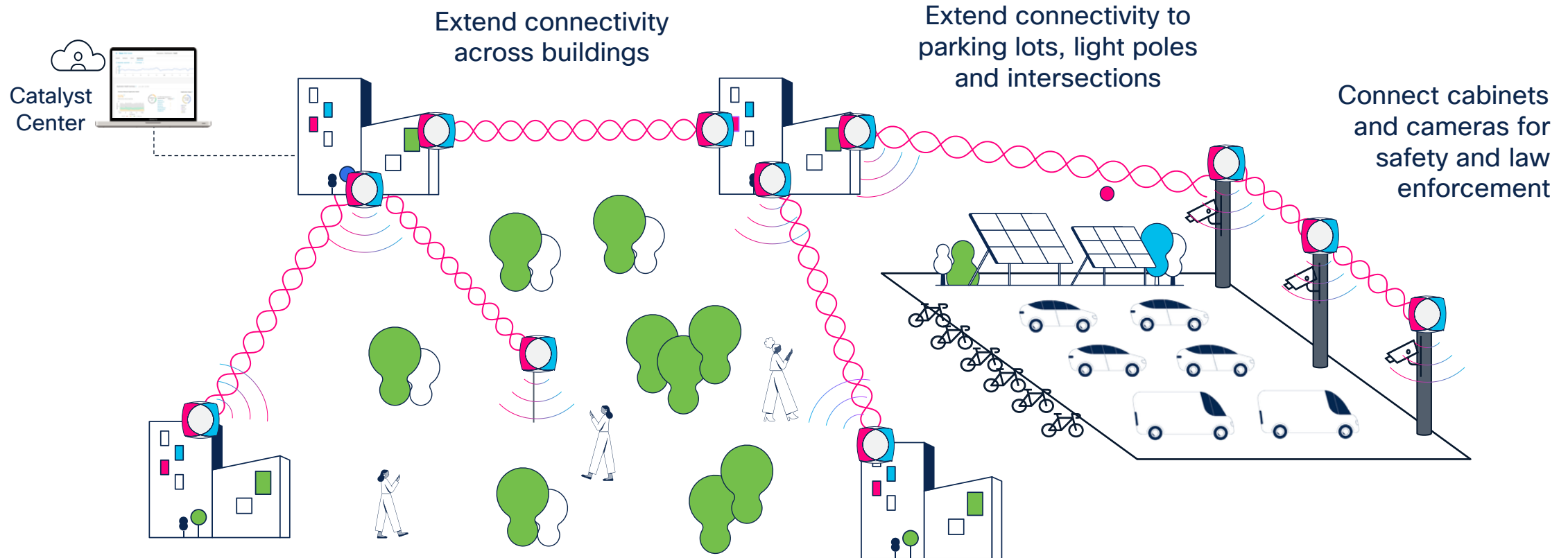


Mobile Example: Mining Autonomy, Manufacturing, Logistics



Fixed Example: Extend Mine or Campus coverage

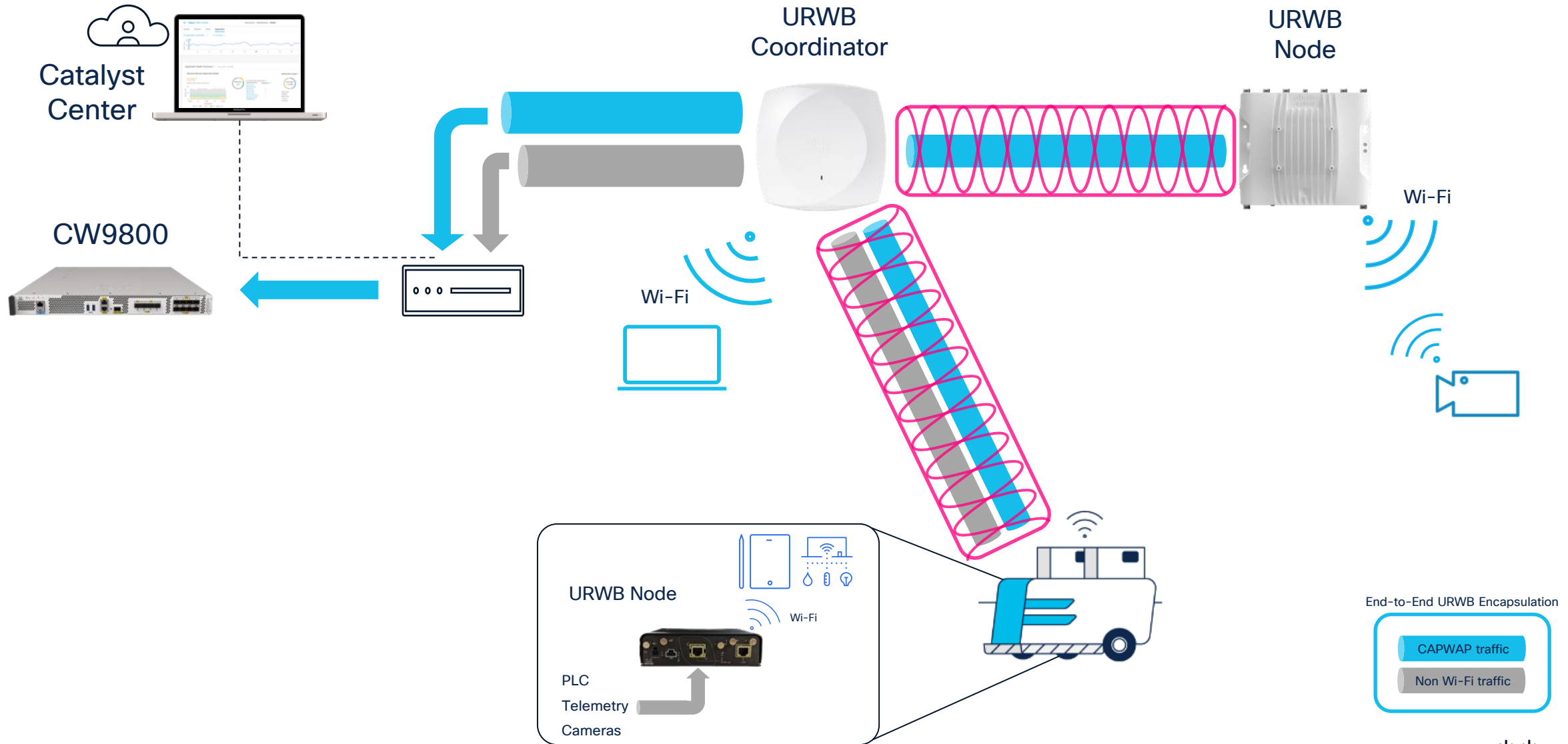
Extend connectivity to places where fiber and copper is not possible or too costly



Terminology

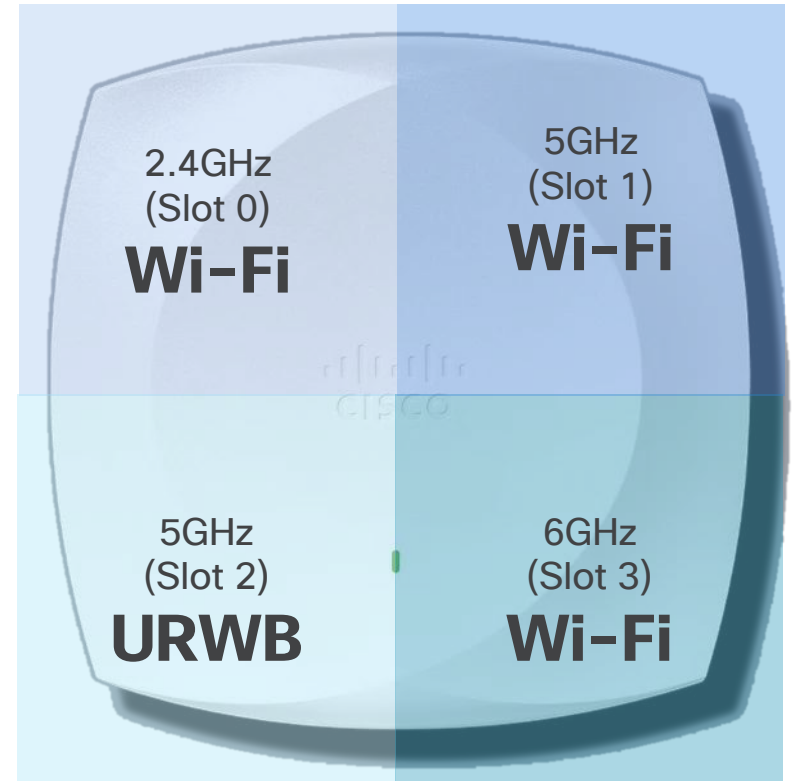
WLC / New Name	URWB Standalone Name
Coordinator	Mesh End or Gateway
Node	Mesh Point
URWB Network Key	Passphrase
Fixed	Fixed
Fixed Point to Multipoint	Fluidmax
Fixed Point to Multipoint Cluster ID	<i>(New item!)</i>
Mobility	Fluidity
Mobility Base	Fluidity Infrastructure
Mobility Client	Fluidity Vehicle
High Availability	Fastfail / TITAN
URWB Monitor	FM Quadro
IW Monitor (WLC support due soon!)	IW / FM Monitor

Data plane and traffic flow



Simultaneous URWB + Wi-Fi – Radio Roles

- Role selection is **per radio/slot**
 - All radio types can do Wi-Fi
 - Only 5GHz and 6GHz supported for URWB
 - URWB is not currently supported on 2.4GHz
 - Feature available from IOS-XE 17.18.1
 - No separate AP mode is necessary
 - Manageable via WLC



Supported Access Points

Wi-Fi 7



CW9176I,
CW9176D1



CW9178I

Focus for 17.18.1
(Early Release)

APs with dual-5GHz will allow split roles.
For example: slot1=Wi-Fi, slot2=URWB

Wi-Fi 6E



CW9136I



CW9166I,
CW9166D1



IW9165E



IW9165D



IW9167E
IW9167E-HZ



IW9167I

Wi-Fi 6



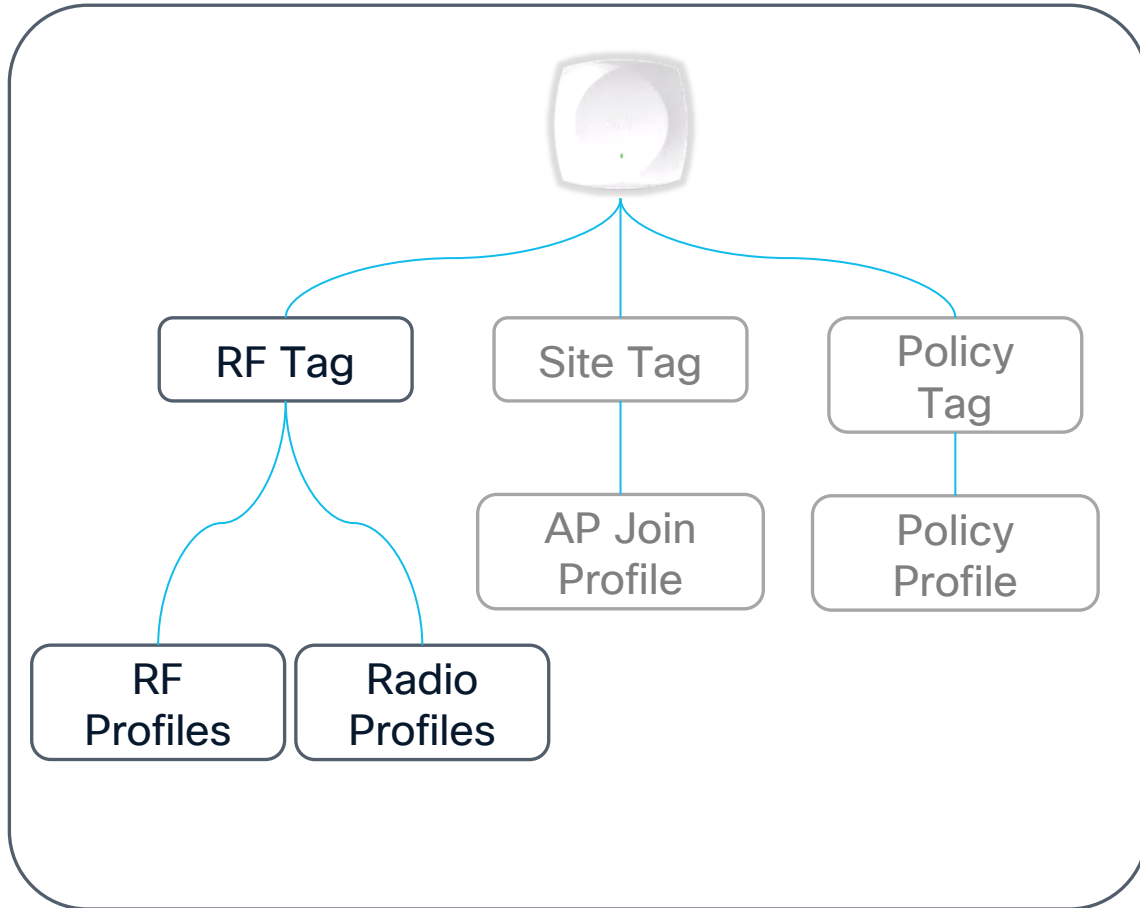
C9130
(AXE, AXI)



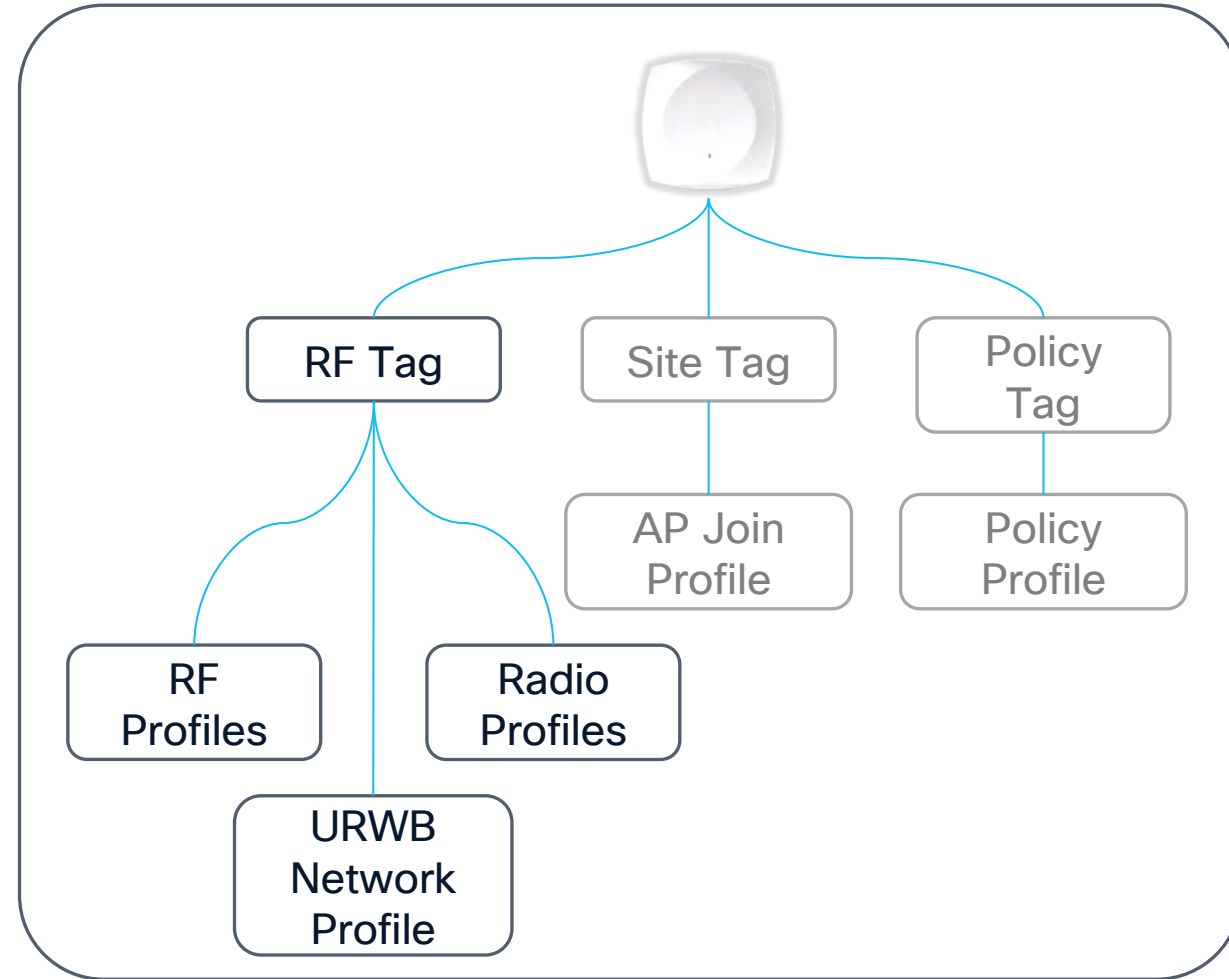
C9124
(AXE, AXI, AXD)

