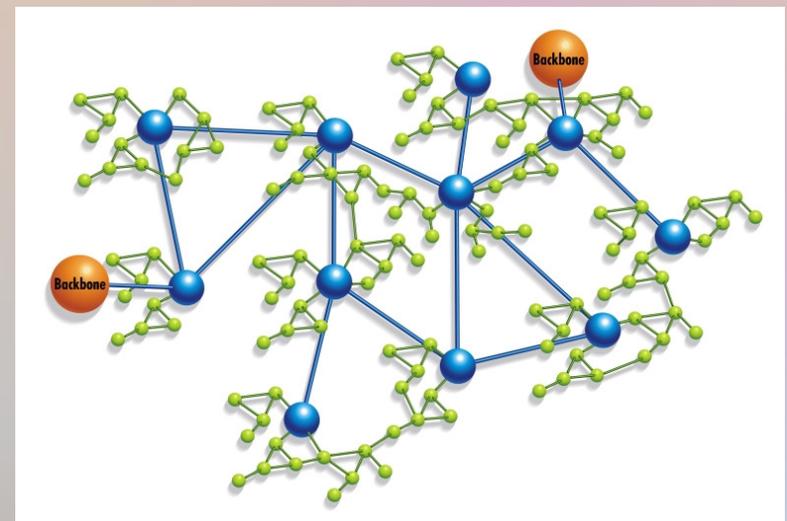


HSMM-MESH™ / Broadband-Hamnet™



Presented by
Don Hill, KE6BXT
and
Joe Ayers, AE6XE



The Orange County Mesh Organization
[Http://ocmesh.org](http://ocmesh.org)

Overview

- What is a HAM Radio Mesh Network?
- How is a Mesh Network differ from normal Wi-Fi?
- What is a MESH network?
- Websites: Broadband-Hamnet.org, AREDN.org, OCMESH.org
- QST Article (July 2013) and Awards

Overview

- Orange County Mesh Organization.
- Major Nodes in Orange County
- Events (A couple of real-world MESH networks)
- Supported Hardware
- What services can you add to a MESH network?
- Connecting a HAM Radio Mesh Network to the Internet.
- Internet Tunneling.
- Demos
- Q & A

What is a HAM Radio Mesh Network

- Was known as High Speed Multimedia (HSMM-MESH)
- Take an inexpensive off-the-shelf wi-fi device...
- Install ham-developed firmware and...
- We can easily create high-speed networks

- Networks are self-discovering and self-configuring
- Hams don't need to be IT personnel to create networks
- With high-gain antennas, range of miles
- Limitation...line of sight range

HAM Radio Mesh Node

Wi-Fi or not Wi-Fi?

Wi-Fi

RF looks for wireless clients



HAM RadioMesh Node

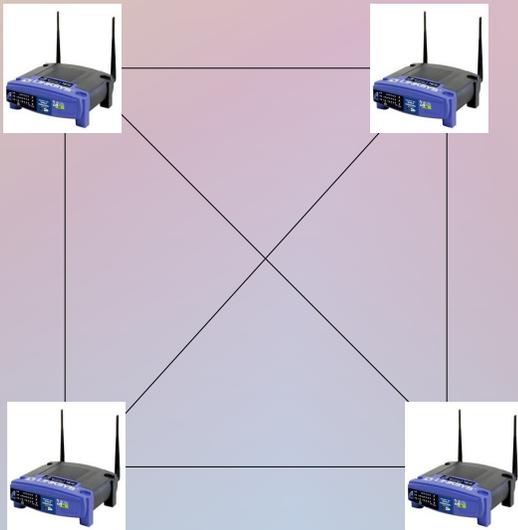
RF looks for other MESH nodes



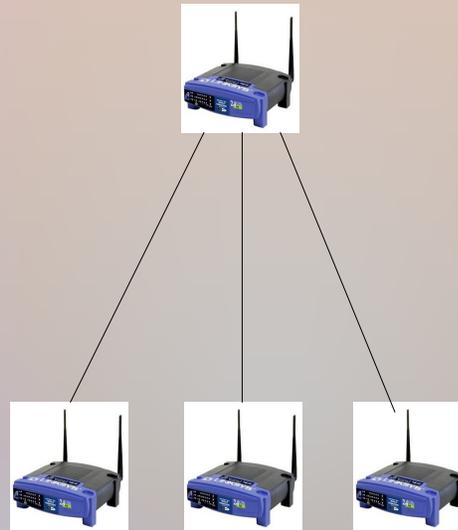
Types of Mesh Networks

Ideal MESH node topology vs reality

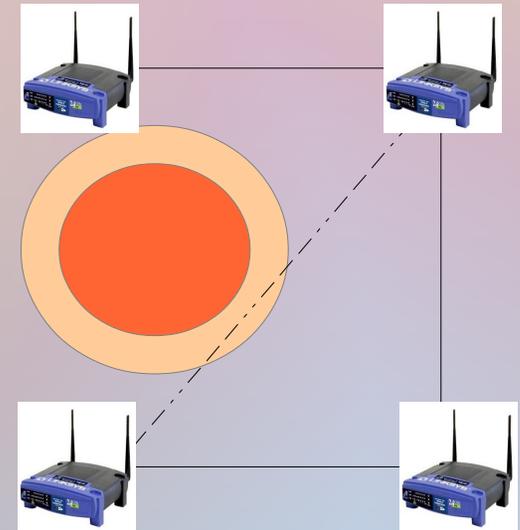
Pear-to-pear



Hub and Spoke



Daisy Chain

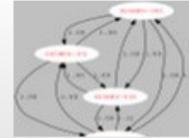


Broadband-hamnet.org

(hsmm-mesh.org)

Broadband-Hamnet™
HSMM-MESH™

Get On the Map



News

search...

Who's Online

We have 1324 guests online

Main Menu

- Home
- Just starting? Read this
- Web Links
- HSMM-MESH™ Forums
- Awards

Resources

- Administrator access
- Contact the Webmaster
- Which hardware to use
- Software Download
- Applications for the mesh
- Voice over IP

HSMM-MESH Info

- Under Development
- User Documentation
- Developer Documentation
- FAQ
- FD Logging With Mesh
- HSMM files
- Videos
- Usage Articles
- Learn about OLSR
- Learn about Open WRT
- Learn about WRT54G
- Learn about WRT54GL

Most Popular Content

- Supported hardware
- Mesh Network Diagram
- Firmware Installation Instructions
- Events and News Updates
- HSMM-MESH Design Philosophy

Supported hardware
Firmware Installation Instructions

Broadband-Hamnet

NEWSFLASH

Written by Administrator
Monday, 07 July 2014 00:00



August 11 2014
Notice Regarding BBHN 1.1.2

There appears to be a bug in release BBHN 1.1.2 which causes OLSR to crash periodically. It seems to be limited to larger, UBNT-based, networks, as it has not been reported on Linksys nor re-creatable on UBNT networks of only a few nodes.

We are looking into the issue and will likely release a patch in the coming days which includes a watchdog reset of the OLSR as an interim workaround until the problem can be better understood and a fix put in place.

We are sorry for the inconvenience it may cause deployed networks, but wanted to get the word out to anyone planning such a deployment in the near term.

Regards,
The BBHN Core Team

Last Updated on Monday, 11 August 2014 08:38

Welcome to the Broadband-Hamnet™ web site

Written by Jim Kinter, K5KTF



Map of registered nodes

Broadband-Hamnet™
HSMM-MESH™

We w



News

search...

Who's Online

We have 1212 guests and 1 member online

- ke6bxt

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HSMM-MESH Info

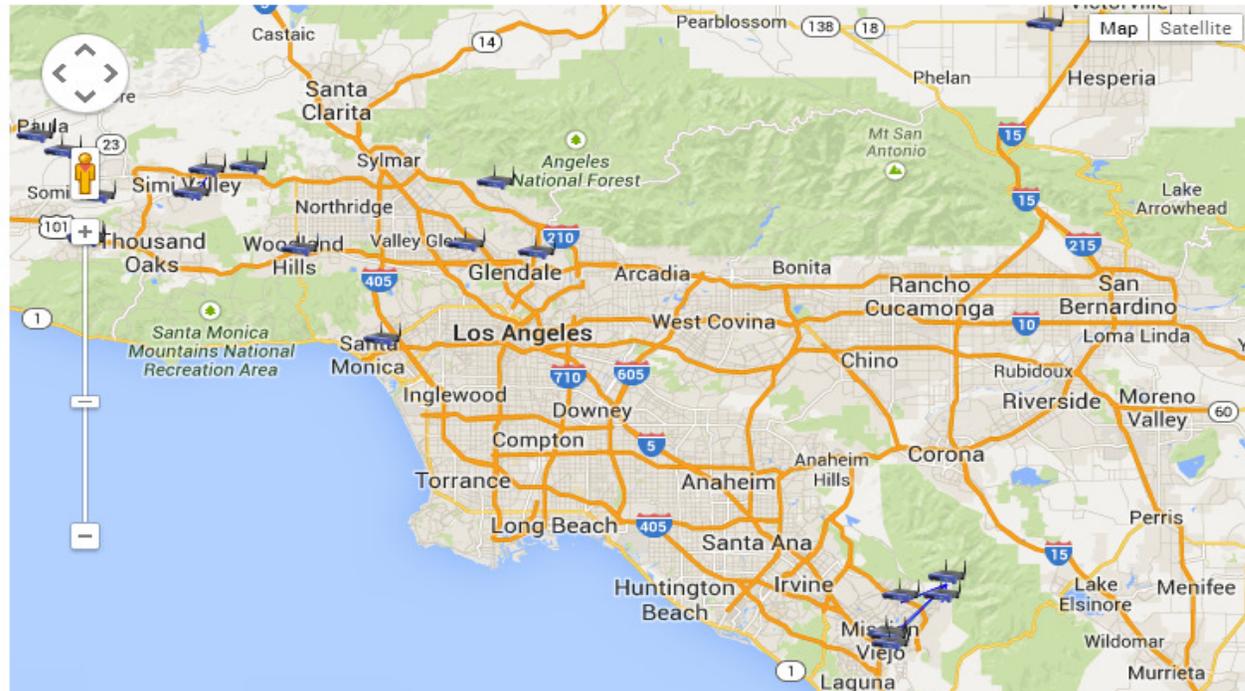
- Under Development
- User Documentation
- Developer Documentation
- FAQ
- FD Logging With Mesh
- HSMM files
- Videos
- Usage Articles

Googlemapped Mesh nodes

Please use [THIS FORM](#) to submit your node(s) to the map.

