



Introducing the Power and Scale of Wi-Fi 7

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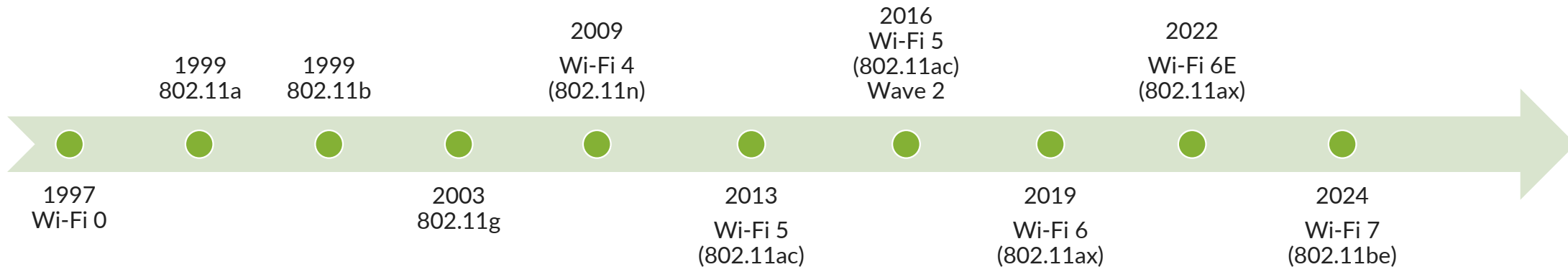
The **NOW** Way to Wi-Fi



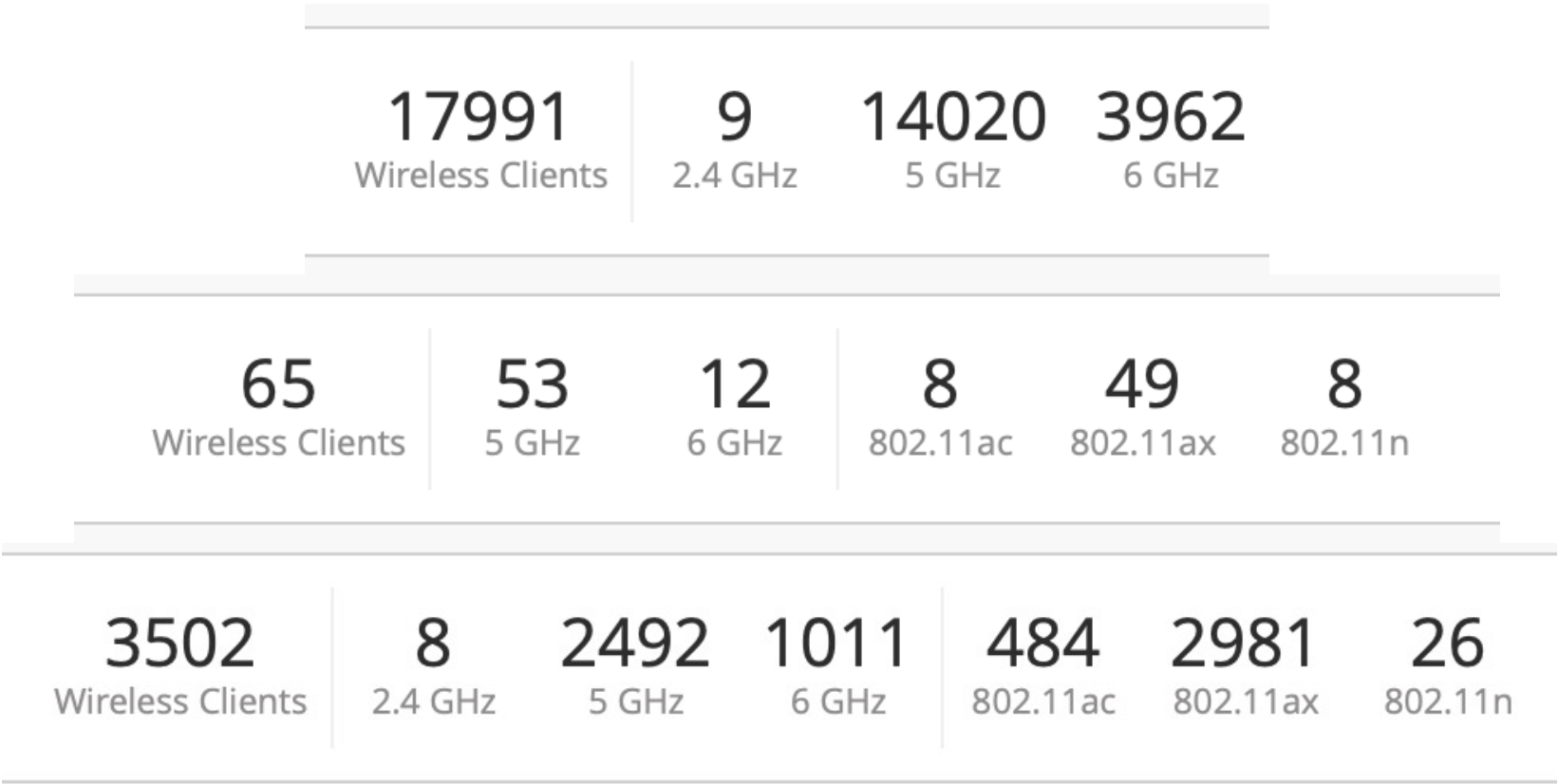
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Consulting Engineer Specialist - EMEA
Juniper Networks

