WIRELESS GLOBAL CONGRESS
WIRELESS BROADBAND ALLIANCE

25 MAY – 8 JULY 2021

WI-FI: POWERING INNOVATION SERIES

Creating new possibilities for Carriers, Enterprise, Cities and Things.

#WGC | #wifirevolution | #lovewifi

WIRELESS GLOBAL CONGRESS
WIRELESS BROADBAND ALLIANCE

JUNE 3, 2021

Wi-Fi Innovations Connecting Your World

Leadership Conference

#WGC | #wifirevolution | #lovewifi

Wi-Fi Powering Innovation Series

Full Program Agenda

May 25th & 26th – WBA Members Only Working Sessions

May 27th – WBA Members Only Working Sessions: **Briefing for Asia-based members**

WI-FI POWERING INNOVATION SERIES: 08:30 PT; 11:30 ET; 15:30 GMT; 23:30 Singapore

Thursday June 3rd	Thursday June 10th	Thursday June 17th	Thursday June 24th	Wednesday June 30th	Thursday July 8th
Wi-Fi Innovations Connecting Your World **Leadership Conference**	**Connecting the Wi-Fi Enabled Enterprise**	**Wireless Innovation, Operation & Customer experience** **Where next for operators?**	**Wi-Fi Innovation For Hospitality**	**Connected Cities get Smarter with Wi-Fi in the 5G Era**	**Carrier Grade Wi-Fi delivering the future for the Smart Connected Home**

WIRELESS GLOBAL CONGRESS
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WIRELESS GLOBAL CONGRESS
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Wi-Fi Innovations Connecting Your World

June 3rd 2021

Tiago Rodrigues
Wireless Broadband Alliance

Edgar Figueroa
Wi-Fi Alliance

JR Wilson
AT&T

Dr. Derek Peterson
Boingo Wireless

Yvette Vincent
Marriott International

Eric A. McLaughlin
Intel

Mark Grayson
Cisco

Vijay Nagarajan
Broadcom

Wi-Fi Innovations Connecting Your World

TODAY'S AGENDA	
08:30am (Pacific time)	**Introduction & Welcome** Tiago Rodrigues, CEO, Wireless Broadband Alliance
08:45am (Pacific time)	**Maximizing the value of Wi-Fi®** Edgar Figueroa, President & CEO, Wi-fi Alliance
09:00am (Pacific time)	**Future of Fiber – Impacts to the connected experience** JR Wilson, Chairman Wireless Broadband Alliance, Vice President, Tower Strategy & Roaming, AT&T Services
09:10am (Pacific time)	**Meeting the future needs of hospitality sector** Yvette Vincent, Marriott International
09:20am (Pacific time)	**Connectivity in the 5G Era: CBRS + Wi-Fi Convergence** Dr. Derek Peterson, Boingo Wireless
09:30am (Pacific time)	**Panel Discussion** AT&T, Boingo Wireless, Marriott International, Wi-Fi Alliance
09:50am (Pacific time)	**Wi-Fi 2030** Eric McLaughlin, VP Client Computing Group, GM Wireless Solutions Group, Intel Corporation
10:05am (GMT)	**Privacy in the age of consumer tracking: Alternative identities enable policy, security and privacy** Mark Grayson, Distinguished Engineer & WBA OpenRoaming Standards Group Chair, Cisco.
10:20am (Pacific time)	**Gigabit Broadband with 6 Ghz Wi-Fi** Vijay Nagarajan, Vice President, Wireless Communications and Connectivity Division, Broadcom
10:35am (Pacific time)	**Panel Discussion** Cisco, Intel, Broadcom.
10:50am (Pacific time)	**Close** Tiago Rodrigues, CEO, Wireless Broadband Alliance

WIRELESS GLOBAL CONGRESS
WIRELESS BROADBAND ALLIANCE

Welcome & Congress Kick off

TIAGO RODRIGUES

CEO

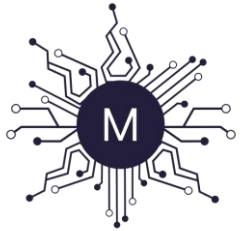
Wireless Broadband Alliance

WIRELESS BROADBAND ALLIANCE

CHICAGO SUMMER 2022 WILL HAPPEN

Wi-Fi Alliance and Wireless Broadband Alliance event co-location

WELCOME TO OUR NEWEST MEMBERS



OUR VISION

WIRELESS BROADBAND ALLIANCE

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

1. Accelerate Next Generation Wi-Fi Networks

2. Drive Convergence of Wi-Fi & Cellular Networks

3. Champion Seamless, Secure and Interoperable Wi-Fi

Established **in 2003**

130+ MEMBERSHIP **COMMUNITY**

PROJECTS & **PROGRAMS**

3 ANNUAL **EVENTS**

PROMOTION AND **GO-TO-MARKET**

THOUGHT LEADERSHIP & **MARKET RESEARCH**

WIRELESS GLOBAL CONGRESS
WIRELESS BROADBAND ALLIANCE

OPENROAMING™
WIRELESS BROADBAND ALLIANCE

WORLD™ Wi-Fi Day

WBA INDUSTRY AWARDS

CARRIER WIRELESS Services Certification

CONNECTED COMMUNITIES Forum

1. ACCELERATE NEXT GENERATION WI-FI NETWORKS

WBA advocates for all new standards, capabilities and features to accelerate next generation Wi-Fi and for that a robust set of programs is in place for 2021

5G Work Group	IoT Work Group	NextGen Work Group	Roaming Work Group	Testing & Interop Work Group
5G & Wi-Fi Convergence in Private 5G Networks	Wi-Fi 6/6E for Industrial IoT	Wi-Fi 6E Trials	Roaming Evolution PKI RadSec	Captive Portal Onboarding Evolution
	Rural Wi-Fi	In-Home Multi-AP Solutions	In-Flight Connectivity	Wi-Fi IMSI Privacy Protection
	AR & VR Requirements	Wi-Fi Sensing Deployment Guidelines	Profiles & RCOIs Prioritization	Wi-Fi Devices Identification
		Trackside Connectivity & Spectrum	OpenRoaming™ for Private LTE/5G	

WBA OpenRoaming™ Task Group	Policy & Regulatory Affairs Work Group	Market Work Group	WBA Certification Task Group

1. ACCELERATE NEXT GENERATION WI-FI NETWORKS

WBA has been active advocating the use of 6Ghz for Wi-Fi 6E, by responding to regulators consultations and developing trials to make Wi-Fi 6E a reality

COUNTRIES DESIGNATING 6 GHZ SPECTRUM FOR UNLICENSED TECHNOLOGIES

2. DRIVE CONVERGENCE OF WI-FI & CELLULAR NETWORKS

WBA advocates the complementary of Wi-Fi 6 and 5G since 2017
Convergence and Coexistence of Wi-Fi and Cellular is no longer a discussion but a reality

Wi-Fi to be essential part of 5G says Wireless Broadband Alliance

By Jon Mundy
12 September 2017

Organizations are adopting Wi-Fi 6 and 5G in parallel to meet the needs of their advanced wireless initiatives

- 45% are already deploying or piloting both 5G and Wi-Fi 6
- 80% are deploying, piloting, or preparing to use both 5G and Wi-Fi 6
- 98% believe they'll be using both technologies within two to three years

5G \ Wi-Fi 6	Deploying	Piloting/ experimenting	Preparing to use	Planning to use in two to three years
Deploying	19%	8%	3%	2%
Piloting/ experimenting	10%	9%	6%	2%
Preparing to use	5%	8%	13%	2%
Planning to use in two to three years	6%	2%	1%	3%

Note: N=437 global networking executives.
Source: Deloitte's Study of Advanced Wireless Adoption, Global Edition, 2021.

3. CHAMPION SEAMLESS, SECURE AND INTEROPERABLE WI-FI

Championing seamless, secure and interoperable Wi-Fi with OpenRoaming and WRIX.
Creating business opportunities for Wi-Fi Roaming, Offload, carrier Wi-Fi and complement to 5G.

OPENROAMING™
WIRELESS BROADBAND ALLIANCE

A lot was accomplished in a year

OpenRoaming Release 1 for free guest access

Legal framework for T&Cs and Privacy Policy

OpenRoaming Release 2 for settled access and QoS

The building blocks to accelerate trials and deployments

OPENROAMING IN ACTION


Canary Wharf, London

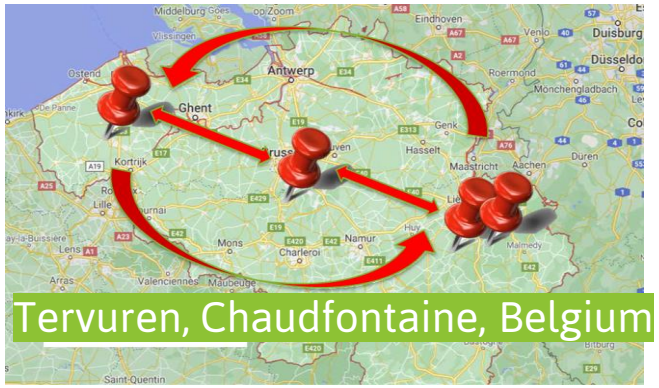

Cityroam, Japan


CEFCU (San Jose State) Stadium


Palma de Mallorca, Spain

Spanish Cities & Islands including Barcelona and Valencia


Barcelona, Spain



Tervuren, Chaudfontaine, Belgium

San Jose State University, USA

100+ networks live globally
100+ trials in progress

WiFi4EU

West Coast, USA

OPENROAMING IN ACTION

Business Drivers for OpenRoaming™ Wireless Broadband Alliance

Provide seamless, secure and automatic Wi-Fi experience	Enlarge the number of devices and customers on your network	Grow your customers base, satisfaction and loyalty
Grow revenues and footprint of networks and partners	Easy roaming agreements, save time, resources & money	Solve security, user privacy and “MAC” rotation issues

BE PART OF THIS REVOLUTION, JOIN OPENROAMING, JOIN WBA


I ♥ Wi-Fi
#worldwifiday
20th JUNE

Maximizing the value of Wi-Fi®

EDGAR FIGUEROA

President & CEO

Wi-Fi Alliance

Maximizing the value of Wi-Fi®

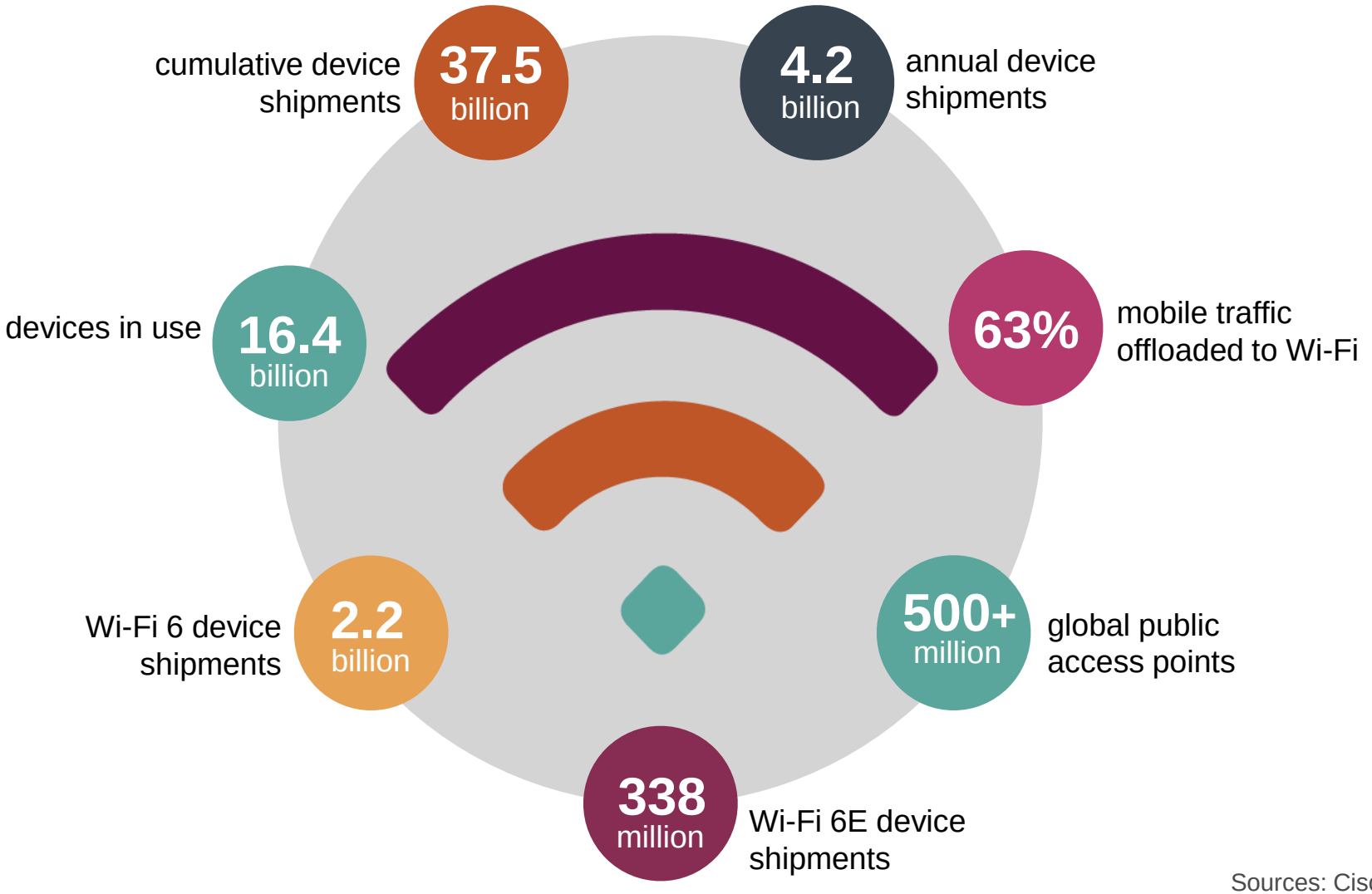
Edgar Figueroa
President and CEO
June 3, 2021

