WIRELESS GLOBAL CONGRESS
WIRELESS BROADBAND ALLIANCE

25 – 27 JAN 2022

WGC ASIA PAC

WI-FI REVOLUTION: DRIVING DIGITAL GROWTH

Swissôtel Al Murooj, Dubai, UAE

Join us at this Wireless Global Congress Asia Pac featuring top executives from the Wi-Fi industry

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#WGCAsia| www.wirelessglobalcongress.com | #wifirevolution

WIRELESS GLOBAL CONGRESS
WIRELESS BROADBAND ALLIANCE

25 – 27 JAN 2022

WGC ASIA PAC

WI-FI REVOLUTION: DRIVING DIGITAL GROWTH

WELCOME & CONGRESS KICK OFF

By Tiago Rodrigues

CEO, Wireless Broadband Alliance

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WIRELESS GLOBAL CONGRESS
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WGC Asia Pac – Wi-Fi Revolution: Driving Digital Growth

Program Overview

09:00 GST (TUES); 21:00 PST (MON); 00:00 EST (TUES); 05:00 GMT (TUES); HONG KONG 13:00 (TUES)

Tuesday January 25	Wednesday January 26	Thursday January 27
WGC ASIA PAC OPEN CONFERENCE	WBA MEMBERS ONLY WORKING SESSIONS	WBA MEMBERS ONLY WORKING SESSIONS

WGC Asia Pac – Wi-Fi Revolution: Driving Digital Growth

Moderator:	Tiago Rodrigues, CEO - Wireless Broadband Alliance		
Time (Dubai)	Speaker	Company	Presentation title
9:00 am	Tiago Rodrigues	Wireless Broadband Alliance	Welcome & Congress Kick Off / Wi-Fi Revolution! Driving Digital Growth
9:15 am	Dr. Andrew Myles	Cisco	Future Wireless Now! Enterprise Everywhere
9:35 am	Dr. Carlos Cordeiro	Intel Corporation	Wi-Fi 7 – Connecting the dots for future innovation
10:00 am	Dr. Derek Peterson	Boingo Wireless	Spectrum Sharing, Wi-Fi and the 5G Future
10:15 am	Leon Hardwick	Handshakr	Enterprises are from Mars & SMBs are from Venus
10:40 am	COFFEE BREAK		
11:15 am	Irvind Ghai	onsemi	Fireside chat: "Wi-Fi State of the Union and the trends towards the metaverse"
11:35 am	Ziyad A AlDobaian	The Communications and Information Technology Commission (CITC), Saudi Arabia	Enabling 6 GHz Wi-Fi in Saudi Arabia
11:55 am	Sari Abu Raed	CommScope	The what, why, and how of AI-enabled converged networks
12:15 pm	David Coleman	Extreme Networks	6 GHz Wi-Fi: It's not just a technology update, it's a spectrum update
12:35 pm	Kishore Raja	Boingo Wireless	WBA Programs: 6GHz Wi-Fi and the Road to Wi-Fi 7
1:00 pm	LUNCH		
2:30 pm	Ahmer Arsalan	STL	Building Future Proof Public WiFi with Offload Monetization and Open Roaming Capabilities
2:50 pm	Vasudevan Venkatakrishnan	CommScope	OpenRoaming: Enhancing the end user experience across public and Guest Wi-Fi
3:10 pm	Bruno Tomás	Wireless Broadband Alliance	Innovation & developments in Public and Guest Wi-Fi
3:30 pm	COFFEE BREAK		
3:50 pm	Donny Chong	Nexusguard	Stepping up capabilities with DDoS Protection for WISPs
4:10 pm	Josh Redmore	CableLabs	WBA Programs for Wi-Fi carrier opportunities
4:30 pm	Tiago Rodrigues	Wireless Broadband Alliance	WGC Open Congress Close

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WIRELESS BROADBAND ALLIANCE

WGC Asia Pac – Wi-Fi Revolution: Driving Digital Growth

JANUARY 25, 2022

Tiago Rodrigues

Wireless Broadband Alliance

Dr. Andrew Myles

Cisco

Dr. Carlos Cordeiro

Intel Corporation

Dr. Derek Peterson

Boingo Wireless

Leon Hardwick

Handshakr

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WIRELESS BROADBAND ALLIANCE

WGC Asia Pac – Wi-Fi Revolution: Driving Digital Growth

JANUARY 25, 2022

Next Gen Wi-Fi 2022 - 2025

Irvind Ghai

onsemi

Ziyad A AlDobaian

The Communications and Information Technology Commission (CITC), Saudi Arabia

Sari Abu Raed

CommScope

David Coleman

Extreme Networks

Kishore Raja

Boingo Wireless

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WGC Asia Pac – Wi-Fi Revolution: Driving Digital Growth

JANUARY 25, 2022

Public & Guest Wi-Fi with OpenRoaming

Ahmer Arsalan

STL

Vasudevan Venkatakrishnan

CommScope

Bruno Tomás

Wireless Broadband Alliance

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WGC Asia Pac – Wi-Fi Revolution: Driving Digital Growth

JANUARY 25, 2022

Wi-Fi Opportunities for Carriers 2022 - 2025

Donny Chong

Nexusguard

Josh Redmore

CableLabs

Tiago Rodrigues

Wireless Broadband Alliance

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Wi-Fi Revolution! Driving Digital Growth

TIAGO RODRIGUES

CEO

Wireless Broadband Alliance

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WIRELESS BROADBAND ALLIANCE

WI-FI REVOLUTION! DRIVING DIGITAL GROWTH

25TH JANUARY 2022

VERSION V1.0

RULES & LOGISTICS FOR THE DAY

- **Wearing of masks is mandatory at all time in public areas, including our event**
- **Social distancing is mandatory, please avoid any type of gathering**
- **Stay seated on the same place for the entire day of the event**
- **Coffee breaks are at the Lower function area outside this Ballroom**
- **Lunch is at the Pergolas Restaurant at the Lobby Level, seated lunch**
- **If you are feeling unwell, please approach any of the WBA Staff, self-tests are available**

The COVID-19 situation is constantly changing. As the UAE authorities may revise or implement additional measures at short notice, we advise you to contact your airline / the nearest UAE Embassy for up-to-date information.

LAST IN PERSON EVENT – Singapore 4th Feb 2020

WELCOME TO 2021 NEW MEMBERS

WIRELESS BROADBAND ALLIANCE

Wi-Fi BECOMING BETTER AND EASIER

Market adoption of Wi-Fi 6 & Wi-Fi 6E

58% said 6 Ghz plays a critical or very important role for their Wi-Fi strategy

High interest for Wi-Fi 6 & 6E
83% have deployed or planning to do it in 2022

OpenRoaming & Wi-Fi Roaming

Wi-Fi Security, Privacy and Identity management across verticals

Growth of OpenRoaming & Passpoint
40% already deployed or plan to deploy in 2021

Next Generation Wi-Fi & New Capabilities

56% are more confident about investing in Wi-Fi in the coming years

Wi-Fi Sensing, Mesh Wi-Fi, Wi-Fi 7, Wi-Fi HaLow, AFC, IoT, OpenWiFi

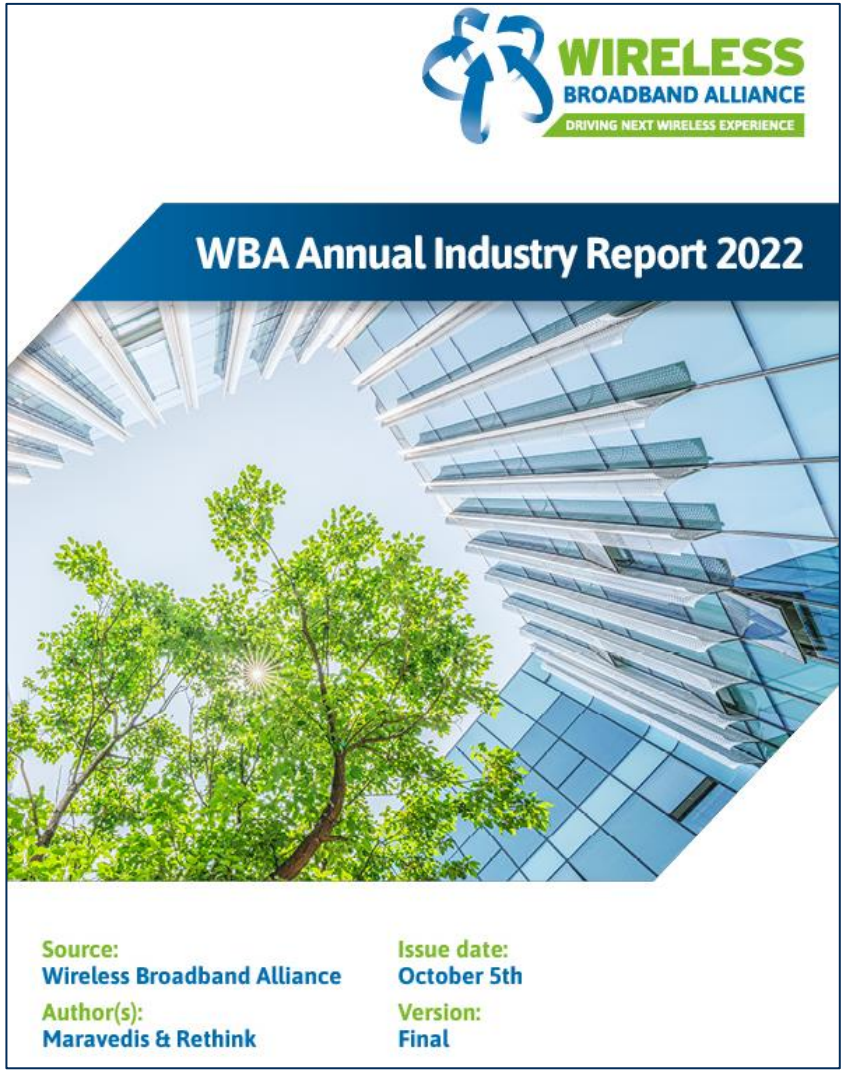
Cellular & Wi-Fi Convergence

Wi-Fi experience becoming more deterministic, QoS / QoE, OpenRAN, HetNet

98% aimed to implement both 5G and Wi-Fi 6, and 39% aimed for integration between the

WBA Annual Industry Report 2022

wballiance.com/resource/wba-annual-industry-report-2022



WIRELESS BROADBAND ALLIANCE

WBA's vision is to lead the development of

"Seamless and interoperable services experience on Wi-Fi within the global wireless ecosystem"

Our Priorities:

- **Massify Wi-Fi Interoperability & Roaming** with OpenRoaming-Passpoint
- **Accelerate Next Generation Wi-Fi Networks** with Wi-Fi 6, 6 GHz Multi-AP, QoS, Wi-Fi Sensing
- **Lead the Convergence & Coexistence of Wi-Fi / Cellular** Ecosystem

1. **Guidelines & Standards**
   Setting the scene, requirements and creating specifications
2. **Testing & Interoperability**
   Creating test plans to showcase the technology capabilities
3. **End-to-End Trials**
   Running field trials / proof the concept on real world environment
4. **Certification**
   Addressing gaps and helping the industry maximizing business opportunities

Established **in 2003**

150+ MEMBERSHIP **COMMUNITY** | PROJECTS & **PROGRAMS** | ANNUAL **EVENTS** | PROMOTION AND **GO-TO-MARKET** | THOUGHT LEADERSHIP & **MARKET RESEARCH**

WIRELESS GLOBAL CONGRESS · CARRIER WIRELESS Services Certification · OPENROAMING WIRELESS BROADBAND ALLIANCE · WORLD Wi-Fi Day · CONNECTED COMMUNITIES Forum · WBA INDUSTRY AWARDS

AREAS OF WORK

MARKET SEGMENTS

- Enterprise
- Home Broadband
- Smart Cities
- Service Providers

WORK AREAS

- 5G & Wi-Fi 6 Convergence
- IoT
- Next Generation Wi-Fi
- Wi-Fi Roaming
- Wi-Fi User Experience
- OpenRoaming
- Policy & Regulatory
- Marketing & Communication
- Connected Cities Forum
- Certification

Technologies

- Wi-Fi 6 / 6E / 7
- 5G-LTE
- Private Cellular
- LoRaWan
- Satellite/Fiber

TECHNICAL ACTIVITIES ROADMAP 2022

WBA WORK GROUPS & PROJECTS

5G Work Group	IoT Work Group	NextGen Work Group	Roaming Work Group	OpenRoaming™ Task Group	Testing & Interoperability Work Group
5G & Wi-Fi Convergence in Private 5G Networks	Wi-Fi 6/6E for Industrial IoT	Wi-Fi 6E & Wi-Fi 7	In-Flight Connectivity (Continuous Experience)	Federated Onboarding Service for OpenRoaming	Access Network QoS
	Smart Home 2.0	Operator Managed Wi-Fi Reference Architecture	Profiles & RCOIs Prioritization	OpenRoaming for Private LTE / 5G	E2E QoS Management Trial
		Rural Wi-Fi		OpenRoaming for IoT	New ANQP Elements Guidelines
					Wi-Fi Devices Identification

Policy & Regulatory Affairs Work Group	Market Work Group	WBA Certification Task Group	Innovation Forum - Led by CTO Group	Connected Communities Forum

Sign up ONLINE for WBA membership now! If you are a WBA Member, join directly via our EXTRANET

CALL FOR ACTION

If not a member, please consider to join WBA

Plan to celebrate World Wi-Fi Day, next June 20th

Future Wireless Now! Enterprise Everywhere

DR. ANDREW MYLES

MANAGER, ENTERPRISE NETWORKING STANDARDS

Cisco

Future Wireless Now!

Enterprise Everywhere

Network Experiences Wireless CTO Group

Andrew Myles, Manager, Enterprise Standards
Matt MacPherson, Wireless CTO

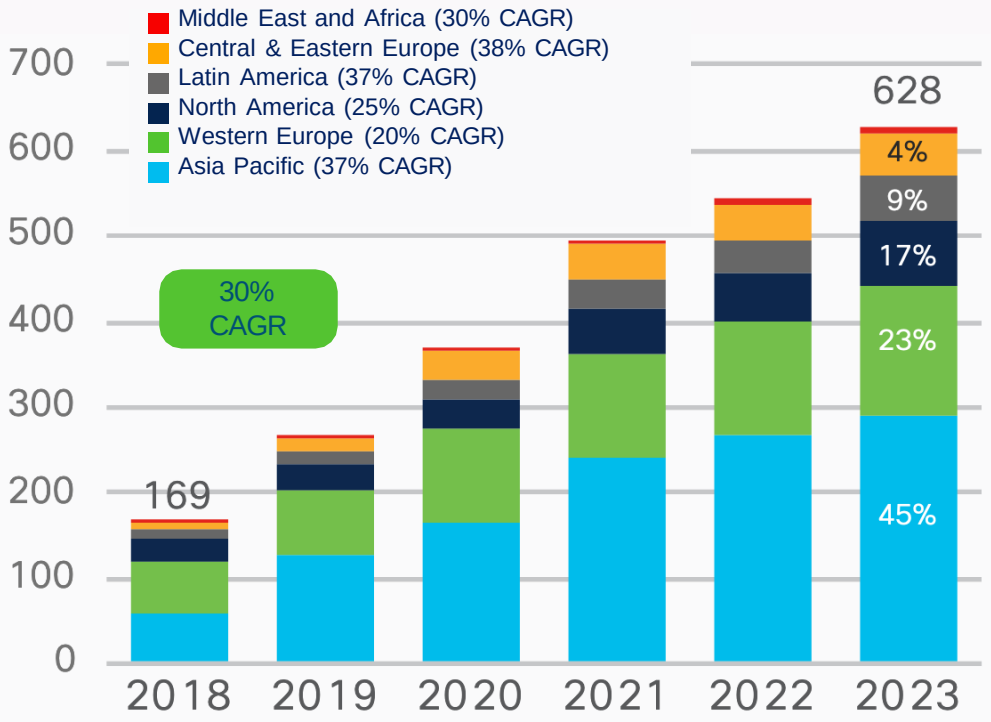
January 2022

Access Network Investment

…leveraging all access for NG Experience!

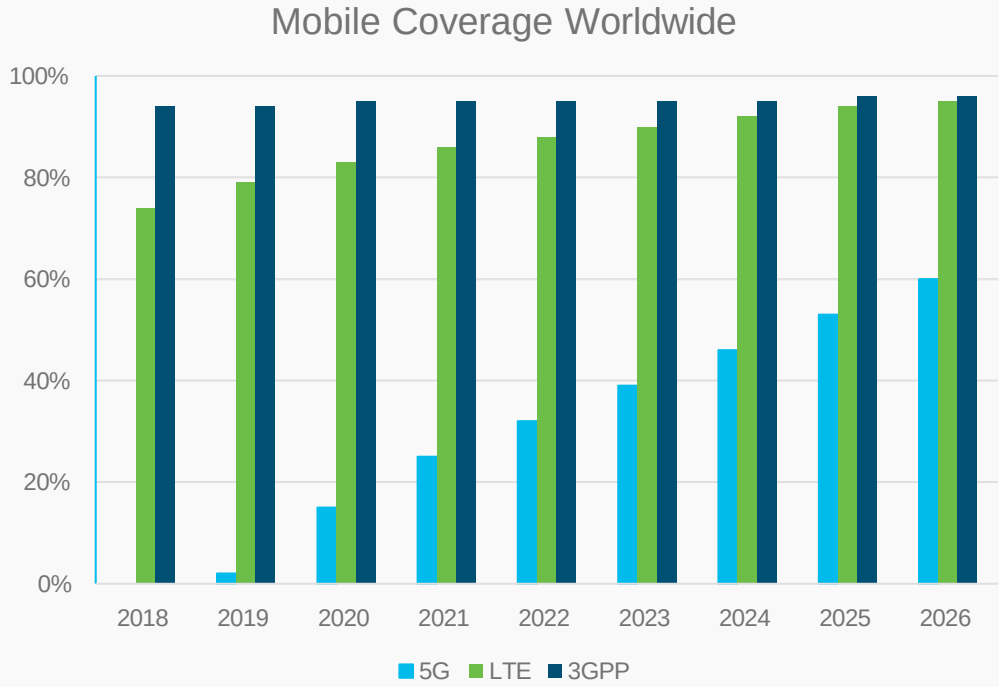
Multi-Access Resiliency/Reliability

Globally 2018 had169M public Wi-Fi hotspots Projection for 2023 is 628M



Globally, Wi-Fi 6 hotspots will grow 13-fold from 2020-2023

5G Cellular Coverage Worldwide



Global private 5G market size
USD 1,224.3 million in 2020
USD 14,284.96 million by 2028
39.7% CAGR

Total 5G Market
USD 80B 2028

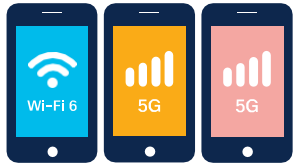
Source: Cisco Annual Internet Report (2018-2023)

Intelligent Access as a Service

Smart Convergence – Seamless roaming across enterprise and service provider based on context and policy

Access providers

Public
Ent. Guest



Identity providers

Service-based

Converged Access for People and Things

To use all stacks better, we need…

Frictionless Onboarding

OpenRoaming for all stacks
(assure access to all available paths)

Seamless Interworking

Policy-based path selection for
Loosely coupled Access Networks

Seamless Handover

Roaming between Wi-Fi (private)
and cellular (public)

Cloud Driven Mega-trends
The Enterprise dilemma

Enterprise apps migrating to Multi-Cloud environment

Data center

Multi-Cloud

N=260 Enterprises worldwide

83% of survey respondents say that **cloud** is very or extremely important to their organizations' **future strategy and growth**.

69% say that 60% or more of their organizations' **infrastructure and applications will be in the cloud** in two years.

Source Harvard Business Review: The State of Cloud-Driven Transformation Sponsored by Splunk

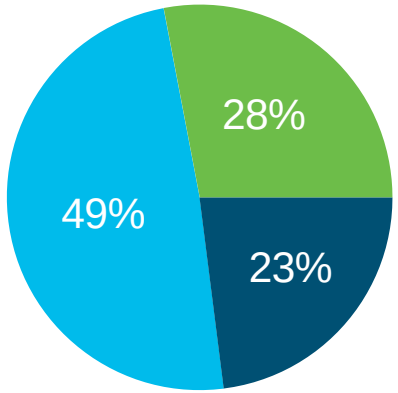
How does Zero-Trust Impact Enterprise Policy?

Workforce going Mobile

Branch/Campus

Mobile Access

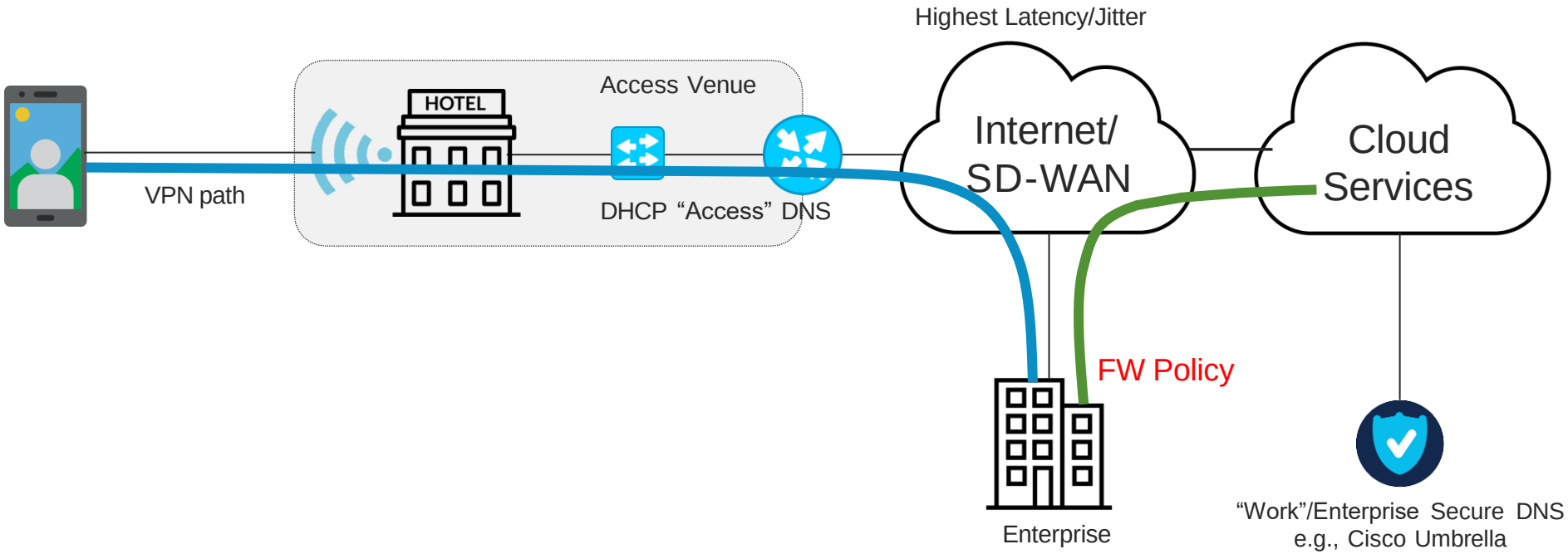
72%
US mobile workforce in 2019 (pre-COVID!)



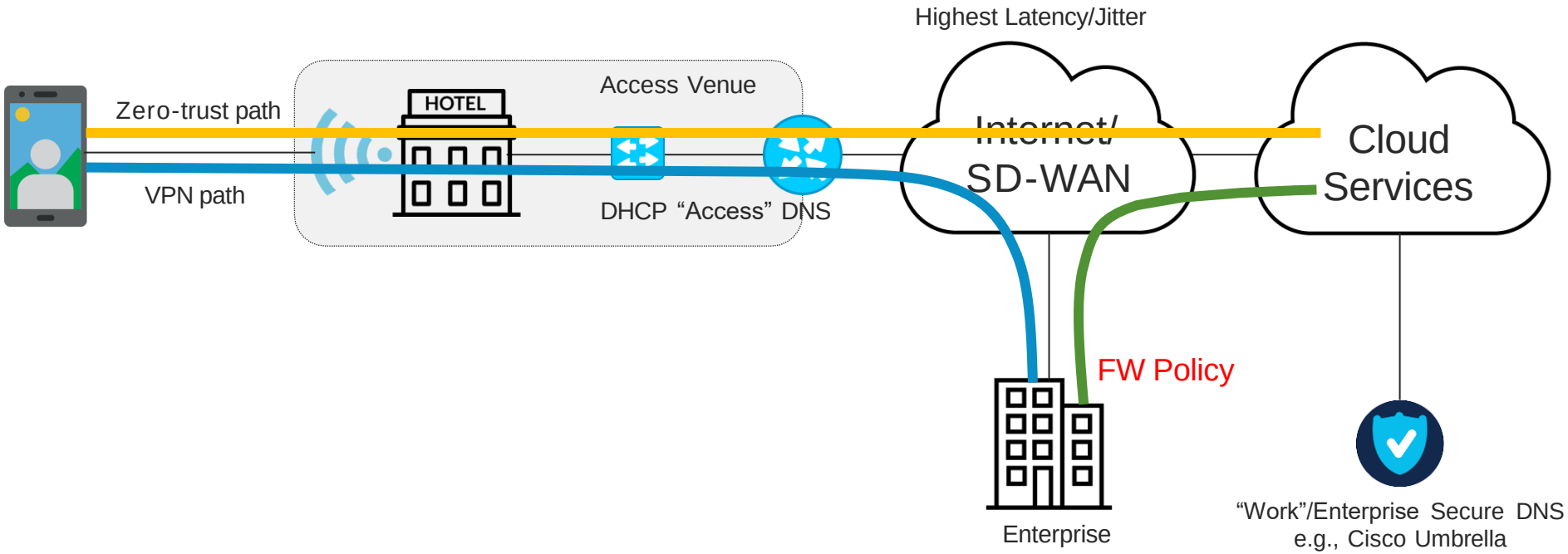
- Non-mobile Workforce
- Office-based Mobile Workforce
- Non-office based Mobile Workforce

VPN inserts you into enterprise policy from anywhere

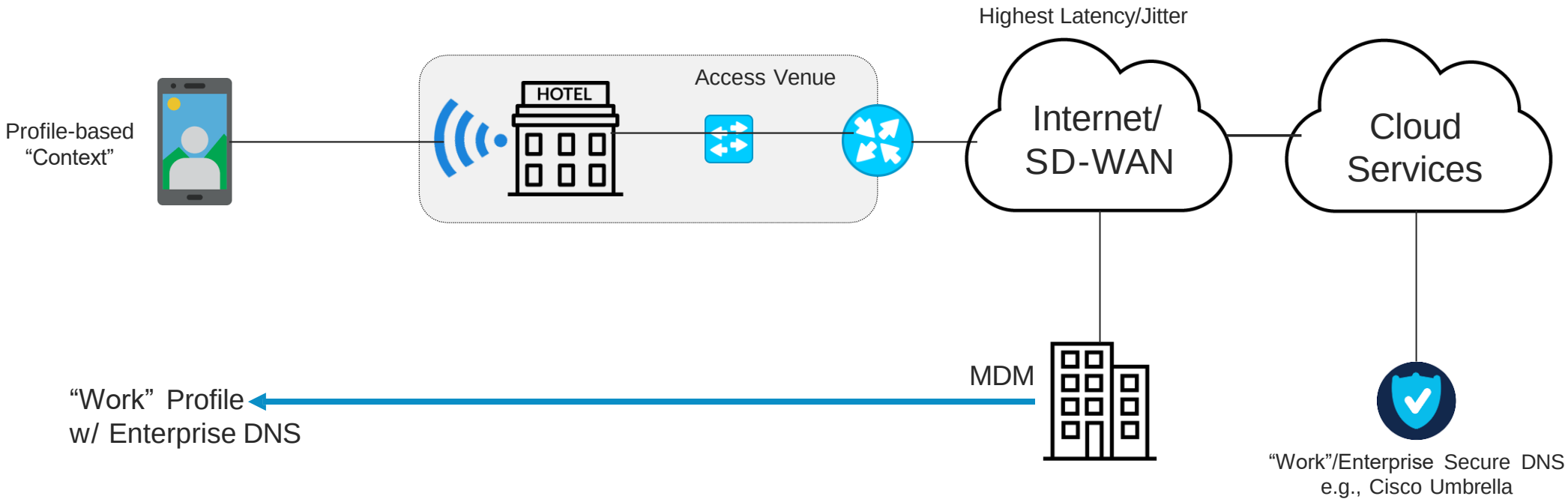
…but hairpins you through corporate



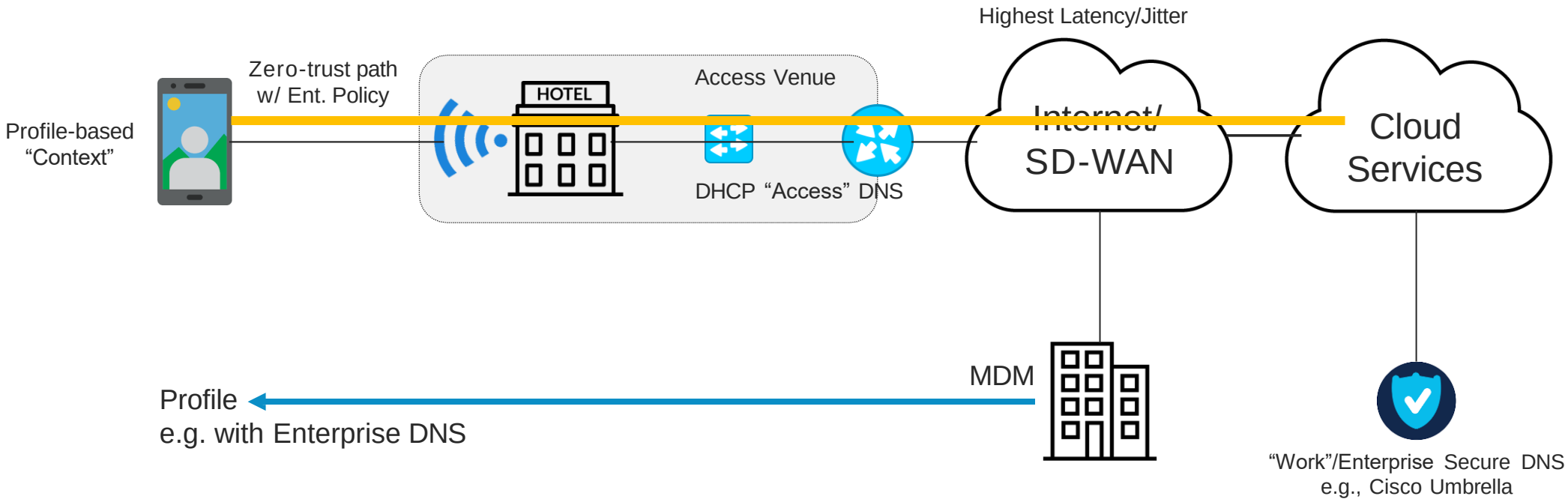
Zero-Trust for better experience
…but Enterprise Policy Lost



“Work” context profile to the rescue



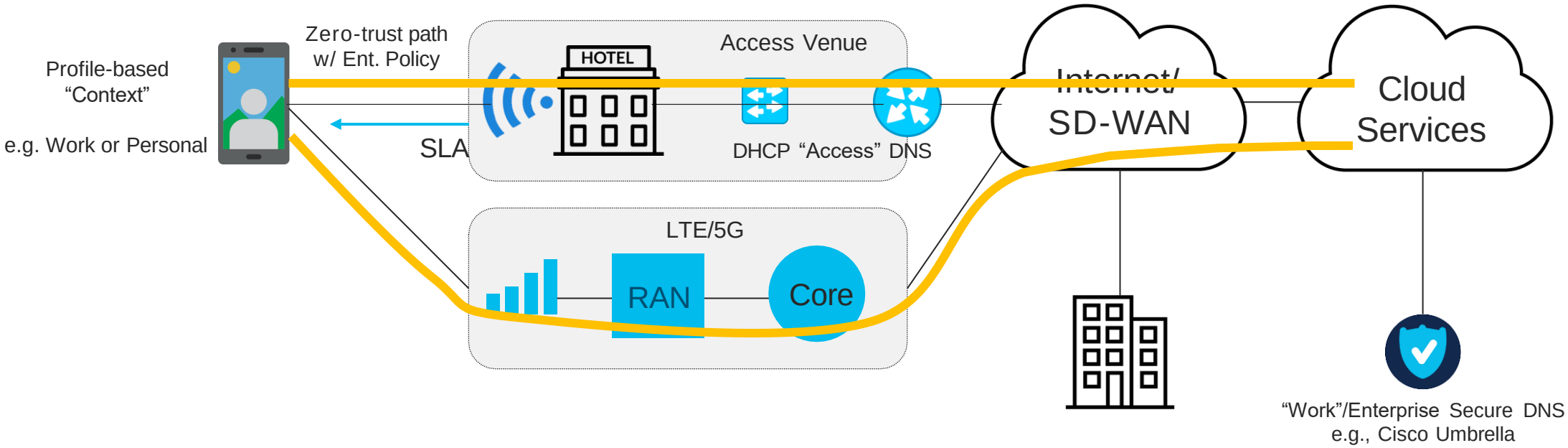
Enterprise policy using zero-trust path



Enterprise policy for any access using zero-trust path

…with intelligent SLA-based path selection

…Experience as a Service ($)