URWB Configuration Model on 9800

Existing Wi-Fi Configuration Model

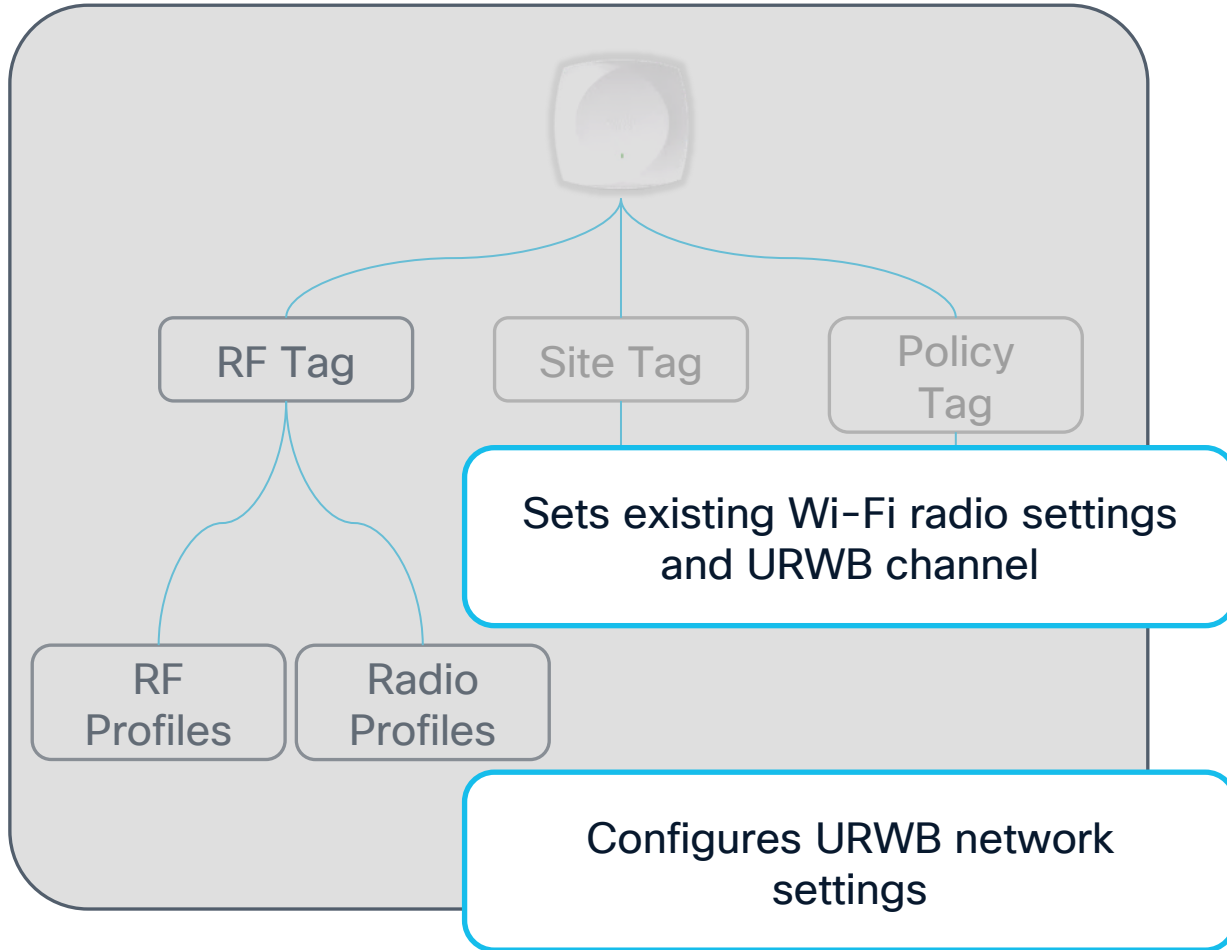


Wi-Fi + URWB Configuration Model

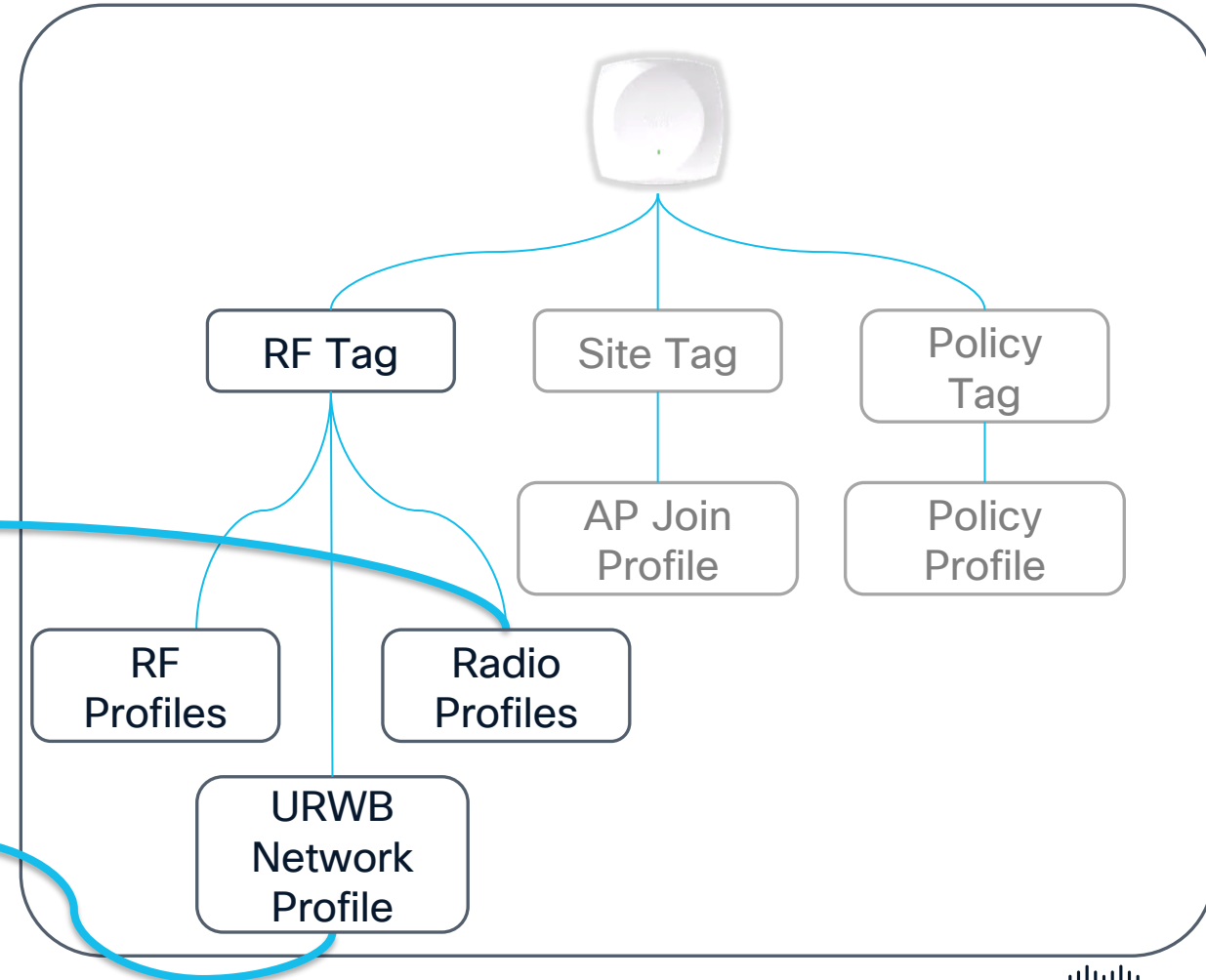


URWB Configuration Model on 9800

Existing Wi-Fi Configuration Model



Wi-Fi + URWB Configuration Model



Simultaneous URWB and Wi-Fi operations

URWB Configuration on WLC

The image shows the Cisco Catalyst 9800-CL Wireless Controller configuration interface. The top header displays the Cisco logo and the controller's name and IP address: "Cisco Catalyst 9800-CL Wireless Controller 17.18.20250306".

The main navigation menu is divided into three sections:

- Interface:** Logical, Ethernet, VRF, Wireless, Layer2 (Discovery Protocols, VI AN, ACL, Advanced EAP, PKI Management, Guest User, Local EAP, Local Policy, Threat Defense, Trustsec, URL Filters).
- Services:** AireOS Config Translator, Application Visibility, Cloud Services, Custom Application, IoT Services, IOx, Location, Power Profile, Remote LAN, RF/Radio, Tags, URWB Network Profile (highlighted with a yellow box), WLANs.
- Wireless:** Access Points.

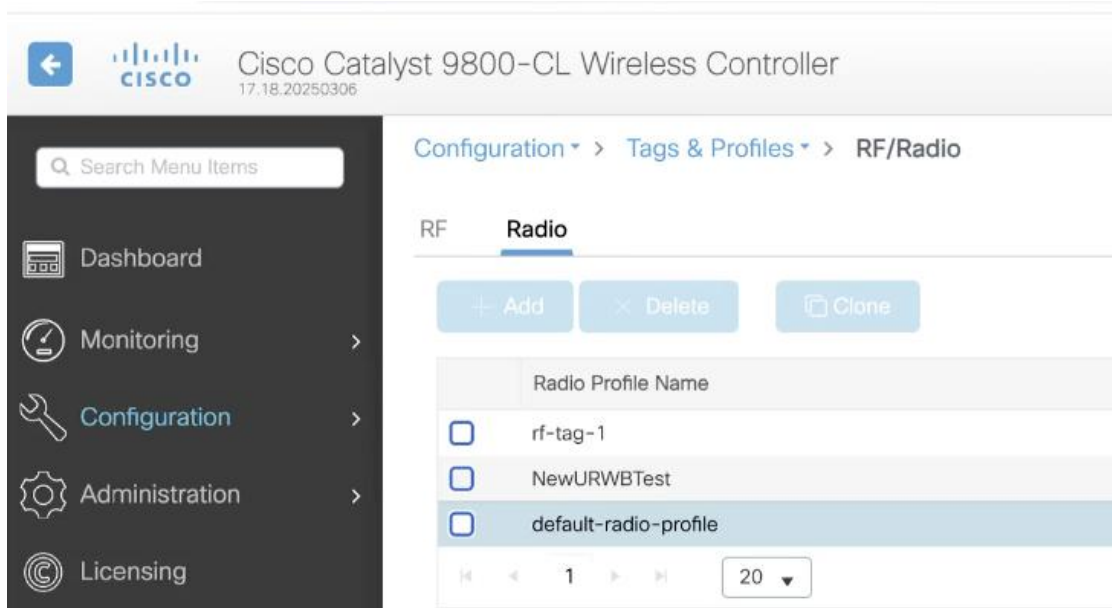
The "Configuration" menu item is expanded, and the "URWB Network Profile" option is selected. This opens the "Add URWB Network Profile" dialog box, which has the following fields and options:

- General tab:** URWB Enabled (checked), URWB Network Profile Name* (text input), Description (text input with placeholder "Enter Description"), Network-Key (text input with placeholder "Enter Passphrase" and an eye icon).
- Buttons:** Cancel, Apply to Device.

Feature available from IOS-XE 17.18.1 onwards

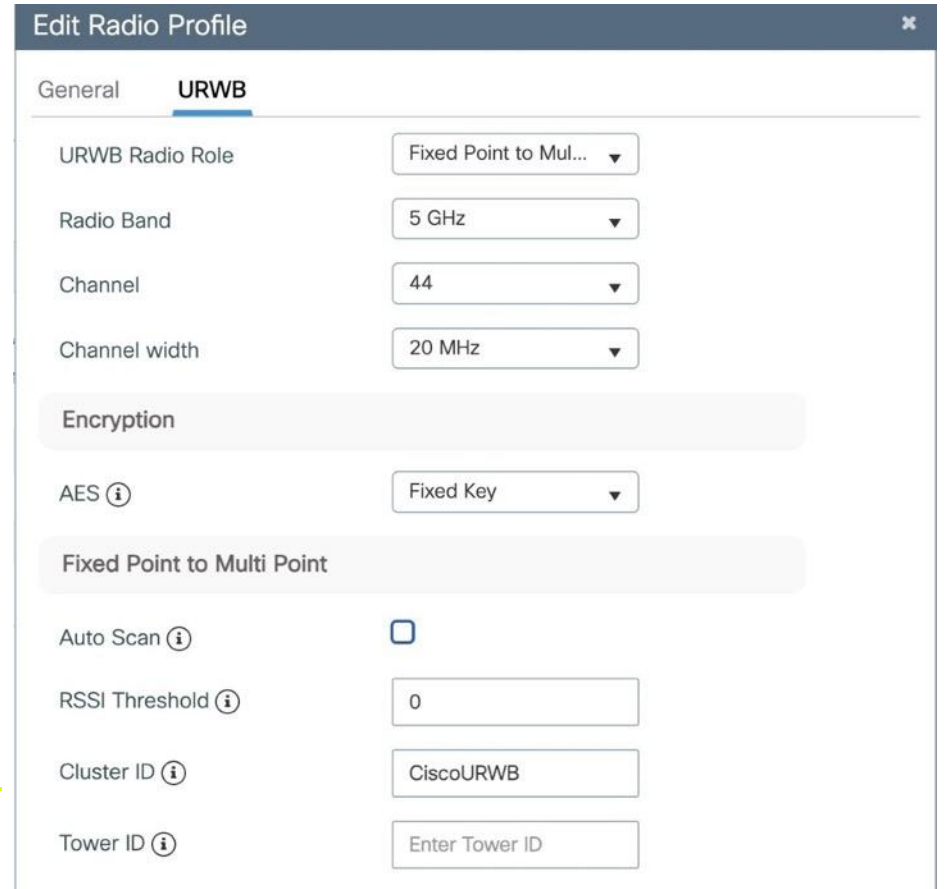
Simultaneous URWB and Wi-Fi operations

Radio Profiles



The screenshot shows the Cisco Catalyst 9800-CL Wireless Controller configuration interface. The breadcrumb navigation is Configuration > Tags & Profiles > RF/Radio. Under the RF > Radio section, there are buttons for Add, Delete, and Clone. A table lists radio profiles: rf-tag-1, NewURWBTest, and default-radio-profile. The 'default-radio-profile' is selected and highlighted in blue. Below the table, there are navigation arrows and a page number '1' with a dropdown menu showing '20'.

Channel and profile role declaration



The screenshot shows the 'Edit Radio Profile' configuration window for URWB. The window has two tabs: 'General' and 'URWB'. The 'URWB' tab is active. The configuration includes the following fields:

- URWB Radio Role: Fixed Point to Mul... (dropdown)
- Radio Band: 5 GHz (dropdown)
- Channel: 44 (dropdown)
- Channel width: 20 MHz (dropdown)
- Encryption section:
 - AES (i): Fixed Key (dropdown)
- Fixed Point to Multi Point section:
 - Auto Scan (i):
 - RSSI Threshold (i): 0 (text input)
 - Cluster ID (i): CiscoURWB (text input)
 - Tower ID (i): Enter Tower ID (text input)

Feature available from IOS-XE 17.18.1 onwards

Simultaneous URWB and Wi-Fi operations

Radio Roles & URWB Profile

The screenshot shows the Cisco Catalyst 9800-CL Wireless Controller configuration interface. The breadcrumb navigation is Configuration > Tags & Profiles > Tags. The 'RF' tab is selected. There are buttons for '+ Add', 'Delete', and 'Clone'. Below these, a table lists RF tags with columns for 'RF Tag Name' and 'Description'. The table contains several entries, including 'RF-TAG-AP1-S1-COORD' and 'RF-TAG-AP1-S2-COORD'.

