

THAIFI DAY #2 | 29 AUGUST 2026

หัวข้อบรรยาย

รีดคุณภาพสัญญาณ Wi-Fi ด้วย การจัดการ Multicast

SPEAKER

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Organized by ThaiFi

Squeezing Wi-Fi Performance: Multicast Management

Reclaiming Wireless Spectrum at Layer 2

ThaiFi Day #2 (2026.08.29)

About the Speaker:

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- Over 10 years of experience in computer networking.
- MikroTik Certified Trainer
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What Is Multicast?



1:1

Unicast

One sender, one receiver
— a private phone call.



1:N

Broadcast

One sender, everyone receives
— whether they want it or not.



1:G

Multicast

One sender, only the group
that “subscribed” receives it.

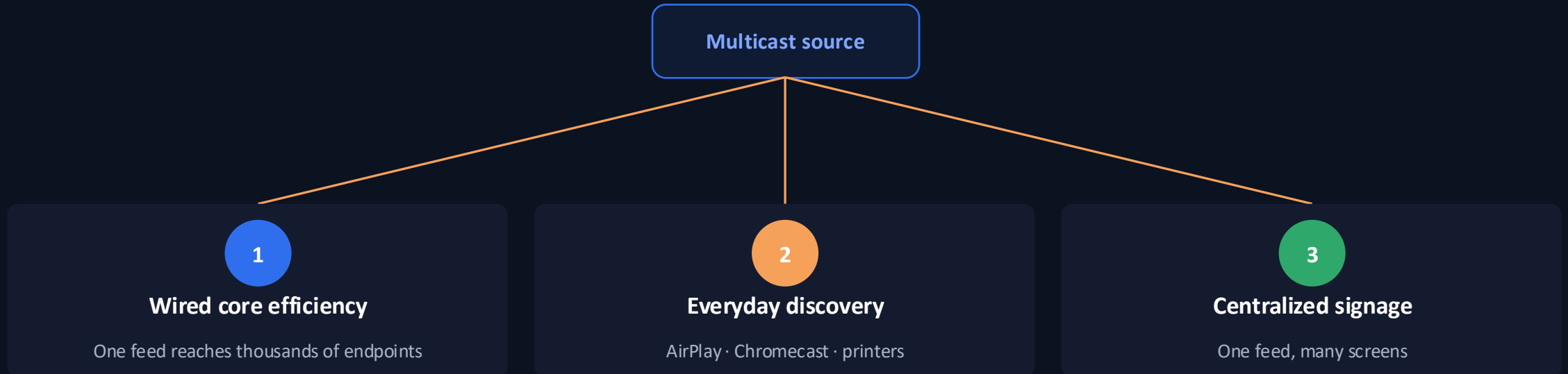
IP MULTICAST ADDRESSING

Class D range: 224.0.0.0 – 239.255.255.255 (IPv4).

IPv6 uses its own multicast prefix, ff00::/8

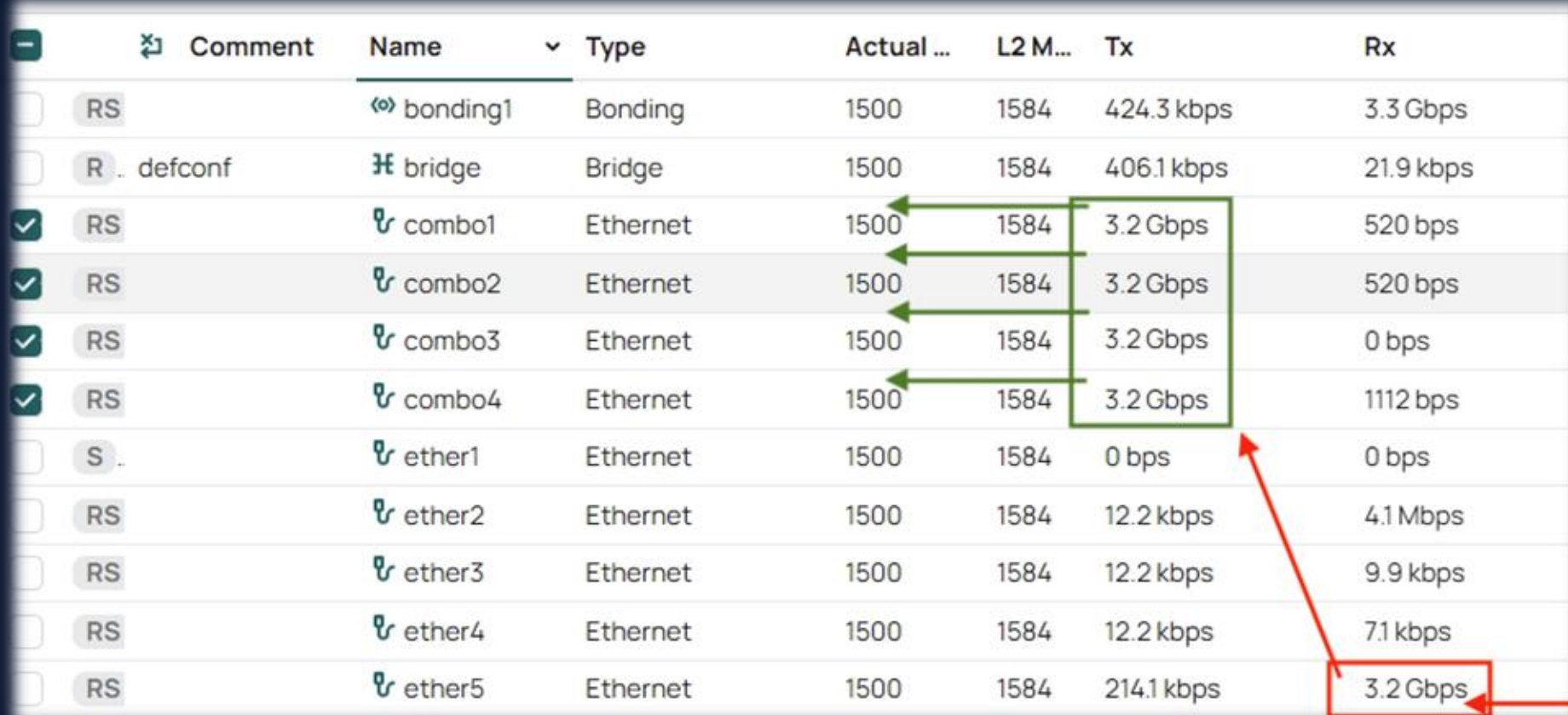
- same subscribe-only idea, different address family. Think of it like a cable TV channel
- only the households that subscribe to that channel receive it, not every house on the street.

