



# Meraki Solution Guide: Offices

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**Version 2.0, August 2010**

Wireless is becoming more and more important in the office. This document summarizes the requirements for a modern office wireless network and describes how IT professionals can use Meraki to meet those requirements.

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## 1 The Benefits of Wireless

Wireless is quickly evolving from a minor convenience to a critical part of the office network infrastructure. As the number of laptops, PDAs, mobile phones, and other devices proliferate, so do the demands on the wireless network.

There are a number of reasons why wireless is becoming more central. Increasing employee productivity is often the leading cause for the implementation of a wireless network in the office. Employees need to be able to give presentations, access shared data, and use corporate applications, anytime and anywhere.

A corporate wireless network also makes it easy to provide secure Internet access to visiting customers, partners, and vendors.

Many businesses are also seeing an increase in IP-connected devices such as printers, video surveillance cameras, bar-code scanners, and RFID readers. In many cases, these devices are mobile or difficult to wire, making wireless the optimal solution.

In some cases, organizations are even opting to reduce or eliminate the number of wired ports they install. Just as people are increasingly abandoning land lines in favor of mobile phones, employees who have fast, reliable wireless coverage are often leaving their wired connections behind.

## 2 Requirements for a Wireless Office

While the benefits of wireless are often well understood, achieving those benefits has historically been complex, expensive, and labor-intensive. There are good reasons for this: covering a business is far more difficult than covering a home or small office. IT professionals often have large areas to cover with multiple RF profiles. Performance, security, reliability, and cost constraints add to the challenge.

In the next two sections of this guide, we will review the requirements for an office network. We will then describe how Meraki can help IT professionals build a wireless network that meets those requirements in an efficient, cost-effective manner.

### 2.1 Great Coverage

In order for the network to be useful, it must be available wherever people need it. In some cases, this will only be common areas such as conference rooms or auditoriums. In other cases, wireless must be available campus-wide, including outdoors. Coverage can also extend to branch offices and even employee homes.

### 2.2 High Performance

Wireless networks must be able to keep up with a rapidly increasing number of users and increased usage per user. Networks must be able to deliver consistent performance even when there are high concentrations of users, for example, in an auditorium or customer briefing center. In addition, voice and video applications are becoming more common, requiring traffic prioritization. Networks must also ensure that a small number of data-hungry clients cannot take over the network, crowding out everyone else.

### 2.3 High Availability

Wireless networks need to be up all the time. It only takes one or two failures to lose users' trust. Any problems that do arise need to be contained and brought to the attention of the administrators promptly.

### 2.4 Serve Multiple Constituencies

Wireless networks often serve many different groups of users, each with its own unique requirements. Employees require secure access to the corporate LAN. Guests need access to the Internet without a lot of hassle. Specialized devices like phones or RFID scanners need low latency connections. Future applications will undoubtedly also need to be accommodated.

## 2.5 Robust Security

Since wireless goes beyond the walls of the office, it is no longer possible to use physical security to control access to the corporate network. A wireless LAN needs robust authentication, authorization, and encryption mechanisms to prevent unauthorized use. The system also needs to integrate with the company's existing authentication infrastructure, like Active Directory or LDAP.

## 2.6 Physical Appearance and Security

Unlike switches or firewalls, wireless access points (APs) are often mounted in publicly accessible locations throughout the office. As a result, it is important that APs can be easily concealed, if required, or that they look aesthetically pleasing when installed out in the open. In some environments it is also important to be able to physically secure the APs to deter theft or tampering.

## 2.7 Future-Proof

Constructing a wireless LAN represents a significant time and resource commitment. It is essential that a WLAN investment last as long as possible. To that end, modular upgrades to the network should be an option. For example, it should be possible to upgrade the access points without upgrading the centralized control system, or to add on a voice over WiFi system without rebuilding the network.

## 2.8 Easy to Maintain

IT staff are being asked to do more with less. A wireless LAN needs to be straightforward to install and maintain. Growing a network should not require expensive consultants or time consuming site surveys. It should be easy to change security policies, add or remove administrators, and bring new sites online.

## 2.9 Low Total Cost

As with any business investment, return on the investment must be front and center. Some of the important cost components in building a wireless LAN include:

- Network design and planning
- Installation
- Hardware and software
- Ongoing maintenance

## 3 The Meraki Approach

In this section we will explain how a Meraki system can help IT organizations build a robust, secure, and high-performance office network. We will begin with an overview of the Meraki system, then delve into detail on each requirement.