RF Tag Name	Description
default-rf-tag	default RF t
RF-TAG-AP1-S1-COORD	
RF-TAG-AP1-S2-COORD	Add CLI: ap
RF-TAG-AP2-S1-TOWER	
RF-TAG-AP3-S1-TRAILER	
RF-TAG-AP4-S1-VEHICLE	
RF-TAG-AP4-S2-CAPADAY	

URWB profile & slot declaration for AP

The 'Edit RF Tag' window shows configuration options for an RF tag. A warning message at the top states: 'Changes to this RF Tag may result in a loss of connectivity for clients associated with APs using this RF Tag. Note: Modifying URWB Network Profile or Radio Profile for URWB requires a reload of the associated AP(s)'. The 'Name*' field is set to 'RF-TAG-AP1-S1-COOR'. The 'URWB Network Profile' is set to 'URWB-BASE-...'. Under the '6 GHz Radio Profile' section, 'Slot 1' is set to 'URWB-RAD5-...'. Under the '5 GHz Radio Profile' section, 'Slot 0' is set to 'default-radio-...' and 'Slot 1' is set to 'URWB-RAD5-...'. The '2.4 GHz Radio Profile' section is currently empty. Buttons for 'Cancel' and 'Update & Apply to Device' are at the bottom.

Feature available from IOS-XE 17.18.1 onwards

Simultaneous URWB and Wi-Fi operations

URWB Coordinator Nomination

The screenshot shows the Cisco Catalyst 9800-CL Wireless Controller interface. The breadcrumb navigation is Configuration > Wireless > Access Points. The page title is "All Access Points" and it shows "Total APs : 3". A table lists the APs:

AP Name	AP Model	Slots	Admin Status	Up Time
AP4	IW9167EH-Z	3	✓	31 days 23 hrs 59 mins 11 secs
AP2	IW9167EH-Z	3	✓	32 days 0 hrs 1 mins 26 secs
AP1	IW9167EH-Z	3	✓	31 days 23 hrs 57 mins 29 secs

AP1 is selected. The interface includes a sidebar with navigation options like Dashboard, Monitoring, Configuration, Administration, Licensing, and Troubleshooting.

The screenshot shows the "Edit AP" configuration page with the "URWB" tab selected. It features two configuration sections:

URWB Coordinator [Config on WLC]	URWB Coordinator [Config on AP]
Coordinator <input checked="" type="checkbox"/>	Coordinator Enabled
Wired-Only Coordinator <input type="checkbox"/>	Wired-Only Coordinator Disabled

Buttons for "Cancel" and "Update & Save" are visible at the bottom.

Electing your Coordinators

Feature available from IOS-XE 17.18.1 onwards

Who can benefit?

- ✓ Customers already using **Cisco Wi-Fi, 9800WLC and Catalyst Center**, and looking for **ultra-reliable wireless connectivity** to cover more critical use cases
- ✓ Customers already implementing **Wi-Fi Mesh and/or WGB** and looking for **future-proof wireless** network ready for AI and critical applications
- ✓ Customers moving towards **converged IT/OT infrastructure** and want to **extend same visibility and security** policies up to the wireless end point
- ✓ Customers who want to optimize their infrastructure and **avoid isolated, dedicated OT networks** to support connectivity for OT and mission-critical use case
- ✓ Customers who are looking for an easy-to-deploy, easy-to-manage **alternative to P5G** to cover their mobility use cases

Licensing

URWB functionalities offered as part of the current DNA or Unified Licensing model

	Wi-Fi 6 and Wi-Fi 6E platforms	Wi-Fi 7 platforms
Functionality	DNA License	Unified License
URWB Fixed Infrastructure (Point-to-point links)	DNA Essentials	Cisco Wireless Essentials
URWB Mobility (Mobile assets)	DNA Advantage	Cisco Wireless Advantage

Design Guidelines for 17.18.1

- L3 Architectures are not supported. All APs in the same URWB network must be in the same layer 2 domain (mostly affects mobility deployments)
- 6 GHz Standard Power (requiring AFC) is not supported on URWB Radios
 - 6GHz LPI for mobile assets is supported in the US (Not AU)
- URWB is limited to two or less 5GHz or 6GHz radios per AP
- SD-Access (Wireless Fabric) is not supported
 - As part of an SDA underlay however, URWB is supported
- URWB only supports one wired network port on each AP
- URWB cannot split VLAN's off at the AP port, switch is required
- IW Monitor has limited support, more WLC support coming in IW Monitor 3.0
- URWB is subject to processing throughput ceilings, varies per platform

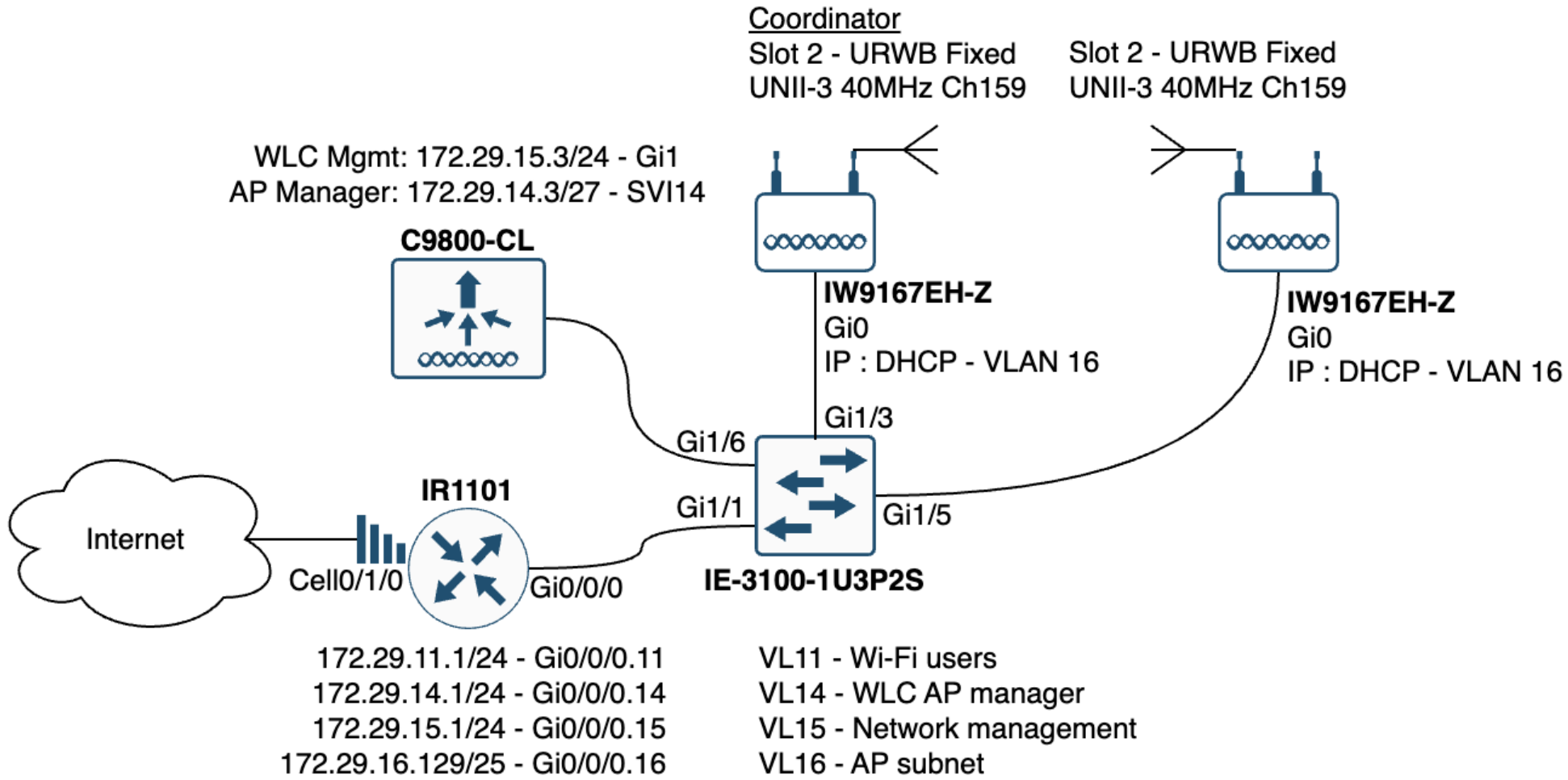
Cisco Simultaneous URWB + Wi-Fi Recap

- Ultra-reliable, low latency connectivity for critical applications
 - Zero-loss roaming
 - Wi-Fi and URWB are available on the same AP at the same time
 - No need for parallel AP infrastructures
 - Supports mobile, point-to-point, point-to-multipoint, mesh, or a mix
 - Works with APs in Local or FlexConnect mode
 - Available starting in 17.18.1 (early release, for PoC and testing)
-
- All this talk about URWB... Is Mesh and WGB going away?



Demo Time!

Provisioning Topology



What's wrong with this picture?



There are safer ways to cook!



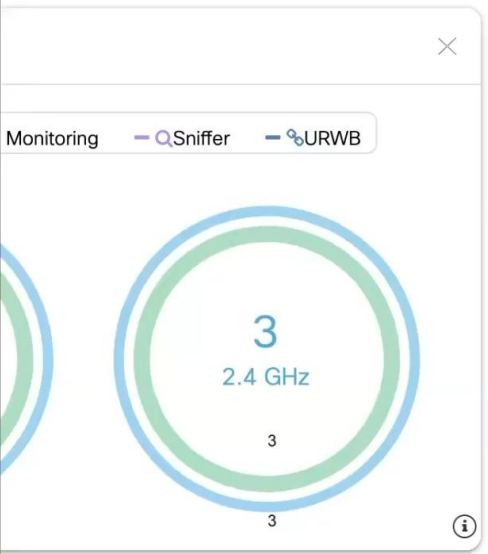
Search Menu Items

- Dashboard
- Monitoring
- Configuration
- Administration
- Licensing
- Troubleshooting
- Walk Me Through

- Interface
 - Logical
 - Ethernet
 - VRF
 - Wireless
 - Layer2
 - Discovery Protocols
 - VLAN
 - VTP
 - Radio Configurations
 - CleanAir
 - High Throughput
 - Media Parameters
 - Network
 - Parameters
 - RRM
 - Routing Protocols
 - OSPF
 - Static Routing
 - Security
 - AAA
 - ACL
 - Advanced EAP
 - PKI Management
 - Guest User
 - Local EAP
 - Local Policy
 - Threat Defense
 - Trustsec
- Services
 - AireOS Config Translator
 - Application Visibility
 - Cloud Services
 - Custom Application
 - IoT Services
 - IOx
 - Location
 - mDNS
 - Multicast
 - NetFlow
 - Python Sandbox
 - QoS
 - RA Throttle Policy
- Tags & Profiles
 - 802.11be
 - AP Join
 - AP Priming
 - Calendar
 - EoGRE
 - Flex
 - Multi BSSID
 - Policy
 - Power Profile
 - Remote LAN
 - RF/Radio
 - Tags
 - URWB Network Profile
 - WLANs
- Wireless

Access Points	Clients	Rogues	Interferers
3	Active 0	APs 70	6 GHz 0
0	Excluded 0	Clients 75	5 GHz 0
0	Sleeping 0	Ad-Hoc 0	2.4 GHz 0

Monitoring - QSniffer - URWB



Top Access Points
Last Updated: 10/7/2025, 10:36:30 AM

No Top APs data available

Device Types
Last Updated: 10/7/2025, 10:36:30 AM

System Information
Last Updated: 10/7/2025, 10:34:30 AM

Hostname: MDR1-G-C9800CL-01

Last step, configure AP's for SSID propagation

The screenshot shows the Cisco Catalyst 9800-CL Wireless Controller interface. The main navigation menu on the left includes Dashboard, Monitoring, Configuration, Administration, Licensing, and Troubleshooting. The breadcrumb trail is Configuration > Wireless > Access Points. The 'All Access Points' table lists AP0, AP2 (selected), and AP1. The 'Edit AP' dialog is open, showing the 'General' tab. The 'Tags' section is highlighted with a green box, and a dropdown menu is open, showing 'TAG-POL-SSID-24-HOTSPOT' selected. A yellow warning box states: 'Changing Tags will cause the AP to momentarily lose association with the Controller. Writing Tag Config to AP is not allowed while changing Tags.'

Configuration > Wireless > Access Points

Edit AP

General Interfaces High Availability Inventory URWB Geolocation ICap Advanced Support Bundle

General

AP Name* AP2

Location* default location

Base Radio MAC 2416.1bfa.4d00

Ethernet MAC 2416.1bf6.49a0

Admin Status **ENABLED**

AP Mode Local

Operation Status Registered

Fabric Status Disabled

CleanAir NSI Key

LED Settings

LED State **ENABLED**

Tags

Policy TAG-POL-SSID-24-
Search or Select
default-policy-tag
TAG-POL-SSID-24-HOTSPOT

Site
RF
Write Tag Config to AP

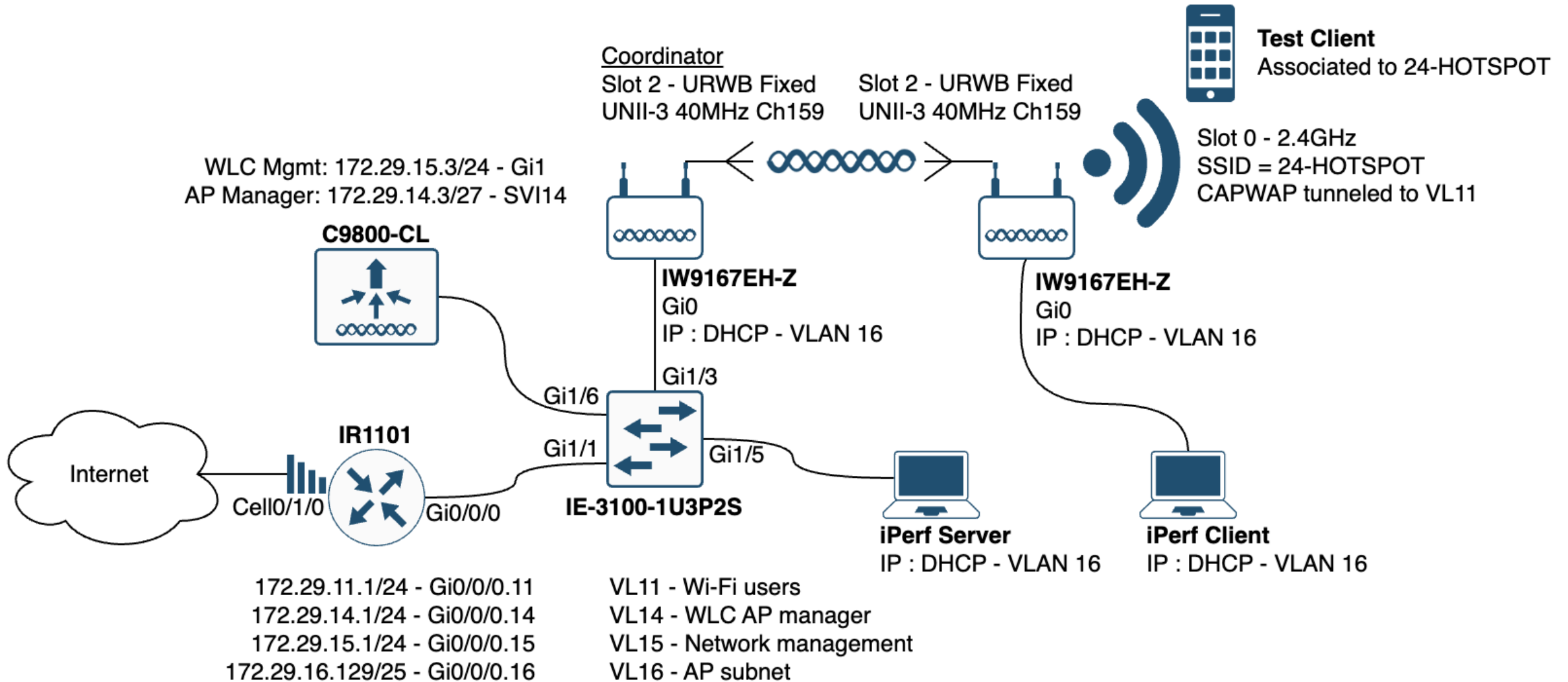
Version

Primary Software Version 17.18.2.37

Predownloaded Status N/A

Predownloaded Version N/A

Completed State



Quick LTE Internet Baseline

The dashboard displays the following performance metrics:

- DOWNLOAD Mbps:** 53.29
- UPLOAD Mbps:** 16.17
- Ping ms:** 22
- Download Latency:** 421
- Upload Latency:** 158

Below the metrics are four icons representing different use cases: a browser cursor, a game controller, a video player, and a user profile. Each icon has a progress indicator below it consisting of five dots, with the first four being green and the last one grey.

On the left side, there is a large circular button labeled "GO". Below it are two menu items:

- Connections:** Multi
- Telstra:** Perth

At the bottom left of the menu is a link labeled "Change Server".

On the right side, there is a section titled "RATE YOUR PROVIDER" for "Telstra", which includes a five-star rating system with all five stars currently greyed out.

