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ARUBA INSTANT BEST PRACTICES & TROUBLESHOOTING

Technical Climb Webinar

12:00 GMT | 13:00 CET | 15:00 GST
March 29th, 2016

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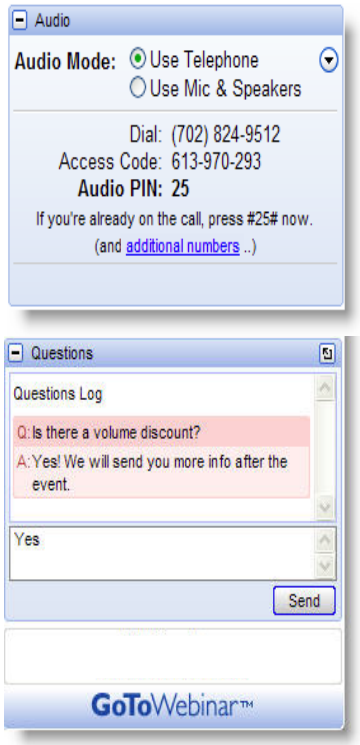

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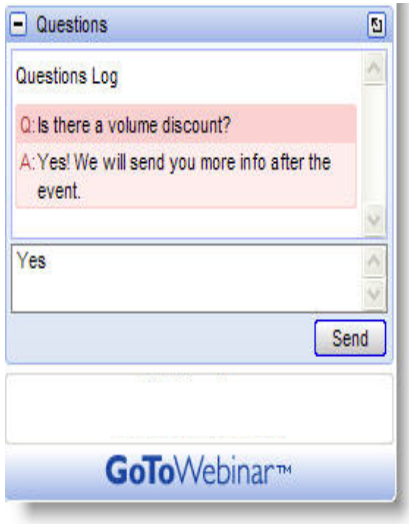

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IDENTIFYING AP AND USER HEALTH

An insight into the areas to analyze, when a given WLAN is experiencing AP or User related performance issues.

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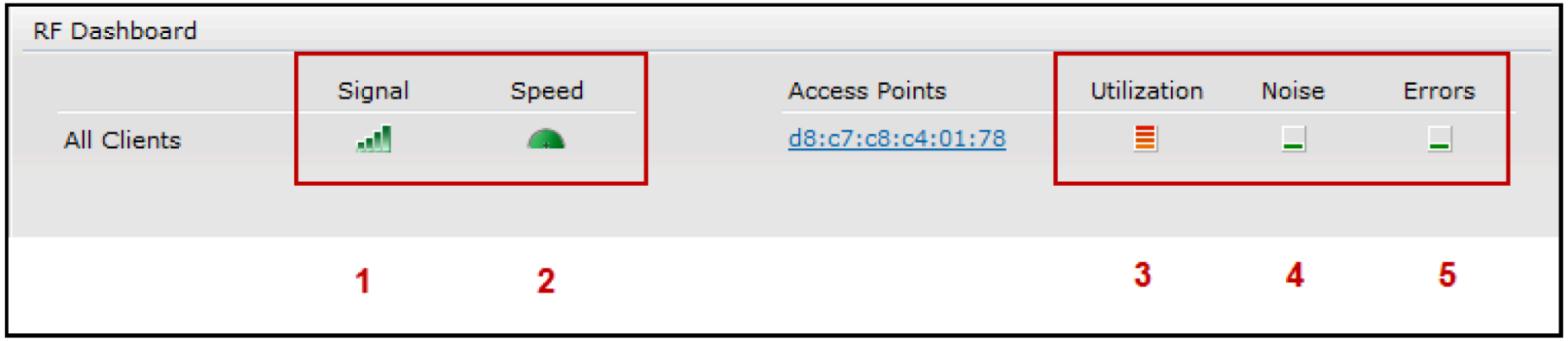
What is User Health?



Major Focus Areas:

1 Client Signal Strength

2 Client Throughput

Signal:

Green – 20dB

Orange – 15 – 20 dB

Red – <15 dB

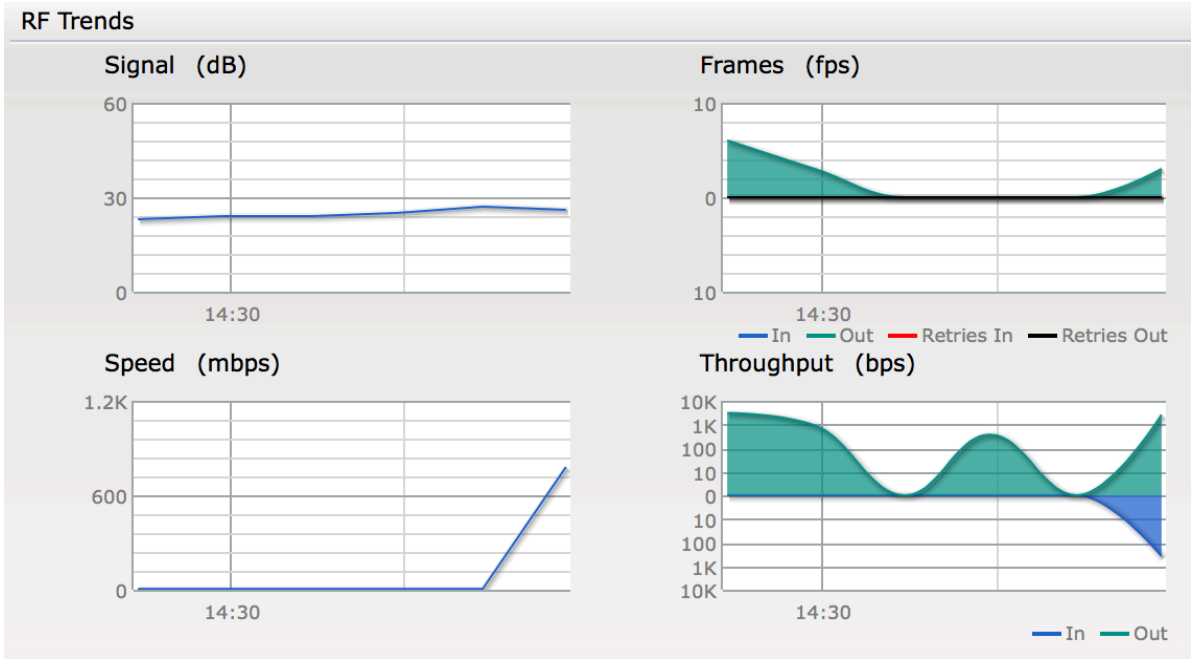
Speed:

Green – >50% of Max

Orange – 25% – 50% of Max

Red – <25% of Max

What are the key factors for quick overview?



RF Trends:

This reading is available on IAP on a per client basis. For WMM deployments,

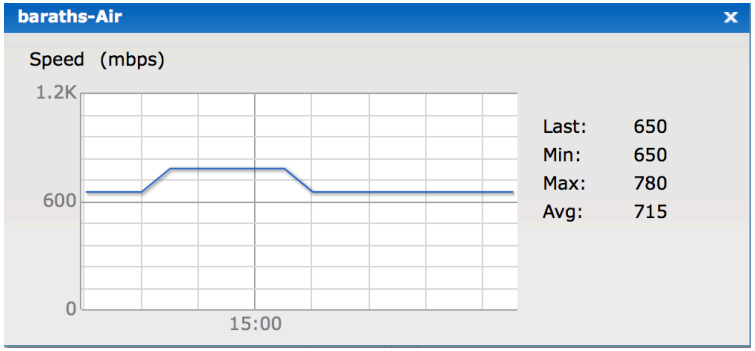
Signal (dB):
<15 Poor
15 – 25 Acceptable
>25 Good

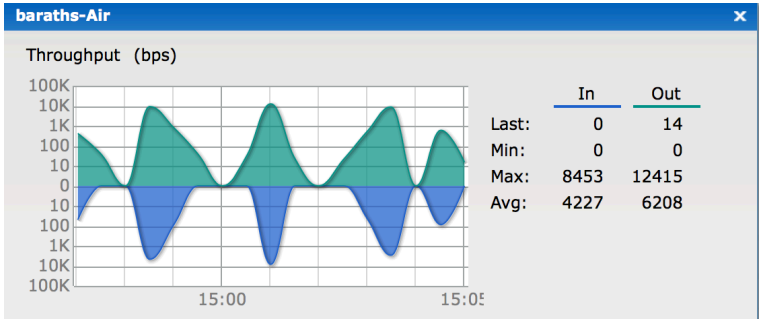
Frames per sec:

Tx/Rx Retries are the prime factors to be observed here.