Topics

- Wi-Fi Alliance®
- Wi-Fi® economic value
- Ensuring the future of Wi-Fi

The global network of companies that brings you Wi-Fi

Wi-Fi by the numbers, 2021



Sources: Cisco, IDC, Telecom Advisory Services, Wi-Fi Alliance

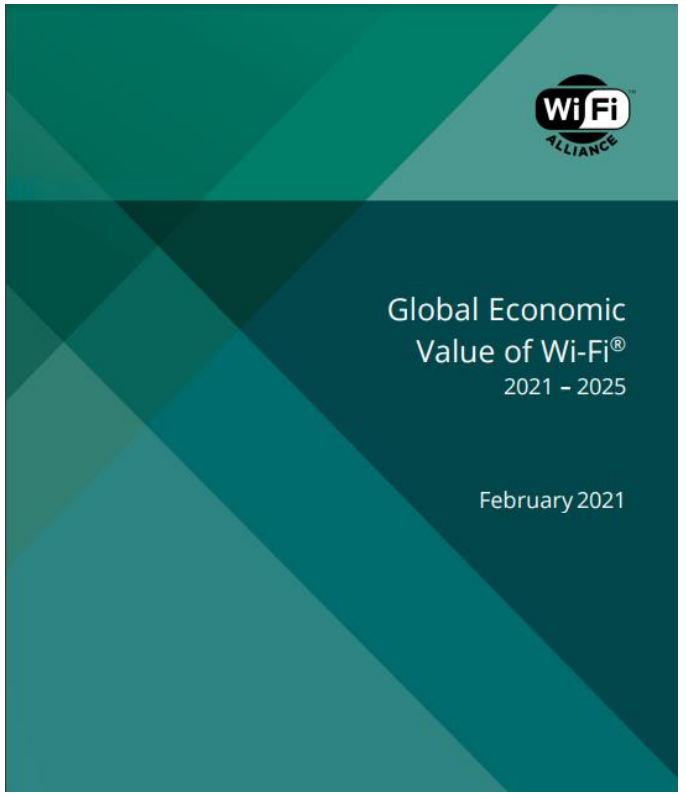
Wi-Fi economic value

Wi-Fi economic value study

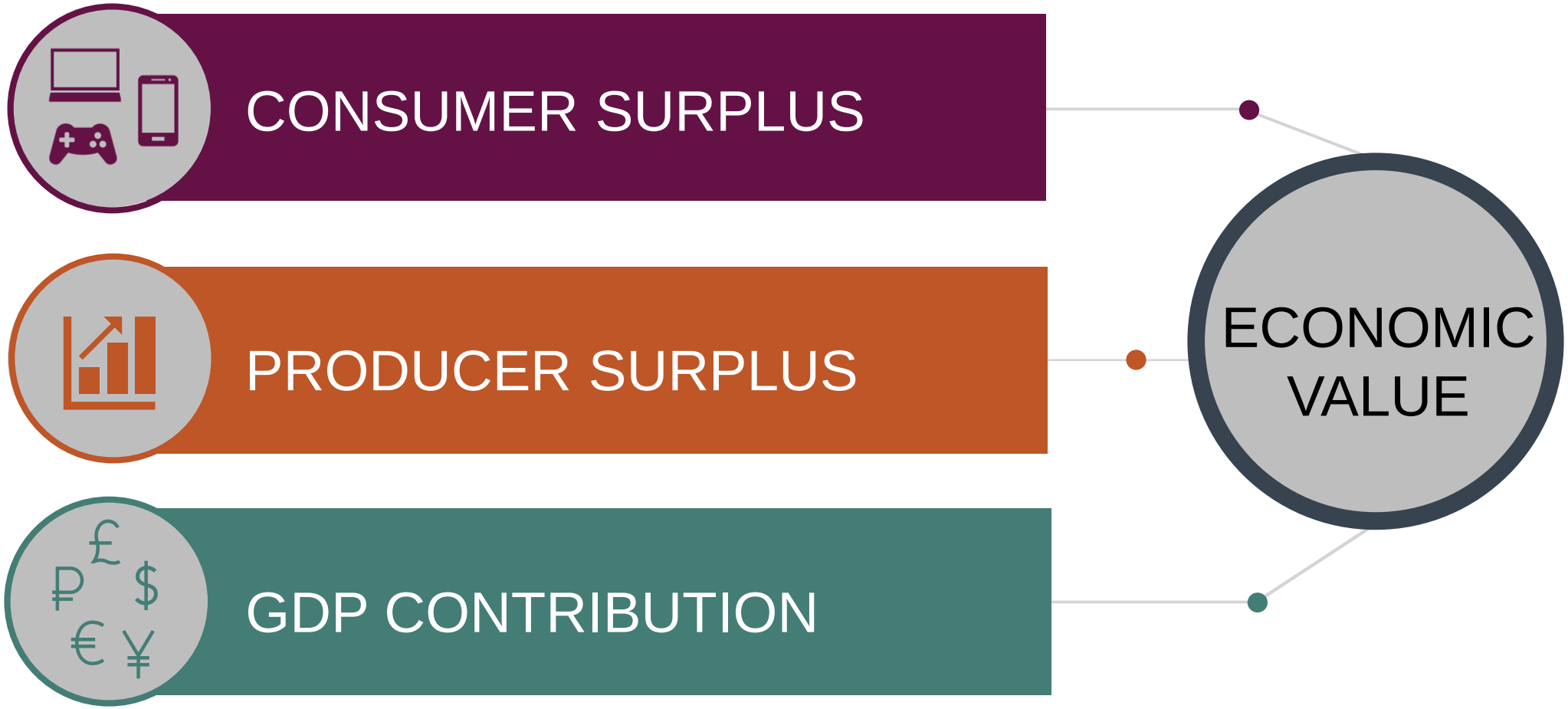
- Study commissioned by Wi-Fi Alliance
- Global, 15 economies, 2021 and 2025

Americas	APAC	EMEA
Brazil Colombia Mexico United States	Australia Japan New Zealand Singapore South Korea	European Union France Germany Poland Spain United Kingdom

- More details: www.valueofwifi.com



Economic value components



2025 global Wi-Fi economic value

$5 trillion (U.S.)

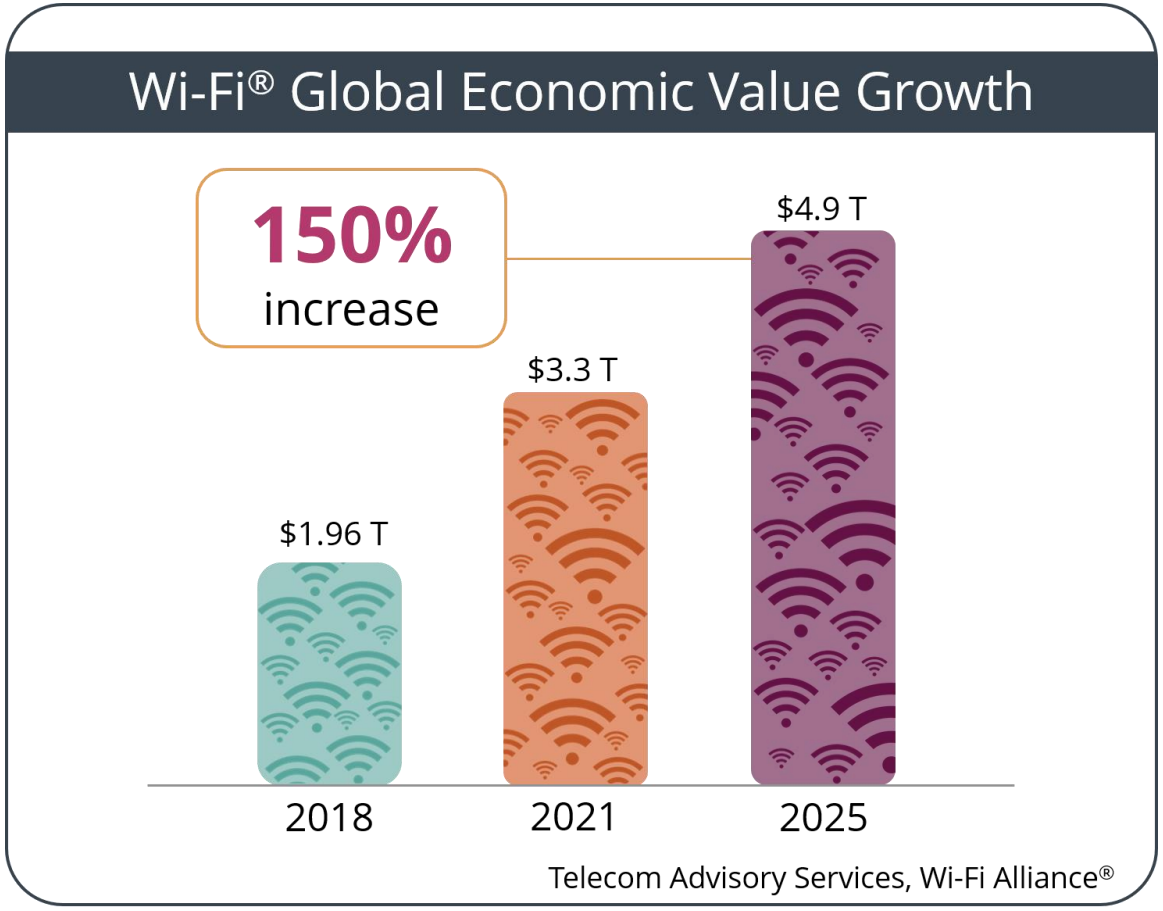
€4+ trillion

£3.5+ trillion

¥547 trillion

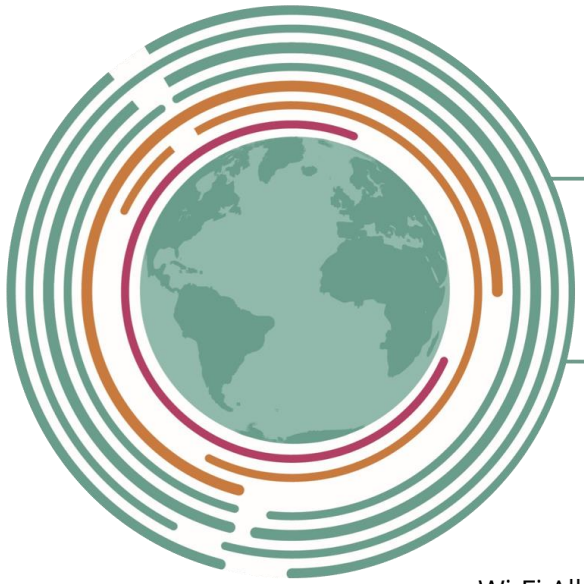
Wi-Fi global economic contribution has outpaced expectations!

- 2025 value **150% increase** from 2018 estimate
- Wi-Fi 6 and Wi-Fi 6E to add **$58 B** globally in 2021



Wi-Fi economic contribution

Global Value of Wi-Fi®



2021 $ 3.3 trillion

2025 $ 4.9 trillion

Wi-Fi Alliance®, Telecom Advisory Services

EUROPEAN UNION

2021	2025
€375 billion	€522 billion

UNITED KINGDOM

2021	2025
£70 billion	£77 billion

COLOMBIA

2021	2025
$71 trillion COP	$153 trillion COP

JAPAN

2021	2025
¥27 trillion	¥35 trillion

The value everyone recognizes:

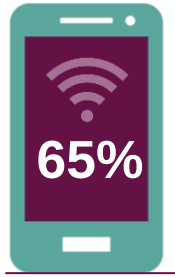
Wi-Fi is a daily essential to people everywhere

Wi-Fi is a key enabler in a digital world

Users cannot imagine a day without Wi-Fi

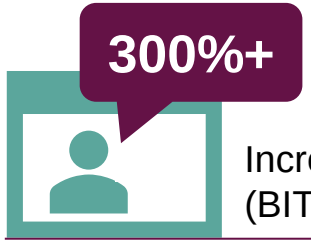
Critical resource during the pandemic

Increase in daily online activity compared to pre-pandemic in the U.S. (Plume)



Devices connected to Wi-Fi over cellular in the U.K. (Ofcom)

Increase in educational software downloads in the U.K. (Airnow)



Increase in videoconferencing (BITAG)

Increase in video streaming in Italy (YouGov)

Average increase in e-Commerce for 12 European countries (Postnord)

Wi-Fi value beyond economics

Functional value

Essential utility for enterprise, education, home, logistics

Social value

Important for psychological health: maintaining contact and relationships

Community value

Key to bringing services and capabilities to remote and underserved areas

Crux: Wi-Fi value and Wi-Fi usage are both astronomical and ever increasing.

