Lab Validation
Report

Aerohive Networks

Scalable, Application-aware Wireless Networking

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ESG Lab Reports

The goal of ESG Lab reports is to educate IT professionals about data center technology products for companies of all types and sizes. ESG Lab reports are not meant to replace the evaluation process that should be conducted before making purchasing decisions, but rather to provide insight into these emerging technologies. Our objective is to go over some of the more valuable feature/functions of products, show how they can be used to solve real customer problems and identify any areas needing improvement. ESG Lab's expert third-party perspective is based on our own hands-on testing as well as on interviews with customers who use these products in production environments. This ESG Lab report was sponsored by Aerohive.
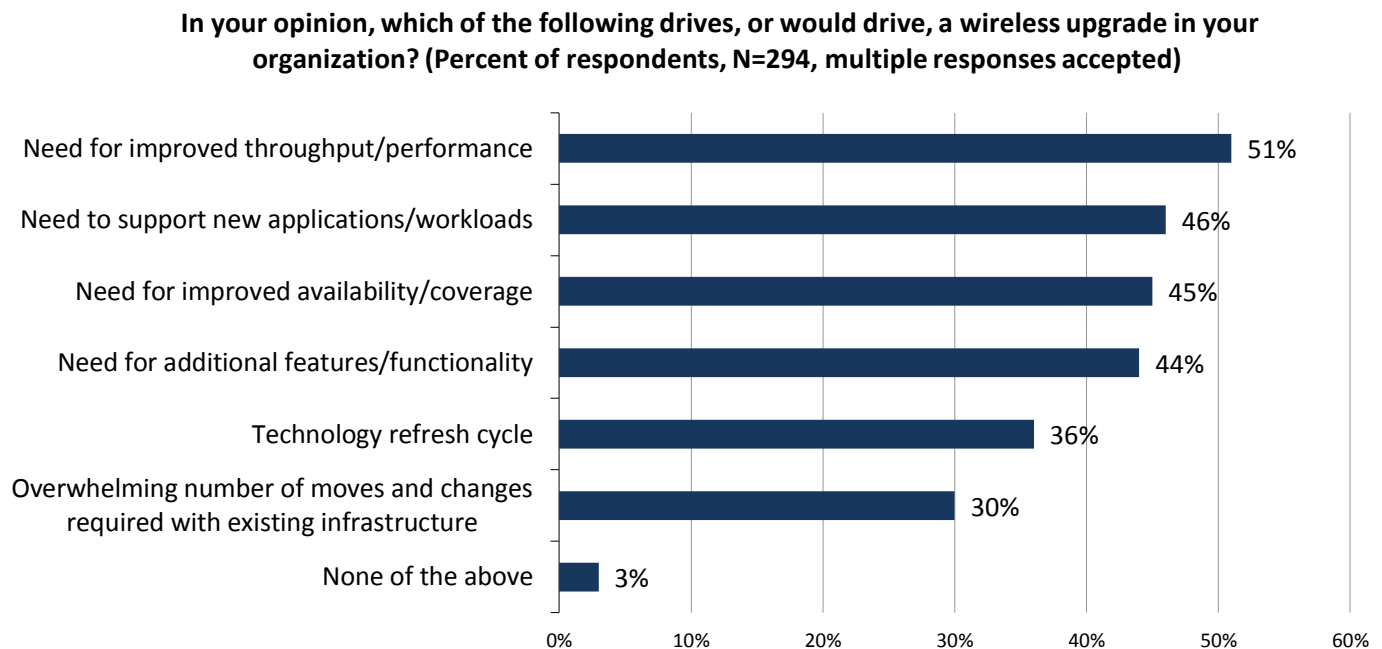
Introduction

IT organizations are being challenged to deliver a robust, individualized wireless experience for an ever-increasing number and variety of devices and use cases. ESG research shows that BYOD policies have created new challenges in handling increases in network traffic, security risk, and administrative overhead.[1] In this report, ESG Lab examined Aerohive Networks' controller-less wireless architecture with a goal of validating the ease of deployment, management, and performance scalability of Aerohive's distributed-intelligence approach to wireless networking.

Background

Planning, deploying, managing, and monitoring a secure wireless network is a difficult challenge for any organization, especially when dealing with multiple geographically dispersed campuses. Today's wireless LANs (WLANs) must be designed to support a wide variety of devices and applications while offering a secure, reliable, and personalized experience for enterprise users, remote offices, teleworkers, and guests. As if the technical challenge was not difficult enough, IT needs to provide this performance, security, and functionality while at the same time minimizing cost and ensuring appropriate utilization of the company's networking resources.

ESG research reveals that the need for performance improvement, better application and workload support, and improved availability and coverage were all identified by the largest percentages of respondents as factors driving wireless upgrades in their organizations today.[2] Also reported by respondents as concerns were the need for additional features and functionality, the need to upgrade an aging technology, and the simplification of a complex architecture. It is not surprising that organizations are looking for a highly performing, full featured wireless solution that is easy to deploy and manage.

Figure 1. Top Factors Driving Wireless Infrastructure Upgrades

In your opinion, which of the following drives, or would drive, a wireless upgrade in your organization? (Percent of respondents, N=294, multiple responses accepted)

Need for improved throughput/performance	51%
Need to support new applications/workloads	46%
Need for improved availability/coverage	45%
Need for additional features/functionality	44%
Technology refresh cycle	36%
Overwhelming number of moves and changes required with existing infrastructure	30%
None of the above	3%

Source: Enterprise Strategy Group, 2014.

The most widely used enterprise grade WLANs today rely on the deployment of a network controller at every site. This controller is expensive to purchase, is difficult to deploy and manage, and must be greatly overprovisioned to avoid introducing network bottlenecks. This solution is often expensive, provides rigid functionality and availability, does not scale well, and is difficult to upgrade, maintain, and manage.

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[1] Source: ESG Research Brief, *Campus and Wireless Network Trends*, August 2014.
[2] Ibid.

The Solution: Aerohive Controller-less Wireless LANs

Aerohive Networks' secure, controller-less, distributed architecture was designed from the ground up to provide a scalable, high-performance mobile wireless LAN (WLAN) for distributed enterprises. By eliminating the need to deploy a dedicated network controller at each campus, Aerohive Networks enables distributed organizations to deploy networks that are more cost-effective, more secure, and simpler to manage and maintain.

Planning and deployment is greatly simplified as compute power, wireless coverage, and network reliability can be scaled easily by simply adding wireless Access Points (AP) to the self-configuring, self-optimizing, self-healing, HIVE network. Management is greatly simplified with a centralized cloud-based deployment, the automatic sharing of network policies, and application awareness that eliminates the need to configure each end-user's mobile devices.

Figure 2. Aerohive Networks Controller-less Architecture
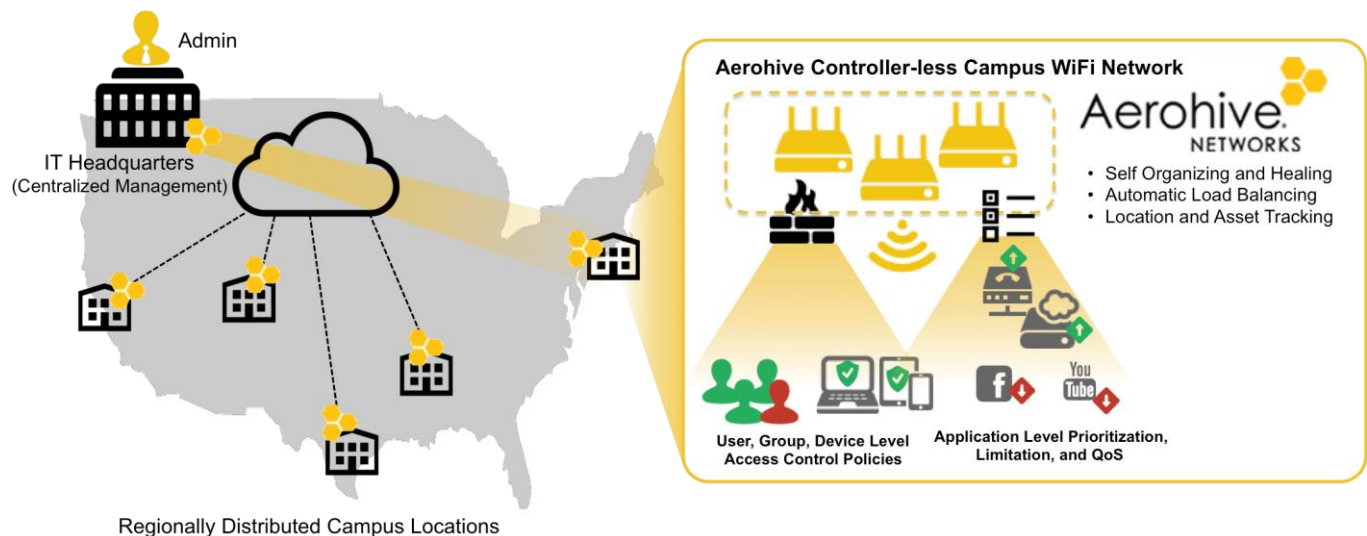
Benefits of deploying an Aerohive Controller-less WLAN include:

