

# AREDN

Amateur Radio Emergency Data Network  
[arednmesh.org](http://arednmesh.org)

What is it?  
How Do I Get  
Started?

Tamiami Amateur Radio Club  
March 9, 2022  
KN4BAR, Paul

# What is AREDN



high-speed ad hoc digital data network

for emergency and service oriented communications

- Data, VoIP, streaming video
- An RF Internet !

- 2.4 GHz – 2 ham channels
- ~~3.5 GHz – 24 ham channels.~~  
FCC ordered sunset on 10-8-20
- 5.8-5.9 GHz – FCC has proposed reduction in number of ham channels
- TCP/IP packet network at Mbps speeds!
- **Uses off-the-shelf commercial wifi equipment with AREDN flashed firmware**

# Part 15 vs. Part 97

## AREDN Offers 2 Non-Shared Channels on 2.4 GHz

2.4 GHz	Channel	-2	-1	0*	1	2	3	4	5	6
	Status	Ham Band			Shared Ham and ISM/WiFi Band					
	Freq	2.397	2.402	2.407	2.412	2.417	2.422	2.427	2.432	2.437

\*Not available for use

## 24 Non-Shared Channels on 3.4 GHz

3.4 GHz	Channel	76	77	78	79	80	81	82	83	84	85	86	87
	Status	Ham Band											
	Freq	3.380	3.385	3.390	3.395	3.400	3.405	3.410	3.415	3.420	3.425	3.430	3.435
		88	89	90	91	92	93	94	95	96	97	98	99
		Ham Band											
		3.440	3.445	3.450	3.455	3.460	3.465	3.470	3.475	3.480	3.485	3.490	3.495

Refer to your local band plan for coordination

## 54 Channels, 14 unshared on 5.8 GHz

5.8 GHz	Channel	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148
	Sharing	Ham Band shared with U-NII-2C/wifi/unlicensed															U-NII-3/wifi/unlicensed		
	Freq	5.655	5.660	5.665	5.670	5.675	5.680	5.685	5.690	5.695	5.700	5.705	5.710	5.715	5.720	5.725	5.730	5.735	5.740
		149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166
		Ham Band shared with U-NII-3/wifi/unlicensed																	
		5.745	5.750	5.755	5.760	5.765	5.770	5.775	5.780	5.785	5.790	5.795	5.800	5.805	5.810	5.815	5.820	5.825	5.830
		167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184
		Ham Band																	
		5.835	5.840	5.845	5.850	5.855	5.860	5.865	5.870	5.875	5.880	5.885	5.890	5.895	5.900	5.905	5.910	5.915	5.920

Refer to your local band plan for coordination

# arednmesh.org

🏠 AREDN Documentation

latest

Search docs

## GETTING STARTED GUIDE

[AREDN® Overview](#)

[Selecting Radio Hardware](#)

[Downloading AREDN® Firmware](#)

[Installing AREDN® Firmware](#)

[Basic Radio Setup](#)

[Node Status Display](#)

[Mesh Status Display](#)

[Configuration Deep Dive](#)

## NETWORK DESIGN GUIDE

[Networking Overview](#)

[Network Topologies](#)

[Radio Spectrum Characteristics](#)

📖 Read the Docs

v: latest ▾

Docs » AREDN® Documentation

[🔗 Edit on GitHub](#)

[Link: AREDN Webpage](#)

## AREDN® Documentation

Release

3.22.1.0




This documentation set consists of several sections which are shown in the navigation list.

The **Getting Started Guide** walks through the process of configuring an AREDN® radio node to be part of a mesh network.

The **Network Design Guide** provides background information and tips for planning and deploying a robust mesh network.

The **Applications and Services Guide** discusses the types of programs or services

# arednmesh.org



Amateur Radio Emergency Data Network

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## Current Software

Like AREDN firmware? Please consider a one-time or [recurring donation](#) to help with our ongoing operating costs.

NOTE:

1. You may notice that the new AREDN download page has firmware for two targets/architectures (ar71xx and ath79). **You should select the latest image based on the type of hardware (and the recommended target) on which it is to be installed.**
2. **IMPORTANT:** Refer to the list of Known Issues in the release notes.

The current AREDN software is available here

[DOWNLOAD](#) 