Links: Red=Planned, Blue=Connected

If you have links between nodes, you can add that in your email, which nodes are linked to which other.
(zoom in on the Austin Texas area to see an example)



AREDN.org

Amateur Radio Emergency Data Network



Amateur Radio Emergency Data Network

[Login](#) | [Register](#)

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- [SOFTWARE](#)
- [DOCUMENTATION](#)
- [HOW TO](#)
- [FORUM](#)
- [ABOUT US](#)
- [FOR DEVELOPERS](#)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |



Alerts

Do not flash a Ubiquiti device that is running, or has been running, airOS version 5.6.2 or higher with AREDN firmware. We have become aware of a change that may be incompatible with current firmware images. We are looking into the concerns raised and will post more details as they are determined. We have developed the following utility to help determine if your device is compatible. Download the [AREDN U-Boot Test Setup Program](#). Requires Windows 7 or higher and Microsoft .NET Framework 4.5.

News

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OCMESH.org

The Orange County Mesh Organization

Orange County Mesh Organization

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- Antennas (MiMo)
- Antennas (non-MiMo)

The Orange County (Broadband-Hamnet/AREDN) Mesh Organization



Who is the Orange County (Broadband-Hamnet/AREDN) Mesh Organization?

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In The News

Laguna Woods Village installs three mesh nodes on gate 14 tower:

[Building a safety net](#)

Mesh networking for the Swallows Day Parade in San

Broadband-HamnetTH in QST – July 2013

QST DEVOTED ENTIRELY TO AMATEUR RADIO
July 2013 WWW.ARRL.ORG

DIGITAL EDITION

Putting High Speed Multimedia to Work in Texas

QST reviews:

- 44 | **Antenna Tuners: MFJ-9982, Palstar AT2K and AT2KD**
- 49 | **Array Solutions VNAuhf Vector Network Analyzer**

Inside:

- 34 | **Use a PIC to Control a Miniature Slow Scan TV Camera**
- 37 | **Build the Real 2 Meter Q-Pole Antenna**
- 41 | **Add a Digital Display to an Older Transceiver**
- 65 | **Go Behind the Scenes with Amateur Radio at the Boston Marathon**

DIGITAL FEATURES

- ▶ 46 | See a Video Overview of the MFJ-9982 Antenna Tuner
- ▶ 47 | See a Video Overview of the Palstar AT2K and AT2KD Antenna Tuners

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Official Journal of **ARRL** The national association for AMATEUR RADIO®

Broadband-HamnetTH in QST – July 2013

A Broadband Ham Network Crosses the Finish Line

A broadband ham network brings long-range video to the Big Bend 50 Ultra Marathon's finish line.

Lynn Jelinski, AG4IU

Big Bend National Park is located north of the Rio Grande River, which separates the United States from Mexico. Big Bend, which is larger than the state of Rhode Island, is a remote and dramatic wilderness located within the harsh Chihuahuan Desert.

Each year in the cool weather of January, Big Bend National Park hosts the Big Bend Ultra Run, a 50 kilometer (31 mile) marathon that is limited to 150 runners to minimize environmental impact. Athletes come from around the world to compete.

The Challenge

To support the marathon, hams from the Big Bend Amateur Radio Club, the Austin Amateur Radio Club and the San Antonio Radio Club established a race control and safety net on 2 meters. The race net had been used during previous races and had proved very effective both for coordination of race activities and runner safety. However, for the spectators, something was missing.

The friends and family of race participants couldn't watch their runners cross the finish line because they were cordoned off in an amphitheater at Rio Grande Village about 10 miles away.



The Solution — a Finish Line Cam

A group of hams from the Austin ARC (Joe Jelinski, KC2KG; Paul Kinney, KD5VRU; Mitch London, KD5HCV, and Alan Russell, KESDTR) got the idea to deploy a high-speed multimedia mesh (HSM-MESH) network to broadcast a live video feed from an Internet protocol video camera (similar to those used in security applications) at the finish line for spectators gathered in the remote

amphitheater. The network is easy to set up, battery powered and far less expensive than a satellite link.

The Equipment

HSM-MESH nodes are made from readily available consumer Wi-Fi routers (see www.hsmm-mesh.org for model numbers that are supported by the software). No internal hardware modification is needed; it's simple to re-

Figure 1 — The equipment used to establish the HSM-MESH nodes are the Linksys router, a 12 V battery-powered UPS, signal mirror, compass and leather gloves. (Lynn Jelinski, AG4IU, photo)



Figure 2 — From the left are Mitch, KD5HCV; Joe, KC2KG, and Alan, KESDTR, who used a compass to aim the antenna and a signal mirror to confirm the orientation. The antenna is secured with guy wires attached to 10 inch steel spikes. The cooler is to keep the battery-powered UPS warm during the night. (Paul Kinney, KD5VRU, photo)



Figure 3 — Alan Russell, KESDTR (L), and Joe, KC2KG, are looking out from the HSM-MESH node location atop Ernst Ridge to the finish line 9.1 miles away. (Mitch London, KD5HCV, photo)



Figure 4 — Paul Kinney, KD5VRU, adjusting the video display and dealing with the bright Texas sun. (Joe Jelinski, KC2KG, photo)

program the router with free software downloaded from the site. The software converts the standard router to a microwave mesh node. [A mesh node operates within a mesh network. Each node in the mesh network can acquire data from an external device (such as a video camera) and also relay data acquired by other nodes. — Ed.] The converted router will still use the factory transmit power of about 80 mW.

As the nodes are powered up, the software enables each node to discover other nodes within range, form network paths and transfer data automatically.

Two of the nodes, the finish line camera node and the Ernst Ridge relay node, were in locations so remote that they didn't have electricity. We chose to use lightweight (6 lb) 12 V battery-powered uninterruptible power supplies (UPS) to power these nodes (see Figure 1).

The Amateur Radio Advantage

These routers normally deliver only household distance operation. This is where Amateur Radio comes in. Some of the 802.11B/G (2.4 GHz) channels overlap the Amateur Radio bands. If you hold a Technician class or higher license you may attach an amplifier, antenna or both to the node to increase its useful range. Remember, only the operating software (firmware) in the Wi-Fi router is changed to convert it to a mesh node.

Deploying the Network

Using microwave path analysis software, we determined we needed two nodes, one for a 9.1 mile path (see Figures 2 and 3) and another for a 1.8 mile path. For the 9.1 mile path from Ernst Ridge to the finish line, we used a 24 dB

dish antenna at both locations. For the 1.8 mile path to the Rio Grande Village, we used a 12 dB omnidirectional antenna paired with a 12 dB Yagi. With these antennas and clear signal paths, we didn't need an RF amplifier.

Network Performance

Thanks to careful placement of the nodes, good antennas and the low RF noise floor at Big Bend National Park, we were able to get 100% copy. We placed backup batteries at each remote node in case we needed them, but the original batteries lasted for the entire 10 hours of the race. The batteries powering the video camera lasted for 6 hours and needed to be changed during the race.

Prior Planning and Testing Payoff

Our group spent many of our Digital Wednesday meetings planning the operation. We studied topographical maps, tested the nodes and checked the cold-temperature performance of the batteries. Having planned the antenna locations, we performed a microwave path analysis of the terrain to see how reliable the paths would be.

Once at Big Bend we validated our planning with on-site testing. We set up the network, checked antenna stability and battery integrity 2 days prior to the event. In preparation for the event each of us had climbed Ernst Ridge with heavy backpacks at least three times, clawing for handholds in the rocks while hoping the temperature was too cold for scorpions and rattlesnakes. Each ascent was the equivalent of climbing 400 stairs.

Hot Wash-up

It was dark by the time the final runner, who was by then a walker, hobbled across the finish line. Under the light of the stars we re-

viewed what went well and what could be improved.

The major glitch of the event was that we underestimated the intensity of the setting Texas sun. It was so bright that it overpowered the video projector. Despite our having erected a canopy over the screen, using a projection screen with a highly reflective surface and a high-powered projector, the finish line video projection was hard to see (see Figure 4). Next year we will use a TV screen or a CRT to display the live video feed.

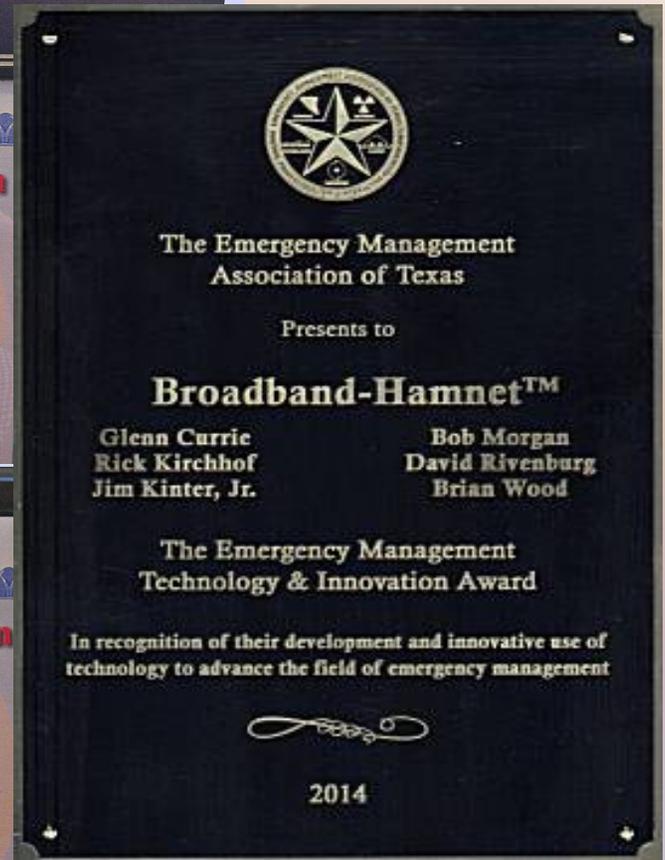
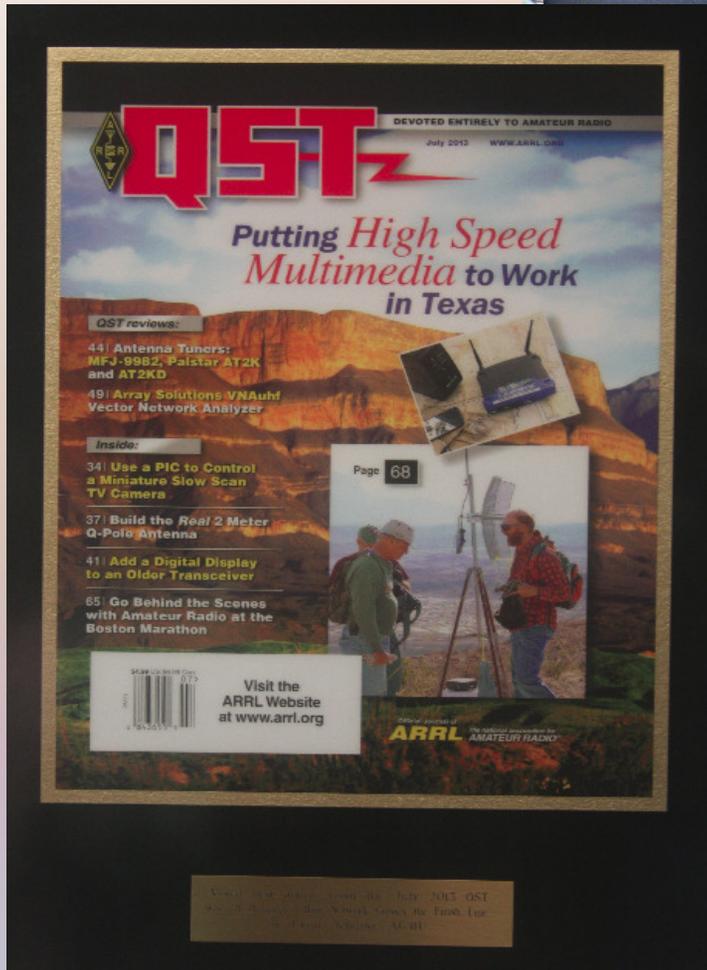
Next Year — Audience Cam

