Future-Proof Your School's Network With Wi-Fi 6 Technology

Cambium Networks™

Wi-Fi 6 in Education

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Today's Agenda

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What is WiFi 6

Why is it critical to success in Education

Planning and Deploying

Funding Options

The Cambium Difference

Q&A

What is WiFi 6 ?

Should I care?

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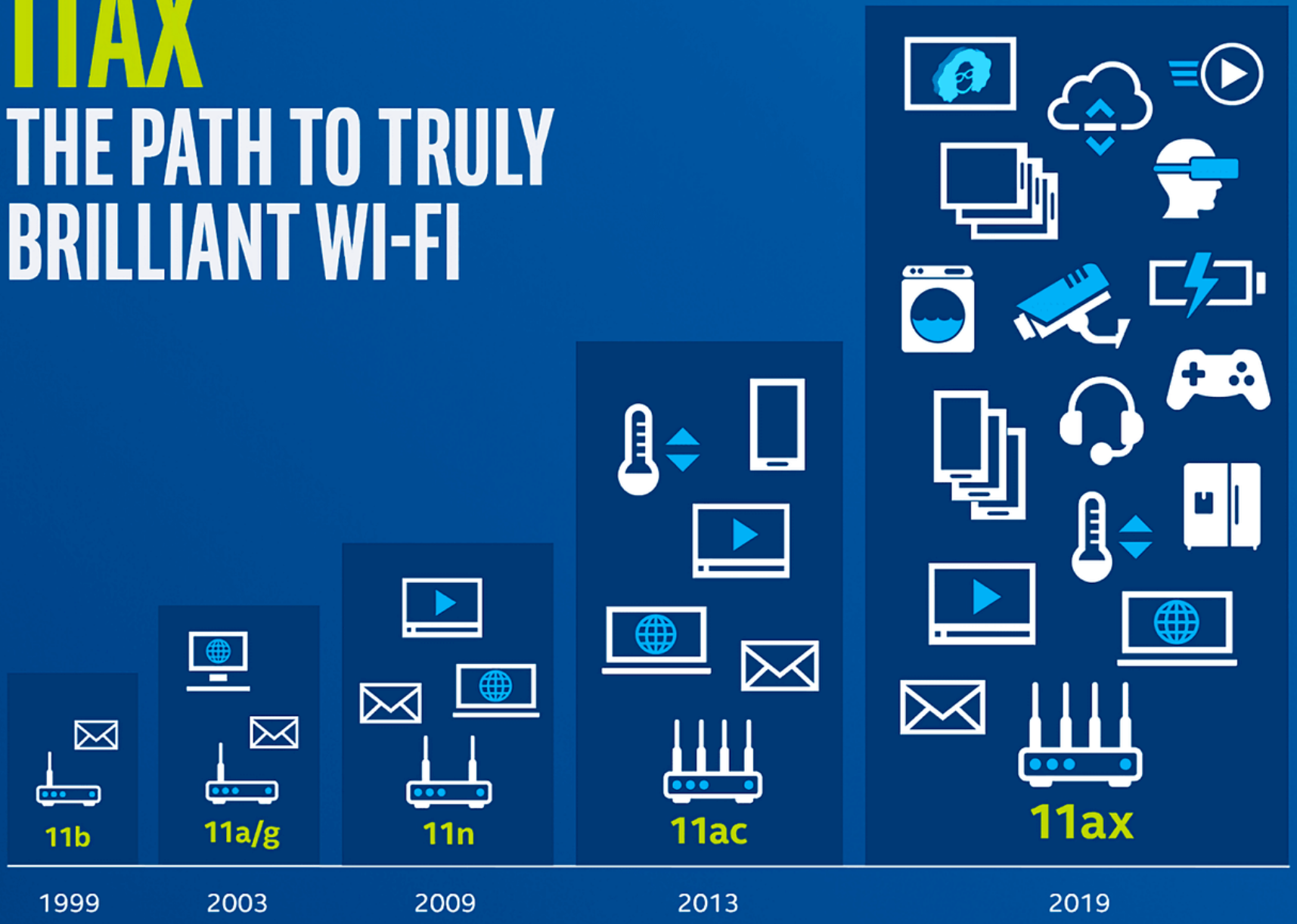
11AX

THE PATH TO TRULY BRILLIANT WI-FI



4x **BETTER IN DENSE ENVIRONMENTS**

Improve average throughput per user by at least four times in dense or congested environments

