AllStar & Echolink Project
What This Presentation Covers

- Methods to link systems
- Our Local Project
- How to use it
  - From a PC or Smartphone
  - From your Radio
- How to Roll Your Own
Methods to Link Ham Systems

Drilling Into AllStar
Types of Ham Radio Linking for Voice

● **Fully Digital**
  ○ Digitized audio end-to-end - from your microphone to their speaker
  ○ Requires new radios & repeaters, all require some proprietary, closed components
  ○ Examples: DMR, DSTAR, System Fusion

● **Analog over IP**
  ○ Analog RF to repeater - digital IP between repeaters, simplex nodes, computers
  ○ Overlays nicely on top of existing radios and repeaters
  ○ Can add Internet connections from PCs, smartphones
  ○ Examples: IRLP, Echolink, AllStar

● **Analog over analog radio**
  ○ Analog (usually FM) end-to-end
  ○ Limited distance, can lose quality with each hop
  ○ Examples: FM radio links, split-site repeaters
Ham Analog Over IP Voice Linking Systems

- **IRLP**
  - Radio to Radio only (by design) - no smartphone/PC connectivity
  - Run by one guy

- **Echolink** (http://echolink.org)
  - Radio/Smartphone/PC to Radio/Smartphone/PC
  - Good (but not great) voice quality
  - Easiest Smartphone option
  - Has some network limitations
  - Used to require Windows PC at repeater
    - Now can do with Raspberry PI and Linux (with some limitations)

- **AllStar** (http://allstarlink.org)
  - Radio/Smartphone/PC to Radio/Smartphone/PC
  - Smart Phone and PC support works, but is a little “rough”
  - Great, crystal clear voice quality (as good as the radio/repeater is)
  - Best repeater-to-repeater options
  - Very flexible network options
  - Can function without the Internet (using private networks)

Two completely separate systems that can run on the same computer.
Allstar Software - some details

- Based on Asterisk - a free, open source Linux based PBX phone system
  - Asterisk used in business to handle many phone extensions, voicemail, auto-attendant, etc
  - Adapted a little to connect radio systems
  - Carries voice, and PTT, COS, other radio-specific information
- App runs on Linux called “app_rpt” that handles Allstar connections between repeaters, simplex nodes, computers
- Can run on any Linux computer (PC, laptop, Raspberry PI, etc)
- Ready made Linux installation called “Dial”
  - Install, configure, tweak, and go
More About AllStar

- More than 1500 nodes online across the world as of Feb 2016
- Including:
  - the statewide W3WAN Wide Area Network in PA
  - several other large multi-state systems across the U.S.
- Since it’s a completely open standard - hams are experimenting
  - Bridges to DMR digital talkgroups, DSTAR reflectors, Echolink
  - Lots of small simplex nodes at people’s houses
    - You can make your own (later in these slides)
  - Some huge statewide and worldwide networks
  - Some small scale networks with 2-3 repeaters linked
  - Some systems are interconnected full time, some on demand
How AllStar/Echolink work

Connections between systems on our network stay on our network and don’t go over the Internet.

Directory of where to find other stations on the Internet

Computer

Repeater 1

Repeater 2

Computer

Echolink plugin

Allstar app_rpt

Allstar Servers

Echolink Servers

Internet

Other repeaters

Connections between systems on our network stay on our network and don’t go over the Internet
Example AllStar Node Map on http://AllStarLink.org

Shows connections to the W3WAN Wide Area Network that covers most of Pennsylvania.
Summary of Linking Modes

- We’re focusing on linking **analog** systems together
  - Nothing wrong with digital modes, just not what we’re doing
- AllStar is great for linking repeaters, networks, and RF users together
- AllStar from a Smart Phone or PC is rough around the edges
- Echolink has some drawbacks
  - but… Echolink is easiest to use from Smart Phones and PCs so we can’t ignore it
Our Local Project
What, Who, and Why of our local project

● What:
  ○ Establish IP data networking between several area repeaters
  ○ Connect it all to the Internet
  ○ Use it for some new and really cool connectivity options, like AllStar

● Who:
  ○ Corroboration between
    ■ N8XPK
    ■ SARA (Silvercreek ARA) ([http://w8wky.org](http://w8wky.org))
    ■ Wayne Technical Fanatics ([http://ke8abm.club](http://ke8abm.club))
    ■ Others including WA8DBW