Yet, increased usage requires enough spectrum to avoid performance degradation

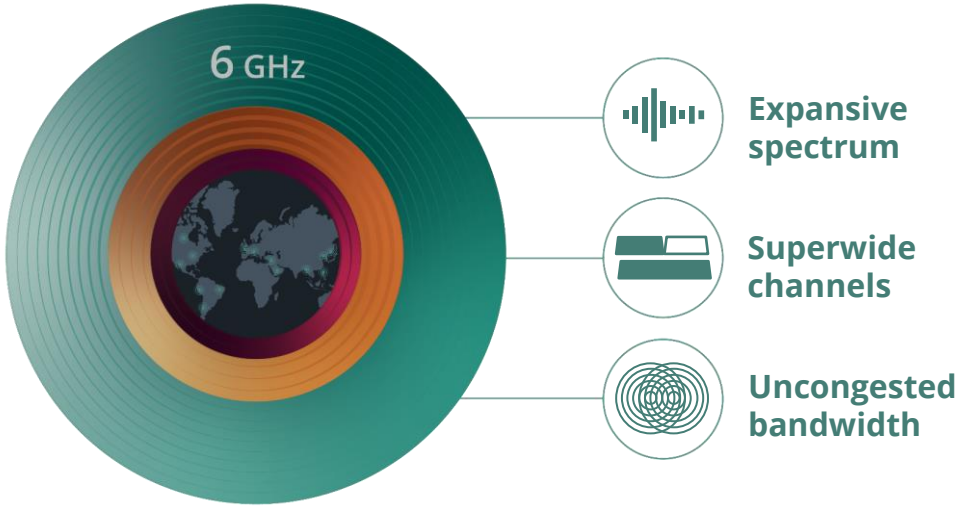
Ensuring the future of Wi-Fi

6 GHz access helps address our connectivity future

- In April 2020 FCC transformed the Wi-Fi ecosystem by allowing 6 GHz access
- Administrations in the Americas, Asia, and Europe followed, recognizing Wi-Fi value by making 6 GHz spectrum available for Wi-Fi
- Industry has galvanized to deliver Wi-Fi 6E technology and devices in record time

Wi-Fi 6E brings:

- Better speed, capacity, and latency
- Quality in demanding environments
- Tailored power consumption for IoT



Wi-Fi Alliance®

Spectrum policy should create an environment suitable for long term evolution

- Starting with Wi-Fi 7, future Wi-Fi generations will support 320 MHz channels
- Future Wi-Fi innovation relies on wider channel bandwidths
  - 500 MHz of the 6 GHz band allows for *one* 320 MHz channel
  - 1200 MHz of the 6 GHz band allows for *three* 320 MHz channels
- To keep up with Wi-Fi innovations for the next 10+ years, and to maximize value from Wi-Fi, countries should enable access to 1200 MHz in the 6 GHz band

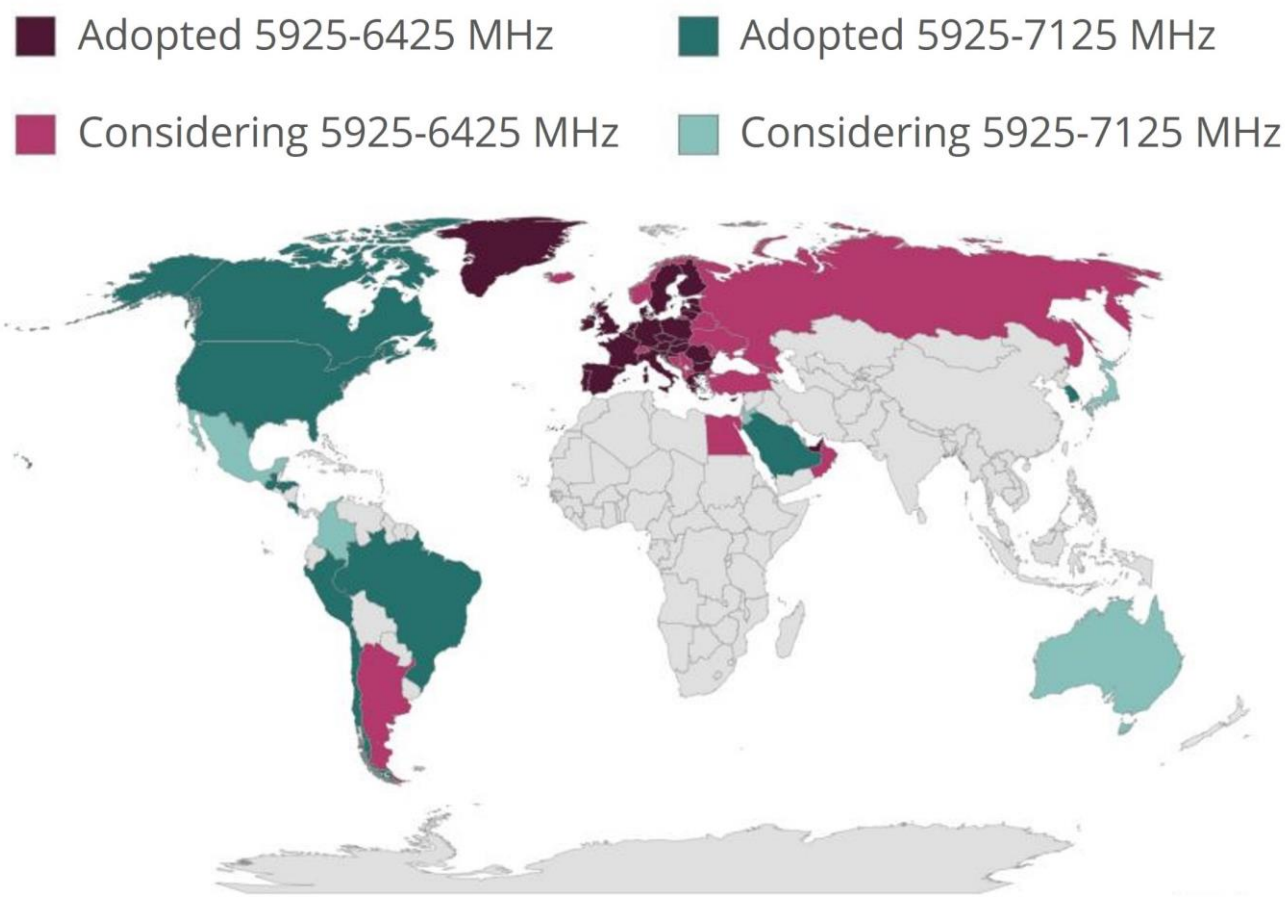
Wi-Fi sensing

Cross-home architecture

Holographic video

6 GHz access progress report

- Please note our useful global regulatory tracker website: https://www.wi-fi.org/countries-enabling-wi-fi-6e
- Identifies country action on granting 6 GHz band access to Wi-Fi
- As of this week:
  - 13 regions have adopted
  - 10 considering



Summary

- In 2021, Wi-Fi economic value is $3.3 T USD globally, growing to $5 T USD by 2025
- Value spans essential functional, social, and community benefits
- 1200 MHz spectrum access in 6 GHz enables Wi-Fi innovation and performance enhancements, maximizing the value of Wi-Fi for decades
- Join Wi-Fi Alliance to lend your support to 6 GHz global harmonization efforts

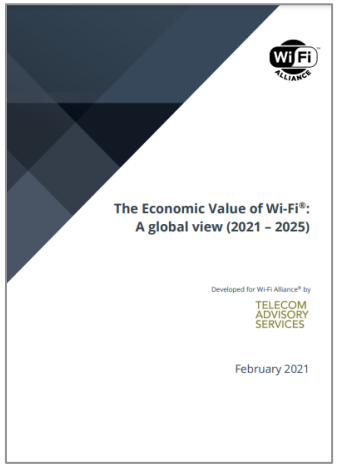
Thank you

www.valueofwifi.com

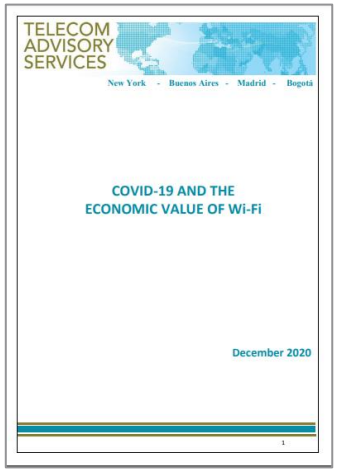
References

Highlights sheet

Study summary



Study details



COVID-19 and Wi-Fi

The Future of Fiber

Impacts To The Connected Experience

JR WILSON

Chairman, Wireless Broadband Alliance, Vice President, Tower Strategy & Roaming.

AT&T Services, Inc.

THE FUTURE OF FIBER

impacts to the connected experience

JR Wilson
AT&T VP of Tower Strategy and Roaming
WBA Chairman

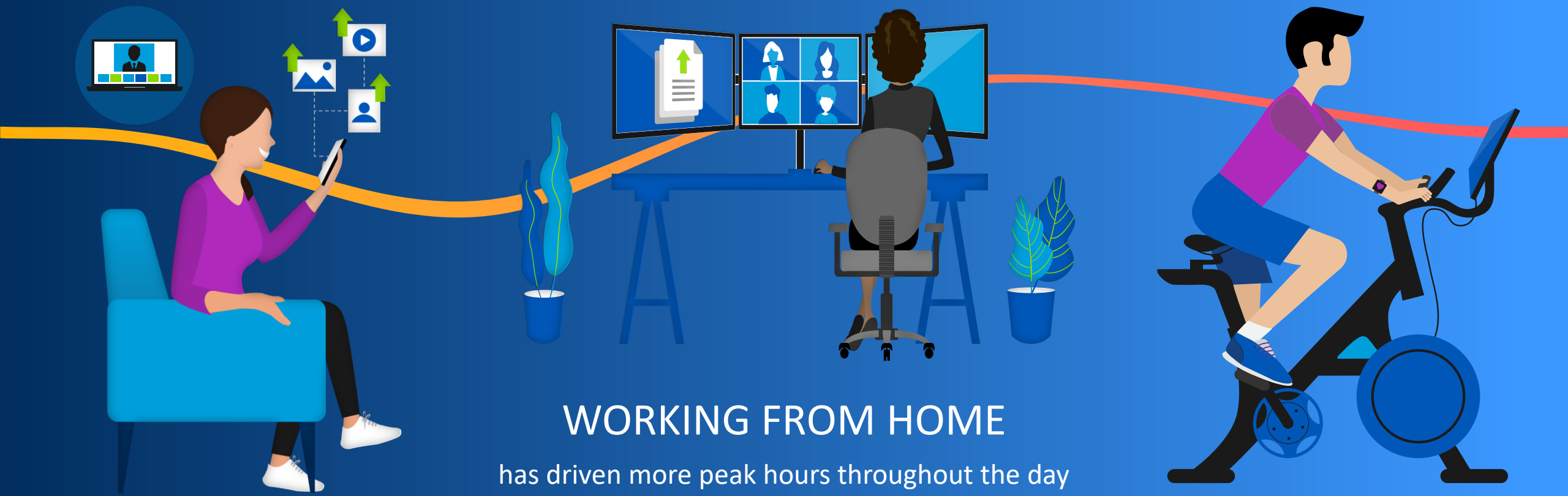
EVOLUTION OF COMMUNICATION

VIDEO CONFERENCING

has driven huge growth in upload demand

LEARNING, SOCIALIZING, EXERCISING FROM HOME

has driven the demand and popularity for next-generation connected devices



WORKING FROM HOME

has driven more peak hours throughout the day

AT&T

WHAT WE'RE DOING WITH FIBER

Expanding fiber throughout 2021

Reaching **3 million** new customer locations (business & consumer)

Building in more then 90 metro areas across the country

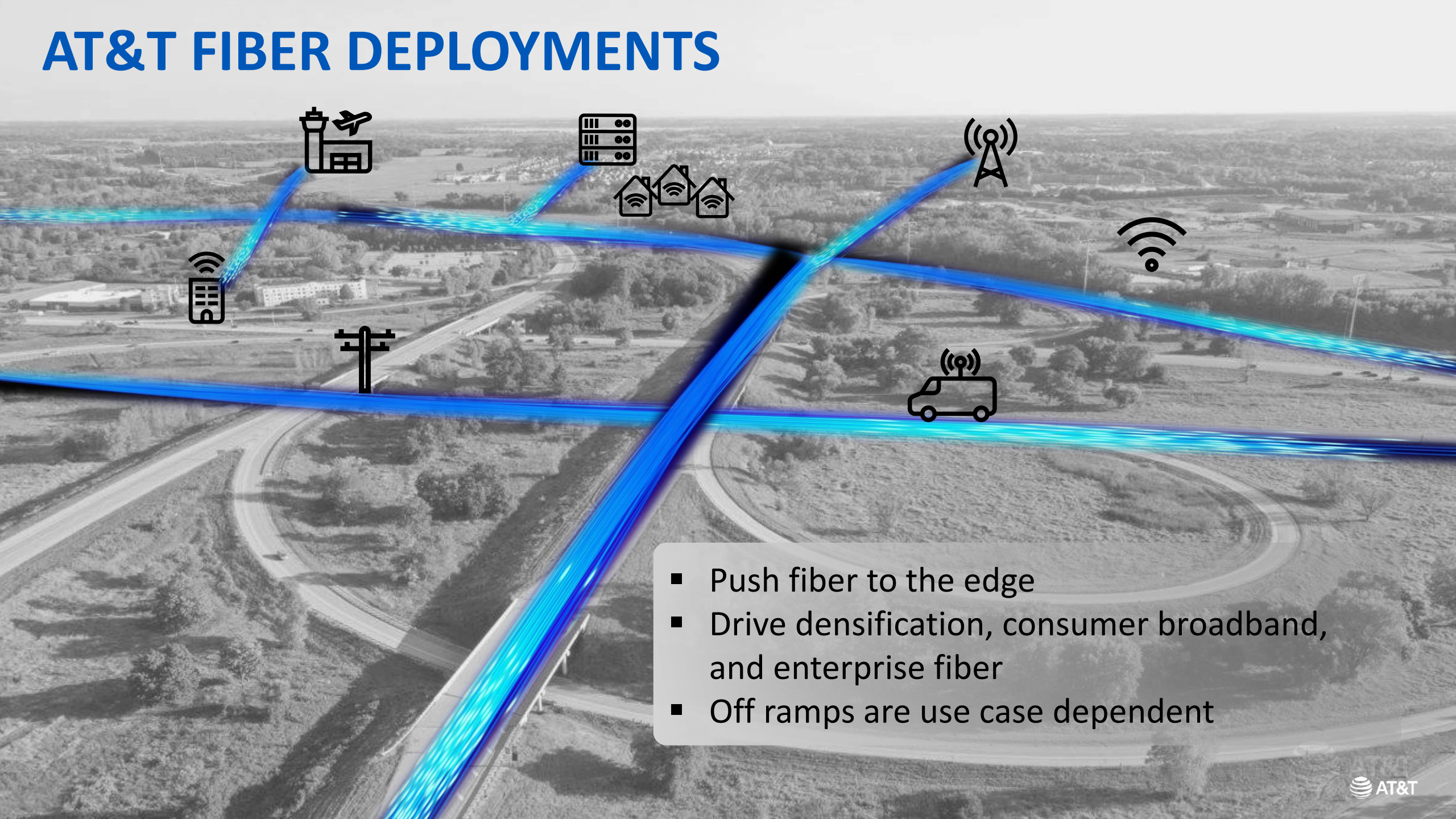
Increased speeds for entry and mid-level AT&T Fiber plans

Delivering more fiber that's **ranked #1** in customer satisfaction (1)

(1) Compared to the publicly measured internet service providers in the ASCI. Claim based on 2020 ACSI survey of customers rating their own internet service provider's performance.