Moving outside



Moving outside

85m away



Moving outside

The screenshot shows the Cisco Prime Network Manager interface. On the left is a navigation sidebar with icons for Dashboard, Monitoring, Configuration, Administration, Licensing, and Troubleshooting. The main area is divided into three tabs: PROBLEMS, OUTPUT, and DEBUG CONSOLE. The OUTPUT tab is active, displaying a list of network statistics. Below the terminal, there is a table for Uplink and Downlink statistics.

Throughput (Mbps)	LER	P
2605.12	16	

Throughput (Mbps)	LER	P
333900.98	10	

The screenshot shows an AI assistant interface titled "Let's get started". It features a search bar with the placeholder text "Add context (#), extensions (@), command...". Below the search bar are two buttons: "Ask @vscode" and "Create Project". A note at the bottom of the interface reads "Review AI output carefully before use." The interface is overlaid on a background that appears to be a grid or a windowed environment.

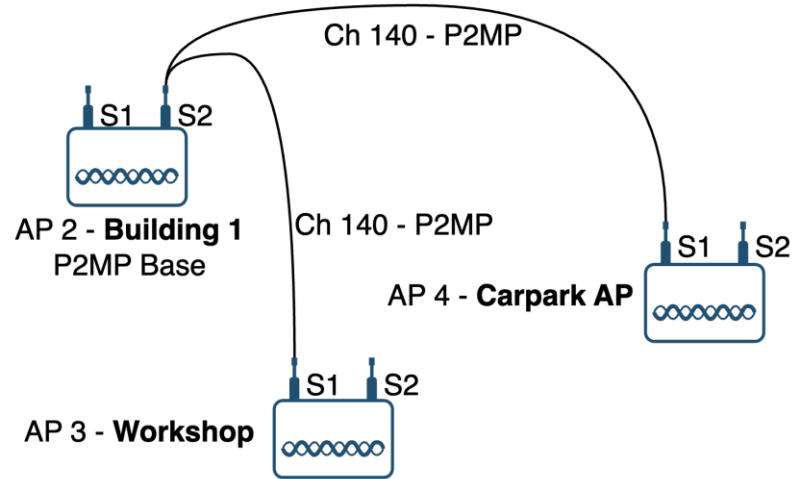
Success!!!

Aaaaand ...

It was delicious!



P2MP Note



Edit Radio Profile

General **URWB**

Change(s) in the URWB configuration of this Radio Profile require a reload of the AP(s) associated with it.

URWB Radio Role: Fixed Point to Mul... ▼

Radio Band: 5 GHz ▼

Channel*: 140 ▼

Channel width: 20 MHz ▼

Encryption

AES ⓘ: Fixed Key ▼

Fixed Point to Multi Point

Auto Scan ⓘ:

Cluster ID ⓘ: PTMP

Tower ID ⓘ: Enter Tower ID

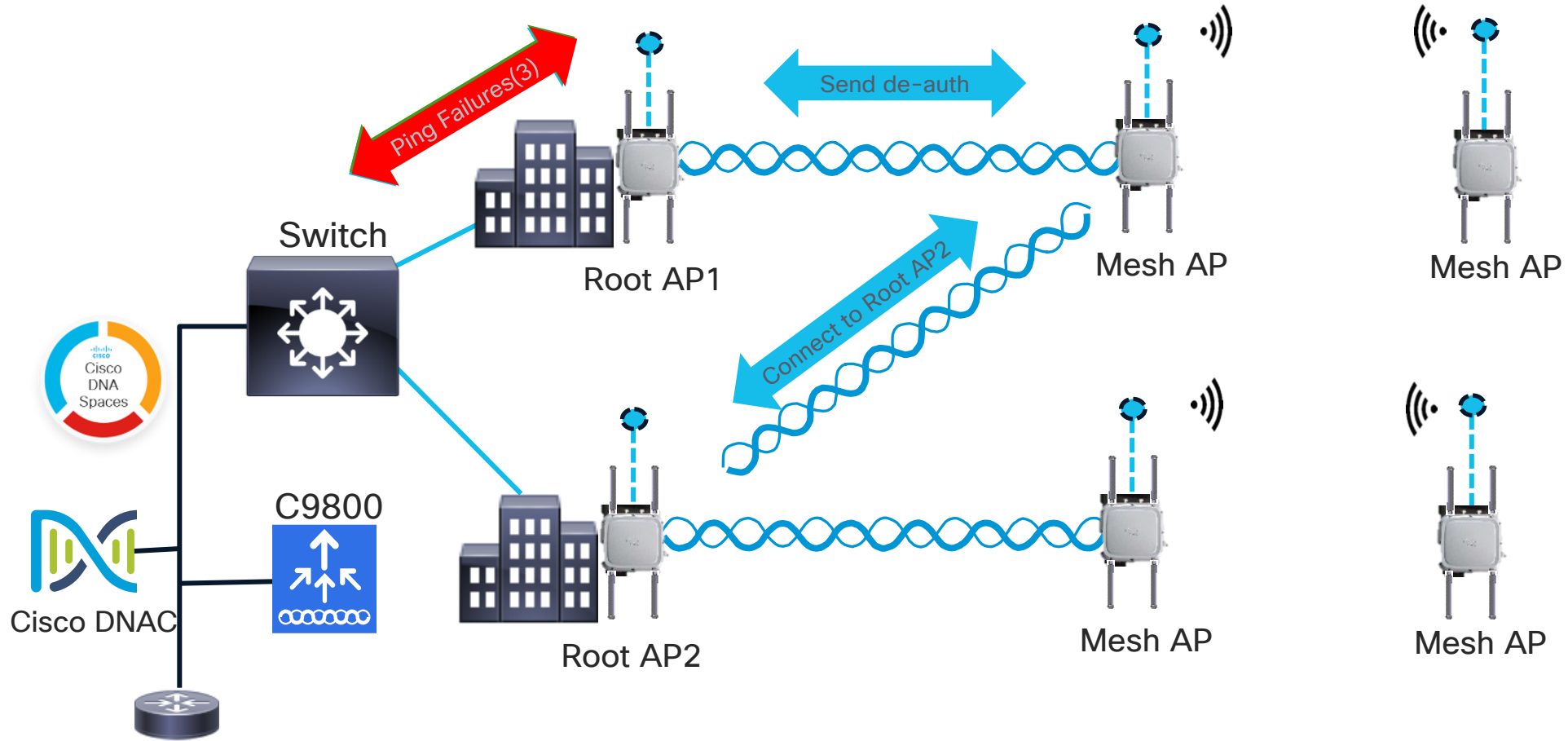
```
PRT3-5-WLC-IOT2#ap name AP2 dot11 5ghz slot 2 urwb ptmp base
```

Recent MESH Improvements

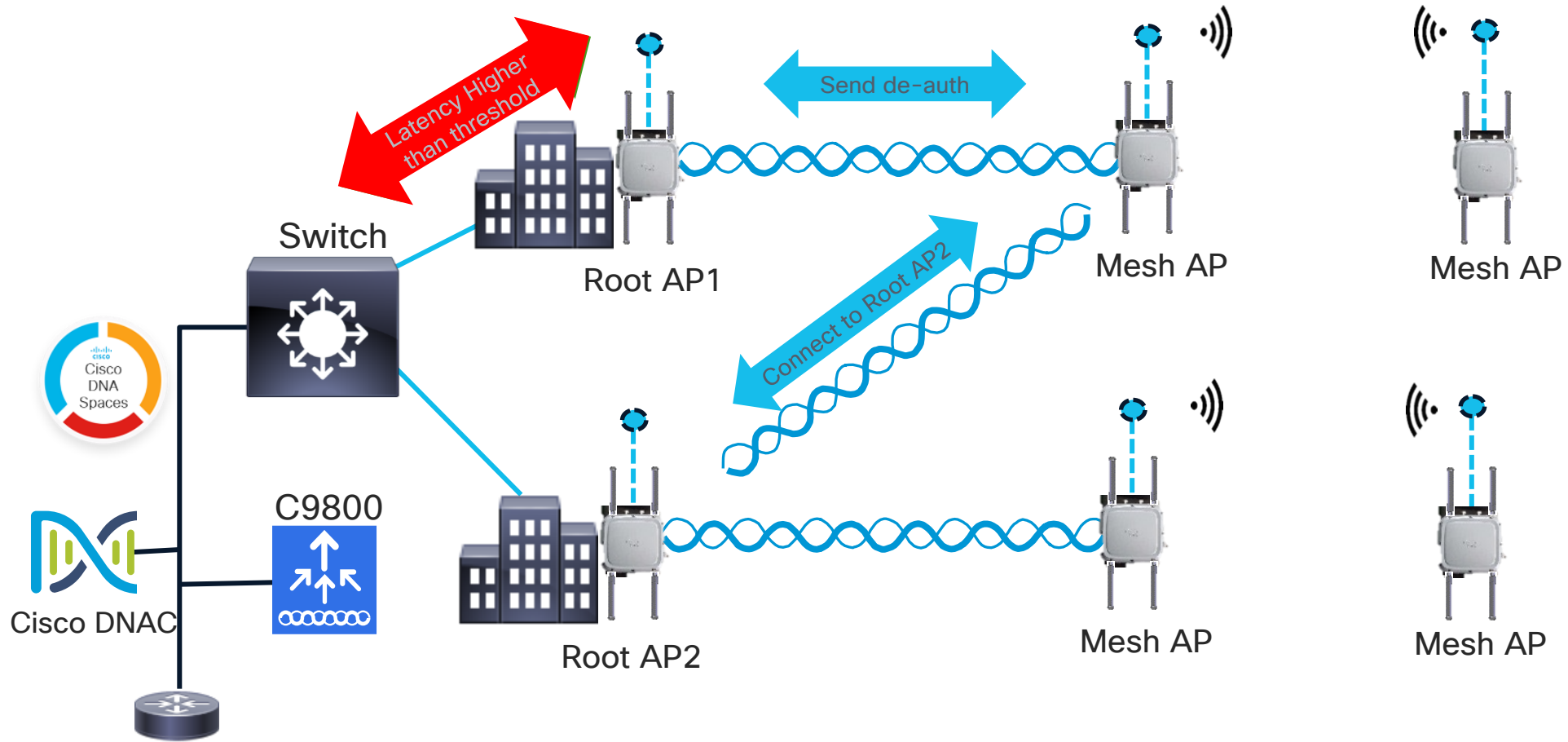
Recent MESH Enhancements

Release	Notable Feature
17.6	Least congested channel scan on RAP boot-up: Optimizes the initial channel the MESH starts on, before RRM gets a chance to start running
17.6	Convergence Time Improvements
17.7	Serial Backhaul for 9124
17.9	Backhaul RRM Phase 1: RAPs can change channels while MESH APs are connected
17.9	Backhaul SNR cutoff lowered to 5dB SNR
17.9	Huge throughput increase on Ethernet Bridging (almost double 😊)
17.12	AP Boot Time Decrease (RS-232 @ 115,200 Baud)
17.12	More MESH OPER STATS in the Yang Model
17.14	Backhaul RRM Phase 2: RAPs take RRM stats from the MAPS in the MESH tree into consideration

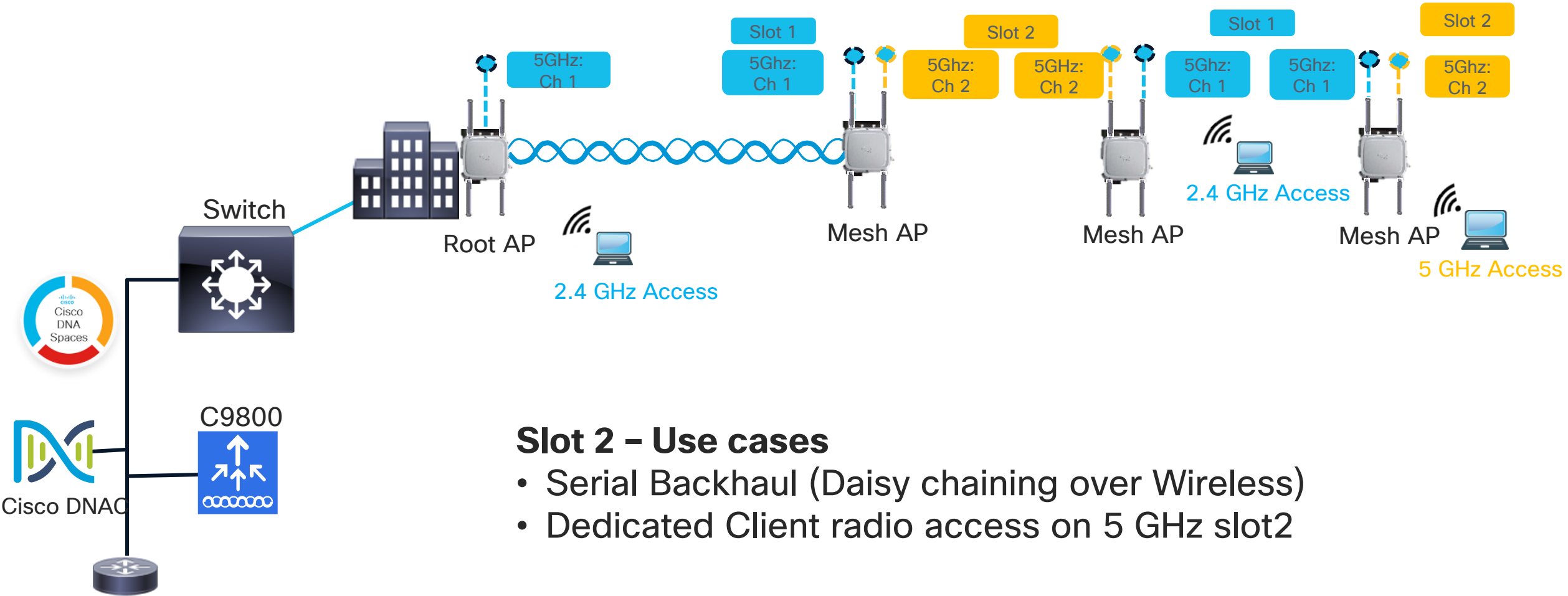
Fast Teardown - Gateway Down



Fast Teardown- Latency High

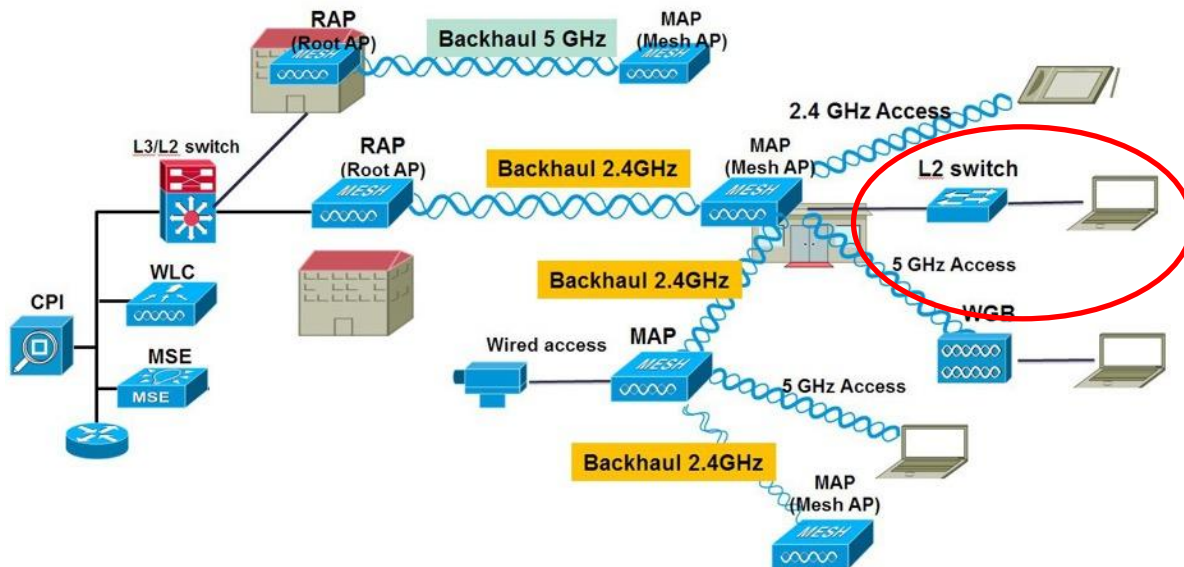


Solution Overview – Mesh Serial Backhaul



Recent MESH Fixes Related to MCAST / UNICAST Flooding

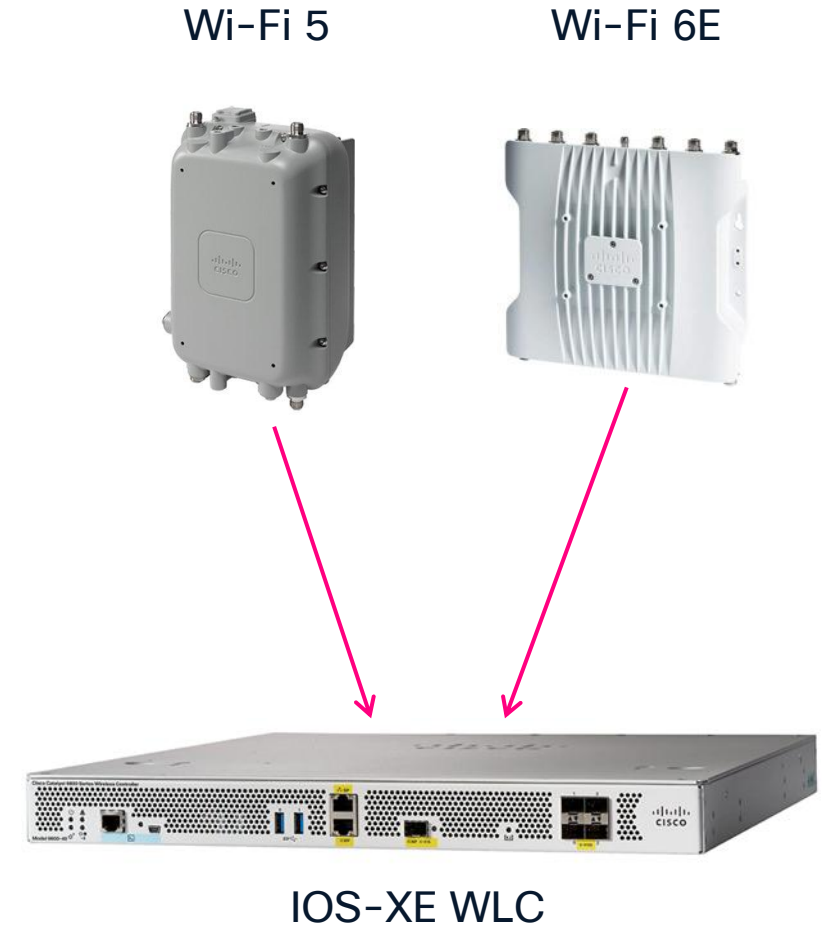
Fixed Release	Notable Feature
17.9.5esc +17.12.4	CSCwi42112 - Wired Clients MAC address are being learn from the 9124 MAP port
17.9.5esc +17.12.4	CSCwj34753 - MAP is reflecting back client unicast traffic on the wired port



