



ENTERPRISE WLAN AS A SERVICE

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Why Controller-less ?



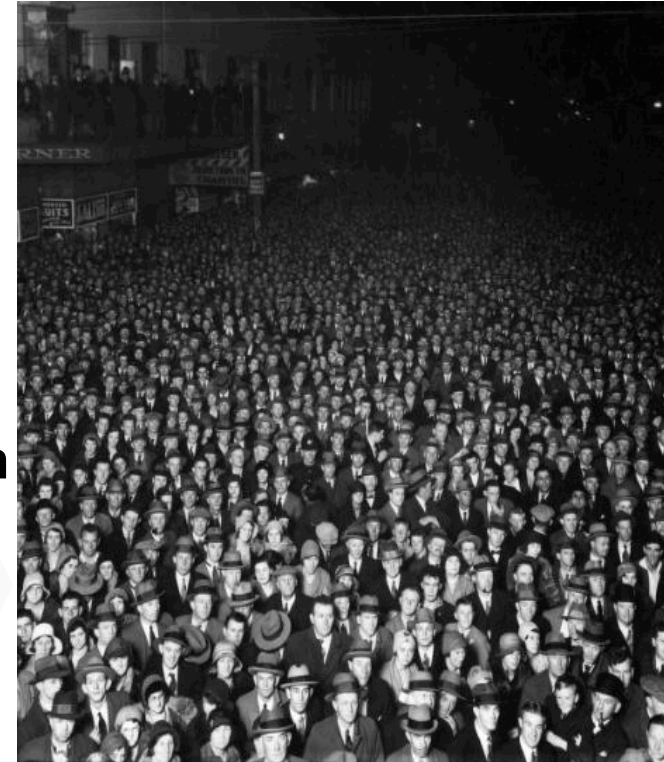
Unified centralized Management !



Centralized Monitoring & Configuration



Centralized Troubleshooting





WHY CONTROLLER-LESS ?

802.11b/a

1999

802.11g

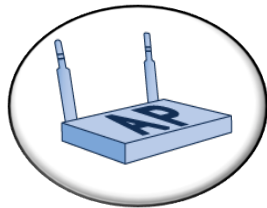
2003

802.11n

2007

802.11ac

2012



Autonomous APs

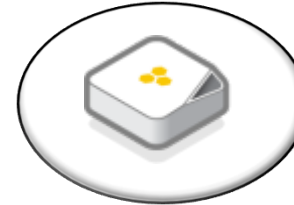
- ✓ Scales linear (AP per AP)
- ✓ Low Cost (no additional Hardware)
- **Limited Intelligence**
- **No Radio-Management/No real Network Integration**
- **Hard to manage (AP by AP)**

Realized by
Moore's Law



Centralized Control

- **Centralized Intelligence**
 - ✓ Radio Resource Management (RRM)
 - ✓ Authentication & Key Management
 - ✓ WIPS, Location Services, L3 Roaming and more
 - **More Design- and Complexity effort**
 - **Single Point of Failure & Redundancy expensive**
 - **Bottleneck and scales not so easy and cheap**

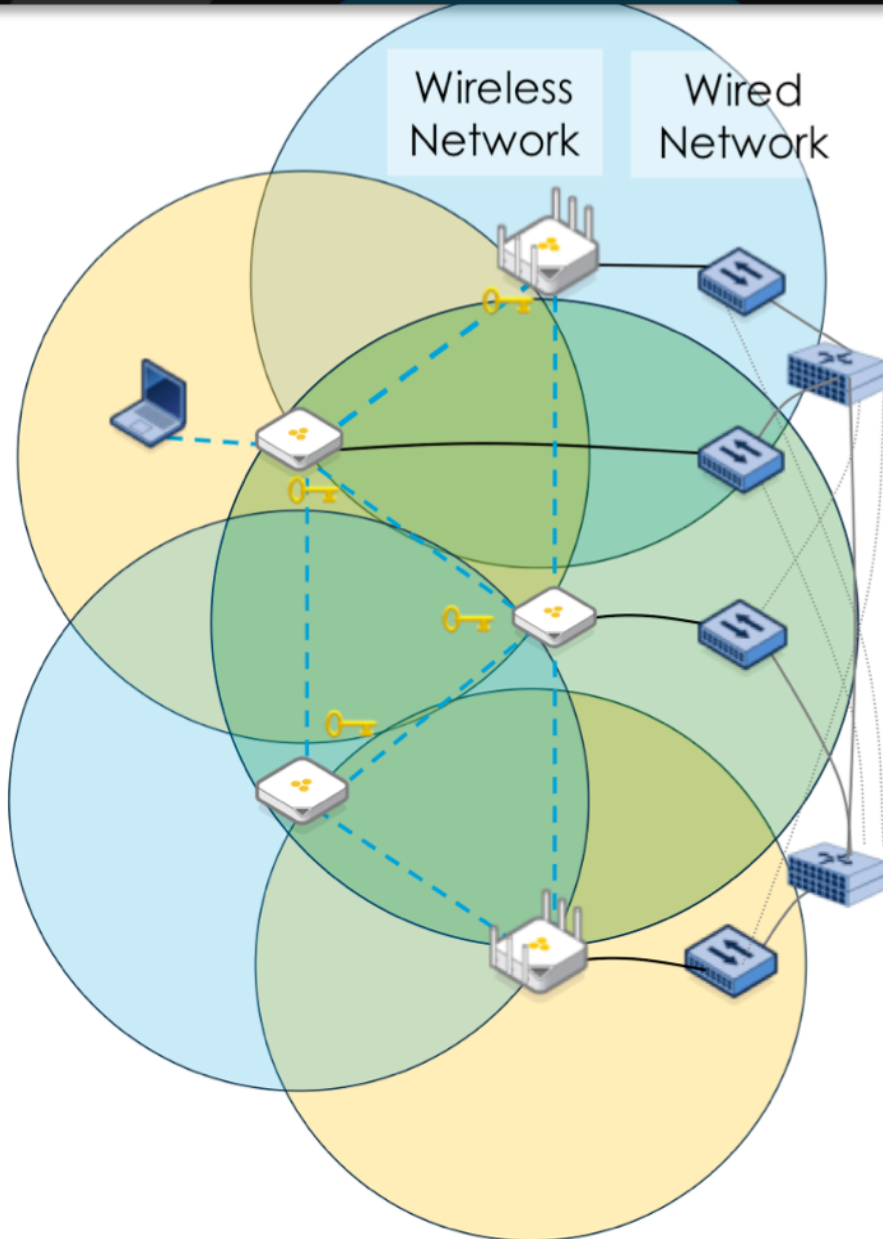


Cooperative Control

- **Distributed Intelligence**
 - ✓ Shared Control- and Data plane
 - ✓ All Enterprise Features
 - ✓ Like a distributed Super-Computer
 - ✓ Best-Path Forwarding & Redundancy
 - ✓ Load Balancing, Band Steering
 - ✓ Linear, unlimited, & cheap scalability
 - ✓ Easy to use and to manage
 - ✓ Private & Public Cloud Mgmt. Options

Security, Manageability & Mobility

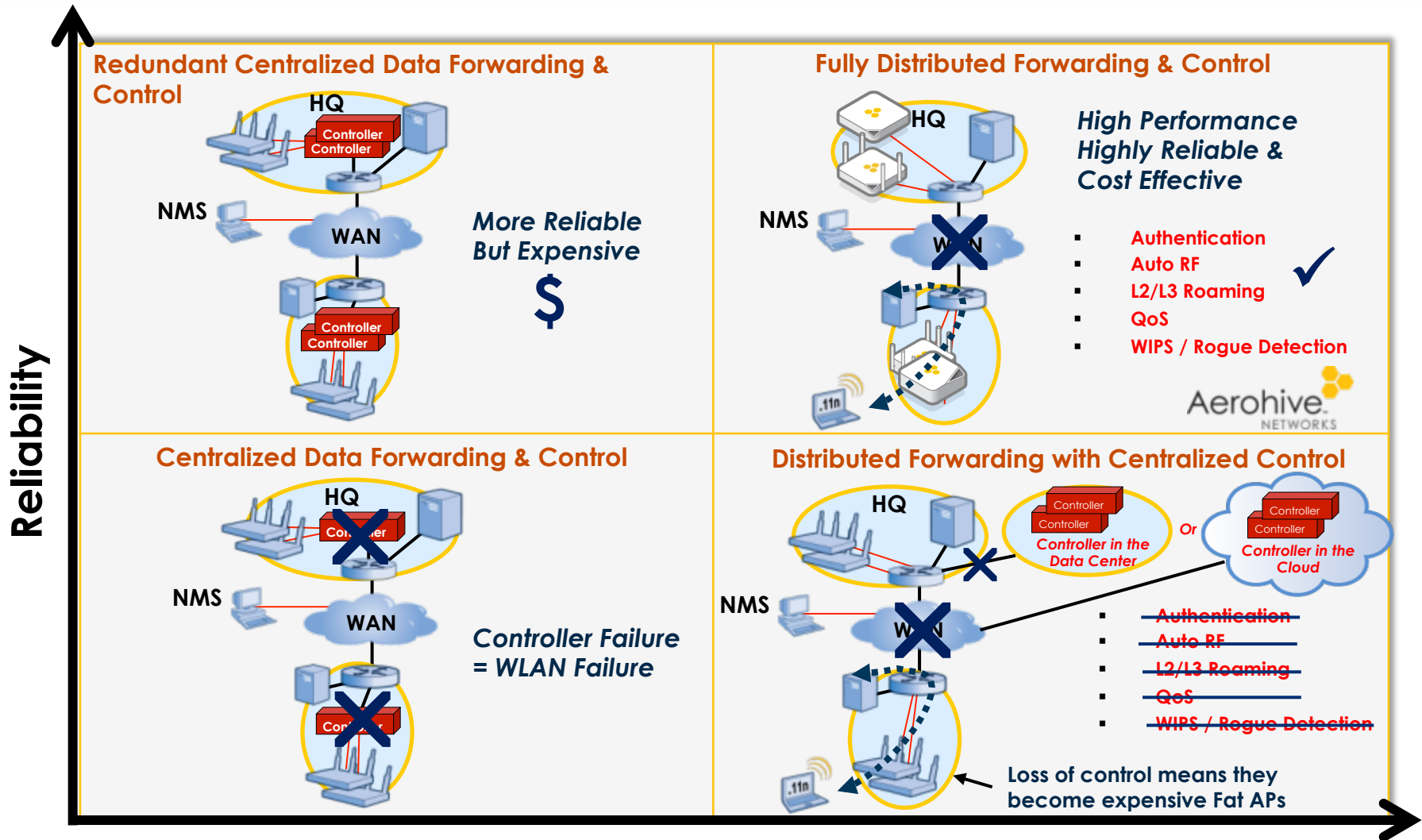
How does it work?



