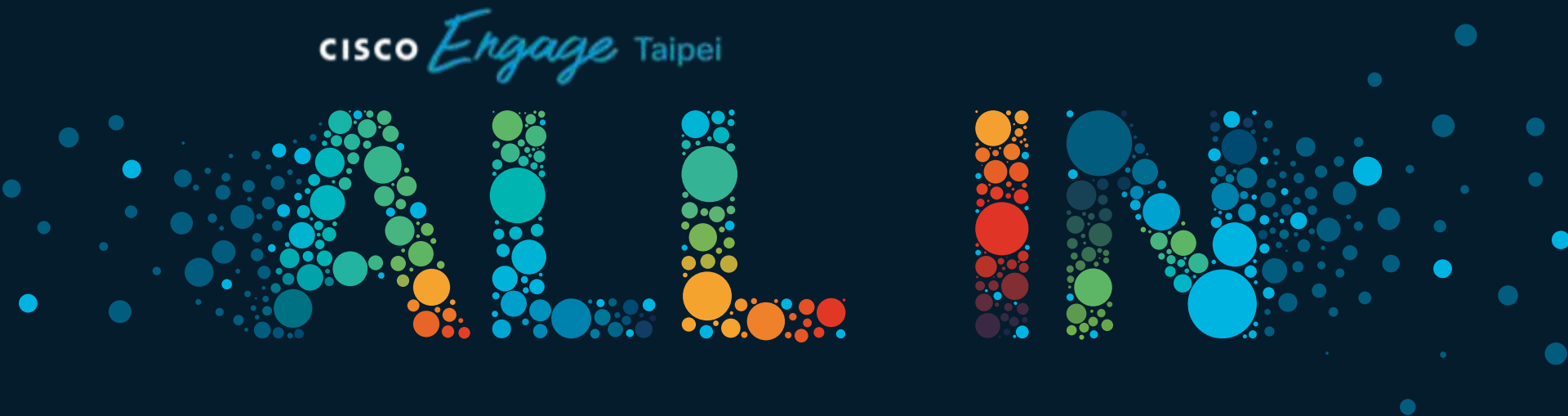
CISCO Engage Taipei
ALL IN

The bridge to possible

Cisco Ultra-Reliable Wireless Backhaul

IoT Solutions for Industrial Applications

David Wang / IoT PSS APJC, Industrial Wireless
January 17, 2023

IoT Networking + Security Portfolio

Industrial Switching
1K, 2K, 3200, 3300, 3400, 3400H, 4K, 5K, 9K

Industrial Routing
IR1101, IR1800, IR8100, IR8300, CGR1120, CGR1240, CGR2010, IoT Gateways (IG21, IG21R, IG31R)

Embedded Networking
ESS, ESR, ESW, Resilient Mesh

Industrial Wireless
Cisco Ultra-Reliable Wireless Backhaul, IW9167, IW6300, IW3702, IR5XX, IXM Gateway

Industrial Cybersecurity
Cyber Vision, ISA3000 Firewall

Data Control and Exchange
Edge Intelligence, IOx

Industrial Sensor Solution
Industrial Asset Vision

Management & Automation
Field Network Director, IoT Operations Dashboard, Cisco DNA Center, vManage

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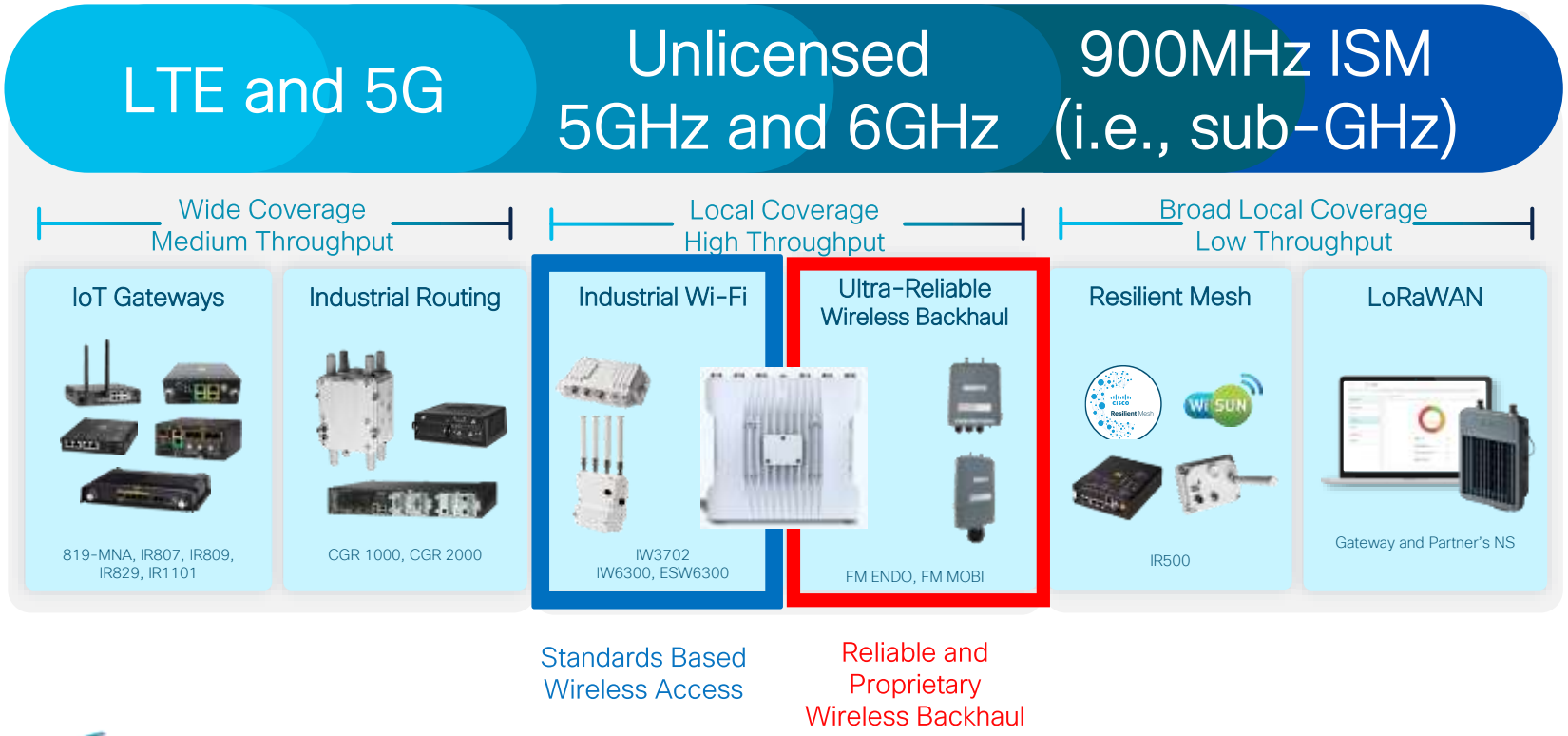
Cisco's Evolving Wireless Portfolio

There are many types of wireless technologies applicable to IoT



Why the name change?

Fluidmesh → Cisco Ultra-Reliable Wireless Backhaul

- **Descriptive**: This is specifically a backhaul technology.
- **Recognizable**: Instantly identifiable as an alternative to 5G URLLC (ultra-reliable low-latency communication).
- **Branded**: This is part of the Cisco Family of wireless technologies, and you'll be seeing more technical integrations in the future.

FM-Series

+

IW-Series

Wireless Backhaul Defined

- Long Range and High Bandwidth Connectivity
- Fast and Accurate Handoff
  (0ms handoff, at 350+ Km/h)
- Support for real-time sensitive traffic.
  (e.g., PROFINET, CANbus, Q-Net, etc.)
- MPLS based solution supports fixed and mobile architectures

What is CURWB (aka. Fluidmesh)?

CURWB wireless solution uses the public ISM RF frequency band to reliably provide a network with fiber-like performance

- Main Application: For OT (Operation Technology) markets.

Outdoor and large-scale IoT network including:

- Smart city, street video surveillance / data communication
- Rail transit vehicle-to-ground communication network
- Unmanned, remote control of heavy machinery
- Industrial or factory automation

CURWB is not a traditional Wi-Fi AP network, there is no controller (No WLAN controller).

Just Another Wireless?

High throughput

Up to 500 Mbps
(up 3.5 Gbps for IW916x)

Actual Usable Throughput

Low Latency

Less than 10ms, enabling real-time, high-demanding applications

Seamless handoff

No downtime when roaming

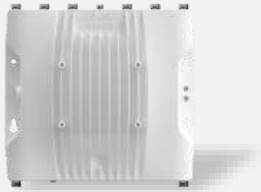
Near 0% packet drop rate

Stability & Reliability

To guarantee extreme uptime and maximum productivity of the OT network

Cisco URWB Portfolio: FM- and IW-Series

Radios



Gateways

Antennas

Tools

CX/ Pro Services

CURWB/FM Radio Lineup: 4.9-6.0 GHz Solutions

Fixed / Backhaul

Mobility

Environment

Rugged

Normal

*Taiwan only

FM Ponte

- Up to 50 Mbps
- Up to 27 dBm
- 2x2 MIMO
- Integrated antenna
- H-Beam: 33 deg
- V-Beam 17 deg
- 2x 10/100 RJ45

FM1200 Volo

- PtP, PtMP, Mesh
- Up to 150Mbps
- Up to 5 miles
- H-Beam: 33 deg
- V-Beam: 17 deg
- Tx Pwr: 27dBm
- 1 x RJ45 Port
- 1 x 24VDC PoE

FM3200 Base

- PtMP Mesh-End (Typ)
- Up to 150 Mbps
- 18dBi directional
- Up to 5 miles
- H-Beam120 deg
- V Beam: 10 deg
- Up to 27dBm
- 1 x RJ45
- 1 x 48VDC PoE

FM4200F

- Tx: 150Mbps
- Output Power: 27dBm
- 1x10/100/1000 M12
- SFP Fiber Port
- 1 x 48vdc input

FM3500E

- Throughput: up to 500 Mbps
- Output Power: up to 30dBm
- 1 x RJ45 Ethernet Port
- 1 x 802.3at PoE Gigabit Port

FM4500M

- Max Tx: 500Mbps
- Max RF: 30dBm
- 2x10/100/1000 M12
- 1 x 802.3at PoE Gb M12 Port
- 1 x 48vdc input

FM4500F

- Throughput: 500 Mbps
- Output Power: 30dBm
- 1 x 10/100/1000 M12
- SFP Fiber Port
- 1 x Redundant 48vdc input

NextGen IW9167E Is Here!