Acceptable values differ according to type of deployment and traffic.

What are the key factors for quick overview?





Speed and Throughput:

Client bandwidth and throughput are directly related entities.

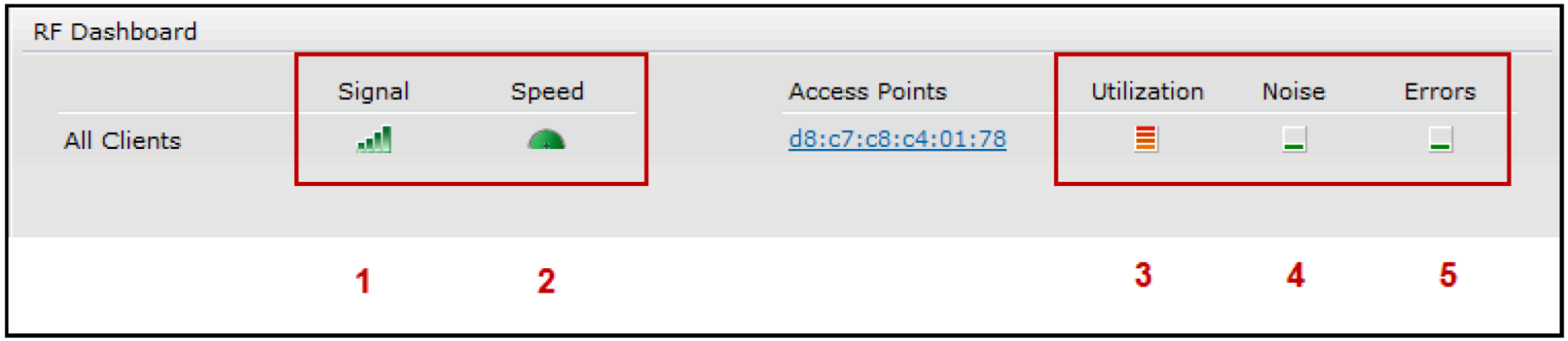
While fluctuations are acceptable for DATA-ONLY WLAN's,

Deployments which focuses on VoWLAN require a consistent and cleaner environment

Latency sensitive environments such as Warehouses (Read: Barcode scanners) and Health care facilities (Patient monitoring systems) require low retry, low interference, low bit error error rate and sometimes high throughput wireless network.

We can use this data as a dip-stick to optimize the client performance

How do I determine if an AP is healthy?



Utilization: %

Green - <50%

Orange – 50-75%

Red - >75%

Noise Floor: dBm

Green - >87 dBm

Orange – 80 dBm – 87 dBm

Red - <80 dBm

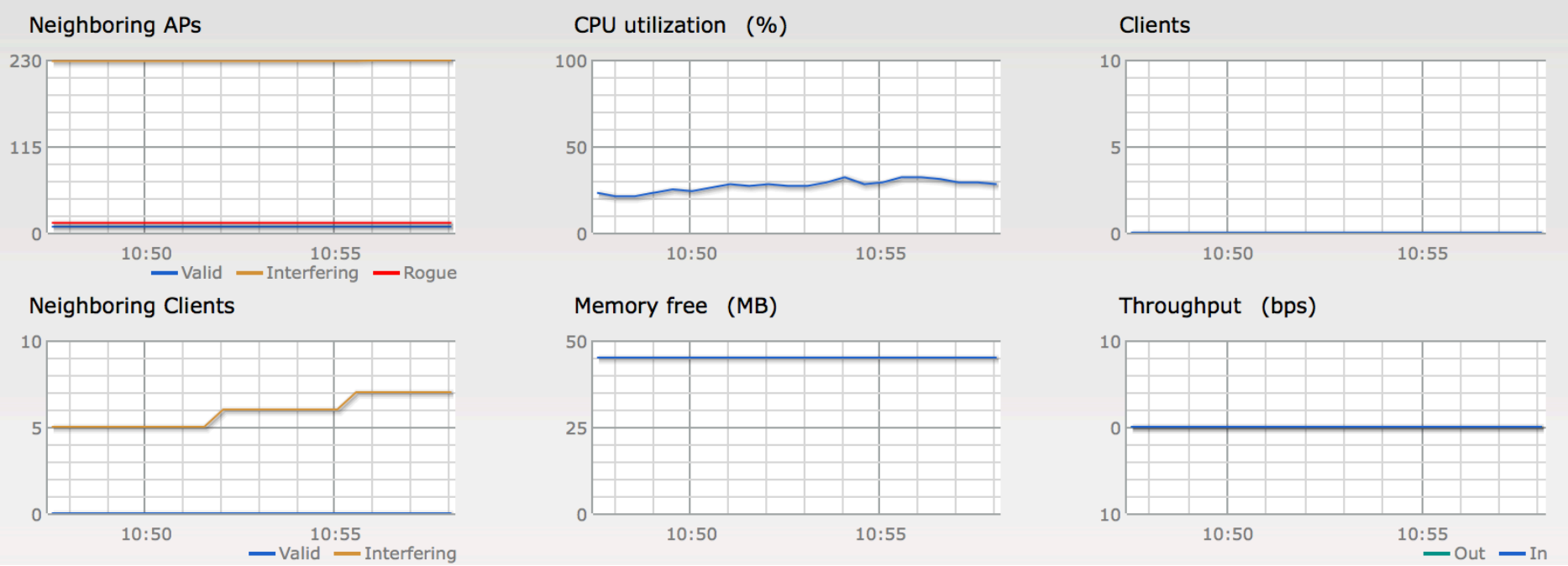
Error rate: fps

Green - <5000 fps

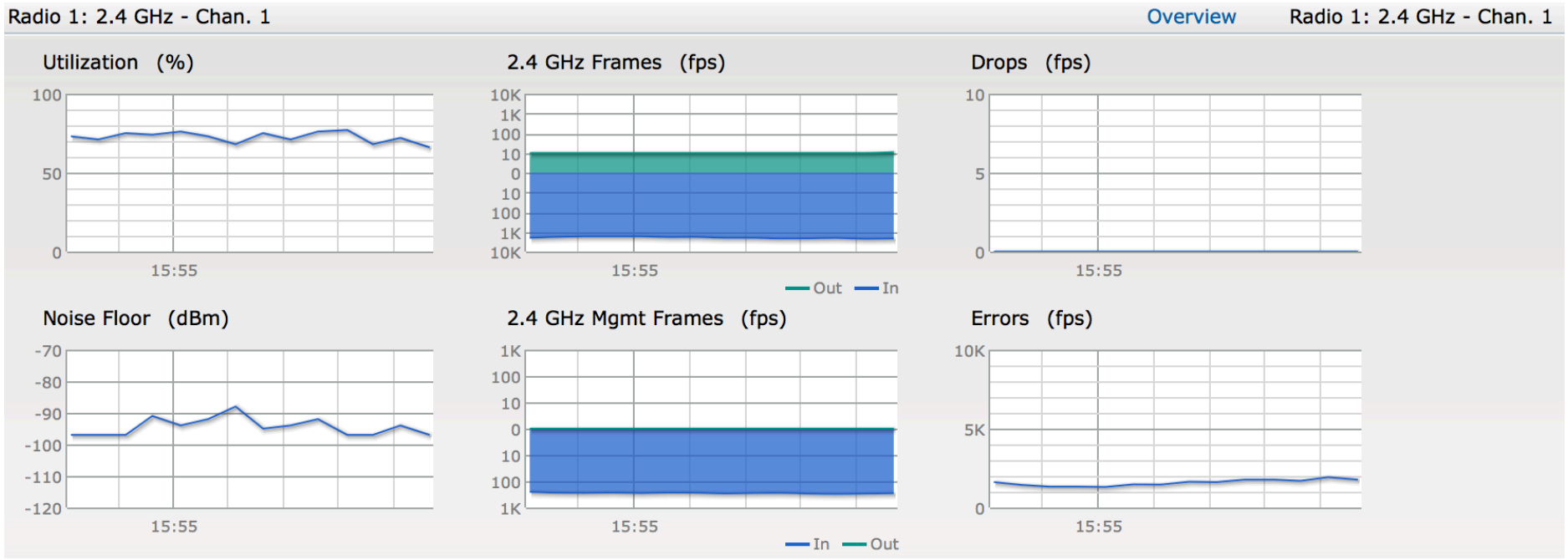
Orange – 5000 – 10000 fps

Red - >10000 fps

Instant Access point Overview



Instant Access point Per radio utilization



CLIENT CONNECTIVITY TROUBLESHOOTING

What are the important commands to analyze in order to isolate a client connectivity issue

