

25 MAY – 8 JULY 2021

WI-FI: POWERING INNOVATION SERIES

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

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Introduction & Welcome

SARAH KOLMER

Marketing Director Wireless Broadband Alliance





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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 3 rd	Thursday June 10 th	Thursday June 17 th	Thursday June 24 th	Wednesday June 30 th	Thursday July 8 th	
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	



JUNE 17, 2021

Wireless Innovation, Operation and Customer Experience – Where Next for Operators?

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Wireless Innovation, Operation and Customer Experience – Where Next for Operators?



Wi-Fi Innovations Connecting Your World

TODAY'S AGENDA				
08:30am	Welcome & Opening Remarks			
(Pacific time)	Sarah Kolmer, Marketing Director, Wireless Broadband Alliance			
08:35am	Fireside Chat: Moderated by Chris Bruce - Wi-Fi & 5G – Future of convergence and what it means for operators			
(Pacific time)	Ravi Sinha, Director, TechDev and Solutions – Reliance Jio, Paul Crane, Converged Network Research Director, BT			
08:55am	Smart scheduling: the key to optimizing your network			
(Pacific time)	Andy Davidson, Senior Director Technology Planning, Qualcomm Technologies			
09:10am	Broadband Operator Implications for Wi-Fi / 5G convergence & OpenRoaming			
(Pacific time)	Metin Taskin, Co-Founder & CTO, Airties.			
09:25am	Wi-Fi 6 Time Sensitive Networking (TSN)			
(Pacific time)	Malcolm Smith, Wireless CTO Advisor – Cisco; Dr. Carlos Cordeiro, Wireless CTO, Intel Corporation			
09:40am	Panel Discussion			
(Pacific time)	Moderator: Chris Bruce, Chairman, Handshakr; Board Advisor, Sentient; Business Consultant. Ex Chair, Wireless Broadband Alliance.; Metin Taskin, Co-Founder & CTO, Airties; Ravi Shankar, Head of Product Management - OSS/BSS, STL; Kevin Robinson, Senior Vice President, Marketing, Wi-Fi Alliance			
10:00am	OpenWiFi for Service Providers			
(Pacific time)	Bernard Herscovici, Founder & CEO, NetExperience			
10:15am	Panel Discussion			
(Pacific time)	Moderator: Matt MacPherson, Wireless CTO, Cisco; Jérôme Henry, Wireless Research Engineer, Cisco; Raj Gajwani, Director Google; Seemab Kadri, Director, Strategic Partnerships and Marketing, Wireless Solutions, Intel Corporation; Bernard Herscovici, Founder & CEO, NetExperience			
10:45am	Close			
(Pacific time)	Sarah Kolmer, Marketing Director, Wireless Broadband Alliance			



Wi-Fi & 5G – Future of Convergence and What it means for operators

Fireside Chat



Chris Bruce

Chairman, **Handshakr**, Board Advisor, **Sentient**



Ravi Sinha

Director, TechDev and Solutions **Reliance Jio**



Paul Crane

Converged Network Research Director BT



Wi-Fi 6 Unlocked How High-Performance Scheduling Brings Out The Best in Wi-Fi 6

ANDY DAVIDSON

Senior Director Technology Planning Qualcomm Atheros



WBA Webinar

@qualcomm

Qualcom

Wi-Fi 6 Unlocked

How high-performance scheduling brings out the best in Wi-Fi 6

Andy Davidson

Senior Director of Technology Planning Qualcomm Atheros, Inc.

Wi-Fi 6 adoption accelerating

79%

Of all new devices will be Wi-Fi 6 by 2022¹

5B+

Wi-Fi 6 devices will have shipped by end of 2025¹

By 2024

Wi-Fi 6 will be de facto Wi-Fi standard²



Driven by network demands







OFDMA delivers significant latency and throughput advantage vs. SU-mode

For intense network use-cases.

