aruba
a Hewlett Packard Enterprise company

TECH BRIEF

ADAPTIVE RADIO MANAGEMENT

Best-in-class RF management

Anytime, anywhere access for mobile devices and applications is a requirement in today's business world. Reliably delivering that access requires a WLAN that actively manages radio frequency (RF) spectrum in step with the dynamic mobile environment itself.

Adaptive Radio Management (ARM) technology from Aruba, a Hewlett Packard Enterprise company, is a proven, patented technology that uses automatic infrastructure-based controls to manage the entire RF spectrum.

ARM dynamically adjusts the RF environment to maximize Wi-Fi stability and predictability, ensuring optimal performance for all clients and applications, including visibility and control of individual Microsoft Skype for Business voice, video, desktop sharing and chat flows.

With ARM, users get a consistently positive user experience – with no IT intervention. A component of ArubaOS, ARM works with all clients and operating systems and is compliant with IEEE 802.11 standards, including the 802.11ac gigabit Wi-Fi standard.

CHALLENGES IN WI-FI ENVIRONMENTS

Wi-Fi deployments have a number of shortcomings that negatively impact reliability and performance.

Wi-Fi is a shared medium

Wi-Fi, like every other RF technology, is a shared medium. Consequently, the radios in access points (APs) must adjust the channels they use to avoid co-channel interference.

Also, since all clients on a channel must share a fixed amount of bandwidth, clients must compete for bandwidth and simultaneously avoid collisions.

Additionally, Wi-Fi technology reduces everyone's operating speed in the presence of slower clients, so just one low-speed client can undermine the performance of devices that would otherwise operate at higher speeds.

Non-Wi-Fi interference can clobber RF signals

Bluetooth devices, cellular antennas, microwave ovens, wireless cameras – even a nearby rooftop air conditioning unit – can interfere with Wi-Fi signals, impairing network performance and inhibiting user access.

Clients are sticky

Clients decide which AP to associate with, at what speed they should send and receive data, and when to roam.

Unfortunately, clients do not have a system-level view of the network and often make poor decisions, such as connecting to the first AP they hear, regardless of whether it matches their needs, and remaining attached to an AP with poor signal strength.

These poor decisions result in overloaded APs and other problems that reduce both client and overall network performance.

Getting the QoS you need

Wi-Fi Multimedia (WMM) offers quality-of-service (QoS) features that help voice, video, and other latency-sensitive traffic get priority treatment over regular data.

However, clients such as smartphones often set the wrong priority level, resulting in a poor user experience. WMM also employs a packet-based approach, while QoS is most effective when applied end-to-end based on network visibility into application traffic.

INFRASTRUCTURE-BASED CONTROLS

ARM technology is specifically engineered to address these Wi-Fi shortcomings. Leveraging the intelligence embedded in the Aruba infrastructure, ARM has visibility into the entire infrastructure and learns about client and application behavior over the air.

By applying infrastructure-based controls, ARM dynamically manages the RF spectrum, and, in the process, optimizes overall client, application and network performance while improving reliability.

All Aruba APs support ARM, putting the Wi-Fi infrastructure – not overburdened IT staff or client devices – in charge of RF management. With its rich functionality, ARM automatically handles a wide range of RF management capabilities.

Boost client performance

ARM works with Aruba ClientMatch technology to maximize client performance. ClientMatch continuously gathers session performance metrics from devices and uses this information to steer each one to the best radio on the best AP.

ClientMatch dynamically optimizes Wi-Fi client performance as users roam and RF conditions change. If a device moves out of range of an AP or RF interference unexpectedly impedes performance, ClientMatch steers it to a better AP.

ClientMatch automatically groups MU-MIMO clients together on Wave 2 APs, so that the AP can transmit simultaneously to multiple clients, thereby realizing the expected Wave 2 throughput and capacity gains for the overall network.

Client agnostic, standards based, and requiring no new client software, ARM and ClientMatch technologies are critical to ensuring that overall network capacity and performance remains consistent.

Cellular hand-off

In Wi-Fi hotspot deployments, ARM is engineered to offer clients the ability to switch from Wi-Fi to an alternate 3G/4G radio that provides better network access. A cellular hand-off feature works together with ClientMatch to help dual-mode, 3G/4G-capable Wi-Fi devices such as iPhone, iPad, or Android clients at the edge of Wi-Fi network coverage, to switch appropriately.

App visibility and performance

ARM works with Aruba AppRF technology, which leverages information from Aruba Mobility Controllers to identify a wide range of business-critical enterprise applications and apply the appropriates QoS tags.

