



**AirWave VisualRF Location and Mapping:  
Improving Operations Efficiency  
Throughout the Wireless Network Lifecycle**

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## Introduction

Driven by the need for mobility, higher productivity and cost reductions through network rightsizing, wireless networks are becoming ubiquitous within all enterprises, government organizations and educational institutions. As wireless evolves into the primary means of connectivity for some of the organization's most important users, network managers need to be more efficient in how they plan, manage and protect their growing wireless LANs (WLANs).

IT organizations are quickly discovering that WLANs bring a unique set of characteristics, including:

- Users that connect from different locations at different times, and sometimes with different devices
- Dependence on a medium that is out of IT's control — the air

To really understand what is happening on your wireless network, IT needs the ability to monitor the whole RF environment — down to the device and user level. Unfortunately, very few solutions provide this level of visibility. The best solutions take into account the full complexity of the RF environment and address the following requirements:

- Predictive and dynamic sampling. Purely predictive or site survey tools only offer a simple snapshot or statistical sampling of the environment. Solutions need to combine both predictive models and sampling of real-world data to effectively support the full network lifecycle from planning to troubleshooting.
- Multi-vendor support. Products that only manage a single vendor's infrastructure — or even a single generation of that vendor's products — provide a similarly incomplete picture. Support for multi-vendor and multi-architecture environments is critical to provide a complete picture of the RF environments that exist in most enterprises.
- Full-time location engine. Products that only capture location data during troubleshooting events typically are not as fast or accurate as an engine that continuously tracks the location of every device.
- Leveraging existing infrastructure. Tools that focus only on location services typically require expensive dedicated infrastructure components, such as sensors and excitors, plus separate application servers. These added costs put the solutions out of reach for many organizations.
- Tracking across the edge of the network. Most APs use power over Ethernet to acquire power and data through one cable. However, beyond 300 feet of wired cable, wired signals passed to the AP can be significantly degraded. Effective solutions can visually model capacity and power constraints, which is a valuable capability in capacity planning.

AirWave VisualRF™ Location and Mapping provides an end-to-end wireless network visualization and lifecycle management solution from initial site planning to ongoing RF monitoring. As a feature of the AirWave Wireless Management Suite™ from Aruba Networks, VisualRF uses dynamic signal propagation technology to accurately calculate signal coverage and the precise location of every wireless device in range of the WLAN. VisualRF exposes this information via an interactive web interface, displaying fully integrated maps and location information. With VisualRF, organizations can solve network problems faster, reduce costs, improve service quality for users and make better-informed network planning and deployment decisions.

## VisualRF Overview: Making the Airwaves Visible

VisualRF automatically generates a real-time picture of the RF environment so that IT staff can visualize the entire network from the core infrastructure and throughout the entire RF environment without having to leave their desks.

VisualRF offers significant advantages:

- Saves time. VisualRF creates a live map of the entire wireless network infrastructure and automatically tracks any device that associates with the network, including laptops, printers, smartphones and even many Wi-Fi asset tags — without any additional setup. Up-to-date RF heat and channel maps as well as highly accurate location data help the service desk and Level 2/3 support staff to pinpoint and resolve coverage problems faster with less direct involvement from users.
- Saves money. As an integrated feature of AirWave, VisualRF is very cost-effective to deploy. It leverages existing real-time information from the network infrastructure. There is no need to install separate dedicated sensors, excimers or location appliances, nor does the product require expensive site surveys or the input of walls and wall properties. The product's bulk floor plan import capability saves hundreds or thousands of man-hours during setup for organizations with large networks comprising thousands of locations. Consequently, organizations can gain higher value without adding anything to their existing infrastructure.
- Robust visibility. VisualRF couples predictive modeling with calculated modeling based on real RF samples to produce the most accurate representation of the RF environment. As a result, VisualRF provides a complete picture of your network, even in multi-vendor, mixed-architecture environments that combine thick and thin access points (APs), mesh APs, point-to-point APs, 802.11 and WiMAX.
- Improves service quality. Good network planning is crucial, since infrastructure deployment mistakes may be costly and time-consuming to fix. VisualRF helps you do it right the first time, heading off potential service calls from frustrated users. If you do have a coverage gap, VisualRF makes it clear where the problem exists so you can take immediate, appropriate action.
- Enables smarter planning. VisualRF enables companies to intelligently plan campuses, buildings, floors and APs. Complete bills-of-materials allow planners and installation contractors to streamline the quote and installation process for both the wired and wireless infrastructure.
- Improves security. VisualRF helps you quickly locate rogue devices within your WLAN, as well as devices that are out of security compliance.