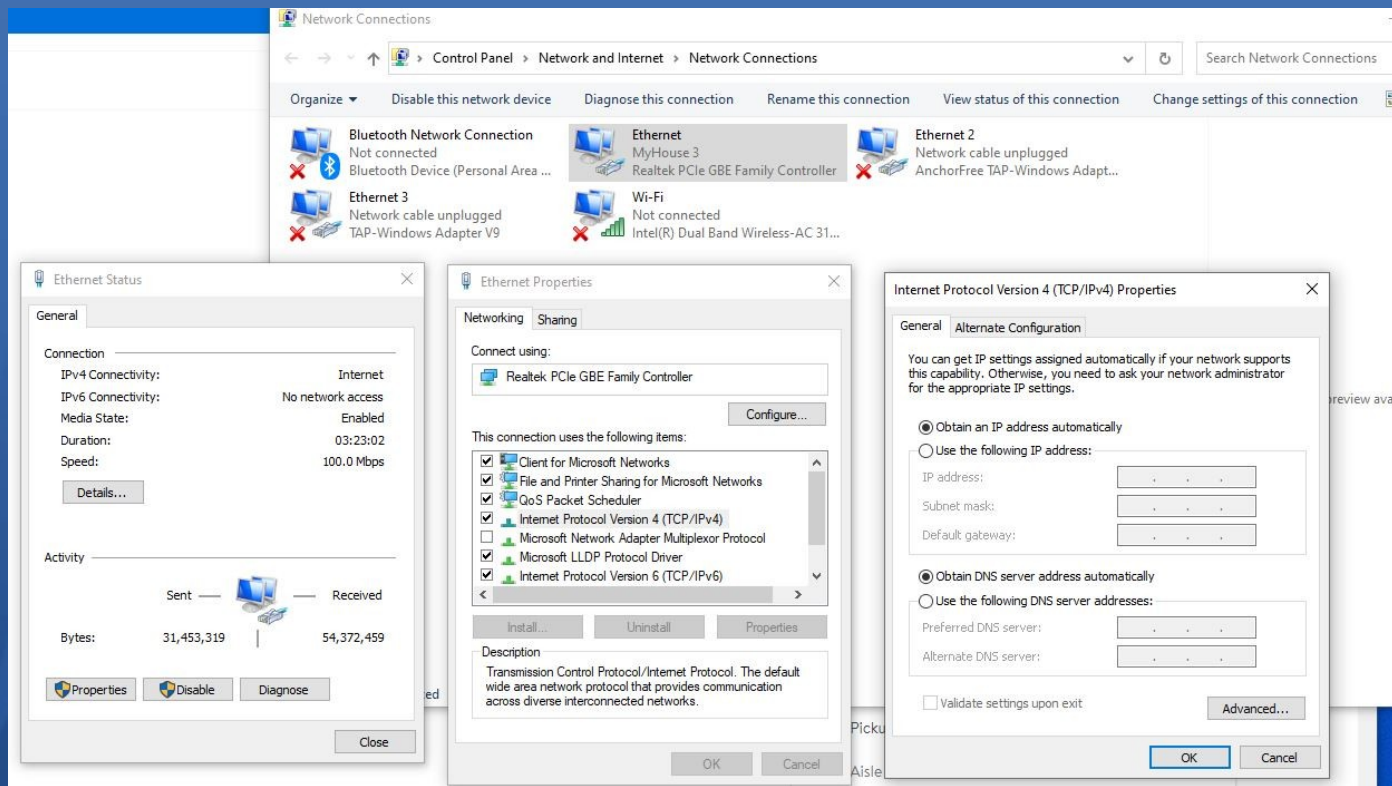
Installation Instructions



# arednmesh.org

Bullet M2 (XW) Bullet M5 (XW)	<a href="#">factory</a> File: aredn-3.22.1.0-ath79-generic-ubnt_bullet-m-xw-squashfs-factory.bin md5sum: 90530e6cb24bac372dbf75e72e9e7d51 <hr/> Size: 6.2M	<a href="#">sysupgrade</a> File: aredn-3.22.1.0-ath79-generic-ubnt_bullet-m-xw-squashfs-sysupgrade.bin md5sum: 765ba9f406037731204b61423b167953 <hr/> Size: 6.2M
NanoStation M2 (XM) NanoStation M3 (XM) NanoStation M5 (XM)	<a href="#">factory</a> File: aredn-3.22.1.0-ath79-generic-ubnt_nanostation-m-squashfs-factory.bin md5sum: bf97fdb83260b452ce54b2c667ca0c16 <hr/> Size: 6.2M	<a href="#">sysupgrade</a> File: aredn-3.22.1.0-ath79-generic-ubnt_nanostation-m-squashfs-sysupgrade.bin md5sum: 75cbf2b0c92f122ac4ad849704dbb6a4 <hr/> Size: 6.2M
NanoStation M2 (XW) NanoStation M5 (XW)	<a href="#">factory</a> File: aredn-3.22.1.0-ath79-generic-ubnt_nanostation-m-xw-squashfs-factory.bin md5sum: 4979fd456fbd44315e9cf4baadd07ed5 <hr/> Size: 6.2M	<a href="#">sysupgrade</a> File: aredn-3.22.1.0-ath79-generic-ubnt_nanostation-m-xw-squashfs-sysupgrade.bin md5sum: af9bfd5b22b8dd53ca227f50e2d90cc3 <hr/> Size: 6.2M
Rocket M2 (XM) Rocket M3 (XM) Rocket M5 (XM) Rocket M9 (XM) Rocket M5GPS (XM)	<a href="#">factory</a> File: aredn-3.22.1.0-ath79-generic-ubnt_rocket-m-squashfs-factory.bin md5sum: af557e752d5d0c0f24935e172b879bc5 <hr/> Size: 6.2M	<a href="#">sysupgrade</a> File: aredn-3.22.1.0-ath79-generic-ubnt_rocket-m-squashfs-sysupgrade.bin md5sum: ea9eec504dd4a8507df0dfd3c32a4ee <hr/> Size: 6.2M

