South County ARES

Bay Area Mesh

Agenda

- History of Mesh Networking at SCARES

- What is a Mesh Network

  - Wifi on steriods
  - Uses least "cost" routing
  - Self-healing

- Plugging in and Connecting Your Mesh Node

- San Francisco Wireless Emergency Mesh / Bay Area Mesh

- Installing Nodes on Kings Mountain

- Setting Up Your Mesh Node

- Services on the Mesh

  - Mesh Map

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History of SCARES Mesh

- SCARES was an early adopter of mesh networking (back when it was still called Broadband Hamnet)

- Built out a "Proof of Concept" 2.4ghz mesh network

- At the peak we had a dozen or more nodes throughout San Mateo county

- New tall buildings going up and members moving out of the area added new challenges

- Began working with the SFWEM / BAM organization in 2020

- Wrote a grant proposal to acquire new mesh equipment for SCARES members and our served agencies

- Moved from 2.4ghz to 5ghz nodes

- Worked with the Kings Mountain Radio Club to install mesh nodes on their radio tower

- Began deploying 5ghz mesh nodes and equipment to our members and served agencies

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What is the AREDN Mesh Network

- Amateur Radio Emergency Data Network

- TCP / IP based network

- Uses off the shelf networking equipment

- AREDN uses the open source OpenWRT software as a base

- Each Mesh Node (e.g. Ubiquiti Nanostation, MicroTik hAP, etc) is a self-contained single-board computer that runs the AREDN software

- The AREDN software is composed of three layers:
  - Linux – Base Operating System
  - OpenWRT – Open source project for network routers
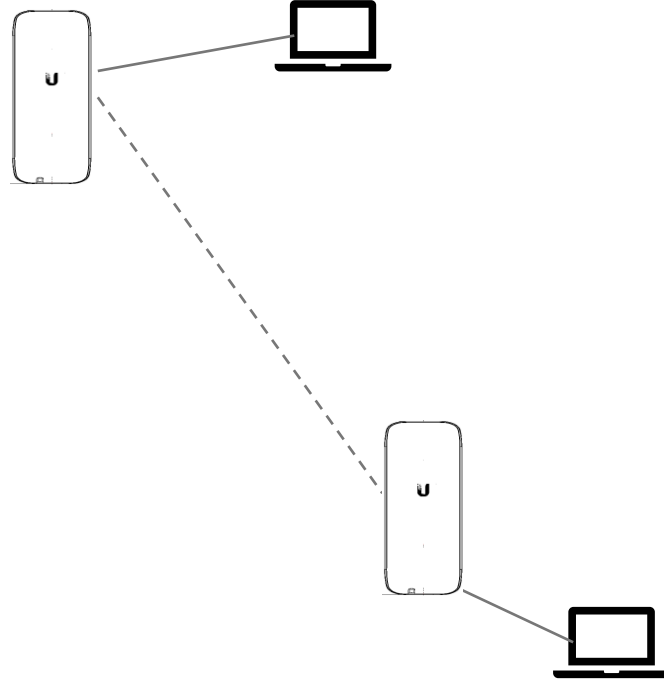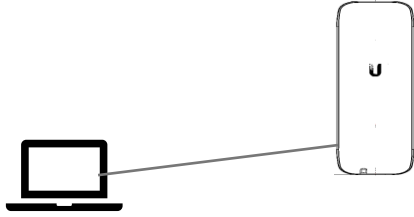 - AREDN – The various components used to connect multiple nodes together
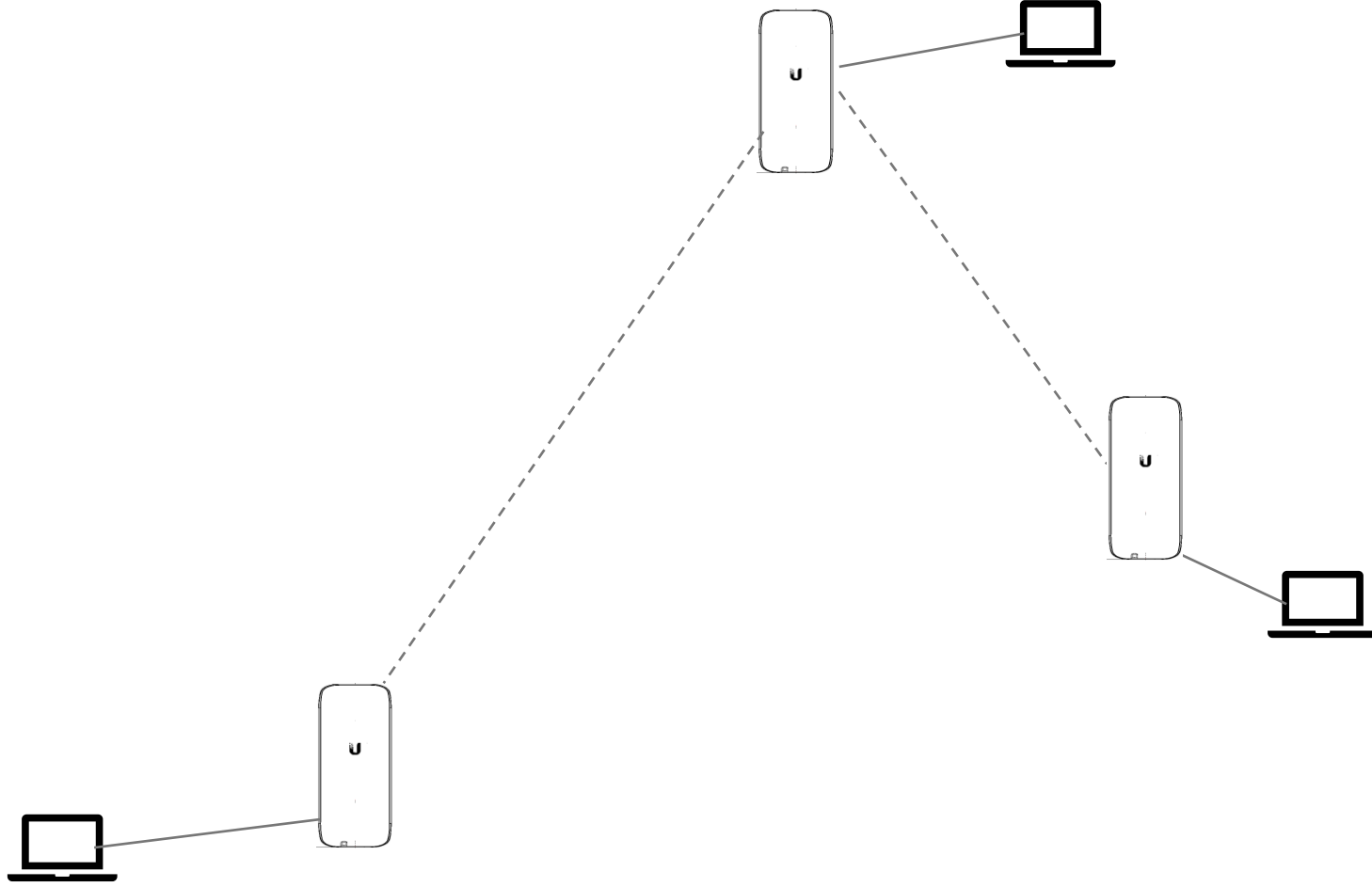
What is Mesh Networking