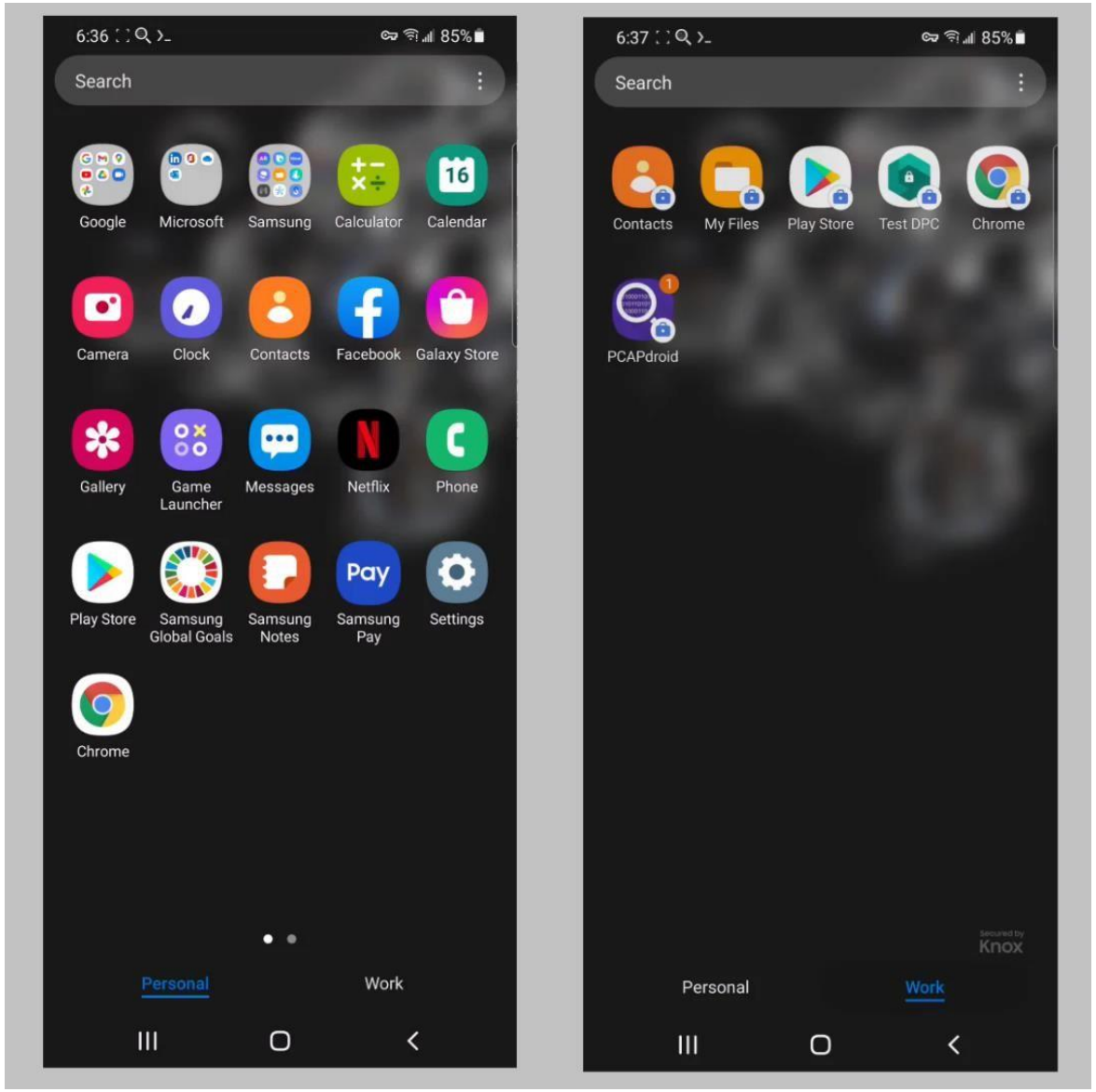


Enterprise Everywhere
Secured Service

In the office or on the road:
A corporate internal server is only accessible from the work profile

Vision:

- In the office, a work/personal flag is received by the network
  - Used to direct traffic to corporate or guest segments
- On the road, work traffic is directed with Umbrella / optionally VPN
  - Other traffic is local



Personal

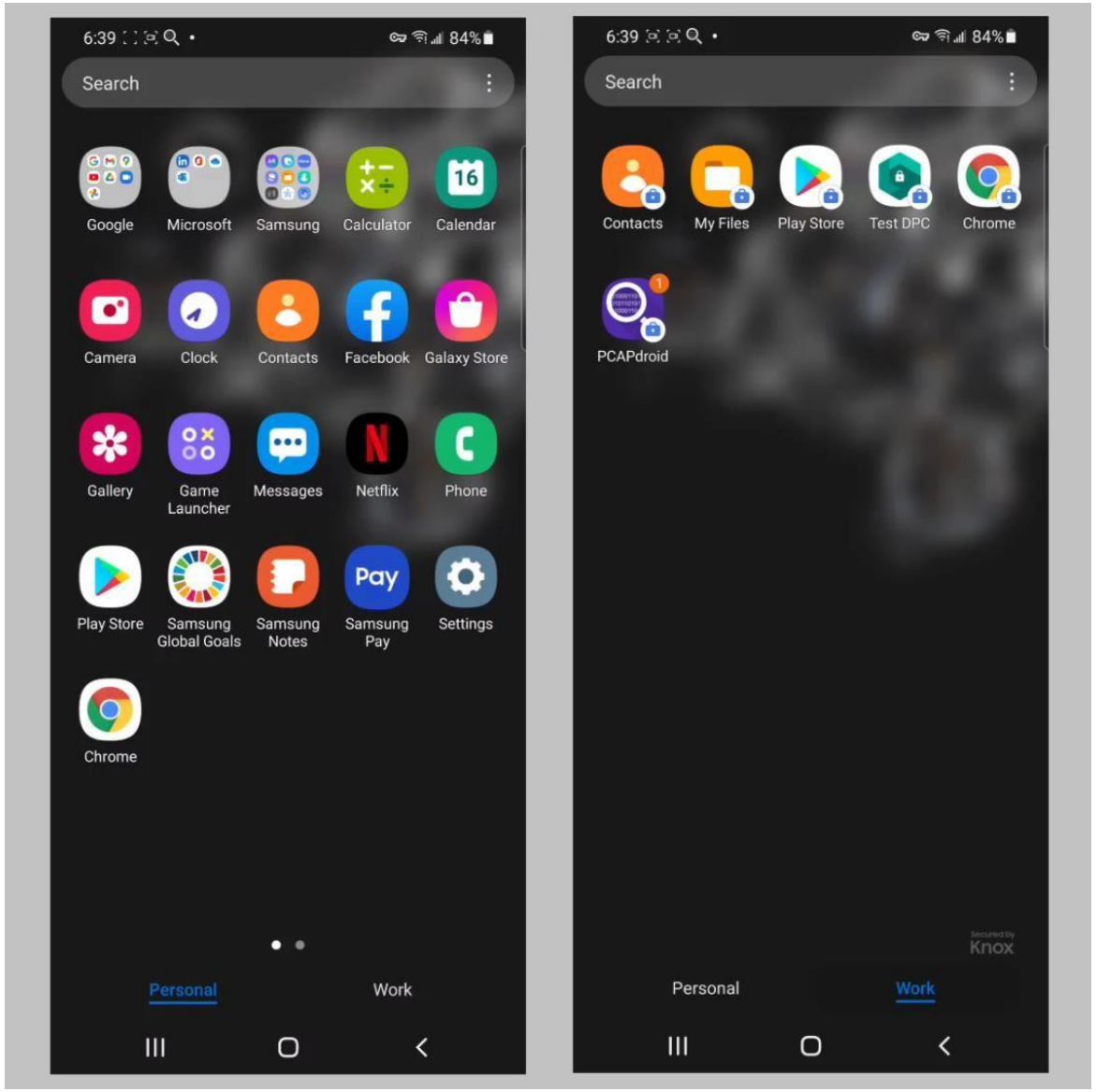
Work

Enterprise Everywhere
Secured Internet

In the office or on the road:
Corporate/Umbrella DNS only applies to work traffic

Vision:

- In the office and on the road, client uses Umbrella and corporate DNS for work traffic
- personal traffic uses general DNS



Personal

Work

Enterprise Everywhere
“Enterprise Class” QoS

In the office or on the road: Optimized QoS applies to work (Enterprise Class) traffic

Vision:

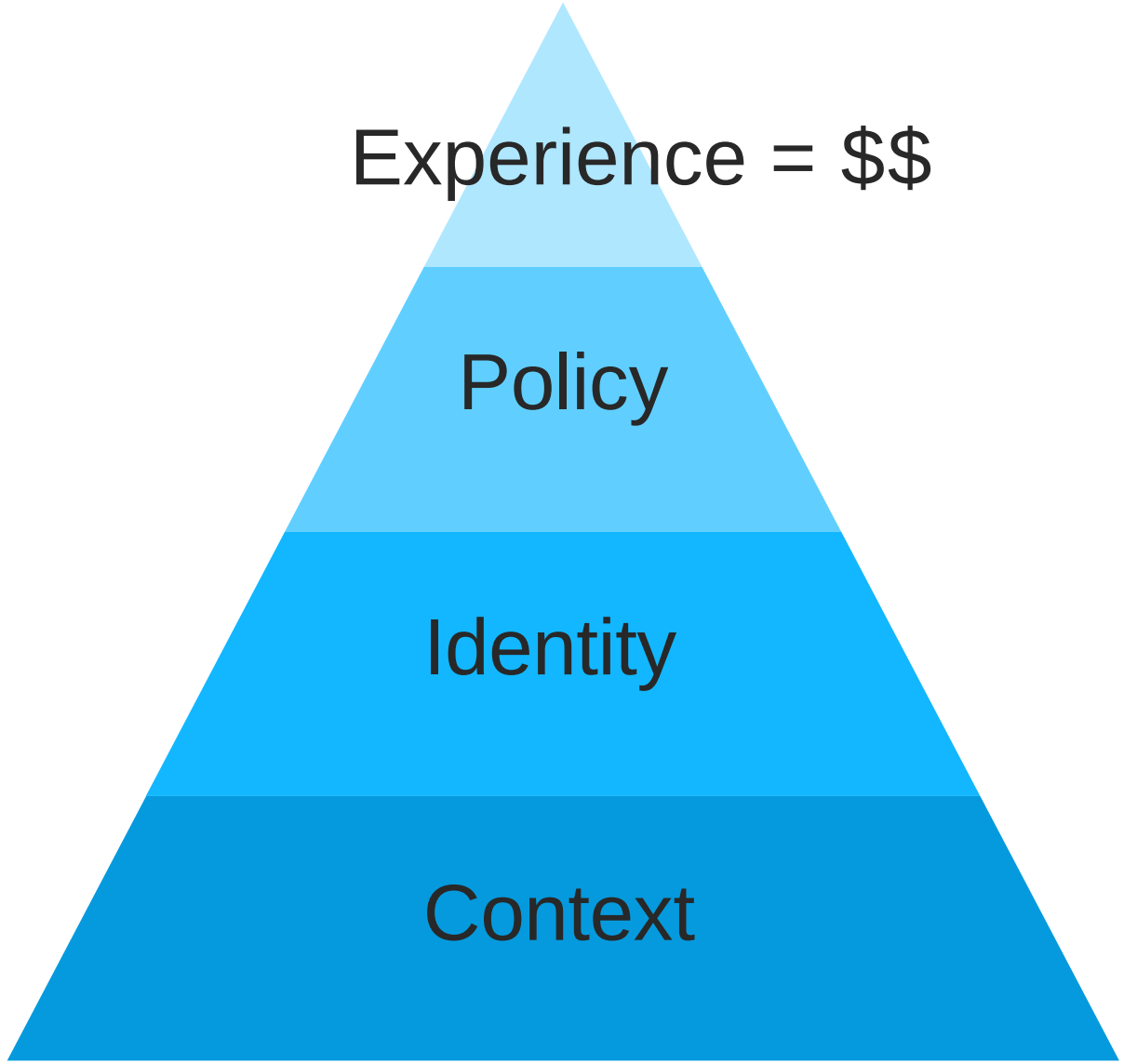
- In the office, work traffic gets QoS treatment, personal traffic is best effort
- On the road, enterprise may select premium access ($) for work traffic

Personal

Work

Conclusion –

- Context determines Identity
- Identity determines Policy
  - Security
  - Privacy
  - Quality of Service
- Policy determines Experience
- Experience is monetized




CISCO

Wi-Fi 7 – Connecting the Dots for Future Innovation

DR. CARLOS CORDEIRO

WIRELESS CTO

Intel Corporation

Spectrum Sharing, Wi-Fi and the 5G Future

DR. DEREK PETERSON

CTO

Boingo Wireless

boingo

WBA WIRELESS GLOBAL CONGRESS

SPECTRUM SHARING, CONVERGENCE AND THE 5G FUTURE

Dr. Derek Peterson, Chief Technology Officer, Boingo Wireless

January 25, 2022

20 Years of Wireless Leadership

LARGEST
DAS Operator
Largest indoor DAS provider in the U.S.

40,500
Small cell nodes

LARGEST
Wi-Fi Operator
Largest operator of airport Wi-Fi networks in the world

1+ MM
Hotspots worldwide

LARGEST
Military Provider
Largest Wi-Fi & Cell Tower provider to US Military bases

2,000+ Buildings

340,000 Beds

FIRST
Commercial DAS Network
to market ('99)

FIRST
Passpoint Network
to market ('14)

FIRST
CBRS Airport Private Network
to market ('18)

FIRST
Wi-Fi 6 Airport Network
to market ('19)

1+ BILLION CUSTOMER REACH/YEAR

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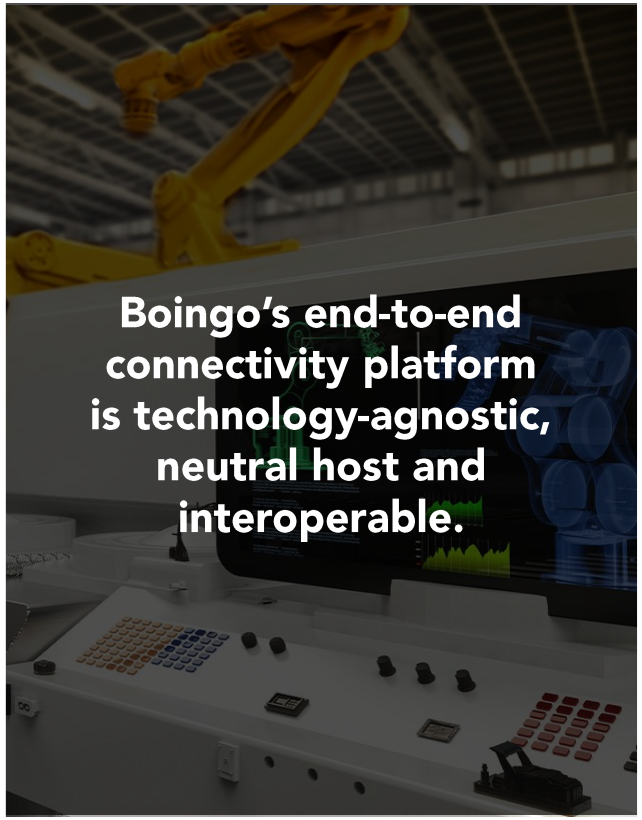
How We Connect Digital Transformation

Boingo simplifies complex wireless challenges to connect people, business and things.

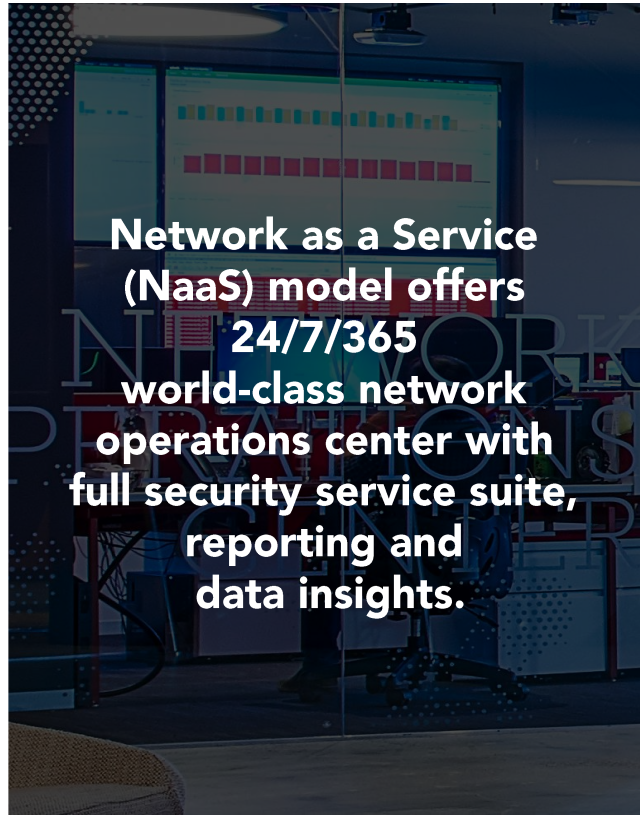
VISION

DESIGN

BUILD



MANAGE



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WBA
VISION
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WBA 2022 Technical Roadmap

WBA WORK GROUPS & PROJECTS

5G Work Group	IoT Work Group	NextGen Work Group	Roaming Work Group	OpenRoaming™ Task Group	Testing & Interoperability Work Group
Leading Wi-Fi and 5G RAN Convergence	Augmenting Wi-Fi role in IoT	Fast-tracking Wi-Fi deployments for operators	Incubating new business opportunities	Development of standards, federation governance and trials	Achieving interoperable Wi-Fi services
5G & Wi-Fi Convergence in Private 5G Networks	Wi-Fi 6/6E for Industrial IoT	Wi-Fi 6E & Wi-Fi 7	In-Flight Connectivity (Continuous Experience)	Federated Onboarding Service for OpenRoaming	Access Network QoS
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		Rural Wi-Fi		OpenRoaming for IoT	ANQP Elements Guidelines
					Wi-Fi Devices Identification

Policy & Regulatory Affairs Work Group	Market Work Group	WBA Certification Task Group
Industry liaison and advocacy of WBA global programs	Marketing activities and industry dissemination	Addressing interoperability to foster adoption

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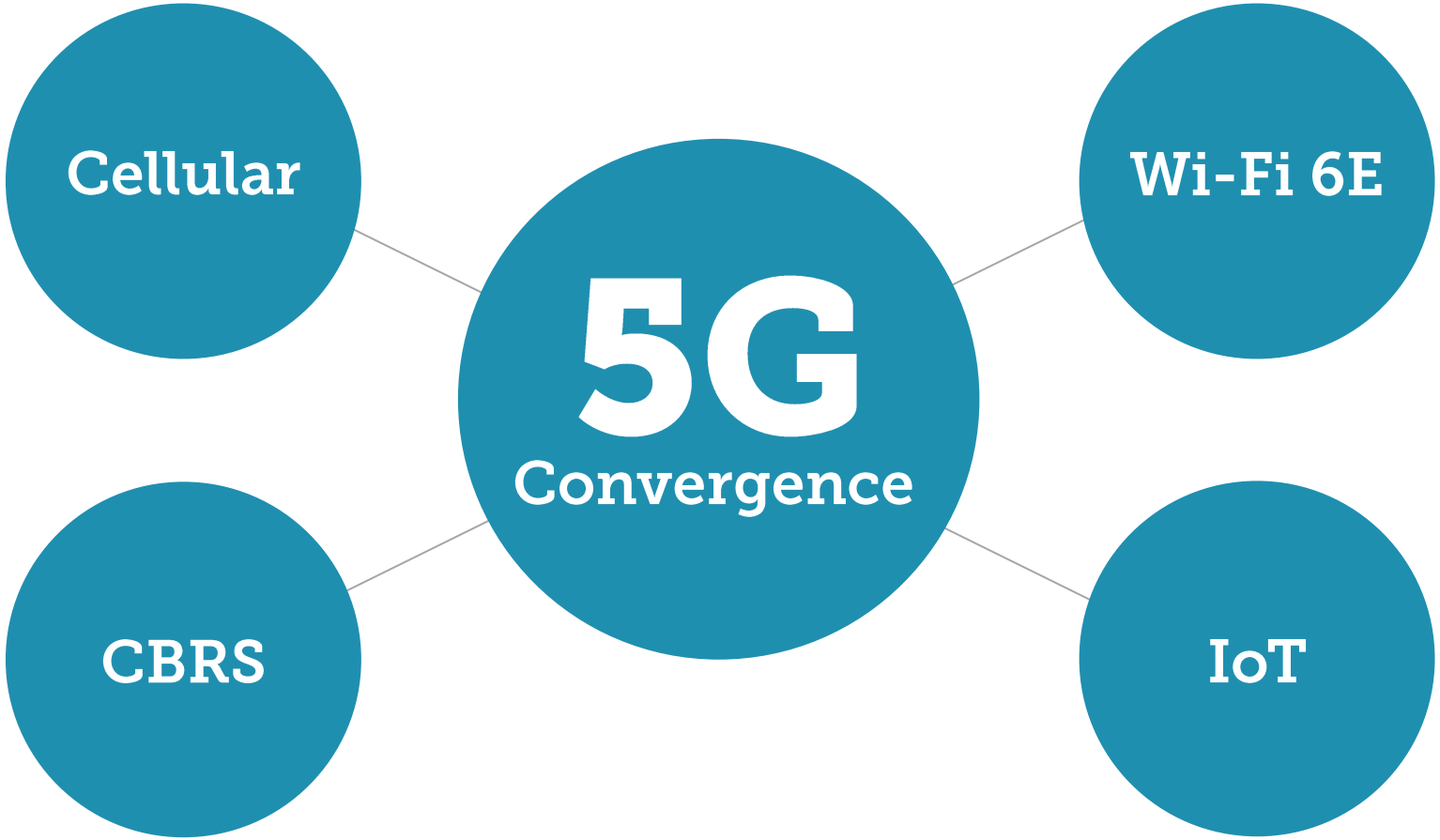
Prioritize Convergence



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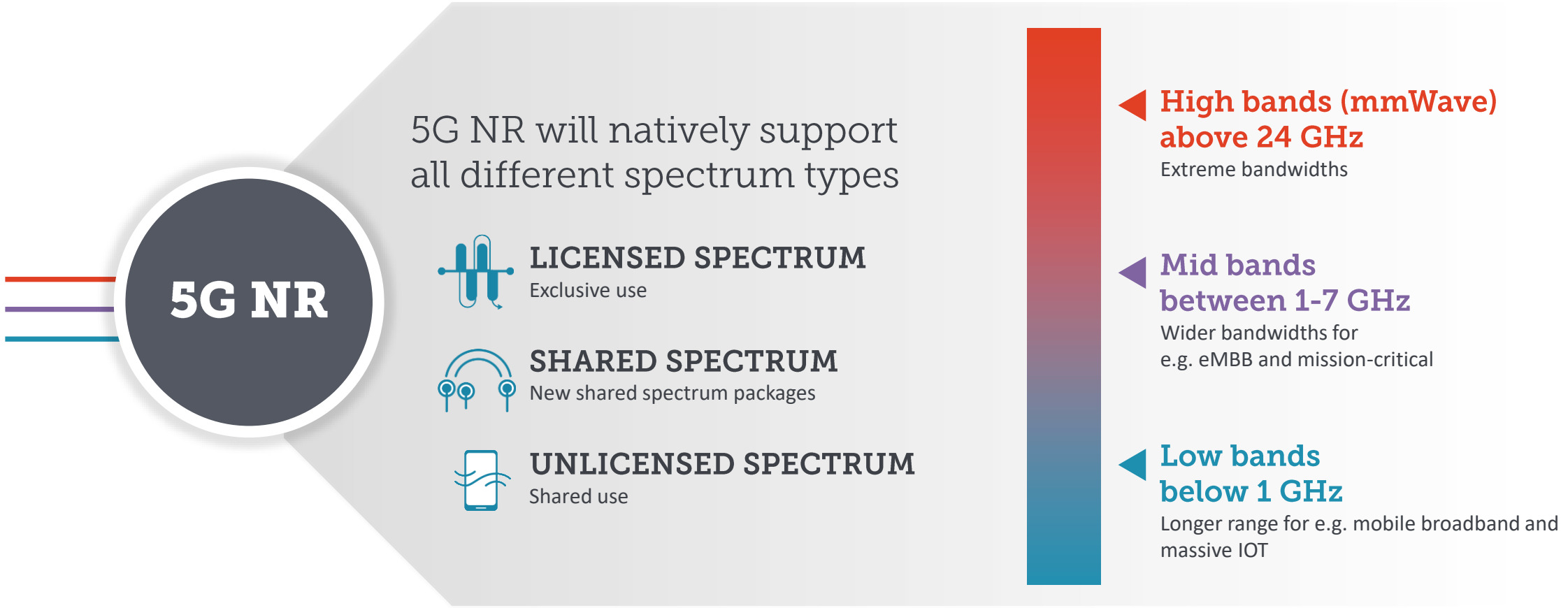
Leveraging All Available Bands



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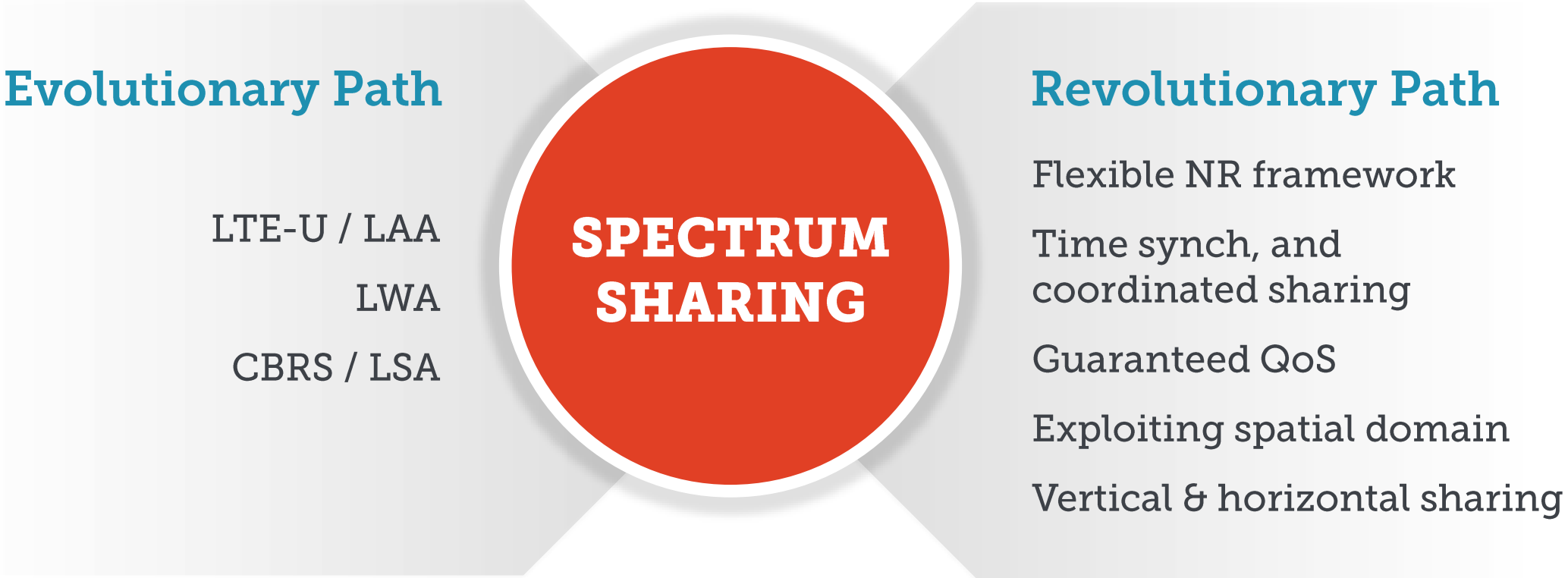
Spectrum Sharing



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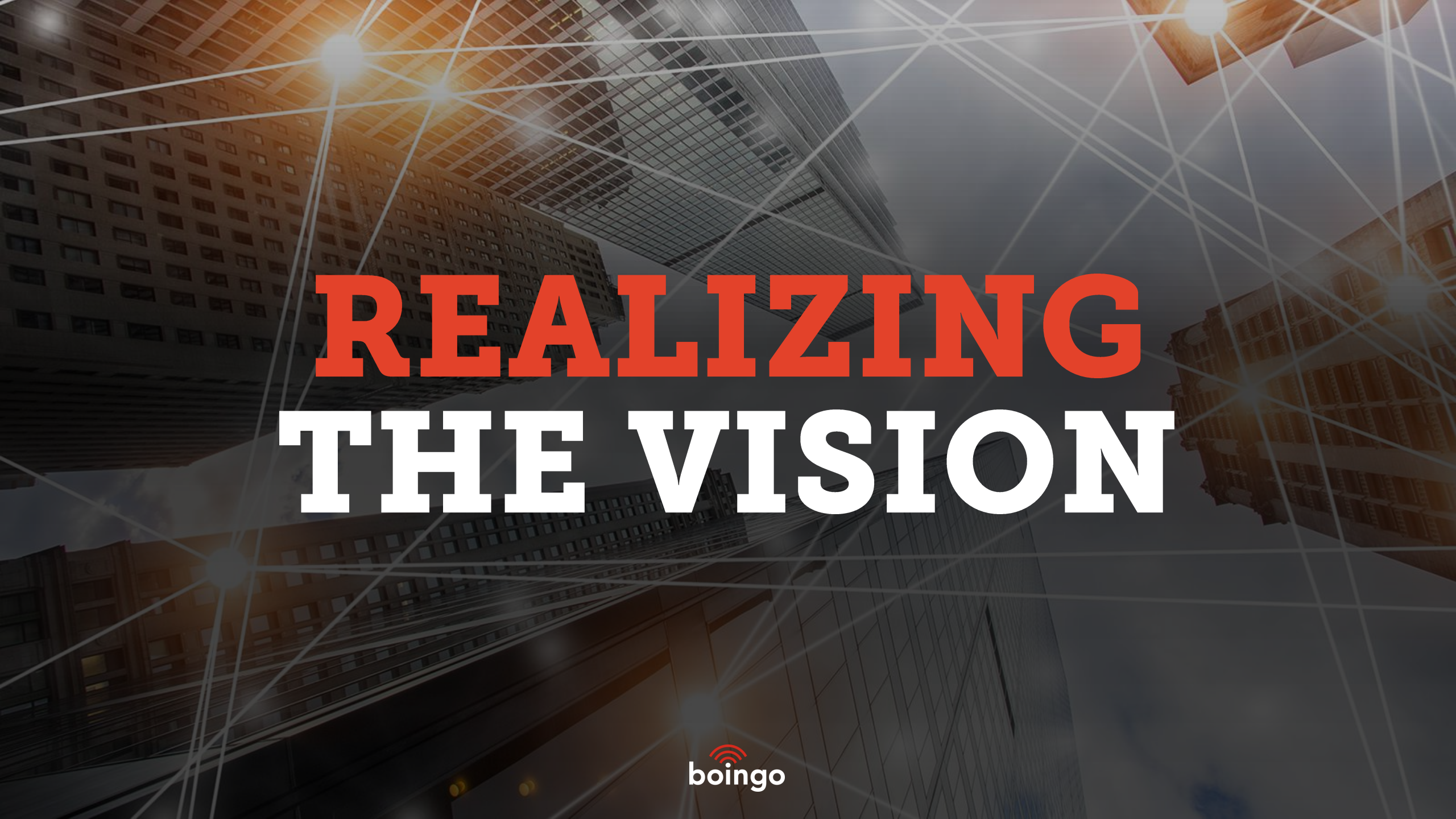
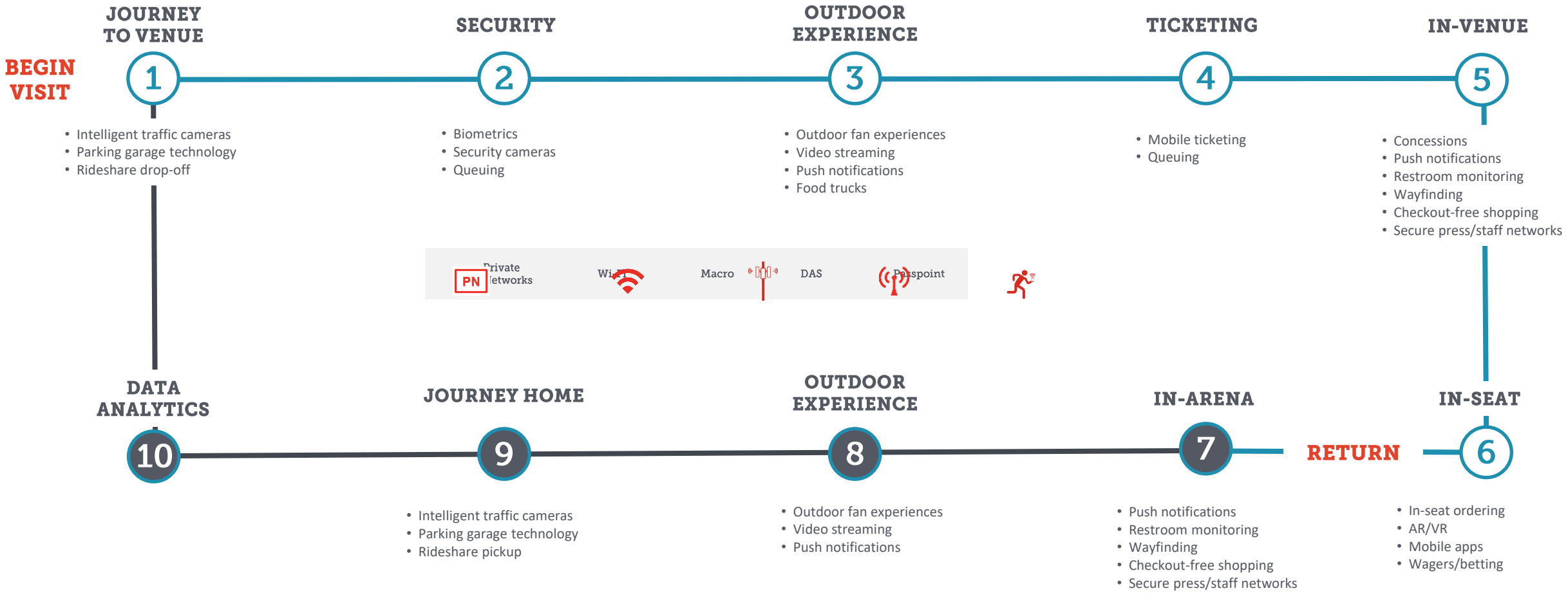

REALIZING
THE VISION
boingo

The Connected Venue Experience

A converged experience at venues blends innovative fan experience with state-of-the-art technology solutions.