# Get IP Address from Node



AREDN Mesh Network

10.xxx.xxx.xxx VPN

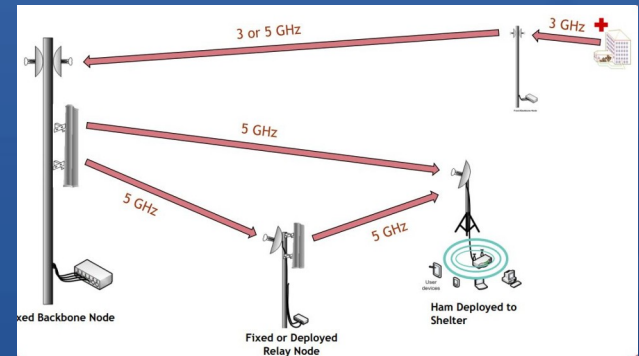
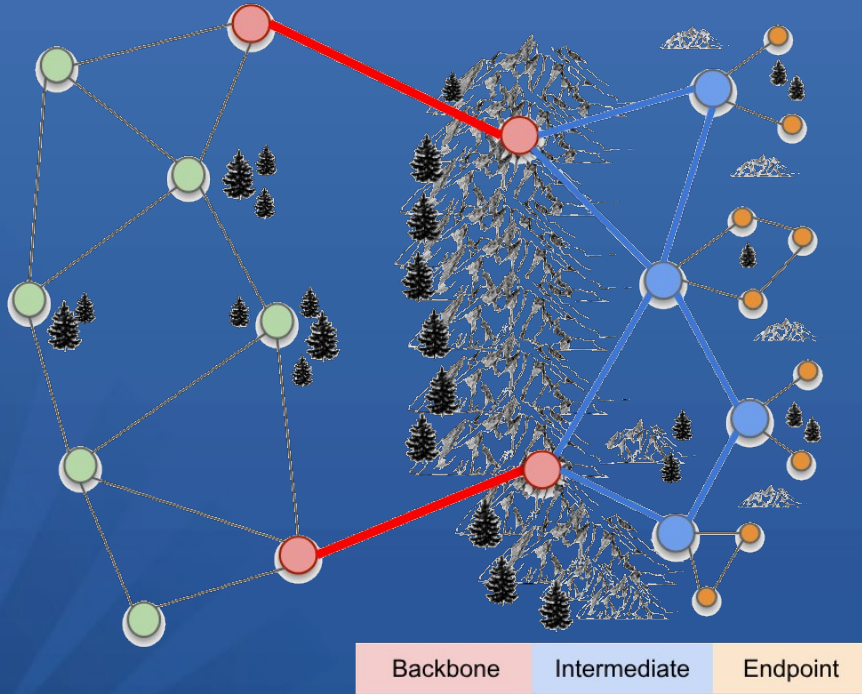
Firmware gives unique IP address to each device. AREDN has its own DNS for routing mesh traffic.

