



WGC AMERICAS

JUN 10 – JUNE 13 2024

Wi-Fi Innovation:
Connecting Our
Digital World

DALLAS MARRIOTT DOWNTOWN. DALLAS, TX, USA.

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Tiago Rodrigues

President & CEO, Wireless Broadband Alliance

Day 2 - Welcome address

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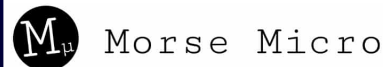




























Tiago Rodrigues
Wireless Broadband Alliance



Andrea Calcagno
Cloud4Wi



Malcolm Smith
Cisco



GS Sickland
Cox Communications



Mittal Parekh
RUCKUS Networks



Rizwan Makhani
Marriott International



Brian Shields
Boingo Wireless

Time	Presentation
9:30 AM (CT)	Day 2 Welcome address Tiago Rodrigues, President & CEO, Wireless Broadband Alliance.
9:45 AM (CT)	Closing the Connectivity Gap: How Wi-Fi Empowers Enterprises and Carriers Andrea Calcagno, CEO & Co-Founder, Cloud4Wi
10:05 AM (CT)	The Path to Wi-Fi Determinism – From Concept to Realization Malcolm Smith, CTO Advisor – Wireless, Cisco.
10:25 AM (CT)	Meeting the needs for Enterprise through AP-Agnostic Networks GS Sickland, Cox Communications
10:40 AM (CT)	Panel: Enterprise Connectivity Forum Moderator: Tiago Rodrigues, President & CEO, Wireless Broadband Alliance. Andrea Calcagno, CEO & Co-Founder, Cloud4Wi. Mittal Parekh, Senior Director Product Marketing, RUCKUS Networks; Rizwan Makhani, Business Solution Architect, Marriott International; Brian Shields, VP of Software Engineering, Boingo Wireless.
11:10 AM (CT)	COFFEE & NETWORKING



Andrea Calcagno

CEO & Co-Founder, Cloud4Wi.

Closing the Connectivity Gap:
How Wi-Fi Empowers Carriers
and Enterprises.

Closing the connectivity gap: how Wi-Fi empowers carriers and enterprises

Andrea Calcagno, CEO & Co-Founder





A trusted by leading global enterprises and partners

Company profile



Enabling enterprises to offer a **seamless, secure WiFi access** and unleash innovative **location-aware experiences**



Global presence with over **150 million mobile users** connected across **70,000 locations** in more than **150 countries**



WBA Principal Member and founding member of the Enterprise Connectivity Forum

Some of our clients



GUESS



PRADA Group



VALENTINO



The challenge: The connectivity gap is a chasm

Poor indoor cellular coverage in many guest-facing facilities

Carriers

- No service and bad customer perception
- Increased churn
- Reduced total mobile cell capacity

Enterprises

- Bad mobile digital experience
- Missed chance for extensive data collection



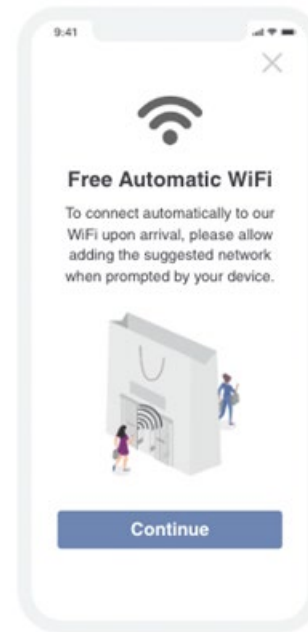


The limitations of the old way for enterprises



Captive Portal

- No seamless experience
- Low security
- Low customer adoption



Carrier Offload / OpenRoaming

- Limited data collection
- Limited actionable events

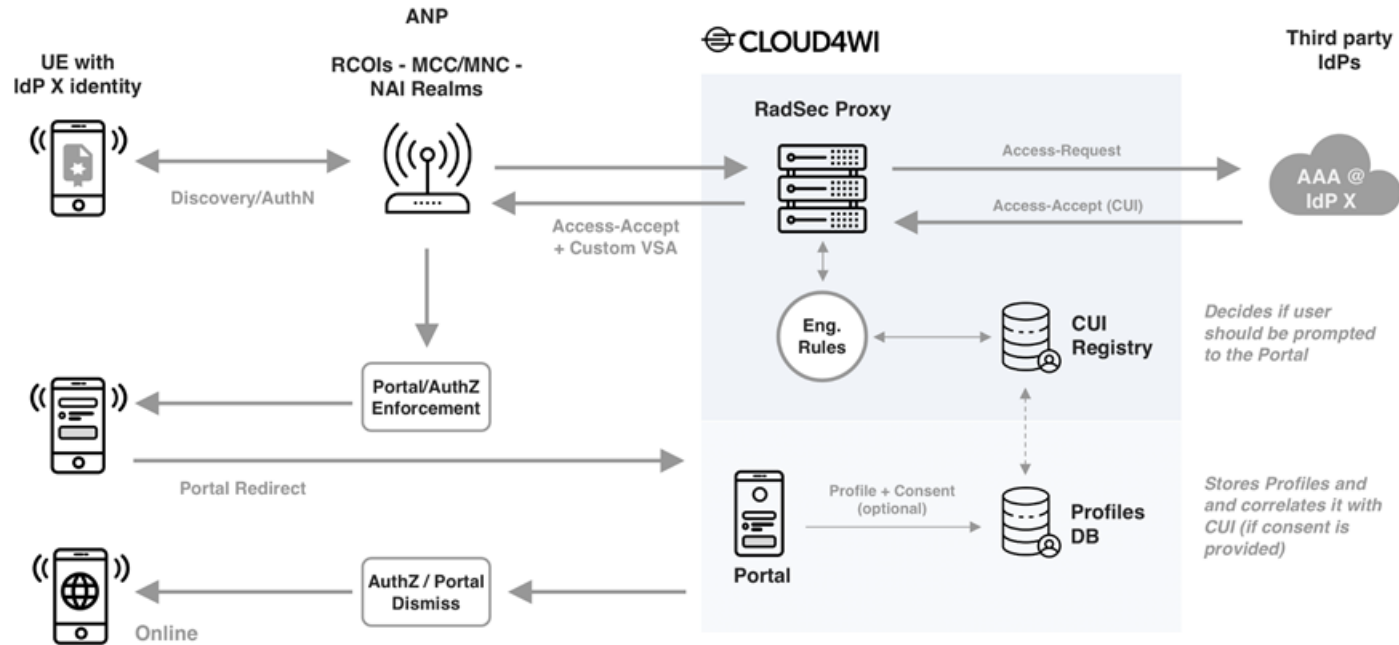


Seamless connectivity and engagement, everywhere





How it works - First time visitors

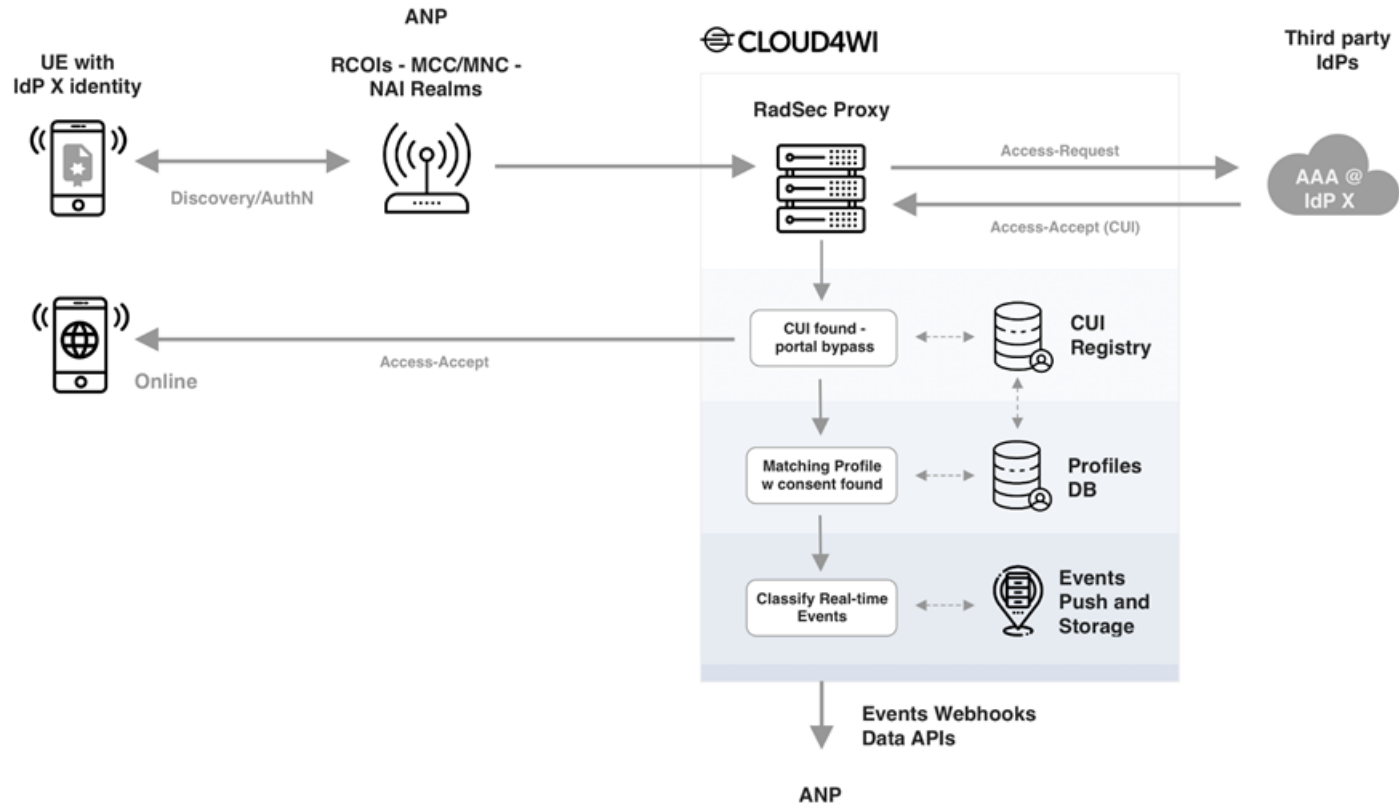


How it works

1. First-time visitors are intercepted on the interact portal.
2. If they provide data and consent, Cloud4Wi creates a related profile.
3. Once authorized, Cloud4Wi grants them internet access.



How it works - Returning visitors



How it works

1. Returning visitors connect seamlessly without interception.
2. If they have provided data and consent, Cloud4Wi classify and process in real time their on-premises events.



Cloud4Wi's dashboards

Visitor Profile

The Visitor Profile dashboard displays the following information:

- View Contacts:** Details, Back
- Contact Info:** Profile picture, Name, Email, Phone, Social media links, Recent visitors, Registered visitors
- Key Metrics:**
 - Loyalty Score: 0.5
 - Attraction Rate: 100%
 - Avg. Visit Duration: 45 min
- About This Contact:** See More
 - Last Visit: 1 day ago
 - Favorite Location: Vicenza
 - Favorite Day: Tuesday
 - Favorite time of day: Evening
 - Total Visits: 1
 - Locations visited: 1
 - Age: -
 - Gender: -
 - Subscription Source: OSU Portal
 - Subscription Location: VI_Vicenza
 - First Seen: May 16, 2024
 - Marketing Opt in: No
- Activities:**
 - Visit: 05/22/2024, Vicenza - 74 minutes
 - Seen: 05/22/2024, Vicenza
 - Visit: 05/22/2024, Vicenza - 25 minutes
 - Seen: 05/21/2024, Vicenza
 - Visit: 05/21/2024, Vicenza - 26 minutes
 - Visit: 05/21/2024, Vicenza - 55 minutes
 - Sign-Up: 05/16/2020, Vicenza

Events

The Events dashboard displays the following information:

- Moments:** Health, Events
- Health:** Analyze what Moments you are tracking
 - Period: Last 30 days
 - Type: On-Site
 - Location: All Locations
- Key Metrics:**
 - Total On-Site Moments: 1.8M (Unique people seen: 1.35M)
 - Arrivals: 1.9M (Engaged Visits: 22.0%)
 - Re-engagement: 15.0% (Re-engagement: 270K)
- Moments volume:** 535 (Avg. Moments per Day)
 - Line chart showing daily volume from 01/1/2022 to 06/21/2022.



The win-win for carriers and enterprises



For carriers

- 1 Reduced no-coverage area
- 2 Improved network performance
- 3 Enhanced subscriber satisfaction and loyalty



For enterprises

- 1 Seamless Wi-Fi experience with uncompromised security
- 2 Augmented and simplified customer data collection
- 3 Deeper customer insights for location-aware experiences



Transforming experiences in the real world



Players

- US grocery chain with over 2,200 stores
- Carriers and WBA OR IDPs

Business outcomes

For the **carriers**

Improved indoor coverage
Very low cost per bit



7.3M Unique users
in 6 months

11.3M Connections
in 6 months



For the **grocery**

10x more data collection
compared to captive portals



Let's connect now

Cloud4Wi is more than a technology provider.
It's a business enabler.



Contact us now



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Q&A



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Malcolm Smith

CTO Advisor - Wireless, Cisco

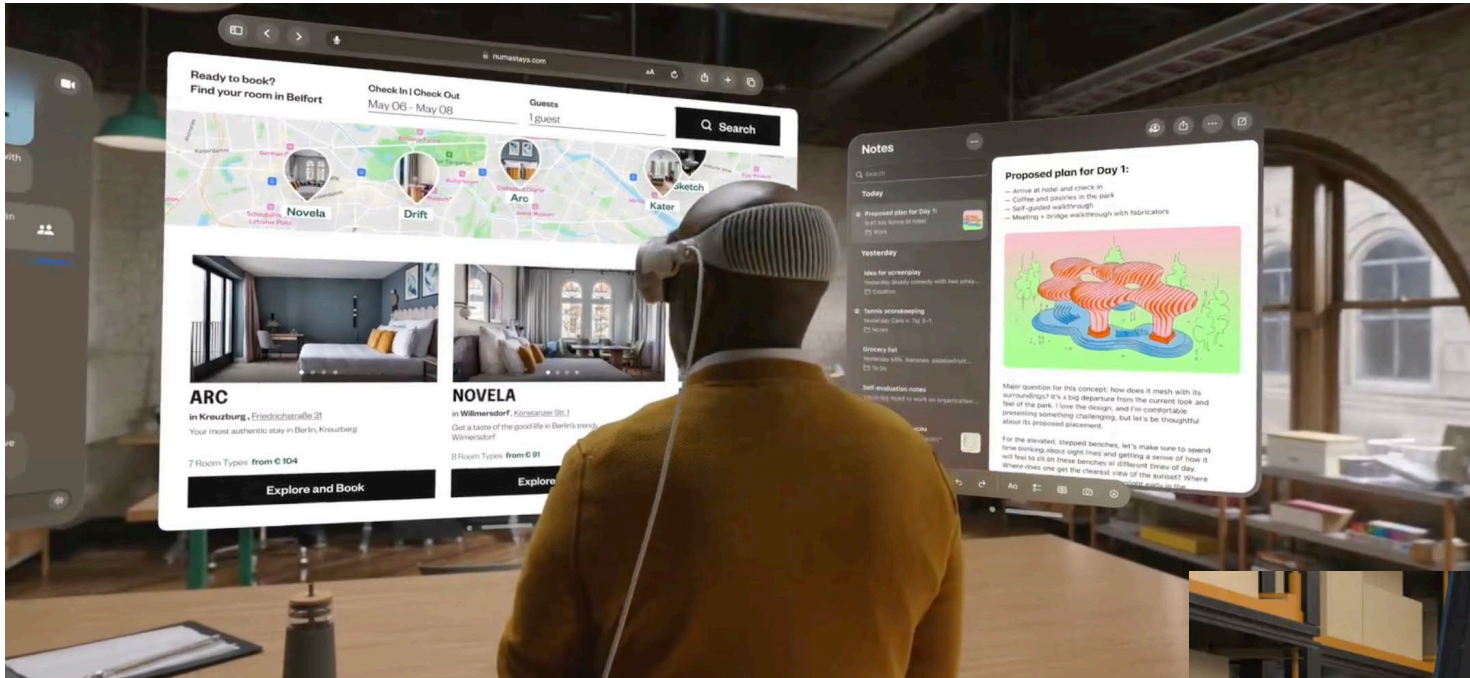
The Path to Wi-Fi Determinism – from concept to realization

The path to Wi-Fi determinism

From concept to
realization



The changing Enterprise space



IT Collaboration / productivity
e.g. immersive AR/VR

OT Automation/AI
e.g. Autonomous Mobile Robot (AMR)

