Montgomery County
(and beyond)
ARES/RACES
MESH NETWORK PROJECT

A unique opportunity to combine radio and computer skills FOR EMERGENCY COMMUNICATIONS

Phil-Mont MEETING
Wednesday May 11, 2022
Tom Nolan W3EX

What is a MESH Network

- A wireless invisible “highway” over which data travels.

- NODEs are routers along the highway that route traffic throughout the mesh.

- Per FCC part 97 regs, NODEs are repeaters

NODE Characteristics

•They are standard commercial network devices that have been *re-programmed* to operate on amateur frequencies, 2.300ghz-2.450ghz and 5.650ghz-5.850ghz.

•NODES are self discovering, self configuring, self advertising and fault tolerant. Connectivity between nodes is completely automatic.

•They are a wireless data network.

•Most tasks that you can do over a wired or wireless network at your home or office will work on a mesh node. Examples to follow.

•They are small, portable, low-power and inexpensive.

•Battery and solar power can be arranged and is being actively worked on.

NODE Characteristics

•All nodes are *remotely managed*, you do not need physical access once a node is installed.

•Mesh nodes can easily have a range of ***10 miles or more using stock power*** and gain antennas if you have true line of sight.

•Mesh nodes communicate with other nodes over Wi-Fi frequencies and ***only talk to other mesh nodes on the wireless port*** .

•It is possible to extend a mesh network with a properly restricted access point (AP) where only hams are given access

•If any node is connected to resources (internet, video camera, file server, mail server, VOIP server, etc.) it can provide access to the entire network

•Computers connect to mesh nodes with an Ethernet cable or WiFi APs and control them using a web browser. *No local programs or apps required*.

Why MESH for EmComm?

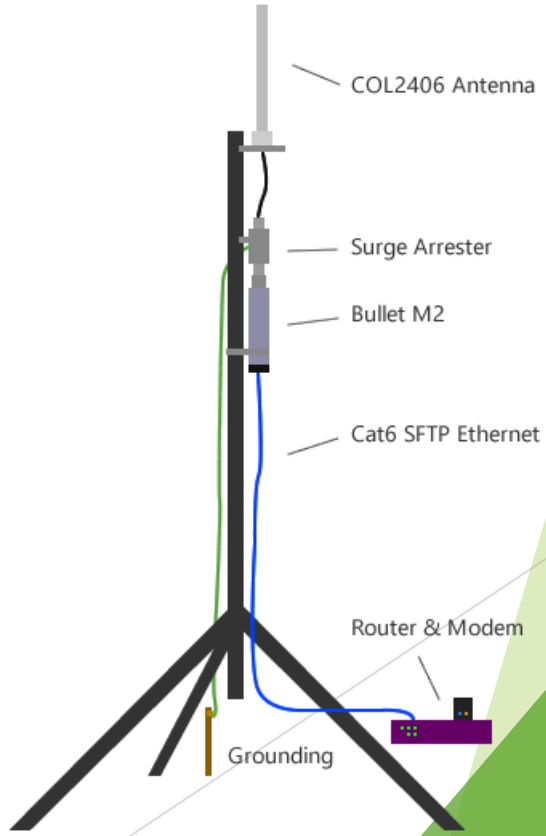
- We live in a digital world.
  - Cell phones and apps, tablets, web apps
  - PDFs, Excel Files, Word docs
  - E-mail, text messaging
  - Video feeds
  - VOIP telephone
  - WEB Hosting – reference data on MESH
- High speed data is the norm; not the exception.
- To be relevant EmComm must provide more than voice and slow speed data to our served agencies.
- Our role as communicators is to get the message (data) through in the most efficient method available to us.

MESH GEAR

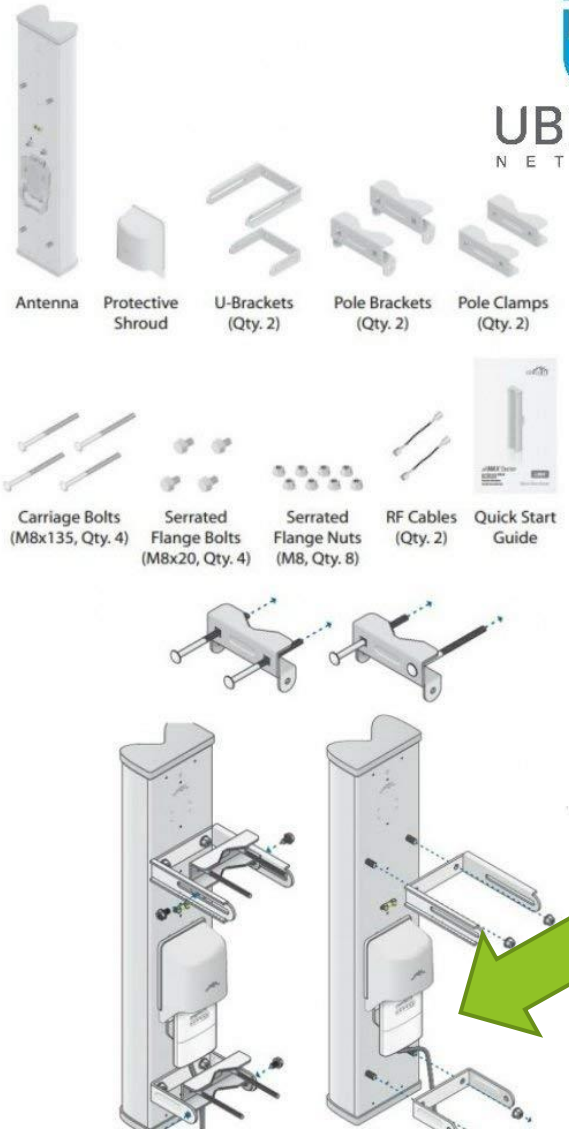
- Ubiquiti NanoStation M2 AirMax 2.4GHz CPE 150+ Mbps real outdoor throughput and up to 15km+ range. $77 on amazon. 5Ghz version $79.