Mesh network is separate from home LAN and WAN

# Mesh Topology

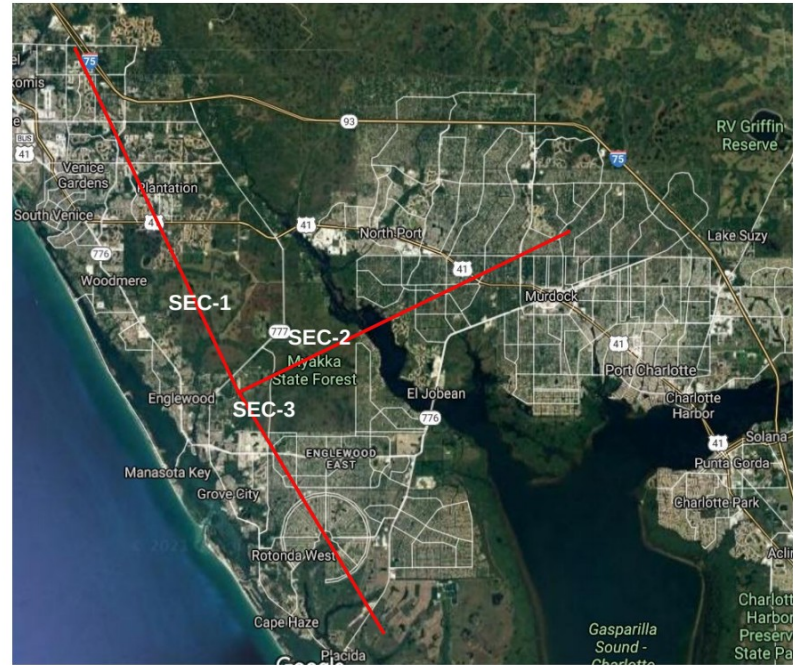
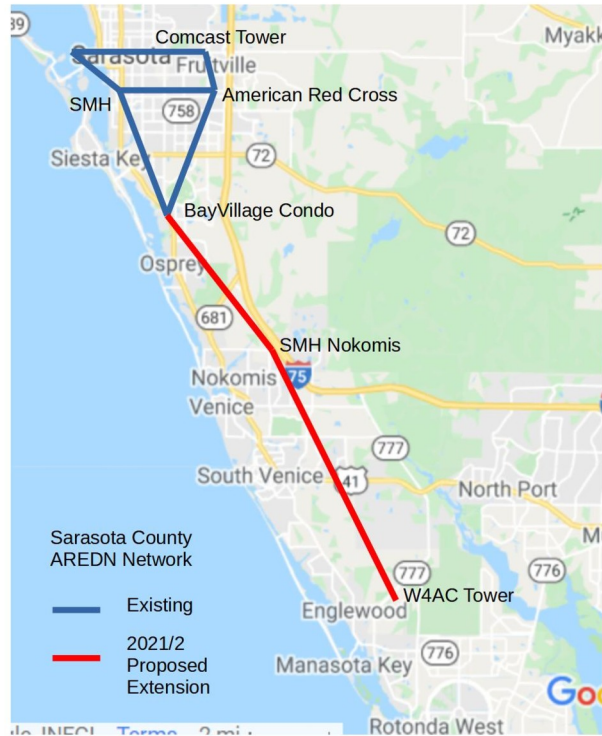
## Typical Intermediate Node