Where Multicast Helps You Every Day



"The goal isn't removing multicast — it's managing it."

Example: Multicast traffic



The screenshot shows a Mikrotik WinBox interface with a table of network configurations. The table has columns: Name, Type, Actual ..., L2 M..., Tx, and Rx. The 'combo' interfaces (combo1, combo2, combo3, combo4) are highlighted with a green box, and their Tx values (3.2 Gbps) are indicated by green arrows. The 'ether5' interface is highlighted with a red box, and its Rx value (3.2 Gbps) is indicated by a red arrow. The 'ether1' interface has a Tx value of 0 bps, which is also indicated by a red arrow.

	Comment	Name	Type	Actual ...	L2 M...	Tx	Rx
☐	RS	bonding1	Bonding	1500	1584	424.3 kbps	3.3 Gbps
☐	R .. defconf	bridge	Bridge	1500	1584	406.1 kbps	21.9 kbps
☒	RS	combo1	Ethernet	1500	1584	3.2 Gbps	520 bps
☒	RS	combo2	Ethernet	1500	1584	3.2 Gbps	520 bps
☒	RS	combo3	Ethernet	1500	1584	3.2 Gbps	0 bps
☒	RS	combo4	Ethernet	1500	1584	3.2 Gbps	1112 bps
☐	S ..	ether1	Ethernet	1500	1584	0 bps	0 bps
☐	RS	ether2	Ethernet	1500	1584	12.2 kbps	4.1 Mbps
☐	RS	ether3	Ethernet	1500	1584	12.2 kbps	9.9 kbps
☐	RS	ether4	Ethernet	1500	1584	12.2 kbps	7.1 kbps
☐	RS	ether5	Ethernet	1500	1584	214.1 kbps	3.2 Gbps

Source: MikroTik

The Hidden Cost Nobody Sees

Wired core

Cheap, controlled



multicast moved here

Wi-Fi edge

Expensive, congested

1

No confirmation, no retry

Lost multicast frames vanish silently — nobody resends them.

2

The most expensive real estate

Traffic that used to stay wired now lives on Wi-Fi.

3

More APs won't fix it

More radios just means more radios fighting for the same airtime.

Who's Making the Noise?



