A Vendor Neutral Approach to Wireless Management & Troubleshooting

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As an old saying goes….

…To the man with a hammer, everything looks like a nail.

Motivation – Why Multi-Vendor?

- Cost savings
  - Able to choose products that more specifically fit use case instead of more expensive fully featured product.
  - Lack of lock-in can be useful in negotiations on pricing
- M&A
  - Acquired company or leased facility may be running different vendor's product.
  - Project timeline or budget may not allow rapid integration
- Able to run trials with different vendors with pressure to go to one vendor.

Typical Intel Office

- No Ethernet to desk.
- No physical VoIP or landline phone.
- VoIP application running on notebook PC.
- Conference calls on server based application
- Video projectors without cables (http://www.intel.com/content/www/us/en/support/software/software-applications/intel-unite-app.html?wapkw=intel+unite+app)

Lessons Learned

- VoIP latency through WLAN/LAN QoS configuration, including client
- Keep on top of wireless infrastructure issues for best call quality:
  - Mobility group
  - Spacing of access points
  - Number of users per AP.
  - Association to correct controllers.
  - Radio adjustment algorithm settings.

Results

- Significantly reduced capital and expense run rate
  - Ethernet switchgear, hard phones, licensing
  - Cabling, office moves, etc.
- Enhanced user experience
  - Integrated Audio, chat, video, whiteboard
  - Able to move during session.
- Global webcast over WLAN

Suggestions

- Download a demo copy of software under evaluation.
- Review this presentation as baseline for comparison.
- Test all features against your requirements during the trial period.

Overview

Overview

- Here is an example of a multivendor solution. Details are presented here to help provide a basis for comparison for other solutions.
- General categories for comparison:
  - Capacity management
  - Monitoring / Troubleshooting
  - Configuration management and software upgrades.

What Are Your Requirements?

- Client troubleshooting
- Monitoring configurations tracking and history
- Reports
- Rogues
- OS upgrades

Other Features – RFID Tags

- What is ‘good enough’ for a feature?
- A vendor specific solution may be accurate, but do you *need* it?

Tag Information

Name:	-	MAC Address:	
Battery Level:	-	Vendor:	
Chirp Interval:	4 mins 35 secs		
First Seen:	8/16/2013 9:11 AM	Last Seen:	8/14/2016 4:27 PM

Notes:
-

Location: Floor 2 (Floor 2)

Last Placed: 8/14/2016 4:27 PM

Detecting APs

AP/Device	Radio	Signal	SNR	First Seen	Last Seen
	802.11bgn	-89	2	8/14/2016 4:27 PM	8/14/2016 4:27 PM
	802.11bgn	-84	4	8/14/2016 4:13 PM	8/14/2016 4:27 PM

Pro's of a Multi-Vendor Solution

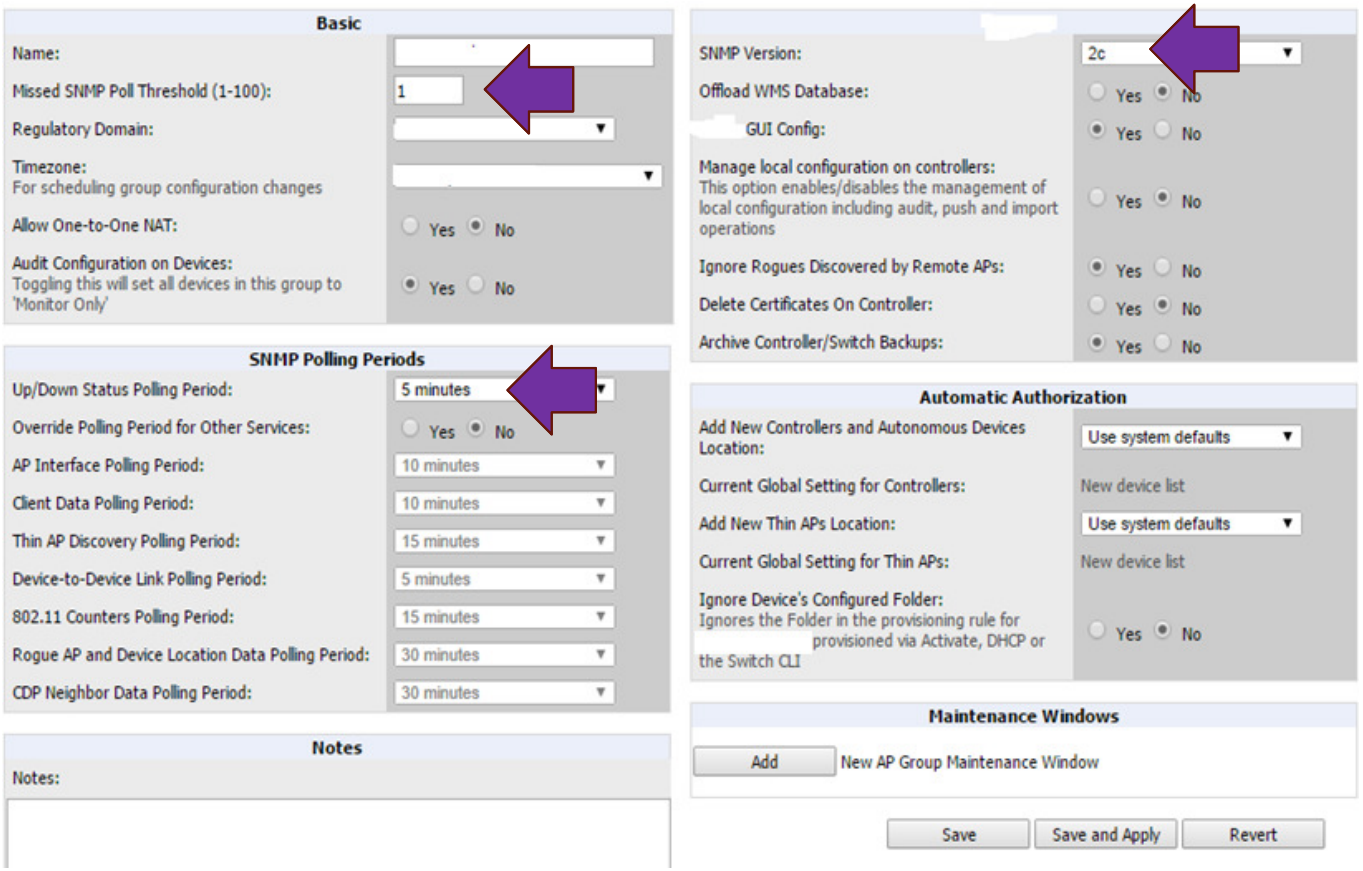
- Not locked into one vendor, making it easier to select and integrate products.
- Ability to monitor and troubleshoot all wireless devices from the same system regardless of vendor.
- Easy for first level help desk people to get a basic idea as to the health of the wireless network without training on specific products.

Con's of a Multi-Vendor Solution

- Not as closely integrated to any specific product line.
- Support staff can be disconnected from what is really going on.
- Vendor neutral monitoring can lag on proprietary features. (For example MIBs.)

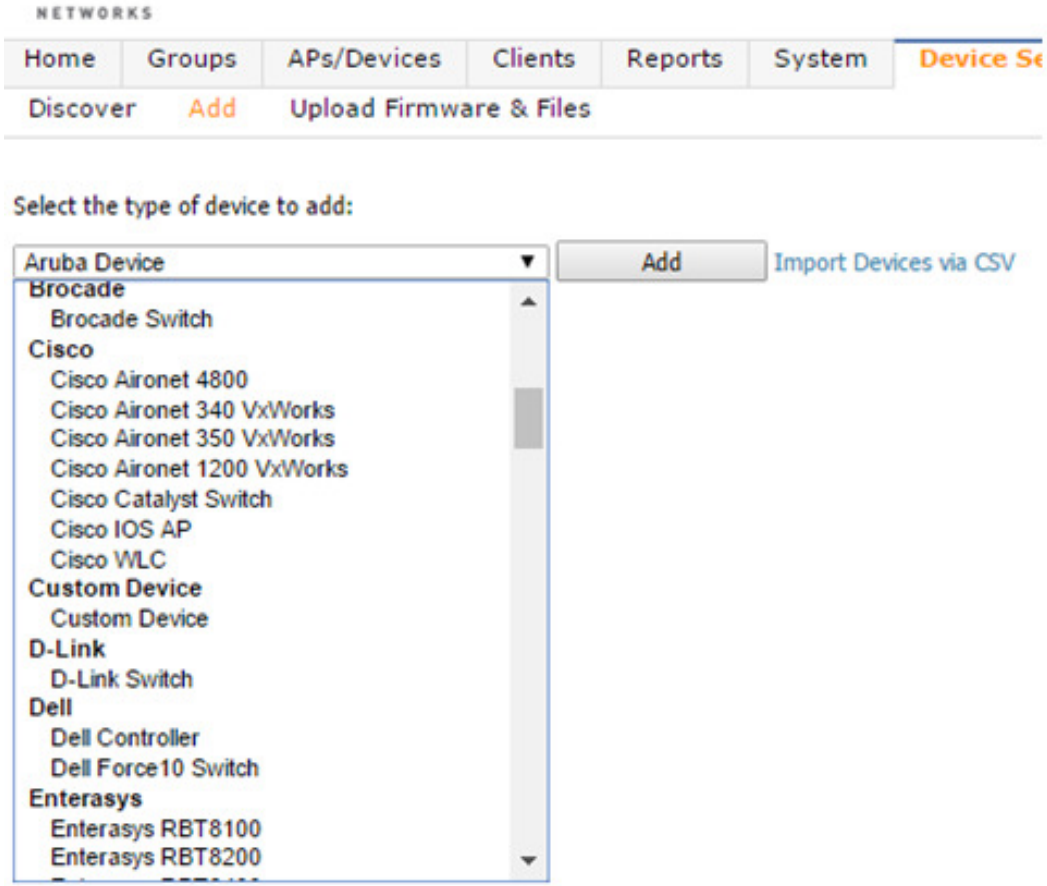
How Flexible is the Device Setup?