## How VisualRF Works

VisualRF provides a comprehensive view of the entire building and campus network infrastructure, enabling IT to see exactly who is on the network, where they are located and how the overall network is performing. VisualRF requires few resources to set up, deploys cost-effectively and provides significant advantages throughout the entire wireless network lifecycle from pre-deployment provisioning and planning to ongoing monitoring and troubleshooting to rogue AP detection and threat mitigation.

## Setup and Tuning

Installed on the same server as the AirWave Management Platform™ (AMP) software, VisualRF setup is fast and straightforward. Once activated, the feature leverages RF data from your existing infrastructure, including all your routers and access points that are managed by AMP. All location engines require uploading floor plans and locating access points. VisualRF has refined the process to make it as easy as possible. You can upload files directly into the server or utilize VisualRF Plan, a desktop version of VisualRF's planning capabilities that does not require access to the server.

VisualRF supports all versions of CAD, including DWG, DWF and DFX formats. It also supports JPEG, GIF, BMP and PNG file formats. VisualRF automatically inherits size information stored in CAD files while providing cropping, de-layering and de-coloring capabilities. For organizations with multiple campuses, buildings, and floor plans, a batch upload feature is available to import thousands of files programmatically, saving hundreds of staff hours. In one case, a retailer estimated that it would take a full staff-year to upload its 2,000 floor plans. It was pleasantly surprised when one employee used VisualRF's batch upload capabilities to complete the task in just one week!

VisualRF automatically incorporates live RF data from all managed access points and inherits device-type grouping information from AMP. For companies with multi-vendor and mixed-architecture environments, VisualRF automatically normalizes RF data from multiple vendors' APs and across different product lines from the same vendor. Different types of associated client devices are displayed using different icons, allowing users to easily view and monitor the status of a wide range of devices, including laptops, PDAs, Wi-Fi asset tags and wireless VoIP phones. You can plan switches and routers and depict them within a wiring closet (or IDF). Understanding the wired topology enables VisualRF to help with the root cause of wireless issues that are actually related to the wired network.

VisualRF generally achieves resolution below 10 meters in properly deployed WLAN installations without requiring special sensors or site surveys. It offers a number of features that help refine location accuracy, including:

- A location accuracy testing tool, which records location accuracy and allows you to compare before-and-after results before making changes to the RF environment.
- A remote site survey tool that allows you to perform cost-effective surveys using any client connected to the infrastructure without the burden of carrying a specialized device to the physical location. For example, you can instruct VisualRF to take signal samples from a specific client device at a known location coordinate to estimate the path loss at that particular area of a floor. This increases the location and path loss accuracy for all clients in that specified area.

## Pre-Deployment Planning and Provisioning

Intelligent planning can save substantial time and costs by avoiding the need to reinstall or reconfigure a wireless network that does not meet coverage requirements. Using VisualRF, wireless network engineers can quickly model floor plans for wireless and wired infrastructures, specifying precise controller and access point locations, as well as determining the required wired upstream infrastructure. As a result, VisualRF helps organizations optimize network performance before any infrastructure is put in place.

VisualRF includes VisualRF, a web-based network planning application that can run on the AMP server, and VisualRF Plan, which operates locally on your desktop. Both VisualRF and VisualRF Plan leverage the same code base and deliver the same planning feature set within a consistent user interface. You can automate the import and export of site plans between VisualRF and VisualRF Plan. AirWave provides VisualRF Plan free of charge for any customers with a valid Aruba support agreement. Networks planned within VisualRF Plan can be exported to Microsoft® Word format, making it easy to share information with your extended team.

