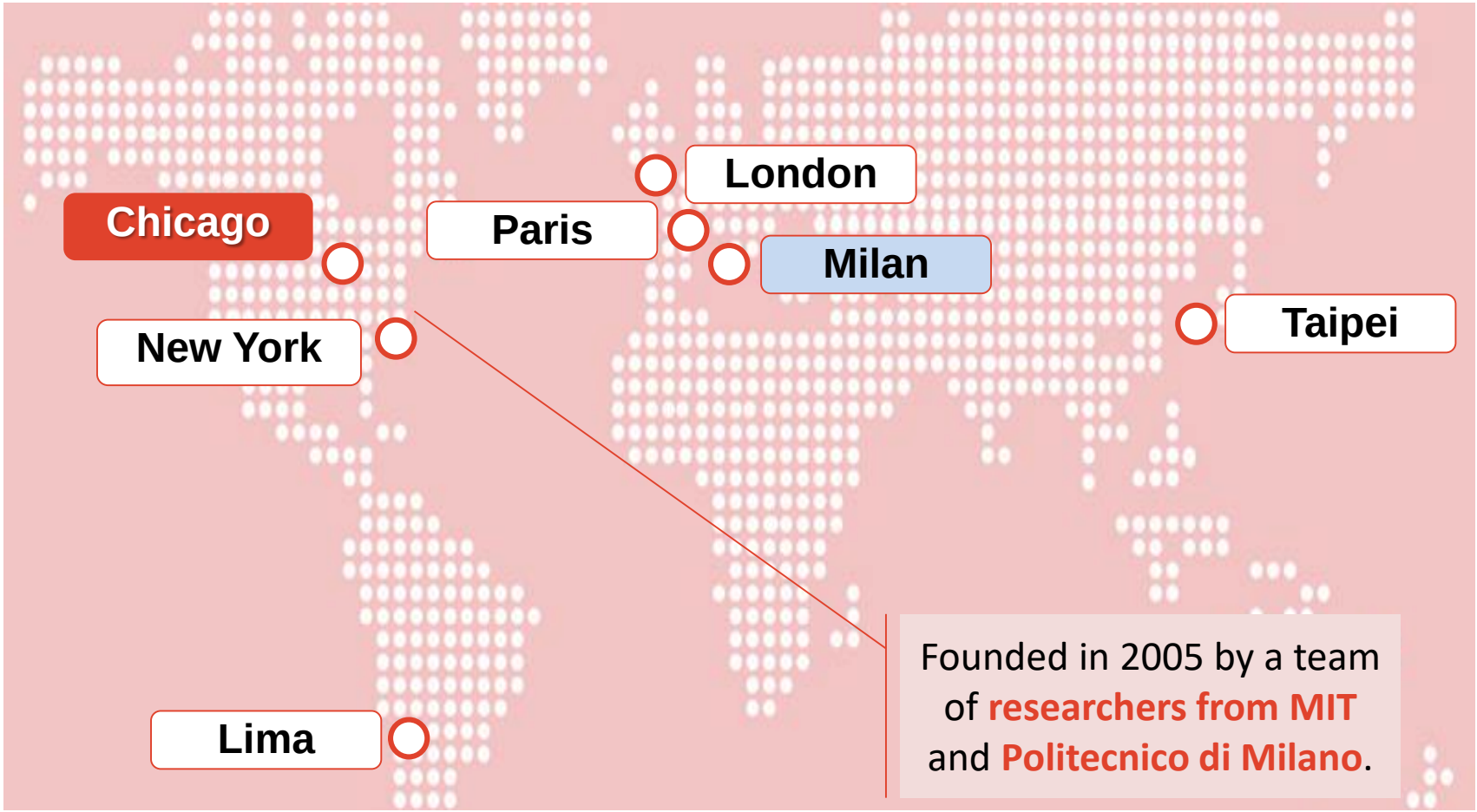
FLUIDITY TECHNOLOGY for YARDS and TERMINALS AUTOMATION

Company Background



Global Partnerships 6 Continents 75 Countries

Why do you need connectivity on cranes in a container terminal?

Remote Control (RTG/RMG)

Autonomous Operations (AGV/ASC)

TOS/Positioning

Live Video

Demand for connectivity in Automation

VEHICLE CONNECTIVITY

=

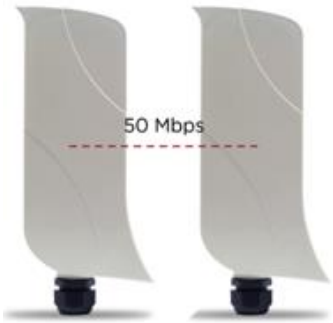
EQUIPMENT AVAILABILITY

=

$ PROFITABILITY

FLUIDMESH HARDWARE

2.3–2.7, 3.3-3.65, 4.9-6.0 GHz



FLUIDMESH PONTE

FM 1200 VOLO

FM 1300 OTTO

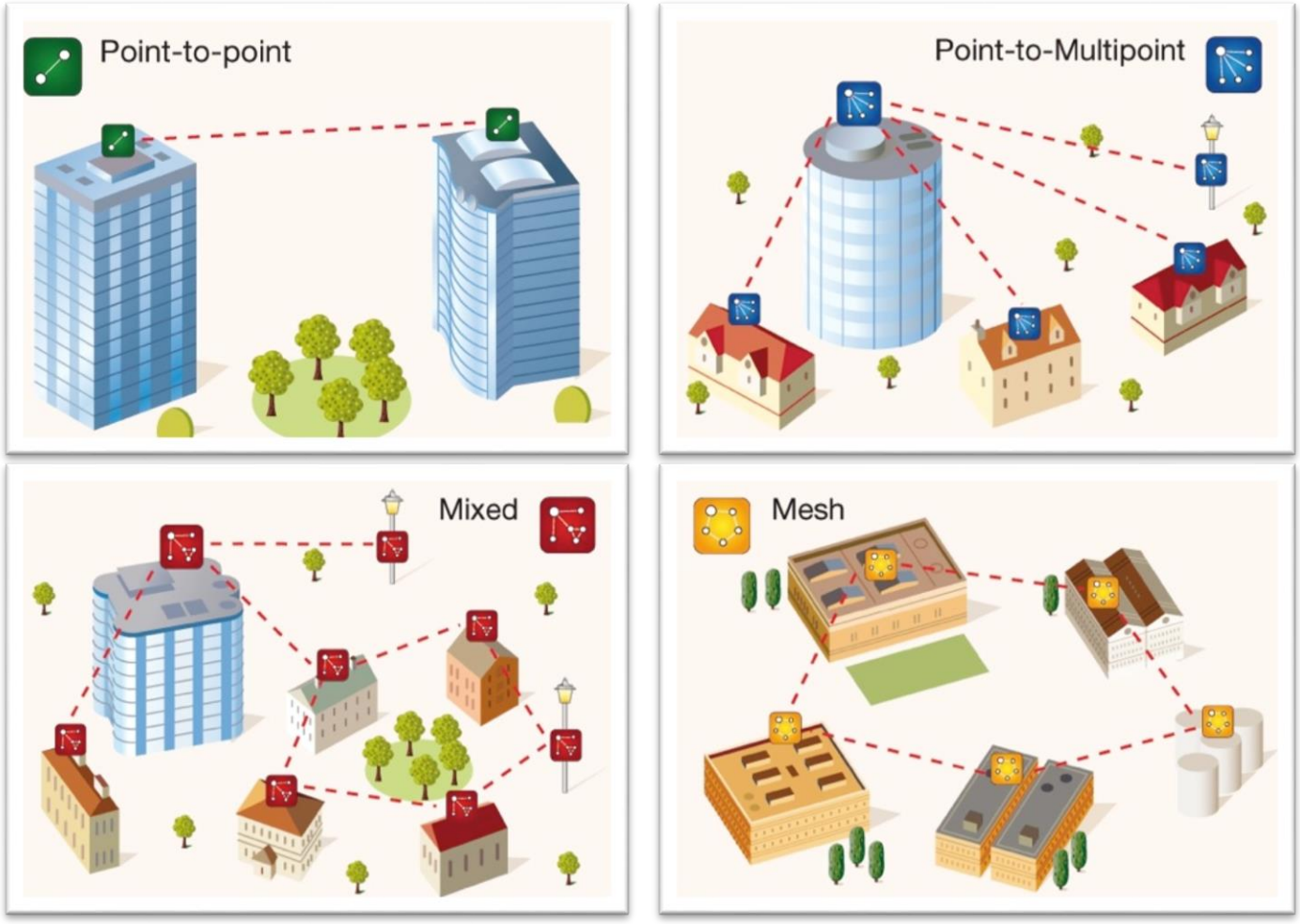
FM 3200 BASE

FM 3200 ENDO

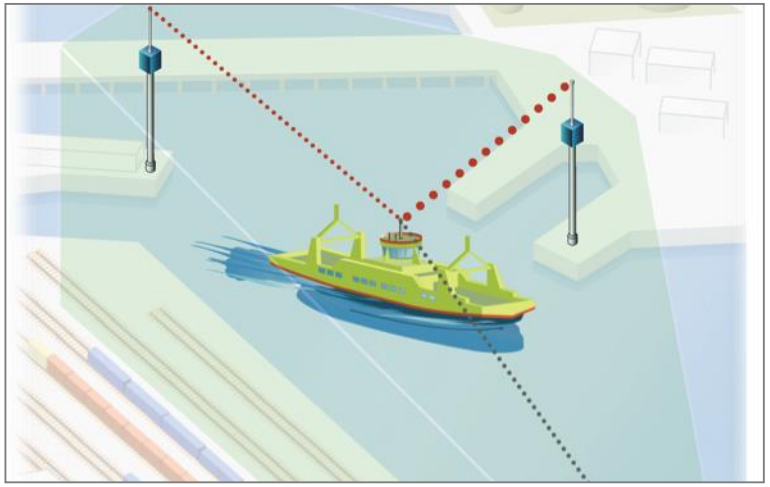
FM 4200/4500 MOBI

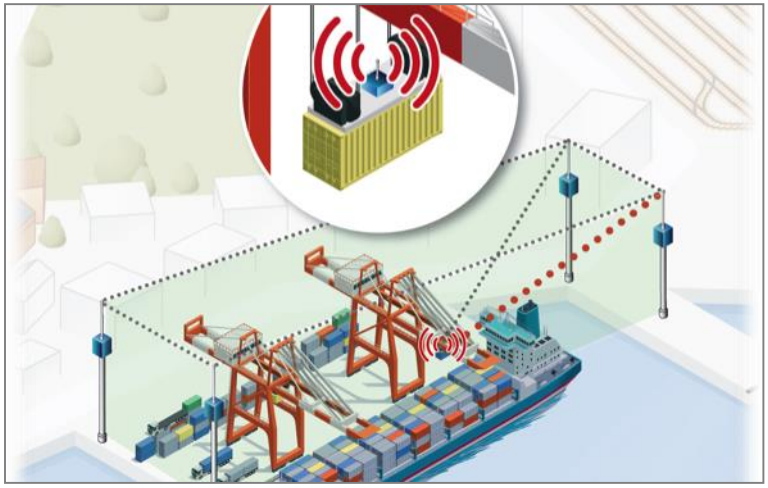
Transportation Radio

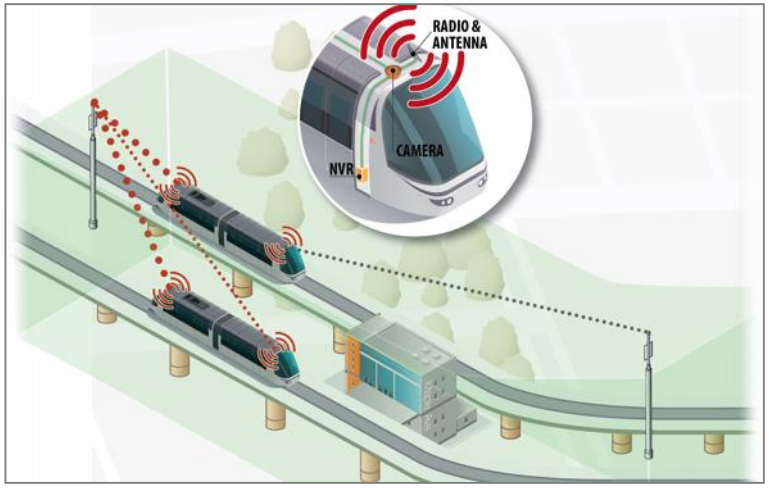
FIXED ARCHITECTURES



FLUIDITY™ NETWORK TOPOLOGY







Container Terminal / Intermodals Operations

- Telemetry/Safety IO
- Cameras on RTGs and Straddle Carriers for remote operations
- Fail Over System for Stacking Cranes Fiber Spools
- AGV Vehicle Connectivity for full automation
- Reduce Costs by Removing Fiber Spools on Cranes
- Facilitate moving cranes between blocks
- Backbone network for WiFi APs for mobile workforce/handheld devices