- SNMP version
- Polling interval
- Customizable polling



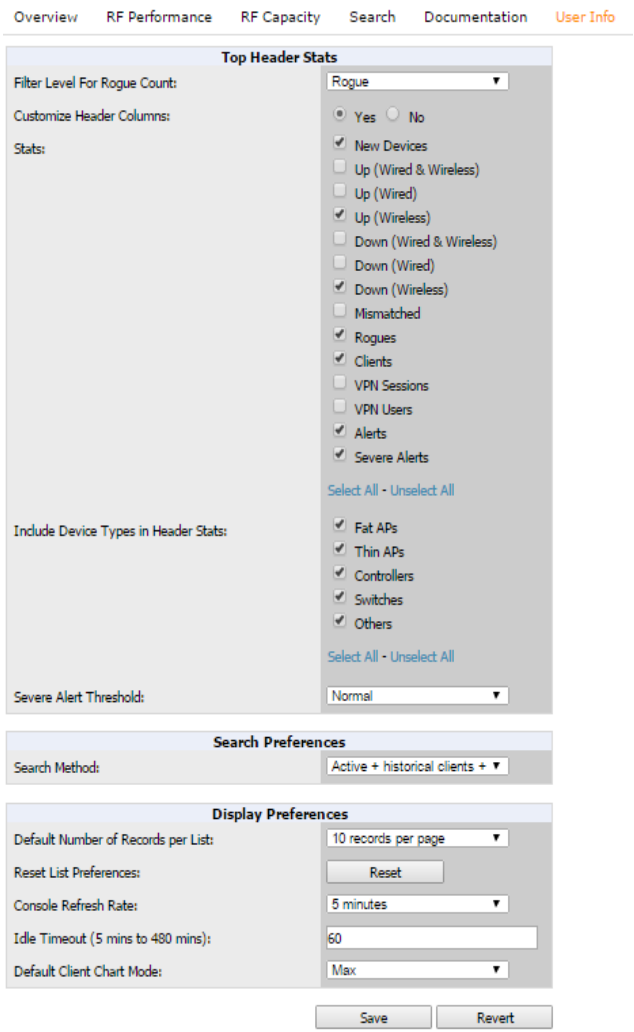
Device Support

- Does the device list support all of your devices?
- Does the list support devices you are considering?
- Do wired supported devices need wired side info. for rogues?



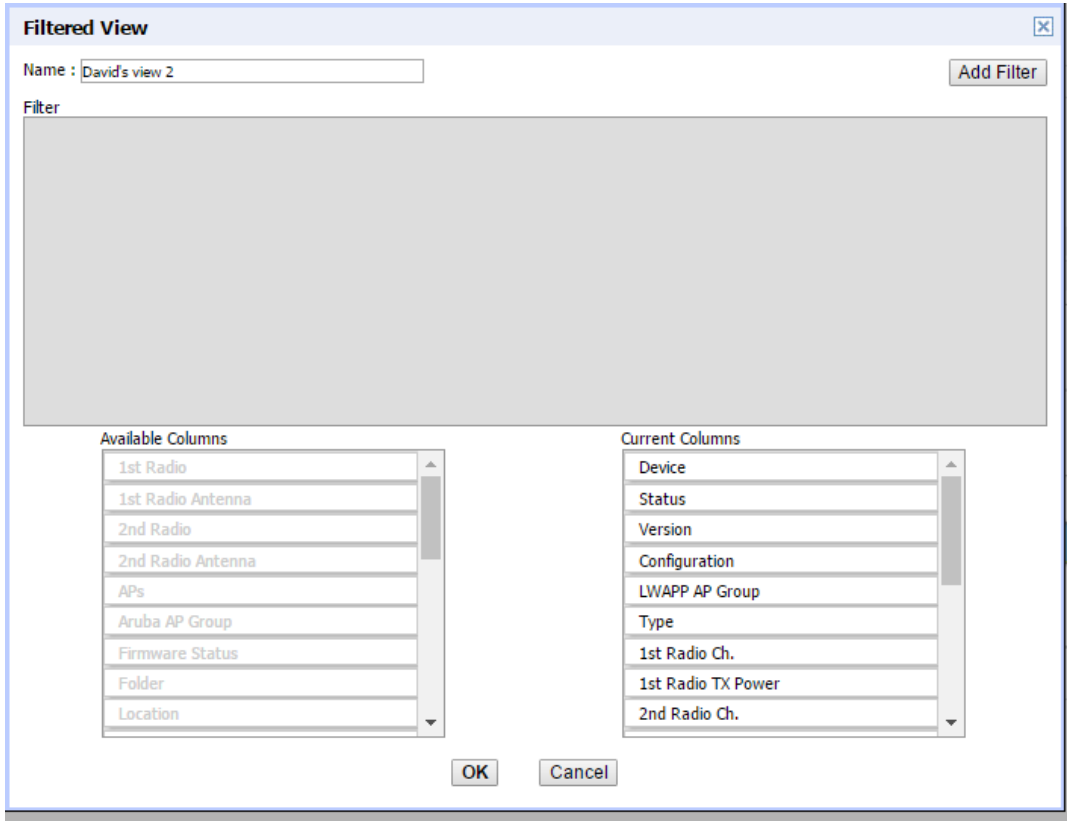
Account View Configuration Options

- Can you toggle items on and off?
- Can you rearrange the list in order of importance to you?

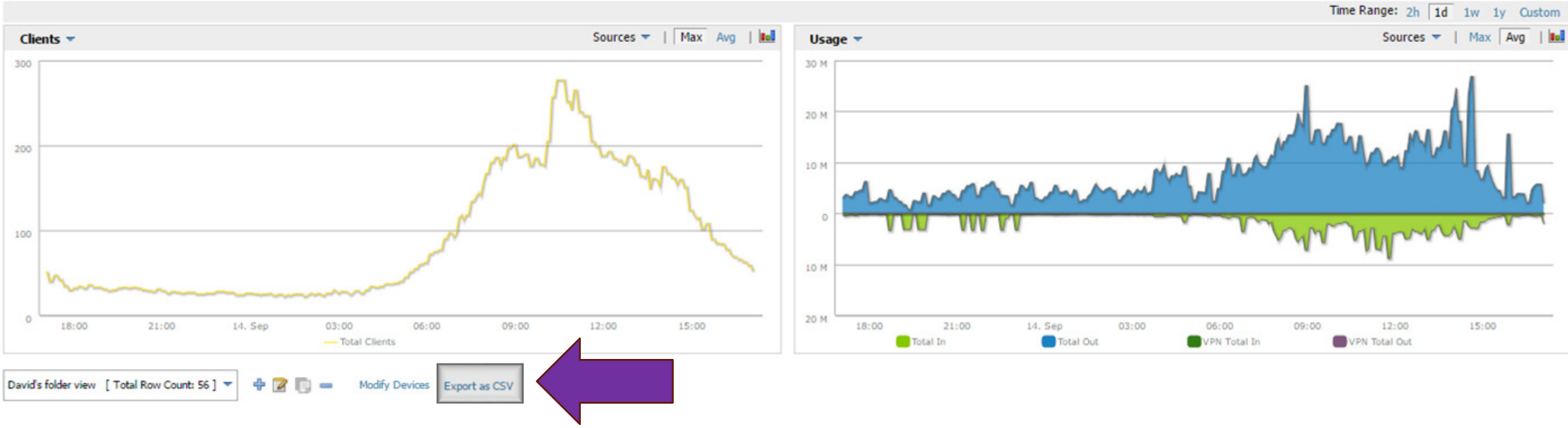


Filtered View – Configuration Options

- How can devices be grouped?
  - Multiple View
  - Common Configuration
  - Arbitrary
- Options for a hierarchy?



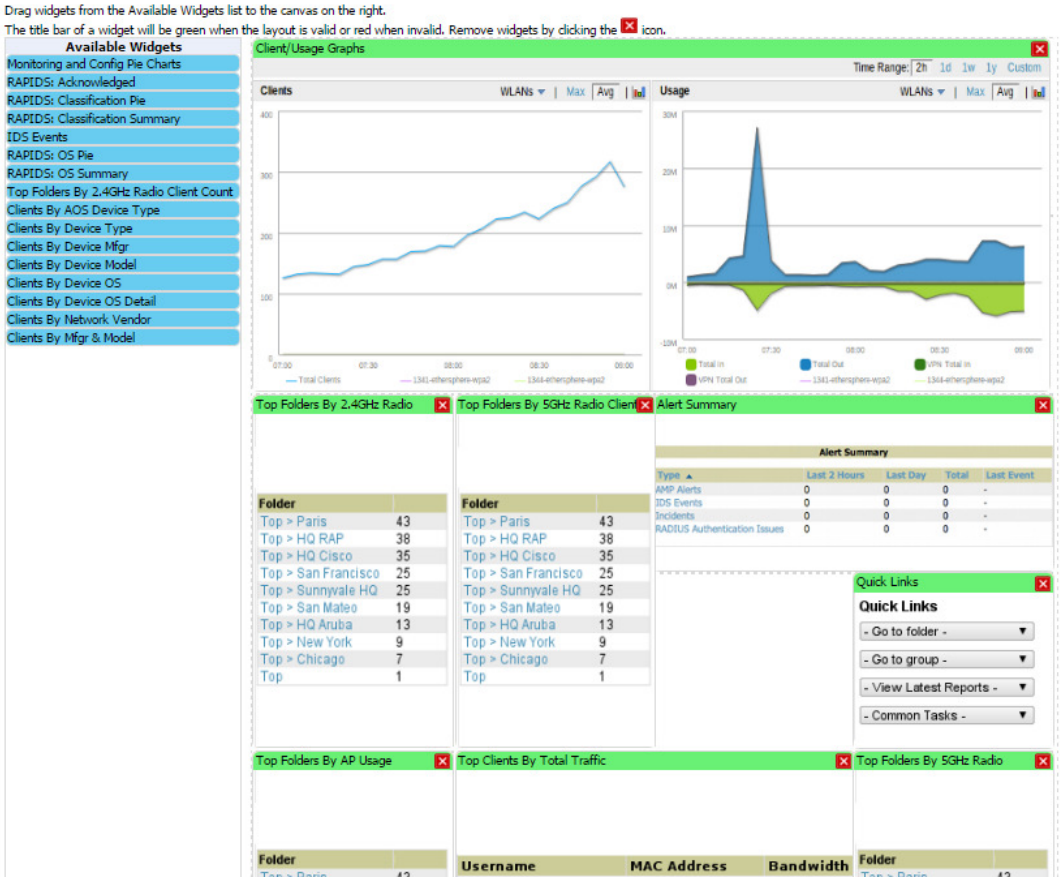
Is ‘View Export’ Option Available?