NextGen IW916x Jan. 24, 2023

50Mbps

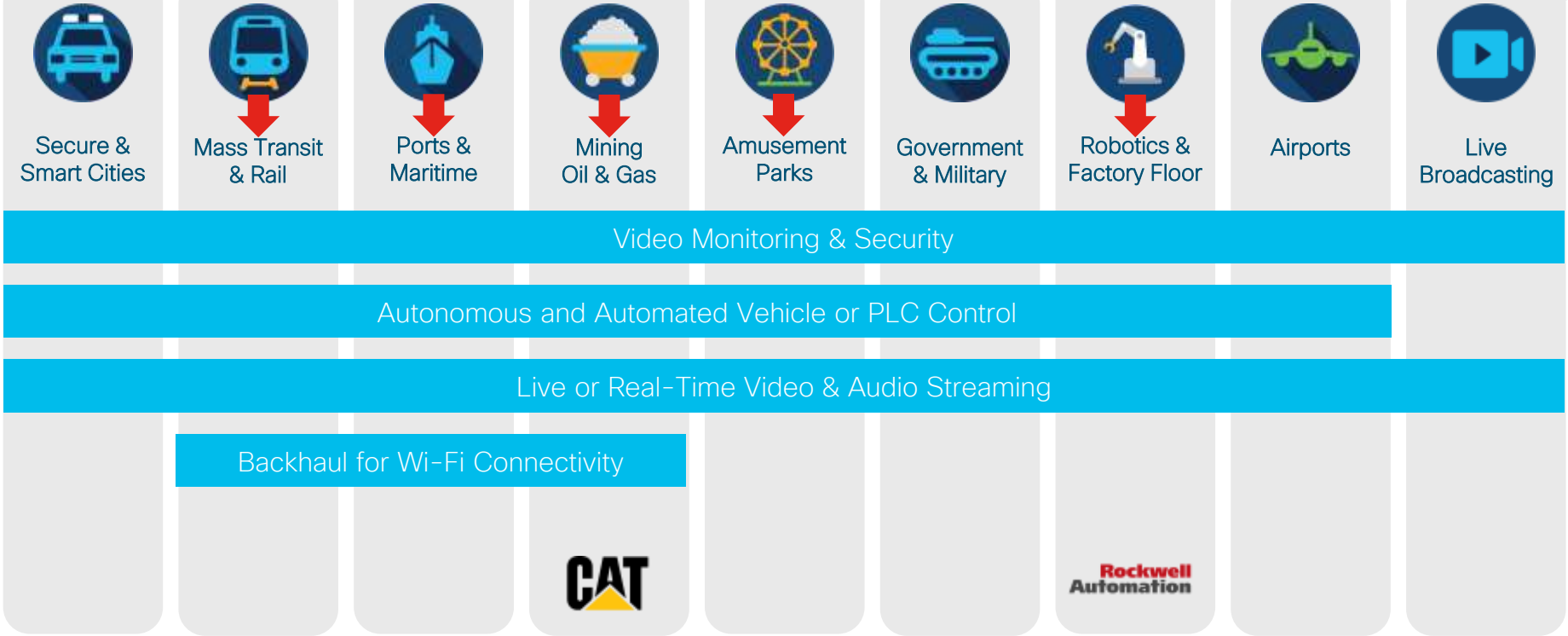
150Mbps

500Mbps

Up to 3.5 Gbps

Product available in Greater China Region (in red)

CURWB/FM Radio Lineup: 4.9-6.0 GHz Solutions

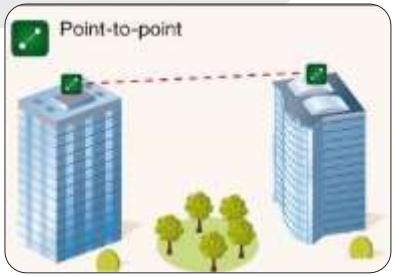


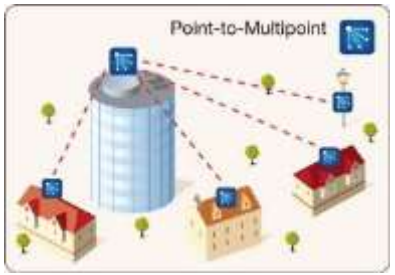
Cisco Ultra-Reliable Wireless Backhaul

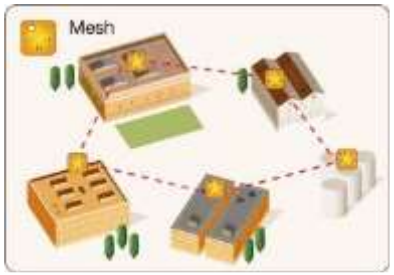
Fixed Infrastructure Backhaul

A Bridge between Fixed Networks and Moving Vehicles

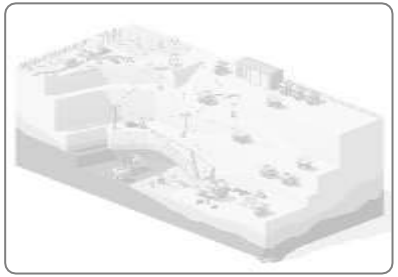
FIXED
Architecture

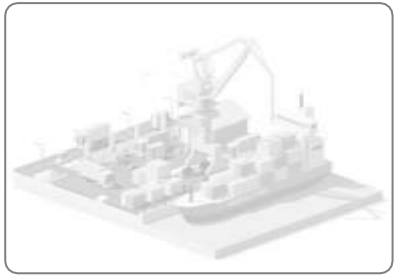






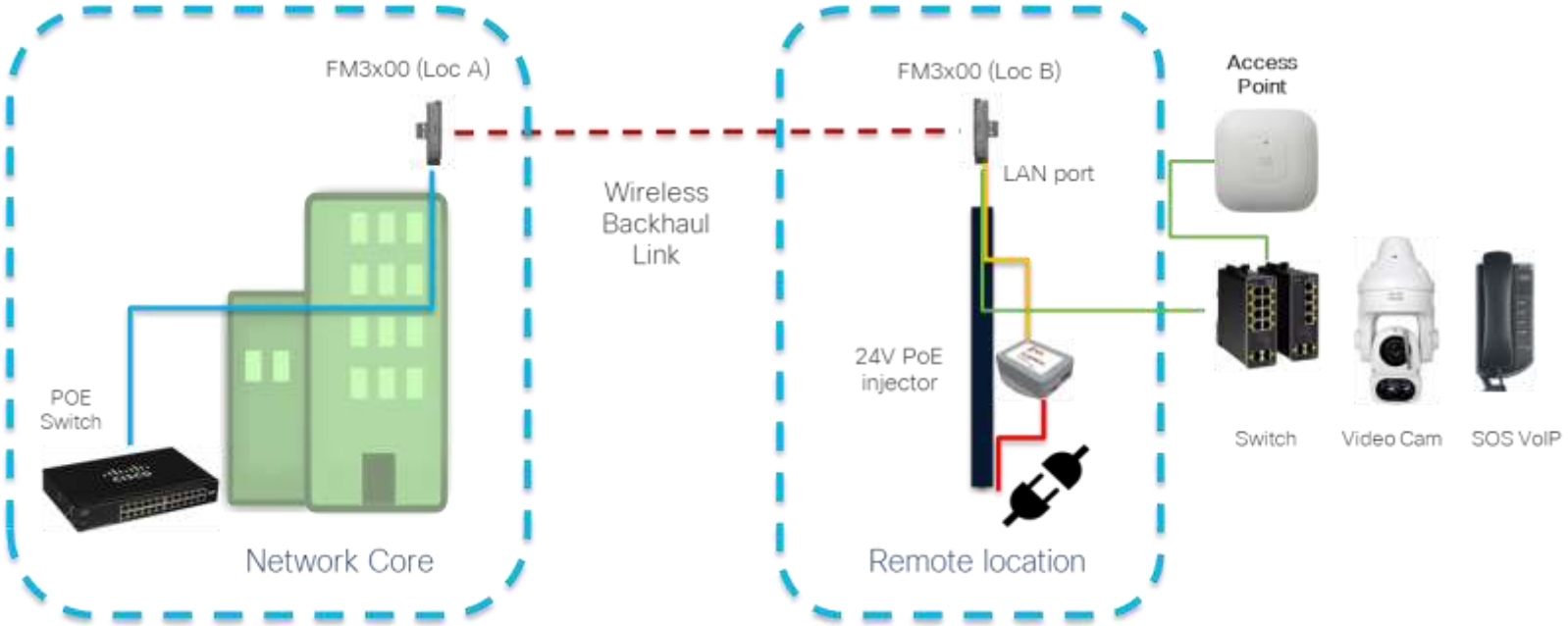
MOBILITY
Architecture



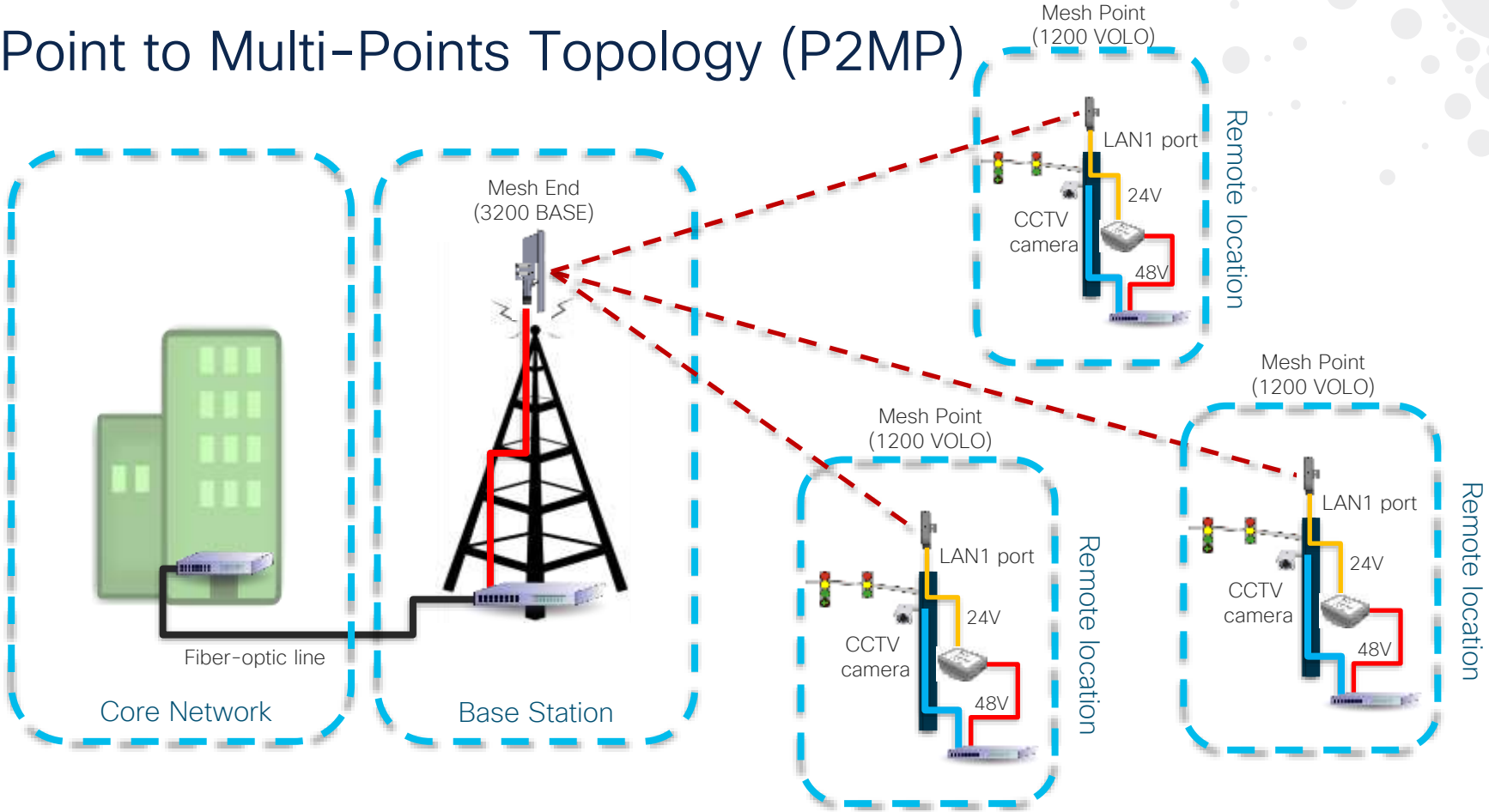


Point to Point Topology (P2P)

The CURWB devices are specifically designed for simple PTP deployments with bandwidth needs of between 1 and up to 500 Mbps or greater and involving physical separation in between link distances. However, all radios have the capability to operate as a point-to-point link, allowing maximum flexibility based on network requirements.



Point to Multi-Points Topology (P2MP)

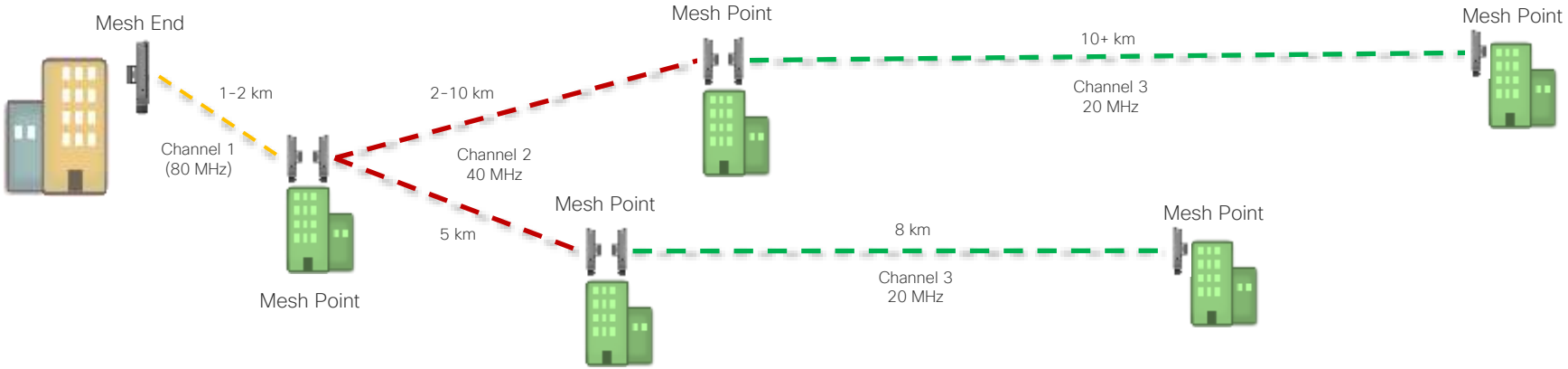


Linear Mesh Topology

Structured mesh: each link uses a separate channel. This optimizes total throughput and prevents interference from neighboring radios.