Policy Configuration Reporting Heat Maps SLA Compliance

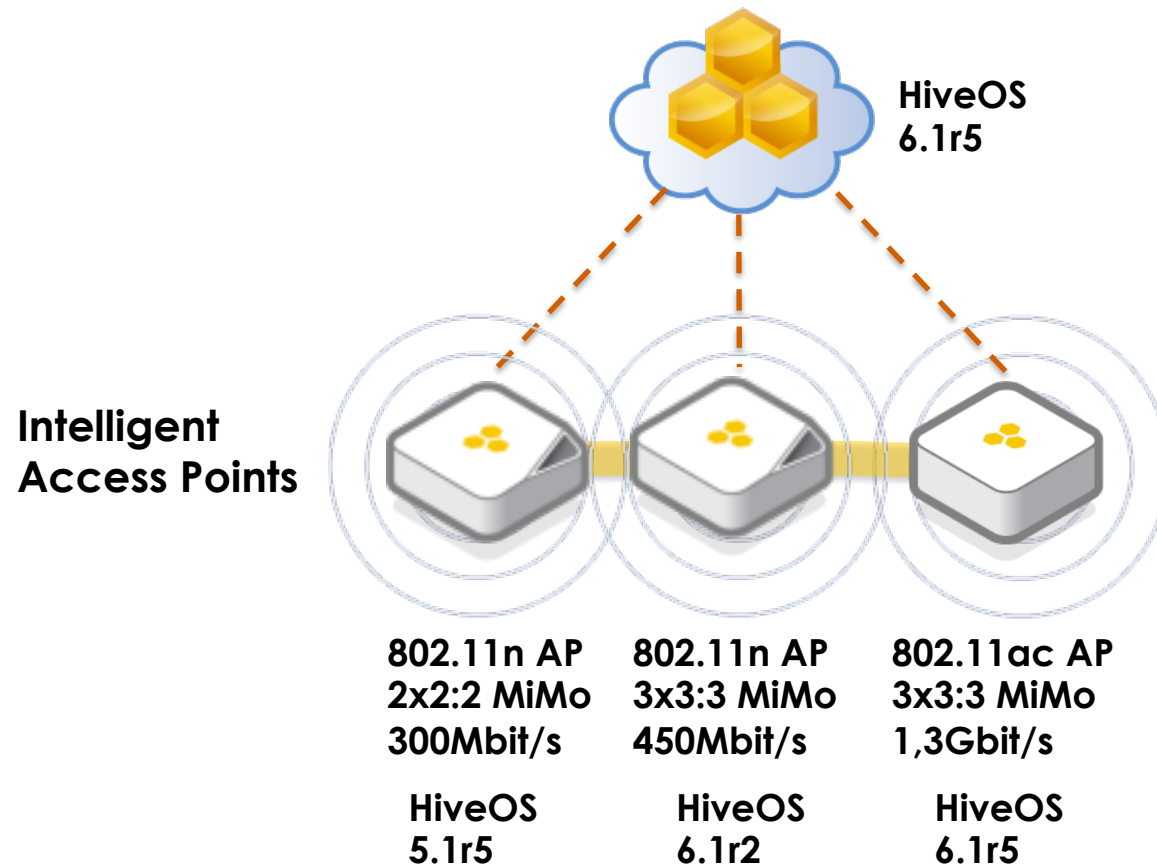
HiveManager NMS

With Cooperative Control,
clients can securely
and seamlessly roam
across the WLAN



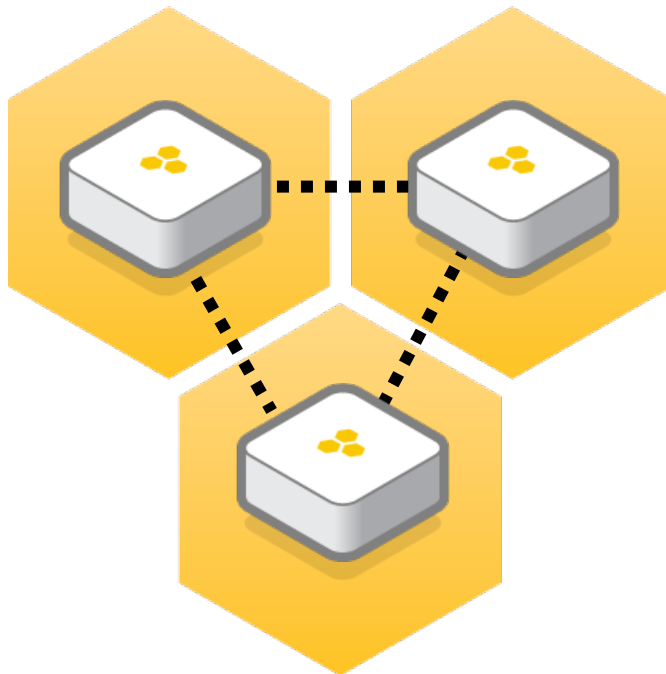
Performance & Cost Effectiveness

HiveManager (NMC) Cloud-based or On-Prem

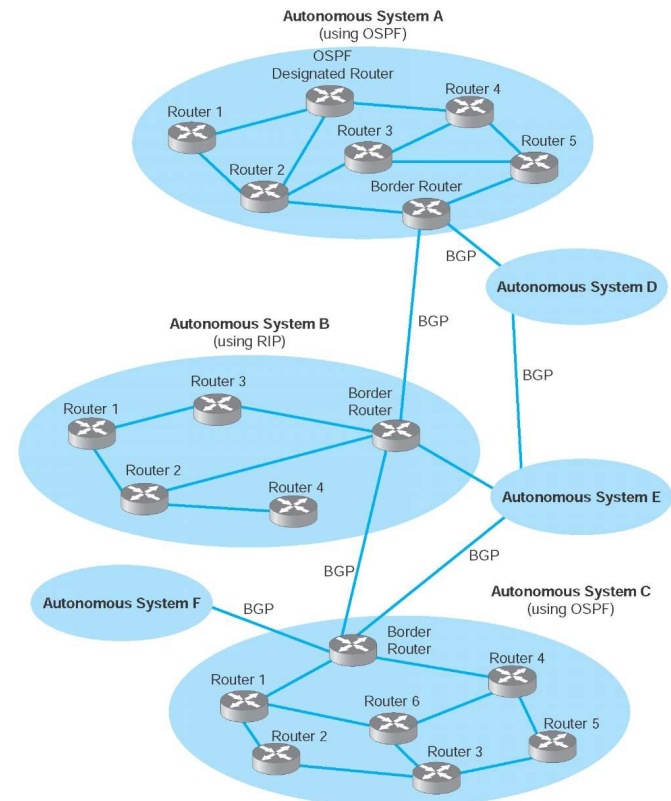


Cooperative Control Architecture

- Control Plane coordination between APs
- Implemented in **Intelligent** Software Protocols
- No Hardware Controller available / required



=



Centralized versus Distributed Control

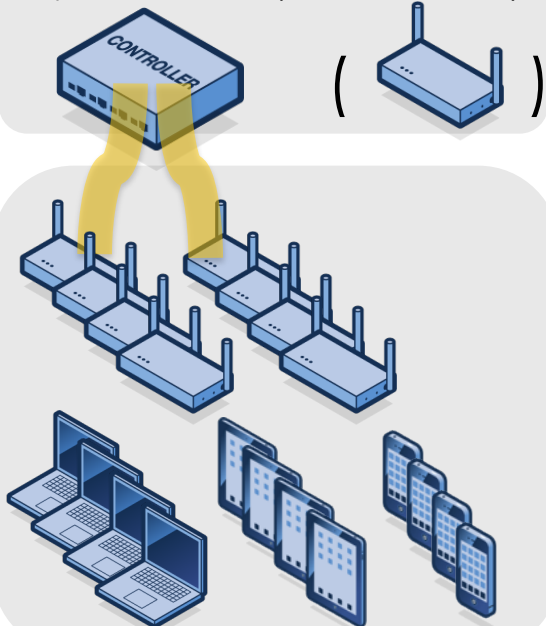
Shared Control Plane Processing

Over Provisioning
(Pay too much)

Under Provisioning
(Impact Performance)



Physical Controller (Virtual Controller)



Parallel Control Plane Processing

Scalable Processing
(Pay for what you need)

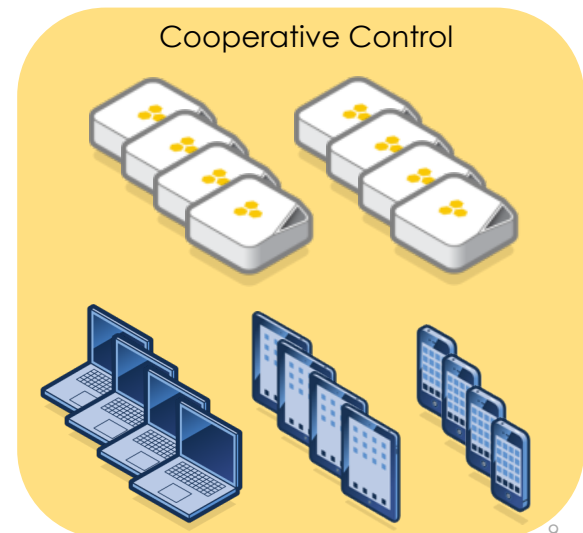


Processing & Cost

Control Functions

- User Authentication
- Role-based Access Control
- Captive Web Portal and Guest Access
- Self-Tuning RF Management
 - › Channel selection & power level
 - › Client load balancing & band steering
- RF Threat Protection and WIPS
- Secure Fast Roaming (L2 & L3)
- Voice over WLAN & QoS support
- Dynamic Mesh Failover

Cooperative Control



Distributed (Controller-less) Wi-Fi Architecture

Delivering simplicity, reliability and affordability

Management

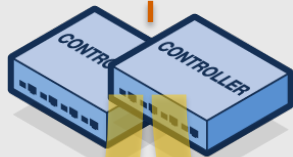


Management *within* the network only

Centralized cloud-based or Local management



Redundancy



Requires multiple controllers
Local data forwarding..what do you lose?

No single point of failure
Self healing mesh architecture
No controller tax

Scalability and future proofing

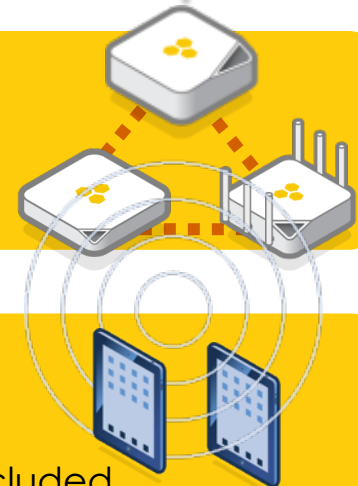
Controller capacity?
Feature licenses?