AT&T

AT&T FIBER DEPLOYMENTS



- Push fiber to the edge
- Drive densification, consumer broadband, and enterprise fiber
- Off ramps are use case dependent

AT&T

WHAT YOU CAN DO WITH FIBER

Work from home with consistently fast speeds

Learn virtually with nearly 1Gbps speeds and avoid congestion

Reach business customers in new & reliable ways

Receive telehealth consultations securely

Game & binge watch without lag or congestion

BRIDGING THE DIGITAL DIVIDE
CLOSING THE HOMEWORK GAP

70%+
think classroom environment will **rely more heavily on technology** after the pandemic [1]

$2 Billion, 3-Year Commitment from AT&T

bring robust broadband connectivity to more Americans

- Low-cost broadband offers
- Emergency Broadband Benefit (EBB)
- AT&T Connected Learning Program

WORLD™ Wi-Fi Day
JUNE 20TH

(1) https://about.att.com/story/2021/digital_divide.html

AT&T

GROWTH OF WI-FI 6 & 6E

US, UK, EU & 9 other countries **enabling Wi-Fi 6E**

Under consideration in 12 more [2]

2021

2 Billion Wi-Fi 6 product shipments [1]
> 338 million Wi-Fi 6E devices will enter the market

2022

3.5 Billion Wi-Fi 6 product shipments [1]
~ 20% support 6GHz

2025

5.2 Billion Wi-Fi 6 product shipments [1]
~ 41% support 6GHz

[2] Wi-Fi Alliance, April 2021

[1] Wi-Fi Alliance, March 2021

AT&T

CALL TO ACTION

For Wi-Fi to truly become another access technology on par with cellular, QoS Class Identifiers (*QCI*) must better align within 3GPP standards and across technologies to allow for equally robust quality of service across Wi-Fi, LTE and 5G

AT&T


AT&T

Connectivity in the 5G ERA: CBRS + Wi-Fi Convergence

DR. DEREK PETERSON

CTO

Boingo Wireless

boingo

WBA WIRELESS GLOBAL CONGRESS

CONNECTIVITY IN THE 5G ERA:

CBRS + WI-FI CONVERGENCE

Dr. Derek Peterson, Chief Technology Officer, Boingo Wireless

June 3, 2021

WORLD CLASS WIRELESS

FOR THE

WORLD'S PREMIER PROPERTIES

Boingo delivers unparalleled wireless solutions at iconic venues serving more than

1 BILLION CONSUMERS ANNUALLY

boingo

Boingo's Converged Leadership

Deploying 5G, Wi-Fi 6, CBRS and OpenRoaming

Wireless strategy leverages all available spectrum

Uniquely positioned as neutral host provider to manage the challenge of multiple 5G technologies in the same venue

Influencing 5G era standards through leadership positions with WBA, OnGo Alliance, Telecom Infra Project and more

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THE
ENTERPRISE DEMAND
boingo

Digital Transformation

Connectivity is even more important today, as COVID-19 has accelerated digital strategies across all industries

77%

Of CEOs stated that the pandemic has accelerated their digital transformation plans

3-4yrs

Pace at which companies have accelerated digitization

$6.6 trillion

The forecasted 2021 value of the digital payments industry, a 40% jump in two years

60%

Of airlines are focused on investing in biometric self-boarding gates

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TODAY'S
USE CASES
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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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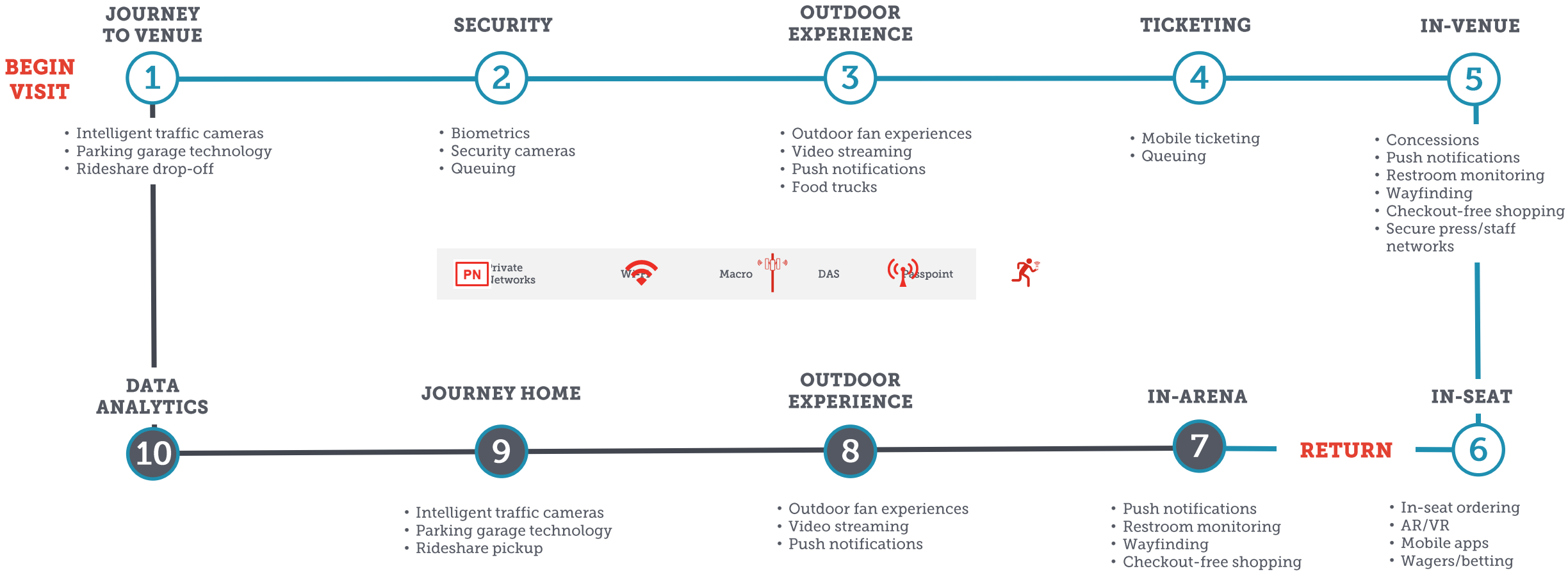
The Connected Venue Experience

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



Delivering the Vision on Military Bases

On base, a convergence of technologies is key to power everyday life, health and safety measures, equipment, research and development.

Security Cameras

Dinning Facilities

AR/VR

Gyms/Recreational Buildings

Wearable Tech

Push-to-talk Devices

Barracks/Dorms

Warfighter

Cellular Solutions

Robotics

Convergence in Action: Airports

Improved safety, business operations and customer experience

BACKEND OPERATIONS

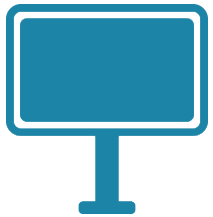
4K video surveillance and near-real-time data analysis for AI-powered security services

PN

FRONTEND AUTOMATION

Facial recognition and biometrics devices facilitate seamless and secure entry and boarding

PN



Proximity-based digital signage uses data and sensors to deliver wayfinding and PSAs

PASSENGER EXPERIENCE

Fast connectivity provides passengers with seamless, convenient access to contactless concessions, streaming content and more

boingo


SPECTRUM
CHALLENGES &
OPPORTUNITIES
boingo

The Myth: CBRS vs Wi-Fi

COINTEGRATION

↑

COEXISTENCE

↑

COLLABORATION

The 5G era is not economically practical without cointegration

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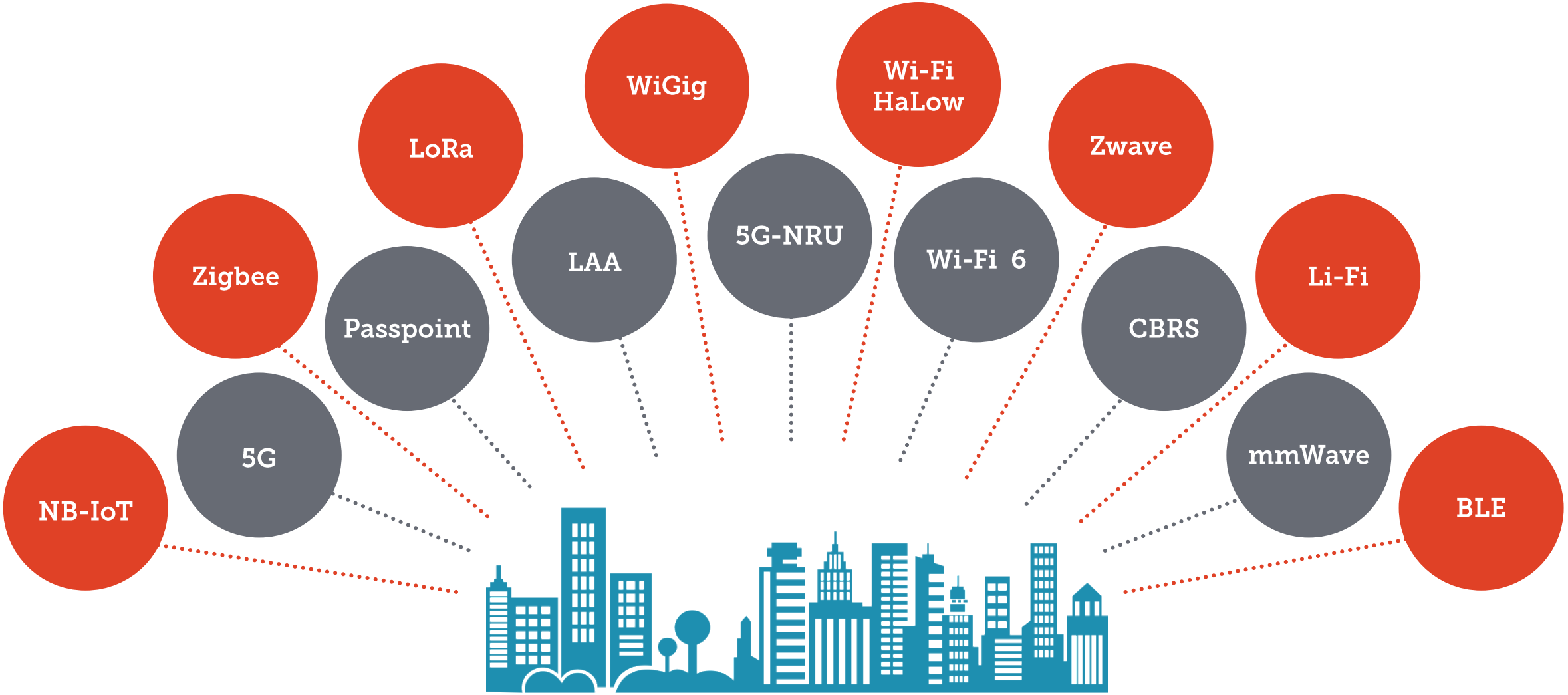
Challenge: 100 MHz Per Provider Per Venue

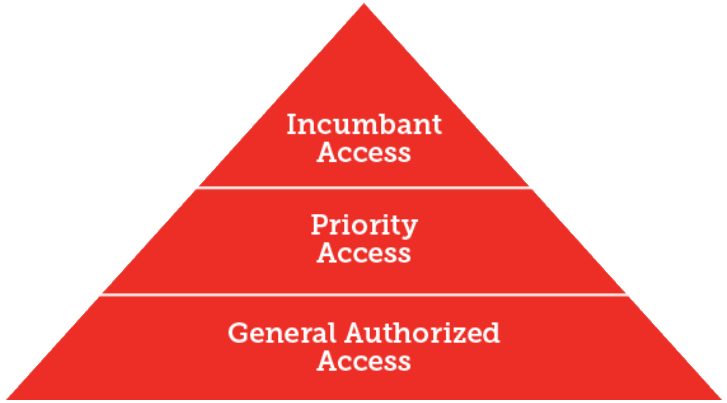


Journey to Add More MHz

Regulators worldwide are exploring dynamic sharing technology to address spectrum challenges, including:

- Making more efficient use of occupied bands
- Increasing spectrum access options for new use cases
- Fostering larger equipment ecosystems
- Facilitating regional cross-border coordination and TDD synchronization

CBRS



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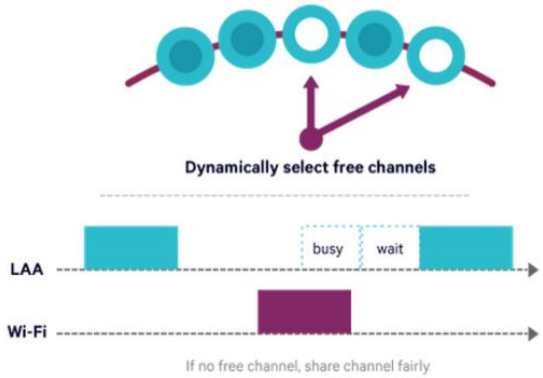

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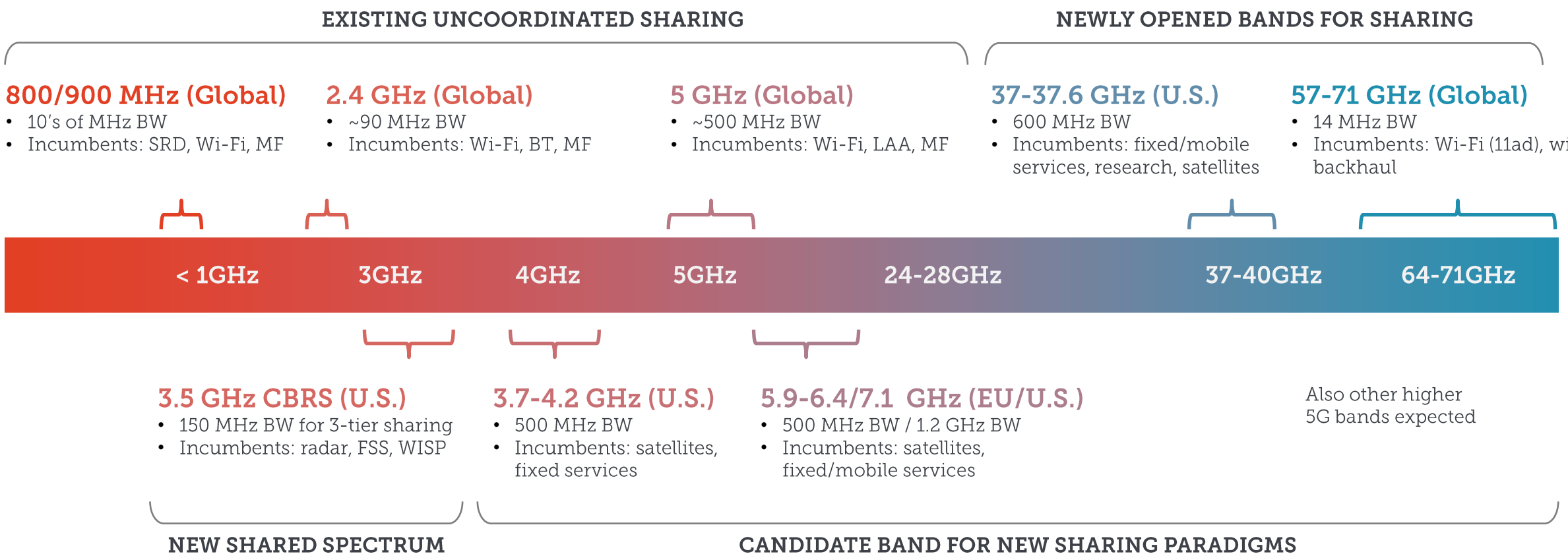
LOOKING
AHEAD
boingo