The radio that is physically closest to the core network is usually configured as the Mesh End.

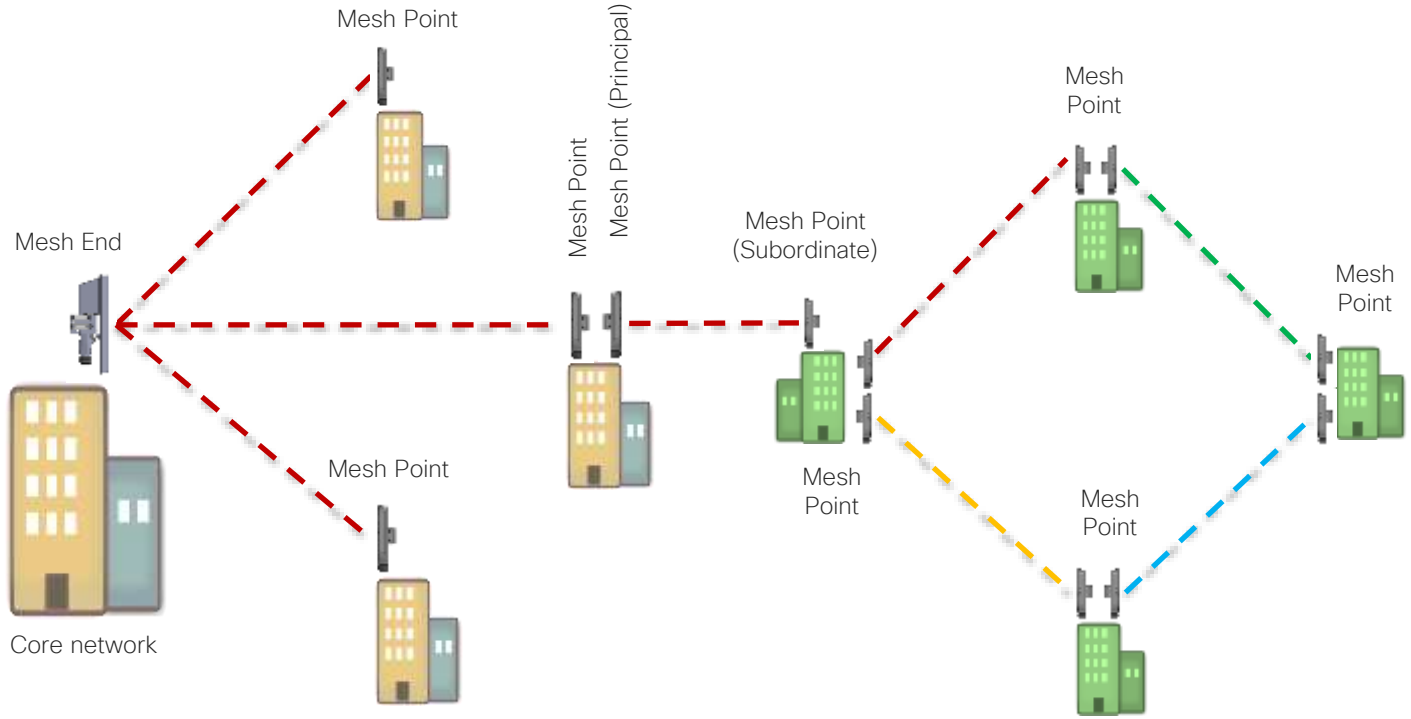
Linear Network Concept:



Note: This linear mesh network design concept shown here is only a concept. Actual project will require engineering to be onsite for site survey.

Mixed Network Topology

By using a modular approach and employing accepted design principles, P2P, P2MP and mesh networks can be converged into a single wireless network that spans areas of almost any size.



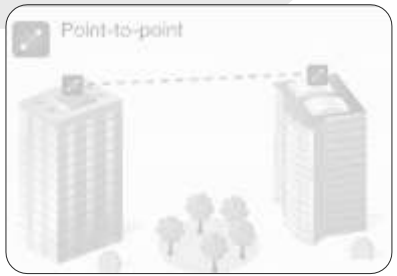
Cisco Ultra-Reliable Wireless Backhaul

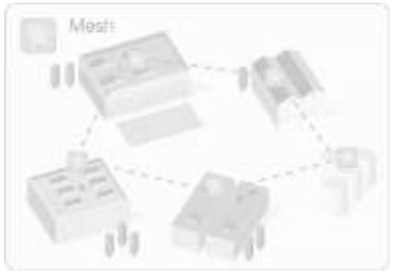
Mobility (Fluidity) Backhaul

A Bridge between Fixed Networks and Moving Vehicles

FIXED
Architecture

MOBILITY
Architecture





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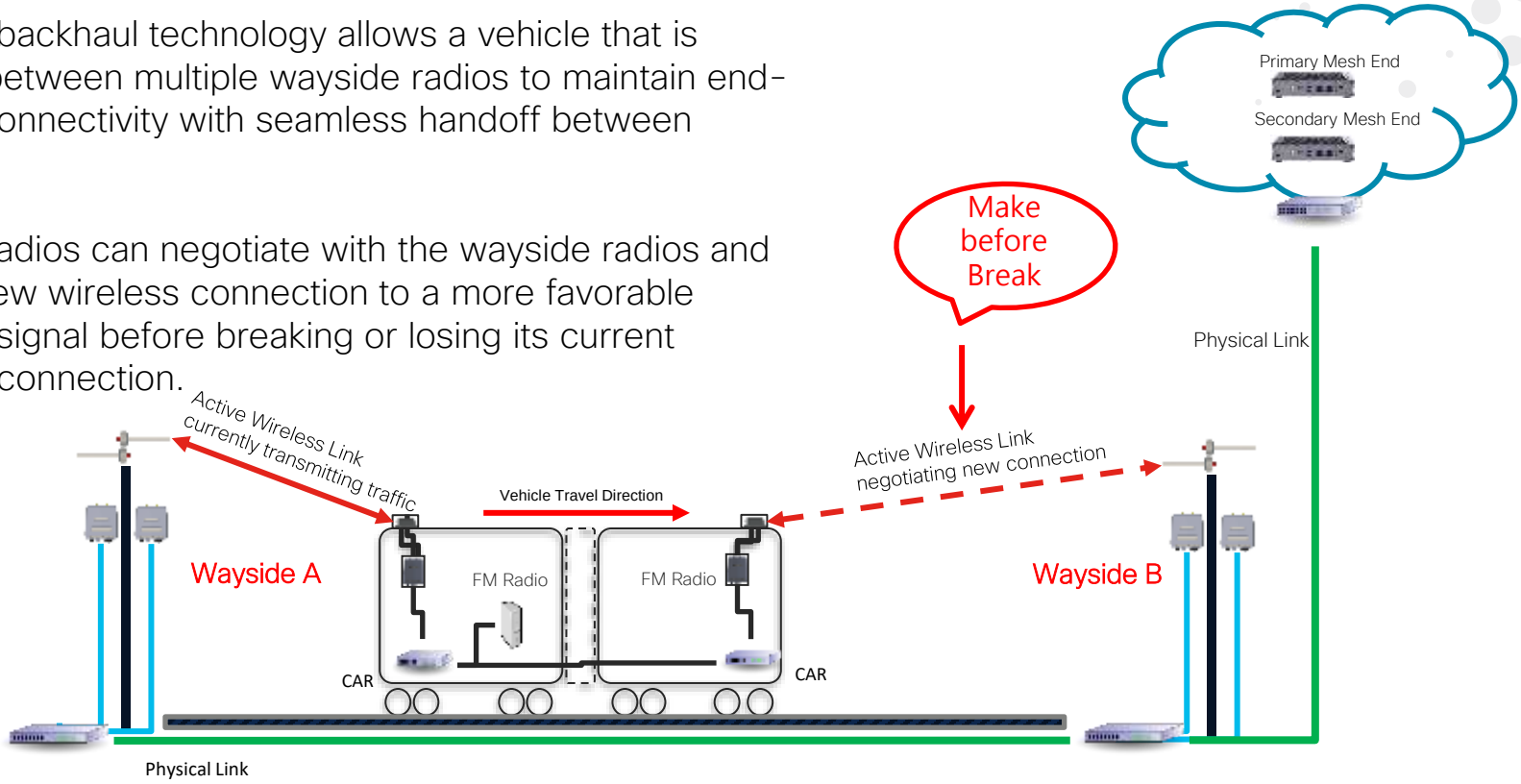
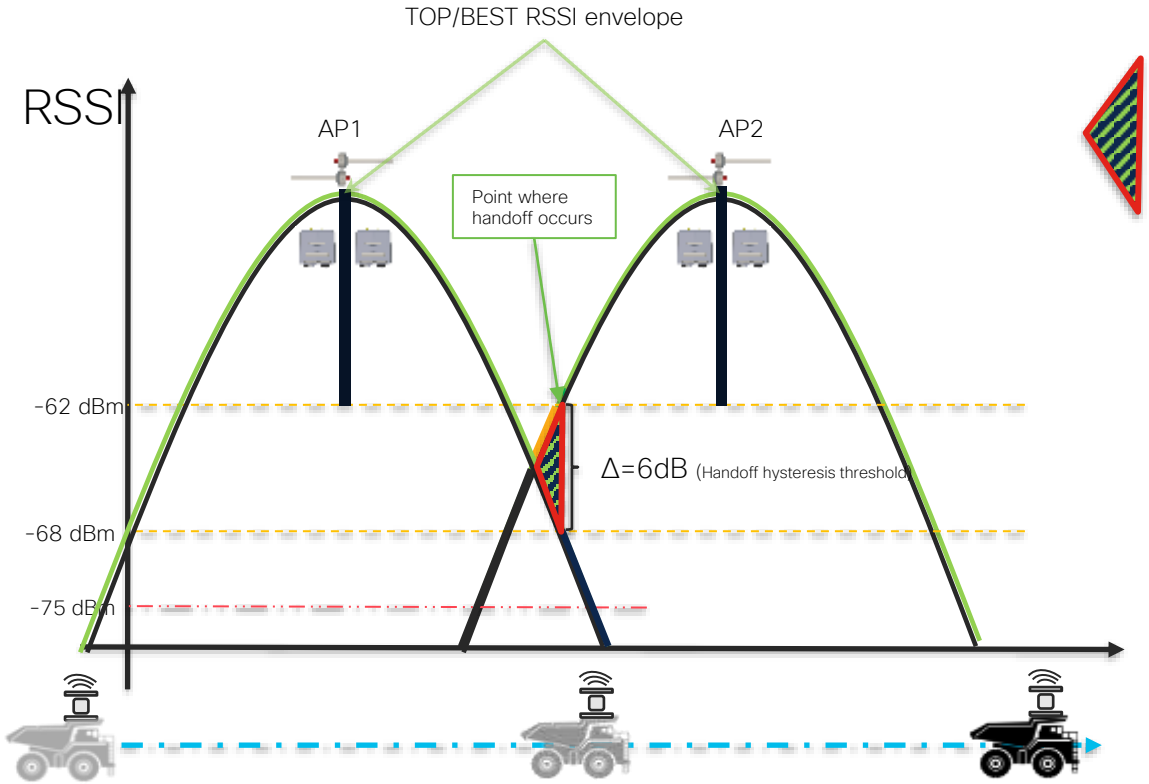
CURWB: Fast-Roaming Mobility Network

CURWB backhaul technology allows a vehicle that is moving between multiple wayside radios to maintain end-to-end connectivity with seamless handoff between radios.

Vehicle radios can negotiate with the wayside radios and form a new wireless connection to a more favorable wayside signal before breaking or losing its current wireless connection.