- Lower CAPEX through the elimination of dedicated network controllers and licensing costs.
- Lower OPEX through simplified, centralized cloud-based management and application deployment.
- Simple planning, deployment, and scalability with the self-optimizing, self–healing, and automatic load balancing HiveOS.
- Scalable performance, reliability, and functionality. Simply add more APs to scale the environment.
- Application-level policies eliminate the need to configure end-user's devices, give insight into utilization of WLAN, and ensure that the most important applications receive top priority on the network and that harmful applications are blocked.
- Enhanced security with a distributed, application-aware firewall that blocks harmful network access before it is allowed on the network.
- High availability with no single point of failure, a self-healing mesh architecture, and simple upgrades.
- High performance networking with 802.11ac access points, and the flexibility to deploy the ideal access points for your implementation.

## Performance and Scalability with Application Visibility and Control

One of the greatest strengths of Aerohive's distributed, controller-less architecture is the ability to scale performance as APs are added with full application visibility and control. Because the functions typically performed by wireless controllers, firewalls, and security event management systems have been distributed across all of the APs in the Hive, there are far fewer potential points of contention. Aerohive's HiveOS was designed to be self-configuring, self-optimizing, and self-healing, making scaling a wireless infrastructure extremely simple. ESG Lab investigated the technology behind Aerohive's simple scalability.

Scaling Performance with Application Visibility and Control

A typical controller-based wireless deployment has multiple challenges that prevent it from scaling while performing deep packet inspection and application control. As APs are added to a traditional environment, each wireless client served adds additional processing requirements on the wireless controller. These controllers typically are provisioned with enough CPU power to handle many APs and connections, but once all available processing power has been consumed, the system reaches its scaling limit. When deep-packet inspection technologies similar to application visibility and control (AVC) are employed, the additional CPU and resource demands will further limit the number of connections a controller can service.

While individual Aerohive APs have less processing power than a chassis-based wireless controller, they are designed to service client connections while simultaneously running AVC. Each AP added to the Hive adds the ability to handle more client connections with AVC directly, without incurring additional overhead on any other system component or increasing traffic as connections need not be routed through a separate controller. Performance is further optimized with automatic load balancing technology that ensures that client connections are balanced across all available access points.

Figure 3. Comparison of Distributed Scale-Out vs. Centralized Scale-Up of Wireless Networks
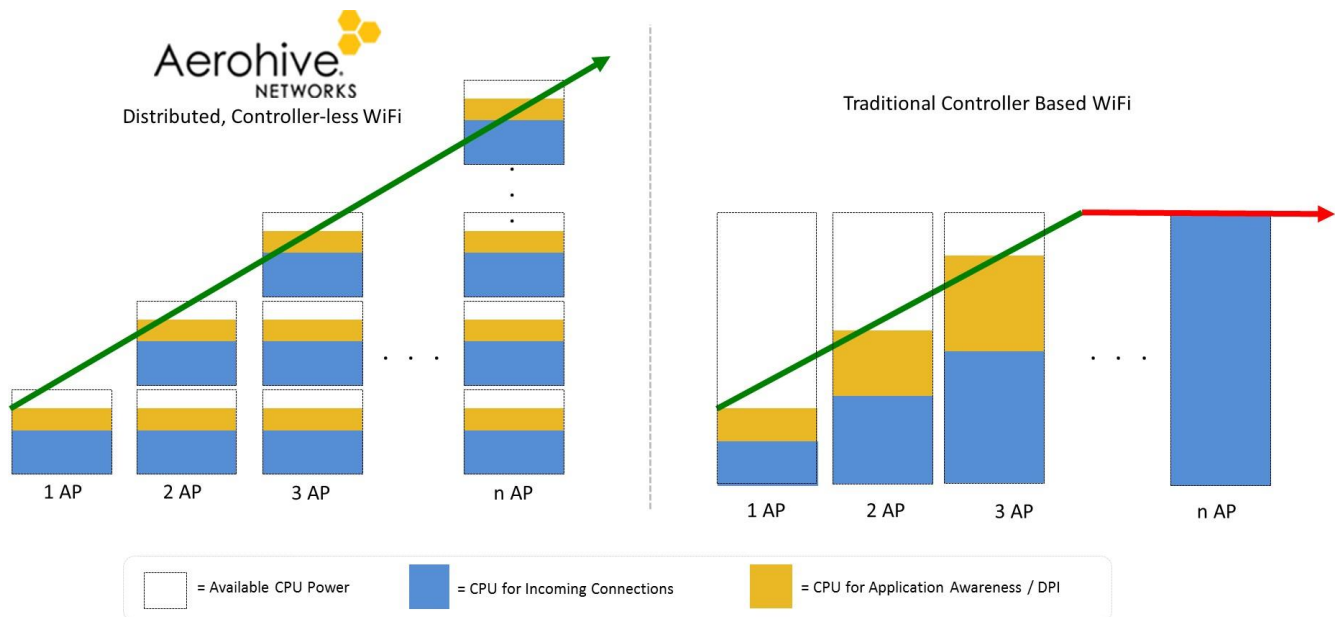
The result is a predictable, highly scalable wireless network that can grow on demand when required by the business. Figure 3 illustrates the scalability of Aerohive's distributed controller-less architecture when compared to that of a typical controller-based deployment.

Figure 4. Advantages of Aerohive Wireless Access Point Scalability
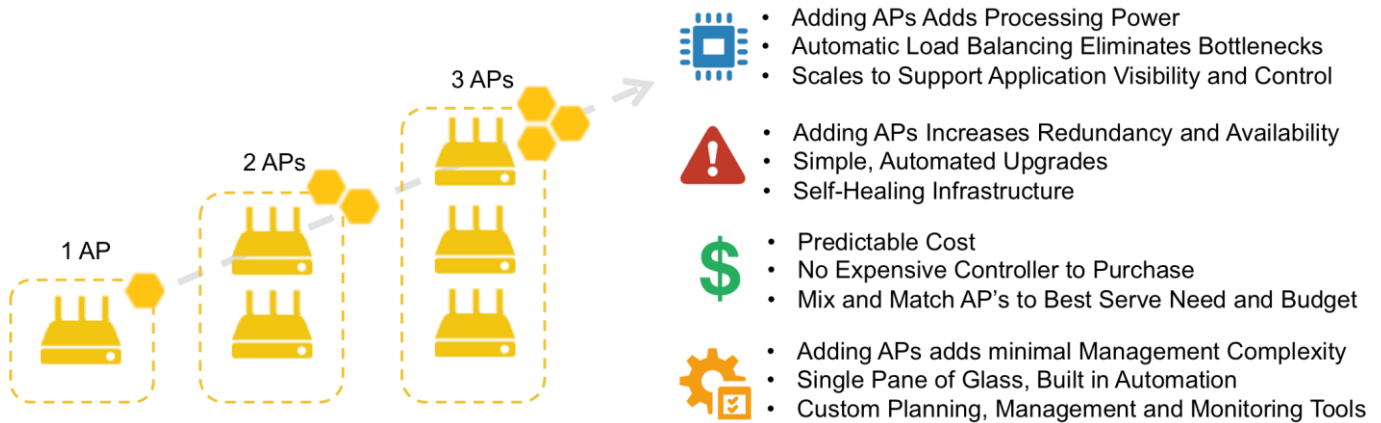
ESG Lab Validation

ESG Lab performed hands-on evaluation and testing of Aerohive Networks controller-less wireless solutions at Aerohive's facilities, in San Jose, CA. Testing was designed to demonstrate the simplicity, advanced functionality, and scalability of an Aerohive deployment using industry standard tools and methodologies. Of particular interest to ESG Lab was application visibility and control, an advanced Aerohive technology that is built into each access point (AP), enabling administrators the power to set access and quality of service (QoS) policies based on application functionality.