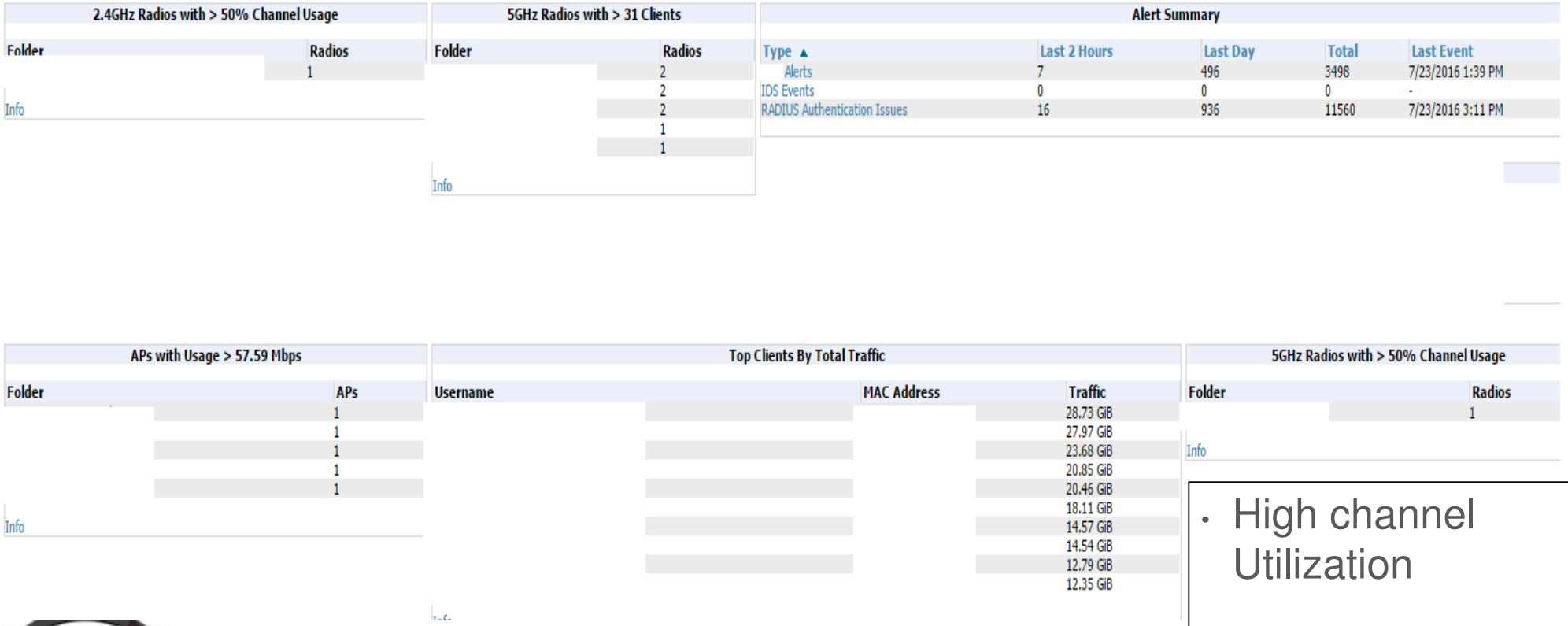
Having the ability to export and manipulate is very useful

Default View Customization

- Can the default view be customized?
- If so, what are the options?
- Can you rearrange portions of the screen?



Example: Default Screen Views



2.4GHz Radios with > 50% Channel Usage

Folder	Radios
	1

Info

5GHz Radios with > 31 Clients

Folder	Radios
	2
	2
	2
	1
	1

Info

Alert Summary

Type ▲	Last 2 Hours	Last Day	Total	Last Event
Alerts	7	496	3498	7/23/2016 1:39 PM
IDS Events	0	0	0	-
RADIUS Authentication Issues	16	936	11560	7/23/2016 3:11 PM

APs with Usage > 57.59 Mbps

Folder	APs
	1
	1
	1
	1
	1

Info

Top Clients By Total Traffic

Username	MAC Address	Traffic
		28.73 GiB
		27.97 GiB
		23.68 GiB
		20.85 GiB
		20.46 GiB
		18.11 GiB
		14.57 GiB
		14.54 GiB
		12.79 GiB
		12.35 GiB

5GHz Radios with > 50% Channel Usage

Folder	Radios
	1

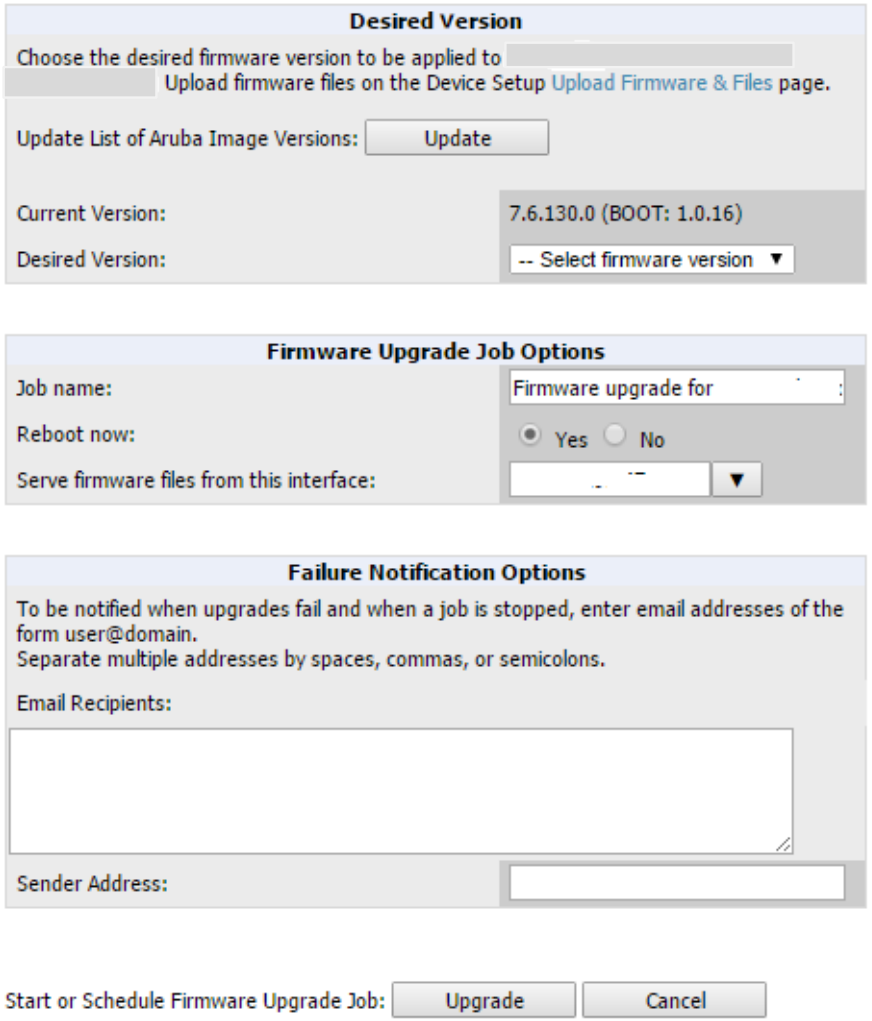
Info

- High channel Utilization
- Top talkers

Upgrades

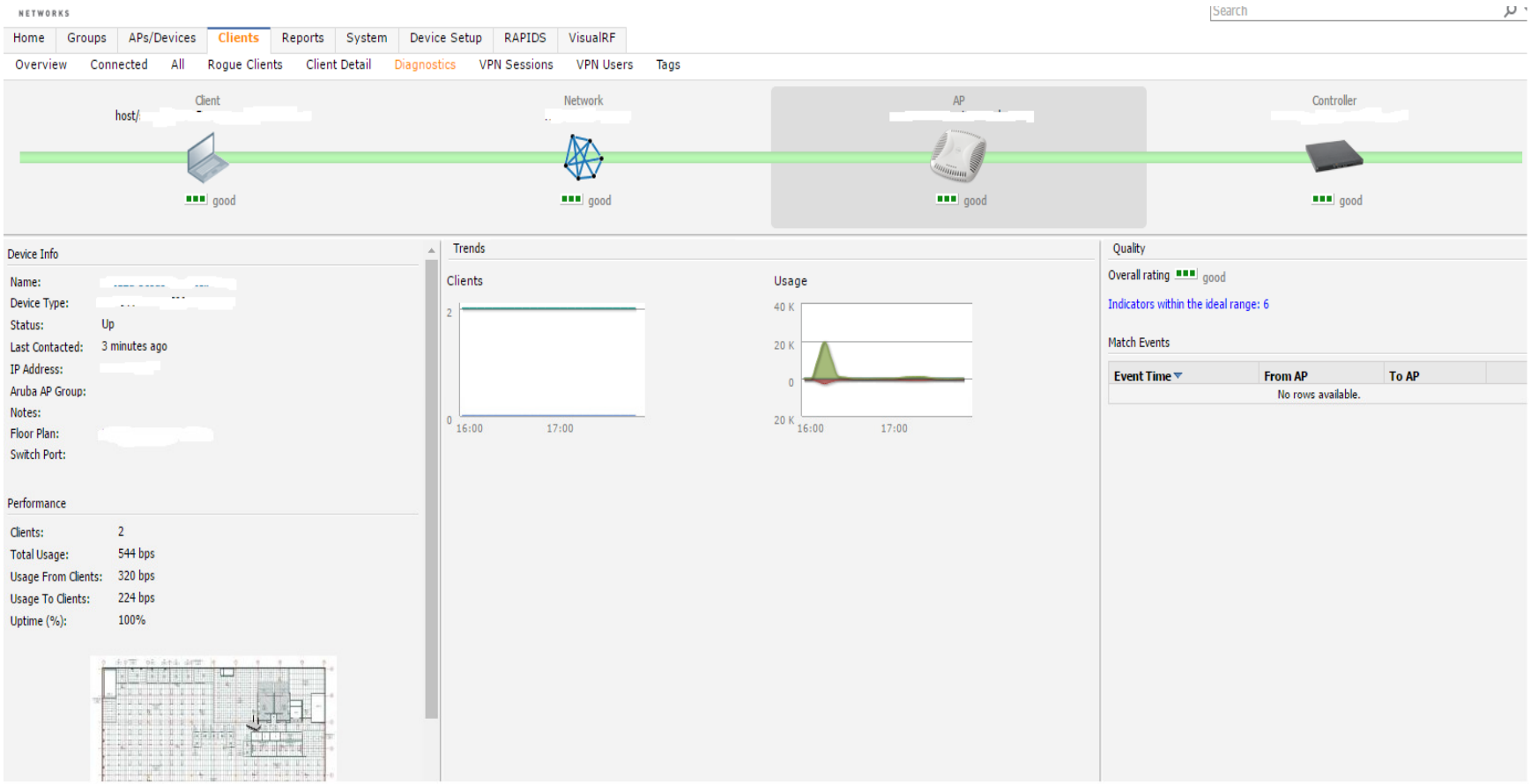
- Why upgrade this way?
  - Only see OS versions compatible with the hardware.
  - OS version option in drop down menu instead of copy/paste
  - Integrated tftp/ftp server

- Caution: Is a configuration pushed from the wireless management server to the wireless device in the process?