FASTER THROUGHPUT

Deliver up to 40 percent higher peak data rates for a single client device

INCREASE NETWORK EFFICIENCY

By more than four times

EXTEND BATTERY LIFE

Of client devices

High capacity deterministic network model

802.11ax Keys	Benefit vs 11ac
MU-OFDMA	Small packet efficiency; 37 users
MU-MIMO	4x capacity, scheduled transmission
Spatial Reuse	Overlapping networks
TWT	Longer battery life
1024QAM	Faster Data Rates
8x8 AP	High capacity 8SS SU/MU
Extended Range	3 dB range improvement

802.11ax focuses on improving the connected client experience by making the network more efficient

Wi-Fi 6 Real-World Performance

2.4GHz only
5GHz only
2.4 / 5GHz

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802.11n: 64QAM, MIMO

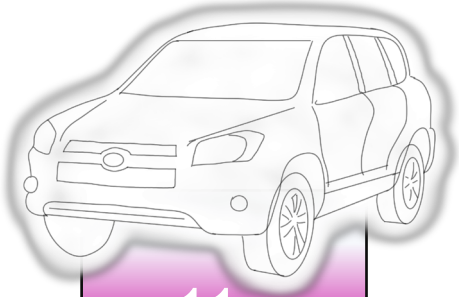
Peak PHY Rate

450Mbps

Real-World

150Mbps

40Mhz channel on 5GHz
2x2 client connected
50% efficient



11n

802.11ac: 256QAM, MU-MIMO

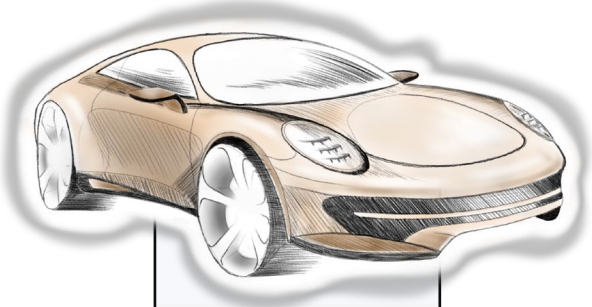
Peak PHY Rate

3.4Gbps

Real-World

253Mbps

40Mhz channel on 5GHz
2x2 client connected
65% efficient

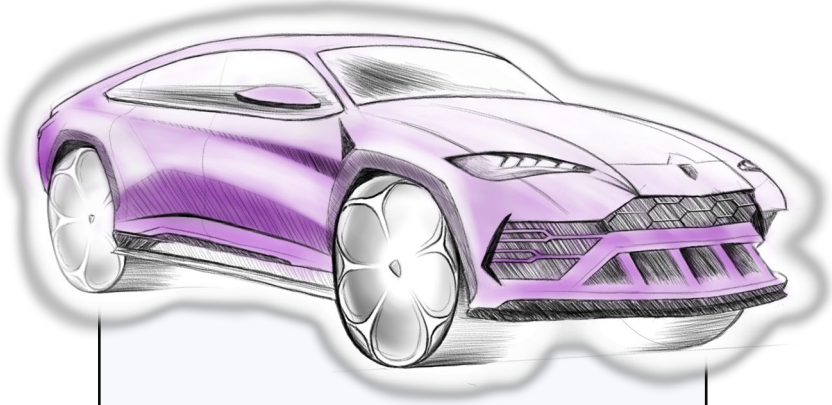


11ac

802.11ax: 1024QAM, OFDMA

Peak PHY Rate

9.6Gbps



Real-World

840Mbps

80Mhz channel on 5GHz
2x2 client connected
1200Mbps PHY
70% efficient

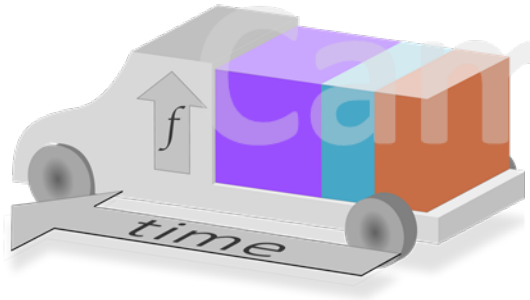
11ax is multi-user, expectation ~2.5Gbps of aggregate throughput