Wi-Fi standards over the years

- Several Wi-Fi iterations over 4-6 year intervals
- Intermittent Wi-Fi 6E update
- Update as Extremely High Throughput from High Efficiency



6 GHz Adoption 20-30% in some Environments

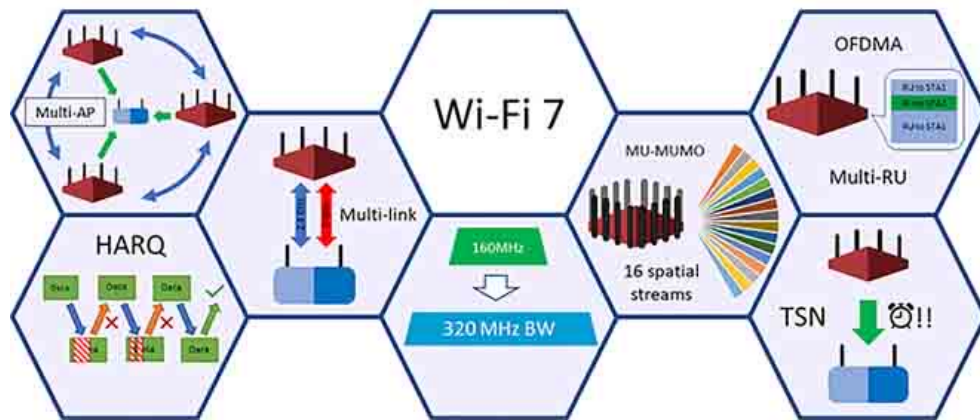




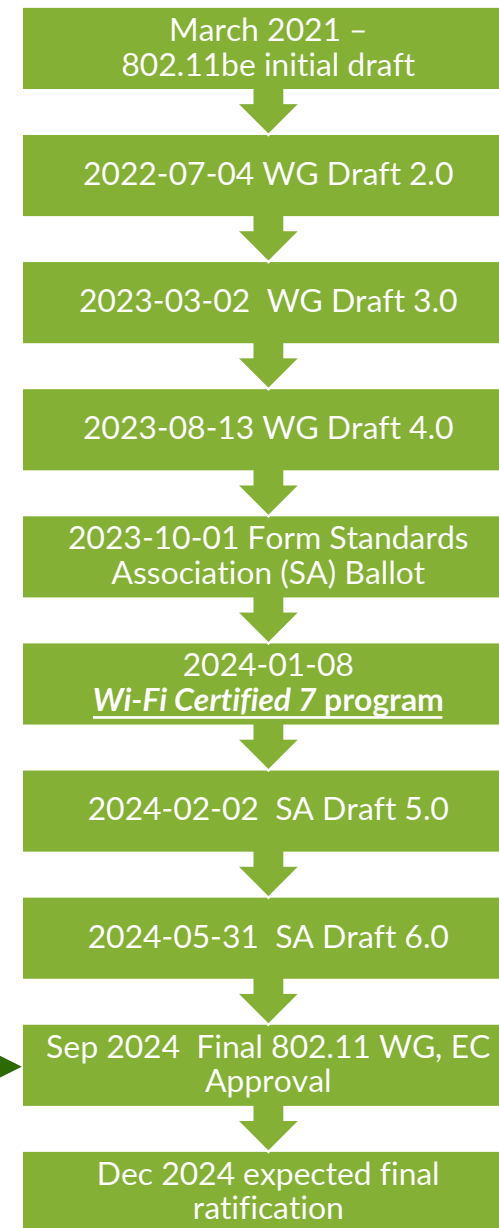
Wi-Fi 7

Wi-Fi 7 Timeline

- 802.11be still being finalized
- Early Wi-Fi 7 certification release
- Technical requirements complete, pending final approval phase



Source: <https://ieeexplore.ieee.org>



We are here →

Wi-Fi 7 Innovations

- 2.4GHz + 5GHz + 6GHz
- 320 MHz – 16SS
- 4096 QAM
- Multi-Link Operation

46 Gbps

(16SS – 320 MHz)

Enterprise Wi-Fi 7 APs likely to max out at a Data Rate of

26 Gbps

Let's get slightly more realistic

2SS Data Rates @ m13

80 MHz = 1441 Mbps

40 MHz = 688 Mbps

20 MHz = 344 Mbps

(Best case single client throughput – usually 50-60% of Data Rate)

16 Spatial Streams – For up to 16×16 MIMO

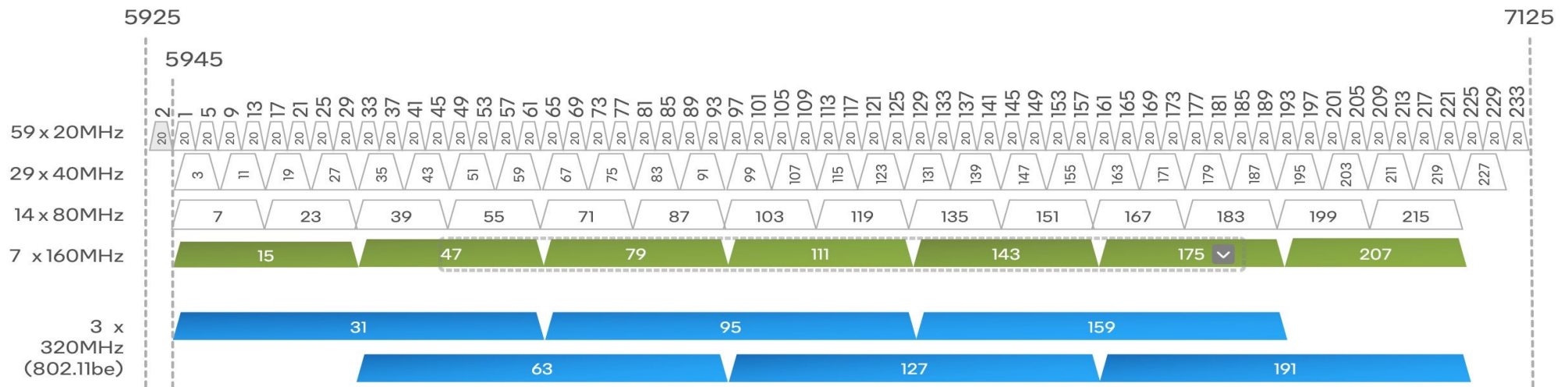
- 802.11be doubles spatial streams up to 16 streams therefore, double throughput compared to 8 stream 802.11ax
- improve spectral efficiency with Multi-User (MU) MIMO support for both Downlink and Uplink MU-MIMO