Everyone Should Benefit from New Spectrum



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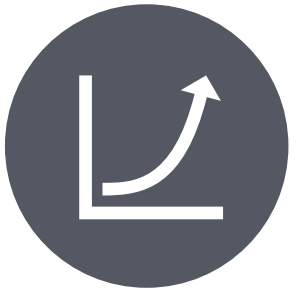
Cointegration Next Steps

Move beyond complementary deployments

Prioritize convergence and create flexibility for users

TRUTH: users don't care what network they're on

Push identity management programs to deliver trusted access among users, applications and spectrum



Carve out spectrum for neutral host deployment—network as a service—to maximize spectrum

boingo

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

boingo

Future Needs of Hospitality

YVETTE VINCENT

The Continent IT Leader, US & Canada

Marriott International

WIRELESS GLOBAL CONGRESS
WIRELESS BROADBAND ALLIANCE

Panel Discussion

Tiago Rodrigues

Wireless Broadband Alliance

JR Wilson

AT&T

Dr. Derek Peterson

Boingo Wireless

Yvette Vincent

Marriott International

Edgar Figueroa

Wi-Fi Alliance

Wi-Fi 2030

ERIC A. MCLAUGHLIN

Vice President, Client Computing Group, General Manager, Wireless Solutions Group,
Intel Corporation

Wireless Broadband Alliance:

Wi-Fi Innovations Connecting Your World - Leadership Conference

(Jun 3, 2021)

Wi-Fi 2030

Eric A. McLaughlin

VP, Client Computing Group & GM, Wireless Solutions Group

Intel Corporation

Distributed Network Transformation

GROWTH OF

Network
(5G/6G)
(Wi-Fi 7/8)

AI

Cloud
Edge
IOT

DISTRIBUTED INTELLIGENCE
(Multi-cloud)

Traditional Network

Analytics
Storage
Compute

Network

Things

Cloud Native/
Virtualization

Storage

Network
Infrastructure

AI/
Analytics

Intelligent Network

Data Center/
Cloud

Network
Core

RAN/
Edge

Things

Compute
Storage
Analytics

MOVE,
STORE,
& PROCESS
DATA
(Across All Workloads)

Proliferation of AI, edge compute, virtualization, and next-generation wireless technologies will accelerate transformation

The Wireless World in 2030

The future is a mix of heterogeneous wireless technologies

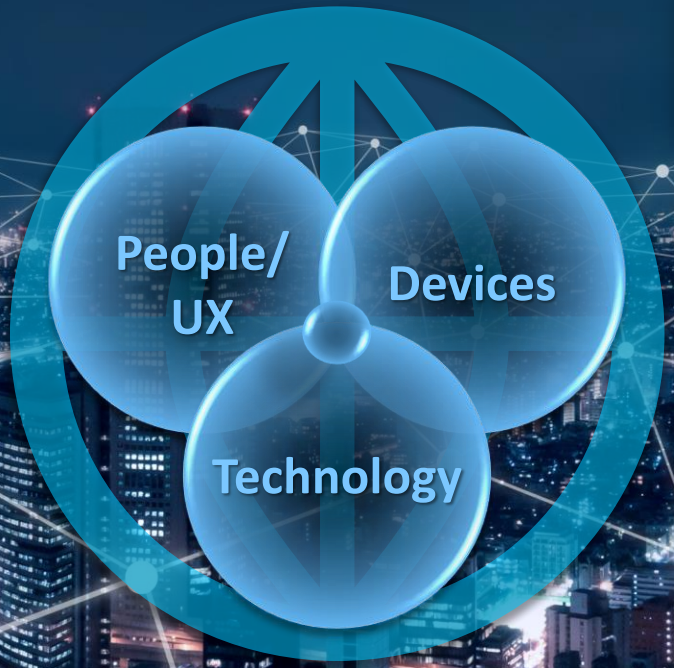
Megatrends Impacting Wireless in 2030

User access to
Massive Data / Compute Power
with ultra-fast speed/low latency

Context aware / Predictive
devices & networks
(AI/SDN/Distributed NW)

Seamless + secure interoperation
across devices / technologies

New HMI expansion
More video, gestures, and voice interaction



Huge growth of
Cellular PWN + Wi-Fi
for home and enterprise

New types of connected devices
(e.g. smart glasses)
become mainstream / essential

IoT exponential ramp
across all market segments

Pervasive
Spectrum sharing & mmWave
become common

Use cases, technologies, and markets will emerge…
based on intersection of technologies, human experiences, devices, and world around them

Emerging Usages: Day in the life 2030

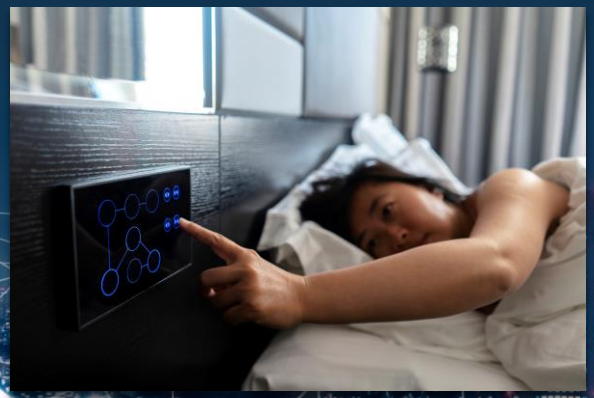
CONTEXT (sensing, ranging, indoor location)

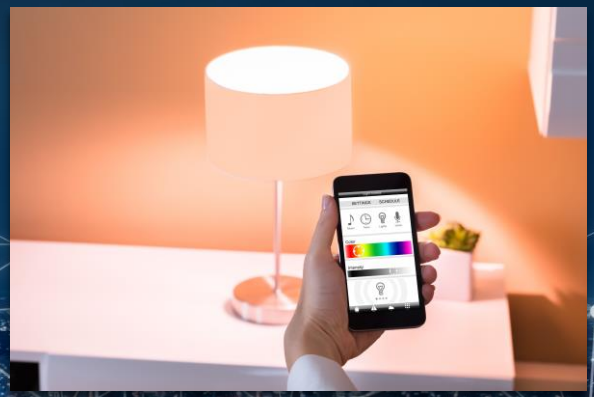
CONSUMER +IOT

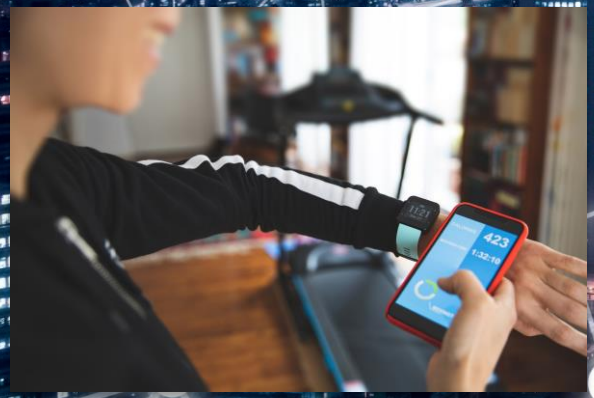
INDUSTRY 4.0

HOME (AM)

- Space Utilization + Control
- AR / VR + Holo
- Wearables
- Health + Activity Monitoring







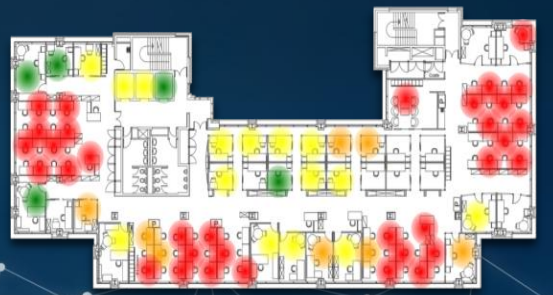
Massive data, faster speeds / processing, ultra-low latency, frictionless roaming, & seamless handover across wireless technologies / bands / devices

Emerging Usages: Day in the life 2030

CONTEXT (sensing, ranging, indoor location)

CONSUMER +IOT

INDUSTRY 4.0



OFFICE (AM/PM)

- Space Utilization + Control
- Asset Tracking
- Docking
- Proximity Wake / Lock
- Room Occupancy
- AR / VR + Holo
- Gesture Control
- Robots

Massive data, faster speeds / processing, ultra-low latency, frictionless roaming, & seamless handover across wireless technologies / bands / devices

Emerging Usages: Day in the life 2030

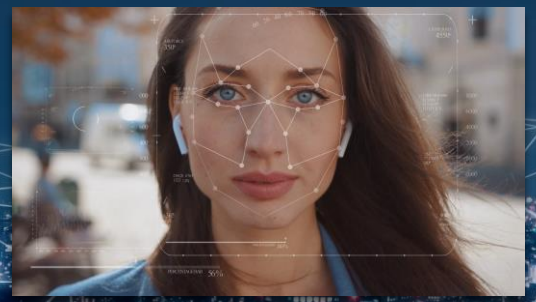
CONTEXT (sensing, ranging, indoor location)

CONSUMER +IOT

INDUSTRY 4.0

HYBRID/HOME (PM)

- Space Utilization + Control
- Docking
- Facial Recognition
- Gesture Control
- Smart Mfg.
- AGV / AMR
- AR / VR + Holo



Massive data, faster speeds / processing, ultra-low latency, frictionless roaming, & seamless handover across wireless technologies / bands / devices

Summary / Call to Action

- The future of wireless is bright!
- Network transformation is facilitated by next-gen wireless synergies
- Seamless wireless technology interoperability / handover required
- Massive data / processing + Multi-gigabit speeds + Ultra-low latencies will drive usage evolution
- Impact of new Contextual, Consumer/IOT, & Industry 4.0 usages - will greatly impact our daily lives

Continued industry collaboration on next-generation wireless technology is the key to this potential bright future in 2030.

THANK YOU!

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Learn more at www.Intel.com/PerformanceIndex (connectivity).
Performance results are based on testing as of dates shown in configurations and may not reflect all publicly available updates.

No product or component can be absolutely secure. Your costs and results may vary.
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Privacy in the age of consumer tracking

Alternative identities enable policy, and privacy.

MARK GRAYSON

Distinguished Consulting Engineer

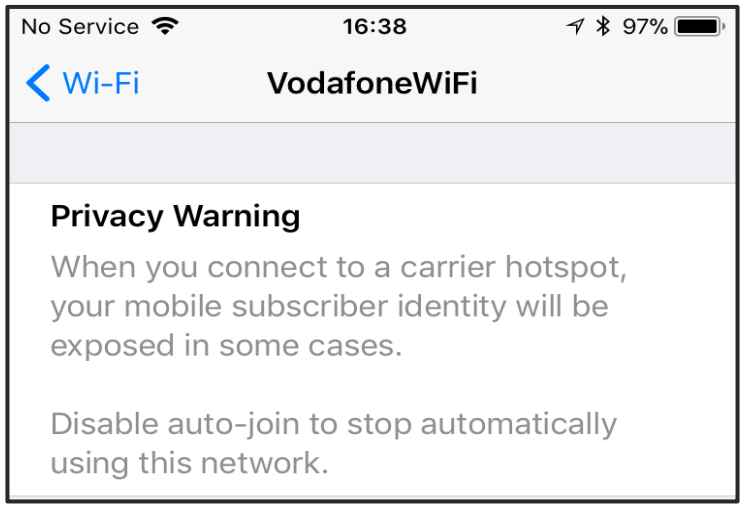
Cisco

Privacy in the age of consumer tracking

Alternative identities enable policy, security, and privacy

Mark Grayson
Distinguished Engineer and WBA OpenRoaming Standards Group Chair
3 June 2021

Re-enforced Messages of Weak Privacy



Cellular Roaming: Exposing your ID

Home Network

Update Location

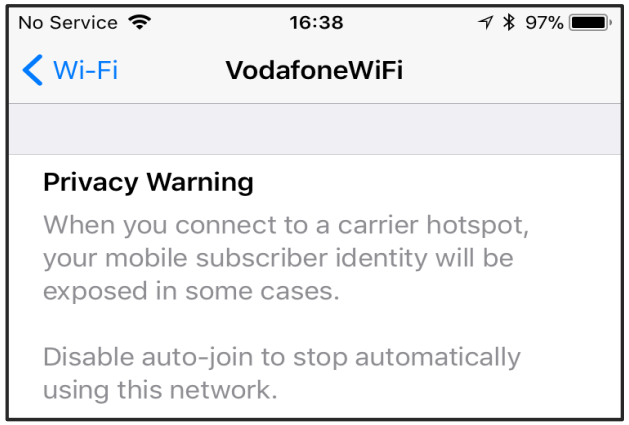
IMSI/TMSI

Insert Subscriber Data

IMSI, MSISDN, Forwarding Numbers, Call Barring Information, APN Information, ..

Roaming agreement prohibits sending of “roaming customer targeted communications” unless authorized by home network

Restrictions on use of Personal Identifiable Information for any other purposes is not standardized



When you connect to **any** cellular network, your mobile subscriber identity, **telephone number and service info will always** be exposed to the visited network!

OpenRoaming: Privacy by Design

Home Network

EAP-Response/Identity

anonymous@home-network

EAP-Method

EAP-Success

Chargeable-User-Identity: an opaque string/identifier

OpenRoaming baseline privacy policy restricts the use by ANP of all subscriber Personal Identifiable Information for provision of the service, troubleshooting and compliance with the law.

