

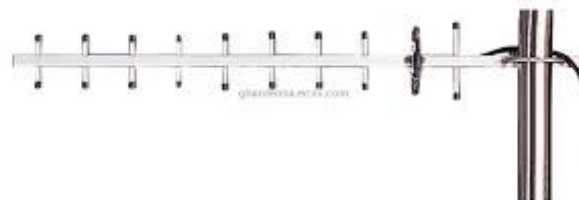
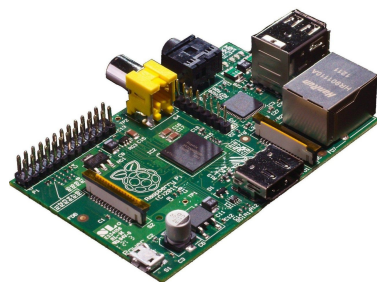
Mesh Networking and the Broadband-Hamnet

A overview of today's implementation of an
Amateur Radio computer Mesh Network.

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Today's Program

- Why an independent network?
- Important Definitions,
- Meet the BBHN,
 - Capabilities,
 - Rules and Limitations,
- How to get going,
- BBHN router set up,
- Available Services on BBHN-Ottawa.

Why a private Ham Data Network?

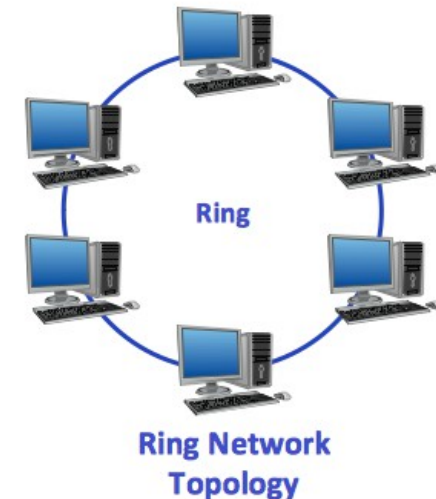
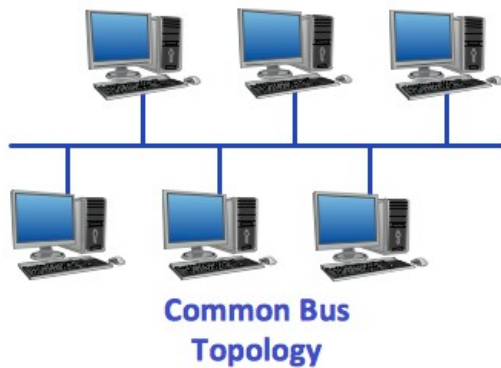
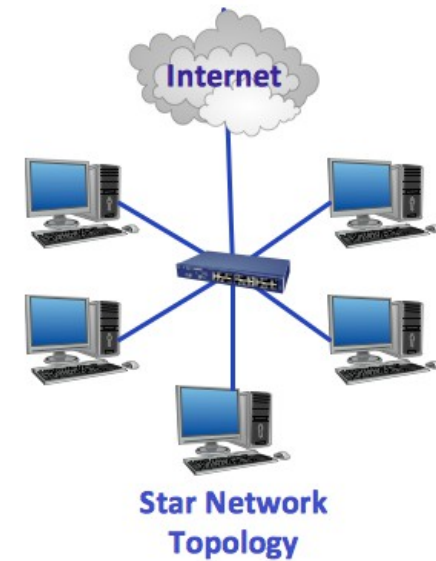
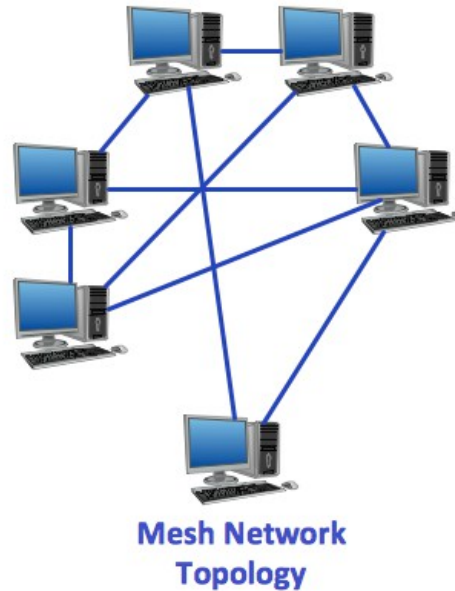
- **Emergency readiness.** Commercial Networks are unreliable in disaster periods.
- **Community services.** For example checkpoint coordination at organized events, video links,
- **Learning experience.** Learn and experiment with data networks, microwave propagation, Linux etc.
- **Amateur radio data linking robustness.** Improve D-Star, packet, APRS data linking.
- **Spectrum occupancy.** Use it or lose it!