The VisualRF planning process consists of the following steps:

1. Upload your floor plans. Whether you are installing a wireless network for the first time or expanding an existing one, VisualRF Plan can facilitate the planning process. Before you have your AMP server in place, you can import your campuses, buildings and floor plans to the VisualRF system from VisualRF Plan, Cisco WCS, and Aruba OS or RF Plan. You can manually upload floor plans based on a wide range of formats, including CAD, JPEG and GIF.
2. Placing wireless networking equipment on a floor plan. VisualRF optimizes AP placement by analyzing your floor plan and determining the number and exact location of APs based on the following variables: coverage criteria, building characteristics, manufacturer and model. For example, you could establish that all areas in your building must have a certain level of coverage. The product includes a wireless catalog that contains all of the RF characteristics for any device supported in AirWave, including minimum receive sensitivities per radio, antenna gain and antenna coverage properties, so that your design takes into account the unique characteristics of your chosen infrastructure. If you are planning to use Aruba air monitors as an overlay system for your wireless intrusion protection system (WIPS), VisualRF can optimize placement of these sensors.

3. Placing wired network equipment on a floor plan. To assist in the planning process, VisualRF provides the capability to plan for wired network equipment necessary to support the WLAN equipment. It provides a view that displays the distance between the AP and the IDF. This allows you to determine the necessary required cabling and power requirements of the planned AP, as well as verifies that the planned wired devices will meet your requirements.

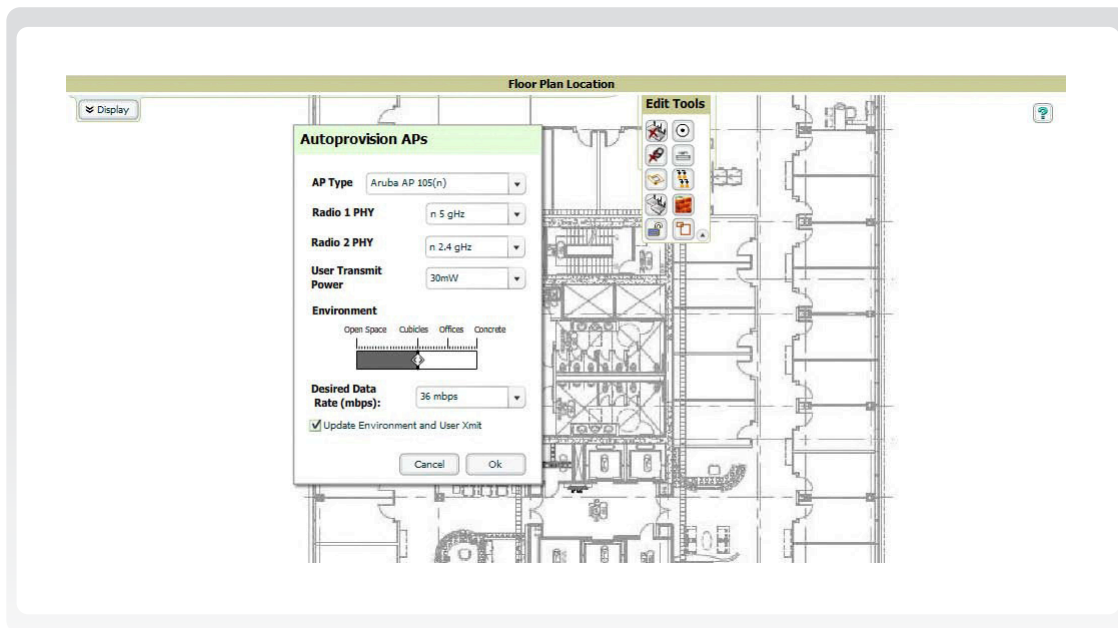


Figure 1. VisualRF auto-provisions APs on a floor plan.

4. Validation and purchasing. VisualRF automatically generates bill-of-material reports. The BOMs provide a hard-copy validation of the technical requirements (in terms of desired RF characteristics) and a complete list of equipment (wired and wireless) required to install the network. This information makes purchasing and contracting for physical installation much easier because you have a table of part numbers and quantities with a graphical representation of the network. The report can be delivered in HTML or Microsoft Word 2007 format.

## Network Monitoring and Troubleshooting

VisualRF enables organizations to reduce the support and operational costs associated with managing a wireless network. In addition to providing a real-time view of the RF environment, the product automatically tracks the location of all devices that associate with the network, including laptops, printers, smartphone and Wi-Fi asset tags.