Container Handling Vehicles requiring Wireless Connectivity

RTGs

Auto Shuttle Carrier

Wide Span RMG

AGVs

WE SUPPORT ALL IP DEVICES

IP & Megapixel Cameras

Thermal Cameras

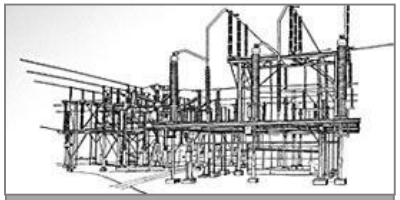
Audio & Voice over IP (VoIP)

Enterprise Backhaul

Emergency phones

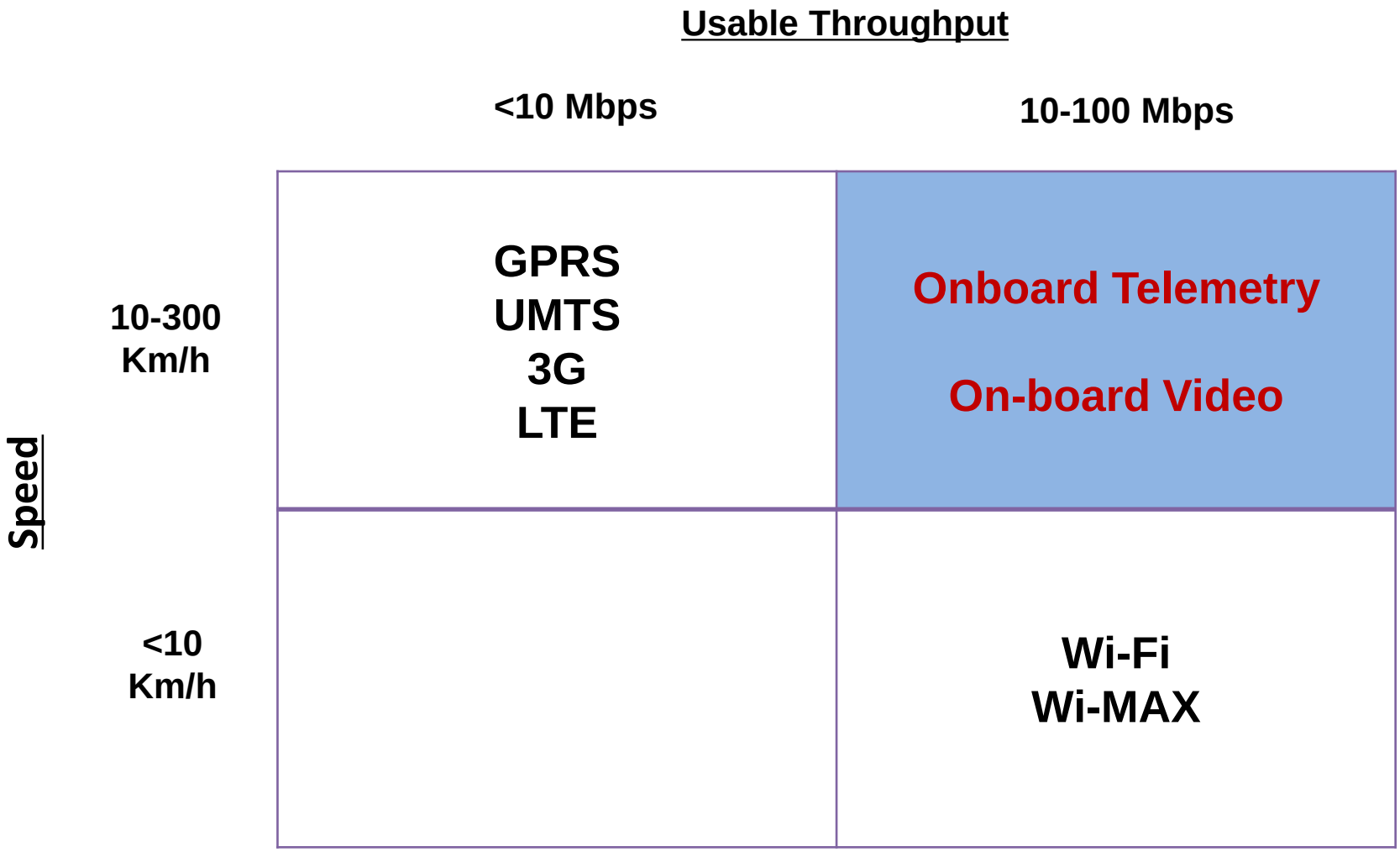
Access Control over IP

Access point Wi-Fi



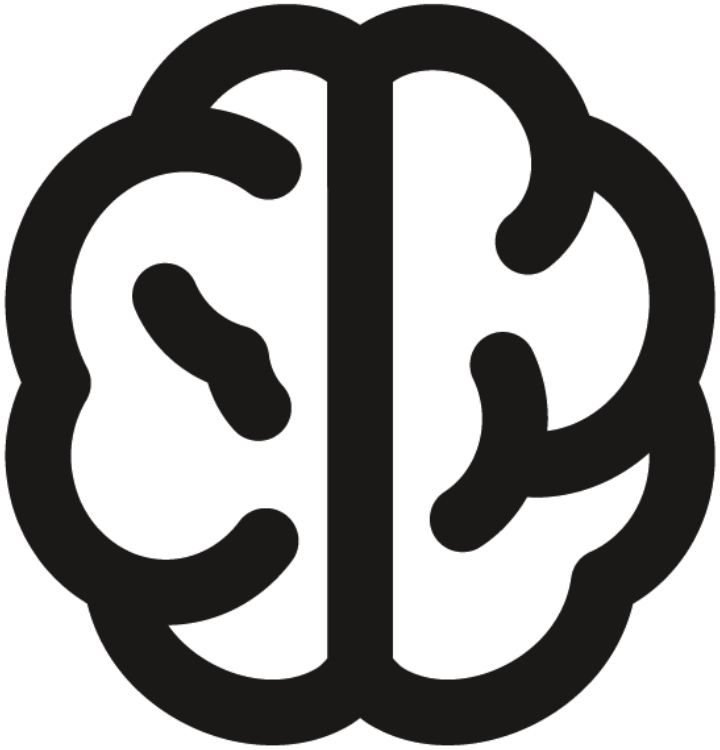
Substation Automation / SCADA

Video and Data streaming from vehicles is difficult



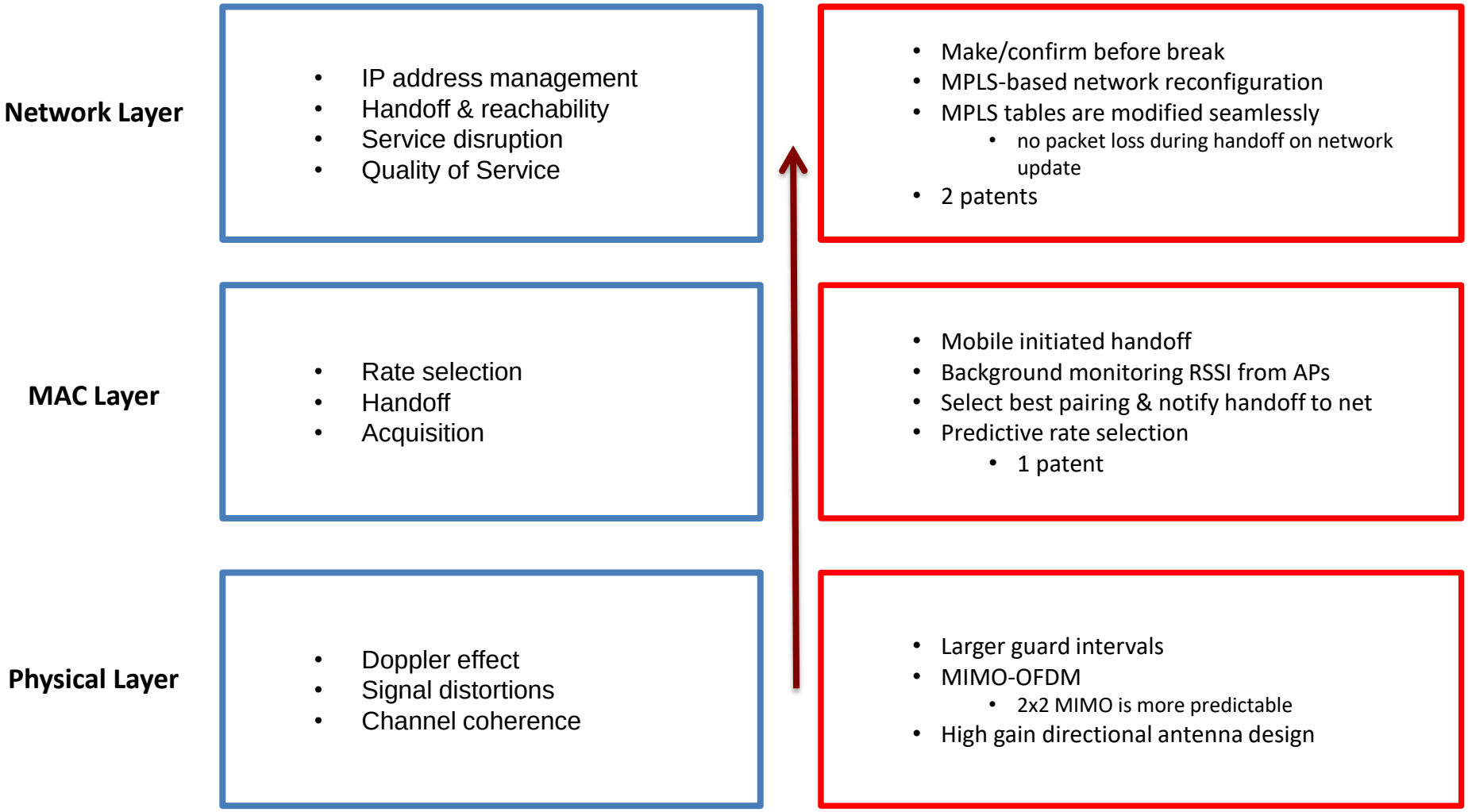
PRODIGY™ 2.0

Reliable wireless transmission for mission-critical applications



- MPLS-based transmission protocol;
- Build-in in-depth packet inspection algorithm to assign a specific level of priority and reliability to every packet transmitted;
- Robust in high interference areas;
- Low latency and jitter;
- Fast Roaming for Mobility Applications.

