

WIRELESS SOLUTIONS OVERVIEW

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SECURE CONNECTIONS
FOR A SMARTER WORLD

PUBLIC

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TECHNOLOGY VS MARKETING



1997

Started

1999

Done?

Wireless LAN Technology
Standard Specification

Purpose

Technology Promotion & Branding
Interoperability Certification

IEEE 802.11 DSSS

**Original
Naming**

Wi-Fi®

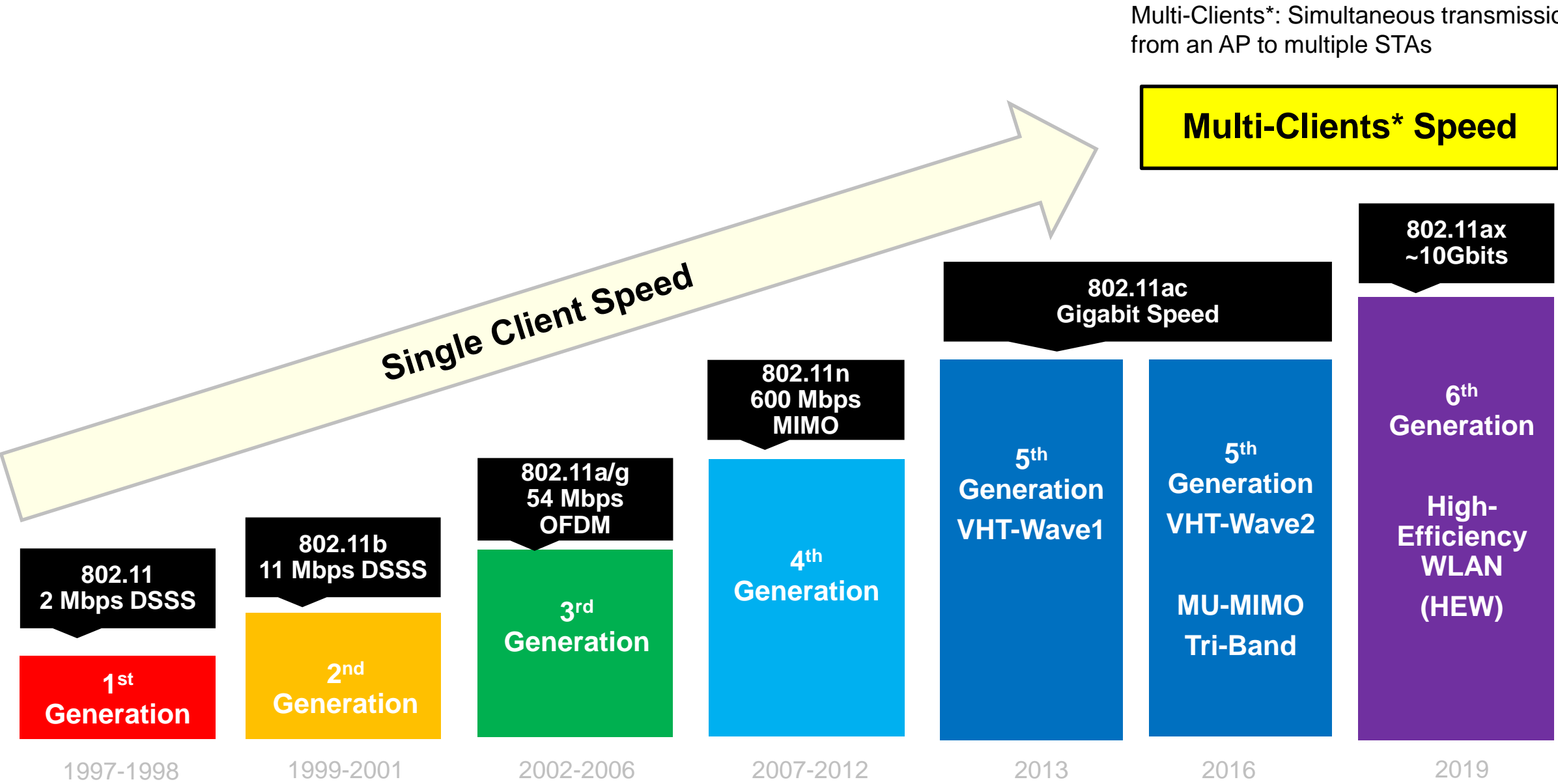
802.11n, 802.11ac, 802.11ax
802.11i, 802.11r, 802.11w