mDNS

Mobile devices

AirPlay & Bonjour constantly announce "I'm here" Apple/Android



SSDP

Casting & displays

Chromecast, smart TVs repeat discovery every few minutes



CoAP

IoT sensors

Announce presence on a fixed schedule



ND

IPv6 devices

Neighbor Discovery multicast runs quietly in the background

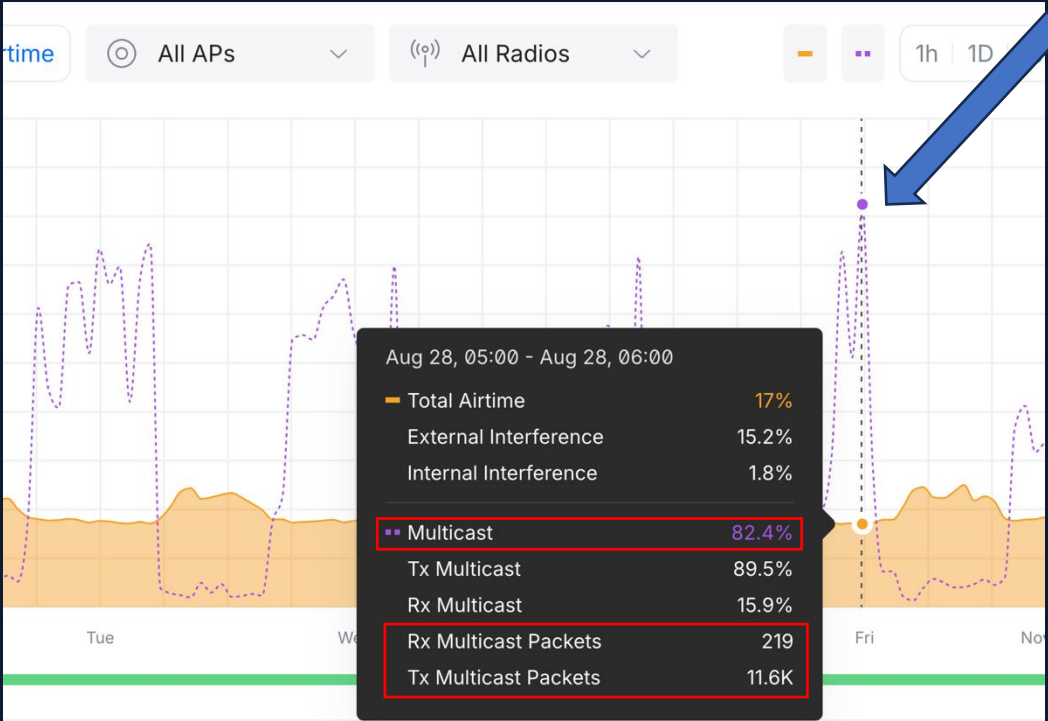
IT DOESN'T STOP AT NIGHT

Devices left powered on keep chattering at a fixed rate, day and night. With fewer people online after hours, this quiet background noise can become the loudest thing on the channel.

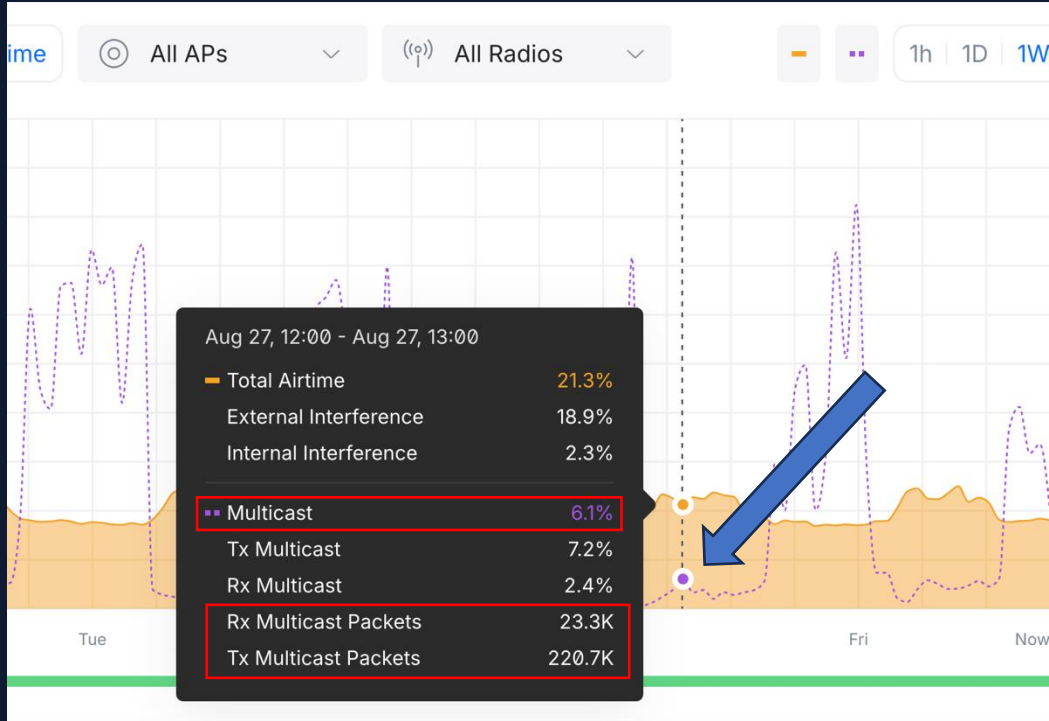
SSDP (Simple Service Discovery Protocol): A UDP multicast-based protocol used to discover UPnP devices and services on a local network (e.g., DLNA, Chromecast).