● Why:
  ○ Because we can, and it’s cool
  ○ It enhances our ability to communicate
  ○ FCC wants hams to “contribute to the advancement of the radio art”
## Our Connectivity Philosophy for the network

### User Connectivity
- Primary user connectivity via RF
- Secondary via Echolink
  - For easy smartphone support
  - Requires one routable Internet address (broadband connection) per node
  - Limited resource, costs money for more Echolink Nodes
- With Broadcastify for dessert
  - So anyone can listen in with or without a license

### Repeater to Repeater
- Primary inter-connectivity via AllStar
  - To serve RF users (after all, this is Ham RADIO)
  - Works on our local network, or via the Internet
  - Very flexible with great network compatibility
  - Best for repeater-to-repeater linking
  - Superior audio quality
- Secondary via Echolink
  - Only from Echolink enabled repeaters
  - Network complications limit this
Our Repeater Configuration

- Raspberry Pi Hardware
- Echolink plugin software
- Broadcastify EZstream Plugin software
- Allstar app_rpt software
- IP network & Internet
Transporting the signal

Raspberry PI 2 running Linux OS
app_rpt program

digitized audio, PTT, COS
over IP using IAX protocol

Internet

private network

USB

URIx Interface
audio in & out
COS & PTT

audio & controls

repeater
What We’re Doing
The end game by summer 2016

Rittman
- 442.375
  - AllStar tbd
  - Echolink

Echolink App

KE8ABM
- 442.7375
  - AllStar 42757

Akron
- 444.2
  - AllStar 43118
  - Echolink 564436

Doylestown
- 1292.2
- 927

Conference Node
- AllStar 43074

Echolink
- tbd
- 564433

Allstar
- 53.17
  - tbd

Internet

- Allstar
- Echolink
- Other repeaters

KE8ABM = Broadcastify
Where We’re Doing It

Notes: Links in Yellow exist as of 1-26-2016
Links in Green are planned for spring 2016
## Nodes, Capabilities, and Schedule in Local Network

<table>
<thead>
<tr>
<th>Callsign</th>
<th>Frequency / CTCSS</th>
<th>AllStar Node</th>
<th>EchoLink Node</th>
<th>Broadcastify</th>
<th>Supported Usage</th>
<th>QTH - Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>N8XPK-R</td>
<td>53.170 / 107.2 Hz **</td>
<td>42993</td>
<td>564433</td>
<td>Yes</td>
<td>Inbound AllStar &amp; Echolink only</td>
<td>Doylestown OH - 60 mile radius</td>
</tr>
<tr>
<td>N8XPK-L</td>
<td>444.200 / 131.8Hz</td>
<td>43118</td>
<td>564436</td>
<td></td>
<td>Inbound AllStar &amp; Echolink only</td>
<td>Akron OH - 30 mile radius</td>
</tr>
<tr>
<td>W8WKY-L</td>
<td>442.275 / 110.9Hz</td>
<td>43078</td>
<td></td>
<td></td>
<td>Inbound and Outbound AllStar</td>
<td>Doylestown OH - 20 mile radius</td>
</tr>
<tr>
<td>W8WKY-R</td>
<td>147.390 / 114.8Hz</td>
<td>spring ’16</td>
<td>spring ’16</td>
<td>spring ’16</td>
<td>Inbound AllStar &amp; Echolink only</td>
<td>Doylestown OH - 40 mile radius</td>
</tr>
<tr>
<td>KE8ABM</td>
<td>442.375 / 100.0Hz</td>
<td>spring ’16</td>
<td>no</td>
<td></td>
<td>Inbound and Outbound AllStar</td>
<td>Rittman OH - 15 mile radius</td>
</tr>
<tr>
<td>KE8ABM</td>
<td>442.7375 / 131.8Hz</td>
<td>42757</td>
<td>no</td>
<td></td>
<td>Inbound and Outbound AllStar</td>
<td>Rittman OH (low profile test system) 5 mile radius</td>
</tr>
<tr>
<td>Conference Hub</td>
<td>n/a</td>
<td>43074</td>
<td>n/a</td>
<td></td>
<td>Inbound AllStar</td>
<td>Doylestown OH - no radio - a meeting &quot;room&quot;</td>
</tr>
</tbody>
</table>

** 4 receiver sites (transmit one of these PL (CTCSS) tones to select which receiver you go through): 107.2Hz Akron, 110.9Hz Loudonville, 123.0Hz Stone Creek, and 136.5Hz Richfield. The repeater's transmitter always transmits 107.2Hz PL
How To Use It
How To Use it - Basic Guidelines (1)

