



Solution Guide

MS Series: VoIP Deployment Guide

JULY 2013

How to deploy a distributed VoIP infrastructure with Meraki MS switches.

Table of Contents

Introduction	3
Getting Started	4
Setting up VoIP using MS switches	5
Ongoing Management	11
Conclusion	13

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Introduction

In today's distributed enterprise network, converged data and voice services on a unified access network are expected, but challenges remain with how to manage a distributed deployment from the initial set up to day-to-day operations and maintenance. Challenges include supporting dynamic network environments where administrators need to quickly deploy configuration changes for voice and data VLAN, rebooting phones remotely after a firmware upgrade, and managing power settings across distributed sites.

Cisco Meraki MS Switches and cloud-based management platform provide a unique solution for easily deploying VoIP technology across multiple locations, reducing complexity, and providing deep visibility and control.

Industry standard technologies that all Meraki MS switches support, such as power over Ethernet (PoE), link layer discovery protocol (LLDP), voice VLAN, and quality-of-service (QoS), help enable a successful VoIP deployment. However, these technologies do not address the challenges faced by distributed networks that have moved beyond the centralized command-and-control model of networking. This guide will walk you through VoIP technologies required for a successful deployment as well as show you how to deploy a distributed VoIP infrastructure with Meraki MS switches and Cisco VoIP endpoints.

Getting Started

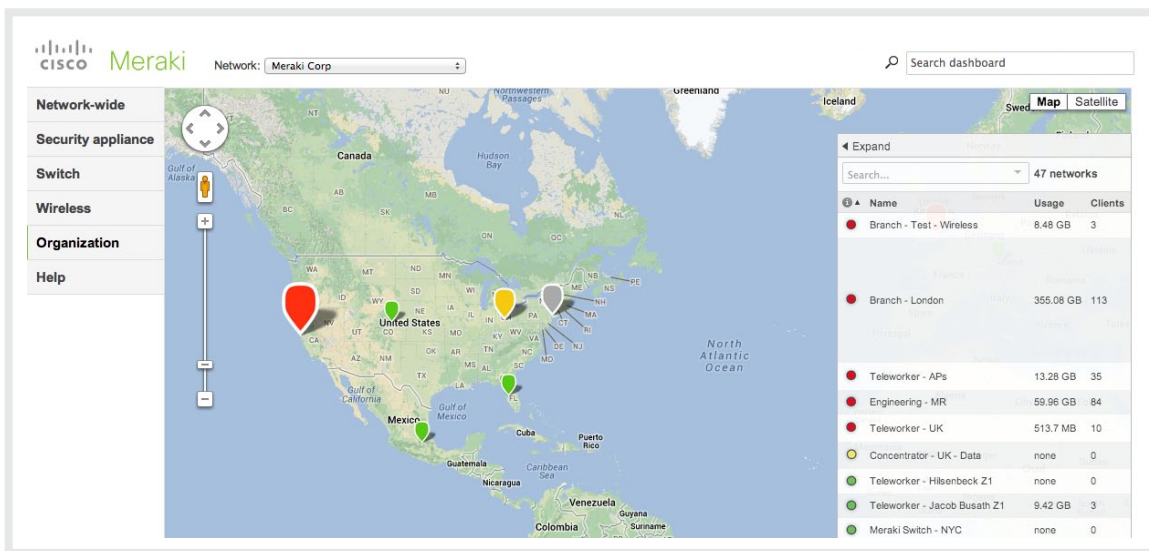
Requirements

To deploy a Cisco VoIP solution¹ using the instructions in this guide, you will need:

1. A Meraki dashboard account with Meraki MS Switch network
Note: If you already have a Meraki dashboard account, log in to <https://dashboard.meraki.com> and select “Create a Switch Network” from the dropdown menu
2. Cisco VoIP phone(s) with LLDP/CDP support for Voice VLAN
3. Meraki MS Switch(es)

¹While this guide focuses on a Cisco VoIP deployment, the basic technologies and guidelines can easily apply to other VoIP solutions as well as general best practices for using the Meraki dashboard.