### 3.1 System Overview

Meraki wireless networking systems are designed from the ground up to build high-quality office networks. A Meraki system has two primary components: wireless access points and a web-hosted controller, the Meraki Cloud Controller.

Wireless APs are deployed throughout the coverage area and communicate directly with users' wireless-enabled devices. Meraki has different APs for different jobs, including 802.11b/g and 802.11n, single and multiple radio APs, as well as indoor and outdoor devices.

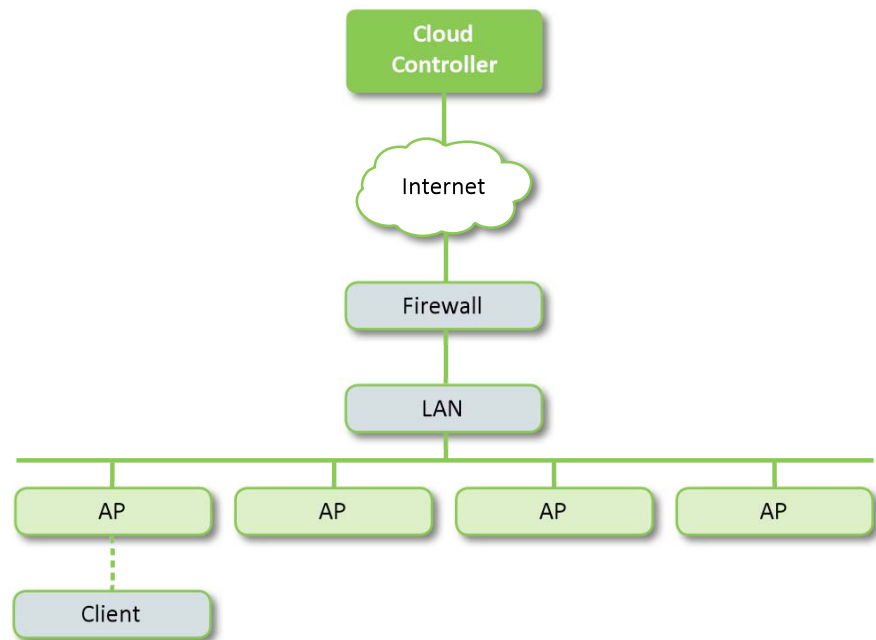
Meraki's Cloud Controller lets administrators control, manage, and optimize their network from a centralized location. Unlike older architectures, Meraki's controller is provided as a service, eliminating the need for an expensive and difficult-to-install hardware solution.

Figure 1 shows an overview of the Meraki system.

Meraki APs communicate with the Cloud Controller over a persistent tunnel using industry-standard protocols. Administrators log into the Meraki Cloud Controller through a web browser. Over the web, they can access all of the wireless networks in the company's account.

For more information on the Meraki architecture, see the Meraki Architecture White Paper.

Figure 1 – Meraki Architecture



### 3.2 Great Coverage

A well-designed wireless network will provide good performance no matter where the client may be. Coverage can be challenging: construction materials, client density, RF noise, and a number of other factors can all effect performance. Meraki has focused on providing a rich set of tools that make it easy for non-experts to build a great wireless network.

#### 3.2.1 Intuitive Visualization Tools

The first step to providing good coverage is making it easy to picture the coverage. Meraki's visualization tools let administrators position access point markers on indoor and outdoor maps. These maps show both the signal strength between the AP and each client as well as the signal strength among access points. When administrators see an area with slow client connectivity, they can do something about it.

#### 3.2.2 Easy to Move and Add APs

If a coverage gap is identified, or a cell's capacity has been reached, Meraki makes it easy to add an access point or reposition existing APs. No special controller or AP configuration is required. Adding an AP is as simple as plugging it in.

### 3.2.3 Mesh That Works

Mesh networking allows access points to repeat the signal of other access points, eliminating the need to run Ethernet cabling to each AP. Mesh makes it quick to provide enhanced coverage to hard-to-reach areas by just plugging in an AP to power. Meraki's award-winning mesh protocols automatically find the best route back to the wired network, without any manual configuration whatsoever.

For more detailed information on how to achieve great wireless coverage, see the Meraki Network Design Guide.

## 3.3 High Performance

Meraki systems are engineered to provide the throughput needed to keep up with a large number of demanding users in an office setting. There are a number of techniques used to provide that performance.