CURWB: Dynamic Handoff Decision



Represents area where handoff to a new AP which performed according to the Delta Low and Hi configuration. Radio on the vehicle detects an increase in RSSI from AP2, where it will negotiate a connection with AP2 before breaking the current connection with AP1 (hence: ***Make-Before-Break Algorithm***).

Radios always operate on the top line (RSSI Envelope), handing over to the next available AP as soon as the RSSI level is better than a designated delta value (Hysteresis Threshold).

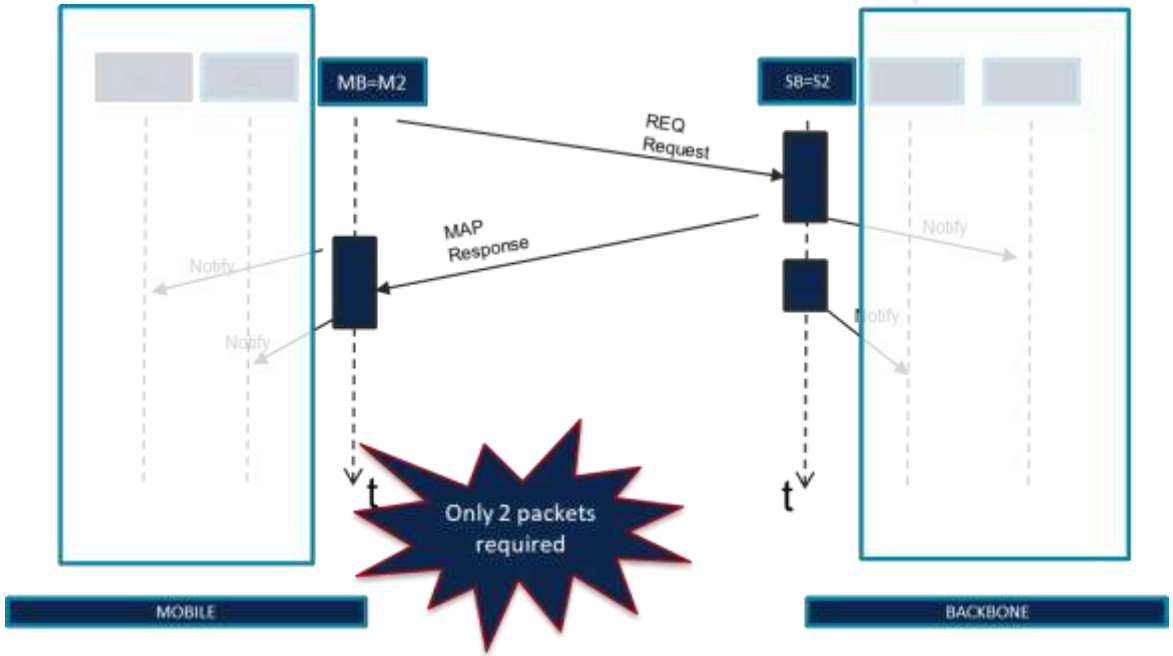
CURWB: MAC Layer Mobile Advantage

MOBILE INITIATED HANDOFF

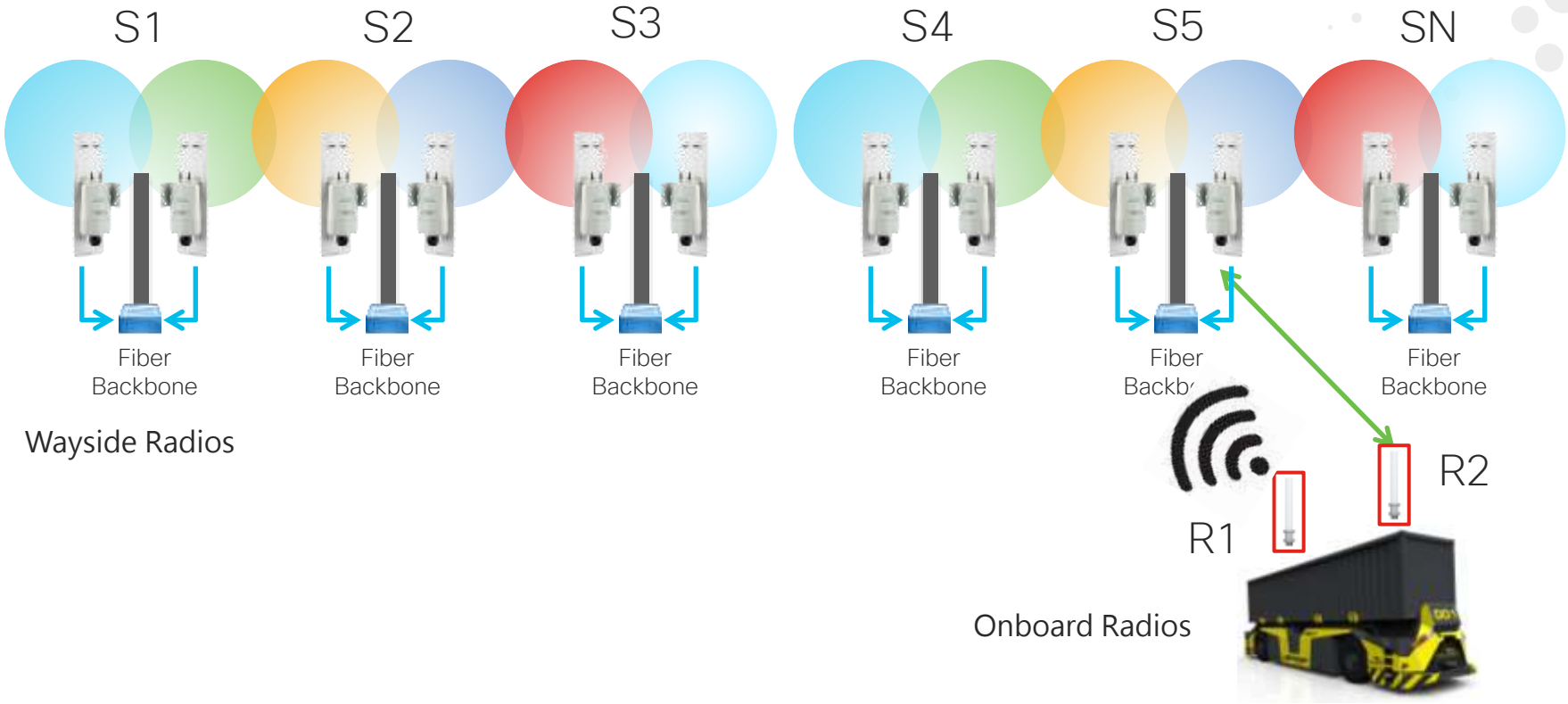
The mobile radio (onboard the vehicles) takes the handoff decision. **No Controller Solution is needed.**

Only two packets are required to initiate the handoff: a request from the mobile unit, and a response from the Infrastructure unit.

S: Static infrastructure
M: Mobile infrastructure



Wireless V2I Network: Seamless Handoff



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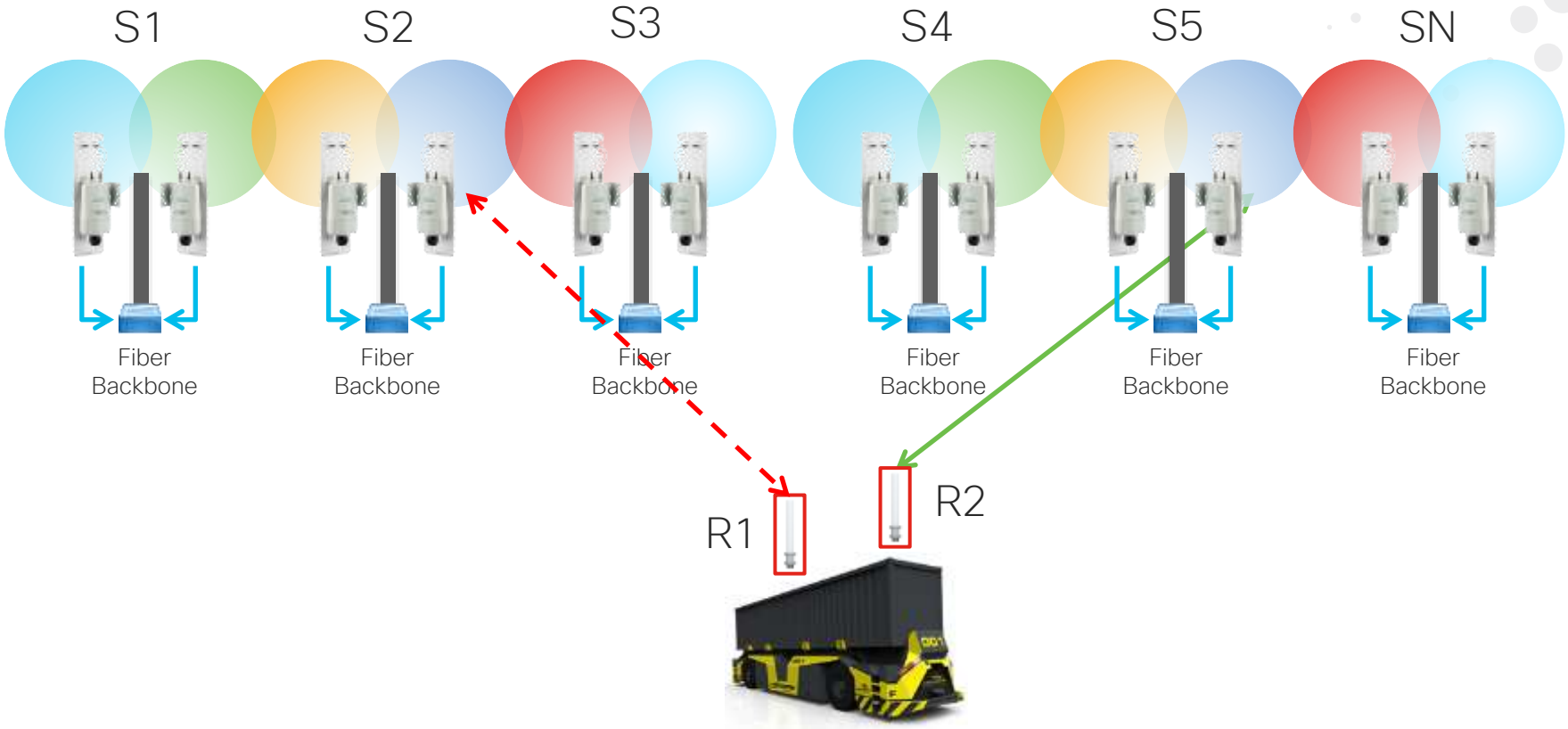

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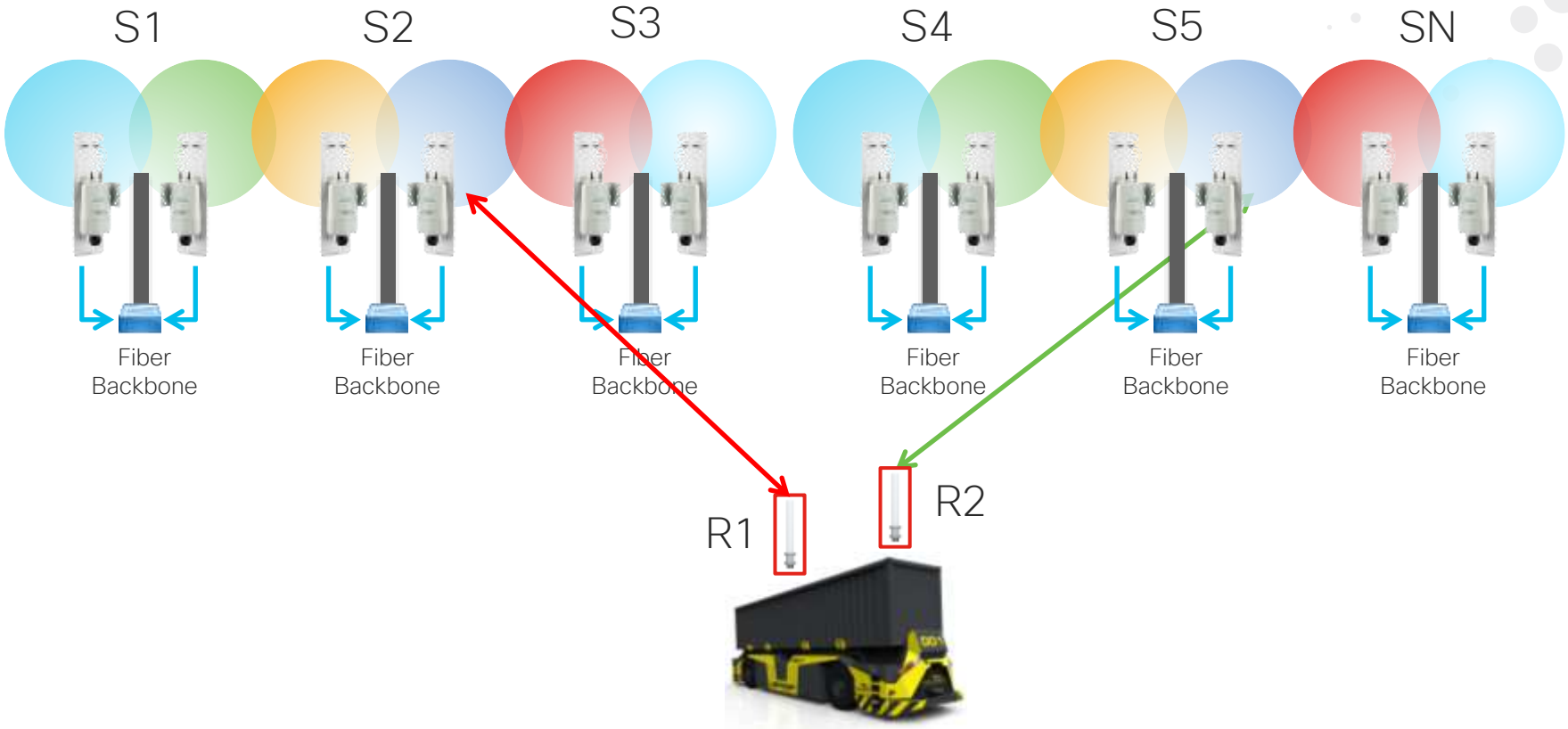