- Dish to backbone
- Omni local AP

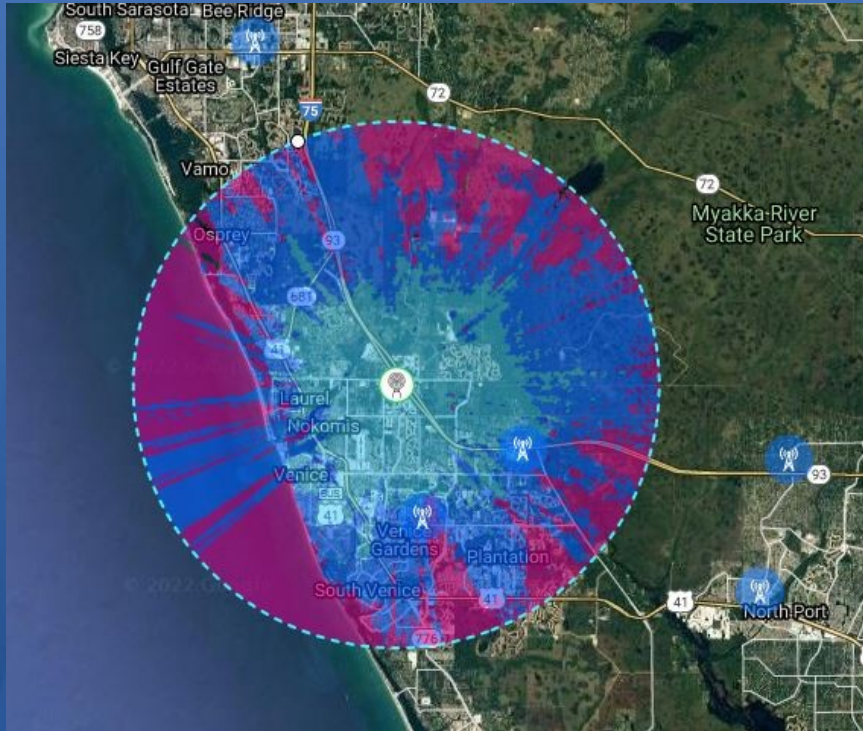




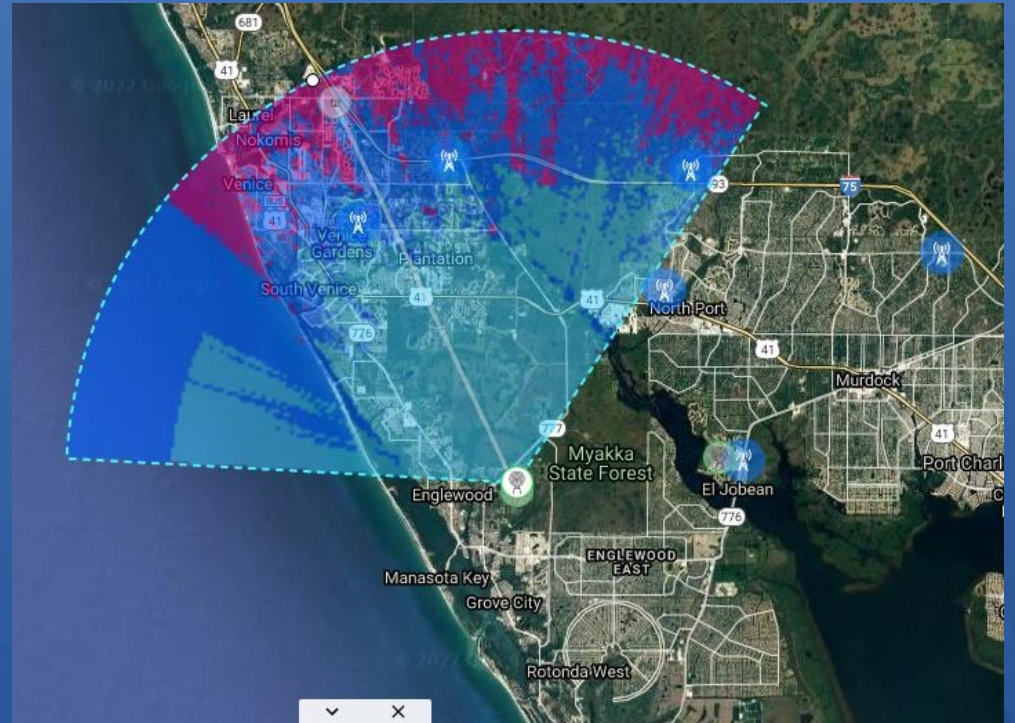
# Sarasota Mesh Topology



# 2.4 GHz Coverage



W4IE-SMHV-Omni Node



W4AC-Sec1 Node



<https://link.ui.com>

**airLink** Try ISP Design Center Feedback Log out

W4AC to KN4BAR Save

Search address, place or coordinates

Strong Weak

**KN4BAR-PB** 60% 44 Mbps 5.8 mi 44 Mbps 60%

PowerBeam 2AC  
27.045399, -82.341406  
Installation Height 19.7 ft  
Output Power 27 dBm  
Channel Width 10 MHz  
Heading / Tilt 167°/0.26°  
18 dBi

Symmetrical link -73 dBm  
1X 2X 4X 6X 8X

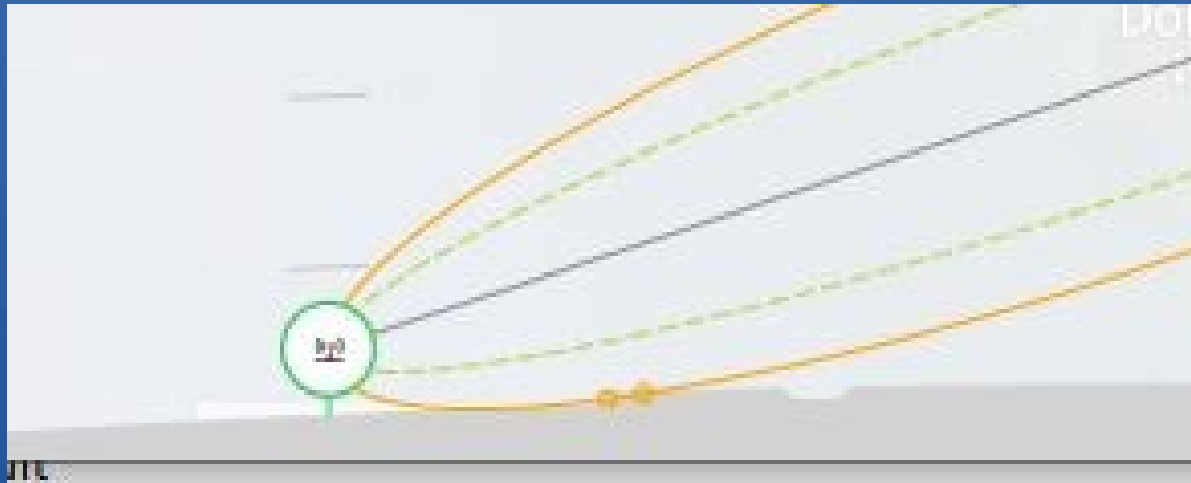
**W4AC-Sec1** 60%

Rocket 2AC Prism  
26.963725, -82.319798  
Installation Height 183.7 ft  
Output Power 27 dBm  
Channel Width 10 MHz  
Heading / Tilt 347°/-0.35°  
15 dBi 16 dBi 24 dBi 13 dBi

Google

## Fresnel Zone

The Fresnel zone is defined as the subsurface area which reflects energy that arrives at the earth's surface within a time delay equal to half the dominant period ( $T/2$ ).