Meraki Dashboard Overview



Meraki’s dashboard provides secure, centralized cloud-based management for all MS switches, MX security appliances, and MR access points. The Meraki solutions provides centralized cloud management, deep Layer 7 application and device visibility, real-time Web diagnostics, reporting, and more right out of the box using the Meraki dashboard. In addition, you can make configuration changes or check the status of your networked devices from any Internet-accessible location.

Setting up VoIP using MS switches

Understanding Existing Technologies for VoIP Deployments

Power over Ethernet (PoE) is an IEEE standard that enables power delivery to end client devices over standard Ethernet cabling. This technology reduces cabling complexity since power can be transmitted over existing Ethernet cabling infrastructure without additional wiring. The two versions of the standard that exist today — IEEE 802.3af and IEEE 802.3at — are supported by Meraki's MS Switches (PoE models). Modern VoIP phones such as Cisco's can be powered using PoE.

VLAN is a technology that allows users to segregate network traffic and separate broadcast domains. The Meraki switches do this via VLAN tagging per the IEEE 802.1Q standard. This can be useful if you want to apply quality-of-service (QoS) rules to prioritize traffic for a given VLAN or to segregate network traffic and enhance network security.

Voice VLAN is an enhancement to switch interface behavior that enables switch access ports to carry IP voice traffic from an IP phone. You can configure a Meraki MS access port to use one VLAN for voice traffic (for an attached Cisco IP Phone) and another VLAN for data traffic (for devices attached to that phone). While this is an optional setting for all access port interfaces, it is recommended for deployments where devices are plugged behind your VoIP phone, which has an internal switch.

Quality of Service (QoS)

Typically, networks operate on a best-effort delivery basis, meaning all traffic has equal priority and an equal chance of timely delivery; during congestion, all traffic has an equal chance of being dropped. Because the sound quality of an IP phone call can deteriorate if the data is sent unevenly, the Meraki MS switch supports quality of service (QoS) based on IEEE 802.1p class of service (CoS). QoS uses classification and scheduling to send network traffic from the switch in a predictable manner. For example, the Cisco 7960 IP Phone can forward voice-over-IP (VoIP) traffic with an IEEE 802.1p priority while the MS switch can be configured to trust or override that traffic priority.

The MS switch QoS implementation is based on the Differentiated Services (Diff-Serv) architecture. This architecture specifies that each packet is classified upon entry into the network. QoS network rules, which are administratively defined in the dashboard, inform the MS switch how DSCP tags should be assigned to incoming packets. Once a packet is assigned a DSCP tag, it is placed into the corresponding Layer 2 CoS queue on the MS switch for forwarding.

Quality of service					
Quality of service	VLAN	Protocol	Source port	Destination port	DSCP Edit DSCP to CoS map
QoS allows for prioritization traffic within the network. The Differentiated Services Code Point (DSCP) bits in the packet header are set to inform the switches which Class-of-Service (CoS) queue should be used.	1 193	UDP	Any	Any	Set DSCP to... 46 -> class 3 (EF voice)

[Add a QoS rule for this network](#)

QoS guarantees a certain fraction of the uplink to each configured priority level when the link is congested. Frames in higher priority queues receive a bigger slice of bandwidth than those in a lower priority queue. If a queue is not fully utilized, the bandwidth will be used by other queues so that bandwidth is not wasted.

Easily Configure VoIP Settings Using the Dashboard

Now that we have reviewed basic VoIP technologies, let's show how to configure voice VLANs, QoS, and view PoE information within the Meraki dashboard. In addition, we will show how you can easily scale from a single site VoIP deployment to thousands of sites.

Single site example

STEP 1: After adding your MS switch to the dashboard, name it and add any notes or tags. This simplifies distributed network management, making searches more intuitive. Go to Monitor>Switches and edit switch details.