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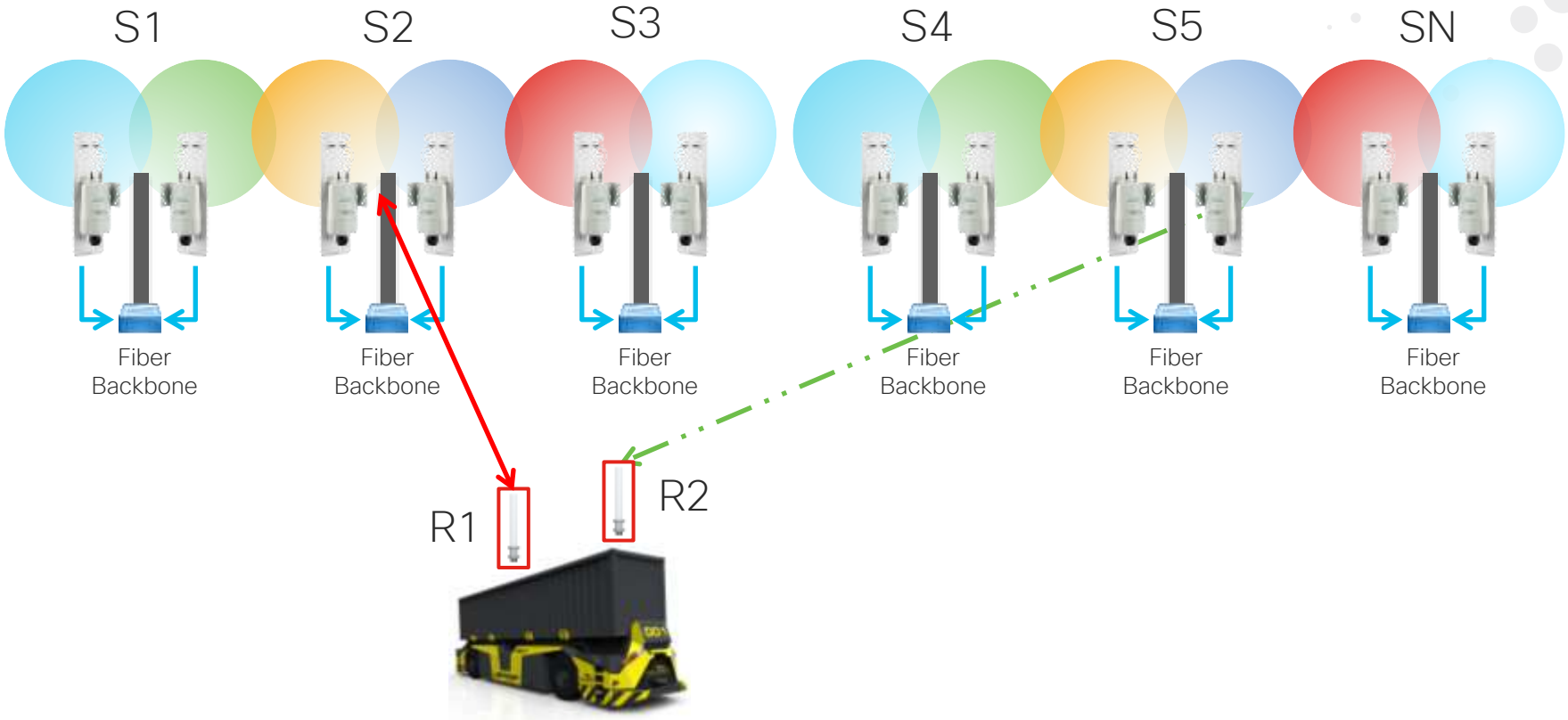
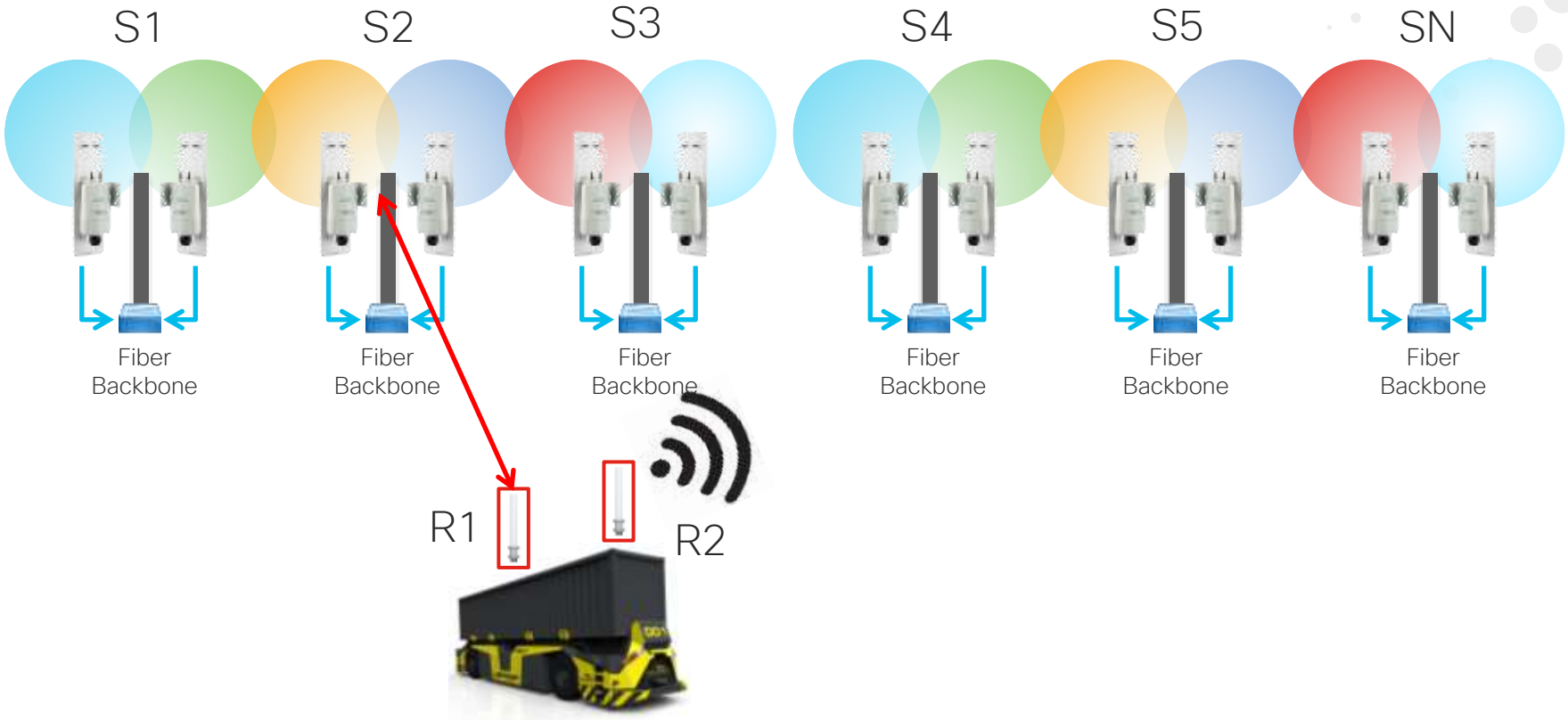
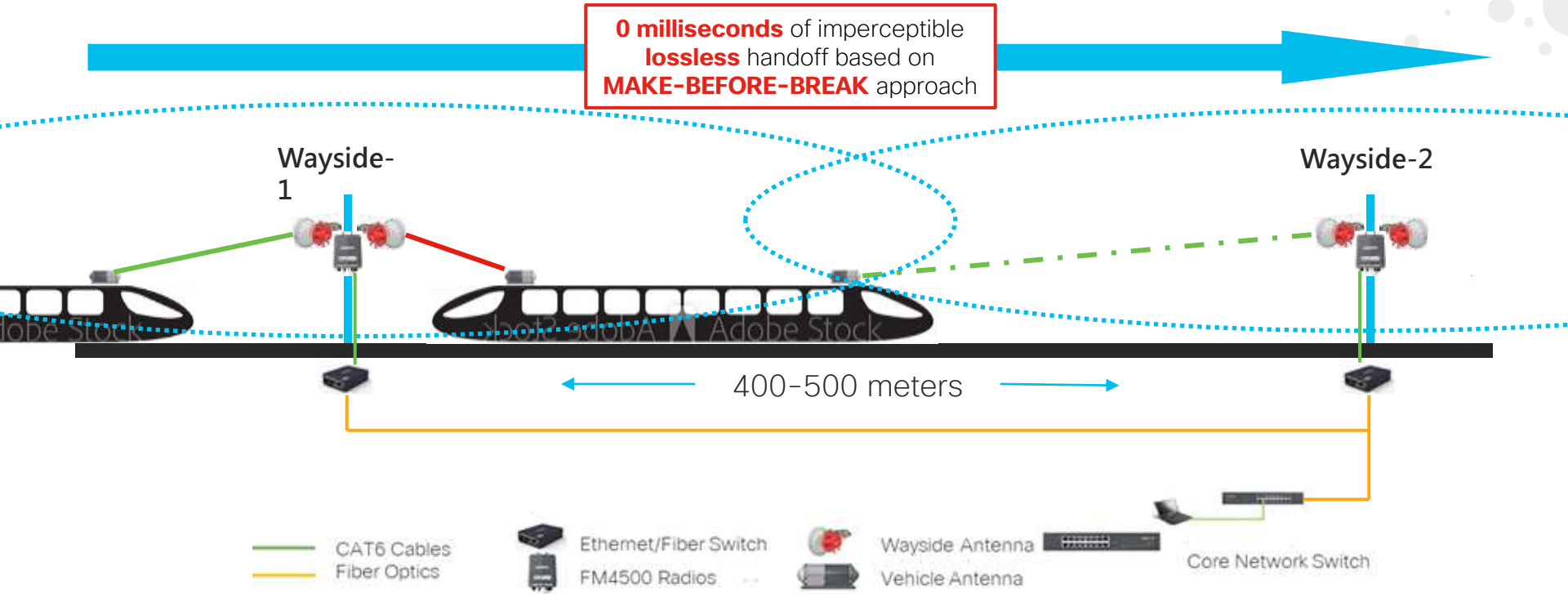