Spectators loved seeing their runners cross the finish line, but the runners themselves didn't hear the cheers or share in their exhilaration. Next year we plan to place a second video camera in the audience — an "audience cam" — so we can provide a live video feed to the athletes at the wilderness finish line. HSM-MESH is up to the task!

Joe Jelinski, KC2KG; Paul Kinney, KD5VRU; Mitch London, KD5HCV, and Alan Russell, KESDTR, contributed to this article. Lynn Jelinski, AG4IU, an ARRL member, was first licensed in 2000. Lynn and her spouse, Joe, KC2KG, were members of the East Coast Waterway Net during their 11 years operating maritime mobile. Lynn helps universities write grants for research funding. Lynn and Joe can be contacted at 6406 Hopkins Dr. Austin, TX 78734. kc2kg@earthlink.net.

VOTE
Did you enjoy this article?
Cast your vote at
www.arrl.org/cover-plaque-poll

Broadband-Hamnet™ Awards



AREDN Team Receives ARRL 2014 Microwave Development Award



2014 ARRL *Microwave Development Award*

presented to

The Principals and Developers
of Broadband-Hamnet™



For developing and promoting commercial, off-the-shelf based mesh networking technology that is used within the 900 MHz, 2.4 GHz, and 5.8 GHz Amateur Radio bands. Currently, this technology is widely used by Amateur Radio operators around the world.



ARRL The national association for
AMATEUR RADIO®

OCMESH.org

The Orange County Mesh Organization

Orange County Mesh Organization

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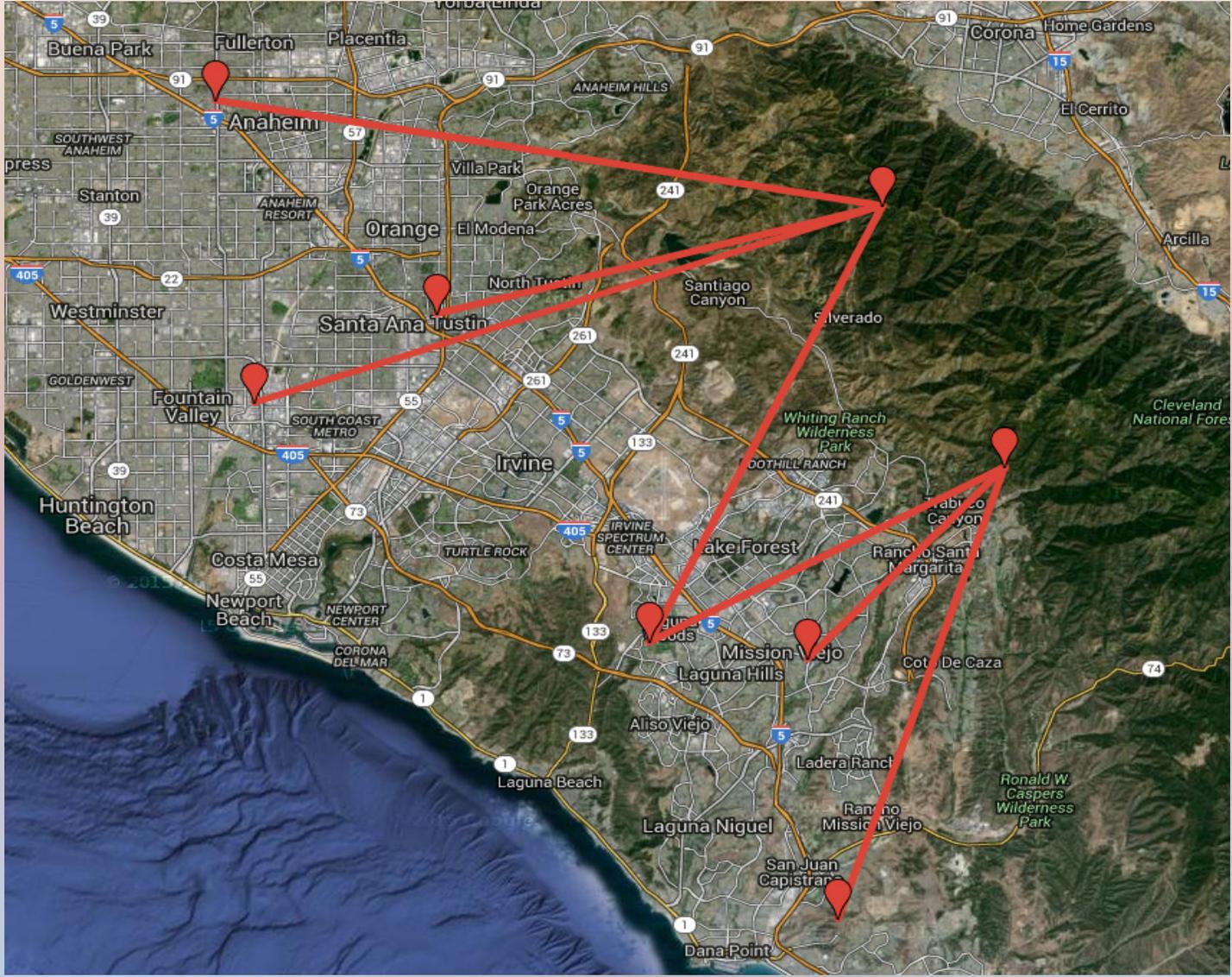
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Major Nodes in Orange County



Saddleback 2.4 GHz, 3 GHz, and 5 GHz



Saddleback 2.4 GHz, 3 GHz, and 5 GHz



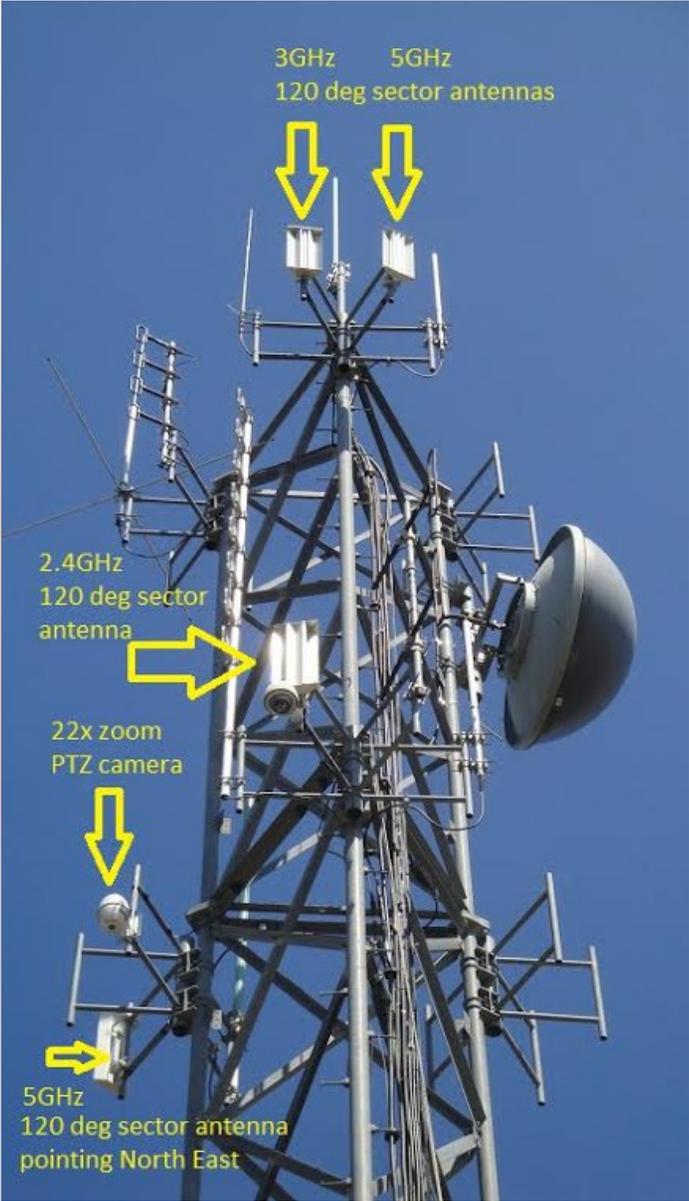
KE6BXT-M5R-68-143-86 (5GHz node)
KE6BXT-MVCHR-Bullet-grid-165
(Locaded on the roof of Mission Viejo City Hall)