Clients

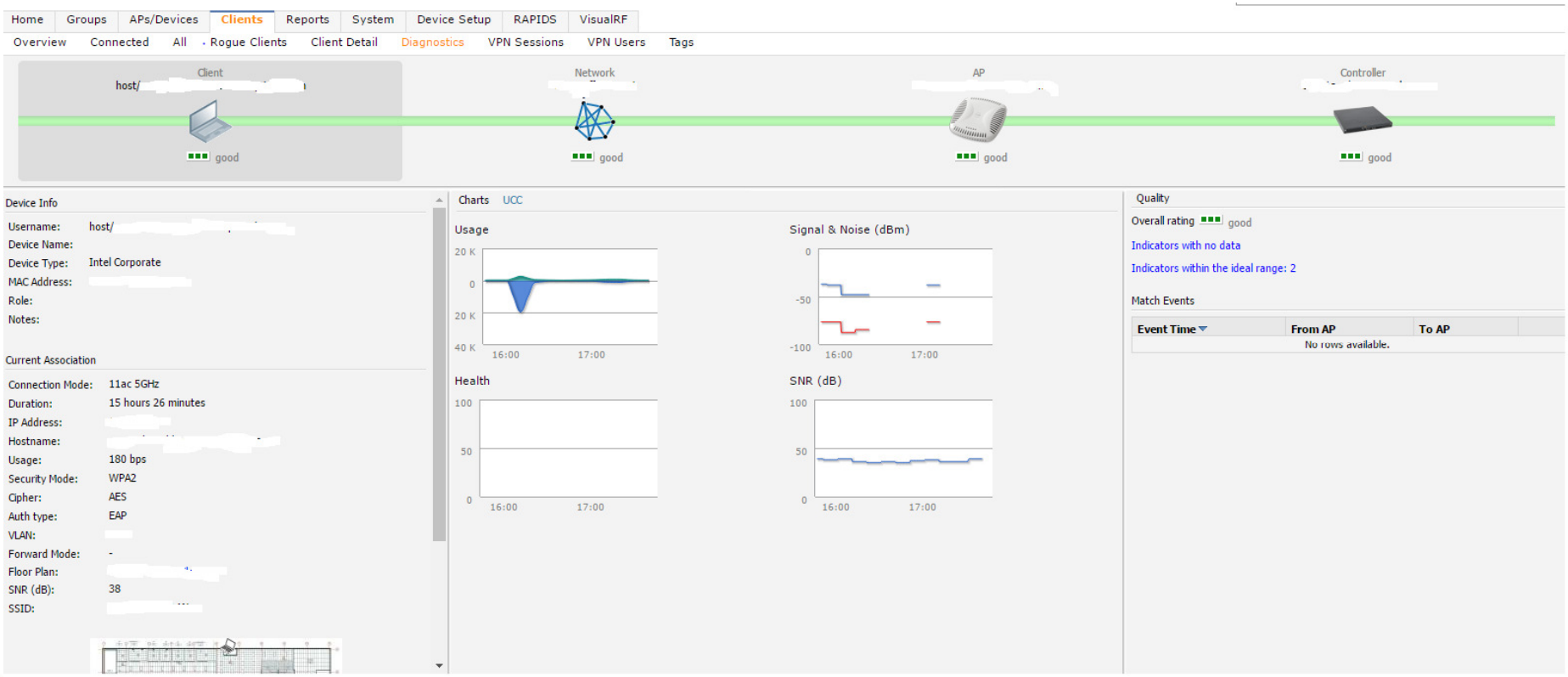
AP Client Diagnostic Detail



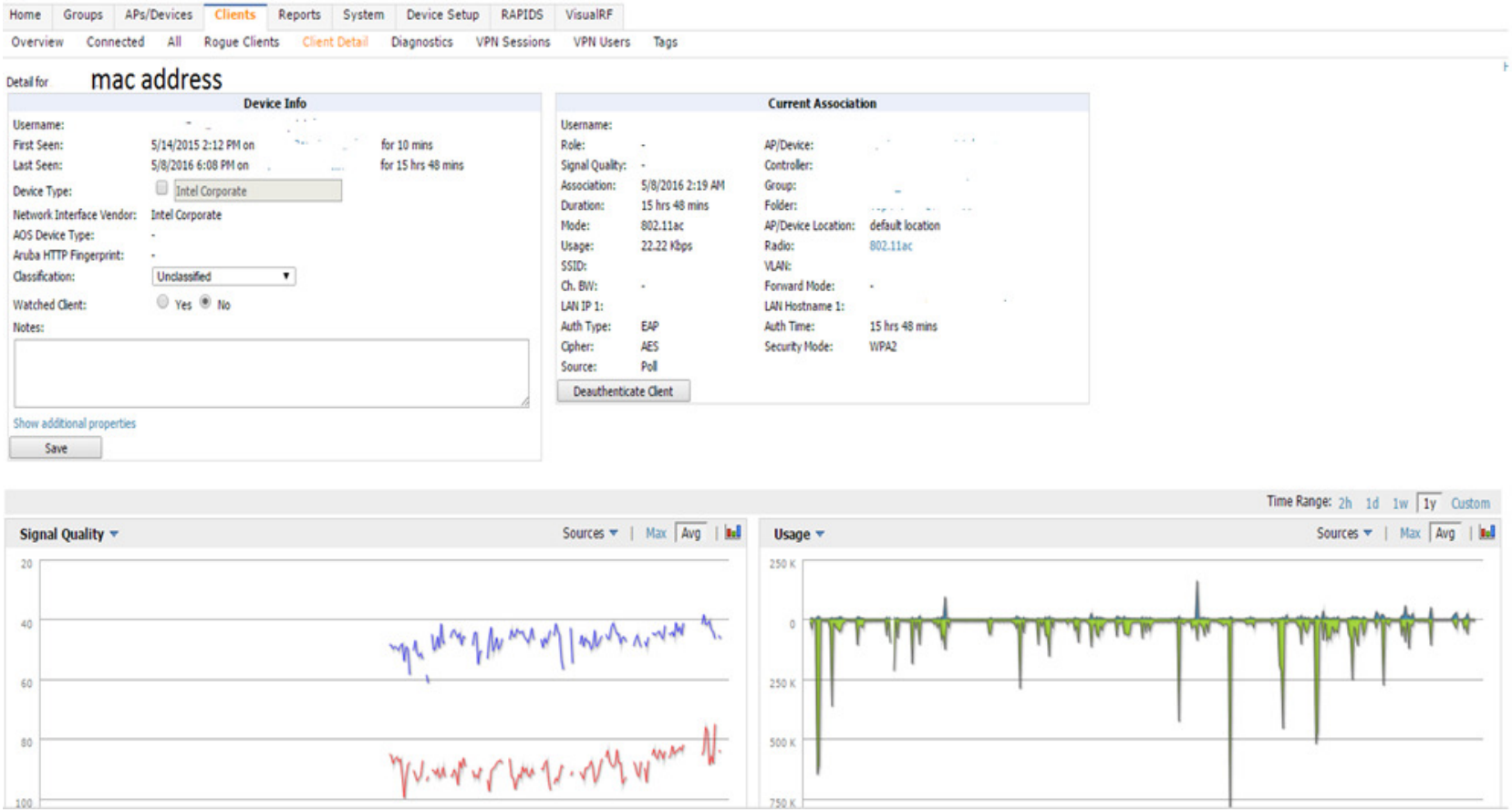
Client Detail

Username	AP/Device	SSID	Auth. Type	Association Time	Total Data Used	Avg. Speed	Connection Mode	Duration
			WPA2 (EAP-TLS)	6/18/16, 4:18 PM	37.1 GB	0 bps	11n 5 GHz	1 day 19 hours 1 minute
			WPA2 (EAP-TLS)	6/15/16, 10:32 AM	596 GB	0 bps	11n 5 GHz	3 days 5 hours 40 minutes
			Authenticated by AP	6/15/16, 10:06 AM	2.22 GB	0 bps	11n 5 GHz	20 minutes
			WPA2 (EAP-TLS)	5/30/16, 7:52 PM	6.1 TB	0 bps	11n 5 GHz	15 days 14 hours 8 minutes
			Authenticated by AP	5/30/16, 7:39 PM	0 B	0 bps	11n 5 GHz	10 minutes
			Authenticated by AP	5/28/16, 11:15 PM	261 MB	0 bps	11n 5 GHz	1 day 20 hours 23 minutes
			WPA2 (EAP-TLS)	5/28/16, 10:35 PM	200 KB	0 bps	11n 5 GHz	30 minutes
			WPA2 (EAP-TLS)	5/28/16, 10:04 PM	603 KB	0 bps	11n 5 GHz	30 minutes
			WPA2 (EAP-TLS)	5/28/16, 9:35 PM	471 KB	0 bps	11n 5 GHz	28 minutes
			WPA2 (EAP-TLS)	5/28/16, 6:23 PM	29.1 MB	0 bps	11n 5 GHz	3 hours 10 minutes
			WPA2 (EAP-TLS)	5/27/16, 9:04 AM	198 MB	0 bps	11n 5 GHz	1 day 9 hours 19 minutes
			WPA2 (EAP-TLS)	5/26/16, 10:50 PM	54.5 MB	0 bps	11n 5 GHz	10 hours 13 minutes
			WPA2 (EAP-TLS)	5/21/16, 10:22 PM	1.54 GB	0 bps	11n 5 GHz	5 days 0 hours 27 minutes
			Authenticated by AP	5/21/16, 9:19 PM	9.47 MB	0 bps	11n 5 GHz	1 hour 0 minutes
			WPA2 (EAP-TLS)	5/14/16, 1:05 AM	3.14 GB	0 bps	11n 5 GHz	7 days 20 hours 6 minutes
			Authenticated by AP	5/13/16, 8:35 PM	44.9 MB	0 bps	11n 5 GHz	4 hours 30 minutes
			WPA2 (EAP-TLS)	5/13/16, 9:34 AM	729 MB	0 bps	11n 5 GHz	11 hours 0 minutes
			WPA2 (EAP-TLS)	5/13/16, 12:03 AM	76.5 MB	0 bps	11n 5 GHz	9 hours 22 minutes
			WPA2 (EAP-TLS)	5/12/16, 12:23 PM	93 MB	0 bps	11n 5 GHz	11 hours 37 minutes
			WPA2 (EAP-TLS)	5/11/16, 1:41 PM	169 MB	0 bps	11n 5 GHz	22 hours 36 minutes
			WPA2 (EAP-TLS)	5/11/16, 11:33 AM	84.3 MB	0 bps	11n 5 GHz	2 hours 5 minutes
			WPA2 (EAP-TLS)	5/9/16, 1:46 PM	2.71 GB	0 bps	11n 5 GHz	1 day 21 hours 25 minutes
			WPA2 (EAP-TLS)	5/4/16, 6:55 PM	8.23 GB	0 bps	11n 5 GHz	4 days 18 hours 29 minutes
			WPA2 (EAP-TLS)	5/4/16, 5:56 AM	162 MB	0 bps	11n 5 GHz	12 hours 58 minutes
			WPA2 (EAP-TLS)	5/3/16, 8:39 PM	40.9 MB	0 bps	11n 5 GHz	9 hours 17 minutes