Visited network is prohibited from selling, renting, releasing, disclosing, any PII.

When you connect to **any** OpenRoaming network, the use of your PII is **always** protected

OpenRoaming
Accelerating the shift from a duopoly of identities

Public Cellular

Wi-Fi

- **Yesterday**: Wi-Fi is the poor relation with no security and MAC address based device identity

OpenRoaming
Accelerating the shift from the current duopoly of Identities

- **Today**: Accelerated integration of new identity providers into the OpenRoaming federation

Public Cellular

OpenRoaming – 802.11

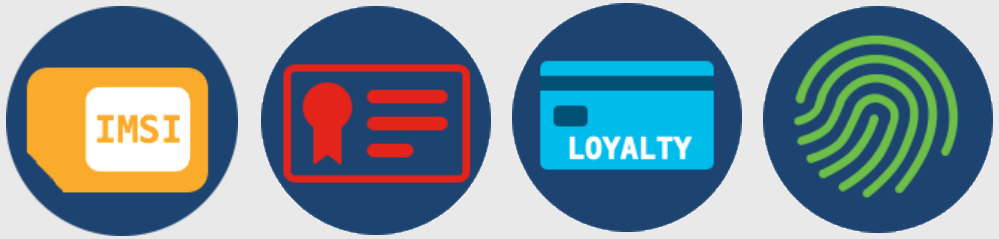
- SIM cards, certificates, loyalty scheme identities, enterprise identities, etc, all used to seamlessly and securely on-board Wi-Fi devices – **no longer reliant on permanent device ID**

OpenRoaming
Accelerating the shift from the current duopoly of Identities

- **Tomorrow**: OpenRoaming enhanced to address scaling requirements of private 3GPP networks.
- 5G's AUSF and EAP support enables same set of identity providers to be used to seamlessly and securely on-board devices onto private 3GPP networks

OpenRoaming – Private 3GPP

OpenRoaming – 802.11



OpenRoaming Policy Diversity:
The Right Identity for the Right Service

OpenRoaming Policy Diversity:
The Right Identity for the Right Service

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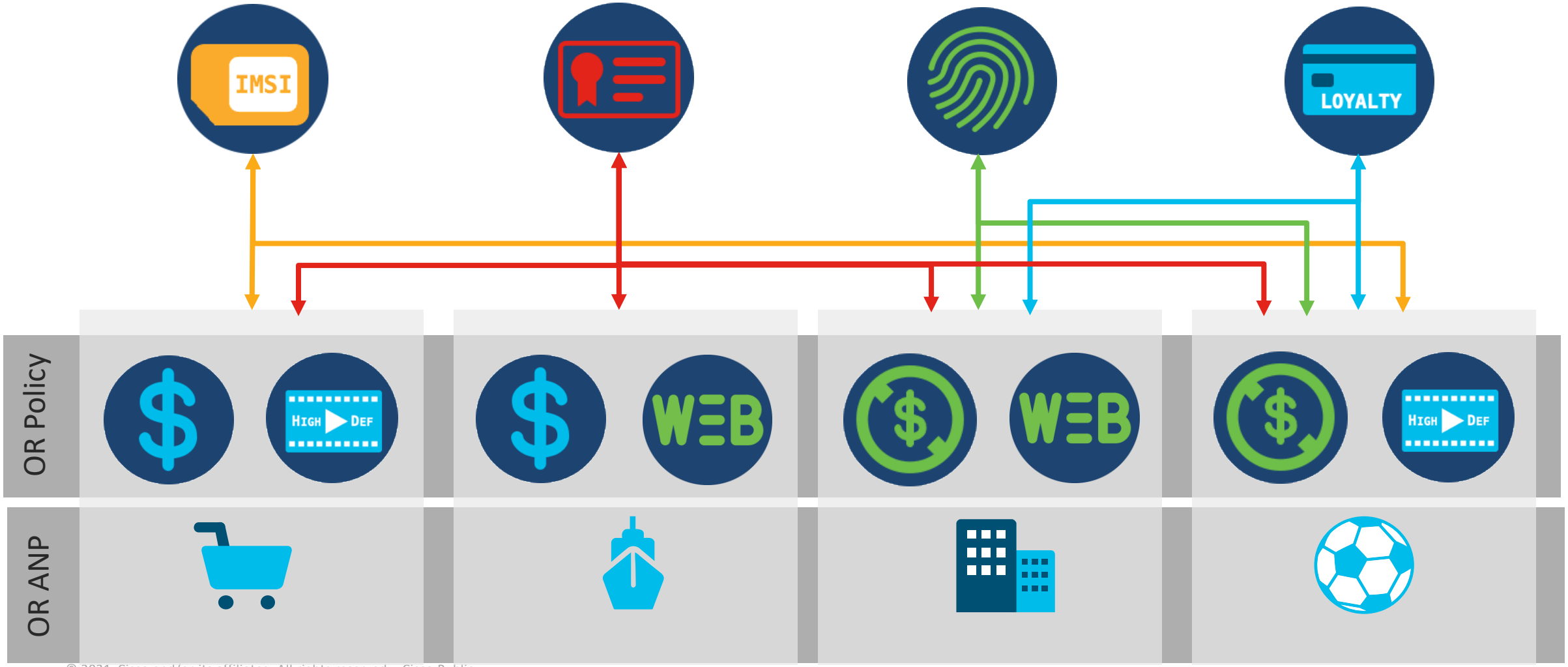
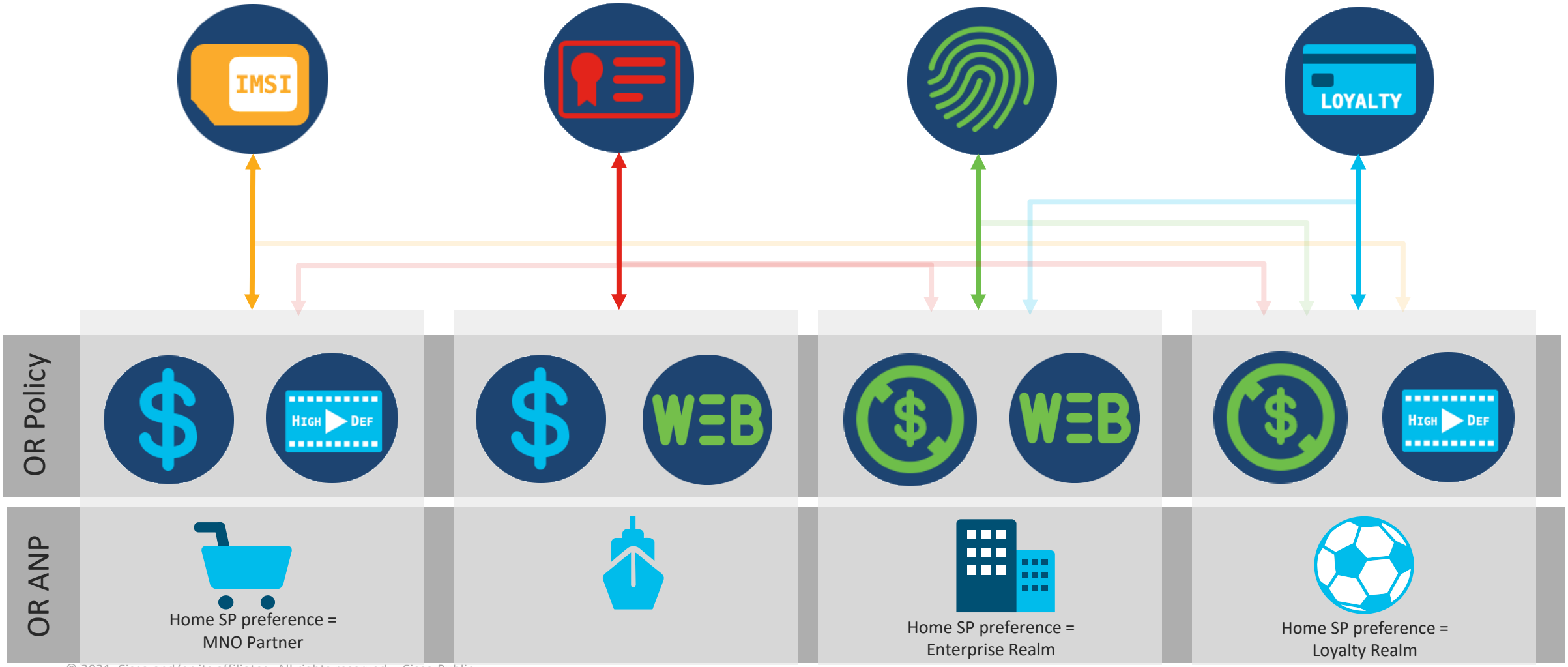
The Right Identity for the Right Service



OpenRoaming Policy Diversity:
The Right Identity for the Right Service



Key Takeaways

- OpenRoaming delivers simple, secure, seamless and scalable Wi-Fi onboarding where users are anonymous by default

1. Privacy by design - all access providers have to sign up to the WBA Baseline Privacy Policy – constrains the use of PII for for provision of the service, troubleshooting and compliance with the law
2. OpenRoaming accelerates shift from MAC address to a broader set of Identity Providers, in 802.11 networks today and in private 3GPP networks tomorrow
3. The Right Identity for the Right Service – OR delivers automated policy matching as well as identity preference handling

OpenRoaming, plus MAC randomization, plus broadening identity provision – setting the new benchmark for wireless privacy


CISCO

Gigabit Broadband with 6 GHz Wi-Fi

VIJAY NAGARAJAN

Vice President, Wireless Communications and Connectivity Division

Broadcom

Gigabit Broadband with 6 GHz Wi-Fi

June 2021

Agenda

The 6GHz Juggernaut

Wi-Fi 6E: The Harbinger for Wi-Fi in 6 GHz

Wi-Fi 7: Fulfilling the Promise of 6 GHz

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The 6 GHz Juggernaut

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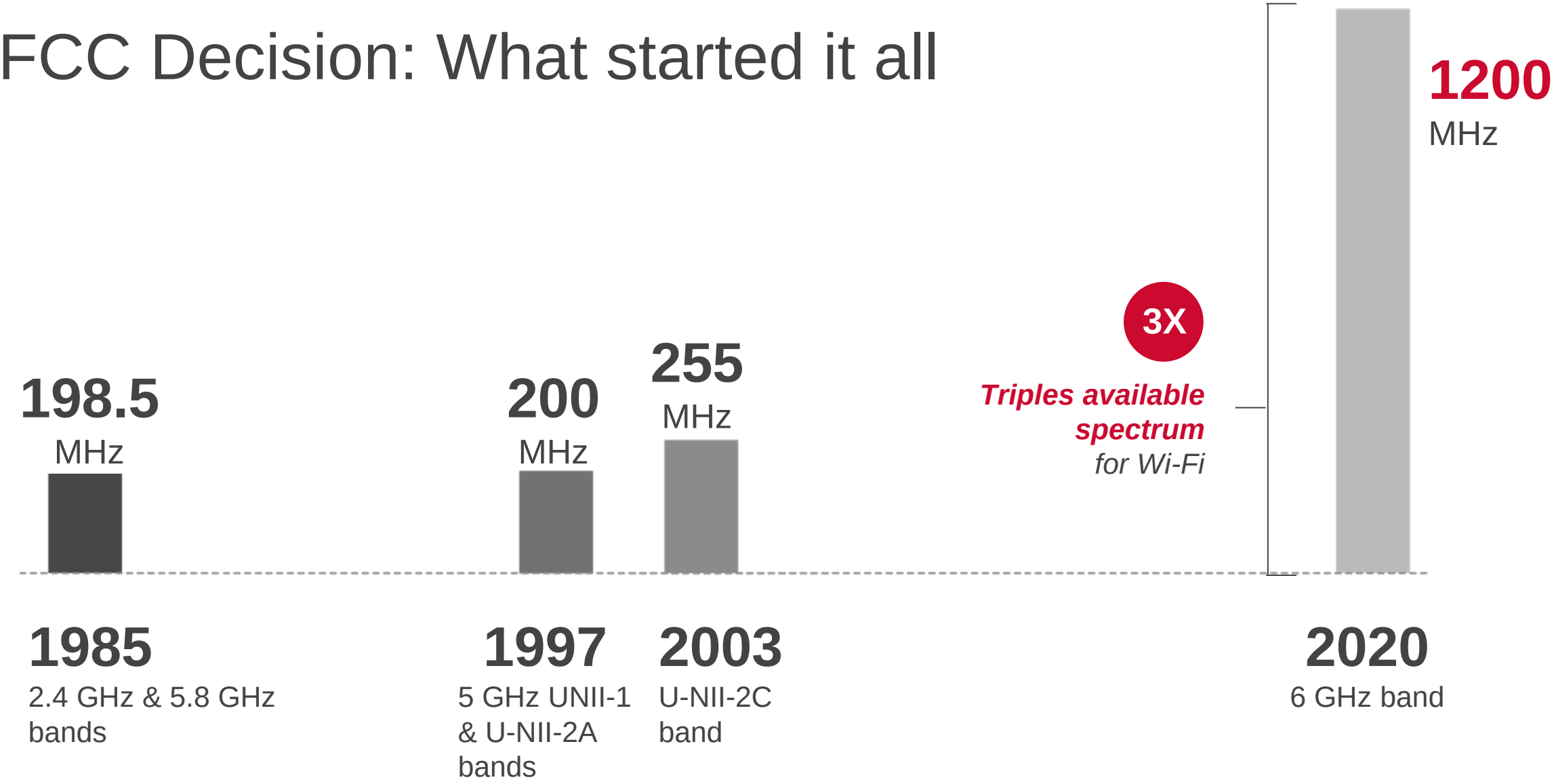
FCC Decision: What started it all