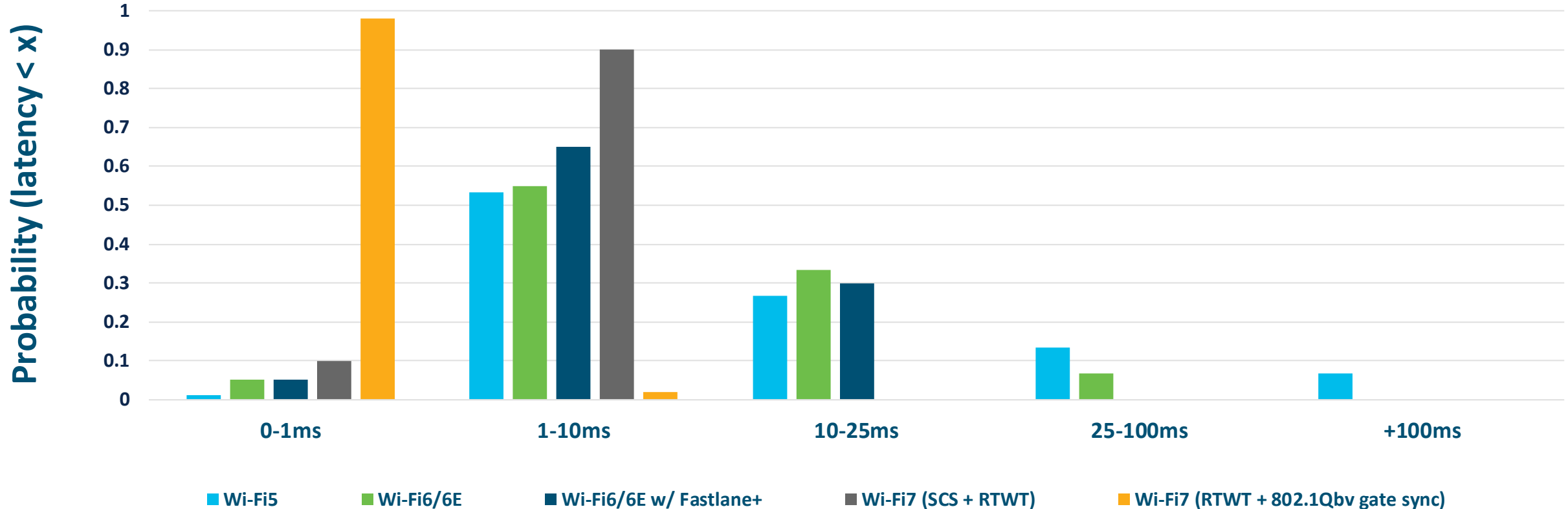


The Determinism Problem

...now and in the future

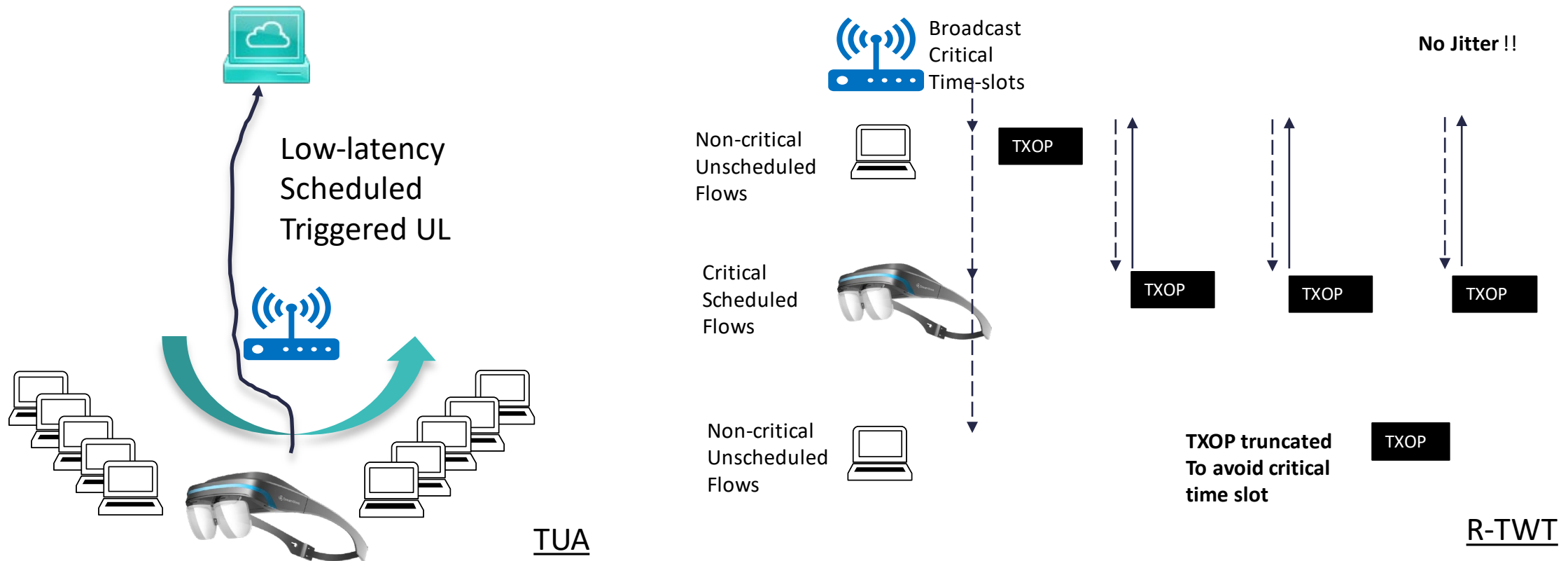
- Next-gen applications (robotics, AR/VR, etc) have **strict** requirements
 - Bounded (**worst-case**) latency, jitter, reliability
- Deployment planning practices are **coverage** and throughput centric
 - QoS is very difficult to predict given traffic load variation across ALL the APPs
 - Increasing spectrum (6GHz) reduces but doesn't *fundamentally* eliminate jitter
- New classes of (non-IT managed) devices exist in the Enterprise footprint
 - IOT and in particular P2P/C2C devices **interfere** with the Enterprise WLAN
- The need for **systematic determinism** is clear

Path to Deterministic Latency & High Reliability



Bounded Latency – even in high-traffic scenarios!

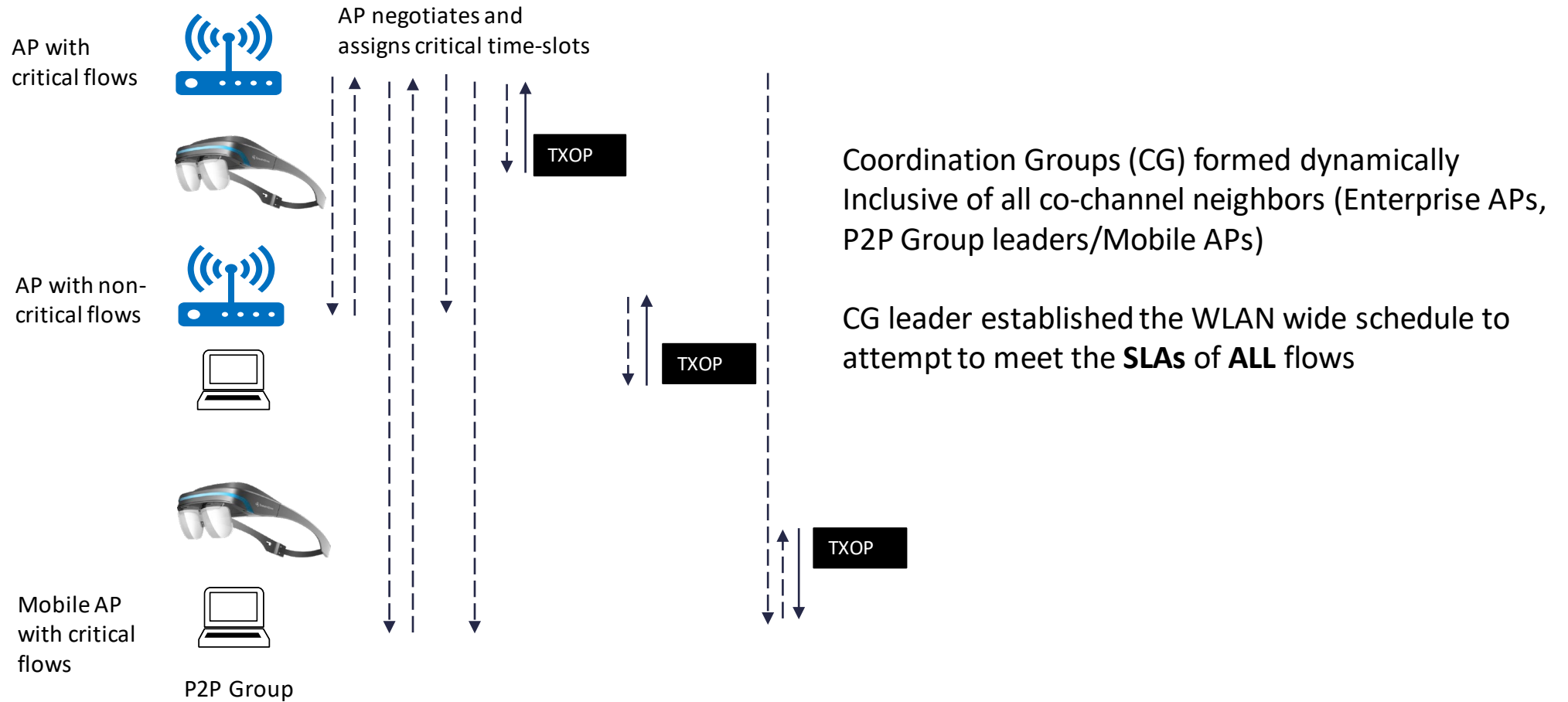
Wi-Fi Determinism – Phase 1 (Wi-Fi 7)



- Triggered uplink access (TUA) allows AP to schedule based on QoS Characteristics (e.g. latency)
- Restricted Target Wake Time (R-TWT) allows AP to “reserve” time-slots avoiding *interference*

Wi-Fi Determinism – Phase 2 (Wi-Fi 8)

MAPC



- Wi-Fi 7 enables determinism on a per AP / BSS basis
- Wi-Fi 8 Multi-AP coordination (MAPC) enables determinism amongst managed APs and P2P Mobile APs

Takeaway

- Deterministic apps are entering the landscape
- Over-provisioning with spectrum doesn't inherently BOUND KPIs
- Protocol-level mechanisms are needed to ensure systematic low-latency outcomes
- Wi-Fi 7 is the beginning of the journey
- Wi-Fi 7 is the next step ...



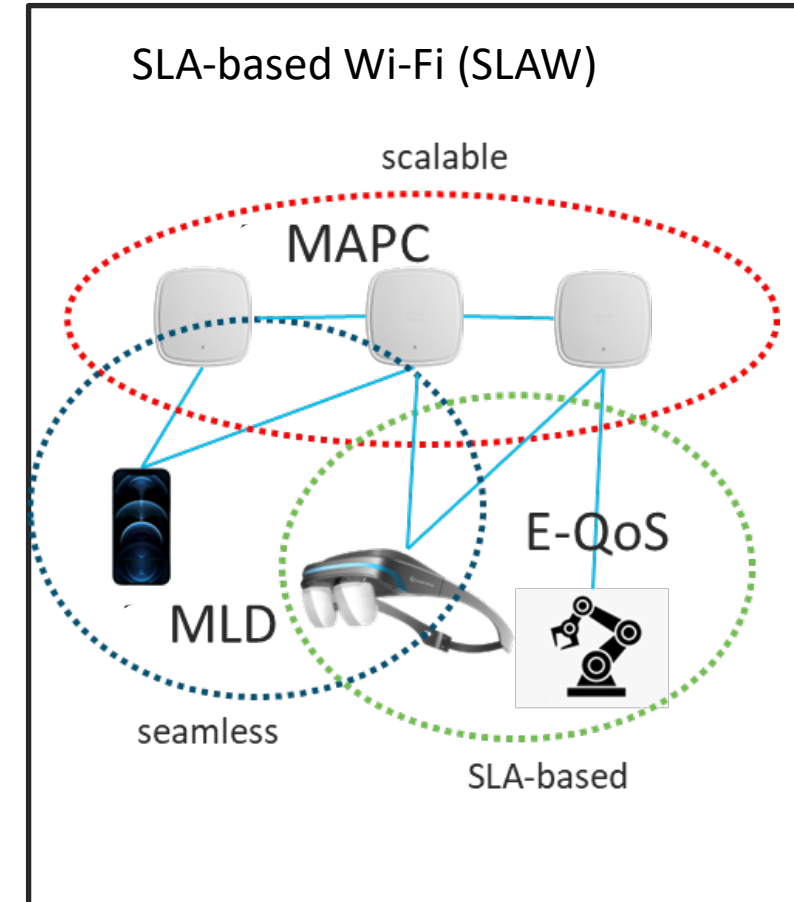
BACKUP



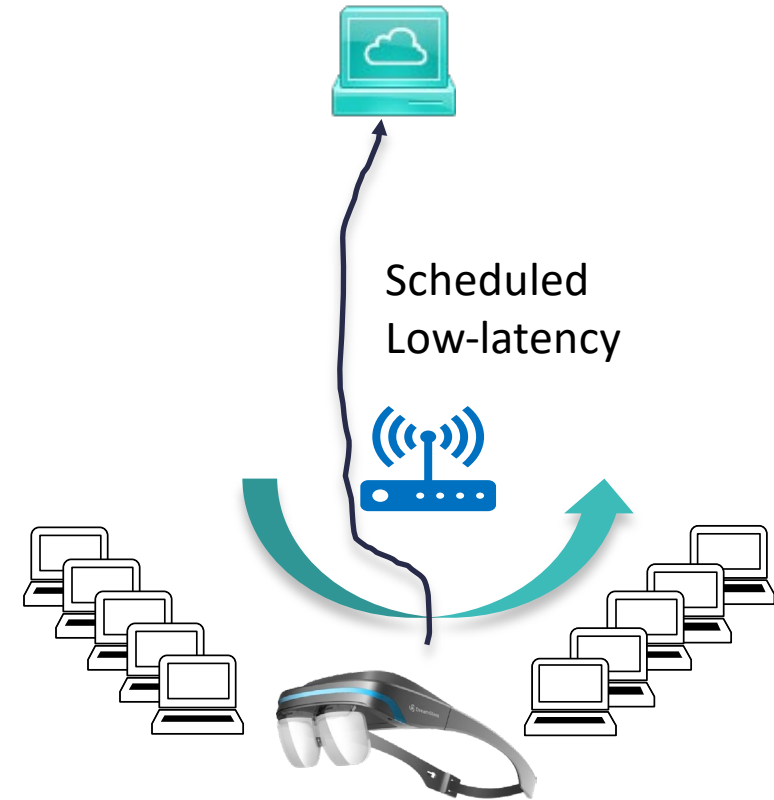
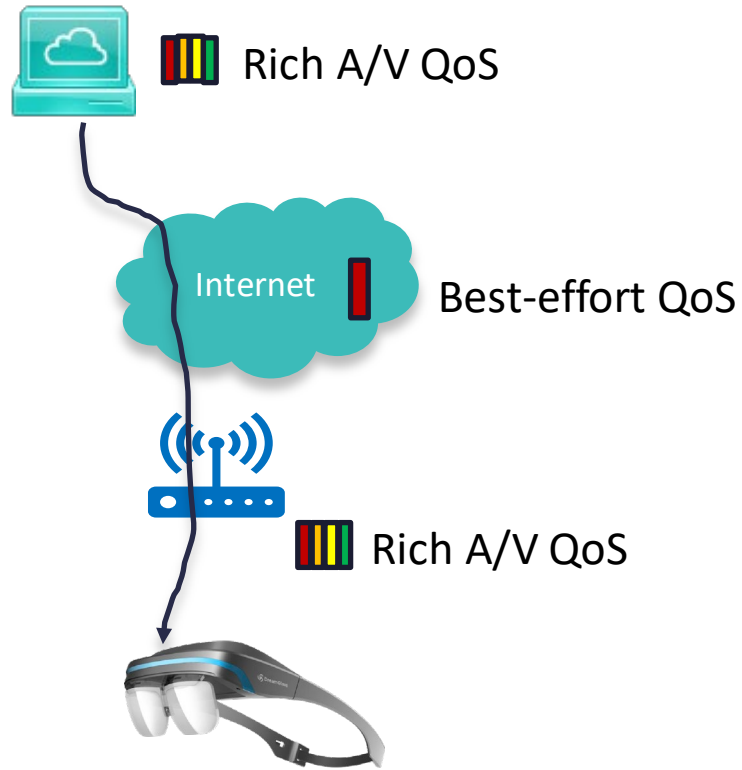
Determinism

...some of the tools

- Enterprise QoS (E-QoS)
 - WiFi7 SCS-based **Service Level Agreement (SLA)** based delivery (latency, jitter, reliability)
 - WiFi7 R2 Restricted Target Wake Time (**R-TWT**) based time-slot reservation
 - WBA, IEEE: L4S (congestion marking)
- Multi-Link-Device (MLD)
 - Wi-Fi7 MLD-based real-time **QoS optimized** link selection (no band steering needed)
 - **Seamless** intra-AP (WiFi7) and inter-AP (Wi-Fi 8) **roaming** (no re-association!)
- Multi-AP Coordination (MAPC)
 - **Scalable** Wi-Fi8-based time/space/frequency coordination for **high-density (HD)** determinism and dynamic wide-channel (e.g. 320MHz)
- Enterprise spectrum/resource management (RRM)
 - Resiliency (interference avoidance) via WiFi7 in-channel (**puncturing**) and WiFi7R2 off-channel peer-to-peer (**P2P**) device coordination