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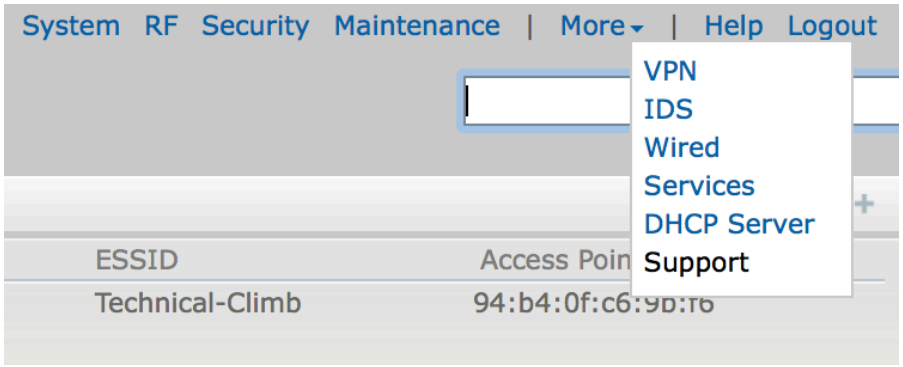
Prerequisites for working on client connectivity

Ensure to have the following information made available to you by the End-User or Customer, Before beginning to work on client connectivity issues.

- Nature of the problem – Frequent disconnection, Unable to associate, Does not work in specific area, Low speed, etc
- Magnitude of the issue reported – How many clients are affected, Partial or complete outage
- Client specific information – Mac or IP address, Client device type, OS and driver version, SSID to which client connects
- Replicable – Is the issue replicable consistently or occurs on a random basis
- Deployment History – Was the issue present since deployment? Did the customer do a code upgrade or config change?

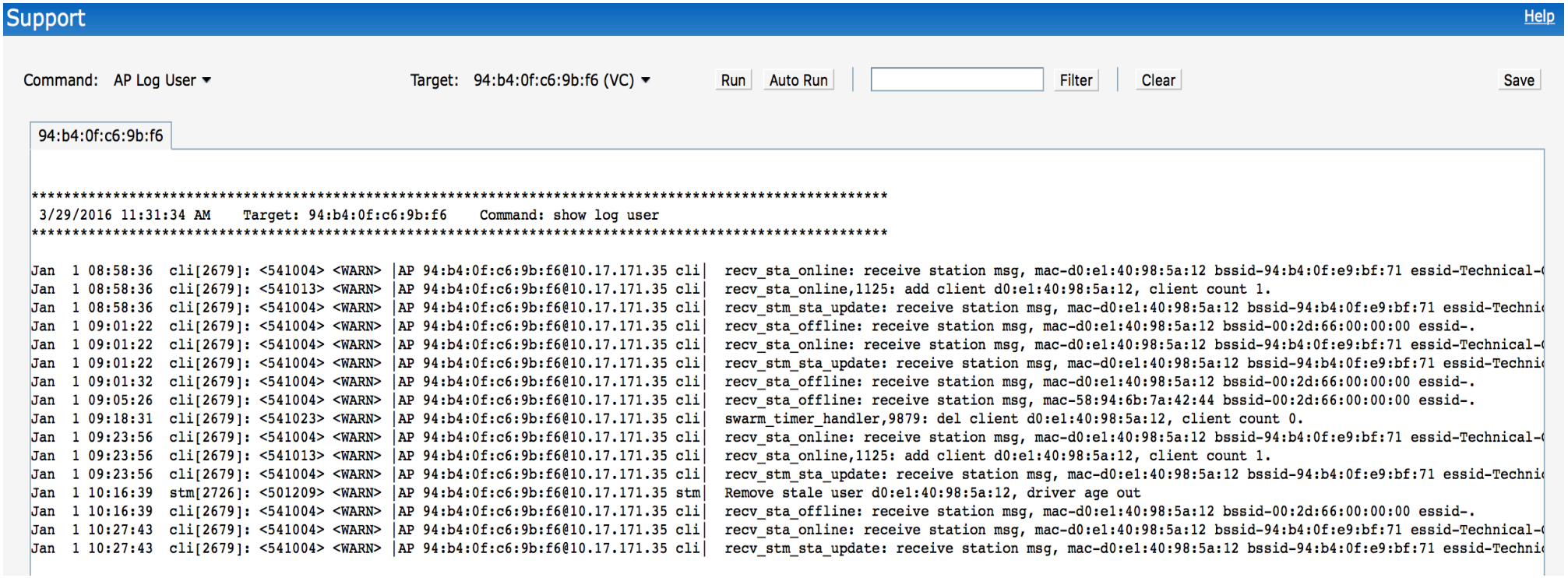
Access the support shell



Useful support commands to isolate the cause

Command: show log user

Purpose: Useful to identify user association pattern and potential causes for disconnection



Useful support commands to isolate the cause

Command: show ap association Purpose: Verify if the user is indeed associating to the intended access point/radio band or not

Command: AP Association Table Target: 94:b4:0f:c6:9b:f6 (VC) Run Auto Run Filter Clear Save

94:b4:0f:c6:9b:f6

```
**********************************************************************************************************
 3/29/2016 11:42:27 AM    Target: 94:b4:0f:c6:9b:f6    Command: show ap association
**********************************************************************************************************

The phy column shows client's operational capabilities for current association

Flags: A: Active, B: Band Steerable, H: Hotspot(802.11u) client, K: 802.11K client, R: 802.11R client, W: WMM client, w: 802.11w client V: 802.11v BSS trans capable

PHY Details: HT   : High throughput;      20: 20MHz;  40: 40MHz; t: turbo-rates (256-QAM)
             VHT  : Very High throughput; 80: 80MHz; 160: 160MHz; 80p80: 80MHz + 80MHz
             <n>ss: <n> spatial streams

Association Table
-----------------
Name               bssid              mac                auth  assoc  aid  l-int  essid            vlan-id  tunnel-id  phy              assoc. time  num assoc  Flags  DataReady
----               -----              ---                ----  -----  ---  -----  -----            -------  ---------  ---              -----------  ---------  -----  ---------
94:b4:0f:c6:9b:f6  94:b4:0f:e9:bf:71  d0:e1:40:98:5a:12  y     y      1    10     Technical-Climb  3333     0x0        a-VHT-80sgi-2ss  37m:26s      1          W      Yes (Implicit)
Num Clients:1
```

Useful support commands to isolate the cause

Command: show network

Purpose: If a specific client is experiencing coverage issues, would it be possible that the AP is frequently dropping out of the cluster and overwrites with a different config, which causes it to not broadcast the intended ESSID to the end user?

Specifically applicable for customer environments with high congestion on wired network.

Command: AP ESSID Table ▾ Target: 94:b4:0f:c6:9b:f6 (VC) ▾ Run Auto Run Filter

94:b4:0f:c6:9b:f6

```
**********************************************************************************************************
 3/29/2016 11:48:24 AM    Target: 94:b4:0f:c6:9b:f6    Command: show network
**********************************************************************************************************

Networks
--------
Profile Name     ESSID            Clients  Type      Band  Authentication Method  Key Management  IP Assignment  Status   Zone  Coding
------------     -----            -------  ----      ----  ---------------------  --------------  -------------  ------   ----  ------
Tech-Climb       Tech-Climb       0        employee  all   None                   WPA2-AES        Default VLAN   Enabled  -     Default
Technical-Climb  Technical-Climb  1        employee  all   None                   WPA2-AES        NAT Mode       Enabled  -     Default
```

Useful support commands to isolate the cause

Command: show ap bss-table Purpose: Used to identify is a specific radio band is broadcasting the required ESSID or not