● Remember to ID properly
  ○ Both on the radio, the computer and the phone
  ○ You’re still going on the air even if you’re on the computer
  ○ When you are entering link and unlink commands, remember you could be transmitting on remote systems
    ■ Good to give your callsign before each DTMF command to ensure proper ID
● There is a delay between the radio and computer
  ○ about 1 second (leave some space between transmissions)
● Courtesy tones will change when link status changes
● If you use your radio to initiate a link to a remote node or hub
  ○ Please listen while it is linked
  ○ Disconnect when you’re done (especially if it’s a busy node)
When linking **outbound** to outside systems, please use these UHF repeaters:

- 442.275 (online now)
- 442.375 (coming on the network spring 2016)
- Gives us all time to work through the processes

**Inbound** Echolink and AllStar connections welcomed on:

- 147.39 (coming on the network spring 2016)
- 53.17 (online now)
- 444.2 (online now)
- Repeater Control Ops may also link these from time to time
- Feel free to use them when they’re already linked or when outsiders have linked up
How To Use it (details on following slides)

- From the radio (best experience)
  - Talk through a repeater that is already linked by someone else
  - Tell the repeater to connect to another system
    - via DTMF tones (give your callsign before entering commands)

- For convenience
  - From a PC
    - AllStar WebTransceiver
    - Echolink Client
  - From a Smartphone
    - Echolink Client
  - Broadcastify website or client for listen-only
How To Use It
From a PC or Smart Phone
A Word About License Verification

- Any ham can use radio to radio links (no validation required)
- To connect using a Smartphone or PC - must get license validated by the AllStar and Echolink teams
  - keeps non-hams from coming out on radio links they aren’t allowed on
- What is required
  - Echolink
    ■ Sign up for an account [http://echolink.org](http://echolink.org)
    ■ License validated by Echolink team (upload official copy to them for approval)
  - Allstar
    ■ Sign up for an account ([https://www.allstarlink.org](https://www.allstarlink.org))
    ■ U.S. hams - Allstar team looks you up on QRZ
How To Use it AllStar WebTransceiver from a PC

- AllStar Web Transciever
- Based on Java (unfortunately)
- It is difficult to get running
- Install Latest Java from java.com
- Go to AllStarLink.org
- Click WebTransceiver
- Launch WebTransceiver
AllStar WebTransceiver

Find the node you want to connect to

Click the Node Number

You will see several security warnings from Java and other things you must accept.

If you get through all that...
**AllStar WebTransceiver**

Click Key to transmit

Unkey to receive
Echolink specifics

- Echolink servers (the Internet) required to find each other
  - No Internet, No Echolink
- Originally a Windows-only app for both users and repeaters
- Officially, supported on Windows
- Compatible apps available on Apple iOS, and Android
- Un-official (mostly) compatible apps can run on Mac, Linux
- We’re using an “unofficial” plugin to connect to Echolink
  - What you keep
    - Ability to connect to & from other Echolink-only repeaters and users
  - What you lose
    - The real callsign and node numbers of connecting users
Echolink from a PC

- Windows program
- Get your call validated
- Sign in to the app
- Use it
How To Use **Echolink** From a Smartphone

- iPhone and Android apps
- Get your call validated
- Sign in to the app
- Use it
Broadcastify

- A way to listen to some of the repeaters on the network
  - 147.39 (coming on the network spring 2016)
  - 53.17 (online now)
- Go to http://radioreference.com
- Click Live Audio… then Live Audio Home
- Drill into map for Ohio… then Wayne County
- Find 53.17 (online now) or 147.39 (Spring 2016)
- Click Listen
  - It’s a little quirky - may not be online 24x7
  - May have to choose HTML5 Web Player, Flash Web Player, others
- There are also Broadcastify apps for iPhone and Android in the app store
How To Use It
From a Radio
How To Use it From A Radio

- Use these UHF Repeaters to link outbound to other systems:
  - 442.275 (online now)
  - 442.375 (coming on the network spring 2016)
  - AllStar nodes: Feel free to connect inbound and outbound from the UHF repeaters
    - Cannot do outbound links to Echolink-only repeaters from these repeaters
  - May expand later - gives us all time to work through the processes