No feature licensing
Start small and grow
Distributed intelligence
(FW, RADIUS, CWP, BYOD, Bonjour GW)

Performance

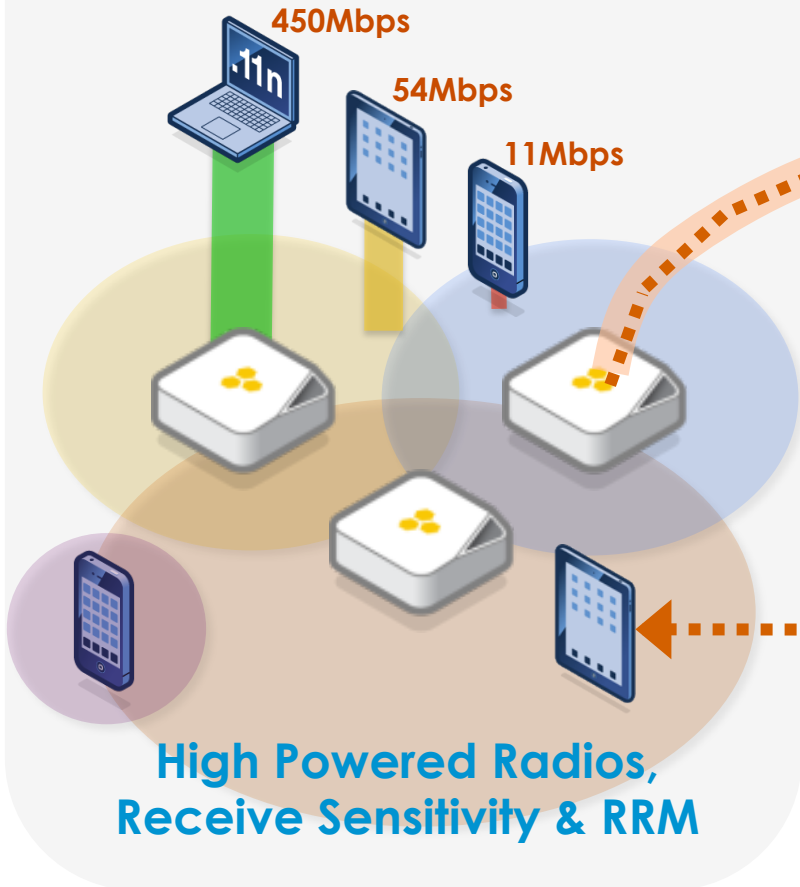
Data bottlenecks
QoS, Spectrum analysis..\$\$\$

No data bottlenecks
Service Level Agreements
QoS & Spectrum analysis included



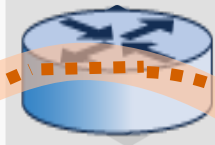
Optimization

SLA, QoS & Dynamic Airtime Scheduling



Mobility

Layer 3 Roaming



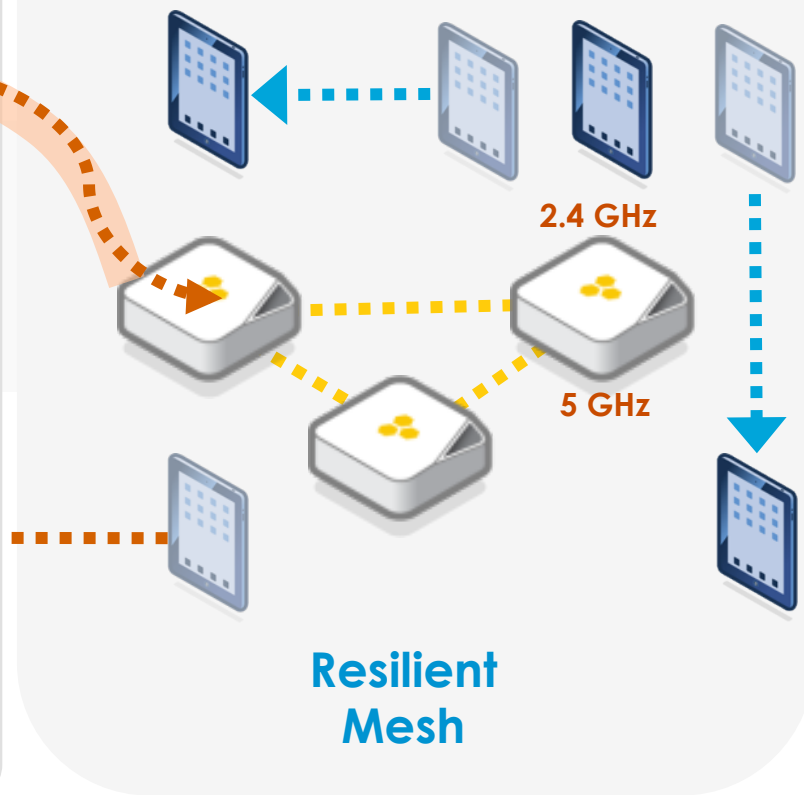
Layer 2 Roaming

Layer 2/3 Roaming

Distribution

Load Balancing

Band Steering

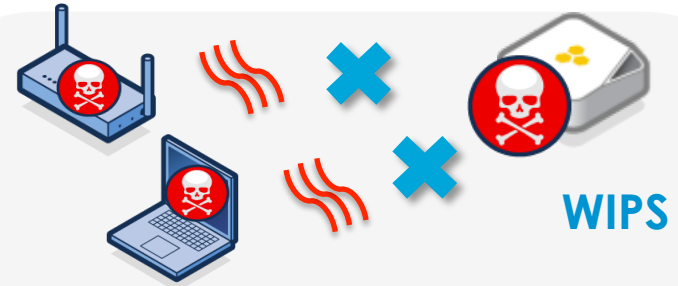


Captive Web Portal

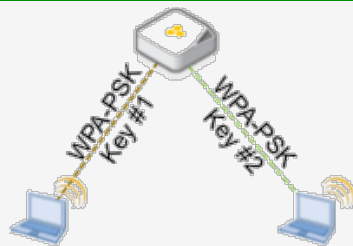


Multiple CWP's able to serve scalably from every AP

Wireless Intrusion Prevention

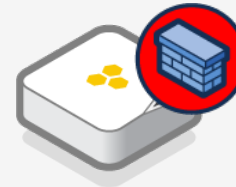


Private PSK



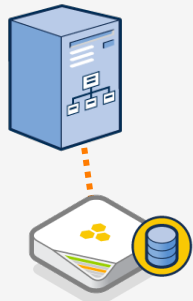
Multiple users, same SSID - easy but unique revocable keys

Stateful L2-L7 Firewall



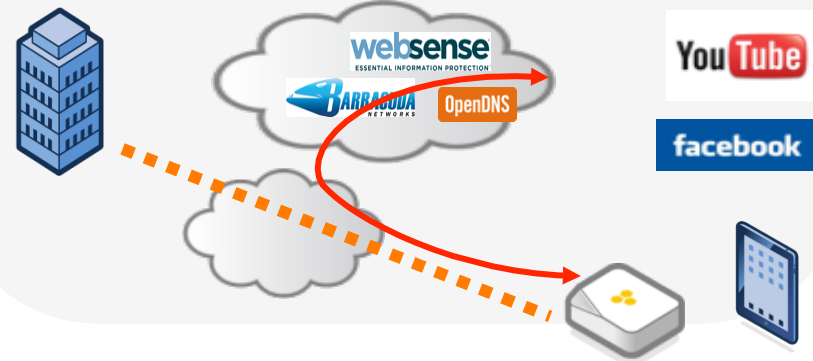
- MAC (L2) based firewall
- Stateful TCP/IP firewall (L3/L4)
- L7 App Visibility & Enforcement
- ALGs for DNS/FTP/SIP
- Policy Based Client Isolation

Directory Integration



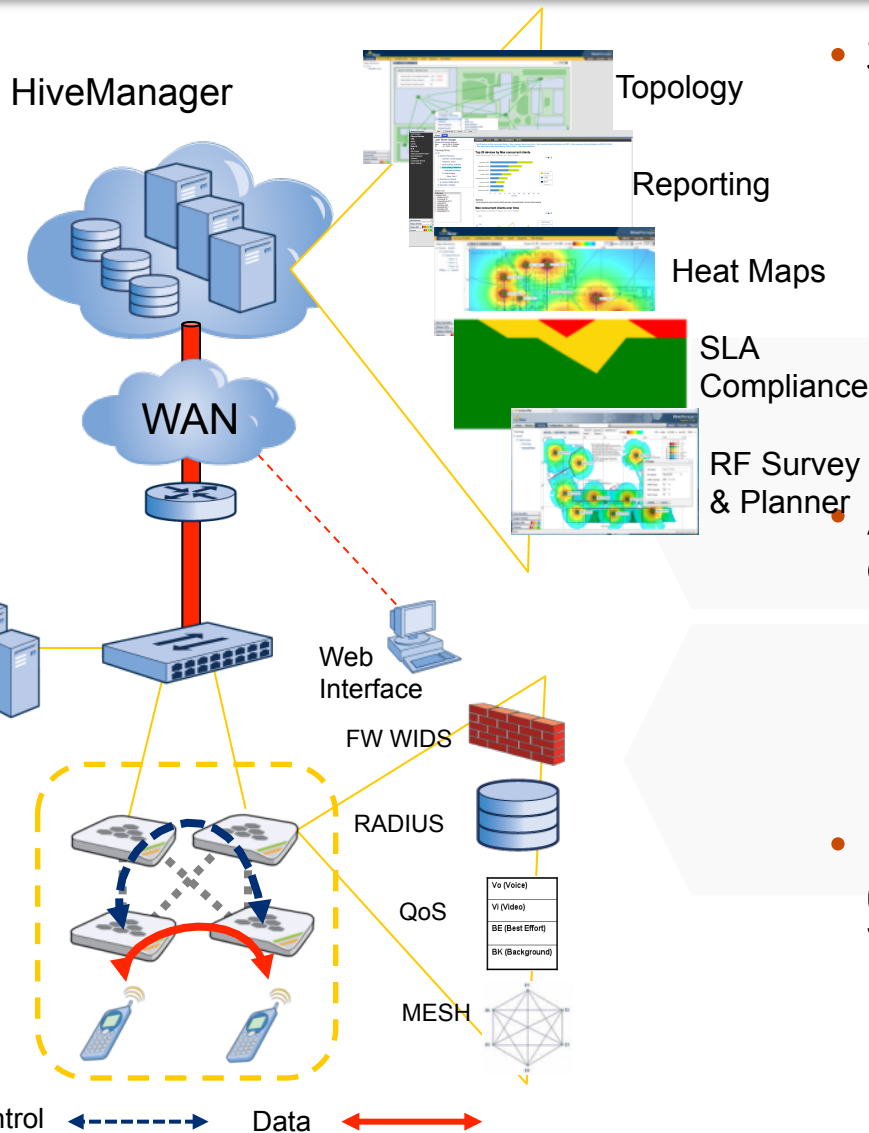
- Authentication support for common directory servers
- Eliminates standalone RADIUS server
- Credential caching for remote/branch survivability

Remote Site Content Security





UNIFIED CENTRALIZED MANAGEMENT



• SaaS delivery of enterprise Wi-Fi and Branch On Demand Mgmt

- › Per AP service / Customer domain
- › Policy-based mgmt, topology, reporting, heat maps, SLA compliance, and RF survey and planning tools
- › Virtualized, resilient infrastructure
- › Two modes – Express & Enterprise
- › Role-based customer administration
- › Seamless transition between online and on-premise HiveManager

• APs with distributed control and data forwarding

- › Minimal onsite hardware
- › Pay as you go expansion
- › No single points of failure!
 - » WAN outage does not impact WLAN Connectivity or Functionality (Roaming, Auto RF, QoS, Authentication)