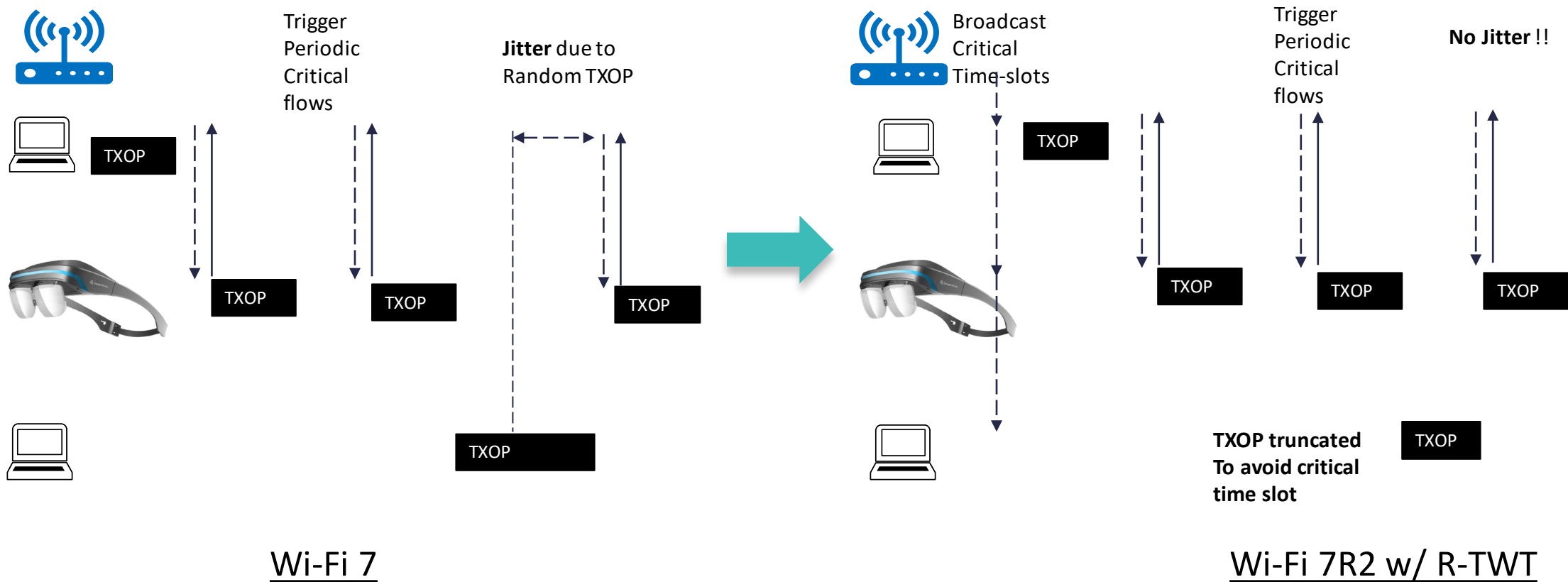


Wi-Fi Certified 7 SCS



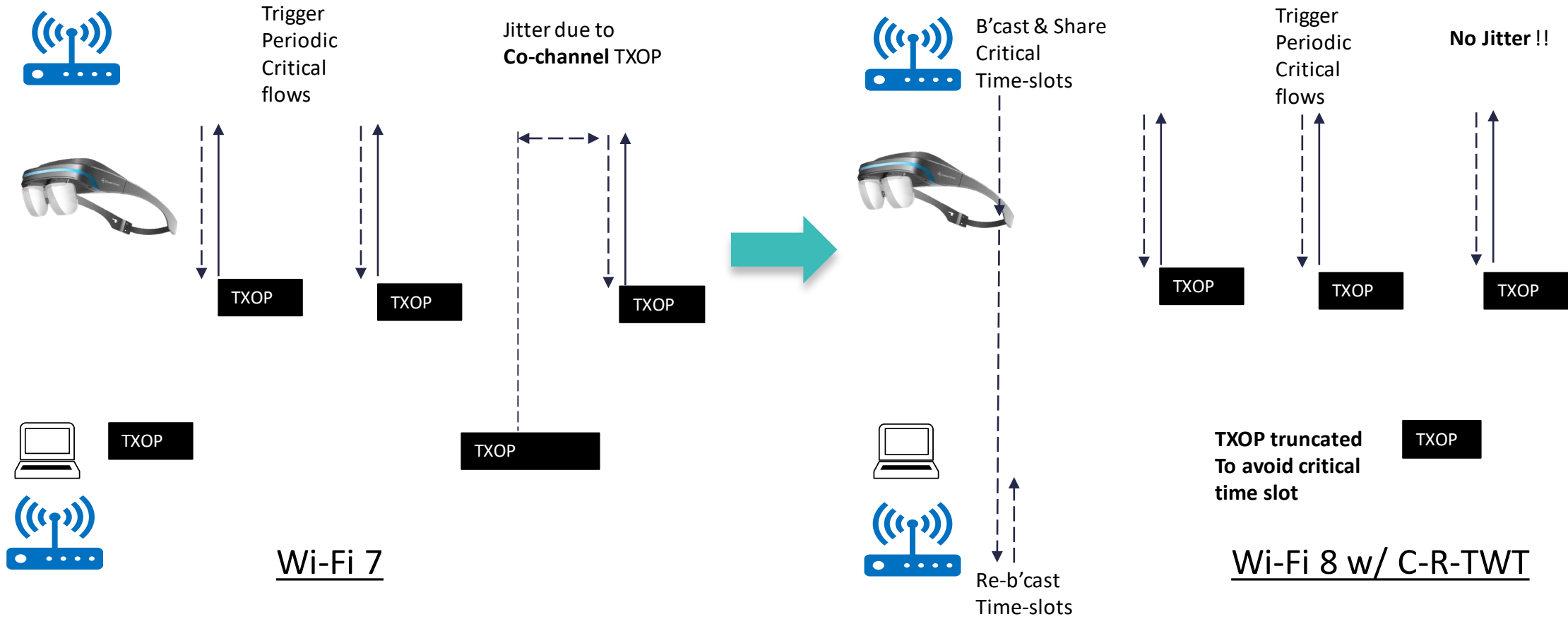
- SCS (TCLAS) correctly classifies downlink (DL) traffic flows – *undo* Internet DSCP blanching
- AP schedules uplink (UL) via SCS (QoS Characteristics) – prioritizes deterministic STA/clients

Wi-Fi 7 R2 – Restricted Target Wake Time (R-TWT)



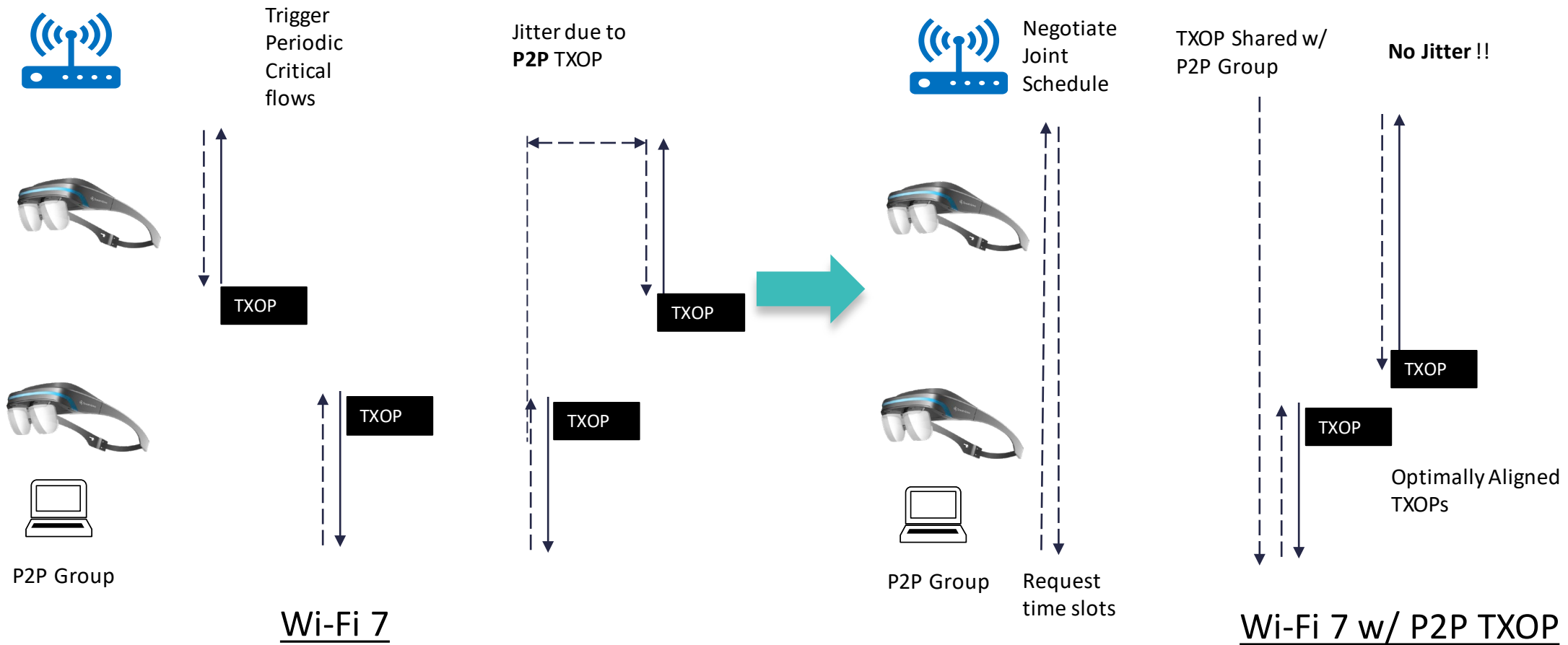
- Wi-Fi 7 SCS periodically schedules critical UL flows, but *non-critical* flows can cause jitter
- R-TWT reserves time-slots for time-critical flows so non-critical STA won't break determinism

Wi-Fi 8 Coordinated R-TWT (C-R-TWT)



- Wi-Fi 7 SCS+R-TWT provide determinism to a single AP but co-channel APs can interfere
- C-R-TWT *extends* determinism to multi-AP co-channel environments (e.g. HD)

Wi-Fi 7 P2P/C2C (e.g. VLP) Coordination



- Determinism can be impacted by P2P Groups (e.g. VLP Wi-Fi Direct) also w/ time-critical flows
- P2P TXOP Sharing allows **both** systems to achieve determinism



GS Sickland

Wireless Engineering, Cox Communications.

**Operator Perspective:
Meeting the needs for
Enterprise through
AP-Agnostic Networks**

Operator Perspective: Meeting the needs for Enterprise through AP-Agnostic Networks

June 13, 2024

Presented by:

GS Sickand

Wireless Engineering

Cox Communications, Inc.





Privately Held & Family-Owned

Founded in 1898 by Ohio Governor James M Cox
120+ Years of Innovation & Technology Leadership



Largest privately held telecom company in the U.S.



World leader in vehicle remarketing services and software for automotive dealers and global consumers



Manheim



Cleantech | Healthcare | Esports



Cox Prosight_{SM}

Cox Edge

Cox Private Networks



ATLANTA REIGN



ATLANTA FAZE



DEPTH IN ALL VERTICALS

Stay Connected, Wi-Fi, Connected Rooms, ITV and Free to Guest



Industry Experience 11 Years

Who We Service

- Luxury & Full-Service Hotels
- Convention Centers

Our Solutions

- Guest Room Entertainment
- Free to Guest Video Services
- Advanced Convention Services
- IPC Voice



Industry Experience 40 Years

- Stadiums & Arenas
- Large Public Venues

Business WiFi

Reliable. Fast. Secure. It's all possible with business WiFi. Cox Business WiFi provides the private and secure access your company depends on – and the reliable connection your customers need.

- ✓ Complete WiFi coverage for your business
- ✓ Enterprise-grade equipment
- ✓ Professional installation
- ✓ 24/7 technical and customer support
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- ✓ NOC as a Service
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[Learn More Here:](#)



COX HOTSPOTS

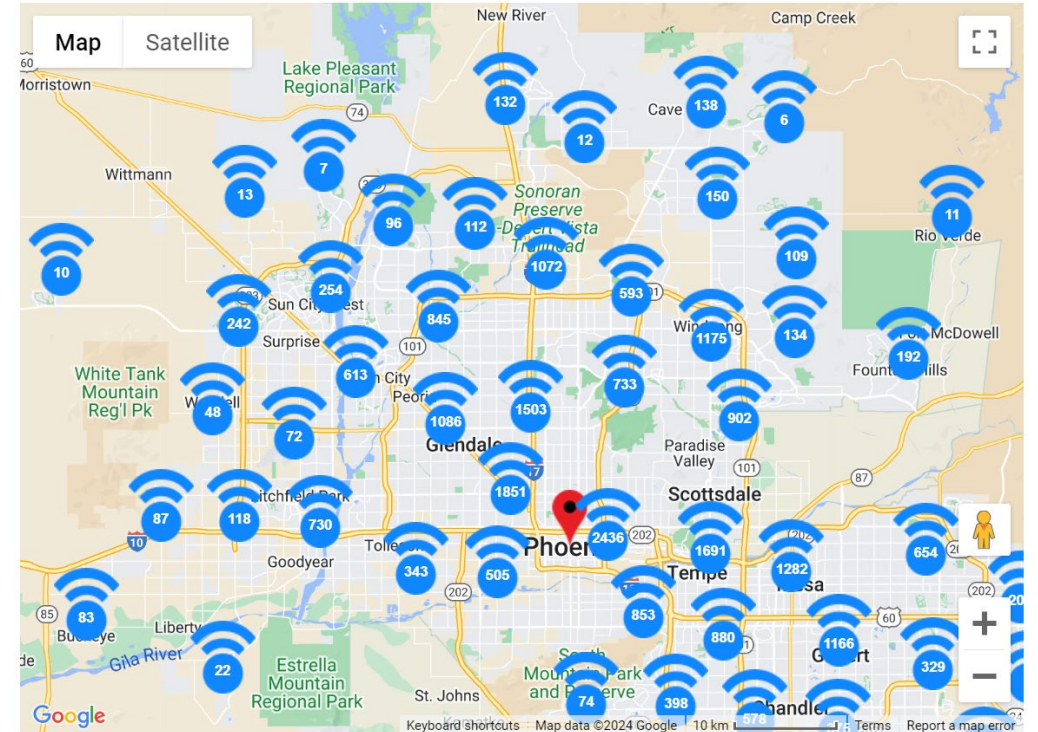
Wi-Fi where you need it

Cox Hotspots provides access to four million Wi-Fi hotspots nationwide for all Cox Internet customers at no additional charge.

- You can take Cox Internet with you when you leave home.
- Cox Hotspots provide fast, wireless, on-the-go internet connectivity for your tablet, smartphone, or other Wi-Fi enabled devices.
- Access more than four million hotspots to help you save on your wireless data plan
- Cox Hotspots are available in all Cox markets at the following outdoor and indoor venues. Find locations near you at our [Cox Hotspots page](#).

Cox Hotspots are available in all Cox markets at the following outdoor and indoor venues.

- Central business districts where people often eat, shop, and socialize
- Waiting areas in professional small and medium size businesses
- Residential multi-dwelling unit (MDU) common areas, including the pool area, lobby, and recreational playground and parks
- Cox Retail Stores



- Wifi Clusters
- Indoor Cox Hotspot
- Outdoor Cox Hotspot
- Indoor CableWiFi*
- Outdoor CableWiFi*

ENTERPRISE: WHAT'S WORKING?



Improvements

- 802.11 speed continues to improve
- More spectrum, more capacity - release of 6GHz is huge!
- Wi-Fi7 adoption will continue to enhance customer experience
- Solutions are more easily integrated into operator dashboards/systems
- BYOD devices are more intelligent handling roaming, stickiness, near-far situations, etc. better than in the past

SPEED AND SPECTRUM ON THE HORIZON

Increasing User Speeds and Experience

- Wi-Fi is still typically the bottleneck
- User demands continue to grow
- More devices connecting
- More APs being deployed
- More bandwidth @ wider channels == more contention across even the new spectrum...

Help on the Horizon

- 6GHz adoption
- Wi-Fi 8 introduction of mmWave and better use of spectrum through increased coordination
- QoS, guaranteed throughput and security to effectively communicate with 3GPP technologies
- **MORE, MORE, MORE...** continue to advocate for more spectrum and better performance to stay in front of user demands



UE OPPORTUNITIES



Device Intelligence and Influence

- Improved wi-fi and cellular decision making
- Algorithm should aim to enhance the user experience
- Provider influence of connection decision
- Network insights on congestion

Experience Visibility

- Native visibility to UE experience
- Should be standards-based
- Should be device agnostic

Industry solution to maintain single SSID experience for Wi-Fi 7/WPA3 and legacy/WPA2

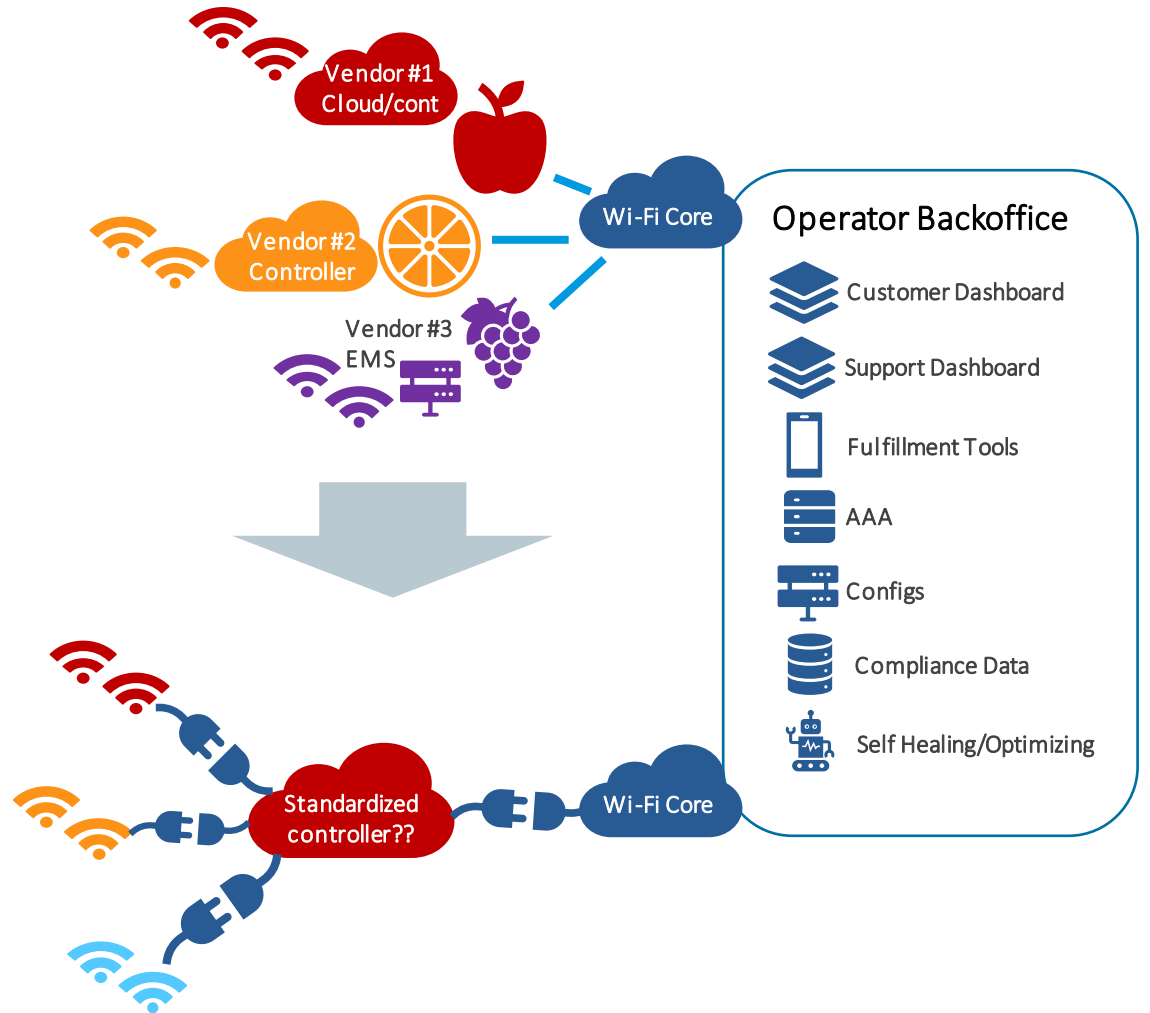
AP-AGNOSTIC NETWORKS

AP agnostic Wi-Fi architecture

- Opportunity to define standardized interface specifications for Wi-Fi architecture
- Define a common CUPS Architecture – control and user plane separation
- User Plane interface spec definition should include:
 - 802.1q/local breakout
 - EoGRE/L2TPv3/L3VPN/VX-LAN
- Control Plane interface spec definition should include:
 - L3VPN
 - IPSEC
- Definition of common northbound API framework and constructs such as AP Groups and attributes such as SSID

Benefits

- Standards and simplification drives lower implementation cost
- Improved supply chains with less disruptions
- Reduce operational complexity
- Improved time to market for new features
- Improved potential coordination and experience across vendors
- Opportunities to enrich vendor eco-system



Questions ???