Important Definitions

- **Data Network:** A system of interconnected computer systems, terminals, and other equipment allowing information to be exchanged.
 - **Infrastructure mode:** A wireless router (joins) a wireless network to a wired network (Internet) while supporting central connection points for local wireless clients.
 - **Ad-Hoc mode:** Network connections do not require a router or a wireless base station (Peer-to-Peer)

Important Definitions (cont.d)

- Network Topology



Important Definitions (cont.d)

- **Mesh Network:** A network topology in which each node (called a mesh node) relays data for the network. All nodes cooperate in the distribution of data in the network.

The Broadband-Hamnet (BBHN)

- **A mesh data network:** Built utilizing re-purposed commercial hardware flashed with amateur-radio-specific firmware (Linksys WRT54 series, Ubiquity, Raspberry Pi).
- **Regular Ham bands:** Wireless links commonly established in the 2.4GHz band, but now also available in the 5.8GHz band.
- **High-speed:** 54Mb/s digital data network, using IEEE 802.11g on 2.4GHz.
- **Previously known as HSMM:** High Speed Multi-Media.

The BBHN (cont.d)

- **Self-building & configuring network:** Nodes can seamlessly enter & leave network.
- **TCP/IP-based network with automatic DNS:** Node names instead of IP addresses.
- **Self-routing:** Uses built in link-cost analysis for efficient data transfer.
- **Self-Healing:** Traffic is automatically re-routed whenever possible.
- **Uses OLSR:** Optimized Link State Routing protocol. Not much for us in there...

Rules and Limitations with BBHN

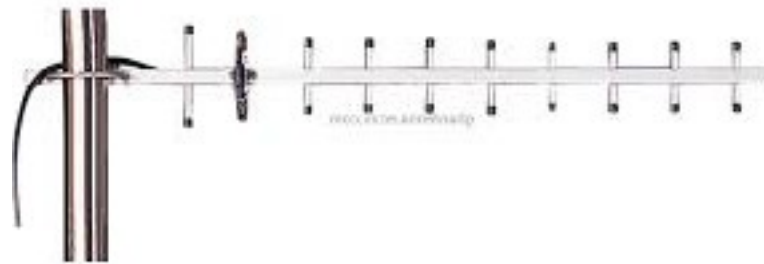
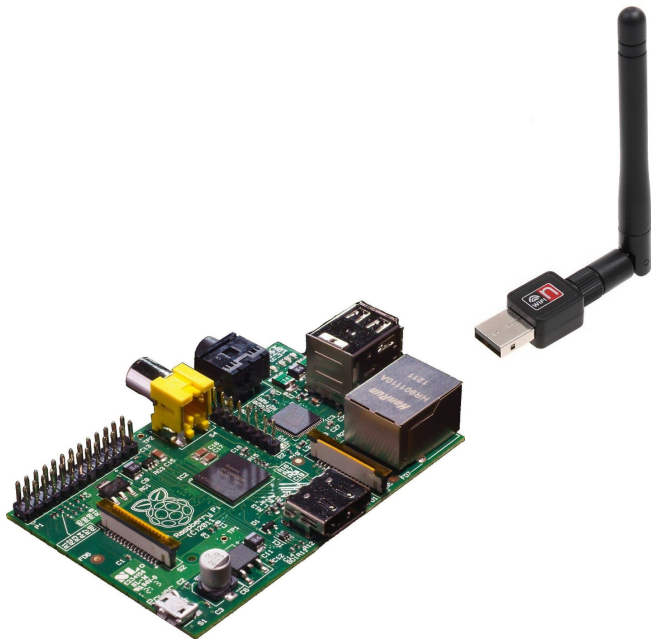
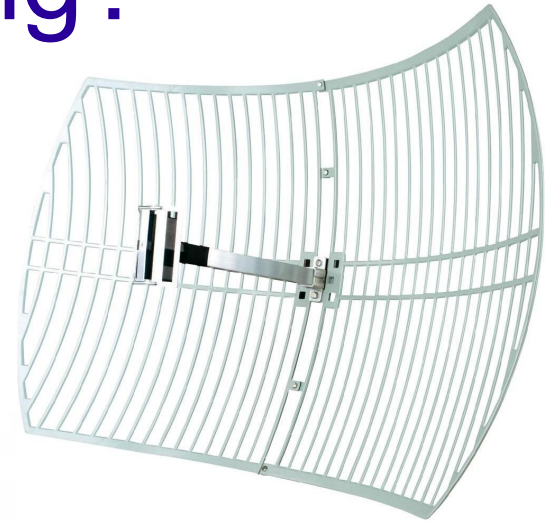
- **Falls under Amateur Radio Service:** With limitations set by the service, like high power!
- **Broadcast SSID:** Must show callsign (like VE2ZAZ-6)
- **No Encryption:** Communications should not be encrypted, same as on any other mode or band.
- **Open to hackers:** Those who understand mesh networks and OLSR.