### 3.3.1 802.11n

The underlying radio hardware has a significant effect on the overall system performance. When high performance is a requirement, Meraki recommends deploying dual-band 802.11n access points, like the Meraki MR14 or MR58.

The following table shows how the radio performance of a dual-band 802.11n Meraki system in a typical mixed-client environment:

Access Point	Client Traffic	Total Client Traffic
2.4 GHz 20 MHz channel	75% 802.11g clients @ 36 Mbps 25% 802.11n clients @ 104 Mbps	53 Mbps
5 GHz 40 MHz channel	100% 802.11n 2x2 clients @ 216 Mbps	216 Mbps
Total traffic (half-duplex)		269 Mbps

For more information on 802.11, see the Meraki 802.11n White Paper

The use of dual-radio 802.11n APs is one of the keys to getting high performance. However, high quality access points alone are not enough.

### 3.3.2 Channel Planning and Optimization

Since wireless spectrum is shared among multiple APs and clients, it is important to put different APs on separate channels to maximize performance. The Meraki Cloud Controller keeps networks running at peak capacity by automatically finding the best set of channels for each of the APs to use, whether the access points are wired or meshed. Furthermore, since changing channel settings can briefly interrupt client access, Meraki allows the administrator to control when channel changes take place, e.g., only when approved by the administrator or when the office is closed at night.

### 3.3.3 No Controller Bottleneck

Since Meraki APs do not send data packets through a hardware controller, there is no need to worry about controller backplane or port capacity. In addition, the Cloud Controller does not introduce any latency between the client and its host, which can occur with a hardware-based controller.

For example, imagine a client is talking to a file server in the same building. In a hardware controller solution, traffic must flow from the AP to the controller, and then back to the file server. The farther away the controller is, the higher the latency. In the Meraki solution, traffic flows directly from the client to the file server.

## 3.4 High Availability

The business cost of downtime increases as more and more clients use the wireless network. Meraki systems provide high availability in several ways.

First, the hosted approach eliminates the hardware controller, which is often a single point of failure. Instead, Meraki networks run off of a number of globally distributed data centers.

In addition, the Meraki system is engineered to continue running even if the connection to the Cloud Controller is lost. One of the reasons this is possible is that the Cloud Controller is not in the data path. That is, client traffic flows directly from the AP to its destination. In the event of a lost connection, some services, such as remote management, are not available, but client traffic continues to route.

Meraki networks also tolerate access point failures well. Even when deployed in a mesh configuration, fail-over from one node to another occurs nearly instantaneously. Clients seamlessly move to a different AP and continue operation. Administrators can also elect to receive email alerts when failure event happen, allowing them to respond to an issue quickly.

## 3.5 Serve Multiple Constituencies

It is key to be able to meet the needs of multiple groups of users, including employees, guests, and specialized devices, each with their own set of service parameters.

To meet this requirement, Meraki networks allow administrators to create multiple virtual access points (VAPs). Each VAP has its own identity, including Service Set Identifier (SSID), security, and other policy settings. The table below shows a typical configuration when a company needs to support employees, guests, and wireless VOIP phones.

Service Parameter	Virtual AP 1	Virtual AP 2	Virtual AP 3
Users	Faculty/Staff	Students	Phones
Security	Access to LAN	Internet only	Access to LAN

<b>Client bandwidth</b>	Unlimited	5 mbit/s	Unlimited
<b>Quality of service</b>	Normal	Normal	High
<b>Authentication</b>	802.1x / LDAP	Open	WPA2-PSK
<b>SSID</b>	Administration	Student	Admin – Phone

Each Meraki access point can have up to four VAPs. Furthermore, VAPs can be created with just a few clicks.

### 3.6 Robust Security

It is important to be able to lock down the company's network. A WLAN solution needs to have a broad set of security tools available to match the needs of different organizations. While each organization is likely to have its own particular set of security requirements, we describe some of the most common configurations below.

#### 3.6.1 VPN

In this approach, all wireless traffic, including employee traffic, is routed outside the firewall. Those needing to access LAN resources, such as file shares, VPN back into the corporate network as if they were outside the LAN. The segregation of WLAN from LAN traffic can be accomplished using VLAN tagging. Alternately, Meraki has a built-in LAN isolation feature which will prevent wireless clients from routing traffic to LAN addresses.