Learn more at Qualcomm.com/OFDMA

Source: Qualcomm Technologies Inc., The Benefits of OFDMA For Wi-Fi 6 Whitepaper, Feb 2021

OFDMA performance analysis: High user count in a heavy traffic environment



SU OFDMA



*Total aggregate throughput, testing conducted in Qualcomm Technologies, Inc. labs - results may vary depending on conditions and other variables

Qualcomm.com/uplink_MU-MIMO



Dynamic scheduling for optimized performance

Triggered channel access control

Efficient use of airtime for both uplink and downlink traffic



Table for illustrative purposes only – actual mode selection may vary based on environment, congestion, and other factors. Qualcomm Technologies' advanced scheduling delivers highly balanced and superior overall performance



Measure the airtime fairness impact of probability-based Wi-Fi 5 scheduling vs.Wi-Fi 6 triggered access control

Wi-Fi 6 Access Point



Analysis conducted in Qualcomm Technologies' labs

Qualcomm Technologies' advanced scheduling delivers highly balanced and superior overall performance



Real-world differentiation – complex scheduling use cases

Video use case

8 bi-directional video clients + 2 generic Wi-Fi 6 clients, w/ 1Gbps uplink traffic load each

VoIP use case

8 bi-directional VoIP clients + 2 generic Wi-Fi 6 clients, w/ 1Gbps uplink traffic load each

Analysis conducted in Qualcomm Technologies' labs



High Performance Scheduling Unlocks Wi-Fi 6 Potential

A technology brief highlighting Qualcomm Technologies' competitive advantage

Authors:

Andy Davidson Xiaolong Huang



High Performance Scheduling Unlocks Wi-Fi 6 Potential

A technology brief highlighting Qualcomm Technologies' competitive advantage

> Authors: Xiaolong Huang Andy Davidson

Qualcomm Technologies, Inc. (QTI) San Jose, June 2021

Download the whitepaper at: Qualcomm.com/WiFi_Scheduler Qualcom

Thank you

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Broadband Operator Implications for Wi-Fi/5G convergence & OpenRoaming

METIN TASKIN

Co-Founder & CTO

Airties



airties Wi-Fi/5G Convergence and OpenRoaming

Broadband Operator Implications

Metin Taskin, CTO Airties, June 2021

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Home Wi-Fi to serve mobile users

Lots of coverage possible from residential Wi-Fi access points



Every home can become a hotspot for mobile devices while continuing to serve the home users

Coverage can be immense as service providers often manage a sizeable percentage of subscribers in the same neighborhood.

Mobile devices want to connect: ANQP requests in a residential street in Paris



Metin Taskin Wi-Fi/5G Convergence & OpenRoaming

What to look out for?

Hot to connect automatically?



How to know which hotspot to choose from?





How to make sure that both home and mobile users get good QoE?



There are solutions

Automatic onboarding: Wi-Fi Passpoint[®] for onboarding WBA OpenRoamingTM for roaming



Smart hotspot management to decide which hotspot to serve



Wi-Fi6 for the right QoE: it has very similar capabilities to 5G

ENHANCED 802.11 CAPABILITIES COMPARED WITH IMT-ADVANCED AND IMT-2020



- Wi-Fi6 and 5G capabilities are very similar in terms of peak data rate, user experienced data rate, spectrum efficiency, latency
- 5G better supports mobility whereas Wi-Fi has a denser bitrate in small areas
- The addition of 6GHz band allows Wi-Fi far greater bandwidth (unlicensed)
- Upstream and downstream OFDMA and MU-MIMO help control bandwidth and latency at a granular level
- BSS coloring improves frequency re-use

Source: WBA white paper, 5G Networks - The Role of Wi-Fi and Unlicensed Technologies, by Florin Baboescu

Wi-Fi6 installed base is rising rapidly



Average **12.4 Wi-Fi** connected devices per home

C 10 HOURS

Connection time per day is **10 hours per device**



34% of wireless devices are not dual-band (can only use 2.4GHz)



Airties Smart Wi-Fi supports Wi-Fi Passpoint[®] and WBA OpenRoaming[™]

- Airties Smart Wi-Fi allows seamless and secure on-boarding and interoperability for roaming
- Airties makes sure that home user QoE is not adversely affected by hotspot users
- Airties manages hotspots and applies admission control, automatic hotspot enablement
- Airties delivers granular QoS with Wi-Fi6
- Airties measures and reports the user experience of all connected client devices including roaming devices



Airties OpenRoaming[™] Solution Architecture



Conclusions

- Home Wi-Fi hotspots can provide significant offload for mobile networks
- Seamless onboarding is addressed by WBA OpenRoaming[™] and WFA Passpoint[™]
- Managed Wi-Fi is necessary to manage the home spots for auto enablement, admission control
- QoE can be achieved through managed Wi-Fi and Wi-Fi 6/6E capabilities
- Converge 5G and Wi-Fi6 which bring the opportunity to deliver uninterrupted QoE



Thank You







Wi-Fi 6 / 6E Time Sensitive Networking (TSN)

MALCOLM SMITH

DR. CARLOS CORDEIRO

Wireless CTO Advisor

Cisco

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June 17, 2021

Wi-Fi 6/6E Time Sensitive Networking (TSN)

Carlos Cordeiro Wireless CTO

Intel Corporation

Malcolm Smith

Wireless CTO Advisor Cisco





Wi-Fi 6 TSN: what is it?