What is Mesh Networking

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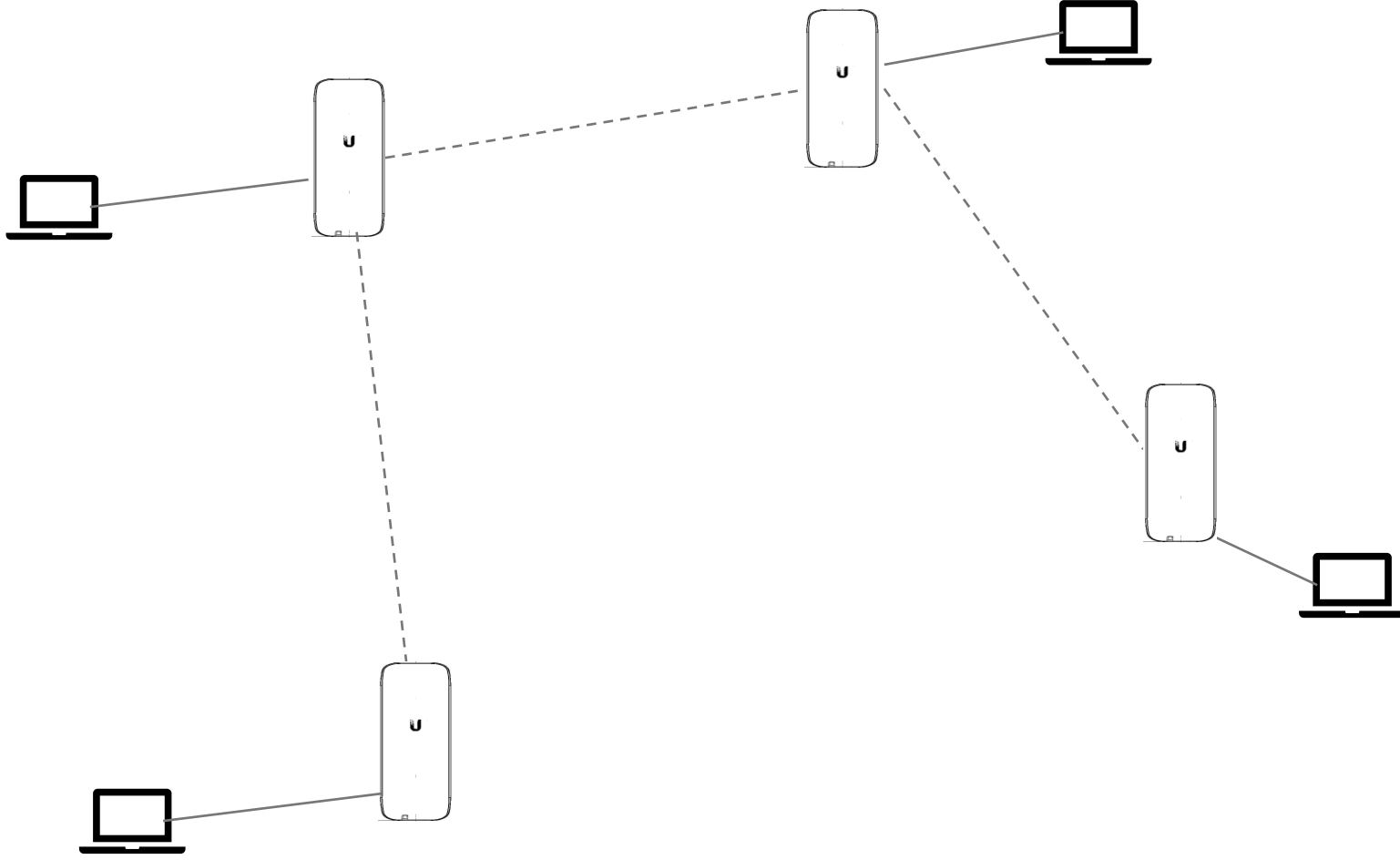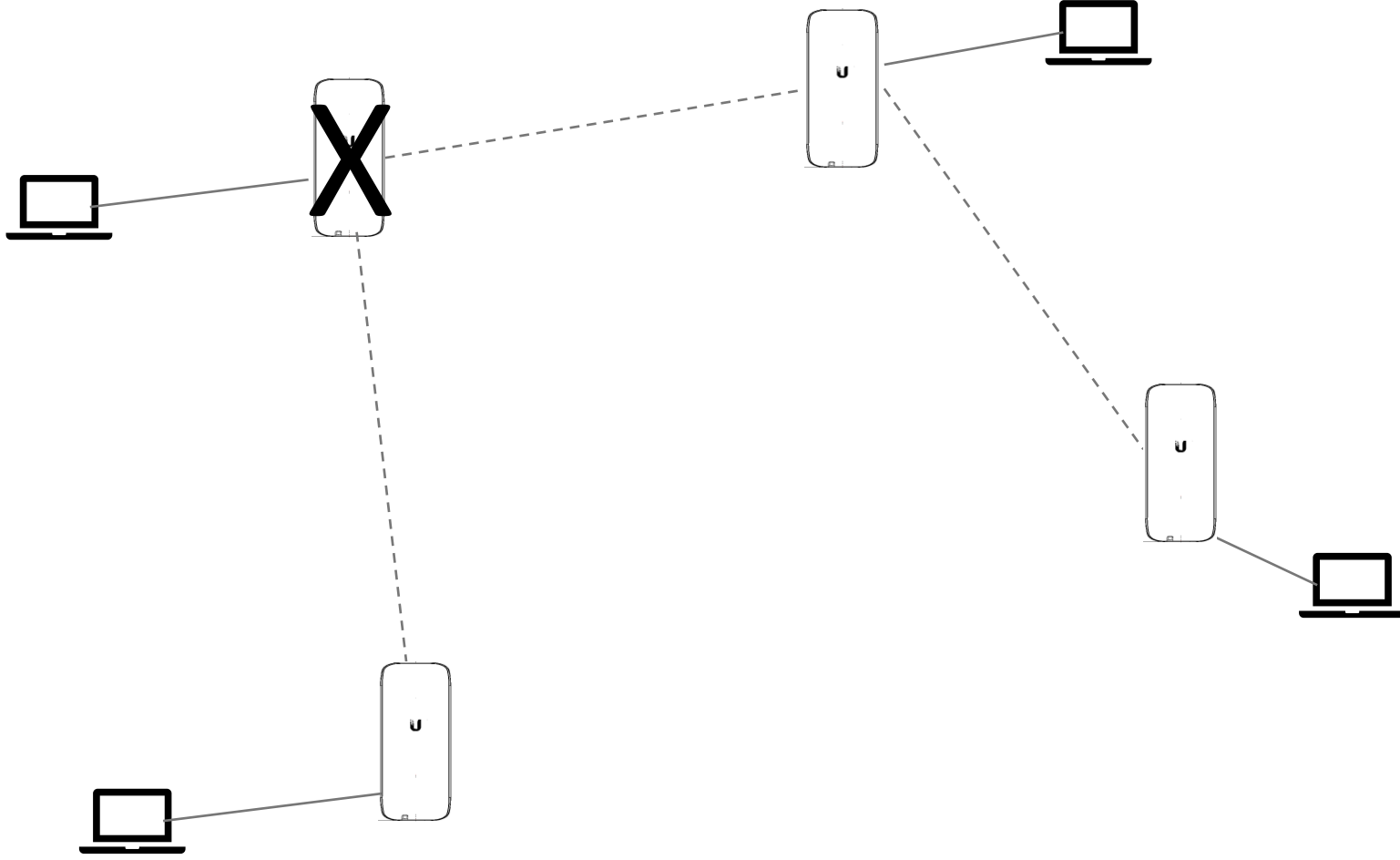
What is Mesh Networking

What is Mesh Networking

Connecting Your Mesh Node

- Power Over Ethernet

- Using the Supplied POE Adapter

- Using Battery and Solar

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Plugging in Your Node

LAN = Local Area Network   POE = Power Over Ethernet

No POE

24vdc POE

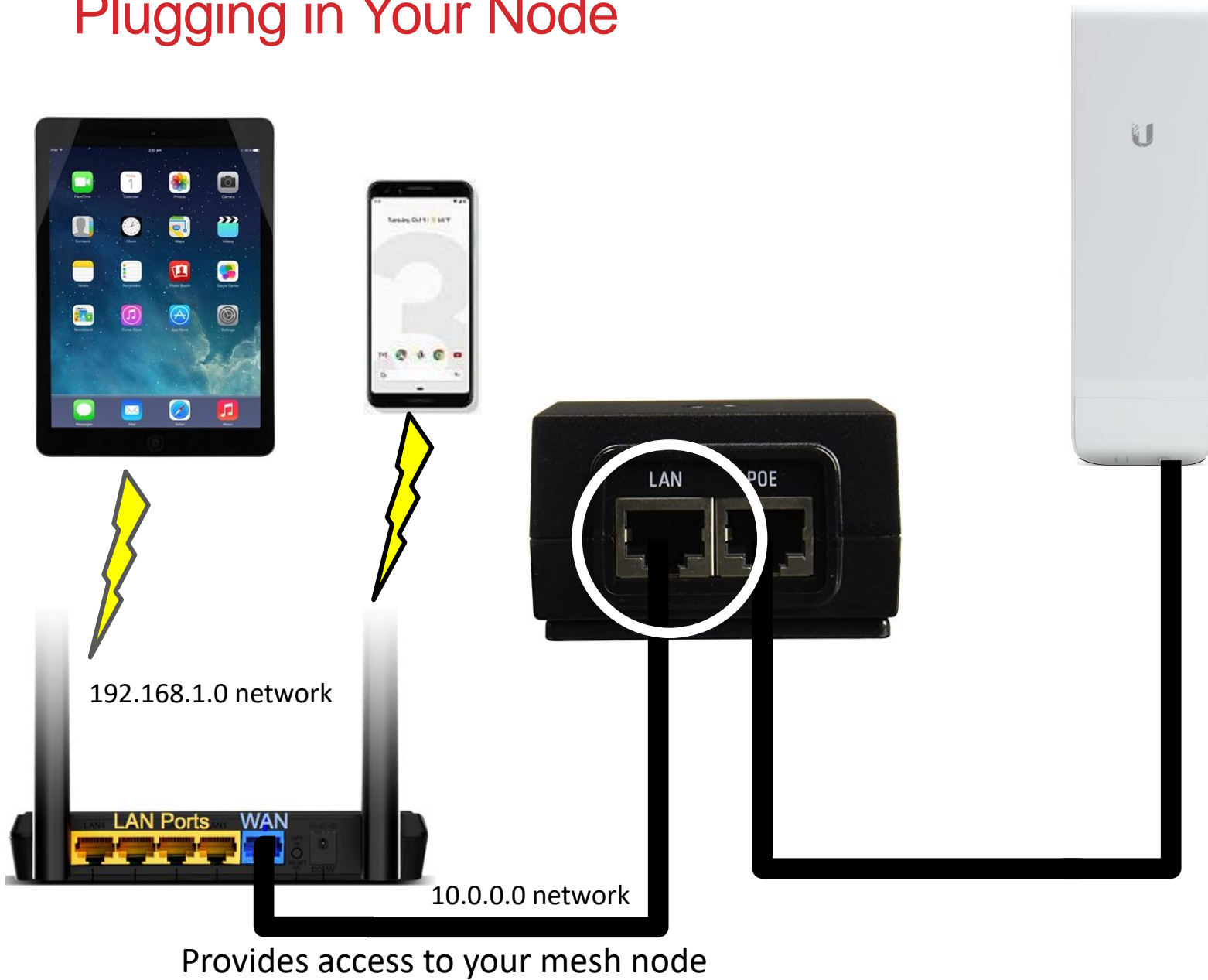The POE Adapter is essentially a two port network switch