Recommended to segregate BBHN from your private home network.

How To Get Going?

- Get Some Hardware:
 - Linksys/Cisco WRT54G/GS/GL router — Be aware that some versions of the WRT54G cannot run the BBHN firmware. Read BBHN website for more information.
eBay, Kijiji, Amazon. <http://http://www.broadband-hamnet.org/>
 - Ubiquiti M2 (2.4GHz) or M5 (5.8GHz) unit.
<http://ubnt.ca>
 - Raspberry Pi and WiFi dongle. Use dongle with Ralink 5370 chipset.
<https://github.com/urlgrey/hsmm-pi>
 - Good antenna or pair of antennas. The higher, the better of course.
eBay, home-brewed, etc.
 - Some CAT-5 cable. You plan to go up in height, right?

How To Get Going?



BBHN: Main Screen

Broadband-Hamnet No... x 

VE2ZAZ-FN25bk

[Help](#) Refresh Mesh Status OLSR Status WiFi Scan Setup ☐ Night Mode

WiFi address	10.244.138.4 / 8 fe80::26a4:3cff:fef4:8a04 Link	Signal/Noise/Ratio	-72 / -94 / 22 dB	Auto
LAN address	10.164.80.33 / 29 fe80::26a4:3cff:fef5:8a04 Link	firmware version	1.1.2	
WAN address	none fe80::26a4:3cff:fef5:8a04 Link	configuration	mesh	
default gateway	none	system time	Fri Jan 9 1970 13:21:57 UTC	
		uptime	8 days, 13:21	
		load average	0.10, 0.06, 0.05	
		free space	flash = 3452 KB /tmp = 14488 KB memory = 7588 KB	

BBHN: Basic Setup Screen

VE2ZAZ-FN25bk setup

[Node Status](#)[Basic Setup](#)[Port Forwarding, DHCP, and Services](#)[Administration](#)

[Help](#)[Save Changes](#)[Reset Values](#)[Default Values](#)[Reboot](#)

Node Name Password

Node Type Verify Password

WiFi

Protocol

IP Address

Netmask

SSID

Mode

Channel

Active Settings

Rx Antenna

Tx Antenna

Tx Power

Distance

[Apply](#)

LAN

LAN Mode

IP Address

Netmask

DHCP Server ☒

DHCP Start

DHCP End

WAN

Protocol

DNS 1

DNS 2

Mesh Gateway ☐

BBHN: DHCP & Services Screen

VE2ZAZ-FN25bk setup x +

[Node Status](#)[Basic Setup](#)**[Port Forwarding, DHCP, and Services](#)**[Administration](#)

[Help](#)[Save Changes](#)[Reset Values](#)[Refresh](#)

DHCP Address Reservations

Hostname	IP Address	MAC Address	
VE2ZAZ-RPi-Se	10.164.80.34	b8:27:eb:04:e8:a6	Del
	- IP Address -		Add

Current DHCP Leases

VE2ZAZ-RPi-Server	10.164.80.34	b8:27:eb:04:e8:a6	Add
zaub-5	10.164.80.35	00:1e:0b:30:37:09	Add
SipuraSPA	10.164.80.36	00:0e:08:fb:ce:9a	Add