11ax

Downlink Multi-User OFDMA and MIMO

OFDMA

Resource units as small as 2MHz



Allocates Resource Units as small as 2MHz
(2 | 4 | 8 | 20 | 40 | 80 MHz)

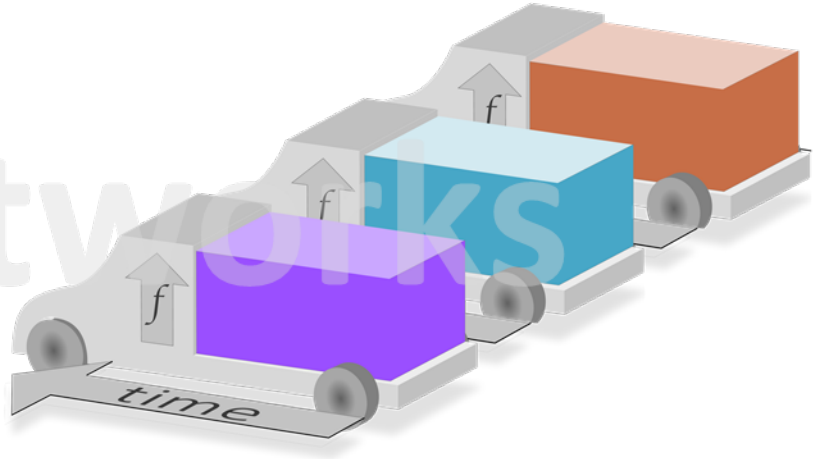
Benefit: Reduced Latency, efficient use of time and frequency

Ideal for: VoWLAN, IOT devices, always-connected mobile devices

Stadiums, Higher Education, Hotels, Enterprise

MU-MIMO

Up to four concurrent transmissions, 2x2



Transmit to multiple devices at the same time

Benefit: high capacity with high bitrate

Ideal for: Streaming media, high bitrate applications, stationary PCs

Higher Education, Hotel Conference center, Enterprise

Uplink Multi-User OFDMA and MIMO

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OFDMA

Resource units as small as 2MHz

Increase reverse-path range of multiple low power clients

Greater combined SNR = improved range

MU-MIMO

Up to four concurrent transmissions, 2x2

Increase uplink datarate, reduce latency
Great for gaming, high density social media

Up to 4.8Gbps PHY rate, combined, bi-directional

Other 802.11ax key technology

Additional 11ax tech	What it will do
1024 QAM	30% topline speed improvement over 11ac. Works with 11ac clients and 11ax
Spatial Reuse	Allows multiple BSS (AP + its connected clients) to overlap in same frequency
Preamble Boost and sub-carrier repetition	3dB power boost increases range outdoor, increased GI improves resilience
Target Wait Time	Sleep time negotiated by AP and Client Longer battery life for mobile devices even while streaming media, extended IOT life
2.4GHz band	AX performance with +30% range, or, AX segmentation for IOT networks
6GHz band	1200MHz of clean RF spectrum, ideal for AX and expanded network services

Why is it critical to success in Education?

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Educational Focus Points

SAFE SCHOOLS

- Many schools (especially in the US) are investing / or upgrading their security infrastructure (IP video surveillance technology, new IP door access control systems, alarms and notification systems)
- These schools will need to invest in a network upgrade to support these enhancements.

STUDENT SUCCESS

- Individual Education Based on Student Data & Classroom Needs
- Analyze Student Attitude, Learning
- Move Tools to the Cloud for 24 x 7 Learning
- Daily Per-User Information
- Online Testing & High Stakes Performance Testing

FLEXIBLE LEARNING

- Distance learning, video & audio based lectures are all now mainstream.
- On-line test applications mandated by most states.
- Requirement for reliable, stable network (both wired and wireless)
- **BYOD and high speed wireless needs to both indoor and outdoor environments.**

No Layer 4 + Visibility For Network Equipment

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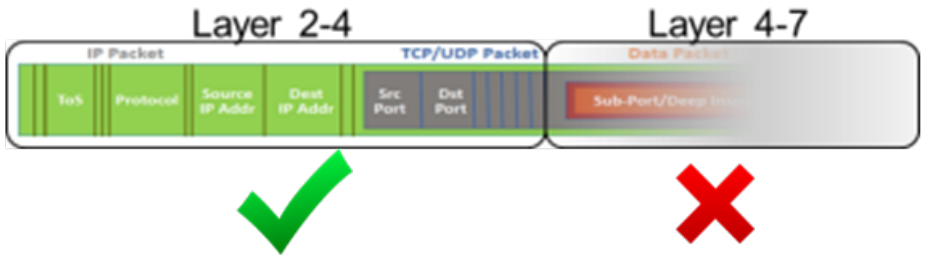
Here is the dilemma

