Healthcare Pop-Up Wireless Strategies
Help where we can with what you have
Introduction and Objective

• To deliver Design Guidance and Leading Practices for Healthcare Providers designing and deploying temporary wireless coverage in response to pandemic screening, triage and treatment needs.

• To make Cisco’s experts available to you virtually during and after this event.
Guidance for the Event

• Your line will be muted throughout the event.
• Please use the Q&A window in WebEx to enter any questions you have.
  • Our expert panelists will respond.
• All content is available at: https://cvent.me/n8QL92
• Our panelists and Cisco wireless experts are available virtually for questions about your situation via email at covid-healthcare-wlan@external.cisco.com.
Shawn Jackman, CEO Clinical Mobility

Shawn’s Background:

• Previously managed national wireless design standards and solutions for The United States’ largest HMO
• Lead author for the *CWDP Certified Wireless Design Professional Official Study Guide*
• Co-author of *CWSP Certified Wireless Security Professional Official Study Guide*
• Co-author, *mHIMSS Roadmap*
• Co-chair, AAMI Wireless Strategy Task Force
• Steering Committee, Healthcare Technology Alliance

Clinical Mobility:

• Business focused on clinical outcomes
• Specialists in healthcare use cases, requirements and regulations
• Focused on solving reliability and security challenges for HDOs
Wireless-Related Use Cases

- Expansion of the RF footprint
- Net-new devices being added/onboarded
- Video usage and why
- Locating key assets
- Managing high census
Expanding the RF Footprint

- Perimeter / On-campus Triage
  - EHR access
  - VoIP / Clinical Communication
  - Biomed devices
- Expansion into offsite facilities
- Temporary pop-ups using cellular / less reliable backhaul
New Device Onboarding

- Ventilators do not need Wi-Fi
- Surge of new communication devices
- Using ‘guest Wi-Fi’ do’s and don’ts (mainly we mean DO NOT)
- Managing – provides visibility
- Extend existing policy
Video Usage During COVID-19

- Not enough PPE for clinicians
- Driving demand for creative alternatives to check-in on patients

**Do:**
- Wired first
- Leverage 5 GHz
- Manage bit-rate especially if wireless
- Leverage WebEx Rooms or WebEx users

**Do Not:**
- Deploy non-Wi-Fi solutions
Locating Assets

- Leverage an RTLS solution
- Alternative is using Prime
Managing Higher Census

- WLAN policies for bandwidth utilization
- Guest user bandwidth limits
- Protect 5 GHz
- Unpopular worst case: AP Groups to pull guest off WLAN to ensure clinical operations
Making the MOST of what you may already have...

The Apollo 13 CO2 Filter

Source: nasa.gov
“I need to extend wired and or wireless connectivity to places I never expected or planned for.

Can I use what I have?...”
Let’s Look At Our Options...
(In order of distance away from an existing building)

1) Existing Indoor to outdoor signal “bleed”

2) Wireless Mesh

3) Point to Point Bridging

4) Rapid Deploy WLAN (autonomous, mobility express, EWC, Meraki)

5) Cellular Based Wireless Backhaul
Typical Field Hospital Scenarios

Temporary Field Hospital Scenarios

- Fixed Location <100’ Away from Building
- Fixed Location <300 yards One Hop MESH
- Fixed Location >300 yards Two Hop MESH (Line Of Site)
- Fixed Location >300 Yards Heavy Usage
- Fixed Location Standalone

Cloud

Internet
LTE Mobile

Pod / Mobile / Pop-Up / Drive Thru

Meraki Autonomous Mobility Express EWC*

*new functionality / new code
Guiding Principles

1. Not a how-to – or config reference: Tips & Tricks to get you going...
2. The approach we are taking here is simple: fundamentals first
3. We are focusing on reliability: Discussing proven platforms / features
4. Extending existing connectivity is going to be easiest / fastest
5. A temporary wireless deployment will never be as robust or reliable as a wired connection. But its better than nothing...
6. Set user expectations accordingly
Typical Field Hospital Scenarios
Option 1: Existing Indoor

- Sounds obvious - but before expending effort on an outdoor deployment can you do anything to improve signal coming from indoors?
  - Increase TX Power ?*
  - Relocate AP near window?
  - Directional antenna?