COX

Bringing us closer

Panel: Enterprise Connectivity Forum



Andrea Calcagno

CEO & Co-Founder,
Cloud4Wi.



Mittal Parekh

Senior Director, Product
Marketing, RUCKUS Networks.



Rizwan Makhani

Business Solution Architect
Marriott International.



Brian Shields

VP of Software Engineering,
Boingo Wireless.

OPENROAMING



Automatic connection

Secure and Private

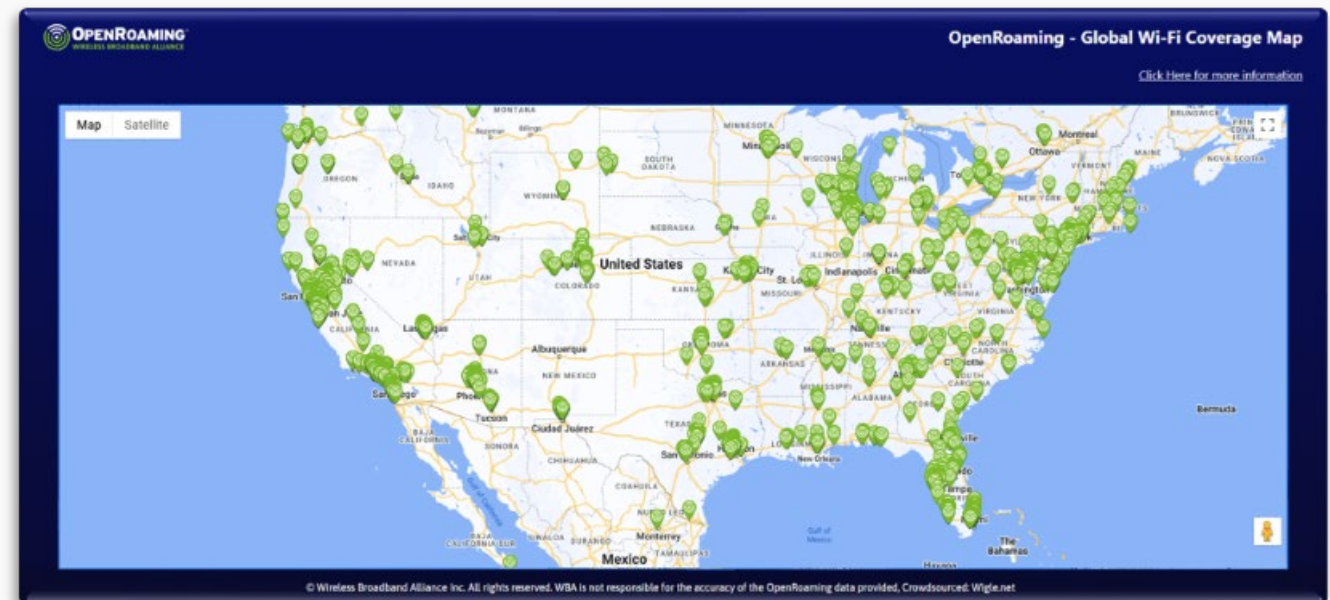
Improves User Experience

Increases Devices Connected

Increases Traffic

Reduces Customer Support Needs

SIM and Non-SIM Devices



<https://wballiance.com/openroamingmaps/>

WGC AMERICAS
CONNECTING OUR DIGITAL WORLD
COFFEE BREAK & NETWORKING
BE BACK IN 30 MINUTES AT
11.40 AM CT



Bruno Tomás

CTO, Wireless Broadband Alliance

Session Moderator

Innovation Forum: Welcome Address



Tiago Rodrigues

President & CEO,
Wireless Broadband Alliance



Dr. Derek Peterson

CTO, Boingo Wireless;
Co-Chairman, Wireless Broadband
Alliance

WGC Americas Speakers



Tiago Rodrigues
Wireless Broadband Alliance



Dr. Derek Peterson
Boingo Wireless



James Allison
Capital Corridor



Matt MacPherson
Cisco



Dr. Necati Canpolat
Intel Corporation



Bruno Tomás
Wireless Broadband Alliance

Time	Presentation
11:40 AM (CT)	Innovation Forum: Welcome Address Tiago Rodrigues, President & CEO, Wireless Broadband Alliance. Dr. Derek Peterson, CTO, Boingo Wireless; Co-Chairman, Wireless Broadband Alliance.
11:50 AM (CT)	Setting the Scene on Wireless Connectivity in Passenger Transport – Expectation vs. Reality Jim Allison, Manager of Planning, Capital Corridor Joint Powers Authority.
12:05 PM (CT)	Panel: CTO Leadership Panel on Future Wireless Trends 2024-2026 Dr. Derek Peterson, CTO, Boingo Wireless; Co-Chairman, Wireless Broadband Alliance. Matt MacPherson, Wireless CTO, Cisco. Dr. Necati Canpolat, Senior Staff - Wireless Systems Architect, Intel Corporation. Jim Allison, Manager of Planning, Capital Corridor Joint Powers Authority.
12:35 PM (CT)	Key Points to Take Forward Bruno Tomás, CTO, Wireless Broadband Alliance.
12:40 PM (CT)	LUNCH & NETWORKING



Jim Allison

Manager of Planning, Capital Corridor Joint Powers Authority.

Setting the Scene on Wireless Connectivity in Passenger Transport – Expectation vs. Reality

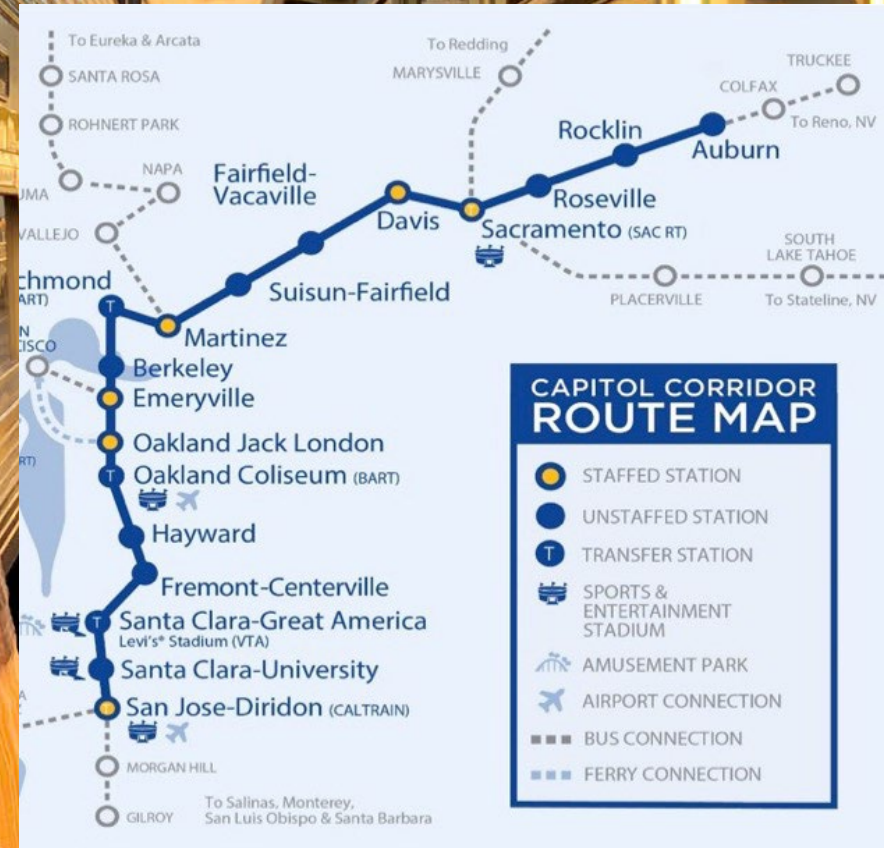
Setting the scene on wireless connectivity in passenger transport – Expectation vs. Reality

Jim Allison

Manager of Planning

Capitol Corridor Joint Powers Authority

jima@capitolcorridor.org



Capitol Corridor Destinations

5 Universities

- UC Berkeley
- UC Davis
- Cal State Sacramento
- Santa Clara University
- San Jose State

Innovation

Silicon Valley: Most vibrant economic center.

Tourism

San Francisco: A top tourist destination in the world.

3 International Airports

- San Francisco (SFO)
- Oakland (OAK)
- San Jose (SJC)

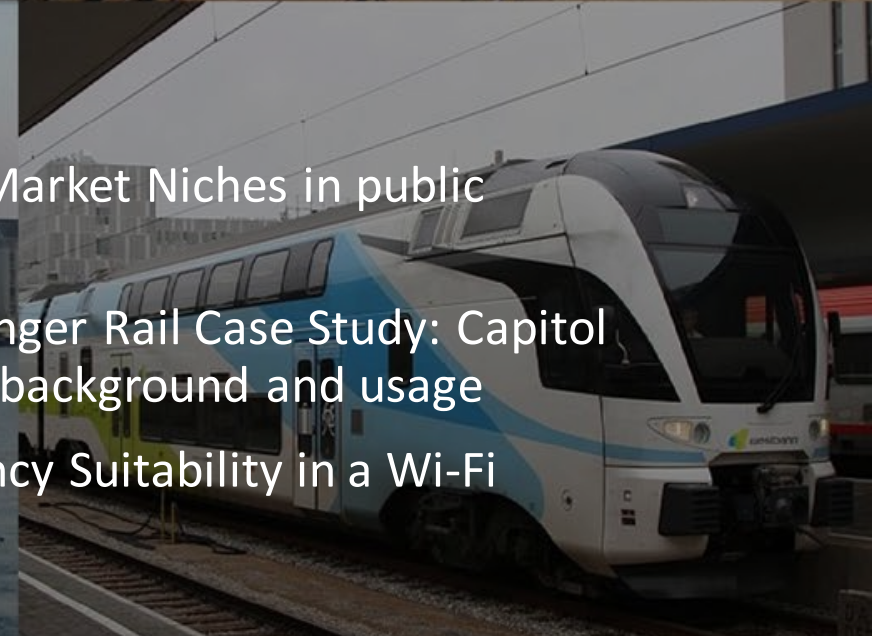
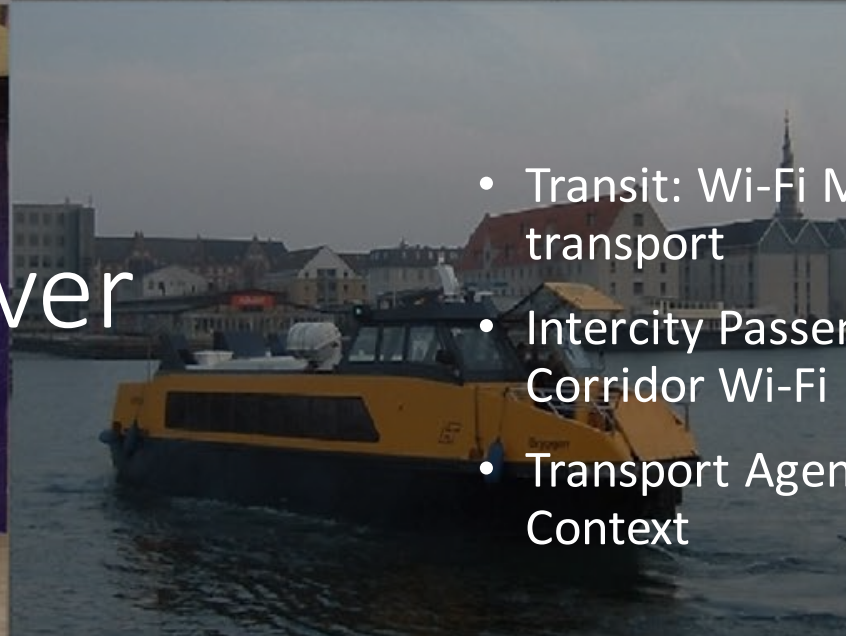
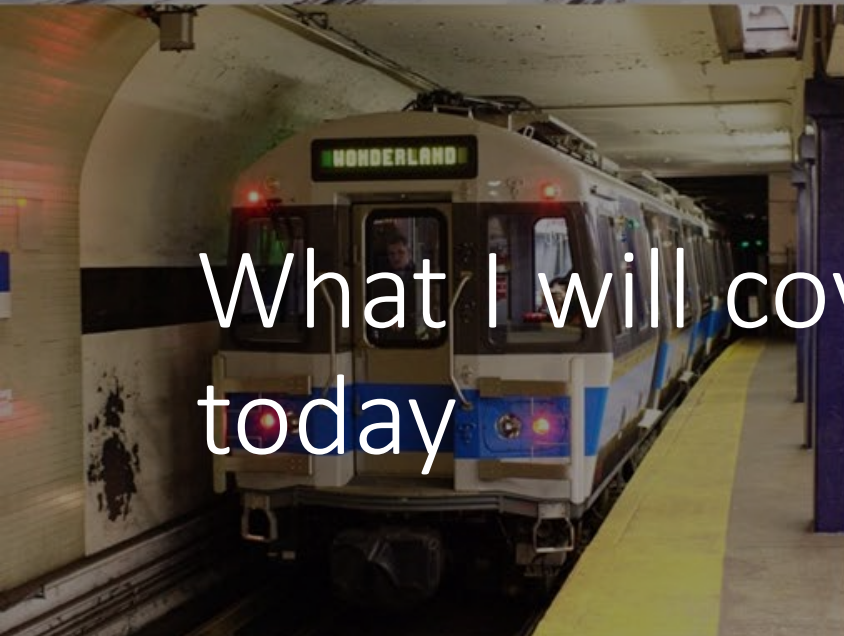
Sports and Entertainment

Levi's Stadium, Oakland Coliseum, Golden 1 Center and SAP Center

Financial Strength

Sacramento: Capitol of the world's 5th largest economy

- 170-mile route (~290 track miles)
 - 168 miles-UPRR
 - 2 miles-Caltrain (SF Peninsula)
- Northern California Megaregion
 - Sacramento / Sierra Foothills
 - Oakland / S.F. Bay Area
 - San Jose/Silicon Valley
- Only public transport serving entire Megaregion
- Rely on extensive connections to local transit and communities
- Operated by Amtrak under management of Capitol Corridor Joint Powers Authority (CCJPA)



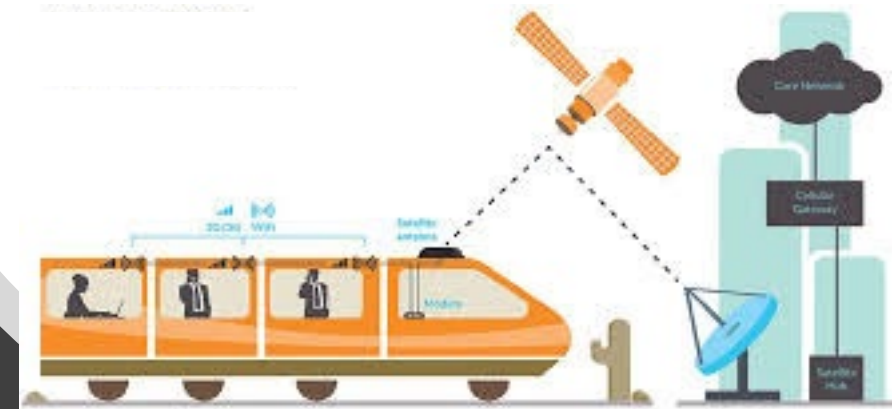
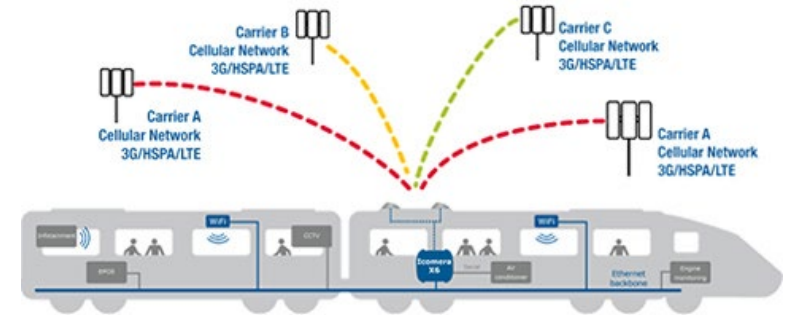
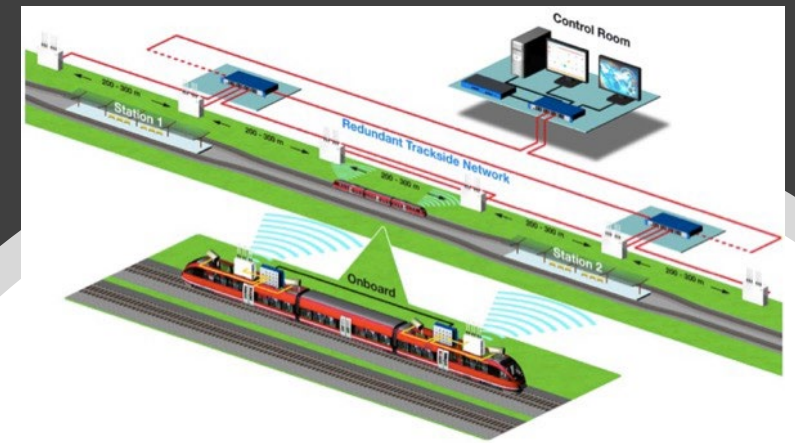
What I will cover today

- Transit: Wi-Fi Market Niches in public transport
- Intercity Passenger Rail Case Study: Capitol Corridor Wi-Fi background and usage
- Transport Agency Suitability in a Wi-Fi Context



Backhaul Shapes Wi-Fi on Transport Characteristics

- **For Heavy Rail:** Three options (including combinations) of the below:
 - Trackside
 - Cellular aggregation
 - Satellite – evolving
- **For Subway:** One option:
 - Trackside
- **For Light Rail/Streetcar:** Two options (including combinations) of the below :
 - Trackside
 - Cellular aggregation
- **For Bus:** Two options (including combinations) of the below:
 - Cellular
 - Satellite – just emerging