Most likely not implemented in Enterprise environments due to cost, size, power...



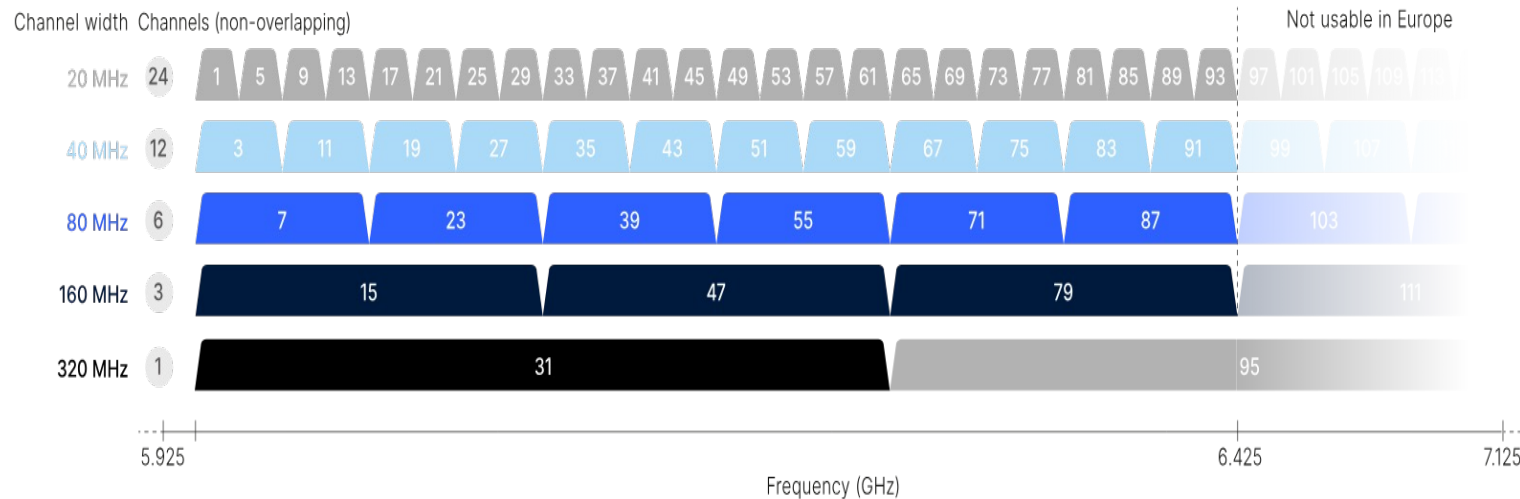
Contiguous and non-contiguous bands - US

- Support for extra-wide 320 MHz channels in the 6 GHz band
- 6 overlapping 320 MHz channels and 3 non-overlapping channels (US)



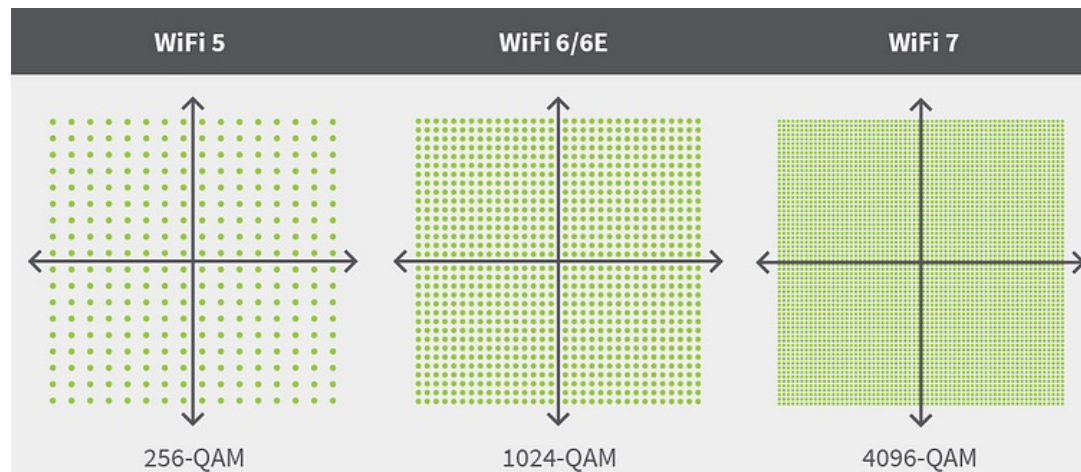
Contiguous and non-contiguous bands –Europe

In Europe due to only 1 320MHz channel used only in non-enterprise consumer devices or corner case by using Multi RU and Puncturing