# Line of Sight

## Line of Sight

*“Microwaves can  
go 15 miles or  
through one tree”*

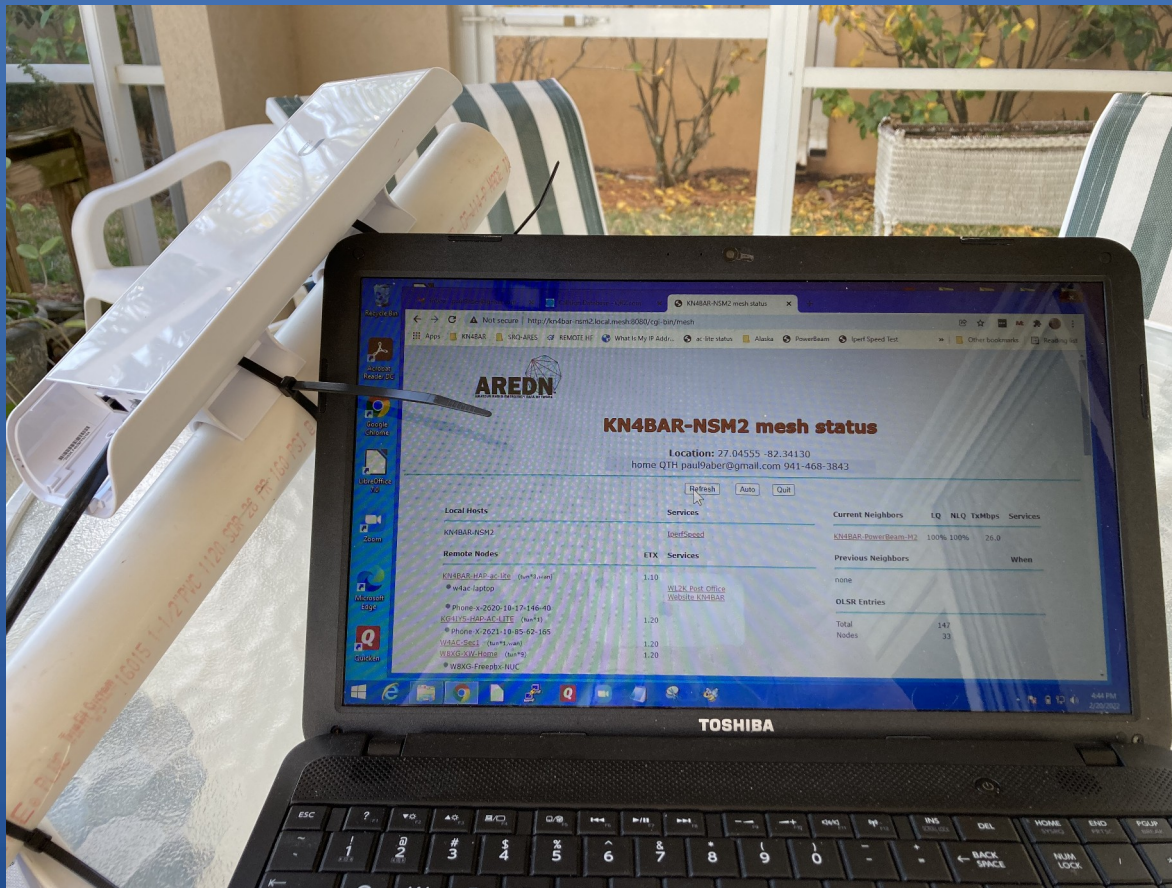


Two's  
Company

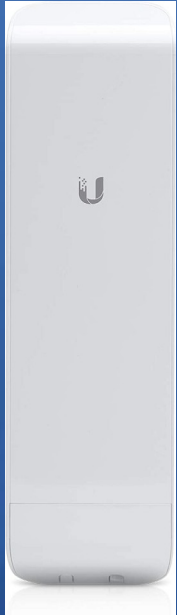
Trees a  
Crowd



# Basic AREDN Node



# Home QTH Station



Ubiquiti NanoStation M2 -  
Wireless Access Point - AirMax  
(NSM2US), White  
Brand: Ubiquiti Networks  
4.6 out of 5 stars 560 ratings |  
189 answered questions  
Price: \$89.90 &  
Brand Ubiquiti Networks  
Color White  
Maximum Range 15000 Meters



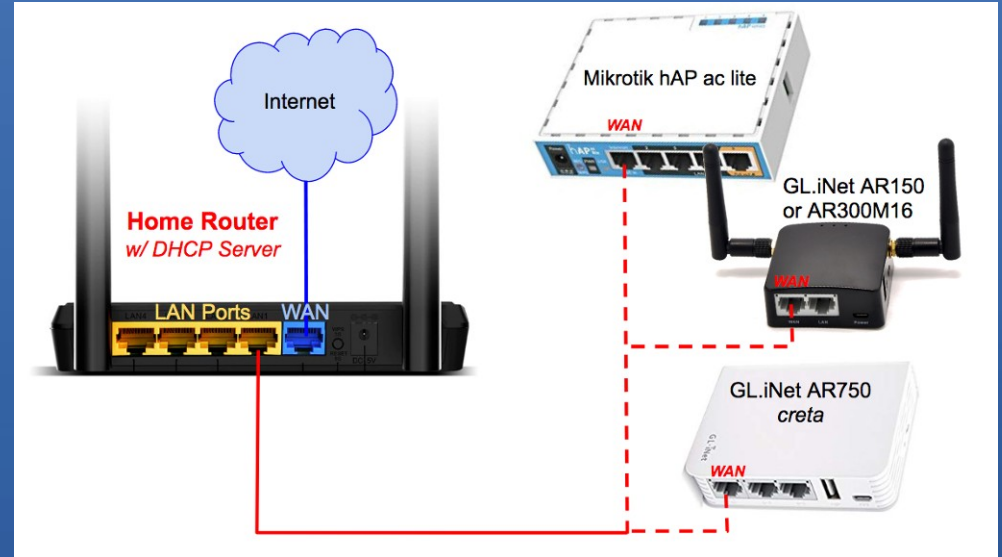
Cat6 Ethernet Patch  
Cable, RJ45 Network  
Internet Stranded Cord,  
50', Black  
\$12.97