Getting Started

ESG Lab began with a look at planning and deployment of an Aerohive WLAN in a simulated corporate environment, with multiple wireless clients connecting via Aerohive WAPs to applications on a corporate LAN and the Internet, as shown in Figure 5.
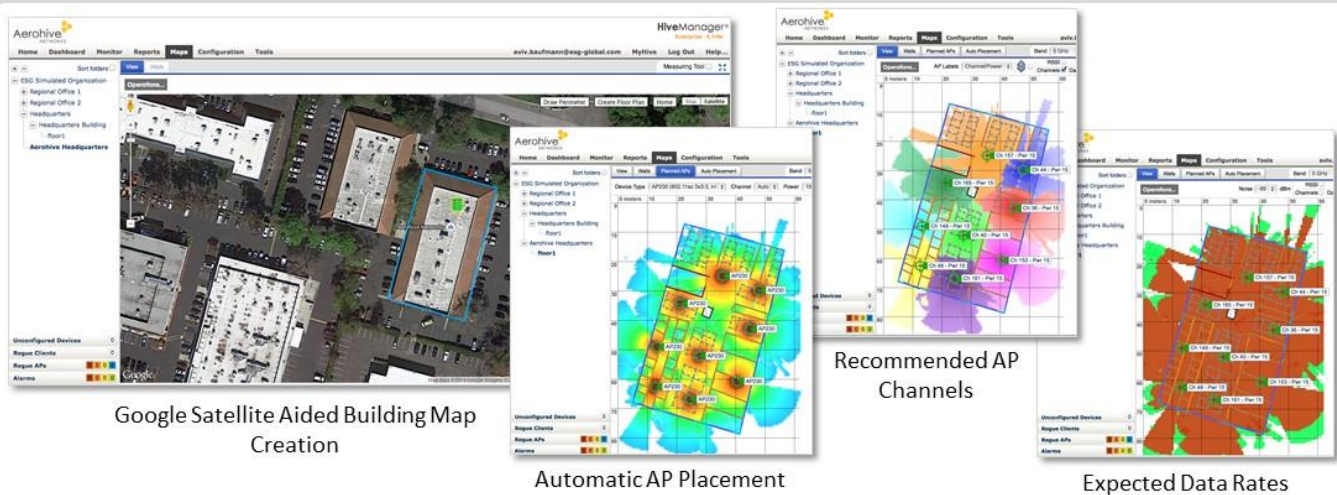
Figure 5. The ESG Lab Test Bed
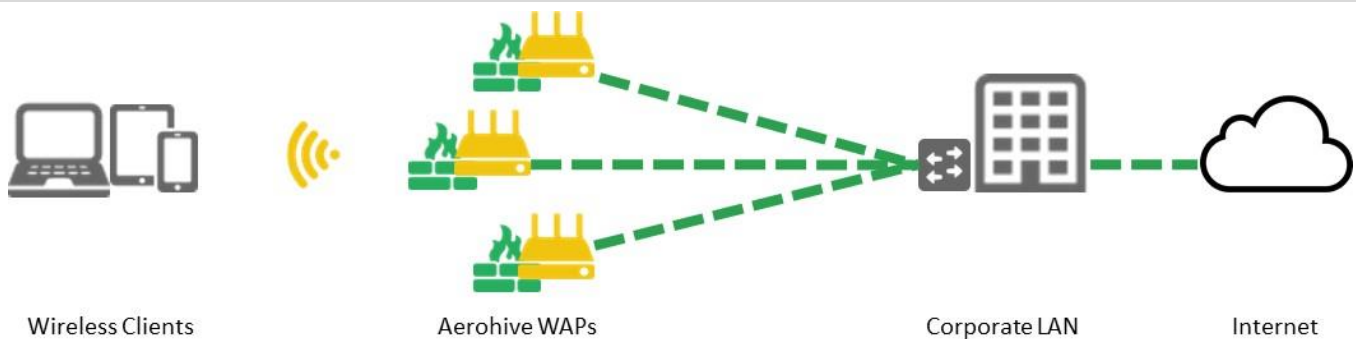
Simple Deployment and Management

Traditionally, planning for a wireless deployment can be a difficult process, involving many groups within an organization, as well as professional services from the wireless vendor. In a controller-based architecture, careful consideration must be made to avoid introducing performance bottlenecks. Aerohive has greatly simplified the process of planning a wireless deployment with their Wi-Fi Planner Tool, offered free of charge on their website, and integrated into their HiveManager software.

While the planner tool can use a .jpeg or .png image of an actual floor plan, the planner tool can also use a Google satellite image of an organization's building, allowing the user to trace the perimeter to create a working scale model of the facility, which is what ESG Lab used to begin the process. Walls, cubicles, and windows were created next, and materials were specified for each floor of the building to create a floor plan. After ESG Lab selected the type of connectivity desired, the Aerohive "Auto Placement" tool automatically figured out the ideal number of APs to deploy, and determined the ideal location and channel for each AP. Signal strength, channel placement, and expected bandwidth for every access point was laid out clearly. The entire process, shown in Figure 6, took only a few minutes to complete.

Figure 6. Simple Planning Tools for an Aerohive Deployment

Google Satellite Aided Building Map Creation

Automatic AP Placement

Recommended AP Channels

Expected Data Rates

The resulting plan was integrated into a detailed report with a bill of materials to facilitate approvals and purchasing. Once an organization purchased and deployed the planned APs, they could continue to leverage the building models and AP placement diagrams with the newly deployed APs without the need to reference complex configuration spreadsheets.

Once deployment of APs was complete, ESG Lab created and configured a new wireless network. A network policy was created and named ESG-TEST. Network policies contain all of the settings and policies necessary for a wireless network. These policies can be created, edited, and cloned to facilitate easy deployment and management at branch offices, floors of a building, or business units with different wireless requirements. The process was driven by an intuitive configuration wizard. ESG Lab was able to completely configure and deploy a high performance wireless network consisting of 10 APs in a 20,000 square foot office floor plan in a matter of minutes. In addition to traditional wireless networks, the wizard also helps to configure networks that require LAN switching, branch routing, and Apple's Bonjour gateway services. The initial wireless configuration process is shown in Figure 7.

Figure 7. Aerohive Network Configuration Wizard
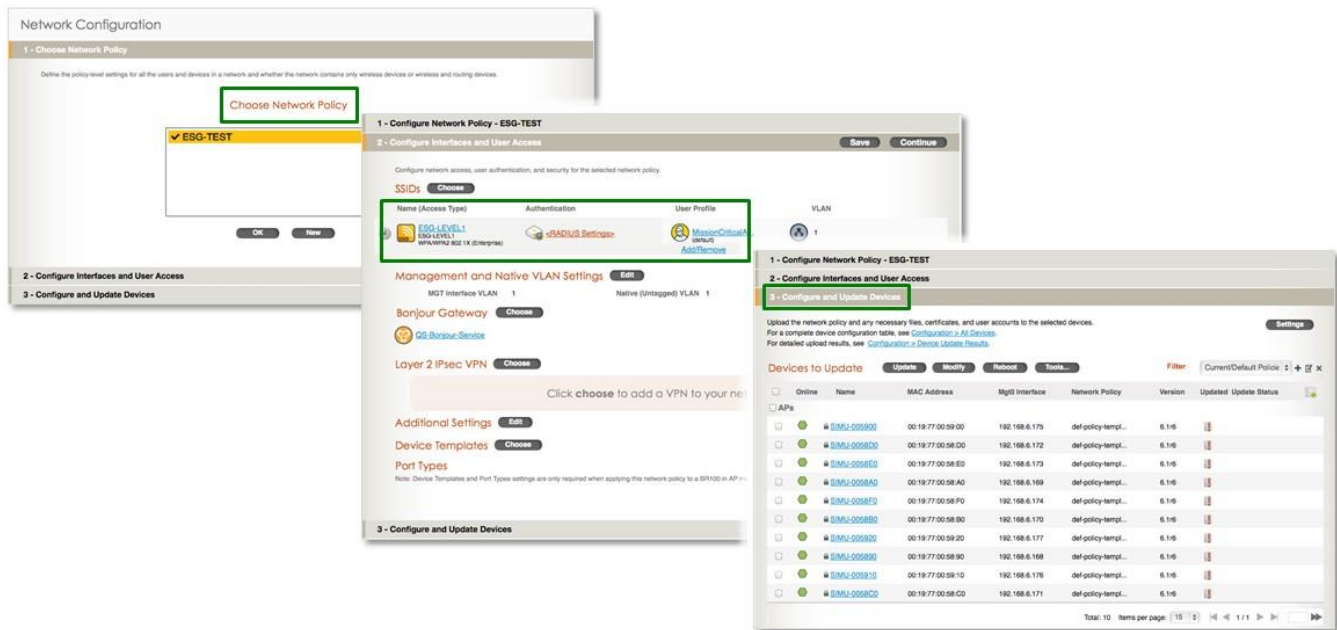
Next, ESG Lab looked at Aerohive's HiveManager software to manage and monitor an Aerohive deployment. The management solution enables users to map networking elements like context, identity, location, time of day, device and OS, to enable an organization to configure the precise security posture they require. Organizations can create administrative groups, and selectively assign administrators to resources, with the granularity of assigning control over specific functionality by administrator. Once the configuration was complete, a single click pushed the new configuration out to all devices on the network, regardless of geographic location. Adding an AP to the Hive was quite simple as well, requiring an administrator to place and power on the new access point, then push the configuration to it.