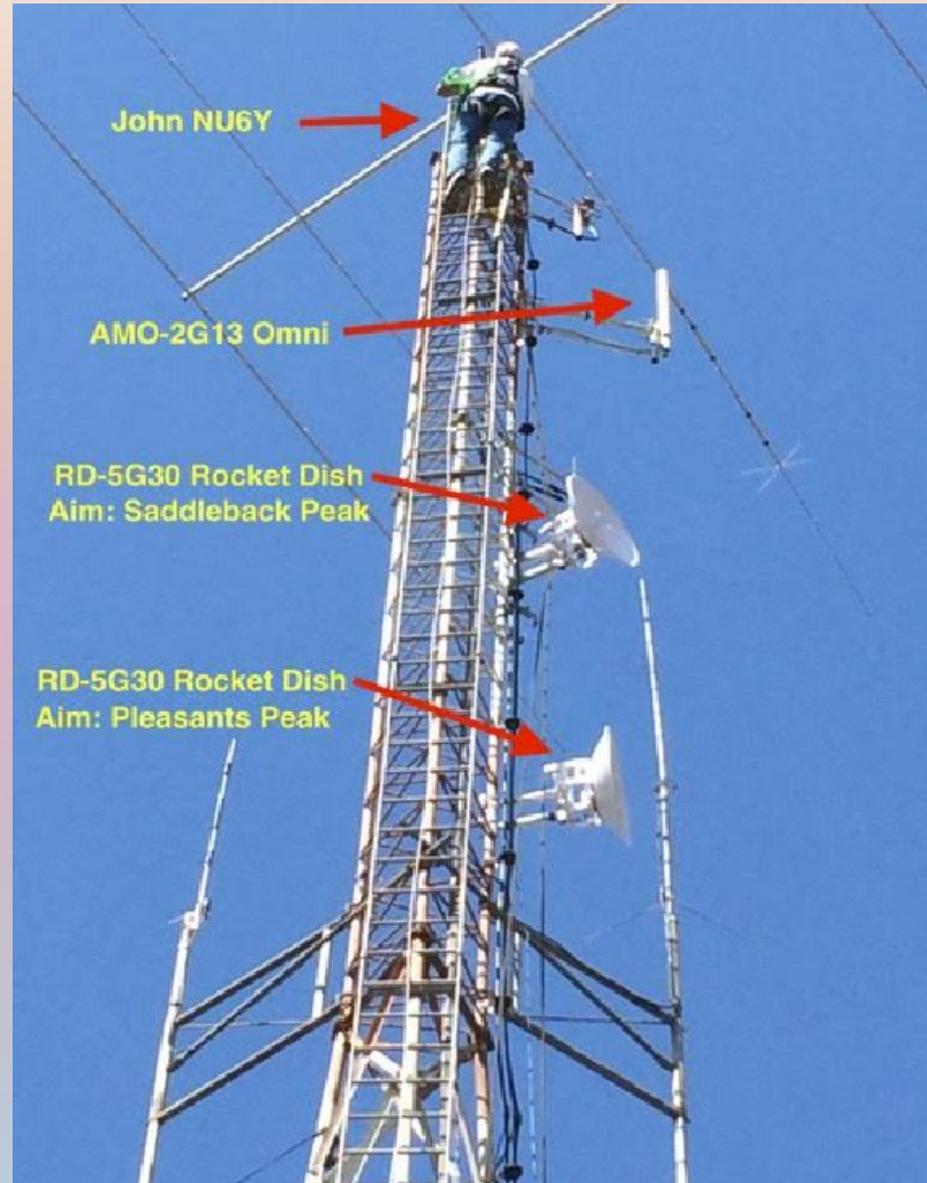
Anaheim Ham Radio Outlet (HRO)



Pleasants Peak



Laguna Woods



Red Cross

2.4 GHz Nanobridge
and
5GHz Rocket w/Omni



Boris Kamenster,
AB6ZS

2.4 GHz Nanobridge
and
5GHz Rocket w/Omni



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- Antennas (non-MiMo)
- airRouter
- AirGateway
 - Wireless Clients or Wireless Internet

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Internet Tunneling

Services

Bands, Channels, and Frequencies

2.4 GHz Band

- 2 (2397) AREDN only
- 1 (2402) AREDN only
- 1 (2412)
- 2 (2417) <-- Ord Mt. To Potosi ATN ATV repeater link
- 3 (2422)
- 4 (2427)
- 5 (2432)
- 6 (2437)
- 7 (2442) <-- ATN repeater input
- 8 (2447)
- 9 (2452)
- 10 (2457)
- 11 (2462)

SCRRBA Band Plan:

- 2395-2400 ≥ 50 kHz ≤ 1 MHz BW, Paired with 2305-2310
- 2400-2410 Space, Earth & Telecommand Stations
- WB1 = 2410-2427
- WB2 = 2427-2433
- WB3 = 2433-2450

3 GHz

BBHN Firmware:

??

AREDN Firmware:

76 > (3380) WB2 <-- Note 3380

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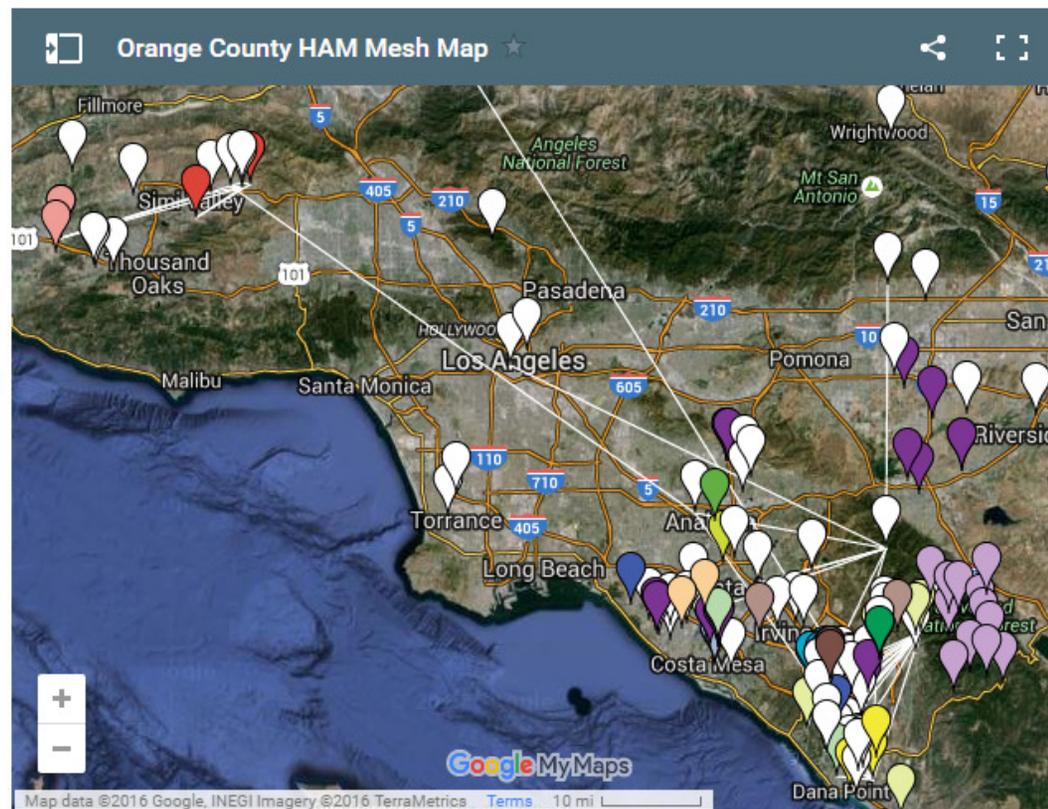
Software (Firmware)

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More Nodes in Orange County



Pop-out map

Get on the Orange County Mesh Map

This map shows locations we are looking at because a HAM has indicated that they have an interest in mesh networking or because a node or nodes have been installed at that location. If you are interested in installing a mesh node in Orange County, please get in touch with either Don Hill or Joe Ayers and we will add

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Swallows Day Parade



Using mesh networks to support public events

We have supported three public events in Orange County in the last two years.

The first was a bicycle race called **Vision Quest**. For that event we deployed four nodes. Two of the nodes had pan/tilt cameras attached, and one of the nodes connected to our hub that acted as a relay to two HAM QTH's with internet access. Using the internet access allowed for remote monitoring of the node status and viewing of the cameras.

The second event was the **Christmas lighting ceremony in San Juan Capistrano**. For that event we deployed five nodes. Four of the nodes had cameras attached and the fifth node was the monitoring station with a laptop and external monitor for monitoring all cameras. The Orange County Sheriff was so impressed that we were asked to provide a mesh network for video streaming for the Swallows Day Parade

The third event was the **Swallows Day Parade in San Juan Capistrano**. For that event we deployed ten nodes and six cameras. The cameras were monitored in the Orange County Sheriff's Mobile Command Center (MCC). Read more in [this article](#).



