# **AEROHIVE NETWORKS**

802.11ax & Cloud Base WiFi Network Architecture

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# AEROHIVE NETWORKS

PATENTS NYSE **HIVE** 

1st 1 st 1<sup>st</sup> **PIONEERED** FOUNDED **ENTERPRISE** PRIVATE CLOUD 2006 802.11ax PLUGGABLE **PRE-SHARED** MANAGEMENT AP KEY AP ONLY 30K+ **GLOBAL** 1ST PUBLIC, PRIVATE CLOUD HAPPY CONTROLLER-LESS & LOCAL **CUSTOMERS** ARCHITECTURE FOOTPRINT CLOUD

# Agenda



# 802.11ax (WiFi 6) Overview

# Cloud Management Architecture for WiFi Networks

**AIRTIME CONSUMPTION** 





RF is a half-duplex medium

 At any given time only one radio can transmit on a frequency domain (channel)

Everybody takes turns

#### **Traffic nightmare**





The bulk of of data frames (75 - 80%) are small and under 256
 bytes

 The result is overhead at the MAC layer and medium contention overhead for each small frame

#### **Traffic nightmare**





# High density of clients

Efficiency at the MAC sublayer always drops as more clients stations join

Increase in collisions and medium contention overhead

### THE SOLUTION:





#### The future: 802.11ax

## 802.11ax – High Efficiency(HE)

 802.11ax uses PHY and MAC layer enhancements for better traffic management

The goal is to increase average throughput 4X per user in high-density scenarios



## Operates in both the 2.4 GHz and 5 GHz frequency bands



OFDM - 802.11A/G/N/AC





Time

Subcarriers

#### **OFDMA Resource Units**





 Frequency allocations for both uplink and downlink
 OFMDA define resource units (RU) with 26, 52, 106, 242, 484 or 996 subcarriers (tones)

 The subcarriers (tones) are in fixed locations of each 20, 40 or 80 MHz channel OFDMA - 802.11AX



Time

Subcarriers



### The future: 802.11ax- What is new?

- OFDMA better use of the frequency space
- BSS Color/Spatial Reuse Mitigate OBSS
- Uplink and Downlink MU-MIMO for up to 8 devices!
- 1024-QAM Higher data rates
- Target Wake Time (TWT) Great for IoT devices





# What is the definition of Multi-User (MU) ???



The term multi-user (MU) simply means that transmissions between an AP and multiple clients can occur at the same time dependent on the supported technology.
MU-OFEDMA

 However, the MU terminology can be very confusing when discussing 802.11ax. MU capabilities exist for both MU-OFDMA and MU-MIMO. They are very different. **MU-MIMO** 





# AP use DL MU-MIMO to serve multiple clients requires spatially diverse position.

Which is better? 8x8:8 or 4x4:4 APs?



Radio #1: SDR radio

2.GHEH: Charmen el 000



Radio #2: Fixed 5 GHz Radio

5 GHz: Channel 40

 Two dual-5 GHz 4x4:4 802.11ax radios transmitting on two separate 5 GHz (20 MHz) channels will provide better performance and efficiency.

Power of 45 watts per port may be a requirement for 8x8:8 APs

#### 802.11n vs. 802.11ac vs. 802.11ax



	802.11n	802.11ac	802.11ax
Channel Size (MHz)	20, 40	20, 40, 80, 80 + 80 and 160	20, 40, 80, 80 + 80 and 160
Subcarrier (KHz)	312.5	312.5	78.125
Symbol time (µs)	3.2	3.2	12.8
Frequency multiplexing	OFDM	OFDM	OFDM and <b>OFDMA</b>
Modulation	BPSK, QPSK, 16-QAM, 64-QAM	BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM	BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM <b>1024-QAM</b>
MU-MIMO	N/A	Downlink	Downlink and Uplink
Spectrum Bands	2.4GHz & 5GHZ	5GHZ	<b>2.4GHz</b> & 5GHZ

Wi-Fi Alliance





 Wi-Fi Alliance has introduced a new generational Wi-Fi naming system that helps users better understand the experience they can expect

 Wi-Fi 6 is the next generation of Wi-Fi based on 802.11ax technology: <u>www.wi-fi.org/wi-fi-6</u> **TECHNICAL RESOURCES** 



802.11ax blog series: <u>https://blog.aerohive.com/tag/11ax/</u>

## 802.11ax for Dummies Booklet: <u>https://content.aerohive.com/802.11ax\_dummies\_book</u>



#### The Elephant in the room!





## Where are the 802.11ax clients?

# **THE EVOLUTION OF WI-FI**





## **DISTRIBUTED CONTROL** WHY IT IS IMPORTANT



#### **Smarter Access Layer**

- Shared control plane increases speed, resiliency, and scale
- No need for dedicated wireless LAN Controllers