#### 3.6.2 VPN with Separate Backhaul

In situations where additional security is desired, it is possible to route the WLAN traffic on a completely isolated physical network and set of backhaul circuits, such as a separate T1 or set of business-class DSL connections. This approach prevents access to the corporate LAN except through VPN. Meraki's mesh capability can help minimize the amount of additional wiring required if using this approach.

#### 3.6.3 Pre-Shared Keys

In the traditional approach to wireless security, users are given a common "pre-shared" key. The IT department may put the key on each client device, or distribute the key itself. WEP was the first key technology, but it has since been replaced with the more secure WPA2. A major advantage of the pre-shared key approach is that it is simple and quick to implement. However, it can be difficult to maintain with a large or changing user base.

#### 3.6.4 Authorized Users

In this approach, each wireless LAN user receives a unique username and password. The user list can be stored on an existing database, like a RADIUS, LDAP, or Microsoft Active Directory server. Alternately, the user list can be hosted by Meraki. Users provide their login credentials through either a web page portal (hosted by Meraki), or using an industry standard 802.1x client.

### 3.7 Physical Appearance and Security

Unlike IT equipment such as servers and switches, access points often need to be mounted in public spaces. Aesthetics can sometimes be an important consideration. Meraki access points, including the enterprise-class MR11 and MR14, are designed to blend into corporate environments. They feature internal antennas, small LEDs, and mounting options that can hide all wiring. They can also be mounted in areas like walls, dropped ceilings, or even in the plenum space. When physical security is a concern, Meraki APs can be padlocked to their mount plates, which also prevents the Ethernet cable from being unplugged.

### 3.8 Future-Proof

Meraki provides both 802.11b/g and 802.11n access points. Organizations that decide to deploy b/g today have a seamless upgrade path to 802.11n technology should the need arise. It is also possible to deploy a mixed network, putting 802.11n in areas with high use, and b/g in less heavily trafficked areas.

Meraki also provides an upgrade path beyond 802.11n. One of the key attributes of a Cloud Controller is that it never becomes obsolete. If a company decides to upgrade its access points two or three years down the road, the Meraki Cloud Controller is guaranteed to be compatible.

### 3.9 Easy to Install and Maintain

Corporate WLAN systems can be difficult for non-experts to design, install, and maintain, leading to expensive and time-consuming implementations. Meraki has gone to great lengths to simplify these processes.

#### 3.9.1 Wiring

Whether APs are mounted on walls, ceilings, or in the plenum space, access point wiring can end up taking a significant amount of time. Power over Ethernet (PoE) is the simplest and cheapest way to power access points. PoE reduces expensive electrical wiring work by making use of existing Ethernet cabling. All Meraki 802.11n APs support the 802.3af PoE standard.

The use of mesh can also greatly simplify the wiring task. Meraki mesh works out of the box with zero configuration, making it easy to plug in repeaters where there is no convenient Ethernet port. The use of multiple radios on an access point also greatly improves the performance of mesh access points.

#### 3.9.2 Intuitive User Interface

“Enterprise-class” does not have to mean “hard to use.” The use of a web-based browser with a streamlined interface means that even non-experts can configure and maintain a Meraki network. There are no rigid configuration files and no need to learn a new command line syntax.

### 3.9.3 Automatic Upgrades

Finally, unlike legacy systems requiring manual upgrades which may be time-consuming and disruptive, Meraki keeps the system software up-to-date automatically.

### 3.10 Low Total Cost

As with any business infrastructure investment, it is imperative to consider all the cost elements of a wireless network. The total cost of a wireless network has several components, including the hardware, installation, wiring, training, and maintenance.

Meraki offers benefits in each of these cost buckets. The following table shows where cost savings are possible.

Cost Component	Legacy	Meraki	How?
Controllers/Appliances	\$\$\$	-	Use the cloud
Wiring	\$\$\$	-	No dedicated wiring
Installation	\$\$\$	\$	Plug and play; no controller config
Access points	\$\$\$	\$	Move intelligence from AP to the cloud
Training	\$\$	\$	Intuitive, web-based management
Upgrades	\$	-	Automatic web upgrades

A Meraki solution is an efficient way to deploy wireless throughout an organization.

## 4 Moving Beyond the Office Building

Many organizations want to cover more than one office building. Additional sites may include other buildings on a corporate campus, distributed branch or sales offices, and even employee homes. This section describes how a network can be extended to cover these areas cost effectively and securely while still maintaining centralized management and control.