Increased modulation rate

- 1024 [10 bits] -> 4096-QAM (4K-QAM) [12 bits]
 - 20% higher transmission - optionally supported by EHT



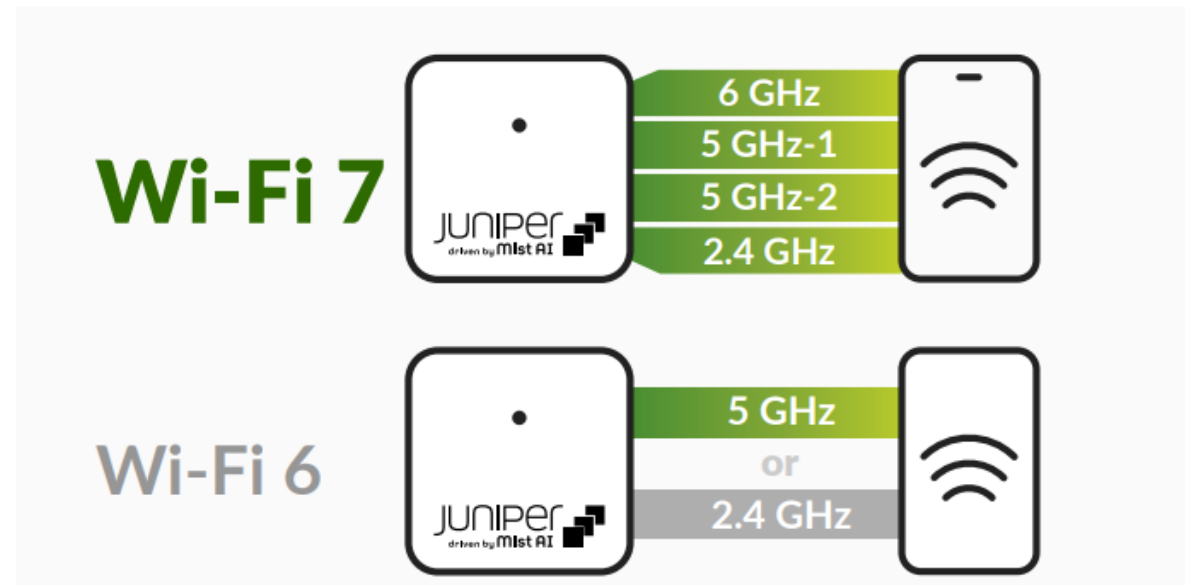
Source: <https://www.netally.com/wifi-solutions/wifi-7-promises-to-achieve-up-to-46gbps-speeds/>

Demands higher performing radio circuitry, most effective only in the 6 GHz band over short distances and requires the use of antenna beamforming to mitigate path loss

Multi-Link Operation (MLO)

Accepted on Wi-Fi 7 “Multi-Link Devices” (MLD)

- Significantly higher throughput
- Lower Latency (theoretically up to 1ms)
- Enhanced reliability

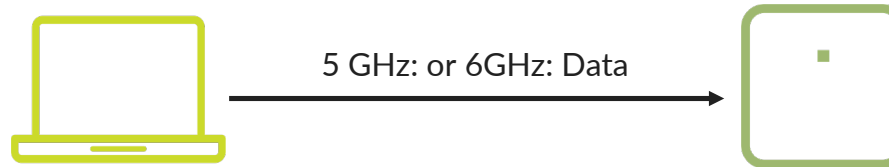


Highlight feature but requires adoption/maturity phase

Multi-Link Operation (MLO)

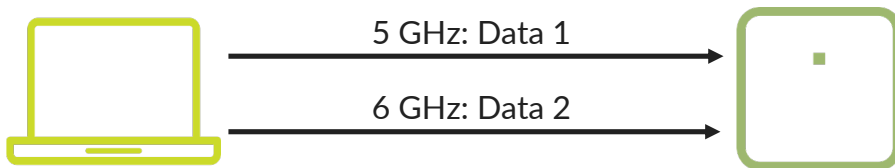
Multi-Link Operation (MLO) – Link Steering

Goal: Increased Reliability / Lower Latency



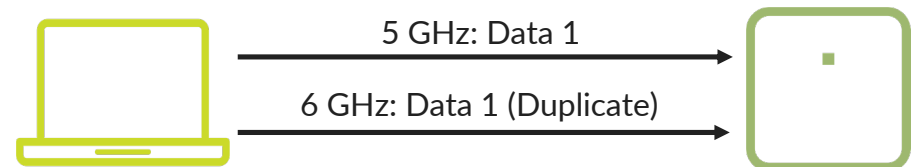
Multi-Link Operation (MLO) – Data Aggregation

Goal: Higher Throughput



Multi-Link Operation (MLO) – Data Redundancy

Goal: Increased Reliability / Lower Latency



Multi-Link Operation (MLO)

Link Switching

Multi-link single radio (MLSR): Lower Latency

- MLO, but TX/RX over one link at a time by switching links (bands)
- Requires one radio on client

Enhanced multi-link single radio (EMLSR): Lowest Latency

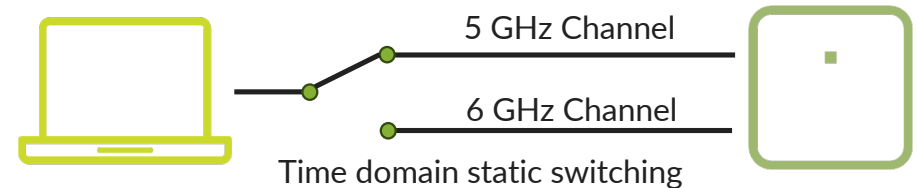
- Same as MLSR, but can listen over multiple links simultaneously
- Requires one radio on client