Note:
 These are critical fixes to take advantage of if you have a switch operating behind your MAP.
 Especially important if you have STP running (TCN's cause a temporary flood of traffic)

IRCM Migration Concepts

- You can do IRCM between AireOS & IOS-XE
- Could an easier way be moving everything compatible to the IOS-XE?
- Wi-Fi 5 AP's supported throughout 17.15, just be mindful of your LDoS dates
- Main benefit, single management plane, one configuration style
- Then plan to swap out Wi-Fi 5 with either 6E or if suitable Wi-Fi 7 units



Recent WGB Improvements

Recent WGB Enhancements

Release	Notable Feature
17.11	Site survey mode, WGB and UWGB support on IW9167
17.12	IAPP Refresh bug, impacting data forwarding post roam
17.13	Concurrent 5GHz Radio coordinated hand-off on 9130 & 9124
17.13	Low Latency profiles for 9165 IOT WGB
17.14	QoS, GPS and SNMP support on 9165 and 9167 WGBs
17.15	Using the scanning radio on the IW9167 to aid in roaming on 2.4GHz (where we only have a single radio)
17.16	Wired Port on IW9167E supporting downshift to 10Mbps
17.17	SFP Slot on IW9167E additionally supporting downshift to 10Mbps on suitable GLC-T's
17.18	Addition of a GUI to make monitoring easier

IW9167 as WGB: The scanning radio in action

```
[*05/10/2024 00:44:27.4028] DOT11_UPLINK_EV: RSSI Low(-77)! Parent lost. Roaming triggered.
```

```
[*05/10/2024 00:44:27.4028] DOT11_UPLINK_EV: Best ap not available in aux radio scan table
```

```
[*05/10/2024 00:44:29.2778] DOT11-UPLINK_ESTABLISHED: Interface Dot11Radio0, Associated To AP KLNK01-A1  
CC:DB:93:48:82:E8 [WPA2 FT-EAP]
```



```
[*05/10/2024 00:44:29.2798] DOT11-UPLINK_ESTABLISHED: Interface Dot11Radio0, Associated To AP KLNK01-A1  
CC:DB:93:48:82:E8 [WPA2 FT-EAP]
```

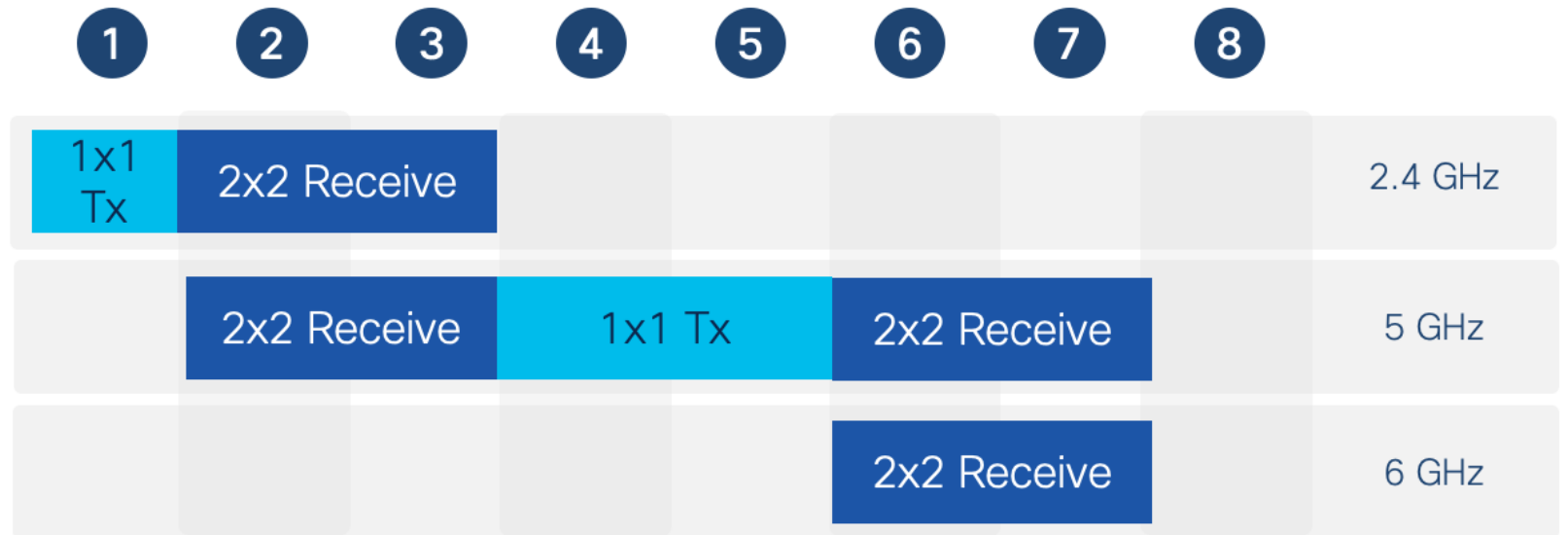
```
[*05/10/2024 00:45:29.2802] DOT11_UPLINK_EV: RSSI Low(-78)! Parent lost. Roaming triggered.
```

```
[*05/10/2024 00:45:29.2802] DOT11_UPLINK_EV: Best ap not available in aux radio scan table
```

IW9167 Scanning Radio Ports



-  GNSS TNC female antenna port
-  Self-identifying antenna port



2.4 GHz: 22 dBm Max Tx Power
 5 GHz: 18 dBm Max Tx Power

17.18.1 WGB mode has a GUI!

Workgroup Bridge | Welcome | Search Clients

Dashboard

Network

6 GHz ↓

5 GHz ↓

2.4 GHz ↑

Wired Client

VLANs 0

Clients 0

Uplink

Link state ↑

Uplink radio 0

Mob

RSSI threshold

11v neighbours

Overview

Uplink WLAN		Uplink Association		System Information	
Profile Name	24-HOTSPOT	Radio	0	Hostname	
Dot11 Type	11ax	Uplink State	CONNECTED	Serial Number	KV
Security	PSK	RSSI	45	Image Version	
Device IP	172.29.11.41/24	Parent AP Name	AP0	Device Type	
Uplink Radio MAC	24:16:1B:FA:4D:11	Parent AP MAC	24:16:1B:F9:A1:00	Board Id	KV
Current Data Rate	258/286Mbps	Connected Time	0 hours, 2 minutes	System uptime	00hrs:04
		Channel/Width	1/20MHz	Image type	

Seriously consider 801.11ax HE in 2.4GHz

- Explore for WGB's in mesh systems with 2.4GHz access
 - Particularly where the WGB is mobile
- Can you enable 2x2 with 2 spatial streams?
- Strongly recommend leveraging HE MCS rates
- Look at low speed HE MCS 2, 3 for 1SS – Note different modulations!
- Look at low speed HE MCS 2, 3 for 2SS – Same modulations as 1SS
- 802.11ax gives you the chance to push out the Guard Interval to 3200ns
 - But note this is only to be played with in low-speed long distance type applications
- Can you run 4x4:2 implementations? 2 TX chains, but 4 antennas to demodulate?

A Note on PoE Boot Times - IW9167E

With CDP/LLDP (PoE Via switch): 1min 54sec

```
alelynn - minicom -D /dev/cu.usbserial-FTDIQ88Y - 135x38
[*10/15/2025 07:59:34.1564] wlan: [0:I:CMN_MLME] mlme_ext_vap_down: VAP (aux_monTx) 24:16:1b:fa:4d:12 is down
[*10/15/2025 07:59:34.1566] wlan: [0:I:CMN_MLME] mlme_ext_vap_start_setup: Beacon rate is : 6000
[*10/15/2025 07:59:34.1566]
[*10/15/2025 07:59:34.1602] DOT11_DRV[4]: wcp/AuxRadDrv :: Dot11BaseDriver: Failed opening CTL binary file:/lib/firmware/CTL/pine_ctl_n
[*10/15/2025 07:59:34.1602] DOT11_DRV[4]: Load power table failed, not sending ctl table
[*10/15/2025 07:59:34.3270] DOT11_CFG[2]: poe_power_mode: low_pwr_mode=6, allowed_tx_ant=3, allowed_rx_ant=3
[*10/15/2025 07:59:34.3859] DOT11_TXP[2]:Max Power table lookup error [Domain: Z, Chan: 100 reg_pwr: -99 Country: ]
[*10/15/2025 07:59:34.3860] DOT11_TXP[2]:Max Power table lookup error [Domain: Z, Chan: 104 reg_pwr: -99 Country: ]
[*10/15/2025 07:59:34.3860] DOT11_TXP[2]:Max Power table lookup error [Domain: Z, Chan: 108 reg_pwr: -99 Country: ]
[*10/15/2025 07:59:34.3860] DOT11_TXP[2]:Max Power table lookup error [Domain: Z, Chan: 112 reg_pwr: -99 Country: ]
[*10/15/2025 07:59:34.3861] DOT11_TXP[2]:Max Power table lookup error [Domain: Z, Chan: 116 reg_pwr: -99 Country: ]
[*10/15/2025 07:59:34.3861] DOT11_TXP[2]:Max Power table lookup error [Domain: Z, Chan: 132 reg_pwr: -99 Country: ]
[*10/15/2025 07:59:34.3861] DOT11_TXP[2]:Max Power table lookup error [Domain: Z, Chan: 136 reg_pwr: -99 Country: ]
[*10/15/2025 07:59:34.3862] DOT11_TXP[2]:Max Power table lookup error [Domain: Z, Chan: 140 reg_pwr: -99 Country: ]
[*10/15/2025 07:59:34.3862] DOT11_TXP[2]:Max Power table lookup error [Domain: Z, Chan: 149 reg_pwr: -99 Country: ]
[*10/15/2025 07:59:34.3862] DOT11_TXP[2]:Max Power table lookup error [Domain: Z, Chan: 153 reg_pwr: -99 Country: ]
[*10/15/2025 07:59:34.3862] DOT11_TXP[2]:Max Power table lookup error [Domain: Z, Chan: 157 reg_pwr: -99 Country: ]
[*10/15/2025 07:59:34.3863] DOT11_TXP[2]:Max Power table lookup error [Domain: Z, Chan: 161 reg_pwr: -99 Country: ]
[*10/15/2025 07:59:34.3863] DOT11_TXP[2]:Max Power table lookup error [Domain: Z, Chan: 165 reg_pwr: -99 Country: ]
[*10/15/2025 07:59:36.0888] Full Power available from Inline PoE(3)
[*10/15/2025 07:59:36.0888]
[*10/15/2025 07:59:36.1741] DOT11_CFG[0]: poe_power_mode: low_pwr_mode=6, allowed_tx_ant=3, allowed_rx_ant=3
[*10/15/2025 07:59:36.2508] chpasswd: password for user changed
[*10/15/2025 07:59:36.2594] DOT11_TXP[0]:Max Power table lookup error [Domain: A, Chan: 1 reg_pwr: -99 Country: ]
[*10/15/2025 07:59:36.2595] DOT11_TXP[0]:Max Power table lookup error [Domain: A, Chan: 2 reg_pwr: -99 Country: ]
[*10/15/2025 07:59:36.2595] DOT11_TXP[0]:Max Power table lookup error [Domain: A, Chan: 3 reg_pwr: -99 Country: ]
[*10/15/2025 07:59:36.2595] DOT11_TXP[0]:Max Power table lookup error [Domain: A, Chan: 4 reg_pwr: -99 Country: ]
[*10/15/2025 07:59:36.2596] DOT11_TXP[0]:Max Power table lookup error [Domain: A, Chan: 5 reg_pwr: -99 Country: ]
[*10/15/2025 07:59:36.2596] DOT11_TXP[0]:Max Power table lookup error [Domain: A, Chan: 6 reg_pwr: -99 Country: ]
[*10/15/2025 07:59:36.2596] DOT11_TXP[0]:Max Power table lookup error [Domain: A, Chan: 7 reg_pwr: -99 Country: ]
[*10/15/2025 07:59:36.2596] DOT11_TXP[0]:Max Power table lookup error [Domain: A, Chan: 8 reg_pwr: -99 Country: ]
[*10/15/2025 07:59:36.2597] DOT11_TXP[0]:Max Power table lookup error [Domain: A, Chan: 9 reg_pwr: -99 Country: ]
[*10/15/2025 07:59:36.2597] DOT11_TXP[0]:Max Power table lookup error [Domain: A, Chan: 10 reg_pwr: -99 Country: ]
[*10/15/2025 07:59:36.2597] DOT11_TXP[0]:Max Power table lookup error [Domain: A, Chan: 11 reg_pwr: -99 Country: ]
[*10/15/2025 07:59:36.8518] systemd[1]: Cannot add dependency job for unit iox_te-watcher.path, ignoring: Unit not found.
[*10/15/2025 07:59:36.8519] systemd[1]: Cannot add dependency job for unit iox_te_srcr2-watcher.path, ignoring: Unit not found.
[*10/15/2025 07:59:36.8560] DOT11_CFG[1]: poe_power_mode: low_pwr_mode=6, allowed_tx_ant=3, allowed_rx_ant=3
[*10/15/2025 07:59:36.8675] systemd[1]: Cannot add dependency job for unit iox_te-watcher.path, ignoring: Unit not found.
```