Advertised Services

Name	Link	URL	
BBHN-Ott	☒	http://VE2ZAZ-RPi-Server:80/	Del
BBHN-Ott	☒	http://VE2ZAZ-RPi-Server:80/	BBHN-Ott Del
BBHN-Ott	☒	http://VE2ZAZ-RPi-Server:80/	BBHN-Ott Del
BBHN-Ott	☒	ftp://VE2ZAZ-RPi-Server:21/	Del
BBHN-Ott	☒	http://VE2ZAZ-RPi-Server:8888/	Del
BBHN-Ott	☒	http://VE2ZAZ-FN25bk:80/	BBHN-Ott Del
	☐	://VE2ZAZ-FN25bk:/	Add

Port Forwarding

Interface	Type	Outside Port	LAN IP	LAN Port	
WAN	TCP		- IP Address -		Add

BBHN: Mesh Screen

VE2ZAZ-FN25bk mesh s... x 

VE2ZAZ-FN25bk mesh status

Stop

Quit

Local Hosts	Services	Current Neighbors	LQ	Services
VE2ZAZ-FN25bk • VE2ZAZ-RPi-Server	BBHN-Ottawa-Mail-Server BBHN-Ottawa-File-Repository BBHN-Ottawa-Home BBHN-Ottawa-LiveChat BBHN-Ottawa-Phone-PBX BBHN-Ottawa-WebMail	VExyyy (mid)	58%	
		Previous Neighbors		When
		none		

Remote Nodes	ETX	Services
none		

BBHN: Mesh Screen

VExyyy mesh status

VExyyy mesh status

Refresh Auto Quit

Local Hosts	Services	Current Neighbors	LQ	Services
VExyyy		VE2ZAZ-FN25bk (mid) 100%		BBHN-Ottawa-Mail-Server
		• VE2ZAZ-RPi-Server		BBHN-Ottawa-File-Repository
				BBHN-Ottawa-Home
				BBHN-Ottawa-LiveChat
				BBHN-Ottawa-Phone-PBX
				BBHN-Ottawa-WebMail

Remote Nodes	ETX	Services
none		

Previous Neighbors	When
none	

VE2ZAZ Pi Server: Home

Broadband-Hamnet o... x +



Welcome to the
Broadband-Hamnet of Ottawa-Gatineau
Amateur Radio Website

This Mesh Network is operated and maintained by the Ottawa - Gatineau area amateur radio community. As a reminder, since this mesh network operates as a Canadian Amateur Radio service, none of the traffic flowing on this mesh network must be encrypted.

Some available services



An email server is available to all mesh users. Email addresses are in the form of *callsign@bbhn-ottawa.org*. WebMail access, POP3, SMTP and IMAP protocols are supported.



A Live Chat server is available to all mesh users. This allows a keyboard-to-keyboard converse between users. Multiple users can converse on this single channel simultaneously.



An FTP file repository is available to the users to download BBHN-related files.



An IP Telephone PBX based on Asterisk is available to make telephone calls between users.

VE2ZAZ Pi Server: Email



BBHN-Ottawa-Gatineau Mail Server and Webmail

An email server is operational on the BBHN-Ottawa network. It allows to send emails between users. The server is based on the Citadel suite, a self-contained linux mail transfer agent with browser webmail support. User interface with the server is done in a similar fashion as most email servers out there. The server supports SMTP, IMAP, Sieve, POP3, GroupDAV, XMPP and Webmail. All protocols offer OpenSSL encryption for additional security, though on BBHN encryption is not allowed.

A new mail account can be created by the user simply by visiting the webmail site at <http://ve2zaz-rpi-server:8888> . Then click on the "New User? Register now" button, and follow the instructions. Please use your 5 or 6-letter amateur radio callsign in lowercase as the user name when creating your mail account. This will produce your email address in the pattern: `callsign@bbhn-ottawa.org` . This same [webmail site](#), right from your web browser, is one access method, of course, to read or send emails.

For simplified mail access through your client software, we recommend you use POP3 for retrieving the emails and SMTP for sending them . Please use the following parameters when defining your account:

Server name: "ve2zaz-rpi-server", without quotes
User name: your callsign in lowercase
Password: to your liking...
POP3 port: 110
SMTP port: 25

An example of client mail program setup is shown here, this being the Mozilla Thunderbird client software.

