

# Mt Vernon Amateur Radio Club

## Mesh Demonstration - Streaming Live Video

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Background Information:

- AREDN is Amateur Radio Emergency Data Network.
- AREDN is based on OpenWRT, an open source project that creates alternate firmware for over 1300 WiFi routers and devices.
- AREDN adds OLSR to create a self configuring, self healing mesh network. The links below will give more details on AREDN, OpenWRT, and OLSR.
- Frequency choice is 2397 MHz (Part 97) ("channel -2") with bandwidth of 5 MHz.
- WiFi channel 1 frequency is 2412 MHz (Part 15), so the mesh network has enough separation to avoid possible channel interference. Note that although WiFi channels are 5 MHz apart, the WiFi transmitter bandwidth is ~20+ MHz. The Wikipedia link below gives details.

Links:

AREDN: <https://www.arednmesh.org/>

OpenWRT: <https://openwrt.org/>

OLSR description on Wikipedia:

[https://en.wikipedia.org/wiki/Optimized\\_Link\\_State\\_Routing\\_Protocol](https://en.wikipedia.org/wiki/Optimized_Link_State_Routing_Protocol)

WiFi channel frequencies description on Wikipedia:

[https://en.wikipedia.org/wiki/List\\_of\\_WLAN\\_channels](https://en.wikipedia.org/wiki/List_of_WLAN_channels)

My OS choice is Ubuntu Linux. I use the Firefox browser to control the camera and VLC media player to view the video stream.

On Windows OS many use AnyCam Security Camera software as an all-in-one control and viewer package. Their website: <https://anycam.io/>

Demonstration Node hardware:

The stable supported devices:

- Ubiquiti Bullet Ti / L-com HG2415U 15 dBi omni - directional vertically polarized antenna with a connected Kkmoon PTZ IP HD video camera. My rover node.
- Ubiquiti Rocket M2 / Ubiquiti 120° Sector 15 dBi dual-polarity antenna. My base node, recently retrieved from KD8ACU's chimney in Upper Arlington.
- Ubiquiti NanoStation M2 with integrated dual-polarity 11 dBi antenna. My test #1 node.
- Ubiquiti AirRouter HP with integrated 5-port switch. My test #3 node.

New devices in the nightly builds repository (Beta firmware):

- MikroTik LHG-2nD-XL, 21 dBi dish, belonging to Bob Dixon, W8ERD.
- GL-iNet USB150 Microuter, bought on Amazon last week.

Critical Requirement:

This demo is focused on streaming video on the mesh network. This works best with RTSP (Real Time Streaming Protocol), which doesn't have error checking or other overhead. It works well if the total LQ (Link Quality) and NLQ (Neighbor Link Quality) is at least 80% for RTSP video to be useful with minimal dropouts. Even at this quality, the number of node hops are limited to about 5. The total quality is the product of the individual values:

Ex: Node 1 LQ = Node 2 LQ = Node 3 LQ = Node 4 LQ = Node 5 LQ = 95, so what's the total quality? Ans:  $0.95 * 0.95 * 0.95 * 0.95 * 0.95 = 0.7737$  which is marginal. A better solution would be a node located on a high point with a high gain antenna that could server as a backbone to the nodes transmitting video. In that case each "remote" node would be communicating with the backbone node in a single hop, so the LQ between a remote and the backbone nodes can be read directly from the remote's mesh status page.

Summary:

Uses:

Video streaming of community events and emergency situations is just one use of the mesh network. Remember the mesh network is just a data highway that can be used by any vehicle you choose to put on that highway.

Hardware:

Ubiquiti Networks products have been the primary target hardware for AREDN firmware. The Ubiquiti products have preformed well since 2012. However, the 802.11n devices went out of production late in 2014, so distributors and vendors are now running out of new stock. Not surprising, the few available devices have higher prices. The AREDN Team is continuing to search for suitable products that can be modified for use in a mesh network. In particular, the MikroTik devices are the most promising. They're in current production and have reasonable prices.

Other Demonstrations:

There are many other aspects of the Mesh Network that could be demonstrated at future meeting if the membership is interested. Possible topics include using Mesh Chat, using VoIP phones, accessing data storage, configuring "Advertised Services", using packet email, setting up tunnel server/client, and installing AREDN firmware to name a few.

Questions:

I'd be happy to answer any questions about mesh networks. Ask at a meeting, or send an email to my address listed on the first page.