Cellular Backhaul

Defines how we structure our entire Wi-Fi service model to maximize the value of our limited supply



This....



not that



CCJPA Onboard Wi-Fi History

2003/2009

- Laying the groundwork
 - Business models
 - Technology options

2010/2011

- 1st Generation system established in partnership with Amtrak
 - Free model
 - Cellular backhaul

2018/2019

- Building upon lessons learned
 - Service model approach
 - Procurement that can respond to benefits of scale

Service Delivery Partnership

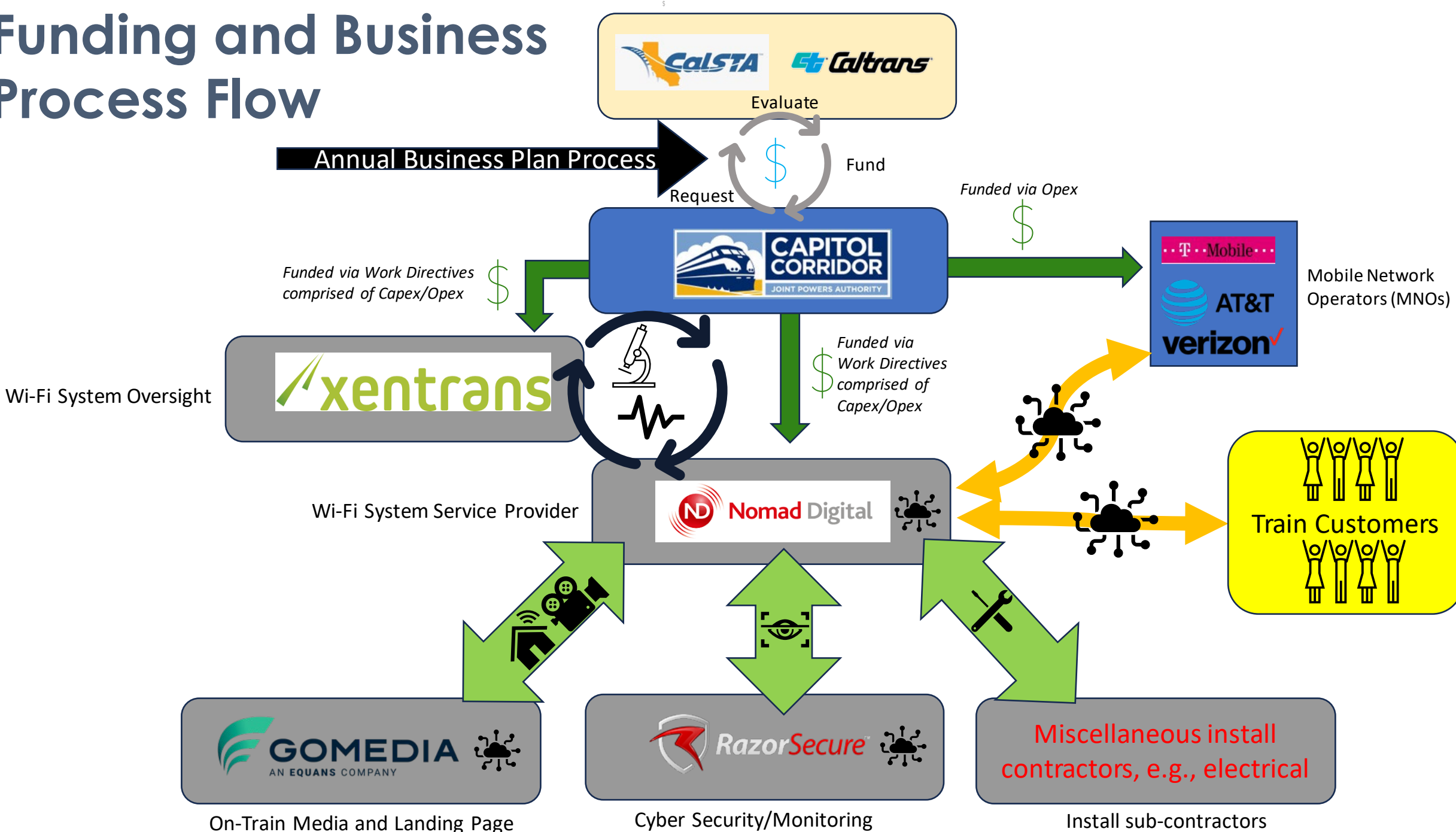
- Nomad Digital (lead service provider)
 - GoMedia – landing page/media content
 - Razor Secure – system security
- Xentrans (CCJPA administrative/program assistance)
 - Subject matter expertise supporting program and service delivery partnership
- Because of this procurement approach, there are several passenger rail agencies in Northern California using this approach



Backhaul and service performance enabled via:

- Aggregated Cellular Network Bandwidth:
 - 2 T-Mobile SIMS (unlimited data plan)
 - 3 AT&T SIMS (unlimited data plan)
 - 1 Verizon SIM (unlimited data plan to 25GB)
- Adjusted user throttling settings in early 2021 to allow more unfettered use
- Portal/landing page accepting T/Cs but also journey tracker and movie entertainment

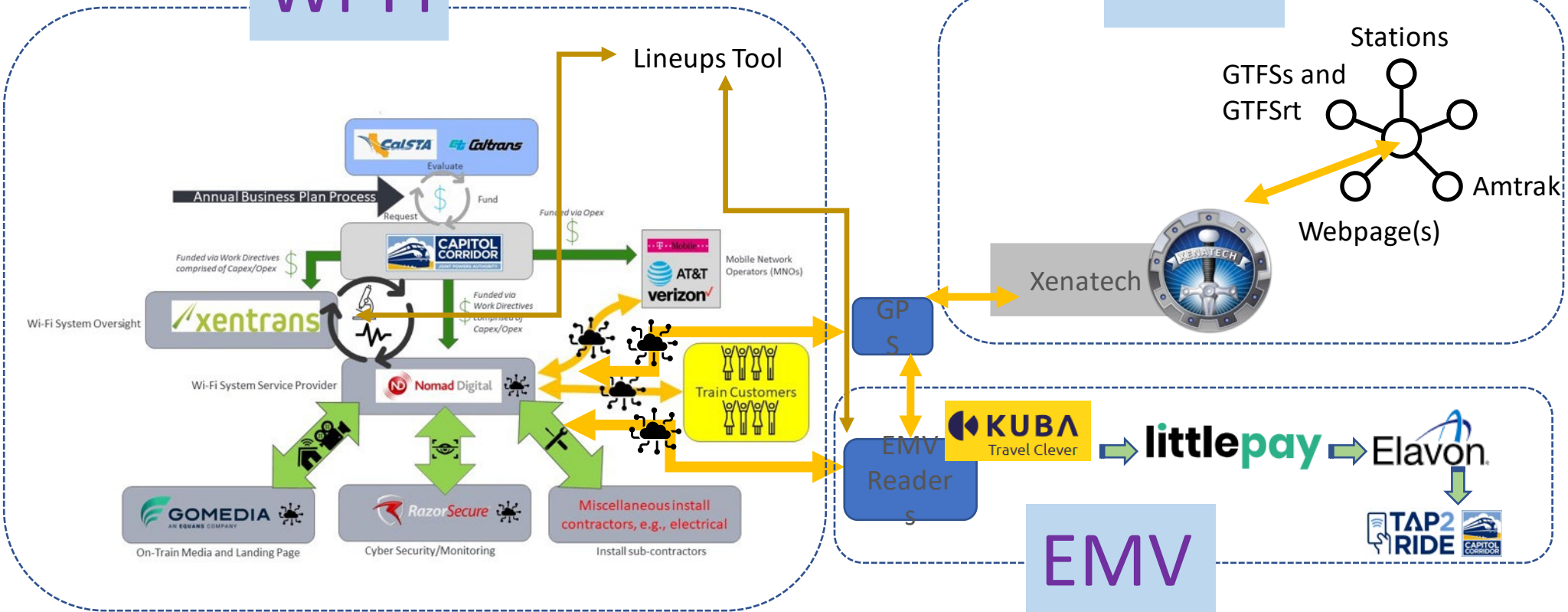
Funding and Business Process Flow



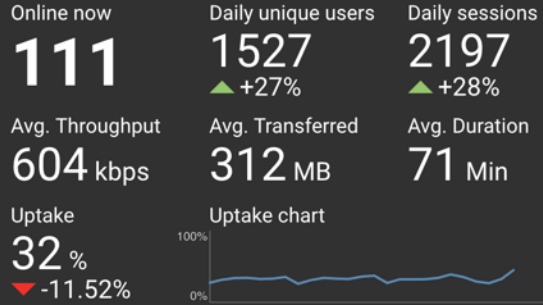
Wi-Fi

Amtrak Aries

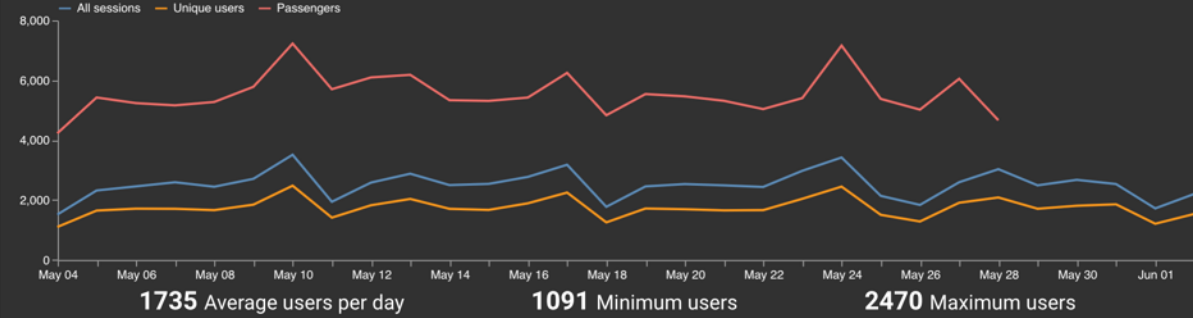
PIDS



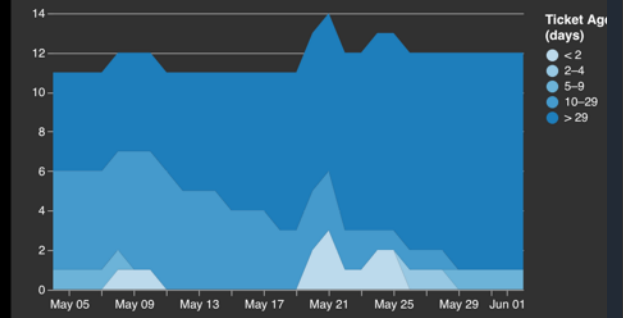
Key Wi-Fi Metrics



Wi-Fi Use

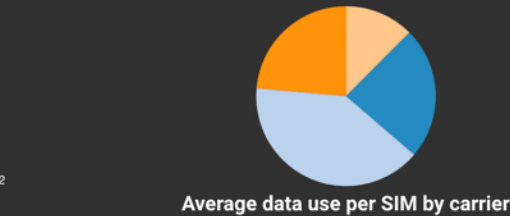
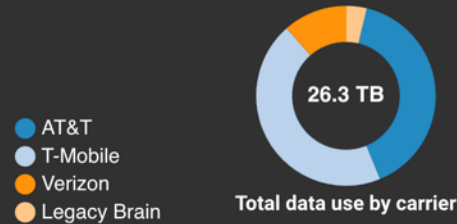
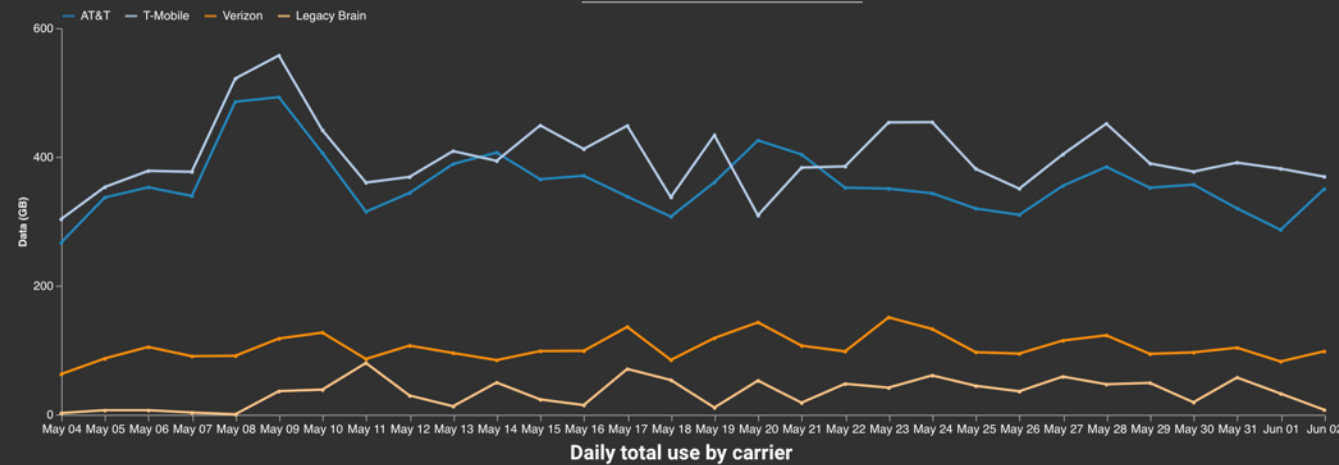