How users see applications:

Port 80

Port 443



Application Intelligence: Policy Enforcement at the Edge

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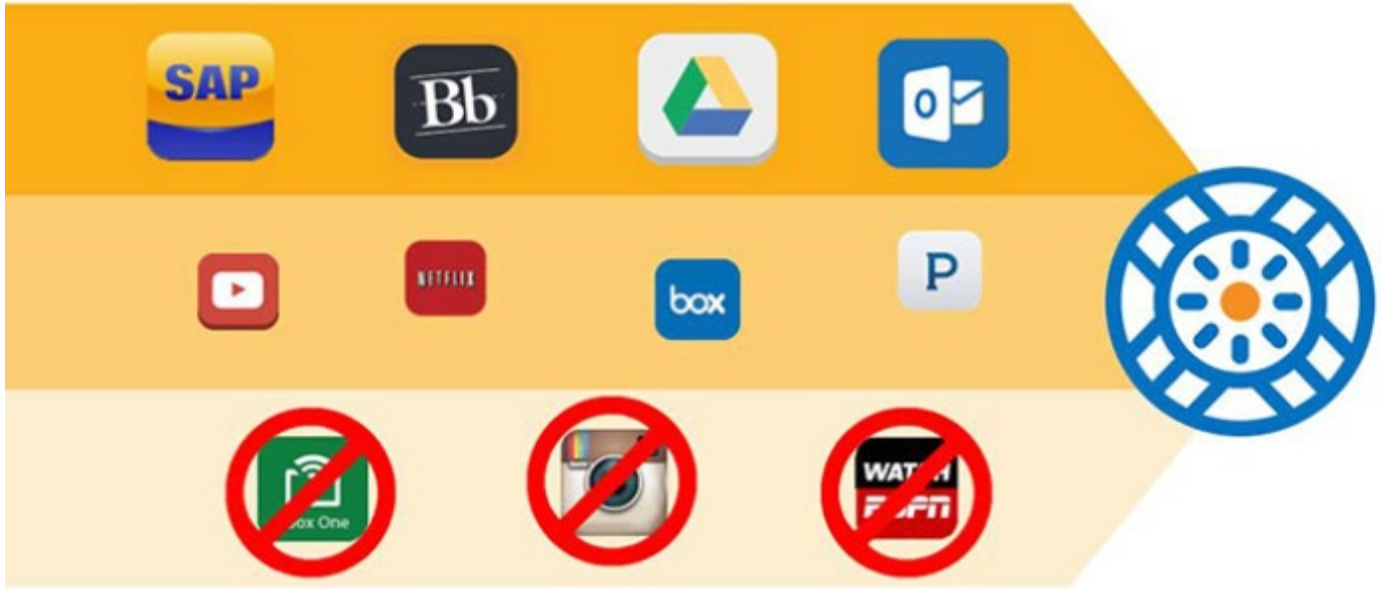

PRIORITIZE

LIMIT

BLOCK

Simplicity: Cloud-based Control from a Single Console

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EasyPass™
Access Control

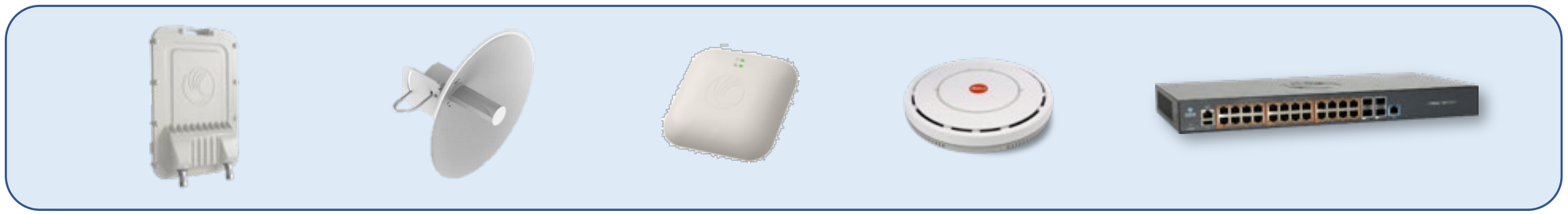
CommandCenter™
Multi-tenant Control

XPS Location
Integrated Service

Zero-touch
Provisioning

Policy Enforcement
L1-L7 Control

Analytics
Who, What, Where



Easy Pass Free for Education

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Employees/Students/IoT

Onboarding
Users gain secure access using a unique PSK.