Cable Length:50 ft

# Home QTH Station



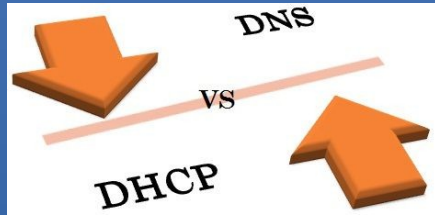
Ubiquity NanoStation  
2.4 GHz - <\$100



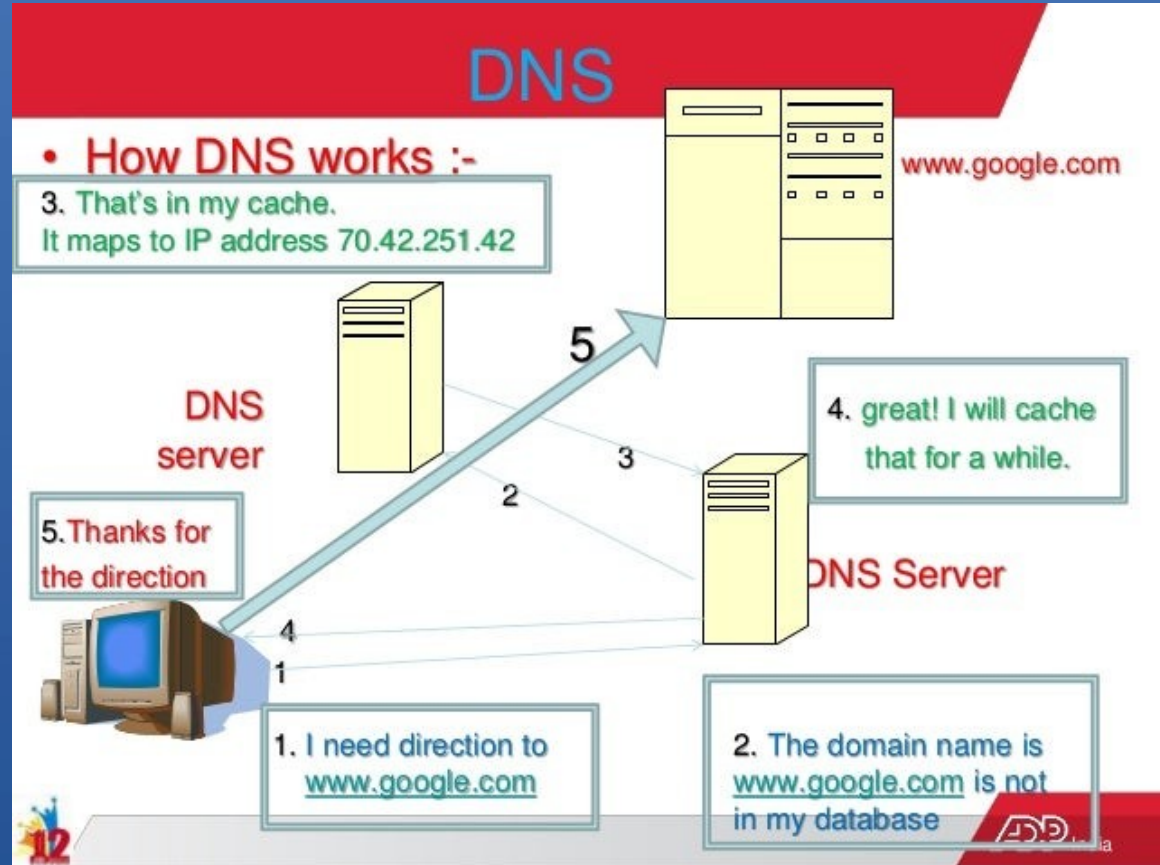
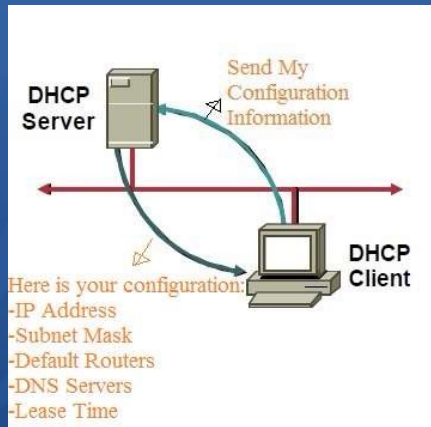
Add AREDN Router/Smart Switch  
and expand to digital phone,  
streaming video, etc. etc.