# CENTRAL VS. DISTRIBUTED PROCESSING FOR WI-FI, FEATURES, AND APPLICATIONS





More APs with Clients →CPU Capacity Decreases on Controller



Processing at APs



More APs with Clients →CPU Capacity Increases as APs are added

## NEW ARCHITECTURE AND ENHANCED FUNCTIONS



- Application Detection with deep packet inspection
- Layer 2 MAC Firewall
- Layer 3  $\rightarrow$  7 IP and Application Firewall
- Layer 2 and Layer 3 DoS prevention
- OS Fingerprinting
- QoS Policy enforcement queuing and rate limiting
- Fast and Secure Roaming
   Voice enterprise 802.11 r/v/k and OKC
- Multicast to unicast conversion
- RADIUS Server, RADIUS Proxy, Cached Credentials

TOP A	PPLICAT	IONS
RDP	715.93 KB	0.16%
SKYPE	000.45 KB	0,13%
APPLE	478.25 KB	0,1%
ADOBE	437.74 KB	0.09%
CNN	422.96 KB	0.09%
LYNC	398 KB	0.09%
LINKEDIN	395.02 KB	0.09%
ONS	360.24 KB	0.08%

### **CLOUD-MANAGEMENT ARCHITECTURE**



#### **CONFIG / POLICY HEATMAPS** REPORTS **ANALYTICS & APIS** DASHBOARD TROUBLESHOOT 13,555 Infilit O 0 11.11 1.11 CONNECT DISCOVER PROVISION MANAGE GO GROW HQ/ VPN DATA CENTER Ø <u>@</u> **.** B Ø GUESTS **APP VISIBILITY** STAFF BYOD IOT & CONTROL

**Cloud Platform** 

- Public, Private, Local
- Native Multi-Tenant
- Micro-services-based
- Infinitely Scalable
- Native ML/AI
- API-driven

#### **Cloud Networking**

- Self-Organizing
- Self-Optimizing
- Self-Healing

#### **Identity-Driven Control**

- User
- Device
- Application

#### **CLIENT 360**



#### MACHINE LEARNING, HERE TO HELP

#### **FULL VISIBILITY FOR CLIENT HEALTH**

Network, DHCP, DNS, Authentication

#### **AUTOMATIC CLIENT MONITORING**

Capture Events When They Occurred

#### **INTEGRATED TROUBLESHOOTING**

Test Connectivity From A Client Perspective

z-bos-wloan				
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URRENT CONNECTION STATUS	6 M8			
os type Windows 7/Vista	0 M8 16:20:16 18:50:16 21:20:16 23:50:16 02:20:16 04:50:16 07:20:16 09:50:16 12:20:16 14:50:16 =			
IP ADDRESS 192.168.1.10	Connectivity			
MAC ADDRESS F816541328F1				
user AEROHIVE\wlpan	From 08/13/2018 16:20:16 to 08/14/2018 16:20:16 TOP SESSION VIEW * From 08/14/2018 16:20:16 to 08/14/2018 16:20:16			
CONNECTED TO AP16-AP650 Last seen: 8/14/18, 3:36	MOST DATA SENT AND RECEIVED AP10-AP650 CLICK TIMELINE TO CHANGE SELECTED TIME			
VLAN 60	8.4 MB 8 4 MRS 29 MINS 25 SECS 4 07% 7 MINS 2014 15:10:16 07% 7 MINS 2014 14:2018 15:20:16 7 MINS 2014 14:2018 14:20			
CAPTIVE WEB PORTAL Unused	Data is based on divice with most time spent.			
USER PROFILE 60				
RADIO 802.11na   5G	Client Irall Device Name From To Duration RSSI SNR SSID Roam Assoc Auth DHCP Default Cateway ARP DNS			
CHANNEL 149	✓ AP10-AP650 2018-08-14 05:02:43 2018-08-14 07:06:48			
LOCATION       ASSOCIATION       RSSI: -66 dBm   SNR: 28 dB         Association       AuthENTICATION       Protocol: WPA2-802.1X   Status: PASS         Image: Status in the stat				
AUTHENTIC	ATION Protocol: WPA2-802.1X   Status: PASS			
DHCP	Server IP Address: 0.0.0.0   Response Time: N/A   IP Address Obtained: 10.16.107.24			
DEFAULT GA	ATEWAY ARP Default Gateway IP Address: 0.0.0.0   Round-trip Delay: N/A			
DNS Server IP Address: 0.0.0.0   Response Time: N/A				

Questions







# THANK YOU