- Time-Sensitive Networking (TSN) is a toolbox of features used to provide deterministic data delivery with bounded latency & without loss due to congestion or errors
 - Largely defined by the IEEE 802.1 TSN TG
- Wi-Fi 6/6E TSN is referred to as the profiling of select features in the TSN toolbox over Wi-Fi 6/6E
 - Different use cases can be addressed by a different set of TSN features



Mapping Wi-Fi and TSN capabilities



Time Synchronization (802.1AS) & Time-Aware Shaping (802.1Qbv) over Wi-Fi



802.11 defined MAC specific support for 802.1AS:

- Timing Measurement (TM) IEEE802.11-2012
- Fine Timing Measurement (FTM) IEEE802.11-2016



- A time-aware (Obv) scheduler defines when gates open/close to ensure time-sensitive frames are not blocked by other traffic
- Wi-Fi 6 triggered based access can be used to provide deterministic latency

Hybrid Wired-Wireless 802.1 TSN bridging



CNC: Central Network Configuration Wireless Talker End Stations See Ref.: https://mentor.ieee.org/802.11/dcn/21/11-21-0668-00-00be-wired-wireless-tsn-configuration-and-**CUC: Central User Configuration**

Wireless Listener End Stations

management poty

Wi-Fi 6 provides the highest quality video/voice

Classroom Scenario, Latency Impact of OFDMA (in ms, 95th percentile)



Source: Cisco 9130

• A typical classroom might have 20students eLearning via video conferencing

- With Wi-Fi 5 (single-user or SU mode), video latency (95%-ile) is very high (due to collisions) making for a *poor user experience*
- With Wi-Fi 6 and OFDMA, delay is significantly reduced and [critically] linearly bounded leading to a *superlative user experience*
- Wi-Fi 6E can improve determinism even more

Wi-Fi 6 can achieve determinism required by TSN usages in managed scenarios

Demo*: Robot fine manipulation over Wi-Fi 6



* Robotic application demo provided by the Intel Labs Human & AI Robotics and Wireless Systems teams





Ecosystem activities in WBA and Avnu Alliance



• Workgroup launched Feb. 2021 https://wballiance.com/wi-fi-6-6e-forindustrial-iot/

• Continuing the IIOT work initiated last year (<u>https://wballiance.com/resource/wi-fi-6-trial-report-industrial-manufacturing/</u>) and adding new Wi-Fi 6 TSN use-cases

- Mobile Robotics (AMR/AGV)
- Stationary robotics & PLC
- Safety Controls
- Video & AR/VR

Wireless TSN WG
<u>https://avnu.org/wirelessTSN/</u>

• Defining use cases, market requirements and TSN capability testing specifications

•<u>https://avnu.org/wireless-tsn-paper/</u>

Questions?





Panel Discussion



Chris Bruce

Chairman, **Handshakr**, Board Advisor, **Sentient**



Metin Taskin

Co-Founder & CTO Airties



Ravi Shankar

Head of Product Management - OSS/BSS **STL**



Kevin Robinson

Senior Vice President, Marketing **Wi-Fi Alliance**



OpenWiFi for Service Providers

BERNARD HERSCOVICI

Founder & CEO NetExperience

NetExperience



Open Wi-Fi for Service Providers

June 17, 2021 Bernard Herscovici – CEO www.netexperience.com





About NetExperience...

- TIP open source Contributor/Maintainer
- OpenWi-Fi platform for service providers
 - Full commercial product
 - Tested with multiple hardware vendors
 - Software, support, integration services
 - Trials with flagship Service Providers
 - US
 - Europe
 - Africa
 - Asia
 - South America



OpenWiFi Platform



- ✓ One Platform for multiple HW Vendors
- ✓ One Platform multiple use cases
- ✓ Open Platform with APIs
- ✓ SaaS or Licensed
- ✓ Low TCO profitability, enlarge market



NetExperies

NetExperience: Full Stack for OpenWi-Fi



Net

OpenRoaming for the "Wi-Fi Focused Service Provider"



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Net OpenWiFi + OpenRoaming = Stronger Business Case

- Access to billions users
- Strong use cases
 - Roaming
 - Offload
- Efficient (star architecture)
- Seamless onboarding
- End to End Security
- Wide Adoption

Wi-Fi Focused Service Provider

- Higher Revenue from roaming
 +
- Lower cost from disaggregation
- Improved profitability!