Without CDP/LLDP (IE an injector only): 3min 12sec

```
alelynn - minicom -D /dev/cu.usbserial-FTDIQ88Y - 135x38
[*10/15/2025 08:01:10.3291]
[*10/15/2025 08:01:13.3297] No good power or POE negotiation is not complete,wait for the negotiation to complete or connect to requiE
[*10/15/2025 08:01:13.3298]
[*10/15/2025 08:01:16.3306] No good power or POE negotiation is not complete,wait for the negotiation to complete or connect to requiE
[*10/15/2025 08:01:16.3306]
[*10/15/2025 08:01:19.3313] No good power or POE negotiation is not complete,wait for the negotiation to complete or connect to requiE
[*10/15/2025 08:01:19.3314]
[*10/15/2025 08:01:22.3322] No good power or POE negotiation is not complete,wait for the negotiation to complete or connect to requiE
[*10/15/2025 08:01:22.3322]
[*10/15/2025 08:01:23.1174] Scan radio tuning: started 6 GHz tuning
[*10/15/2025 08:01:23.1449] wlan: [0:I:CMN_MLME] mlme_ext_vap_down: VAP (aux_monTx) 24:16:1b:fa:4d:12 is down
[*10/15/2025 08:01:23.1576] wlan: [9835:E:ANY] dfs_init_chan_state_array: channel state array initialized
[*10/15/2025 08:01:23.1632] wlan: [0:I:CMN_MLME] mlme_ext_vap_start_setup: Beacon rate is : 6000
[*10/15/2025 08:01:23.1632]
[*10/15/2025 08:01:23.1633] wlan: [9835:E:ANY] reg_get_band_channel_list_for_pwrmode: Querying band chan list for 6g_pwr_mode -1 nchan9
[*10/15/2025 08:01:23.1633] wlan: [9835:E:ANY] wlan_cfg80211_populate_band_6g: Initial sband nchans 24
[*10/15/2025 08:01:23.1633] wlan: [9835:E:ANY] wlan_cfg80211_populate_band_6g: Initial Vap 0000000e1d6b62b, chandef chan 0000000b4e90
[*10/15/2025 08:01:23.1633] wlan: [9835:E:ANY] reg_get_band_channel_list_for_pwrmode: Querying band chan list for 6g_pwr_mode -1 nchan9
[*10/15/2025 08:01:23.1633] wlan: [9835:E:ANY] wlan_cfg80211_populate_channels: Populating 6GHz channels. Num chans: 59. max chans 64,0
[*10/15/2025 08:01:23.1633] wlan: [9835:E:ANY] wlan_cfg80211_populate_band_6g: 6G AP device type: 0 Num chans 59 curchan Freq: 5640 F10
[*10/15/2025 08:01:23.1634] wlan: [9835:E:ANY] wlan_cfg80211_populate_band_6g: Final Vap 0000000e1d6b62b chandef chan 0000000b4e97840
[*10/15/2025 08:01:23.1634] wlan: [9835:I:ANY] wlan_cfg80211_set_country: wlan_cfg80211_set_country: Country: US ret: 0
[*10/15/2025 08:01:25.3330] No good power or POE negotiation is not complete,wait for the negotiation to complete or connect to requiE
[*10/15/2025 08:01:25.3330]
[*10/15/2025 08:01:28.3338] No good power or POE negotiation is not complete,wait for the negotiation to complete or connect to requiE
[*10/15/2025 08:01:28.3339]
[*10/15/2025 08:01:31.3347] No good power or POE negotiation is not complete,wait for the negotiation to complete or connect to requiE
[*10/15/2025 08:01:31.3347]
[*10/15/2025 08:01:34.3354] No good power or POE negotiation is not complete,wait for the negotiation to complete or connect to requiE
[*10/15/2025 08:01:34.3355]
[*10/15/2025 08:01:37.3362] No good power or POE negotiation is not complete,wait for the negotiation to complete or connect to requiE
[*10/15/2025 08:01:37.3362]
[*10/15/2025 08:01:40.3369] No good power or POE negotiation is not complete,wait for the negotiation to complete or connect to requiE
[*10/15/2025 08:01:40.3369]
[*10/15/2025 08:01:43.3377] No good power or POE negotiation is not complete,wait for the negotiation to complete or connect to requiE
[*10/15/2025 08:01:43.3377]
Meta-Z for help | 115200 8N1 | NOR | Minicom 2.10 | VT102 | Offline | cu.usbserial-FTDIQ88Y
```

[*05/07/2024 16:17:32.6353] No good power or POE negotiation is not complete, wait for the negotiation to complete or connect to required PSE

Without an injector, you will see this printed on console while we timeout CDP/LLP negotiation.

Sample AP-COS WGB Config (Roaming Tweaks)

```
Rx Beacon Missing Action : Enable
Rx Beacon Missing Count  : 30
Packet retries Action     : Reconnect
Packet retries Value      : 64
RSSI Threshold Value      : -70 dBm
Threshold timeout         : 20 sec
HSR-Scan status           : Disable
Auth response timeout     : 5000 Msec
Assoc response timeout    : 5000 Msec
WGB channel scan timeout  : 8 Msec
Dhcp response timeout     : 60 Sec
EAP timeout               : 3 sec
Bridge table aging-time   : 300 Sec
Probe pak data rate type  : NA
Probe pak data rate       : 0
Antenna Band Mode         : Dual
Broadcast tagging         : Disable
Wired Client 802.1x Auth  : Disable
IGMP querier IP address  : ::
```

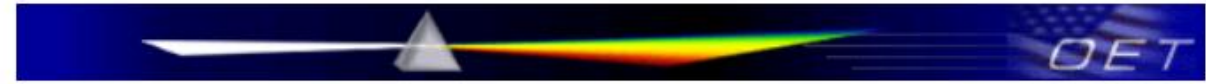
Retries that can trigger an action

You will want to tweak based on your env.



6GHz Outdoors

6E (5.925-7.125GHz) FCC Regulatory Recap



Federal Communications Commission
Office of Engineering and Technology
Laboratory Division Publication

February 4 2021

Part 15 Subpart E U-NII 6 GHz General Guidance Bands 5, 6, 7, 8

Low Power Indoor (LPI)

- must have integrated antennas
- operation on oil platforms, automobiles, trains, maritime vessels and aircraft shall be prohibited
- Must be inside a building

Outdoor (Standard Power APs)

- Requires AFC –internet connected
- Can use external antennas
- Specifically prohibited in certain deployments.

4. Standard Power Access Points and Associated Clients (6SD, 6FX, 6FC)

Standard power APs and Fixed clients are prohibited on oil platforms, cars, trains, boats, and aircraft. The operation of transmitters in the 5.925-7.125 GHz band is prohibited for controlling or communicating with unmanned aircraft systems.

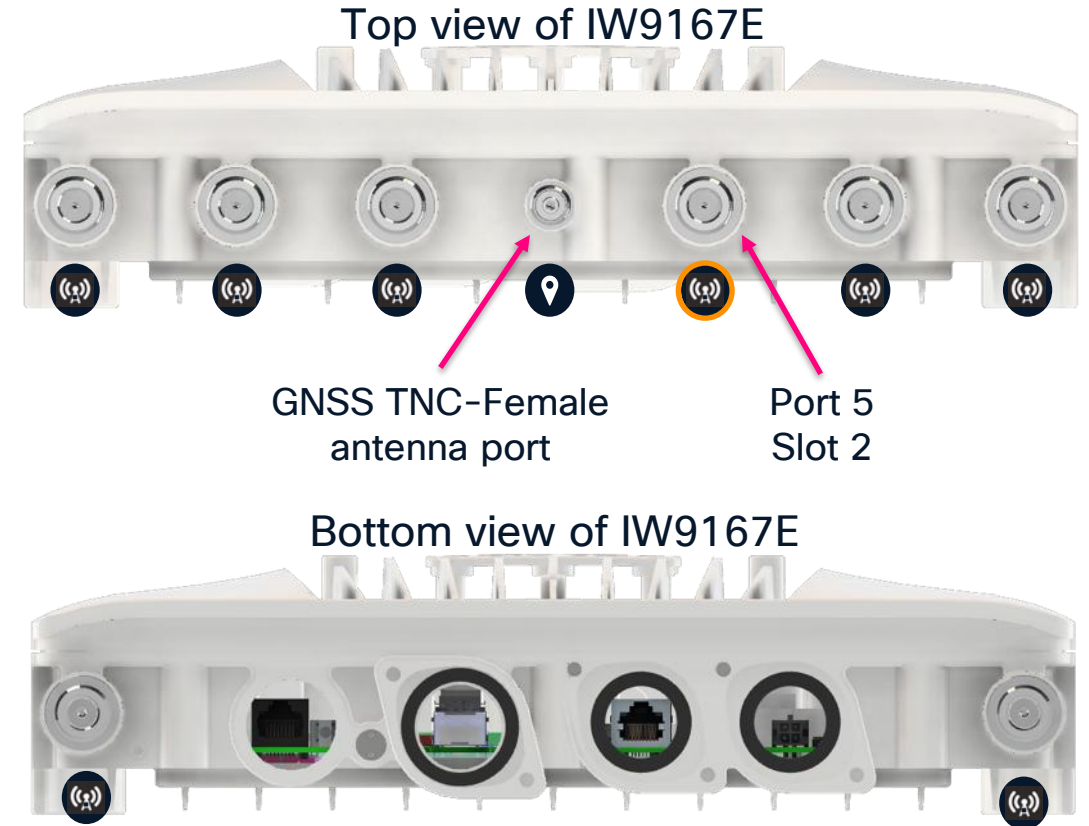
All U-NII devices must have a security description (15.407(i), Device Security) to protect against software modification by unauthorized parties (see KDB 789033).

Label information is required in the exhibit types. ID Label/Location Info FCC ID E-labelling is permitted on devices qualifying for e-labelling.

Anticipated Australian Timeline – LPI & AFC

- LPI permitted in Wi-Fi networks with similar restrictions to FCC
- But no LPI road mapped for URWB in AU in the near term
- AFC anticipated during 2028 in AU
- IW9167E Slot 2 is XOR 5/6GHz
- To be AFC ready for Wi-Fi, you need
 - GPS antenna fitted
 - SIA antennas fitted

IW9167E Access Point Key Antenna Ports for 6GHz



○ SIA Antenna Port for 6GHz

Field Test Results

The Man Who Could: Ian Procyk, VE7HHS



Cisco Systems (Wireless Guy) 2011–today
GBIT Logistics (IT Consultancy)
Canadian Coast Guard (Telecom)
University of B.C. (WLAN team)

Ham Radio – Licensed 1997 – **VE7HHS**
Run a WISP for EMCOMM (BCWARN.net)
Support many amateur radio clubs / repeater sites

Pitt Lake Boat Launch: A Long, Relatively Straight Road, With Nothing Around!

5.6KM / 3.5mi



Rate & Range Testing – Vehicle Side



2513+9124 AXE on Vehicle



What 5.6km away from RAP looks like



VE7SCC
Officially supports the
BC SWAN Network

FEATHERLITE



Rate & Range Testing - 9124

Base Station:

- 1x 9124AXE-A UNII-3 TX PWR 1
- 2x 14dBi 5114P2M-N Patches
- Tested out to 5.6km
- Mast @ 10m

On Vehicle:

- 1x 9124AXE-A
- 1x 13dBi patch ANT2513P4M-N



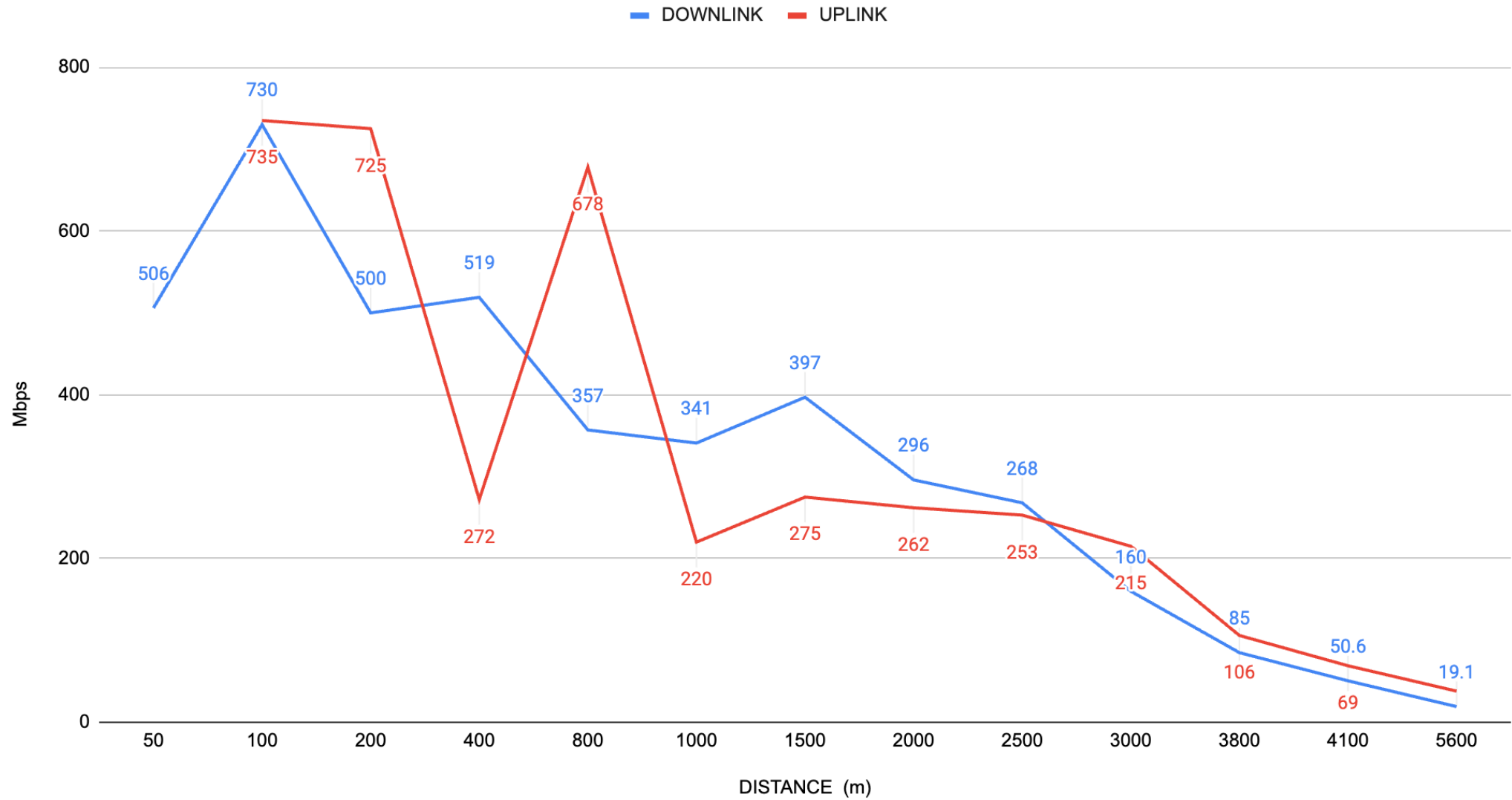
P2P Tests (MESH) To 5.6km & beyond!

Rate vs Range for P2P RAP<->MAP Data

DISTANCE (Mi)	DISTANCE (m)	TCP UPLINK FROM MAP	TCP DOWNLINK TO MAP	Reported MESH SNR (dB)
0.03	50	735	506	56
0.06	100	725	730	56
0.12	200	272	500	40
0.25	400	678	519	49
0.50	800	220	357	29
0.62	1000	275	341	37
0.93	1500	262	397	37
1.24	2000	253	296	37
1.55	2500	215	268	32
1.86	3000	106	160	25
2.36	3800	69	85	21
2.55	4100	38	50.6	16
3.48	5600	10.4	19.1	12

Rate vs Range For P2P RAP<->MAP

80MHz,UNII-3, 4chains with 2x5114 on RAP and 1x2513 on MAP



How to Look @ MESH SNR / Parent Selection

```
9124AXE-MAP#show mesh adjacency parent
```

```
Mesh AWPP Radio adjacency info
```

```
Flags: Parent(P), Child(C), Neighbor(N), Reachable(R), CapwapUp(W),
```

```
BlockListed(B), Authenticated(A), HTCappable(H), VHTCappable(V)
```

```
OldParent(O), BGScan(S)
```

```
AdjInfo: Radio Backhaul: 1 [48:8B:0A:78:86:31]
```

```
Hops to Root: 1
```

```
Address          Cost RawCost LinkCost ReportedCost Snr BCount Ch Width Bgn Flags: P O C N R W B A H V S Rej
```

```
ect reason
```

```
4C:A6:4D:23:2A:71 64 80 64 16 56 0 149 80 MHz - (T/F): T F F T T T F T T T F -
```



How To See Data Rates On AP-COS

```
9124AXE-MAP#debug dot11 client rate 4C:A6:4D:23:2A:71
```

Time	Source	Kernel	MAC	TX	RX	HE	MCS	GI	Rate	SNR	RSSI	Other
May 30 22:03:32	9124AXE-MAP	kernel	4C:A6:4D:23:2A:71	61748	5993	HE-80, 2SS, MCS11, GI0.8 (1200)				-37	54	0
May 30 22:03:33	9124AXE-MAP	kernel	4C:A6:4D:23:2A:71	60660	5813	HE-80, 2SS, MCS11, GI0.8 (1200)				-37	54	89
May 30 22:03:34	9124AXE-MAP	kernel	4C:A6:4D:23:2A:71	61764	5963	HE-80, 2SS, MCS11, GI0.8 (1200)				-36	55	0
May 30 22:03:35	9124AXE-MAP	kernel	4C:A6:4D:23:2A:71	61481	5943	HE-80, 2SS, MCS11, GI0.8 (1200)			12	-27	66	0
May 30 22:03:36	9124AXE-MAP	kernel	4C:A6:4D:23:2A:71	60896	5786	HE-80, 2SS, MCS11, GI0.8 (1200)				-36	57	0
May 30 22:03:37	9124AXE-MAP	kernel	4C:A6:4D:23:2A:71	60778	5894	HE-80, 2SS, MCS11, GI0.8 (1200)			12	-27	66	0