MESH GEAR

- **Ubiquiti BulletM2-HP BM2HP 802.11n airMAX Integrated Radio 2.4GHz + (AU24G6-NF) 6dBi WiFi Omni Antenna. $90 on Amazon**



AirMax Sector Antennas Plus Rocket



Mikrotik hAP router

dual radio for MESH and WiFi access
VPN tunnels (MESH <> Internet
Cameras
IP Phones
USB Port
expanded memory
$50 amazon

airGateway

- Provides for WIFI access to your mesh network.
- Attaches to POE adapter.
- No Ethernet cable required between NODE and computer.

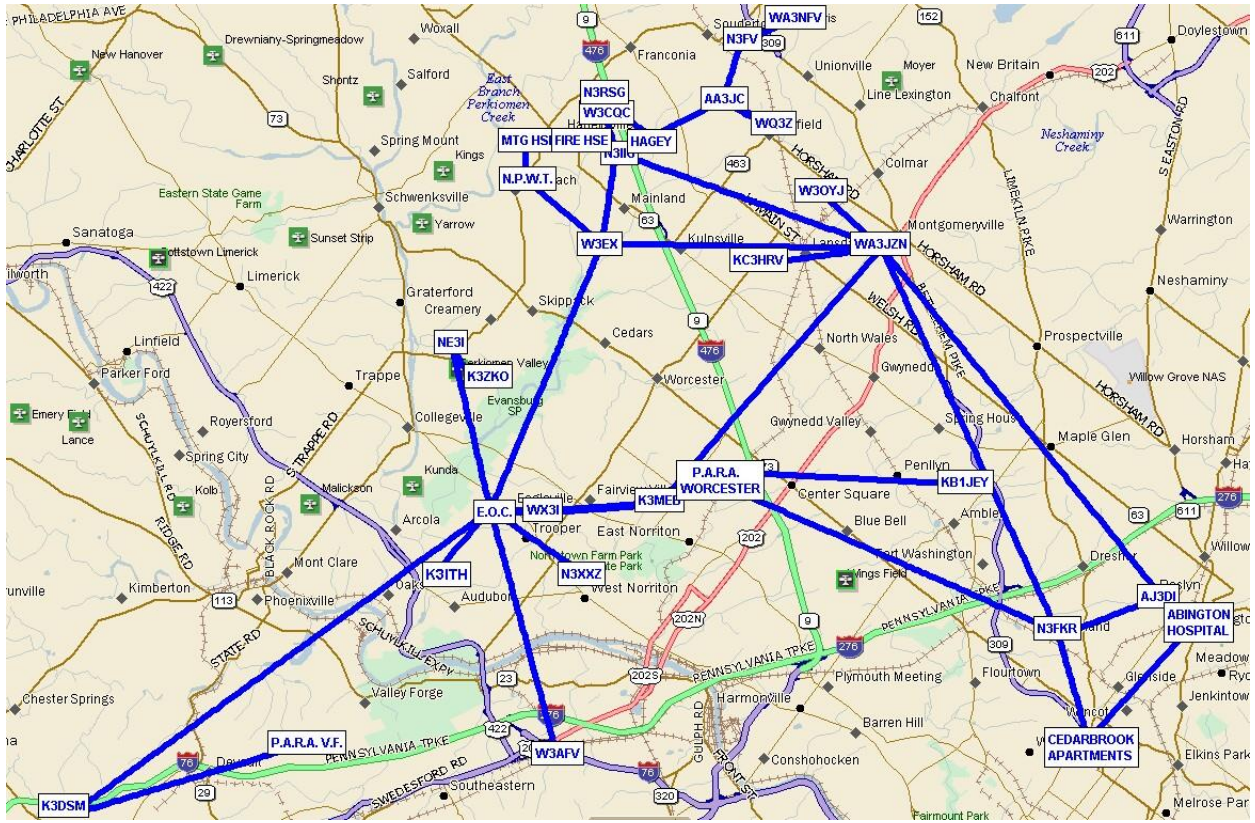
MODIFICATION OF THE MESH GEAR

- All equipment must be modified to work in the 13 cm ham band.
  - 2397 mhz (2.300 GHz – 2.450 GHz)
  - Flashing of EPROM using FTP
  - Same for 5 cm band
- Requires some computer and networking skills.
- MORE IS NOT BETTER.
  - Maximum power
  - But, set distance accurately.