Plugging in Your Node

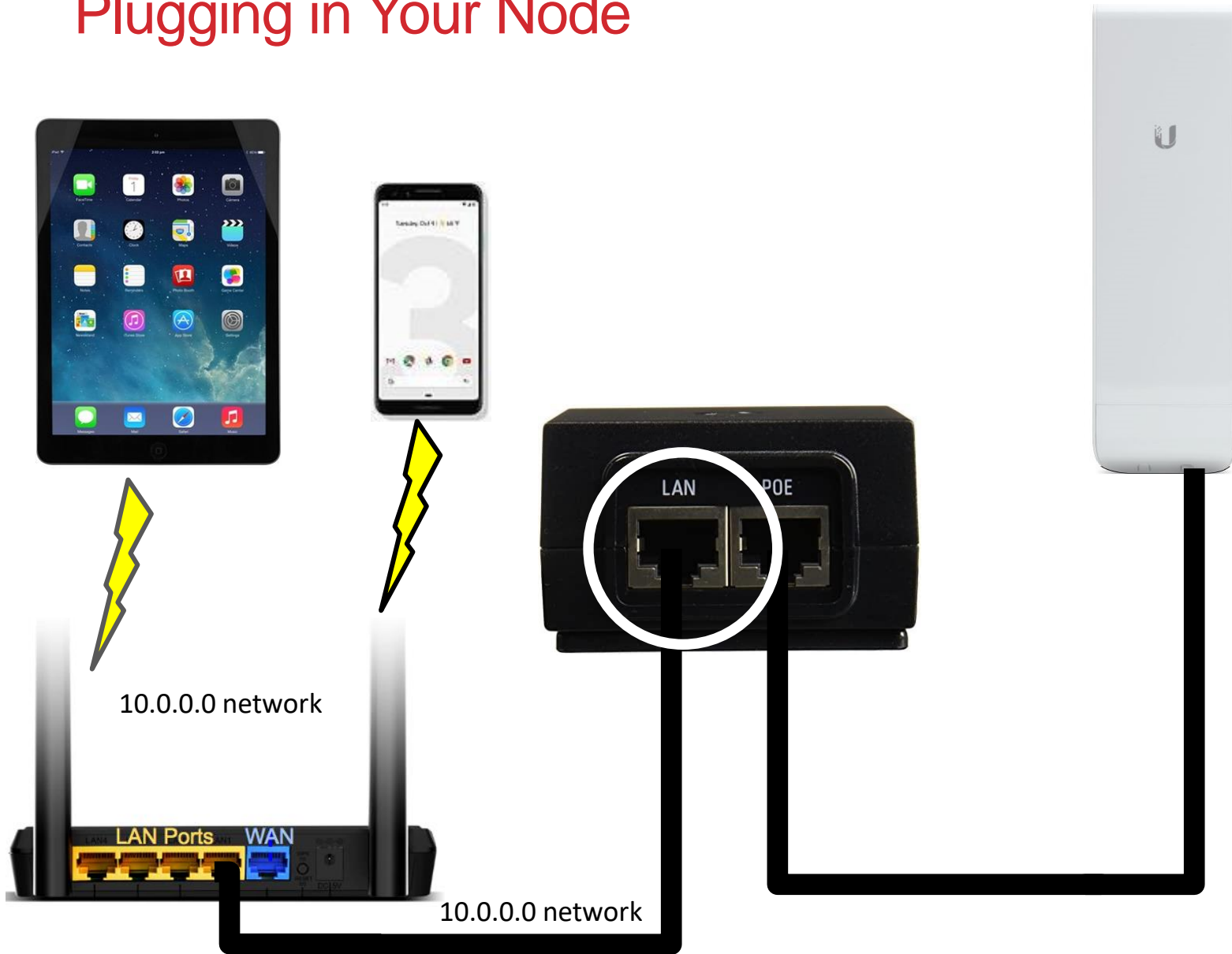Supplies both power to the Nanostation
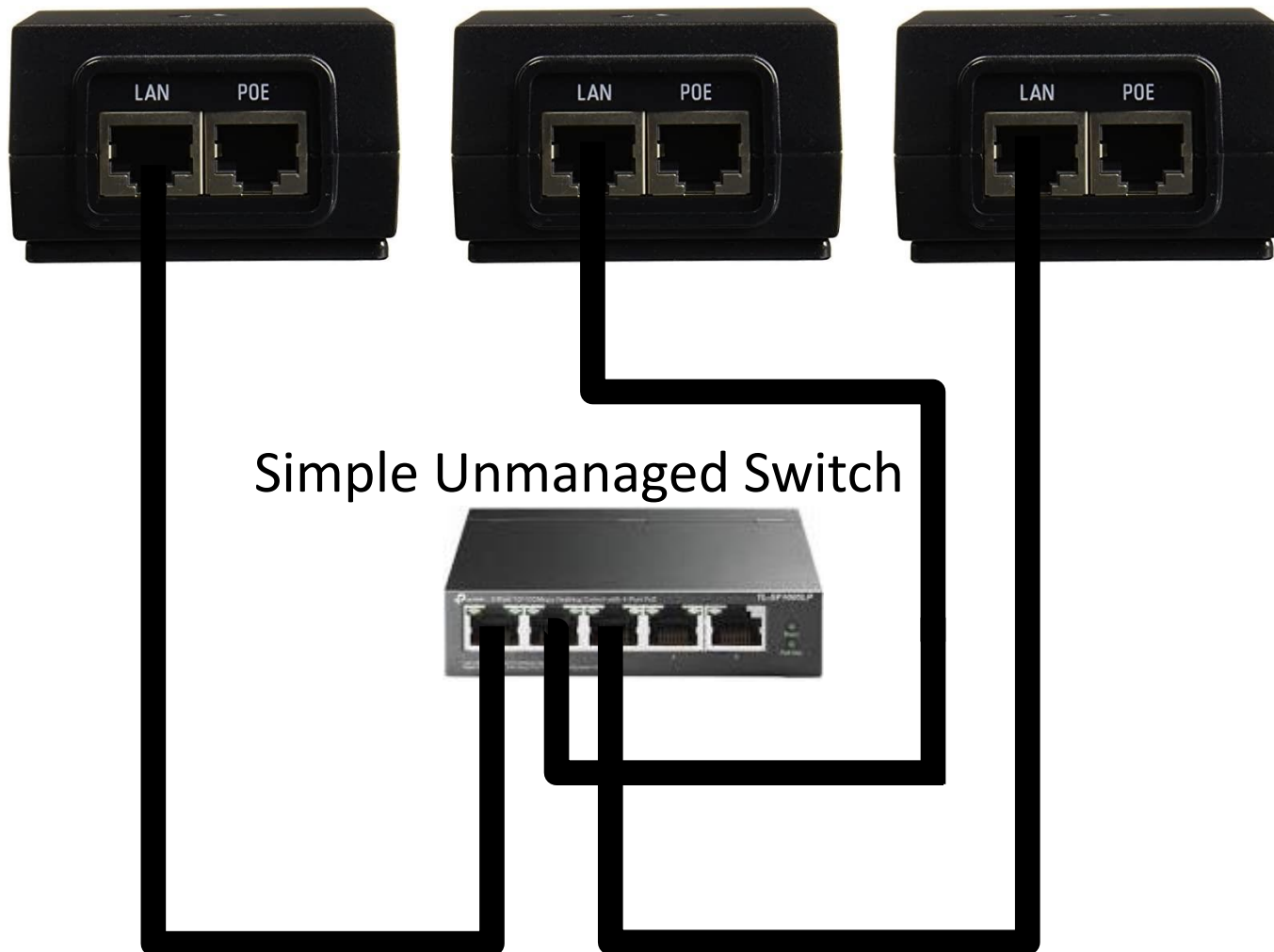and Ethernet Connection