HE=11ax

2SS=2 Spatial Streams

MCS Rate

RSSI

*Note:
If on a MAP, do show mesh-adj parent to see the radio mac being used for backhaul.
Run the above debug on that MAC.*

P2P Tests (URWB)
<5.6km | 3.5mi



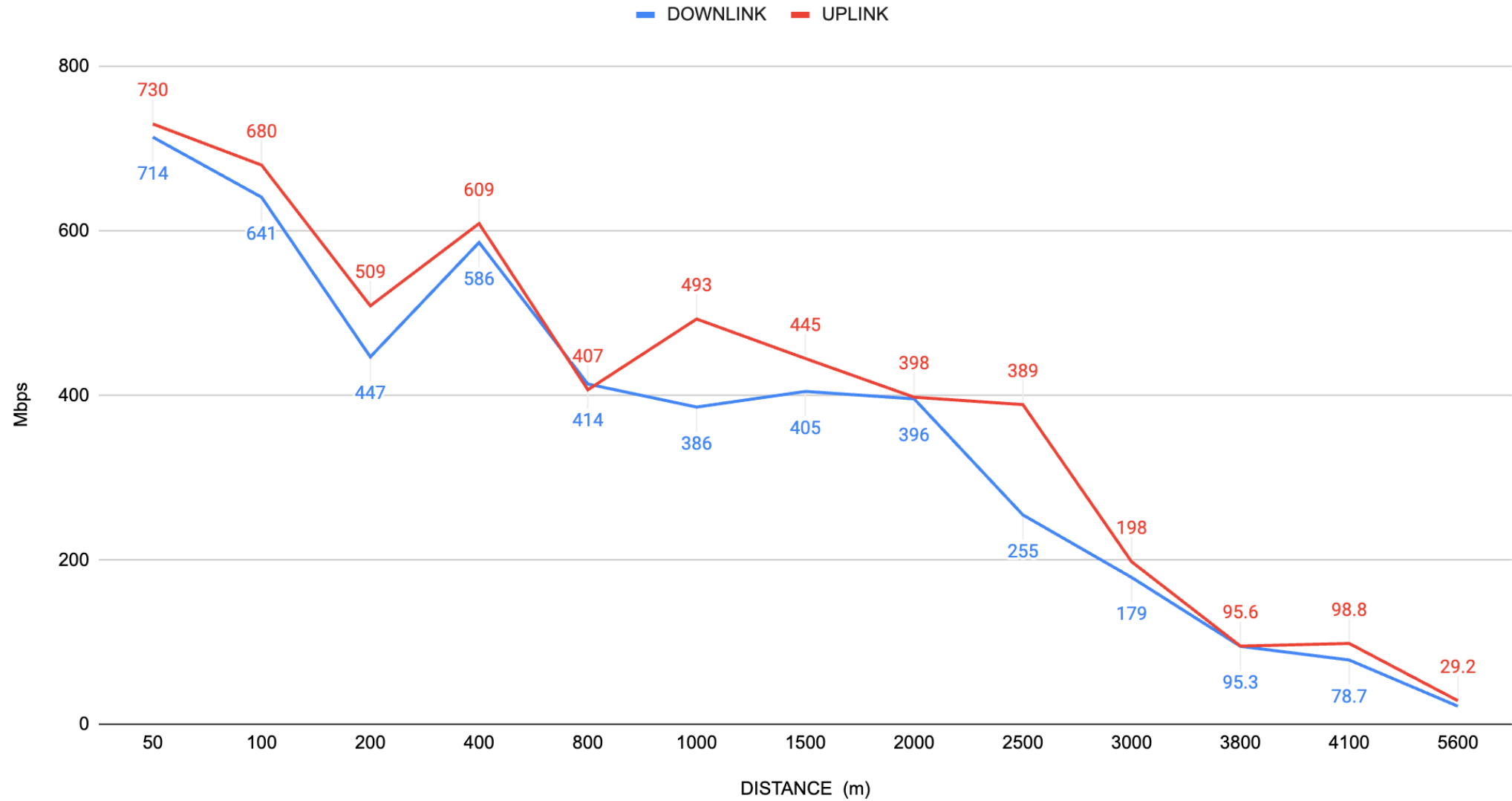
Don't mind the homebrew bracket 😊

Rate vs Range for P2P URWB /w 9167E

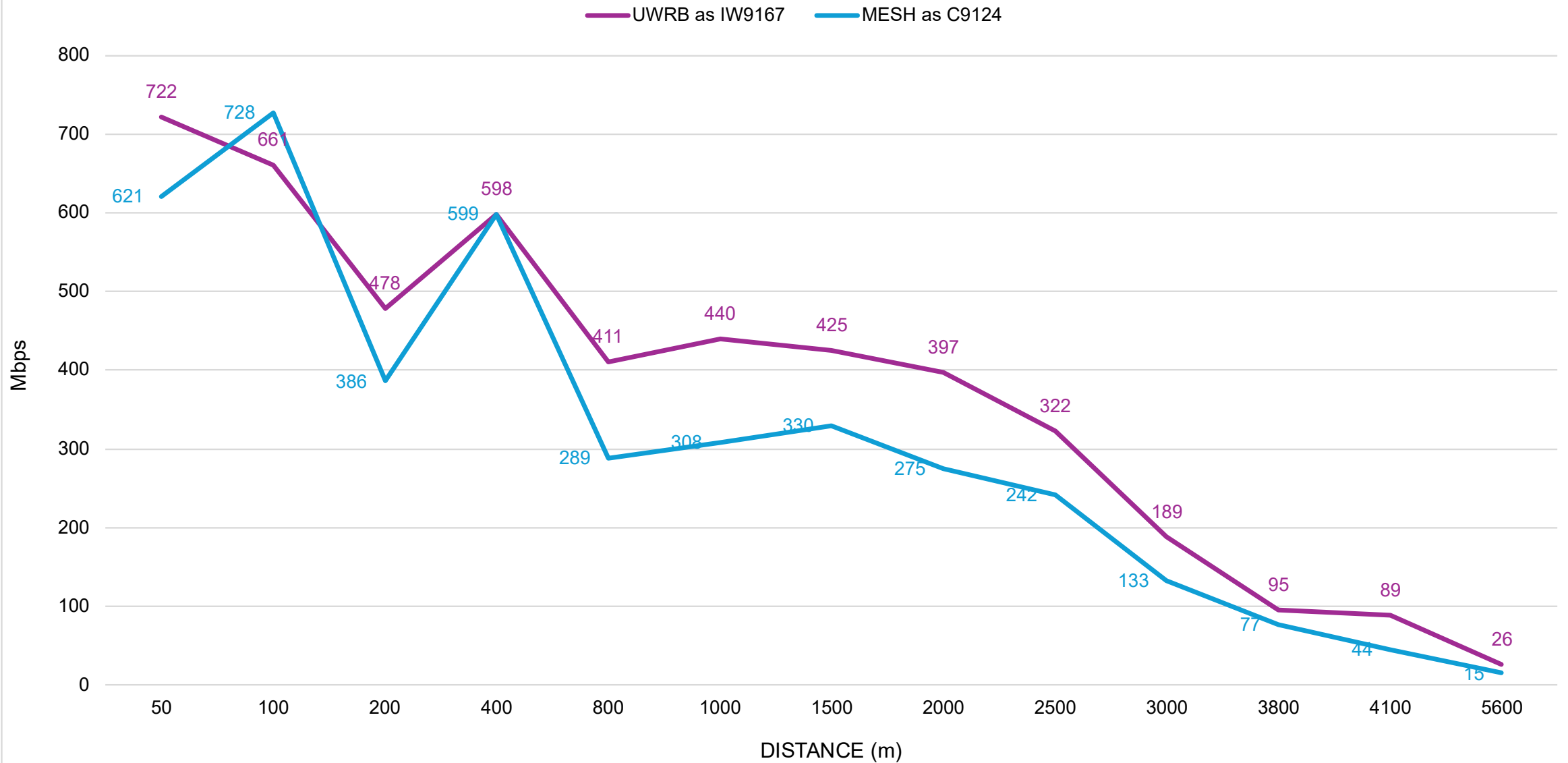
DISTANCE (Mi)	DISTANCE (m)	TCP UPLINK FROM Vehicle	TCP Downlink From Vehicle	SIGNAL LEVEL (dBm)
0.03	50	714	730	-32
0.06	100	641	680	-44
0.12	200	447	509	-43
0.25	400	586	609	-46
0.50	800	414	407	-58
0.62	1000	386	493	-55
0.93	1500	405	445	-57
1.24	2000	396	398	-58
1.55	2500	255	389	-61
1.86	3000	179	198	-71
2.36	3800	95.3	95.6	-75
2.55	4100	78.7	98.8	-77
3.48	5600	22.5	29.2	-81

Rate vs Range For P2P URWB

80MHz, UNII-3, 4chains with 2x5114 on Mesh End and 1x2513 on Mesh Point



Overlaid Rate vs Range: URWB & Mesh



How Far is Too Far?