A number of capabilities are available to IT staff — both service desk and Level 2/3 support staff — to assist in troubleshooting. First and foremost, VisualRF provides real-time visual overlays, including:

- Heat maps — depict the strength of the RF coverage in each location. VisualRF uses a unique dynamic RF sampling technique that incorporates AP-to-AP, AP-to-client and AP-to-rogue data to build an attenuation grid that graphically indicates coverage levels. If you have dedicated sensors in place, the data from those sensors (sensor-to-AP, sensor-to-client and sensor-to-rogue) will also feed into the dynamic RF sampling. VisualRF automatically recalculates the path loss and device locations as it receives real-time data from the wireless LAN.
- Data rate — calculates the data rate at every location using dynamic RF sampling.
- Color-coded channels — help reduce interference and recommend RF channel and other settings for optimal performance and coverage.
- Voice overlay — indicates how well the network is functioning relative to voice coverage.
- Google Earth integration — shows device locations and mesh network links for outdoor deployments.
- Sensor coverage — this features displays the areas that are covered by your air monitors and those that are not, so that you can verify that you are providing adequate coverage for rogue scanning.

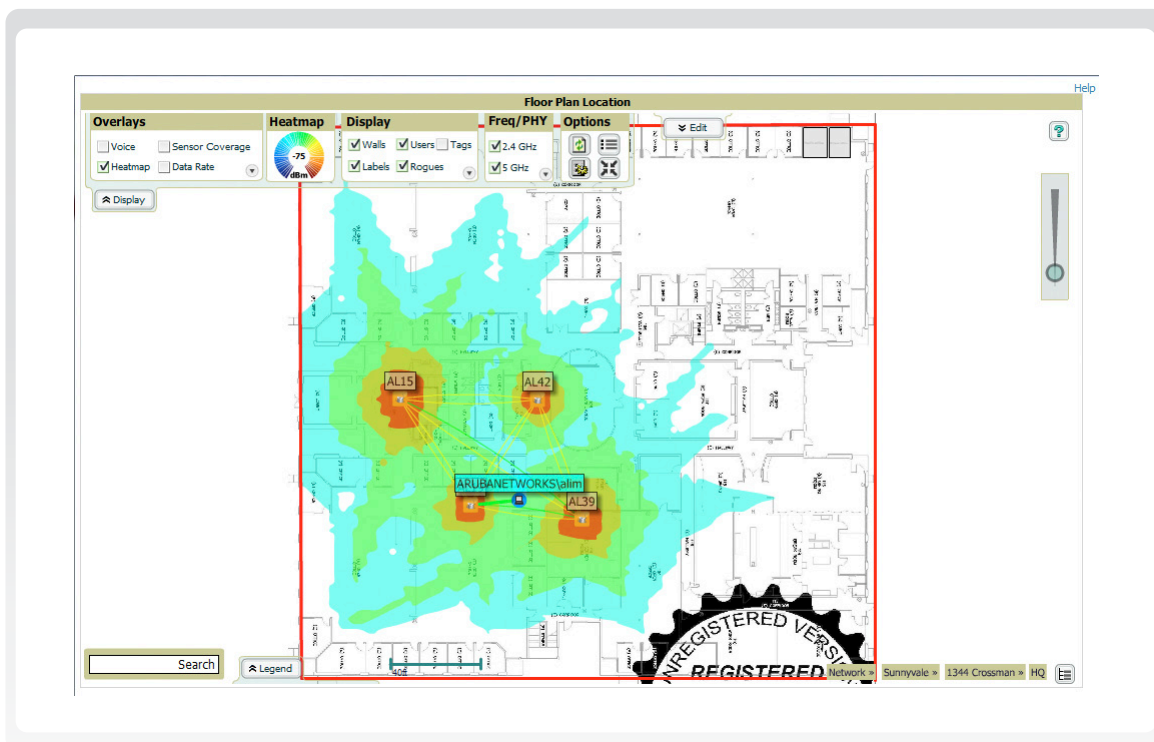


Figure 2. VisualRF's heat map view depicts the strength of the RF coverage in each location.