Configuration

Name:

MAC address: 00:18:0a:57:74:09

Serial number: Q2DP-SWWC-CKGW (MS42P)

Remove:

Notes:

Tags:
Tags are used to group switches, and in some cases apply settings.

Address:

Move map marker

STEP 2: Navigate to the Configure>Switch ports page, select all ports that you will plug VoIP phones into, and tag those ports with a useful name such as “phone.”

Switch ports for the last day

Edit Aggregate Split Tag voip help 52 switch ports

Add: phone Add

Remove: Choose tags to remove Remove

Switch / Port	Enabled	Tags	VLAN	Type	Name
<input type="checkbox"/> VoIP Switch #1 / 1					
<input type="checkbox"/> VoIP Switch #1 / 2					
<input type="checkbox"/> VoIP Switch #1 / 3 - uplink					
<input checked="" type="checkbox"/> VoIP Switch #1 / 4					
<input checked="" type="checkbox"/> VoIP Switch #1 / 5					
<input checked="" type="checkbox"/> VoIP Switch #1 / 6	enabled	phone	native 1	trunk	
<input checked="" type="checkbox"/> VoIP Switch #1 / 7	enabled	phone	native 1	trunk	
<input checked="" type="checkbox"/> VoIP Switch #1 / 8	enabled	phone	native 1	trunk	
<input checked="" type="checkbox"/> VoIP Switch #1 / 9	enabled	phone	native 1	trunk	
<input checked="" type="checkbox"/> VoIP Switch #1 / 10	enabled	phone	native 1	trunk	
<input checked="" type="checkbox"/> VoIP Switch #1 / 11	enabled	phone	native 1	trunk	

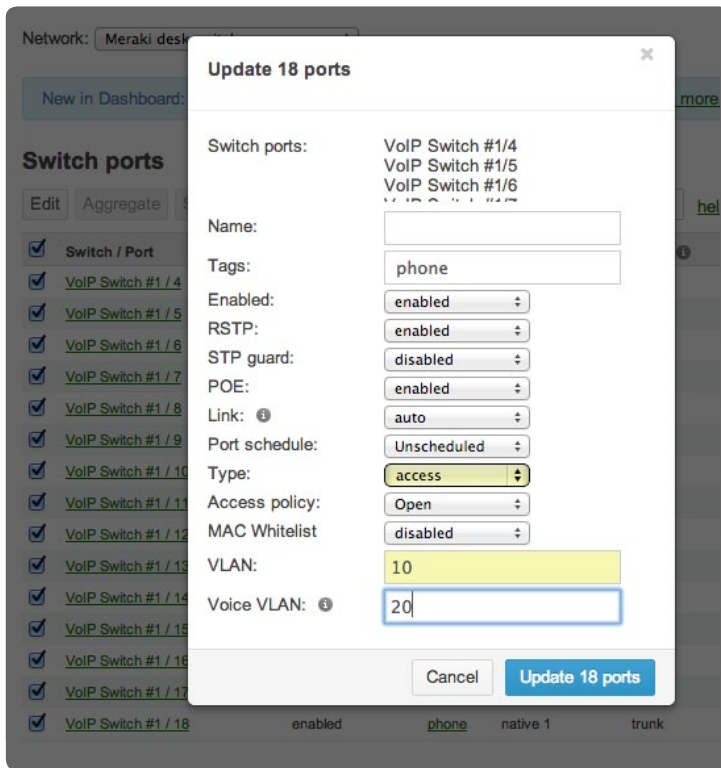
STEP 3: In the Configure>Switch ports page, search for your VoIP ports based on the tag applied in the step above. You will now see all the switch ports associated with your VoIP tag.