Plugging in Your Node

Provides access to your
mesh node

Plugging in Your Node

192.168.1.0 network

LAN Ports **WAN**

10.0.0.0 network

Provides access to your mesh node

LAN   POE

Plugging in Your Node
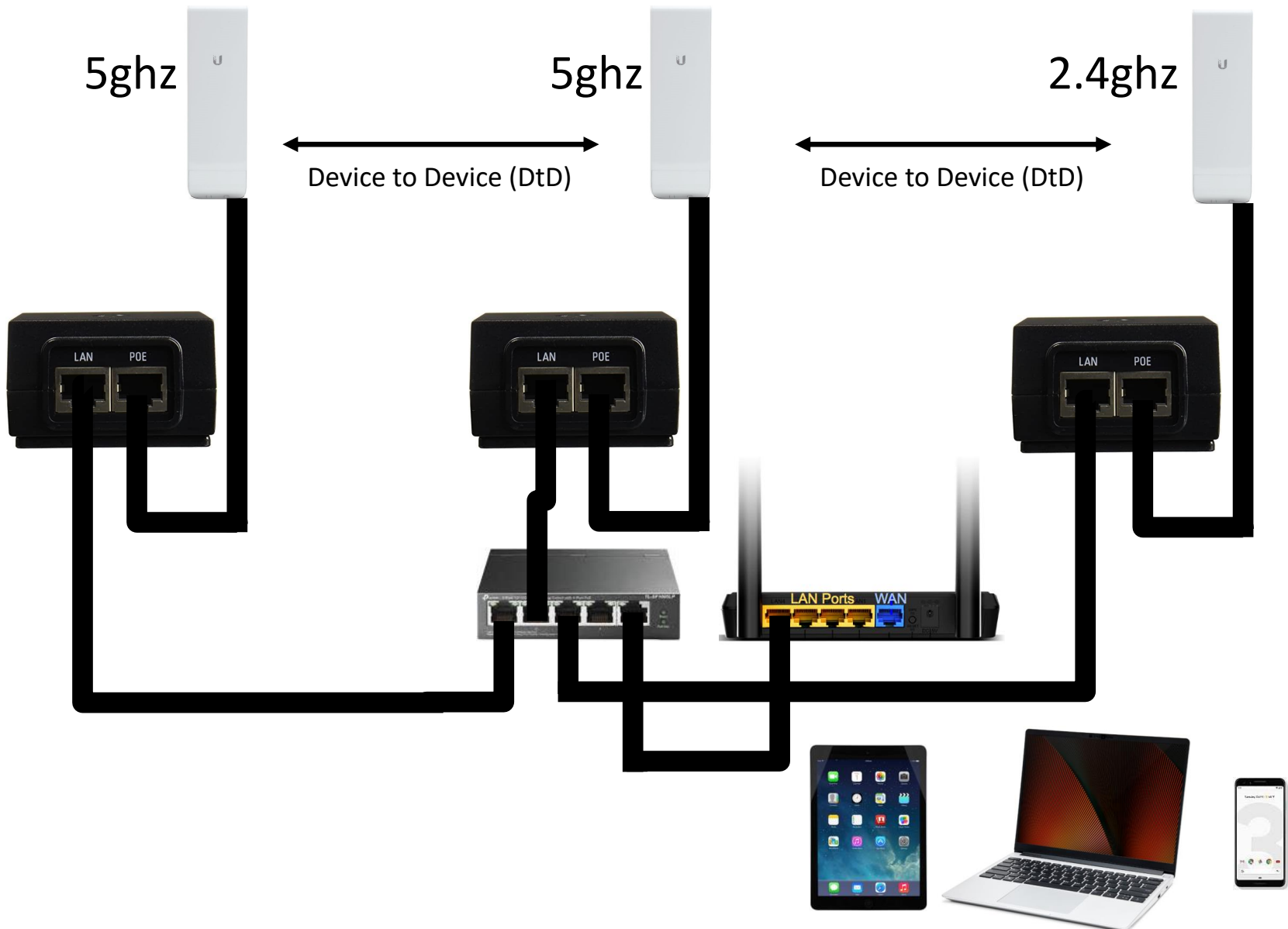

10.0.0.0 network

LAN   POE

10.0.0.0 network

Alternatively disable DHCP at your Wifi Router
and the mesh node will provide DHCP

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Plugging in Your Node

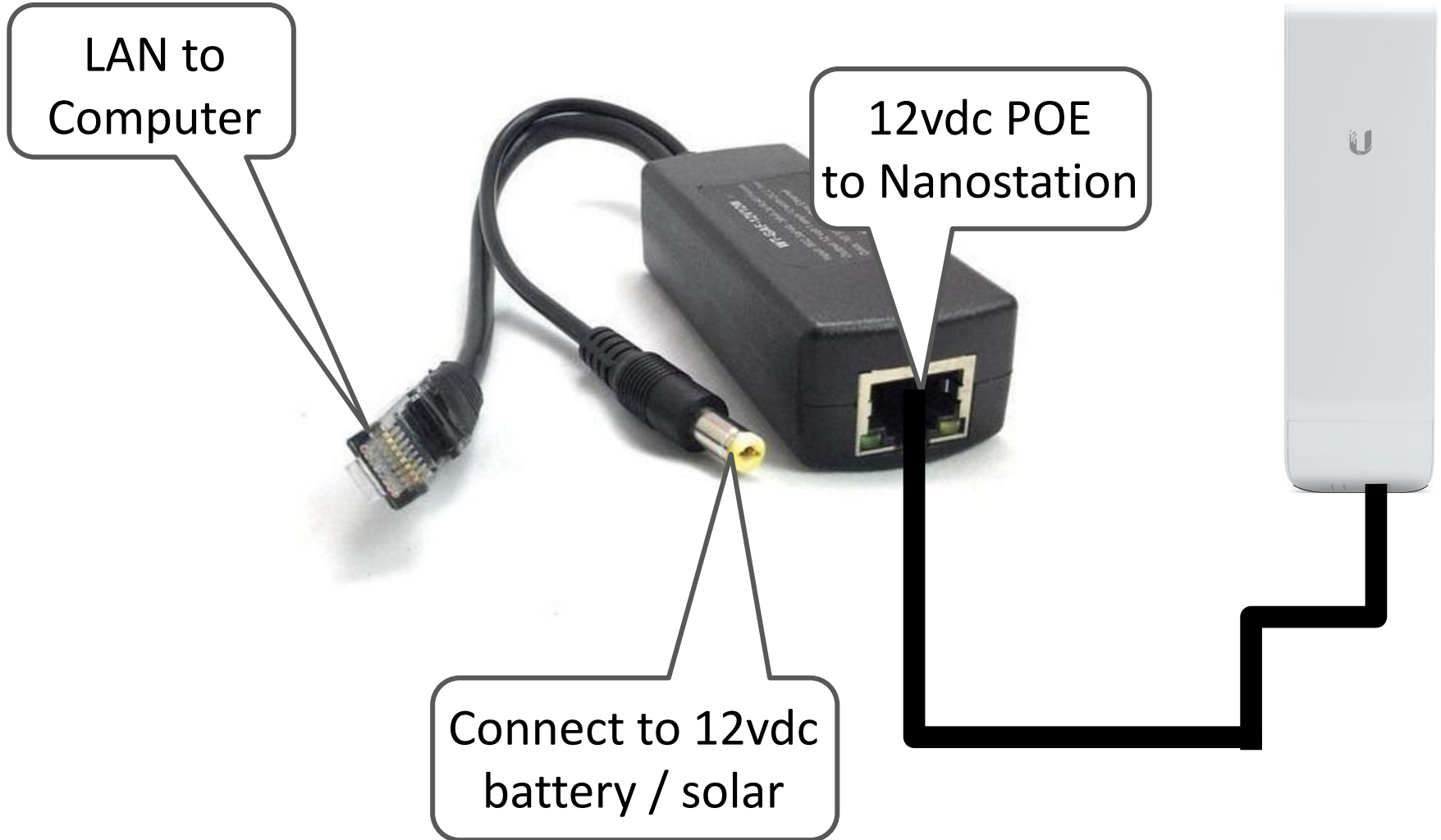Connecting multiple nodes via Device to Device (DtD)

Simple Unmanaged Switch

Plugging in Your Node

5ghz

5ghz

2.4ghz

Device to Device (DtD)

Device to Device (DtD)

LAN POE

LAN POE

LAN POE

LAN Ports   WAN

Plugging in Your Node

Most Ubiquiti equipment can be powered with 9vdc to 24vdc

LAN to Computer

12vdc POE to Nanostation

Connect to 12vdc battery / solar

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SF Wireless Emergency Mesh / Bay Area Mesh

- SFWEM (now BAM) received a grant from the Amateur Radio Digital Communications (ARDC) to build out the Bay Area Mesh

- SCARES applied for a grant from SFWEM for mesh nodes, cameras, outdoor UV resistant CAT 6 ethernet cable, RJ-45 connectors, etc

- Two Ubiquiti Rockets and 120-degree sector antennas and a PTZ camera have been installed on the Kings Mountain Radio Tower

- 40 Nanostations have been distributed to our members and EOCs

- Ethernet cables have been built and distributed

- Currently, due to supply chain issues, Ubiquiti equipment has become hard to find and the prices have doubled

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K6MPN-Kings-Mtn-North and South

Ubiquiti Rocket M5 attached to a Ubiquiti 120-degree sector antenna. North uses channel 179

Ubiquiti Rocket M5 attached to a Ubiquiti 120-degree sector antenna. South uses channel 175