GOING FAST IS HARD: FLUIDITY CROSS-LAYER APPROACH



Advantages

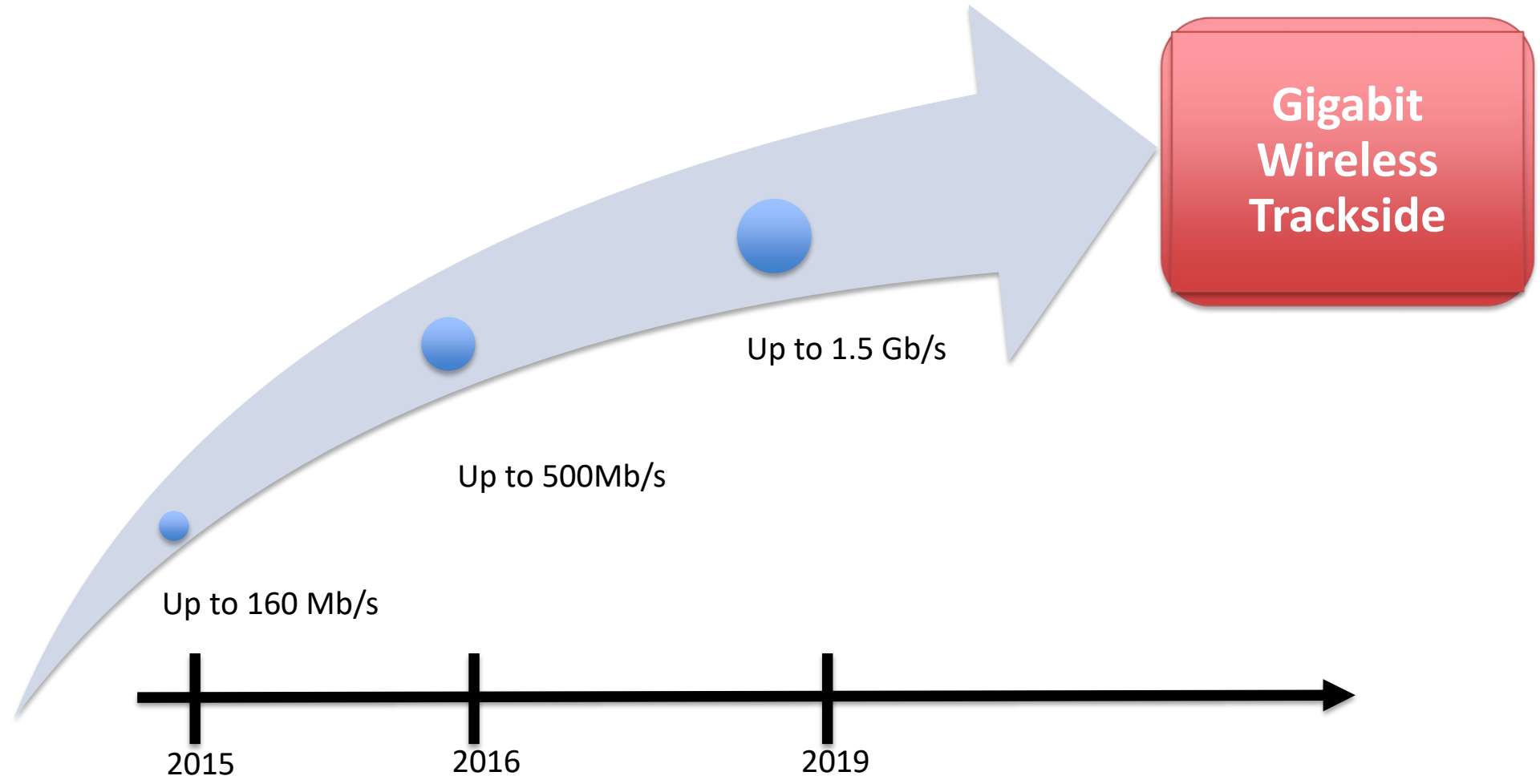
up to 500 Mbps
per vehicle

30% Less Wayside Infrastructure
High Gain Antenna Technology

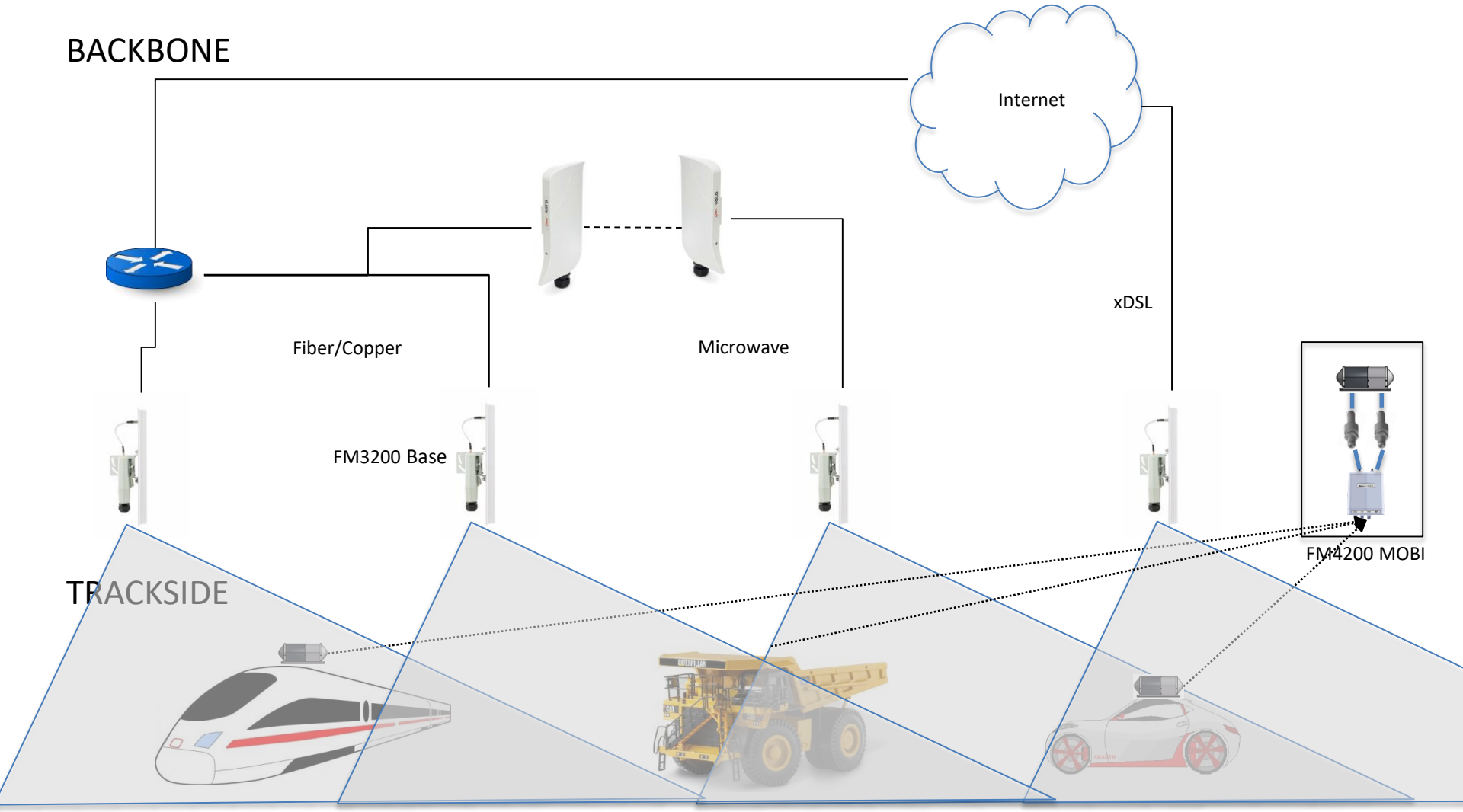
0 ms
handoff time

99.999%
network availability

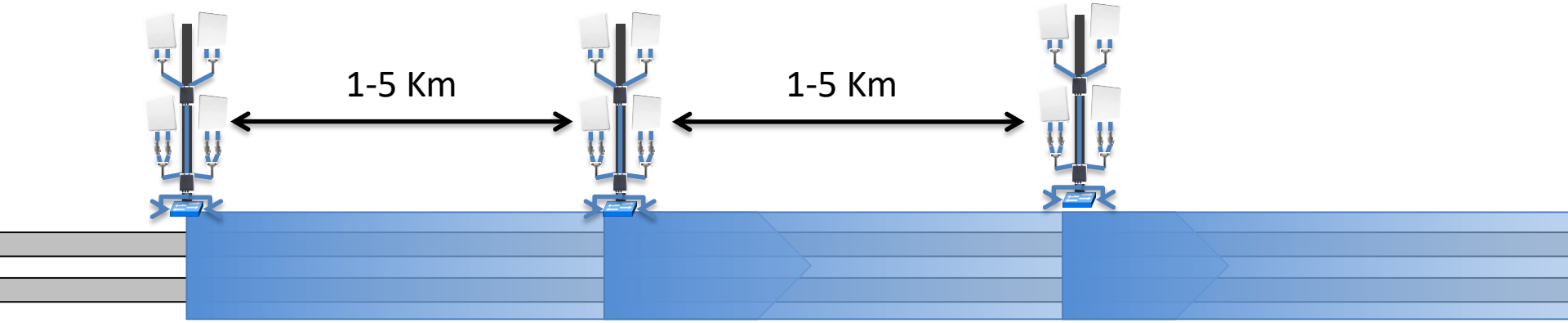
1 Gb/s Trackside Network Roadmap

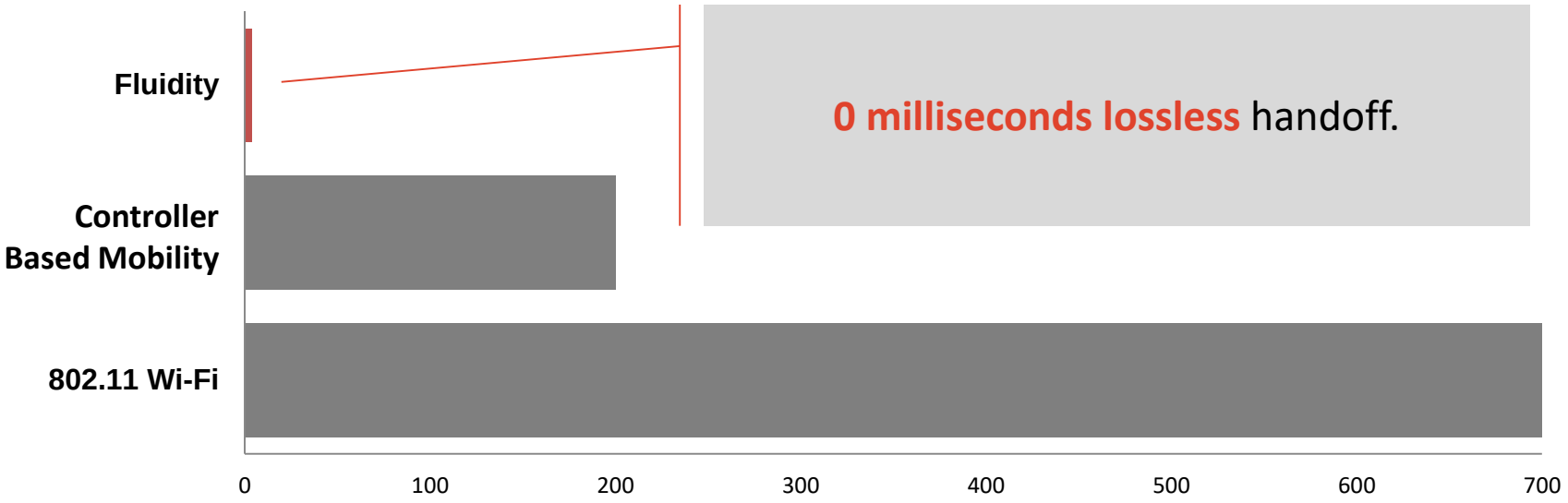