Microsoft Azure
Users gain secure access using Microsoft Azure authentication.

Google Login
Users gain secure access using Google authentication.

Guests

Self-Registration
Guests sign up to gain access using an online form.

Guest Ambassador
A guest ambassador must register the guest.

Personal Wi-Fi
Users create their own secure personal network.

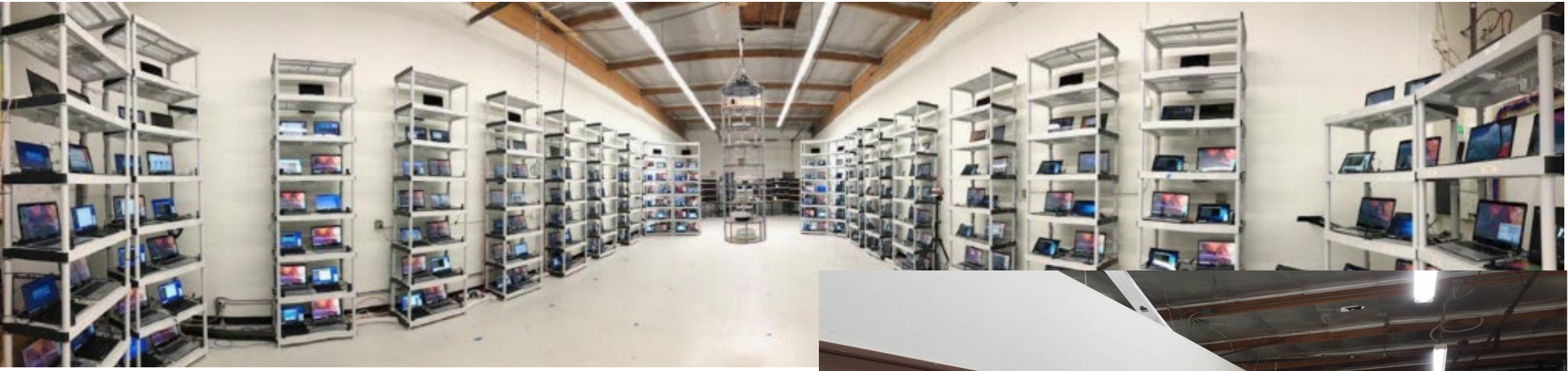
Customers

Voucher
Users gain access using a pre-assigned access code.

One-Click Access
Guests gain access after agreeing to terms of use.