Command: AP BSSID Table ▾ Target: 94:b4:0f:c6:9b:f6 (VC) ▾ Run Auto Run Filter

94:b4:0f:c6:9b:f6

```
**********************************************************************************************
 3/29/2016 11:53:48 AM    Target: 94:b4:0f:c6:9b:f6    Command: show ap bss-table
**********************************************************************************************

Aruba AP BSS Table
------------------
bss                ess              port  ip            phy    type  ch/EIRP/max-EIRP  cur-cl  ap name            in-t(s)  tot-t
---                ---              ----  --            ---    ----  ----------------  ------  -------            -------  -----
94:b4:0f:e9:bf:70  Tech-Climb       ?/?   10.17.171.35  a-VHT  ap    52E/22/22         0       94:b4:0f:c6:9b:f6  0        6m:3s
94:b4:0f:e9:bf:71  Technical-Climb  ?/?   10.17.171.35  a-VHT  ap    52E/22/22         1       94:b4:0f:c6:9b:f6  0        2h:15m:13s
94:b4:0f:e9:bf:60  Tech-Climb       ?/?   10.17.171.35  g-HT   ap    1/21/21           0       94:b4:0f:c6:9b:f6  0        6m:3s
94:b4:0f:e9:bf:61  Technical-Climb  ?/?   10.17.171.35  g-HT   ap    1/21/21           0       94:b4:0f:c6:9b:f6  0        2h:15m:13s

Channel followed by "*" indicates channel selected due to unsupported configured channel.
"Spectrum" followed by "^" indicates Local Spectrum Override in effect.

Num APs:4
Num Associations:1
```

Useful support commands to isolate the cause

Command: show ap debug radio-stats 0

Purpose: If the customer is reporting that their users are noticing very low data transfer speeds despite having low number of clients associated on a per AP basis, this command becomes quite useful.
It can be used to identify what is the fluctuation in channel busy percentage. NOTE: Radio '0' denotes 5Ghz radio

Command: AP Radio 0 Stats ▾ Target: 94:b4:0f:c6:9b:f6 (VC) ▾ Run Auto Run

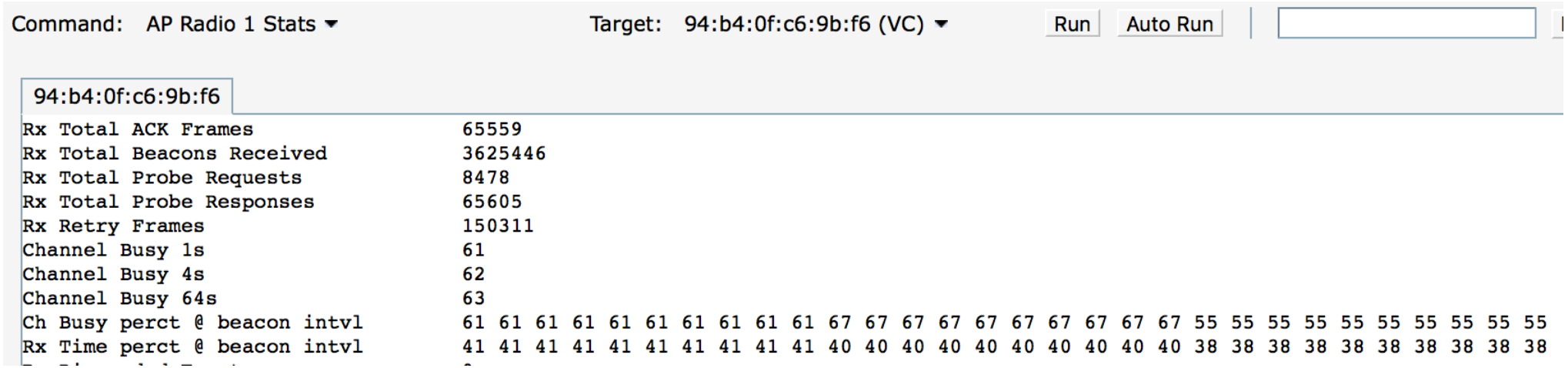
94:b4:0f:c6:9b:f6

Rx Total Data Bytes Recvd	1192939505
Rx Total RTS Frames Recvd	1805822
Rx Total CTS Frames Recvd	1997371
Rx Total ACK Frames	1884378
Rx Total Beacons Received	8038809
Rx Total Probe Requests	151723
Rx Total Probe Responses	1082573
Rx Retry Frames	376897
Channel Busy 1s	25
Channel Busy 4s	30
Channel Busy 64s	30
Ch Busy perct @ beacon intvl	25 25 25 25 25 25 25 25 25 25 30 30 30 30 30 30 30 30 30 30 35 35 35 35 35 35 35 35 35 35
Rx Time perct @ beacon intvl	20 20 20 20 20 20 20 20 20 20 21 21 21 21 21 21 21 21 21 21 23 23 23 23 23 23 23 23 23 23

Useful support commands to isolate the cause

Command: show ap debug radio-stats 1

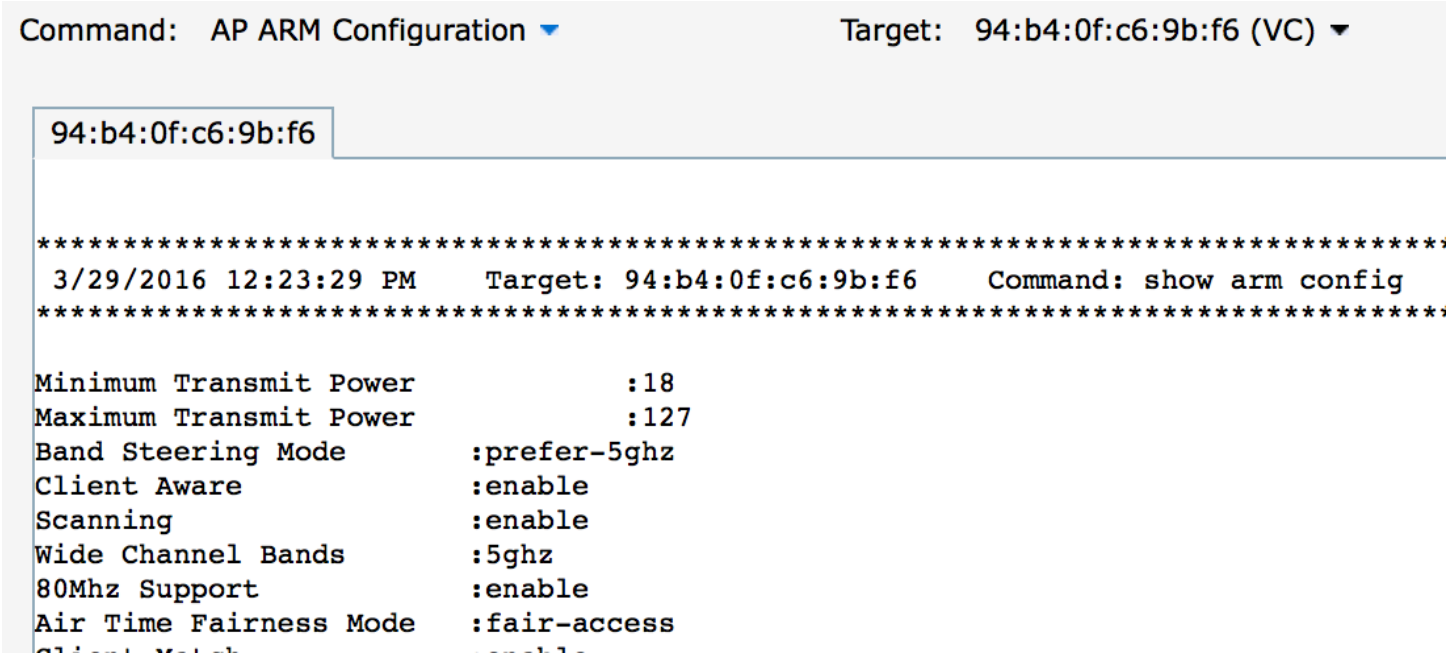
Purpose: If the customer is reporting that their users are noticing very low data transfer speeds despite having low number of clients associated on a per AP basis, this command becomes quite useful.
It can be used to identify what is the fluctuation in channel busy percentage. NOTE: Radio '1' denotes 2.4Ghz radio



Useful support commands to isolate the cause

Command: show arm config

Purpose: To have a quick overview of the Adaptive radio management configuration and determine the power setting configuration when working on low client signal issues



Useful support commands to isolate the cause

Command: show arm-channels

Purpose: Channels enabled for ARM to move the AP's to beacon on

Command: AP ARM Channels ▾ Target: 94:b4:0f:c6:9b:f6 (VC) ▾

94:b4:0f:c6:9b:f6

```
********************************************************************************
 3/29/2016 12:36:15 PM    Target: 94:b4:0f:c6:9b:f6    Command: show arm-channels
********************************************************************************

2.4 GHz
-------
Channel  Status
-------  ------
1        enable
2        disable
3        disable
4        disable
5        disable
6        enable
7        disable
8        disable
9        disable
10       disable
11       enable
```