By selecting the "Dashboard" view, ESG Lab was able to gain insight into the environment from a network, system, application, or custom perspective. Each fully-customizable tab-based view included easy-to-read tables and charts that listed important information about the configuration. As shown in Figure 8, the "My Perspective" view gave us quick insight into the activity of wireless clients and Aerohive APs. The dashboards not only gave us a quick summary of the active configuration, but also helped identify the types of devices, operating systems, and applications that were consuming bandwidth on the wireless network.

Figure 8. Aerohive HiveManager Dashboard

The dashboards are fully customizable, allowing the administrator the ability to specify the most important elements on their network to monitor. New dashboard tabs can be created, saved, and modified as needed. ESG Lab created a customized dashboard in a matter of seconds by simply clicking on the plus sign to add a new tab, and selecting the desired metrics from a list of dozens of predefined widgets. Figure 9 shows the creation of a dashboard by adding a widget that monitors the usage of WLAN clients by OS over time.

*Figure 9. Creating a Custom Aerohive Dashboard*
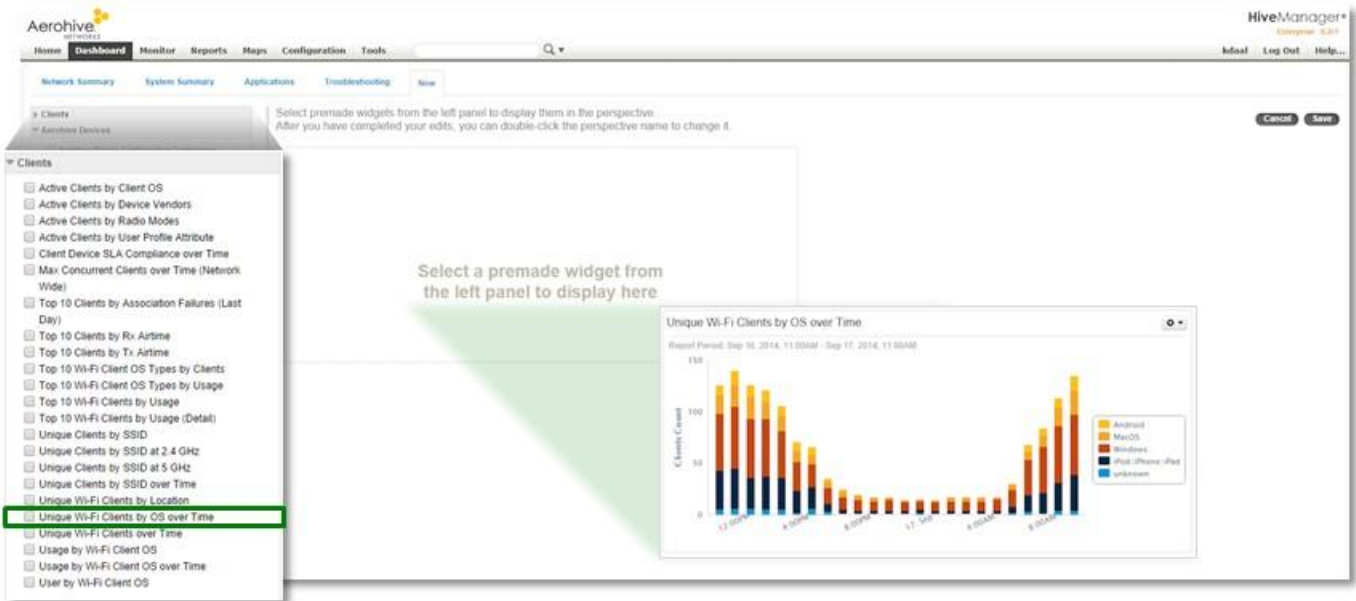
Next, ESG Lab used HiveManager to monitor the APs and clients. The Monitor tab allowed us to see and get details about the components that made up the wireless infrastructure and view and export alarms and event logs. By drilling down on an access point or client, ESG Lab was able to monitor the performance of the device over time and see and modify important configuration information, connections, relationships and device-specific events. Figure 7 shows the performance monitoring screens for an access point and a client.

Figure 10. Monitoring Performance of an Access Point and Client
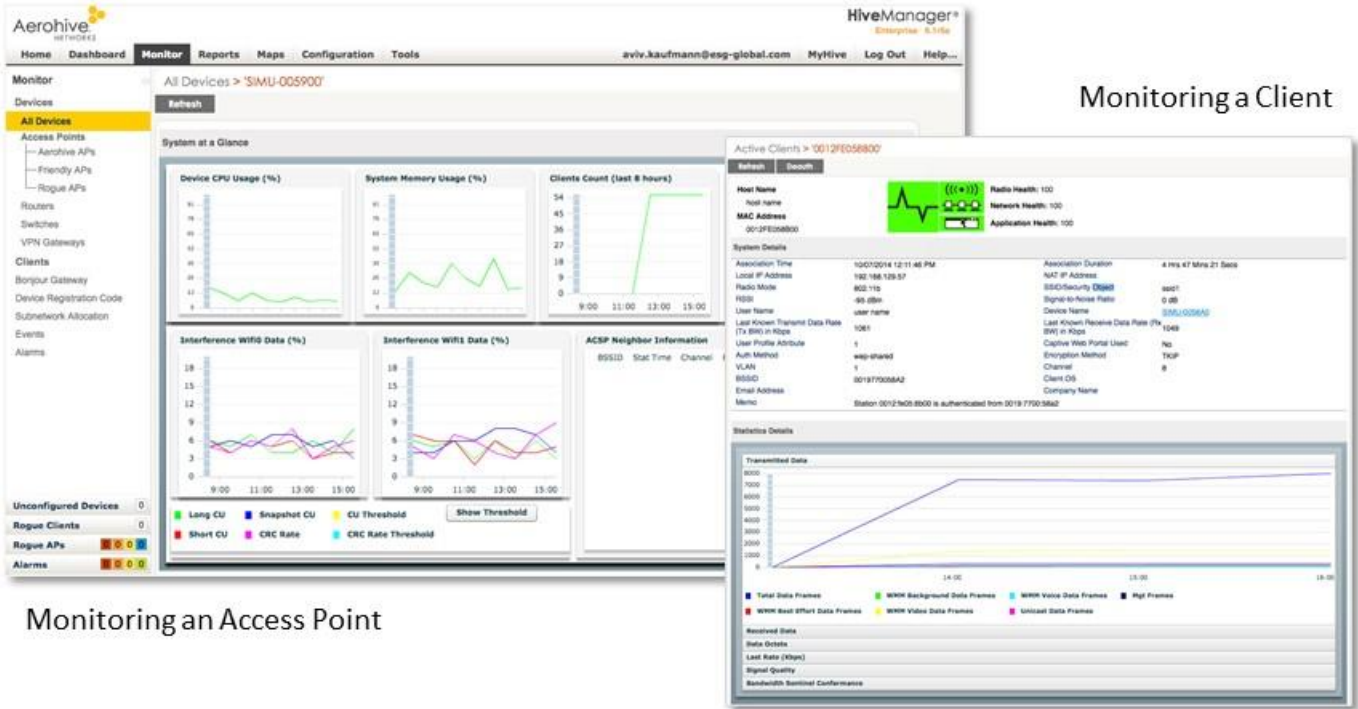
Finally, ESG Lab created a report to monitor the usage of the different applications running on the wireless network by selecting widgets in the Application tab. Once finished, the report was exported to .pdf format for easy distribution. Scheduling HiveManager to e-mail the detailed .pdf-formatted report to an administrator on a daily, weekly, or monthly period was easy as well. Figure 11 shows a sample report detailing application usage by summary.

