



Meraki White Paper:

Successful Wi-Fi Deployment for Large Events

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This document describes best practices that help ensure a successful wireless network deployment at large events with thousands of users.

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1 Executive Summary

While deploying a wireless network at a large event with thousands of users can be challenging, there are many ways to increase the odds of a running a successful wireless network. This paper discusses the challenges posed by such events, offers recommended network designs and configuration settings, and gives tips to use during the event's duration.

2 The challenges of event Wi-Fi

News stories about a CEO's product demo going bad due to a network failure are all too common. Why do so many events still suffer from poor Wi-Fi, even though Wi-Fi is a mature technology?

Often times a number of challenges conspire to "break the network." The following are some of the more common challenges Meraki has observed.

2.1 Technical challenges

- User density can be very high, with often hundreds or thousands of devices in a single conference room. However, there is only a finite amount of radio spectrum (channels) available to serve these clients.
- The number and type of wireless devices is hard to predict. Users bring many wireless devices on-site—Windows laptops, MacBooks, iPhones, iPads, and more—and expect them all to work.
- The wireless devices all associate simultaneously when the users arrive on-site.

2.2 Operational challenges

- It is very difficult to simulate the actual network load before the crowds arrive.
- There is very little time to fix the network if it breaks during the event.
- It may be difficult or expensive to get enough backhaul capacity.
- Time on-site before the event begins may be very limited.

3 Design recommendations

While large event Wi-Fi can be challenging, taking the time to design the network and using the right network settings can dramatically increase the odds of running a successful event. The following are network design recommendations that Meraki has found to be useful when deploying a large wireless network.

3.1 Allocate enough time for planning

The first step in planning a successful event is to allocate enough time. Ideally, begin planning 4-8 weeks ahead of the event. This ensures there is enough time to procure the necessary Wi-Fi equipment, switches, and backhaul circuits (often the longest lead-time item).

3.2 Calculate the expected number of clients that will be served

This number will be used throughout the planning process. One approach is to use the expected number of attendees and assume a certain number (often 0.5-2) of devices per attendee.

3.3 Determine the number of access points (APs) needed

Although the APs do not have a hard client limit (they are limited by bandwidth, not number of clients), as a practical matter 50 client sessions is a safe limit and is convenient for planning. To avoid too many active clients, enable power reduction, band steering, and ensure there are enough APs installed in the environment to support the required load.

3.4 Calculate the backhaul required

Events are often plagued by limited backhaul. To calculate the backhaul requirement, multiply the bandwidth limit by the expected number of clients. For instance, if there are 500 expected devices, and each device is limited to 100 kbps, then 50 Mbps of wired backhaul are required. While it is unlikely that all devices will use up to their full bandwidth limit, this conservative calculation will minimize the odds that the backhaul is insufficient.

3.5 Maximize the number of APs that are connected to the wired network

This allows an AP to use the full bandwidth of its wired connection, rather than having to go through a neighboring AP via a mesh link. If possible, Meraki recommends against using mesh at high-density events.

3.6 Use multi-radio APs

With multi-radio APs, the Meraki wireless network can make optimal decisions about channel assignment, band steering, and mesh networking. This maximizes throughput and minimizes channel interference for clients. Higher throughput 802.11n clients can operate on the 5 GHz band without being slowed down by older 802.11b/g clients, which remain on the 2.4 GHz band. Moreover, if mesh links are necessary, they can be provided on multiple radios, significantly improving the performance of the network across multiple mesh hops.

3.7 Map the APs

Name the APs and place them on the map appropriately. The network decides the best mesh route based partially on the locations of APs on the map.

3.8 Ensure signal strength

The signal strength between a client and an AP should be at least 20 dB for optimal stability and performance. Anything less than 10 dB is unusable.

3.9 Budget for spare hardware

Spare hardware should be readily available in case of failures. For example, have an extra switch, APs, cables, and associated power supplies.

4 Network configuration recommendations

This section describes configuration settings that are appropriate for most large events.

4.1 Enable bandwidth limits

This is probably the most important single consideration. If bandwidth limits are not enabled, a small number of clients can quickly saturate a channel. For most events, a per-client limit of 100-200 kbit/s is appropriate, and this will provide a snappy web browsing experience, reasonably fast email, and usable video. Higher limits (1-2 Mbit/s) will of course enable higher-bandwidth applications; however, this will require that there is enough local and wide area bandwidth available to support all users at this limit.

One simple and effective strategy is to start with low limits and, if no problems are encountered, then gradually increase the limit.

4.2 Enable Meraki NAT

Centralized DHCP servers often fail or become slow when hundreds or thousands of clients request an IP address in a short time. Meraki strongly recommends enabling Meraki NAT, which spreads the DHCP load among all the APs.

4.3 Limit splash page size

If a splash page is used, Meraki recommends limiting the size of the splash page. This reduces congestion during a time at which many clients are accessing the network for the first time. 10-50 KB is a reasonable target.

4.4 Enable auto channel assignment

Auto channel assignment allows the Meraki Cloud Controller to assign channels to Meraki APs in the network using RF information that the APs constantly send up to the Cloud Controller. Unlike traditional wireless solutions, in which channel assignment decisions are made by each AP in a localized manner, the Meraki Cloud Controller ensures that channel assignments make sense locally as well as globally, relative to the rest of the network.