Multi-Link Concurrent

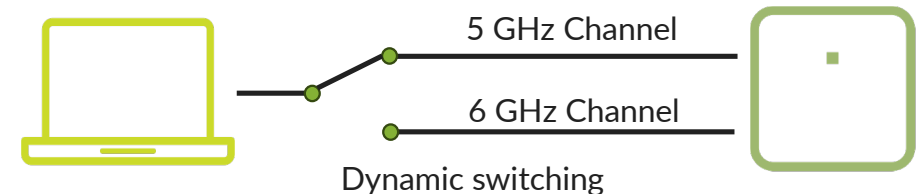
Multi-link Multi-Radio (MLMR): Higher Throughput

- TX/TX, RX/RX, and TX/RX over multiple radios
- Non-Simultaneous MLMR: Constrained by in-device TX/RX interference for TX/TX and RX/RX over multiple links
- Simultaneous MLMR: Simultaneous transmit and receive (or STR) can support TX/RX over multiple links
- Enhanced MLMR: RX/TX chain switching

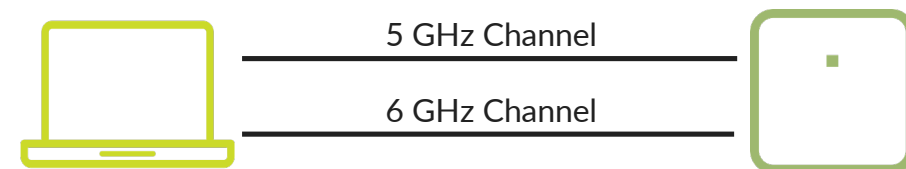
Multi-link Single Radio (MLSR) Operation



Enhanced Multi-link Single Radio (EMLSR) Operation

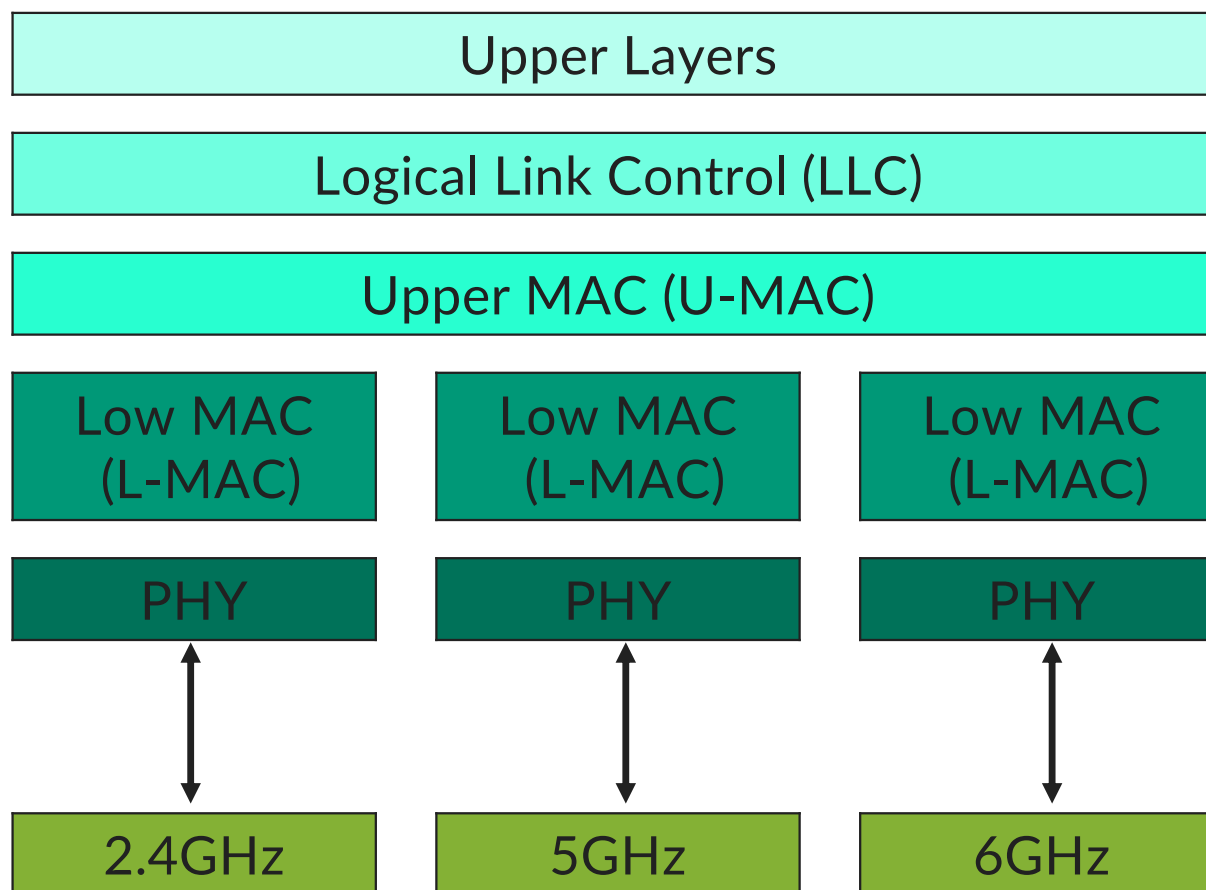


Multi-link Multi-Radio (MLMR) Operation




Multi-Link Operation (MLO) – Two MAC layers

MLO introduces a “higher level” MAC Address across the radios in a Wi-Fi 7 **MLD** (Multi-Link Device)