**Some
Task Groups/
Programs**

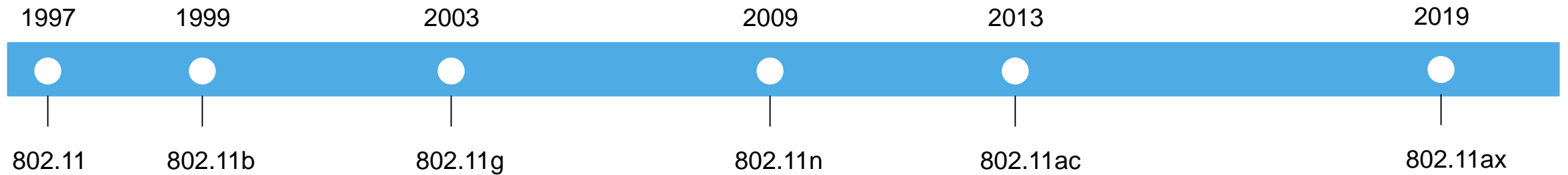
Wi-Fi CERTIFIED n, Wi-Fi CERTIFIED ac
WPA2, WPS, WMM
Wi-Fi Direct, Miracast
Easy Mesh



EVOLUTION OF WI-FI STANDARDS



WLAN STANDARDS EVOLUTION



Focus: Improving Throughput vs. Range

Enable higher speed Internet access, high-definition media streaming etc.