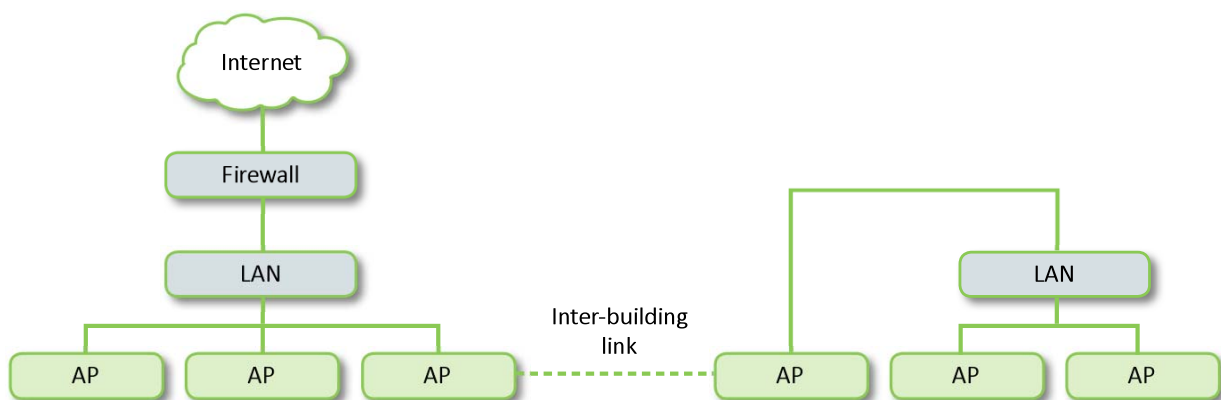
### 4.1 Campus Environments

Many organizations have multiple buildings on a single campus. The wireless network should enable users of the network to move easily from one building to another.

Setting up a multi-building Meraki network is straightforward. In most cases Meraki recommends placing all the campus APs within a single network on the Cloud Controller. This configuration ensures that each AP has the same configuration. In addition, the Cloud Controller will automatically summarize usage statistics across the entire network. Administrators can visualize different buildings and the floors on each building using the visualization tools on Meraki Dashboard.

IT managers can also use Meraki radios to create a high-speed, wireless point-to-point bridge between two buildings. Figure 2 illustrates this configuration.

Figure 2 – Point-to-Point Bridge



### 4.2 Branch Offices

Many companies want to provide wireless coverage throughout their network of branch offices. However, branch offices often lack IT staff familiar with the wireless network.

Other solutions require that each remote location either have their own controller (which is expensive) or have a connection back to the corporate data center (which may not always be possible and may represent a single point of failure). Meraki does not require that branch offices have an MPLS or VPN connection in order to function properly, making it easier to set up branch sites quickly. It also makes it feasible to set up temporary corporate-controlled network at conferences, seminars, or trade shows.

Meraki recommends setting up a different wireless network for each branch office or site. This configuration makes it easy to isolate network events to the office in which they are taking place and to view statistics and reports per office. Each branch office uses its own configuration, while still giving the administrator a centralized view of all the Meraki networks managed by the company.

### 4.3 Employees at Home and on the Road

Sometimes the IT department needs to manage wireless access outside the office. For example, certain executives may want corporate wireless at home, or marketing personnel may need to setup a corporate network on the road.

Meraki provides both the hardware and software required for these small, off-site networks. On the hardware side, Meraki makes cost-effective and highly portable access points that can fit in a laptop bag, such as the Meraki Indoor.

On the software side, Meraki makes it easy to manage all of the employee networks in one place, and ensure they all have a common configuration. Administrators can centrally control and monitor these networks, and help users troubleshoot them when they have problems.

If the networks are used at home, it is also possible to create separate virtual access points (or SSIDs) for work and personal use. The personal network might be used by family and be either open or secured using a private WPA key.

This approach remains secure because the Meraki units do not create insecure tunnels back into the corporate network. Employees continue to use standard VPN software to tunnel back to the corporate network.

## 5 Conclusion

As the number of wireless users continues to grow, wireless is becoming more and more important in the workplace. Offices need security, performance, and manageability, without complexity or additional cost. Meraki's complete wireless LAN offering can help IT organizations deploy an office wireless LAN quickly, easily, and at a price that will not break the bank.

## 6 References

1. Meraki Network Design Guide
2. Meraki Branch Office Solution Guide
3. Meraki Architecture White Paper
4. Meraki 802.11n White Paper
5. Meraki Guest Access White Paper

These reference documents are available for download at [meraki.com](https://meraki.com).