Vision Quest

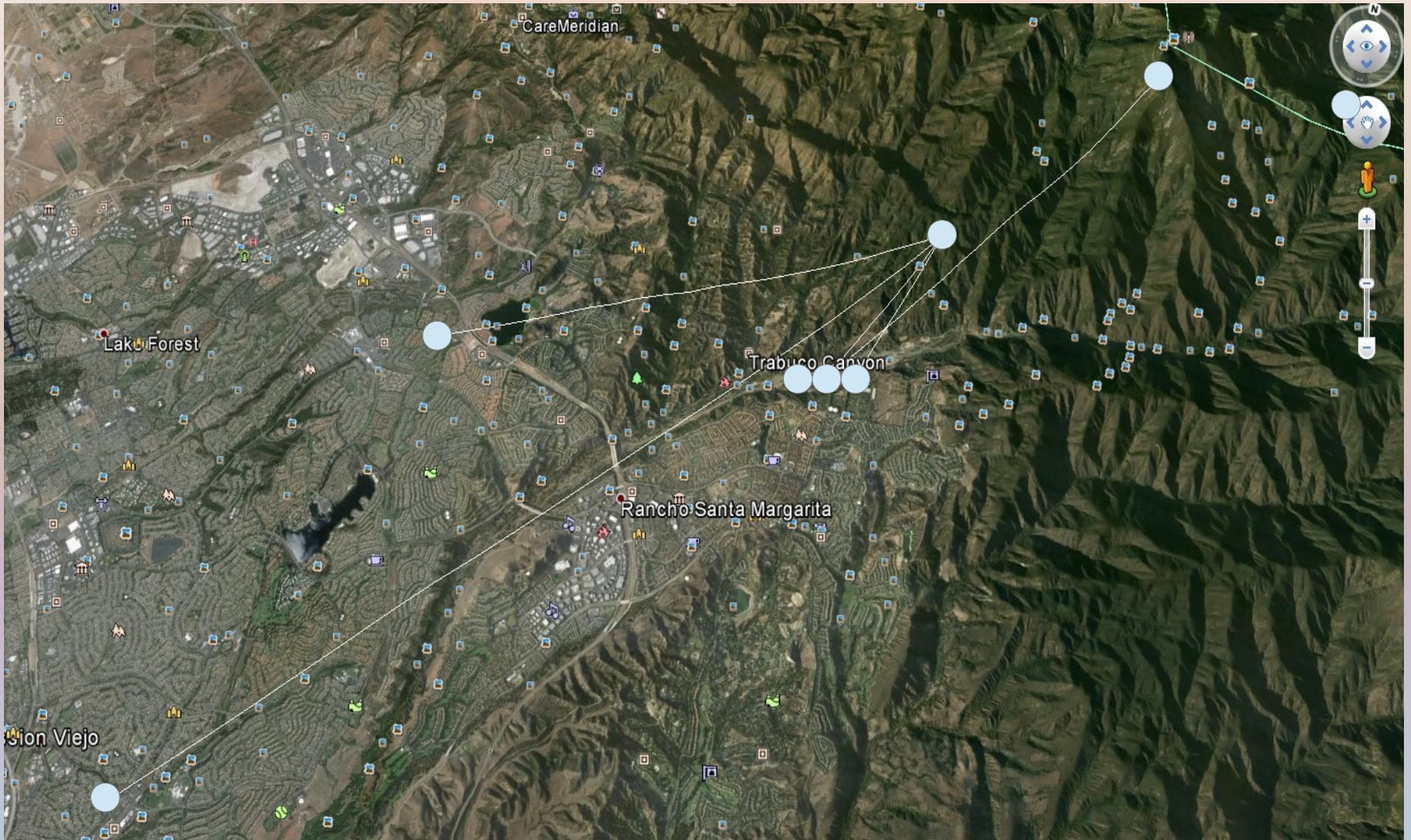
Date & Location

Event Date: April 4th, 2015
Santa Ana Mountains, Orange County, CA
Event Start: 5:30 AM

Registration opens October 1st, 2014 @ 8:00 p.m.

The event fee is \$130 which includes finishing award, t-shirt, and post-event food.

Vision Quest Google Earth



Grid-dish-Bullet and Camera 1



Vision Quest - Camera 1

2014/04/05 09:57:38D TV-IP862IC



Vision Quest – Airgrid and Camera 2



Video from Camera 2

Real-time IP Camera Monitoring System

Device Status
Live Video



Flip Mirror

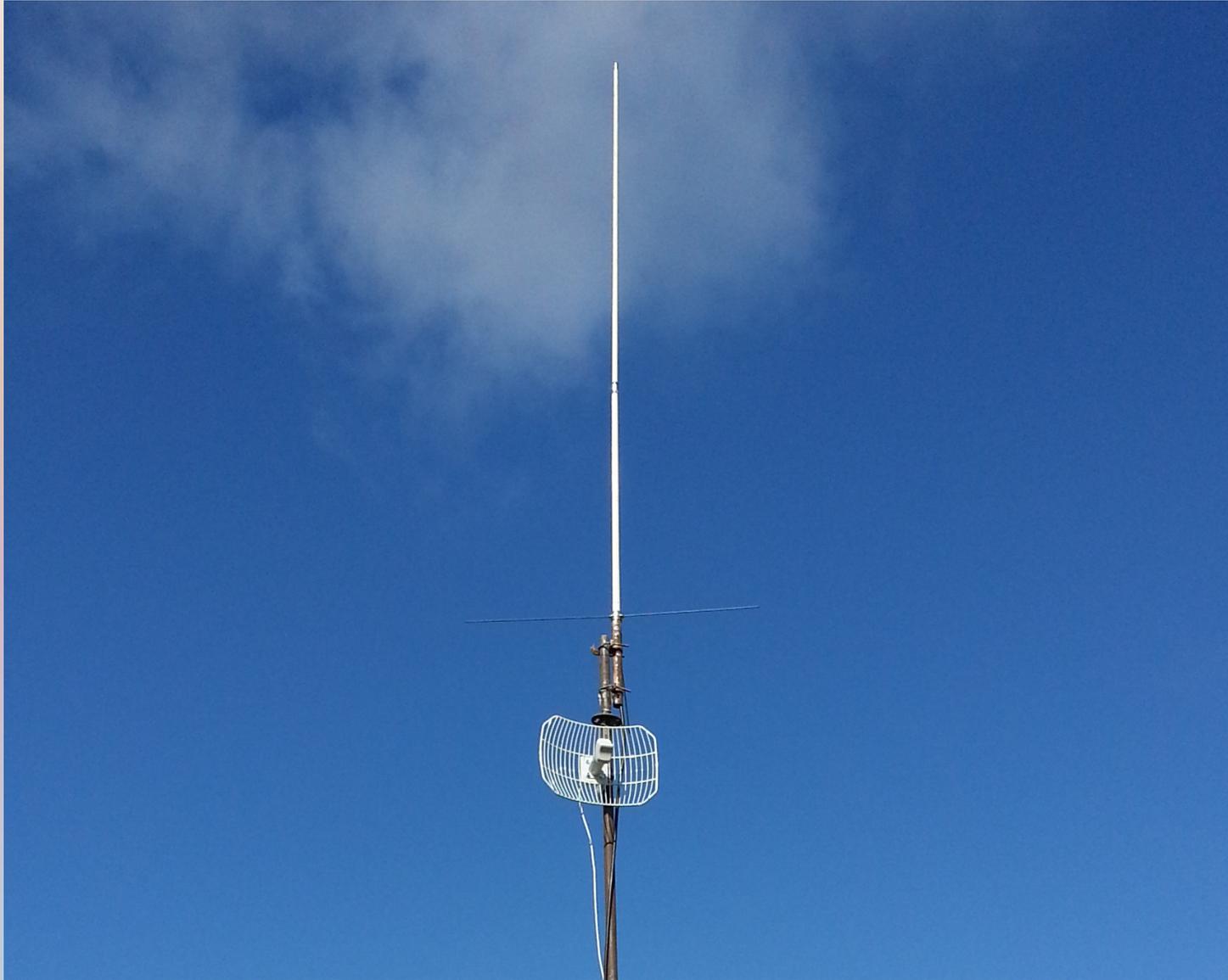
Resolution: 640*480
Mode: 50 HZ
Brightness: 7
Contrast: 5
Preset: set 1 go

[refresh camera params](#)
[refresh video](#)
[Snapshot](#)
[audio](#)
[CloseAudio](#)

Device Management



Vision Quest – Airgrid and 2m/440cm omni antenna



Vision Quest Mesh Status

ae6xe-15 mesh status

Refresh

Auto

Quit

Local Hosts		Services	Current Neighbors	LQ	Services
ae6xe-15			KE6BXT-AirgridM2-10-27-49	47%	
	● TrendNet	TV-IP862IC	● DLink		DCS-932L
			KE6BXT-Bullet-66-184-163	83%	
			KE6BXT-W8RRV-Roof	6%	
			KE6BXT-airGrid-160-74-179	33%	
			● smarthome		webcam
Remote Nodes	ETX	Services	Previous Neighbors	When	
ae6xe-10-ubnt	5.53				
ae6xe-14	7.74				
			none		

Vision Quest Mesh Status

ae6xe-10-ubnt mesh status

Refresh

Auto

Quit

Local Hosts	Services	Current Neighbors	LQ	Services
ae6xe-10-ubnt		KE6BXT-Bullet-66-184-163	61%	
		KE6BXT-W8RRV-Roof	26%	
		KE6BXT-airGrid-160-74-179	78%	
		● smarthome		webcam
		ae6xe-14	44%	
Remote Nodes	ETX	Services		
KE6BXT-AirgridM2-10-27-49	6.42	DCS-932L		
● DLink				
KE6BXT-W8RRV-Inside	10.56			
ae6xe-15	3.35			
● TrendNet		TV-IP862IC		
		Previous Neighbors		When
		none		

Camera Viewing Station



San Juan Capistrano Swallows Day Parade



San Juan Capistrano Swallows Day Parade



Orange County Mesh Organization

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[Why we do not recommend using the Linksys WRT54G Routers for HAM Mesh Networking](#)

Bullet/Bullet-Ti					
					
BM2HP	2.4 GHz	100+ Mbps	600mw	28 dBm	2412-2462 MHz
BM2-Ti	2.4 GHz	100+ Mbps	600mw	28 dBm	412-2462 MHz
BM5HP	5 GHz	100+ Mbps	600mw	25 dBm	5170-5825 MHz*
BM5-Ti	5 GHz	100+ Mbps	600mw	25 dBm	5170-5825 MHz*

Source: [bm_ds.web.pdf](#) and [BulletM_Ti_DS.pdf](#)

* Only 5725 - 5850 MHz is supported in the USA

Note: dBm refers to output power

AirGrid M					
					

Supported Hardware

Linksys:

- WRT54G*

Ubiquiti

- Nanostation Loco
- Nanostation
- NanoBridge
- Rocket
- Bullet
- Airgrid



Supported Hardware

- Rockt Dish
- Airmax Basestation
Sector antenna
(90 deg, 120 deg)
- MIMO Omni
- Non-MIMO Omni
or Grid Dish



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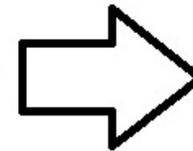
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- Cameras

Software (Firmware)



Turning your Ubiquiti radio into an AREDN mesh node

All of the instructions on how to download and load the AREDN firmware are on the AREDN website. Rather than repeating the steps here, we will refer you to <http://AREDN.org>

Go to the menu at the top of the page and mouse over SOFTWARE.

Below **SOFTWARE** is **DOWNLOAD** that allows you to download the firmware from the web site and store it on your computer.

Below **DOWNLOAD** is **INSTALLATION** that walks you through verifying that your hardware will support the AREDN firmware, and then upload the firmware from your computer to the Ubiquiti radio.



Amateur Radio Emergency Data Network

[Login](#) | [Register](#)

- HOME
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- SHOP

Software

- SUPPORTED PLATFORM MATRIX
- DOWNLOAD**
- INSTALLATION
- NETWORK SWITCH CONFIGS

[Before flashing a node that is running or has been running AirOS version 5.6, please run the AREDN U-Boot Test program below to ensure that the node is compatible with the new firmware load or upgrade.](#)

We have developed the following utility to help you determine if your device is compatible, as well as being able to take a BACKUP of your node's critical partitions.

Download and run the [AREDN U-Boot Test Setup Program](#). If the test results in a "GOOD/GOOD" result, then you may proceed to load the appropriate AREDN firmware onto it.

If the test results are "BAD," then you should do the following:

1. Backup your device partitions using the AREDN U-Boot Test program.
2. Use the AirOS GUI to downgrade to AirOS v5.5.x.
3. Re-run the AREDN U-Boot Test program and look for a "GOOD/GOOD" test.
4. If "GOOD/GOOD", you can safely use the AirOS GUI to install the AREDN firmware.