CoAP (Constrained Application Protocol): A lightweight, UDP-based application protocol (RFC 7252) designed for resource-constrained IoT devices, supporting multicast group communication.

Example: IT DOESN'T STOP AT NIGHT (Multicast : Unicast graph (%))



Night – low unicast >>> (%) Surge

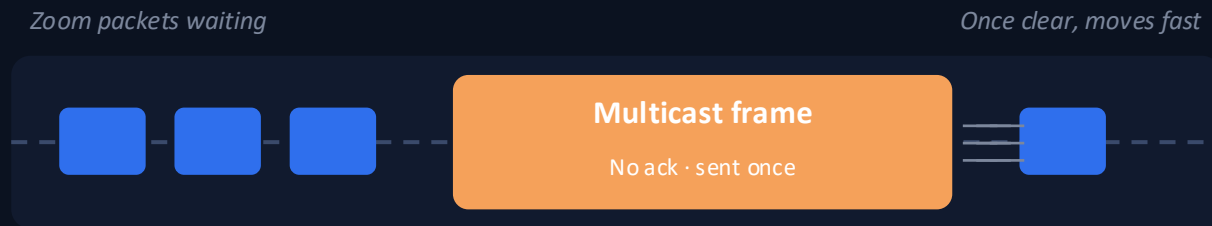


Day – high unicast >>> (%) Drop

"These graphs show continuous multicast traffic even at night. However, further network analysis is required to find the actual impact."

Source: UniFi

Why Multicast Is So Expensive on Wi-Fi



Wi-Fi is one shared lane — nothing else moves until the truck clears it.

6 Mbps Basic Rate

Sent at the network's slowest mandatory speed.

Zero Layer-2 ACKs

No acknowledgment, no automatic retry.

Up to ~100x Airtime Penalty

Worst-case multicast vs. best-case unicast (illustrative).

Reference: RFC 9119, "Multicast Considerations over IEEE 802 Wireless Media" · Standards-level fix in progress: IEEE 802.11aa (GCR), not yet common in deployed hardware

Does This Actually Help Zoom and YouTube?



DIRECT EFFECT: NEAR ZERO

Zoom, Teams, YouTube, TikTok all run unicast over the internet. None of them use IP multicast — there's no multicast group to convert.



INDIRECT EFFECT: THE REAL STORY

Wi-Fi is a shared medium. While a slow multicast frame is on air, nothing else can transmit — including your Zoom call.

“You're not fixing Zoom. You're clearing the road so Zoom's packets don't get stuck behind traffic.”

No real multicast apps in your org (no IPTV, no CCTV, no signage)?

Focus on noise reduction — not multicast-to-unicast conversion, which only helps where true multicast traffic exists.

Get the Noise Off Wi-Fi Entirely



Wire what doesn't move

Smart TVs, printers, desktop PCs — put them on Ethernet.



Give IoT its own lane

Use Zigbee or Thread instead of loading it onto Wi-Fi.



Keep Wi-Fi clean

Reserve the airwaves for what truly needs mobility: laptops and phones.

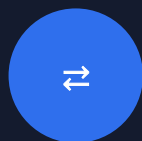
Fixing What's Left on Wi-Fi



Raise Minimum Basic Rate

Forces every device to talk faster, shrinking how long noise sits on air. Trade-off: distant devices may drop — pair with good AP placement.

Configured per-SSID on any enterprise WLC / AP



Multicast-to-Unicast

Converts one slow, unconfirmed frame into fast, individual, confirmed deliveries — only useful where real multicast traffic exists.

Cisco: Multicast-Direct / DMS · Aruba: Dynamic Multicast Optimization · UniFi/TP-Link/Ruijie: Multicast to Unicast · MikroTik: multicast-helper · Ruckus: Directed Multicast