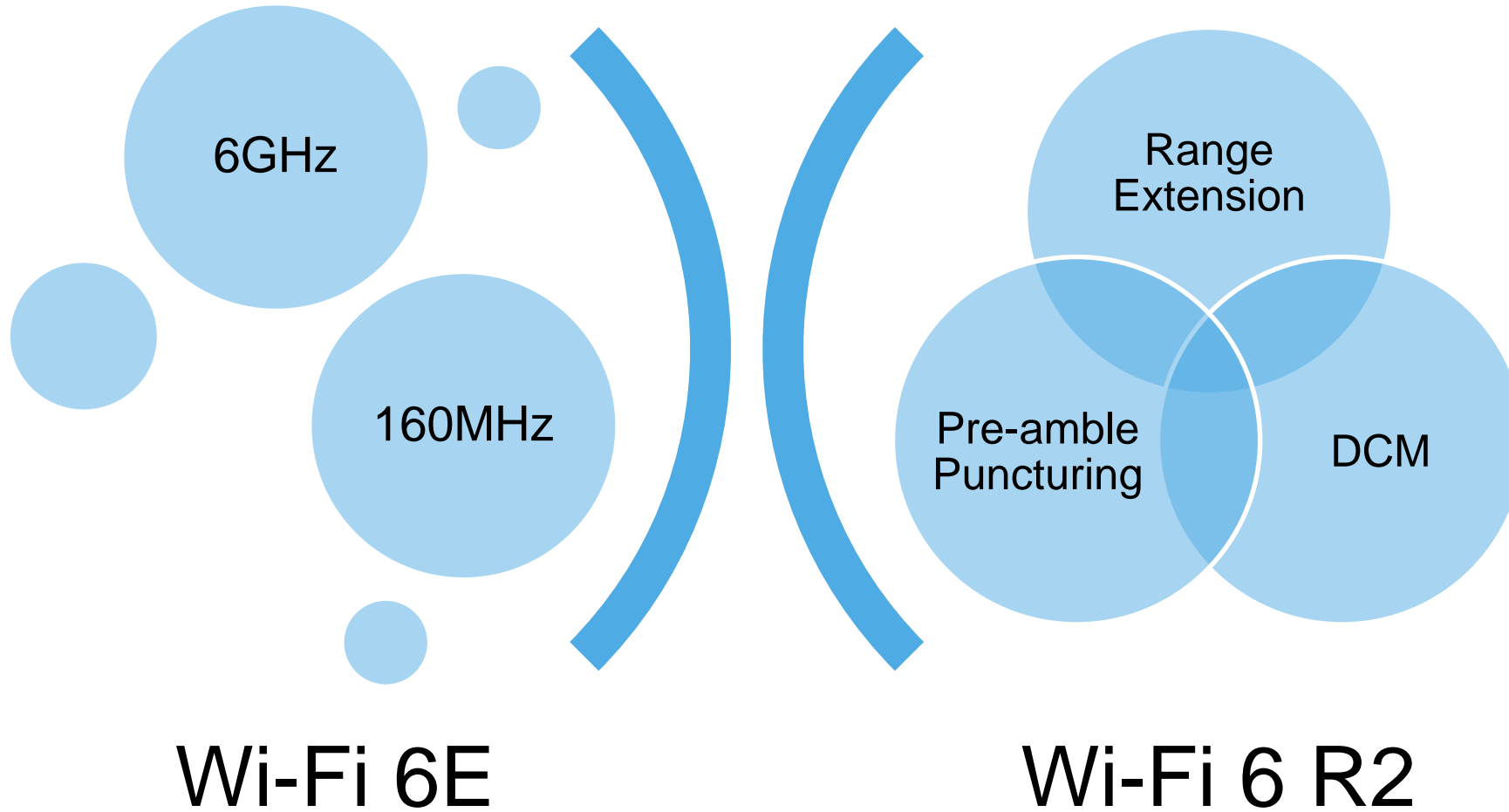
Focus: Improving Network Efficiency

Enable efficient network usage in high-density environments (Airports, Stadia, Stations, High-rise Multi-Tenant Units etc.)

NXP FIRST TO BE WI-FI CERTIFIED 6™



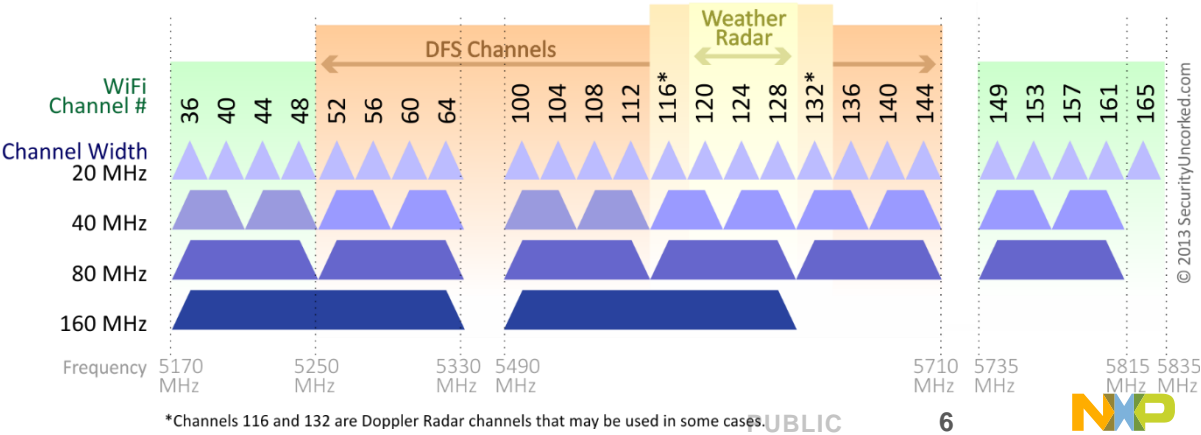
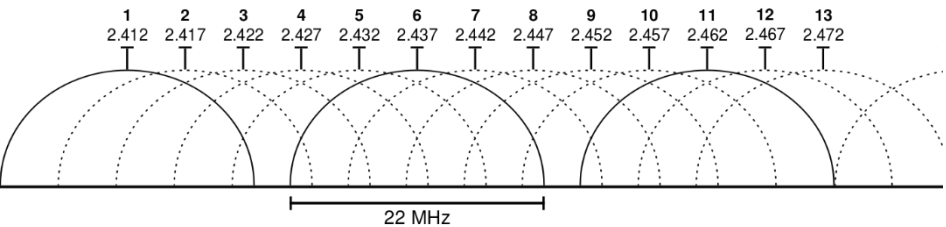
IN ADDITION...



WI-FI SPECTRUM - IT IS **FREE** TO USE!

- Unlicensed (license-exempt) spectrum

2.4GHz		5GHz
ISM (industrial, scientific and medical)	Band	U-NII (Unlicensed-National Information Infrastructure)
2.4-2.4835GHz	Frequency	5.180–5.825 GHz
20 / 40 MHz	Operation BW	20 / 40 / 80 / 160 MHz
100 MHz	Total Spectrum	~ 500 MHz
1-14	Channel Number	36-165



6 GHZ WI-FI – POTENTIAL MODELS



Standard Power Indoor & Outdoor

- Automated Frequency Control (AFC) database lookup scheme for interference protection
- Permit outdoor and indoor APs & devices to use AFC-protected bands (in cities, stadiums, and some higher powered indoor use cases)



Low Power Indoor

- Low Power Indoor specification being defined
- Need to establish Power level (EIRP)
- LPI model gaining industry traction