*watch out for asymmetric links, avoid MAX power
Option 1: Existing Indoor

Only consider this as an option if AP TX power was low to start with (ie 7-8)

*watch out for asymmetric links, avoid MAX power
Option 1: Existing Indoor

Typically Used:
Mounted nearby and connected via provided pigtail to external connector versions of indoor AP’s
(1602e, 2602e, 3602e, 1702e, 2702e, 3702e, 1832e, 1852e, 2802e, 3802e, 9120AX-e)

Connector Type:
RP-TNC

Pattern:
120º patch

Gain:
2.4GHz: 6dBi
5GHz: 6dBi

AIR-ANT2566P4W-R
Option 1: Existing Indoor

Typically Used:
Directly attached to external connector versions of indoor AP’s (1602e, 2602e, 3602e, 1702e, 2702e, 3702e, 1832e, 1852e, 2802e, 3802e, 9120AX-E)

Connector Type:
RP-TNC

Pattern:
60º patch

Gain:
2.4GHz: 6dBi
5GHz: 6dBi

AIR-ANT2566D4M-R
Option 1: Existing Indoor / Macro/Macro

Dual 5 GHz External Antenna
Macro/Macro Cells

- Using the DART connector on the E Model enables Dual 5 GHz cells with external antenna’s
- Doubles the effective coverage for the cost of one additional antenna
- Double capacity on existing cable plan
Typical Field Hospital Scenarios
Option 2: Wireless MESH/Bridge Architecture

- L3/L2 switch
- RAP (Root AP)
- MAP (Mesh AP)
- Wired access
- Backhaul 5GHz
- 2.4 GHz Access
- L2 switch
- 5 GHz Access
- WGB
- Wired access

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Option 2: Wireless MESH

• Been around for 15 years. Will work even on old code
• Suggest 8.0 WLC code or higher if possible
• For an AP to start operating as a MESH AP, it needs to be in Bridge or Flex+Bridge Mode. **LOCAL mode AP’s will not participate in MESH.**
  • We have two roles in MESH:
    • 1 - Root AP aka RAP (uses wired backhaul, this would be on a building)
    • 2 - Mesh AP aka MAP (uses 5GHz backhaul, this would be a wireless node in the middle or at the far end of a MESH link)
Option 2: Wireless MESH

• Just about any IOS AP can operate in BRIDGE mode

• You can mix and match indoor and outdoor.
  *You should always use an outdoor AP as your RAP as it will have a smaller number of supported channels. MAPS always scan for all channels, and YOU set the channel the RAP uses for the MESH chain.

• More recently AP-COS AP’s like the AP2800/3800/1562 allow mesh. * Requires 8.8 or higher *8.10 recommended.

• Note: 11ax APs such as 9115/9117/9120/9130 do not support mesh right now.
Option 2: Wireless MESH
Option 2: Wireless MESH
Option 2: Wireless MESH

Don’t have any spare outdoor cables?

What about re-purposing that rooftop CCTV drop?

Using AP1572 - the secondary ethernet port could be used to connect the camera...
Option 2: Wireless MESH

No time to get something permanently installed?

Non-penetrating roof mounts / speaker stands
Using sand bags / concrete blocks

* Moisture and water in connectors are a BIG problem.
Option 2: Wireless MESH
Option 2: Wireless MESH

Keep in mind:

Light poles make ideal mounting locations for MAPs. Keeping radios above the height of surrounding cars/obstacles will ensure optimum link performance.

Some parking lot lights may have 120V “convenience” plugs available as seen on the pole to the right.
Option 2: Wireless MESH

MAP Power Sources:

1572:
1. AC 100–277V (or inverter)
2. DC 10–16V (car/truck battery)
3. PoE UPoE or AIR-PWRINJ1500-2=

1562/1542:
1. PoE
2. 48V DC (1562 only)

Indoor APs:
1. PoE Injector
2. 48V DC power wall wart * on
Important Considerations Before Deployment:

- MESH AP’s authenticate to the WLC via MAC Filter. Ensure you enter the ethernet MAC address for each AP you put into Bridge mode on the WLC’s MAC filter page. Otherwise AP won't join when it powers up as a MAP.

- You will need to manually set channel for RAP.