Simplify and secure user connections

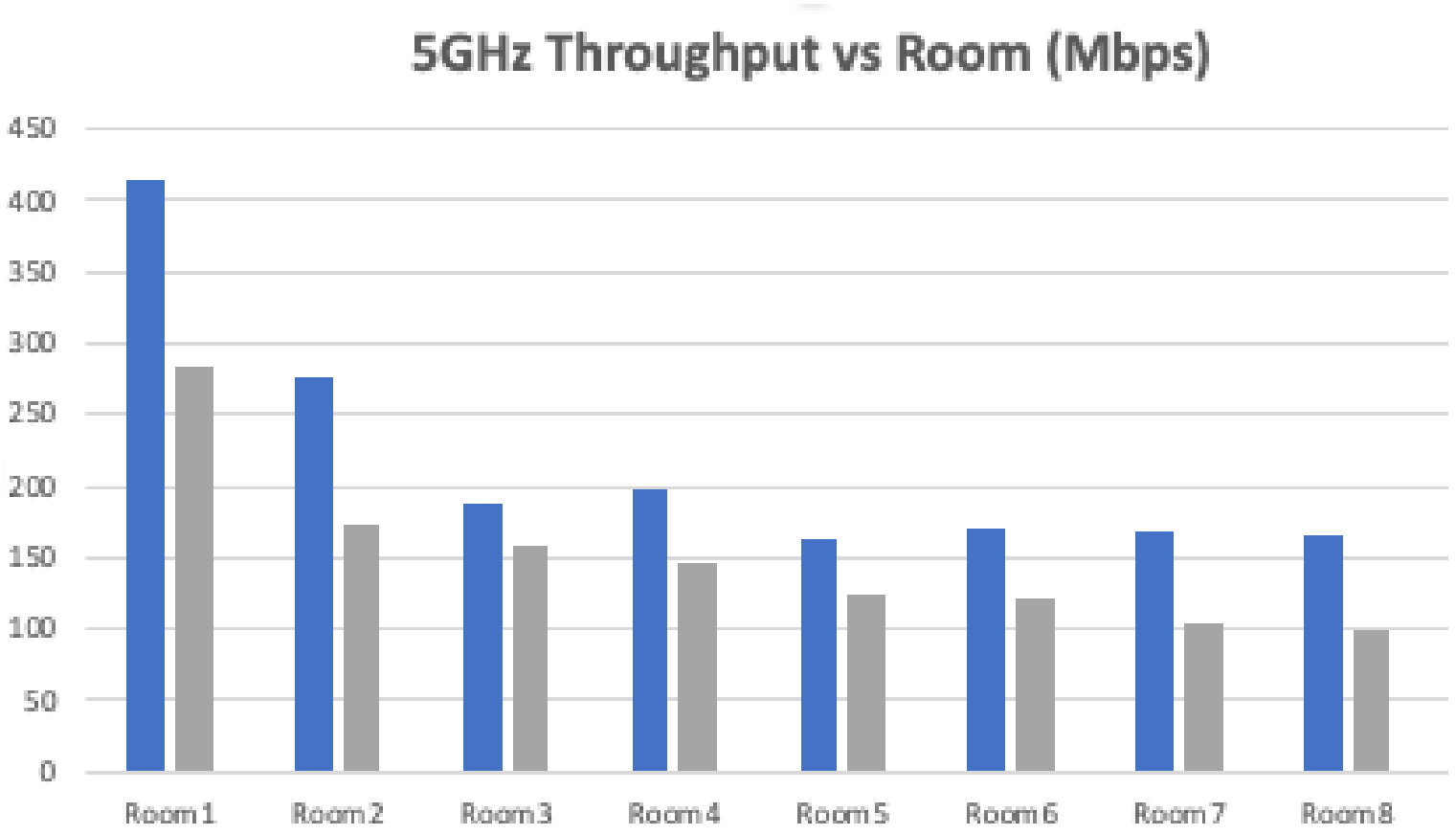
Cambium Real-world Testing Labs



Automated Testing Facilities
Thousand Oaks, CA

Ensure Real World EDU Success

Wi-Fi 6 Improves Wireless Performance



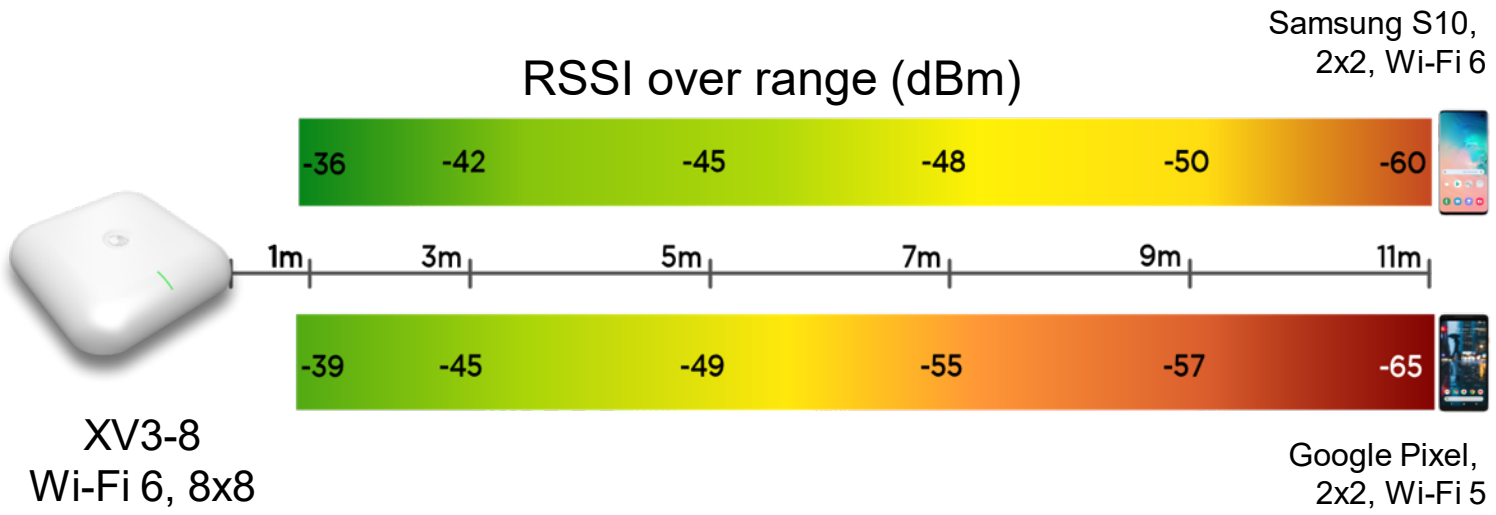
Wi-Fi 6 Advantage:
Up to **40%** Higher Performance vs. Wi-Fi 5