Foscam PTZ Camera

K6MPN-Kings-Mtn-North and South

K6MPN-Kings-Mtn-North and South

K6MPN-Kings-Mtn-North and South

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K6MPN-Kings-Mtn-North and South

Image courtesy of Frank Adams
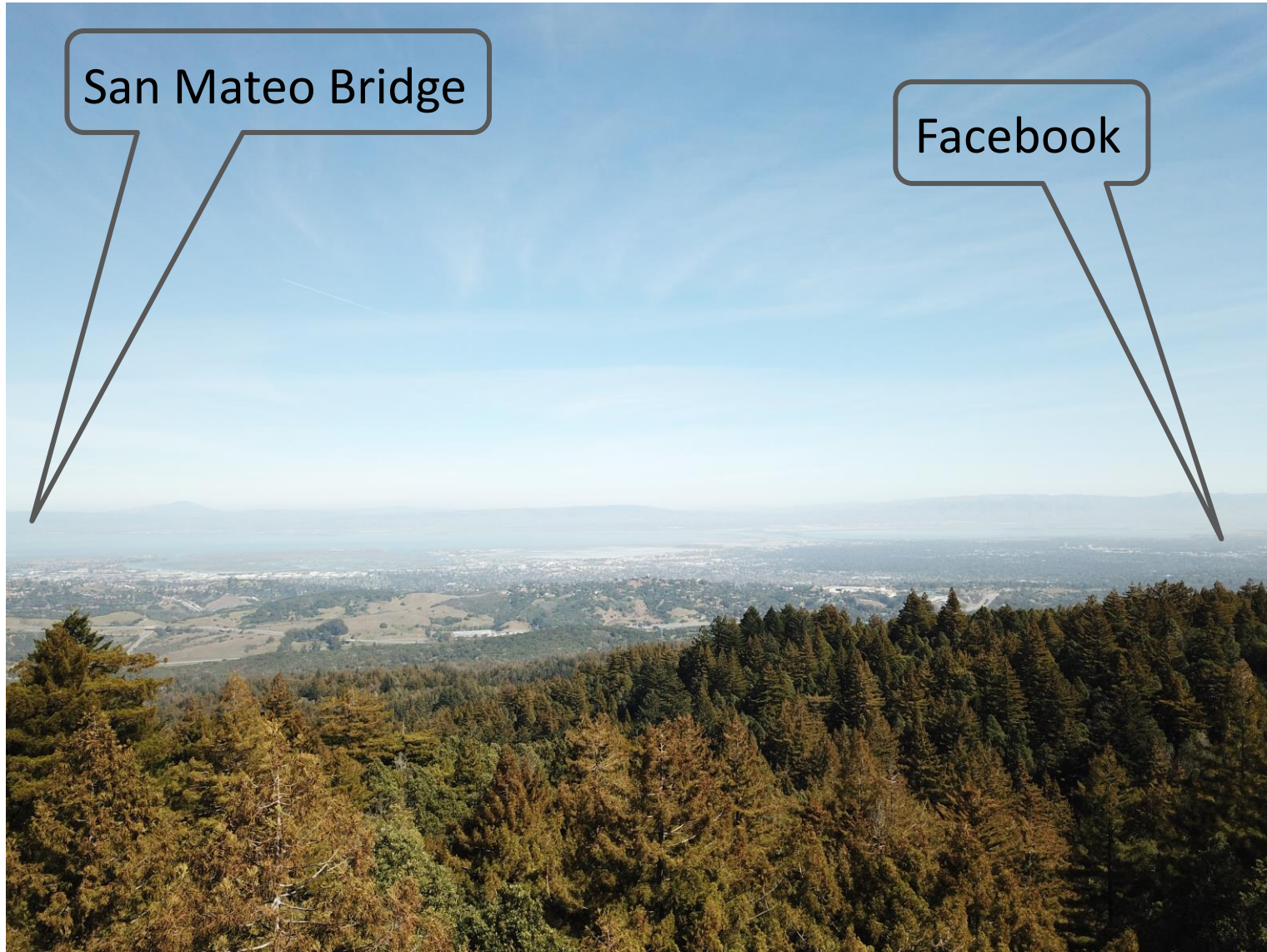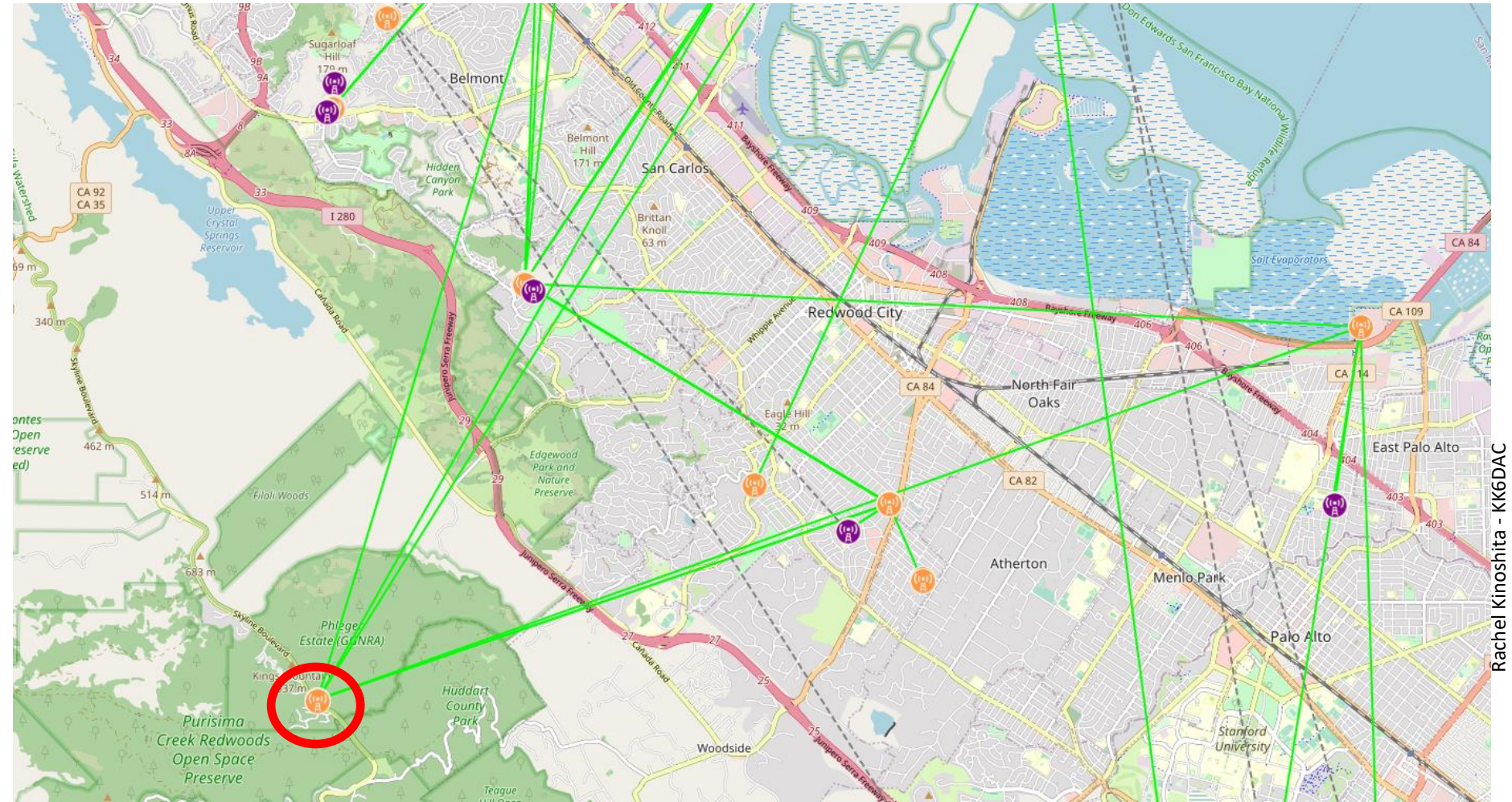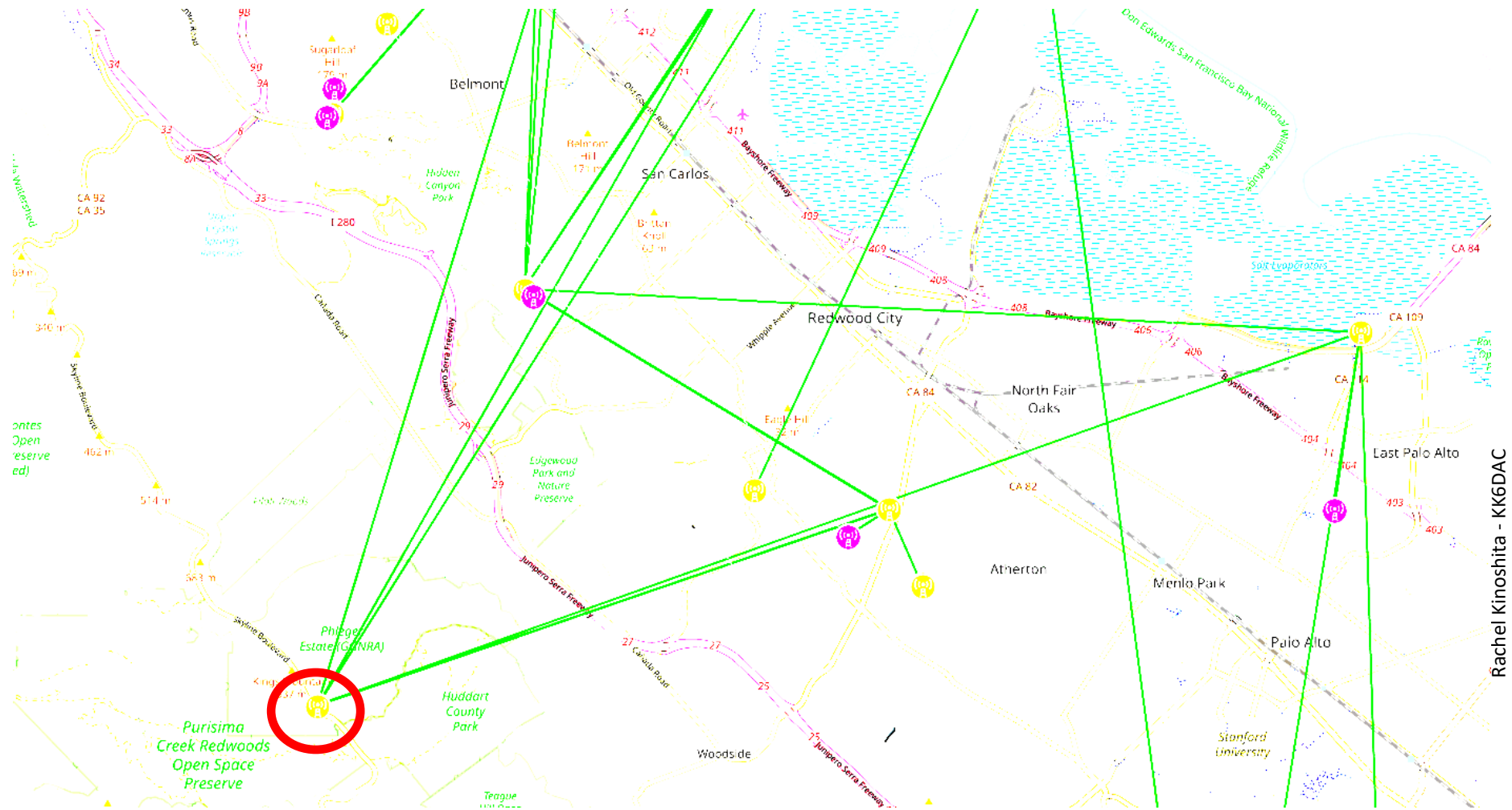
K6MPN-Kings-Mtn-North and South

