Ham Radio For a New Generation

Andre, Hansen, K6AH
Hamvention 2019
Greene County Fairgrounds, Xenia, OH
May 17 - 19, 2019

AT THE CENTER OF EMERGENCY PREPAREDNESS
• Appealing to younger hams
• IBM’s Call For Code
• New Development
  • New Features
  • Updated Documentation
  • Support for More Devices/Manufacturers
• User Applications
• Network Growth
A white-haired, retiree, with 50 years of ham radio experience is about to tell you this can appeal to younger hams.

...the irony is not lost on me.
Appealing to Younger Hams

Linux Opensource Developers Conference
... a new interest area for OpenSource Developers

Joe Ayers

Presentation: AREDN: The technology and considerations to build adhoc wireless networks
Developer
AREDN Inc.
Professionally Joe has worked in Product Development for over 30 years starting out at Texas Instruments in the 1980s and now works for Schneider Electric in the Industrial Automation R&D group creating control systems to automate Industrial facilities including Oil Refineries, Nuclear, and Coal Power Plants.

Orv Beach

Presentation: The Ham Radio Internet - a Progress Report
System Administrator
Abbott Labs
Orv Beach is a long-time Linux user, and has been a ham radio operator for even longer (license callsign W6BI). He's an ARRL Technical Specialist, and the Training Chair for the Southern California Linux expo. He's deeply involved in the build-out of the local ham radio "Internet" using off-the-shelf wireless equipment.
What we didn’t foresee
Ham Classes and VE Exam Sessions
New Contributors

- Andrew, KK4ZUZ
- Peter, KK6RUH
- Patrick, KE0RSX
- Steve, KC0EUW - Documentation
- Eric, KC6WXC - Various
- Ray, KK6RAY
- Ryan, KI4VMI

New Device Support
New User Interface
IBM’s Call For Code 2019
How to build an internet when it's gone

Long Distance connections brought to you by:
IBM’s Call For Code

2018 Call for Code winner pilots mesh network in Puerto Rico

Following a natural disaster, first responders need an effective solution to prioritize relief efforts when connectivity is lost. Project Owl, the Call for Code 2018 winner, addresses this with a network of quickly deployed hotspots that can gather vital information from people in need.

See this feature on Project Owl's Puerto Rico deployment pilot →
Updated Documentation
**AREDN Overview**

The AREDN™ acronym stands for Amateur Radio Emergency Data Network, and it is a service-oriented communication network.

For many years amateurs have been transmitting for emergency communications involving conveying the ICS-213 form. The message is transmitted or type it on another device and is then delivered to the recipient and can then be handled through traditional methods.

This tried-and-true method is still a standard practice for emergency and event communications. AREDN is a modern take on that, it is electronic form, with a simple installation.

In today's high-tech world, we are accustomed to different forms of communication such as short messaging and audio-visual mediums.

**Radio Spectrum Characteristics**

- Channel Planning
- Route Flipping
- Collocated Nodes
- Aligning Link Nodes
- Channel Planning Tips

**Aligning Link Nodes**

The AREDN™ web interface provides a tool for aligning link nodes and aligning the antenna. You can focus on the antenna position using the Sound feature and align the antenna from the Signal to Noise Ratio of 15 dB is an ideal ratio.

Most of the latest AREDN™ devices use dual polarity antennas and MIMO features in the radios that exploit multipath propagation. However, if you are using single polarity antennas with “single chain” radios, another way to achieve signal separation for colocated devices is to orient the site’s antennas so that one is vertically polarized and the other is horizontally polarized. This can result in a signal separation of up to 20 dB. Vertical polarization is usually preferred because it tends to be less susceptible to reflections and provides a clear line of sight.

**Using WinLink to Send Email**

Although it is not typically used as a TCP/IP network, WinLink is familiar with WinLink 2000 for sending messages over amateur radio frequencies. It is possible to configure your computer to use WinLink for sending email with attachments across a short distance. You can use a Windows computer with plenty of memory to run the email server and send messages to other WinLink users.

The maximum attachment size is currently 5MB per message, but this may change in the future. For additional information, visit the WinLink Forum located here: [WinLink Forum](https://www.winlink.org/).
Recent Development
Recent Development

• 3.19.3.0 Released on March 23rd.

• Continue to add new devices. Check out the Supported Platform Matrix.

• Expect to add support for new “AC” devices. Benefit of AC is not yet understood in AREDN environments.