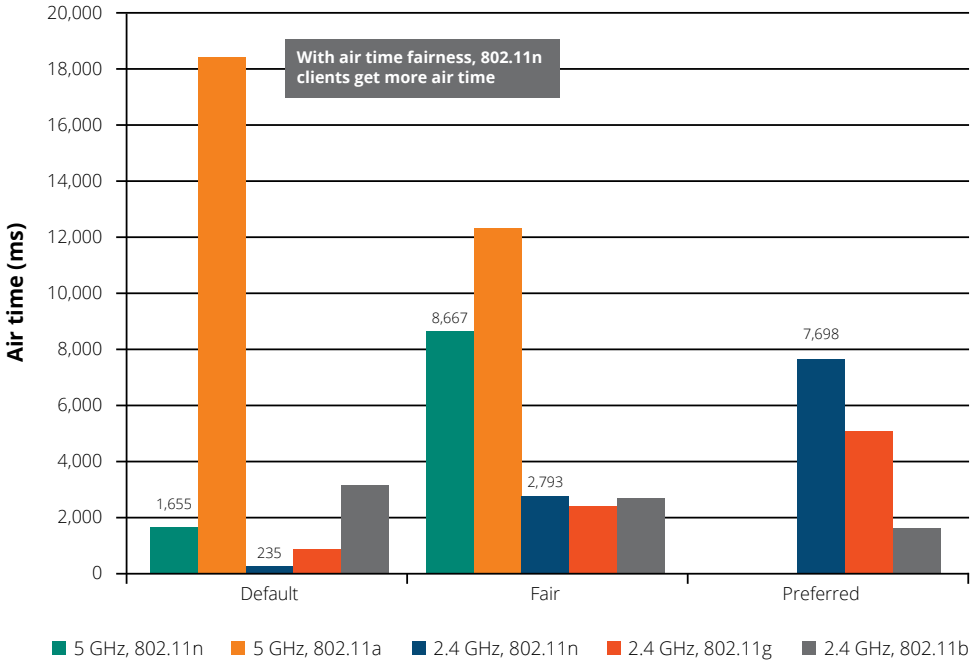
ARM and AppRF ensure that these apps – mobile and web apps, voice, video, and services like Apple AirPrint and AirPlay – get the end-to-end QoS they need, and give IT visibility and control over traffic, including individual Microsoft Skype for Business voice, video, desktop sharing, and chat flows.

Ensure airtime fairness

Because Wi-Fi is a shared resource, it's important that all clients have fair airtime access. ARM maximizes client performance by giving each client fair access and ensuring that no single client or group of clients monopolizes resources at the expense of others.

Reduce co-channel interference

Interference occurs when multiple devices in the same area try to access the same channel simultaneously, which reduces overall performance on that channel. This illustrates why interference mitigation is so important to ensure proper network operation.



ARM ensures airtime fairness and prevents clients from monopolizing resources.

To minimize interference, ARM adjusts channels and transmit-power based on the changing RF environment. For example, if an AP goes down, ARM automatically adjusts the transmit power of surrounding APs accordingly to fill coverage holes.

ARM also coordinates access to a single channel, which allows neighboring APs to share the RF spectrum without increasing co-channel interference.

Immune to non-Wi-Fi interference

ARM ensures that network access and data throughput is maintained, even in the presence of significant interference from non-Wi-Fi sources that would otherwise render portions of the WLAN unusable.

To ensure that the network continues to perform optimally, ARM automatically adjusts the affected APs using a variety of techniques, such as shrinking the coverage area, raising the noise floor, and throttling back the maximum throughput.

Aruba APs also perform spectrum analysis, which is integrated with ArubaOS. This enables APs to identify sources of non-Wi-Fi interference like video bridges, microwave ovens or Bluetooth devices. IT can then take corrective action to mitigate the interference.

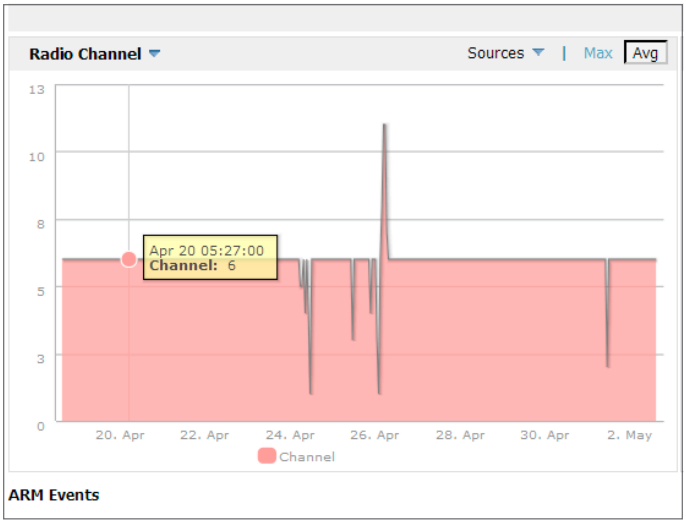
Optimize spectrum usage

The number of channels in the 2.4- and 5-GHz bands is limited and varies based on regulatory domain, PHY and RF coverage. Therefore, the network must adapt to these conditions and use all active channels to maximize spectrum availability.