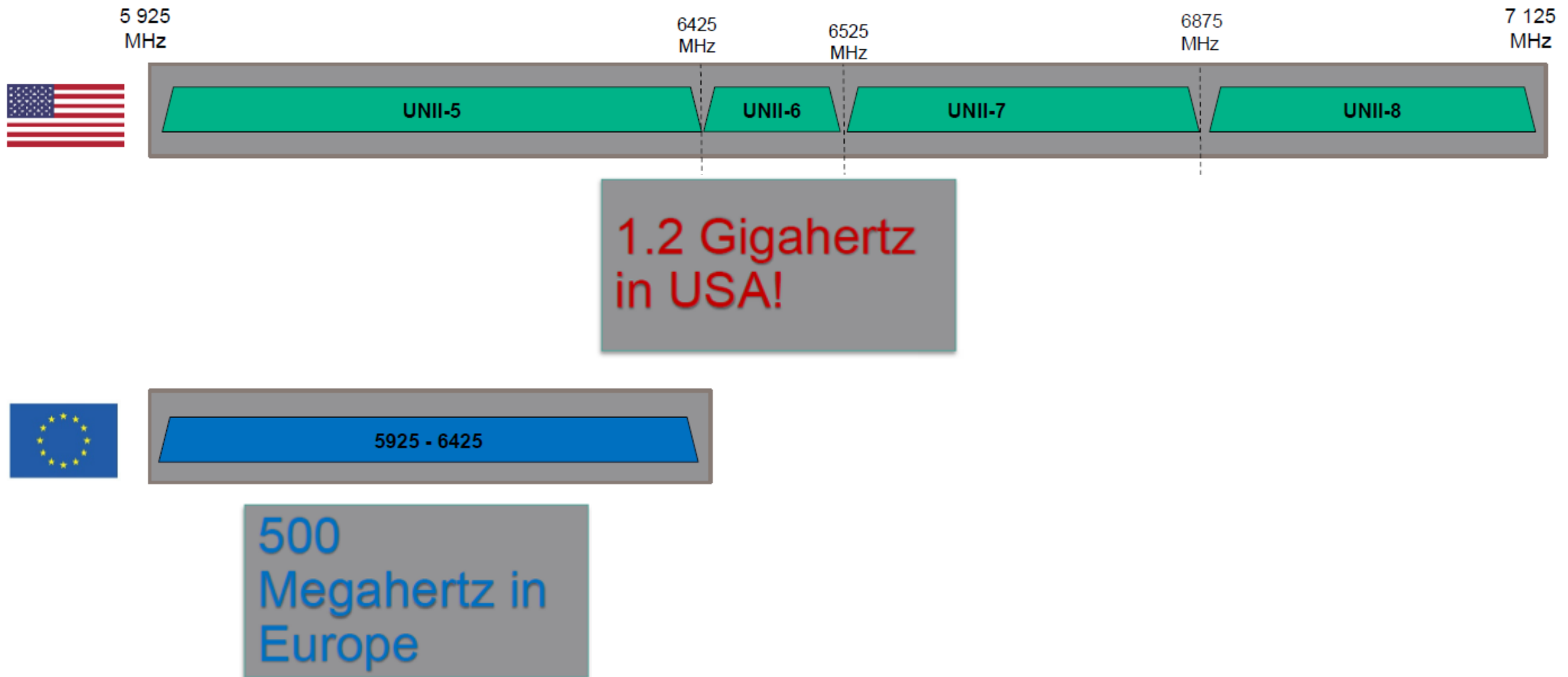


Very Low Power

- Very Low Power being considered for short range connectivity in Portable Class Devices (AR/VR) & in vehicle
- VLP is not included in Draft R&O