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Touchless Experience Use Cases

USE CASE	CHALLENGE	COMPONENTS	CONNECTIVITY SOLUTION
Social distancing		Cameras; sensors	
Security measurement and monitoring		Cameras; sensors	PN
Personal identification checkpoints (e.g. ticketing, CBP, TSA security, gates)		Touchless, self-service facial/ biometrics recognition devices, e.g. Simplified Arrival	PN
Concessions and point of sale		Touchless, self-service payment; direct-to-consumer delivery and pickup; dispersed concession areas and mobile kiosks	PN
Staff and first responder communication		Push-to-talk devices	PN
Cleaning and maintenance tracking		Robotics; cameras; sensors	PN
Health check screening		Infrared scanners; sensors; autonomous thermometers	
Passenger communications		Digital signage; Wi-Fi connection portal; push notifications	

= Health
= Monitoring
= Communication
PN = Private Networks
= Wired Internet
= Wi-Fi
= Cellular

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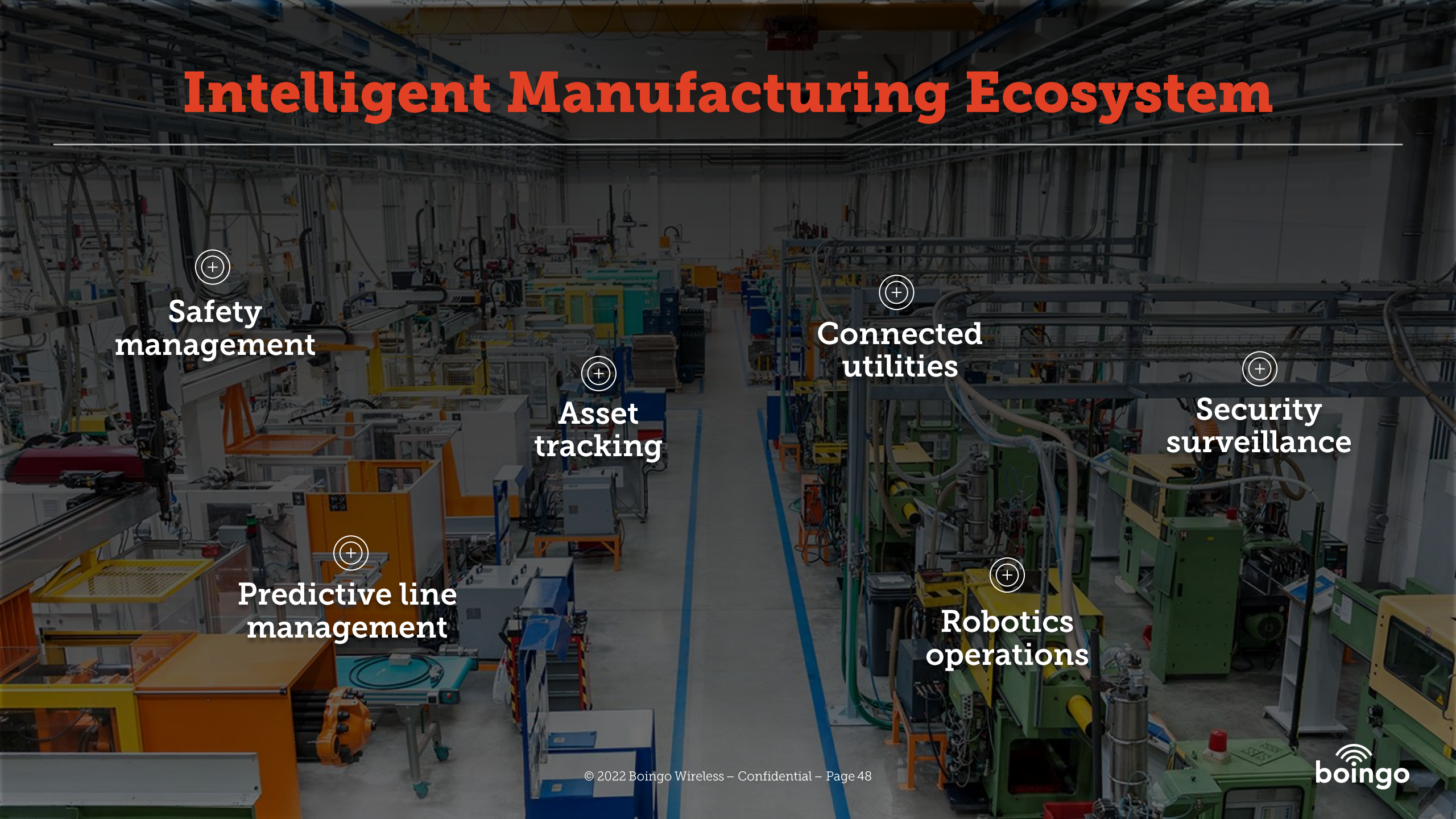
Intelligent Manufacturing Ecosystem



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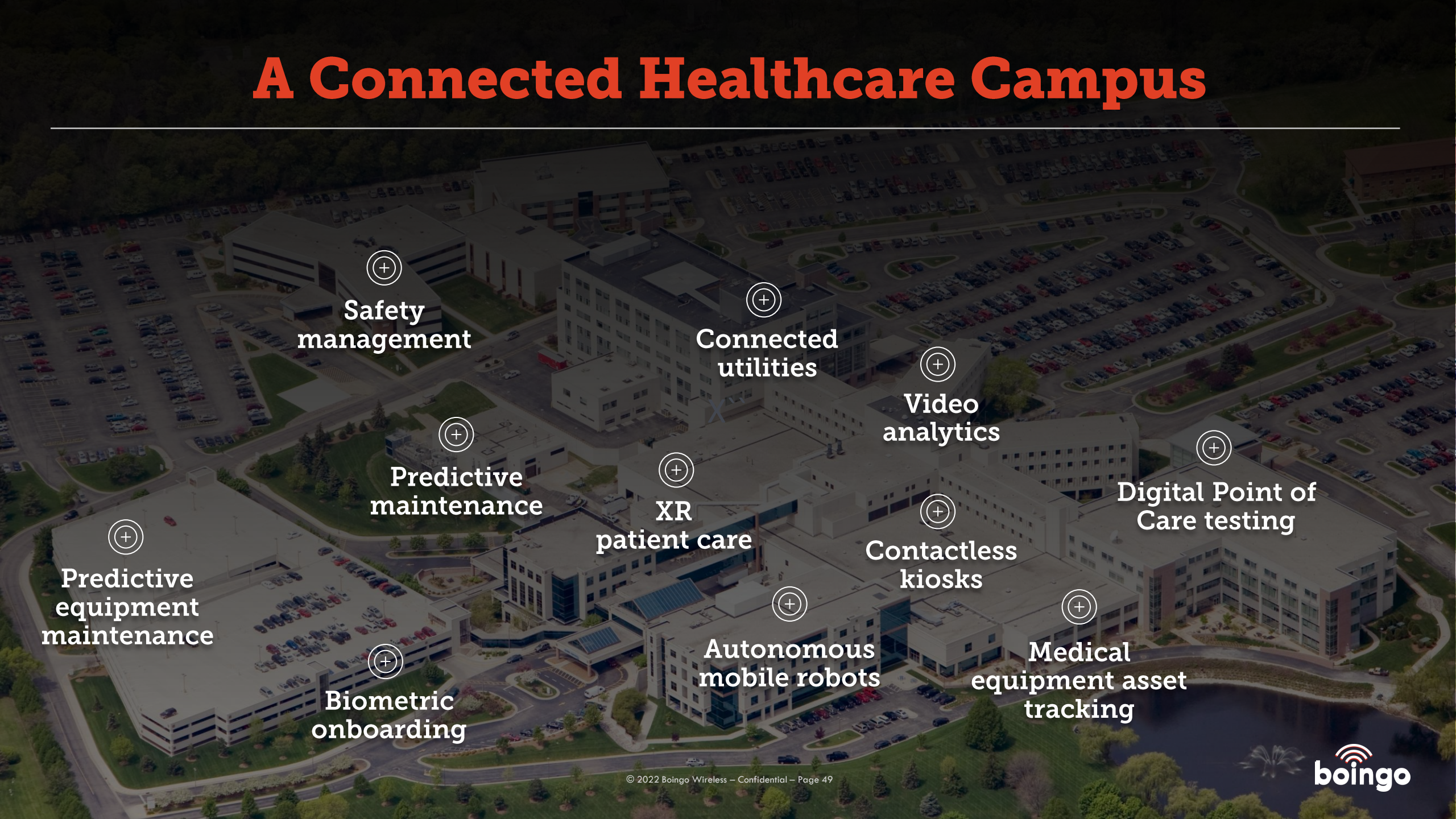
A Connected Healthcare Campus



boingo

Join the Revolution

Join the WBA work groups
and help create industry change
through the 2022 initiatives.

boingo

THANK YOU

Dr. Derek Peterson
CTO, Boingo Wireless
dpeterson@boingo.com

boingo

WIRELESS GLOBAL CONGRESS
WIRELESS BROADBAND ALLIANCE

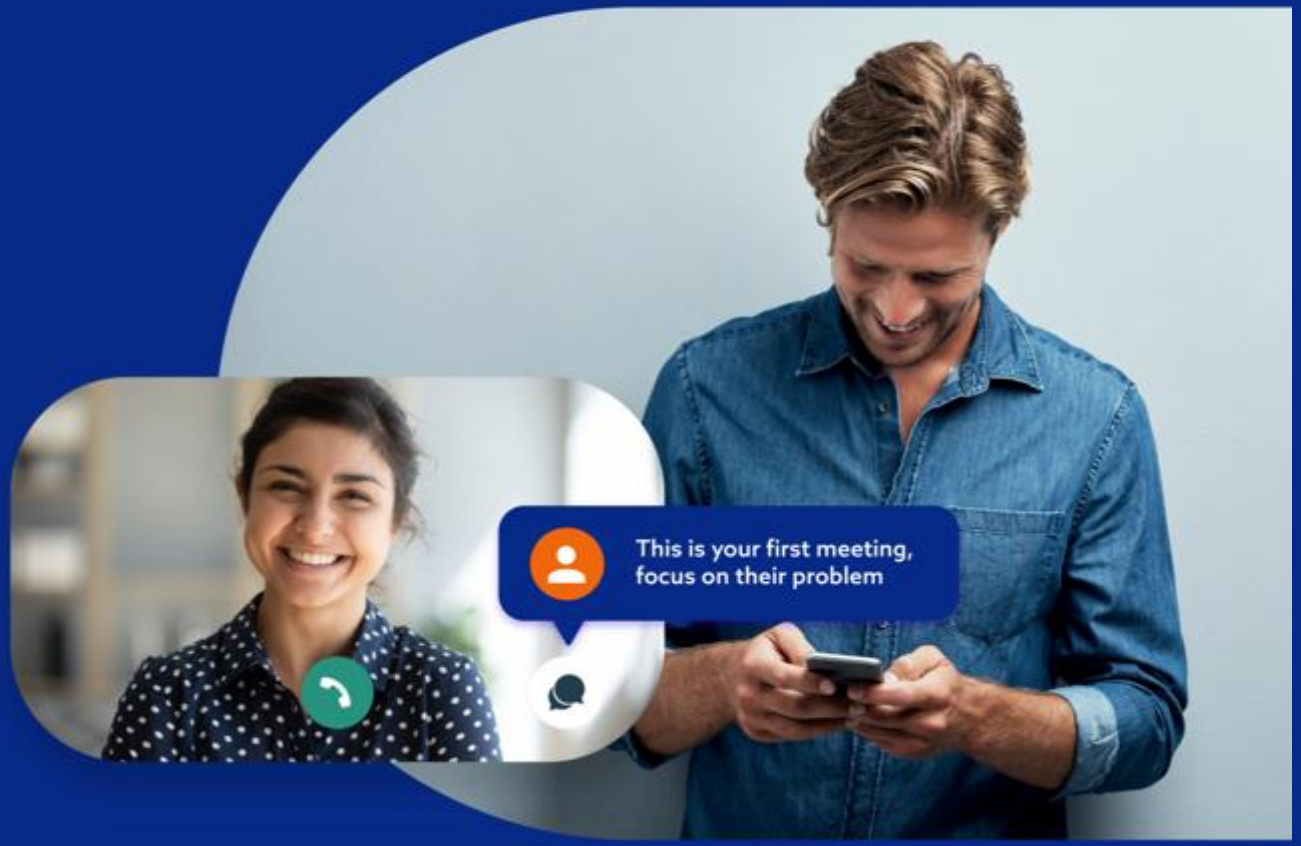
Enterprises are from Mars & SMBs are from Venus

LEON HARDWICK

FOUNDER & CEO

Handshakr

HANDSHAKR



HANDSHAKR™

Wireless Global Congress 2022

ENTERPRISES

SMBs

My experience has exposed a big problem

Leon Hardwick
Founder & CEO of Handshakr.

I've spent **20 years** selling high-value software & consulting to **Enterprises worldwide**.

Arcweso A JDSU Mobility Solution
spatialbuzz
Norconsult Telematics
TEOCO

*Data from Mckinsey B2B Buyer Research , Statista & CCGroup PR Market Research

HANDSHAKR™

How do we find and forge B2B relationships?

Personal

Human > Digital

B2B

Finding and forging business relationships

Marriage

Engagement

Courting

Dating

Matchmaking

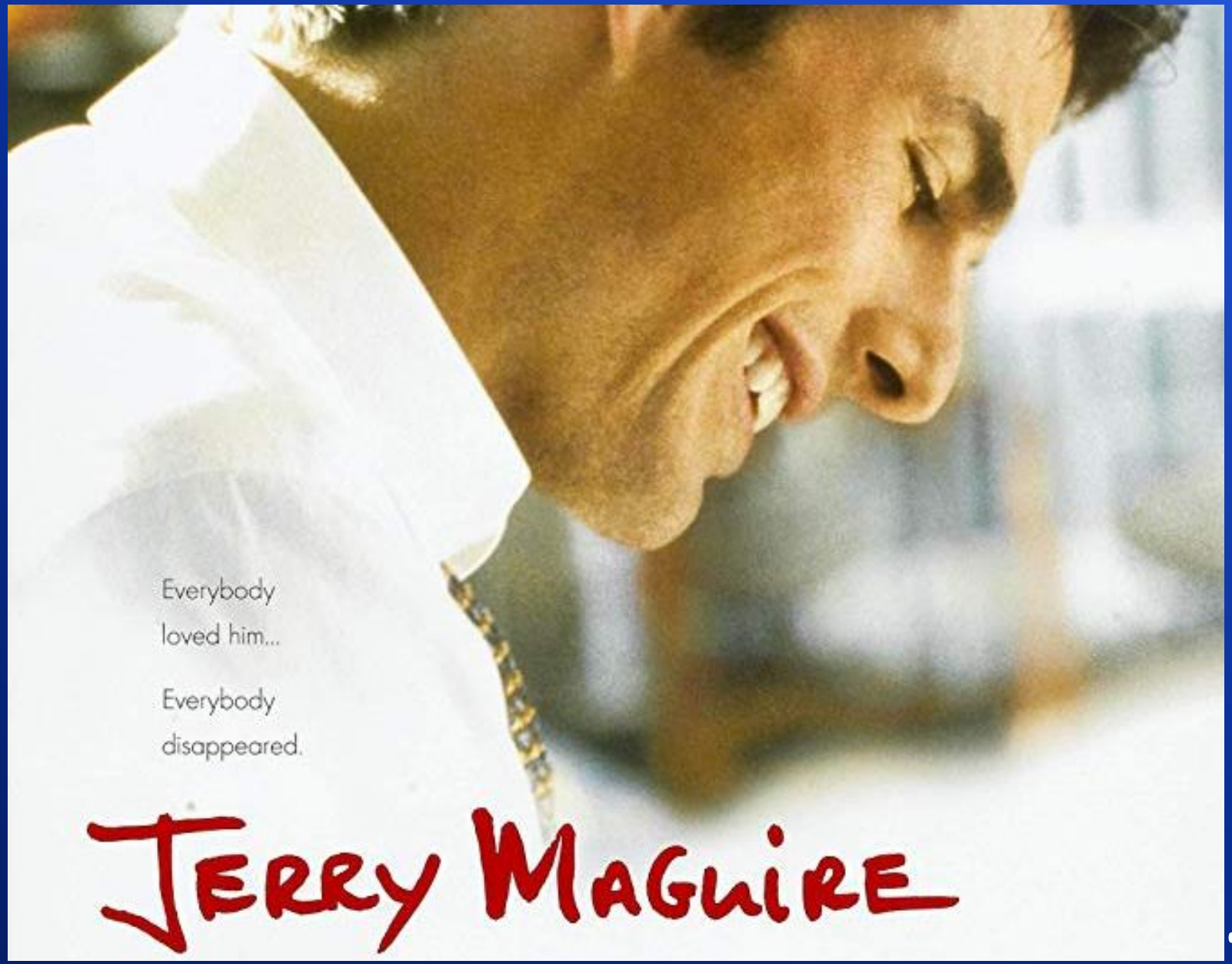
How do you keep the relationship going?

How do you navigate through to a long-term relationship?

How do you discover your new compatible partner?

The questions that led to…

My…



…moment

B2B is far too complex and inefficient

* A Gartner B2B Buying Journey

and...

Being seen and heard is challenging

Famous comms breakdowns

excite

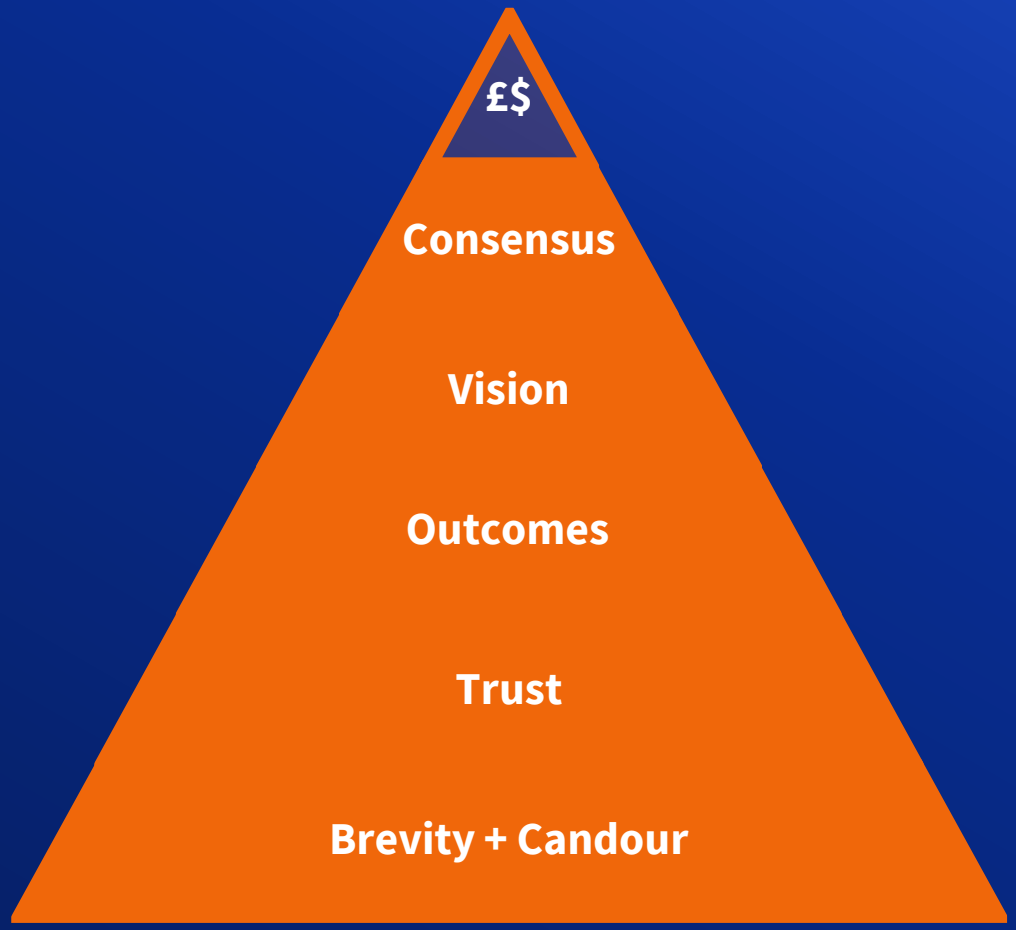
passed on buying

Google

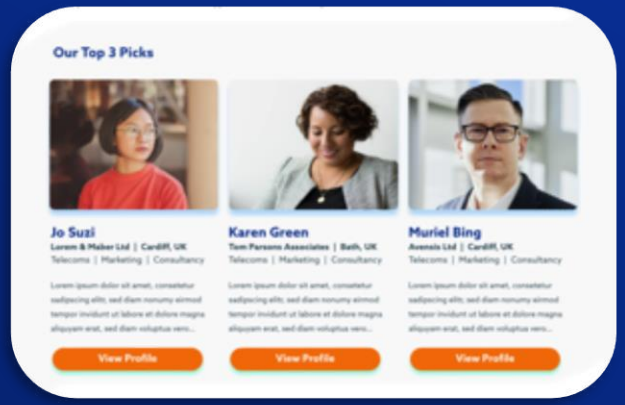
for $750,000

The Partnership Pyramid

Building blocks for finding and then forging relationships that matter



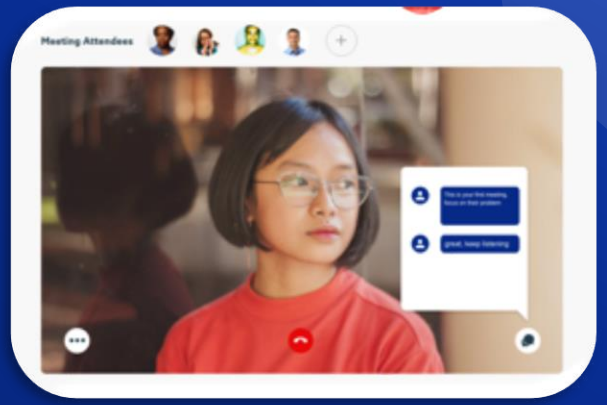
Our B2B Orchestration Platform



Discover

(Matchmaking)

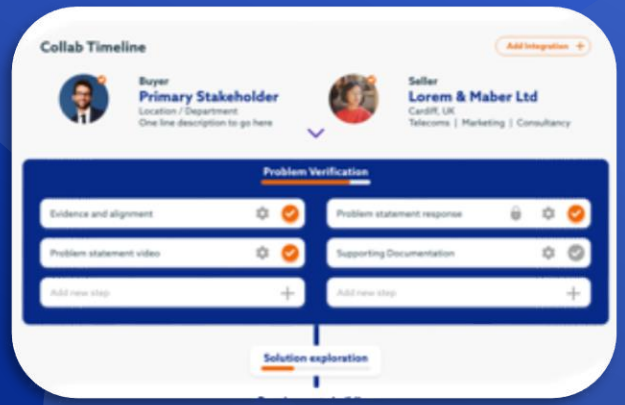
Intelligent matchmaking and innovation optics for B2B to discover compatible technologies to solve business problems, deliver change or enable a competitive edge



Engage

(Dating)

Expert assistance to guide all parties through those uncomfortable early meetings and focusing all on positive outcomes



Collaborate

(Courting)

Smooth the integration between each business family by **syncing functions, process and tools** to ensure a lasting collaborative relationship

= Bilateral B2B driving better outcomes for both parties

A disruptive solution that aligns people, process and systems bilaterally to achieve a B2B deal.

HANDSHAKR™

Brevity + Candour = Trust

So let’s try this out Matrix style…

https://www.handshakr.com/wba-matchmaking/

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HANDSHAKR

WIRELESS GLOBAL CONGRESS
WIRELESS BROADBAND ALLIANCE

Its time for...

Coffee

Break!

The Conference will resume at 11.15 AM

WIRELESS GLOBAL CONGRESS
WIRELESS BROADBAND ALLIANCE

Fireside chat: “Wi-Fi State of the Union and the Trends Towards the Metaverse”

IRVIND GHAI

VICE PRESIDENT OF MARKETING

onsemi

TIAGO RODRIGUES

CEO

Wireless Broadband Alliance

Enabling 6 GHz Wi-Fi in Saudi Arabia

ZIYAD A. ALDOBAIAN

RADIO SPECTRUM PLANNING AND REGULATIONS SPECIALIST

The Communications and Information Technology Commission (CITC), Saudi Arabia.

هيئة الاتصالات وتقنية المعلومات
Communications & Information Technology Commission

Enabling 6 GHz Wi-Fi in Saudi Arabia

WBA Event:

WI-FI REVOLUTION: DRIVING DIGITAL GROWTH

January 2021

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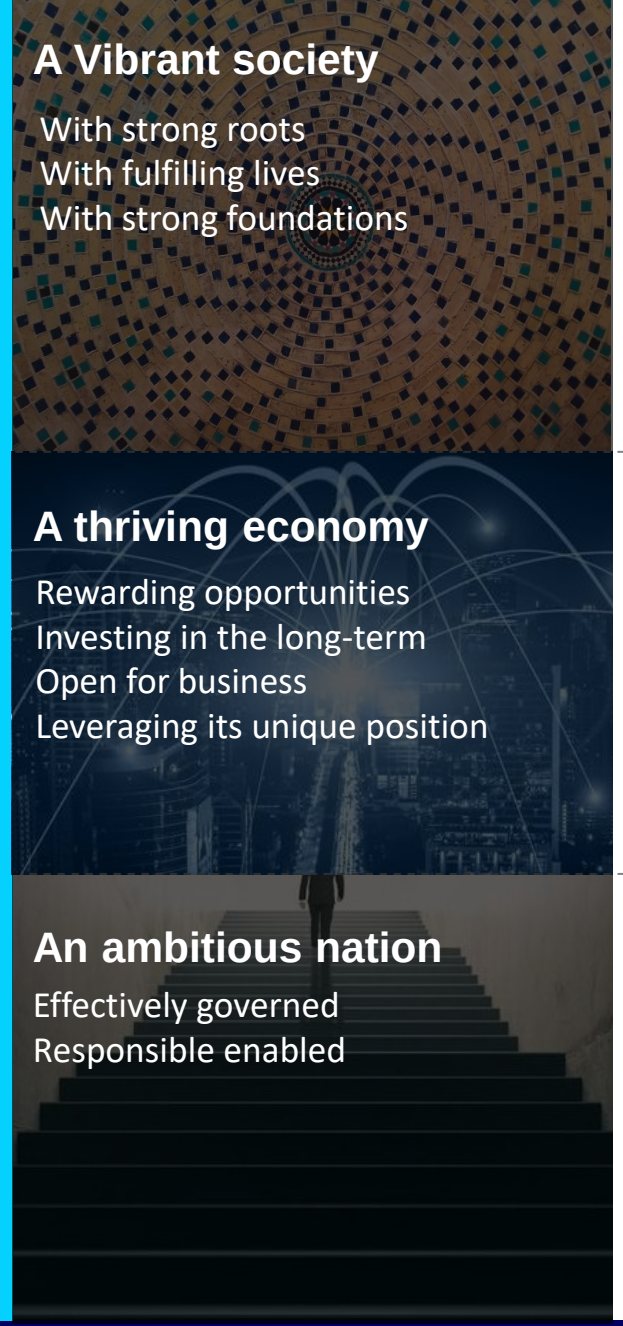
Communications & Information Technology Commission

National Spectrum Strategy (NSS) (2020-2025)

In KSA particularly, spectrum is key to achieve Vision 2030



Spectrum provides the network back-bone for **smart cities** (e.g. sensors, IoT, …) to achieve their ambition

Spectrum directly unlocks varied citizen services, incl. aviation, entertainment, medical services, …

Spectrum is critical to becoming a **logistic hub** (e.g. through best-in-class maritime / railway comms)

Spectrum is a **critical driver of non-oil sectors' future** (e.g. IMT/ IoT)

Spectrum is the pedestal of ICT, and maximizing its value is key to **reaching top 20 countries**

Spectrum is a valuable asset directly **contributing to national revenues** (through usage fees, auctions, …)

SAUDI ARABIA NATIONAL SPECTRUM STRATEGY 2025

Vision

Unlock the potential of radio-communication in KSA for a smarter and safer future

Mission

Offer all users the access to spectrum they need to innovate and grow by managing the spectrum effectively and efficiently in close collaboration with our stakeholders

Guiding Principles

Future Orientation

We are forward-looking in our policies to anticipate future needs and cater for tomorrow's demand while protecting spectrum predictability

Efficiency

We proactively identify opportunities to Optimize Spectrum Use, maximize the value it generates, and streamline our way of working

Engagement

We build "win-win" relationships with our stakeholders and increase collaboration within the ecosystem to shape together a 'One KSA voice'

National Spectrum Strategy (2020-2025)

UNLOCK THE POTENTIAL OF RADIO-COMMUNICATION IN KSA FOR A SMARTER AND SAFER FUTURE

OFFER ALL USERS THE ACCESS TO SPECTRUM THEY NEED TO INNOVATE AND GROW BY MANAGING THE SPECTRUM EFFECTIVELY AND EFFICIENTLY IN CLOSE COLLABORATION WITH OUR STAKEHOLDERS

A UNLOCK THE FUTURE

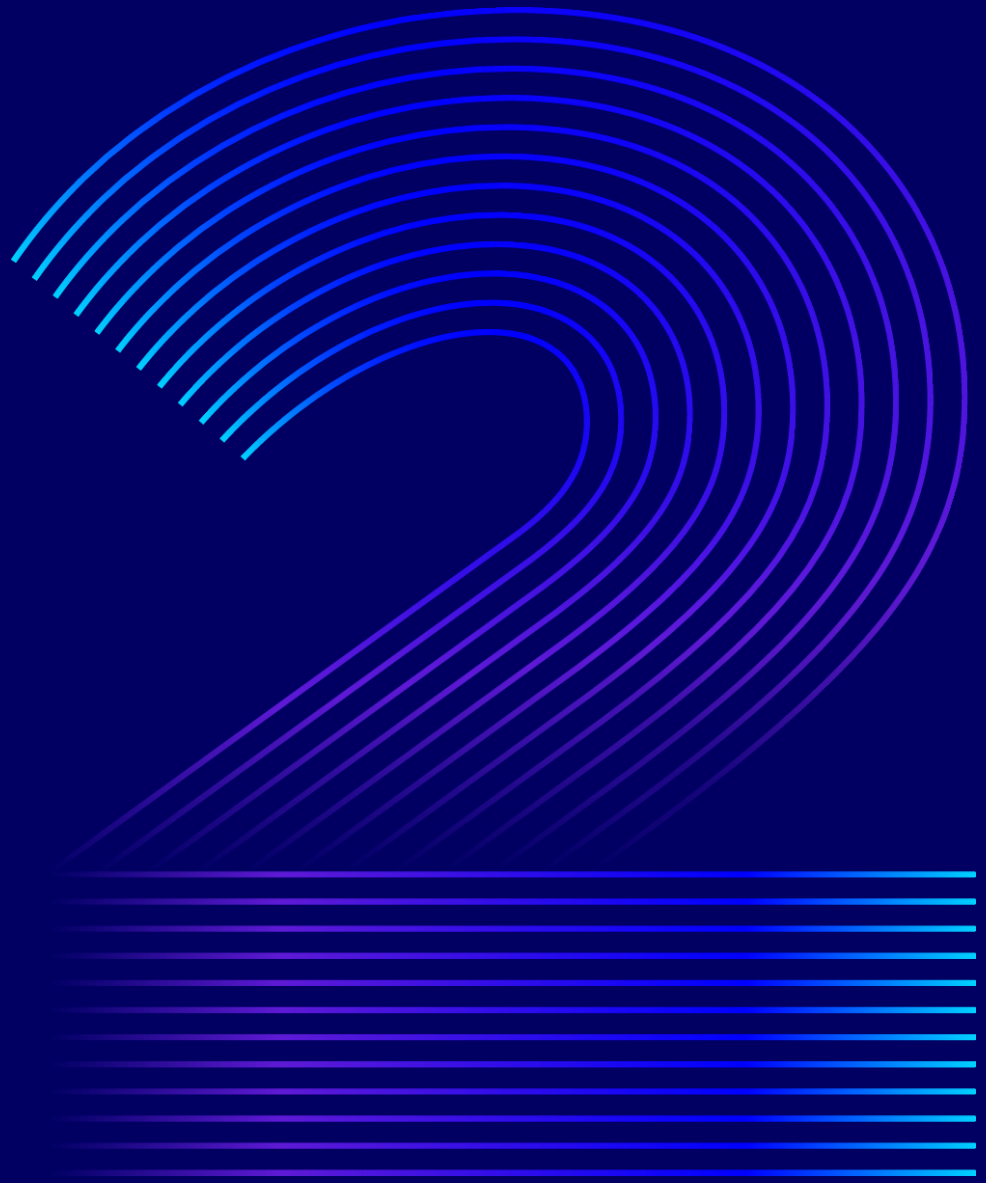
- A1 OPTIMIZE LEGACY SPECTRUM
- A2 **FOSTER COMMERCIAL AND INNOVATIVE USES**
- A3 SAFEGUARD NATIONAL ACCESS

B EMPOWER A 'SMART' SPECTRUM

- B1 ADOPT ADAPTIVE REGULATORY MECHANISMS
- B2 FACILITATE WIRELESS ACCESS AND INVESTMENTS
- B3 EMBRACE MARKET-ORIENTED APPROACHES

C BUILD THE FOUNDATION

- C1 ENGAGE THE ECOSYSTEM
- C2 EXPAND THE TOOLKIT
- C3 GROW CAPABILITIES



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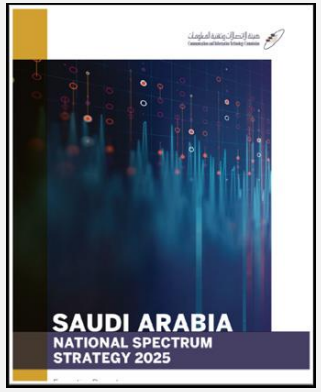
Spectrum Outlook 2021-2023

citc.gov.sa

INPUTS



Saudi Arabia National Spectrum Strategy 2025

This document provides guidance on high-level strategic considerations Spectrum Outlook implements these to the greatest extent possible

CITC Spectrum consultation

66 responses from:

- Individuals
- Academics
- Government agencies
- Mobile operators
- Verticals
- Satellite operators
- Industry associations
- International technology companies
- International consultants

OUTPUTS

Consultation Report

In-depth summary of consultation responses and CITC's analysis, providing rationale for CITC's decisions

Values:

- Transparency
- Predictability
- Evidence-Based, Data-Driven Policy Decisions

Spectrum Outlook for Commercial and Innovative Use

Plan for spectrum releases between 2021 and 2023, to enable technologies of the future such as 5G, broadband satellite and new generation of Wi-Fi in order to have fair access to spectrum, and adopt innovative spectrum management regimes

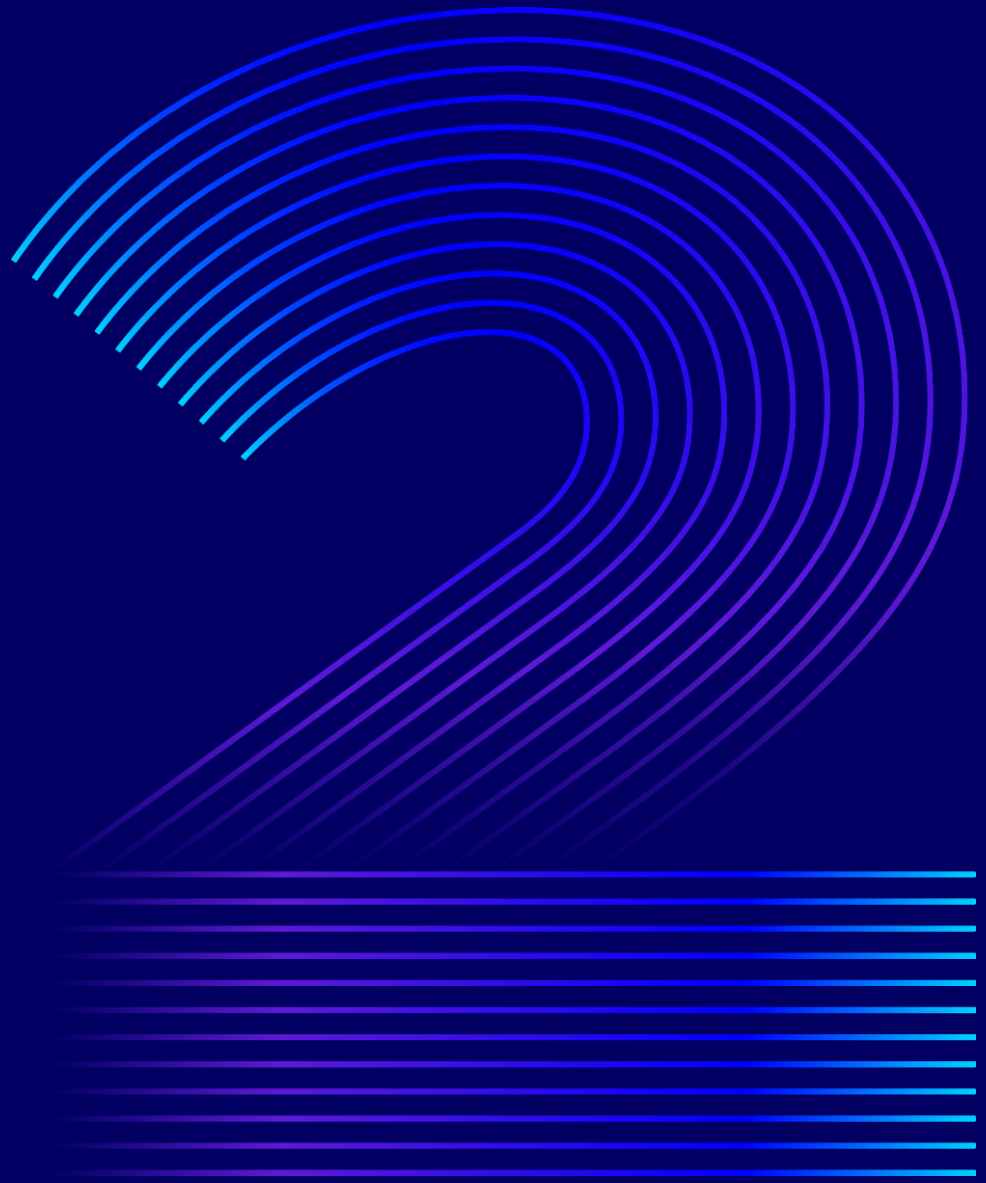
Historic Expansion of Spectrum for Commercial Use

NEWLY AVAILABLE SPECTRUM . . .