FLUIDITY: Typical Network Topology



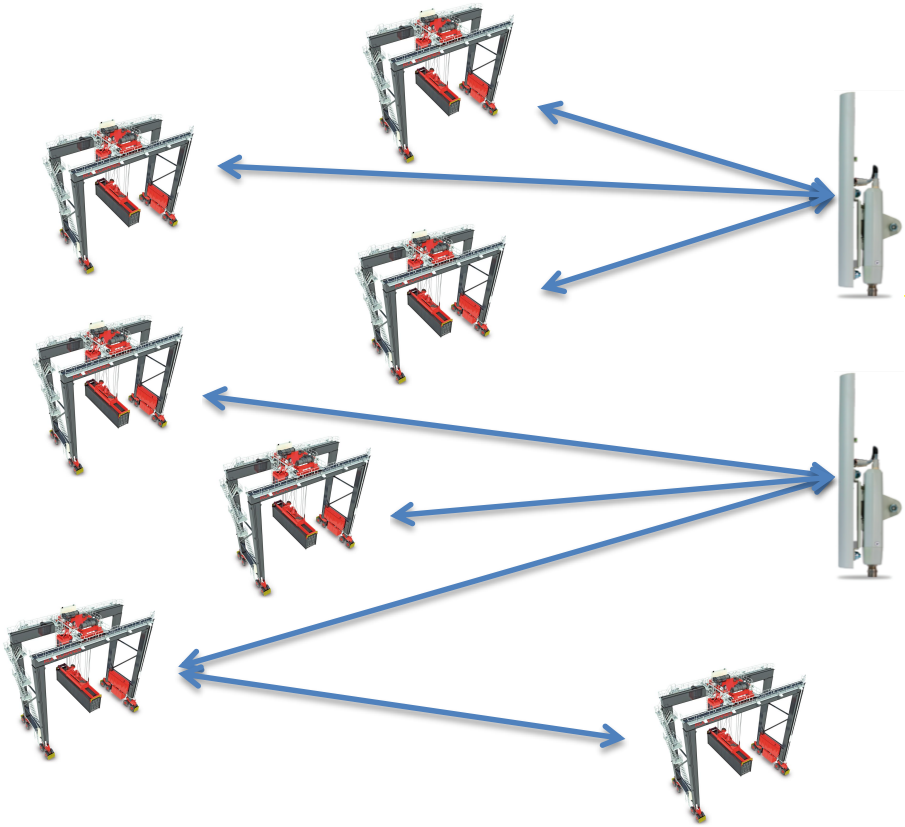
Fluidity: Handoff Time is KEY (Patent no. 8,355,368)





Depot Broadband Wireless for Vehicle Fleets

FLUIDITY



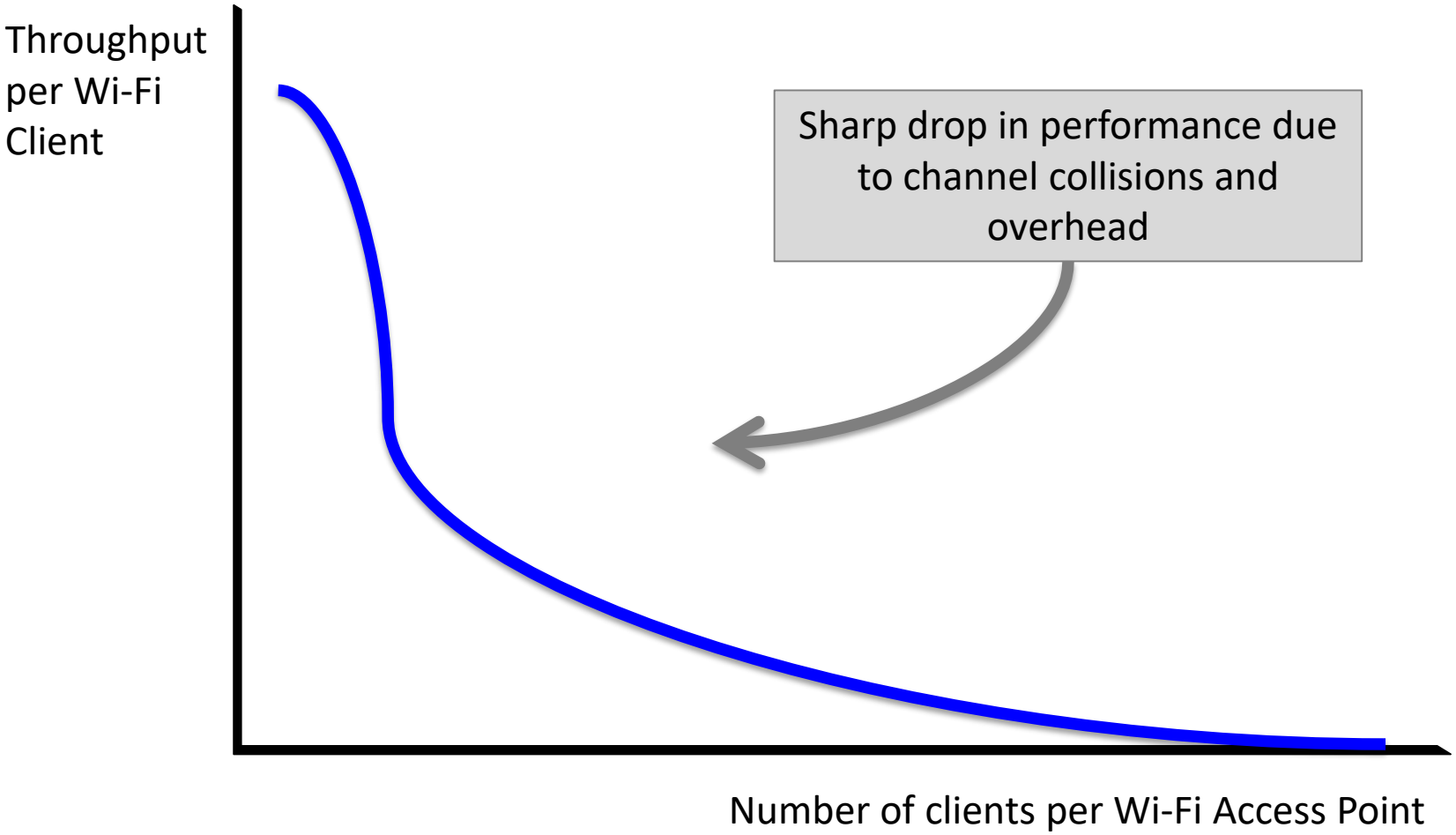
Up to 1.5 Gbps of Aggregate Throughput

On-board Video Surveillance

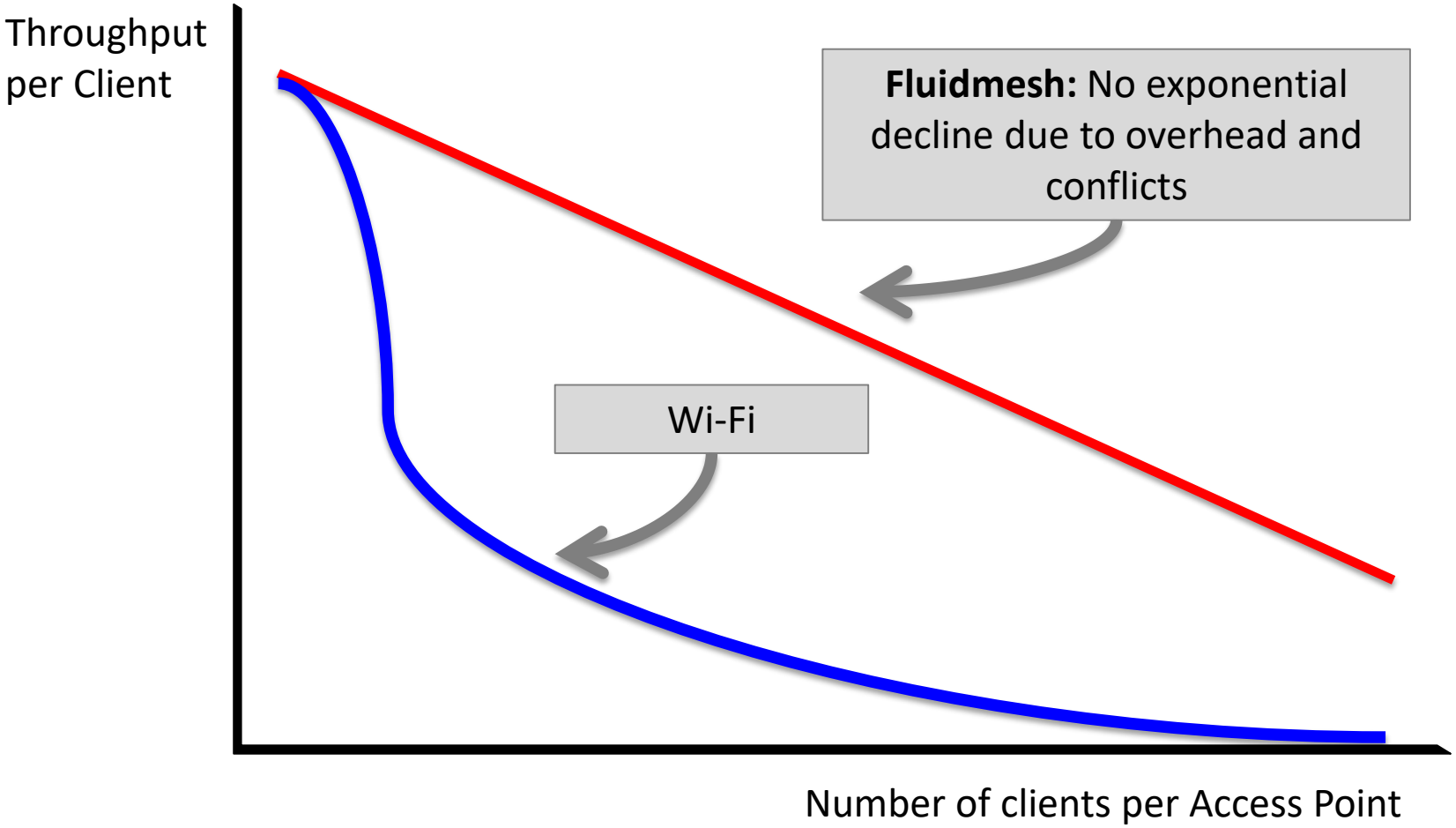
Telemetry and Automation (Profinet)