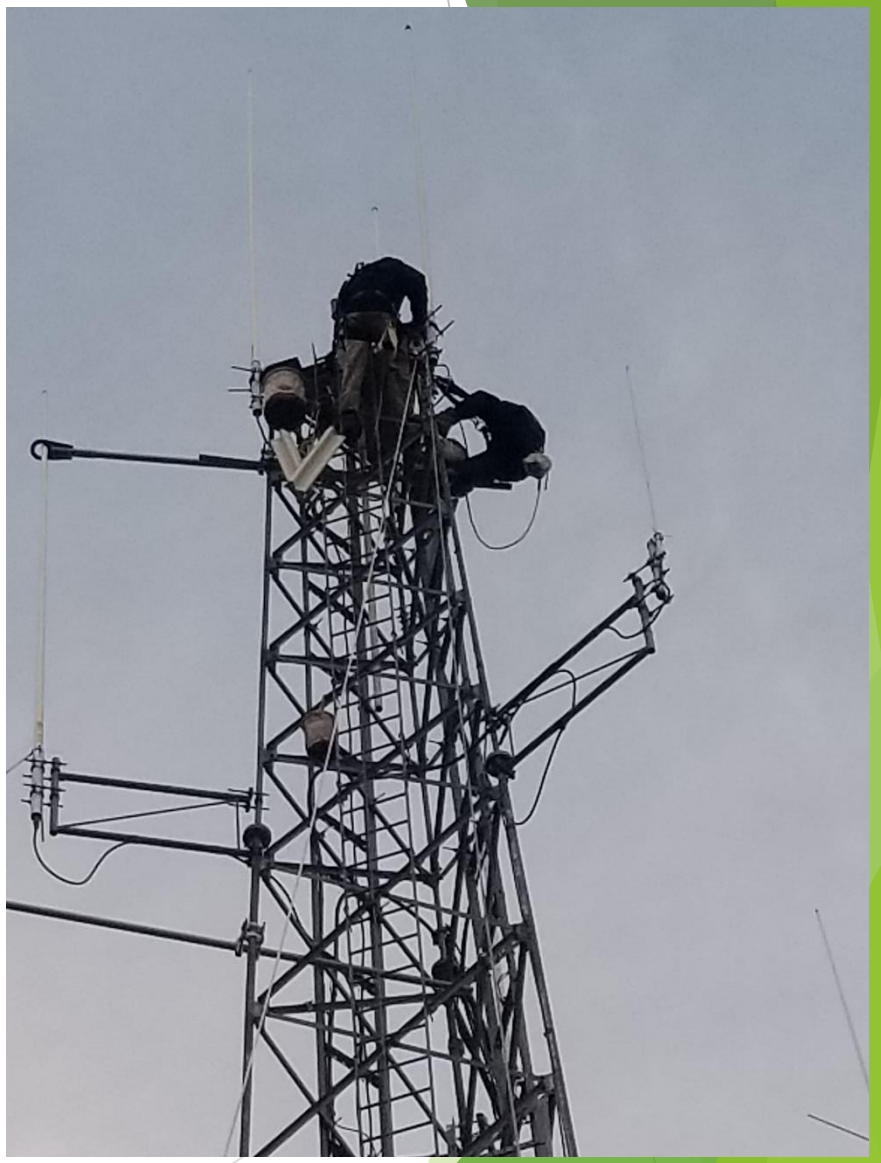
MCAR Eagleville EOC MESH SYSTEM

- Three directional nodes covering 120 degrees each
- One on each side of the 100 ft. tower.
- Expand throughout the county and beyond