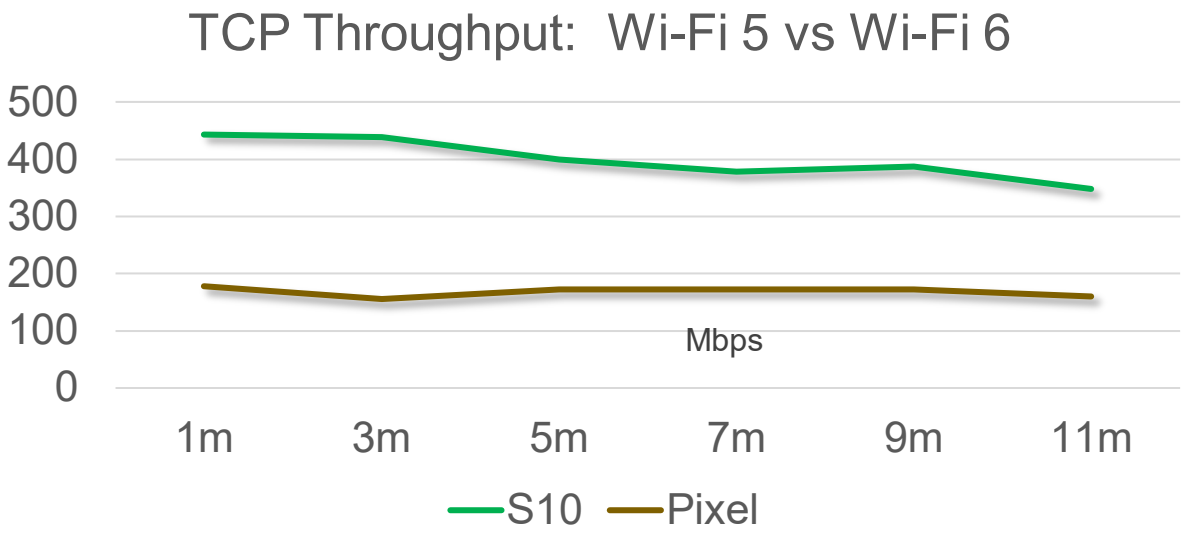
What is happening?

- 8x8 antennas provide better receive sensitivity and signal integrity
- Improved radio driver and offload
- 1024QAM is 25% more bits/Hz

Test Details
AP located outside of Room 1
Increasing distance from AP to Rooms on the right of graph
Throughput measured to single Macbook 3x3 11ac client

Wi-Fi 6 Improves Wireless Performance





Wi-Fi 6 Advantage:
Average **135%**
Improvement vs. Wi-Fi 5

What is happening?

- 1024QAM is 25% more bits/Hz
- More efficient signaling protocols
- Client-side CPU speed increase

Test Details
iPerf3 client on Windows 10 PC
iPerf3 server on smart phone
iperf3 –c <ip> -i 10 –t 10 –P 6
40Mhz channel, 44/48, short guard

Planning and Deploying

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WiFi Designer Tool (Free)

Wi-Fi Designer, it is a free, cloud-based app for designing and planning Wi-Fi networks.

It is available on the Cambium web site at https://www.cambiumnetworks.com/products/software/wifi-designer-and-wifi-inspector/ and can be used by customer, partners, or anyone.