ARM uses dynamic channel selection to automatically assign channel and power settings for all APs in the network. This ensures that APs operate over the healthiest or least congested channels and the WLAN makes efficient use of the available spectrum.

Client health metric

To assist clients in associating with the best possible AP, an enhanced client health metric is determined by ARM, which is a measure of the AP's efficiency in transmitting downstream traffic to a particular client. A lower health metric indicates that increased airtime is needed to transmit every packet to a client.



This graph shows that ARM automatically changed the radio channel due to excessive RF interference.

Channel scanning intervals

Most APs can go off-channel at fixed intervals to scan other channels for noise and rogue devices. This scanning helps APs choose a channel that maximizes their performance and is essential to detect unauthorized or malicious devices.

Dynamic Scanning

ARM uses sophisticated scanning techniques to properly identify the noise floors of individual channels within 40MHz or 80MHz channel pairs to select the best channels for AP channel assignments.

ARM dynamically adjusts its channel scanning based on various parameters:

- AP load: ARM tracks the traffic load on each AP and dynamically adjusts the scanning frequency accordingly. A lightly-loaded AP will scan frequently, such as once a second, while a heavily-loaded AP will scan less often.
- Traffic type: ARM leverages information from Aruba Mobility Controllers to identify voice and video traffic traversing an AP. When these flows are detected, the AP stops scanning to avert latency. As a result, voice and video – and the user experience – are optimized.

Update neighboring APs

When an AP pauses scanning to accommodate application traffic, that AP still receives updates over the air from neighboring APs with information they've collected about the RF environment.

Receiving these updates over the air enables the AP that has paused scanning to determine the signal strength and transmit power of the APs sending out updates – information that is critical to building a path-loss diagram or mapping where other APs are located.

Dynamic bandwidth switch

Interference avoidance techniques are carried out reactively at the AP during its operation beyond the initial channel assignments. Specifically, for 80MHz channel assignments, upon detecting a 20 MHz interferer, ARM makes a dynamic bandwidth switch and moves to another 80 MHz channel or downgrades to 40 MHz.

THE ARUBA DIFFERENCE

RF management is complex. It must be done automatically to support today's mobile users and media-rich applications. Engineered with this in mind, ARM delivers the most comprehensive RF management in the industry.

ARM optimizes overall WLAN performance by adapting to changes in the RF environment. This is achieved by shifting radios between channels, adjusting transmit power, mitigating co-channel interference, modifying scan intervals, and enforcing airtime fairness for all clients.

With ARM, there's no need for IT to manage channel assignments, determine AP placement or control the RF environment using dedicated RF sensors, separate monitoring devices or management servers. And there's no need to install client software or even touch clients.

ARM FEATURE	VALUE
Voice- and video-aware scanning: ARM leverages application-layer gateways to detect voice and video traffic traversing an AP and pauses scanning to avert latency.	Optimizes voice and video application performance and improves the user experience.
Airtime fairness: Gives clients equal access to the Wi-Fi medium, regardless of client type, capabilities or operating system.	Delivers uniform performance across the WLAN by preventing any one client from monopolizing resources at the expense of others.
Coordinated access to a single channel: Nearby APs on the same channel can share the spectrum without increasing co-channel interference.	Overcomes the challenges of dense AP deployments in the 2.4-GHz band typically seen in lecture halls, airport lounges and conference centers.
Non-Wi-Fi interference immunity: Adjusts AP coverage area, noise floor, and other parameters to ensure data throughput.	Ensures wireless connectivity, even in the presence of adverse RF conditions.
Adaptive power and channel assignments: Automatically assigns all AP channel and power settings. Supports 802.11n and 802.11ac wide-band channels, including 40 MHz and 80 MHz.	Automates many setup tasks during network installation and during ongoing operation when RF conditions change.
Dynamic channel scanning: Adjusts AP scanning intervals based on the traffic load on the AP.	Provides more data for ARM, improving RF management while minimizing the impact on traffic.
Over-the-air updates: When APs go off-channel to scan the air, ARM over-the-air updates ensure that these APs are aware of all changes in the Wi-Fi environment.	Enables APs to adapt to changes in the RF environment with a full understanding of location, signal strength, transmit power, and other information about neighboring APs.
Mode-aware ARM: Aruba APs dynamically detect when radios have overlapping coverage, remove oversubscribed APs from serving clients, stop beaconing, and turn into air monitors.	Provides additional network security through greater wireless intrusion detection and frees-up airspace for client traffic.
Coverage-hole detection: Provides detection and notification when clients are unable to associate at acceptable speeds.	Automatically detects potential coverage problems so they can be corrected quickly.

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