Requires Windows 7 or higher and Microsoft .NET Framework 4.5.

Notes for Over the Air Upgrade are [below](#)

Use this "factory" file when loading from AirOS or TFTP
Use this "sysupgrade" file when loading from AREDN (or BBHN)

Use this "factory" file when loading from AirOS or TFTP
 Use this "sysupgrade" file when loading from AREDN (or BBHN)

Latest Stable version is: 3.15.1.0

AREDN™ Firmware for Ubiquiti

Bullet M2 Bullet M5 Bullet M2 Titanium Bullet M5 Titanium NanoStation Loco M2 NanoStation Loco M5 (XM) NanoStation Loco M9 NanoBridge M2 NanoBridge M5 NanoBridge M9 AirGrid M2 AirGrid M5 PicoStation M2	factory md5sum: 284883fd8158466c0322735a0568db18 Size: 4.4M	sysupgrade md5sum: 78c38e1d8d01240f70db069d59866dc6 Size: 4.4M
NanoStation M2 NanoStation M3 NanoStation M5 (XM) NanoBridge M3	factory md5sum: 2bf57572e27cd6a328371af1885e73e4 Size: 4.4M	sysupgrade md5sum: 90a07696015a3f7c52dfd2ad085d3c02 Size: 4.4M
Rocket M2 Rocket M3 Rocket M5 Rocket M9	factory md5sum: 83850ee1f7cccef92a3938b286bcc3ec Size: 4.4M	sysupgrade md5sum: 790d25a1e6d0a04d5168dbd2840ffd8a Size: 4.4M
NanoStation M5 (XW)	factory md5sum: 3d80d30764c65d6e60ca67289cb1b94c Size: 4.4M	sysupgrade md5sum: 50cc9e479bb24aaf500e6cf7ba698b59 Size: 4.4M

AREDN™ Firmware for TP-Link

CPE210 CPE510	factory md5sum: 77598cd1c8b53beeb36eddb5867bf5b1 Size: 4.5M	sysupgrade md5sum: 2db1d122a51f9d3189a017213ec56ea1 Size: 4.9M
------------------	--	---

Patches

Over The Air Upgrade support for AREDN v3.0.2. To be used	V3.0.2 OTA Support Final
---	--

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Basic Setup

Configuring your node to attach to another node in the OC Meah

Now that you have flashed the AREDN firmware on your new Ubiquiti or TP-Link node there are a few settings you need to make (in addition to naming your node with your callsign).

Clicking on the Setup button should take you to the Basic Setup page. Looking at the [OC Mesh map](#) determine which node you want to connect to and enter the following information in the WiFi section.

After you have entered your SSID, Channel, and Channel Width, click on the **Save Settings** button and, when prompted, click on the **Reboot** button.

2.4 GHz nodes

Node Name	SSID	Channel	Chanel Width
W6ARH-M2HP-24A43C	BroadbandHamnet	-2 (2397)	10 MHz
AE6XE-PleasantsPk-RM2	BroadbandHamnet	-2 (2397)	10 MHz
AE6XE-Saddleback-RM2	BroadbandHamnet	-2 (2397)	10 MHz
KE6BXT-MVCH-M2B-Grid-140-228-165	BroadbandHamnet	-2 (2397)	10 MHz
KE6BXT-MVCH-M2R-NORTH-122-48-97	BroadbandHamnet	-2 (2397)	10 MHz
KE6BXT-MVCH-M2R-SOUTH-62-84-116	BroadbandHamnet	-2 (2397)	10 MHz
KE6BXT-M2NB-RedCross	BroadbandHamnet	-2 (2397)	10 MHz
KE6BXT-W6HRO-M2R-12-238-64	BroadbandHamnet	-2 (2397)	10 MHz
KE6BXT-W6HRO-M2R-RDISH	BroadbandHamnet	-2 (2397)	10 MHz

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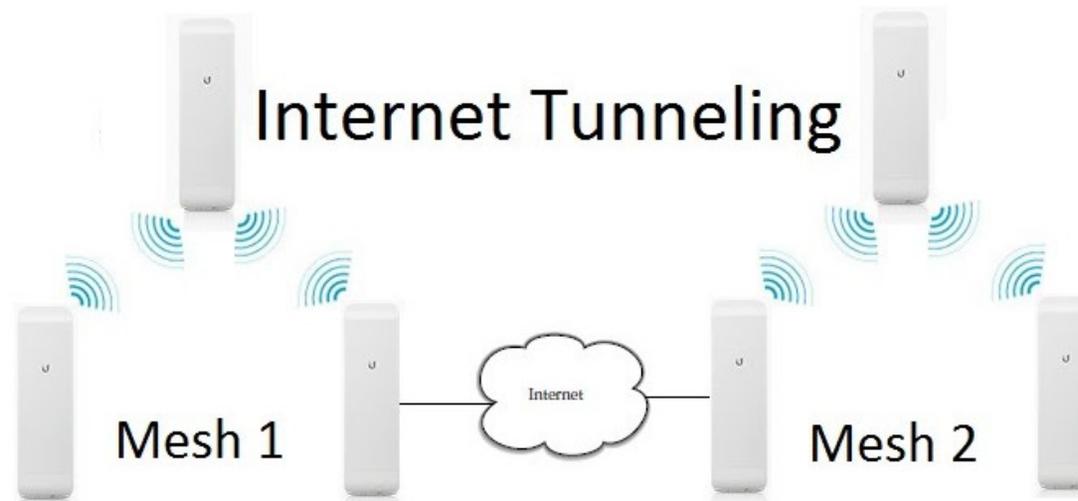
Basic Setup

Internet Tunneling

Services

- Adding Services to a Node
- Cameras

Internet Tunneling



Internet Tunneling is a method to connect Mesh Islands together using the Internet. Each AREDN Mesh Node has the capability to either be a Tunnel Server, a Tunnel Client, or both a Tunnel Server and a Tunnel Server.

After flashing the AREDN firmware on your node you must install the Tunneling software before you can configure it. Click on the Setup button to go to the Basic Setup page. Next, click on either the [Tunnel Server](#) or [Tunnel Client](#) links. If the Tunnel software has not yet been installed you will see one of the following messages:

[Node Status](#)[Basic Setup](#)[Port Forwarding, DHCP, and Services](#)[Tunnel Server](#)[Tunnel Client](#)[Administration](#)

[Node Status](#)

[Basic Setup](#)

[Port Forwarding,
DHCP, and Services](#)

**Tunnel
Server**

[Tunnel
Client](#)

[Administration](#)

Tunnel software needs to be installed.

[Click to install](#)

[Node Status](#)

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[Port Forwarding,
DHCP, and Services](#)

[Tunnel
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**Tunnel
Client**

[Administration](#)

Tunnel software needs to be installed.

[Click to install](#)

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**Tunnel
Server**

[Tunnel
Client](#)

[Administration](#)

[Help](#)

Save Changes

Reset Values

Refresh

Tunnel Server Network: 172.31.140 .180 (must be between 0 and 254)

Tunnel Server DNS Name:

Enabled?

Allow the following clients to connect to this server:

Client

Pwd

Net

Active Action

172.31.140.180



Add

[Node Status](#)

[Basic Setup](#)

[Port Forwarding,
DHCP, and Services](#)

[Tunnel
Server](#)

**Tunnel
Client**

[Administration](#)

[Help](#)

Save Changes

Reset Values

Refresh

Connect this node to the following servers:

Enabled?

Server

Pwd

Network

Active Action

Add

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Server](#)**

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Tunnel software needs to be installed.

[Click to install](#)

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 - ▶ Adding Services to a Node
 - Cameras
 - VOIP
 - Ham-Chat / MeshChat
 - WinLink
 - Raspberry Pi Applications
- Don & Joe's Schedule
- Don & Joe's Mesh Presentation
- External Links
- FAQs
- OCMESH Tools/Status
- Contact Us
- Sitemap

Affiliations



Services



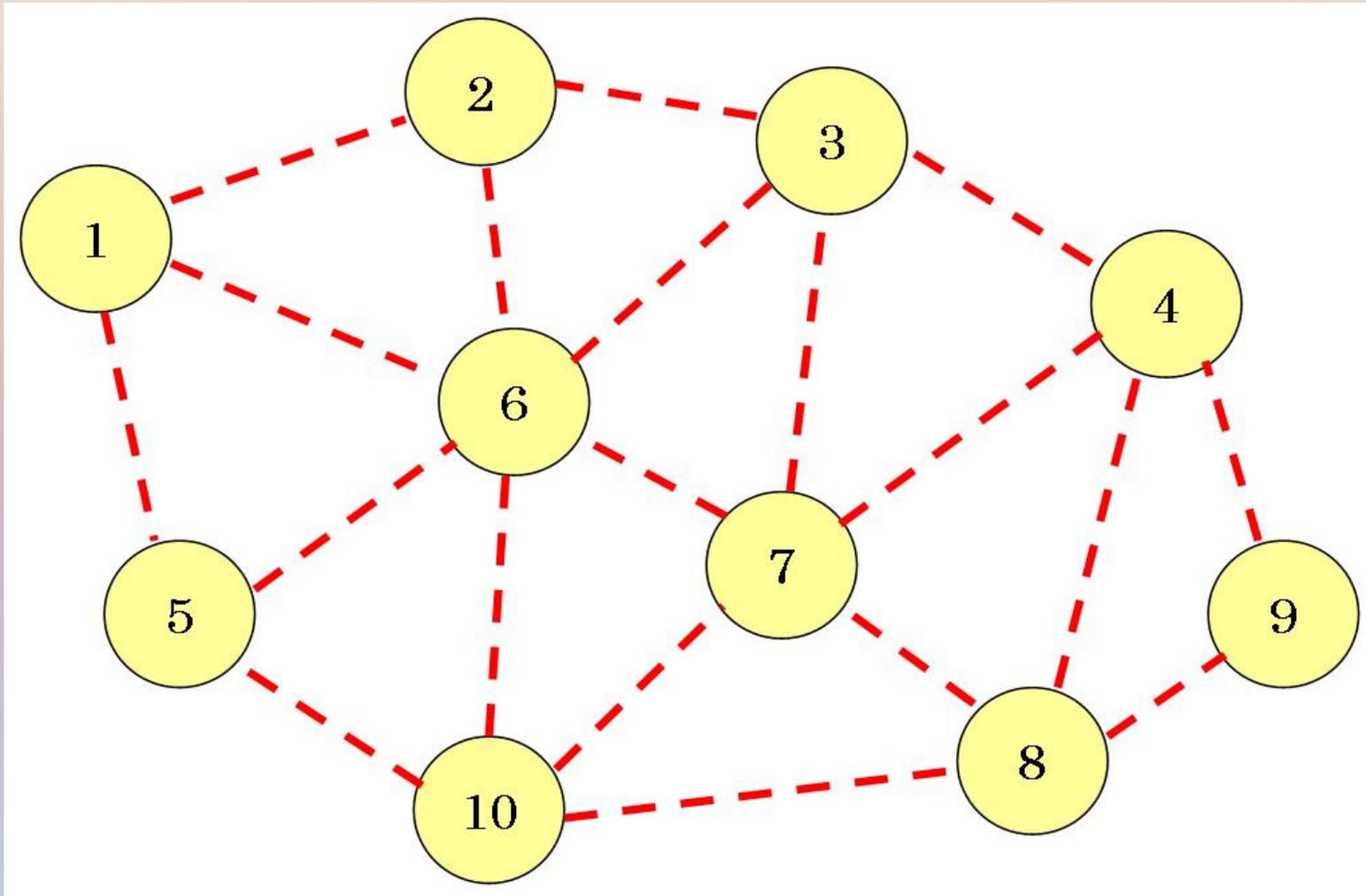
Services

A mesh network, or any network for that matter, is of no use unless you have services. Having a large mesh network would be similar to having a large number of routers connected with cat5e cables or having your home router connected to your Internet Service Provider's modem and then not connecting any computers, printers, video streaming encoders, or home automation devices to it.