Features include:

- **Import or draw floor plans**
- **Visualize Wi-Fi coverage by AP model**
- **Tune AP parameters – rotation, 5GHz/2.4GHz, power**
- **Develop a bill of materials**
- **Create/email PDF reports**

It can be used in a guest mode, or users can register to save their designs and get a PDF report.

Deployment Considerations

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Density Concerns

Locations needs

End User Devices

Adoption of Wi-Fi 6 client devices for 1-1 deployments

Switching and Cabling Upgrade

Cloud Deployment and Management

Network As A Service

Funding Options

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Considerations

E-Rate

All Schools have refreshed 5 Year Budgets

Cares Act

Focused on COVID-19 support and NTI environments

Leasing vs NAAS

Payment Planning vs Outsourcing Day to Day deployments and support.

What is real cost of Wireless Refresh?

All APs are NOT made the same. Number of Radios, Shared Services, Annual Software Subscriptions, Add-Ons, Support & Integration

About Cambium

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Cambium Networks at a Glance

- **Spun out of Motorola Solutions** in October 2011
- Pioneer in Point-to-Multipoint & Point-to-Point **IP Wireless Broadband Solutions**
- Focused on wireless connectivity; **2 meters to 200 km** – people, places & things
- HQ outside of **Chicago, IL**
- **700+ employees** across **6 continents**
- More than **8 million nodes** shipped totaling over **$1.5B**
- Emerging leader in **IIoT and 5G like solutions**

Enterprise Wi-Fi from SMBs to Large Businesses

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cnMaestro

Single Cloud Dashboard
for Broadband/Eth/Wi-Fi

XMS

Simple Management
App Control, Security

- **EasyPass™** Access Control
- **CommandCenter™** Multi-tenant Control
- **Zero-touch** Provisioning
- **Policy Enforcement** L1-L7 Control
- **XPS Location** Integrated Service
- **Analytics** Who, What, Where

Broad Range of Dual Radio, Software-Defined, and High-Density APs

Small Form Factor to High Density Wi-Fi Solutions from Wi-Fi 5 (11ac) and Wi-Fi 6 (11ax)
Segmented IOT, BYOD, WIFI, App Ctrl, Security services

Intelligent PoE Switches

Hotels/Dorms | Small Offices | Offices | Classrooms | Auditoriums | Stadiums/Conventions

High Density Wi-Fi 6

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Tri-Radio with SDR

Cloud or on-premises managed

5GHz 8x8/4x4 11a/n/ac/ax
2.4GHz 4x4 11b/g/n/ax

WPA3 secure public access

Application Control

802.3bz uplink (5Gbps)

XV3-8 Wi-Fi 6 Access Point	
Unique Value	Tri-Radio 11ax with Software Defined Radio and Dedicated Sensor
802.11 Radios	2 or 3 (software defined radio)
Streams	4x4 in 2.4G; 8x8 in 5GHz; or dual 4x4 5GHz
Antennas	Internal
BT / BLE	Yes, BLE 4.0
Sensor	Dedicated dual-band sensor radio. 2x2:2 for WIPs / Location services / RF scan / Network scan
Technology	Wi-Fi 6 11AX Software defined + BLE + Sensor
Wired	1 x GigE + 1 x 5GigE
Power	802.3at
USB	Yes
Management	XMS-Cloud or cnMaestro

Education	Public Venues	Enterprise	Retail

Cost Effective Wi-Fi 6

Cost Effective 11ax

Cloud or on-premises managed

5GHz 2x2 11a/n/ac/ax
2.4GHz 2x2 11b/g/n/ax

WPA3 secure public access

Application Control

802.3bz uplink (2.5Gbps)

XV2-2 Wi-Fi 6 Access Point	
Unique Value	Cost effective 11ax, standards-compliant, high performance 2x2
802.11 Radios	2
Streams	2x2 in 2.4G; 2x2 in 5GHz
Antennas	Internal
BT / BLE	No
Sensor	Shared sensor with data radios. Control duration, periodicity. WIPs / Location services / RF scan / Network scan
Technology	Wi-Fi 6 11ax
Wired	1 x 2.5GigE
Power	802.3at
USB	Yes – USB 2.0 port
Management	XMS-Cloud or cnMaestro

Education	Hospitality	S/M Enterprise	Retail

Questions

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- cambiumnetworks.com