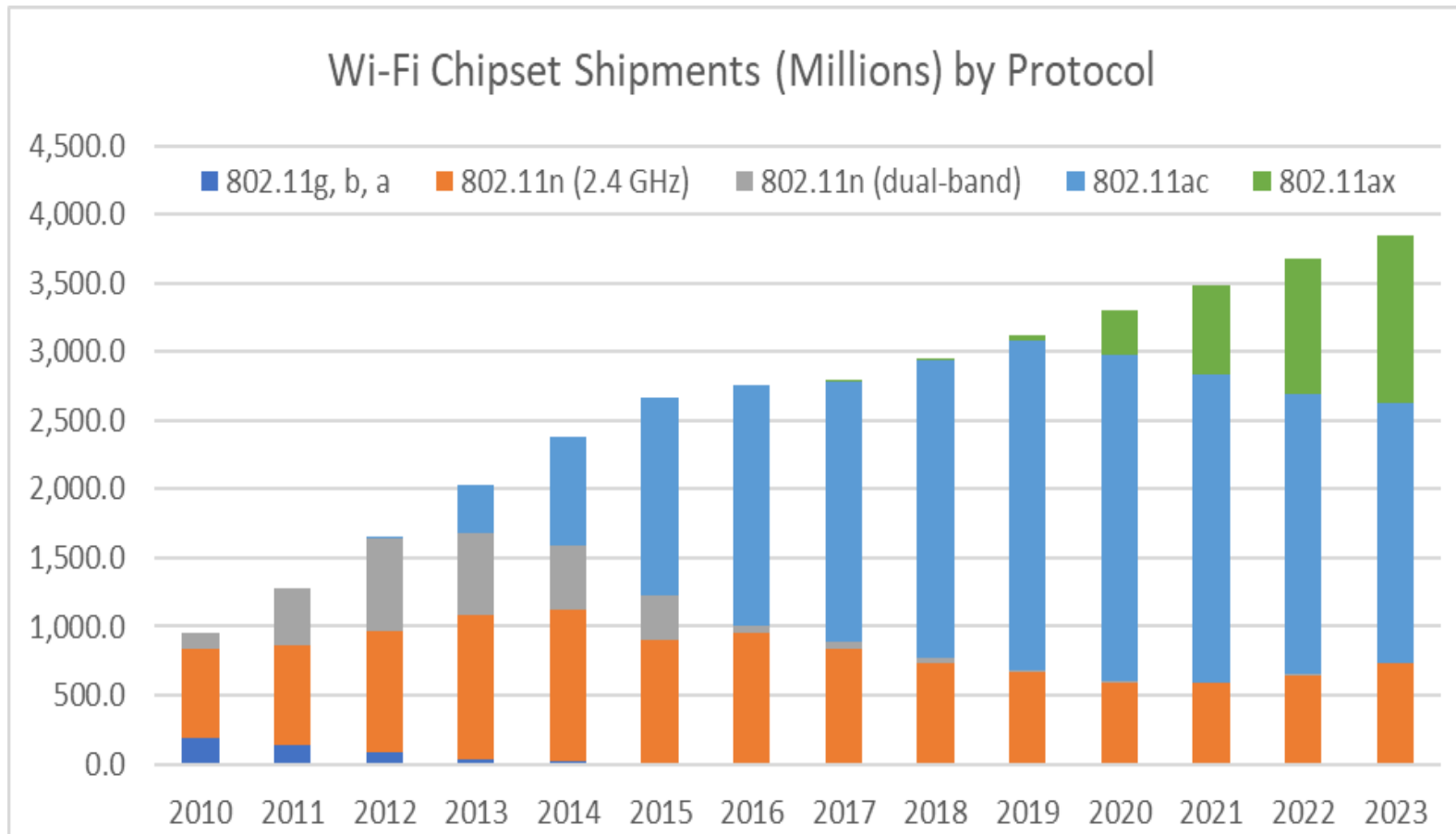
Independently, FCC has reopened the case for Wi-Fi in the 5.9 GHz band which will enable superfast, low-latency 160 MHz Wi-Fi channel

6 GHZ SPECTRUM IN US AND EU



WI-FI 6 AND 802.11AX

- Wi-Fi 6 is the official brand name for 802.11ax (11ac is Wi-Fi 5 and 11n is Wi-Fi 4)
- ASUS, Netgear Nighthawk, Huawei, Tplink and Xiaomi routers available for purchase
- “Flagship 11ax Smartphone” Samsung Galaxy S10/ Note 10/ S20, iPhone11, Xiaomi 10