Snoop & Filter at the Switch

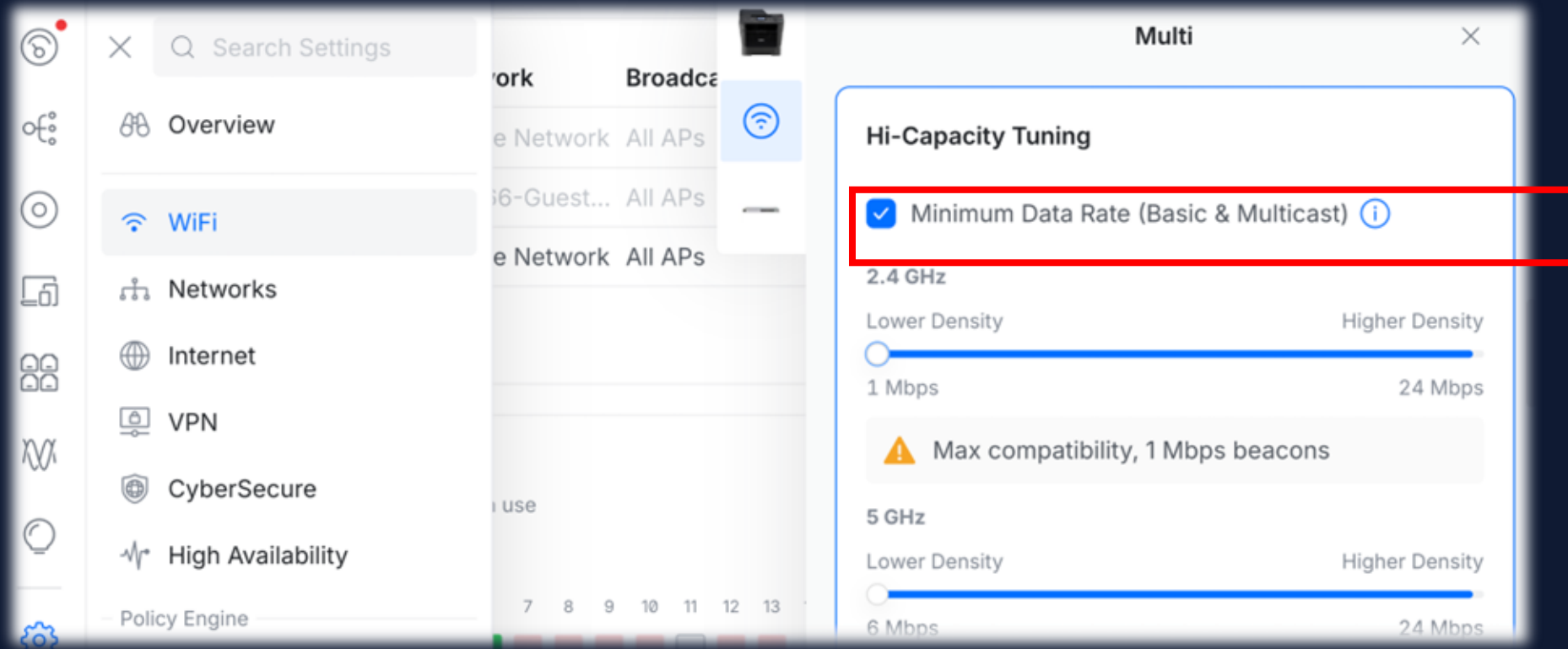
IGMP/MLD Snooping stops forwarding multicast to ports that never asked for it (RFC 4541).

Aruba: AirGroup · Cisco: mDNS Gateway · UniFi: mDNS Proxy · MikroTik/TP-Link: mDNS repeater · Ruckus/Ruijie: Bonjour Gateway

* Unicast replication costs more airtime than native multicast.