Building a Pan/Tilt Antenna Positioner

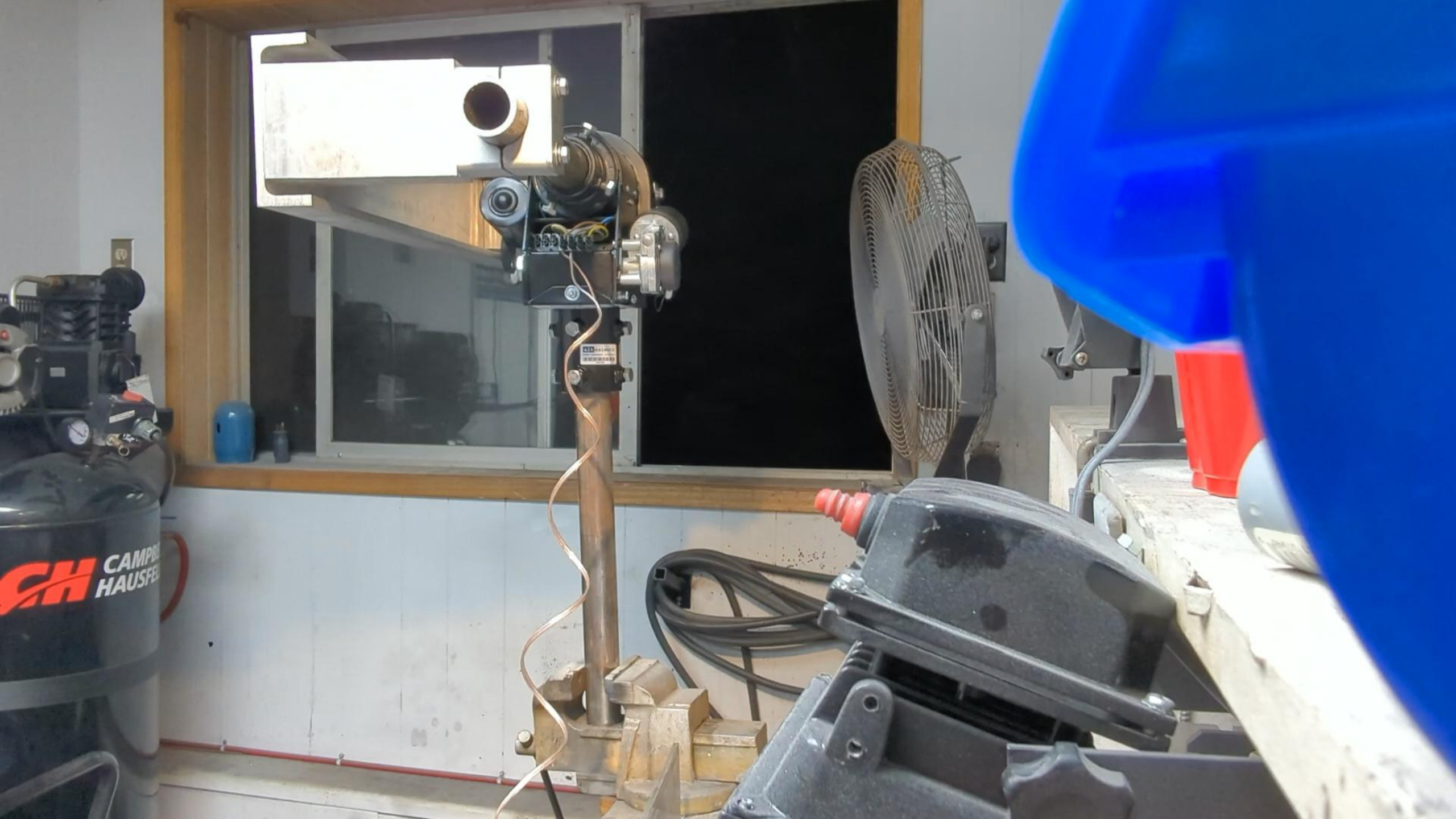


Building a Pan/Tilt Antenna Positioner



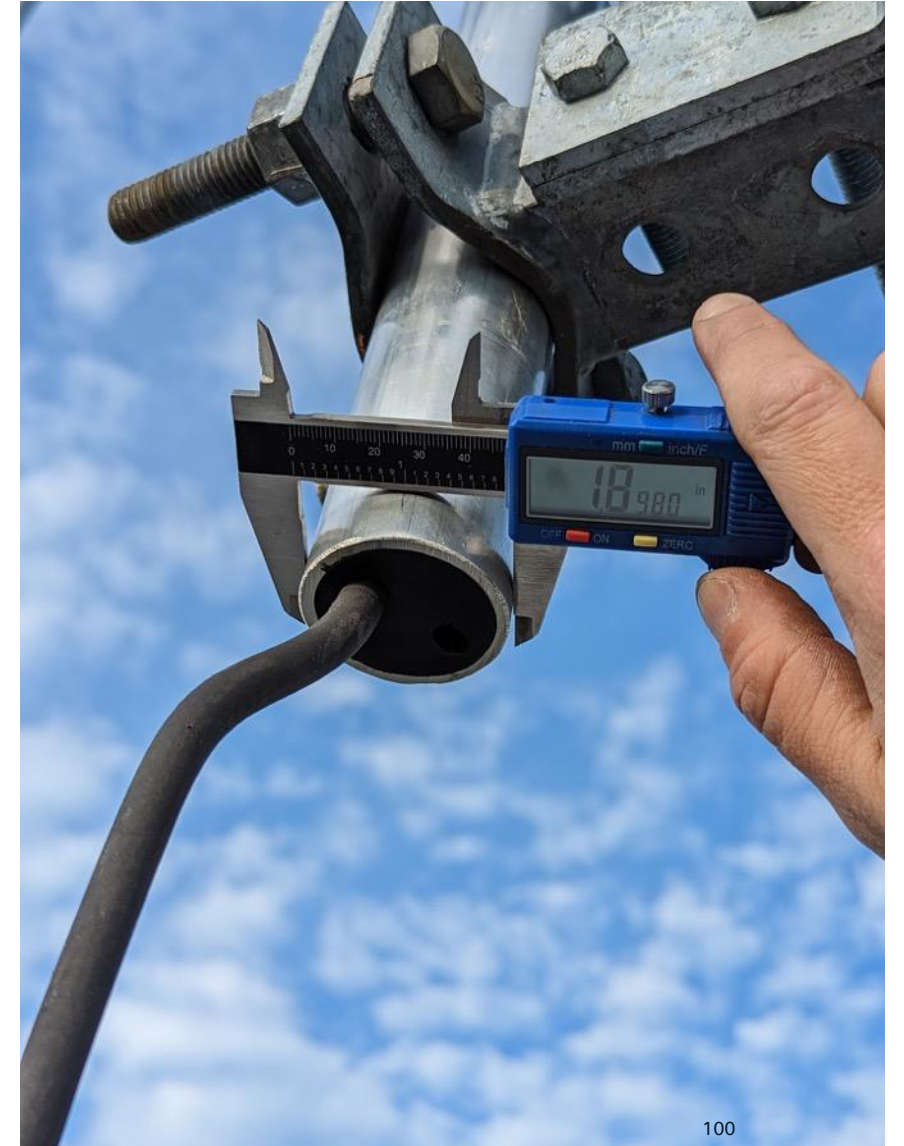
Building a Pan/Tilt Antenna Positioner





CH CAMPBELL HAUSER

Building a Pan/Tilt Antenna Positioner



Building a Pan/Tilt Antenna Positioner



Building a Pan/Tilt Antenna Positioner



Building a Pan/Tilt Antenna Positioner





CAT
1R-0749
Advanced

BRKIOT18027

04

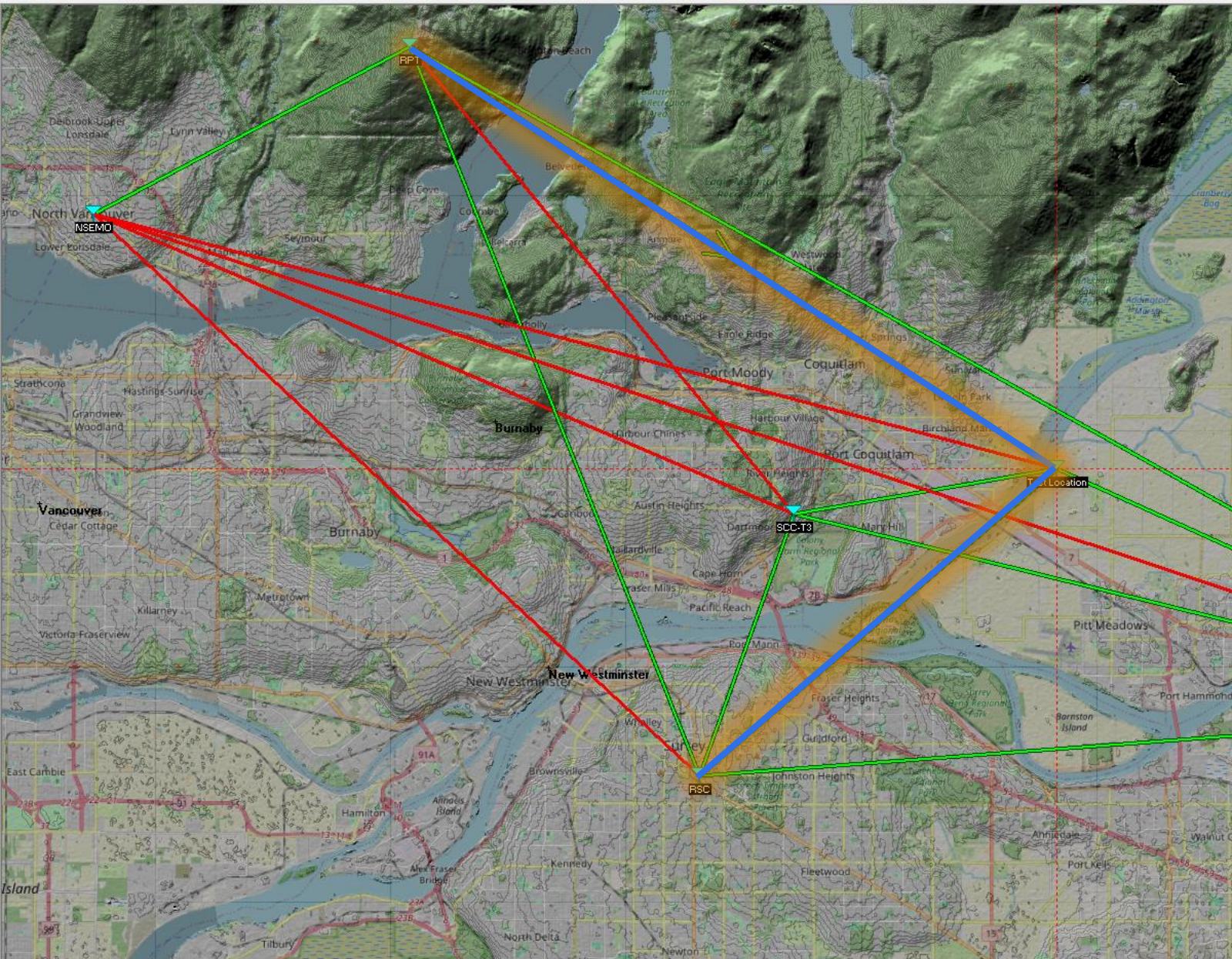
The IW3702 / IW9167E Test Jig

- Magnetic mounted to vehicle
- 4SS setup
- 4x MobileMark OD2's Rugged 2.4GHz Antenna



The IW3702 / IW9167E Test Jig





A WGB @ 21km from a 9124?



A WGB @ 21km from a 9124?



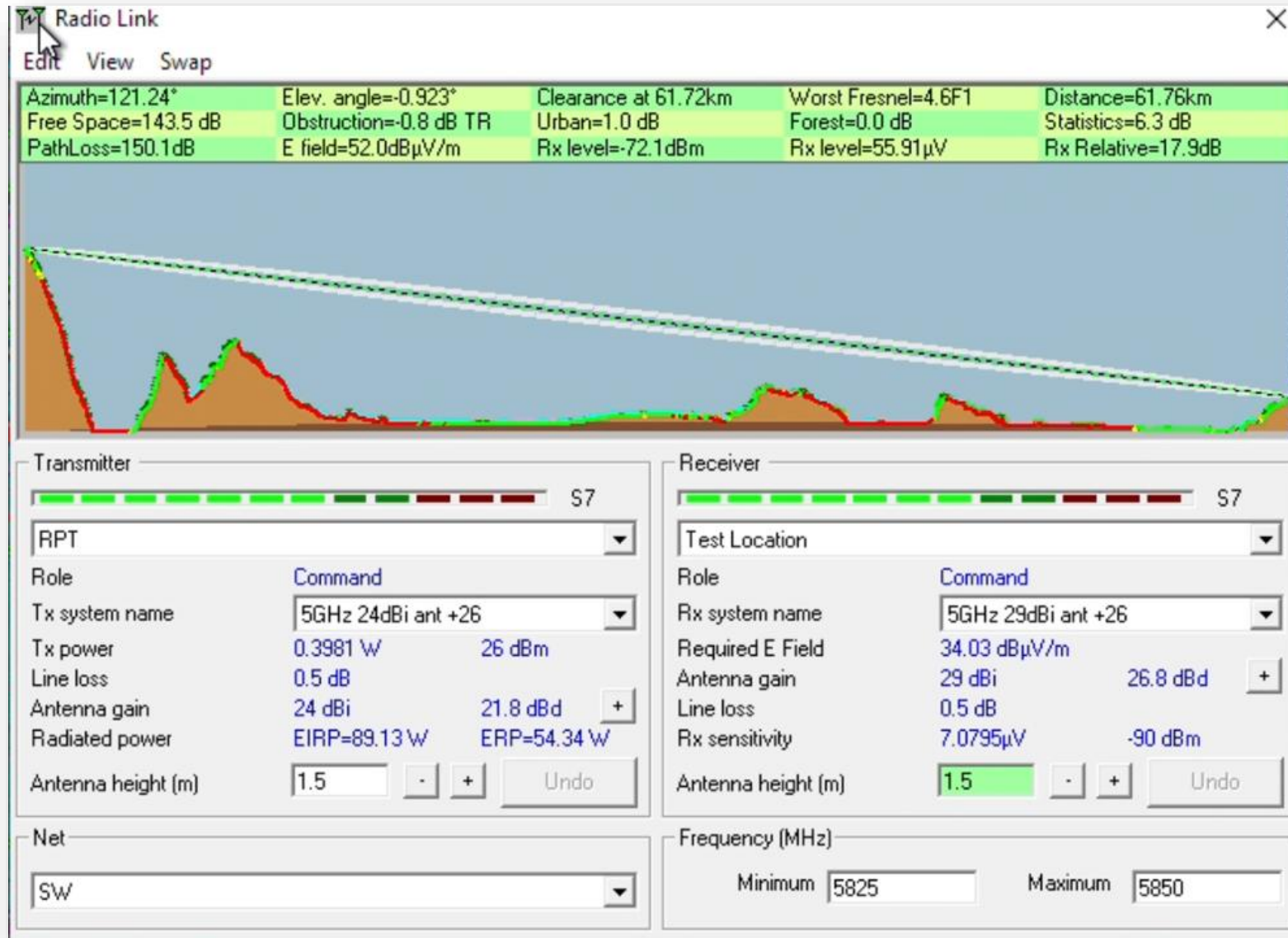
A WGB @ 21km from a 9124?




```
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Reply from 44.135.209.126: bytes=32 time=27ms TTL=255
Reply from 44.135.209.126: bytes=32 time=9ms TTL=255
Reply from 44.135.209.126: bytes=32 time=584ms TTL=255
Reply from 44.135.209.126: bytes=32 time=1816ms TTL=255
Reply from 44.135.209.126: bytes=32 time=799ms TTL=255
Reply from 44.135.209.126: bytes=32 time=787ms TTL=255
Reply from 44.135.209.126: bytes=32 time=1912ms TTL=255
Reply from 44.135.209.126: bytes=32 time=1751ms TTL=255
Reply from 44.135.209.126: bytes=32 time=779ms TTL=255
Reply from 44.135.209.126: bytes=32 time=35ms TTL=255
Reply from 44.135.209.126: bytes=32 time=161ms TTL=255
Reply from 44.135.209.126: bytes=32 time=62ms TTL=255
Reply from 44.135.209.126: bytes=32 time=164ms TTL=255
Reply from 44.135.209.126: bytes=32 time=153ms TTL=255
Reply from 44.135.209.126: bytes=32 time=116ms TTL=255
Reply from 44.135.209.126: bytes=32 time=177ms TTL=255
Reply from 44.135.209.126: bytes=32 time=167ms TTL=255
Reply from 44.135.209.126: bytes=32 time=171ms TTL=255
Reply from 44.135.209.126: bytes=32 time=146ms TTL=255
Reply from 44.135.209.126: bytes=32 time=155ms TTL=255
Reply from 44.135.209.126: bytes=32 time=146ms TTL=255
Reply from 44.135.209.126: bytes=32 time=26ms TTL=255
Reply from 44.135.209.126: bytes=32 time=153ms TTL=255
Reply from 44.135.209.126: bytes=32 time=154ms TTL=255
Reply from 44.135.209.126: bytes=32 time=167ms TTL=255
Reply from 44.135.209.126: bytes=32 time=167ms TTL=255
Reply from 44.135.209.126: bytes=32 time=153ms TTL=255
Reply from 44.135.209.126: bytes=32 time=1245ms TTL=255
Reply from 44.135.209.126: bytes=32 time=2442ms TTL=255
Reply from 44.135.209.126: bytes=32 time=2193ms TTL=255
Reply from 44.135.209.126: bytes=32 time=1331ms TTL=255
Reply from 44.135.209.126: bytes=32 time=1036ms TTL=255
Reply from 44.135.209.126: bytes=32 time=469ms TTL=255
Reply from 44.135.209.126: bytes=32 time=753ms TTL=255
Reply from 44.135.209.126: bytes=32 time=542ms TTL=255
Reply from 44.135.209.126: bytes=32 time=1051ms TTL=255
Reply from 44.135.209.126: bytes=32 time=2989ms TTL=255
Reply from 44.135.209.126: bytes=32 time=3184ms TTL=255
```

ACK timing not happy – notice latency in ICMP.

How About @ 62km?





Lots of signal – but barely any packets...



```
iperf3: interrupt - the client has terminated
C:\iperf>
C:\iperf>iperf3.exe -c 44.135.209.65 -w 1024k
Connecting to host 44.135.209.65, port 5201
[ 4] local 44.135.209.73 port 62025 connected to 44.135.209.65 port 5201

iperf3: interrupt - the client has terminated

[ 12] 8.00-9.00 sec 0.00 Bytes 0.00 bits/sec
[SUM] 8.00-9.00 sec 128 KBytes 1.05 Mbits/sec

[ 4] 10.00-13.97 sec 0.00 Bytes 0.00 bits/sec
[ 6] 10.00-13.97 sec 0.00 Bytes 0.00 bits/sec
[ 8] 10.00-13.97 sec 0.00 Bytes 0.00 bits/sec
[10] 10.00-13.97 sec 0.00 Bytes 0.00 bits/sec
[12] 10.00-13.97 sec 0.00 Bytes 0.00 bits/sec
[SUM] 10.00-13.97 sec 0.00 Bytes 0.00 bits/sec

[ ID] Interval      Transfer      Bandwidth
[ 4] 0.00-13.97 sec 1.25 MBytes  750 Kbits/sec
[ 4] 0.00-13.97 sec 0.00 Bytes  0.00 bits/sec
[ 6] 0.00-13.97 sec 1.38 MBytes  825 Kbits/sec
[ 6] 0.00-13.97 sec 0.00 Bytes  0.00 bits/sec
[ 8] 0.00-13.97 sec 1.25 MBytes  750 Kbits/sec
[ 8] 0.00-13.97 sec 0.00 Bytes  0.00 bits/sec
[10] 0.00-13.97 sec 1.12 MBytes  675 Kbits/sec
[10] 0.00-13.97 sec 0.00 Bytes  0.00 bits/sec
[12] 0.00-13.97 sec 1.12 MBytes  675 Kbits/sec
[12] 0.00-13.97 sec 0.00 Bytes  0.00 bits/sec
[SUM] 0.00-13.97 sec 6.12 MBytes  3.68 Mbits/sec
[SUM] 0.00-13.97 sec 0.00 Bytes  0.00 bits/sec
iperf3: interrupt - the client has terminated

Reply from 206.12.105.252: bytes=32 time=10ms TTL=61
Reply from 206.12.105.252: bytes=32 time=9ms TTL=61
Reply from 206.12.105.252: bytes=32 time=6ms TTL=61
Reply from 206.12.105.252: bytes=32 time=10ms TTL=61
Reply from 206.12.105.252: bytes=32 time=6ms TTL=61
Reply from 206.12.105.252: bytes=32 time=7ms TTL=61
Reply from 206.12.105.252: bytes=32 time=8ms TTL=61
Reply from 206.12.105.252: bytes=32 time=9ms TTL=61
Reply from 206.12.105.252: bytes=32 time=8ms TTL=61
Reply from 206.12.105.252: bytes=32 time=15ms TTL=61
Reply from 206.12.105.252: bytes=32 time=11ms TTL=61
Reply from 206.12.105.252: bytes=32 time=8ms TTL=61
Reply from 206.12.105.252: bytes=32 time=7ms TTL=61
Reply from 206.12.105.252: bytes=32 time=10ms TTL=61
Reply from 206.12.105.252: bytes=32 time=6ms TTL=61
Reply from 206.12.105.252: bytes=32 time=8ms TTL=61
Reply from 206.12.105.252: bytes=32 time=10ms TTL=61
Reply from 206.12.105.252: bytes=32 time=1451ms TTL=61
Request timed out.
Request timed out.
Reply from 206.12.105.252: bytes=32 time=1092ms TTL=61
Reply from 206.12.105.252: bytes=32 time=117ms TTL=61
Reply from 206.12.105.252: bytes=32 time=676ms TTL=61
Reply from 206.12.105.252: bytes=32 time=342ms TTL=61
Reply from 206.12.105.252: bytes=32 time=110ms TTL=61
Reply from 206.12.105.252: bytes=32 time=1255ms TTL=61
Reply from 206.12.105.252: bytes=32 time=2479ms TTL=61
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Reply from 206.12.105.252: bytes=32 time=2573ms TTL=61
Reply from 206.12.105.252: bytes=32 time=852ms TTL=61
Reply from 206.12.105.252: bytes=32 time=2169ms TTL=61
Reply from 206.12.105.252: bytes=32 time=803ms TTL=61
```

Summary

AP platform vs capability matrix

Platform	CAPWAP AP	MESH	WGB	WLC URWB	SA URWB
IW9167E				17.18>	
IW9167I	17.12>			17.18.2	
IW9165E (no 2.4GHz)	17.14>		17.13>	17.18>	
IW9165D (no 2.4GHz)	17.14>			17.18.2	
C9115					
C9120					
C9124					
C9130				17.18.2	
C9136				17.18.2	
CW9166				17.18.2	
CW9176,9178				17.18>	

What have we learned?

- Continued wireless evolution, driven by business demands
- URWB and CAPWAP coexist in the same infrastructure today
- Performed a URWB+WLC configuration deep dive
- Existing Mesh and WGB investments still being enhanced
- Reinforcing the realities of physics through Field Tests
 - *Just because you can, doesn't mean you should!!!*

Call to Action:

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- Check out the latest Cisco Industry Validated Design Guides at www.cisco.com/go/iotcvd
- Consider partnering with Cisco to develop your next-gen AI-ready Industrial IoT network architecture

Complete your session evaluations



Complete a minimum of 4 session surveys and the Overall Event Survey to claim a Cisco Live T-Shirt.



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Visit the Cisco Stand for related demos



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Visit the On-Demand Library for more sessions at www.CiscoLive.com/on-demand

Thank you

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