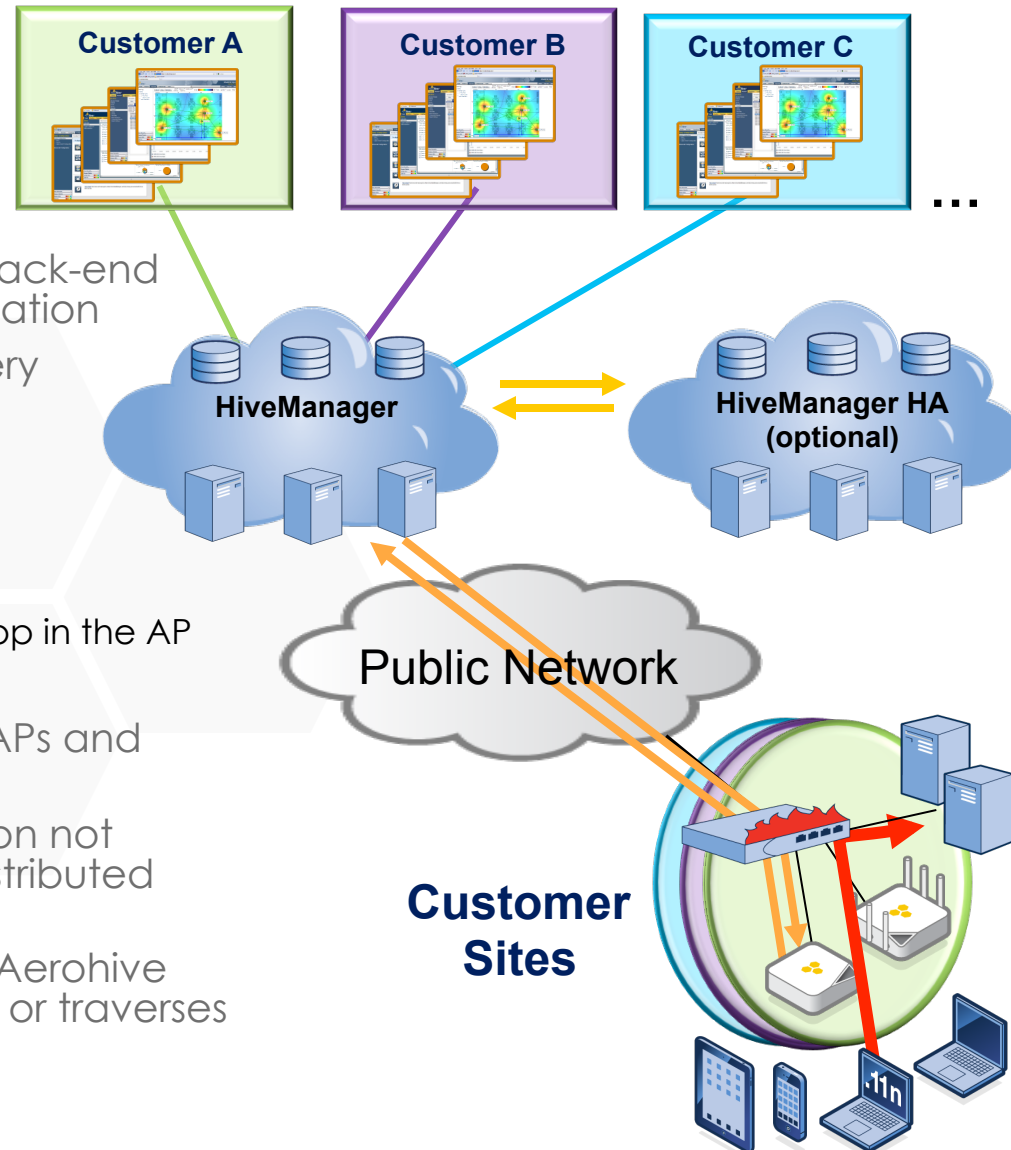
• Intelligent APs and branch routers (Integrated Firewall, RADIUS, QoS, VPN, Mesh)

• Infrastructure

- › Uses HiveManager
 - » AJAX interface
 - » Database virtualization
- › Customer and system management back-end provides support and customer automation
- › Automatic system backup and recovery

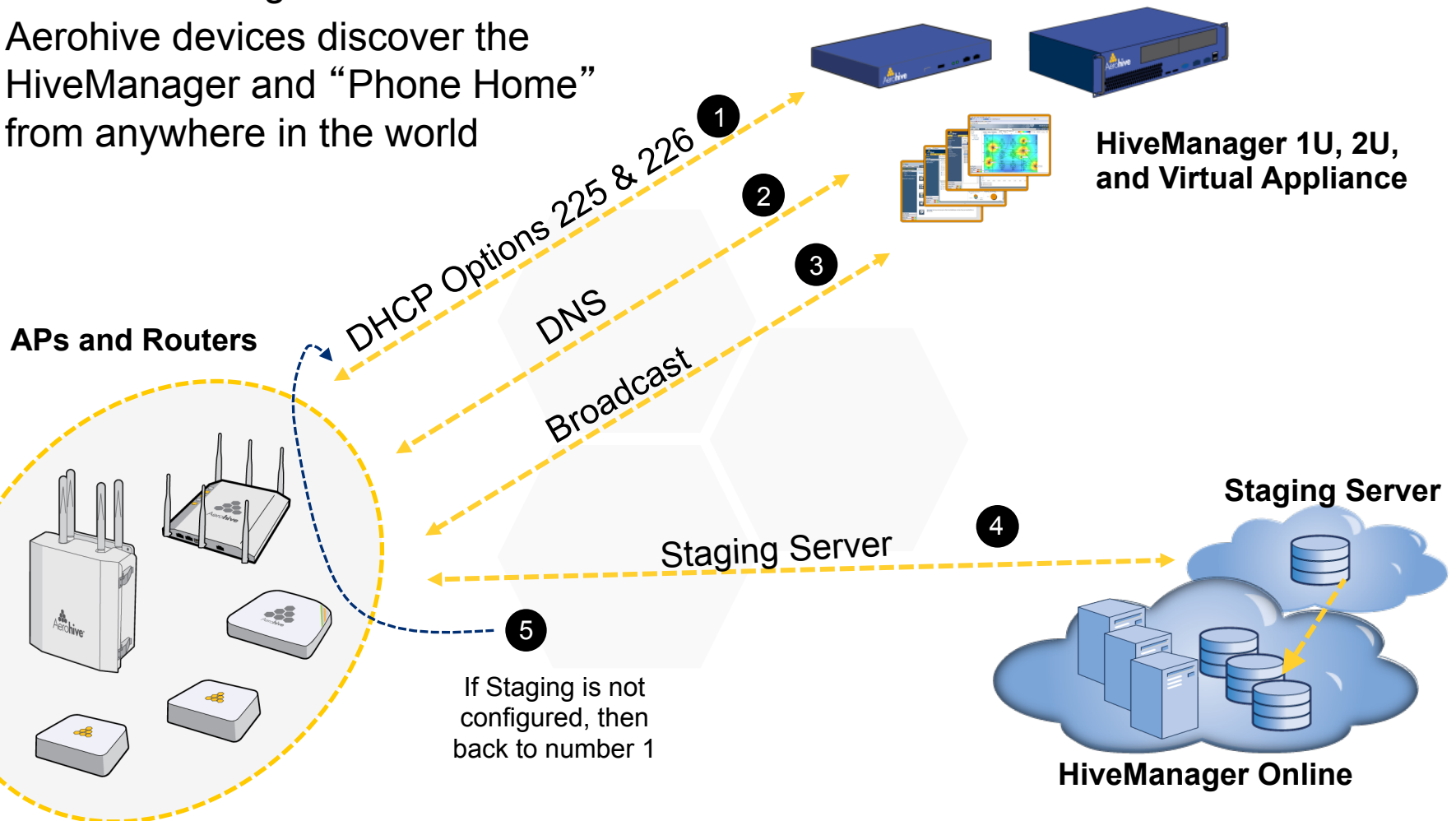
• Network Connectivity

- › AP initiates connection
 - » Requires no firewall configuration, just drop in the AP
 - » Traffic is secured using SSH and DTLS
- › Policy and configuration is pushed to APs and routers
- › HiveManager monitoring / configuration not essential to WLAN operation due to distributed control and data forwarding
- › No actual **data** traffic from managed Aerohive devices (APs and routers) is forwarded or traverses the Aerohive Cloud Services Platform.



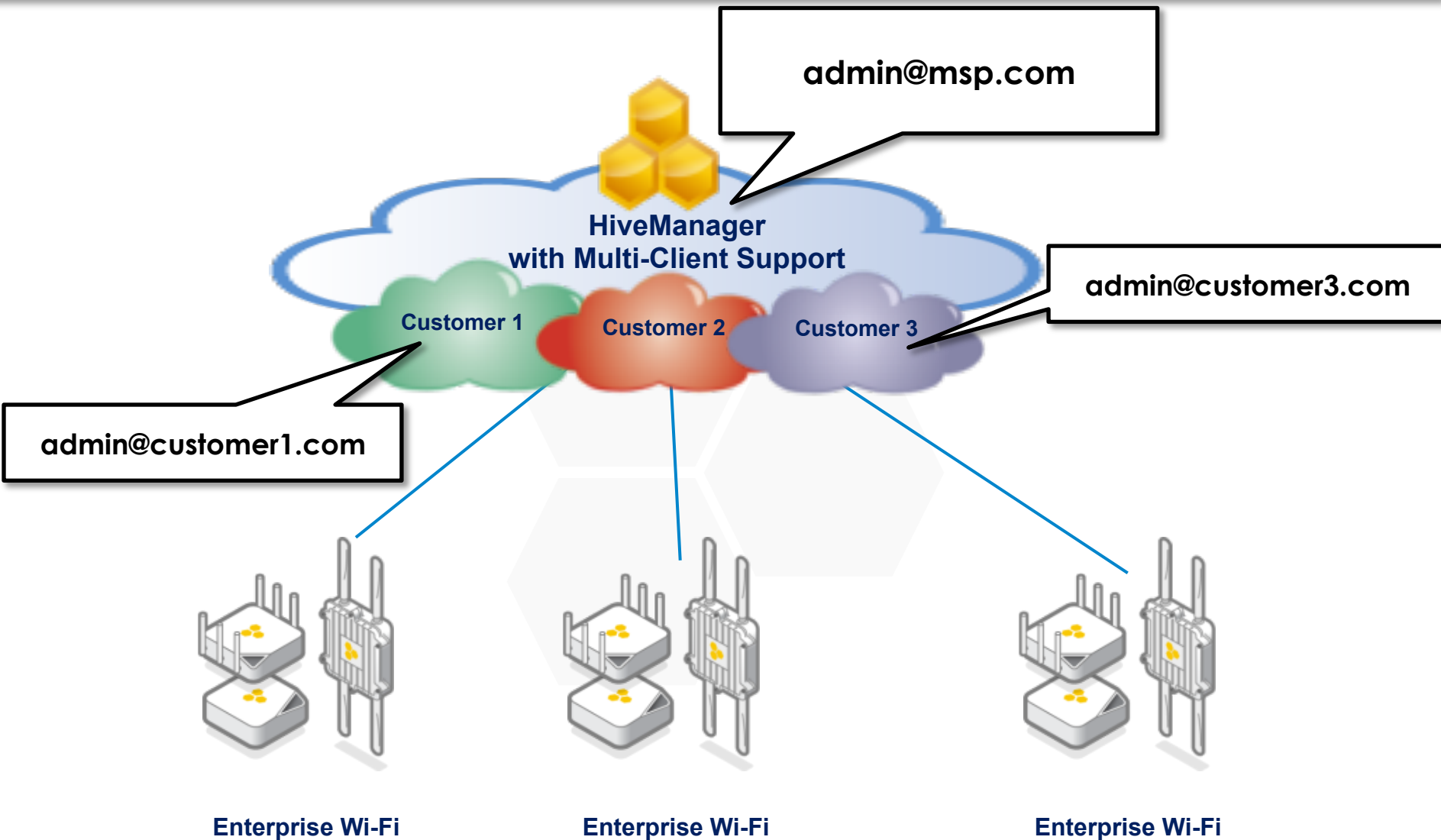
HiveAP Auto-Discovery Functionality

- Zero Pre-Configuration Needed!
- Aerohive devices discover the HiveManager and “Phone Home” from anywhere in the world



*Note: It is also possible to statically configure the HiveManager information, which disables the auto-discovery functionality

Centralized Management





CENTRALIZED MONITORING & CONFIGURATION

Planning & Monitoring

Aerohive **HiveManager Enterprise 5**

Home Monitor Reports **Topology** Configuration Tools gweltmaierx@web.de MyHive Log Out

View Walls **APs** Auto Placement Band 5 GHz Grid Measuring Tool Scaling Tool Zoom 100%