** Monitor network stability after tuning the Unicast-to-Multicast feature.

Example: Minimum Basic Rate



Convert Multicast to Unicast per SSID

Source: UniFi

Example: Minimum Basic Rate

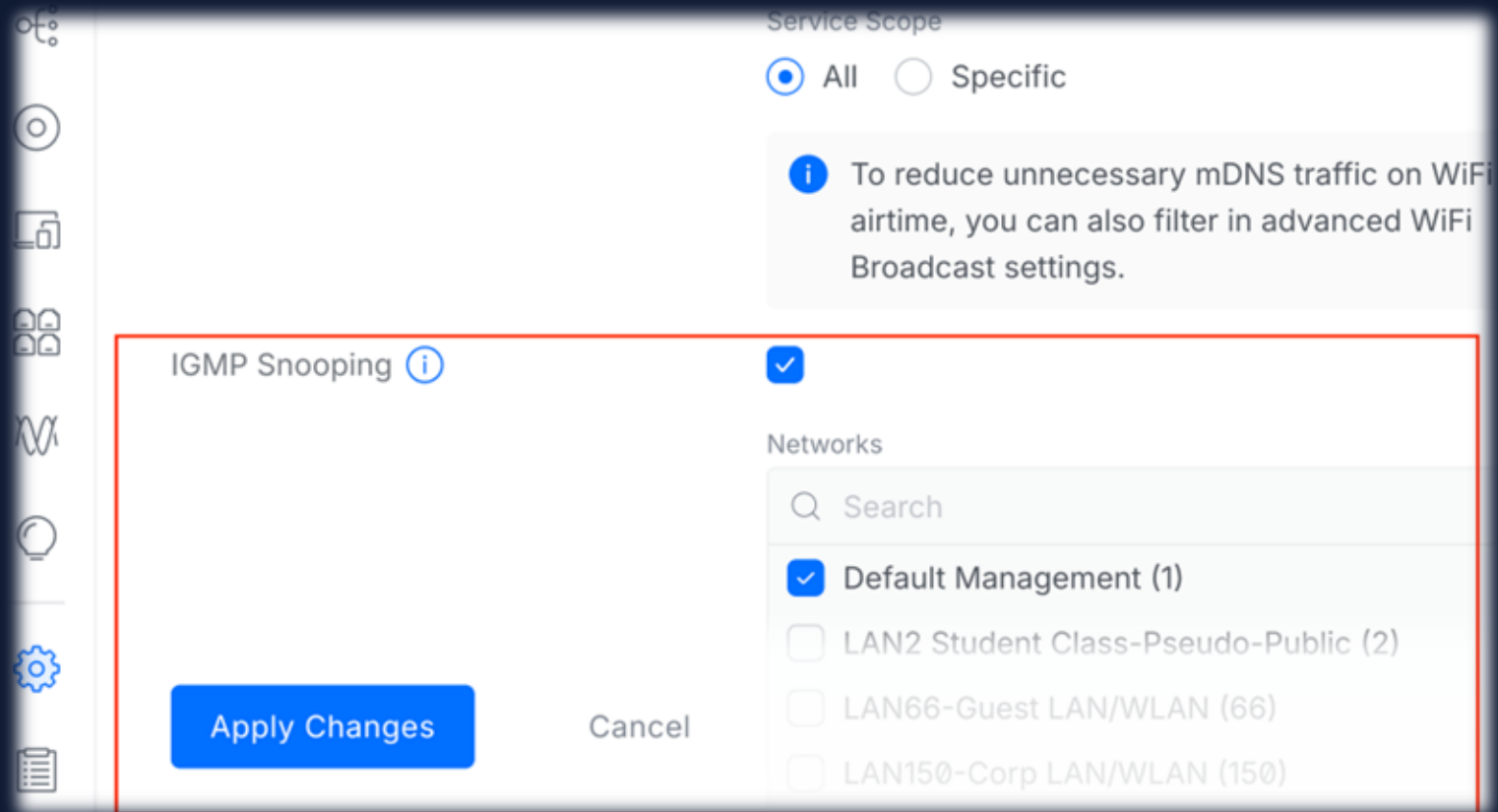
```
Ubiquiti_18:08:53 MDNS 152 224.0.0.251 S
> Radiotap Header v0, Length 36
v 802.11 radio information
  PHY type: 802.11a (OFDM) (5)
  Turbo type: Non-turbo (0)
  Data rate: 6.0 Mb/s
  Channel: 165
  Frequency: 5825MHz
  Signal strength (dBm): -68 dBm
  Noise level (dBm): -100 dBm
  Signal/noise ratio (dB): 32 dB
  TSF timestamp: 3619109962
  > [Duration: 176µs]
v IEEE 802.11 Data, Flags: .p....F.C
  Type/Subtype: Data (0x0020)
  v Frame Control Field: 0x0842
    .... ..00 = Version: 0
    .... 10.. = Type: Data frame (2)
    0000 .... = Subtype: 0
```

before

```
IPv4mcast_fb Ubiquiti_18:08:53 MDNS 253 224.0.0.251
IPv6mcast_fb Ubiquiti_18:08:53 MDNS 273
> Radiotap Header v0, Length 36
v 802.11 radio information
  PHY type: 802.11a (OFDM) (5)
  Turbo type: Non-turbo (0)
  Data rate: 24.0 Mb/s
  Channel: 165
  Frequency: 5825MHz
  Signal strength (dBm): -79 dBm
  Noise level (dBm): -101 dBm
  Signal/noise ratio (dB): 22 dB
  TSF timestamp: 911631486
  > [Duration: 64µs]
> IEEE 802.11 Data, Flags: .p....F.C
> Logical-Link Control
> Internet Protocol Version 4, Src: 172.26.66.254, Dst: 224.0.0.
> User Datagram Protocol, Src Port: 54502, Dst Port: 5353
v Multicast Domain Name System (query)
  > Transaction ID: 0x0000
```

after

Example: IGMP Snooping



The screenshot shows the UniFi Network Settings interface for IGMP Snooping. The 'Service Scope' is set to 'All'. A note indicates that filtering can be used to reduce unnecessary mDNS traffic. The 'IGMP Snooping' checkbox is checked. Below, a list of networks is shown with checkboxes for enabling snooping on each. The 'Default Management (1)' network is selected, while others like 'LAN2 Student Class-Pseudo-Public (2)', 'LAN66-Guest LAN/WLAN (66)', and 'LAN150-Corp LAN/WLAN (150)' are not selected. 'Apply Changes' and 'Cancel' buttons are at the bottom.

Service Scope

☒ All ☐ Specific

i To reduce unnecessary mDNS traffic on WiFi
airtime, you can also filter in advanced WiFi
Broadcast settings.