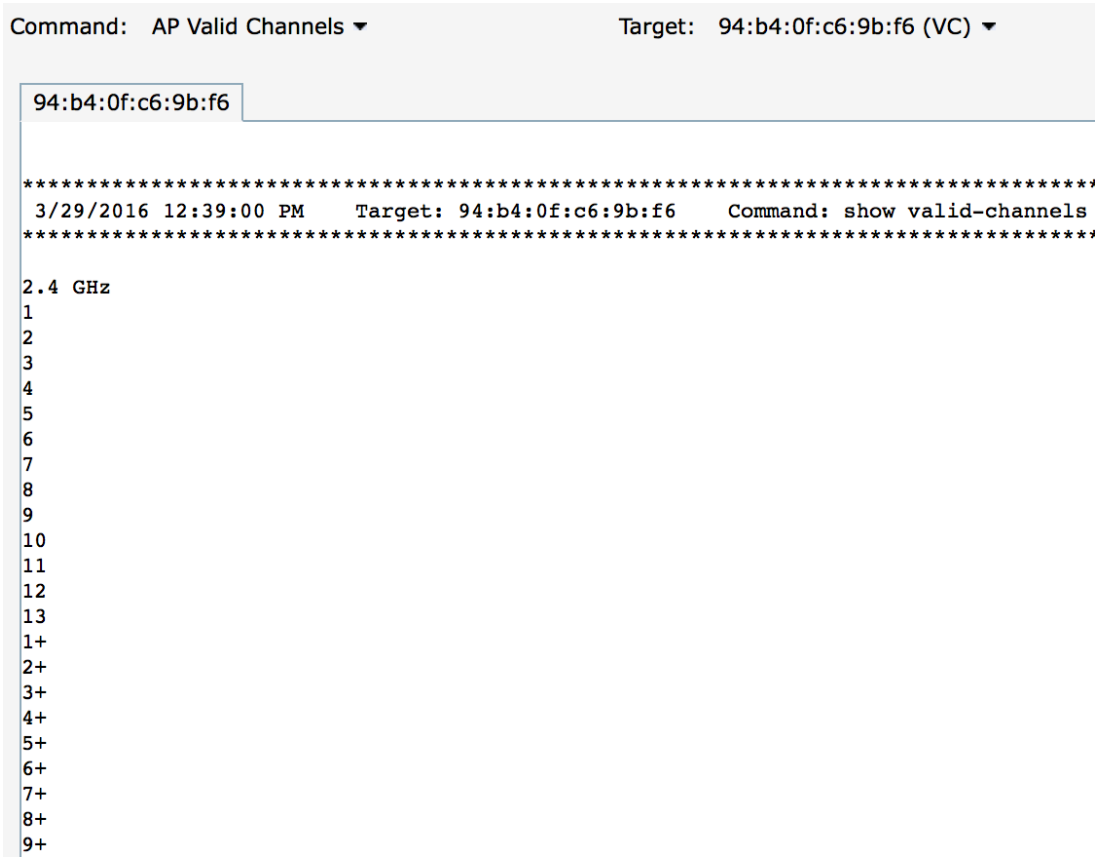
Useful support commands to isolate the cause

Command: show valid-channels

Purpose: Channels enabled for the designated AP radio to scan the immediate WLAN environment.

The data acquired through these scans helps the VC to build a repository which determines the best channel to which the AP can move, in the event that the existing channel becomes too congested for optimal client performance.

NOTE: This is frequently confused with ARM channels. It is vital to be able to clearly differentiate between what are valid channels and ARM channels



Useful support commands to isolate the cause

Command: show ap arm history

Purpose: If there is an excessive interference in the WLAN network or if there is a coverage hole in the network, ARM has the ability to adjust the AP's channel and power accordingly to optimize performance.

In this example, we see that there are numerous channel changes occurring where the reason is mention as
I – denoting 'Interference'

Command: AP ARM History ▾ Target: 94:b4:0f:c6:9b:f6 (VC) ▾

94:b4:0f:c6:9b:f6

```
********************************************************************************
 3/29/2016 12:44:17 PM    Target: 94:b4:0f:c6:9b:f6    Command: show ap arm history
********************************************************************************

Interface :wifi0
ARM History
-----------
```

Time of Change	Old Channel	New Channel	Old Power	New Power	Reason
1970-01-01 11:56:03	149E	36E	24	24	I
1970-01-01 11:49:43	52E	149E	24	24	I
1970-01-01 09:17:51	36E	52E	24	24	I
1970-01-01 09:12:36	149E	36E	24	24	I
1970-01-01 08:47:52	36E	149E	24	24	I
1970-01-01 08:41:26	149E	36E	24	24	I
1970-01-01 08:36:44	36E	149E	24	24	I
1970-01-01 08:29:27	149E	36E	24	24	I
1970-01-01 08:24:49	52E	149E	24	24	I
1970-01-01 08:01:53	52E	52E	Max	24	P-

Useful support commands to isolate the cause

Command: show ap arm neighbors

Purpose: The AP would be scanning the list of valid channels and during this scan, it would be able to detect the neighboring BSSID, ESSID, Channel, SNR, tx-power of discovered radio, Path loss and the type of scan via the discovery was made.

This information is useful when working with customers who have their IAP network setup in a multitenant environment and to verify if any of the neighboring BSS are encroaching on a channel allocated to the customer in concern.

Command: AP ARM Neighbors ▾ Target: 94:b4:0f:c6:9b:f6 (VC) ▾

94:b4:0f:c6:9b:f6

ARM Neighbors

bssid	essid	channel	snr	tx-power	PL (dB)	AP Flags	La
18:64:72:a0:76:52	alpha-wpa2	64	43	18	66	Passive	
18:64:72:02:0b:91	rguestcpt	56	46	21	68	Passive	
18:64:72:02:0b:92	rguestcpat	56	45	21	68	Passive	
18:64:72:02:0b:93	GUHOAdev	56	46	21	68	Passive	
18:64:72:02:0b:94	leowavet	56	45	21	68	Passive	
9c:1c:12:8a:7c:31	test123	52	8	22	105	Passive	
40:e3:d6:be:2c:31	ssid_914	52	15	18	100	Passive	
40:e3:d6:be:2c:35	ssid_8514	52	12	18	100	Passive	

BEST PRACTICES

Default WLAN config is not suitable for all customer environments.

The following section gives a preview of how to right-size a given WLAN depending on requirements and environmental conditions.

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Best Practices – Network RightSizing

What is meant by network Right-Sizing?

It is a proven fact that network rightsizing results in cutting network operation costs by 70%.
Converging from wired to wireless would be the first step but optimizing the WLAN environment for best performance is absolute key for your customers to achieve this result.

You can refer the following data for in-depth details,

http://www.arubanetworks.com/pdf/technology/whitepapers/wp_Rightsizing.pdf

http://www.arubanetworks.com/assets/so/SB_Rightsizing.pdf

Optimizing a poorly performing WLAN may result in customers requiring fewer data ports to be active, Also the connected devices can utilize the VHT data rates along with mobility, which results in an extremely agile as well as high performing access network for your customers.

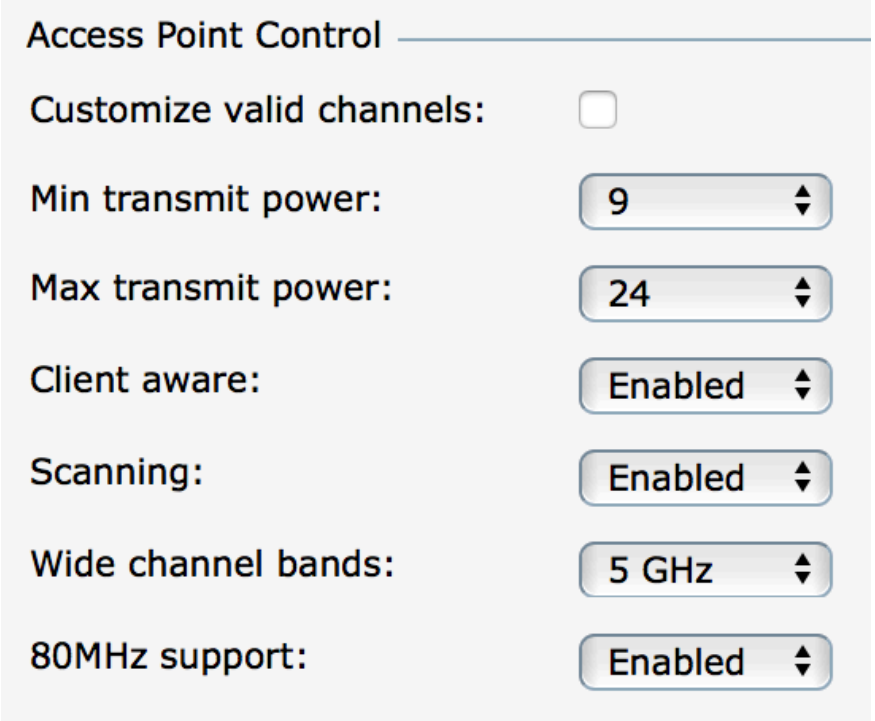
The primary bottleneck is during the post-deployment phase, where the deployed network under-performs.
Let us have a quick overview on how to help customers optimize this and take advantage of their HPE-Aruba WLAN.