Figure 11. Aerohive Daily Report
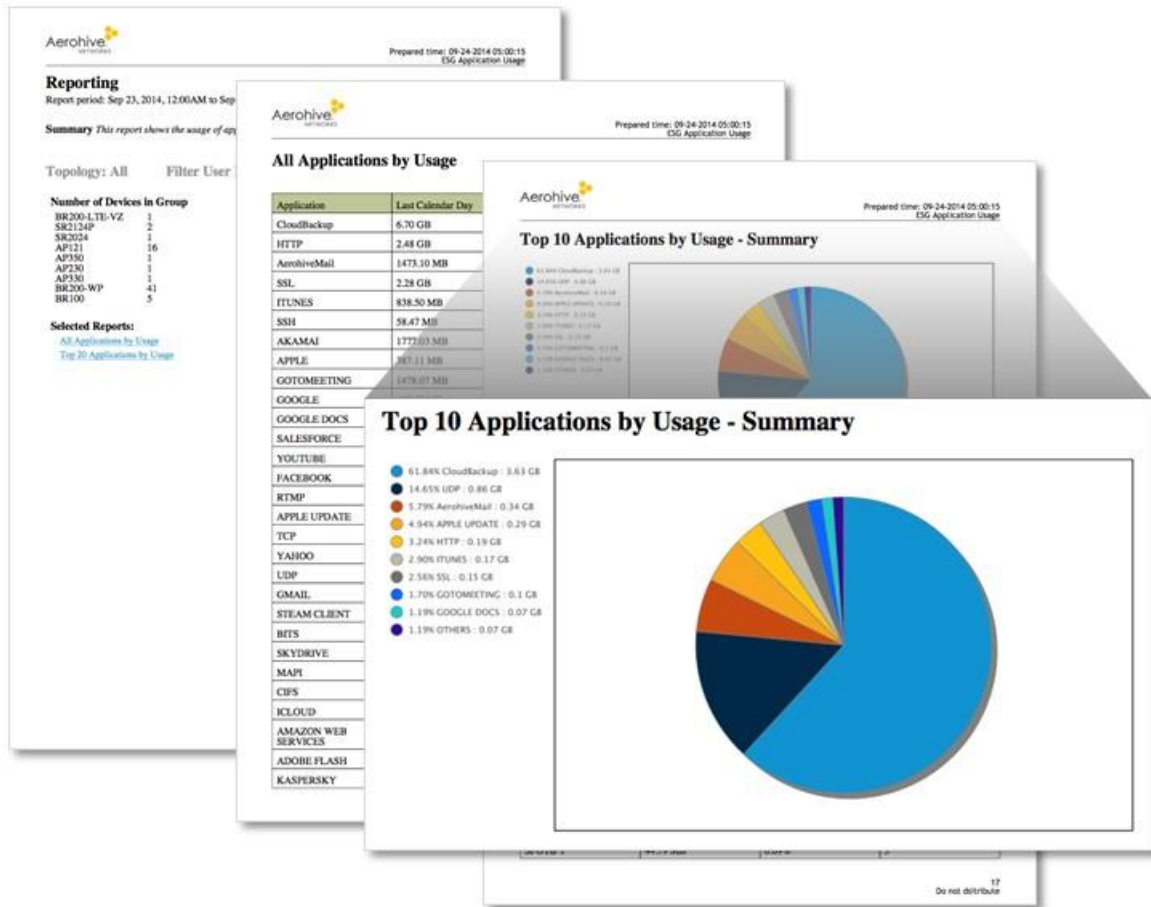
Why This Matters

Planning for, deploying, managing, and monitoring a traditional wireless network can be a difficult task that requires complex coordination of multiple areas of expertise. It is not surprising that many IT organizations have chosen to sub-contract this function to wireless professionals. The organizations that handle this responsibility in-house often must staff a team of administrators to manage and monitor the network and oversee time-consuming planning, coordination, and deployment cycles.

Using Aerohive's simple controller-less architecture and HiveManager cloud-based management platform, ESG Lab was able to plan, configure, manage, and monitor a wireless deployment quickly and securely, using guided wizards and intuitive tools. HiveManager is designed to reduce administrative overhead while providing the ability to manage and monitor the entire wireless environment with a simple, intuitive interface. Based on hands-on testing, ESG Lab has concluded that an Aerohive controller-less deployment can save an organization time and effort, leading to reduced operational expenses while providing robust wireless coverage using comprehensive planning tools.

Application Visibility and Control (AVC)

Aerohive access points (APs) powered by HiveOS leverage deep packet inspection to help understand and classify network traffic by application and network service. This application visibility gives Aerohive administrators the ability to monitor application usage and control application use, as well as control the application's priority on the wireless network. Applications can be prioritized and permitted for use by particular users, devices, specific locations, and time periods. AVC can be turned on or off for each AP.

ESG Lab validated Aerohive's AVC technology by monitoring application usage as well as prioritizing and restricting application access. Using the built-in Application Dashboard in the HiveManager GUI, all applications running on the network were categorized by how often they were used and by user. By adjusting the granularity of the timescale, administrators can view this information over a historical time period or in near-real time as people use the network. Using this knowledge, organizations can better understand where network bandwidth is being consumed, who is using it, and for which applications. Figure 12 shows the built-in Application Dashboard tab.

Figure 12. Insight into Application Usage with Aerohive's Application Dashboard
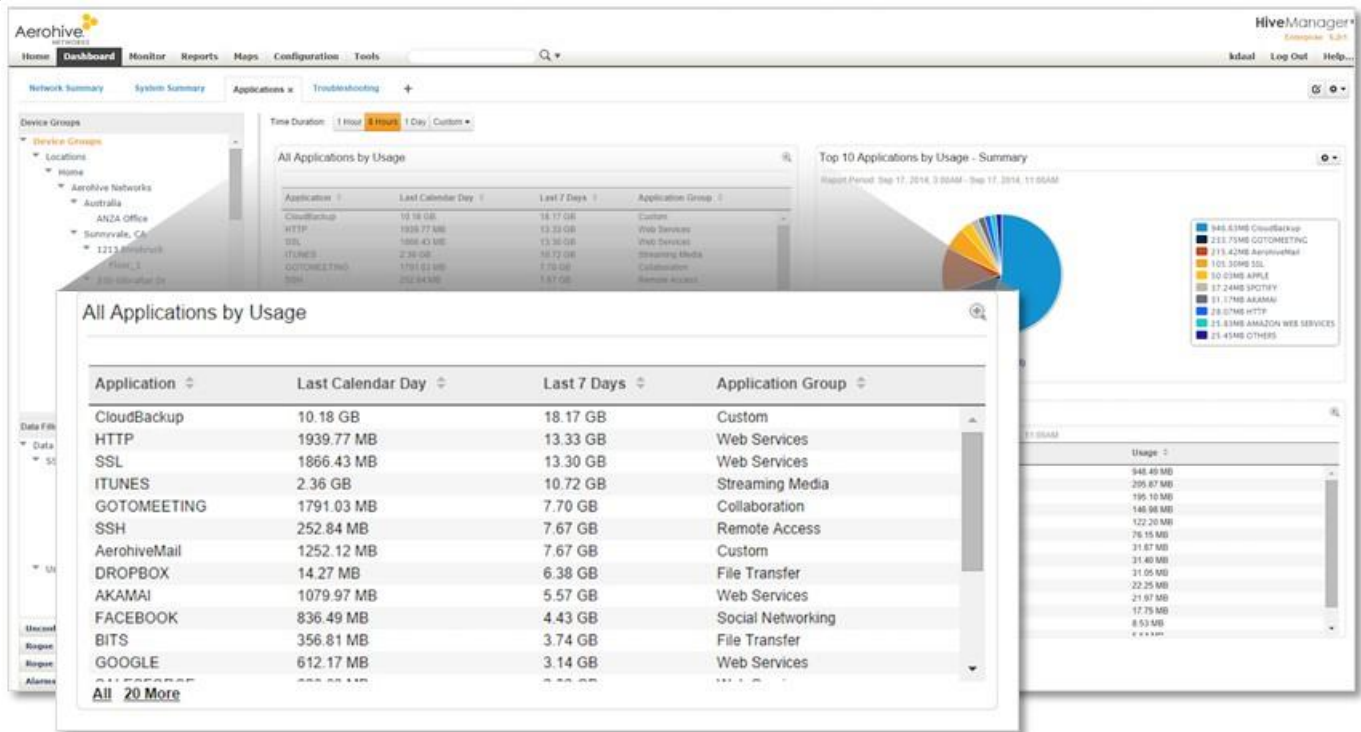
Next, ESG Lab examined the list of applications HiveOS is pre-configured to support. A selection of 712 popular, pre-defined applications and services were listed to choose from. These services included everything from business critical applications like mail, VPN, voice, and video, to popular non-business related applications—movie services, game services, and non-business related social networking. It's important to note that this functionality is extremely granular, allowing for the monitoring and control of specific functions within an application for specific users or groups. For example, users may be permitted to view their Facebook timeline only, with the corporate PR department solely allowed to post.