IGMP Snooping *i* ☒

Networks

Search

☒ Default Management (1)

☐ LAN2 Student Class-Pseudo-Public (2)

☐ LAN66-Guest LAN/WLAN (66)

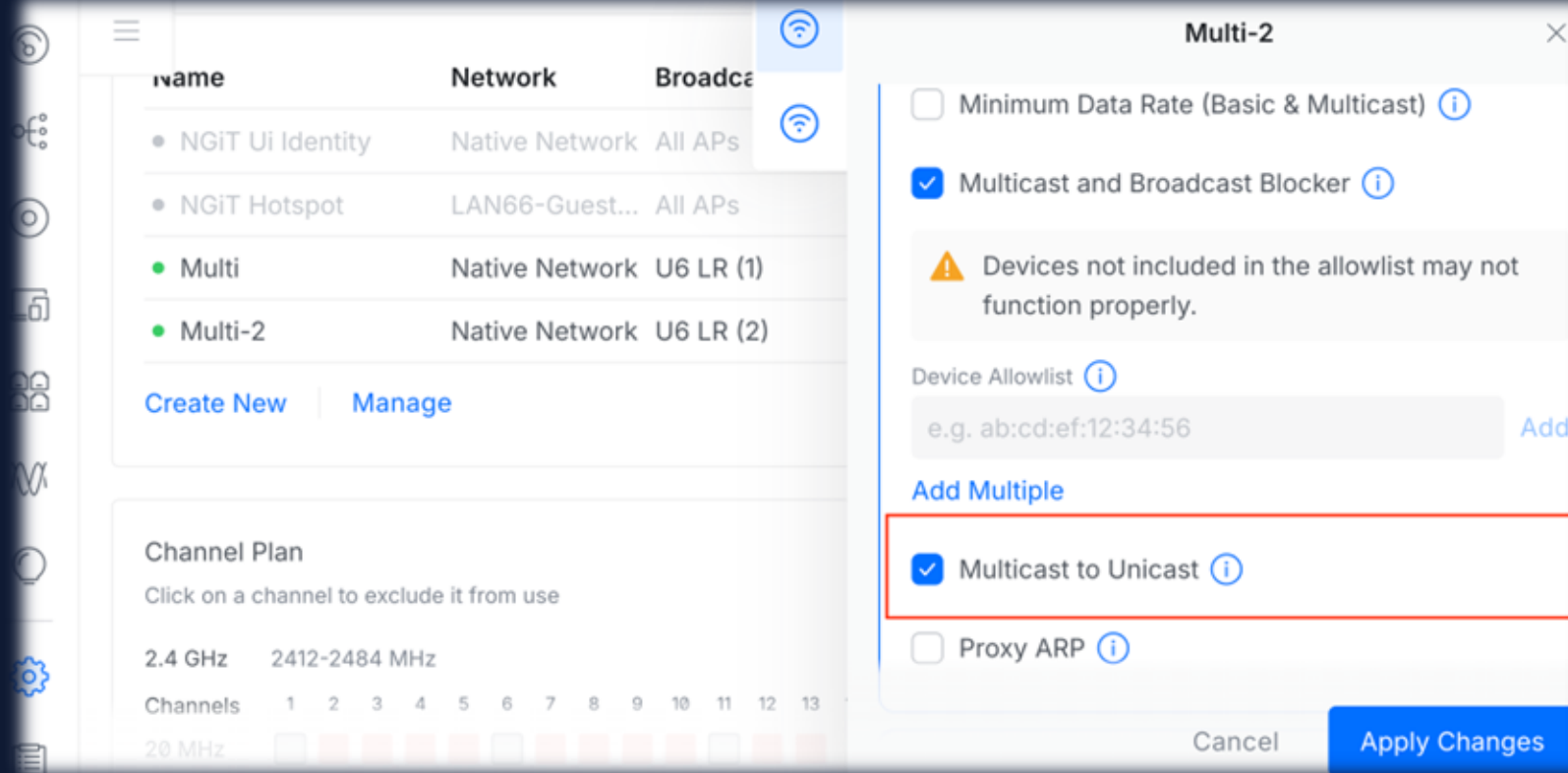
☐ LAN150-Corp LAN/WLAN (150)

Apply Changes Cancel

Can enable (tuning) per network or VLAN segment

Source: UniFi

Example: Multicast to Unicast



Convert Multicast to Unicast per SSID

Converts multicast to unicast for better performance in most networks.

-Best for: Small to medium networks.

-Avoid in: Large-scale deployments. Converting multicast to unicast may increase airtime if many clients are subscribed.