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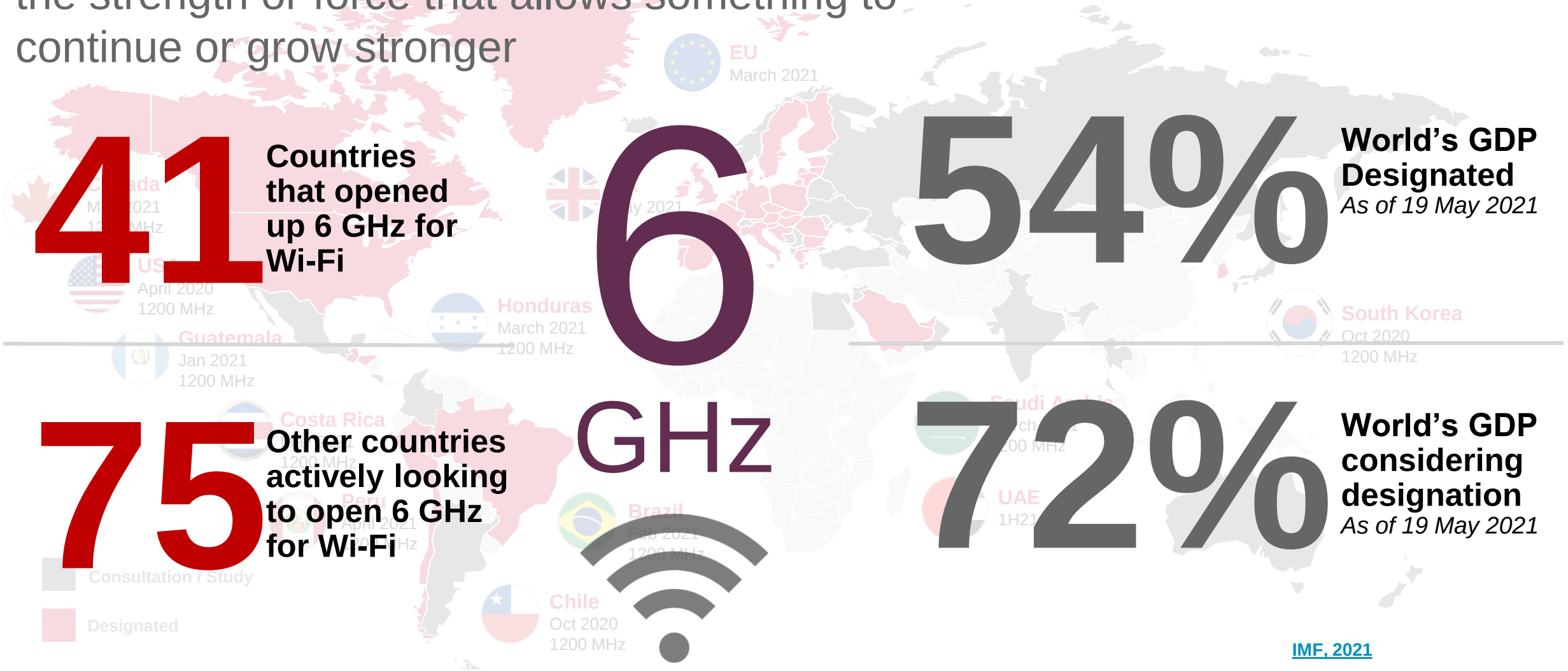
Momentum *noun*

the strength or force that allows something to continue or grow stronger



41 **Countries that opened up 6 GHz for Wi-Fi**

6 GHz

54% **World's GDP Designated**
As of 19 May 2021

75 **Other countries actively looking to open 6 GHz for Wi-Fi**

72% **World's GDP considering designation**
As of 19 May 2021

IMF, 2021

 |

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Broadcom: First to enable full Wi-Fi 6E ecosystem

Smartphone

2x2
160 MHz

Consumer Access Point, Extenders

4x4
160 MHz

3x3
80 MHz

2x2
80 MHz

Dual 2x2
80 MHz

Enterprise Access Point

4x4
160 MHz

3x3
80 MHz

2x2
80 MHz

Dual 2x2
80 MHz

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Samsung Galaxy S21 Ultra sports Wi-Fi 6E thanks to Broadcom

FIERCE Wireless

Wi-Fi 6E arrives at CES 2021

ars TECHNICA

8K TV sales forecast to hit 72 million by 2025

WHAT HI-FI?

Samsung launches Galaxy Book Pro Windows 10 laptops with OLED screens and Wi-Fi 6E

betanews

Wi-Fi 6E Proliferates

The Wi-Fi industry is already taking advantage of the FCC's 2020 decision to allow unlicensed services in the 6 GHz band.

- **Wi-Fi 6E** — **Thirty-three Wi-Fi 6E devices** have already been certified by the Wi-Fi Alliance.
  - Netgear and ASUS access points (routers) already available in the market.
  - Samsung GS-21 Ultra is first Wi-Fi 6E smartphone, and MediaTek and Intel introduced Wi-Fi 6E platforms for PCs.
- The Wi-Fi Alliance projects **over 338 million Wi-Fi 6E devices** will enter the market in 2021 alone.

Wi-Fi 6E - The 6 GHz Wi-Fi harbinger

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“One **small chip** heralds one **giant leap.**”

-- Former FCC Chairman Ajit Pai tweeted on 12/7/2020 regarding authorization of first 6 GHz Wi-Fi device (Broadcom BCM4389)

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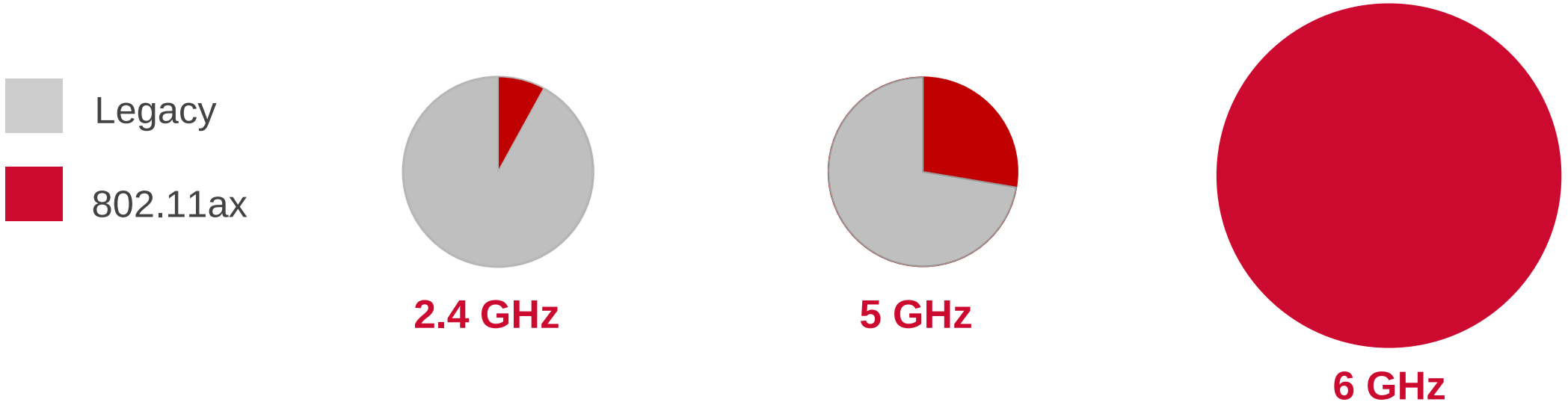
Wi-Fi that's exclusive ***and*** efficient



Wi-Fi data-rate in Phones

2.4 GHz (20 MHz)	**5 GHz** (80 MHz)	**6 GHz** (160 MHz)
237 Mbps	1.2 Gbps	2.4 Gbps

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Wi-Fi that enables robust **Low Power indoor use cases**

6 GHz delivers whole home **Gigabit+** throughput

- Homes
- Apartments
- Offices
- Indoor public venues
- Industrial IoT

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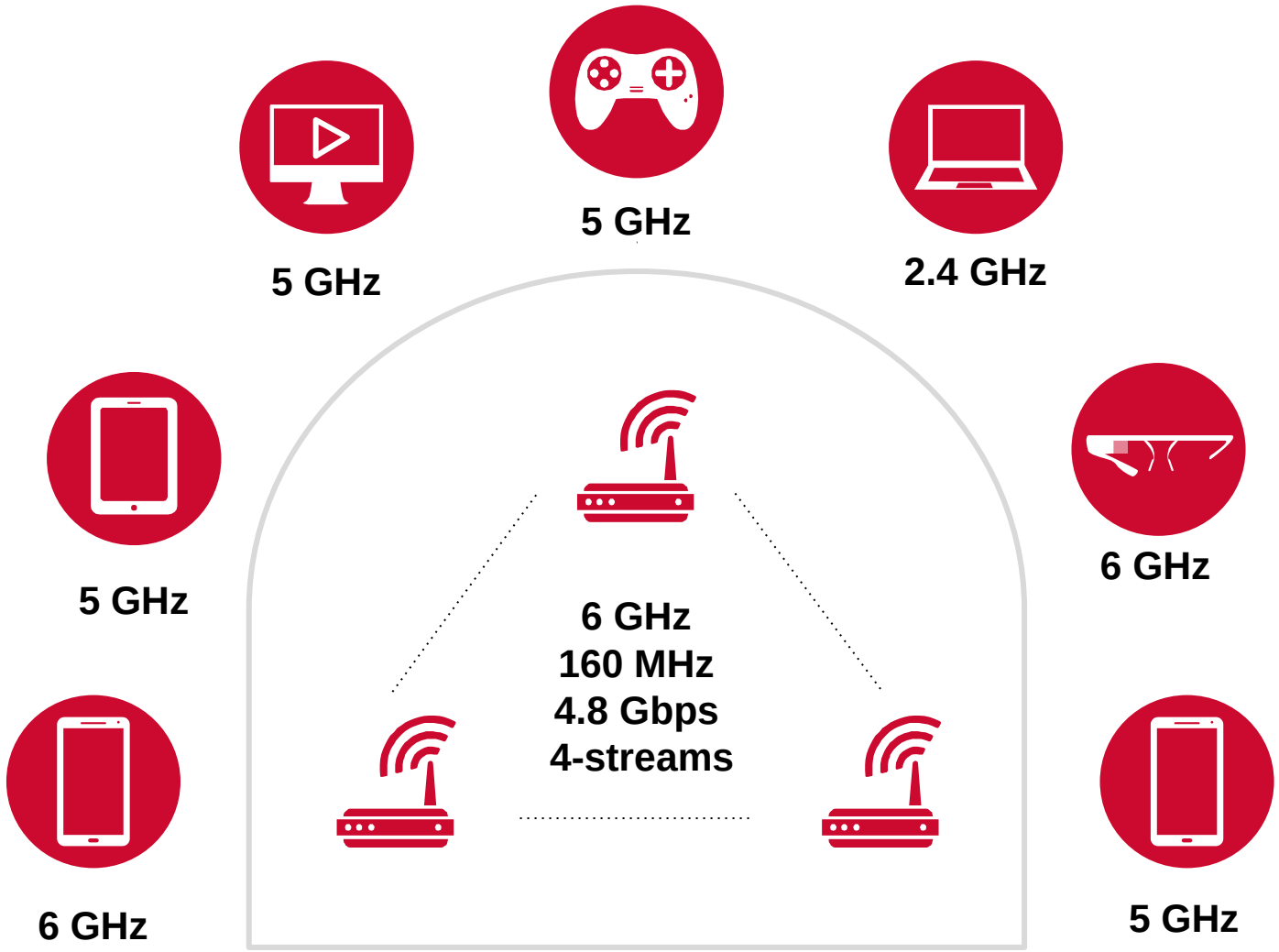
Robust **whole home Wi-Fi mesh**



Flexible
Connect clients on 3 bands

Robust
6 GHz ‘clean’ backhaul

Fast
160 MHz channel, 4 streams

Coverage
Gigabit speed whole home

Capacity
More clients across home

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Wi-Fi 7 - realizing the promise of 6 GHz

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Wi-Fi 7 - the broadband complement

Use Cases

6 GHz

Spectrum

10G

Broadband

Wi-Fi 7 is the convergence of use cases, new 6 GHz spectrum and 10 gigabit broadband.

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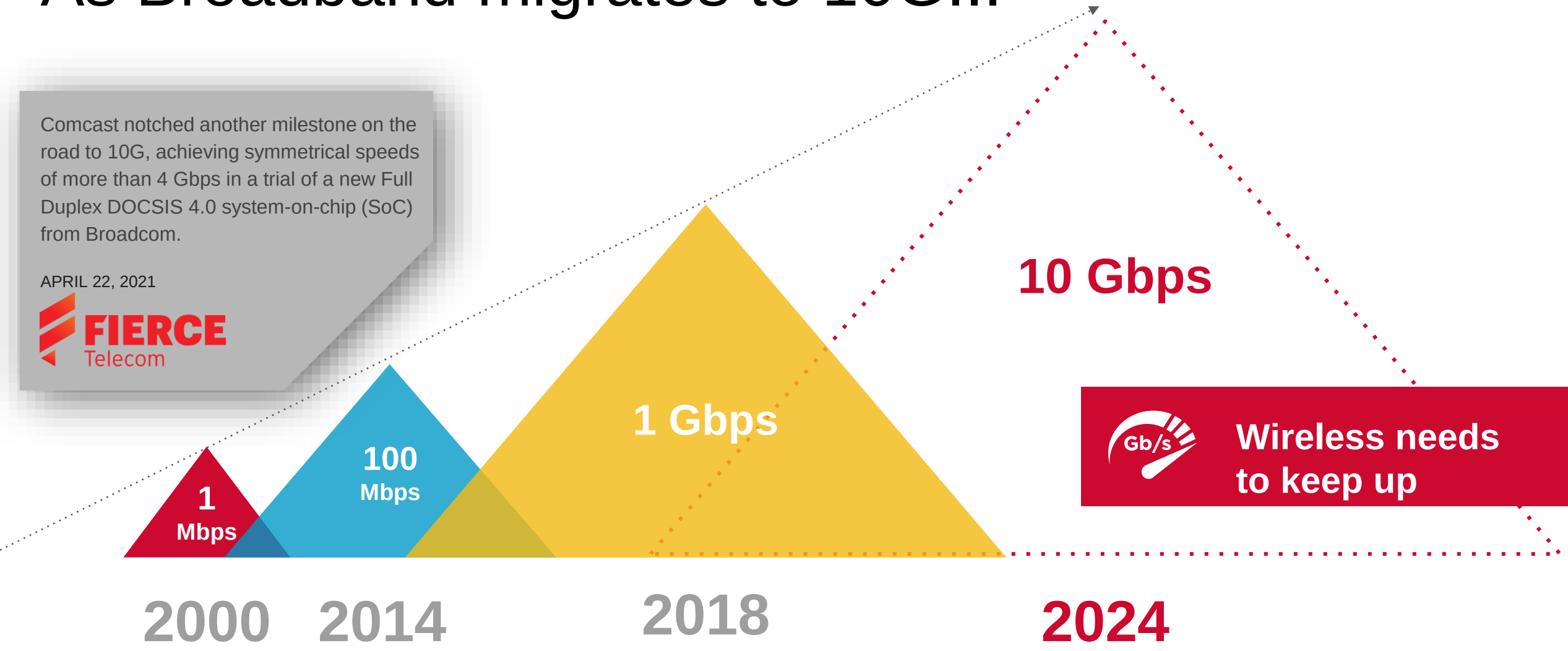
As Broadband migrates to 10G...