VisualRF includes location playback capabilities, allowing you to play back up to 24 hours of location history on your screen. This capability assists with troubleshooting — for example, if a user is not sure exactly where he or she was when a problem occurred — and with finding lost or stolen devices. VisualRF also displays the “last known location” if a device disappears off the network.

#### Asset Tracking: Real World Scenario

A university library that offered rental computers had lost one of its computer units. Weeks after it was reported missing, the IT department located the unit using VisualRF. The IT team used AirWave Wireless Management Suite to set an alert to be triggered when the device was associated to the wireless network. When the machine was eventually turned on, the alert was received, and the IT team was able to use VisualRF to track it down to a cart in a storage closet.

With VisualRF, users customize their view to suit specific preferences and requirements. For example, the feature offers:

- Visual alerts and personal thresholds — user-defined alerts and error conditions can be displayed on the floor plan, clearly indicating the alert location and making error patterns easier to resolve. Alerts can be based on pre-defined thresholds or YES/NO and are color-coded for higher visibility. For example, you can establish specific breakpoints for when a user consuming large amounts of bandwidth shows up as green, yellow or red.
- Grid lines — VisualRF layers grid lines on the coverage map, facilitating a more intuitive view for troubleshooting in some physical environments.
- Custom device types — users can customize device type icons including the icon size, for example to distinguish a laptop from a printer. If you have a previously deployed network that is experiencing coverage problems, you can use VisualRF to determine if coverage will improve if you add more APs. You can review before-and-after RF maps to compare the current setup to the proposed optimal configuration. In addition, you can address potential coverage problems proactively with a “simulate failure” feature that allows you to examine what happens if an existing AP fails. This allows you to incorporate the right level of redundancy into mission-critical networks.

### Managing Security and Compliance

VisualRF integrates with AirWave RAPIDS™, the rogue detection feature of AirWave Wireless Management Suite, and provides rogue AP locations on your floor plans for faster mitigation and removal. The feature provides clues as to which wired subnet any rogue devices are located in. VisualRF can also validate coverage for dedicated sensors such as Aruba air monitors for better location accuracy and PCI compliance.