Licensed spectrum	Approaching 4GHz	
License - exempt spectrum	6.2 GHz	6 GHz 60 GHZ
Lightly - licensed spectrum	> 13 GHz	

> 23 GHz

of newly available spectrum for commercial use in the Kingdom



هيئة الاتصالات وتقنية المعلومات
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Enabling Wi-Fi 6e in the Kingdom

citc.gov.sa

The Need for More Wi-Fi Spectrum

The Kingdom has announced the release of 1200 MHz in the 6 GHz for the use of Wi-Fi technologies in CITC's Spectrum Outlook 2021-2023. This release is an outcome of the following reasons:

Meet Wi-Fi Spectrum Demand

- 2.4 and 5 GHz have been only used for Wi-Fi since the release of (IEEE 802.11n) standard in 2009. [1]
- According to Cisco, in 2023, the number of Wi-Fi connected devices will increase to be 29.3 billion devices (59 % increase compared to 2018) [2]
- According to Ericsson, the average amount of data per month used by a smartphone will increase from 7 gigabytes in 2018 to 39 gigabytes by 2024 (457% increase). [3]

Mobile data traffic offload

- A large proportion of the mobile data traffic is delivered on an unlicensed basis through Wi-Fi, Bluetooth and similar protocols.
- In fact, according to Cisco, 59% of mobile data traffic will be offloaded to Wi-Fi by 2022 . [4]

Wi-Fi Economical Impact

- According to Wi-Fi Alliance, the economic value of Wi-Fi in the kingdom will increase from $ 17.3 Billion in 2021 to an expected $ 23.7 billion in 2025 (37% increase). [5]

1) CableFree, The History of WiFi (May 2017)
2) Cisco, Annual Internet Report (March 2020)
3) Ericsson, Ericsson Mobility Report (June 2019)
4) Cisco, Cisco Visual Networking Index Update
5) Wi-Fi Alliance, Global Economic Value pf Wi-Fi (Sep 2021)

The Kingdoms approach to Enable Wi-Fi 6e

CITC had a strong engagement and collaboration with all stakeholders leading to the decision to make the entire 6 and 60 GHz bands available for license exempt uses.

Public Consultation: Drafted Spectrum Outlook

- CITC has consulted the public, analyzed the received responses, and studied the countries' best practices to initially envision an allocation proposals.

Q1 2021

Statement Spectrum Outlook 2021-2023

- CITC published a final Spectrum Outlook and announced the release of the 6 and 60 GHz along with other bands' releases.

Q2 2021

Public Consultation Drafted WLAN Regulations

- CITC has published a public consultation on the proposed regulations and restrictions for the 6 and 60 GHz.

Q3 2021

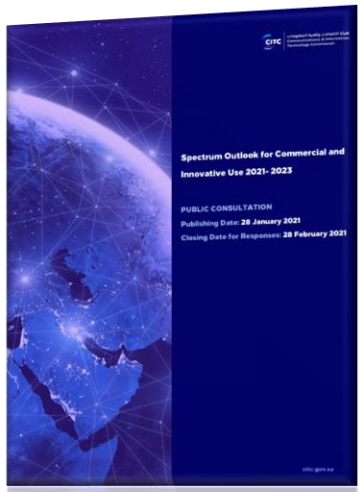
Statement WLAN Regulations

- CITC has carefully reviewed all the received responses and adopted flexible regulations to enable WiFi6e along with the other unlicensed WLAN technologies in the Kingdom.

Q4 2021

+19 Country

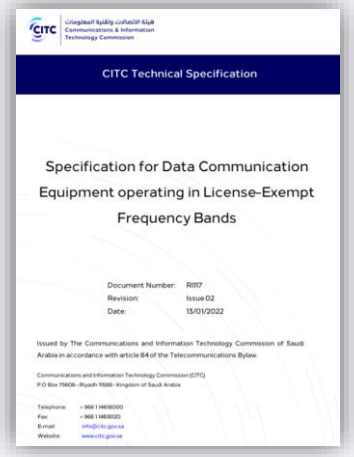
+60 Organization



+9 Country

+27 Organization

The Kingdom Wi-Fi 6e Regulations



RI 117
Technical Specification

WLAN Regulation

CITC has launched the "WLAN Regulations" that regulates the spectrum use of WLAN applications including the new 6 and 60 GHz bands. In line with the WLAN regulation, CITC has updated the technical specification "RI 117" to enable Wi-Fi 6e and other unlicensed applications in the Kingdom. These regulations include:

Defining the WLAN Spectrum Bands
Define the bands that can be used for WLAN applications such as Wi-Fi 5, Wi-Fi 6/6e, etc.

Spectrum Access Regimes
Introduce the light licensing regime that permit the use of WLAN band with more flexible power restriction

Sharing Conditions
Impose technical and operational conditions to enable sharing and coexistence with other services and users.

Equipment Type Approval
Guidance on gaining the approval to import devices into the kingdom .

Percentage Increase of Spectrum

200%

Increase in the amount of spectrum made available for Wi-Fi technologies compared to the previous status in the Kingdom.

The Kingdom's Position on Unleashing the Full 6GHz

1 Europe

1 Africa

1 Middle East

The Kingdom is leading the release of the full 6 GHz for unlicensed uses in the Europe, Africa, and the Middle East.

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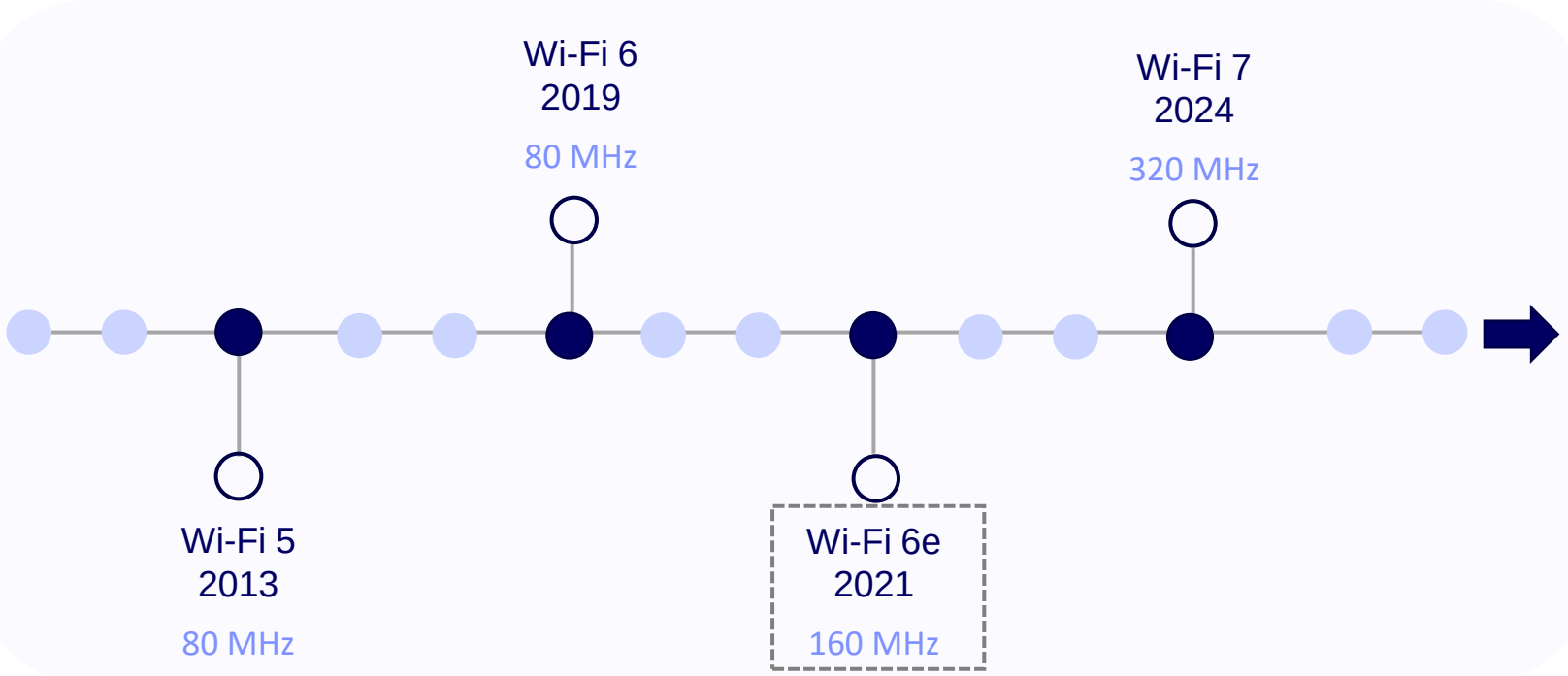
Communications & Information Technology Commission

Wi-Fi 6e and Beyond

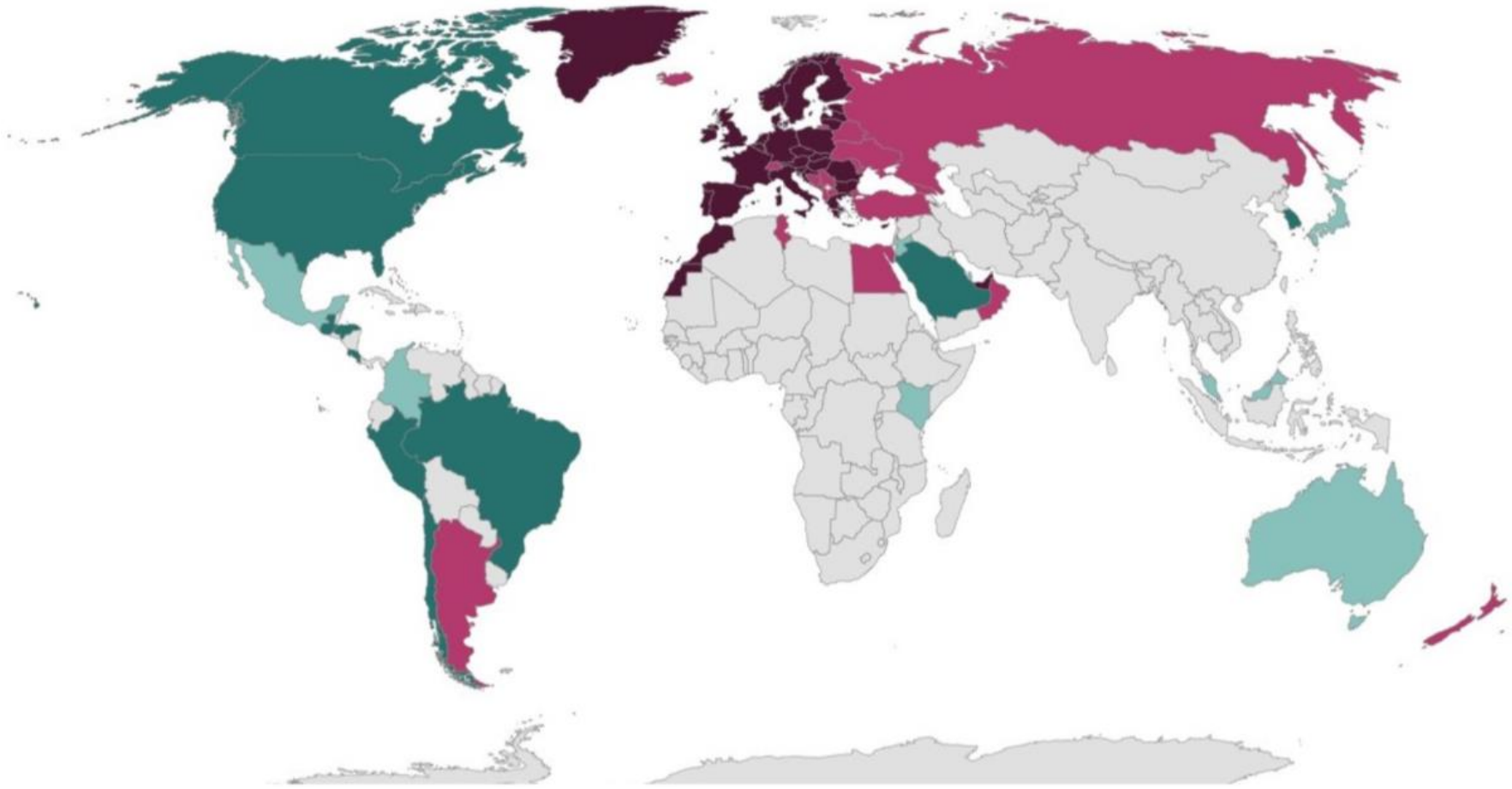
Progressive Spectrum Policies to Anticipate Future Needs

CITC is already looking ahead to the future by fast tracking the process of allocating additional spectrum in order fulfill the market needs and will continue to facilitate the access of spectrum to meet the connectivity demand.

We are forward-looking in our policies to anticipate future needs and working closely with the industry to support technologies to reach their full potential.



The Release of 6 GHz for Wi-Fi Around the Globe



Adopted 5925-7125 MHz

Considering 5925-7125 MHz

Adopted 5925-6425 MHz

Considering 5925-6425 MHz

Source: Countries Enabling Wi-Fi 6E, WiFi alliance

We Encourage International Spectrum Regulators

To consider unleashing the full 6 GHz for Wi-Fi applications

The need for sufficient and easy access to spectrum became even more evident for Wi-Fi applications. Especially, that these applications are developing and continuing to evolve to meet the global connectivity growing demands.

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Communications & Information Technology Commission

Thank You

citc.gov.sa

The What, Why, and How of AI-enabled Converged Networks

SARI ABU RAED

SYSTEMS ENGINEER

CommScope

COMMSCOPE®
RUCKUS®

The what, why, and how of AI-enabled converged networks

Sari Abu Raed
Sr. Systems Engineer

January 2022

WIRELESS GLOBAL CONGRESS
WIRELESS BROADBAND ALLIANCE

Enterprise network

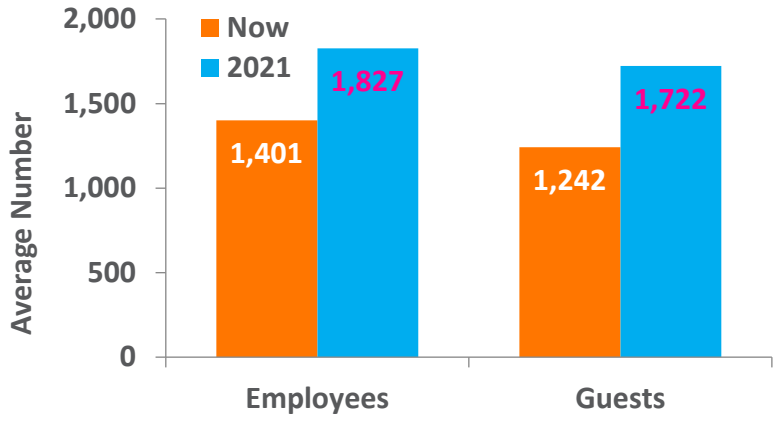
More Users

More Devices

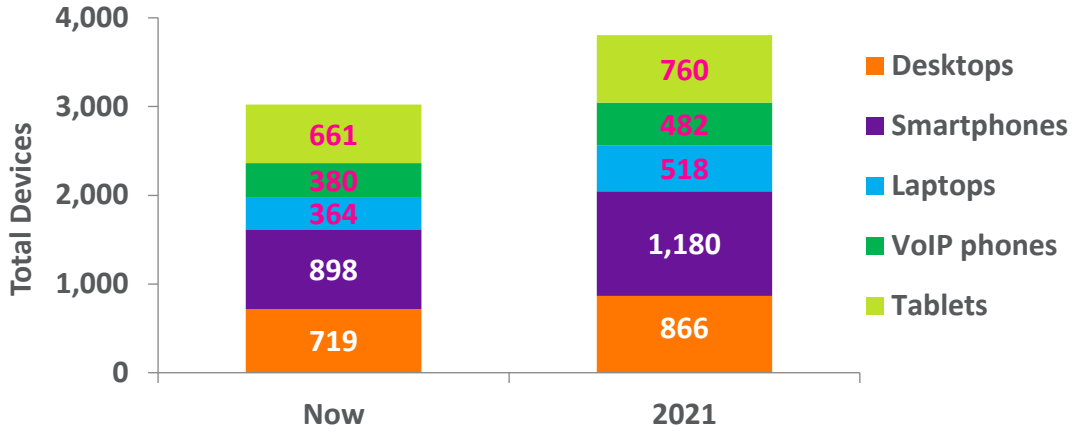
More Bandwidth-Intensive Applications

COMMSCOPE® RUCKUS®

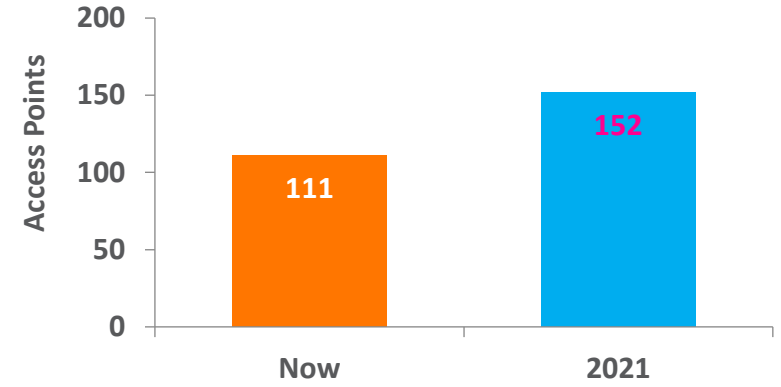
More Users



More Devices



More Network Elements



Greater Device Diversity

Networks Are Changing Rapidly

Source: Omdia *WLAN Strategies Survey*, August 2019

NETWORKS ARE NOW TOO COMPLEX FOR NORMAL HUMANS TO MANAGE EFFECTIVELY

Typical challenges

Lack of insight into complex networks

IT helpdesk flooded with competing issues

Mounting priorities, degraded user experience

Costs are going up, end user satisfaction is going down

Resource-Consuming
Network Administration

Unsatisfactory
User Experience

Growing
Costs

No wonder

42%

of network professionals spend too much time troubleshooting

38%

of network professionals cannot proactively identify network performance issues

#1

ranking of **wireless** as the top network challenge

WITHOUT HELP, THINGS WILL GET WORSE

Source: Sirkin Research, 2019

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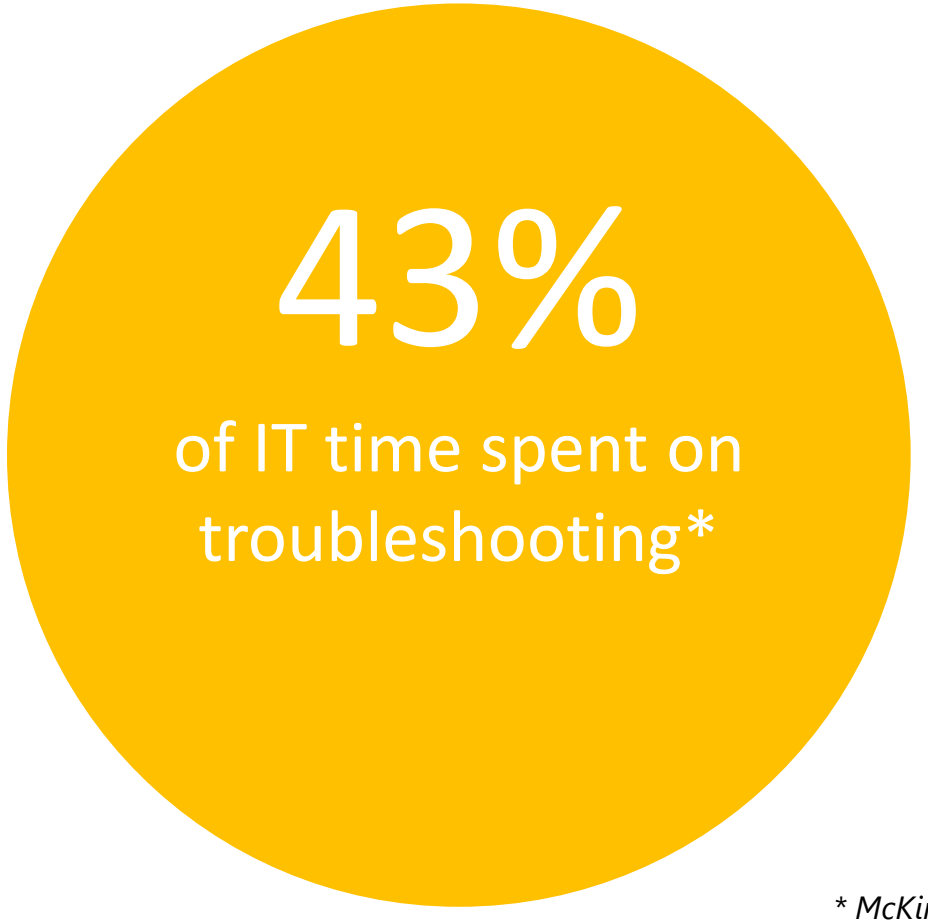
Cost of network troubleshooting is skyrocketing



* *McKinsey study, 2016*

We are living in a new era of networking

"Moving forward, organizations won't be able to rely on acts of individual heroism, but rather will need to evolve to more automated, self-optimizing, and healing network environments."

ESG Network Predictions for 2020

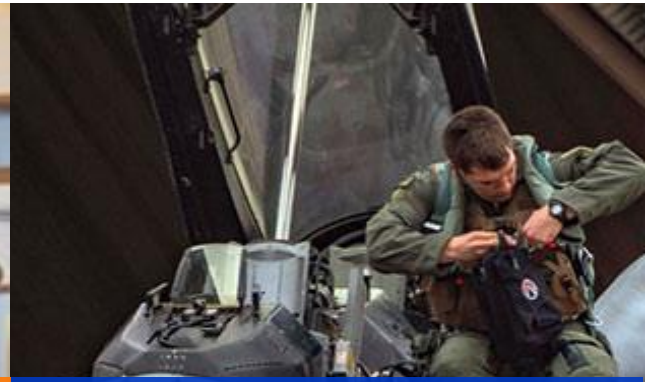
Every industry is evolving

IT leaders are improving user experience with the help of ML and AI

ENTERPRISE

MANAGED SERVICE PROVIDERS

HOSPITALITY



FEDERAL / NATIONAL

HIGHER ED

PRIMARY ED

HEALTHCARE

LARGE PUBLIC VENUES

The Old Way

Manual troubleshooting after incident reported

Respond in order incidents were logged

Manual root cause investigation

Visibility means (just) information

The AI/ML Way

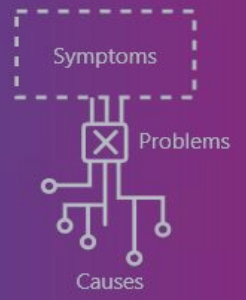
Surface issues before they blow up

ML-driven incident and anomaly detection

Address the most urgent issues first

AI-driven prioritization

Fix them fast



ML-driven root cause and recommendations

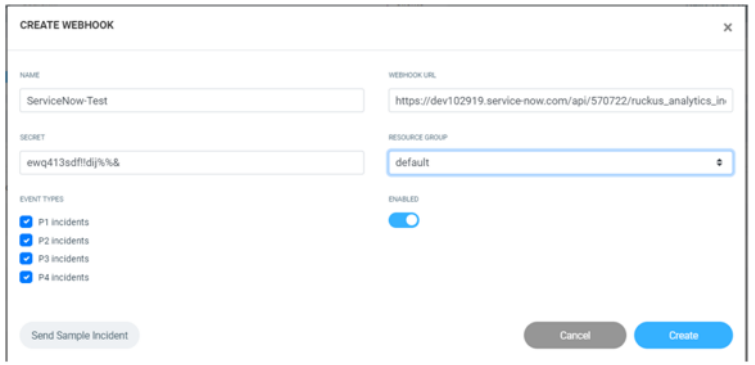
AI/ML from RUCKUS

Network Health Monitoring

Incident Analytics

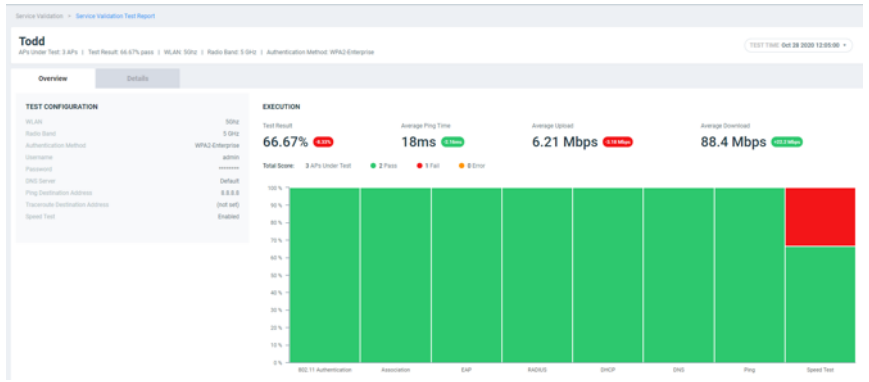
Client Troubleshooting

Reporting and Dashboards

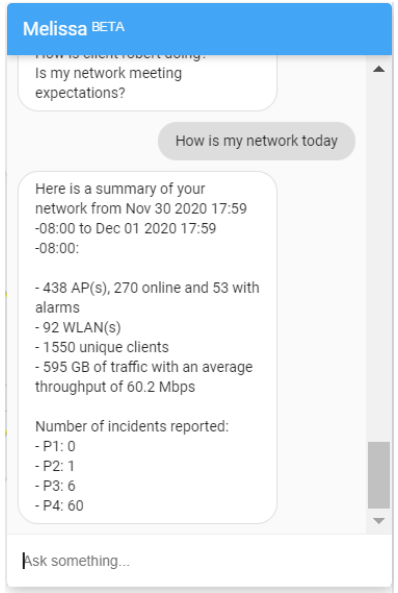


Helpdesk Integration

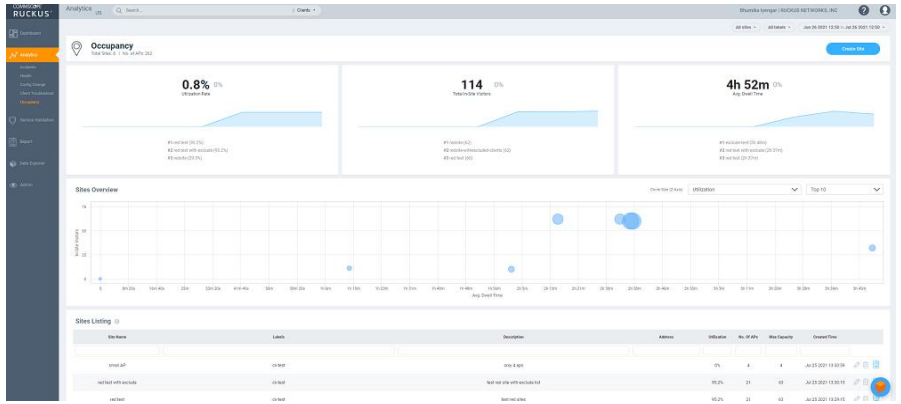
AI/ML from RUCKUS



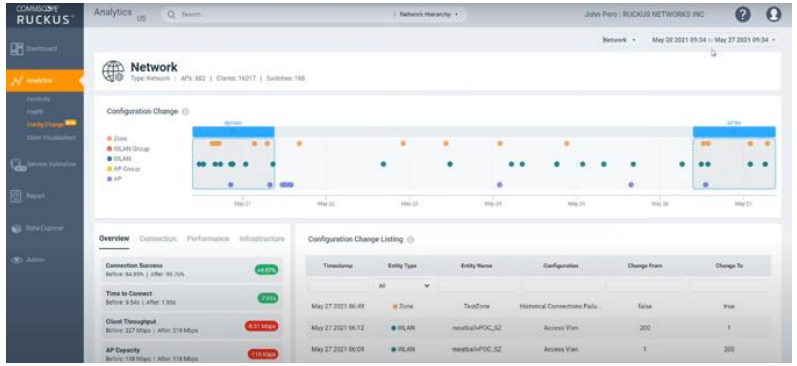
Service Validation



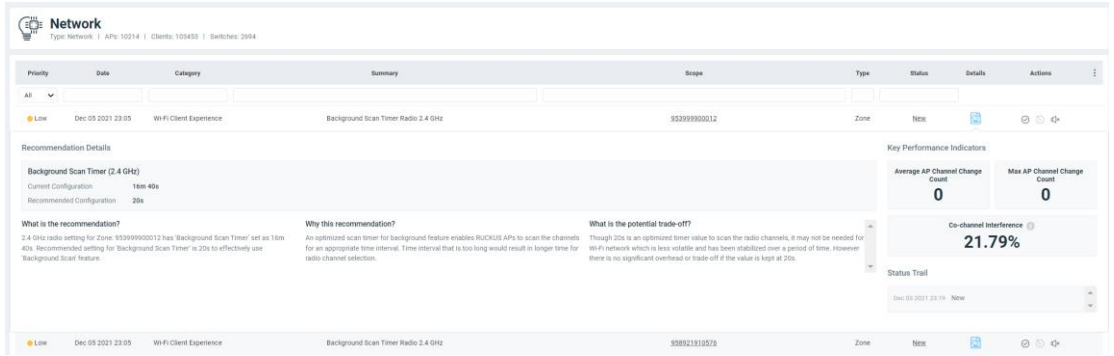
Melissa Virtual Assistant



Occupancy Analytics



Configuration Change Analysis



AI-assisted autonomous networking

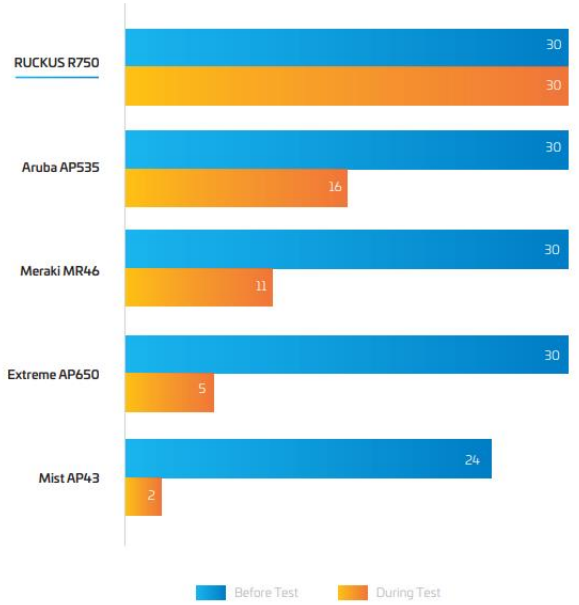
The best Wi-Fi

Network throughput

Throughput is a measure of the aggregate data traffic flowing between the AP and all of the clients in the network. A higher number is better, as it indicates that the AP can accommodate more users, devices and applications.

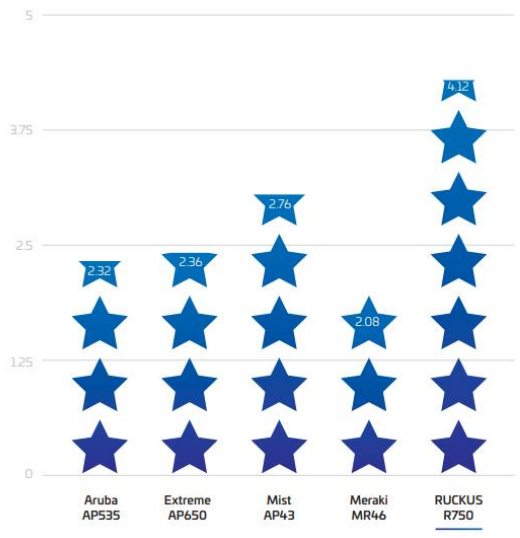
Stall-free streaming video

Streaming video and other video formats are common in work and school environments. When videos stall, it creates a poor user experience and may result in extra IT work. The score indicates the number of videos, out of 30, that were delivered without stalling.