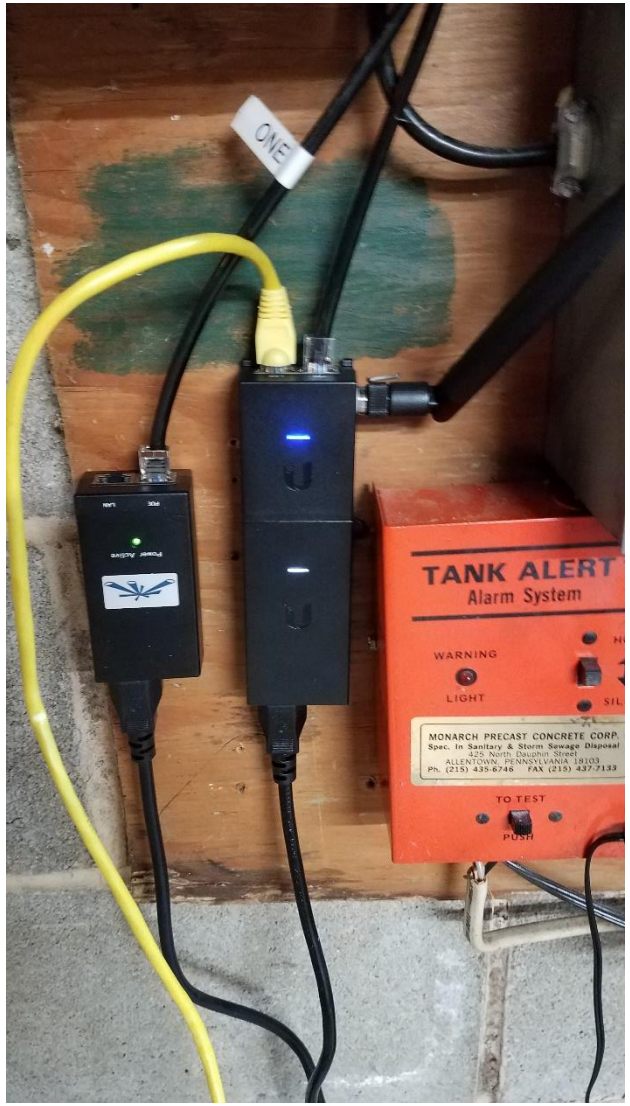
Current Nodes



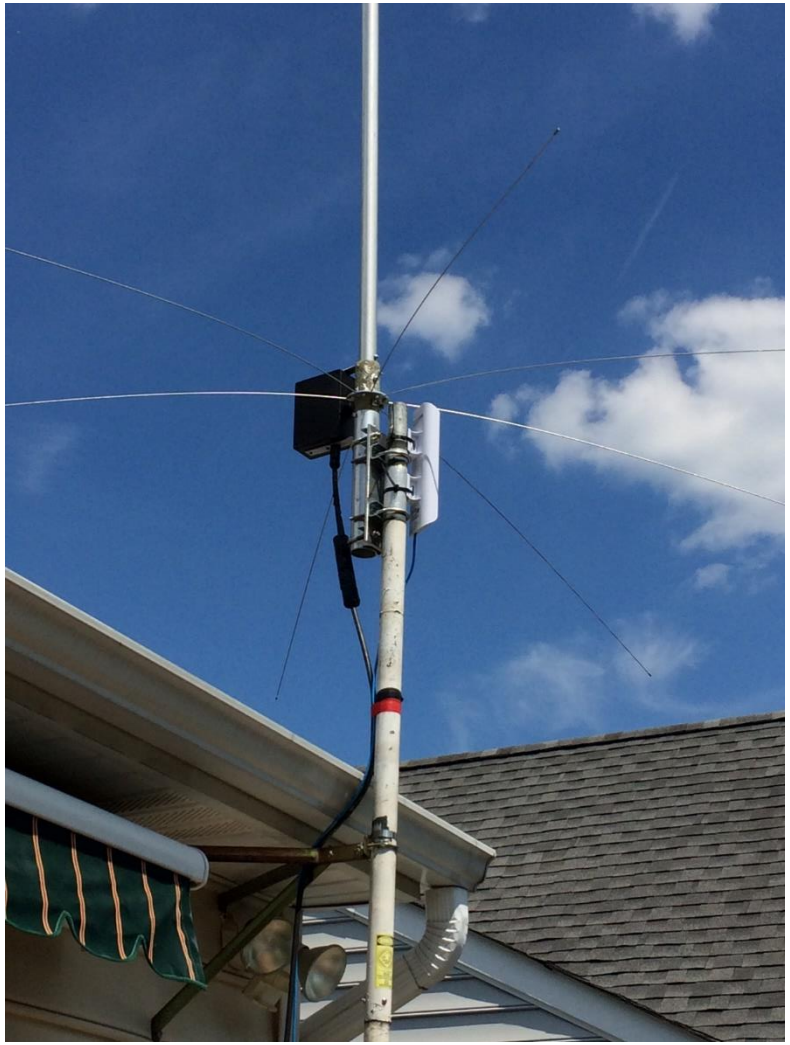
MONTCO ARES/RACES

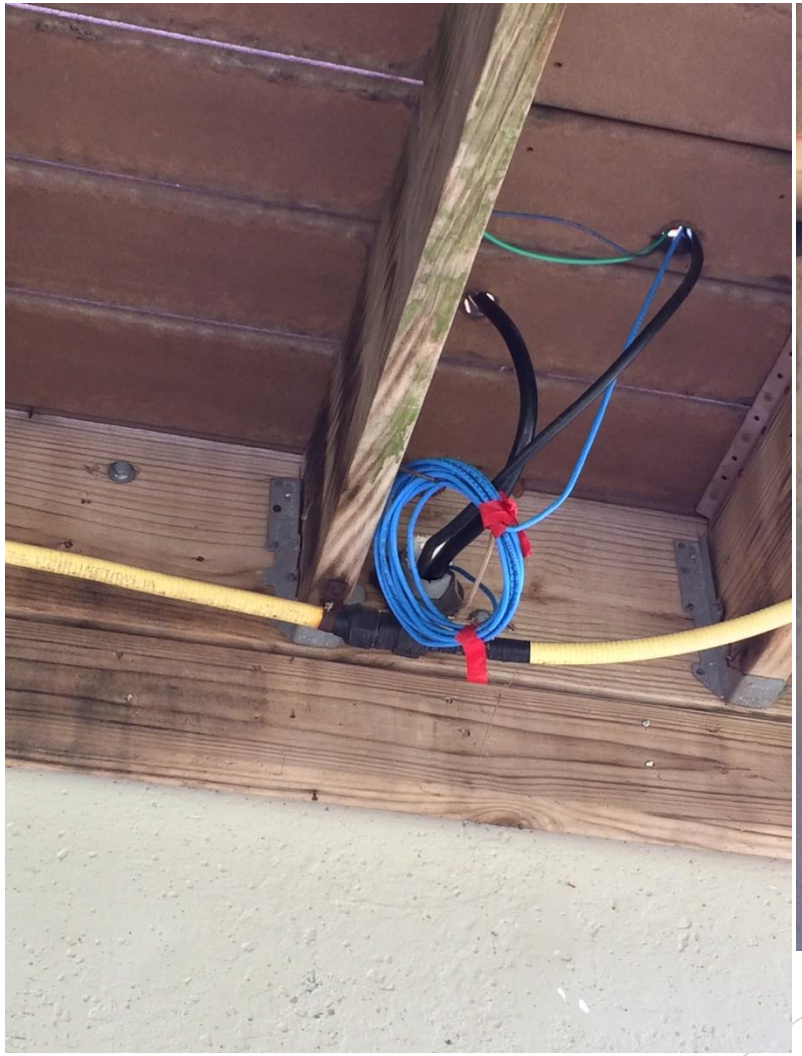


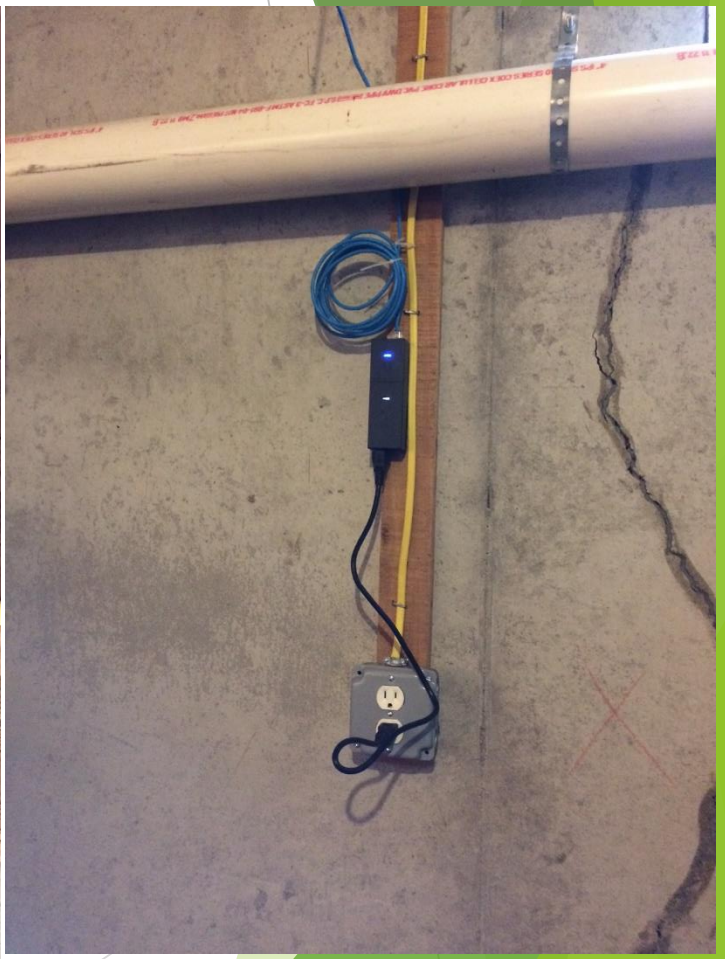
Typical Installations

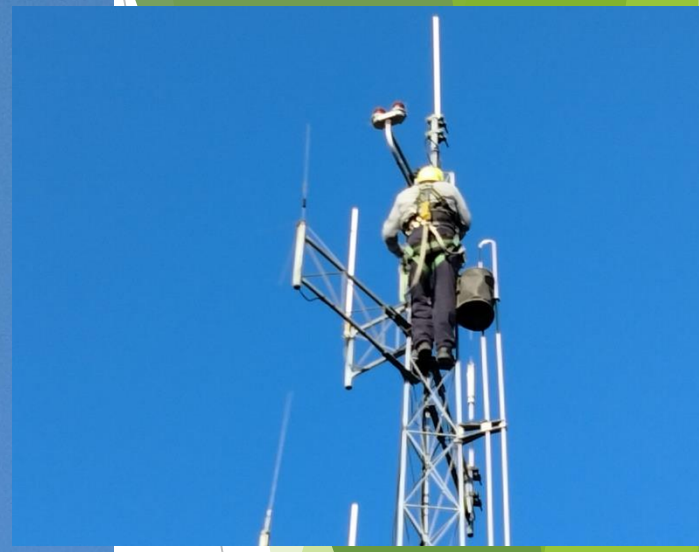