• In the Nightly Build: Max Link Distance parameter can now be calculated by the node. The result is dynamic and optimized. Seeing as much as 40% increase in link throughput.
New Device Support
Ubiquiti
Wide variety of devices for all topologies

MikroTik
Wide variety of devices for all topologies

TP-Link
Ubiquiti look-alikes

GL-iNet
MikroTik - Device Focus

- LDF
- LHG & LHG-XL
- Economical Antennas
- hAP AC Lite
# Spec Comparisons for Long 5 GHz links

<table>
<thead>
<tr>
<th>Manuf</th>
<th>Model</th>
<th>Antenna</th>
<th>Power</th>
<th>Ant Gain</th>
<th>IERP</th>
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</thead>
<tbody>
<tr>
<td>MikroTik</td>
<td>BaseBox5</td>
<td>Rocket Dish</td>
<td>30</td>
<td>30</td>
<td>60</td>
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<td>Ubiquiti</td>
<td>Rocket M5</td>
<td>Rocket Dish</td>
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<td>MikroTik</td>
<td>LHG-5nD XL</td>
<td>Dish Included</td>
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<td>52</td>
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<td>Ubiquiti</td>
<td>Rocket M5</td>
<td>120° Sector</td>
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<td>19</td>
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<tr>
<td>MikroTik</td>
<td>LDF-5nD</td>
<td>Satellite Dish</td>
<td>25</td>
<td>20</td>
<td>45</td>
</tr>
</tbody>
</table>
GL-iNet - Device Focus

AR150 Mini

AR150 USB Microuter
A triage is setup in a public park. You’ve pre-loaded a dozen or more AR150 USB’s. Sign them out to those needing access to the network via their own/company laptops. Each laptop becomes an AREDN mesh node. Network coverage expands with every laptop added.
Applications for AREDN
How will you use AREDN?

- Public Service / Public Safety
- Red Cross Disaster Services Technology
- Community Emergency Response Team
- Support MOUs with your municipal EOC
- Deliver paradigm changing services
  - VoIP & Chat with other sites
  - Cell Service Restoration - BYO
  - Access to cloud-based systems
  - Augment Winlink services
### Applications Running on AREDN Networks

<table>
<thead>
<tr>
<th>Administrative</th>
<th>User Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced config</td>
<td>Air Traffic Control</td>
</tr>
<tr>
<td>iperf Speed Test</td>
<td>EmComMap / Tickets</td>
</tr>
<tr>
<td>Network monitoring</td>
<td>CERT Damage Assessment</td>
</tr>
<tr>
<td>NNTP Time services</td>
<td>MeshChat</td>
</tr>
<tr>
<td>Antenna pointing/peaking</td>
<td>Weather Stations</td>
</tr>
<tr>
<td></td>
<td>Remote cameras</td>
</tr>
<tr>
<td></td>
<td>VoIP telephony (226 assigned numbers)</td>
</tr>
<tr>
<td></td>
<td>Winlink</td>
</tr>
<tr>
<td></td>
<td>DMR linking</td>
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<tr>
<td></td>
<td>Web-based Email</td>
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<tr>
<td></td>
<td>Mattermost</td>
</tr>
<tr>
<td></td>
<td>FTP / fileshare</td>
</tr>
<tr>
<td></td>
<td>Website with network/node info</td>
</tr>
</tbody>
</table>

**AREDN**

**AMATEUR RADIO EMERGENCY DATA NETWORK**
PBX Configuration for VoIP Phones
Mesh Chat v1.0

Zone: MeshChat
Call Sign: K6AH

Node: kd7vea-rocketchip-to-westmountain
Updated: 86 seconds ago

Send a Message

New Message
Enter message here

Channel:
Everything

Mesh Chat Users

<table>
<thead>
<tr>
<th>Call Sign</th>
<th>Node</th>
<th>Last Seen</th>
</tr>
</thead>
<tbody>
<tr>
<td>K6AH</td>
<td>kd7vea-rocketchip-to-westmountain</td>
<td>2/14/19</td>
</tr>
<tr>
<td>N0GZ</td>
<td>e7gz-402</td>
<td>2/14/19</td>
</tr>
</tbody>
</table>

Messages

<table>
<thead>
<tr>
<th>Time</th>
<th>Message</th>
<th>Call Sign</th>
<th>Channel</th>
<th>Node</th>
</tr>
</thead>
<tbody>
<tr>
<td>2/13/19 6:02 PM</td>
<td>Testing...</td>
<td>W6BI</td>
<td></td>
<td>ai6bx-2-chatpi</td>
</tr>
<tr>
<td>2/13/19 6:01 PM</td>
<td>Just checking in</td>
<td>W6BI</td>
<td></td>
<td>ai6bx-2-chatpi</td>
</tr>
</tbody>
</table>
Node Management thru Smart Switches
Network Management with SNMP
EmComMap