Some of these services may be considered non-essential for many organizations, but may be business-critical to others, depending on the nature of the business. In addition, as shown in Figure 13, ESG Lab was also able to custom-define an application that was not listed.

Figure 13. System-defined Applications and Definition of Custom Application
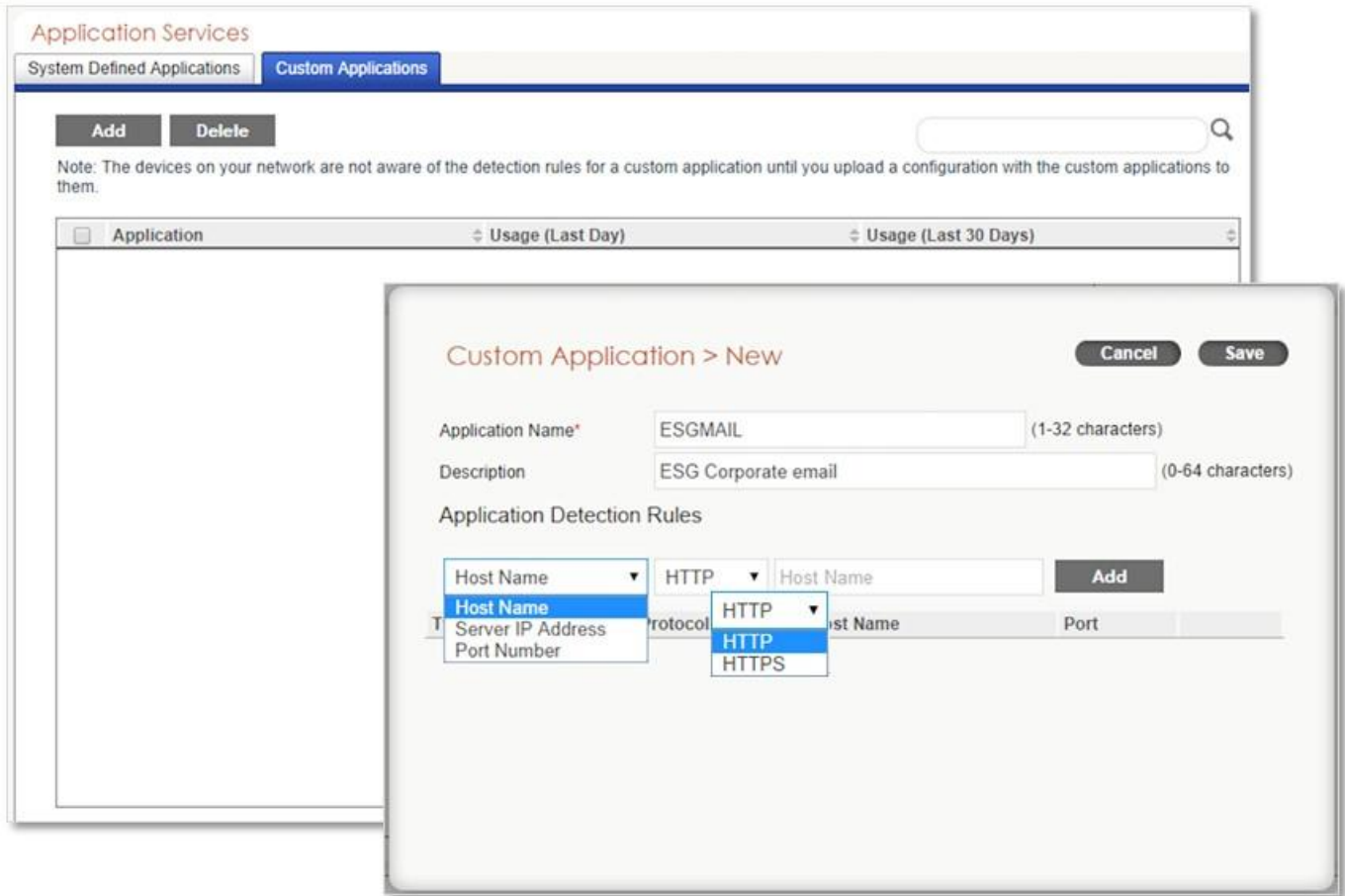

In addition to application definitions, HiveOS also contains seven predefined quality of service (QoS) classes. QoS classes define a maximum per user rate limit in Kbps for the particular applications that fall into the category defined by that class. For example, QoS Class 6 provides throughput appropriate for voice applications, while QoS Class 7 provides slightly higher bandwidth for video applications. ESG Lab next created custom Classifier Maps that prioritized the traffic of one particular application and lowered the priority of others. As Figure 14 shows, the QoS class of non-business related entertainment services Hulu and Netflix was lowered to the "Background" class, while the QoS class of YouTube, a site that often contains business videos, was changed to "Best Effort."

Figure 14. Fine Tuning Application Priority with Predefined and Custom QoS Class Settings.
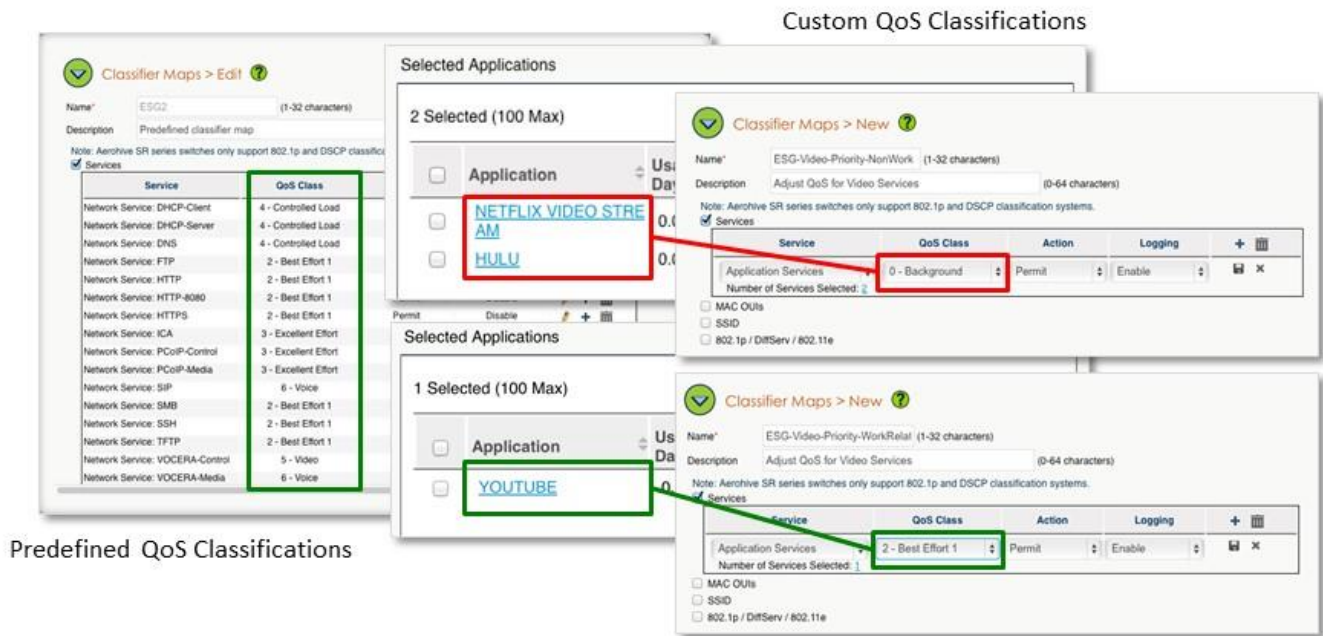