Image courtesy of Frank Adams

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K6MPN-Kings-Mtn-North and South

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K6MPN-Kings-Mntn-North

Location: 37.4360027 -122.3202621

Help | Refresh | Mesh Status | Neighbor Status | WiFi Scan | Setup | Select a theme ▾

Wifi address	10.122.175.163 / 8	**Signal/Noise/Ratio**	-82 / -95 / 13 dB [Charts]
LAN address	10.213.125.25 / 29	**firmware version**	3.22.8.0
WAN address	none	**model**	Ubiquiti Rocket M5 XW
default gateway	10.48.2.50 N6IMY-Nano1	**system time**	Mon Oct 10 2022 04:11:09 UTC
		uptime	7 days, 9:32
SSID	AREDN-10-v3	**load average**	0.13, 0.08, 0.08
Channel	179	**free space**	flash = 2428 KB
Bandwidth	10 MHz		/tmp = 29620 KB memory = 28728 KB
		OLSR Entries	Total = 925 Nodes = 276

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

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Traversing the Mesh

K6MPN-Kings-Mntn-North mesh status

Location: 37.4360027 -122.3202621

Refresh | Auto | Quit

Local Hosts		Services
K6MPN-Kings-Mntn-North		

Remote Nodes	ETX	Services
N6IMY-hAP1 (wan)	1.66	
N6AMQ-SP1	1.82	
n6amq-sp-host		
N6AMQ-SP3	1.92	
N6AMQ-SP4	1.92	
K6GDA-NS-Home	2.35	
AJ6VV-SC-90Sect-345	2.47	
AJ6VV-SC-LHG300-91	2.57	
AJ6VV-SC-90Sect-86	2.57	
AJ6VV-SC-hAP1	2.57	
AJ6VV-SC-EdgeRouterX-SFP		ER-X-SFP
AJ6VV-SC-EP24		EP24
San-Carlos-to-San-Bruno		AF-to-Bruno
AJ6VV-SC-90Sect-26-175 / 10.local.mesh	2.57	
AJ6VV-SC-LHG-XL-1-003	2.57	
WB6WGM-PB400-North	2.69	
W6TEO-RWC-NS5-53	3.14	
W6TEO-RWC-hAP1 (tun*1,wan)	3.24	

Current Neighbors		LQ	NLQ	TxMbps	Services
K6GDA-NS-Home2		85%	87%	8.7	
K6KBL-SL-NSM5		77%	93%	21.2	
K6MPN-Kings-Mntn-South	(dtd)	100%	100%		
firecam					PTZ Cam
N6IMY-Nano1		71%	90%	21.6	

Previous Neighbors	When
KD8DRX-CHABOT-5G	1.1 hours ago
chabot-cam.local.mesh	

OLSR Entries

Total	925
Nodes	276

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Traversing the Mesh

K6MPN-Kings-Mntn-South mesh status

Location: 37.4360027 -122.3202621

Refresh | Auto | Quit

Local Hosts		Services		Current Neighbors	LQ	NLQ	TxMbps	Services
K6MPN-Kings-Mntn-South				K6MPN-Kings-Mntn-North (dtd)	100%	100%		
● firecam		PTZ Cam		N6AMQ-SP1	77%	85%	9.5	
				● n6amq-sp-host				
Remote Nodes	ETX	Services		W2GMD-MENLOPARK-5G-OMNI-175	67%	45%		

Remote Nodes	ETX
N6AMQ-SP4	1.61
N6AMQ-SP3	1.61
K6KBL-SL-NSM5	1.80
N6IMY-Nano1	1.84
N6IMY-hAP1 (wan)	1.94
K6GDA-NS-Home2	2.22
W6TEO-RWC-NS5-53	2.87
AJ6VV-SC-90Sect-26-175 / 10.local.mesh	2.93
W6TEO-RWC-hAP1 (tun*1,wan)	2.97
AJ6VV-SC-90Sect-345	3.03
AJ6VV-SC-hAP1	3.03
● AJ6VV-SC-EdgeRouterX-SFP	
● AJ6VV-SC-EP24	
● San-Carlos-to-San-Bruno	
AJ6VV-SC-LHG300-91	3.03
AJ6VV-SC-90Sect-86	3.03
AJ6VV-SC-LHG-XL-1-003	3.03
K0DYY-SM-hAP-2 (tun*7,wan)	3.07
● x6399	

Services for remote nodes:
- ER-X-SFP
- EP24
- AF-to-Bruno

Previous Neighbors — When
- K6ORI-LPD-TABLETOP-OMNI — 9.4 hours ago
- KN6PLV-BrkOxfLA-Ryle — 22.3 hours ago

OLSR Entries
- Total: 925
- Nodes: 276

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Traversing the Mesh

W2GMD-MENLOPARK-5G-OMNI-175

Location: 37.48437 -122.15015

Ubiquiti Rocket M5 + AMO-5G10 10 dBi Omni ch 175 10mhz in Menlo Park, CA. Part of SFWEM.net. MAC: 68:72:51:5:c5:cf

Help   Refresh   Mesh Status   Neighbor Status   WiFi Scan   Setup   Select a theme ▾

Wifi address	10.4.197.207 / 8	**Signal/Noise/Ratio**	-75 / -95 / 20 dB Charts
LAN address	10.38.46.121 / 29	**firmware version**	3.22.8.0
WAN address	none	**model**	Ubiquiti Rocket M5
default gateway	10.182.101.112 N9JIM-PBE2	**system time**	Sat Oct 1 2022 21:13:29 PDT
		uptime	36 days, 2:14
SSID	AREDN-10-v3	**load average**	0.37, 0.18, 0.12
Channel	175	**free space**	flash = 2568 KB
Bandwidth	10 MHz		/tmp = 29072 KB
			memory = 24364 KB
		OLSR Entries	Total = 901
			Nodes = 267

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

Traversing the Mesh

W2GMD-MENLOPARK-5G-OMNI-175 mesh status

Location: 37.48437 -122.15015

Ubiquiti Rocket M5 + AMO-5G10 10 dBi Omni ch 175 10mhz in Menlo Park, CA. Part of SFWEM.net. MAC: 68:72:51:5:c5:cf

[Refresh] [Auto] [Quit]