# DNS vs DHCP

## Domain Name Server



## Dynamic Host Configuration Protocol





# Node Status Screen



## KN4BAR-HAP-ac-lite

**Location:** 27.04555 -82.34130

Microtik HAp ac lite RouterBoard Paul KN4BAR, 941-468-3843 paul9aber@gmail.com

[Help](#)

Refresh

Mesh Status

WiFi Scan

Setup

Select a theme ▾

**Wifi address** 10.225.25.34 / 8  
**LAN address** 10.17.146.33 / 28  
**WAN address** 10.0.0.187 / 24  
**default gateway** 10.0.0.1  
**SSID** AREDN-5-v3  
**Channel** -2  
**Bandwidth** 5 MHz

**Signal/Noise/Ratio** N/A

[Charts](#)

**firmware version** 3.22.1.0

**system time** Sat Feb 19 2022  
10:27:03 EST

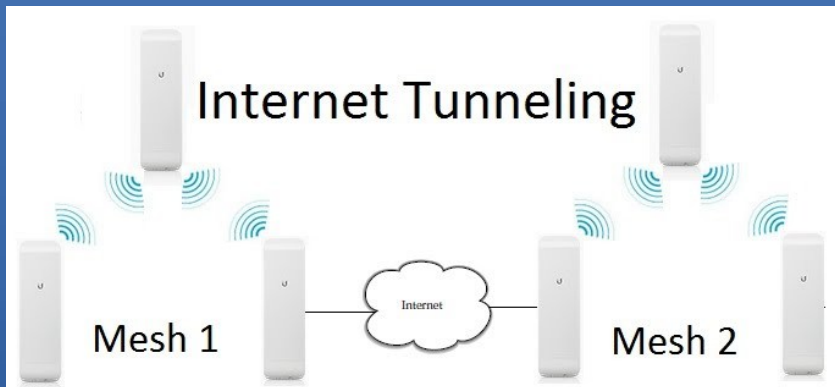
**uptime** 6 days, 30 min  
**load average** 0.16, 0.11, 0.09

**free space** flash = 8640 KB  
/tmp = 29884 KB  
memory = 37728 KB

**OLSR Entries** Total = 144  
Nodes = 33



# Internet Tunneling



## KN4BAR-HAP-ac-lite mesh status

Location: 27.04555 -82.34130

Microtik HAP ac lite RouterBoard Paul KN4BAR, 941-468-3843  
paul9aber@gmail.com

Refresh Auto Quit

Local Hosts	Services	Current Neighbors	LQ	NLQ	TxMbps	Services
KN4BAR-HAP-ac-lite		<a href="#">KG4IYS-HAP-AC-LITE</a> (tun)	100%	100%		
● Phone-x-2620-10-17-146-40		● Phone-X-2621-10-85-62-165				
		<a href="#">KN4BAR-NSM2</a> (dts)	100%	100%		
		<a href="#">W8XG-XW-Home</a> (tun)	100%	100%		
		● W8XG-Freepbx-NUC				
Remote Nodes	ETX	Services				
<a href="#">W8XG-GGP-NSM2-E60</a> (wan)	1.10					
● W8XG-Ebay64bitM64Sept18						
● W8XG-Phone-941-2655-10-163-137-135-Main-Home						
● W8XG-freepbx						
● W8XG-BP-Surface						
<a href="#">W8XG-ROCKET-TUNNEL</a> (tun*7,wan)	2.00					
<a href="#">WB9AYD-NSM2-1</a> (tun*2)	2.00					
● RC710-Remoterig						
● WB9AYD-Phone-2680-10-208-20-202						
<a href="#">W8XG-PHOENIX-SMH-LINK</a>	2.00					
<a href="#">W2DEN-NOKOMIS-M2-N</a> (tun*2)	2.00					
● W2DEN-Phone-Home-2260-10-209-196-12						
● W2DEN-PI-WX		<a href="#">WX-Nekomis_FL</a>				
● W2DEN-Computer		<a href="#">NOAA_POES</a>				
<a href="#">W8XG-Office-XW</a> (tun*3)	2.00					
Previous Neighbors	none					
OLSR Entries						
Total Nodes			106			
			21			

[Node Status](#)

[Basic Setup](#)

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

[Tunnel  
Server](#)

[Tunnel  
Client](#)

[Administration](#)

Tunnel software needs to be installed.

[Click to install](#)

Tunnel when node to node RF is not possible. Requires working Internet.

# AREDN Services

- PBX for VoiP Phones
- Weather Stations
- WebSite Server
- WinLink Gateway and Post Office
- FTP Server
- Keyboard Chat
- Voice/Video Chat
- Streaming Video
- Anything that runs on TCP/IP network!

# Questions ?

73, KN4BAR - Paul