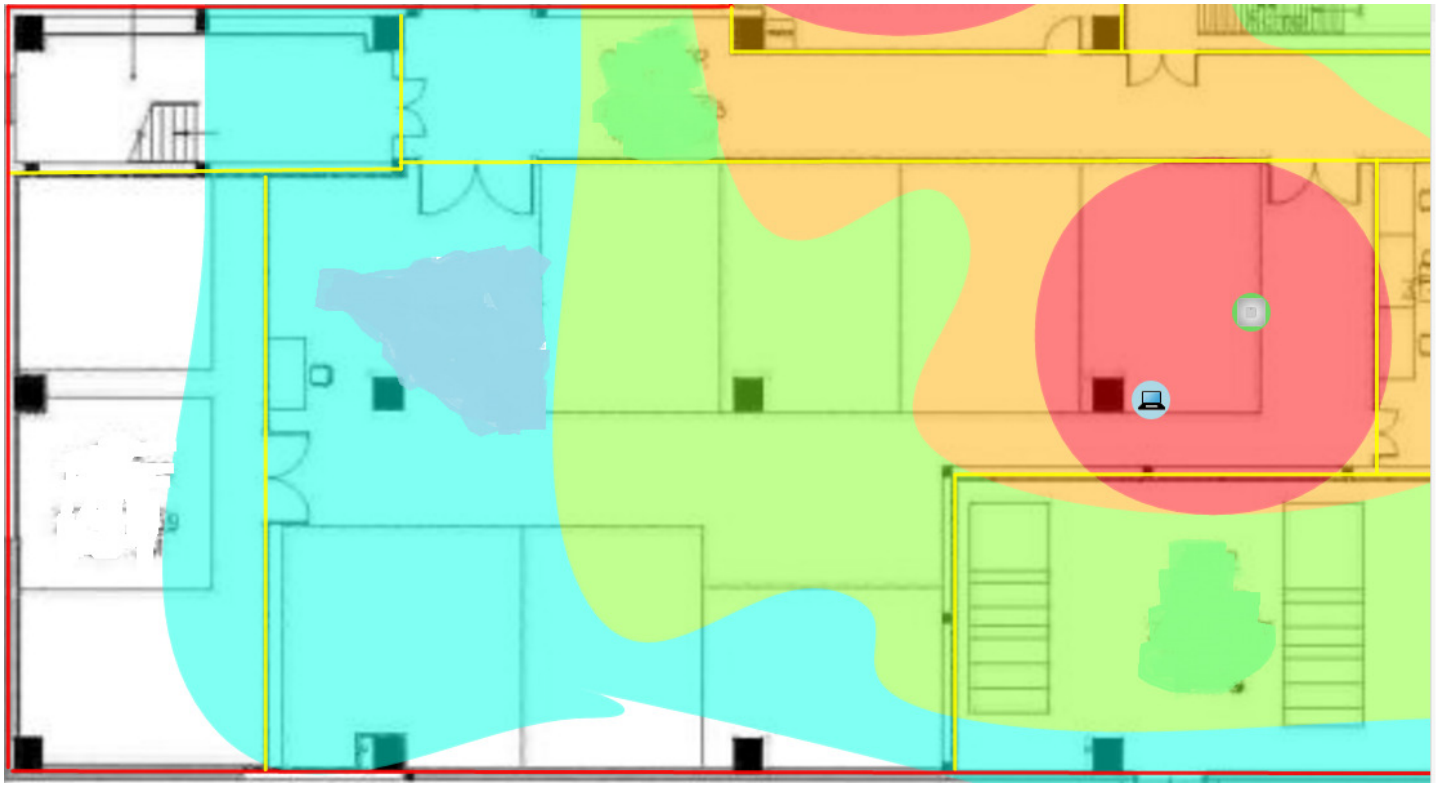
Wireless Client Troubleshooting



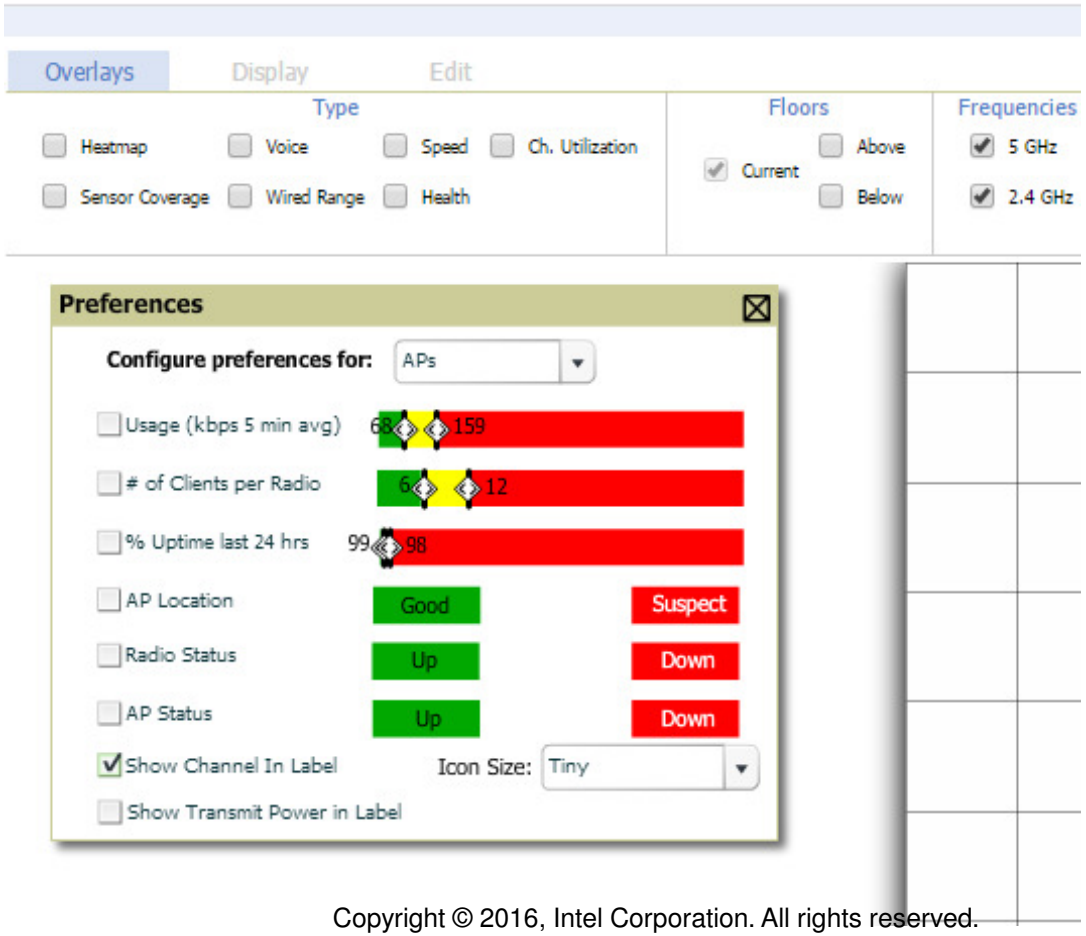
Client Detail



Heatmap: Myth vs. Reality

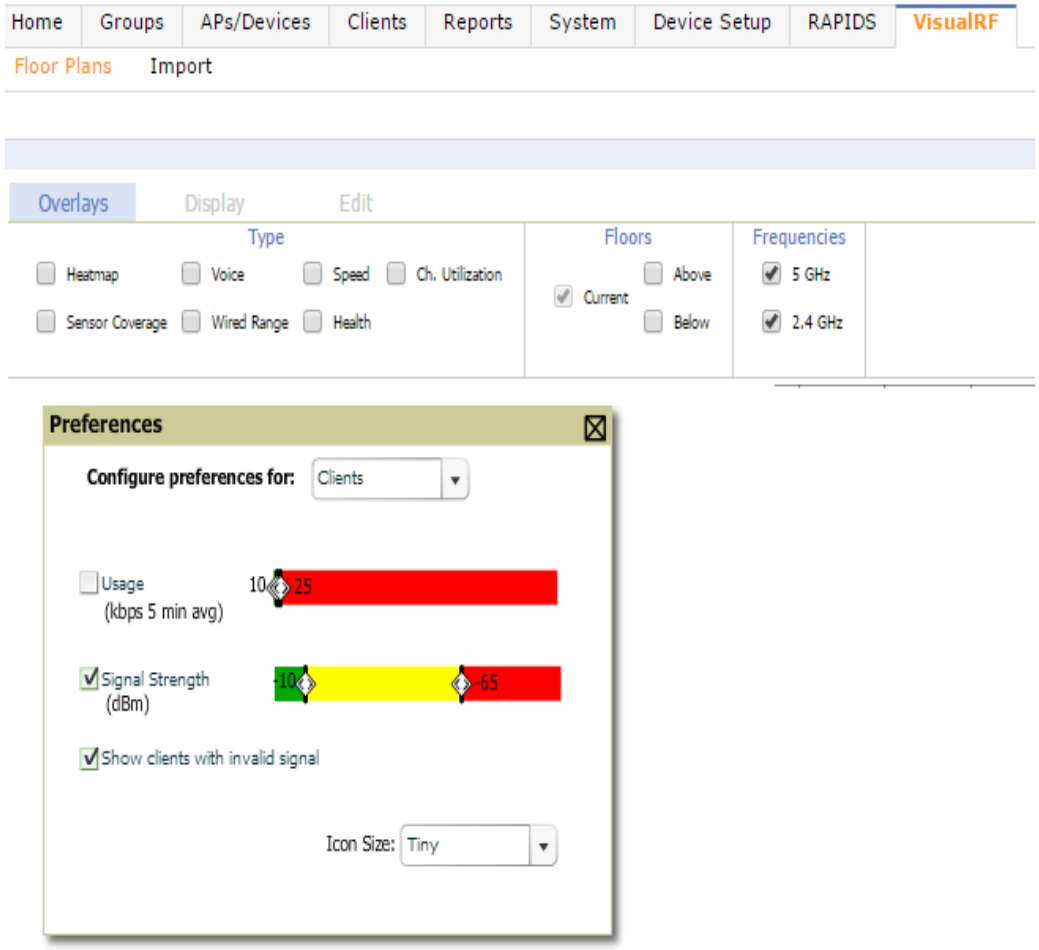


Map-Based Troubleshooting

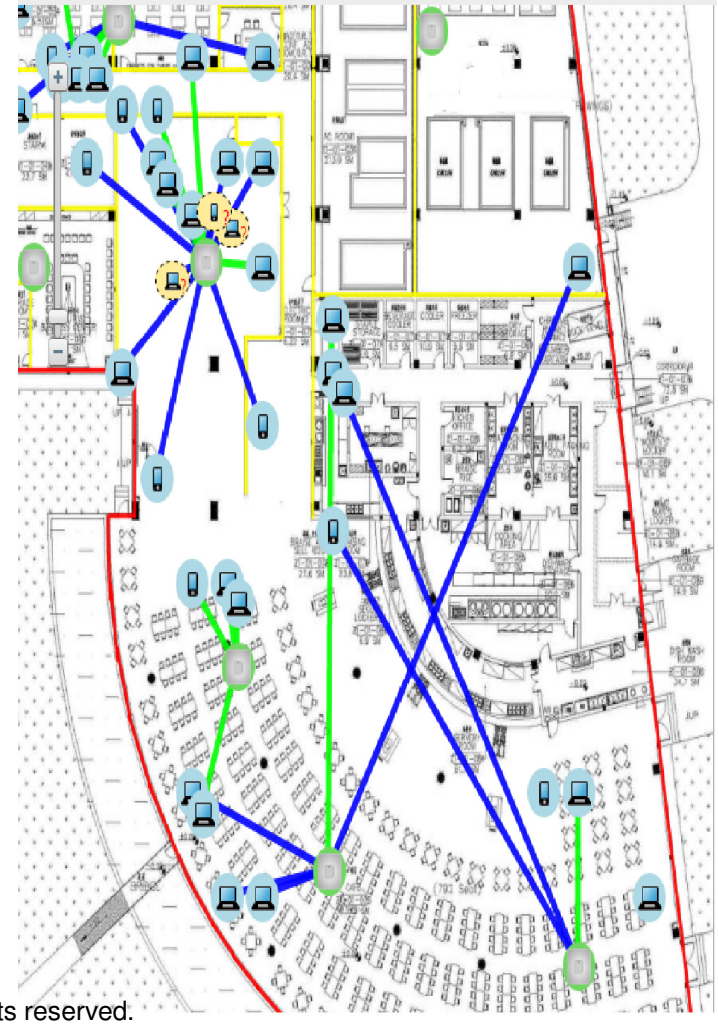


Map of APs with Channel Information

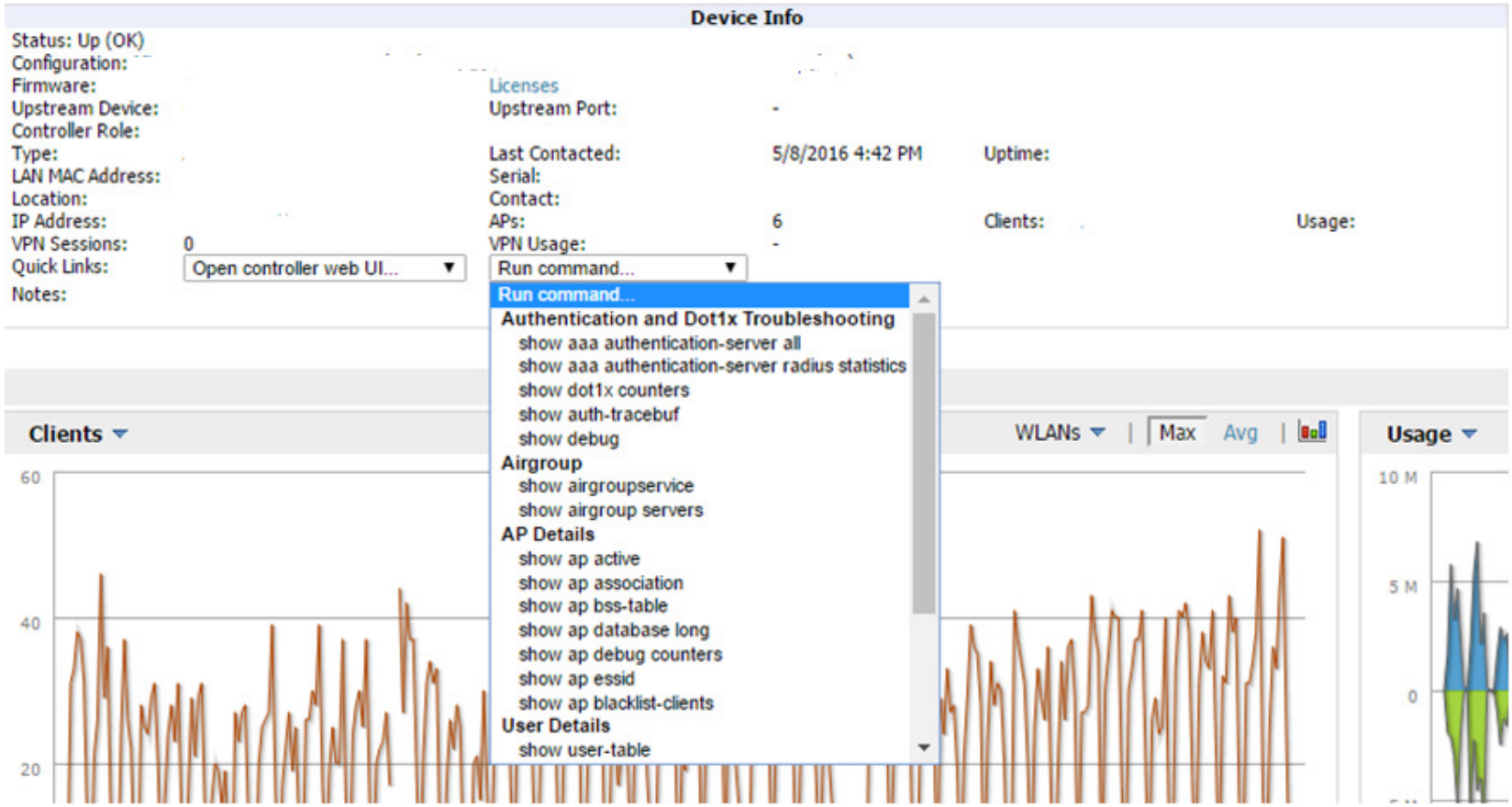
Client Signal Data



Roaming with Sticky Clients



Integrated Troubleshooting May Vary by Vendor



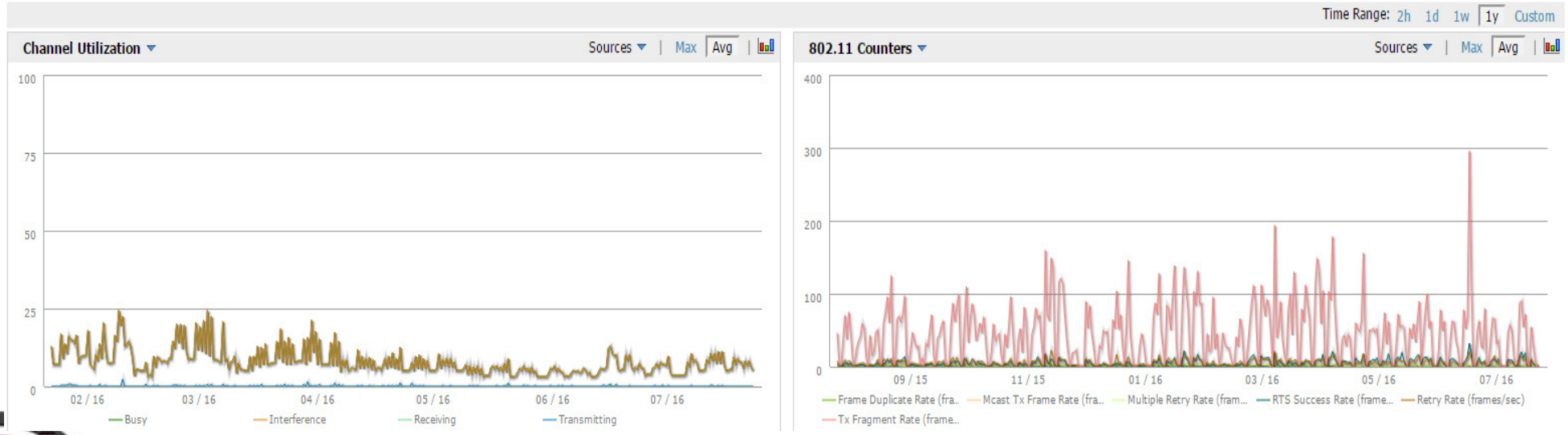
AP Radio Metrics