Voice MOS

Voice mean opinion score (MOS) is a commonly used measure of user-perceived voice quality during a PSTN or VoIP call. The higher the score, the higher the call quality. A high-performing network prioritizes voice traffic over other data traffic to ensure good call quality.

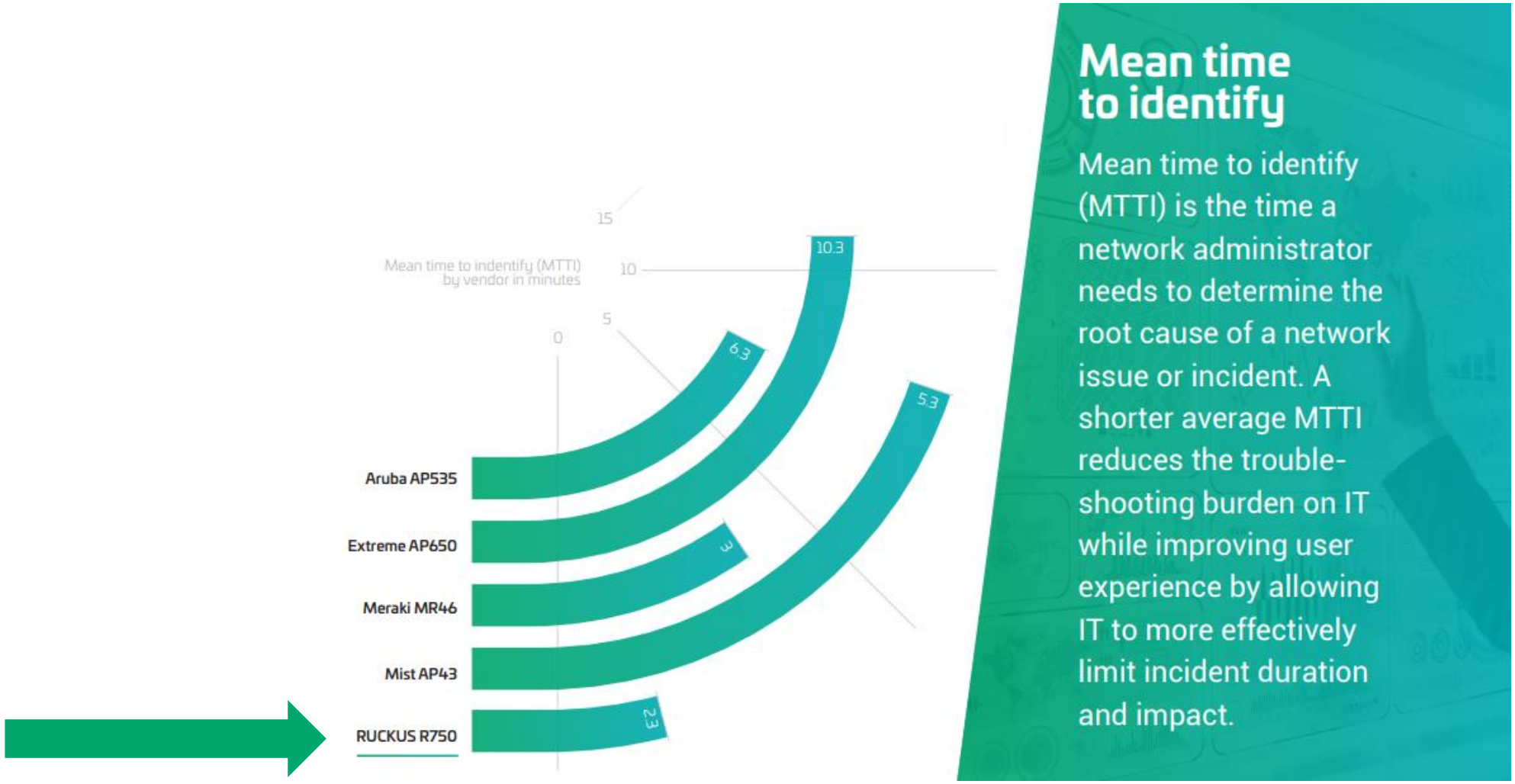


PACKET6

Download this report: **http://www.wifi6stresstest.com/**

COMMSCOPE® RUCKUS®

The best AI/ML solution



Mean time to identify

Mean time to identify (MTTI) is the time a network administrator needs to determine the root cause of a network issue or incident. A shorter average MTTI reduces the trouble-shooting burden on IT while improving user experience by allowing IT to more effectively limit incident duration and impact.

Download this report: http://www.wifi6stresstest.com/

PACKET6

COMMSCOPE® RUCKUS®

Our customers are already experiencing it

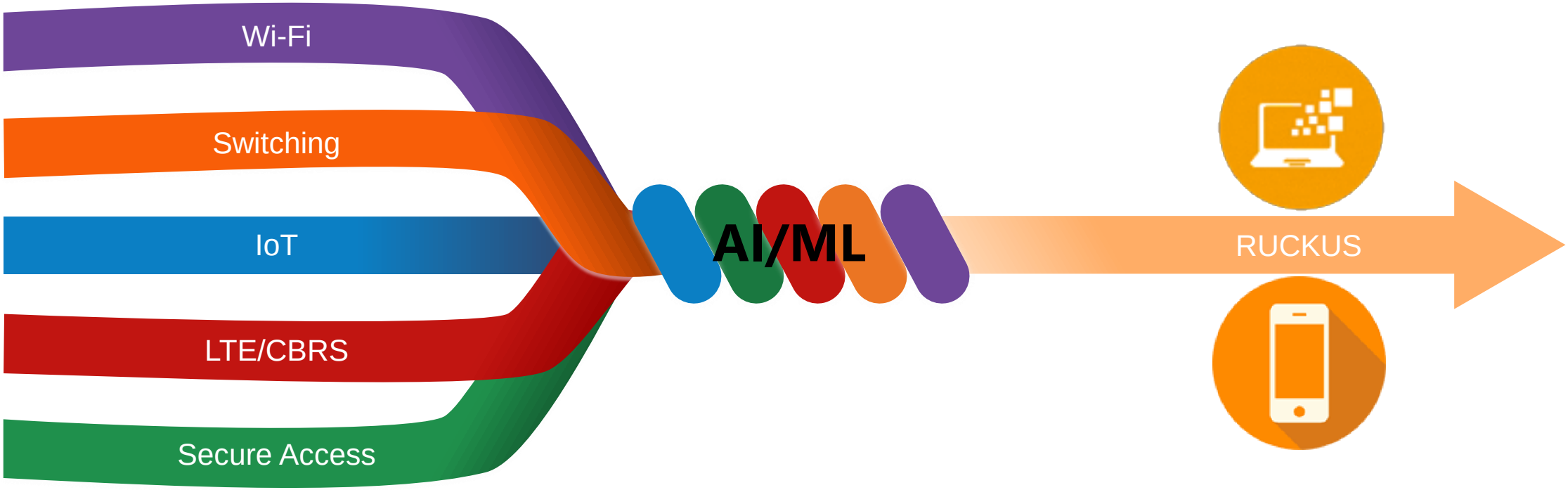
Benefits of our AI/ML

- 67% reduction in Mean Time To Resolution (MTTR)
- 40% reduction in time prioritizing and triaging
- 20% fewer helpdesk tickets
- 60% savings of SME IT time
- 50% reduction in new IT hire training

- 80% reduction in customer churn

Video Testimonial | *URL: https://video.commscope.com/watch/ZbCjXAB8ZbxaguZS1WaPdT?*

RUCKUS AI-enabled Converged Management and Assurance



Learn more about our AI-enabled converged management today

Contact your RUCKUS partner
or
Send us an email

Sari.AbuRaed@commscope.com
vasudevan.venkatakrishnan@commscope.com

6 GHz Wi-Fi: It's Not Just a Technology Update, It's a Spectrum Update

DAVID COLEMAN

DIRECTOR, WIRELESS TECHNOLOGY, OFFICE of the CTO

Extreme Networks

WBA Programs: 6 GHz Wi-Fi and The Road to Wi-Fi 7

KISHORE RAJA

VP ENGINEERING & STRATEGIC PROGRAMS

Boingo Wireless

January 2022 WBA Wireless Global Congress Asia PAC

Wi-Fi: 6GHz and Road to Wi-Fi 7

Kishore Raja
Vice President, Engineering & Strategy, Boingo Wireless
Chair, Nextgen Workgroup, WBA

boingo

20 Years of Wireless Leadership

LARGEST
DAS Operator
Largest indoor DAS provider in the U.S.

40,500
Small cell nodes

LARGEST
Wi-Fi Operator
Largest operator of airport Wi-Fi networks in the world

1+ MM
Hotspots worldwide

LARGEST
Military Provider
Largest Wi-Fi & Cell Tower provider to US Military bases

2,000+ Buildings

340,000 Beds

FIRST
Commercial DAS Network
to market ('99)

FIRST
Passpoint Network
to market ('14)

FIRST
CBRS Airport Private Network
to market ('18)

FIRST
Wi-Fi 6 Airport Network
to market ('19)

1+ BILLION CUSTOMER REACH/YEAR

boingo

A Trusted Connectivity Partner

INDUSTRIES

CUSTOMERS

Department of the Army · Department of the Air Force · Department of the Navy · U.S. Department of Homeland Security · State Farm · Port Authority NY NJ · CDA Chicago Department of Aviation · One World Trade Center · MTA

Tishman Speyer · Live Nation · LAX · Rockefeller Center · Soldier Field · Hines

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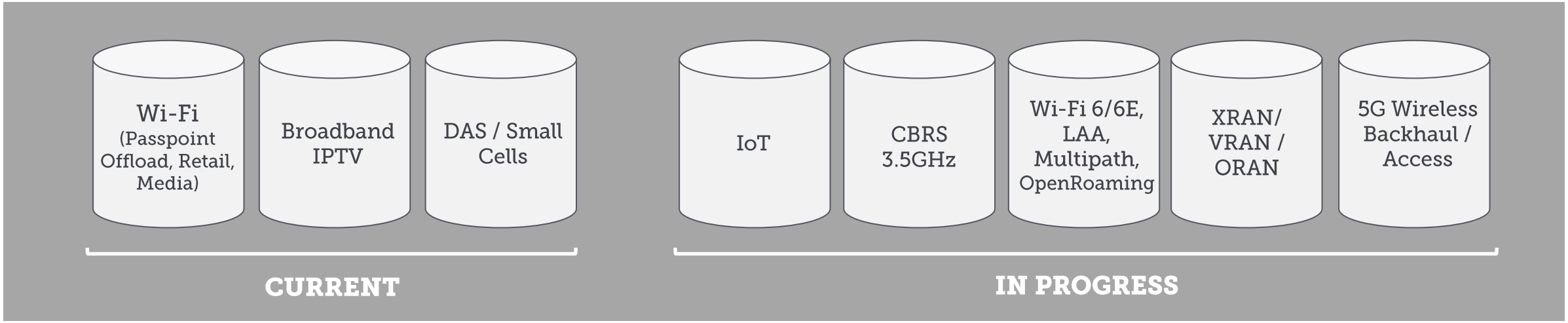
Boingo Technology Portfolio



CURRENT

WI-FI

DAS/SMALL CELLS

IN PROGRESS

CBRS (3.5GHz)

MILLIMETER WAVE

NEUTRAL HOST CARRIER OFFLOAD MONETIZATION OPPORTUNITIES

5G

WBA Activities

boingo

VISION OF WIRELESS BROADBAND ALLIANCE

WBA's vision is to lead the development of

"Seamless and interoperable services experience on Wi-Fi within the global wireless ecosystem"

- Enable collaboration among service providers, technology companies and the organizations in the industry who share the vision
- Undertake programs and activities to address business and technical issues and opportunities for the member companies

WORKGROUPS

1	5G	Project Team-1
2	IoT	Project Team-2
3	NextGen	Project Team-3
4	Roaming	Project Team-3
5	Testing & Interoperability	↕
6	Policy & Regulator Affairs	
7	Market	Project Team-n

Strategic

Innovation Forum - By CTO Group | OpenRoaming™ | Connected Communities Forum

Established **in 2003**

150+ MEMBERSHIP **COMMUNITY**

PROJECTS & **PROGRAMS**

2 ANNUAL **EVENTS**

PROMOTION AND **GO-TO-MARKET**

THOUGHT LEADERSHIP & **MARKET RESEARCH**

Wireless Global Congress · Carrier Wireless Services Certification · OpenRoaming Wireless Broadband Alliance · World Wi-Fi Day · WBA Industry Awards · Innovation Forum · Connected Communities Forum

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WBA Members

For the complete list of current WBA members, click here.

Last updated – October 2021

WBA 2022 Technical Roadmap

WBA WORK GROUPS & PROJECTS

5G Work Group	IoT Work Group	NextGen Work Group	Roaming Work Group	OpenRoaming™ Task Group	Testing & Interoperability Work Group
Leading Wi-Fi and 5G RAN Convergence	Augmenting Wi-Fi role in IoT	Fast-tracking Wi-Fi deployments for operators	Incubating new business opportunities	Development of standards, federation governance and trials	Achieving interoperable Wi-Fi services
5G & Wi-Fi Convergence in Private 5G Networks	Wi-Fi 6/6E for Industrial IoT	Wi-Fi 6E & Wi-Fi 7	In-Flight Connectivity (Continuous Experience)	Federated Onboarding Service for OpenRoaming	Access Network QoS
	Smart Home 2.0	Operator Managed Wi-Fi Reference Architecture	Profiles & RCOIs Prioritization	OpenRoaming for Private LTE / 5G	E2E QoS Management Trial
		Rural Wi-Fi		OpenRoaming for IoT	ANQP Elements Guidelines
					Wi-Fi Devices Identification

Policy & Regulatory Affairs Work Group	Market Work Group	WBA Certification Task Group
Industry liaison and advocacy of WBA global programs	Marketing activities and industry dissemination	Addressing interoperability to foster adoption

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5G WORK GROUP

LEADERSHIP TEAM

Chair: Jim Sturges – AT&T

Co-Chair: Florin Baboescu - Broadcom

Co-Chair: Mark Grayson - Cisco

OPPORTUNITIES / BUSINESS BENEFITS

Trends and Opportunities: Private 5G network deployments are expected to ramp up significantly over in 2021 to 2025 in sectors like manufacturing (industrial IoT), utilities, supply chain, healthcare, transportation etc. Private 5G networks can provide new business opportunities to enterprises to enhance services and deliver new use cases with greater level of control and flexibility.

Business Benefit: Private 5G networks with 5G connectivity and on-premises edge computing capability are being evaluated by different enterprises to provide optimized services with improved security to meet specific requirements for their verticals

This project aims to evaluate potential optimization of 5G and Wi-Fi convergence architecture with collocated deployments of 5G access and Wi-Fi access networks, identify roaming use cases between 5G and Wi-Fi within and across private 5G networks and analyze how the enterprise Wi-Fi segmentation and 5G slicing come together in private network deployments.

TECHNICAL PROGRAMS

ACTIVE PROGRAMS:

- **5G AND Wi-Fi CONVERGENCE IN PRIVATE 5G NETWORKS**

EXPECTED DELIVERABLES:

Phase 1:

- Develop a Whitepaper with the evaluation on business opportunities for convergence in private 5G networks and identify use cases, deployment scenarios and architectures between 5G and Wi-Fi.

Phase 2:

- Analyze how the enterprise Wi-Fi segmentation and 5G slicing in private network deployments.
- Provide deployment guidelines for converged Wi-Fi and 5G deployments in private 5G networks;

RELEVANT LINKS

Learn more about **RAN Convergence**

5G and Wi-Fi RAN Convergence Whitepaper

WBA & NGMN RAN Convergence 2019

Unlicensed Integration with 5G Networks

LEADING MEMBERS

AMERICAN TOWER · BROADCOM · BT · CISCO · Charter COMMUNICATIONS · Google · intel · NOKIA · orange · tessares

Get involved now, sign up ONLINE! If you are a WBA Member, join directly via our EXTRANET

IOT WORK GROUP

LEADERSHIP TEAM

Chair: Sandeep Agarwal - C-DOT

OPPORTUNITIES / BUSINESS BENEFITS

Trends and Opportunities: The global industrial IoT (IIoT) market is expected to exceed USD 750B by 2020. Wi-Fi is the most prevalent wireless technology in industrial environments. However, there are wide range of applications with latency and reliability requirements unmet with existing wireless capabilities; hence, the footprint of wireless solutions in manufacturing for automation applications has been limited due to the challenge of meeting the stringent latency and reliability requirements

Business Benefit: Wi-Fi 6E introduces operation in greenfield 6 GHz band that can be used to meet the majority of the stringent low latency requirements of IIoT usage

Wi-Fi 6 /6E provides more capacity than all the other Wi-Fi bands put together and deliver connections with speeds equivalent to the new advanced 5G mobile, support low-latency levels required for mobile gaming, virtual and augmented reality (VR/AR) applications, and Industry 4.0 solutions. WBA continues to develop and expand new trials that support Wi-Fi 6 and 6E expansion into new areas in different geographies around the world

TECHNICAL PROGRAMS

ACTIVE PROGRAMS:

- **Wi-Fi 6/6E FOR INDUSTRIAL IoT**
- **SMART HOME 2.0**

PAST PROGRAMS:

- **Wi-Fi & LORAWAN TRIALS REPORT**
- **CONNECTED VEHICLE**
- **IN-HOME WI-FI**
- **IOT DYNAMIC INTEROPRABILITY**

EXPECTED DELIVERABLES:

- Industry guidelines deployments in various environments
- Develop and execute trials
- Provide analysis and market data to drive the standardization and unlock business potentials

RELEVANT LINKS

Learn more about **Wi-Fi 6 for Industrial IoT**

In-Home Wi-Fi Multi-AP Solutions Trial

In-Home Wi-Fi Multi-AP Trial Report

Connected Vehicle

LEADING MEMBERS

Aerial, American Tower, aruba a Hewlett Packard Enterprise company, Cisco, Charter Communications, eleven, intel, orange, Cognitive, Comcast, Hotwire Communications, Plume, Samsung, SingleDigits, Turkcell

Get involved now, sign up ONLINE! If you are a WBA Member, join directly via our EXTRANET

NEXTGEN WORK GROUP

LEADERSHIP TEAM

Chair: Kishore Raja - Boingo Wireless

Co-Chair: Necati Canpolat - Intel

Co-Chair: Steve Dyett - BT

OPPORTUNITIES / BUSINESS BENEFITS

Trends and Opportunities: Actively work on identifying Next Generation Technologies in the Wireless Industry. Current and upcoming standards in Wi-Fi have evolved to make the technology address a plethora of Industry use cases including Industry 4.0 applications, Enterprise, Residential, Rural etc.

Business Benefit: Wi-Fi 6 technology would remove pain points currently caused by overcrowding on many Wi-Fi networks. With upcoming Wi-Fi 7 standards, certified devices enter the market in full force enabled by more countries opening the 6GHz spectrum and more IoT adoption in the market.

TECHNICAL PROGRAMS

ACTIVE PROGRAMS:

- **WI-FI 6E TRIALS AND WI-FI 7**
- **OPERATOR MANAGED WI-FI – REFERENCE ARCHITECTURE**
- **RURAL WI-FI**

PAST PROGRAMS:

- **WI-FI 6 DEPLOYMENT GUIDELINES**
- **WI-Fi Sensing**

EXPECTED DELIVERABLES:

- Technology use cases and applications
- Create Deployment guidelines
- Conduct Joint Industry Trials

RELEVANT LINKS

Learn more about Wi-Fi 6 & 6GHZ Trials

In-Home Wi-Fi Multi-AP Solutions Trial

Global Implications Of Wi-Fi 6 & 6GHz

Learn more about Rural Wi-Fi

Wi-Fi Sensing Whitepaper

LEADING MEMBERS

AT&T, boingo, BROADCOM, LIQUID INTELLIGENT TECHNOLOGIES, CableLabs, cisco, intel, SAMSUNG, SK telecom, HFCL GROUP, airties, ASSIA, BT, CableLabs, Charter COMMUNICATIONS, Google, MEDIATEK, Plume, Viasat, ER-TELECOM

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ROAMING WORK GROUP

LEADERSHIP TEAM

Chair: Erinn Hall – AT&T

Co-Chair: Betty Cockrell – Single Digits

OPPORTUNITIES / BUSINESS BENEFITS

Trends and Opportunities: The Roaming Work Group (RWG) is the umbrella group where all the topics related to Wi-Fi Roaming are addressed.

Business Benefit: Introduce new opportunities on Wi-Fi Roaming business by enabling and extending available footprint across the globe

TECHNICAL PROGRAMS

ACTIVE PROGRAMS:

- **ROAMING WORK GROUP**
- **IN-FLIGHT CONNECTIVITY**
- **PROFILES AND RCOI PRIORITIZATION**

PAST PROGRAMS:

- **WI-FI ROAMING STANDARD (WRIX)**

EXPECTED DELIVERABLES:

- WI-FI Roaming best practices
- Maintenance and evolution of WRIX specification
- Analyze Technical challenges and set benchmarks for In-flight connectivity.

RELEVANT LINKS

Learn more about **Roaming Work Group**

Wi-Fi Roaming Standard (WRIX)

WBA OpenRoaming

Testing & Interoperability Work Group

LEADING MEMBERS

aruba a Hewlett Packard Enterprise company · AT&T · boingo · CableLabs · cisco · globalreach · Google · SINGLEDIGITS · orange · T-Mobile · AMERICAN TOWER · inmarsat · Panasonic · Charter COMMUNICATIONS · Viasat

Get involved now, sign up ONLINE! If you are a WBA Member, join directly via our EXTRANET

WBA OPENROAMING – TECHNICAL STANDARDS TASK GROUP

LEADERSHIP TEAM

Chair: Mark Grayson – Cisco

Co-Chair: Betty Cockrell – Single Digits

Co-Chair: Necati Canpolat - Intel

OPPORTUNITIES / BUSINESS BENEFITS

Trends and Opportunities: WBA OpenRoaming™ is a roaming federation service enabling an automatic and secure Wi-Fi experience globally. With WBA OpenRoaming™, we are creating an open connectivity framework for all organizations in the wireless ecosystem to power new opportunities in the 5G era.

Business Benefit: Creates a federation of networks and identity providers to enable automatic roaming and user onboarding on Wi-Fi

Enable simple, secure and scalable Wi-Fi connections amongst different organizations that are part of WBA OpenRoaming™

OpenRoaming participants can have access and make use of Federated Onboarding Service without each one of them implementing and deploying full fledge standalone Online Sign-Up service, and thus avoiding cost and complexity.

TECHNICAL PROGRAMS

ACTIVE PROGRAMS:

- **WBA OPENROAMING™ STANDARDS**
- **FEDERATED ONBOARDING SERVICE FOR OPENROAMING**
- **WBA OPENROAMING™ FOR PRIVATE 5G**
- **WBA OPENROAMING™ FOR IOT**

PAST PROGRAMS:

- **PROFILES AND RCOI PRIORITZATION**

EXPECTED DELIVERABLES:

- Automatic and secure roaming between millions of networks
- Develop Industry best practice Federated Onboarding service
- Identify business opportunities with potential optimization of 5G and Wi-Fi
- Develop addendum to Openroaming to address IoT opportunities

RELEVANT LINKS

About **WBA OpenRoaming™**

WBA OpenRoaming™ Release 2

Wi-Fi Devices Identification

Profiles & RCOI Prioritization

LEADING MEMBERS

AT&T, boingo, CableLabs, cisco, globalreach, Google, intel, orange, SINGLEDIGITS, BT, COMCAST, COMMSCOPE, eleven, gm

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TESING & INTEROPERABILITY WORK GROUP

LEADERSHIP TEAM

Chair: Michael Sym – Single Digits

Co-Chair: Erinn Hall – AT&T

Co-Chair: Peter Thornycroft – Aruba Networks

OPPORTUNITIES / BUSINESS BENEFITS

Trends and Opportunities: Determining the Quality of Service (QoS) on a given Access Network Provider (ANP) location has always been a challenge. Identity Providers (IDPs) often want insight into QoS to help decide if a roamer should attach to a given location. There is lack of standardized framework to provide visibility between Wi-Fi and cellular networks of their respective QoS requirements or their fulfillment. Also Wi-Fi networks have until now relied on the original permanence of device MAC addresses to facilitate access to or management of the network. This permanence is actively being removed and can no longer be relied upon.

TECHNICAL PROGRAMS

ACTIVE PROGRAMS:

- **ACCESS NETWORK QUALITY OF SERVICE**
- **END TO END QUALITY OF SERVICE MANAGEMENT TRIAL**
- **WI-FI & DEVICES IDENTIFICATION**

EXPECTED DELIVERABLES:

- Provide platform for end-to-end trials to obtain valuable data in identifying performance bottlenecks for newer (more challenging) applications like AR/VR, process control in Industrial/robotic applications, etc.,
- Develop Industry guidelines and determine any new and existing QoS metrics
- Examine the removal of reliance on a persistent Wi-Fi MAC from Wi-Fi networks by identifying long-term solutions for stable, private, network-specific identifiers that are appropriate for the use to which they

RELEVANT LINKS

Wi-Fi & Devices Identification

Testing & Interoperability **Work Group**

Enhanced Wi-Fi 6 Decoded

Roaming Work Group

LEADING MEMBERS

aruba a Hewlett Packard Enterprise company, BROADCOM, CableLabs, cisco, COMMSCOPE, MEDIATEK, NetExperience, SINGLEDIGITS, airties, boingo, Charter COMMUNICATIONS, intel, Aerial WIFI MOTION ANALYTICS, BT, eleven, Google, Maxima telecom, NOKIA

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MARKET WORK GROUP

LEADERSHIP TEAM

Chair: Melody Eclavea – AT&T

Co-Chair: Melody Walker – Boingo Wireless

Co-Chair: Gabriel Desjardins - Broadcom

Supported by WBA Marketing

SARAH KOLMER

Director of Marketing & PR

ALICE LAI

Senior Marketing Manager

BRYAN SMITH

Marketing Manager

WILSON TAN

Senior Events Manager

OPPORTUNITIES / BUSINESS BENEFITS

Work closely with WBA members and partners to enable marketing and business opportunities.

Promote effective marketing channels for members to increase their influence in the industry.

TECHNICAL PROGRAMS

- Strengthen branding positioning – ensure success of the Alliance and other initiatives reflects on the WBA brands and sub-brands
- Continue to enhance WBA's members leadership position as the 'voice of Wi-Fi'
- Drive the engagement among exiting members and followers
- Promote the works of the Alliance members which address business & technical issues, as well as opportunities for member companies.
- Work closely with media, journalists, research and analysts to strengthen and communicate all the potentials and benefits of Wi-Fi.

RELEVANT LINKS

Current Members

WBA Programs & Projects

Wireless Global Congress

Industry Awards

LEADING MEMBERS

AT&T boingo BROADCOM CableLabs COMMSCOPE cisco Google intel Jio orange SINGLEDIGITS

Get involved now, sign up ONLINE! If you are a WBA Member, join directly via our EXTRANET

POLICY AND REGULATORY AFFAIRS WORK GROUP

LEADERSHIP TEAM

Chair: **Burhan Masood Broadcom**

Co-Chair: **Brian Josef Comcast**

OPPORTUNITIES / BUSINESS BENEFITS

Trends and Opportunities: The WBA's Policy & Regulatory Affairs Work Group is to track global trends and relevant policy & spectrum issues that are of concern to the WBA membership.

The Work Group will coordinate Wi-Fi advocacy efforts across membership, cities, regions and regulators globally to provide and issue industry guidelines and white papers that outline recommendations to regulators and authorities in respect to various spectrums ranges, worldwide bands allocation and public consultation consensus and responses

Business Benefits: Work closely with WBA members and regulatory bodies for improved Wi-Fi (more spectrum, better security, user experience, Passpoint® & OpenRoaming™)

Validate business opportunities of new Wi-Fi generations working in new spectrum brands and work with regulators globally

Embrace the benefits of WBA OpenRoamingTM to support user authentication and address regulatory requirements for user identification issues

TECHNICAL PROGRAMS

- 6 GHz band harmonization
- US FCC 6 GHz FNPRM ruling gaps coverage
- Client-to-client communication
- Successful advocacy with regional leaders in Asia, and South America
- Strategy for upper 6 GHz band in EU
- OpenRoaming and Passpoint collaboration strategy
- 911 emergency calling over Wi-Fi

RELEVANT LINKS

Learn more about **Policy Work Group**

Wi-Fi 6 Deployment Guidelines

Wi-Fi 6E Trials

Global Implication for Wi-Fi 6 & 6Ghz

LEADING MEMBERS

aruba a Hewlett Packard Enterprise company · BROADCOM · Charter COMMUNICATIONS · COMCAST · globalreach · intel · Qualcomm · ROGERS

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WBA CERTIFICATION

LEADERSHIP TEAM

BRUNO TOMAS
Director
Programs & PMO

JONAH ROSS
Program Manager

PEDRO MOUTA
Senior Manager

Contact our PMO team at
pmo@wballiance.com

OPPORTUNITIES / BUSINESS BENEFITS

Trends and Opportunities: Join the WBA Certification group either to certify your products or to help developing WBA's certification models to the benefit of your organization

WBA Certification is expanding the testing opportunities to services such as network interoperability, roaming, offload and captive portal behavior

Business Benefits: WBA has launched its Certification Program starting with the Carrier Wireless Services Certification (CWSC) testing for members and sponsored partners. CWSC provides unprecedented capabilities to test the end-to-end wireless ecosystem to guarantee that the service operation and user experience is consistent across real life networks

TECHNICAL PROGRAMS

- Joint collaboration between operators and vendors to develop a compliance program to guarantee broad industry deployment and alignment
- Maintain a current set of equipment to get used in certification
- Evaluate and monitor the Authorized Test Labs
- Work with Wi-Fi Alliance and 3GPP to promote the adoption of potential solutions

RELEVANT LINKS

Learn more about **CWSC**

Wi-Fi Roaming Standards

Roaming Evolution

WBA OpenRoaming™

LEADING MEMBERS

MaximaTelecom · aruba a Hewlett Packard Enterprise company · CableLabs · cisco · Charter COMMUNICATIONS · COMMSCOPE · SINGLEDIGITS

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Wi-Fi
Industry Update

Wi-Fi 6/6E Delivers KPI Improvements

ENHANCED

Efficiency

Speed

Capacity

Performance

- DENSE/DEMANDING ENVIROMENTS
- SUPPORT GROWING MOBILE TRAFFIC
- ACCOMMODATE FUTURE USE CASES
- CONNECT MORE DEVICES
- QUICKER RESPONSE TIMES

WBA is championing a global Wi-Fi 6/6E program to ensure that industry needs are addressed

boingo

Wi-Fi 6/6E Trials

Trial Categories

- Residential Wi-Fi
- University
- Airports
- Industrial IoT
- Transportation Hubs
- Food chain
- Smartcity
- Aerospace
- Testhouse
- Metro / Subway
- Stadiums / Sports Arenas
- Rural

Companies Involved

boingo

Road to Wi-Fi 7

Wi-Fi 7 / 802.11be Specifications

- 7th generation
- 30Gbps – 46Gps Throughput
- 4096 QAM
- 320MHz channels
- Multi-AP operation
- Milti-link operation
- 16 Spatial Streams
- Multi-RU
- WPA4 Security

- Extended Spectrum in 6GHz
- Spectrum sharing with Incumbents

Innovative Use cases

- Wi-Fi Sensing
- IoT segment with smaller channels
- 3D content
- XR (AR/VR) type of applications
- Location Based Services
- Convergence and Co-Integration with 5G / CBRS etc.
- Rural
- Multi AP for Residential
- SmartHome
- Connected Vehicles

Infrastructure Digitization

- NFV/SDN
- RAN Virtualization with Software Defined Radios
- Cloud based Controllers
- Open standards (OpenWiFi)

Quality of Service

- WMM
- OCE and MBO
- Wi-Fi Vantage™
- Similar quality to QCI/5QI
- Deterministic Transmission
- Deterministic Low Latency
- Higher Spectral efficiency (~80%)
- Traffic Classification advancements

Market Segments

- Airports
- Healthcare
- Smart Cities
- Transit Hubs
- Manufacturing
- Office Buildings
- Industrial IoT
- Public Safety
- Outdoor Spaces
- MDU
- Hospitality
- Automotive
- Stadiums
- Concert Venues

THANK YOU

Kishore Raja
Vice President, Engineering & Strategy, Boingo Wireless
Chair, NextGen Workgroup, WBA
Co-chair, Open Converged Wireless, TIP

kraja@boingo.com

boingo

WIRELESS GLOBAL CONGRESS
WIRELESS BROADBAND ALLIANCE

Its time for lunch!

The Pergolas Restaurant, Lobby Level.