Northeast Survey
Traffic Net for ARES LAX NE

Tactical ID:

Incident: Northeast Survey
Description: Traffic Net for ARES LAX NE

Incident start: [Date]
Incident end (blank if ongoing):

Info last updated:

Update incident info
Refreshed 2 minutes ago

EmComMap © 2018 Dan Ruderman (k5oa)
### Status for K8BKT - Node 44098

Last update - 02/14/2019 11:40:15  My IP - 76.27.25.238

<table>
<thead>
<tr>
<th>Node</th>
<th>Call</th>
<th>Description</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>44098</td>
<td>K8BKT</td>
<td>449.775 -</td>
<td>Pleasant Grove, Utah</td>
</tr>
<tr>
<td>2256*</td>
<td>VE3RTR</td>
<td>444.975-</td>
<td>Cobourg, ON</td>
</tr>
</tbody>
</table>

#### Node 2256 Peer 72.142.154.178

- Reconnects: 0
- Direction: OUT
- Connect Time: 11:25:50.61
- Connect State: ESTABLISHED

#### Host 44.98.254.145:4569

- Node: 44098
- State: Registered
Allstar via Pi-Star Application
## Index of /

<table>
<thead>
<tr>
<th>Name</th>
<th>Size</th>
<th>Date Modified</th>
</tr>
</thead>
<tbody>
<tr>
<td>3CXPhone6.msi</td>
<td>13.3 MB</td>
<td>8/21/16, 5:00:00 PM</td>
</tr>
<tr>
<td>AV.exe</td>
<td>6.0 MB</td>
<td>9/5/18, 5:00:00 PM</td>
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<tr>
<td>Camera Uploads/</td>
<td></td>
<td>1/28/19, 4:46:00 PM</td>
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<tr>
<td>DMR Software/</td>
<td></td>
<td>12/25/16, 4:00:00 PM</td>
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<tr>
<td>emergencycommlan.pdf</td>
<td>2.5 MB</td>
<td>10/14/18, 5:00:00 PM</td>
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<tr>
<td>ExtIO_RTL_TCP.zip</td>
<td>58.2 kB</td>
<td>10/11/16, 5:00:00 PM</td>
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<td>HDSDR/</td>
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<td>10/11/16, 5:00:00 PM</td>
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<td>ipscan-3.5.2-setup (1).exe</td>
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<td>7/23/18, 5:00:00 PM</td>
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<td>js8call-0.7.3-devel-win32.exe</td>
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<tr>
<td>KD7BKO Shared Docs/</td>
<td></td>
<td>3/19/17, 5:00:00 PM</td>
</tr>
<tr>
<td>My radio software/</td>
<td></td>
<td>6/14/17, 5:00:00 PM</td>
</tr>
<tr>
<td>P2P ID Finder Software/</td>
<td></td>
<td>9/30/16, 5:00:00 PM</td>
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<tr>
<td>Packages/</td>
<td></td>
<td>10/23/16, 5:00:00 PM</td>
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<td></td>
<td>11/5/16, 5:00:00 PM</td>
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<td>sdrsharp-x86/</td>
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<td>11/10/16, 4:00:00 PM</td>
</tr>
<tr>
<td>South-Tower-Camera/</td>
<td></td>
<td>4/18/17, 5:00:00 PM</td>
</tr>
</tbody>
</table>
TeamTalk Video Conferencing / Fileshare

http://boothoverheadcamera.local.mesh/browse/index.asp?id=1558185023384
Air Traffic ADS-B / SDR Dongle