Adaptive Radio Management Config – AP Tx Power

Adjust the AP's transmit power to suit the customer environment.
More Tx power does not always mean that the AP is performing at its best.

While this could mean that the AP is going to have a larger coverage cell,

If the Min Tx power of the AP is forced to a higher value, it is very much likely to cause Interference for a valid neighbor AP in the cluster, Especially in the 2.4Ghz radio as the channels get re-used more frequently compared to 5Ghz



Adaptive Radio Management Config – AP Tx Power

How do I quickly determine what would be a suitable Tx power range for a customer? They cannot budget a site survey just for this purpose.

The customer does not have to run a WLAN network analysis to determine this.
Observe the Tx EIRP of the AP's in the cluster, if the Min Tx is set to 18 and most of the AP's
are reporting their Tx EIRP as '18', then the next step would be to check whether we have ARM doing excessive channel changes with the reason being "I - Interference".

LOGIC:
As the Min Tx has already been capped at a high value, the AP is trying to shrink its cell size.
However, it cannot push lower than 18, hence it keeps bouncing between multiple channels.

Adaptive Radio Management Config – AP Tx Power

What is the next course of action if we see that AP's are either stuck at Min Tx Or Max Tx EIRP?

While its permissible for AP's to use Min and Max Tx power levels, a network wide usage of this signifies room for improvement.

Min Tx – Excessive coverage
Max Tx – Potential coverage hole

If AP's are stuck in Min Tx, try and reduce the ARM Min Tx value by 3 dBm until the AP stops reporting interference

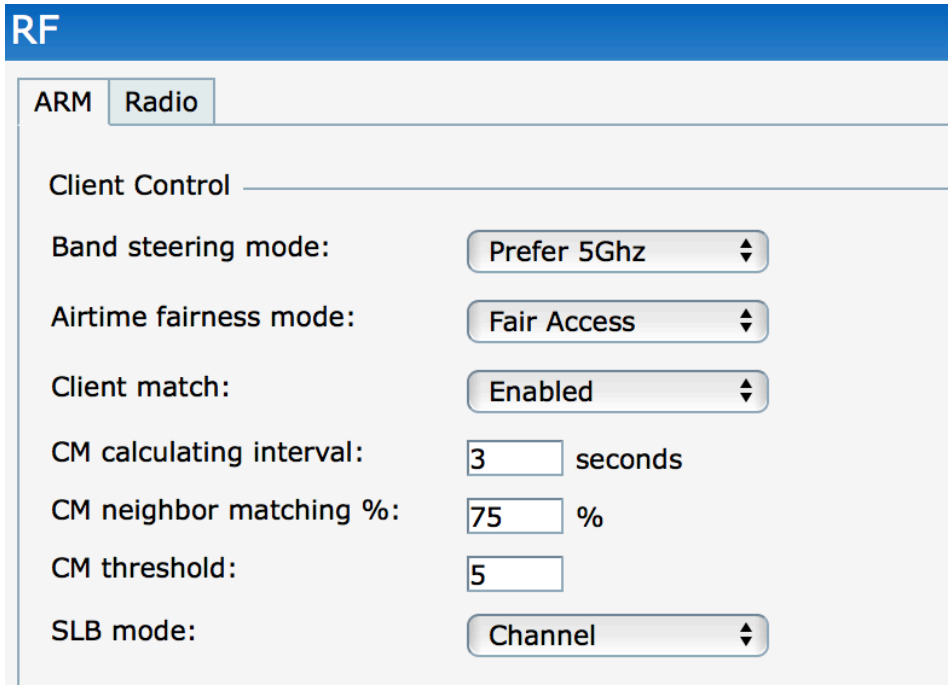
If the AP is stuck in Max Tx, Check whether there are any AP coverage holes and the specific AP may need to be moved/oriented, else the area might require an additional access point.

Band Steering – Prefer 5Ghz

Ensure customer network uses band steering whenever permissible.
Default configuration is as below and may not be applicable for all customers.

There are three modes for Band steering with the default being – Prefer 5Ghz. If the conditions below are met, the AP will not respond to 2.4Ghz probe from the client.

- The client has already probed the AP on the 5Ghz band and therefore is known to be capable of sending probes on the 5Ghz band.
- The client is not currently associated on the 2.4Ghz radio to this AP.
- The client has sent less than 8 probes requests/auth in the last 10 seconds. If the client has sent more than 8 probes in the last 10 seconds, the client will be able to connect using whatever band it prefers



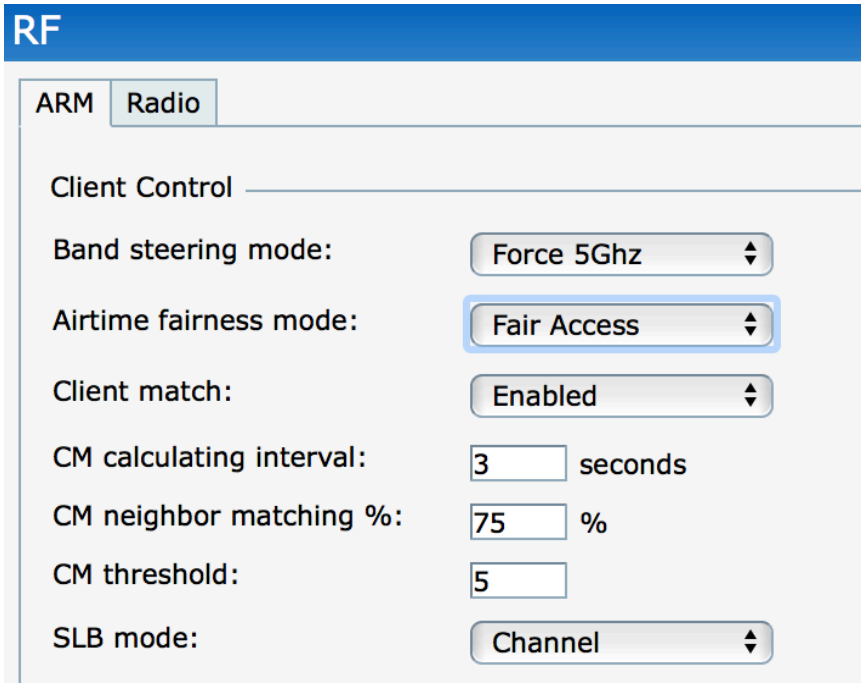
Band Steering – Force 5Ghz

Ensure customer network uses band steering whenever permissible.
Default configuration is as below and may not be applicable for all customers.

Force 5Ghz is applicable in cases where we have an already very crowded 2.4Ghz spectrum and additionally, the available 5Ghz clients are exhibiting sticky client behavior are not preferring to join 5Ghz radio.

AP will stop responding to client's 2.4Ghz probe, if

- The client has already probed the AP on the 5Ghz band and therefore is known to be capable of sending probes on the 5Ghz band.
- The client is not currently associated on the 2.4Ghz radio of this AP.