AP Monitoring | **Radio Statistics**

Monitoring **802.11ac** radio for AP

802.11 Radio Counters Summary (frames/sec)

	Current	Last Hour	Last Day	Last Week
Unacked	0	0	0	12
Retries	0	0	0	78
Failures	0	0	0	5
Dup Frames	0	0	0	0
FCS Errors	0	0	0	95



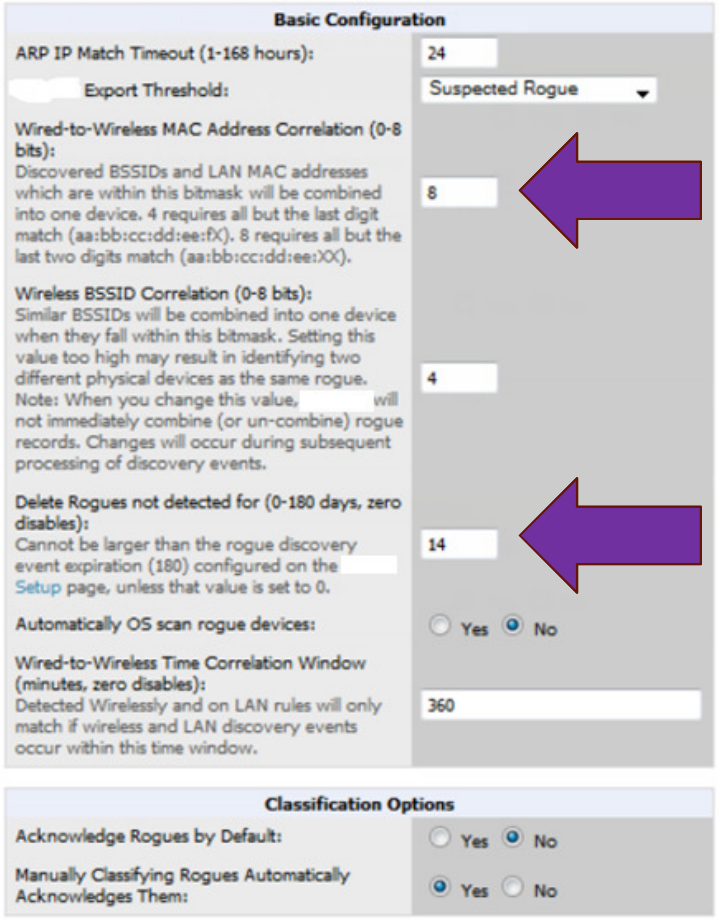
Rogues

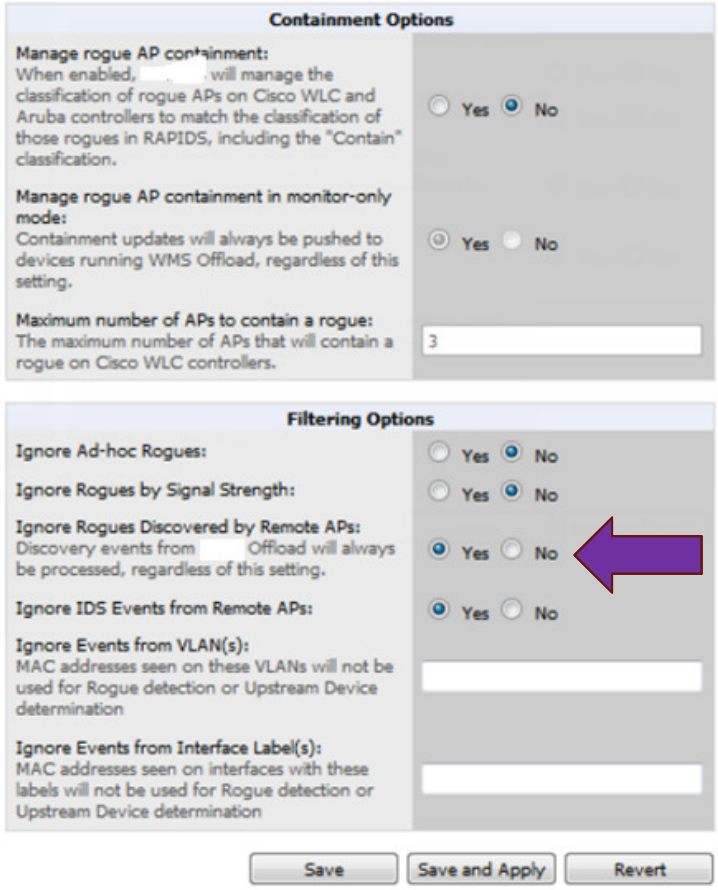
Rogues

- Can gather wired information across multiple vendors
- Watch out for licensing.
  - To save money you can put the licenses on the distribution devices then just trace the access switch.