Mail Account Setup

Your name: Your name, as shown to others

Email address:

Password:

☒ Remember password

The following settings were found by probing the given server

	Server hostname	Port	SSL	Authentication
Incoming:	POP3 ve2zaz-rpi-server	110	None	Normal password
Outgoing:	SMTP ve2zaz-rpi-server	25	None	Normal password

VE2ZAZ Pi Server: WebMail

Mail - BBHN-Ottawa-... x

BBHN OTTAWA
WEBMAIL



Mail

0 new of 0 messages

Make this my start page

Logged in as ve2zaz

Search:

View as: Mail Folder

Language: en_GB

Ungoto

Refresh message list

Delete

Write mail

Skip this room

Goto next room

Summary

Mail

Calendar

Contacts

Notes

Tasks

Rooms

Online users

Chat

Advanced

Administration

Log off

customise this menu

Subject	Sender	Date
This is only a test!	ve2zaz	9:04

Tue Aug 26 2014 09:04:58 UTC from [ve2zaz](#) to ve2zaz <ve2zaz@bbhn-ottawa.org>

Subject: This is only a test!

[\[Reply\]](#) [\[ReplyAll\]](#) [\[Forward\]](#) [\[Move\]](#) [\[Delete\]](#) [\[Headers\]](#) [\[Print\]](#)

Remain in your shelter!

Bert, VE2ZAZ

VE2ZAZ Pi Server: Live Chat

BBHN-Ottawa-Gatineau... x

**BBHN Ottawa-Gatineau Live Chat**

Your Callsign:

Online Users: VE2ZAZ -

(VE2ZAZ 26/08/2014-09:08:00)
Try again now with my repositioned antenna...

(VE2ZAZ 26/08/2014-09:07:31)
Rick, are you there?

(VE2ZAZ 26/08/2014-09:07:14)
Allo Bozo!

(VE2ZAZ 26/08/2014-09:07:01)
Salut toi!

(VE2ZAZ 26/08/2014-09:06:46)
Hello Everyone!

VE2ZAZ Pi Server: Asterisk PBX

BBHN-Ottawa-Gatineau... x



BBHN-Ottawa-Gatineau IP Telephone PBX (Asterisk)

This telephone Private Branch Exchange allows to communicate by voice between BBHN-Ottawa users, using the same SIP protocol and hardware as in businesses today. A simple SIP phone client software installed on your PC is sufficient to use this phone system. On Linux, Twinkle is recommended. Alternatively, a SIP telephone or SIP Analog-Telephone-Adapter (ATA) can be used.

The following settings should be used to configure the client software in order to connect with the Asterisk server. Note that in most cases, the user merely has to enter the userID, the password and the server address:

UserID: the two digit extension,
Password: your password assigned at account creation,
Server IP Address: 10.13.5.130
SIP Port: 5060,
Codec: u-Law,
Protocol: SIP.

Current Telephone Directory

Users	Telephone Extension
Bert, VE2ZAZ	11
Rick, VE3CVG	12
Test-1 *	31
Test-2 *	32
Test-3 *	33
Test-4 *	34

To be added to the list of registered users, please contact Bert, VE2ZAZ at one of the addresses at the bottom of this page.

*Test Extensions are enabled and available to all for short term connectivity testing. Register with userID's "31" to "34". Use "test" as the registration password.