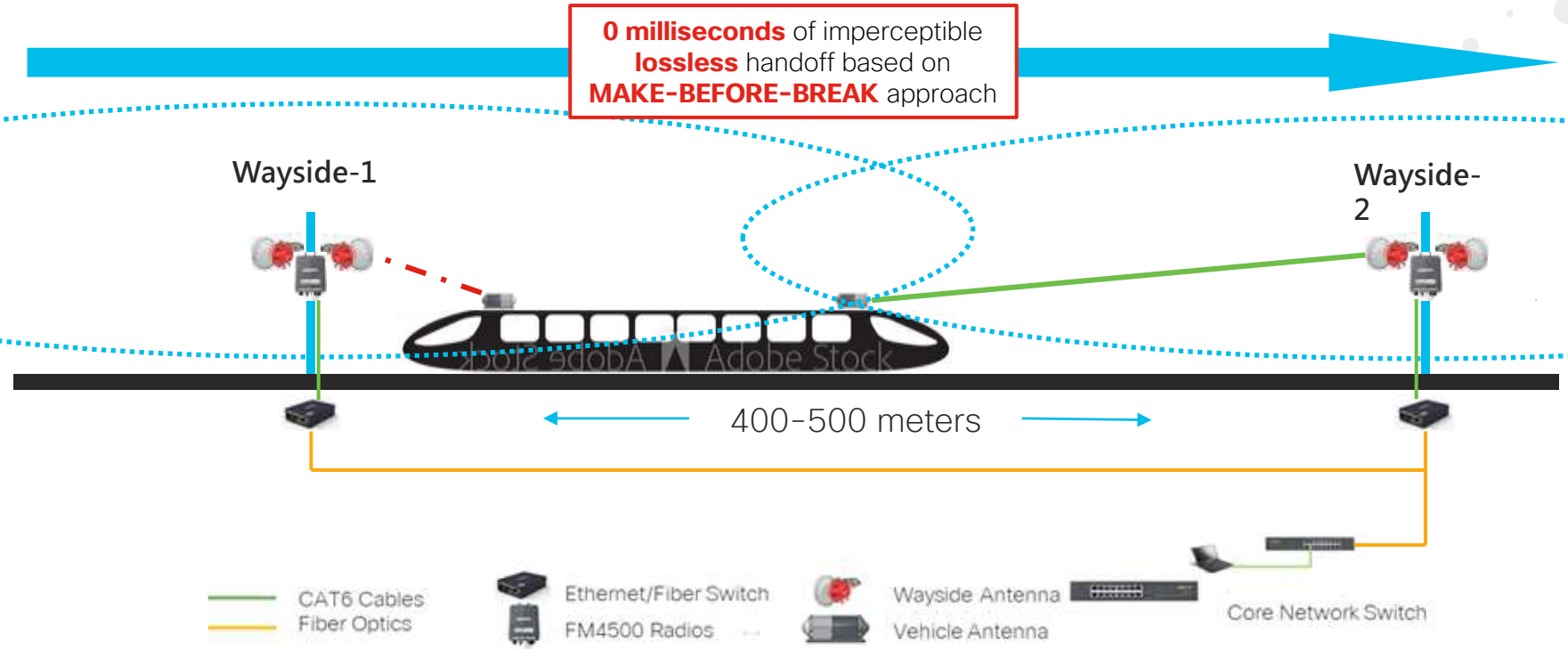
Wireless V2I Network: Seamless Handoff



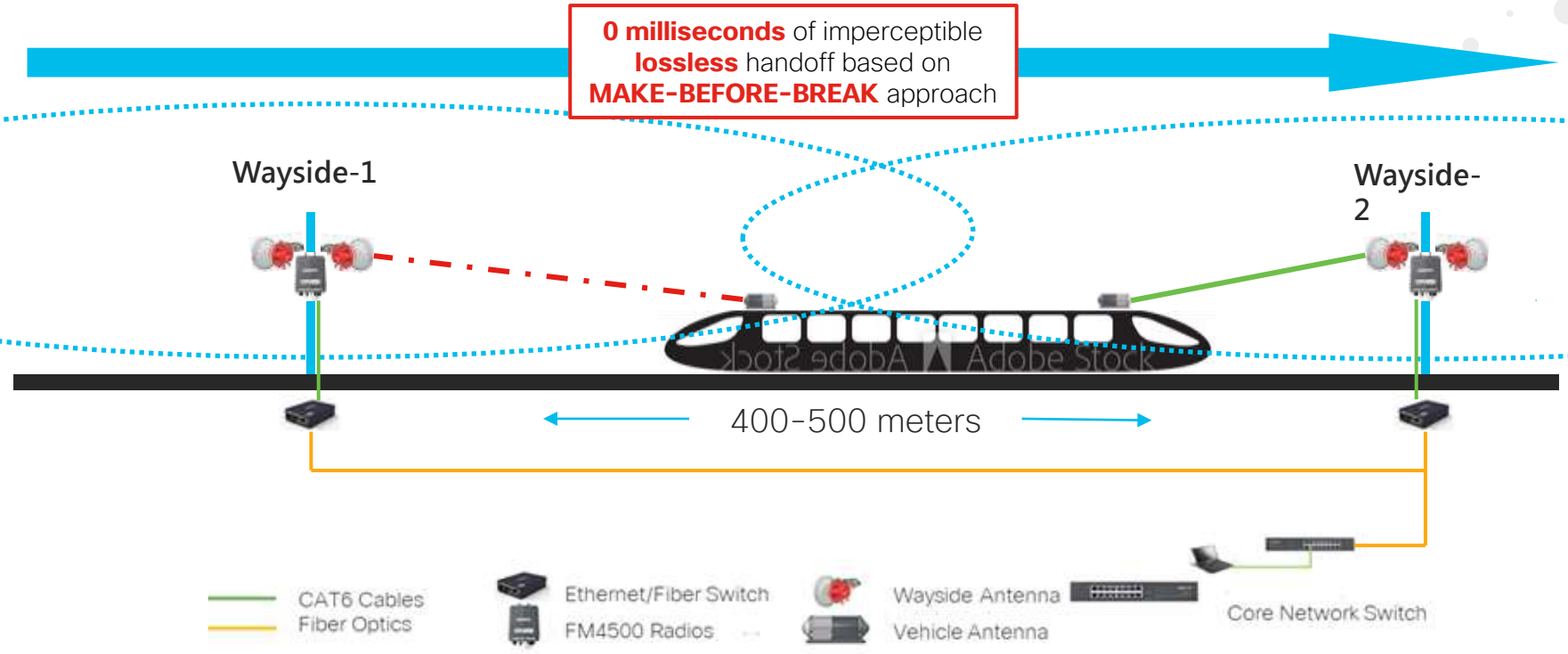
Train-to-Ground (T2G) Network: Seamless Handoff



Train-to-Ground (T2G) Network: Seamless Handoff



Train-to-Ground (T2G) Network: Seamless Handoff



Cisco URWB: Industrial

AGV, AMR, and More

Manufacturing Use Cases

Mobile Robotics
AGVs and AMRs

Mobile Assets

Overhead Cranes

SCADA and
PLC Process Control

Cisco URWB: Industrial

International Ports & Terminals

Project Assumptions and Requirements

Application: V2I Wireless Mobility Network for Warehouse Overhead Crane Operations

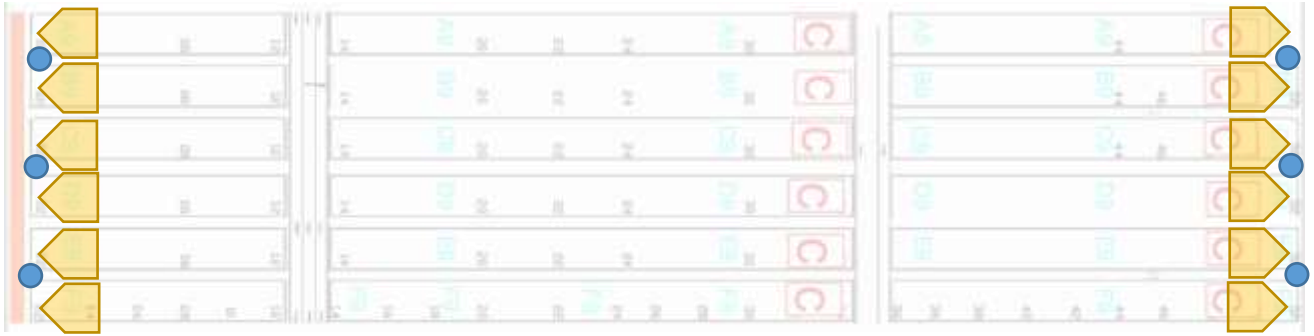
- Applications:
  - ❖ PLC-to-PLC control data communication
- Coverage Area: L 383m x W 92m
- Number of Vehicles: 12 overhead cranes
- Top Speed: minimal
- Proposed bandwidth per crane: 5 Mbps
- Number of est. wayside radios: 12 units
- Proposed bandwidth per wayside network: 15 Mbps
- Total Wayside Network Capacity: up to 180 Mbps
- Estimated Latency: 20ms or less
- Data Packet Drop Rate: Minimal

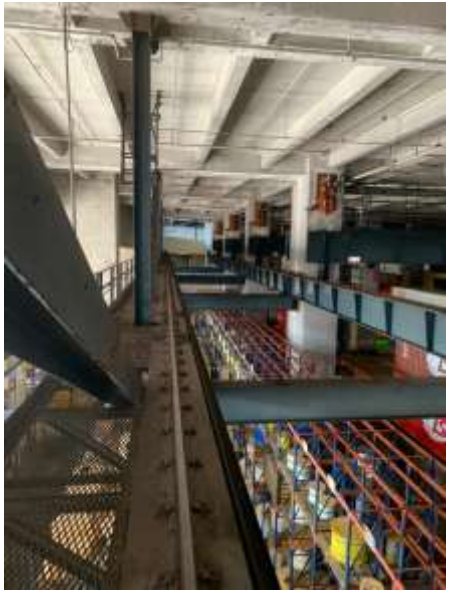
Area of Coverage: 383m x 92m

FM4500 Radio

FM-HORN-60 Antenna

C Overhead Cranes





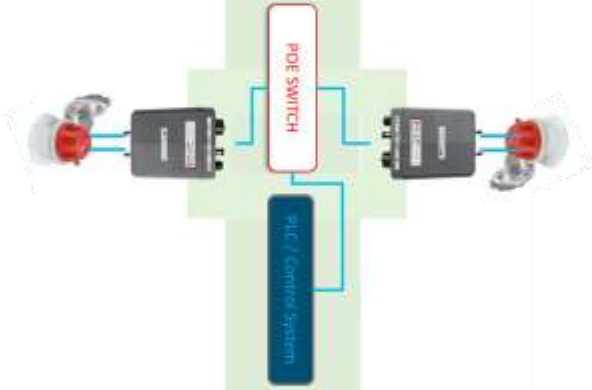
Overhead Crane: Onboard Setup – Dual Radios Design

FM4500 Radio

FM-HORN-60 Antenna

x12 SETS

Hardware	2x FM4500M-HW
	4x FM-LMR240-QMA2N
	2x FM-HORN-60
Software	2x FM4500-FLU-MOB-5
	2x FM-VLAN
	2x FM-AES



Overhead Crane

Cisco URWB: Industrial

Disney: Star Wars, Galaxy's Edge

AGV in Amusement Attraction Ride System

Disney's Star Wars: Galaxy's Edge

Customer: Disney Resort WDI

Industry: Entertainment

Requirements: Autonomous-Grade wireless network for attraction ride vehicles

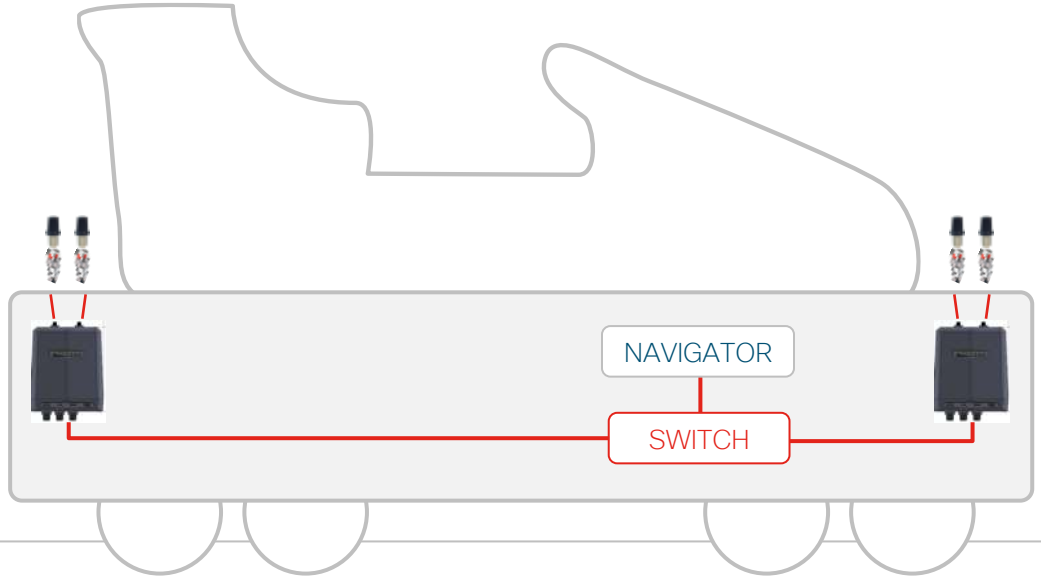
Application: Vehicle-to-Wayside (V2W) Wireless Communication Network