Open Tickets Include problem tickets

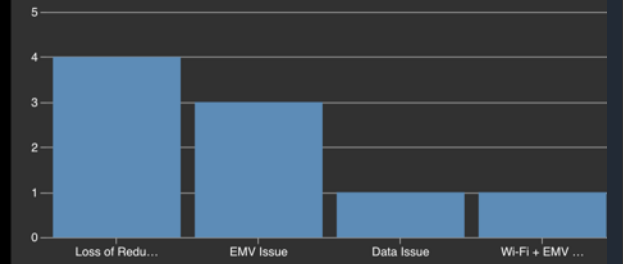


Cellular Use & Performance

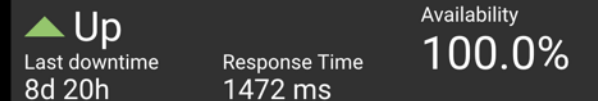
Aggregate Select secondary axis ▾



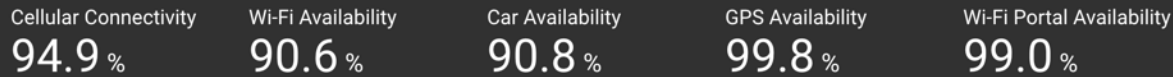
Top Ticket Causes



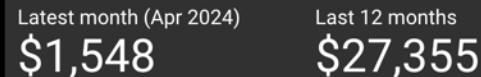
Service Desk Status



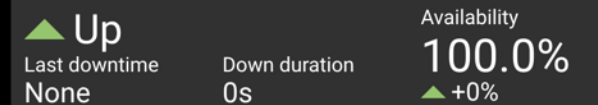
Key Performance Indicators



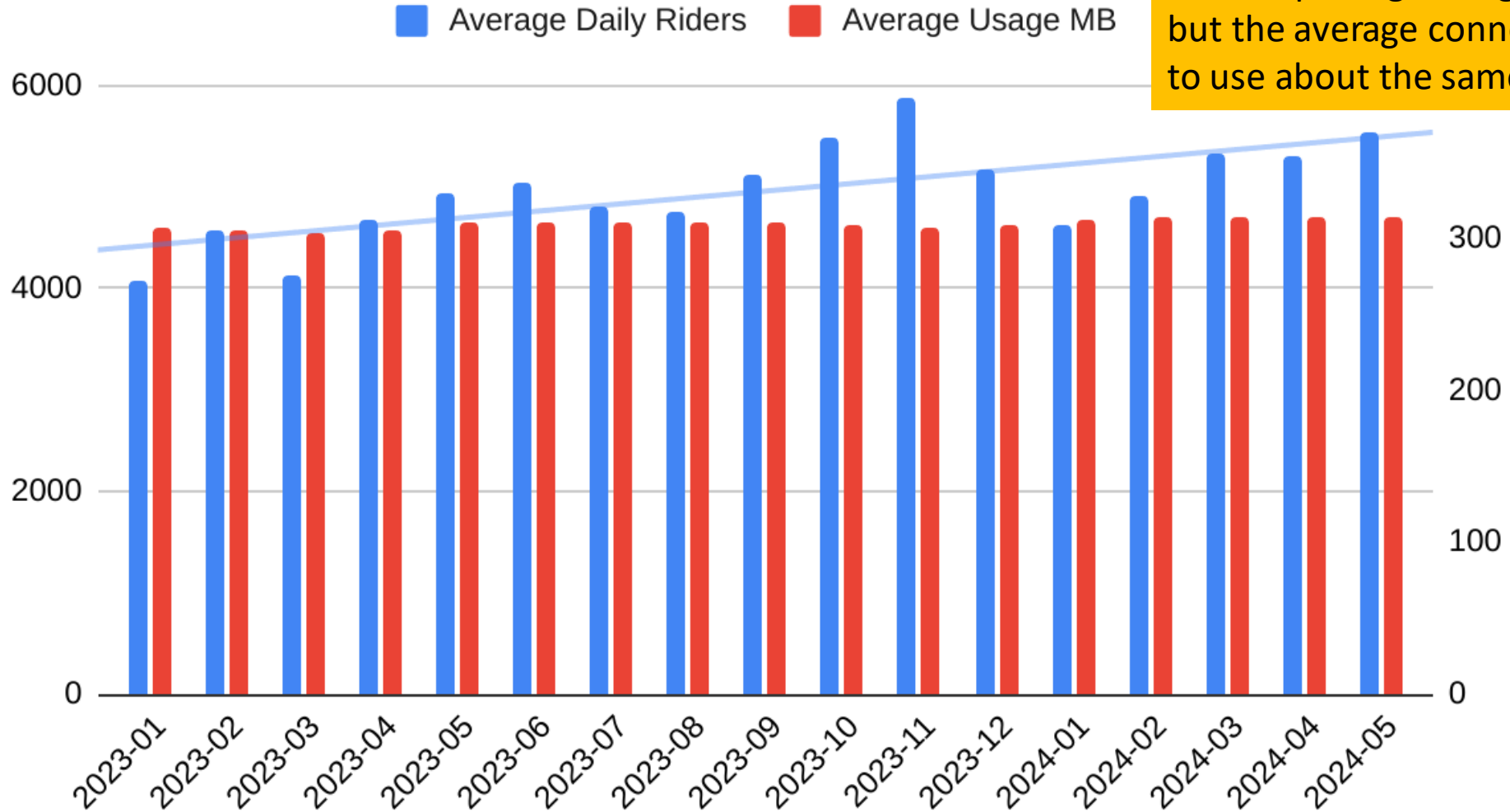
Service Credit



Wi-Fi CDC Status

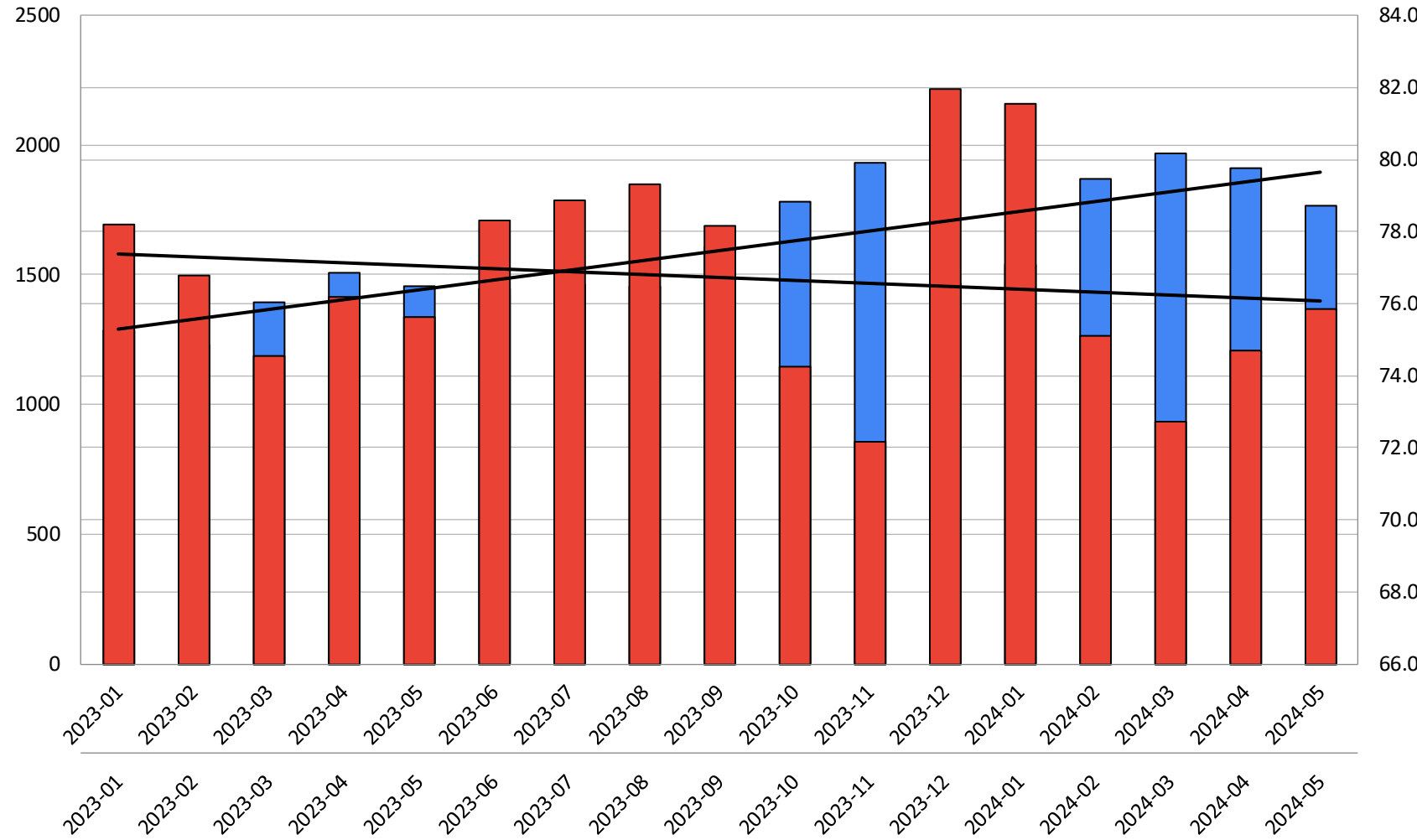


Usage MB vs Rider Count



Since Jan 2023, very stable (~300 MB used per connected trip) as ridership grows steadily, overall MB consumption growing at ridership rate but the average connected user seems to use about the same steady amount.

Average Throughput vs Wi-Fi User Count



Since Jan 2023, while connected ridership steadily increases, average throughput per connected users is trending slightly downward.

- Wi-Fi Users
- Average Throughput KBPS
- Linear (Wi-Fi Users)
- Linear (Average Throughput KBPS)

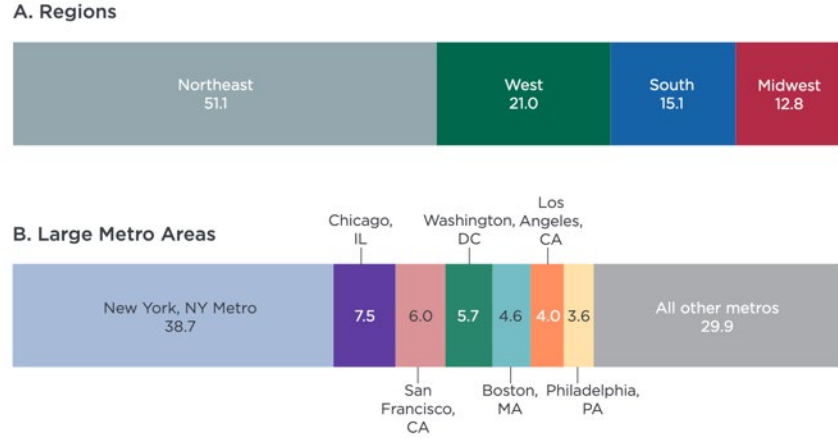


Commercial Wi-Fi Interest in Public Transport

- All public transport is not commercially interesting nor is the public transport agency caring about Wi-Fi
- Layers of filtering down are required to find suitable mutual interest
- Characteristics that help:
 - Long average travel time
 - Transport ownership of land assets
 - Rolling stock design/suitability for enjoying a Wi-Fi session
 - AND/OR, an operational need for Wi-Fi, such as video streaming

Figure 6.
Distribution of All Public Transportation Commuters Across Regions and Large Metro Areas: 2019

(A. Workers 16 years and over who commute by public transportation. B. Workers 16 years and over living in metro areas who commute by public transportation. Percent of all public transportation commuters)



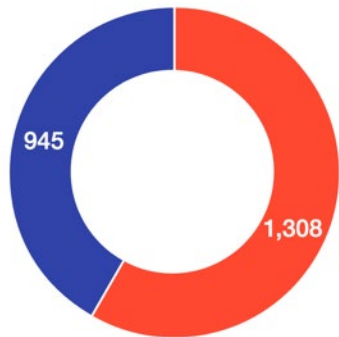
Notes: Each panel presents the total transit commuter population in that universe of workers and sums to 100. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see <www.census.gov/acs>. Source: U.S. Census Bureau, 2019 American Community Survey, 1-year estimates.

Public Transport: A Spectrum of characteristics related to WiFi use

- Form (type of transit vehicle or transit station) follows flows (mobility demand for transport across a market or between markets)
- Wi-Fi on transit for passenger use follows the mobility flow where time spent in work/entertainment mode is suitable for the form factor of the connected device in the form factor of the transit vehicle
 - Spacious Capitol Corridor with tables/seat trays for 2 hours vs crowded bus for 15 minutes
- Then assets – what does the transit agency own?
 - Right-of-way or sub-surface right-of-way
 - Sharing access to the passengers with some monetization agreement with an outside party

Figure 1: The Majority of Transit Systems are in Rural Areas

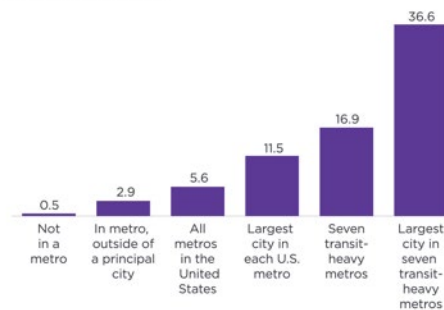
Number of NTD Reporting Transit Systems



Urbanized Areas Rural Areas

SOURCE: NATIONAL TRANSIT DATABASE

Figure 5.
Percent of Workers Commuting by Public Transportation Across Geographies: 2019
 (Workers 16 years and over)



Note: For information on confidentiality protection, sampling error, nonsampling error, and definitions, see <www.census.gov/acs>. Source: U.S. Census Bureau, 2019 American Community Survey, 1-year estimates.

Finding Wi-Fi/Cellular/Network/Radio Signal Employees in Public Transport

- When you consider the public transport industry there will be very few public transport employees that are natively being exposed WBA objectives
- Challenges start with understanding a business model, procurement, keeping upon industry trends, etc.
- Even Transit IT folks, usually will not be up on emerging standards or business partnerships in Wi-Fi associated tech. They will be VERY concerned about network security
- Only larger transit systems that own land assets and have larger ridership might have radio/IT/Wi-Fi savvy IT professionals – example, BART, works with American Tower & Boldyn Networks
 - Entities like BART will leverage assets potentially with companies like Boingo, using direct VPN via network prioritization for certain clients where BART will want a guaranteed minimum payment and revenue share.
- Most non-IT transit managers will have retail Wi-Fi knowledge and lean on their tech savvy staff if they have them





Public Transport and Wi-Fi For Smaller Agencies

- Smaller transit agencies will barely have an IT department and majority of bus transit agencies typically will not think about Wi-Fi for customers, even more so in rural areas.
- HOWEVER,...fare systems, vehicle location, and transit data reporting requirements are all applications where a hotspot backhauled by cellular or satellite (e.g., Starlink which is good in rural areas) benefit from a Wi-Fi system.
- Perhaps...the nature of the public transport journey is compelling enough to where the presence of Wi-Fi in transport is a valued amenity

What I covered today

- Transit: WiFi Market Niches in public transport
- Intercity Passenger Rail Case Study: Capitol Corridor Wi-Fi background and usage
- Transport Agency Suitability in a Wi-Fi Context



Jim Allison
Manager of Planning
Capitol Corridor Joint Powers Authority
jjima@capitolcorridor.org

CTO Leadership Panel on Future Wireless Trends 2024-2026



Dr. Derek Peterson

CTO, Boingo Wireless.
Co-Chairman, Wireless Broadband
Alliance.



Matt MacPherson

Wireless CTO,
Cisco.



Dr. Necati Canpolat

Senior Staff - Wireless Systems
Architect.
Intel Corporation.



Jim Allison

Manager of Planning
Capital Corridor Joint
Powers Authority.



Bruno Tomás

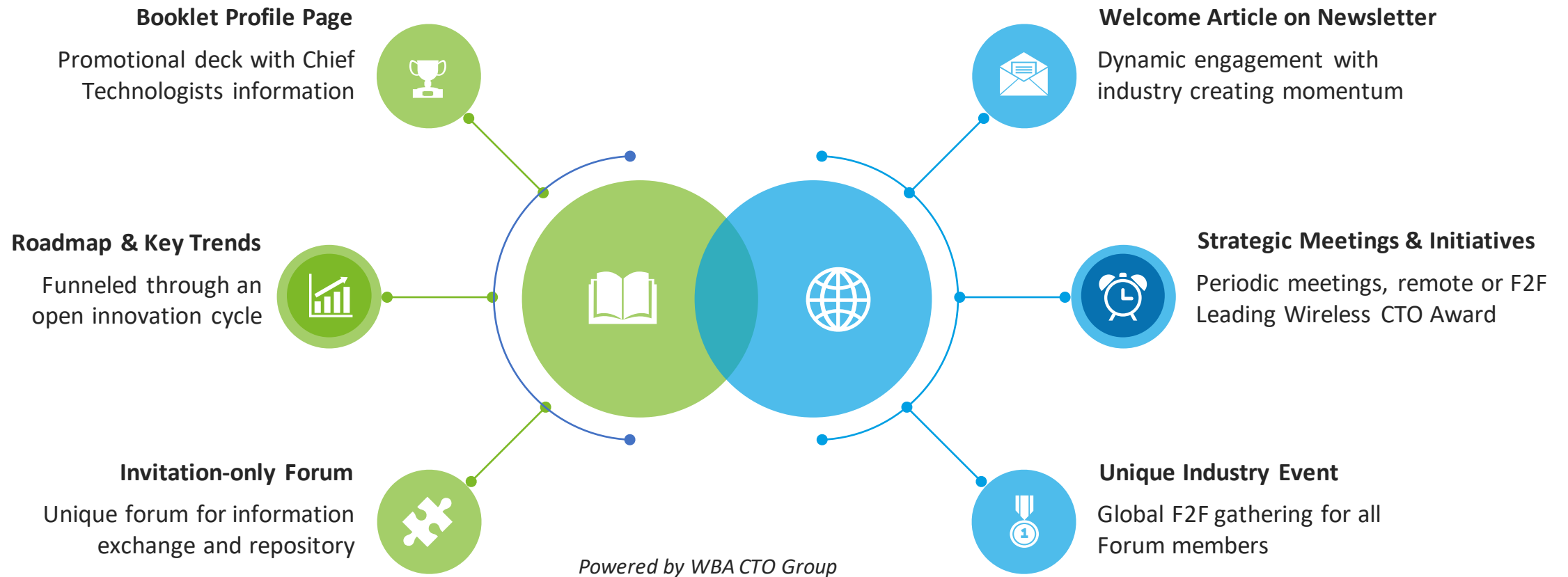
CTO, Wireless Broadband Alliance

Key Points to Take Forward

Innovation Forum Meeting

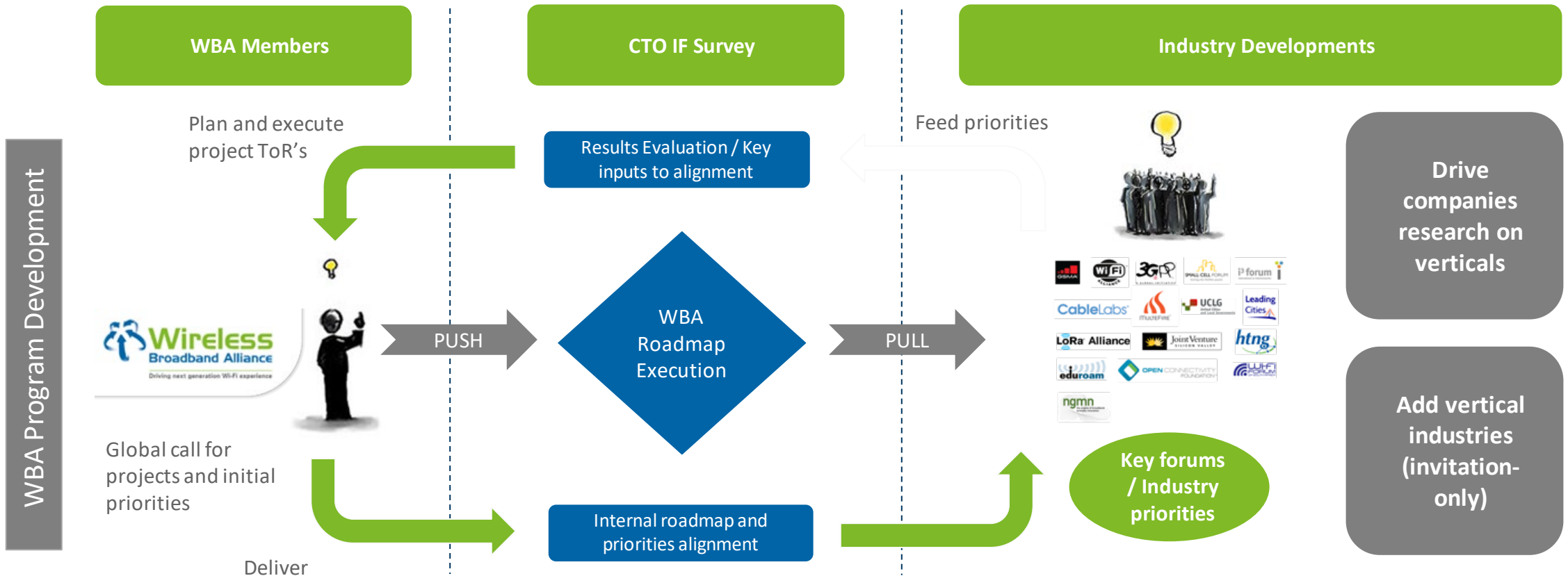
Powered by WBA CTO Group





Working Items: Roadmap & Key Trends

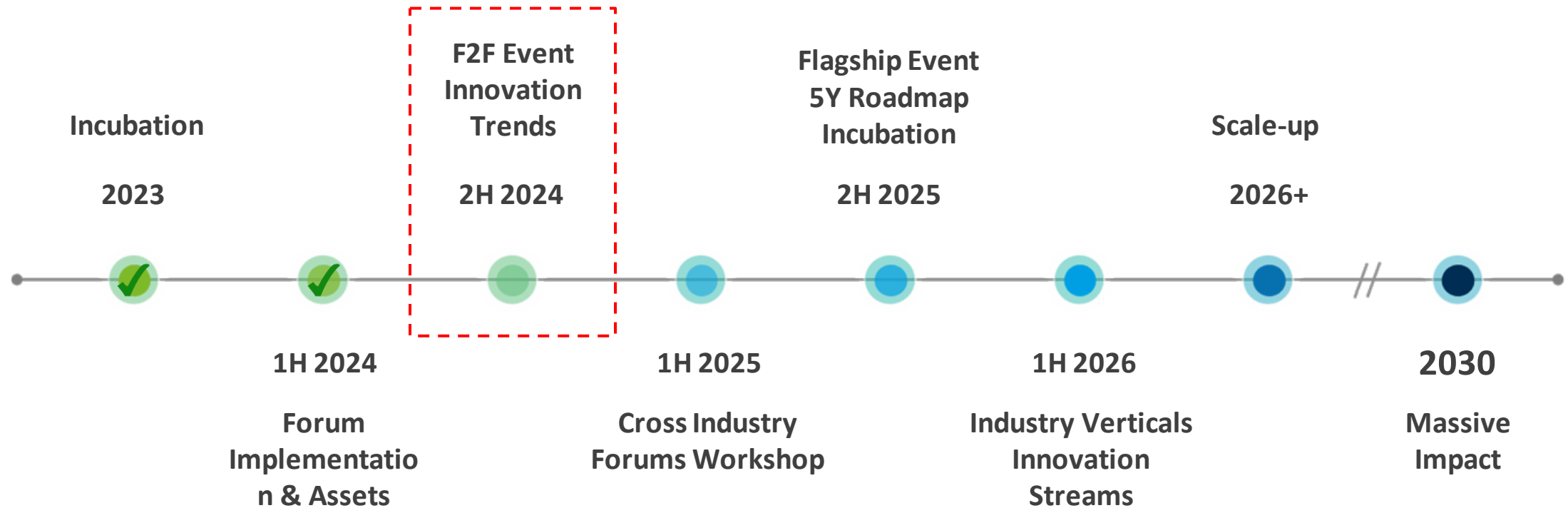
The group will be developing a technology roadmap aligned with industry key trends (CTO Survey)