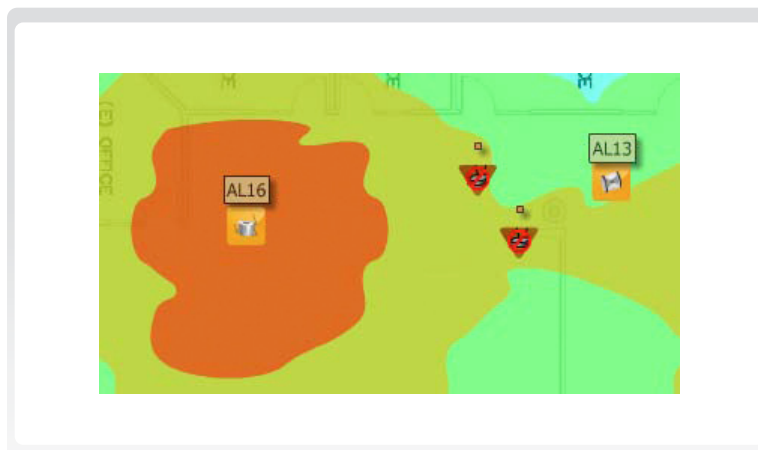


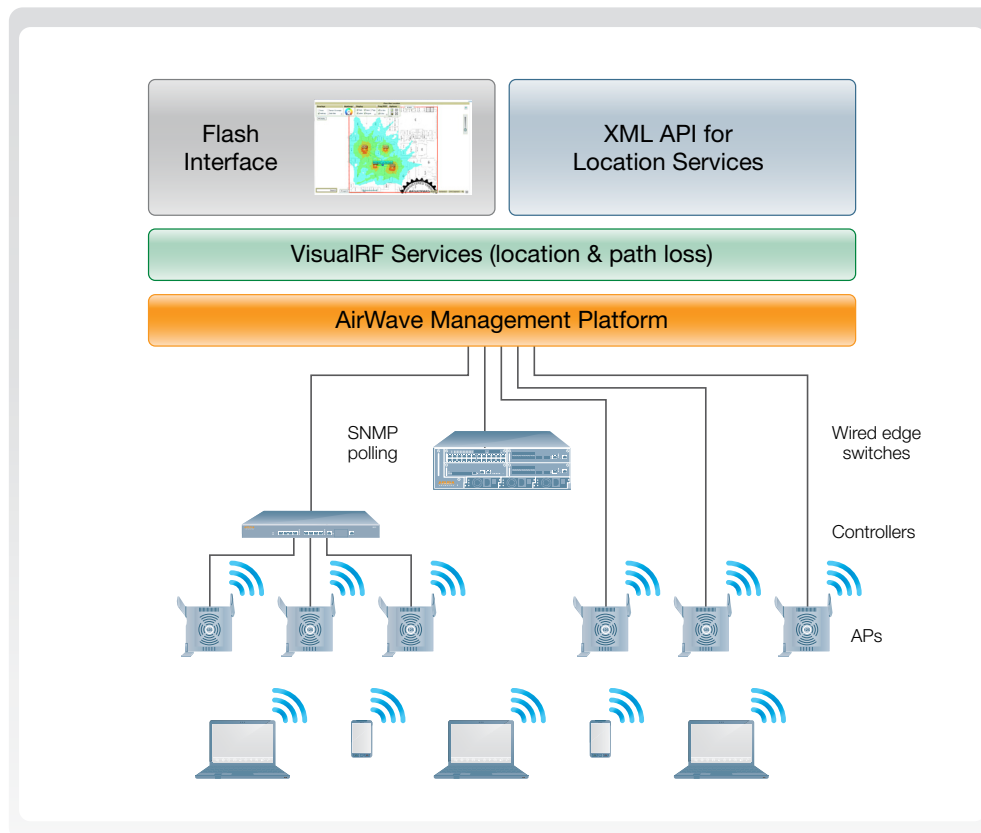
Figure 3. VisualRF displays the locations of all rogue devices found by RAPIDS.



## Architectural Overview

VisualRF is an integrated feature of AirWave. At the core is the AirWave Management Platform (AMP), which provides efficient centralized management of the wireless infrastructure. AMP communicates with APs, controllers, switches and routers over SNMP at configurable intervals.

These components return a vast amount of RF signal information, such as AP-to-AP, AP-to-client, and AP-to-rogue, which when received by AMP, is routed to VisualRF. As a full-time location engine, VisualRF continually calculates RF coverage and device locations for all wireless clients within your WLAN airspace. In addition, through integration with the RAPIDS feature, VisualRF calculates the location of rogue devices and all devices that are associated with the wireless network. VisualRF then presents this data to the user via a Flash interface.



*Figure 4. The AirWave Management Platform, a core component of the AirWave Management Suite, provides efficient, centralized management of your wireless infrastructure and visibility across the wired edge of your network.*

VisualRF is unparalleled in the way it calculates path loss and device locations. AirWave uses a combination of both dynamic RF sampling to determine signal path loss at a particular site and a predictive model based on the site plan and infrastructure specifications for areas where RF sampling isn't available. VisualRF has a number of configuration settings that allow you to customize and optimize it for your physical and operational environments, including how frequently it calculates device locations or device tracking sensitivity thresholds. This allows you to set different device tracking movement thresholds depending on the specific environment to give you the most accurate, relevant location information. For instance, you could customize the settings for an office building that won't have as much device roaming as a warehouse, where the client devices are mounted on forklifts and constantly move.

VisualRF takes a distinctive approach to solving location challenges within a wireless environment. It leverages RF data from the existing infrastructure to build a near real-time attenuation grid. VisualRF continuously tunes and adjusts this grid based on incoming data samples while including a small portion of predictive modeling for those areas that might not provide continuous RF samples. This approach enables VisualRF to work immediately out-of-the-box without requiring time-consuming surveys, drawing walls on the floor plan or installing special hardware.

All of the location information is integrated into AMP as well and available via XML API. The API provides an open, simple integration with a variety of third-party applications, such as public safety and fixed asset tracking. AirWave customers use VisualRF's to reduce support calls, save money, improve productivity and make campuses safer.