Status: Deployed, Successful

Project Details:

- 36x ride vehicles / 2x FM radios each
- 45-50x Fluidmesh base station radios
- 30 Mbps per vehicle, connectivity for PLC, Cisco switches (IE4000s & 1000s), various sensors and 5 onboard industrial computers.
- Must have 0ms handoff, low packet drop (<1%), targeted to >99.999% network availability

AGV Onboard Setup – Dual Radio System



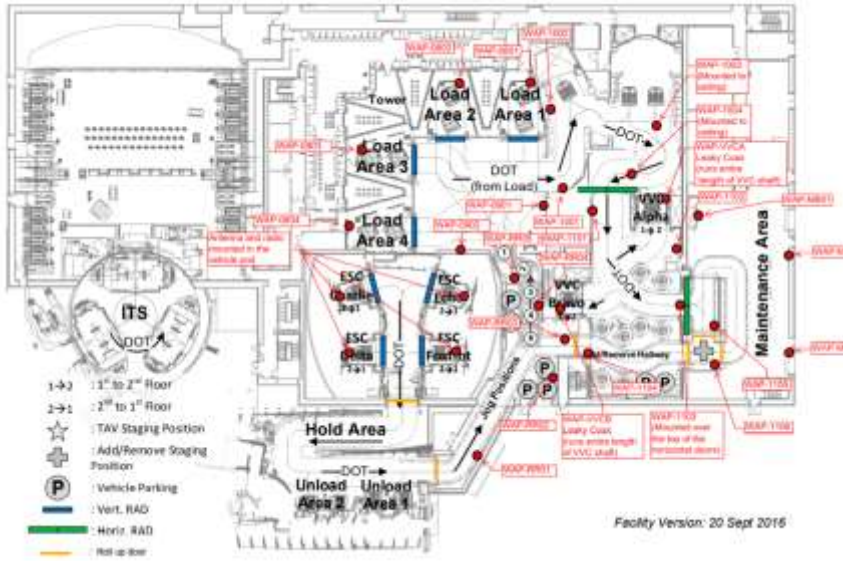
- 2x FM4500M-HW
- 4x FM-OMNI-3
- 4x FM-ATT-06-N
- 4x FM-QMA2N-6ft

Hardware

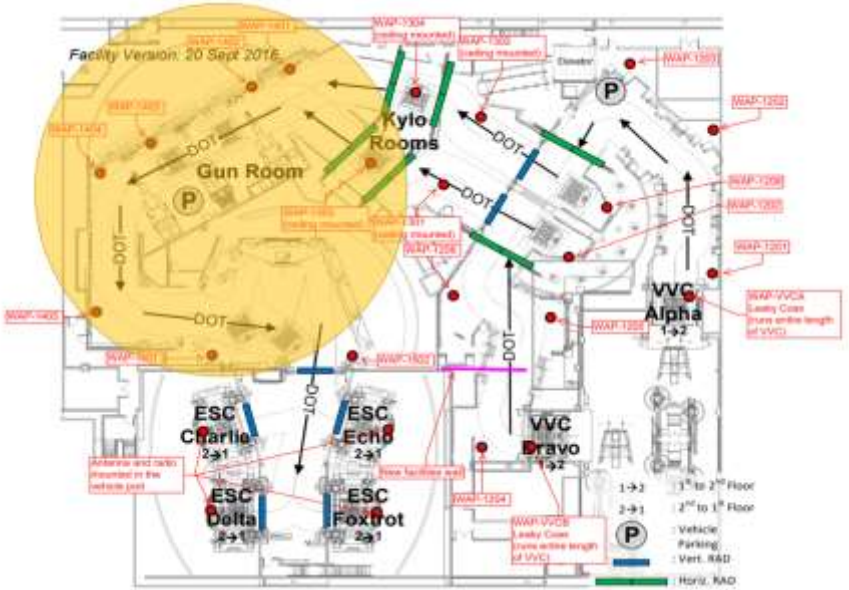
- 2x FM4500-FLU-MOB-05
- 2x FM-VLAN
- 2x FM-SUP-Y-3425

Software

AGV Wayside Setup & Radio Placement



1st Floor Layout



2nd Floor Layout

Cisco URWB: Industrial

Heavy Industries

Steel Mill: Torpedo Ladle Cars (TLC)

Project Requirements and KPI

Application: Autonomous-Grade Network

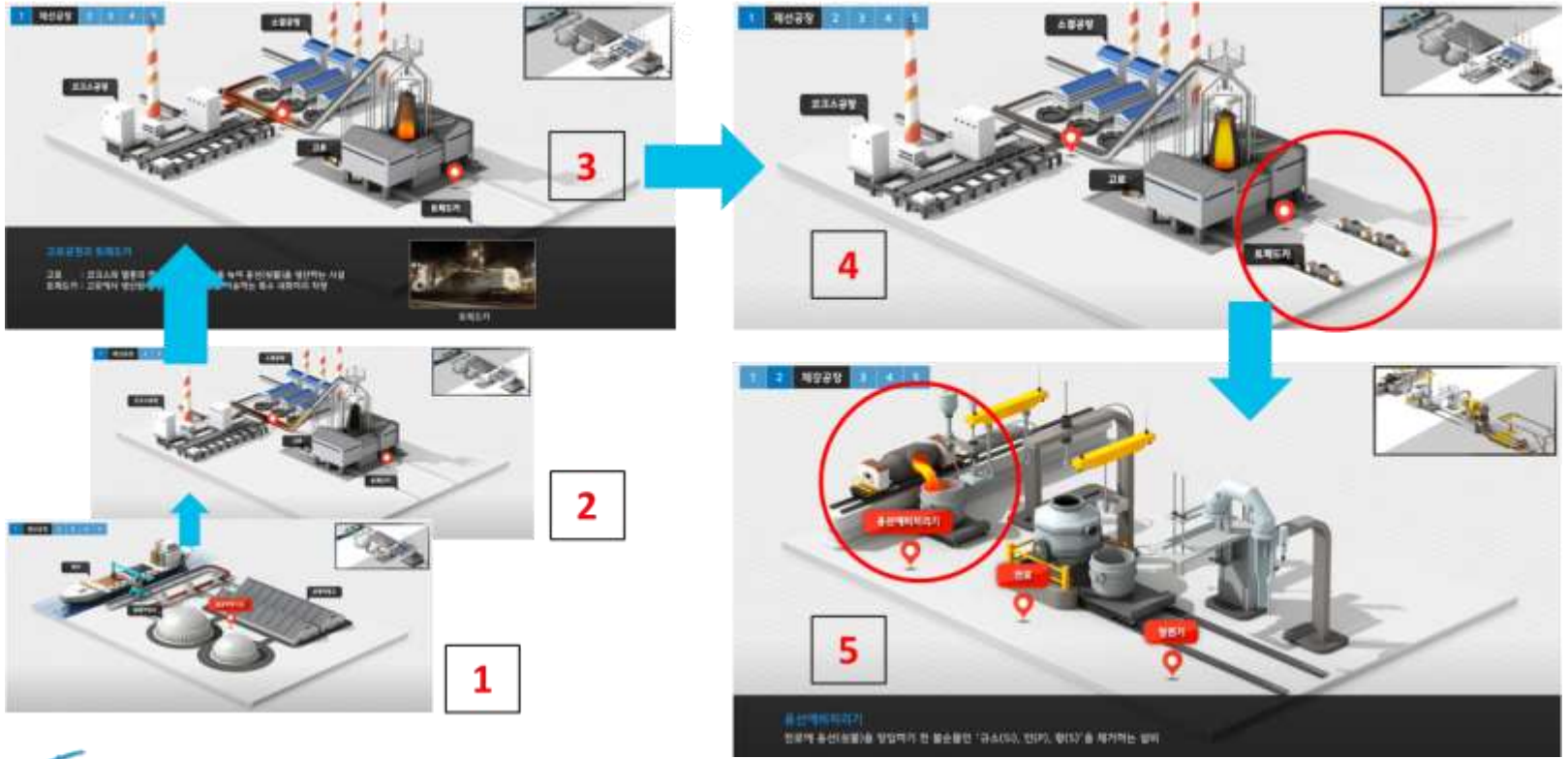
- Applications:
  1. Video: Camera x 12
  2. Vehicle Control Data and Telemetry
- Wayside Coverage Area:
  - Rail Track Section 1: 750m
  - Rail Track Section 2: 300m
- Number of TLC: 13 vehicles
- Vehicle Bandwidth: 30 Mbps
- Latency: 20ms or less
- Total Network Capacity: up to 450 Mbps

Steel Mill: Torpedo Ladle Cars (TLC)

Autonomous Vehicle Wireless Network

Steel Mill: Torpedo Ladle Cars (TLC) Operations

Autonomous Vehicle Wireless Network

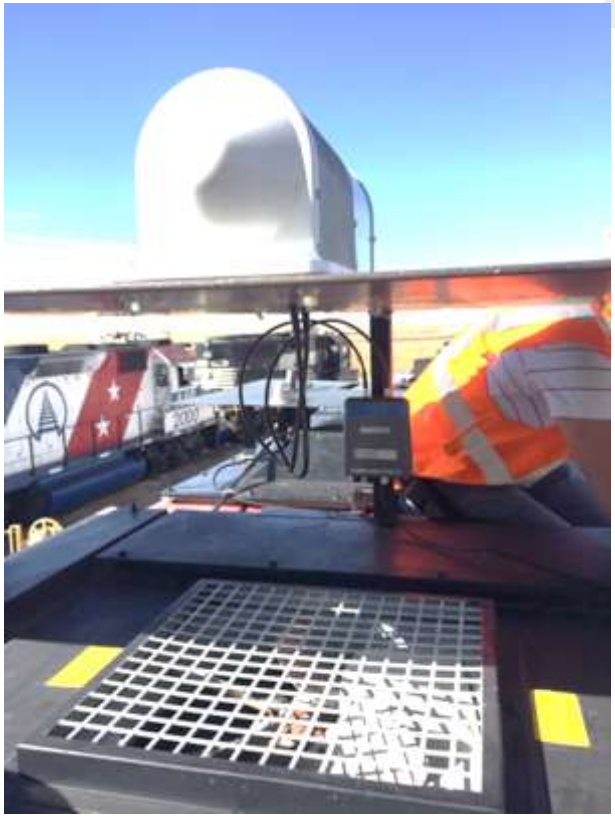


Cisco URWB: Transportation

High Speed Rail, Metro, APM

Railway Applications: Critical vs. Non-Critical

- **CBTC (Communication-Based Train Control):**
  - Communication Train Control System
  - Railway Signaling
- **BBRS (Broadband Radio System):**
  - Real-time HD video surveillance
  - PA system and emergency VoIP calls
  - Passenger Information System (PIS)
  - Wi-Fi services for passengers
  - Advertising and multimedia
  - Video or Data Offload in train depots



TRENITALIA: High Speed T2G Network at 402 km/h

TRENITALIA
GRUPPO FERROVIE DELLO STATO ITALIANE

70 Km	5 GHz	402 km/h	100+ Mbps
Tot Coverage Area	Frequency (40 MHz CH)	Train Speed	Onboard

GSM-R
Tower Infrastructure

19,000
Daily Ridership Per Km

Milan Metro

Cisco URWB for Communication-Based Train Control (CBTC) System

MILANO METRO LINE M4
90 mil passengers per year

APPLICATIONS
CBTC

Details:

- FM T2G wireless backhaul communication network, providing CBTC system (A/B networks) for signaling and train control
- If primary Network A is down, secondary/backup Network B needs to pickup the workload within 500ms.