**ICAO** | **Ident** | **Squawk** | **Altitude (ft)** | **Speed (kt)** | **Distance (NM)** | **Heading**
--- | --- | --- | --- | --- | --- | ---
AD6884 | AAL2287 | 4033 | 18,975 | 397 | 5.2 | 10
A8C4D8 | UAL18 | 2465 | 110 | 135 | 6.2 | 20
C01ECS | POE130 | ground | 19 | 7.0 | 2
AAB37C | N693MM | 3042 | 1,375 | 202 | 7.0 | 24
A936FA | JBU516 | 1200 | 1,025 | 104 | 7.5 | 3
ADA227 | JBU516 | 3223 | 16,400 | 321 | 9.3 | 16
ACB285 | AAL1489 | 3567 | 4,875 | 229 | 9.5 | 4
ACF2A2 | SKW3486 | 1735 | 12,175 | 261 | 10.0 | 19
478F4 | SAS909 | 2451 | 4,375 | 282 | 10.0 | 14
A6F2B8 | LJS547 | 2643 | 14,925 | 298 | 10.0 | 24
A8B43 | EJA390 | 3656 | 2,625 | 241 | 10.6 | 6
ACBF73 | N920PD | 1200 | 1,400 | 97 | 11.8 | 4
A1AD1F | N207MH | 3035 | 5,850 | 225 | 11.2 | 29
AC0A22 | AAL1333 | 1200 | 1,400 | 97 | 11.8 | 4
A089L6 | N130RU | 3310 | 1,300 | 192 | 12.3 | 2
A07464 | N603WM | 200 | 200 | | 12.6 | 5
2AC772 | | | | | |
A09L495 | N721R | 0307 | 1,000 | | | |
Los Angeles Emergency Communications Team

The Los Angeles Emergency Communications Team ("LAECT") is a group of dedicated individuals committed to training and education in all aspects of emergency preparedness, management and response, with an emphasis on emergency communications.

LAECT partners with cities, community groups and other preparedness organizations to coordinate and provide practical preparedness and communications training throughout Southern California. Its members have received specialized training related to emergency preparedness, including Community Emergency Response Team ("CERT"), and the federal Incident Management System and National Incident Management System, both used to manage response to disasters and emergency situations by all levels of government. They also actively participate in numerous preparedness exercises each year, including the California ShakeOut, the California Statewide Medical and Healthcare Exercise and various local and regional exercises.

LAECT also works cooperatively with the Los Angeles Section of Amateur Radio Emergency Service ("ARESLAX"). ARESLAX encompasses all of Los Angeles County, encompassing more than 4000 square miles, and its more than 10 million residents. ARESLAX is the largest ARES Section, and the only one comprised of a single county. There are more than 22,000 Amateur Radio operators licensed in Los Angeles County.

As its primary mission, ARESLAX provides backup and emergency communications support to the Los Angeles County Medical Alert Center and almost 70 hospitals throughout the County, including virtually all "911 receiving" hospitals (those with emergency departments). ARESLAX is recognized as a formal component of the Los Angeles County Emergency Medical Services Agency Emergency Communications Plan.

FCC station license KA6ECT
AREDN Mesh Nodes
Located at Huntington Hospital in Pasadena, California (DM4WD)

K4EECT-PAS-NE-115-15-95  5 GHz link to JPL
K4EECT-PAS-NE-RMS-5MS-42-20-142  5 GHz, 120 degree sector pointing northeast
K4EECT-PAS-SE-RMS-5MS-42-20-142  5 GHz, 120 degree sector pointing southeast
K4EECT-AMHP-76-210-212  2 GHz device linking node
K4EECT-BM2-170-202-183  2 GHz campus access
K4EECT-BM2-170-201-235  2 GHz campus access

Other AREDN mesh nodes are operated by individual LAECT participants.

AREDN Mesh Services
Winlink RMS gateway K4EECT-10 with RMS Relay, connecting to Winlink CMS
VHF packet, 145.000 MHz, 1200 baud
UHF packet, 431.250 MHz, 9600 baud
Mesh access using Telnet or Telnet Post Office session in Winlink Express, 10.205.45.75
Winlink Telnet Post Office for local messages, no link to CMS, 10.205.45.70
Anonymous FTP server, 10.205.45.70 (files may be deleted at any time)
NTP service, Stratum 1 (provided by W6GSW), 10.101.205.250
AREDN in the SW Division
Ham Deployed to Shelter

Fixed Backbone Node

Fixed or Deployed Relay Node

Ham Deployed to Shelter
Southwestern Division

Nodes: 450+
OLSR Routes: 1200+
For More Info

- WWW.AREDNMesh.ORG
- QST June 2017, “AREDN - A High-Speed Data Network”
- QST Feb 2019, ARRL, Steve Ford, WB8IMY, article
- Search YouTube, HamRadio 2.0, HamRadioNow videos
Contact Info

Andre Hansen, K6AH
www.arednmeshr.org/forum
• Randy, WU2S, Webmaster, President
• Joe, AE6XE - Lead Developer
• Darryl, K5DLQ - Lead Developer
• Andre, K6AH, Project Manager