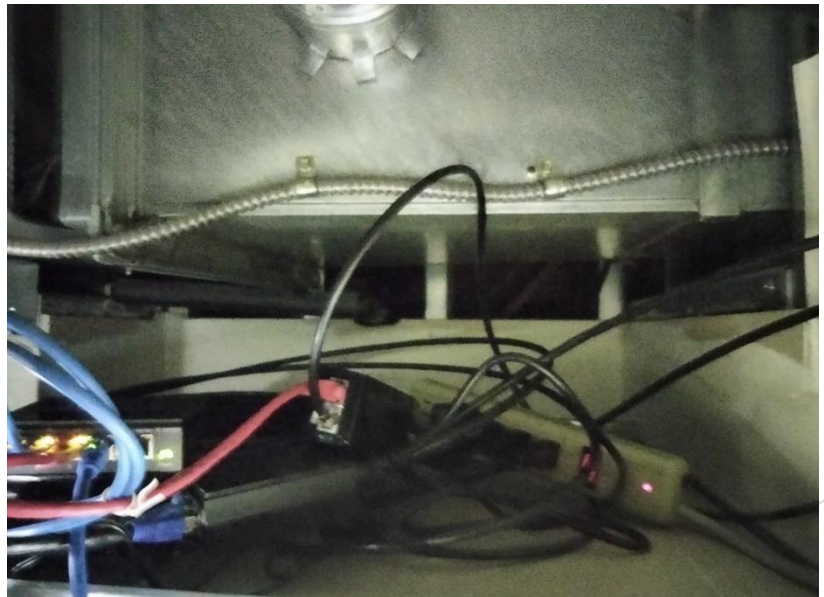
Typical Installations

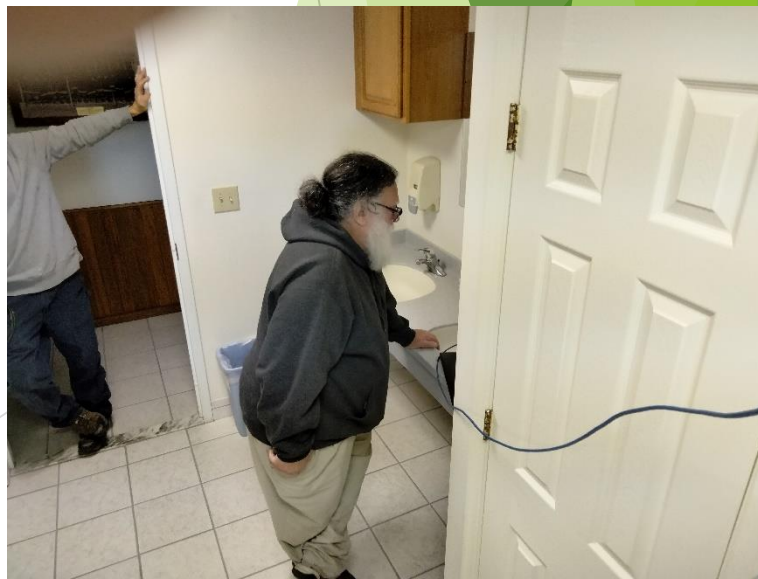








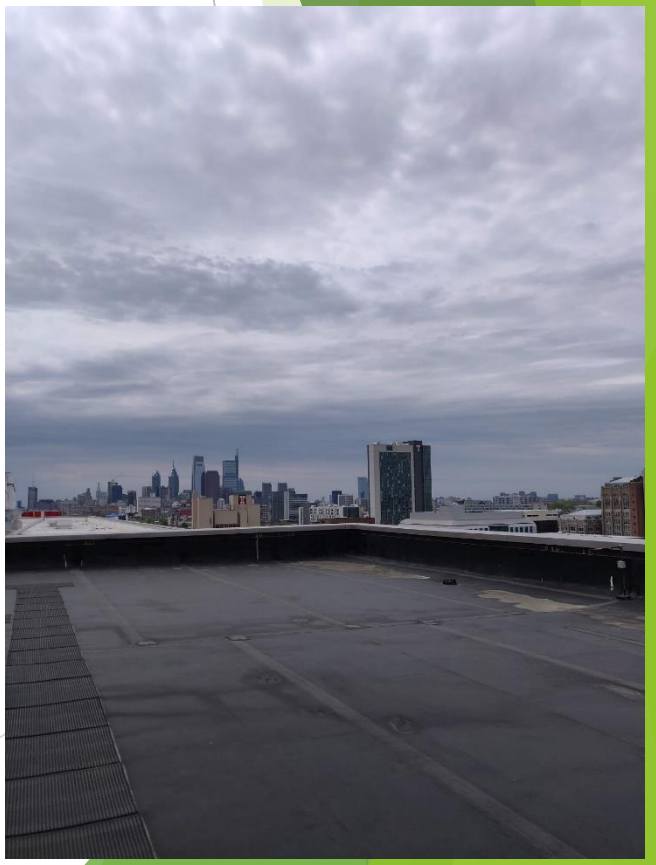




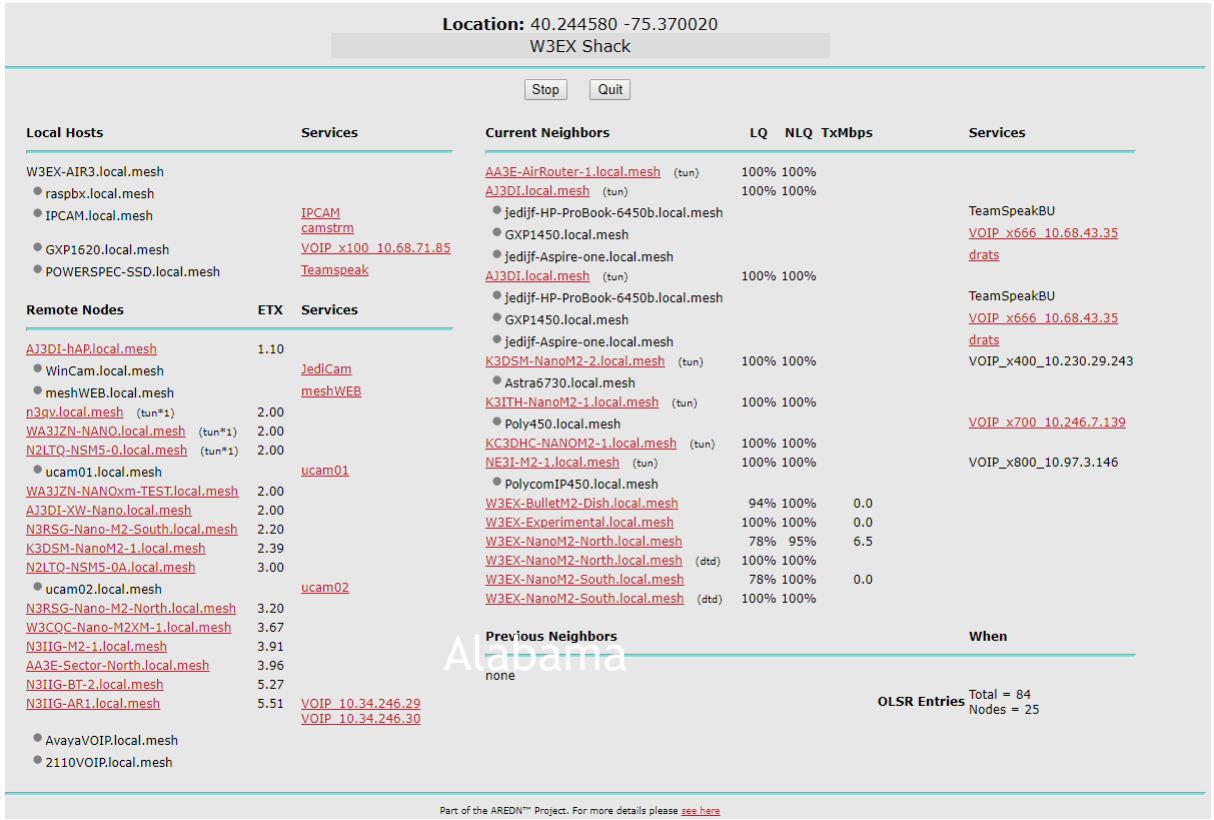
Future Installations

Lower Salford Township
Rt 113 and old Morris Rd.

Temple University Engineering Building



User Interface
All Browser Based



Location: 40.244580 -75.370020
W3EX Shack

Stop Quit

Local Hosts	Services
W3EX-AIR3.local.mesh	
• raspbx.local.mesh	
• IPCAM.local.mesh	IPCAM camstrm
• GXP1620.local.mesh	VOIP_x100_10.68.71.85
• POWERSPEC-SSD.local.mesh	Teamspeak