Switch ports for the last day

Edit Aggregate Split Tag phone help 18 switch ports

Switch / Port	Enabled	Tags	VLAN	Type	Name	Allowed VLANs
<input type="checkbox"/> VoIP Switch #1 / 4	enabled	phone	native 1	trunk		all
<input type="checkbox"/> VoIP Switch #1 / 5	enabled	phone	native 1	trunk		all
<input type="checkbox"/> VoIP Switch #1 / 6	enabled	phone	native 1	trunk		all
<input type="checkbox"/> VoIP Switch #1 / 7	enabled	phone	native 1	trunk		all
<input type="checkbox"/> VoIP Switch #1 / 8	enabled	phone	native 1	trunk		all
<input type="checkbox"/> VoIP Switch #1 / 9	enabled	phone	native 1	trunk		all
<input type="checkbox"/> VoIP Switch #1 / 10	enabled	phone	native 1	trunk		all
<input type="checkbox"/> VoIP Switch #1 / 11	enabled	phone	native 1	trunk		all
<input type="checkbox"/> VoIP Switch #1 / 12	enabled	phone	native 1	trunk		all
<input type="checkbox"/> VoIP Switch #1 / 13	enabled	phone	native 1	trunk		all
<input type="checkbox"/> VoIP Switch #1 / 14	enabled	phone	native 1	trunk		all
<input type="checkbox"/> VoIP Switch #1 / 15	enabled	phone	native 1	trunk		all
<input type="checkbox"/> VoIP Switch #1 / 16	enabled	phone	native 1	trunk		all
<input type="checkbox"/> VoIP Switch #1 / 17	enabled	phone	native 1	trunk		all
<input type="checkbox"/> VoIP Switch #1 / 18	enabled	phone	native 1	trunk		all

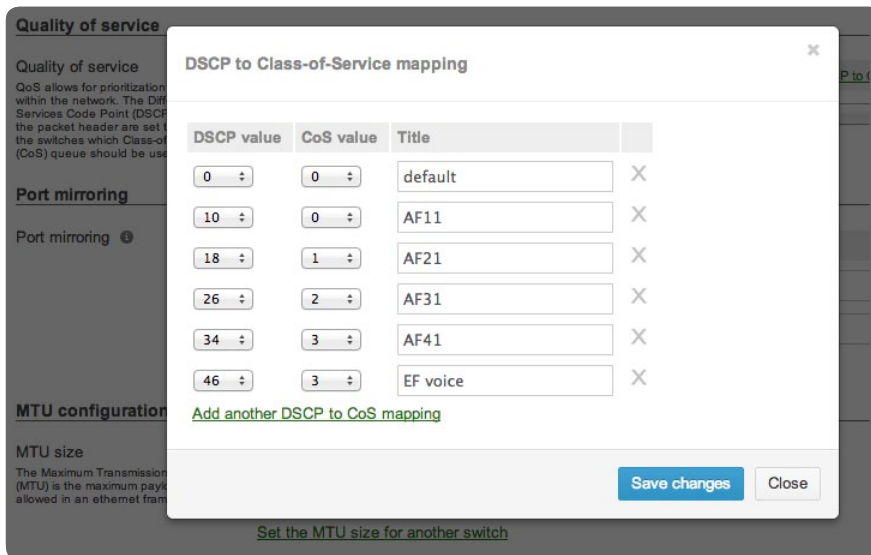
STEP 4: Select all of the tagged ports, and click “edit.” Change the ports’ type from trunk to access, and define voice and data VLAN settings. Optional settings include enabling energy-saving port schedules, applying 802.1X access policies, and more.



STEP 5: To manage QoS services on your Meraki MS network:

1. Navigate to Configure>Switch settings
2. Click the “Add a QoS rule for this network” link in the “Quality of Service” section
3. Optional - Click “Edit DSCP to CoS map.” Map the DSCP tags used in your network to the desired CoS queue. The default is to trust incoming DSCP values.

Note: In general, for a Cisco VoIP deployment, you do not need to modify the DSCP to CoS mapping.



Note, each DSCP to CoS mapping has three values: the DSCP value, the CoS value, and the title. The DSCP value specifies the DSCP tag in an IP header to map to a particular CoS queue, while the CoS value specifies that queue. The title is a label for the the mapping. The default mappings are shown in the screenshot above.