Local Hosts	Services
W2GMD-MENLOPARK-5G-OMNI-175	

Remote Nodes		ETX	Services
N9JIM-HAP1	(tun*3)	1.40	
N9JIM-BlackMtn		1.40	
KI6ZHD-HAP1	(tun*1)	1.50	
KN6PLV-BrkOxfLA-Merlin	(tun*2,wan)	1.50	Cam
● kn6plv-backbone			Backbone
● KN6PLV-cam360			Cam360
● kn6plv-antennas			
● kn6plv-cam1			
● KN6PLV-ntp			NTP
K0DYY-SM-hAP-2	(tun*7,wan)	1.50	
● x6399			
W6EI-FS8-SFWEM-LINK		1.55	IperfSpeed
W6EI-FS8-DoC		1.55	IperfSpeed
● w6ei-fs8-powermon			PowerMonitor
● w6ei-fs8-edgeswitch			EdgeSwitch
KN6PLV-BrkOxfLA-Arecibo	(wan)	1.60	Radio Waterfall
K0DYY-SM-hAP-1	(tun*1,wan)	1.60	
● K0DYY-Cam1--326--36			SM-Cam
			Cam-Admin
KN6PLV-BrkOxfLA-Ryle		1.60	
KN6PLV-Services		1.60	
● KN6PLV-wiki			Wiki
● KN6PLV-links			OLSR Traffic Monitor
			Live Mesh Map (Internet)
			GitHub Projects
● KN6PLV-tiles			OpenStreetMap Tiles (West Coast)
● KN6PLV-search			Mesh Search
● KN6PLV-website			AREDN Bandwidth, where did it go (PDF)
			AREDN Supernodes (PDF)
			Network Storms (PDF)
			Yealink Phones, LDAP setup
			Live Mesh Map
● KN6PLV-helicorder			Helicorder / Earthquakes

Current Neighbors	LQ	NLQ	TxMbps	Services
AJ6VV-SC-LHG300-91	87%	51%	18.3	
K6MPN-Kings-Mntn-South	68%	54%		
KK6DAC-NanoM5-01	16%	93%		
N9JIM-PBE2	89%	85%	13.0	
W6EI-FS8-Sector-East	80%	85%		

Previous Neighbors	When
AJ6VV-SC-90Sect-86	15.3 hours ago
N9JIM-BlackMtn	16.4 hours ago
AJ6VV-SC-90Sect-26-175 / 10	23.4 hours ago

OLSR Entries

Total	889
Nodes	263

Traversing the Mesh

Current Neighbors	LQ	NLQ	TxMbps	Services
AJ6VV-SC-LHG300-91	87%	51%	18.3	
K6MPN-Kings-Mntn-South	68%	54%		
KK6DAC-NanoM5-01	16%	93%		
N9JIM-PBE2	89%	85%	13.0	
W6EI-FS8-Sector-East	80%	85%		

Previous Neighbors				When
AJ6VV-SC-90Sect-86				15.3 hours ago
N9JIM-BlackMtn				16.4 hours ago
AJ6VV-SC-90Sect-26-175 / 10				23.4 hours ago

OLSR Entries

Total	889
Nodes	263

Traversing the Mesh

KK6DAC-NanoM5-01 mesh status

Location: 37.46130788972225 -122.15433183615541

Nanostation M5

[Refresh] [Auto] [Quit]

Local Hosts		Services
KK6DAC-NanoM5-01		

Remote Nodes	ETX	Services
N9JIM-PBE2	6.12	
W6EI-FS8-Sector-East	6.16	
N9JIM-HAP1 (tun*3)	6.22	
N9JIM-BlackMtn	6.22	
W6EI-FS8-SFWEM-LINK	6.26	IperfSpeed
W6EI-FS8-DoC	6.26	IperfSpeed
● w6ei-fs8-powermon		PowerMonitor
● w6ei-fs8-edgeswitch		EdgeSwitch
K0DYY-SM-hAP-2 (tun*7,wan)	6.32	
● x6399		
KN6PLV-BrkOxfLA-Merlin (tun*2,wan)	6.32	Cam
● kn6plv-antennas		
● kn6plv-backbone		Backbone
● kn6plv-cam1		
● KN6PLV-cam360		Cam360
● KN6PLV-ntp		NTP
KI6ZHD-HAP1 (tun*1)	6.32	
KM6PXH-hAP2 (tun*1)	6.42	
● VVX300		
KN6PLV-BrkOxfLA-Haystack	6.42	
KN6PLV-Services	6.42	
● KN6PLV-wiki		Wiki
● KN6PLV-links		OLSR Traffic Monitor
		Live Mesh Map (Internet)
		GitHub Projects
● KN6PLV-tiles		OpenStreetMap Tiles (West Coast)
● KN6PLV-search		Mesh Search
● KN6PLV-website		AREDN Bandwidth, where did it go (PDF)
		AREDN Supernodes (PDF)
		Network Storms (PDF)
		Yealink Phones, LDAP setup
		Live Mesh Map
● KN6PLV-helicorder		Helicorder / Earthquakes

Current Neighbors	LQ	NLQ	TxMbps	Services
KK6DAC-Nano-10 (dtd)	100%	100%		
● mail10				
● KK6DAC-WRT54GL-11				
● irc10				
● jabber10				
W2GMD-MENLOPARK-5G-OMNI-175	82%	28%	2.3	

Previous Neighbors				When
none				

OLSR Entries

Total	892
Nodes	264

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Setting Up Your Node

- The mesh nodes we provided to our members have already been pre-configured with your call sign, the most likely channel to connect to the mesh and the channel width

- However, there are changes you will need to make once you get your node operational

  - Set the Lat / Lon of your location
  - Possibly need to change change the channel of your node

- Will occasionally need to upgrade your AREDN firmware

Setting Up Your Node

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Setting Up Your Node

Setting Up Your Node

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Setting Up Your Node

North of San Carlos use 179
South of San Carlos use 175

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Setting Up Your Node

Setting Your Location – Must set to show up on the Mesh Map

Optional Settings

Latitude: 37.46130788972

Longitude: -122.154331836

Find Me | Apply Location Settings | Show Map | Upload data to AREDN Servers

Grid Square: [ ]

Timezone: UTC

NTP Server: us.pool.ntp.org

- Go to Google Maps
- Enter the address
- Click on the location
- Right click and the Lat / Lon will pop up
- Click on the Lat / Lon and it will be copied to your clipboard

Setting Up Your Node

Setting Up Your Node

Help   Save Changes   Reset Values   Default Values   Reboot

Configuration saved.

Reboot is required for changes to take effect

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Setting Up Your Node

KK6DAC-NanoM5-01

Location: 37.46130788972225 -122.15433183615541

Nanostation M5

Help | Refresh | Mesh Status | Neighbor Status | WiFi Scan | Setup | Select a theme ⌄

Wifi address	10.212.134.10 / 8	**Signal/Noise/Ratio**	-91 / -95 / 4 dB Charts
LAN address	10.164.48.81 / 29	**firmware version**	3.22.8.0
WAN address	none	**model**	Ubiquiti NanoStation M5 XW
default gateway	none	**system time**	Sun Apr 17 2022 22:46:07 UTC
		uptime	0:20
SSID	AREDN-10-v3		
Channel	175	**load average**	0.13, 0.03, 0.01
Bandwidth	10 MHz	**free space**	flash = 2616 KB
			/tmp = 29996 KB
			memory = 34720 KB
		OLSR Entries	Total = 3
			Nodes = 1

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

SCARES Members on the Mesh

- K6MPN (Kings Mountain)

- K6GDA (Gary)

- WB6WGN / KD6JTU (Robert and Madeline)

- W6TEO (Tim)

- KK6ISP (Clark)

- AI6XM (David)

- KK6DAC (Rachel)

Services on the Mesh

- Remote Cameras

- Kiwix (offline Wikipedia)

- OwnCloud (like Dropbox)

- Team Talk (like Zoom)

- Mail Servers (Postfix, Dovecot, Roundcube)

- Chat Servers (Meshchat, Jabber, etc)

- VOIP Phones / PBX

Services on the Mesh – Remote Cameras

2022-10-16 10:10:29
Foscam_camera

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Services on the Mesh – Remote Cameras

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Services on the Mesh – VOIP Phones

Grandstream PBX

Or a Raspberry Pi
running RasPBX

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Services on the Mesh – Kiwix Offline Wikipedia

🏠 | Wikipedia | ⬡ | 🔍

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Biography • Community • Culture • Death • Education • Freedom of speech • Human rights • Internet • Law • Philosophy • Politics • Religion • Sexuality • Social movements

ARRL Radiogram

An **ARRL radiogram** is an instance of formal written message traffic routed by a network of amateur radio operators through traffic nets, called the National Traffic System (NTS).

It is a plaintext message, along with relevant metadata (headers), that is placed into a traffic net by an amateur radio operator. Each radiogram is relayed, possibly through one or more other amateur radio operators, to a radio operator who volunteers to deliver the radiogram content to its destination.

historic ARRL radiogram form

Form overview

Radiogram forms facilitate a standard protocol between amateur radio operators, allowing much faster relay of formal messages. They do this by always having the message headers in a certain order, allowing operators to read and understand the headers without explicit verbal labels. This is especially important in hectic and stressful environments such as during a disaster, when many parties call upon radio operators to quickly transfer messages in and out of the affected areas.