The distributed, controller-less design of Aerohive APs enables them to enforce policies for security, access control, and QoS at the edge of the network. This can enhance both security and performance as each access point can control traffic before it is allowed on the corporate network, avoiding the need to make multiple hops to dedicated controllers and appliances. Figure 15 illustrates the advantage of Aerohive's edge-based policy enforcement versus a traditional wireless deployment.

Figure 15. Aerohive's Distributed Model Compared to Traditional Architecture.
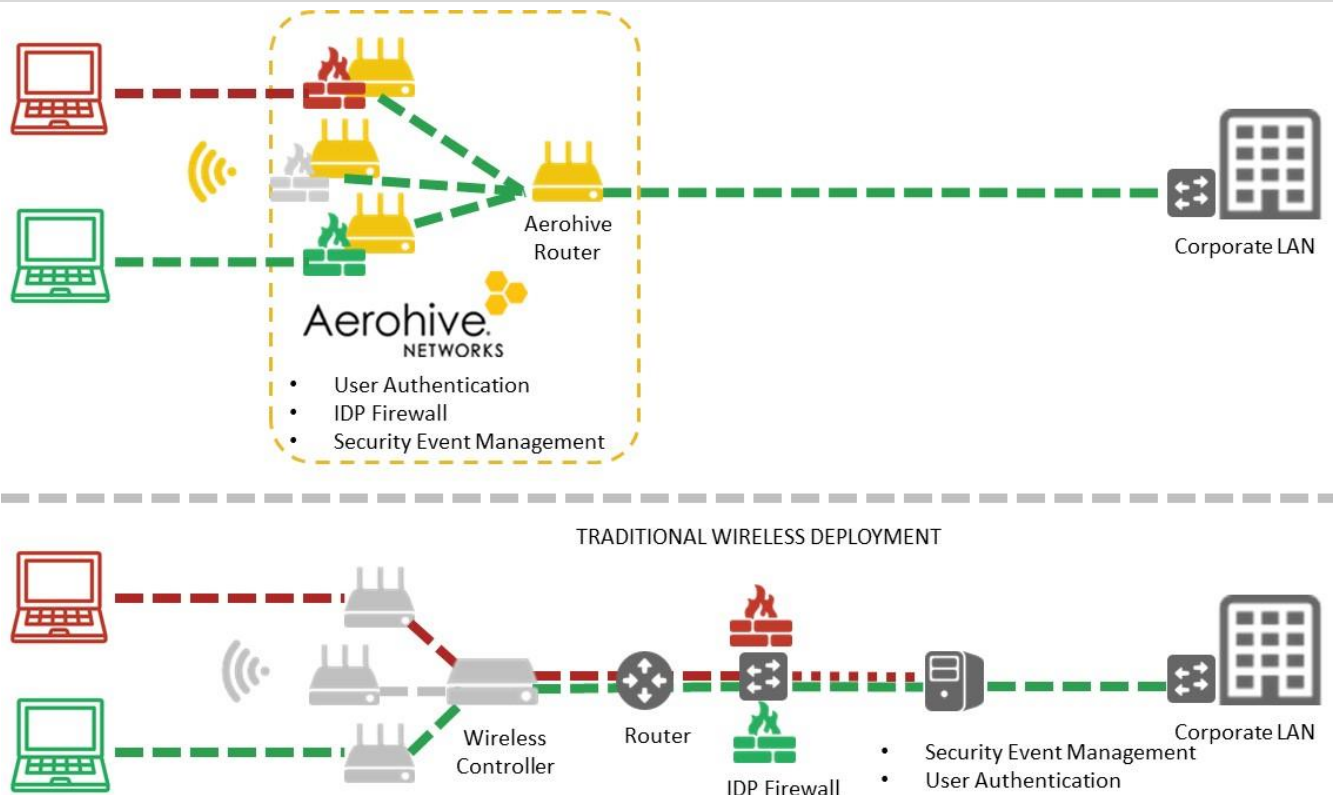
ESG Lab validated the granularity of Aerohive's edge-based firewall policy enforcement to protect against the scenario in which employees of an organization post unapproved social networking material on the company's official Facebook site. First, a new application services-based firewall policy was created that allowed all users to view Facebook pages, but denied access to posting and the messaging service. Figure 16 shows the creation of the application services-based IP firewall policy.

Figure 16. Configuring the Aerohive Firewall For General Social Media Access
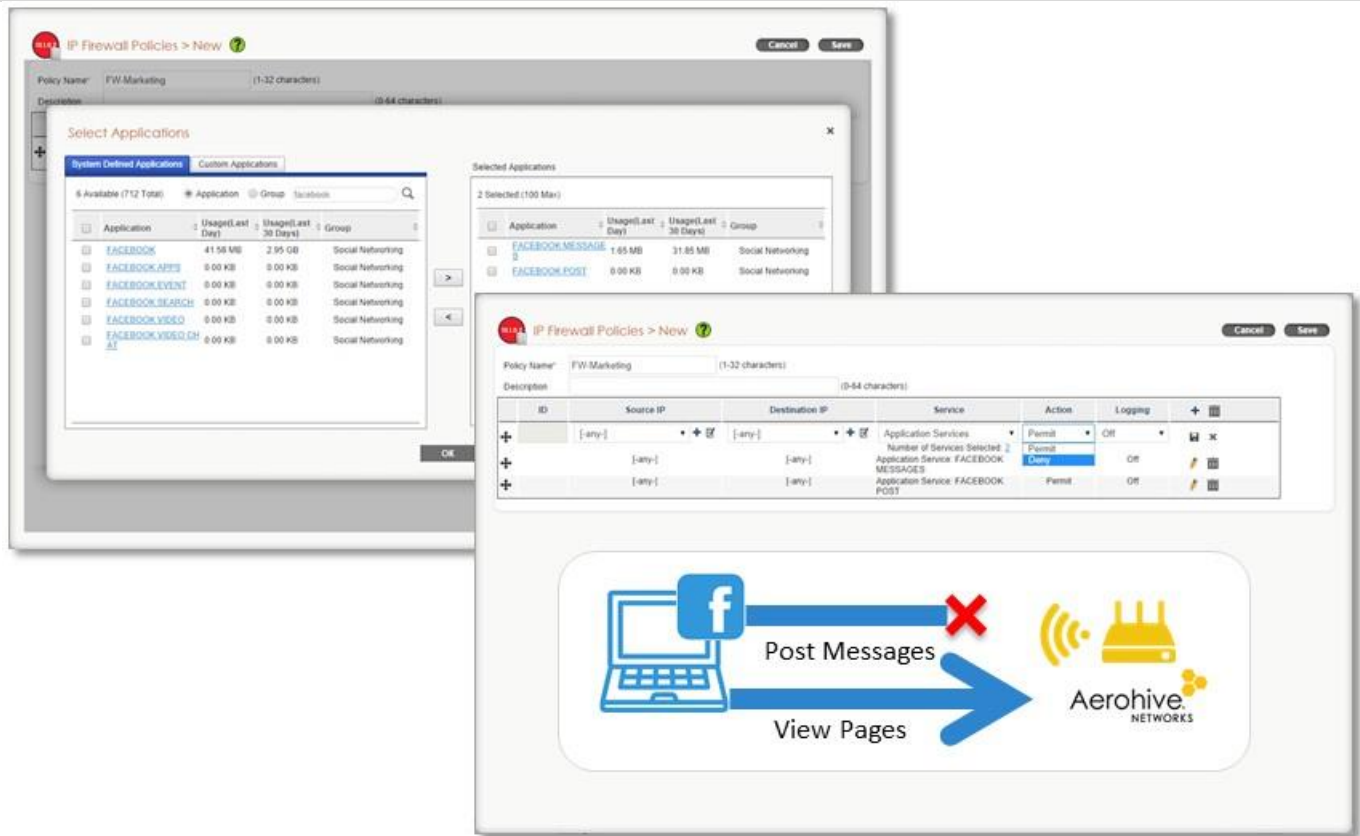
Next, the Marketing User Profile was selected, and using the same process, the policy was modified to allow just the marketing group to create posts and send messages on Facebook, as shown in Figure 17. The resulting policies ensured that the company's strict policy of having marketing approve all social media posts to the company's Facebook page could now be automatically enforced, ultimately making the policy much more effective.