Source: ABI Wi-Fi Report, Sep 2018

POSITIONED TO DELIVER FULL SYSTEM SOLUTIONS

EXCEPTIONAL CONNECTIVITY PORTFOLIO



COMBINED WITH MCU & MPU CONTINUUM

i.MX 6, 7, 8, 8M
High-performance,
3D graphics

Layerscape™
High-speed Ethernet, TSN

i.MX RT
Highest performing MCUs

Kinetis™ & LPC
Low cost to high integration

ADDING TRUSTED SECURITY SOLUTIONS



IoT Secure
Elements



Secure
Processors for IoT



Authentication



Secure Automotive
Products

MAXIMIZE DEPTH & REACH OF CUSTOMER ACCESS



AUTOMOTIVE



INDUSTRIAL

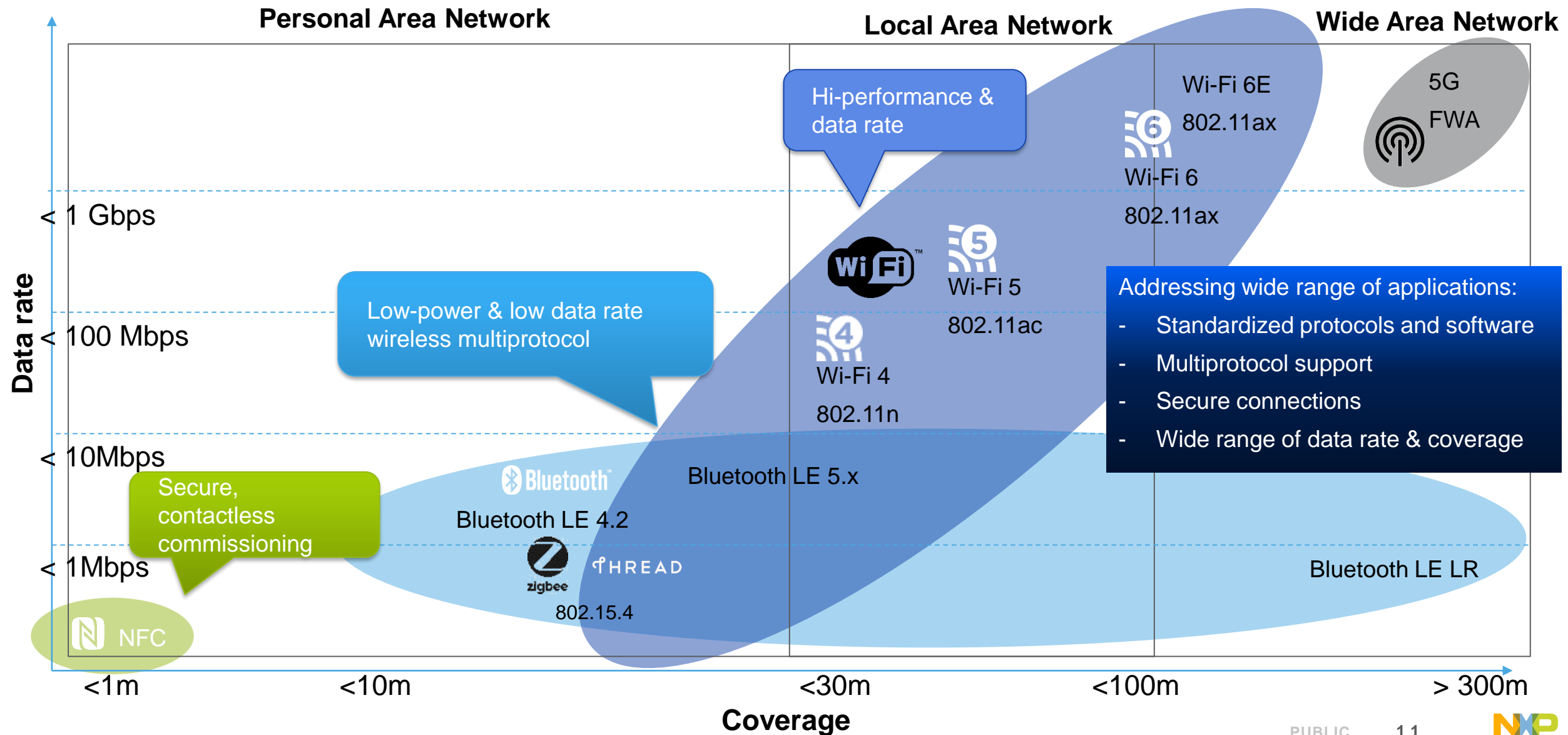


MOBILE



COMMUNICATIONS
INFRASTRUCTURE

NXP WIRELESS CONNECTIVITY PORTFOLIO TECHNOLOGIES



NXP WIRELESS TARGET MARKETS & IOT TECHNOLOGIES



Connected IoT: WiFi-6 Designed for Home

Complete 11ax solution to enhance seamless connectivity in home



Gaming and voice assistants to largely benefit from 11ax

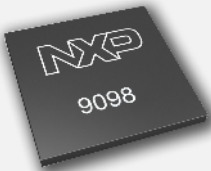


SPEED

40% Higher Throughput

COVERAGE

Extended Range



EFFICIENCY

OFDMA

CAPACITY

MU-MIMO



Devices with varying data & latency requirements



CONNECTED AUTO – KEY APPLICATIONS

Infotainment
(BT/BLE/WLAN)

Rear Entertainment Console
(BT/WLAN)