#### **Location Services: Real World Scenario**

Like many universities, University of Cincinnati was experiencing an explosion in the number of students with mobile phones. At the same time, it needed to provide location-based services to students who used their cell phones for general assistance, such as directions to specific destinations, campus safety (non-emergency) calls such as requests for late-night escorts, assistance with parking and other infractions, and emergency call assistance. The University wanted to enable students to dial \*UC and have the call routed to the main PBX. The caller's number is then identified and used for a database lookup, resulting in the caller's database record being automatically pushed to the call center operator's screen. At the same time as the database record lookup, the application shows the caller's location on a campus map. If the caller requires assistance from campus public safety, the initial answering agent forwards the call to the public safety dispatcher, who has access to the same caller's record, campus map and location information without any further intervention.

## **A New Focus on Wired Management**

Wireless networks don't operate in a vacuum. Their operation and reliability depend on a number of wired infrastructure components. With AirWave, VisualRF's real-time views incorporate wired and wireless components. This expansion enables end-to-end visibility ----- from the client device to the AP, edge switch, controller and core switch. A new wired overlay shows AP-to-wiring closet relationship information, including physical cable length and power loss. From this display, you can drill down into a detailed IDF view that shows the racks and server locations, as well as the switch locations in those racks, along with AP-to-port mapping. These features are extremely beneficial for network expansion planning or in green-field deployments.

VisualRF facilitates more effective communication between remote personnel and on-site personnel and reduces finger-pointing. For example, if cabling needs to be moved or swapped, a network engineer can easily view and relay specific rack, switch or port information to on-site colleagues. It also enables a more comprehensive planning process that takes a full account of all network requirements and generates a single bill-of-materials report for necessary wired and wireless equipment. Finally, it aids in planning power and backplane capacity in the remote IDF.

## Summary

Organizations across almost every industry are installing or expanding their wireless networks to improve productivity and control costs. Meanwhile, CIOs continue to struggle with network operations and security issues as well as how to extract higher returns from their wireless network investments. AirWave VisualRF provides an end-to-end visualization solution from initial site planning to real-time RF monitoring. It helps a wide range of organizations solve problems faster, improve service quality, make well-informed business decisions and boost their wireless network ROI.

AirWave VisualRF Features	Benefits
Simple setup process with no additional sensors, servers or site surveys	Captures valuable data with little up-front cost.
Single web-based interface for server and offline planning	Saves time in the transition from planning to deployment. Provides planning capabilities to contractors and outside partners without giving them full monitoring access to your management server.
Automated planning support and bill of materials	Simplifies the quote and build-out cycle. Makes it easier to justify infrastructure purchases.
Graphical overlays, such as heat maps, data rate, channel and voice	Saves time and improves service level by enabling faster root cause analysis and troubleshooting.
Accurate location data	Allows quick location of users and wireless devices for troubleshooting, planning, and asset tracking. Also improves security.
Location playback and “last known location”	Improves troubleshooting capabilities. Assists in locating lost or stolen devices.
Visual alerts and personal thresholds	Accelerates troubleshooting and improves service levels by proactively notifying staff of important conditions and helping them quickly pinpoint problems.
Predictive modeling for what-if planning and “simulate failure”	Addresses potential coverage problems proactively and helps plan for the right level of redundancy in mission-critical networks.
Open, XML-based API	Makes it easy to incorporate valuable location data into external applications.
Integrated architecture	Saves money by eliminating the need for separate location sensors, excitors or servers.
Multi-vendor, mixed-architecture support	Faster implementation, accurate heat maps and location information in multi-vendor, mixed-architecture environments.

## About Aruba Networks, Inc.

Aruba Networks is a leading provider of next-generation network access solutions for the mobile enterprise. The company's Mobile Virtual Enterprise (MOVE) architecture unifies wired and wireless network infrastructures into one seamless access solution for corporate headquarters, mobile business professionals, remote workers and guests. This unified approach to access networks enables IT organizations and users to securely address the Bring Your Own Device (BYOD) phenomenon, dramatically improving productivity and lowering capital and operational costs.

Listed on the NASDAQ and Russell 2000® Index, Aruba is based in Sunnyvale, California, and has operations throughout the Americas, Europe, Middle East, Africa and Asia Pacific regions. To learn more, visit Aruba at <http://www.arubanetworks.com>. For real-time news updates follow Aruba on [Twitter](#) and [Facebook](#), and for the latest technical discussions on mobility and Aruba products visit Airheads Social at <http://community.arubanetworks.com>.



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