4. Once the DSCP to CoS mapping are configured, create QoS network rules to specify which incoming packets should have DSCP applied
5. Save your changes

Scaling the Deployment

Switches > FD 5.3.6 > Port 35

1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 49 50 51 52

Configuration | [Edit configuration](#)

Description: Access port on VLAN 110; voice VLAN 104
Tags: VOIP
PoE: 7.4 W (Advertised 12.9 W, Mode AT) ⓘ
RSTP: Forwarding ⓘ
Link negotiation: Auto negotiate (1 Gbps)

Status

Connectivity: ⓘ
Usage: 388.9 MB (387.6 MB sent, 1.2 MB received) ⓘ
Traffic: 64.5 Kbps (64.3 Kbps sent, 196 bps received) ⓘ
LLDP: SEP34BDC8C744C6 (Cisco IP Phone 9971 IOS sip9971.9-3-2-10) raw ⓘ

Current clients ⓘ

Description ▲	IP address	VLAN ⓘ	MAC address	Traffic (sent ↓, received ↑) ⓘ
SEP34BDC8C744C6 - TCAR	172.16.20.149	104	34:bd:c8:c7:44:c6	2 Kbps (none ↓, 2 Kbps ↑)

Since Meraki MS switches are managed through the cloud, it's easy to scale from a single site to a large, multi-site deployment. You can quickly add new switches to your network by entering an order or serial number under Configure>Add Switches.

Once added, switches are displayed in the dashboard and can be configured before being physically plugged into a network.

Network: Meraki desk

New in Dashboard

Add switches

Add switches from your inventory by its serial number, or by its order number.

Search inventory

All your switches are

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Claim by serial and/or order number

Enter one or more serial/order numbers (one per row). [Where can I find these numbers?](#)

1234-5678

Close Claim

Cloning allows you to copy configuration settings from one MS switch to others in your network, and is easy to do in the dashboard:

1. Select recently added switches in the Monitor>Switches page
2. Select “clone” and choose the operating switch whose configuration you'd like to copy from

Within minutes, all of your recently added switches will be properly configured. Cloning thus allows for rapid, zero-touch deployments of several switches at once: just power on the switch at its final destination and enable Internet access — the switch will automatically download its cloned configuration settings. Scaling VoIP deployments is that simple.

Ongoing Management

Now that you have set up and scaled your VoIP deployment, let's discuss how you can use Meraki's cloud management to optimize your deployment. One of the larger expenditures in Corporate IT is energy and Meraki simplifies energy management through time-based ports. See our [Ethernet Power Study White paper](#) for details on how to configure time-based ports and the energy savings achievable.

In addition, securing the enterprise is a critical for many organizations and the industry standard is to use IEEE 802.1X for port-based security. You can easily create access policies on Meraki switches under Configure>Access policies. Simply name your policy, input your RADIUS server credentials, and apply the policies to desired ports.

Access policies

Access policies

Name

RADIUS servers

#	Host	Port	Secret	Actions
1	<input type="text" value="10.1.1.3"/>	<input type="text" value="90"/>	<input type="text" value="*****"/>	Show secret + X Test

[Add a server](#)