Remote Nodes	ETX	Services
AJ3DI-hAP.local.mesh	1.10	
• WinCam.local.mesh		JediCam
• meshWEB.local.mesh		meshWEB
n3gv.local.mesh (tun*1)	2.00	
WA3JZN-NANO.local.mesh (tun*1)	2.00	
N2LTQ-NSM5-0.local.mesh (tun*1)	2.00	
• ucam01.local.mesh		ucam01
WA3JZN-NANOxm-TEST.local.mesh	2.00	
AJ3DI-XW-Nano.local.mesh	2.00	
N3RSG-Nano-M2-South.local.mesh	2.20	
K3DSM-NanoM2-1.local.mesh	2.39	
N2LTQ-NSM5-0A.local.mesh	3.00	
• ucam02.local.mesh		ucam02
N3RSG-Nano-M2-North.local.mesh	3.20	
W3CQC-Nano-M2XM-1.local.mesh	3.67	
N3IIG-M2-1.local.mesh	3.91	
AA3E-Sector-North.local.mesh	3.96	
N3IIG-BT-2.local.mesh	5.27	
N3IIG-AR1.local.mesh	5.51	VOIP_10.34.246.29 VOIP_10.34.246.30
• AvayaVOIP.local.mesh		
• 2110VOIP.local.mesh		

Current Neighbors	LQ	NLQ	TxMbps	Services
AA3E-AirRouter-1.local.mesh (tun)	100%	100%		
AJ3DI.local.mesh (tun)	100%	100%		
• jedijf-HP-ProBook-6450b.local.mesh				TeamSpeakBU
• GXP1450.local.mesh				VOIP_x666_10.68.43.35
• jedijf-Aspire-one.local.mesh				drats
AJ3DI.local.mesh (tun)	100%	100%		
• jedijf-HP-ProBook-6450b.local.mesh				TeamSpeakBU
• GXP1450.local.mesh				VOIP_x666_10.68.43.35
• jedijf-Aspire-one.local.mesh				drats
K3DSM-NanoM2-2.local.mesh (tun)	100%	100%		VOIP_x400_10.230.29.243
• Astra6730.local.mesh				
K3ITH-NanoM2-1.local.mesh (tun)	100%	100%		
• Poly450.local.mesh				VOIP_x700_10.246.7.139
KC3DHC-NANOM2-1.local.mesh (tun)	100%	100%		
NE3I-M2-1.local.mesh (tun)	100%	100%		VOIP_x800_10.97.3.146
• PolycomIP450.local.mesh				
W3EX-BulletM2-Dish.local.mesh	94%	100%	0.0	
W3EX-Experimental.local.mesh	100%	100%	0.0	
W3EX-NanoM2-North.local.mesh	78%	95%	6.5	
W3EX-NanoM2-North.local.mesh (dtd)	100%	100%		
W3EX-NanoM2-South.local.mesh	78%	100%	0.0	
W3EX-NanoM2-South.local.mesh (dtd)	100%	100%		

Previous Neighbors	When
none	

OLSR Entries Total = 84
Nodes = 25

Part of the AREDN™ Project. For more details please see here

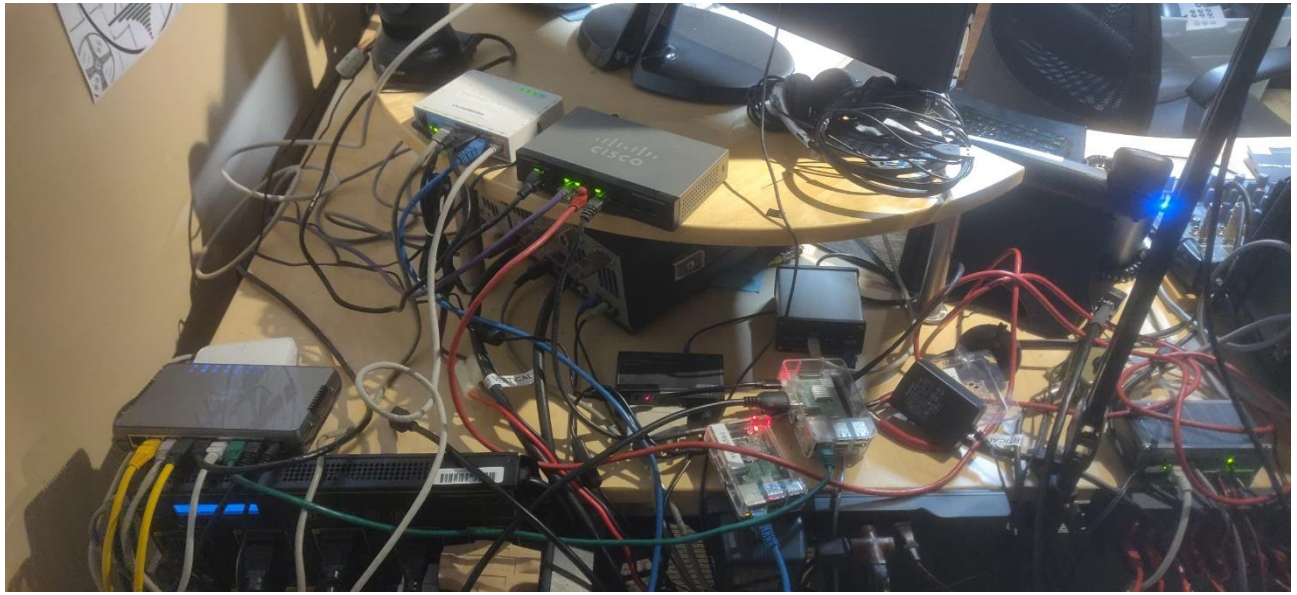
MESH NETWORK SERVICES

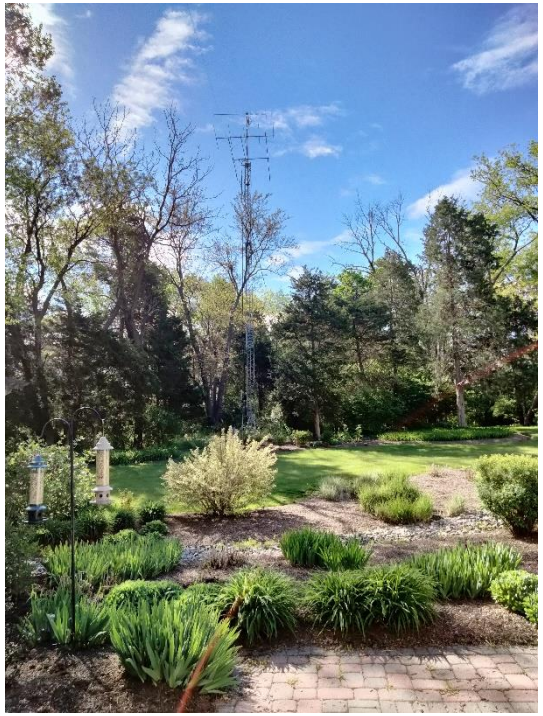
- EMAIL
- Text Messaging
- High Speed Data Transfer
- Video Camera Capability
- VOIP telephony
- Weather
- Printer
- WEB hosting
- Remote rig control
- Links To Other Counties, states and countries.