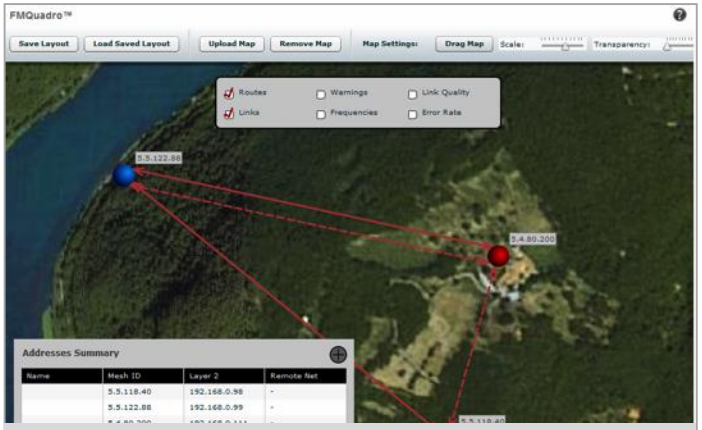
Wi-Fi Backbone

Wi-Fi: LIMITED THROUGHPUT DUE TO LACK OF CLIENT COORDINATION

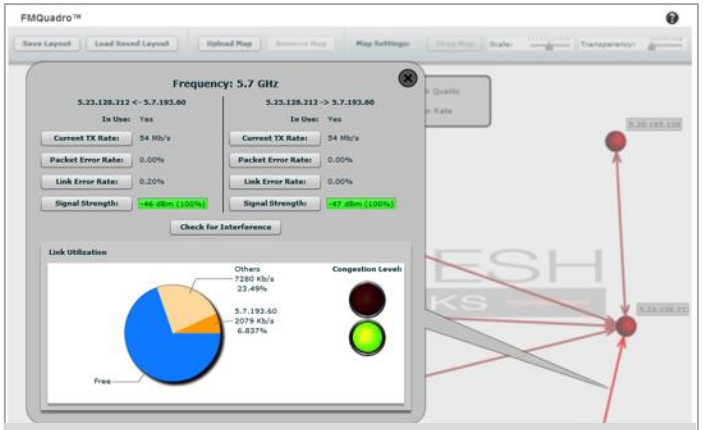


FLUIDITY SERIALIZED AND COORDINATED ACCESS ALGORITHM MAXIMISES CHANNEL USAGE MINIMISING OVERHEAD

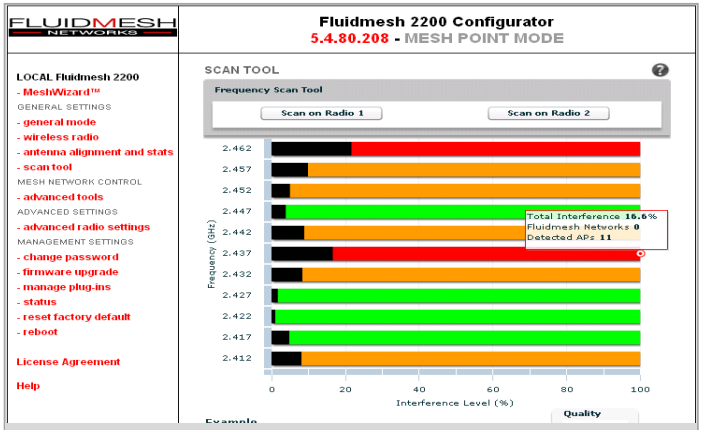




Interactive **network manager**



Auto-troubleshooting tool



Spectrum Analyzer

network analytics

ONBOARD - FM4200/FM4500 MOBI TRANSPORTATION RADIO

QMA connectors

Redundant 48V DC input

Gigabit PoE M12 connectors

Transportation Standards:

- EN50155
  - EN50121-3
  - EN50121-4
- EN45545 (Fire)
- AREMA 11.5.1
- IEC 60571
- EN50129 (CBTC)

TRACKSIDE OMNIDIRECTIONAL ANTENNA

- 12 dBi 2x2 MIMO Omnidirectional Antenna

FM3200ENDO-OMNI-12

Dimensions: 3.3 Inches (Diameter) x 23.6 in (Length)

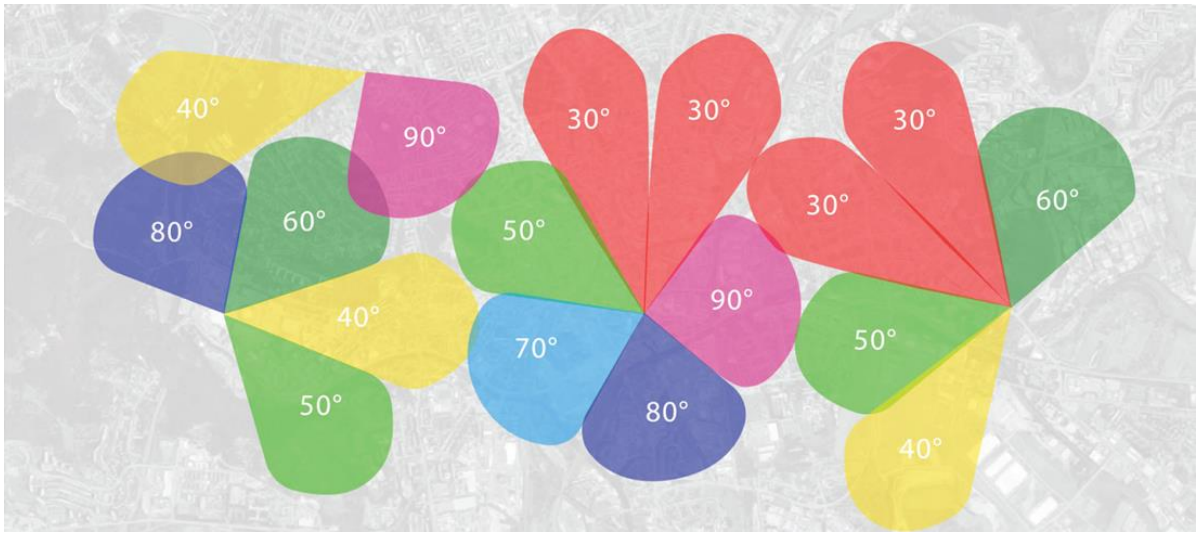
12 dBi Gain

- 2x2 MIMO provides highest predictable datarate in outdoor mobility

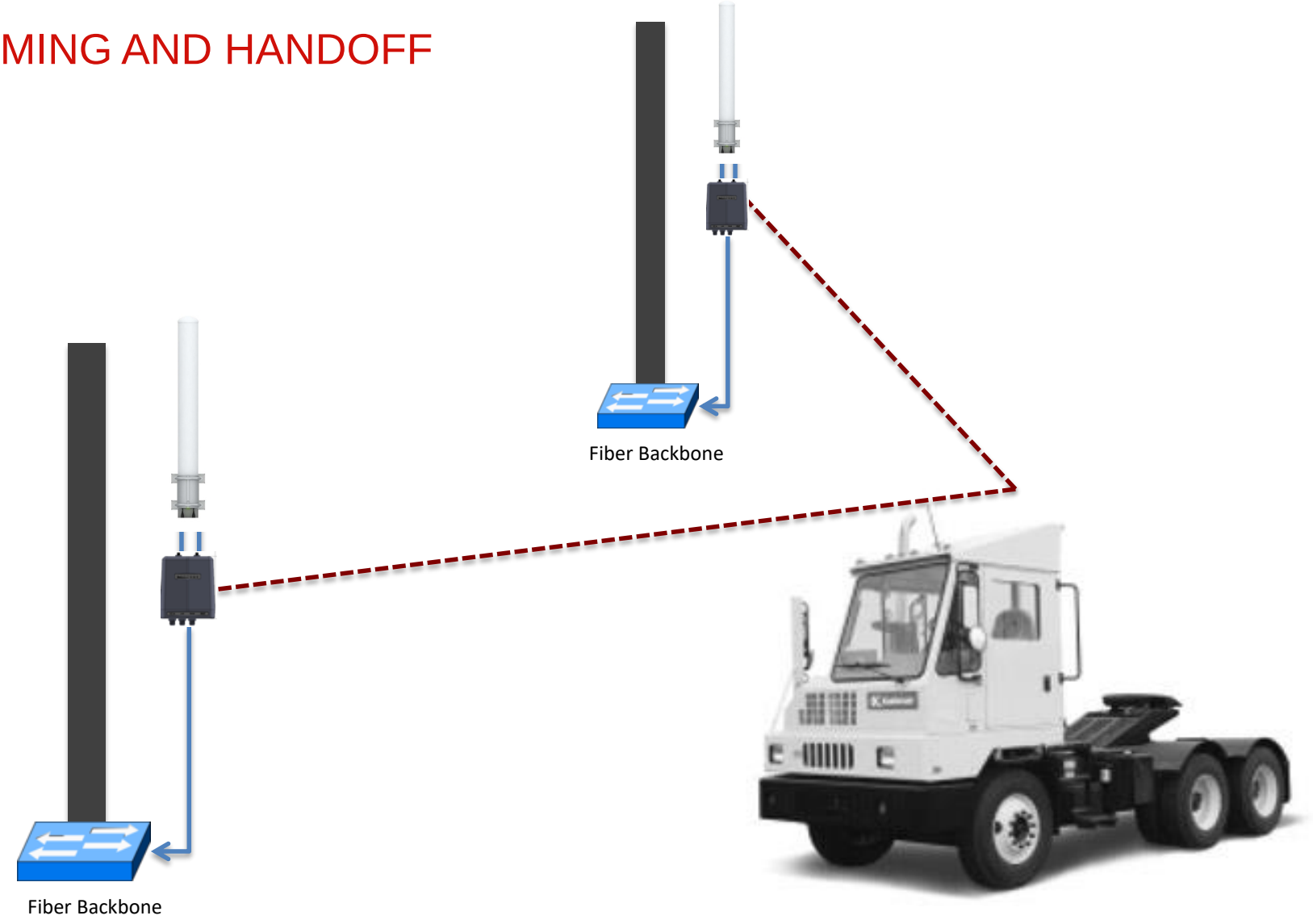
Horn High Gain ANTENNA

- 10 dBi 90deg X 90deg 2x2 MIMO Horn Antenna

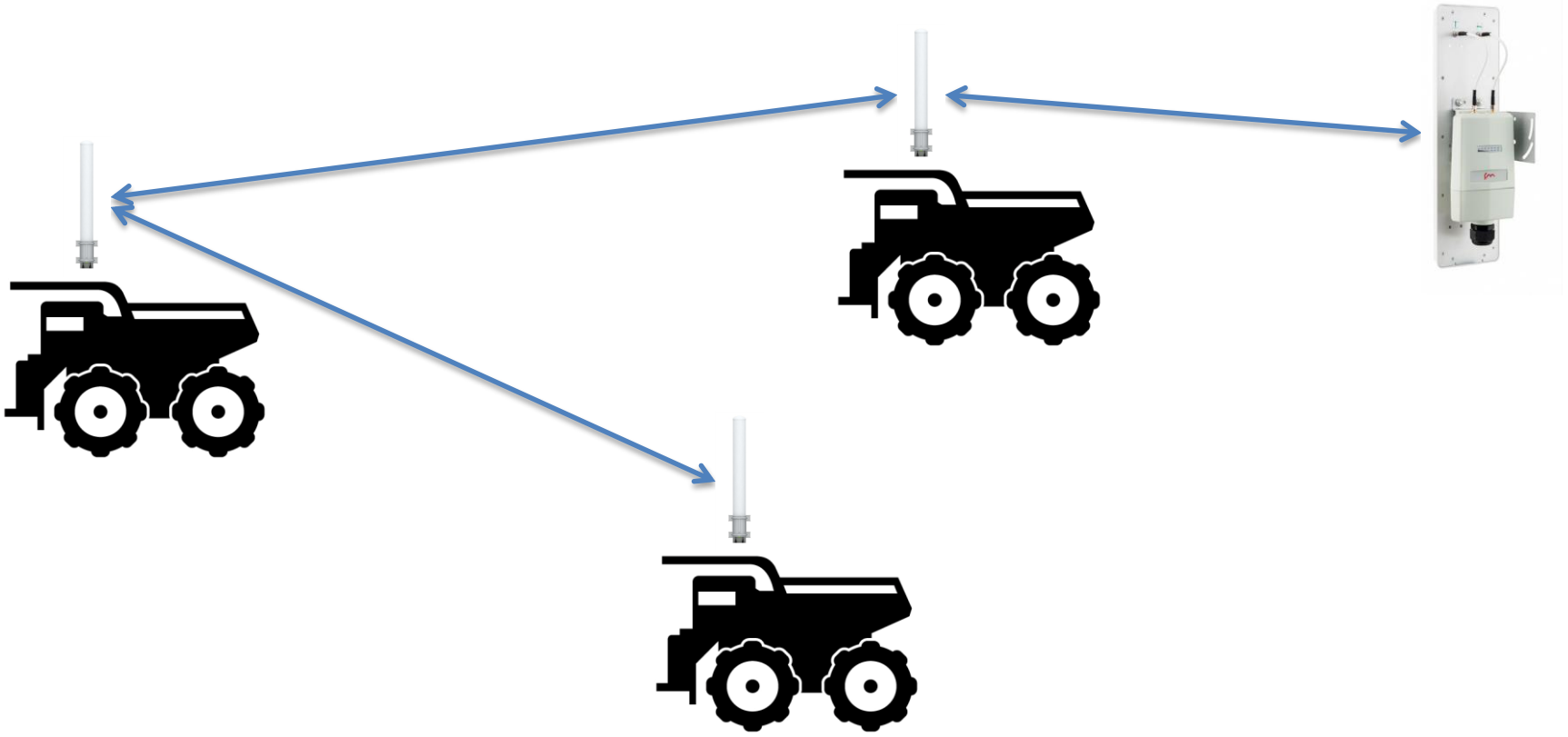
- 13 dBi 60deg X 60 deg 2x2 MIMO Horn Antenna