- Keep in mind channels 149-> allow longer range (more power)

- By default 5GHz is used for backhauling wired and wireless traffic from the far end MAP. If you want to enable 5GHz access you need to enabled “5GHz Backhaul Client Access”.
## Wireless MESH 101

### Online Cisco RF Coverage / Link Budget Calculator

<table>
<thead>
<tr>
<th>Head End Equipment</th>
<th>Throughput @ .5Mi</th>
<th>Throughput @ 1Mi</th>
<th>Throughput @ 1.5Mi</th>
<th>Throughput @ 2Mi</th>
<th>Throughput @ 2.5Mi</th>
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<td>48Mbps</td>
<td>44Mbps</td>
<td>AP1570 14dB ant</td>
</tr>
</tbody>
</table>
Wireless MESH 101

Most "outdoor" APs have flexible Antenna ports.

This allows you to specify what ports are used for a directional backhaul antenna.

Flexible Antenna Port on 1532/1562

Flexible Antenna Port on 1572
Wireless MESH 101

Ethernet Bridging extends the wired network from the RAP switchport to the MAP

Ethernet bridging needs to be enabled manually

Typical Field Hospital Scenarios
Option 3: Point to Point Bridging

• This option typically makes sense if you need to provide high capacity connectivity to a location that is beyond ½ mile.

• Typically not a Cisco product unless you are using older kit like the AP1410/1310 or smaller distances using ethernet bridging in MESH.

• 2.4GHz & 5GHz are crowded, use spectrum analyzer to identify cleanest channel. Consider other microwave such as 24GHz?.

• Always use directional antennas to focus signal, reduce interference and maximize performance.

• The bridge is a single purpose device. Most do not offer Wi-Fi connectivity at the same time.
Option 3: Point to Point Bridging

**NEW Feature:**

Mobility Express
Supports MESH in 8.10

Suggest 8.10.105

*TX power bug in 8.10.112 (MR1)
CSCvs58757

Option 3: Point to Point Bridging

Meraki P2P Mesh Links

- Zero-touch remote provisioning via Meraki Dashboard
- Automated meshing algorithm
- Easily extend wired or wireless access from an existing LAN
- Various external antennas for optimal mesh link
Option 3: Point to Point Bridging

Installation doesn’t need to be fancy.

A speaker stand, camera tripod with some sandbags can be used to bring up a temp link.

Using video camera tripod for aiming
Typical Field Hospital Scenarios
Option 5: Rapid Deploy WLAN (autonomous, mobility express, Meraki)

Do you have a stack of “retired” AP’s?

Most, if not all could be put into service as autonomous APs or AP’s controlled by Mobility Express.
Option 5: Rapid Deploy WLAN (autonomous, mobility express, Meraki)

• Nearly all the typical “ceiling mounted” IOS-based APs sold over the last 10 years support autonomous mode.

• Not super intuitive, but rock solid.

• AP just acts as AP, no DHCP, no NAT...
Starting with 11ac wave2 products (1850/2800/3800/1562) the APs support running a controller. This is Called Mobility Express and is simple to setup.

- Configured via GUI
- One AP runs as AP + WLC – others like normal
- Note: This is not the same GUI experience as a 2504/3504 you may be familiar with (basic functionality).

Option 5: Rapid Deploy WLAN
(autonomous, mobility express, Meraki)

It is not uncommon for customer to get the wrong Mobility Express Access Point (AP) when ordering. This is because they order or they have someone order the AP for them based on model number. An example of an 1852 model number for ordering a lightweight version is AIR-AP1852I-B-K9 but for a Mobility Express capable AP is AIR-AP1852I-B-K9C.
Option 5: Rapid Deploy WLAN (autonomous, mobility express, Meraki)

- Only 802.11ac Wave 2 APs have Mobility Express (ME) functionality
- Cisco Catalyst 9100 Series and 802.11ac Wave 1 APs can be subordinate APs
- No AireOS ME on 9100 Series APs*

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<thead>
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<th>ME APs</th>
<th>Subordinate APs (no ME)</th>
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<td>AIR-AP1815</td>
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<td>AIR-AP1832</td>
<td>AP1700/2700/3700 Series APs</td>
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<td>AIR-AP1840</td>
<td>AP1800i</td>
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<td>AIR-AP1542</td>
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<tr>
<td>AIR-AP1562</td>
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</table>

*11ax Indoor APS can run in a mode like Mobility Express. This is known as the embedded WLC, which is still very new and probably not yet seen in the field yet.
Option 5: Rapid Deploy WLAN
(autonomous, mobility express, Meraki)