AP Type 802.11n 2x2 - AP121 (802.11n) Channel Auto Power 15 Add AP Remove All APs Channel Width 20 MHz

0 meters 10 20 30 40 50 60

0 10 20 30

Topology

- DACH
 - Akademie
 - Berlin
 - Duesseldorf
 - Bahnhofstrasse
 - OG_D_Bahnhofstr**
 - EG_D_Bahnhofstras

New Devices 0
Rogue Clients 0
Rogue APs 0 0 0 0

<https://hm-amst51-04.aerohive.com/hm/mans.action?operation=topology&start=1355757871721#tln>

Planning & Monitoring

Aerohive HIVeManage Enterprise 5.1r

Home Monitor Reports **Topology** Configuration Tools gweltmaierx@web.de MyHive Log Out Help

Topology Band 5 GHz Grid Measuring Tool Scaling Tool Zoom 100%

View Walls APs **Auto Placement**

Application High Speed Connectivity Signal Strength -70 dBm **Auto Place APs** Remove All APs

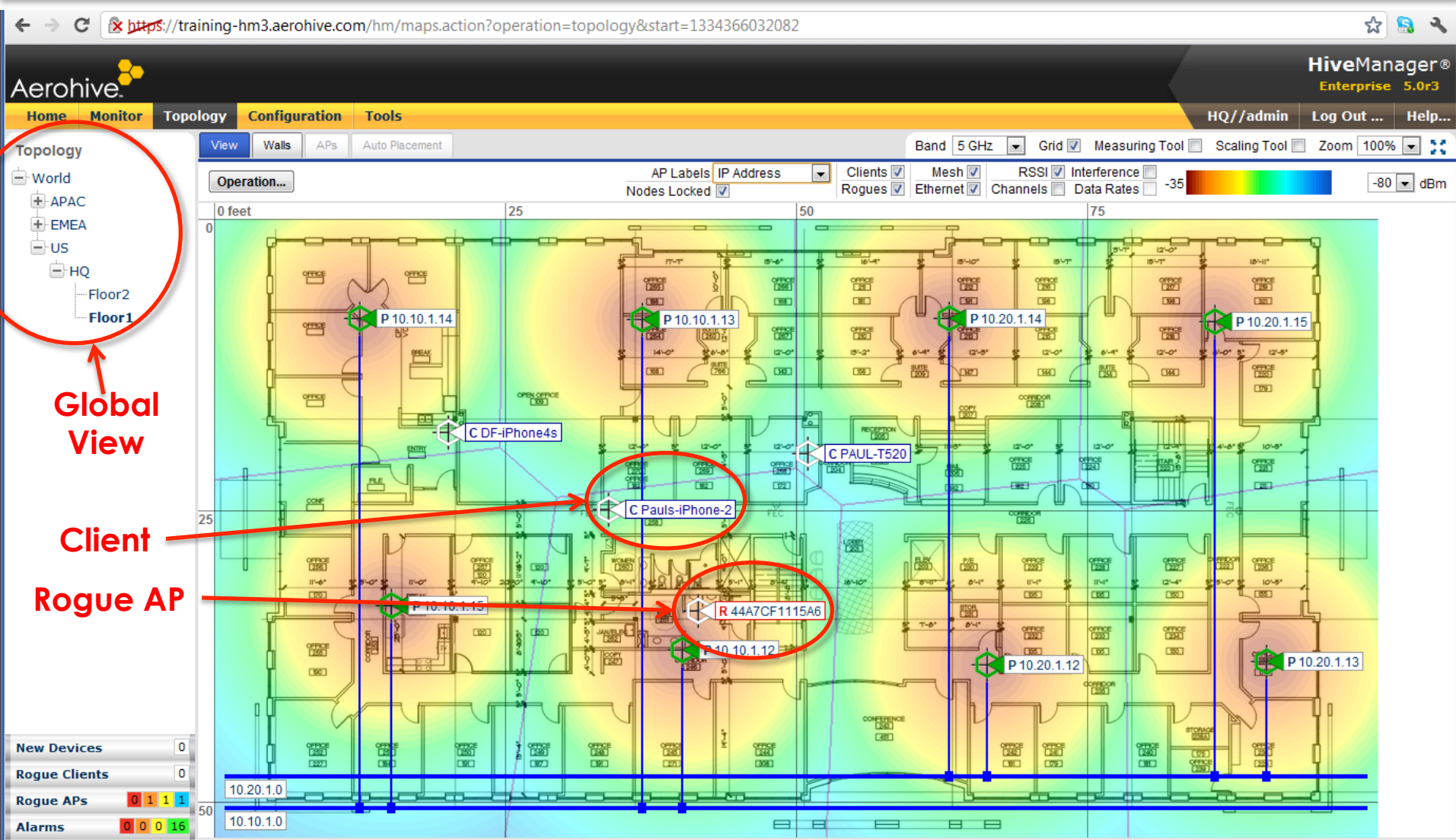
0 meters 10 20 30 40 50 60

0 10 20 30

DACH
+ Akademie
Berlin
Duesseldorf
- Bahnhofstrasse
 OG_D_Bahnhofstr
 EG_D_Bahnhofstras
+ Muenchen

New Devices 0
Rogue Clients 0
Rogue APs 0 0 0 0
Alarms 4 0 0 7

Planning & Monitoring



Global View

Client

Rogue AP

Auto RF Airtime Scheduling L2/L3 Roaming Load Balance User Policy Security Location ...

Device Groups

- Device Groups
 - Locations
 - Aerohive
 - Sunnyvale, CA
 - 328 Gibraltar
 - Floor 1
 - 330 Gibraltar
 - Floor 1
 - Surrey, UK**
 - 16-18 West**
 - Floor 1
 - Network Policies

Data Filters

- Data Filters
 - SSIDs
 - AVC_Demo
 - User Profiles
 - Contractors
 - Employees
 - Executives

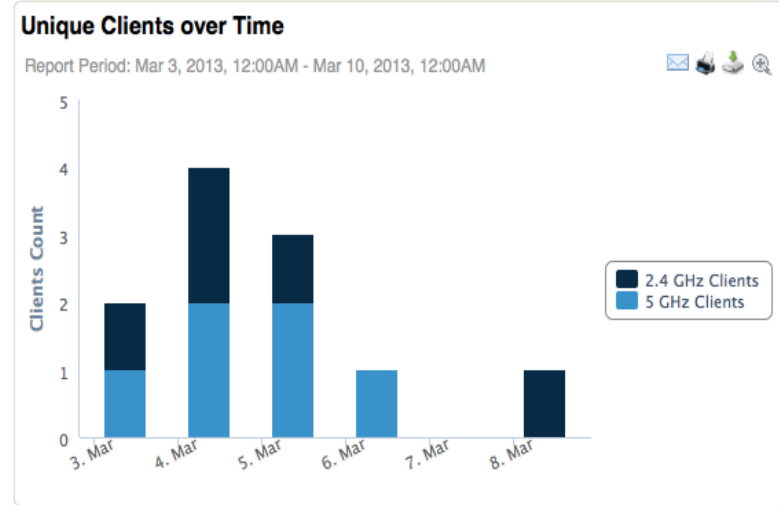
New Devices 3

Rogue Clients 1

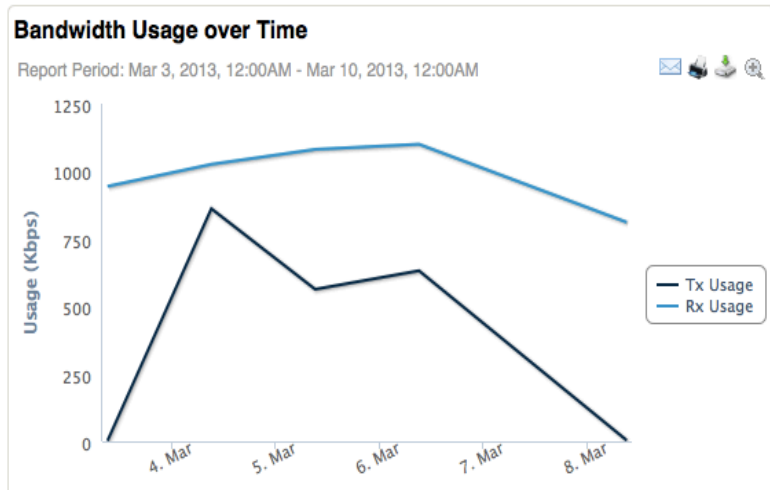
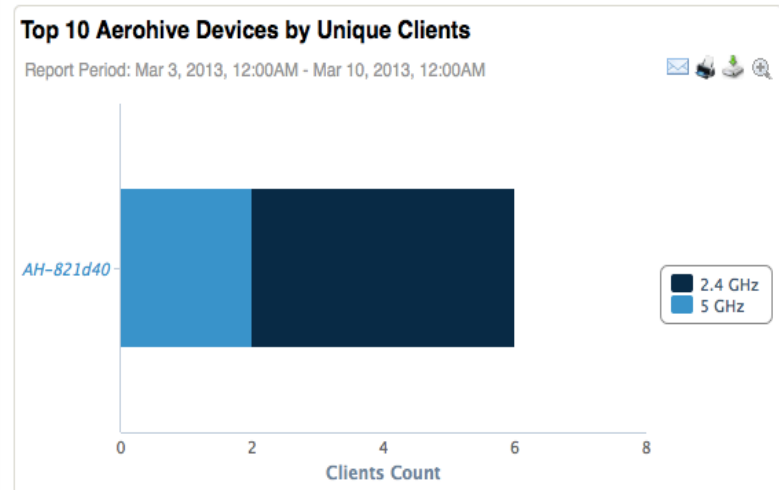
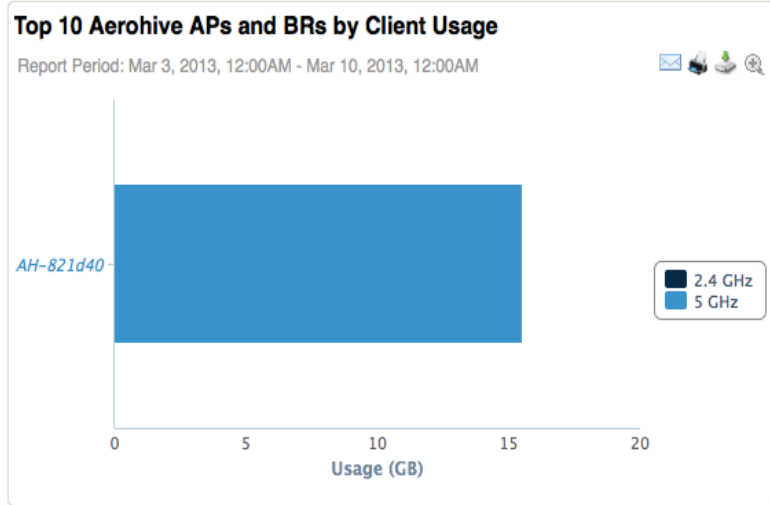
Rogue APs 0 0 0 0

Alarms 7 1 0 2

Last Hour
Last Day
Last Week
Custom
Last Update: 2013-03-10 10:14PM



Edit
Schedule a Report
Export
Email



Device Groups

- Device Groups
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 - Sunnyvale, CA
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 - Floor 1
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 - Network Policies

Data Filters

- Data Filters
 - SSIDs
 - AD_Demo
 - AVC_Demo**
 - MDM-Demo
 - STARFISH
 - User Profiles