A typical form has a place for the plaintext message, as well as for several headers that are important for routing the message to its proper destination in a timely manner. These fields include the message's priority, the callsign of the station of origin (the amateur radio operator who placed the message onto the message net), the date and time of origin, contact information of the message's recipient, as well as the callsign of the station that delivered the message.

The headers' purpose and order is logical and intuitive enough that many amateur radio operators have memorized it and in extremis can transmit and receive radiograms without referring to the form.

Preamble part

All messages must have a preamble. The preamble of the message contains information about the message necessary to keep track of it as it passes through the amateur system. The parts of the preamble, except for the check as noted later, are NOT changed by any station relaying or delivering the message. They are permanent parts of the message created by the station of origin and must remain with the message all the way to the delivery point. Preamble information is used to service undeliverable messages and to generate replies to specific handling instructions.

Message number

The message number is selected by the station originating the message and it must be on all messages. It stays with the message all the way to the point of delivery. The delivering station may need to reply to the station of origin and refer to this number. Use number digits only, no letters, leading zeros, or dashes. Numbers are usually begun with 1 at the start of a year or month at the pleasure of the originating station.
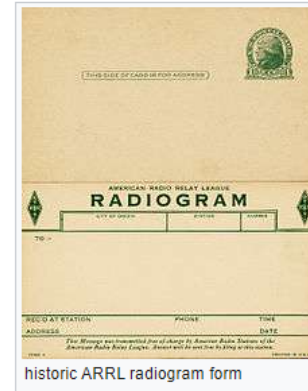
Services on the Mesh – OwnCloud Like Dropbox

Services on the Mesh – OwnCloud Like Dropbox

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Services on the Mesh – OwnCloud Like Dropbox

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Services on the Mesh – TeamTalk Zoom like System

Services on the Mesh – Team Talk Zoom like System

Services on the Mesh – Email Servers

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Services on the Mesh – Email Servers

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Services on the Mesh – Email Servers

Services on the Mesh – Chat / Instant Messaging

MeshChat
Jabber

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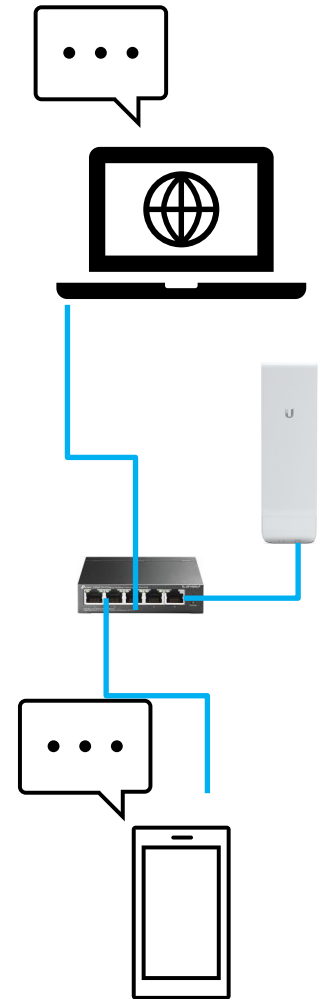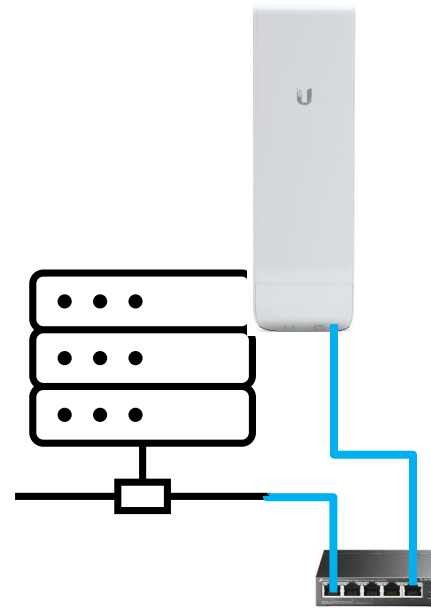
Services on the Mesh – Chat / Instant Messaging

Mesh Chat v1.02

Zone: MeshChat   **Node:** kk6dac-rp41
Call Sign: KK6DAC   **Updated:** 11 seconds ago

Send a Message

New Message

Enter message here

Channel: Everything   **SEND**

Mesh Chat Users   1

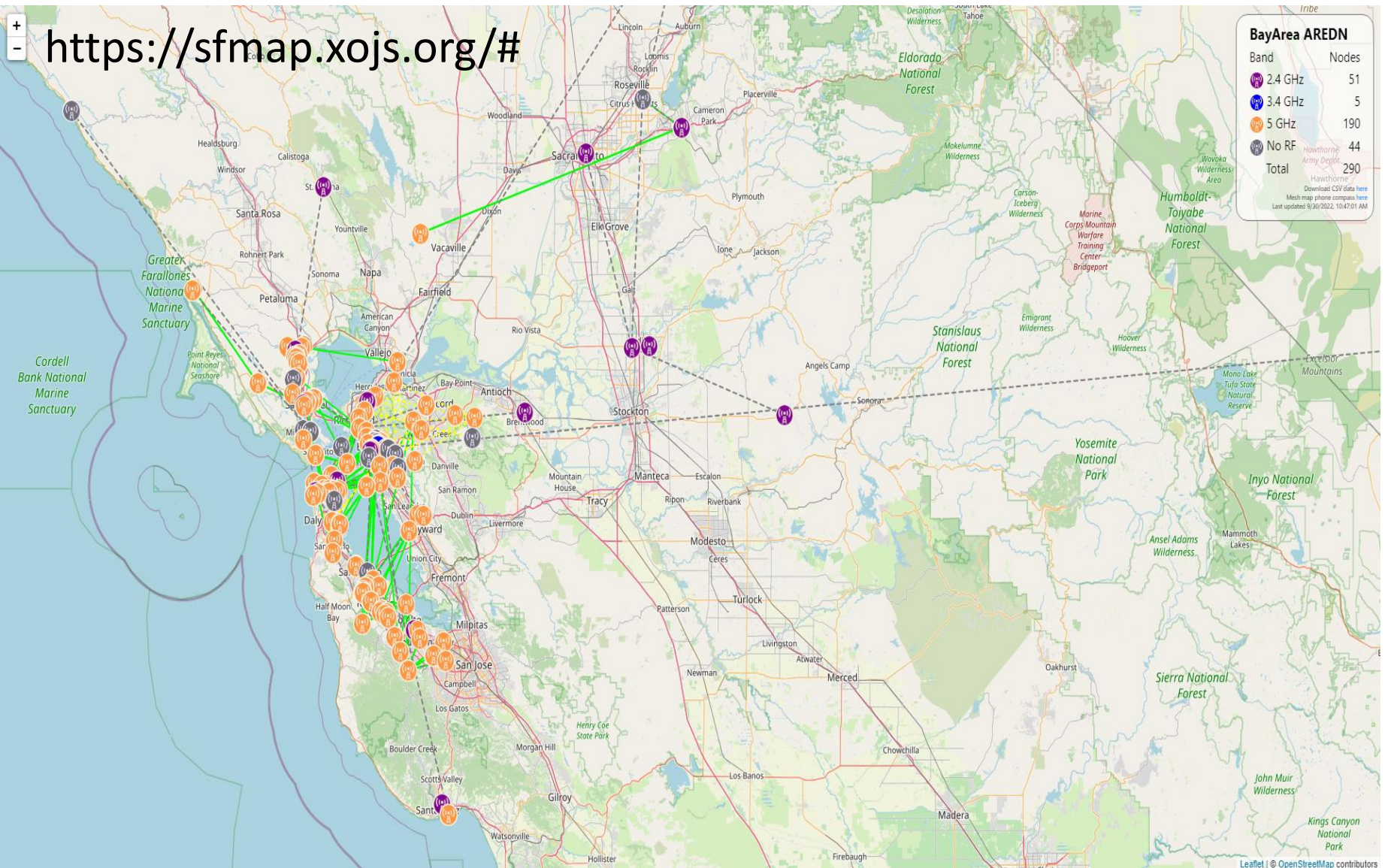| Call Sign	Node	Last Seen
KK6DAC	kk6dac-rp41	10/19/22 9:50 PM

Messages

Search: Enter search   **Channel:** Everything

Time	Message	Call Sign	Channel	Node
10/19/22 9:50 PM	Did anyone else feel that? It felt like at least a 5.0. Is everyone OK?	KK6DAC		kk6dac-rp41
10/19/22 9:49 PM	I'm heading over to the Menlo Park EOC and will be online from that QTH for the next few hours	KK6DAC		kk6dac-rp41
10/19/22 9:48 PM	Hey, does anyone have an extra USB C cable I can borrow?	KK6DAC		kk6dac-rp41
10/18/22 9:56 PM	Test 3	KK6DAC		raspberrypi

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Mesh Map Demo – Developed by Eric - KG6WXC

https://sfmap.xojs.org/#

BayArea AREDN

Band	Nodes
2.4 GHz	51
3.4 GHz	5
5 GHz	190
No RF	44
Total	290

Download CSV data here
Mesh map phone compass here
Last updated 9/30/2022, 10:47:01 AM

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Leaflet | © OpenStreetMap contributors

Questions

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