Rogue Configuration

- Can You:
  - Configure by signal strength?
  - Exclude remote AP discovered rogues?
  - Match closeness?
  - Age out time (over weekend events)?
- Can the monitoring system declassify certain devices no longer deemed rogue?



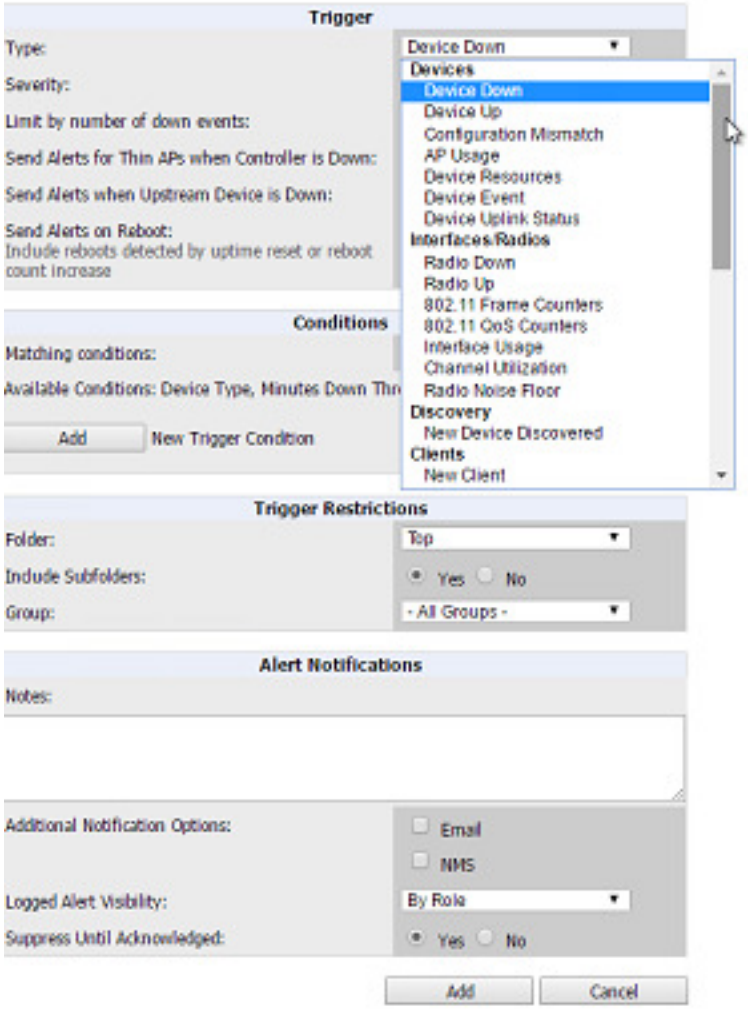


Triggered Alerts

- Faster hunting when you are playing cat and mouse with rogue AP. (Rogue mac address shows up.)
- AP or radio down.
- Number of users per AP exceeds a threshold.
- Controller CPU utilization.

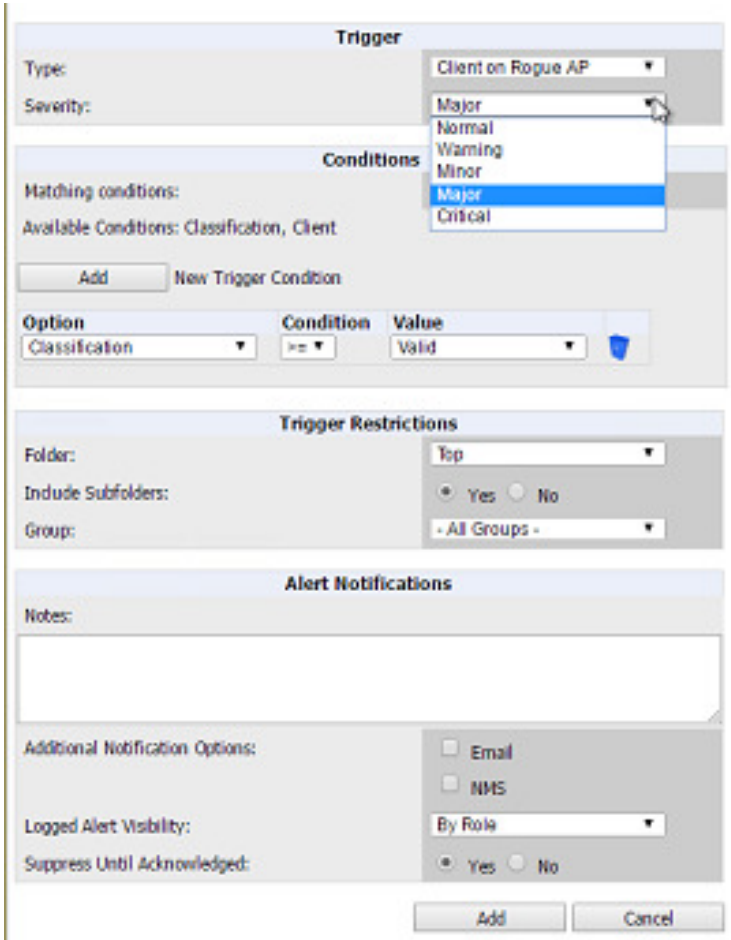
General Trigger Types: Example

- Text or email
- Radio/AP, up/down, channel utilization
- Arbitrary or configuration group options



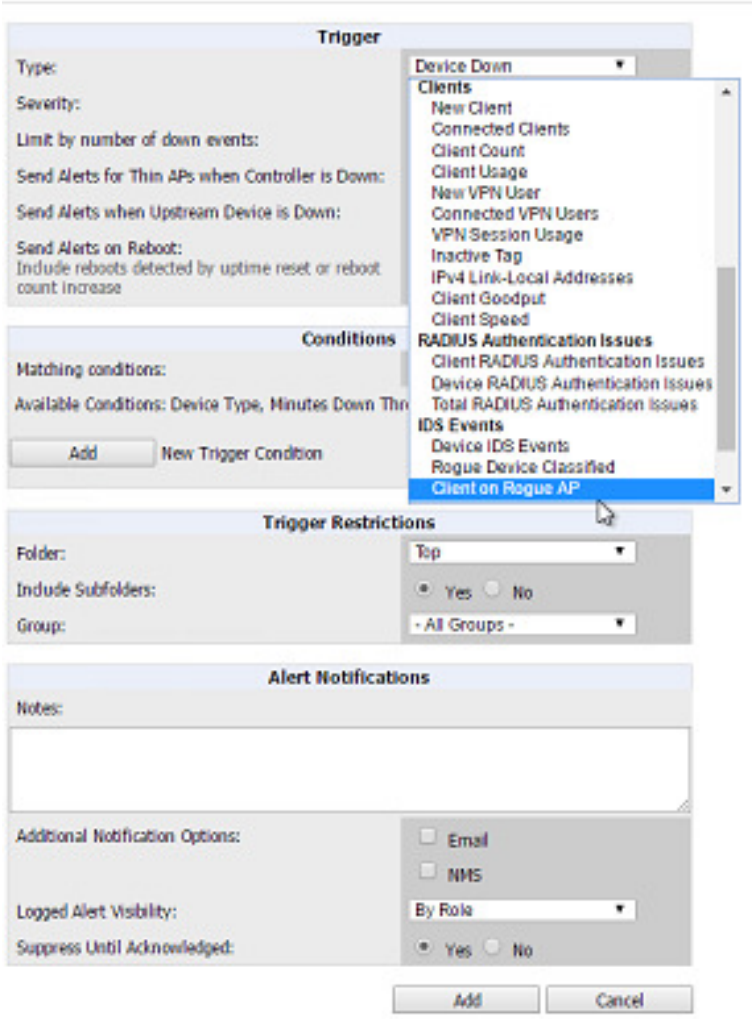
Trigger Classification & Response

- Can you customize trigger level?
- Options for scope of trigger?
- Email and logging server options?



Client & Radius Triggered Alerts

- What are options for client alerts?
- Client alert for too many users per AP
- What are the radius alert options?



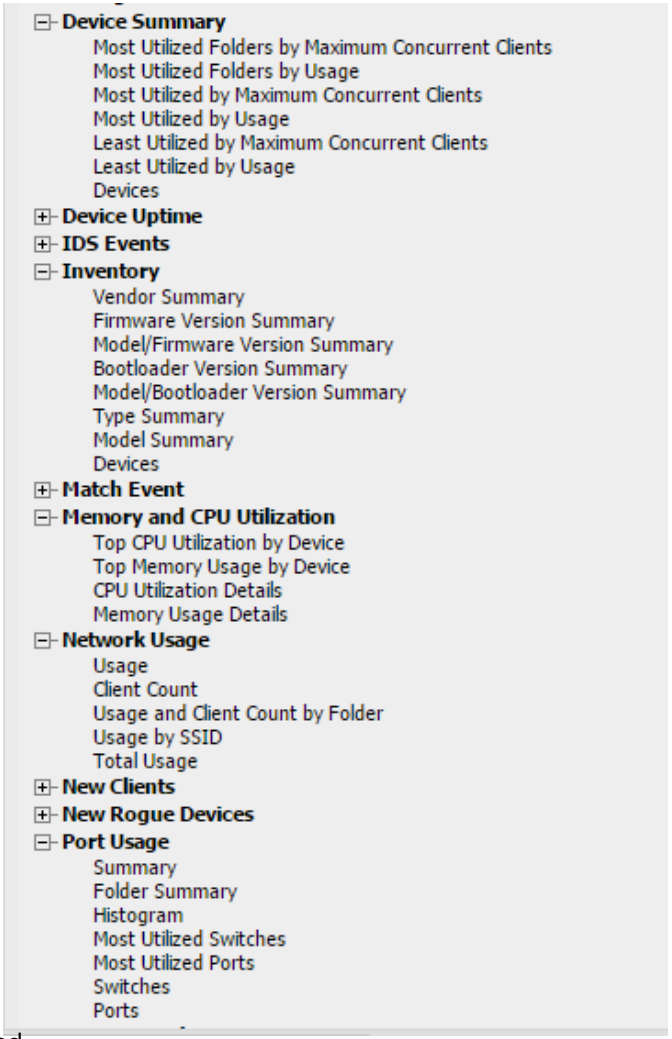
Useful Triggers to Configure

Type ▲	Trigger	Additional Notification Options
AP Usage	Usage >= 50000 Kbps for 2 hr	NMS
Client Count	Client Count on Devices is at least 35 and for 1 hr	-
Device Down	Device Type is Access Point	NMS
Device Down	Device Type is Controller	NMS
Device RADIUS Authentication Issues	Count >= 2 for 1 minute	NMS
Device Up	Device Type is Access Point	NMS
Device Up	Device Type is Controller	NMS
Disk Usage	Partition Percent Used >= 95%	-
Radio Down	-	NMS
Radio Up	-	NMS
Rogue Device Classified	Threat Level >= 9	NMS and Email

Reports

Reports

- What are the usage views by device?
- Device memory and CPU report options?
- LAN report options?