Start with technology and market trends based on group assessment > summary / roadmap

Forum email: wba-ctog@connectedcommunity.org

Evolution Timeline / Next Steps



Next Steps - WBA will help you get on board the CTO Innovation Forum:

- 1) Participate on the technology roadmap effort – drive the industry forward
- 2) Attend the flagship Innovation Forum meeting planned activities for 2024

WGC AMERICAS

CONNECTING OUR DIGITAL WORLD

LUNCH BREAK & NETWORKING

BE BACK IN 1 HOUR & 20 MINUTES AT
2.00 PM CT



Jack Raynor

Meta, OpenLAN & OpenWiFi Group Chair

TIP OpenLAN Summit
Welcome Address

Time	Presentation
2:00 PM (CT)	TIP OpenLAN Summit Welcome Address Jack Raynor, Meta, OpenLAN & OpenWiFi Group Chair
2:10 PM (CT)	WorldVue & OpenWifi Robert Grosz, President & COO, WorldVue.
2:25 PM (CT)	NaaS for MSP's Tim Race, Director of Customer Success, Shasta Cloud
2:40 PM (CT)	OpenWiFi Platform, Example Deployments & Roadmap Huw Rees, VP Business Development, NetExperience.
2:55 PM (CT)	Panel – OpenLAN MSPs Moderator: Howard Buzick, Principal, Buzick Consulting. Dr. Derek Peterson, CTO, Boingo Wireless; Co-Chairman, Wireless Broadband Alliance Kevin Franzen, Principal Wi-Fi Architect, AT&T. Eran Dor, VP of Products, Pavlov Media.
3:40 PM (CT)	DAY 2 Closing Remarks Tiago Rodrigues, President & CEO, Wireless Broadband Alliance
4:00 PM (CT)	WGC Event Close



TIP OpenLAN Summit Welcome Address

Jack Raynor, Meta
OpenLAN & OpenWiFi Group Chair



Thank You!



OpenLAN Summit



1 Jack Raynor - Meta
Welcome Address

2 Robert Grosz – WorldVue
OpenWiFi Case Study

3 Tim Race – Shasta Cloud
Shasta Cloud & OLS

4 Huw Rees – NetExperience
NetExperience Solution
Overview

5 Dr. Derek Peterson, Eran Dor,
Kevin Franzen, Howard Buzick
MSP Alliance Roundtable

Thank You!





Robert Grosz

President & COO, WorldVue

WorldVue & OpenWiFi



WORLDVUE®

WorldVue & OpenWiFi

Robert Grosz
President & COO

About WorldVue



WorldVue Deploys Their First OpenWiFi Network



The Emory in Historic Downtown Plano, Texas.

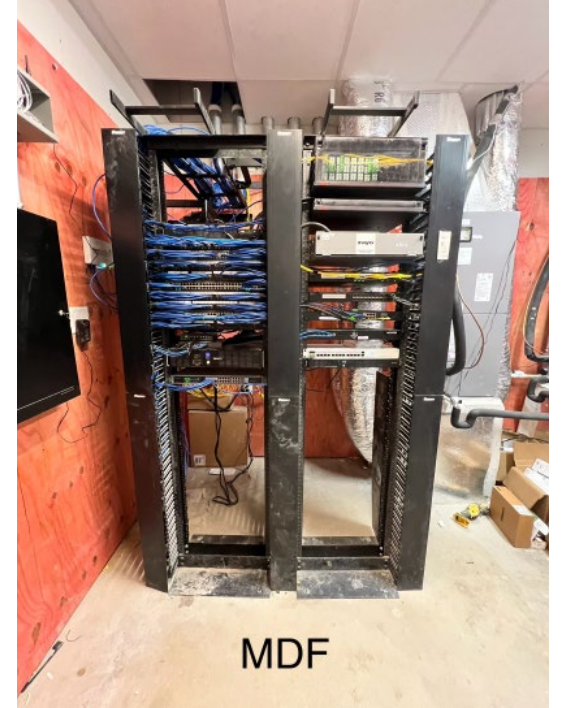
- TIP OpenWiFi-certified software and hardware,
- Edgecore's OpenWiFi-Ready Access Points (APs) and switches
- NetExperience's vendor-agnostic OpenWiFi Cloud Controller that support OpenRoaming™
- 270 units
- 299 Access Points (289 indoor and 10 outdoor)

Three challenges to operating Wi-Fi in an apartment community

1. Lots of RF Noise
2. Resident users want an “at home” experience, but are very transient.
3. Access Points are exposed to a lot of potential unintended vandalism and theft.

Our OpenWiFi Strategy

- Greater flexibility, seamless connectivity, and easier setup
- MDU space allows us to break free from vendor lock
- Develop deep integrations with mission-critical applications
- Offer customers the most flexibility and lowest total cost of ownership





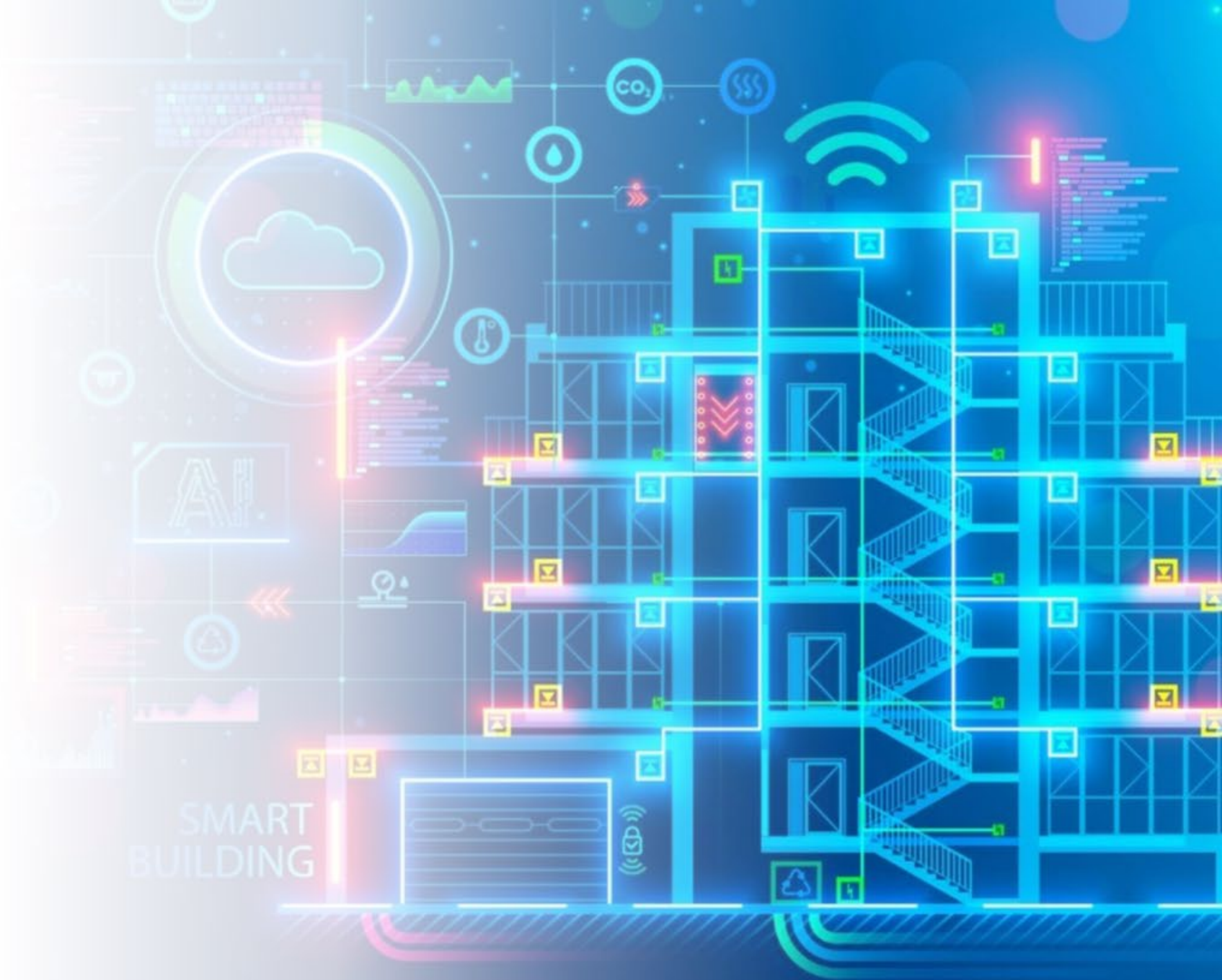
Tim Race

President & COO, Shasta Cloud.

NaaS for MSP's



NaaS for MSP's



Strong Roots in Wireless



Steve Martin

CEO, Co-Founder

- **Ruckus** GM/CTO (\$1.3B IPO, Brocade M&A)
- **Airspace** VP Eng (\$450M acquisition Cisco)



Ted Watson

VP Sales & BD

- **Ruckus** VP Sales Hospitality & MDU
- **Ubiquiti / Aerohive / HP** - VP Hospitality & MDU



Doron Givoni

CTO, Co-Founder

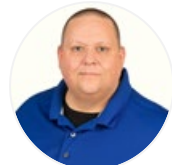
- **Meta** Founded OpenWiFi
- **ComAbility** Founder (**Ruckus** acquisition)



Erez Biton, PhD

VP Systems & AI

- **Parallel Wireless / Nokia** - VP Arch
- **Post PhD** - Cognitive Wireless



Paul White

VP Engineering

- **Plume** - VP Engineering (50M+ AP's)
- **Bivio / Livingston** - Engineering



Ron Gill

VP Strategic Partners

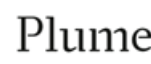
- **Celona / Aerohive / Cisco**
- **Ruckus** - VP Americas



Tim Race

Dir. Customer Success

- **Extreme / Ruckus** – SE Manager
- **Ubiquiti / Aerohive** – Principal SE



NaaS platform for MSP's

Shasta NaaS

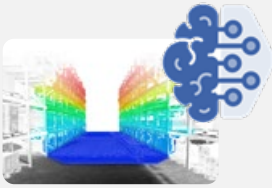
MSP Partners

10M's of large buildings



Monthly Subscription
All inclusive, per radio

Plan, Deploy, NoOps
Shasta Cloud Lifecycle Mgmt.



Reduce labor
Novel Technology



Reduce cost
Factory Direct HW



Modernized supply chain
All Digital, Direct to MSP's

Shasta NaaS For Partners

Tech Stack



Cloud service



Network operating system



Whitebox WiFi



Whitebox Switches

Self-Service Digital Business



Support



Hardware financing



Logistics



Evergreen Hardware

All Inclusive Subscription

\$x / radio or switch / month



OpenLAN Switching (OLS)



**Behind every great
OpenWiFi AP... You
need a great PoE
switch**

OpenLAN Switching (OLS)



OpenLAN Switching Goals:

- Enable diverse, open & competitive alternatives for campus switching
- Replicate OpenWiFi attributes
 - Diverse Whitebox lineup (8-48 ports)
 - Open interfaces & open-source SW
 - Validated solution, hardened system
 - Zero touch deployment, secure by design
 - Unified cloud management for Wi-Fi & switching
- Solve for next major network upgrade
 - High power (PoE++), high throughput & low latency (WiFi 6E/7 ready)
 - Cloud managed, advanced L2 & L3 feature set



Yet Another Open Switching Project ????

Campus Access is VERY different from Datacenter

Environmental differences

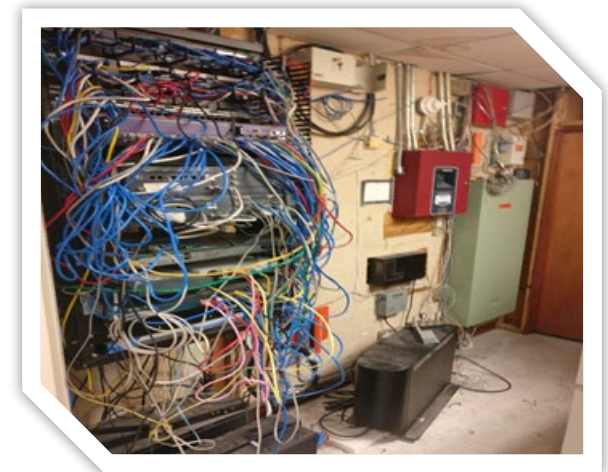
- Trusted vs untrusted networks
- Secure physical access vs unsecured
- Trained personnel vs untrained
- Onsite access vs remote access only

Practical enterprise requirements

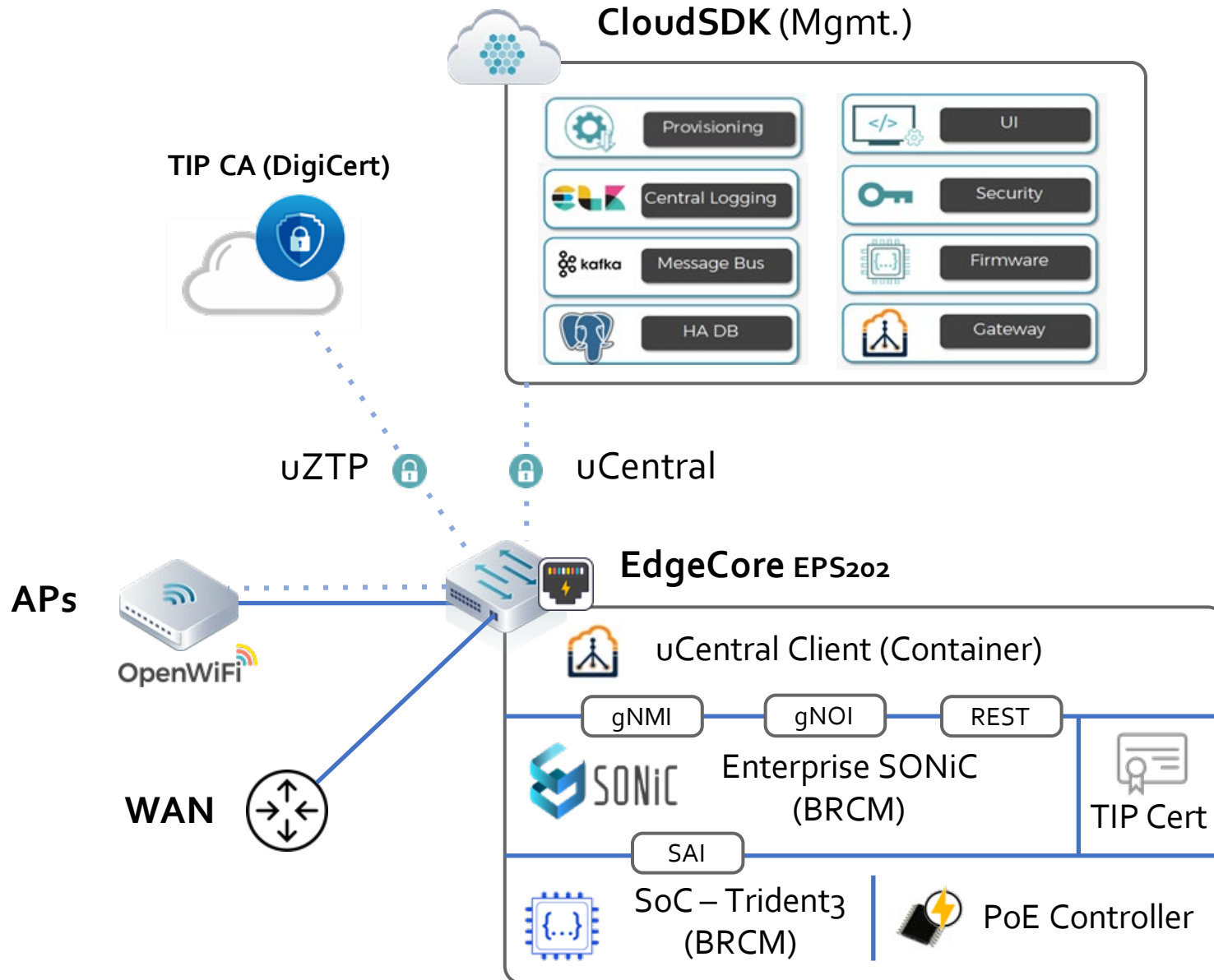
- No trusted OOB network access available
- ZTP over the public internet (inherently secure E2E)
- Unified management for Wi-Fi APs, switches, wired & wireless clients
- More cost-effective solutions \$200-2,000

Whitebox key modifications

- ZTP for drop shipment of factory units:
 - Plug-n-Play on front panel switches (plug uplink anywhere)
 - Certificate partition, factory default config
- Running uCentral Client as 3rd party container
- Run on lower end SoC with less RAM/Flash



OpenLAN Switching – SONiC Architecture



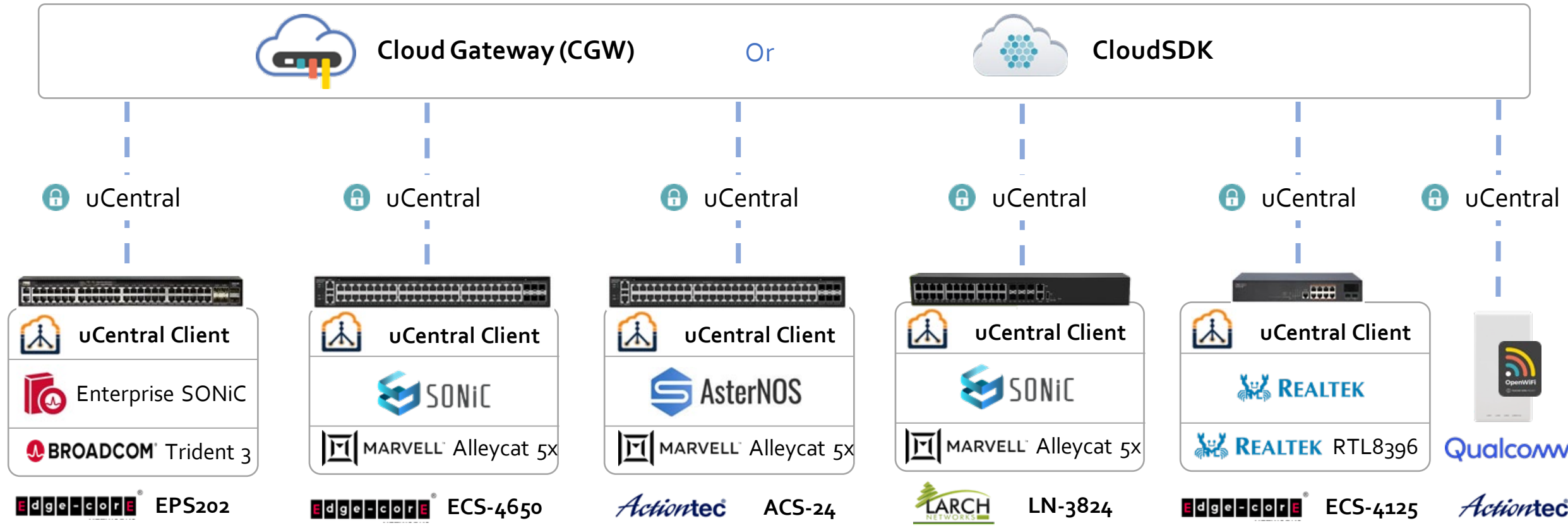
CloudSDK:

- Concurrent Mgmt. of AP & Switch
- Demonstrate for Switch:
 - ZTP using TIP Cert
 - Configuration push from Cloud
 - Events collection
 - SW update from Cloud
 - Telemetry streaming
 - Troubleshooting

Edgecore EPS202 (AS4630-54PE):

- Access ports - 1Gb / PoE++
- Uplinks 25Gb
- L2 features: LLDP, 802.1q, ...