Comcast notched another milestone on the road to 10G, achieving symmetrical speeds of more than 4 Gbps in a trial of a new Full Duplex DOCSIS 4.0 system-on-chip (SoC) from Broadcom.

APRIL 22, 2021

FIERCE Telecom



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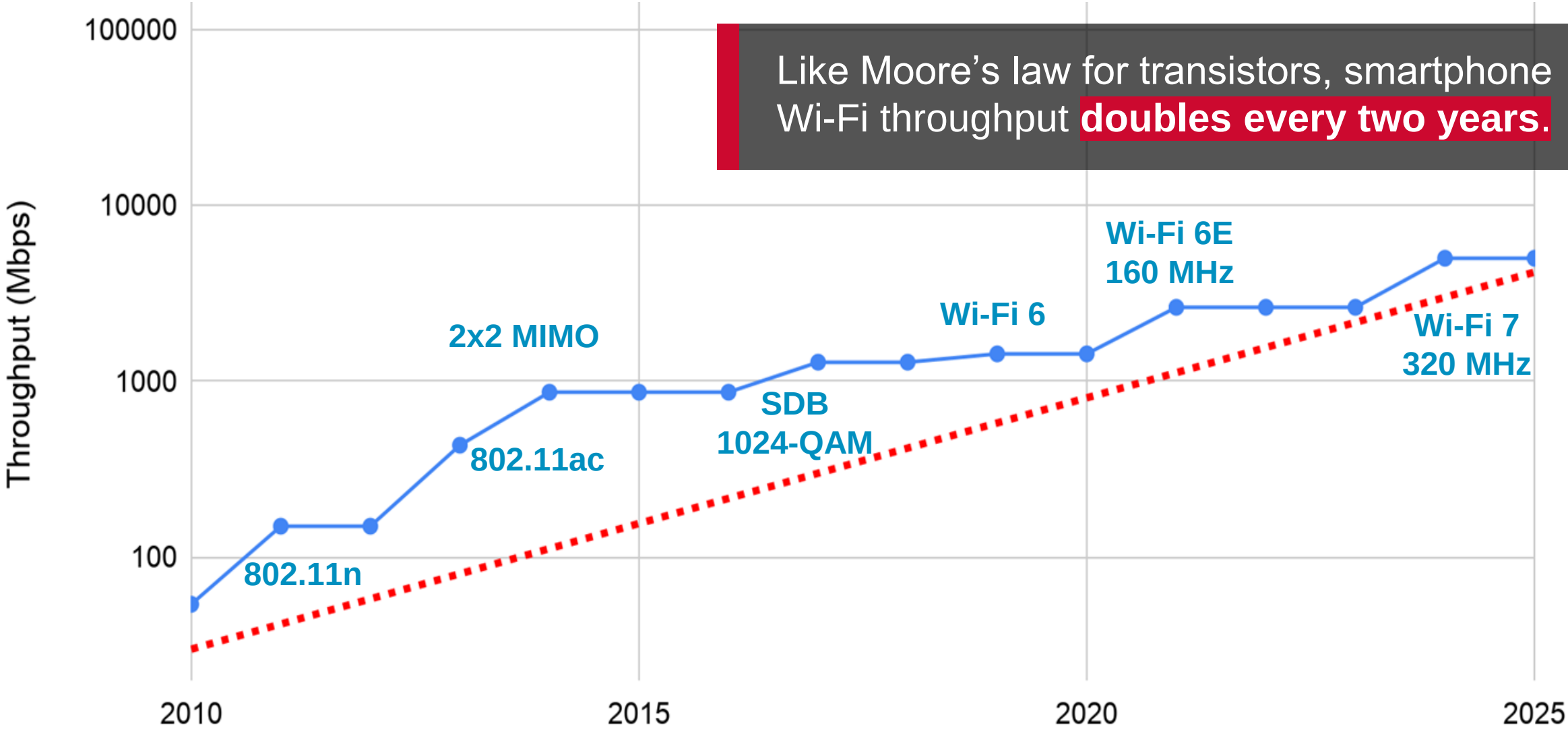
Wi-Fi 7 matches broadband progress



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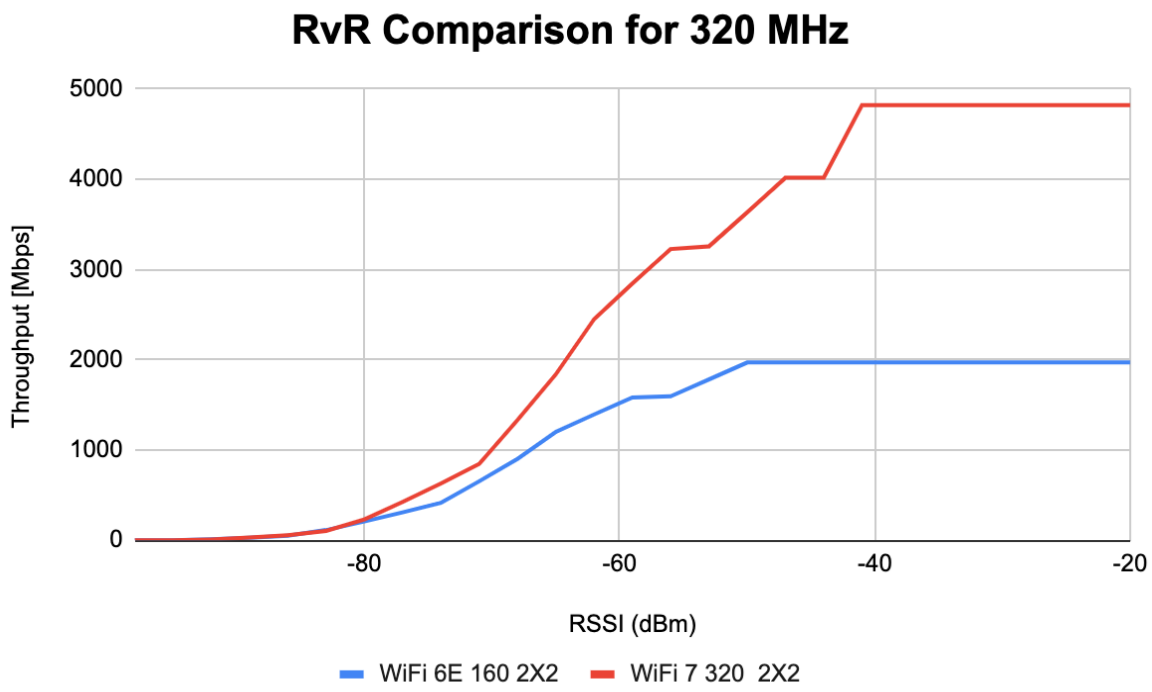
Wi-Fi 7: High Speeds and Wide Coverage



- 2x2 peak throughput: **5 Gbps**
- Significant coverage improvement: **multi-Gigabit whole home Wi-Fi**
  - 15+ dB improvement for 2 Gbps RvR

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Wi-Fi 7 provides whole home multi-gigabit broadband

Improved mesh
320 MHz 6 GHz Backhaul

Whole home
Multi gigabit coverage

Latency
Multilink redundancy

Range
AFC boost

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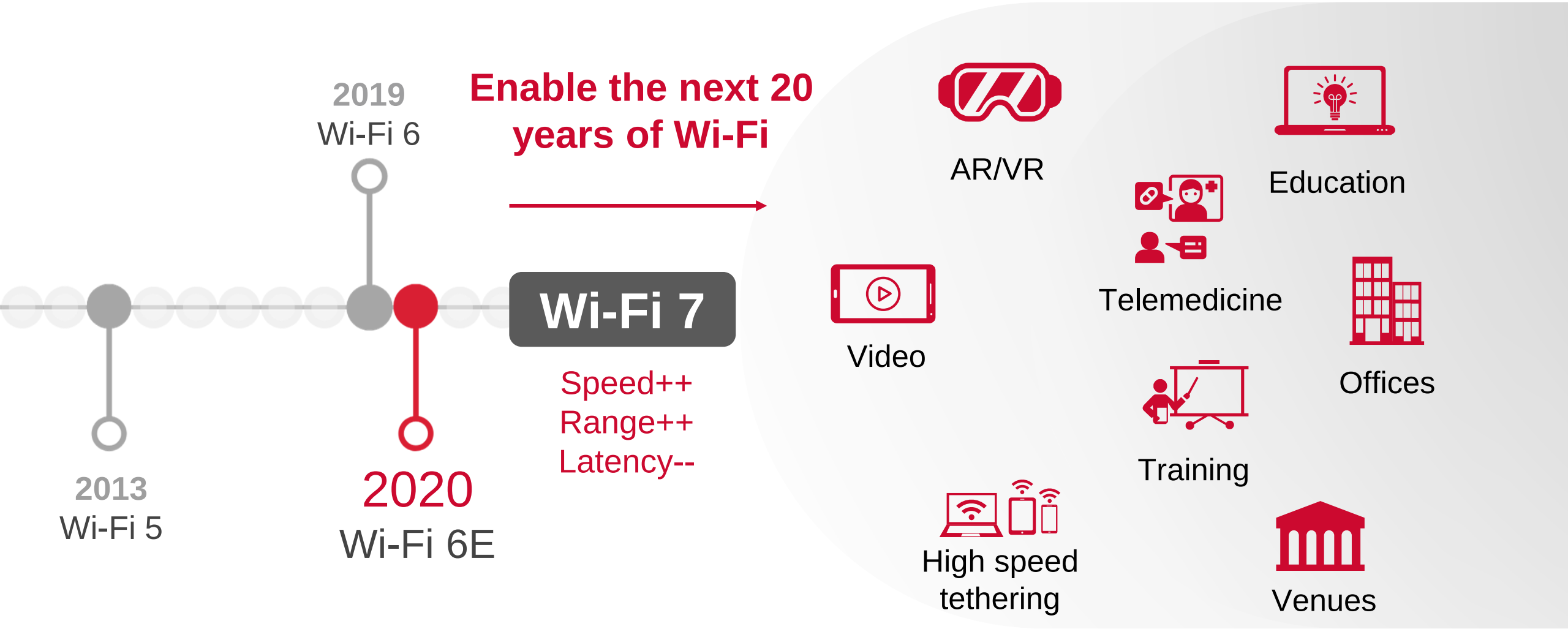
Wi-Fi 7 delivers value for the next decade



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Summary

- Unmistakable regulatory and product momentum for 6 GHz Wi-Fi in 2021
- Wi-Fi 6E launched as harbinger for things to come with 6 GHz
- Wi-Fi 7 will fulfil the promise of 6 GHz
- Wi-Fi 7 complements multi-gigabit broadband for whole home coverage

WIRELESS GLOBAL CONGRESS
WIRELESS BROADBAND ALLIANCE

Panel Discussion

Tiago Rodrigues

Wireless Broadband Alliance

Vijay Nagarajan

Broadcom

Mark Grayson

Cisco

Eric McLaughlin

Intel

WIRELESS GLOBAL CONGRESS
WIRELESS BROADBAND ALLIANCE

Closing

TIAGO RODRIGUES

CEO

Wireless Broadband Alliance

WIRELESS BROADBAND ALLIANCE

Wi-Fi Powering Innovation Series

Thursday June 3rd

Wi-Fi Innovations
Connecting your Worl

- Social Impact of Wi-Fi – from wering the world economy to how Wi- elping the green agenda and bridg e digital divide.
- Future of Wi-Fi – the de ahead – overall market trends.
- D ivering the wireless experience for carr nter onsumers and things.
- Regula es for Wi-Fi 7, Wi-Fi 6E and OpenRoa

Thursday June 10th

Connecting the
Wi-Fi -enabled Enterprise

- How can Wi-Fi address the emerging needs of enterprise to innovate and adapt post COVID 19.
- Industry 4.0 & IoT: Emerging opportunities for Wi-Fi in the 5G era.
- Driving the connectivity revolution in retail and hospitality post COVID 19.
- Trains, planes and automobiles – connectivity into 2030.
- Marketing applications for Wi-Fi
- Private 5G and Wi-Fi

Thursday June 17th

Wireless Innovation, Operation and Customer experience – Where next for operators?

- The future of wireless networks.
- Delivering a gold standard public Wi-Fi experience – Seamless, secure, permission-based privacy.
- Testing performance and optimization monitoring.
- Wi-Fi 6E & 5G – the road to convergence & OpenRoaming.
- Emerging technologies – Wi-Fi 7, FWA, 802.11be and beyond.

Thursday June 24th

Wi-Fi Innovations
For Hospitality

- Hospitality 2021 – What does the industry need from Wi-Fi operators and service providers.
- Delivering the next generation Wi-Fi experience in hotels and venues.
- Driving loyalty: Marketing applications and analytics for Wi-Fi in the next decade.

Wednesday June 30th

Connected Communities:
Wi-Fi gets Smarter in the 5G Era

- Market trends and drivers for smart cities and connected communities.
- Protecting our citizens: privacy, security and identity.
- Addressing the digital divide through public Wi-Fi.
- The benefits of convergence of 5G and Wi-Fi 6E.
- Monetizing Wi-Fi and the opportunity case for cities and local business.

Thursday July 8th

Carrier Grade Wi-Fi delivering the future for the smart connected Home

- Market trends and drivers for residential Wi-Fi.
- Key enablers for the Work at Home Era post COVID 19.
- Delivering on the connected home experience – Next 5 years of IoT.
- Next Generation of Wi-Fi Capabilities for in-Home (sensing, mesh, AR/VR and more....)

WIRELESS GLOBAL CONGRESS
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STL

THANKS FOR ATTENDING

Next Time:

June 10th – Connecting the Wi-Fi –enabled Enterprise

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