The Conference will resume at 2.30 PM

WIRELESS GLOBAL CONGRESS
WIRELESS BROADBAND ALLIANCE

Building Future Proof Public Wi-Fi with Offload Monetization and Open Roaming Capabilities

AHMER ARSALAN

HEAD SOFTWARE SALES - MEA

STL

STL

stl.tech

WIRELESS GLOBAL CONGRESS

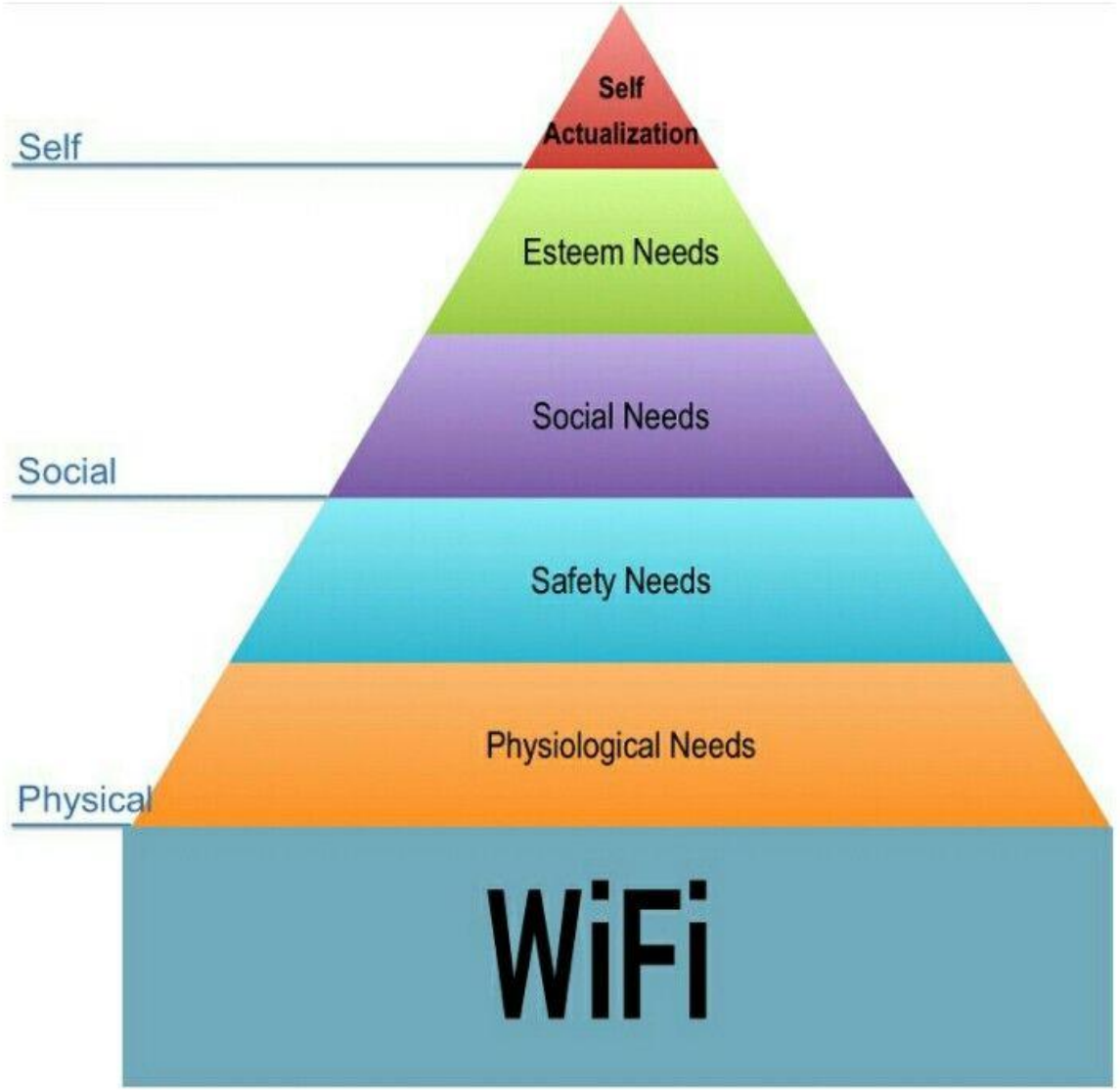
WI-FI REVOLUTION: DRIVING DIGITAL GROWTH

25-27 JAN 2022

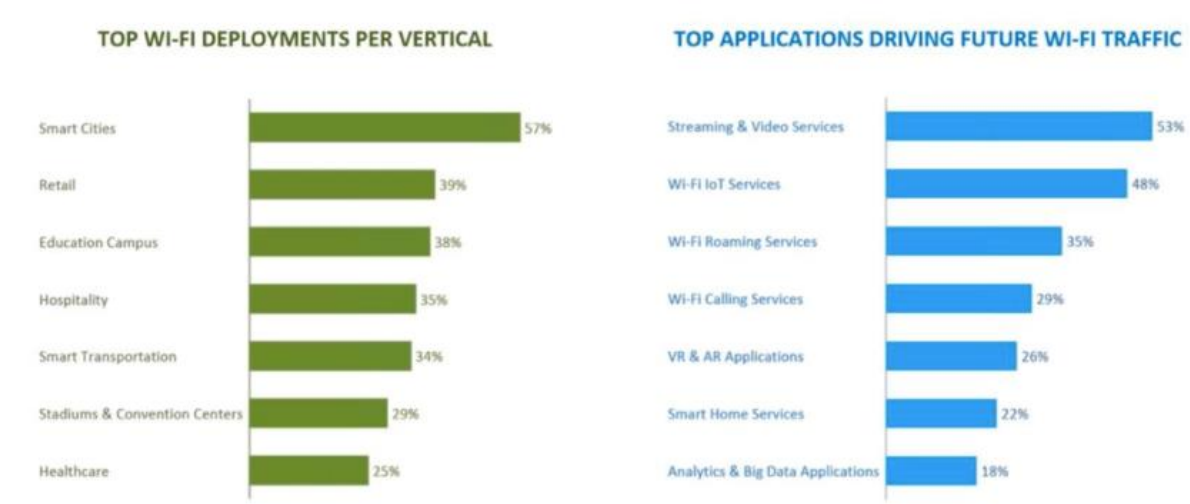
WGC Asia Pac – Wi-Fi Revolution: Driving Digital growth

Building Future Proof Public WiFi with Offload monetization and Open Roaming Capabilities

Most important need of human-kind in 21st century…

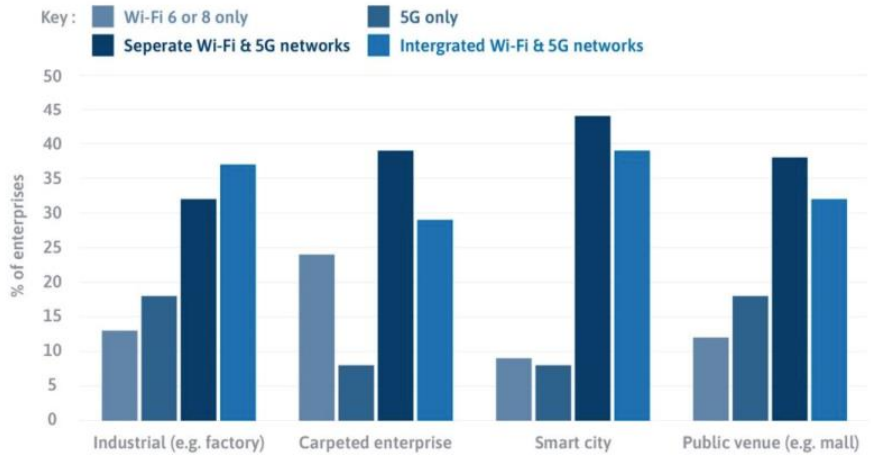


Market Trends & Wi-Fi Evolution



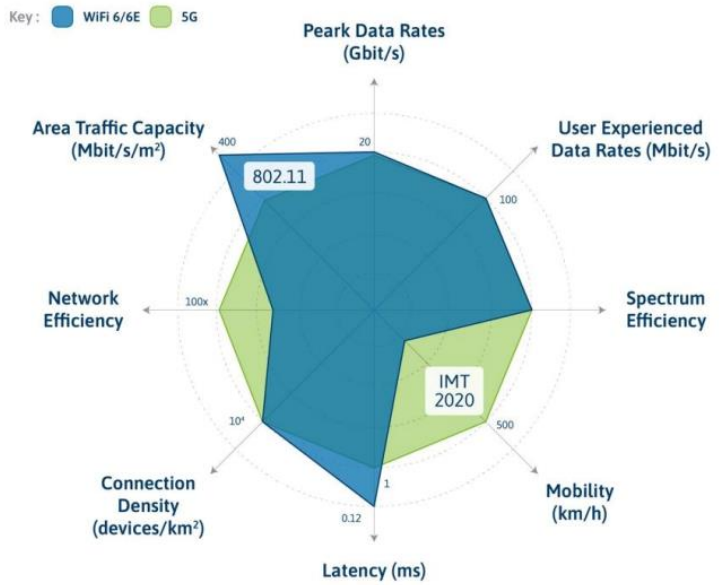
Source: WBA Industry Report 2020

Top Verticals for Wi-Fi Adoption



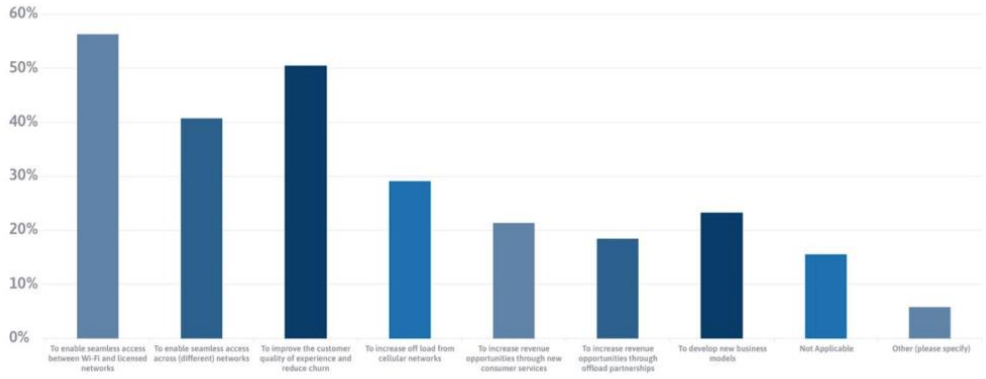
Source: Rethink Technology Research enterprise survey May 2021 (n=210)

Intention to deploy Wi-Fi 6/6E/7 and /or 5G in 2021-25, by enterprise type



Source: Wireless Broadband Alliance (WBA)

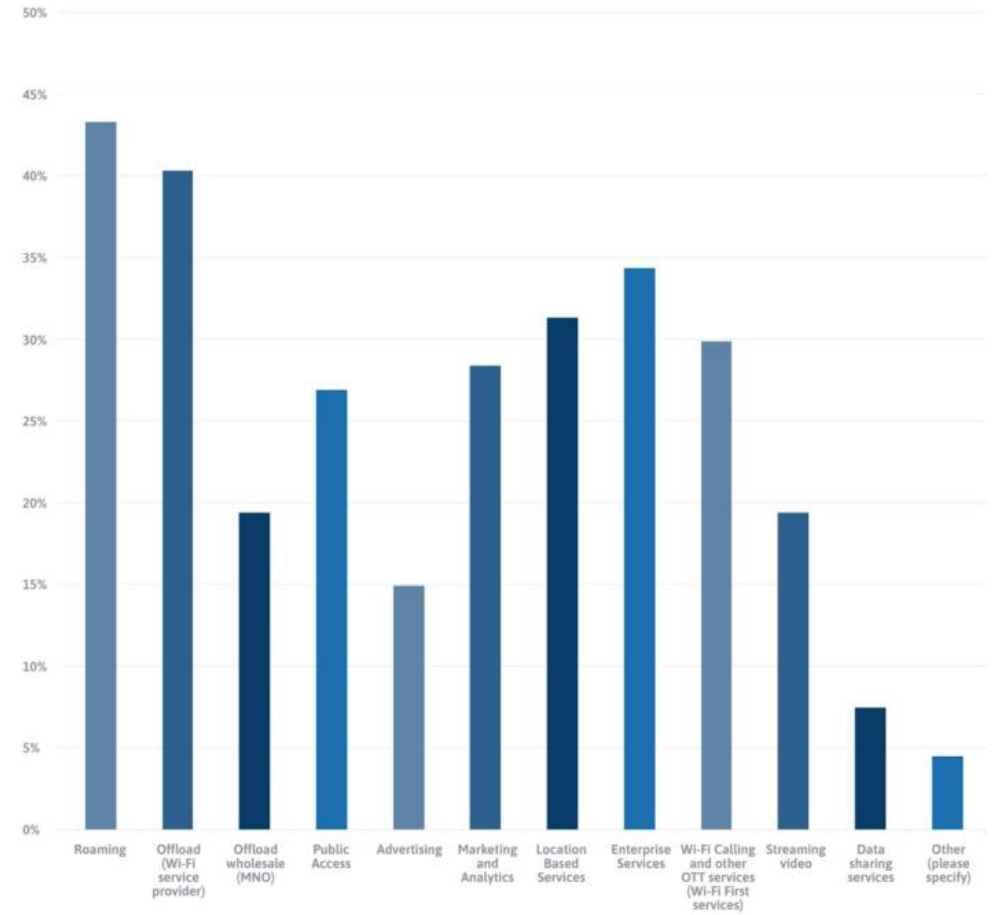
5G and Wi-Fi 6/6E Performance



Source: Wireless Broadband Alliance (WBA)

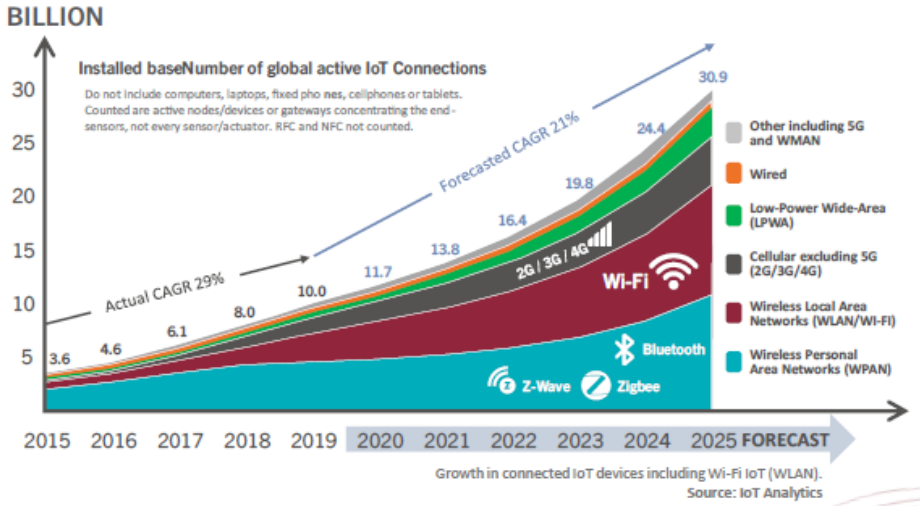
Top 3 Drivers for Investing in a Passpoint Compliant Network

Market Trends & Wi-Fi Evolution



Source: Wireless Broadband Alliance (WBA)

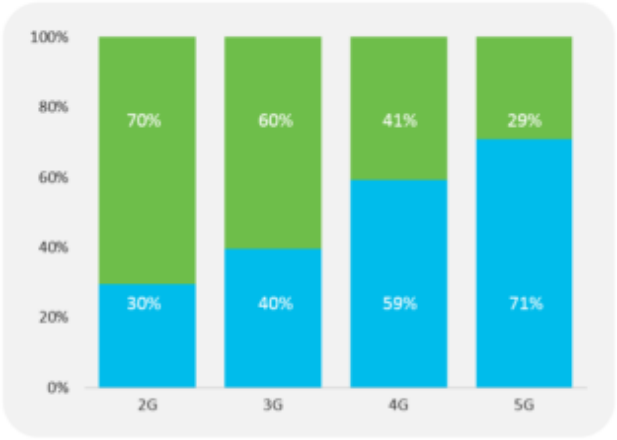
TOP 3 Wi-Fi monetization strategies in terms of importance for the next 12 months



Growth in connected IoT devices including Wi-Fi IoT (WLAN).
Source: IoT Analytics

7.5 billion IoT units as of 2020 are short-range and non-cellular and uses only Wi-Fi

Mobile and Offload Traffic from Mobile-Connected Devices



*Offload includes traffic from dual-mode devices (i.e., supports cell & Wi-Fi, excl. PCs) over Wi-Fi/small cell networks

Source: Cisco VNI Global Mobile Data Traffic Forecast, 2017–2022

The share of offloaded traffic will only increase with 5G (from 59% in 4G to 71% in 5G)

Wi-Fi Going through Unprecedented Evolution & Adoption

1

Vanilla Wi-Fi Offload

Basic offload use case
3GPP parameter check
Location based offload

2

Policy based Offload

ANDSF Compliance
QoE check, Periodic evaluation, Real Time offload, Analytics

3

Wi-Fi 6 Adoption

Faster Speed (upto 9.6 Gbps compared to 3.5 in WiFi5, Better QoE, Better Battery Life

4

Next Gen Hot Spot

HS 2.0, Open Roaming & Cloud Native SaaS Models

5

Network Convergence

5G, Wi-Fi Convergence, ATSSS,

Next Gen Hot Spot for Offloading & Open-roaming

Enables cellular like connectivity experience and will further improve the WiFi connectivity experience through;

- Transparent, automatic WiFi connection and authentication
- No manual selection of SSID or input of access credentials
- Policy configuration for differentiated QoS
- Improved security (WPA2 and EAP)
- Enabling WiFi Roaming for inexpensive but better network coverage

Device and network negotiate capabilities

Device auto select best WiFi network

Policies pushed to phone

Users do nothing and connection happens in background

Wi-Fi Network Aggregator Model (STL case study)

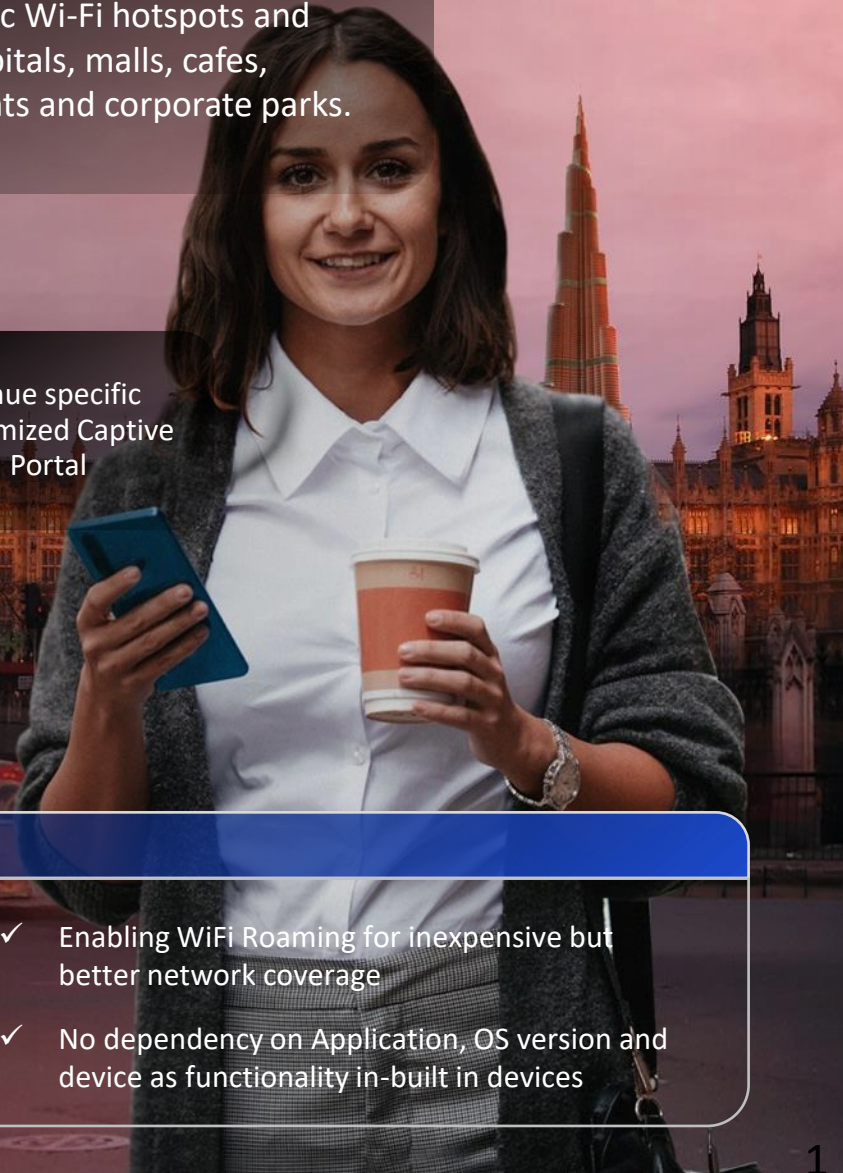
Using shared Wi-Fi infrastructure to provide public Wi-Fi hotspots and roaming across cities, educational institutes, hospitals, malls, cafes, airports, public hangout and markets, transit points and corporate parks.

Public Wi-Fi

Truly SaaS Proposition

- Mobile Data Offload via EAP SIM/TTLS, Hotspot 2.0
- Property Management System based authentication
- Location specific real time advertisement
- Venue specific customized Captive Portal
- Revenue Partnership between venue owners and operators based on advertisements
- Business intelligence & Analytics reports
- Social media login/Survey based login

Unique Offering Access Point Aggregation



Benefits

- ✓ Transparent, automatic WiFi connection and authentication
- ✓ No manual selection of SSID or input of access credentials
- ✓ Policy configuration support for differentiated QoS
- ✓ Enhanced security (WPA2 and EAP)
- ✓ Enabling WiFi Roaming for inexpensive but better network coverage
- ✓ No dependency on Application, OS version and device as functionality in-built in devices

STL's Role in overall WiFi Value Chain

Market Challenges

- Network congestions
- Higher LTE/5G CAPEX/OPEX
- Vendor Lock-in
- Lack of data and network insights
- Monetization issues
- Poor end user experience

STL dWiFi Platform (Containerized, Virtualized, Microservices based)

Access Points (WiFi5 / WiFi6)	Wireless Controller	TWAG/ePDG	dSmartMobility	App Store + APIs (for 3rd party dev)
HS 2.0	OpenRoaming	AAA	AUSF	Captive Portal Editor
WiFi Analytics	Advertisement Server	Monetization Server	Mobile App/SDK	Property Management
Voucher Management	TNGF/N3IF	Link Aggregation	Location Based Services	Monitoring & Reporting

SOLUTIONS

Public WiFi	Smart City	WiFi Roaming	WiFi Offload	WiFi Calling
Guest WiFi	In Flight WiFi	Carrier WiFi	Hospitality / Retail	Transportation

Integration Middleware

- SMSC
- EMAIL
- Location Engine
- Payment Gateway
- LI System
- Google/iOS Push Service
- Roaming Partners

Value Propositions

- Smart & Intelligent Network Services
- Elevate digital experience
- Innovate new revenue channels
- Reduced time to market
- Better Customer Experience
- Seamless access & authentication
- Low Cost to serve
- Network Agnostic & Vendor Neutral

STL dWiFi Excellence: Expertise & Experience

40+ Operators have chosen STL for WiFi deployments

50M
Registered Users offloading to Wi-Fi

15%
Acceleration in Wi-Fi offload Adoption


Higher Data usage volumes on Wi-Fi as compared to LTE


Wi-Fi usage duration is longer than LTE

Operational excellence with Tier-1 Telco

Successful experience for delivery, implementation and services support with large scale Live projects

Proven Interoperability

Highest number of integrations with Tier 1 multi vendors' equipment and WiFi partner ecosystems worldwide

Fastest Go-Live

Flexible platform, seamless integration with existing IT & packet core infrastructure. Plus on-site team in every region

Rich experience in BSS & OSS

Easy understanding of operator business requirements and helps providing customized solution

Comprehensive and Converged WiFi portfolio

Pre-integrated, modular platform to enable quick launch to innovative services to the market

beyond tomorrow

STL WiFi Offload Solutions

1 dSmartMobility

- Client App (Android/iOS SDK) Based Approach
- Auto offload to WiFi network when in range and have better connectivity than LTE
- Offload based on the QoS parameters/threshold
- Notifications for the nearby available hotspots

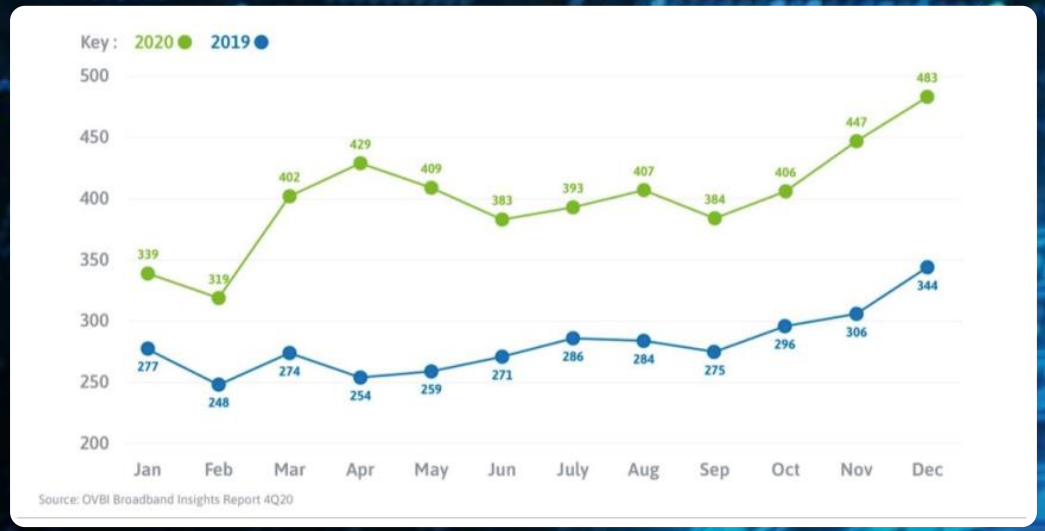
2 NGH (Hotspot 2.0 + OpenRoaming)

- Client Less Approach (in built functionality in devices)
- Auto authentication and Seamless connectivity to WiFi without any manual login or intervention
- Offload based on the QoS parameters/threshold
- OpenRoaming to offer extended WiFi coverage by seamless roaming

3 WI-FI and 5G Offload + Convergence

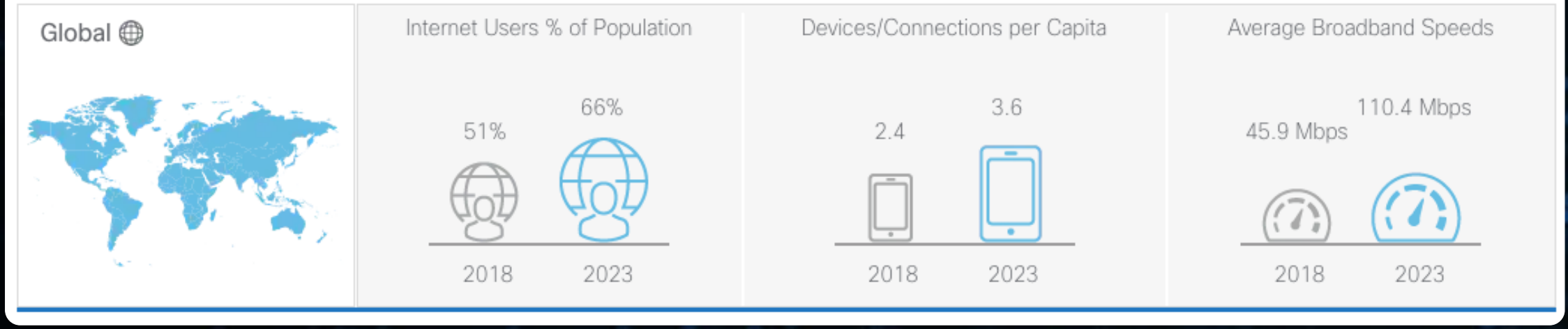
- App less approach where intelligence built in 5G devices
- Uses ANDSP and UE Route Selection Policy (URSP) for traffic selection and steering
- ATSSS rules which defines rules to dictate how the device should utilize the 3GPP and Non-3GPP access networks

Market Trends & Wi-Fi Evolution



Data Usage Trends, Bandwidth Consumption 2020 vs 2019
(Source: OVBI Broadband Insights report 4Q20)

Proliferation of devices and adoption of IoT increasing the # of connected devices More data consumption, more speed, lower latency demands



Source: https://www.cisco.com/c/en/us/solutions/executive-perspectives/annual-internet-report/air-highlights.html

Market Trends & Wi-Fi Evolution

- Rapid adoption of WiFi 6 and 6E - High interest in Wi-Fi 6/6E, with 83% having deployed the technology, or planning to do so before the end of 2022.
- OpenRoaming to unlock the value of Wi-Fi roaming, redefine the QoE for public WiFi & OpenWiFi – innovate faster, bring connectivity to 1B+ people without access to internet
- Higher throughput, lower latency, guaranteed (deterministic) speed/experience
- IDC reported a net increase of 12% in access point shipments in 2020
- Airties reports that Wi-Fi 6 already represents 12% of the home-installed base in the client devices.
- 82%[3] of U.S. office workers prefer working from home, 74%[4] of CFOs plan to reduce the office space

3. Global Workplace Analytics' Global Work from Home Experience Survey 4. 2020 Iometrics and Global Workplace Analytics

OpenRoaming: Enhancing the End User Experience Across Public and Guest Wi-Fi

VASUDEVAN VENKATAKRISHNAN

BUSINESS DEVELOPMENT DIRECTOR, APAC.

CommScope

COMMSCOPE®
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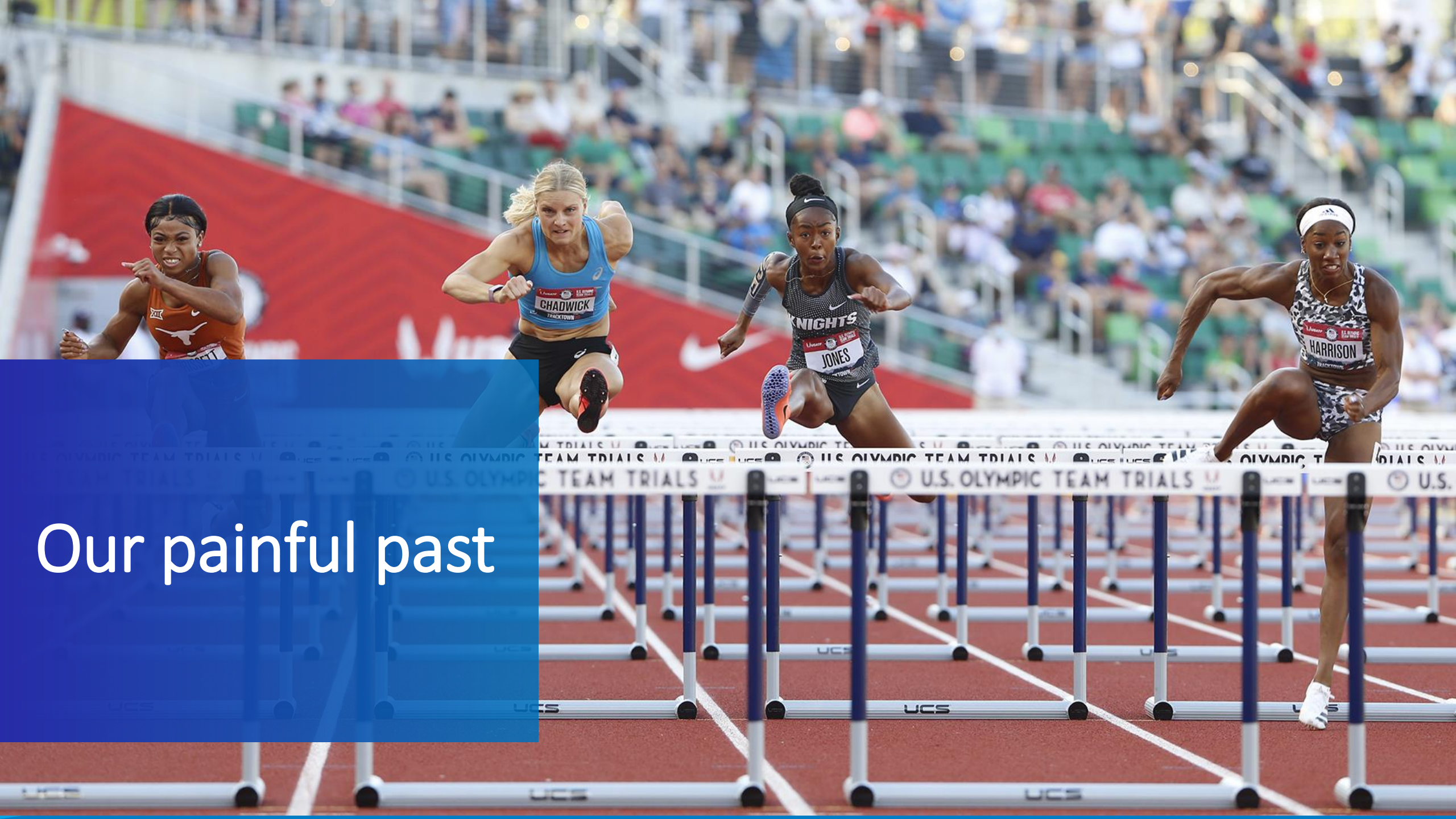
OpenRoaming:
Enhancing the end user experience across public and guest Wi-Fi Connectivity

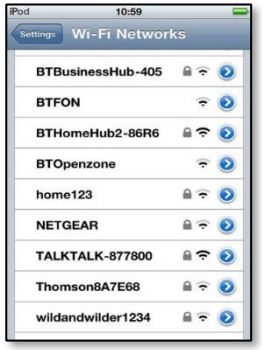
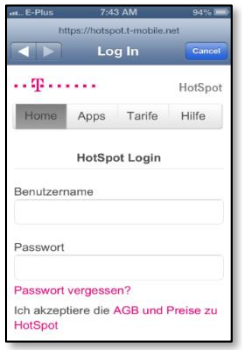
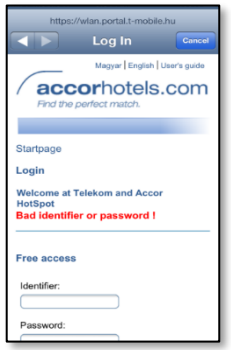
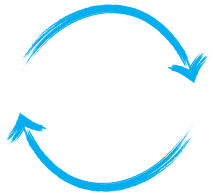
Vasudevan Venkatakrishnan
Business Development Director
APAC

WIRELESS GLOBAL CONGRESS
WIRELESS BROADBAND ALLIANCE



Our painful past

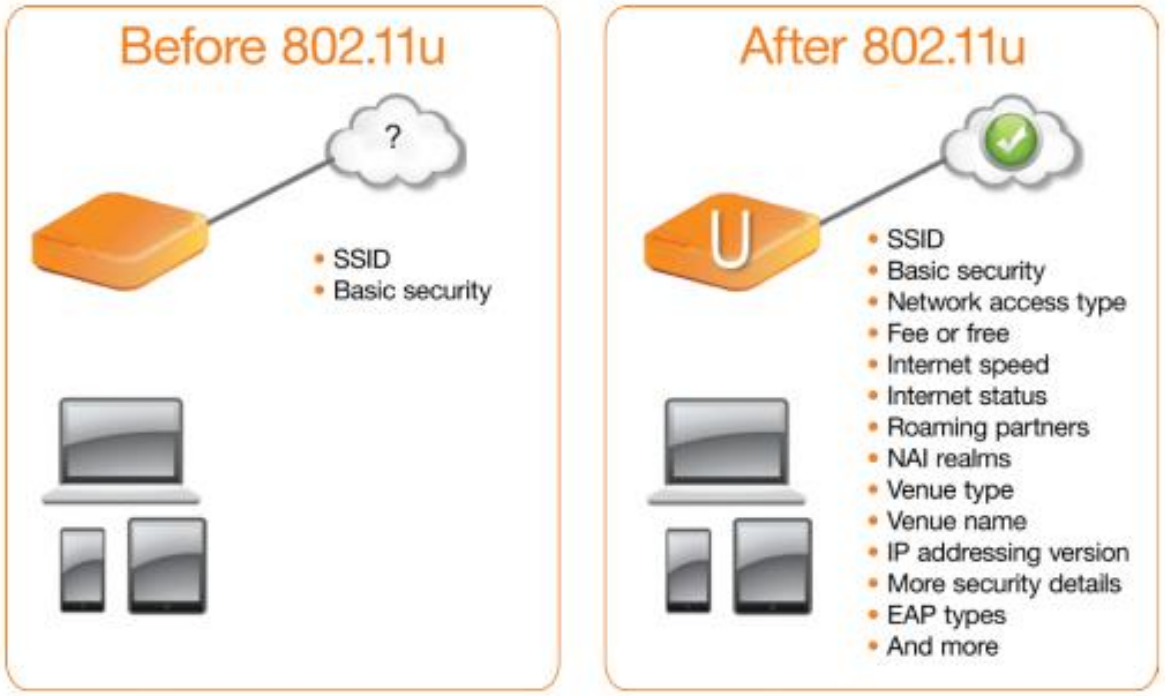
This is not new! We've gone through this

1	2	3	4	5	6	7	8
							
Manually scan for SSIDs, pick "open" or "free" from long list of SSIDs	Trying to connect. (cross fingers)	Launch browser. Wait for redirection (keep fingers crossed).	Additional steps required (CWP, username/ password, cost, language)	Pay, and/or enter username/ password.	Connected. Use network if it's acceptable.	Phone goes to sleep, disconnects from Wi-Fi.	Repeat from Step 1. If any step from 1-7 fails, return to Step 1

Present (Mostly)

Wi-Fi HotSpot 2.0 (Passpoint)

Network Discovery: With and Without 802.11u



With Hotspot 2.0: Everything Automated

	Today's Hotspot	Hotspot 2.0
Network Discovery/ Selection	Manual (SSID)	802.11u
Subscriber Authentication	Captive Portal, WISPr	802.1X
Over-the-Air Encryption	none	AES-CCMP (802.11i)
Mutual Authentication	none	EAP-SIM/AKA, EAP-TLS, EAP-TTLS
Rogue/Hijacking Protection	none	Yes (802.1X/EAP)

Wi-Fi HotSpot 2.0 (Passpoint)

Challenges

Establishing Roaming Agreements:

Long and tedious process

Individual Agreements

MSO, MNO, Enterprises & Venue Operators

Commercial arrangements with all parties

Takes Time

OpenRoaming™

We've got a winner!

