Introduction to Broadband Hamnet

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The Need for Speed

- NBEMS is a great suite for sending data but...
- It is slow...MT63-2000 is only 1 kb per sec
- 3 min to send a modest 3000 byte file
- Can send only text
- Even low res photos are impractical to send
- Forget about sending video
- Would like to send rich multimedia data
- Live streaming video
- Large spreadsheets and documents
The Solution: Broadband Hamnet

- One solution is Broadband Hamnet (BBHN)
- Was known as High Speed Multimedia (HSMM)
- Take an inexpensive off-the-shelf wi-fi device...
- Install ham-developed firmware and...
- We can easily create high-speed networks
- Networks are self-discovering and self-configuring
- Hams don't need to be IT personnel to create networks
- Limitation...line of sight range
- But, in the clear and with high-gain antennas, range of miles
Mesh Network Concepts

- Each BBHN router is known as a “node”
- Nodes listen for other nodes
- When another node is found, it is added to the network.
- We have multiple redundant paths through the network.
- Looks like a fish net, or a mesh
- No ham intervention is required for nodes to form a mesh.
- Ham shows up, plugs in router, it's added to mesh
- It's all automagical!
Mesh Network Diagram

Mesh Network Diagram
Note multiple paths between Nodes A and F
Wi-fi concepts

- Commercial wi-fi networking devices use the 2.4 GHz amateur radio band
- Wi-fi channels 1-6 fall in the 2.4 GHz ham band
- We can operate wi-fi devices under FCC Part 97 meaning...
  - No limits on antenna gain
  - Higher power than allowed under Part 15
  - Drawback to Part 97...no encryption
## Wi-fi channels in 2.4 GHz ham band

<table>
<thead>
<tr>
<th>Channel</th>
<th>Center Frequency</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>2.412 GHz</td>
</tr>
<tr>
<td>2</td>
<td>2.417 GHz</td>
</tr>
<tr>
<td>3</td>
<td>2.422 GHz</td>
</tr>
<tr>
<td>4</td>
<td>2.427 GHz</td>
</tr>
<tr>
<td>5</td>
<td>2.432 GHz</td>
</tr>
<tr>
<td>6</td>
<td>2.437 GHz</td>
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</tbody>
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Supported Hardware

- Two families of wi-fi devices supported by BBHN
- Linksys
- Ubiquiti
- Linksys suitable for short range indoor use
- Ubiquiti appropriate for outdoor use
- Including antenna, can easily put together a BBHN system with new hardware for under $100
- Hardware available via Amazon, NewEgg, etc.
Linksys WRT54G...a classic!
Be careful before buying...
- Lots of versions of WRT54G produced
- Not all of them will run the BBHN firmware
- Check http://broadband-hamnet.org for list of supported Linksys devices
- WRT54GL available new for around $50
- Often see older versions of WRT54G at hamfests for as little as $10
Ubiquiti Hardware

- Ubiquiti hardware recently supported by BBHN
- Two favorites...
- Ubiquiti Bullet M2...600 mW radio
- N connector on top
- Attaches directly to antenna...no feedline loss!
- Ubiquiti AirGrid...200 mW radio integrated into 16 dBi – 23 dBi dish antennas
- Both use Power Over Ethernet (PoE)
- Bullet available for about $80 from Amazon
- 16 dBi AirGrid available around $60
Ubiquiti Bullet M2
Ubiquiti Bullet on 24 dBi antenna
Ubiquiti AirGrid 16 dBi
Installing the BBHN Firmware

- Detailed instructions available on BBHN website
- Slightly different between Linksys and Ubiquiti
- DON'T TURN OFF POWER WHILE INSTALLING!
- Not as intimidating as it sounds
- Pretty easy, takes about 15 minutes
Connecting to new BBHN router

- Configure your computer to use DHCP to obtain IP address
- In Windows, configure to “obtain IP address automatically”
- Also select “obtain DNS server automatically”
- Plug in Ethernet cable, power up router
- On Windows, run ipconfig command to verify you have IP address starting with 10.x.x.x
- Go to http://localnode:8080 in browser
- Initial login credentials root, hsmm
Initial Node Configuration
# Exploring the Mesh

![W3YJ-5 mesh status](http://localhost:8000/status)
Configuring Services

- When you plug a device into a router, it will be assigned an IP address
- IP addresses are great for computers, lousy for humans!
- Set up your router to advertise a service
- Tell you operators the name of the mesh node
- They can then point and click on the desired service
Advertising a Service
What can we do with a mesh?

- Use your imagination!
- Any Internet application can be run
- We will show how to do the following...
- Live streaming video
- File transfer with FTP for integration with NBEMS
- Will show how to use with point-and-click and drag-and-drop
- Need to keep applications easy to use
- Remember, we're hams, not IT professionals
Live Streaming Video

- Lots of cheap IP webcams available starting at $50
- Configure webcam for DHCP and...
- Plug into node
- Advertise the service on a node
- Go to the service, click on the link and...
- You'll see live streaming video!
- Video can be displayed on smartphone or tablet device
- Useful for public events
- Crowd control, traffic jams, disaster scenes
- Provide remote eyes for our Served Agencies
IP Webcam for Streaming Video
FTP Integration with NBEMS

- Goal: Send data from an aid station to an NBEMS station for long-haul relay
- Set up an anon FTP server and attach to the mesh
- Use Flmsg to write and read forms
- Will send Flmsg messages to our NBEMS station using the mesh and the FTP server
- Frees up NBEMS station for communication with outside the scene
- Can setup Windows or Linux FTP server
- Good Windows FTP server is FileZilla: https://filezilla-project.org/
FTP to NBEMS Workflow

- Entire workflow uses point-and-click, drag-and-drop from end-to-end
- For the ham at an aid station...
- Create message with Flmsg
- Save file to desktop
- Open IE
- Go to advertised FTP service on mesh
- Click on link
- In IE, View-> Open FTP Site in IE
- Drag file from desktop into FTP window
FTP to NBEMS Workflow

Drop Flmsg file into FTP window
FTP to NBEMS Workflow Cont...

- To retrieve Flmsg file from FTP server for NBEMS transmission...
- Go to advertised FTP server, open FTP window as before
- Drag file from FTP window onto Desktop
- Open Flmsg
- Drag file into little blue circle at top right of Flmsg
- Save file, hit AutoSend
- The file is on the way!
Obtain Flmsg file from FTP Server
Drop file into Flmsg
Where do we go from here?

- New technology for us
- Must get out in the field and experiment!
- Will be using at upcoming airport drill and possibly airshow
- We will be holding additional workshops
- Let's think of additional uses for technology
References

- BBHN website
  http://broadband-hamnet.org
- Wireless Networking in the Developing World
  http://wndw.net
  Free book!
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