Meraki Rapid Remote Deployment

- Zero-touch remote provisioning
- Secure access to patient records over Meraki Auto-VPN
- Secure direct internet access to cloud hosted applications
- Flexible wireless access that mimics corporate security
Option 5: Rapid Deploy WLAN (autonomous, mobility express, Meraki)

End to end journey:

1. Equipment & Licensing Ordered
2. Claim Order on Dashboard
3. Assign Devices to Networks (Templates/API acceleration)
4. Devices dropped shipped to end location
5. Devices receive configuration when plugged in. (ZTP)
6. Network Live & ready for users
A Note on Weather Protection

- Anything with an IP67 rating is suitable for outdoor exposure without enclosure.
- Indoor AP’s can be temporarily used outside with protection against rain/humidity.
- Enclosure should be RF transparent (no metal).
- Get creative if need be: Garbage bag, poncho, Tupperware/Rubbermaid etc.
3rd Party Antennas / Enclosures / Power Systems

**Ventev Directional Antenna (M6130130MP1D3607D)**
- Dual-Band
- 13dBi
- H: 35°
- V: 35°
- Compatible with AP 1562E, 1572EAC

**Ventev PoE+ Solar Powered System (VS04-WIFI-POE-01)**
- Fully-integrated power enclosure system that is pre-wired and pre-assembled for on-site installation of outdoor access points requiring PoE/PoE+ power.
- Designed for 5 days of operation without recharge due to inclement weather.
- Some location reliability restrictions apply. See product details for more info.

**Direct Links:**

**Ventev NEMA Outdoor WiFi Enclosures**
- Protect Access Points from elements, theft & tampering
- Wall or pole mount
Typical Field Hospital Scenarios
Option 4: Cellular Backhaul + WiFi
Cisco 1100 Series Integrated Services Routers

High Performance
- Multi-core hardware architecture
- Open and programmable operating system IOS® XE

Connectivity & Advanced Mobility
- Gigabit Ethernet WAN, DSL (G.fast), LTE Advanced Pro
- Gigabit Ethernet LAN, 802.11ac wave2 with Mobility Express

WAN & Application Assurance
- Centralized management and orchestration with Cisco DNA Center and vManage
- Zero touch deployment and provisioning

Comprehensive Security
- App aware FW, IPS, URL-F, AMP & TG, DNS/web-layer security on SD-WAN
- Advanced threat defense with encryption at high-performance

Cisco® 1000 Series Integrated Services Routers (ISRs) with Cisco IOS® XE Software combine Internet access, comprehensive security, and wireless services (LTE Advanced 3.0 wireless WAN and 802.11ac wireless LAN) in a single, high-performance device. The routers are easy to deploy and manage, with separate data and control plane capabilities.

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## Option 4: ISR 1100
Portfolio & References

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<tr>
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<td></td>
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</table>

* 4GB DRAM/FLASH variants available – Supports only Ent. FW App aware, DNS/web-layer security on SD-WAN

→ ISR 1K Data Sheet
→ ISR 1K Ordering Guide
→ ISR 1K Configuration Guides
→ CiscoLive ISR Overview & Architecture Presentation
→ IR829 Guide
→ IR829 Data Sheet
Option 4: Cellular Based Backhaul

The Meraki MG21 Cellular Gateway

Feature Highlights
- Integrated CAT6 modem with up to 300Mbps
- DC / PoE power in
- ×2 Ethernet ports
- Nano SIM card slot
- Multi-surface mounting bracket (wall, ceiling, pole, and tabletop)
- Integrated high performance antenna
- External antennas on MG21E
  Dipole included
  Patch available as an accessory
- Spin up across multiple locations in a fraction of the time of MPLS
- Available in areas with no broadband or fiber coverage

IP67 Rated with Lifetime Warranty

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Wireless Licensing Flexibility

AireOS and IOS-XE WLCs

Leverage WLC Evaluation License
Supports maximum WLC platform AP Limit
Duration: 60 Days (AireOS), 90 Days (IOS-XE)

No AP Count license required for Mobility
Express or Autonomous Mode APs

Meraki

Until May 18, 2020, all customer licenses will stay in effect (even if they have expired)
Engaging with TAC

Special Handling of COVID-19 Response Service Requests (SRs)

- Service Request should include COVID-19 in the Title field
  Example: COVID-19: <Issue Title Here>

- If you need time-sensitive emergency support, call the TAC Frontline to escalate your existing or new SR to Severity 2 (Sev2) or higher for live handoff to an on-shift engineer.