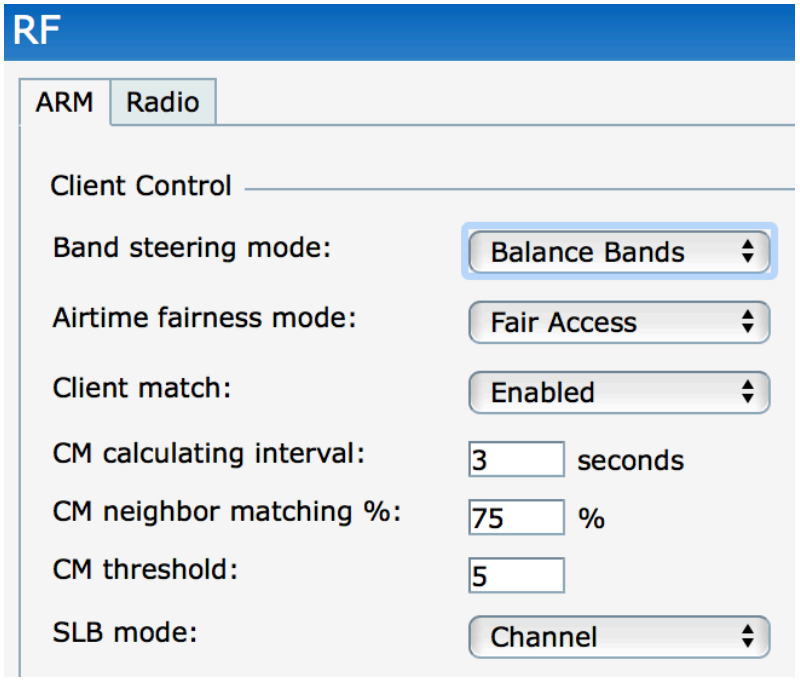
Band Steering – Band Balance

Ensure customer network uses band steering whenever permissible.
Default configuration is as below and may not be applicable for all customers.

In this band steering mode, the AP uses client load and RSSI information to balance the clients across the two radios and best utilize the available 2.4G bandwidth.

This feature takes into account the fact that the 5Ghz band has more channels than the 2.4 Ghz band, and that the 5Ghz channels operate in 40MHz while the 2.4Ghz band operates in 20MHz.

Due to the higher bandwidth availability in 5Ghz, it is always preferred to have a higher ratio of 5Ghz band based client association.

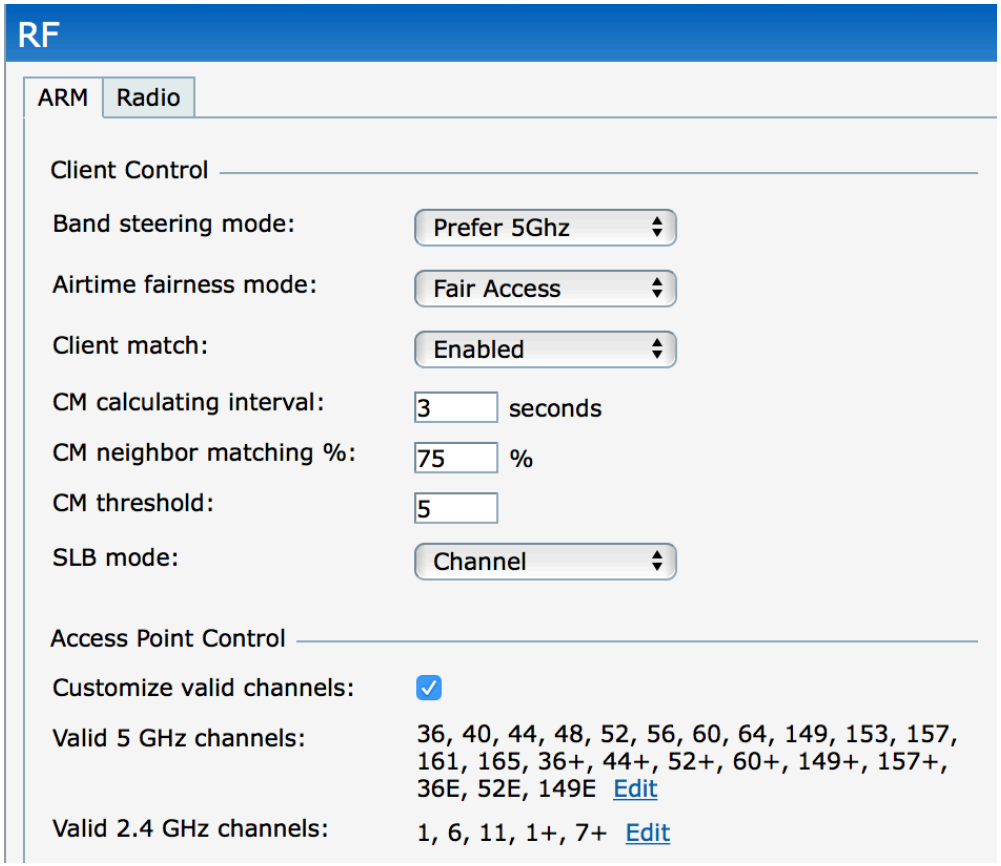


Efficient Channel Management System

Customizing valid channels available for the AP to operate is a key factor in improving WLAN performance.

Customer network might need this for following reasons,

- Presence of a known Rogue AP in a specific channel
- Heavy Utilization of a specific channel by neighboring/multitenant WLAN
- 3rd party stand alone WLAN video/security cameras operating in a certain channel

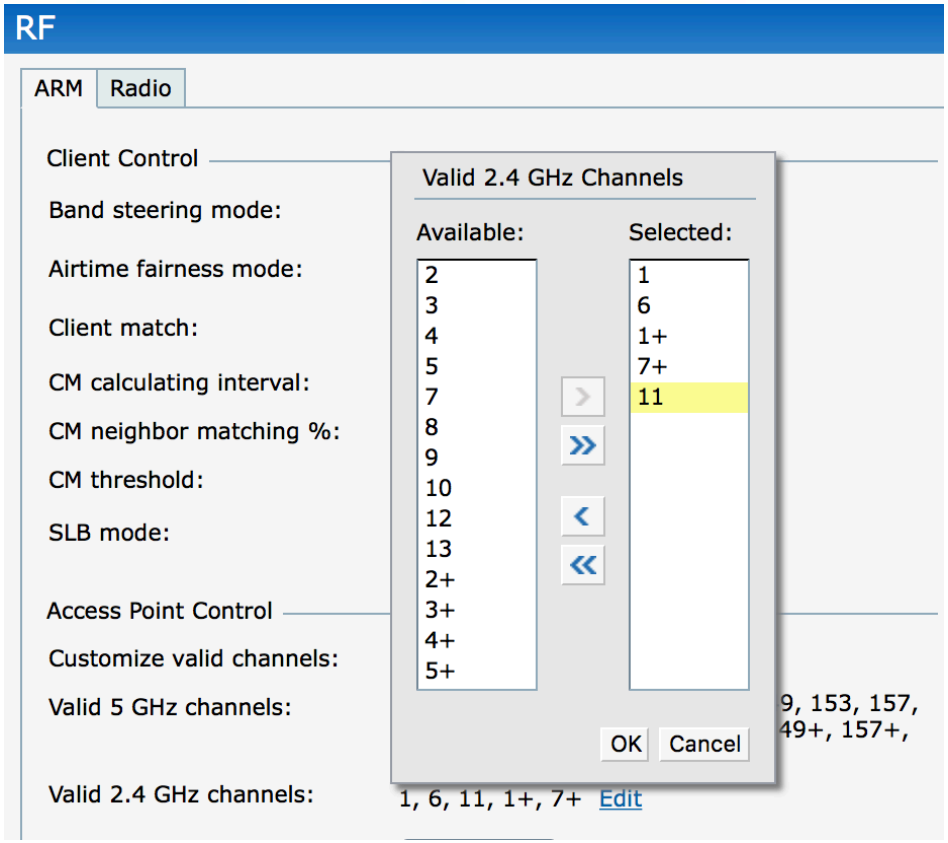


Efficient Channel Management System

In this example,
We are removing channel – 11
From being a part of the valid channel list.

With the scenario where – Channel 11 is considered as a known LOW PERFORMING channel.

By removing it from ARM channel as well as valid channel list, AP's performance can be improved.