ROAMING AND HANDOFF



Wireless V2V – V2I Network Infrastructure

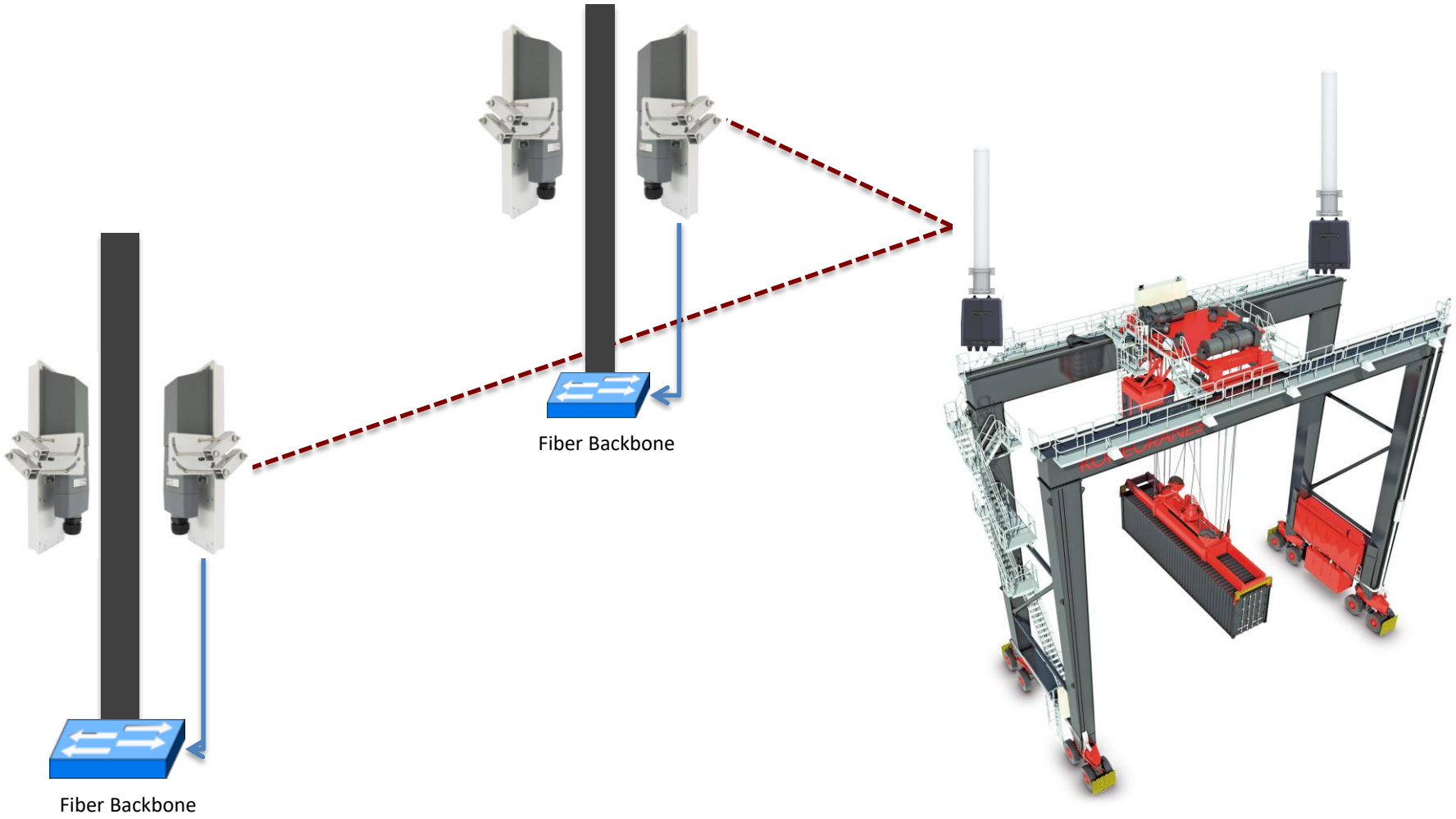


On-board Video Surveillance

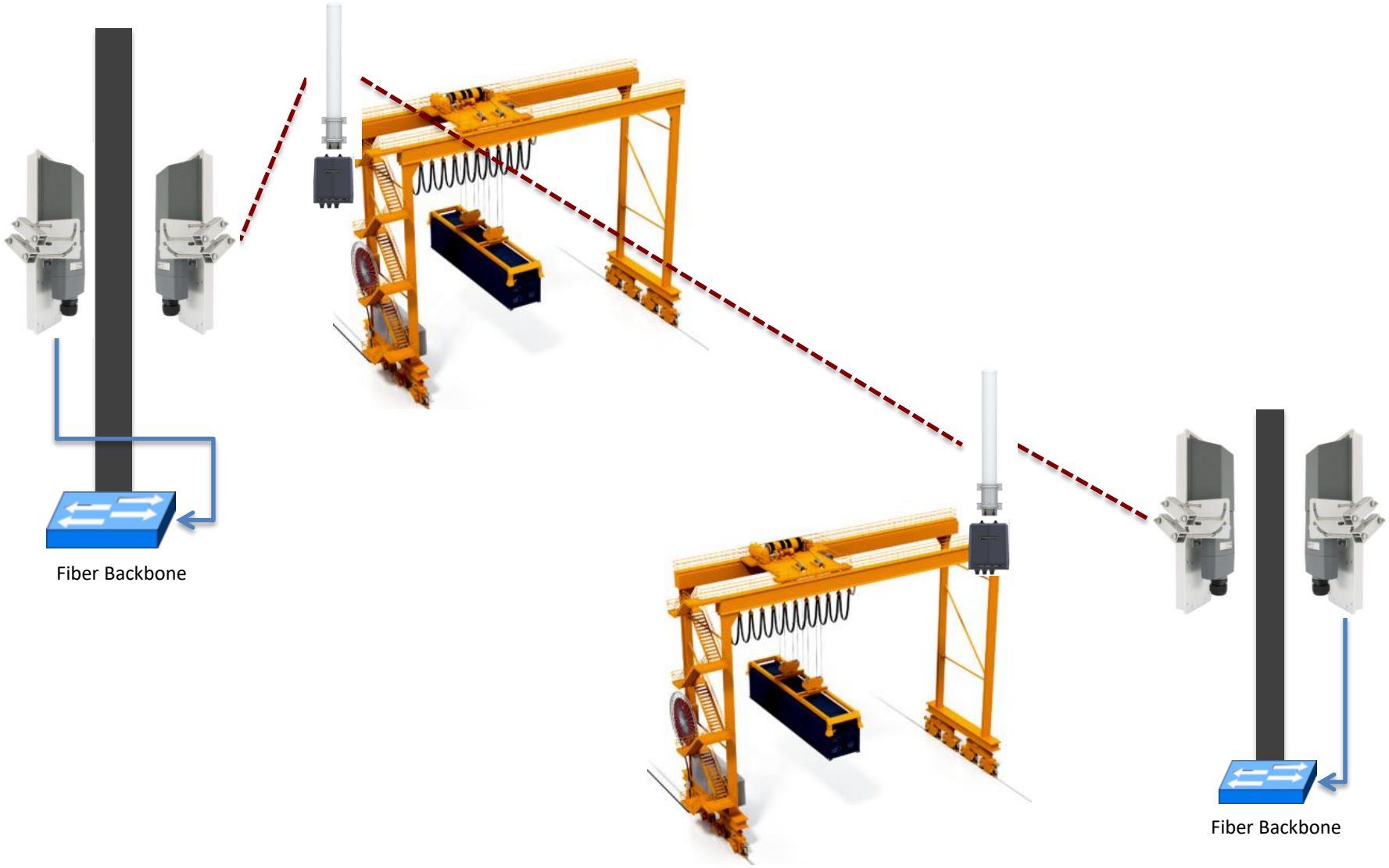
Vehicle Telemetry and Automation

Emergency Communication

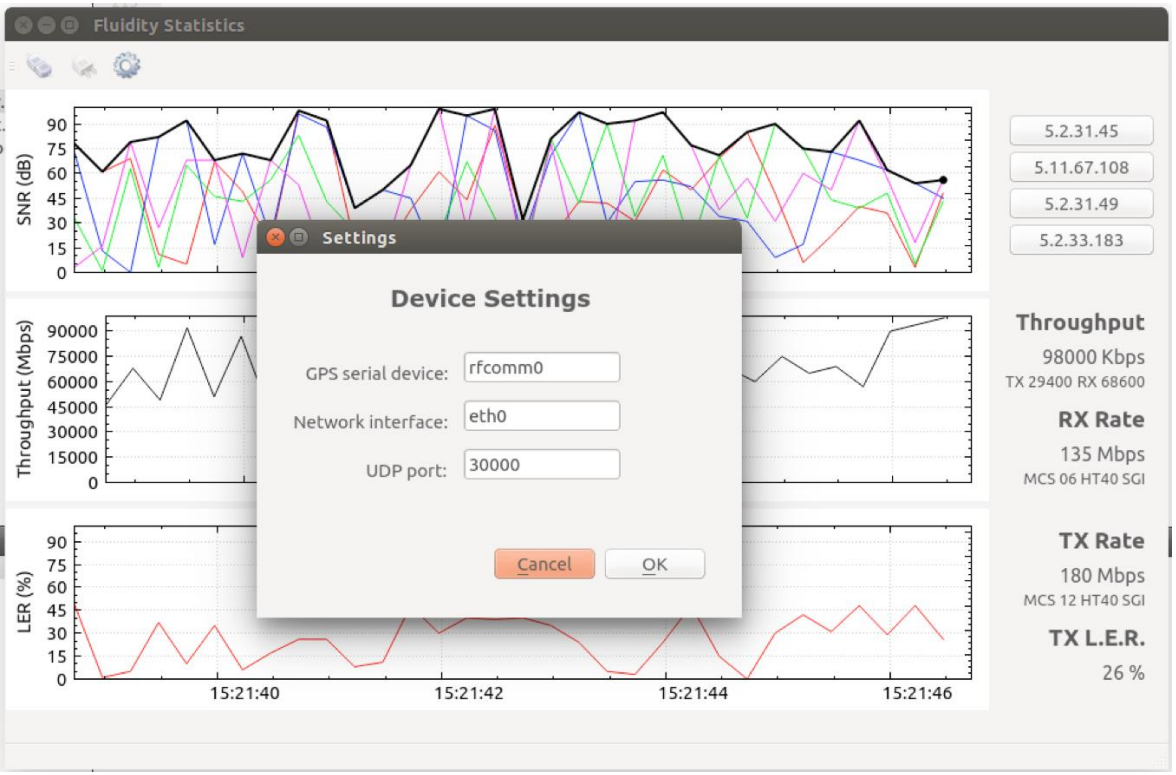
RTGs Radio/Antenna Setup (Two Radios)



ASC Radio/Antenna Setup (One Radio - Multihop)