Open Wi-Fi ... LOWER COST

• One platform

REVENUE

OpenRoaming

- All hardware vendors and models
- All use cases: MDU, SMB, Hospitality, Education, Enterprise
- All functions: controller, management, automation, analytics
- Vendor flexibility
- Low TCO: capex, opex

Netexperione

Early days for OpenWiFi... but where is this going?

- Technical Velocity
 - Already a major upgrade in the works...
 - Compatibility with lower cost hardware
- OpenWRT evolution to support Wi-Fi use cases
- OpenWi-Fi + OpenRoaming reinforce each other
- Eco-system enhancement
- Broadening the solution
 - Switches
 - Hybrid Wi-Fi / cellular

Touches all elements of the supply chain...

• Silicon providers

Net

- Full featured, tested, timely open-source drivers
- Open-source software
 - OpenWRT gaining, adding features, robustness
- Hardware providers
 - Hardware innovation, scale, distribution, product management
- Software providers
 - Velocity with quality, eco-system participation
- Local Distributors
 - Separate orders for HW and SW
- Service Providers / MSPs / ISPs
 - Support, operational processes

Neterpenson

For a Service Provider / MSP / ISP ...

- 1. From 3-4 Wi-Fi platforms to one
- 2. Buy from multiple hardware vendors
- 3. Network automation
- 4. Features to avoid truck rolls
- 5. SaaS or licensed platform
- 6. Compatible with OpenRoaming
- 7. Low hardware cost
- 8. Low license fees
- 9. Low operating cost





In Summary....

• Open Wi-Fi

- Lowers the cost to acquire and operate Wi-Fi networks
- Increase innovation velocity
- Promotes a dynamic eco-system
- Together with OpenRoaming increases revenue and monetization
- NetExperience provides a full commercial suite based on Open Wi-Fi
 - Help create the TIP Wi-Fi solution
 - Provides an end-to-end service platform for managing enterprise WLANs

www.netexperience.com

bernard@netexperience.com

NetExperience



Benefits of a gold standard public Wi-Fi experience – Seamless, secure, permission-based privacy

Panel of Industry Experts



Matt MacPherson

Wireless CTO **Cisco**



Raj Gajwani

Director **Google**



Seemab Kadri Director, Strategic Partnerships and Marketing, Wireless Solutions

Intel Corporation



Jérôme Henry

Wireless Research Engineer **Cisco**



Bernard Herscovici

Founder & CEO
NetExperience



Closing

SARAH KOLMER

Marketing Director Wireless Broadband Alliance





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Wi-Fi Powering Innovation Series

Thursday June 3 rd	Thursday June 10 th	Thursday June 17 th	
 Wi-Fi Innovations Connecting your Worl Social Impact of Wi-Fi – from wering the world economy to how Wi-fi Lielping the green agenda and bridging the digital divide. Future of Wi-Fi – the state a head – overall market trends. I plivering the state wireless experience for carry onter should be an under the distance. Regula es for Wi-Fi 7, Wi-Fi 6E and OpenRoan. 	 Connecting the Wi-Fi -enabled Enterprise How can Wi-Fi address the employed geneeds of enterprise to innovate and ployed geneeds of cost COVID 19. Industry 4.0 & IoT: Employed generation of the SG era. D. Wi-Fi in the SG era. D. Wing the control of provide the second seco	 Wireless Innovation, Operation and Cur Amerexperience – Where next for operators? The future of wireless networks Delivering a gold standard r AWi-Fi experience – Seamless, ser a permission-based privacy. Testing performance a optimization monitations. Wi-Fi 6 - Ad to convergence & OpenRoam. Emerging tea arises – Wi-Fi 7, FWA, 802.11be and beyond. 	
Thursday June 24 th	Wednesday June 30 th	Thursday July 8 th	
Wi-Fi Innovations For Hospitality	Connected Communities: Wi-Fi gets Smarter in the 5G Era	Carrier Grade Wi-Fi delivering the future for the smart connected Home	
 Hospitality 2021 – What does the industry need from Wi-Fi operators and service providers. Delivering the next generation Wi-Fi 	 Market trends and drivers for smart cities and connected communities. Protecting our citizens: privacy, security and 	 Market trends and drivers for residential Wi-Fi. Key enablers for the Work at Home Era post COVID 19. 	



THANKS FOR ATTENDING

Next Time:

June 24th – Wi-Fi Innovation for Hospitality

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