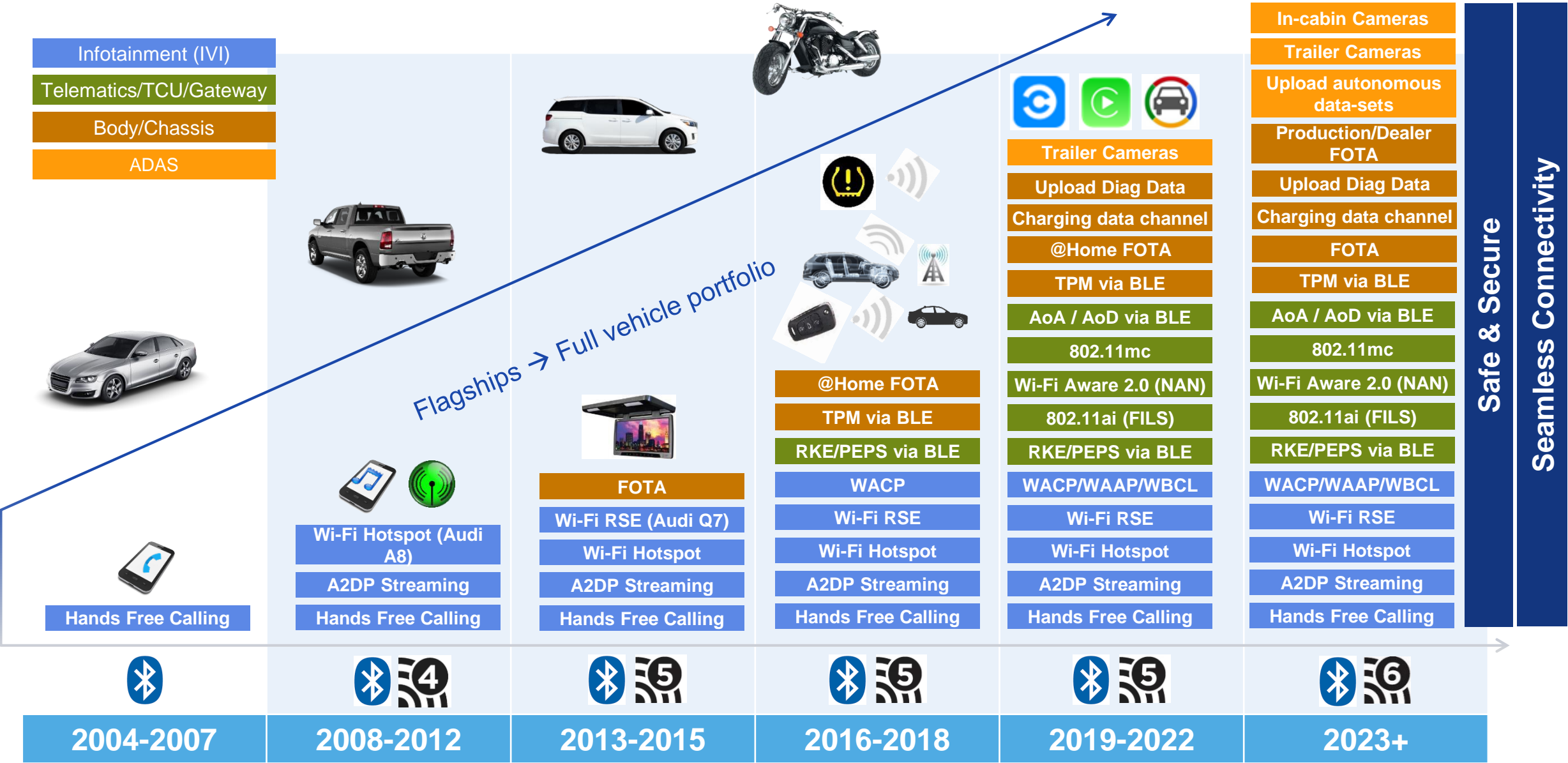
Telematics Control Units (TCUs)
+ Smart Antenna(s)
(BLE/WLAN)

Connected Central Gateway
(BLE/WLAN)