On a Broadband-Hamnet/ARDEN mesh network there are a lot of devices (services) that can be added in order to make having the mesh network worthwhile. There are also several devices that you can connect to your home or business network that you can NOT connect to a Broadband-Hamnet/ARDEN mesh network. After all, a Broadband-hamnet/AREDN network uses Amateur Radio (HAM) radio frequencies and therefore must comply with FCC rules, Part 97.

But for now, let's not concentrate on what you can't do on a Broadband-Hamnet/AREDN mesh network and look at some of the things you can do.

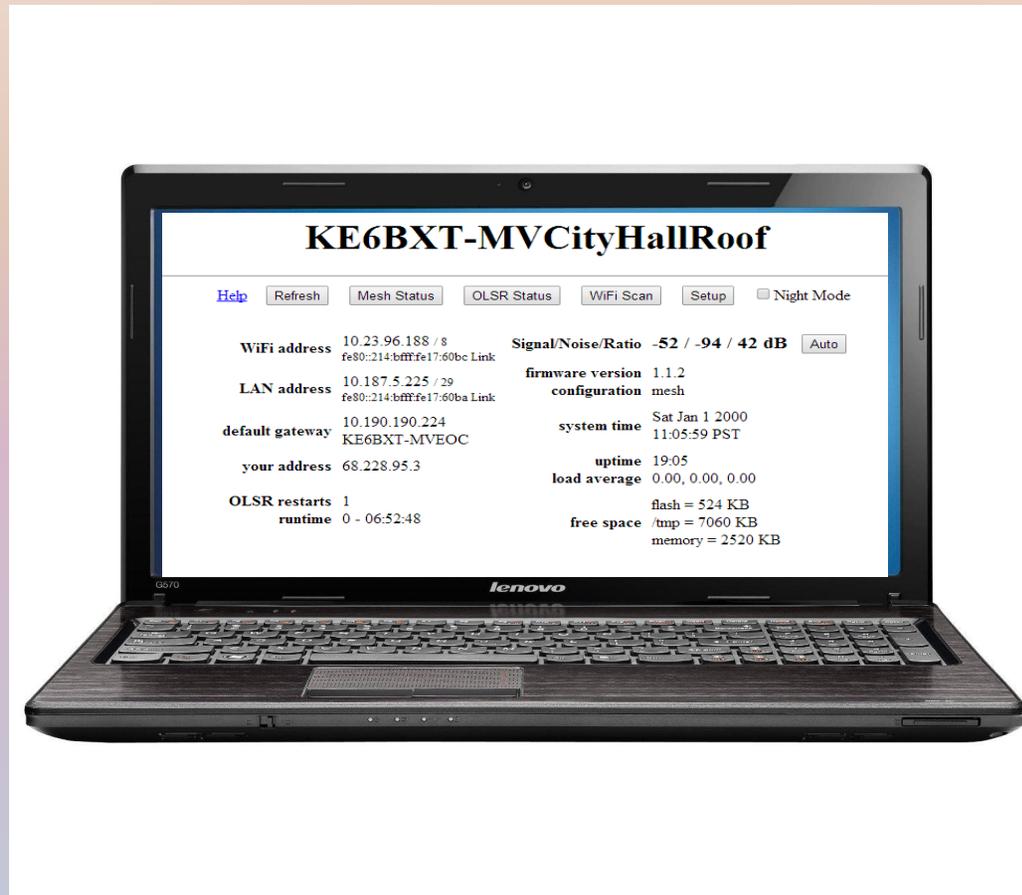
So you have a MESH network...
What can you do with it???



First, you will need a Computer!



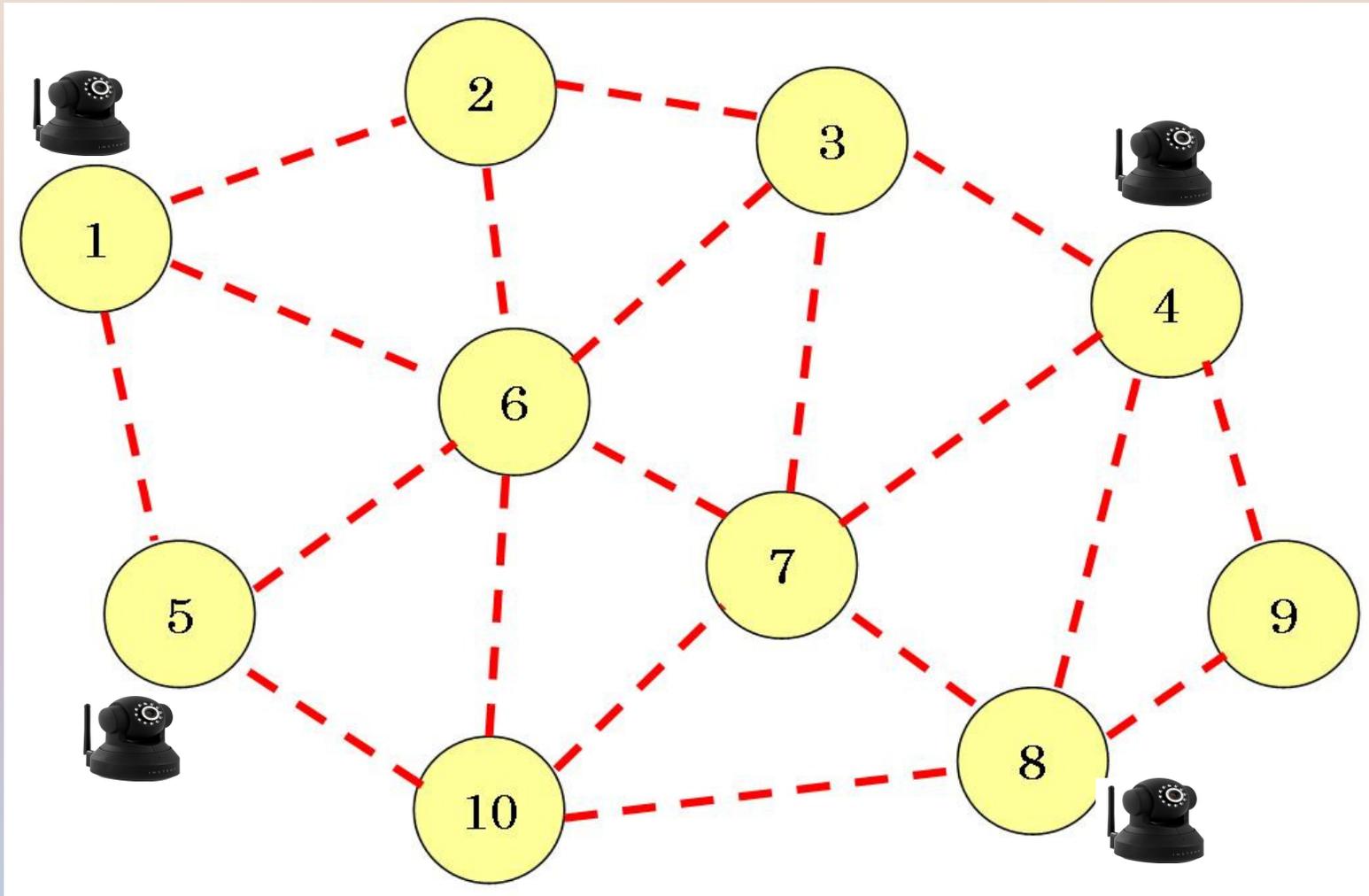
First, you will need a Computer!
So you can check the Node/Mesh status.