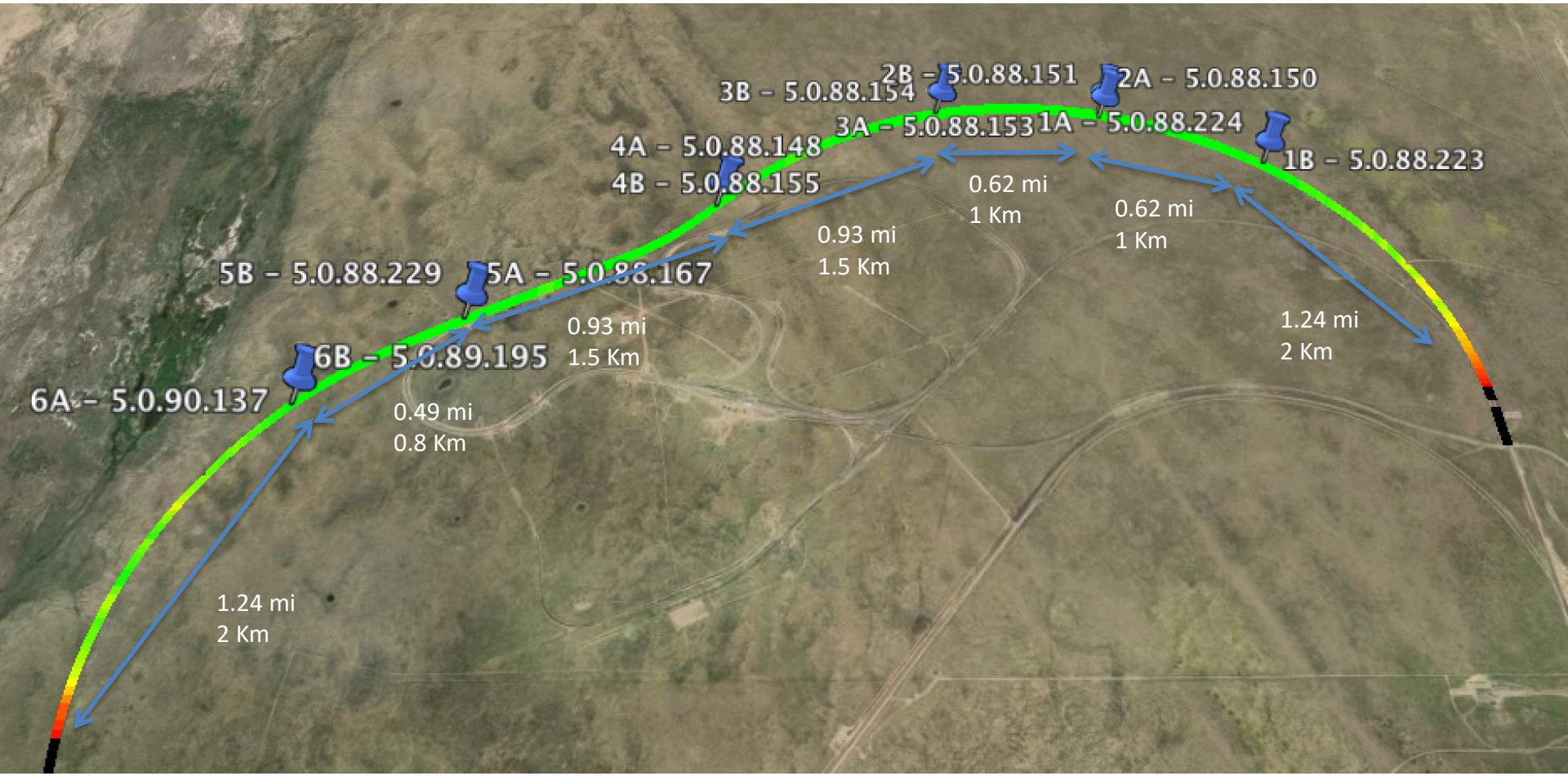


Fluidmesh Commissioning Tool



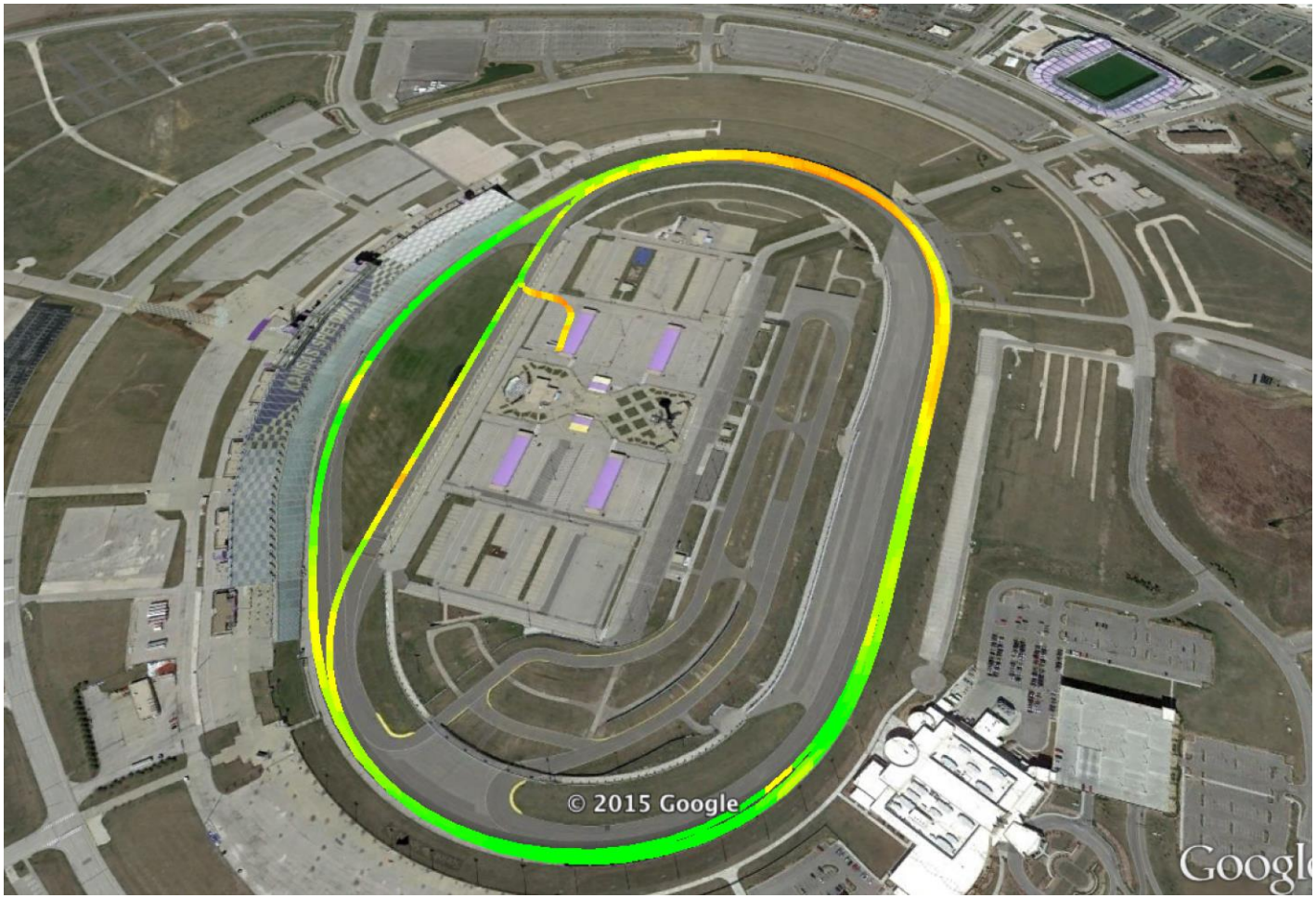
- Real-time data performance visualization
- Performance KPI capture for post-processing
- Parameters Logged:
  - Throughput
  - Link Error Rate
  - SNR received from trackside radios
  - Modulation and coding schemes
  - GPS position
  - Handoff