- User initiated outbound linking is not supported at this time on these repeaters:
  - 147.39 (coming on the network spring 2016)
  - 53.17 (online now)
  - 444.2 (coming on the network spring 2016)
  - Feel free to link to these repeaters from the outside
  - If you hear a linked station on these repeaters, feel free to jump in
How To Use it From A Radio - Guidelines

- If you use your radio to initiate a link to a remote node or hub
  - Please keep an ear on things while you have it linked
  - Disconnect when you’re done if you initiated it (especially if it’s a busy node)

- Try to maintain a good signal into the repeater
  - 100mw on an HT / rubber duck inside your car is not your friend

- Use courteous radio and linking practices
  - Listen
  - Don’t do a “drive by”
    - Don’t Link, interrupt a QSO in progress, Unlink
    - If you’re not sure what you’re linking into:
      - Link in Receive Only Mode first ( * 2 ) to hear what’s on the remote
      - Then change to transceive mode ( * 3 ) when you want to join in
      - More in following slides
First - What are all these numbers?

- Every AllStar repeater, simplex node, and conference hub is assigned a node number.
- From a PC or Smartphone, you normally don’t need them.
  - You can search lists and connect by callsign from computers.
- To connect from another repeater or radio, you need to enter the node number on your DTMF pad.
  - Since you can’t browse for a callsign from your radio.
- Where do I get the Node Numbers?
  - EchoLink Node Numbers: [http://echolink.org/logins.jsp](http://echolink.org/logins.jsp)
User DTMF Commands and Connection Examples

- Common DTMF commands from a radio through a repeater on our UHF machines
  - Connect to a node Receive Only: *2 [node number]
  - Connect to a node Transceive: *3 [node number]
  - Read back list of what is connected: *7 0
  - Unlink everything: *7 1
  - Unlink a specific node: *1 [node number]
  - Give the time *8 1

- Example 1:
  - You are on a radio through the 442.275 repeater, node 43078
  - You wish to connect to the 53.17 repeater, node 42993
  - Key up, say your callsign, and enter:
    - *3 42993
    - If the repeater doesn’t speak an error, you’re connected
    - Give your ID again, and make your call or announce you are listening
More User DTMF Commands and Connection Examples

● Example 2:
  ○ You are on a radio through the 442.275 repeater, node 43078
  ○ You wish to call another station on the same repeater, and don’t want to tie up other systems
  ○ Key up, **say your callsign**, and enter:
    ■ * 7 1 which will disconnect ALL linked stations
    ■ If the repeater doesn’t speak an error, you’re disconnected
    ■ Give your ID again, and make your call or announce you are listening

● Example 3:
  ○ You are on a radio through the 442.275 repeater, node 43078
  ○ You wish to see what is linked to the 442.275 repeater
  ○ Key up, **say your callsign**, and enter:
    ■ * 7 0 which will read back the nodes of everything connected
Still More Examples

- **Example 4:**
  - You are on a radio through the 442.275 repeater, node 43078
  - You wish to connect to a remote hub node number **27225**, but you don’t want to interfere with something on the remote node
  - Key up, **say your callsign**, and enter:
    - * 2 27225 which will connect in Receive Only mode
    - Transmissions on 442.275 will NOT go to the remote link
    - Activity on the remote link will be heard on 442.275

- **Example 5:**
  - You initiated a receive only link earlier to node 27225 (above)
  - You wish to initiate transceive mode to talk to the other end
  - Key up, **say your callsign**, and enter:
    - * 3 27225
    - Give your callsign again (but don’t interrupt remote QSOs)
  - 442.275 is now in full 2 way mode to all systems on the remote hub
Roll Your Own
What does it take to build one of these nodes?

- If you want to do more than use the system, you can build your own!
- Anyone can build an AllStar node
- It’s a great learning experience, and useful too!
- You can build:
  - A full fledged repeater
  - A simple low profile repeater out of spare HT’s or mobiles
  - A simplex node to access the network easily from your house
- Or you can use your radio and/or computer to use this new system
- **Linux Computer** ($29)
  - PC, Laptop
  - Raspberry PI or Beaglebone Black

  AND

- **Sound card USB dongle**
  - Can buy URIx from MRK Engineering ($69.95)

  OR

  - Can modify cheap USB sound dongle to add PTT and COS (~ $15)

- **Radio or Repeater**
Warning: If you want to make your own repeater - You’re going to have to do some Linux

AllStarLink.org makes things easier, but you will need to do some Linux command line to make it all work well.