4.5 Enable Channel Spreading

Channel spreading enables Meraki APs in the same vicinity (e.g. in the same auditorium) to broadcast on different channels so that channel utilization on each channel is minimized. This maximizes throughput and minimizes interference in the network. The Meraki Cloud Controller automatically assigns channels to achieve channel spreading.

Configuration

1. Logon to the Meraki Dashboard --> Configure --> Radio Settings
2. Navigate to the Channel Settings section and update the Channel planning selection to "Automatic channel selection - channel spreading"
3. Once all APs are in their desired location and on, push the "Update channels now" button to force a calculation of the best channel arrangement.
4. Save changes

4.6 Enable Band Steering

Band steering forces 5 GHz-capable wireless devices (e.g. most 802.11n clients) to migrate away from the 2.4 GHz band. This opens up radio spectrum for legacy wireless devices (e.g. 802.11b/g clients). This is highly beneficial since there are many more 5 GHz channels than 2.4 GHz channels.

Configuration

1. Logon to the Meraki Dashboard --> Configure --> Access Control
2. Select the appropriate SSID from the drop down list at the top
3. Navigate to the Wireless Options section near the bottom of the page
4. Set the Band Selection to "Dual band operation with Band Steering"
5. Save changes

4.7 Reduce Transmit Power

Reduced transmit power enables administrators to create "microcells", such that a user associates only with the nearest AP in a room containing multiple APs. This guarantees an even distribution of users across the APs deployed in a physical space.

Configuration

1. Logon to the Meraki Dashboard --> Configure --> Radio Settings

2. Navigate to the Power and Country Settings section and update the Country to the appropriate location.
3. Set the Radio power option to "Enable power reduction on nearby APs"
4. Save Changes

4.8 Set 5 GHz channel width to 20 MHz

This configuration allows for a greater number of individual channels, which might be desired in a high-density setup. This change is only applied to 5 GHz radios since 2.4 GHz radios already use 20 MHz channels by default. Note: please contact Meraki technical support to enable 5 GHz 20 MHz channels.

4.9 Consider application traffic shaping

Consider blocking applications that might be considered abusive, such as file-sharing software. Configure application traffic shaping under "Configure -> Traffic shaping." Meraki application traffic shaping runs at line rate and does not decrease the maximum speed of an AP.

4.10 Use static IP addresses on APs

Static IP addresses are more difficult to configure. However, this setting reduces the dependency on an upstream DHCP server.

4.11 Disable legacy 802.11b rates

Slow rates (e.g. 1 or 2 Mbit/s) can enable a small number of clients to consume a disproportionate amount of "airtime." Disable legacy bitrates under "Configure -> Access Control."

4.12 Optional: enable manual channel assignment

Meraki typically recommends using automatic channel planning. However, if the inspected result of the automatic channel plan shows that the channels are not well spread out, it is possible to manually assign channels. The downside to this method is that it requires more administrative effort and it may not be ideal over a long period of time. Any AP with this custom configuration will not automatically update until a Meraki engineer removes this setting. Note: please contact Meraki technical support to enable manual channel planning.

5 Tips for the event

5.1 Start conservatively

Since there is often significant uncertainty about how many clients will appear and how heavily they will use the network, start with conservative settings and ease them up as the event progresses. For example, start with a 100 kbit/s per-client bandwidth limit, and later raise it to 200 kbit/s.

5.2 Monitor the network

The Meraki Cloud Controller shows a real-time view of the network's performance. Keep a close eye on the network as clients begin to show up and be ready to react. Careful monitoring gives the confidence to know that when a problem is reported, whether it's a real problem or a client-specific issue. Inevitably someone will tweet that the Wi-Fi isn't working, but if monitoring of the network shows it is working for 700 people, it is very likely this person is having a client-specific problem.

5.3 Try the network

Go out on the floor and run a speed test at certain intervals, for example, every hour. It's possible to find issues before users notice them.

5.4 Communicate with users

Consider using twitter or another mass communication tool. To some extent, if users are having problems, knowing that someone cares may avoid escalations. Also, by delivering reports on the network, it's possible to avoid getting into a situation where one person's bad experience leads to a general perception that the network wasn't performing as well as it actually was.

6 Case study: LeWeb

The LeWeb conference is an excellent example of a successfully deployed wireless network at a large event with many users. LeWeb is one of Europe's largest Internet conferences, with over 2,500 attendees from 50 across the world. The event is sponsored by prominent web companies including Google, Facebook, and Twitter.

A few of the network challenges for the conference organizers were to:

- Provide high-speed wireless coverage for over 1,000 attendees in one giant 12,000 square foot room as well as many other areas
- Get the network working in under 3 days
- Succeed in a high-stakes, high-publicity environment

Using Meraki dual-radio 802.11n access points and the Meraki Enterprise Cloud Controller, British Telecom was able to deliver an outstanding wireless experience with:

- No downtime during the entire 2-day conference
- 470 GB of data served to over 2,500 clients at aggregate speeds faster than 300 Mbit/s
- Zero customer complaints since launch
- Extremely positive reviews by conference organizers and attendees



Figure 1: LeWeb conference attendees

More information can be found in Meraki LeWeb case study, available at: <http://meraki.com/library/collateral/>

7 Conclusions

While providing Wi-Fi for large, high-density events can be challenging, careful planning, a suitable network design, and a properly configured network can greatly increase the odds of success. In addition, having good communication mechanisms and careful monitoring during the event will help smooth over any issues that occur.

8 References

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