TAC Frontline: 1 800 553 2447 (USA)
Cisco Worldwide Support Contacts
Where to Get More Info

• Ask the experts mailto: covid-healthcare-wlan@external.cisco.com

• Clinical Mobility non-wireless COVID response free help: covid@clinical.mobi

• Supporting business continuity during the COVID-19 pandemic: www.cisco.com/covid19

• Cisco Solutions for Healthcare Providers: http://cisco.com/go/healthcare

• Additional Business Continuity Webinars: https://www.cisco.com/c/m/en_us/covid19/atx-webinars.html

• All content and recording from today: https://cvent.me/n8QL92

• Healthcare Technology Alliance webinar: https://my.aami.org/store/events/registration.aspx?event=HWHT200324
Reference Material
Non-Wireless Centric Use Cases

**Remote/External**
- Video visits / telehealth – one customer reported 500% increase
- Increased capacity for remote workforce – related equipment

**General**
- Staying security conscious (PCI and HIPAA)
- Voice related changes for hotlines and communication to customers; SIP offload
- Influx of new communications being added (hardware and software)
- Increase in VDI, Citrix (et al.) demand
- Existing projects placed in hold status
- Strained supply chain; previously strained to begin with
Site Survey On 11ax Indoor APs

Cisco EWC on Catalyst APs is next-generation autonomous and supports Site Survey in Cisco IOS XE Release 16.12.2. The following access points with the EWC image support the Site Survey capability:

- Cisco Catalyst 9120AX Series (C9120AX-x)
- Cisco Catalyst 9117AX Series (C9117AX-x)
- Cisco Catalyst 9115AX Series (C9115AX-x)
- Cisco Catalyst 9130AX Series (C91130AX-x)

Cisco EWC supports an internal DHCP server and operates without a pingable gateway. This enables the user to take the access point powered by a battery pack and a client device to perform an active survey.
PtP Bridges - Long range, full duplex, high bandwidth

**airFiber 5**
- Unlicensed mid and high band 5GHz
- Long range, low latency PtP bridge links up to 1.2+ Gbps
- Potential of 60+ miles of range (multiple hop)

https://www.ui.com/airfiber/airfiber5/

**PtP 550**
- Unlicensed 5GHz
- Long range, PtP bridge links up to 1.4 Gbps
- 802.11ac Wave 2


**Please note:** The above solutions utilize a very narrow beamwidth for the PtP link. Installation, radio alignment and link fine-tuning will require more planning and time on average. Each vendor provides tools to assist tuning.
Healthcare Offsite RF Bridging Considerations
Cisco Wireless PtP, PtMP & Mesh Bridging for nearby clear line of sight locations

→ Outdoor Wireless Products

• AP’s
  • AIR-AP1562I-x-K9
  • AIR-AP1562D-x-K9  → AP1560
  • AIR-AP1562E-x-K9
  • AIR-AP1542I-x-K9  → AP1540
  • AIR-AP1542D-x-K9
  • AIR-AP1572EAC-x-K9  → AP1570
  (x = Select appropriate domain)

• Powering Options
  • US: AIR-PWRINJ-60RGD1=
  • RoW: AIR-PWRINJ-60RGD2=
  • AIR-PWRINJ1500-2=

• Mouting Options
  • AIR-ACC1530-PMK2=
  • AIR-ACCPMK1570-1

→ AireOS Mesh Deployment Guide
→ IOS XE Mesh Deployment Config
→ Wireless Hardware Support Links

→ Cisco RF Coverage / Link Budget Calculator
Getting Started with Outdoor Setup

- Configure Mobility Express: Running a single outdoor AP or Mesh is quickly accomplished with running AP with Mobility Express
  - SW Option: SWAP1540-MBEXP-K9
  - SW Option: SWAP1540-MBEXP-K9

Watch video: https://www.youtube.com/watch?v=6MxDGM7iIzE

- If additional coverage is needed leverage mesh option – though remember for every hop the throughput will decrease by half.
3rd Party Outdoor Solutions
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airFiber 5

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Additional Resources


Outdoor WiFi Bridge and Mesh equipment links:


OEAP WLC guided configuration video: https://www.youtube.com/watch?v=OWJwPbXREPQ
Additional Resources (2)


WLC 3504/5520/8540 Mesh Deployment Guide (AireOS 8.5):

WLC c9800 Mesh Config: https://www.youtube.com/watch?v=HwF5SJRL8R4