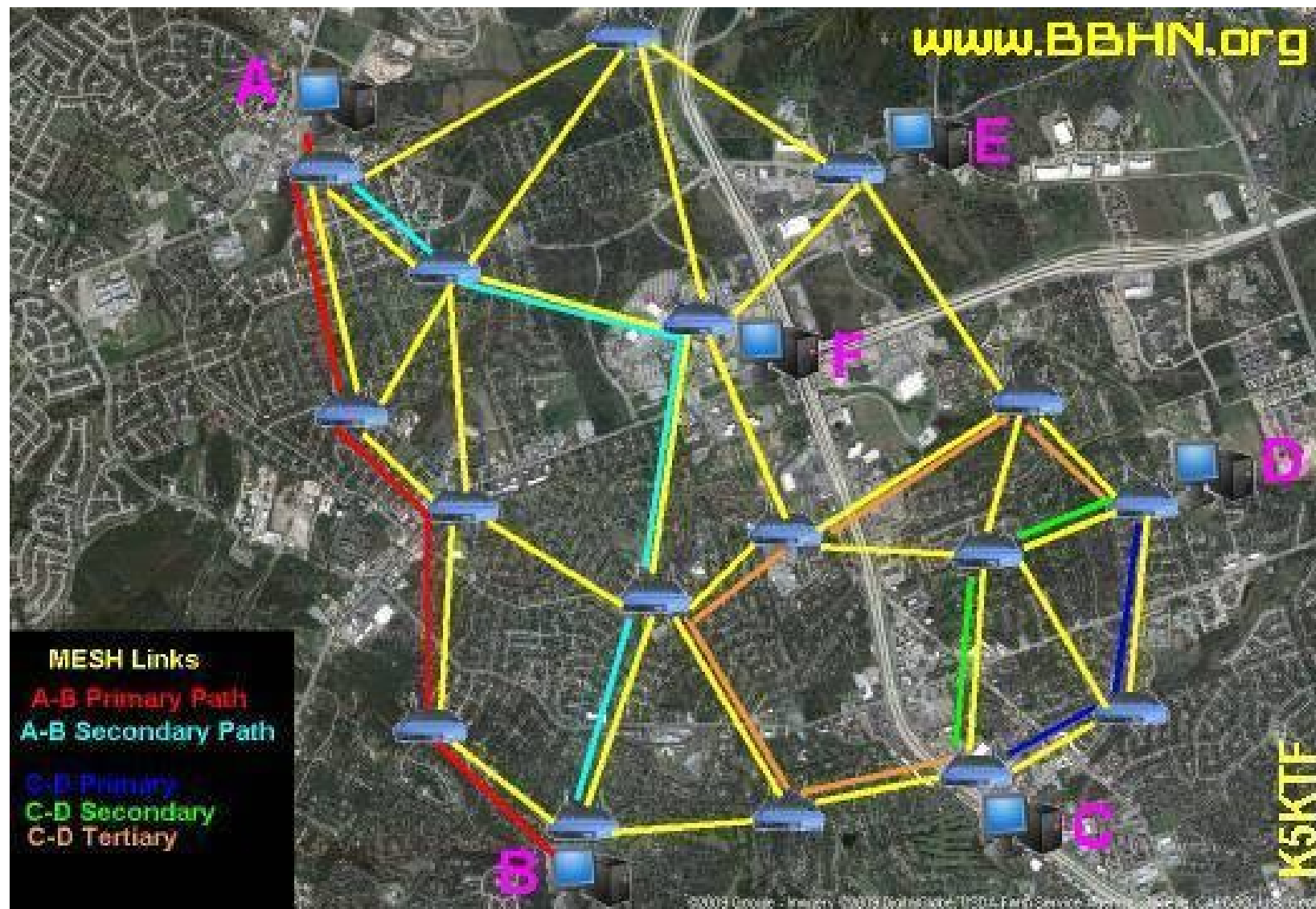
Services

User	Telephone Extension
Conference bridge (party line) for all	75
Time Announcement	70

VE2ZAZ Pi Server: File Repository

Index of ftp://10.164.... x			
Index of ftp://10.164.80.34/			
Up to higher level directory			
Name	Size	Last Modified	
 Basic_Setup.png	78 KB	14-08-26	09:10:00 AM
 DMC_10G_Oscillator_Brick_110389.zip	385 KB	14-08-26	09:11:00 AM
 GPS_Std_MonTrol_v4_Setup.exe	417 KB	14-08-26	09:11:00 AM
 _Read_Me_Welcome.txt	1 KB	14-08-02	08:18:00 PM

An Example of BBHN: Austin, TX



BBHN in Ottawa

- YMCA-Ottawa Hub
 - WRT54G
 - One antenna pointed at VA3YH,
 - One antenna is the standard Linksys antenna.
 - Ubiquiti M2 Loco pointed WNW,
 - Ubiquiti M2 Loco pointed SSW,
- Hull/Gatineau plans,
- Several individual stations currently active:
 - VE3CVG, VE2ZAZ, VE3IRR, VA3YH, VA3OMP, ...
- **We need you onboard!**

More Info...

- **Broadband-Hamnet Website**
<http://www.broadband-hamnet.org>
- **VA3ODG Bulletin Board (Forum)**
<http://va3odg.webqth.com/forum/viewforum.php?f=3>
- **HSMM-Pi (Raspberry Pi BBHN)**
<https://github.com/urlgrey/hsmm-pi>
- **Youtube Videos**
Search for “Broadband Hamnet” or “HSMM”



Thank You!