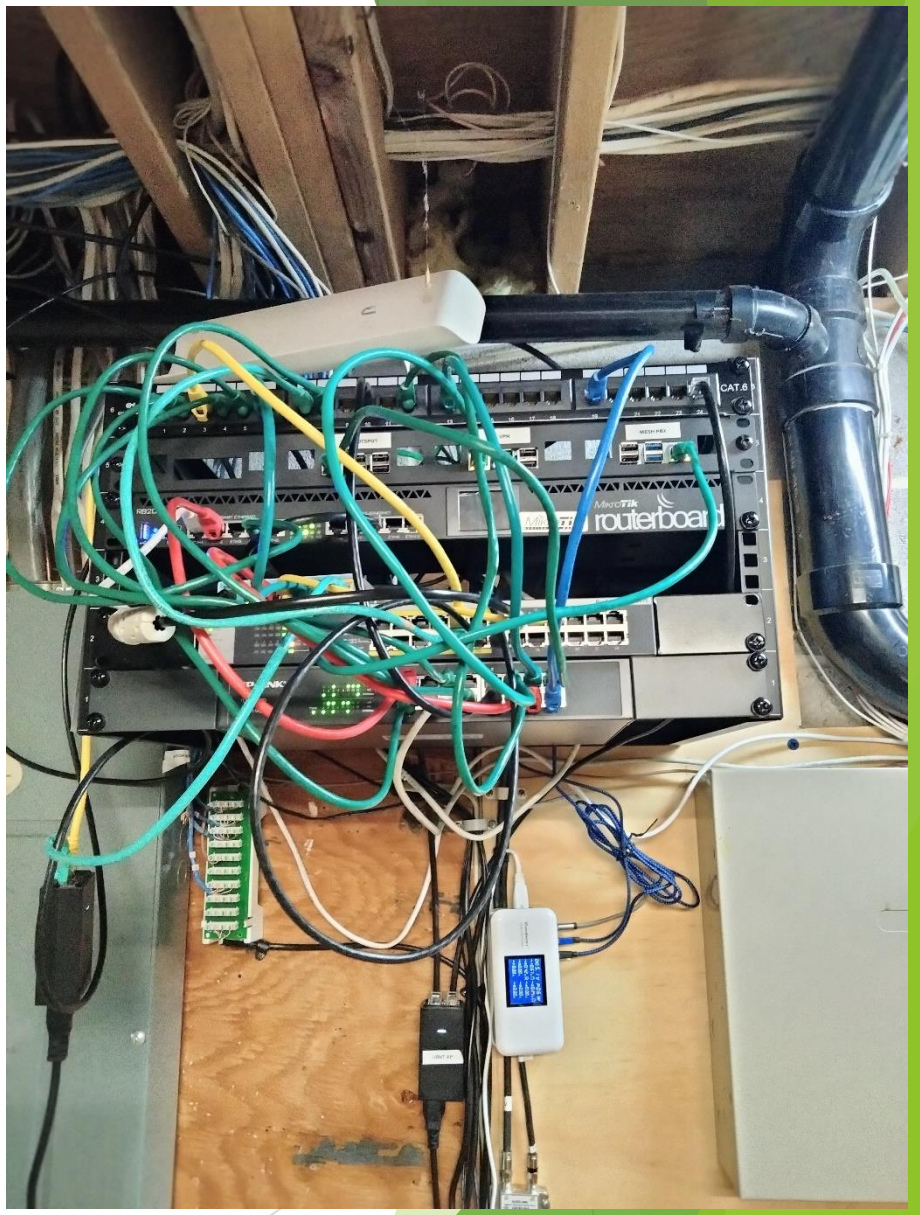
CURRENT SERVICES RUNNING

- D-rats
  - Messaging
  - Email
  - File transfer
- Teamspeak – raspberry PI
  - Peer to peer VOIP
- FreePBX – raspberry PI
  - Fully functional VOIP phone system with extension number, phonebook, music on hold, voicemail etc.
- Laser Printer
- Live Video – any IP camera

Services Hardware







SOURCES OF MESH TECH INFO

- https://www.arednmesh.org/
- BROADBAND – HAMNET
- https://www.ubnt.com/
- https://www.youtube.com/watch?v=hUeW2ju-RZk
- http://www.hotarc.org/mesh/
- Join our groups.io reflector

Subscribe to our groups.io reflector.

MCARMESH+subscribe@groups.io

OUT MOTO

NODES UP!

Thanks to:

- Amateur Radio Emergency Network (AREDN)
- Philadelphia Digital Repeater Association
- Pottstown Area Amateur Radio Club
- Jim Fisher AJ3DI from PDRA
- Dr. Dennis Silage K3DS and Temple University
- Jim Linden N3IIG
- Dr. Tom Paparelli KB3HOV
- Ron Cohen K3ZKO
- Dr. Tom Riethof W3CQC
- Marten Beels K3HUW
- Dick Stewart K3ITH
- Montgomery County $$$