MAP OF TRACK

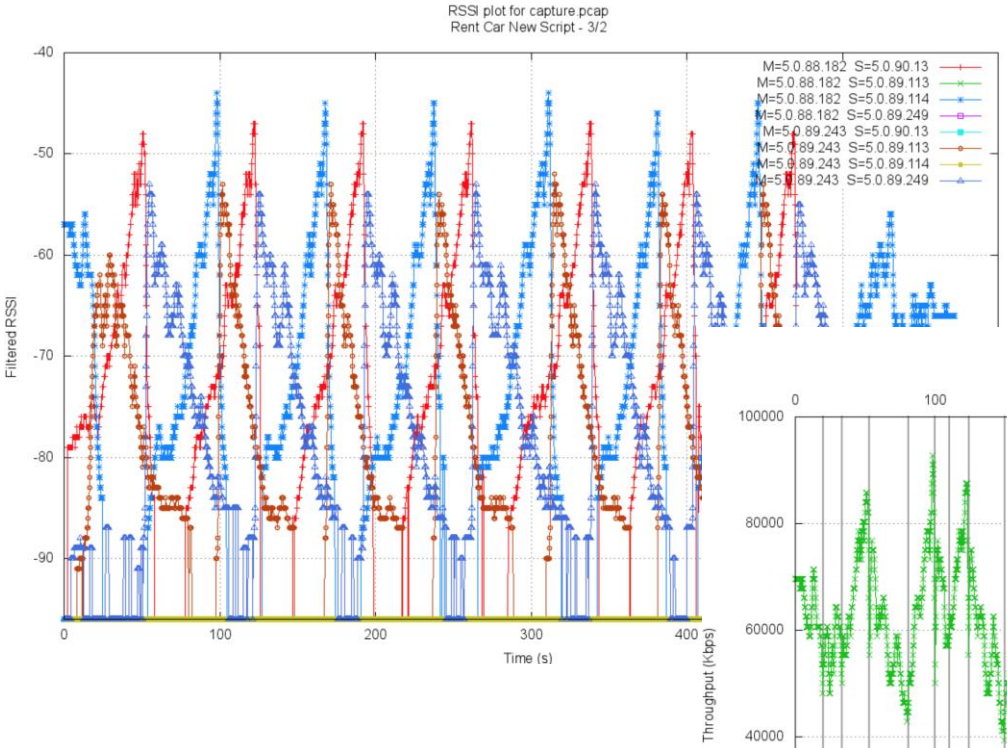


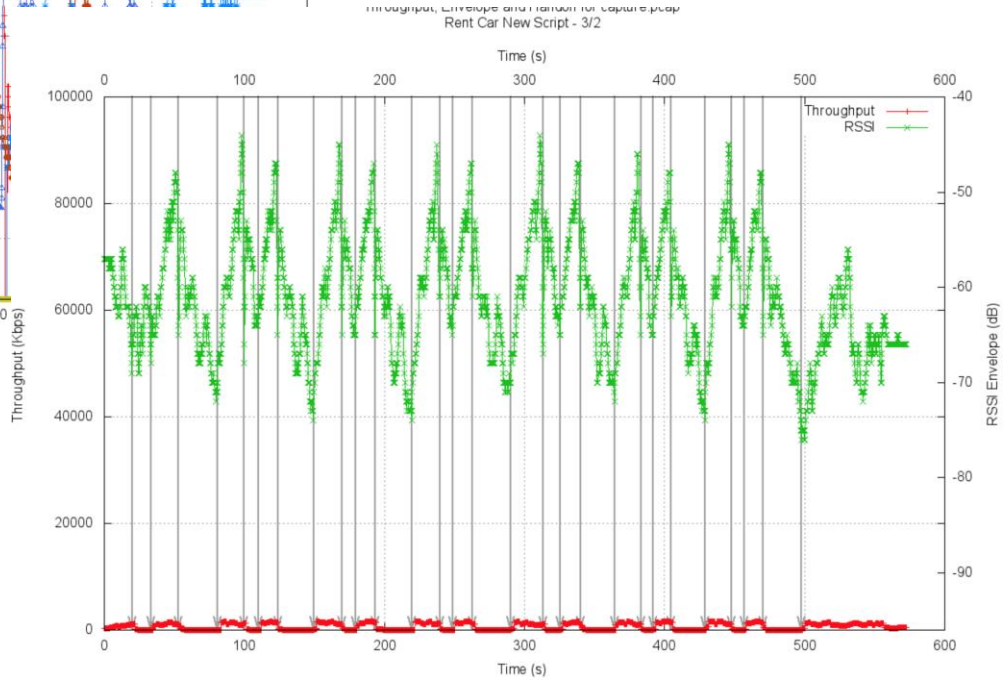
Tot coverage area: 6 miles / 9.8 Km

MAPS OF TRACK



RSSI PLOT + RSSI ENVELOPE





Container Terminal – Conceptual design

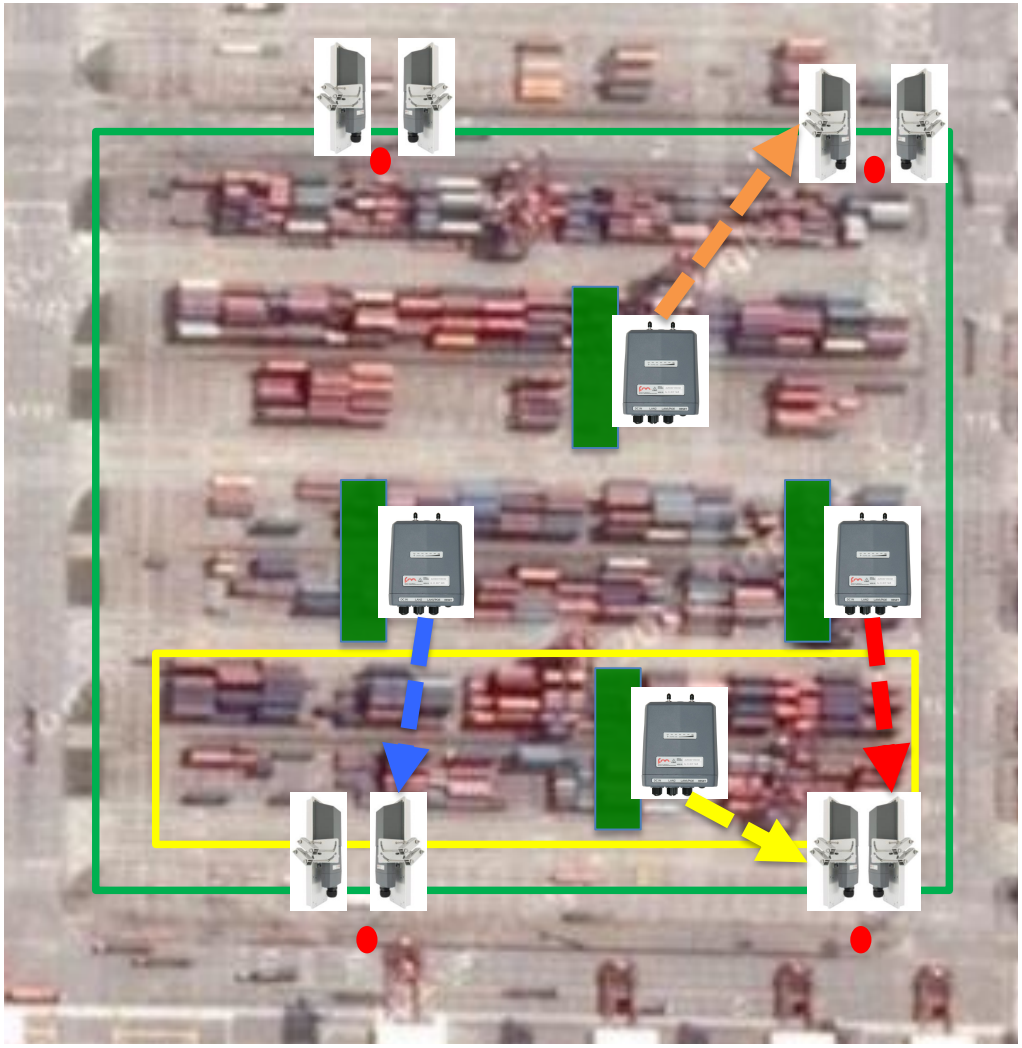
Max Number of RTGs: 8-12
Max Bandwidth per RTG: 30 Mbps
Number of lightpoles: 4
Redundancy needed on Trackside

Horizontal spacing lightpoles: 120m
Vertical spacing lightpoles: 220m

Container Terminal – Conceptual design

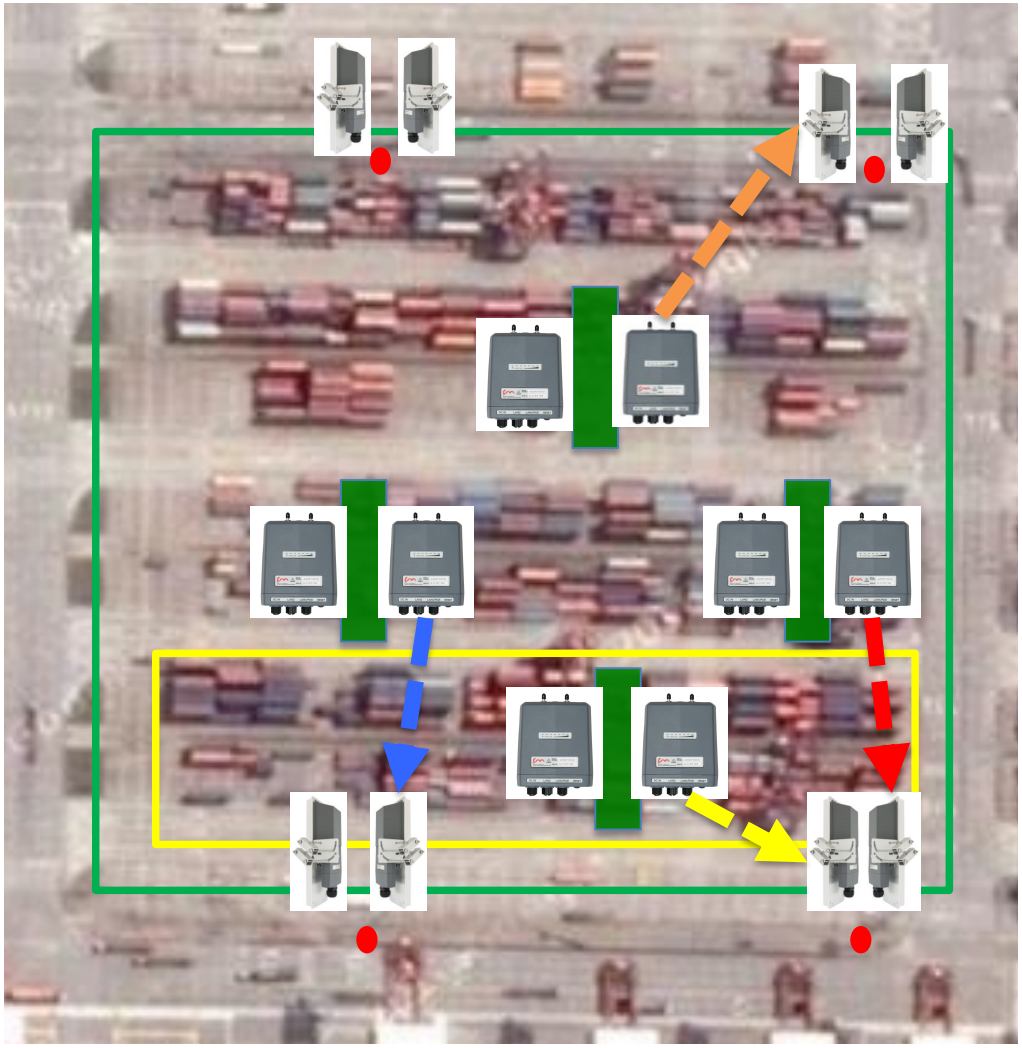
HARDWARE	SOFTWARE LICENSE
8x FM3200B-HW	
	8x FM3200-MOB-TRK-UN
	8x FM-VLAN
	8x FM3200-EEW-3Y

Container Terminal – Conceptual design – One Radio per RTG



HARDWARE	SOFTWARE LICENSE
1x FM4200E-HW	1x FM4200-MOB-TRK-UN
	1x FM-VLAN
	1x FM3200-EEW-3Y

Container Terminal – Conceptual design – Two Radios per RTGs



HARDWARE	SOFTWARE LICENSE
2x FM4200E-HW	2x FM4200-MOB-TRK-UN
	2x FM-VLAN
	2x FM3200-EEW-3Y

Successful Track Record

CSX

PORT OF NEW ORLEANS

BART

NORFOLK SOUTHERN

BNSF RAILWAY

INTERNATIONAL PORT OF MEMPHIS

AnsaldoSTS
A Finmeccanica Company

NY WATERWAY

AIRTRAIN JFK

PENN TERMINALS INC

UNION PACIFIC

KANSAS CITY SOUTHERN Lines

BOMBARDIER

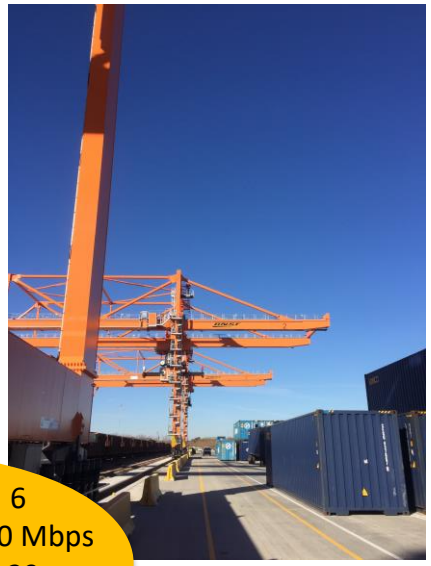
ExxonMobil

DRUMMOND COMPANY, INC.

CISCO

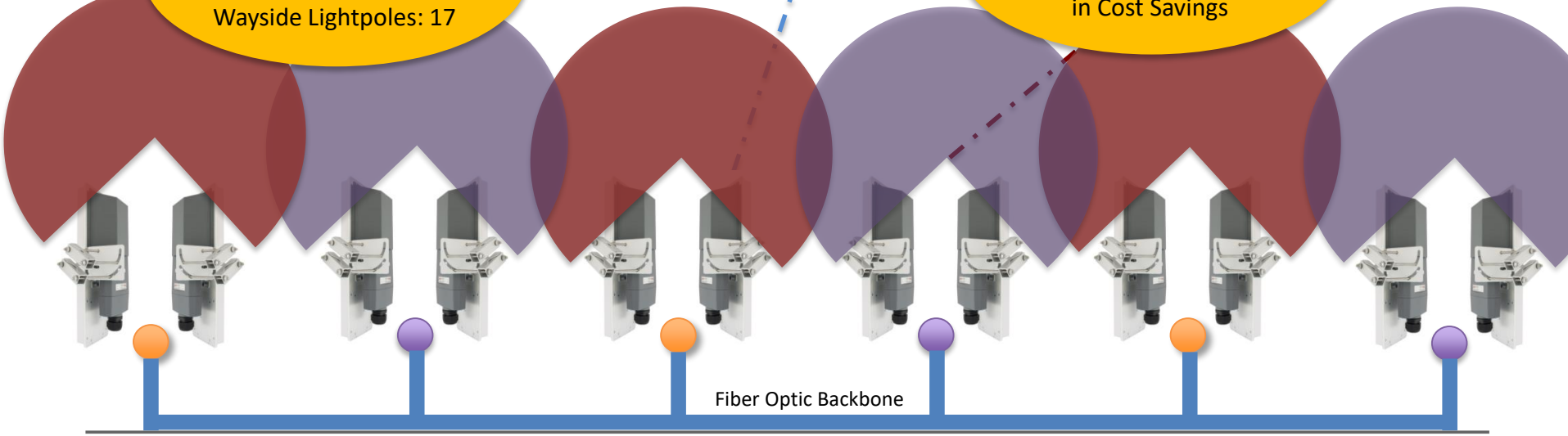
DP WORLD

BNSF LPC Intermodal Yard – Fluidmesh RMGs Backbone



Number of RMGs: 6
Bandwidth per RMG: 60 Mbps
Cameras per RMG: 29
Wayside Lightpoles: 17

No Need for Dedicated Towers
$500k
in Cost Savings



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