<https://help.ui.com/hc/en-us/articles/27384925962647-Managing-Broadcast-Traffic-with-UniFi>

Source: UniFi

Example: mDNS packet after Multicast to Unicast

```
lect_a4:76:44 0e 66 MDNS 490 10.0.0.33
```

```
> Frame 33548: Packet, 510 bytes on wire (4080 bits), 510 bytes captured (4080 bits) on interface0  
> Radiotap Header v0, Length 58  
v 802.11 radio information  
  PHY type: 802.11n (HT) (7)  
  MCS index: 13  
  Bandwidth: 20 MHz (0)  
  Short GI: False  
  Greenfield: False  
  FEC: LDPC (1)  
  Data rate: 104.0 Mb/s  
  Channel: 11  
  Frequency: 2462MHz  
  Signal strength (dBm): -55 dBm  
  Noise level (dBm): -82 dBm  
  Signal/noise ratio (dB): 27 dB  
  TSF timestamp: 2826700668
```



Where to Start Monday Morning



“You can't fix what you haven't measured.”

Example: Wireshark Filter

Wireshark > Perference > Protocols > IEEE802.11 > Decryption keys > Edit > wpa-pwd > wpa2Key:ssid
filter: eapol #จับ 4-way handshake

(แนะนำให้ทดลองกับ wpa2-psk ในการทำ lab กรณีเป็น Security ประเภทอื่นจะดั่งค่ากันคนละแบบ)

#####

wlan.sa == <MAC ต้นทางที่สนใจ> && wlan.fc.fromds == 1 && wlan.bssid == <BSSID ของ AP ที่ capture> &&
<เงื่อนไขปลายทาง>

"เงื่อนไขปลายทาง":

เป็น multicast/broadcast อะไรก็ได้	:	(wlan.da[0] & 1 == 1)
เป็น multicast แต่ไม่รวม broadcast	:	(wlan.da[0] & 1 == 1) && wlan.da != ff:ff:ff:ff:ff:ff
ถูกส่งตรงถึงเครื่องใดเครื่องหนึ่ง (unicast)	:	wlan.da == <MAC ปลายทาง>
เป็น protocol เฉพาะ (ระบุ IP ปลายทางตรง ๆ)	:	ip.dst == <IP หรือกลุ่ม multicast address>
เป็น protocol เฉพาะฝั่ง IPv6	:	ipv6.dst == <IPv6 multicast address>

ตัวอย่าง ระบุ protocol เช่น

ip.dst == 224.0.0.251	:	mDNS (IPv4)
ipv6.dst == ff02::fb	:	mDNS (IPv6)
ip.dst == 239.255.255.250	:	SSDP

Example: Wireshark Filter

wlan.sa == <MAC ต้นทางที่สนใจ> && wlan.fc.fromds == 1 && wlan.bssid == <BSSID ของ AP ที่ capture> && (wlan.da[0] & 1 == 1) && wlan.da != ff:ff:ff:ff:ff:ff #เป็น multicast แต่ไม่รวม broadcast

DA (Destination)	BSSID	Protocol	Length	Destination Address	Info
IPv4mcast_16	0e:00:00:00:00:00	EAPOL	171		Key (Message 1 of 4)
IPv6mcast_16	0e:00:00:00:00:00	EAPOL	193		Key (Message 2 of 4)
IPv4mcast_fb	0e:00:00:00:00:00	EAPOL	227		Key (Message 3 of 4)
IPv6mcast_fb	0e:00:00:00:00:00	EAPOL	171		Key (Message 4 of 4)
IPv4mcast_fb	0e:00:00:00:00:00	MDNS	353		
IPv6mcast_fb	0e:00:00:00:00:00	MDNS	353		
IPv4mcast_07	0e:00:00:00:00:00	802.11	308		
IPv4mcast_fb	0e:00:00:00:00:00	802.11	333		
IPv6mcast_fb	0e:00:00:00:00:00	MDNS	353		
IPv6mcast_16	0e:00:00:00:00:00	ICMPv6	164		
IPv4mcast_fb	0e:00:00:00:00:00	MDNS	333	224.0.0.251	
IPv6mcast_fb	0e:00:00:00:00:00	MDNS	353		
IPv6mcast_fb	0e:00:00:00:00:00	MDNS	317		
IPv4mcast_fb	0e:00:00:00:00:00	MDNS	215	224.0.0.251	

หลังจากเก็บข้อมูลได้แล้ว จึงค่อยนำไปประมวลผลในลำดับต่อไป

CLOSING THOUGHTS

Airtime Over Bandwidth



Airtime Over Bandwidth

Wi-Fi performance is about managing airtime, not raw signal strength.



Data-Driven Pruning

Analyze L2 traffic, eliminate junk discovery, offload static clients to LAN.



Open Discussion

Multicast Tuning · Real-Time Apps · WLC Policies

***“The RF medium is shared and finite.
Every multicast frame is a tax on every client in the cell.”***

Squeezing Wi-Fi Performance: Multicast Management

Thank you — let's optimize together.