State of MLO – Sept 2024

- Windows 11 -> Requires 24H2
 - Intel BE200 – EMLSR
 - QCA Fastconnect 7800 – STR MLMR (2.4/5/6) and EMLSR
- Android
 - Android 13 first support, but Android 14 is better (link reconfiguration, use MLD in roaming algorithm)
 - **Pixel 9 – STR MLMR (2.4/5/6) and EMLSR**  Wi-Fi 7 (802.11be) with 2.4GHz+5GHz+6GHz, 2x2+2x2 MIMO
 - Pixel 8 - STR MLMR (2.4 + 5/6) and EMLSR (
 - Samsung S24 Ultra - STR MLMR (2.4 + 5/6) and EMLSR
 - One Plus 11 - STR MLMR (2.4 + 5/6) and EMLSR
- Apple
 - iPhone 16 - Wi-Fi 7 (802.11be) with 2x2 MIMO
not Wi-Fi CERTIFIED 7 yet
- Android MLO Doc
 - <https://source.android.com/docs/core/connect/wifi-7>



Getting Ready For Wi-Fi 7

Making sure your Infrastructure is ready for Wi-Fi 7

- Device Support
- Multi-Gig Switching
- Powering Devices
- Transmit Power
- Security (WPA3 Requirement)

Not all Certified devices are equal

Currently Certified Devices

- 11x Computer & 1x TV Chipsets
- 3x Phones & 1x Tablet:
 - Google Pixel 8/Pro (GKWS6, G9BQD /G1MNV) 802.11be but not WFA Wi-Fi 7 certified
 - Samsung S24 Ultra (SM-S928U) but not Samsung Z Fold 6 with same chipset not Wi-Fi 7 certified

But

- 62x Routers & 9x Other devices
- Signs for Wi-Fi 7 market still in infancy
- Example Phase 1 devices:
 - No PC Intel chipset: STR (Simultaneous Transmit and Receive)
 - Missing Compressed Block Ack (buffer size 512), MCS 12-13
 - Triggered uplink access optimization

[Product Finder Results | Wi-Fi Alliance](#)

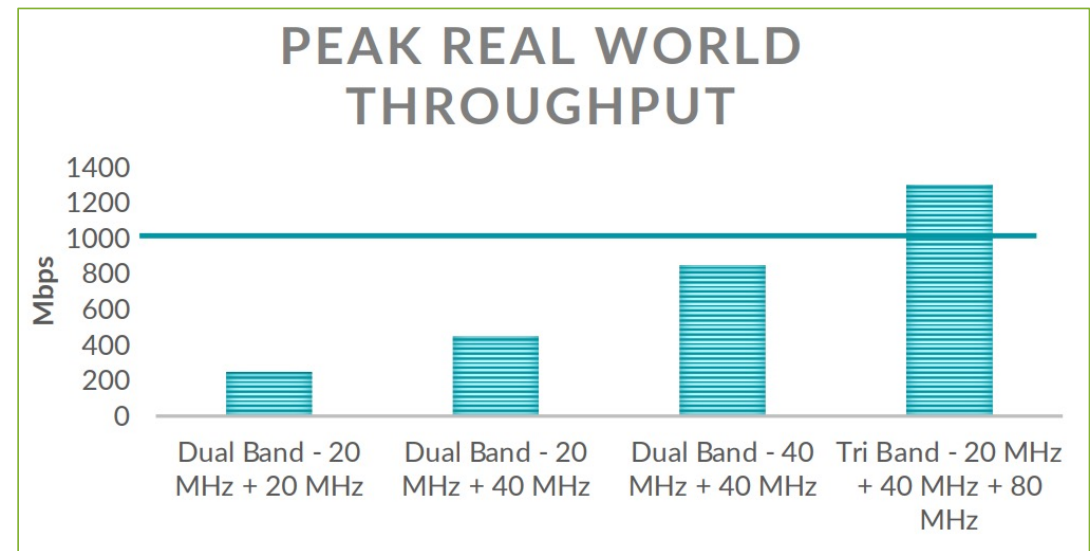
Wi-Fi CERTIFIED 7™

Advertised TID-to-link mapping
 A-MPDU with A-MSDU
 Beamforming sounding
 BSS critical update
 Compressed Block Ack Rx (buffer size 256)
 Compressed Block Ack Tx (buffer size 256)
 Compressed Block Ack Rx (buffer size 512)
 Compressed Block Ack Tx (buffer size 512)
 DL MU-MIMO
 EMLSR (Enhanced Multilink Single-Radio)
 EPCS (Emergency Preparedness Communications Services) priority access
 LDPC Rx
 LDPC Tx
 Load Balancing in MLO
 MCS 8-9 Rx
 MCS 8-9 Tx
 MCS 10-11 Rx
 MCS 10-11 Tx
 MCS 12-13 Rx
 MCS 12-13 Tx
 Multi-link reconfiguration – AP removal
 Multi-link reconfiguration – AP restart
 Multi-RU
 Operating mode indication
 Operating mode indication for 320 MHz
 Static puncturing
 STR (Simultaneous Transmit and Receive)
 SU-MIMO
 Triggered uplink access optimization
 UL MU-MIMO
 UL OFDMA

So, Do we need mGig for AP uplink?