You'll want an IP Camera



... or several IP Cameras



Do you want to talk over the network?
Add phones using a VoIP adapter



Add a Raspberry Pi or Arduino or BeagleBoard



Arduino



BeagleBoard

- Web server
- File server
- Asterick server (PBX)

Access, monitor and control USB devices over your network



Access your HAM radio remotely (HAM radio over HAM radio)



RemoteRig

1258MKIIS-RADIO

STEREO (DUAL RX) RADIO SIDE UNIT REMOTERIG

HRO Discount Price: **\$285.95**



This item qualifies for **FREE SHIPPING**

In 48 Continental US States by UPS Ground Service

Add To Cart

You can turn power on or off



[Front Panel]

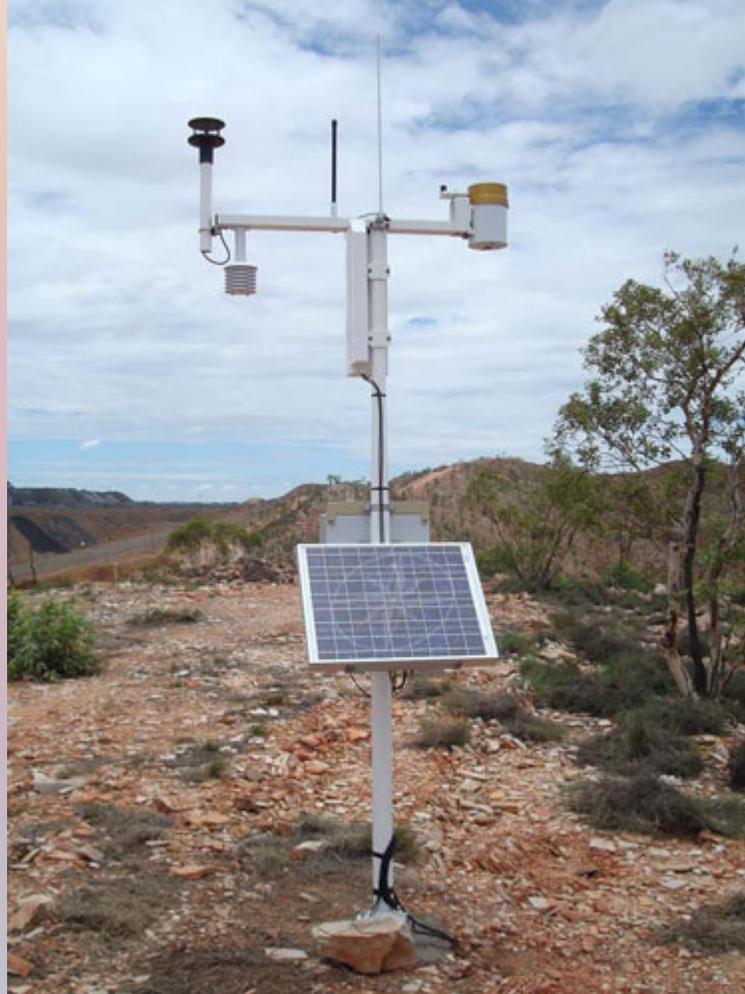


- | | |
|---------------------------------|--|
| [5]: RS-232 Serial Port Console | [1]: Ethernet Port |
| [6]: Outlet LED Indication | [2]: Manual On/Off Button |
| [7]: Circuit Breaker | [3]: Manual Power Outlet Selection Button |
| [8]: Master Power On/Off Button | [4]: Loop Through For Daisy-Chain Connection |

[Back Panel]



~~Control~~ Monitor the weather



What would you add to your MESH network?



Connecting your MESH network to the Internet



Monitor/control nodes and service from anywhere with internet access



KE6BXT-MVCityHallRoof

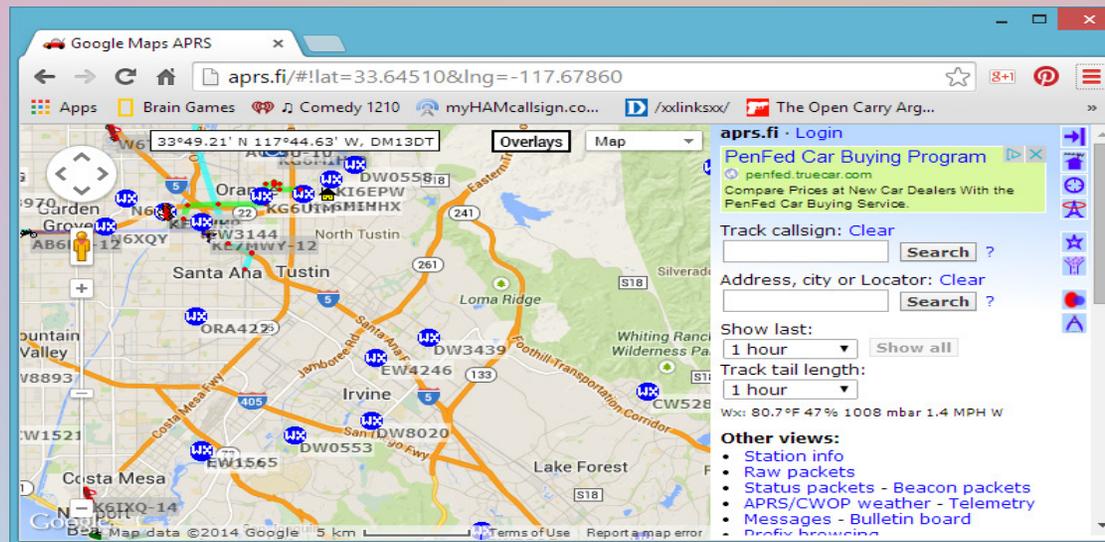
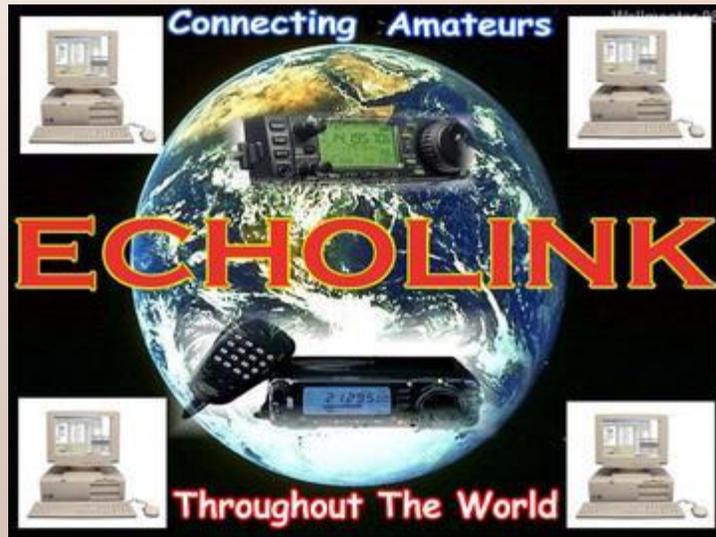
[Help](#) Night Mode

WiFi address	10.23.96.188 / s fe80::214:bfff:fe17:60bc Link	Signal/Noise/Ratio	-52 / -94 / 42 dB <input type="button" value="Auto"/>
LAN address	10.187.5.225 / 29 fe80::214:bfff:fe17:60ba Link	firmware version	1.1.2
default gateway	10.190.190.224 KE6BXT-MVEOC	configuration	mesh
your address	68.228.95.3	system time	Sat Jan 1 2000 11:05:59 PST
OLSR restarts	1	uptime	19:05
runtime	0 - 06:52:48	load average	0.00, 0.00, 0.00
		free space	flash = 524 KB /tmp = 7060 KB memory = 2520 KB

2014/04/05 09:57:38D TV-IP862IC



Access HAM Internet services

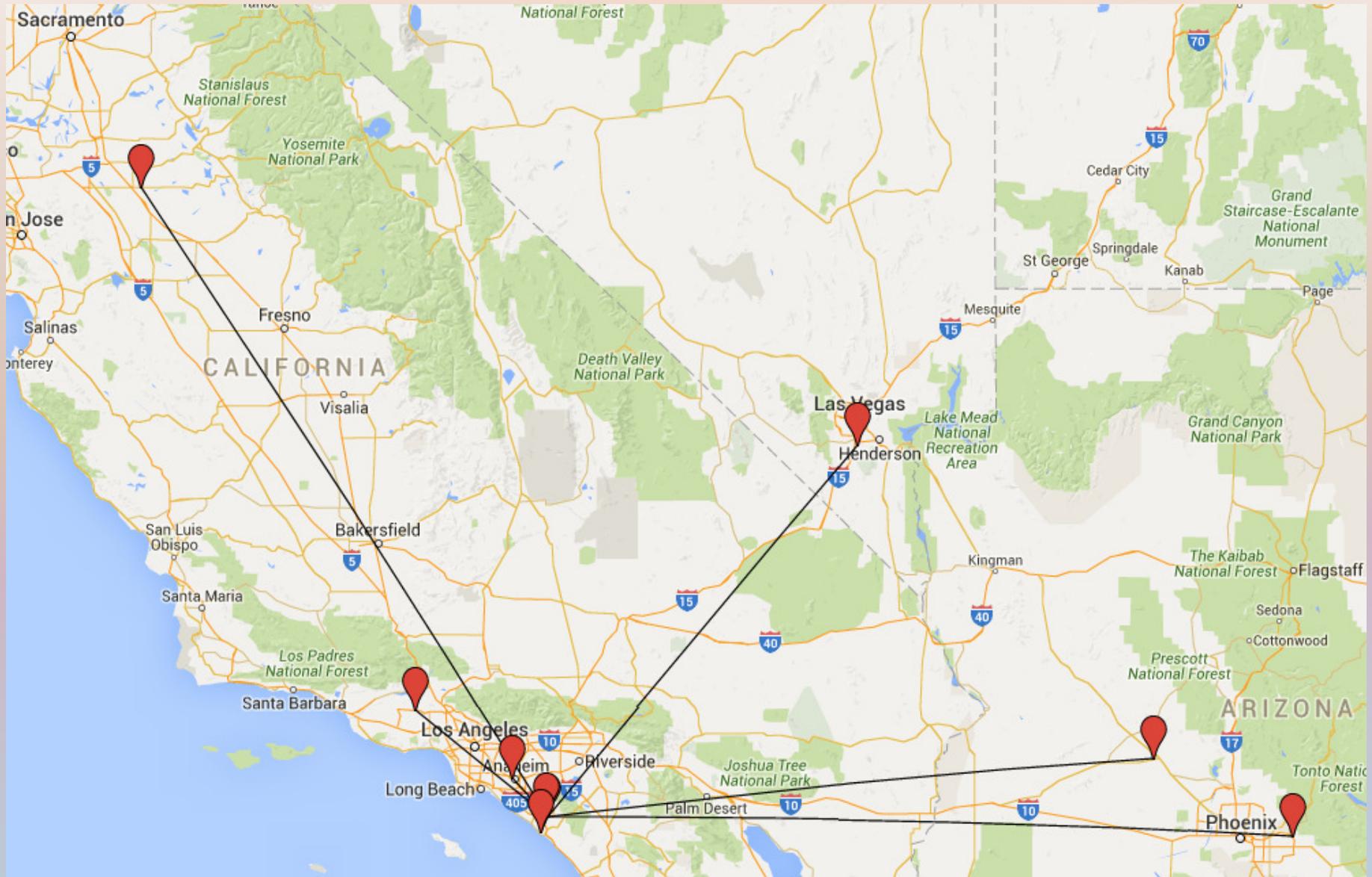


Allow “cloud based” services



Connecting Mesh Islands

Internet Tunneling



Links

- Orange County Mesh Organization

<http://ocmesh.org/>

- AREDN website (Amateur Radio Emergency Data Network)

<http://aredn.org/>

- Broadband Hamnet website

<http://Broadband-Hamnet.org>

- Heart O' Texas Amateur Radio Club Mesh Network

<http://www.hotarc.org/mesh.html>

- Speed Test

<http://www.speedtest.net/>

And finally....

Ready for some Demos?

THE END

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THE END

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