Figure 17. Granular Control of Applications and Services with Aerohive
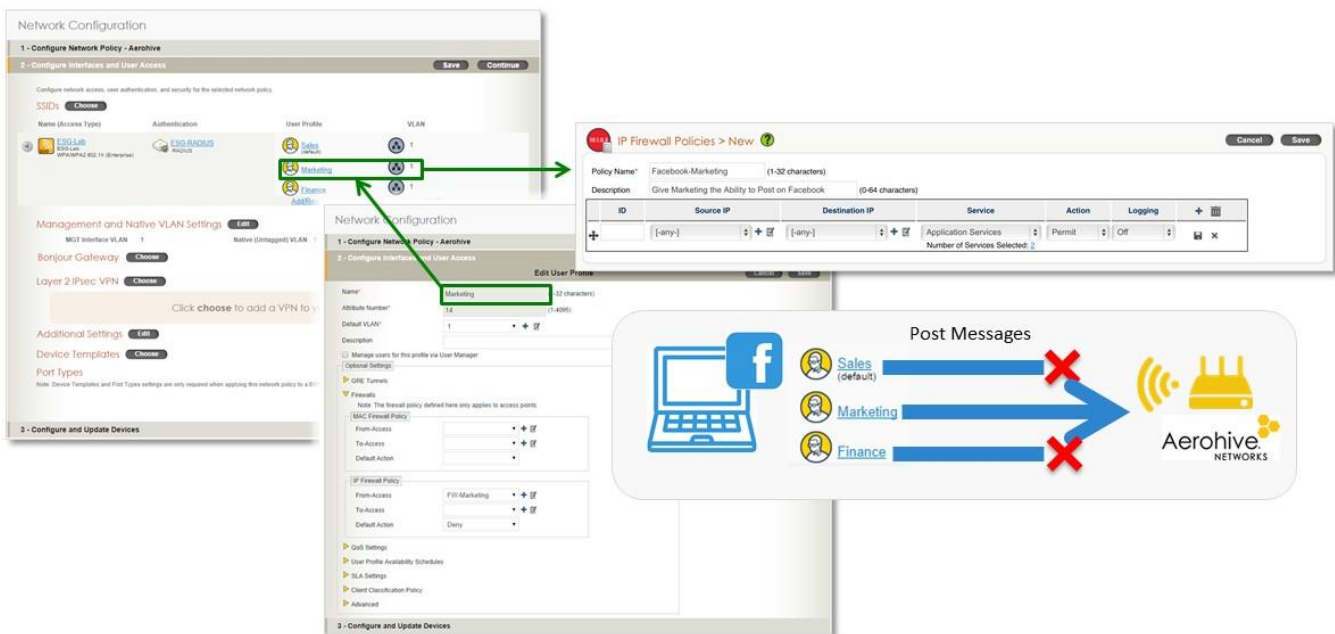
Why This Matters

ESG research indicates that information security is a top concern of IT professionals—thirty-two percent of the organizations surveyed cited information security initiatives as one of their most important IT priorities for 2014. [3]

Administrators of traditional wireless networks must maintain complex lists of users, devices, IP addresses, and application characteristics, and cross-reference these lists with controls and policies on wired network devices. Performance bottlenecks are common, as users consume valuable network throughput for any application they wish—whether it is business-critical or not.

ESG Lab was able to quickly and easily create application-based policies to control user activity on the network and prioritize business-critical applications. With over 700 commonly used applications predefined and the ability to define custom applications, Aerohive has greatly simplified the task of managing wireless network access, enforcing company policies, and guaranteeing that an organization's valuable resources are used to their best advantage.

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[3] Source: ESG Research Report, *2014 IT Spending Intentions Survey,* February 2014.

ESG Lab Validation Highlights

- ☑ ESG Lab concluded that Aerohive's HiveOS and controller-less architecture are designed to deliver a predictable, highly scalable wireless network that can grow on demand when required by the business.
- ☑ Aerohive demonstrated that their controller-less deployment can save an organization time and effort while providing robust wireless coverage through excellent planning tools.
- ☑ ESG Lab was able to step through the planning and configuration of a wireless deployment quickly and securely, using guided wizards and intuitive tools.
- ☑ HiveManager provided the ability to manage and monitor the wireless environment with deep visibility into users, applications, and traffic via a simple and intuitive interface.
- ☑ Aerohive has greatly simplified the task of managing wireless network access, enforcing company policies, and guaranteeing that an organization's valuable resources are used to their best advantage.
- ☑ ESG Lab was able to quickly and easily create application-based policies to monitor and control wireless user activity on the network and prioritize business-critical applications.

Issues to Consider

- ☑ The test results and data presented in this document are based on testing in a controlled lab setting. Due to the many variables in each production environment, it is important to perform planning and testing in your own environment to validate the viability and efficacy of any solution.

The Bigger Truth

Advancements in technology and support for flexible policies such as remote workspaces and bring-your-own-device (BYOD) initiatives have resulted in a demand on IT organizations to deliver an individualized wireless experience for an ever-increasing number and variety of devices. ESG research shows that the support of the popular BYOD policy has resulted in new challenges handling increases in network traffic, security risk, and administrative overhead. What's more, while the demand for wireless support is clearly a top priority for IT departments, only 15% of respondents reported the ability to deliver 100% wireless coverage within their own buildings.[4] The cost and complexity of deploying traditional controller-based wireless solutions may be a large factor in an organization's willingness to accept less than complete coverage within their walls.

Aerohive Networks is poised to solve these challenges with their distributed wireless solutions. A pioneer in controller-less wireless networks, Aerohive's tools make it easy for an organization to plan, deploy, manage, monitor, and grow a secure, high performance wireless network. ESG's 2014 Economic Value Validation (EVV) of Aerohive's Controller-less Architecture[5] showed that Aerohive networks not only solves the complexity problem, but allows organizations to do so at a significant cost savings versus a traditional controller-based architecture.

By distributing the function of the wireless controller across all access points in the network, Aerohive Networks has reduced both the cost and complexity of the wireless network, while providing deep application visibility and control at the network's edge. The result is a more secure network. Granular access control policies based on users, groups, devices, or applications make administration of network access both simple and effective.

ESG Lab validated that Aerohive's guided wizards and comprehensive management tools made the planning and deployment of a wireless network fast and easy, while HiveManager provided deep intelligence and control. ESG Lab was able to quickly and easily create fine-grained application-based policies to monitor and control wireless user activity on the network and prioritize business-critical applications.

Aerohive Networks is in a great position for success and growth delivering their solutions to organizations looking to cost-effectively deploy an enterprise grade wireless network that seamlessly delivers a high performing and secure wireless networking experience for all users, devices, and applications. If your organization is looking to provide secure, dependable, and simple wireless access to your employees, customers, and guests, ESG Lab recommends that you consider the next-generation, distributed, controller-less solution from Aerohive Networks.

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[4] Source: ESG Research Report, *Campus and Wireless Network Trends*, August 2014.
[5] http://www.aerohive.com/pdfs/ESG-Economic-Value-Validation-Whitepaper.pdf

Appendix

Table 1. ESG Lab Test Bed

Hardware	Software
Aerohive AP230 Access Point	HiveOS 6.2r1 1924 HiveManager Enterprise 6.2r1
Ixia BreakingPoint Storm 1Gbps Blade	Software Version 3