Facts of life:

- Today most APs utilize <100 Mbps aggregate (dual band APs)
- Will burst up to 200-500 Mbps depending on channel bandwidth
- Generally need 100 MHz of spectrum to exceed 1 Gbps of real world burst throughput



So, mGig is not mandatory for Wi-Fi 7, but it is the best chance yet of exceeding 1 Gbps in the real world

Powering Devices

- Assume .3bt power

802.3bt

Connected Switch Properties	
Switch Name	AP45-EX4400-SW
Switch Description	Juniper Networks, Inc. ex4400-24mp Ethernet Switch, kernel JUNOS 21.2R1.10, Build date: 2021-06-21 17:07:11 UTC Copyright (c) 1996-2021 Juniper Networks, Inc.
LLDP Neighbor Address	192.168.3.1
Port ID	mge-0/0/12
Port Description	mge-0/0/12
LLDP-MED Supported	Yes
Power Request Count	1
Power Allocated	31.1 W
Power Requested	31.1 W
Power Required	31.1 W



802.3at

Connected Switch Properties	
Switch Name	ex2300-1_tiny_svr_closet
Switch Description	Juniper Networks, Inc. ex2300-48mp Ethernet Switch, kernel JUNOS 18.4R2.7, Build date: 2019-06-27 10:13:52 UTC Copyright (c) 1996-2019 Juniper Networks, Inc.
LLDP Neighbor Address	10.85.15.239
Port ID	mge-0/0/30
Port Description	mge-0/0/30
LLDP-MED Supported	Yes
Power Request Count	1
Power Allocated	30 W
Power Requested	31.1 W
Power Required	31.1 W

6 GHz Transmit Power

slightly denser network than in the past

Current Radio Values

SVLB-F4 ▾ 26 APs on the floorplan



svlb-mist-f4-ap22	ac-23-16-ec-f5-35
svlb-mist-f4-ap24	ac-23-16-ec-f5-4e
svlb-mist-f4-ap25	ac-23-16-ed-3c-48
svlb-mist-f4-ap05	ac-23-16-ed-3c-ed
svlb-mist-f4-ap13	ac-23-16-ed-54-c6
svlb-mist-f4-ap23	ac-23-16-ed-55-2a
svlb-mist-f4-ap20	ac-23-16-ed-55-61
svlb-mist-f4-ap09	ac-23-16-ed-57-9b
svlb-mist-f4-ap04	ac-23-16-ed-57-aa
svlb-mist-f4-an10	ac-23-16-ed-57-af

WPA3 Requirements – Migrating to WPA3 and OWE

WPA3 is required by the Wi-Fi Alliance for Wi-Fi 7 certifications and 6 GHz Operation only supported with WPA3 or OWE

WPA3 Enterprise

- Ultra Low Risk
- Safe and easy to enable (especially transition)

WPA3 Personal

- Low-ish Risk
- Old devices may encounter interop issues with transition mode
- MPSK Limited

OWE

- Low Risk
- Probably need to use transition mode due to device support

Note: you can enable WPA3 or OWE even before you have 6 GHz APs, and probably should

An abstract visualization of a network or data flow, featuring a dense, glowing green and yellow particle structure that forms a complex, organic shape, resembling a stylized 'J' or a network topology, set against a dark background.

Juniper Wi-Fi 7

Expanding Portfolio with AI for Wi-Fi 7

Juniper AP47, driven by Mist AI™

NEW



2.4, 5 and 6 GHz

5 GHz

6GHz

2.4/5/6 GHz Scan

GPS

Pressure/Accelerometer

vBLE

IoT and ESL

UWB

USB

* = future software release

1

Quad-Radio – 3 data radios and a dedicated Scan radio

- 4x4:4SS Data and 2x2:2SS Scanning

2

Wi-Fi modes of operation

- Mode 1: 2.4 GHz + 5 GHz + 6 GHz
- Mode 2: 5 GHz + 5 GHz + 6 GHz
- Mode 3: 6 GHz + 6 GHz + 5 GHz

3

Location and IoT

- Patented Virtual Bluetooth LE 5.4 (1st 802.15.4 radio)
- Second 802.15.4 radio – Thread*, ZigBee*, or Matter*
- Ultrawide Band (UWB) – For additional location use cases
- GPS/GNSS L1/L5

4

Dual 10G mGig Support (802.3bz)

- 2 x 10 GbE- 10G, 5G, 2.5G, 1G, 100M
- Full functionality on 802.3bt power
- Hitless PoE – Dual 802.3bt and link failover

5

3 x AP47 Models

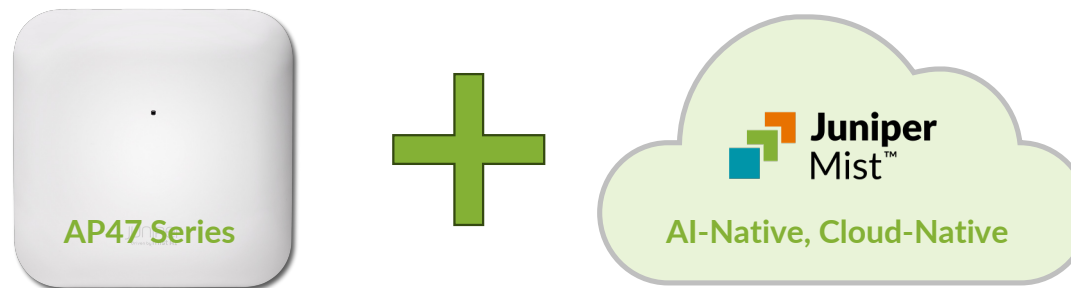
- Integrated Omni, Integrated Directional, and External Antenna

6

AI for Wi-Fi 7

- Deliver better user experiences
- Simplify IT operations and optimize performance

Why Juniper Mist? hint it's more than just hardware...