New Devices 3

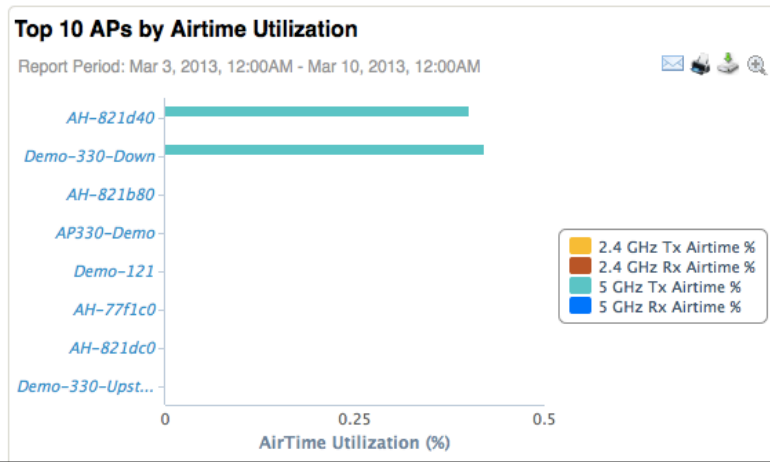
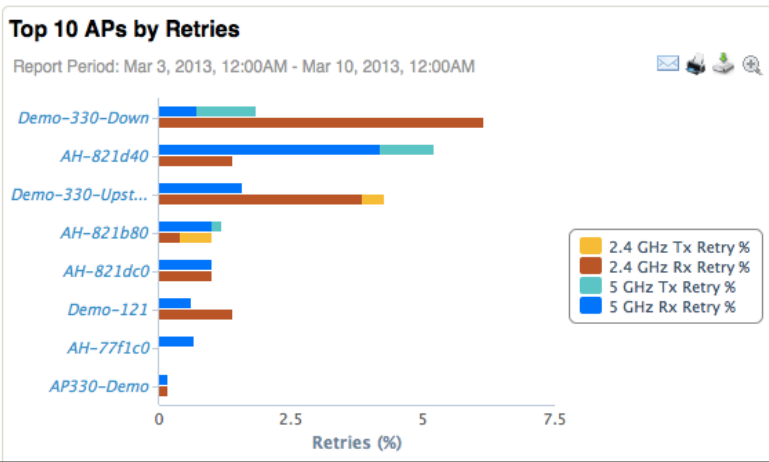
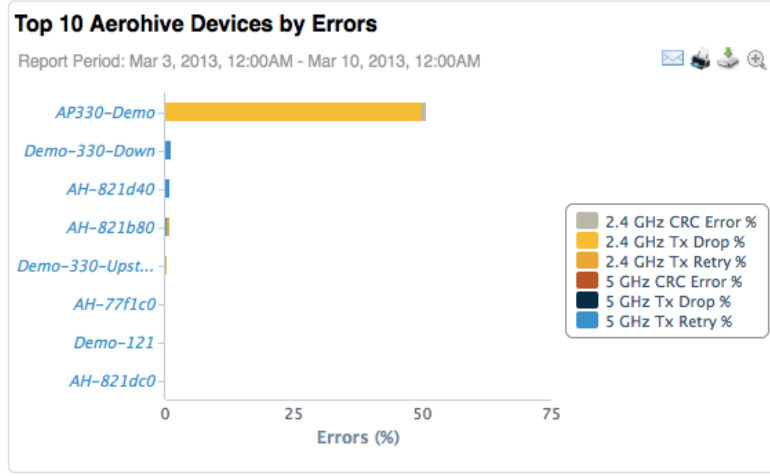
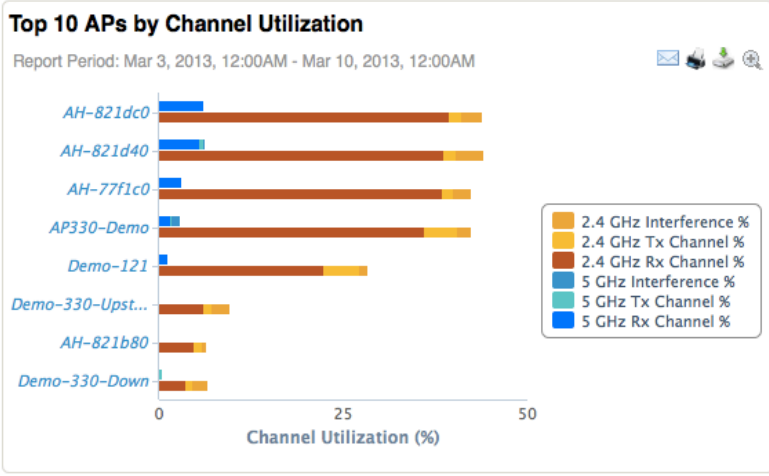
Rogue Clients 1

Rogue APs 0 0 0 0

Alarms 7 1 0 2

Last Hour
Last Day
Last Week
Custom
Last Update: 2013-03-10 10:18PM

Edit
Schedule a Report
Export
Email



Device Groups

- Device Groups
 - Locations
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 - Floor 1
 - 330 Gibraltar
 - Floor 1
 - Surrey, UK
 - 16-18 West
 - Floor 1
 - Network Policies

Data Filters

- Data Filters
 - SSIDs
 - AD_Demo
 - AVC_Demo
 - MDM-Demo
 - STARFISH
 - User Profiles

New Devices 3

Rogue Clients 1

Rogue APs 0 0 0 0

Alarms 7 1 0 2

Last Hour Last Day Last Week Custom Last Update: 2013-03-10 10:13PM

Edit Schedule a Report Export Email

Top 10 Applications by Usage - Summary

Report Period: Mar 3, 2013, 12:00AM - Mar 10, 2013, 12:00AM

Last Update: 2013-03-10 10:25PM

Top 20 Applications by Usage

Report Period: Mar 3, 2013, 12:00AM - Mar 10, 2013, 12:00AM

Application	Usage	Usage Percentage	# of Users	Top User
YOUTUBE	113.74 MB	23.67%	2	Sinclair Lewis

Export Email

Top 20 Applications by Usage

Report Period: Mar 3, 2013, 12:00AM - Mar 10, 2013, 12:00AM

Application	Usage	Applic
OTHERS	1.11 MB	Network
AMAZON	3.09 MB	Web Se
HTTP	99.85 MB	Web Se
ITUNES	74.58 MB	Streami
SSL	113.26 MB	Web Se
TCP	24.18 MB	Networki
UDP	5.06 MB	Networki
YOUTUBE	113.74 MB	Streaming
FACEBOOK	12.92 MB	Social Net

Application Details

Report Period: Mar 3, 2013, 12:00AM - Mar 10, 2013, 12:00AM

Application: **YOUTUBE**

Application Group: **Streaming Media**

Last Update: 2013-03-10 10:26PM

Top 20 Users by Usage

Report Period: Mar 3, 2013, 12:00AM - Mar 10, 2013, 12:00AM

User	Usage	# of Applications	Recent AP	Last Seen
Sinclair Lewis	113.31 MB	1	AH-821b80	2013-03-06 09:00AM

Export Email

User Details

Report Period: Mar 3, 2013, 12:00AM - Mar 10, 2013, 12:00AM

User: **Sinclair Lewis**

Usage: **392.03 MB**

User Profiles: **Contractors**

Last Seen: **2013-03-08 09:00AM**

Top 20 Applications by Usage

Report Period: Mar 3, 2013, 12:00AM - Mar 10, 2013, 12:00AM

Application	Usage	Usage Percentage	# of Users	Top User
YOUTUBE	113.31 MB	28.9%	1	Sinclair Lewis
ITUNES	74.18 MB	18.92%	1	Sinclair Lewis
SSL	72.60 MB	18.51%	1	Sinclair Lewis
HTTP	60.59 MB	15.45%	1	Sinclair Lewis
TCP	24.14 MB	6.15%	1	Sinclair Lewis
HTTP VIDEO	14.77 MB	3.76%	1	Sinclair Lewis
FACEBOOK	10.67 MB	2.72%	1	Sinclair Lewis
HULU	7.78 MB	1.98%	1	Sinclair Lewis
GOOGLE	5.90 MB	1.5%	1	Sinclair Lewis
AMAZON	3.02 MB	0.76%	1	Sinclair Lewis
PANDORA AUDIO	1.64 MB	0.41%	1	Sinclair Lewis
UDP	1.11 MB	0.28%	1	Sinclair Lewis
SKYPE P2P	0.75 MB	0.19%	1	Sinclair Lewis
ICLOUD	0.56 MB	0.14%	1	Sinclair Lewis
OTHERS	0.53 MB	0.13%	1	Sinclair Lewis
SALESFORCE CRM	0.19 MB	0.04%	1	Sinclair Lewis

Client Accessed by this User

Report Period: Mar 3, 2013, 12:00AM - Mar 10, 2013, 12:00AM

MAC Address	Host Name	Client OS	Usage	Device Name
DC2B6184FA2A	DC2B6184FA2A	iPod/iPhone/iPad	4.28 MB	Demo-121
A4D1D2431A35	Pad	iPod/iPhone/iPad	35.60 MB	AH-821d60
64200CE9B132	64200CE9B132	iPod/iPhone/iPad	0.00 MB	AH-821d40
A4D1D2431A35	Pad	iPod/iPhone/iPad	0.00 MB	AH-821d40
E4CE8F2B7B44	E4CE8F2B7B44	Mac OS	96.62 MB	AH-7711c0
64200CE9B132	64200CE9B132	iPod/iPhone/iPad	0.04 MB	AH-821d60

SSIDs Accessed by this User

Report Period: Mar 3, 2013, 12:00AM - Mar 10, 2013, 12:00AM

SSID	Usage	# of Users
AVC_Demo	387.75 MB	1
ARC_Demo	4.28 MB	1

- **Flexible mapping of SSIDs and Users access to the network**
 - › QoS Policy
 - › Firewall Policy
 - › Mobility Policy
 - › VLAN and Tunnel mapping
 - › Routing policy
- **Configurations can be applied across any number of APs and routers**
- **Enables easy large scale management – a wide reaching change can be pushed across a network in seconds**

The screenshot displays the 'Network Configuration' interface for 'Configure Network Policy - AH-Wireless'. It features a 'Configure Interfaces & User Access' section with 'Save' and 'Continue' buttons. Below this, a table lists three network policies:

Name (Access Type)	Authentication	User Profile	VLAN
AH-Guest AH-Guest Open	Guest-CWP CWP: User Authentication GuestManager RADIUS	Guest-Profile (default) Add/Remove	Guest-vlan(144)
AH-Employee AH-Employee WPA/WPA2 802.1X (Enterprise)	Corp-AD RADIUS	Employee-Profile (default) Add/Remove	Employee-vlan(132)
AH-PPSK AH-PPSK Private PSK	<PSK User_Groups> AH-PPSK-Group	AH-PPSK (default) Add/Remove	PPSK-vlan(148)

Below the table are sections for 'VLAN Settings' (MGT Interface VLAN 1, Native (Untagged) VLAN 1), 'Bonjour Gateway', 'Layer 2 IPsec VPN', and 'Additional Settings'. A note at the bottom states: 'LAN port settings are only required when applying this network policy to a BR100 in AP mode.' The interface is branded with the Aerohive logo in the bottom right corner.

Unified Wired and Wireless Policy

Wi-Fi

Network Configuration
Configure Network Policy - UnifiedPolicy
Configure Interfaces & User Access Save Continue

Configure network access, user authentication, and security for the selected network policy.

SSIDs Choose

Name (Access Type)	Authentication	User Profile
Employees Employees WPA/WPA2 PSK (Personal)		Employees (default) Add/B...