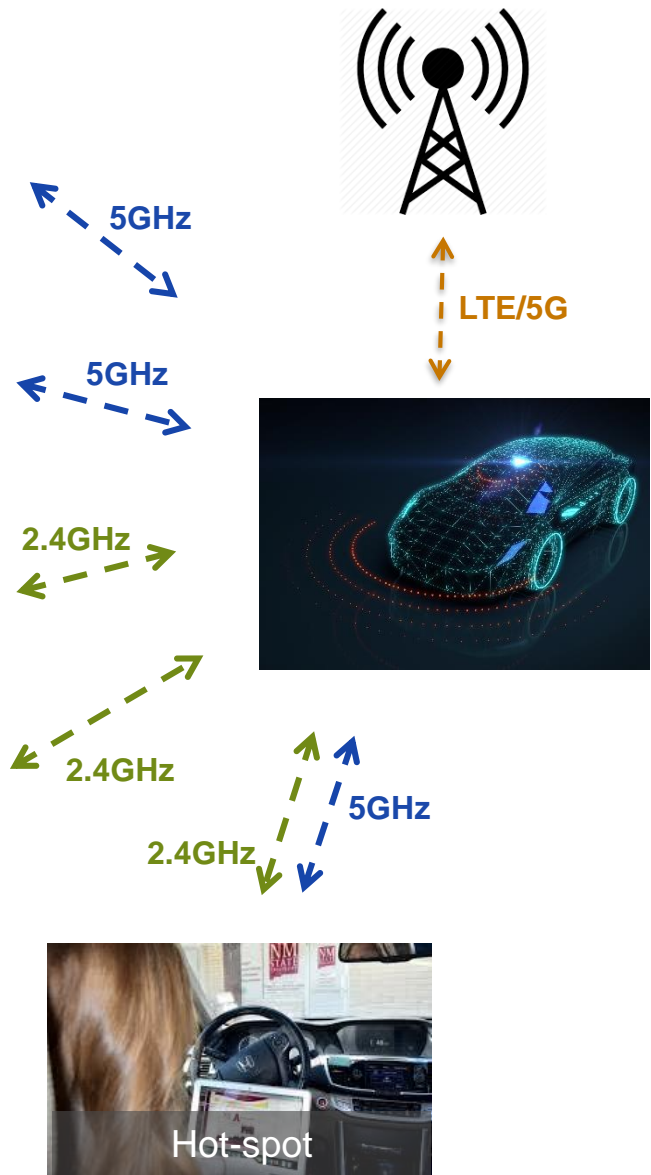
Rear View & Trailer
Cameras
(BLE/WLAN)



NXP CONNECTIVITY FOCUS – AUTOMOTIVE USE-CASES



CONNECTIVITY FOR TOMORROW'S CAR – ON-THE-ROAD



Requirements

- Concurrent Dual Wi-Fi (CDW) in both 2.4 GHz and 5 GHz to support simultaneous operation
- MIMO (2x2) performance in both bands
- Wi-Fi 6 improvements for
 - ✓ Speed
 - ✓ Congestion

Qty	Application	2.4 GHz / 5 GHz	Assumption	BW	Total
1	Apple CarPlay	5	per spec (Mbps): 20 TCP + 6 UDP	30	30
4	RSE streams	5	FHD (1,920x1,080, 30fps, H.264)	25	100
2	in-cabin cameras	5	FHD (1,920x1,080, 30fps, H.264)	25	50
2	exterior (trailer, assist) cameras	2.4 / 5	FHD (1,920x1,080, 30fps, H.264)	25	50
4	hot-spot devices	2.4 / 5	FHD (1,920x1,080, 30fps, H.264)	25	100
	overhead		20%		66
Total Bandwidth					396
Available Bandwidth					1,600

>2026					
Qty	Application	2.4 GHz / 5 GHz	Assumption	BW	Total
2	Apple CarPlay	5	forecast (Mbps): 40 + 12	60	120
4	RSE streams	5	4K (4096x2160, 30fps, H.265)	50	200
4	in-cabin cameras	5	4K (4096x2160, 30fps, H.265)	50	200
4	exterior (trailer, assist) cameras	2.4 / 5	4K (4096x2160, 30fps, H.265)	50	200
6	hot-spot devices	2.4 / 5	4K (4096x2160, 30fps, H.265)	50	300
	overhead		20%		204
Total Bandwidth					1,224
Available Bandwidth					1,600

CONNECTIVITY FOR TOMORROW'S CAR – PARKED AT HOME



Requirements

- MIMO (2x2) performance for OTA updates or offloading of car-generate data
- Wi-Fi 6 improvements for
 - ✓ Range
 - ✓ Speed
 - ✓ Congestion
 - ✓ Power

Application	2.4 GHz / 5 GHz	Assumption	BW
OTA updates OR data offloading	2.4 / 5	Available BW	1,077
car charger	2.4	basic communication	10
child presence detect	5	30Hz ping packet	2
overhead		20%	272
Total Available Bandwidth (2.4G + 5G)		2.4G + 5G, 256 QAM	1,361

Application	2.4 GHz / 5 GHz	Assumption	BW
OTA updates OR data offloading	2.4	Available BW	356
car charger	2.4	basic communication	10
child presence detect	5	30 Hz ping packet	2
overhead		20%	92
Total Available Bandwidth (2.4G)		2.4G, 256 QAM	458



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