AI-NATIVE

- **AI-Driven RRM** for dynamically managing capacity complexities of old and new spectrum; dynamic power save modes
- Dynamically downloadable **Minis** built-in for user experience anomaly detection
- Integrated **CUEL agents** continually enhance experience models

AIoT-DRIVEN

- **AI-Driven RRM** optimizes spectrum capacity beyond Wi-Fi for IoT
- vBLE and **Unsupervised Machine Learning** enable location-based services use cases across verticals
- Built-in **sensors** augment hyper-location use cases

CLOUD-NATIVE

- **150+ client event states** monitored
- Massive horizontal and vertical **elastic scale**, high performance
- **Microservices agility** delivers enhancements on a weekly basis

Future Proof with Juniper's Campus Access Switching

Juniper's EX Switching Portfolio Capabilities

Wi-Fi 6E/7 Transition...

Wi-Fi 6E/7 driving MGig and 802.3bt PoE

Introducing EX4400-48MXP, EX4400-48XP Switches for Wi-Fi 7

Competitive, Enhanced PoE requirements

PoE++ up to 90W, Fast and Perpetual PoE...

New EX4400-48MXP, EX4400-48XP has PoE budget of 3600W, bringing power & sustainability to smart buildings, and more...

Microsegmentation

Build granular access control security policies with EVPN-VXLAN and Group Based Policy

Security Threat detection

Monitor real time traffic flows with Flow-Based Telemetry against security threats

Zero Trust Network, via Juniper's NAC Assurance

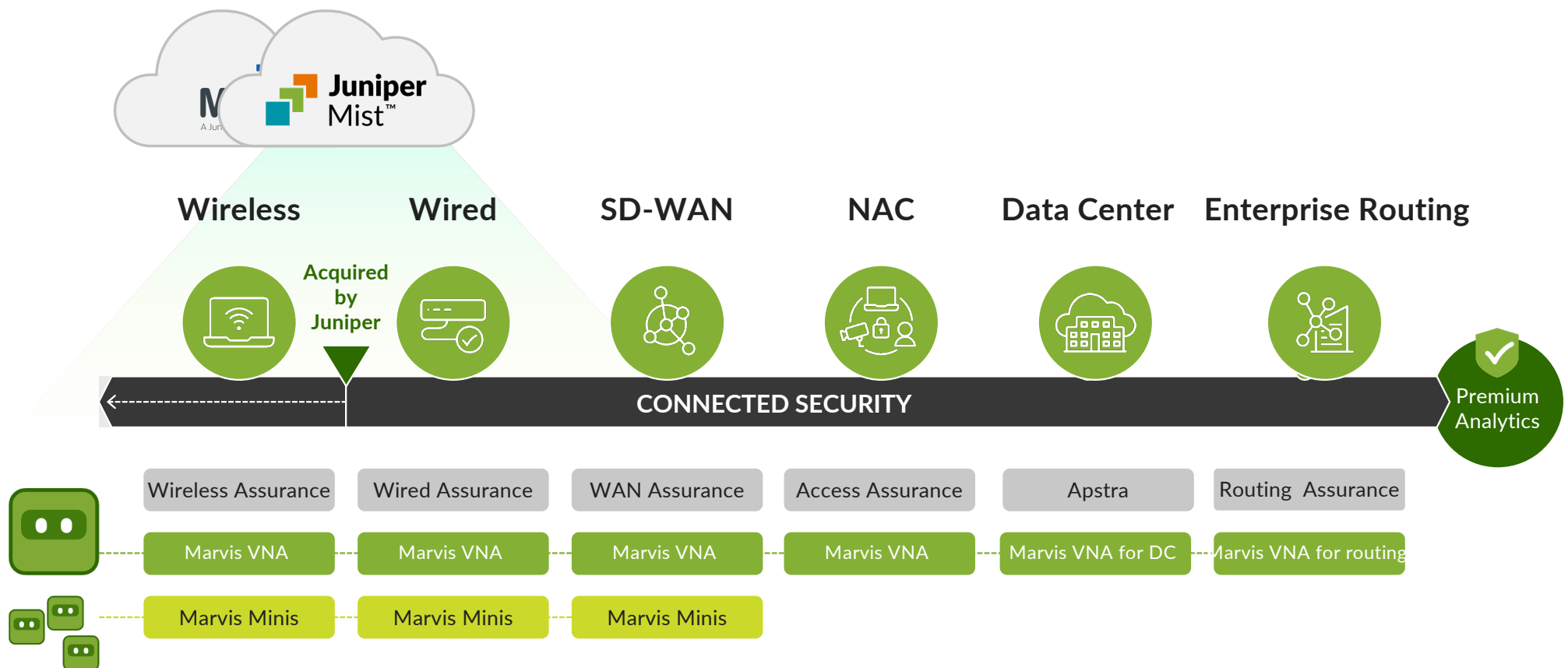
Switch - Switch/Host traffic Encryption

Encrypt traffic with MACsec AES256

Cloud Native, AI Native Switching

Simplify operations, deliver best user experience, and future proof network with scale & agility, via Mist AI -- Marvis and Wired Assurance.

AI for Networking: Only common cloud and VNA across all enterprise domains

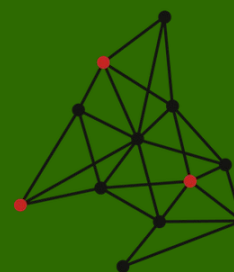




Thank you

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The **NOW** Way to Wi-Fi



redi
madrid