**One-Time Port Provisioning
Kann bei einem oder
tausenden Devices**

Switching

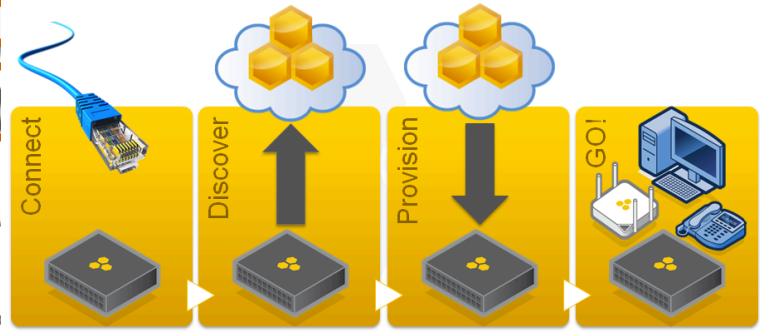
Management and Native VLAN Settings Edit

MGT Interface VLAN 1 Native (Untagged) VL...

▼ **VLAN-to-Subnet Assignments for Router Interfaces**

VLAN	Network	DHCP
1	QS-MGT-172.18.0.0 (Management)	Enabled

[Add](#)



Routing
VPN
Firewall
Bonjour

Router Firewall Choose **Bonjour Gateway** Choose

[Firewall](#) [QS-Bonjour-Service](#)

Layer 3 IPsec VPN Choose

Click **choose** to add a VPN to your network.

Additional Settings Edit

<< Active Clients > '7056819D244D'

Refresh

Deauth

Host Name



Radio Health: 100



Network Health: 100



Application Health: 100

MAC Address

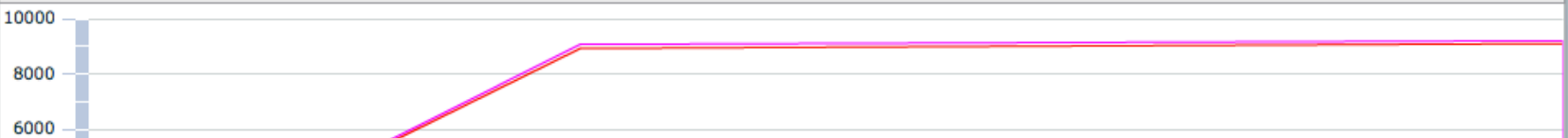
7056819D244D

System Details

Association Time	2012-12-17 16:28:30	Association Duration	6 Mins 58 Secs
IP Address	10.5.1.124	Radio Mode	802.11na
SSID/Security Object	Aerohive_PSK	RSSI	-52 dBm
		Signal-to-Noise ratio	45
User Name		Device Name	AP330-757700
Last Known transmit data rate (Tx BW) in Kbps	364500	Last Known receive data rate (Rx BW) in Kbps	405000
User Profile Attribute	1	CWP Used	No
Auth Method	wpa2-psk	Encryption Method	AES
VLAN	1	Channel	36
BSSID	00197775772A	Client OS	Mac OS
Email Address		Company Name	
Memo	Station 7056:819d:244d is authenticated to 0019:7775:772a thru SSID Aerohive_PSK		

Statistics Details









Transmitted Data



Client Health Score at a glance...understanding a client's health.

Active Clients

Operation... Modify Settings...

<input type="checkbox"/>	Health	MAC Address	IP Address	Host Name	User Name
<input type="checkbox"/>		0015AFDB9EB0	10.16.8.6	your-ecfdcc5b29	
<input type="checkbox"/>		001B7752E4F1	10.16.5.7	Akers-PC	AEROHIVEv
<input type="checkbox"/>		9027E4447886	10.16.5.28	iPhone	marevalo
<input type="checkbox"/>		00215D4E...			
<input type="checkbox"/>		0024D70A0674	10.16.5...		
<input type="checkbox"/>		0026C68B2D8E	10.16.5.55		
<input type="checkbox"/>		0024D7075344	10.16.5.1	SPHILIP-X201	svt-...
<input type="checkbox"/>		001E652A658A	10.16.5.4	MAREVALO-T400	AEROHIVEv



Good connection

High data rates & high successful transmission rates



Marginal connection

Lower data rates / lower successful transmission rates



Poor connection

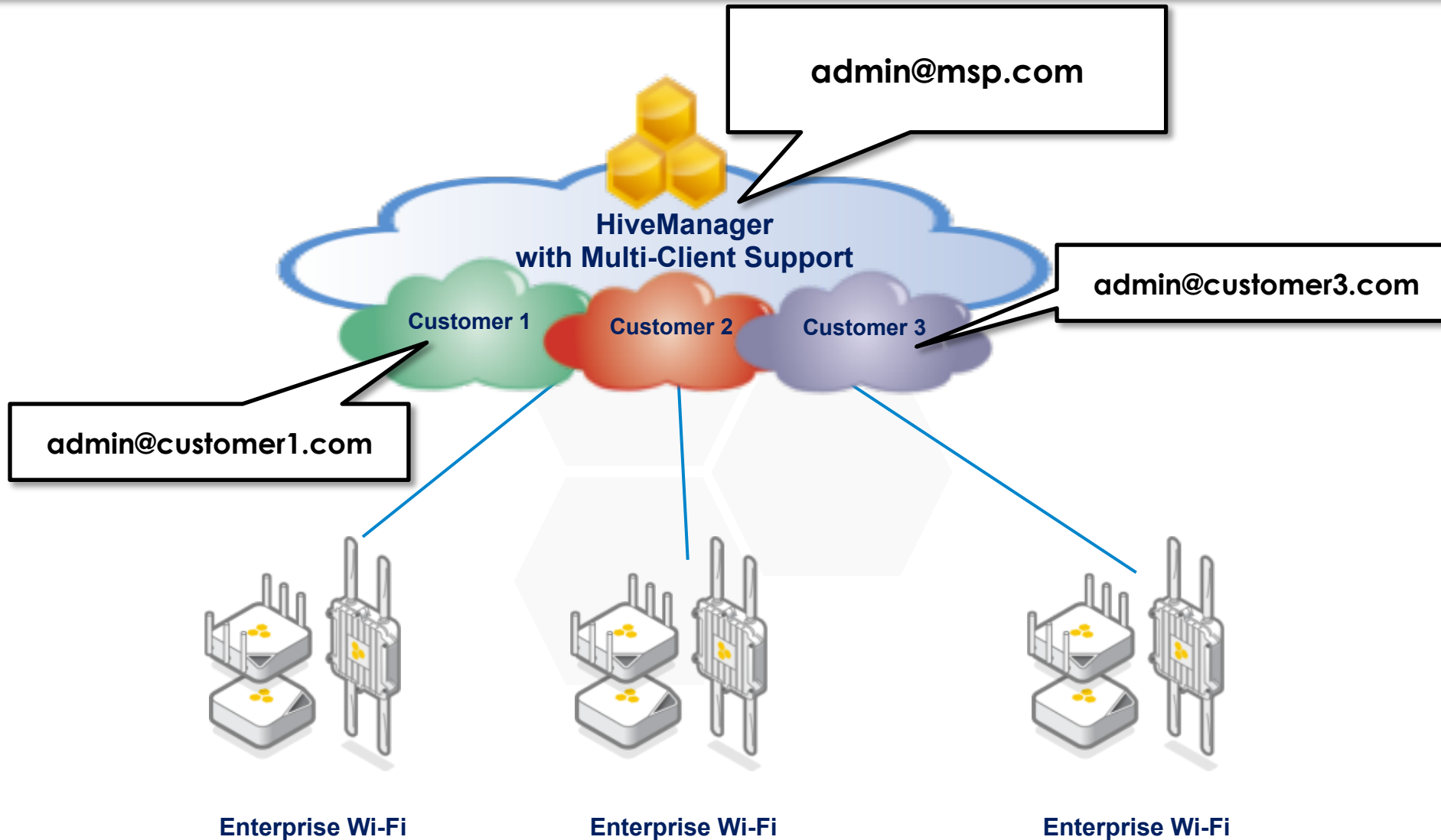
Low data rates / low successful transmission rates

Automatically Remediate Client & Network Issues

- **Move Clients**
 - › Band steer or load balance clients triggered by low client health score
- **Airtime Boost**
 - › Boosts clients' airtime if unable to hit performance target



Centralized Management

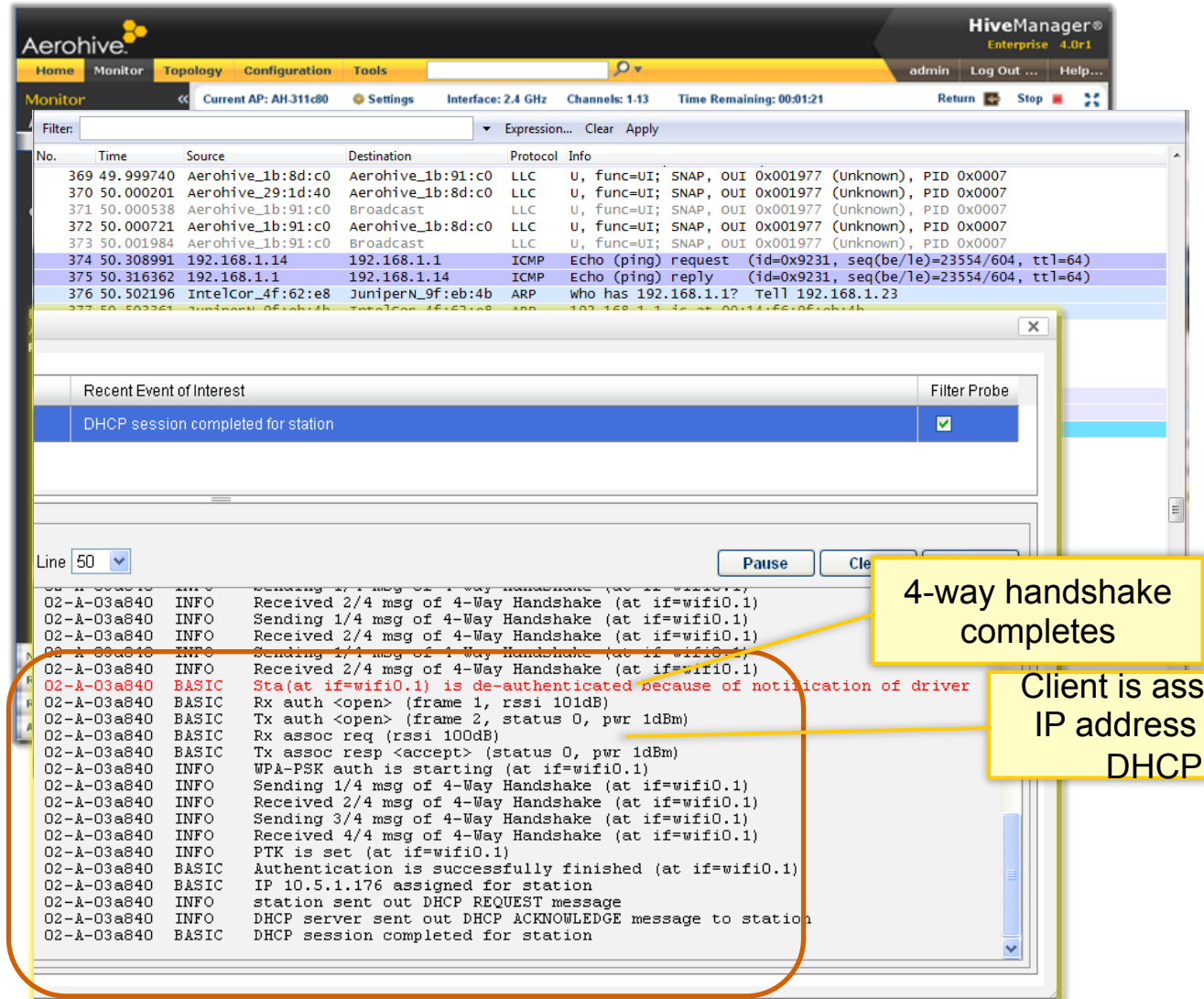




CENTRALIZED TROUBLESHOOTING

Troubleshoot

- RF Problems
 - › Spectrum Analyzer
- Application Problems
 - › Remote Sniffer
- Authentication Problems
 - › Client Monitor
- VLAN Probe
 - › Network Setup



The screenshot displays the Aerohive HiveManager Enterprise 4.0r1 interface. The top navigation bar includes Home, Monitor, Topology, Configuration, and Tools. The Monitor section is active, showing details for 'Current AP: AH-311c80' with an interface of 2.4 GHz and 1-13 channels. A table of network traffic is visible, with a filter applied. Below the traffic table, a 'Recent Event of Interest' section shows a 'DHCP session completed for station' event. The bottom portion of the interface displays a log of network events, including 4-way handshake messages and DHCP session completion. A yellow callout box points to the '4-way handshake completes' message, and another yellow callout box points to the 'Client is assigned IP address DHCP' message.