Lyon Metro System

- More than 1,000 new cameras were installed on 84 trains operating on two Lyon lines B and D.
- Main application: CURWB FM train-to-ground wireless communication backhaul, connecting cameras in the train cars, providing real-time video monitoring for public safety surveillance.

Hong Kong MTR DRL
(Disney Resort Line)

- Average of 11,000 passengers per day
- Total length of subway line: 3.8 km
- Train top speed: 80 km/h
- Application: Cisco URWB/FM network provided a sustained 450+ Mbps wireless throughput performance for in-train passenger Wi-Fi Services
- SI Partner: BAI Communications (HK)

Track Records of Success in Rail Transport

(Partial List)

Cisco Ultra-Reliable Wireless Backhaul

IW916x NextGen Products

The next generation of **Outdoor and Industrial Wireless** is upon us.

New Cisco Catalyst IW9167 Heavy Duty Access Point

General Overview

cisco Engage Taipei

Introducing Cisco Catalyst IW9167E Access Point

One hardware, two wireless technologies

NEW
Industrial and outdoor access point (Wi-Fi 6/6E)

Manage with Cisco Catalyst 9800 Series Wireless Controllers

OR

ENHANCED
Cisco Ultra-Reliable Wireless Backhaul (Cisco URWB)

Deploy and manage with Cisco IoT Operations Dashboard

- Built-for outdoor and industrial spaces
- Security you can trust from Cisco
- Improved sustainability via platform flexibility

Meeting the needs of operations and IT

Catalyst IW9167E Overview

Catalyst® IW9167E Access Point

Tri-Radio Architecture in Heavy-Duty Design

- Wi-Fi 6/6E *, 802.11AX, MU-MIMO, OFDMA
- External antenna – 8 x Type N
- Tri-Radio architecture
  - 2.4-GHz, 4x4:4SS, up to 20MHz
  - 5-GHz radio, 4x4:4SS, up to 80 MHz
  - 5/6-GHz radio, 4x4:4SS, up to 160 MHz
- Dedicated scanning radio for spectrum intelligence
- 2.4-GHz IoT radio
- Built-in GNSS with TNC connector

Wireless backhaul (Cisco URWB) **OR** Wi-Fi 6E access point

* 6E ready

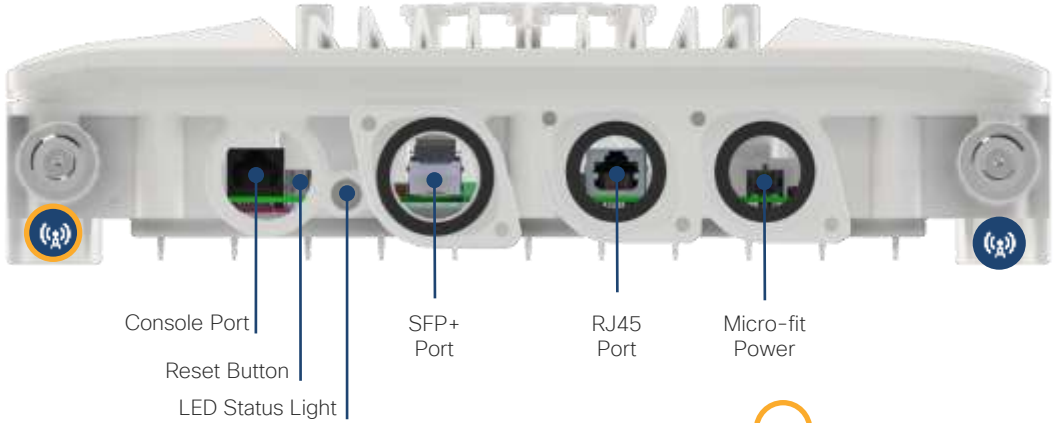
Catalyst IW9167E Overview

Catalyst® IW9167E Access Point

Flexible hardware options

- 1 x 5Gbps mGig RJ45 Interface
- 1 x SFP/SFP+ interface
- Dual power options
  - PoE-in (802.3at, 802.3bt, UPoE)
  - 24-48 VDC (max voltage range: 18 to 60 VDC)
- Dual mounting options – Pole & Wall mount
- IP67 rated
- Shock and vibration resistant, EN50155 (Rail certified) with optional M12 adapters

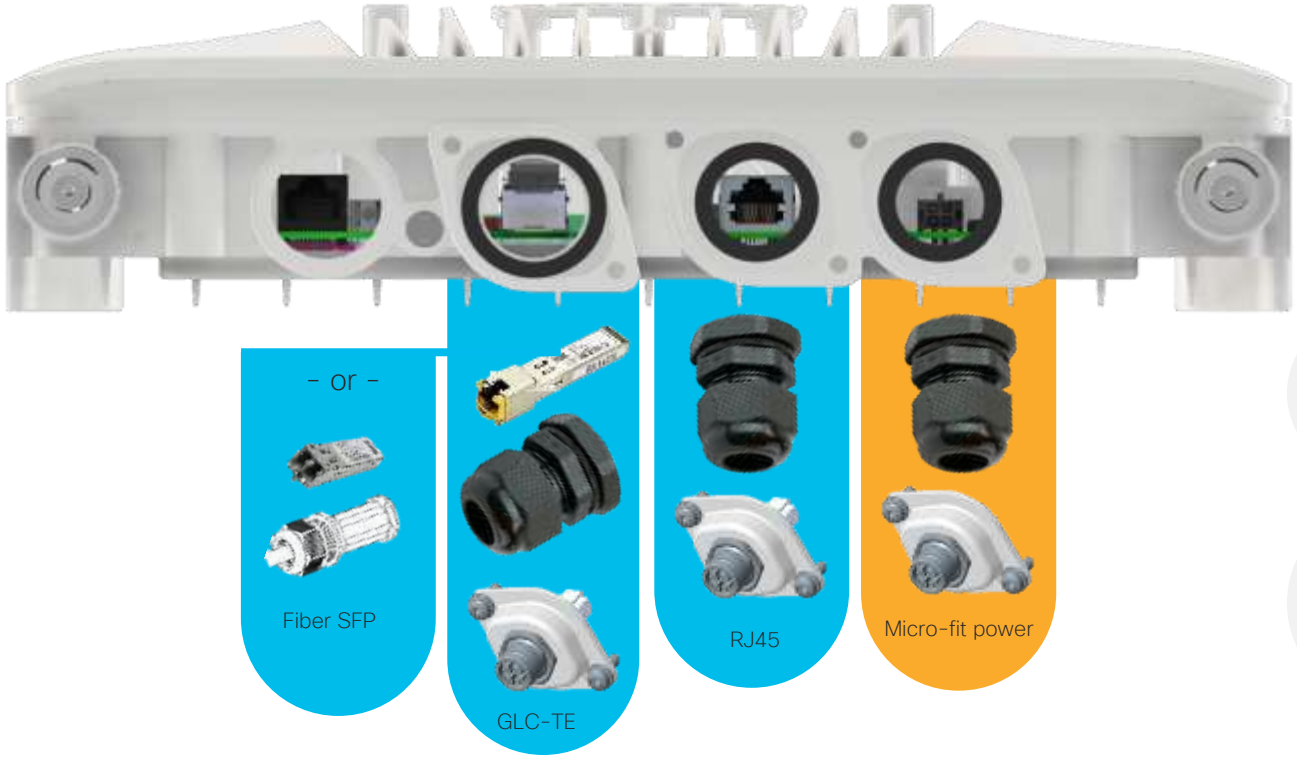
Port Overview



Self-identifying antenna port

* Hardware ready - supported in a future software release († Cisco URWB only)

One Hardware, Multiple Weatherproofing Options



Cable Glands
- Maintain IP67 rating
- Optional accessory

M12 Adapter
- Maintain IP67 rating
- Vibration rated for rail (EN50155)
- Optional accessory

Cisco IoT
Technical Marketing Engineers

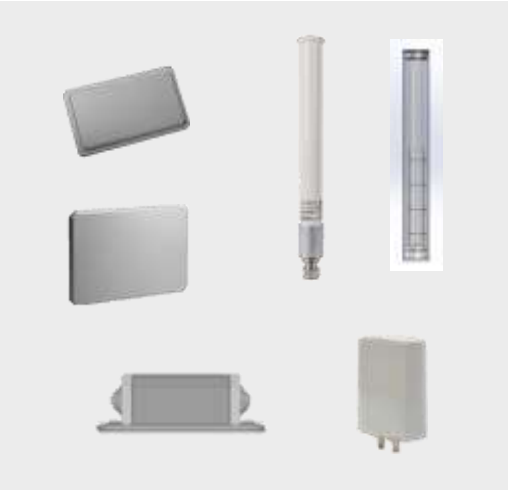
Accessories designed for easy deployment

Power Injectors and Adapters

Flexible power for any use case

Mounting Brackets

Reuse IW3702 brackets for easy drop-in field replacement



Antennas

Comprehensive antenna portfolio for maximum performance

Catalyst IW9167E Heavy Duty Access Point

Your network goes wherever you need it

- 50C

+75C

Shock / Vibration

Water

Dust

Cisco IoT
Technical Marketing Engineers

Cisco Catalyst IW9167E Heavy Duty Series

Two proven technologies to support all use cases

Cisco Ultra-Reliable Wireless Backhaul (Cisco URWB)

Extend your network to remote or mobile locations

Deploy and Manage at any scale with
Cisco IoT Operations Dashboard

Cisco Catalyst Wireless

Connect devices to your network

Pair with Cisco DNA software for deep network insights and management

New Cisco Catalyst IW9165 Series Heavy Duty Access Point

A New Product Pre-Launch Introduction

cisco Engage Taipei

Cisco Catalyst IW9165 series

Connect more devices. Wirelessly. Even on the move.

802.11AX 6 GHz-ready

Catalyst IW9165D

Wireless backhaul that's easy to deploy for connecting fixed and mobile assets

Heavy-duty access point to easily build your wireless backbone and extend your network to fixed and mobile assets.

Catalyst IW9165E

Mobile wireless connectivity for the most demanding industrial assets

Compact wireless client enabling industrial vehicles to connect to ultra reliable wireless networks, even when on the move.

Catalyst IW9165E

Rugged Access Point and Wireless Client

The 6 GHz-ready wireless client that connects mobile industrial assets

Prototype device pictured. Production device will vary.

Autonomous robots and vehicles for manufacturing, ports, logistics

Rail and light-rail rolling stock

EN50155 certified for rail operations

Connect more machines to your network
Compact form factor for integration in existing assets

Get more from your industrial assets
BLE, GNSS, GPIO capabilities for advanced use cases

Connect moving vehicles to your systems
Ultra low latency and zero packet loss during handoff

High performance and modular wireless
Dual 802.11ax radio with wide choice of antenna

Works with your Wi-Fi infrastructure
Supports WGB or URWB. Evolve as your needs change

Ultra-reliable broadband wireless connectivity for moving machines and vehicles

IW9167E Heavy Duty vs. IW9165E Rugged

Prototype devices pictured. Production device may vary.

Catalyst IW9165D Heavy Duty Access Point

6 GHz-ready Wireless backhaul that's easy to deploy where fiber is not an option

Building-to-building, smart cities, intersections, roadways, railway, mining

- **Easily extend your network anywhere**
  Built-in directional antenna for long range connectivity
- **Fixed and mobile use cases simultaneously**
  External antennas enable future usages as needs evolve
- **Connect moving vehicles to your systems**
  Ultra low latency and zero packet loss during handoff
- **Build for harsh outdoors environments**
  IP67 rated enclosure, -40 to +70C, optional M12 adapters
- **High performance and modular wireless**
  Dual 802.11ax radio for PTP, PTMP, and mobile applications

Ultra-reliable broadband wireless connectivity for moving machines and vehicles

Powered by Cisco

Indy Autonomous Challenge


INDY
AUTONOMOUS
CHALLENGE
OCT. 23, 2021
POWERED BY CISCO
TAG Heuer

Indy IMS Autonomous Racing Network Setup

Race Car
Onboard Setup

Tracksid e
Network Setup

- CURWB FM4500 wireless backhaul radio installed onboard.
- IE5000 switch in each car, and 40Gbps link to the onboard computer.
- 11 Wayside Radios (FM4500) with IE3400 and fiber uplink integrated with IMS Network
- IE4010 provided connectivity to each team's pit area

Indy Autonomous Challenge Powered by Cisco

The bridge to possible

Thank you

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