OpenRoaming™ : A global Wi-Fi roaming federation

Pan-Industry Engagement: Grow Wi-Fi Roaming

- MSO, MNO, Enterprises, Roaming Hubs, Certificate Authorities, Infrastructure Vendors

Seamless Secure Onboarding User Experience

- Cellular like Wi-Fi Roaming Experience
- Secure – PKI/Radsec Ecosystem
- Tiered “Settlement” Policies

Vendor / Venue/ Service Provider Agnostic

- Truly “open” – enable broad acceptance

IS…

- Industry effort facilitated by WBA
- Based on a set of business & technical components
- Built on HotSpot 2.0/Passpoint
- Focused on Wi-Fi Data Offload

IS NOT…

- A new IEEE Std / WFA Program
- Cellular Offload for Voice Calls
- Competing with any other Industry Initiatives

Three pillars of OpenRoaming

- Global federation of public and private Wi-Fi networks and identity providers
- Robust cyber security framework
- Network automation


Top 3 benefits to end users
COMMSCOPE®
RUCKUS®

- Login-free seamless experience
- Global reach
- Enhanced Security

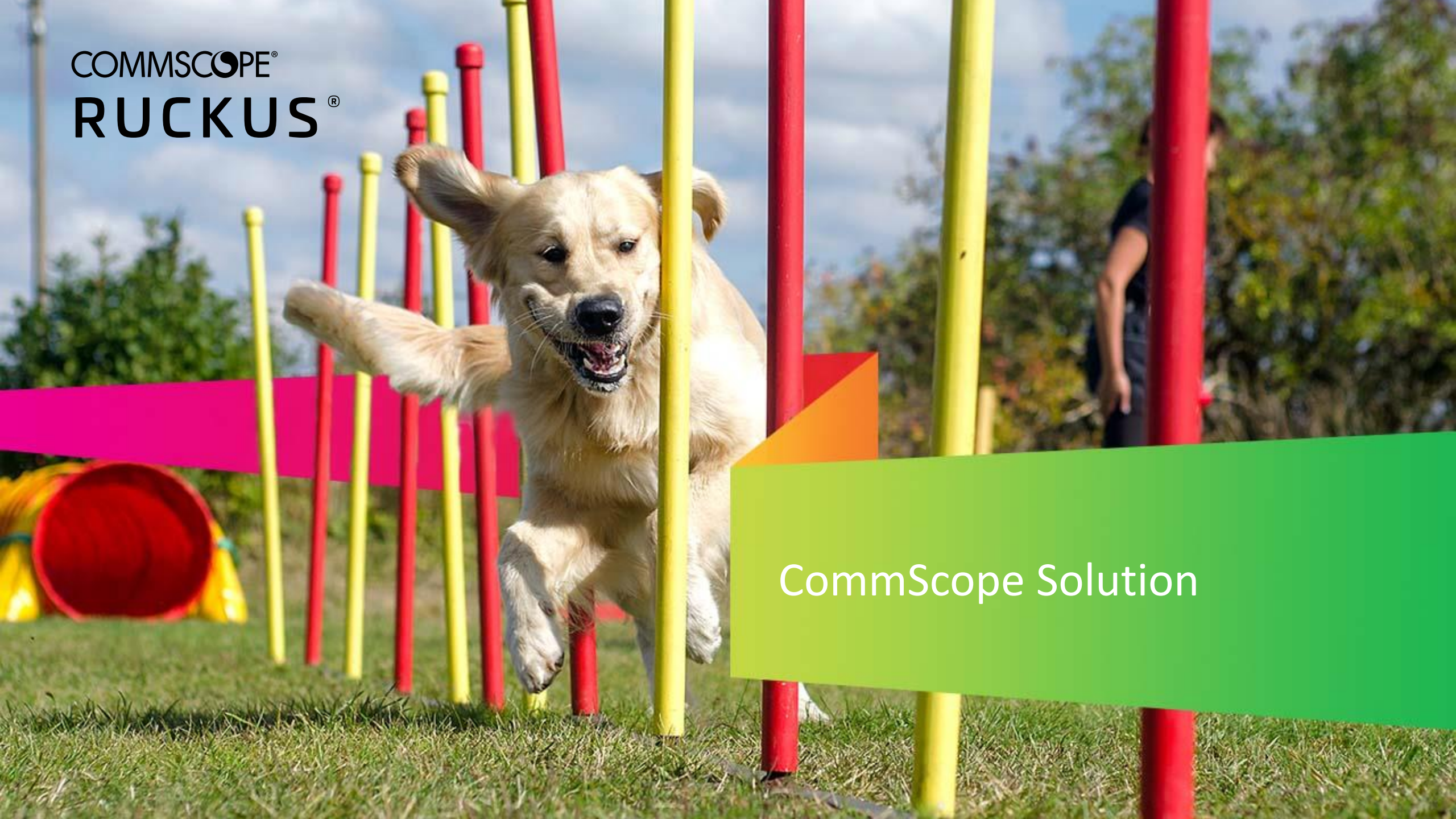
COMMSCOPE® RUCKUS®

COMMSCOPE®
RUCKUS®

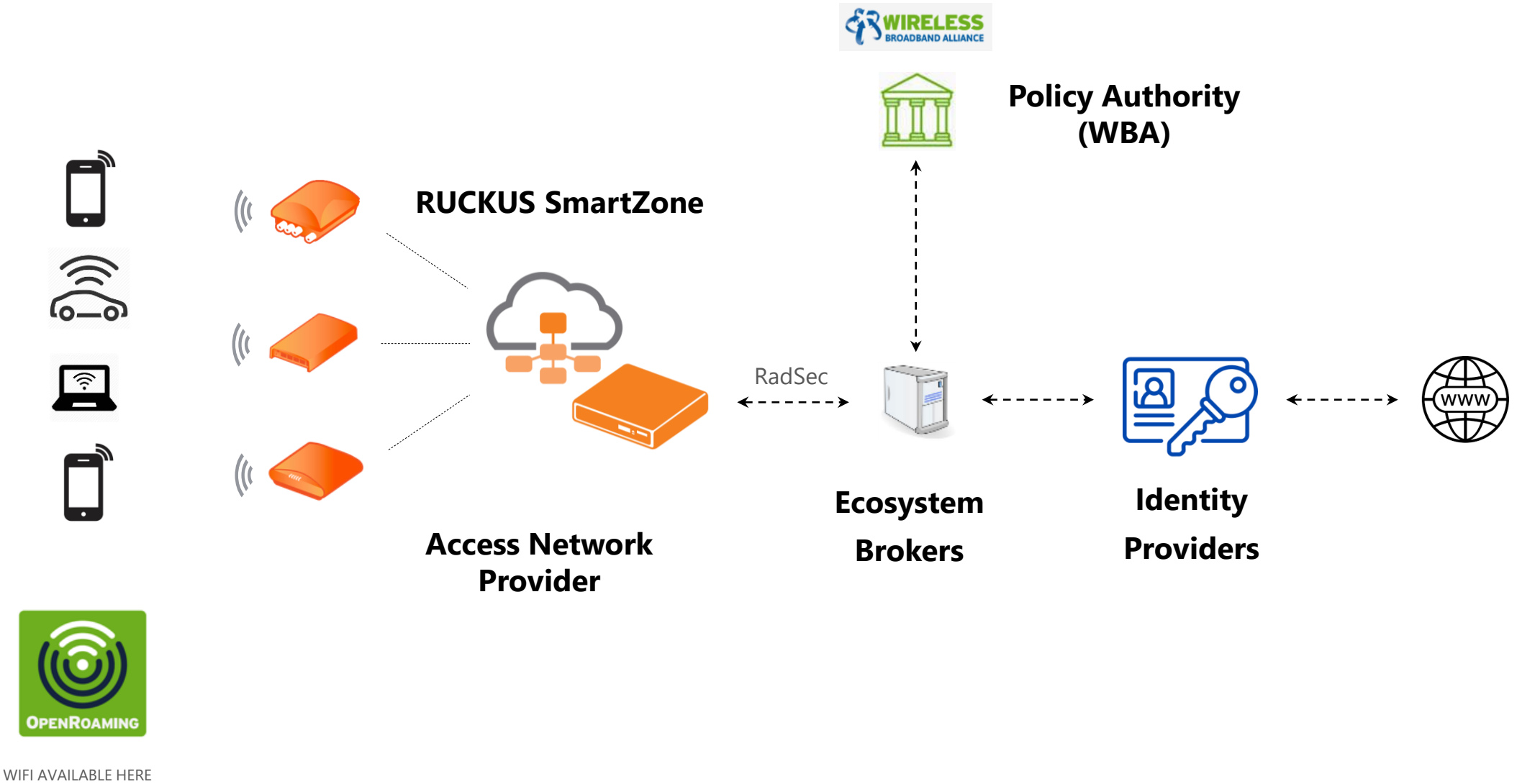
Top 3 benefits to venues, operators, access providers

- Interoperability
- Scale
- New revenue sources

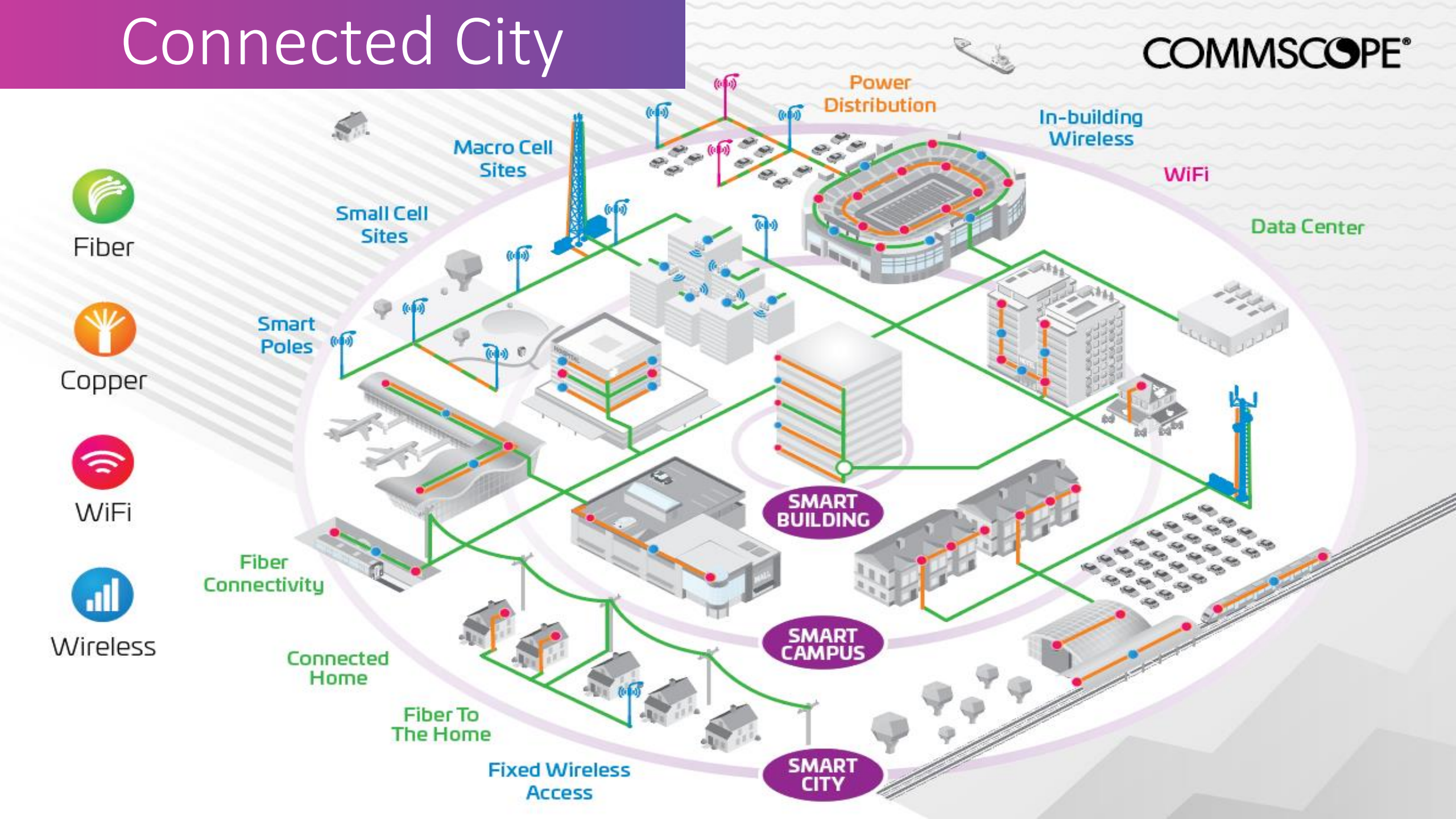
COMMSCOPE® RUCKUS®


COMMSCOPE®
RUCKUS®
CommScope Solution

CommScope OpenRoaming Solution



Connected City



CommScope is READY! Are you?

Proof of Concepts in all 3 geos – APAC, EMEA, and AMERICAS

City, Federation, Wi-Fi Service Provider, Telco Service Provider

Contact us today to learn more

Thank you!

Vasudevan Venkatakrishnan
vasudevan.venkatakrishnan@commscope.com

Innovation Developments in Public and Guest Wi-Fi

BRUNO TOMÁS

PROGRAM DIRECTOR

Wireless Broadband Alliance

WIRELESS BROADBAND ALLIANCE

DRIVING NEXT WIRELESS EXPERIENCE

WI-FI INNOVATION FOR 2022+

WGC Asia, Bruno Tomas

WBA TECHNICAL ROADMAP – IMPACT ON PUBLIC & GUEST WI-FI

Lead the development of ***"Seamless and interoperable services experience on Wi-Fi within the global wireless ecosystem" ...***

5G Work Group

Leading Wi-Fi and 5G RAN Convergence

IoT Work Group

Augmenting Wi-Fi role in IoT

NextGen Work Group

Fast-tracking Wi-Fi deployments for operators

Roaming Work Group

Incubating new business opportunities

Testing & Interop Work Group

Achieving interoperable Wi-Fi services

WBA WORK GROUPS

WBA OpenRoaming™ Task Group

Development of standards, federation governance and trials

Policy & Regulatory Affairs Work Group

Industry liaison and advocacy of WBA global programs

Market Work Group

Marketing activities and industry dissemination

Certification Task Group

Addressing interoperability to foster adoption

More Information about WBA projects - https://wballiance.com/what-we-do

WBA WI-FI 6 & 6E PROGRAM – TRIALS & GO TO MARKET

Fast-tracking Wi-Fi 6 (802.11ax) leveraging Carrier-Grade capabilities.
Deliver industry guidelines and end-to-end live trials with multiple ecosystem players.

*Not exhaustive

Latest Projects

I. Enhanced 802.11ax - Overview, Use Cases, Features, 5G Context

II. Wi-Fi 6 Deployment Guidelines & Scenarios

Current Work

Wi-Fi 6 Trials: Real-world end-to-end testing of key features and new services to raise confidence and adoption in the technology

Deployment Scenarios	Use Cases
Enterprise - Industrial 4.0	High-density connectivity / latency
Transportation hub	Improved roaming behavior
Residential/MDU	Multi stream live video monitoring (facilities / campus)
Smart Cities/Rural	Real time energy monitoring
Transportation hub	IoT sensor networks
Public Venues	Ultra-reliable low latency communications / critical sensors
University Campus	Augmented reality for trouble shooting
Stadium	Gaming / Health devices > improved latency for key target
Entertainment	Virtual classroom/venue - UHD video intercampus
Public Wi-Fi	

Next Steps

Wi-Fi 6E global trials: Leveraging most relevant use cases, the "Wi-Fi End-to-end Trials" will confirm this technology evolution is set to deliver systems that are ready to support key 5G requirements

Wi-Fi 6/6E & QoS: Deliver a framework for the technology to act as standalone solution for any service providers. QoS enhanced proofing, distributed QoS

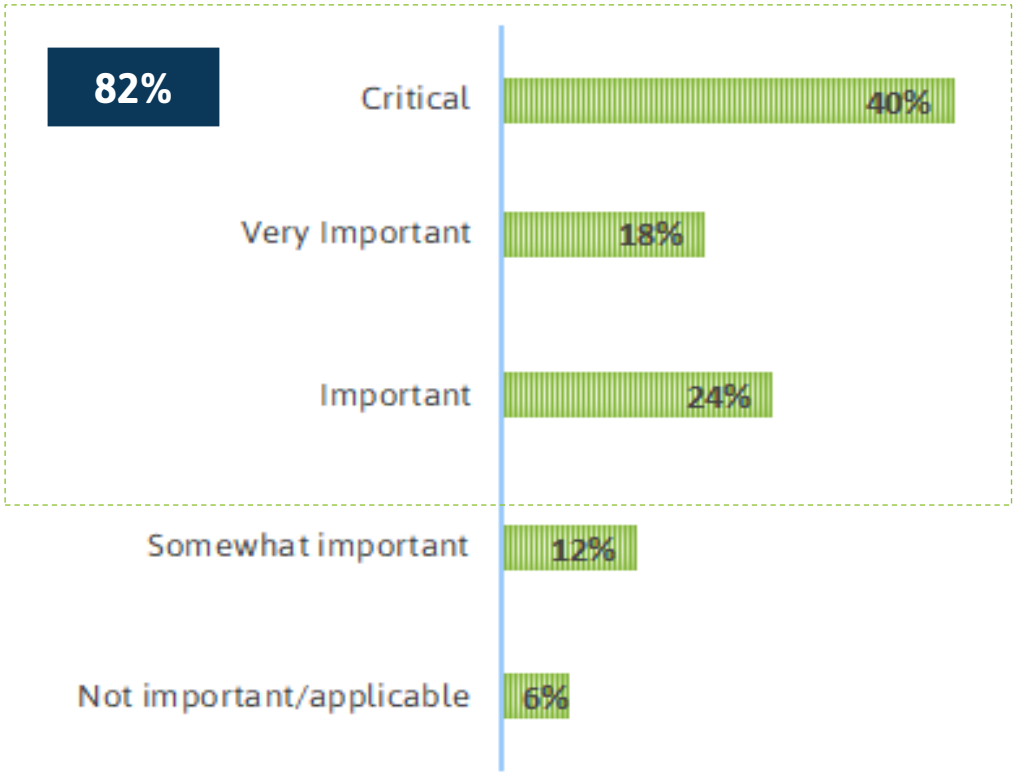
*Leading Members

AT&T, intel, Cisco, C-DOT, boingo, BROADCOM, SK telecom, COMMSCOPE, CableLabs, aruba a Hewlett Packard Enterprise company, HUAWEI, SAMSUNG, Qualcomm

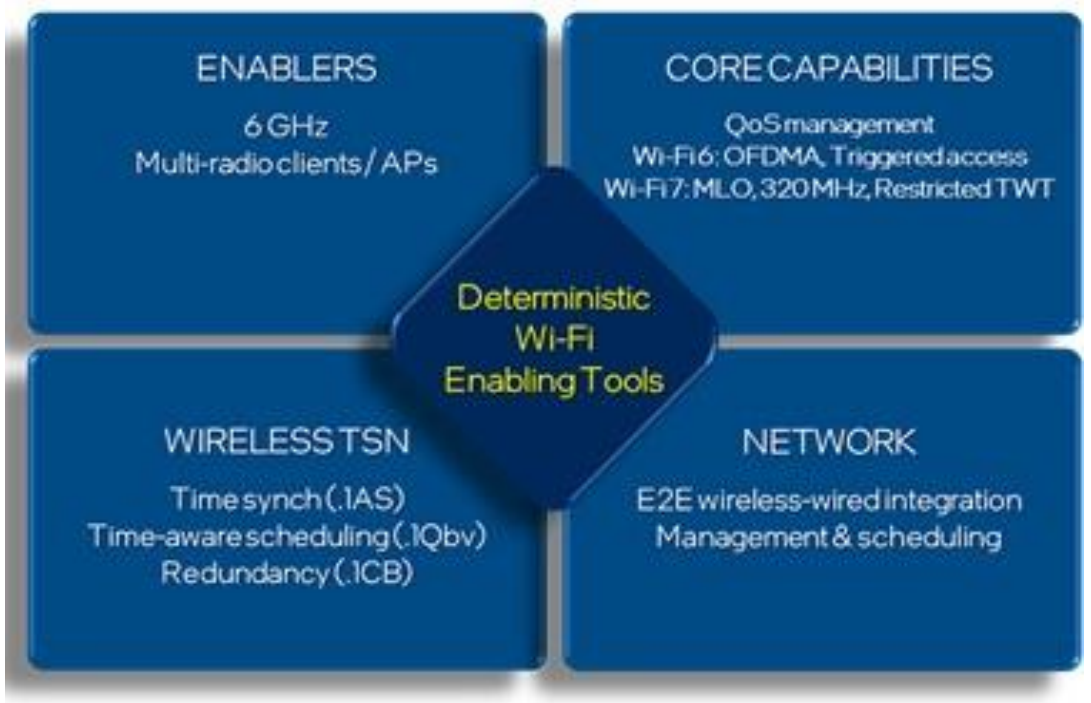
6 GHZ INDUSTRY FEEDBACK & Wi-Fi 7

2022

How important is the availability of additional spectrum on 6GHz to your Wi-Fi business and rollout?



Wi-Fi 7 Disruptive Features



72% indicate most important use case is "no legacy devices affecting airwaves"

77% of respondents want more spectrum for unlicensed

Co-Existence mechanism is a must have for 81% of the respondents

Source: WBA 6Ghz & Wi-Fi 6 Survey; Intel

LEADERSHIP IN 6 GHz WIFI - AFC

2022

WIRELESS BROADBAND ALLIANCE

Industry Progress

Future Wi-Fi Generations Scoping

- IEEE Wi-Fi 6E & Wi-Fi 7 Standards
- WFA Certification Program
- WFA & Open AFC Specifications
- Regulatory work on 6 GHz rules & procedures

Industry Milestone

AFC

Critical development for the success and deployment of 6 GHz wireless technology

Global Action on AFC & Deployments

- FCC opened a call for candidates to run AFC in US
- Global countries expected to follow US soon, with Korea, Canada on the forefront
- All incumbents' operators and Wi-Fi vendors should get involved

WBA Actuation

Commercialization Work

- Operator deployment guidelines
- Test plans & field trials across verticals
- Close cooperation and submissions to regulators globally (e.g. CITC 6E Trial)

WBA is developing an AFC system based on Open AFC and open to present candidatures globally

Open AFC

- WBA has a large community of operators, chipset vendors and AP vendors – the key players to make AFC work
- All incumbents' operators and Wi-Fi vendors should get involved now

WIRELESS BROADBAND ALLIANCE

WBA is eager to make AFC, Wi-Fi 6E and Wi-Fi 7 successful, and will be championing this work globally

WHAT IS WBA OPENROAMING™?

OPENROAMING™
WIRELESS BROADBAND ALLIANCE

- **Cybersecurity Service**
- **Cloud Federation**
- **Network Automation**

Seamless and Secure onboarding

- No More SSID-password guessing games, insecure login credentials or reconnecting to public Wi-Fi
- Creating an automatic and secure connected experience on Wi-Fi
- Automatic and secure connection of billions of devices to millions of Wi-Fi networks globally

Improves consumers satisfaction

- No more bill shock with overseas cellular roaming data
- Wi-Fi Roaming/ cellular combined for best coverage and costs options with guest & public Wi-Fi access across the world
- Seamless user experience anytime, anywhere

Industry Impact

- Defines industry policy & standards for all players in the Wi-Fi ecosystem to join and develop their Wi-Fi services
- Grow your business opportunities with Wi-Fi roaming & offload
- Prepare your Wi-Fi network for convergence with 5G

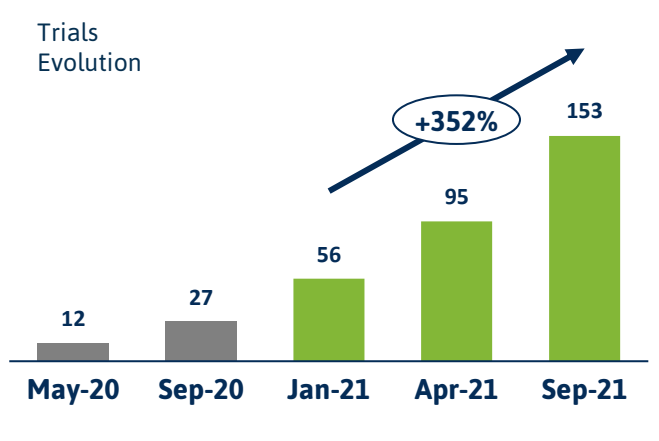
OPENROAMING PROGRESS STATUS

Achievements

1. Impactful OpenRoaming deployments

non exhaustive

2. Momentum around global trials and deployments



Global coverage

In Progress

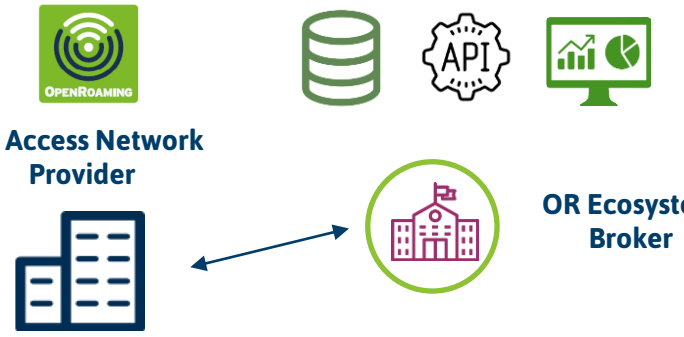
1. Truly holistic OpenRoaming standard, key industry players engaging

11 Vendor OEM Implementing

Identity Provider massification with key players virtually covering all the market (smartphones, tablets)

2. Accelerating adoption of Federation assets (e.g. API, DB)

Fostering standards compliance acting the Policy Authority to make sure the foundational components of the federation are used globally



OpenRoaming leading the Public-Guest Wi-Fi > Focusing on evolving horizontally and vertically

OPENROAMING STANDARDS FOR ANY BUSINESS MODEL

2022

WIRELESS BROADBAND ALLIANCE

OpenRoaming Standard - Release 1 Settlement "free" traffic

"Baseline" QoS for Service Availability & Bandwidth

OpenRoaming Standard - Release 2 Settlement "paid" traffic

"Silver" QoS for Service Availability & Bandwidth

Now Available - Released Q3 2021

OpenRoaming Release 3 (WIP - 2022)

- Enhanced identity proofing
- Private 3GPP Networks (LTE/CBRS, 5G)
- IoT (LPWA and short range)
- Automated tools (for testing & troubleshooting)

WBA 5G PROGRAM

Identifying main convergence and coexistence use cases for 5G & Wi-Fi

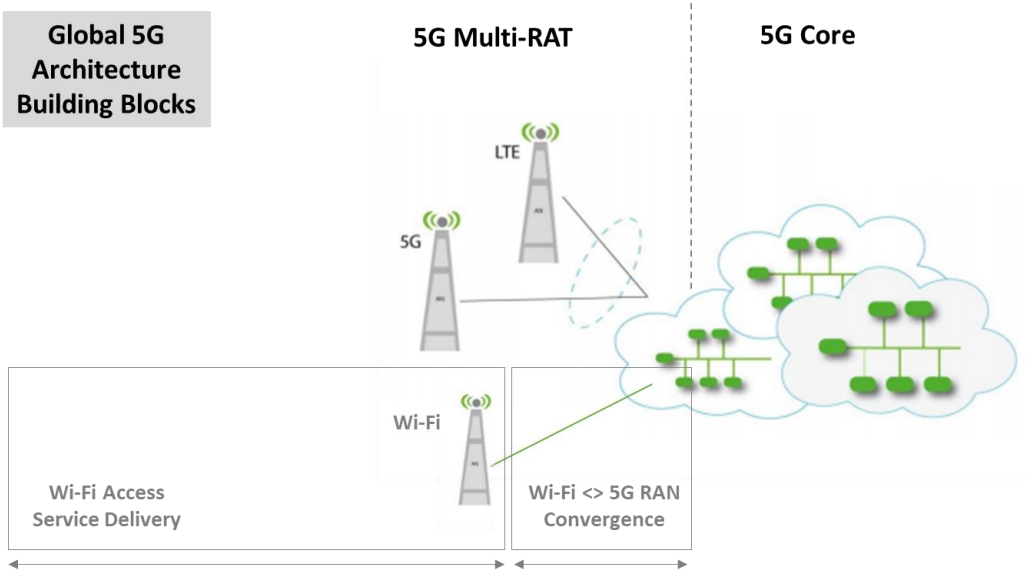
Developing guidelines, requirements and test plans

*Not exhaustive

Latest Projects

1. **5G Networks –** The Role of Wi-Fi and Unlicensed Technologies
2. **Network Slicing for 5G –** Wi-Fi Capabilities
3. **Unlicensed Integration with 5G Networks** – Assessing the approaches on how to integrate Wi-Fi and 5G

Current Work



End game: Standardize use cases and identify gaps which need to be addressed to realize convergence between 5G and Wi-Fi

Addressed Areas

- **Multi-Access Edge Computing**
  Define a set of services and use cases for Wi-Fi and ensure that the MEC APIs are suitable
- **Multipath Technologies**
  Explore new technologies MP-TCP/QUIC and trial the aggregation schemes
- **Fixed Wireless Access**
  Address possibilities of providing services for specific use cases
- **ATSSS, ANDSP**
  Proof of concept for new policy mechanisms

*Leading Members

AT&T, orange, BT, intel, CISCO, BROADCOM, Google, tessares

5G & WI-FI CONVERGENCE IN PRIVATE 5G NETWORKS

2022

WIRELESS BROADBAND ALLIANCE

BACKGROUND & INDUSTRY CHALLENGES

- Evaluate potential optimization of 5G and Wi-Fi convergence architecture with collocated deployments of 5G access and Wi-Fi access networks
- Examine management/control for 5G and Wi-Fi access networks and devices from a single management entity for 1) operational benefits and 2) simplify device management
- Identify roaming use cases between 5G and Wi-Fi within and across private 5G networks
- Analyze how the enterprise Wi-Fi segmentation and 5G slicing come together in private network deployments
- Within a 5G context, analyze how managed QoS can be provided over Wi-Fi for Time Sensitive Networking applications

BUSINESS OPPORTUNITIES & BENEFITS

- Analyze business opportunities & challenges for Wi-Fi and 5G convergence in private 5G networks
- Provide deployment guidelines for converged Wi-Fi and 5G deployments in private 5G networks
- Collaborate and liaise with industry standards bodies (3GPP, IEEE, Wi-Fi Alliance, NGMN, GSMA, ETSI)
- Explore potential trials and compliance for Wi-Fi and 5G convergence in private 5G networks

EXPECTED DELIVERABLES

- Address co-existence of MEC (Multi-Access Edge Computing) traffic management and the traffic management (ATSSS) within the 5G Core
- Evaluate if any enhancements are needed to ETSI MEC WLAN APIs or ETSI MEC Location APIs to support Wi-Fi access in private 5G networks
- Address how IEEE 802.1 TSN standards (such as 802.1AS, 802.1Qbv) can be supported over the converged
- Industry guidelines and requirements for optimal deployments

2022 **Project Kick off** **Work Output**

Q1	Q2	Q3	Q4

LEADING PARTICIPANTS

AMERICAN TOWER
aruba a Hewlett Packard Enterprise company
BROADCOM
BT
cisco
Charter COMMUNICATIONS
Google
intel
NOKIA
orange
tessares

RELEVANT PROJECTS

Understand more about **RAN Convergence**

RAN Convergence 2020 Whitepaper

WBA & NGMN RAN Convergence 2019

Unlicensed Integration with 5G Networks

IN CONCLUSION – EXCITING TIMES FOR 2022 AND BEYOND

WIRELESS BROADBAND ALLIANCE

Achieving "Seamless and interoperable services experience on Wi-Fi within the global wireless ecosystem" …

Key Priorities

- **Best Ever Next-Gen Wi-Fi Fast Track**
- **Network Convergence Delivery**
- **Disruptive Services Implementation**

Wi-Fi 6E Trials	5G & Wi-Fi Convergence in Private 5G Networks	Smart Home Multi-AP, RAN
Wi-Fi 6/6E for Industrial IoT	OpenRoaming for Private LTE/5G	Operator Managed Residential Wi-Fi
Wi-Fi 7	OpenRoaming for IoT	Wi-Fi & Devices Identification
Wi-Fi Sensing	In-Flight Connectivity	Wi-Fi IMSI Privacy Protection
Rural Wi-Fi	Access Network Quality of Service	Profiles & Roaming Consortium Prioritization

*More Information about WBA projects - https://wballiance.com/what-we-do

WIRELESS BROADBAND ALLIANCE

DRIVING NEXT WIRELESS EXPERIENCE

JOIN NOW!