Power or Channel Changes

channel changes report - daily for (Multiple...)

5/20/2016 6:00 PM to 5/21/2016 6:00 PM
Generated on 5/21/2016 6:05 PM

Most Channel Changes (5 GHz)

Rank ▲	Device	Channel Changes	Avg Noise (dBm)	Avg Channel Busy (%)	Clients	Usage	Location	Controller	Folder	Group
1		3	-99.50	3.94	0	48 bps				
2		2	-94.50	1.18	2	5.48 Kbps				
3		2	-98.00	2.76	0	1 bps				
4		2	-97.50	1.57	0	0 bps				
5		2	-99.00	4.72	0	15 bps				
6		2	-97.50	3.15	0	691 bps				
7		2	-98.00	3.54	0	244 bps				
8		1	-95.00	7.87	0	6.24 Kbps				
9		1	-97.50	1.97	0	0 bps				
10		1	-96.50	4.33	0	3.58 Kbps				
11		1	-97.00	7.48	1	54.66 Kbps				
12		1	-93.50	3.54	1	23.03 Kbps				
13		1	-96.00	1.57	0	0 bps				
14		1	-98.50	0.79	0	3 bps				
15		1	-96.50	3.94	0	0 bps				
16		1	-98.00	2.76	0	25 bps				
17		1	-99.00	4.72	2	796 bps				
18		1	-99.00	2.36	1	22.56 Kbps				
19		1	-97.00	0.79	1	160 bps				
20		1	-93.00	0.79	0	0 bps				
21		1	-96.50	2.36	0	0 bps				
22		1	-98.50	2.76	0	0 bps				
23		1	-96.50	1.97	1	17.49 Kbps				
24		1	-100.50	5.51	0	0 bps				
25		1	-99.00	2.76	0	7.04 Kbps				
26		1	-96.50	1.97	0	0 bps				
27		1	-97.50	1.97	0	0 bps				
28		1	-98.00	1.57	0	44.08 Kbps				
29		1	-93.00	1.97	0	0 bps				
30		1	-98.50	3.15	0	0 bps				

Client & Usage Report

- Top 10 list by client count?
- Top 10 list by usage?
- What is in each top 10 list?

Most Utilized by Maximum Concurrent Clients

Rank ▲	AP/Device	Clients	Max Clients	Total Data	Avg Usage	Location	Controller	Folder	Group
1		781	197	212.43 GB	351.46 Kbps				
2		2049	175	126.26 GB	208.89 Kbps				
3		1495	166	65.38 GB	108.26 Kbps				
4		1297	144	101.13 GB	167.31 Kbps				
5		1217	144	18.64 GB	30.84 Kbps				
6		1286	132	30.10 GB	49.83 Kbps				
7		310	130	80.20 GB	132.68 Kbps				
8		763	127	21.34 GB	35.33 Kbps				
9		279	118	143.70 GB	237.93 Kbps				
10		697	117	186.28 GB	308.19 Kbps				

Most Utilized by Usage

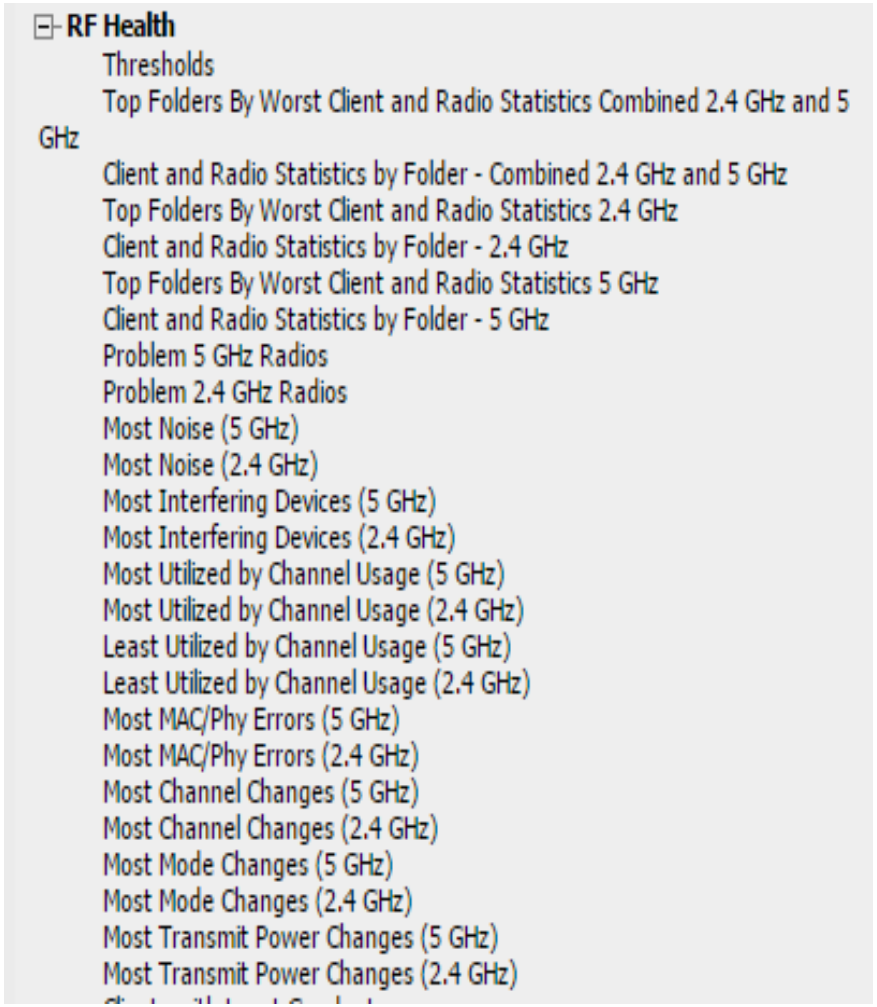
Rank ▲	AP/Device	Clients	Max Clients	Total Data	Avg Usage	Location	Controller	Folder	Group
1		182	55	1.74 TB	2.88 Mbps				
2		334	47	1.51 TB	2.51 Mbps				
3		76	26	1.45 TB	2.40 Mbps				
4		127	14	1.39 TB	2.31 Mbps				
5		376	45	1.27 TB	2.11 Mbps				
6		112	9	1.25 TB	2.07 Mbps				
7		1267	29	1.20 TB	1.99 Mbps				
8		209	35	1.11 TB	1.84 Mbps				
9		300	8	925.81 GB	1.53 Mbps				
10		739	19	917.67 GB	1.52 Mbps				

Reports

- For future installs and long term health. (Investigate trends)
- Seamless reporting regardless of vendor.
- Report types:
  - Usage by SSID
  - Maximum by concurrent clients.
  - Maximum by usage.
  - Power/channel changes
  - Good to have a option for maximum and average.

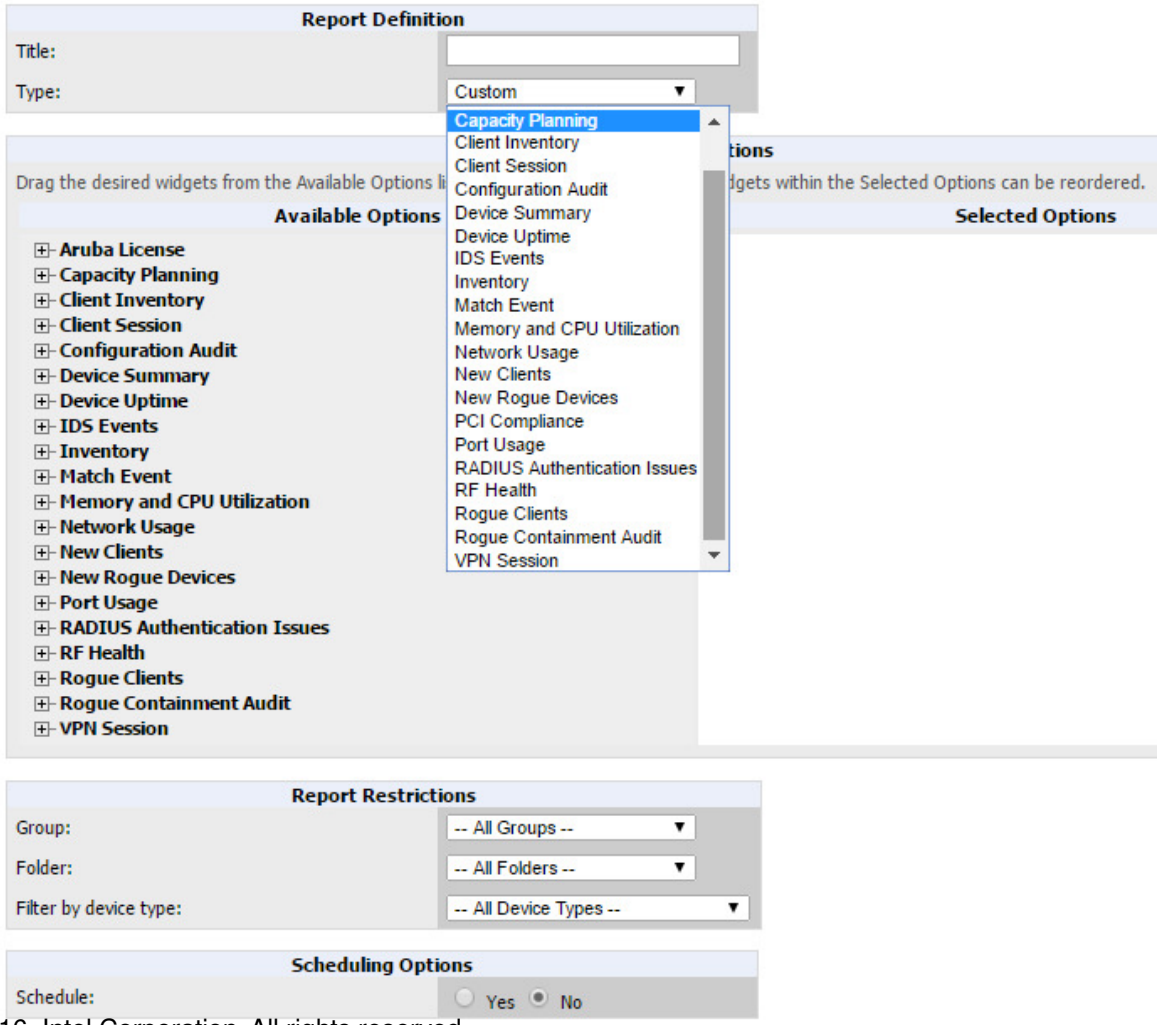
RF Health Report Options

- 802.11 error counter report options?
- Power and channel change report options?
- Report option for noise and interference?



Report Types

- General categories of report?
- Report options for capacity planning?
- Specialized reports such as PCI?



Enterprise vs. Regional

- Enterprise console for big picture.
- How is the support team organized?
- Regional server grouped by similar time zone so can do maintenance.
- Regional support users can have their access restricted to a subset of the servers, even portions of servers.

Enterprise Wide Console

- Enables a global view.
- Big picture for
  - Hardware deployed with software currently running.
  - License utilization.
  - Memory and CPU.
  - Uptime

Questions?

Thank you