RADIUS testing

Access Policy Type

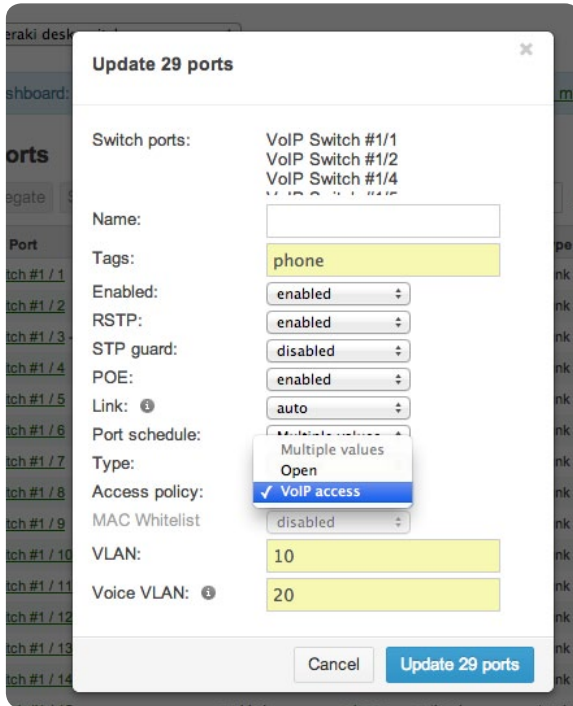
Guest VLAN

Switch ports There are currently [0 Switch ports](#) using this policy

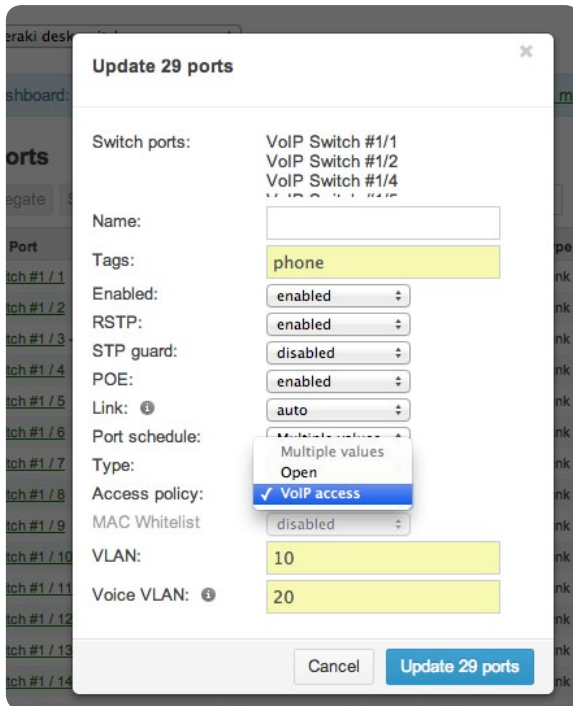
[Remove this access policy](#)

[Add an access policy](#)

To apply access policies, simply go back to your virtual stack under Configure>Switch ports, search by tag, and edit the configuration settings.



Another pain point that Cisco Meraki switches can address is how to reboot VoIP clients after a firmware upgrade. With Dashboard, it just takes a few clicks. Simply go to Configure>Switch ports, search by tag, and edit configuration. From here, simply power off PoE, save the settings and re-enable PoE to reboot phones remotely.



If further configuration and maintenance is needed, you can quickly find switch ports hosting Cisco phones by searching in the dashboard.

Switch ports for the last day ▾

Edit Aggregate Split Tag ▾ help 296 switch ports

<input type="checkbox"/> Switch / Port ▲	Name ⓘ	Type ⓘ	VLAN ⓘ	Link ⓘ	POE ⓘ	LLDP ⓘ
<input type="checkbox"/> 5 A9-27 / 1		trunk	native 1	Auto negotiate (100 Mbps)	enabled	Cisco 9971 SN:00104910AF59
<input type="checkbox"/> FD 4.1.10 / 1		access	108, voice 104	Auto negotiate (100 Mbps)	enabled	Cisco 9971 SN:001049207579
<input type="checkbox"/> FD 4.1.10 / 2		access	108, voice 104	Auto negotiate (100 Mbps)	enabled	Cisco 9971 SN:0010490A4DAD

Easily and dynamically search using discovery protocols to find phones not in the correct VLAN

Conclusion

With Cisco Meraki's cloud managed switches, deploying, scaling, and operating a distributed VoIP network has never been easier. The challenges faced by IT administrators with traditional technologies are mitigated by a management platform that scales for distributed deployments and offers network administrators a single-pane-of-glass platform to easily configure and update settings with just a few clicks.