Diverse HW/SoC/NOS – Unified Mgmt. Paradigm



15 Switch Hardware models today (+30 in flight)
 8/24/48 - 1/2.5/5G ports, PoE+/++ , 1/10/25/40/100G uplinks

OpenLAN Switch Project

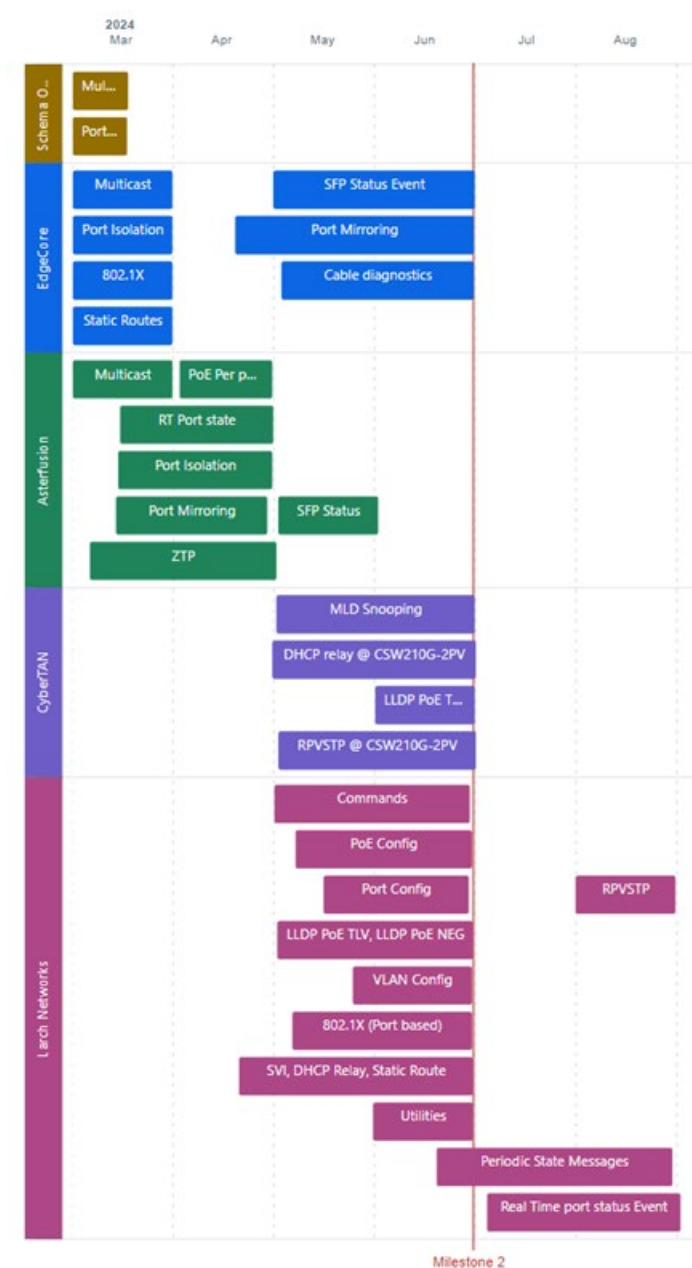
Community Meetings:

- **OLS developer call:** weekly - Wednesday 7am pacific
- **OLS group:** bi-weekly – wednesday 8am pacific

Open-Source

- Quarterly release cadence (aligned with OpenWiFi)
- Code repo's:
 - OLS schema ([Link](#)) & OLS Client ([Link](#)) (**Shasta**)
 - OLS-NOS ([Link](#)) – under development (**PLVision**)
 - Based on community SONiC
 - Similar concept to AP-NOS (common OS)
- E2E Test lab & automation verification – In-progress (**CandelaTech**)
- Feature compatibility matrix – ([Link](#))
- OLS JIRA tracking – [Link](#)

Rel 3.1 Q2 scope





Come Join OLS Community !!!



Huw Rees

VP Business Development

OpenWiFi platform, example
deployments & roadmap

OpenWiFi platform, example deployments & roadmap

WBA, June 2024

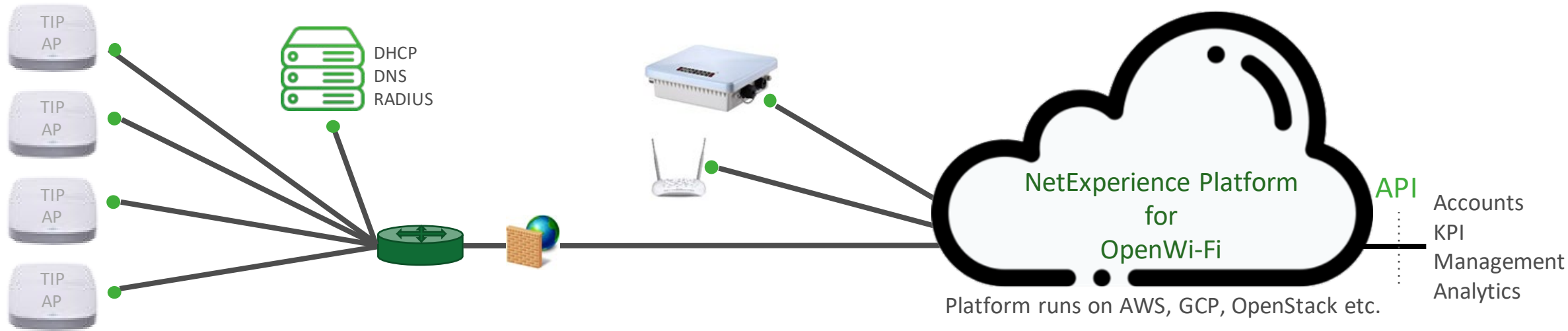
www.netexperience.com



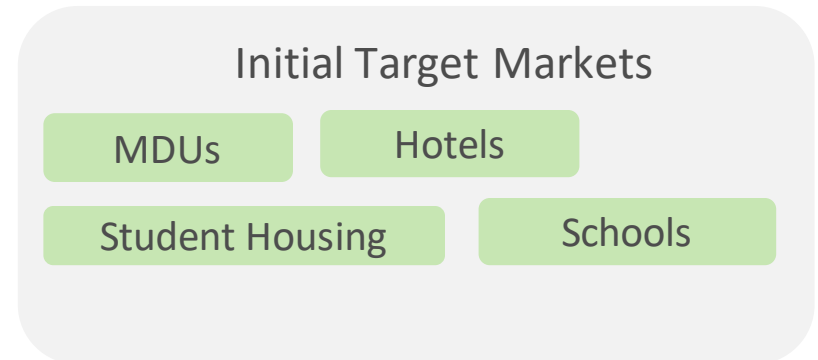
About NetExperience



- OpenWiFi Software company
 - Cloud-based management and controller platform
 - Runs on AWS, GCP and OpenStack
 - Access point embedded software expertise
 - Contributor / Maintainer of open source
- QA Labs
- Full solution (HW/SW) support – single throat to choke!
- Builds beyond open source in core areas
- Tested with multiple hardware vendors
- Software, support, integration



- ✓ One Platform multiple HW vendors
- ✓ One Platform multiple use cases
- ✓ Save >50% on hardware and software vs traditional vendors
- ✓ Start with SaaS, move to Licensed as volume builds
- ✓ Open Platform with APIs – backoffice / analytics
- ✓ Manage APs and **switches** via TIP OpenLAN Switch



WLAN Controller

- Auto Channel
- Auto Cell Size
- Client Steering
- Band Steering
- Device Profile
- Mesh
- QoS
- App Detection
- Per App handoff
- QoE
- Synthetic Client

Network and Workflow Management

- Location Hierarchy
- Configuration/Profiles
- Workflow (i.e move, floorplans, onboard)
- FW Management
- Dashboard
- QoE
- Alarms
- Inventory
- Analytics / History
- Troubleshooting

Business/Monetization

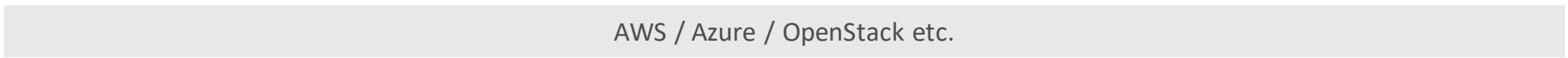
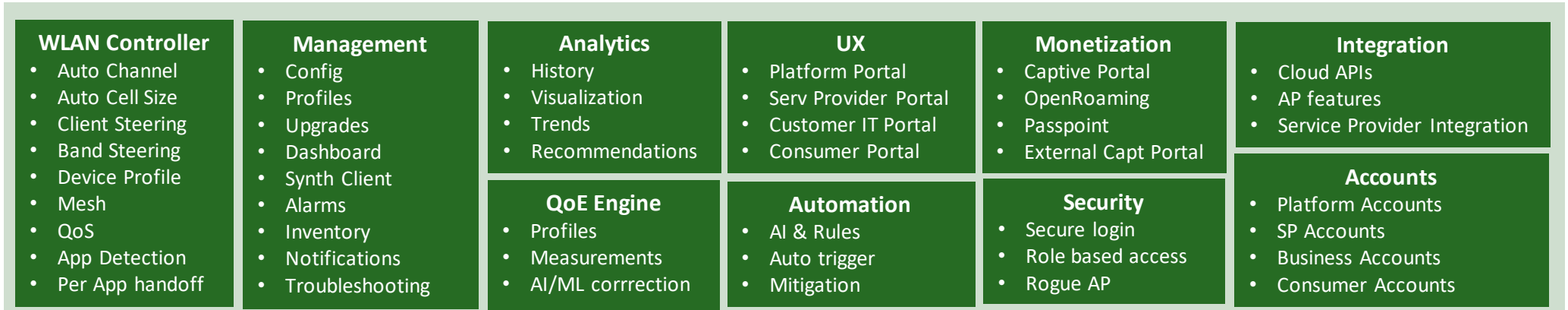
- Radius PSK for MDUs
- Location mPSK for MDUs
- External Captive Portal Interface with service policy
- OpenRoaming
- Passpoint
- APIs to CSP Backend

- Multitenant Architecture
- Containerized, Elastic

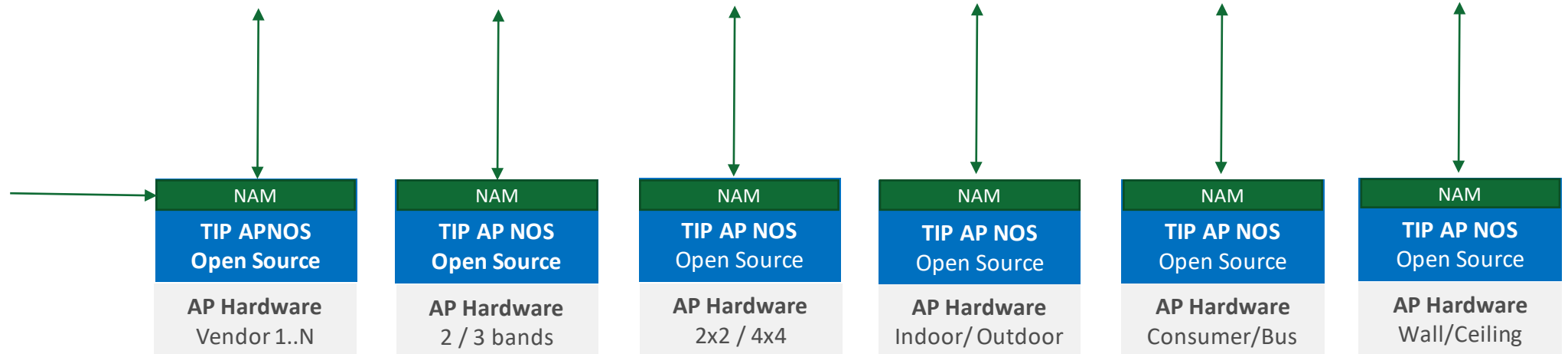
- Algorithms partitioned between AP and Cloud

- AP/Cloud support of custom use cases/protocols

NetExperience
Cloud
Applications



NetExperience
AP SW Modules



Vertical Markets

- Initial vertical markets
 - MDU & Student Housing – stressed business case
 - Hospitality – worldwide opportunities including US, Asia and Europe
 - Senior Living
 - Public WiFi, hotspots, indoor and outdoor mixed.
 - Education – colleges and universities in developing countries
- Other markets expressing interest
 - Enterprise
 - Residential



Types of Service Providers

- A variety of service provider types are adopting or testing OpenWiFi
 - WiFi focused service providers (ex. Boingo)
 - Developing country incumbents and competitive carriers
 - ISPs and Managed service providers looking to lower costs and improve the manageability of multiple customer deployments
 - Very large multi-faceted service providers worldwide, evaluating OpenWiFi for residential, SMB, MDU, Hospitality.

Examples

- Boingo
 - Required low cost solution with security of supply
 - Primarily replacement of existing, old APs in US barracks around the world.
 - Wanted 6GHz band as future proofing, deployed Actiontc WF196 6E APs
- YTL
 - National Malaysian operator
 - Own 100+ hotels, need replacement WiFi solutions
 - Also deploying in schools and public WiFi
- Pavlov Media
 - NetExperience's parent company
 - Operate independently
 - Over 10,000 APs deployed
- Very Large Indian Operator
 - Needed a solution that would scale to potentially millions of APs
- More than 20 other trial or full deployments with a growing pipeline of new opportunities



2Q2024	3Q2024	4Q2024
<ul style="list-style-type: none"> L2TP Metric reports preferences Secured Captive Portal AP Log upload Client flow tracking Expanded metrics graph 6GHz RRM Scalability enhancements Indoor Wi-Fi7 APs (EdgeCore, ActionTec, Cybertan, Sercomm) Expanded OLS switch portfolio support 	<ul style="list-style-type: none"> Improved client fingerprinting AP Ethernet MAB IPV6 enhancements AFC interface for SP Wi-Fi6E and Wi-Fi7 Automated edge configuration WLAN+LAN QoS profiles for L1/L2/L3 MDU Optimized RRM cell size algo Scalability enhancements Outdoor Wi-Fi7 (SP) Expanded OLS switch portfolio support 	<ul style="list-style-type: none"> QoE Analytics Residential Gateway Phase-1 (PON) GDPR compliance Scalability enhancements IoT radio and application support AI/ML Anomaly detection Scalability enhancements



2024 now includes full switch management from the same NetExperience portal



The logo for NetExperience features a stylized white icon on the left, composed of several overlapping, curved segments that resemble a signal or a fan. To the right of this icon, the word "NetExperience" is written in a bold, white, sans-serif font. The background is a solid green color with several large, overlapping, semi-transparent green shapes that create a layered, abstract effect.

NetExperience



Howard Buzick

Principal, Buzick Consulting, LLC.

Panel Moderator



Dr. Derek Peterson

CTO, Boingo Wireless;
Co-Chairman, Wireless
Broadband Alliance.



Kevin Franzen

Principal Wi-Fi Architect, AT&T Labs.



Eran Dor

Vp of Products.
Pavlov Media.



Tiago Rodrigues

President & CEO, Wireless Broadband Alliance.

Day 2 – Closing Remarks

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OpenRoaming™ Broker



OpenRoaming™ Hardware Partner



Event Partner









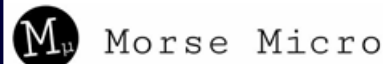

Perfecting Broadband
















TELECOM INFRA PROJECT









Q1 2024

Q2 2024

Q4 2024



Wireless Global Congress – APAC

THE LALIT NEW DELHI, DELHI, INDIA.

30 Jan – Open Congress

31 Jan – 01 Feb – Working Sessions
(Strictly Members Only)



Wireless Global Congress – Americas

DALLAS MARRIOTT DOWNTOWN, USA

10 – 11 Jun – Working Sessions
(Strictly Members Only)

12 – 13 Jun – Working Sessions



Wireless Global Congress – EMEA

MERCURE PARIS PORTE DE VERSAILLES,
FRANCE

07 – 08 Oct – Working Sessions
(Strictly Members Only)

09 – 10 Oct – Open Congress

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Contact WBA Events team – events@wballiance.com

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REGISTER NOW FOR WGC EMEA 2024

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