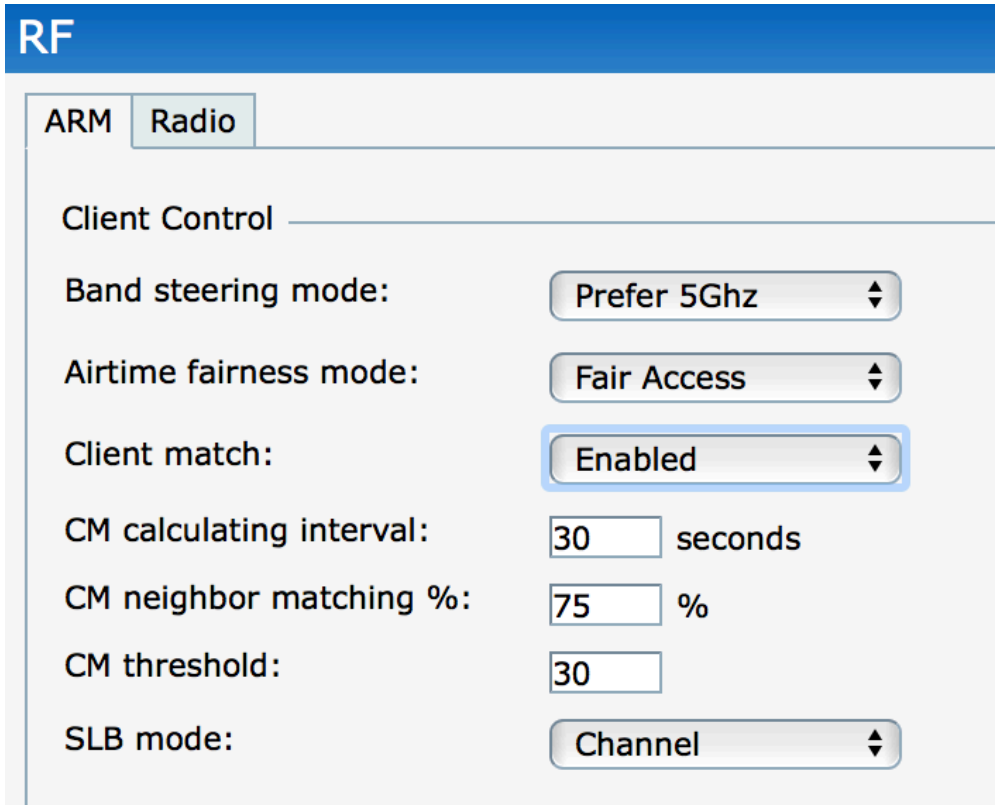
Enable Client Match

Client Match is important as it integrates multiple Features into a unified stream.

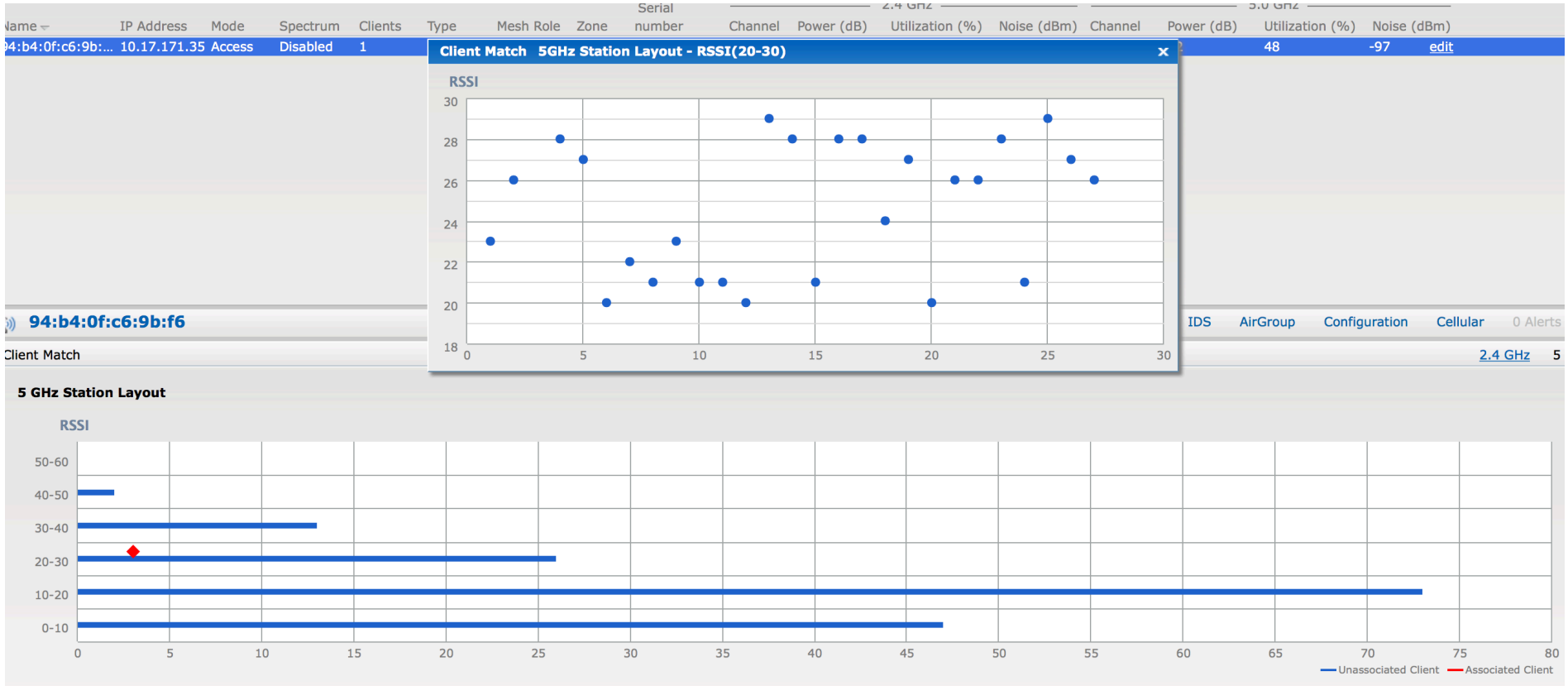
On clicking an access point in the Access Points tab and the Client Match link, a stations map view is
displayed and a graph is drawn with real-time data points for the AP radio. If the AP supports dual band, you

can toggle between 2.4GHz and 5 GHz links in the client match graph area to view the data. When you hover

the mouse on the graph, details such as RSSI, client match status, and the client distribution on channels are displayed.



Enable Client Match



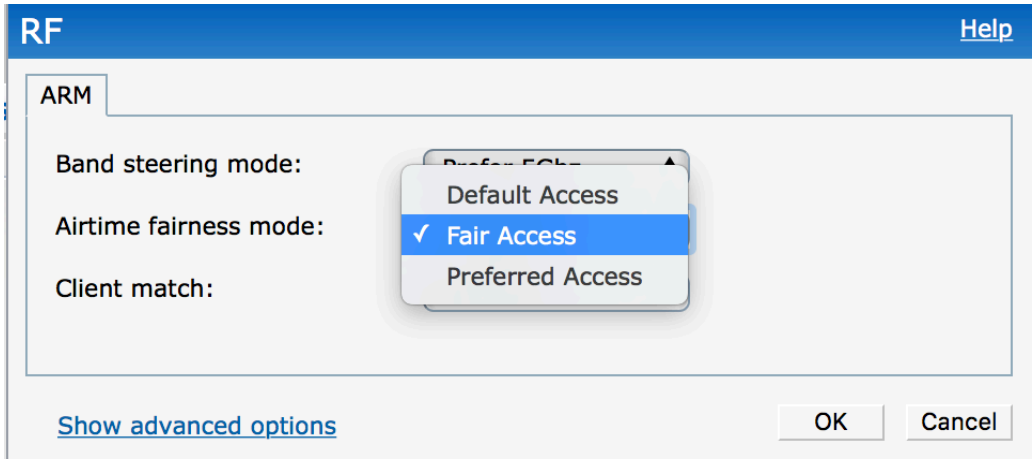
Use Airtime Fairness feature Effectively

The airtime fairness feature provides equal access to all clients on the wireless medium, regardless of client type, capability, or operating system, thus delivering uniform performance to all clients.
This feature prevents the clients from monopolizing AP's radio resources.

Default Access – This option will provide access based on client requests. When Air Time Fairness is set to default access, per user and per SSID bandwidth limits are not enforced.

Fair Access – This option will allocate Airtime evenly across all the clients.

Preferred Access - Select this option to set a preference where 11n clients are assigned more airtime than 11a/11g. The 11a/11g clients get more airtime than 11b. The ratio is 16:4:1



Next month

- **Original topic request: Aruba Instant Best practices and Troubleshooting**
- **Split in two Technical climbs:**
  - Today: Part1: Basics - Identifying AP and User health, Best Practices
  - Next month on Technical Climb Webinar: Part2: Advanced Troubleshooting, WMM
    - Quick Recap of Part-1 Essentials required for the session-2
    - Understanding and interpreting system debug logs
    - What does it really mean? How to use it to fix customer network issues
    - What is WMM? How does it work with Aruba Instant AP's?

QUESTIONS

Any Questions?

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