Bruno Tomas – bruno@wballiance.com

www.wballiance.com

WIRELESS GLOBAL CONGRESS
WIRELESS BROADBAND ALLIANCE

Its time for...

Coffee

Break!

The Conference will resume at 3.50 PM

Stepping Up Capabilities with DDoS Protection for WISPs

DONNY CHONG

PRODUCT DIRECTOR

Nexusguard

NEXUSGUARD®

DDoS Protection Made Simple

Stepping up capabilities with DDoS Protection for WISPs

Presented by

Donny Chong
Product Director, Nexusguard

NEXUSGUARD®

Simplifying DDoS for Communications Service Providers

Application Protection
Origin Protection
DNS Protection

360 DDoS Protection

Managed DDoS Mitigation Platform

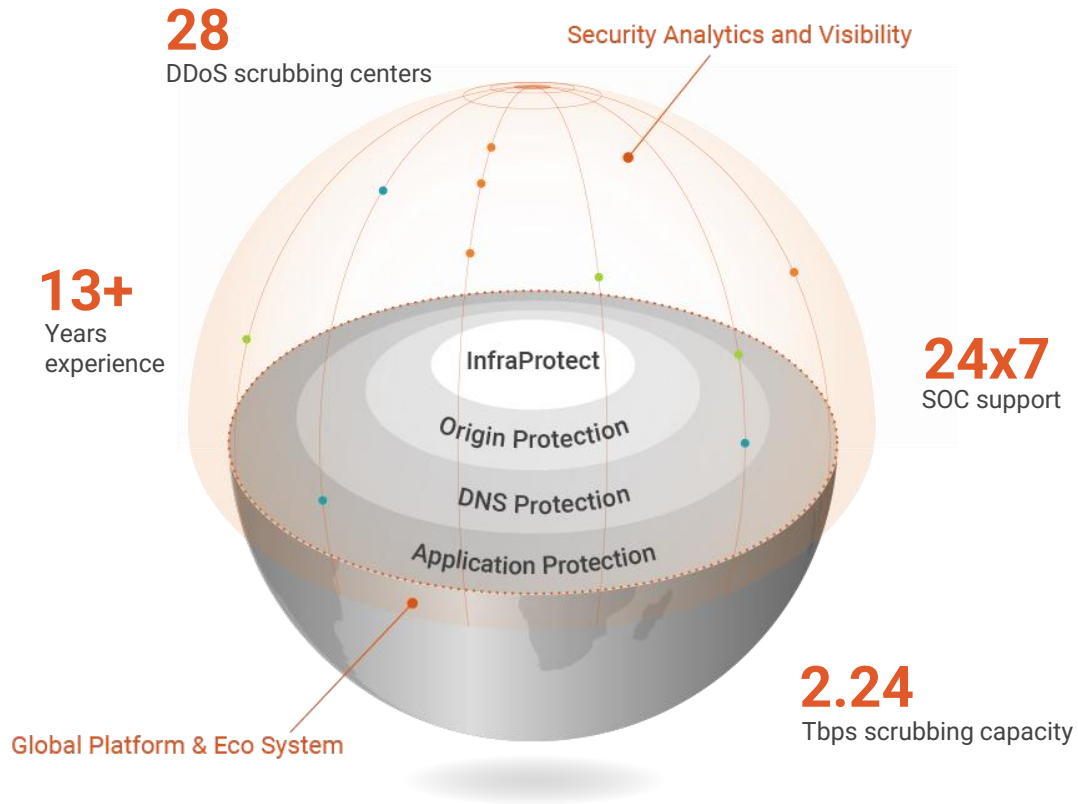
Cloud-in-a-box solution

Transformational Alliance Partner

DDoS-Protection-as-a-Service Enablement Program

Nexusguard Academy

Nexusguard Certified Courses to Enhance your SOC/NOC team with cybersecurity skills



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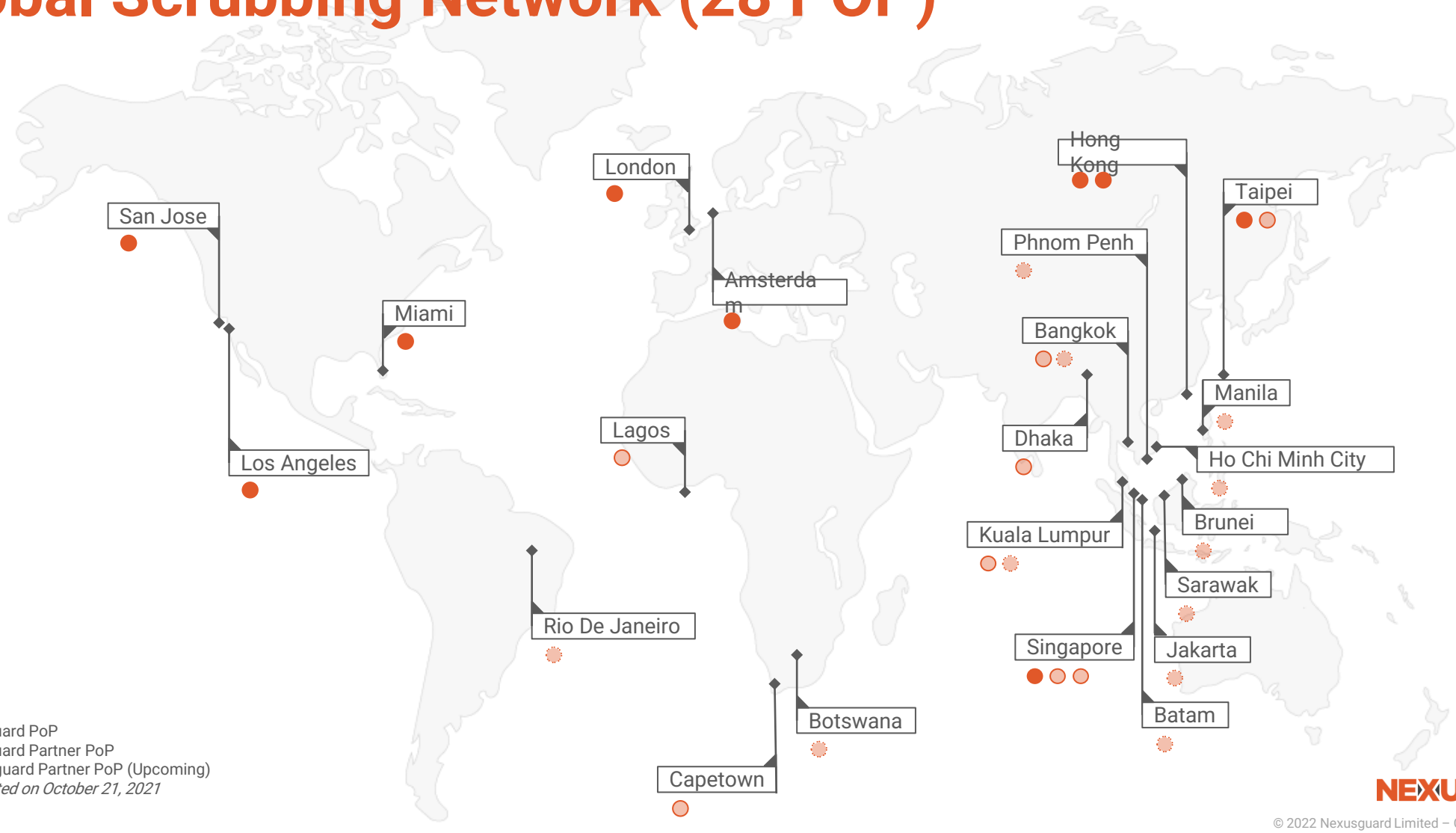
IS 655990

Global Scrubbing Network (28 POP)



- 9 Nexusguard PoP
- 8 Nexusguard Partner PoP
- 11 Nexusguard Partner PoP (Upcoming)

Last updated on October 21, 2021

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DDoS attacks - What, How, Why?

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What is DDoS?

- In a denial of service (DoS) attack, a perpetrator attempts to make websites or network services unavailable to their intended users
- DDoS attacks flood the target with requests, overloading infrastructure and preventing legitimate requests from being properly serviced
- A Distributed Denial of Service attack (DDoS) is a Denial of Service attack using multiple attack sources
- DDoS attacks are often conducted using compromised devices (botnet)

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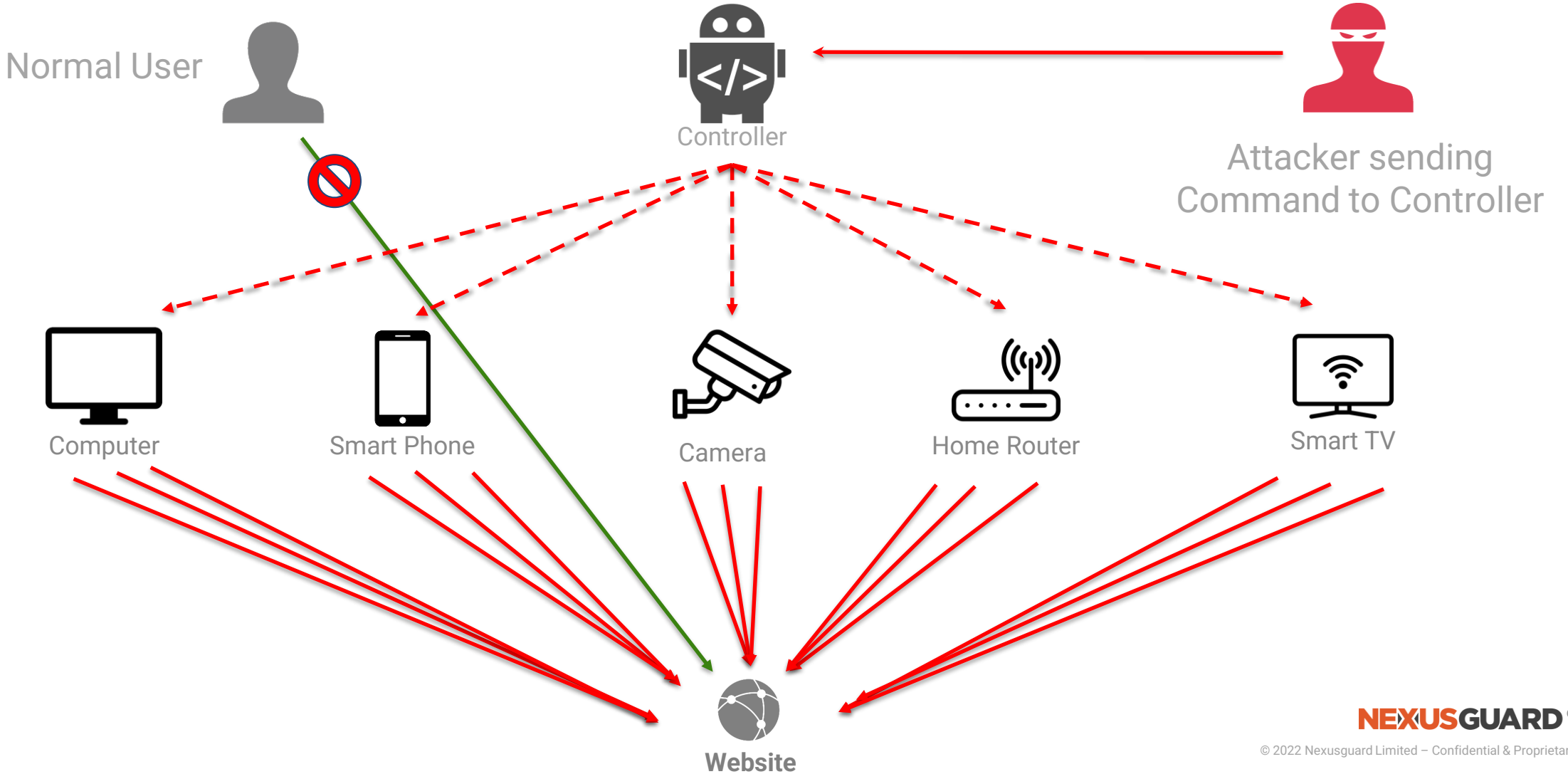
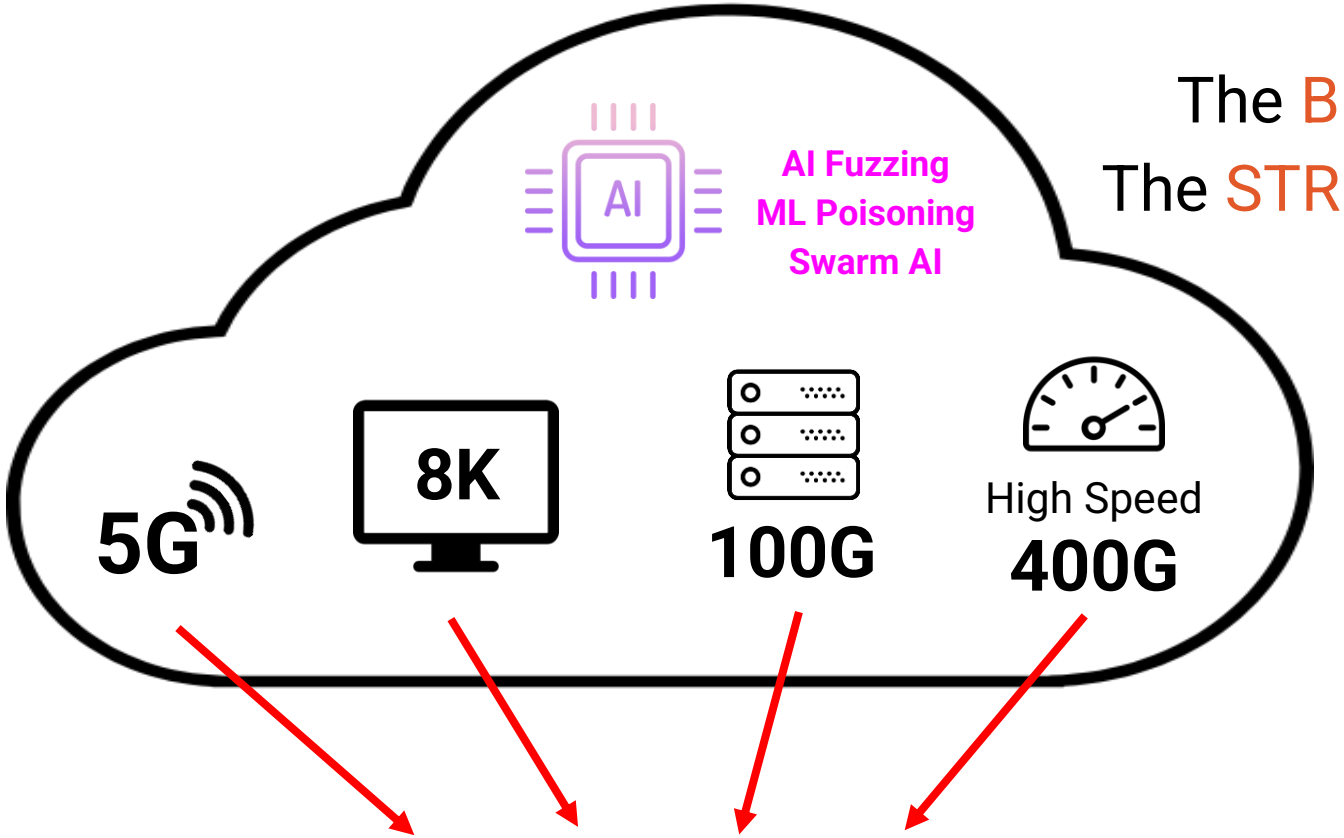
The basics of a DDoS attack



The Rise of Terabits DDoS Attacks



The BIGGER the pipe
The STRONGER the threat

TERABITS DDoS Attack
Powered by Millions of large-bandwidth IOT devices

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DDoS Evolution over the last Decade

DDoS Attack	2008	Now	
Size	Avg 1 Gbps Max 40 Gbps	Avg 350 Gbps Max 1.35 Tbps	350X BIGGER
Duration	6 - 8 Hours	>30 Days	60X LONGER
Sophistication	1~2 Vectors	>10 Vectors	5X MORE COMPLEX

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Who, and Why?

The motivation behind DDoS attacks are vast

- Hacktivism
- Rivalry
- Revenge
- Blackmail
- Smokescreen
- For fun

Everyone is a target

- Communication Service Providers
- Banking and Financial Services
- E-Businesses
- Media and Entertainment
- Government
- Medical & Health Services
- Gaming

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Not only the big boys, SOHOs are at Risk Too!

According to IBM, “The average cost of a data breach involving theft of assets totaled $879,582 for these SMBs. They spent another $955,429 to restore normal business in the wake of successful attacks.”

7 Most Common Attacks

- APT (Advanced Persistent Threats)
- Phishing
- **DDoS (Distributed Denial of Service)**
- Inside Attacks: Inside attacks
- Malware:
- Password Attacks: Password Attacks (aka Brute Force attacks)
- Ransomware

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Simplifying DDoS for Service Providers

MANAGED PROTECTION

Simplified Managed DDoS Protection for ISPs

Cloud

- 24x7 Monitoring
- Layer 3-7 Protection
- Auto Diversion
- Fully Managed

Hybrid

- On-premise Appliance
- Unlimited Attacks
- Global DDoS Mitigation Network
- Lowest Latency

PARTNER PRODUCTIZATION

ISPs that desire to sell Managed DDoS Services

Cloud Partner

- 15 Days to Deploy
- Resell DDoS/ WAF Protection
- No Hardware Required
- Co-branded Multi-Tenant Portal

Hybrid TAP Partner

- 90 Days to Deploy
- Clean Pipe Protection for Internet Services
- Fully Managed On-premise Appliance
- Training/ Certification

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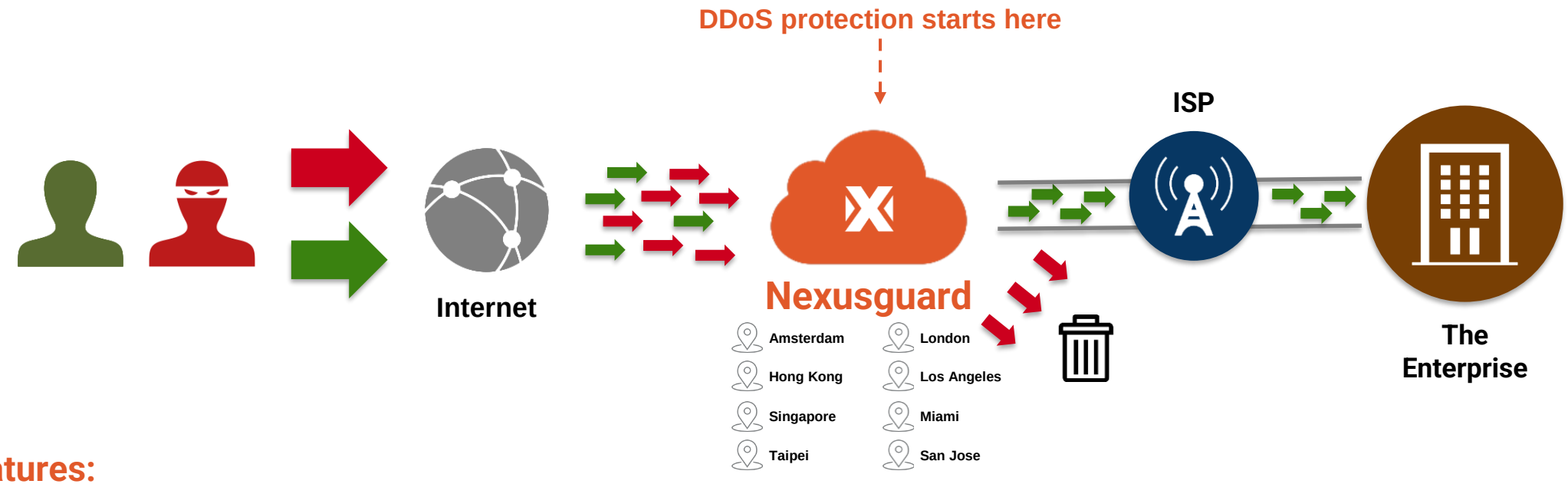
1. Cloud-based Network Protection Solution



Features:

- Manual/Automatic BGP-Base Traffic Diversion
- Up to 3Tbps Protection
- Supports GRE tunnel/ Direct Circuit/ VPLS
- SLA-Backed
- Ease of deployment (non-intrusive)
- Fully Managed

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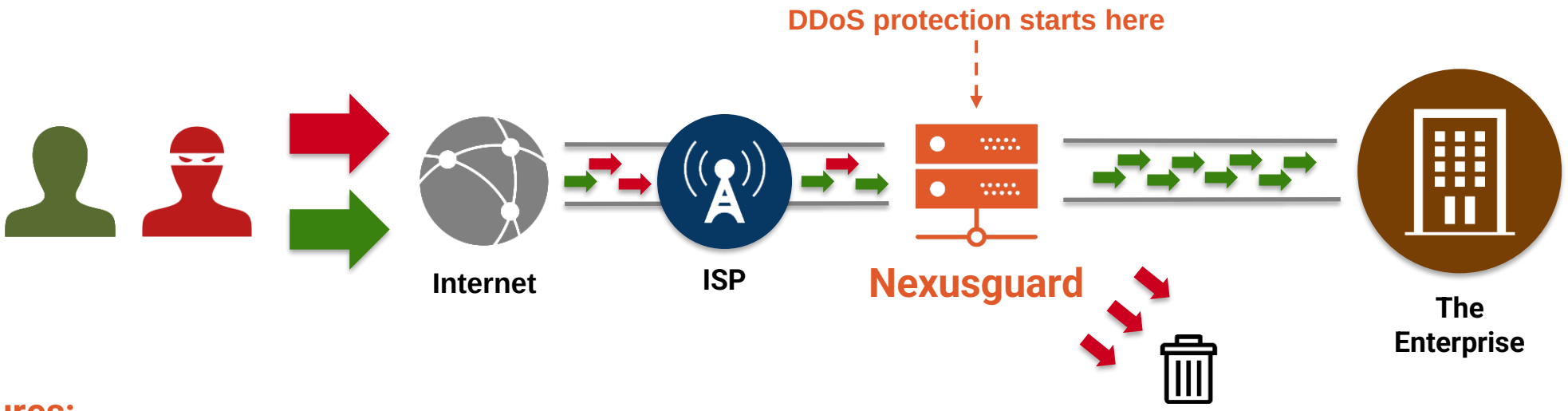
2. On-Premise Network Protection Solution



Features:

- Multiple Deployment - off-ramp, logical inline, proxy
- 10G/20G/40G/100G/200G Capacities
- Flow-based threat Monitoring and Alerting
- Proprietary NXG Threat Detection & Mitigation
- Supports GRE tunnel for off-net deployment
- Client onboarding-ready
- Full featured Dashboard and UI for NOC/SOC and Clients

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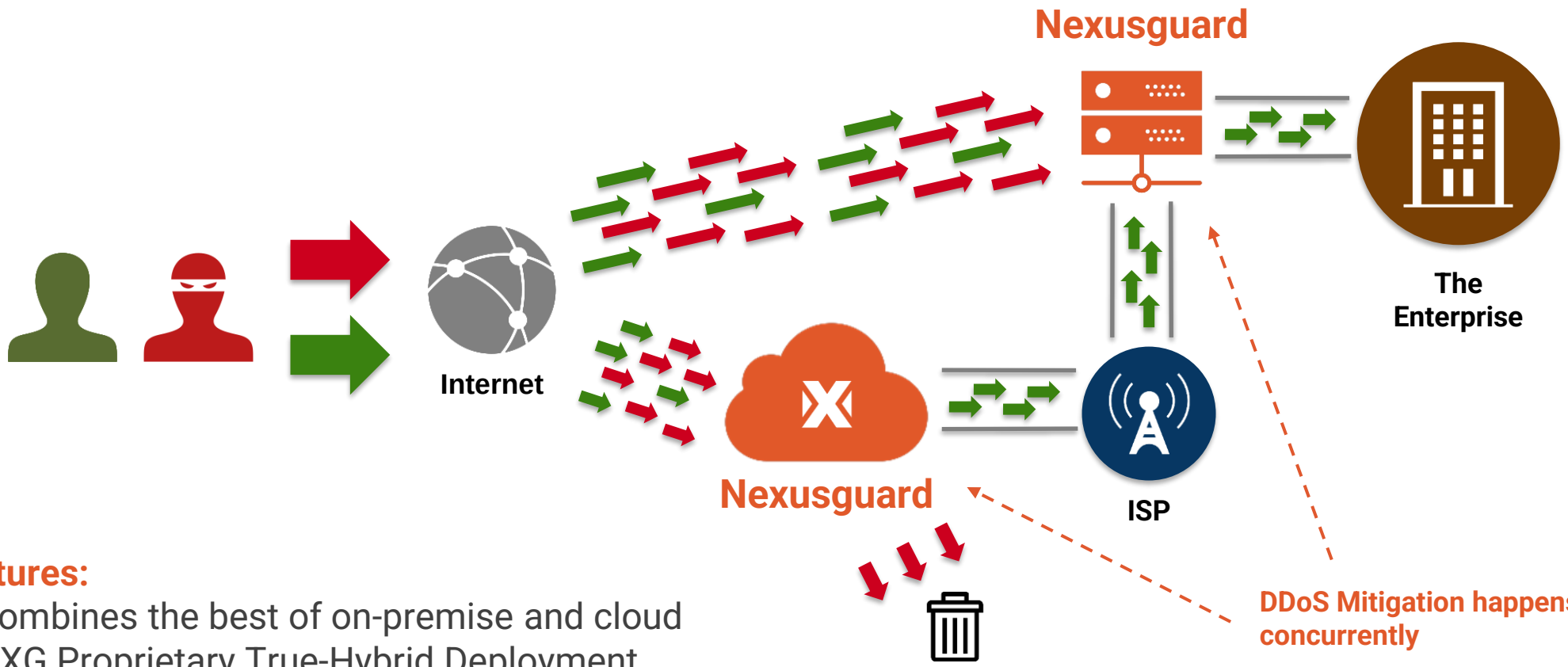
3. True-Hybrid Network Protection Solution



Features:

- Combines the best of on-premise and cloud
- NXG Proprietary True-Hybrid Deployment for concurrent protection - Performance & Resiliency
- Full protection against the all types/sizes of DDoS Attacks

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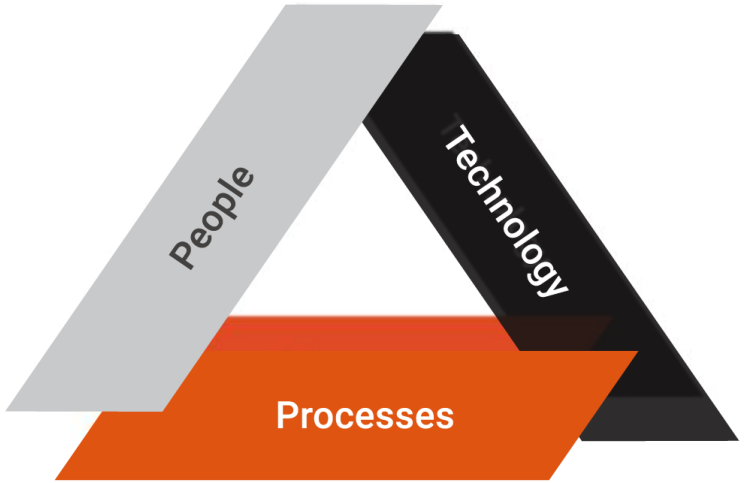
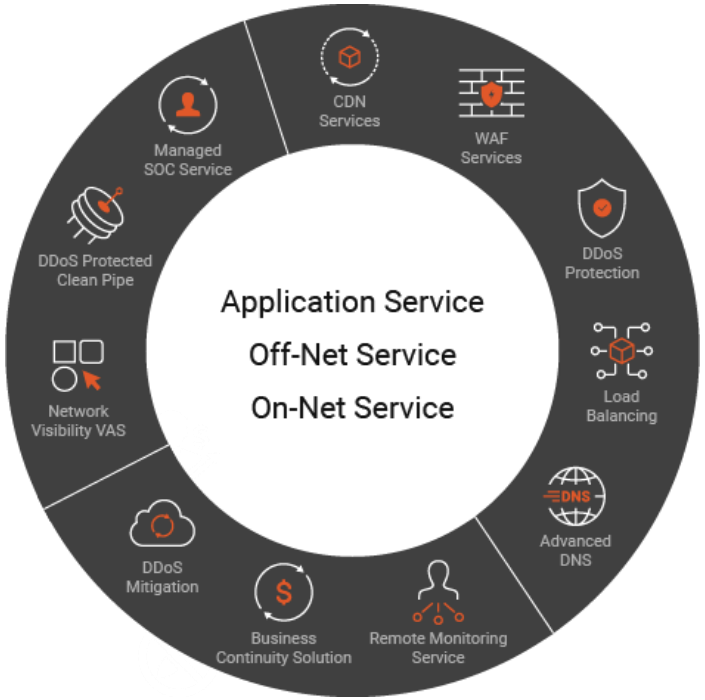
4. Fully Managed DDoS-Protection-as-a-Service

Launch Managed Security Services in 90 days

- Technical
- Infrastructure
- Productization / Support





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Many CSPs understand the strategic importance of the need to offer Anti-DDoS and other Cyber Security services to its customers. The motivation could be either:

- To **Retain Key Customers** or
- To **Attract New Customers** to your network

Fact

Launching & maintaining a cybersecurity Service is both **Expensive** and **Challenging** and CSP product launches fails 90%* of the time

* Gartner Report

NEXUSGUARD®

Hit the ground running with our comprehensive go-to-market support for your business team

Your existing customer base is your biggest asset, and yields the highest potential for business growth. We want you to be successful so that we can be.

We provide training, research papers, GTM kits and more to enable your sales and marketing team to start selling successfully right from day 1.

Support, processes, operational readiness - we've got you covered!

Our fully-managed offerings takes pressure away from your organization so that you can focus on what you do best.

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Thank you for joining us

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WBA Programs for Wi-Fi Carrier Opportunities

JOSH REDMORE

PRINCIPAL ARCHITECT – WIRELESS RESEARCH

CableLabs

WIRELESS BROADBAND ALLIANCE

WBA PROGRAMS FOR WI-FI CARRIER OPPORTUNITIES

JOSH REDMORE, CABLELABS

VERSION V1.0

About CableLabs

CableLabs®

Non-profit R&D center for the global cable industry

63 Members Worldwide

HQ Louisville, Colorado

Programs of Note

- Wi-Fi 6E Trials
- 6 GHz AFC
- 5G and Wi-Fi Convergence
- Rural Wi-Fi

NextGen Workgroup

New technology with myriad use cases

CableLabs Test House

- Home Security (intruder motion detection)
- Aging in place
    - Heart rate detection
    - Breath rate detection
    - Fall detection

Test Methodology and Deployment Guidelines White Papers

NextGen Workgroup

Exponential growth in STAs demands ubiquitous coverage and throughput

- WFH / Remote Learning
- IoT

Multiple APs are needed to service this demand

Customers need this to be an easy deployment experience

MAPs are needed for Wi-Fi Sensing

White Papers available

Testing & Interop

MAC Randomization created to fight client tracking

This breaks MAC-based authentication, damaging the user experience

WG is focused on defining the broken use cases and identifying an identification standard

Addressing MAC Randomization is critical to the cable industry

White Paper in-progress

Testing & Interop

New program just approved and launching Thursday

How do you know if a network is worth connecting to?

- Wi-Fi Attachment Policy guidance
- WFA's Data Elements program, 4G Quality of Service Class Identifiers (QCI), 5G QoS Identifiers (5QI), and IP Differentiated Serviced Code Point (DSCP) values

WG goal to provide actionable deployment guidance beyond just a White Paper

Questions?

WGC Open Congress Close

TIAGO RODRIGUES

CEO

Wireless Broadband Alliance

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DDoS Protection Made Simple

onsemi

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WGC Asia Pac – Wi-Fi Revolution: Driving Digital Growth

Program Overview

09:00 GST (TUES); 21:00 PST (MON); 00:00 EST (TUES); 05:00 GMT (TUES); HONG KONG 13:00 (TUES)

Tuesday January 25	Wednesday January 26	Thursday January 27
WGC AS PAC PEN FERENCE	WBA MEMBERS ONLY WORKNG SESSIONS	WBA MEMBERS ONLY WORKNG SESSIONS

WBA 2022 EVENTS PLAN

Q1 2022

Hybrid

Wireless Global Congress – APAC
Dubai, UAE

25 January - Open Congress
(F2F will be members only)

26-27 January - Working Sessions
(Strictly Members Only)

Virtual and Physical attendance
Situation may vary due to COVID19 pandemic

Q2 2022

Hybrid

Wireless Global Congress - Americas
Chicago, USA

6-7 June - Working Sessions
(Strictly Members Only)

8-9 June - Open Congress

Co-Located with
Wi-Fi Alliance

Virtual and Physical attendance
Situation may vary due to COVID19 pandemic

Q4 2022

Hybrid

Wireless Global Congress – EMEA
Amsterdam, Netherlands

17–18 October - Open Congress*

18-19 October - Working Sessions*
(Strictly Members Only)

Co-Located with
Broadband World Forum

Virtual and Physical attendance
Situation may vary due to COVID19 pandemic
**** Final dates subject to confirmation***

THANKS FOR ATTENDING

WGC Asia Pac recordings will be available from January 26th

Check out our next events
www.wirelessglobalcongress.com

#wifirevolution | #lovewifi