No.	Time	Source	Destination	Protocol	Info
369	49.999740	Aerohive_1b:8d:c0	Aerohive_1b:91:c0	LLC	U, func=UI; SNAP, OUI 0x001977 (Unknown), PID 0x0007
370	50.000201	Aerohive_29:1d:40	Aerohive_1b:8d:c0	LLC	U, func=UI; SNAP, OUI 0x001977 (Unknown), PID 0x0007
371	50.000538	Aerohive_1b:91:c0	Broadcast	LLC	U, func=UI; SNAP, OUI 0x001977 (Unknown), PID 0x0007
372	50.000721	Aerohive_1b:91:c0	Aerohive_1b:8d:c0	LLC	U, func=UI; SNAP, OUI 0x001977 (Unknown), PID 0x0007
373	50.001984	Aerohive_1b:91:c0	Broadcast	LLC	U, func=UI; SNAP, OUI 0x001977 (Unknown), PID 0x0007
374	50.308991	192.168.1.14	192.168.1.1	ICMP	Echo (ping) request (id=0x9231, seq(be/le)=23554/604, ttl=64)
375	50.316362	192.168.1.1	192.168.1.14	ICMP	Echo (ping) reply (id=0x9231, seq(be/le)=23554/604, ttl=64)
376	50.502196	IntelCor_4f:62:e8	JuniperN_9f:eb:4b	ARP	who has 192.168.1.1? Tell 192.168.1.23

Recent Event of Interest

Event	Filter Probe
DHCP session completed for station	<input checked="" type="checkbox"/>

Line 50

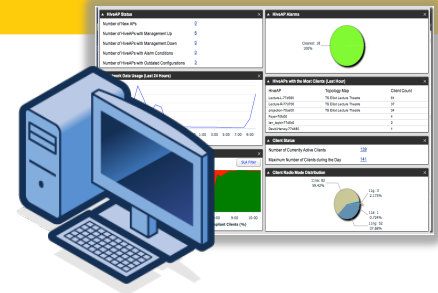
```
02-A-03a840 INFO Sending 2/4 msg of 4-Way Handshake (at if=wifi0.1)
02-A-03a840 INFO Received 2/4 msg of 4-Way Handshake (at if=wifi0.1)
02-A-03a840 INFO Sending 1/4 msg of 4-Way Handshake (at if=wifi0.1)
02-A-03a840 INFO Received 2/4 msg of 4-Way Handshake (at if=wifi0.1)
02-A-03a840 INFO Sending 1/4 msg of 4-Way Handshake (at if=wifi0.1)
02-A-03a840 INFO Received 2/4 msg of 4-Way Handshake (at if=wifi0.1)
02-A-03a840 BASIC Sta(at if=wifi0.1) is de-authenticated because of notification of driver
02-A-03a840 BASIC Rx auth <open> (frame 1, rssi 10dB)
02-A-03a840 BASIC Tx auth <open> (frame 2, status 0, pwr 1dBm)
02-A-03a840 BASIC Rx assoc req (rssi 100dB)
02-A-03a840 BASIC Tx assoc resp <accept> (status 0, pwr 1dBm)
02-A-03a840 INFO WPA-PSK auth is starting (at if=wifi0.1)
02-A-03a840 INFO Sending 1/4 msg of 4-Way Handshake (at if=wifi0.1)
02-A-03a840 INFO Received 2/4 msg of 4-Way Handshake (at if=wifi0.1)
02-A-03a840 INFO Sending 3/4 msg of 4-Way Handshake (at if=wifi0.1)
02-A-03a840 INFO Received 4/4 msg of 4-Way Handshake (at if=wifi0.1)
02-A-03a840 INFO PTK is set (at if=wifi0.1)
02-A-03a840 BASIC Authentication is successfully finished (at if=wifi0.1)
02-A-03a840 BASIC IP 10.5.1.176 assigned for station
02-A-03a840 INFO station sent out DHCP REQUEST message
02-A-03a840 INFO DHCP server sent out DHCP ACKNOWLEDGE message to station
02-A-03a840 BASIC DHCP session completed for station
```

Manage

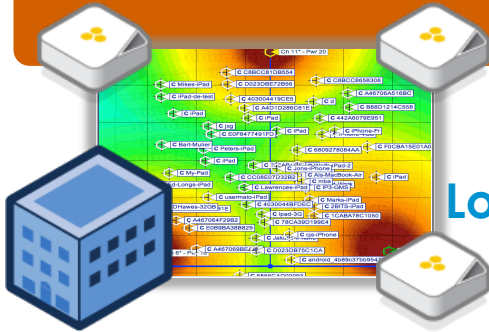


Cloud Management

Simple GUI

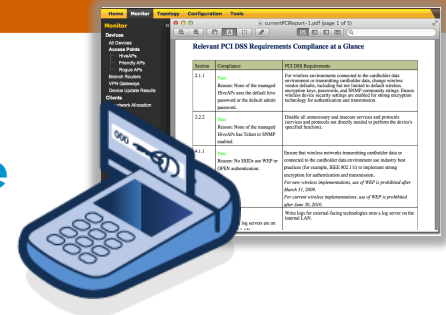


Monitor

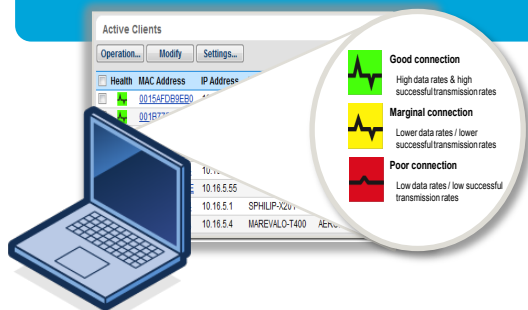


Topology & Location Tracking

PCI Compliance

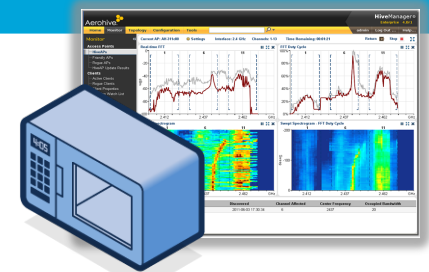


Support

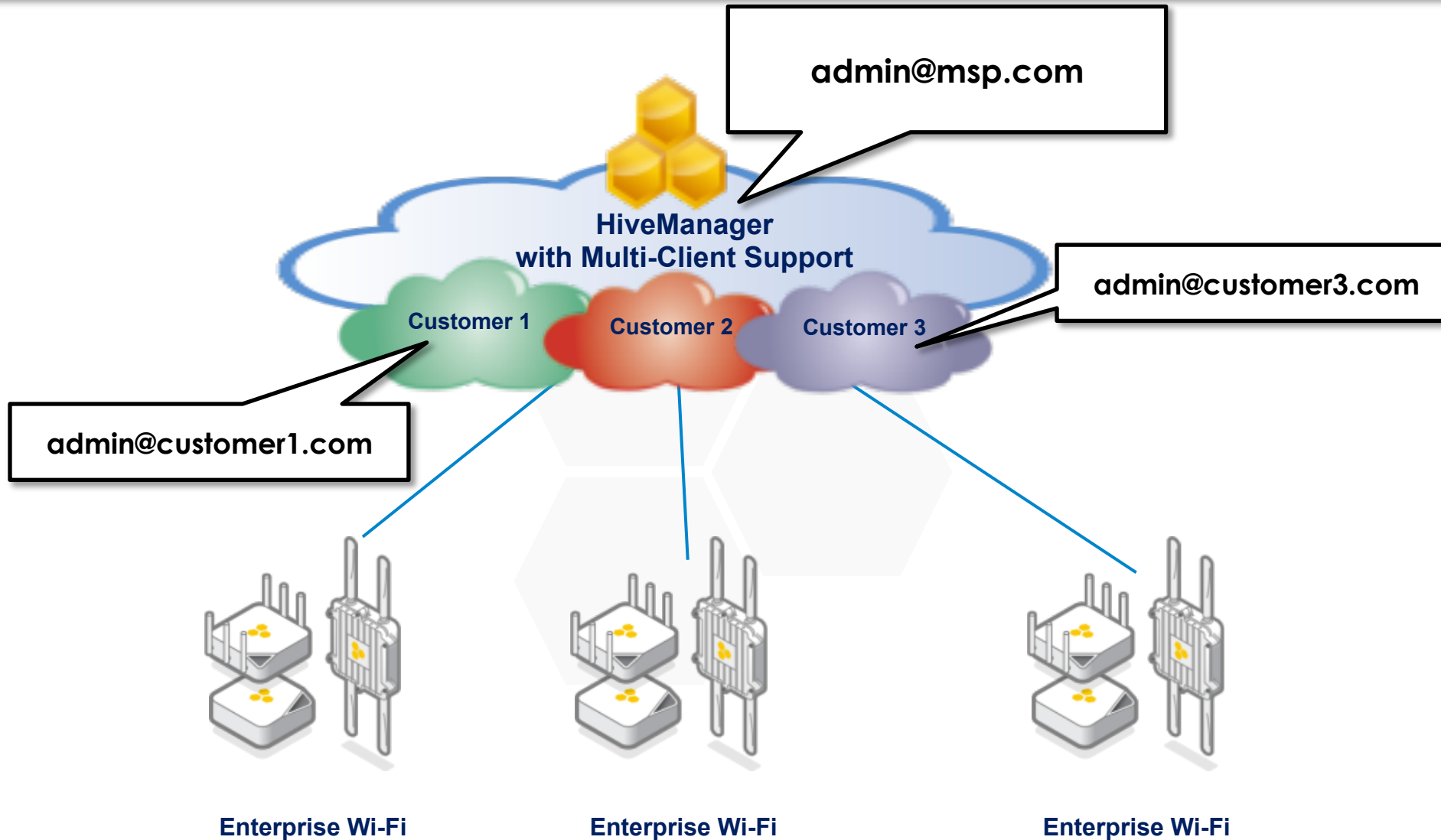


Client Health Score

Spectrum Analysis



Centralized Management





THANK YOU!