

Amateur Microwave Data Transmission

How to configure and when to build routed vs. bridged network.

Rocky Mountain Ham University
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<http://www.rmham.org>

Equipment Considerations

- ◆ A small sample of equipment that is available readily to transmit data.

	Ease of Config	Out of Band	Price	Quality
Ubiquiti	5	Int'l Only (Limited)	Low-Medium	Medium
Engenius	5	None	Low	Low
Mimosa	5	None	Medium	Medium
Mikrotik	2	Intl Only (Limited)	Medium	Medium

Ubiquiti

- Good general purpose data radio, popular in commercial environments
- Not many “out of band options”
- Some international radios have some ham band overlap
- Good PtP and PtMP options



Engenius

- ◆ Short range Access Points
- ◆ Short range Link Radios
- ◆ Only ISM and UNii options
- ◆ No ham band options



Mimosa

- ◆ Great PtP and PtMP options, GPS timing options, and good throughput.
- ◆ Not your average wifi junk
- ◆ Price is much higher due to the class of equipment
- ◆ No out-of-band options for ham use.



Mikrotik



- ◆ Our personal favorite, very versatile and cost effective
- ◆ Excellent options for ham-band in 5GHz.
- ◆ 2.4GHz ham band doesn't have a 20 mhz option. Most Mikrotik product require 20mhz channels to operate.
- ◆ 3.3-3.5GHz is possible with Dbii networks cards (no integrated solutions) which can be somewhat expensive.
- ◆ Somewhat difficult and confusing to configure for new users. Lots of options!!

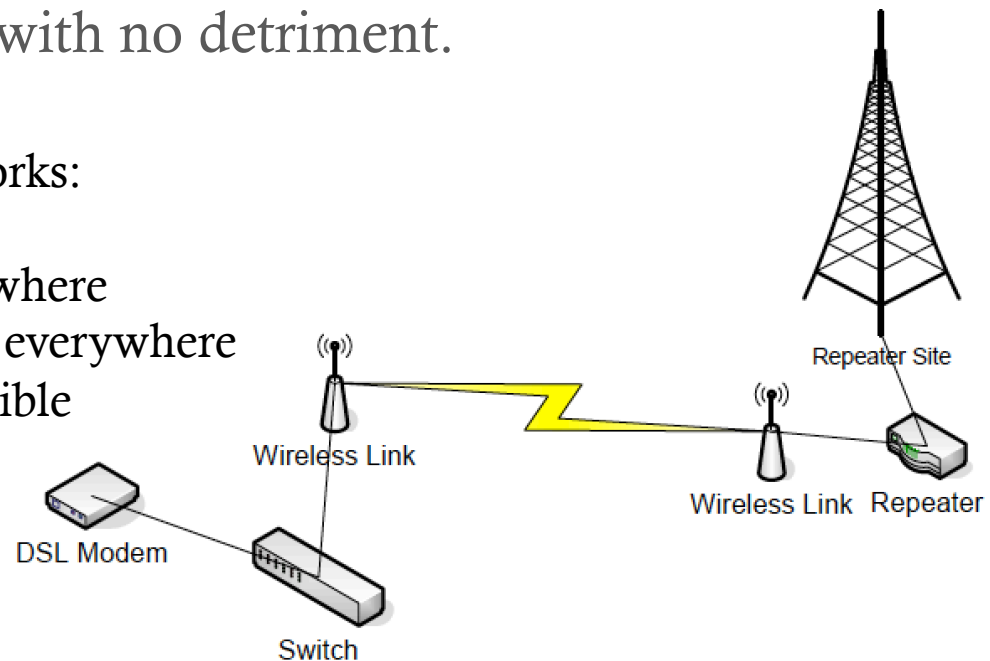


Networking for Amateur

- Transmission of data to a single point can be done on a bridge only network with no detriment.

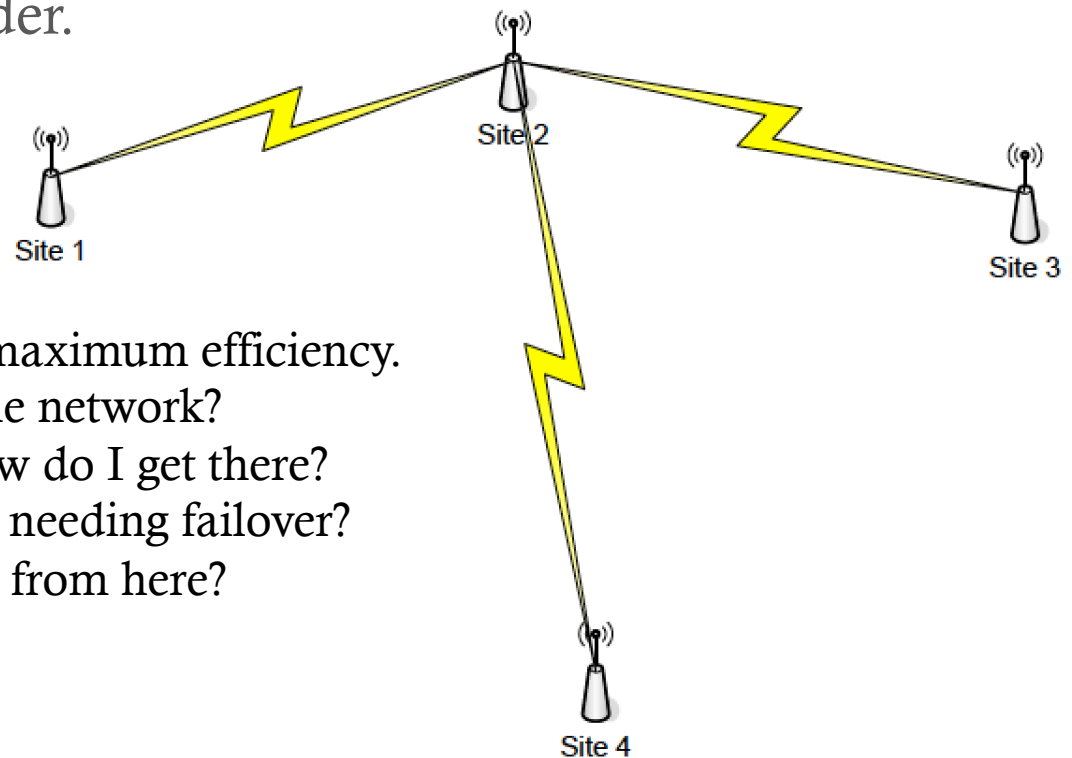
Concerns with bridged networks:

- Privacy
- All traffic goes everywhere
- Multicast traffic goes everywhere
- ARP Storms are possible



Multiple Sites

- With multiple sites, the difficulty is magnified and there are many items to consider.



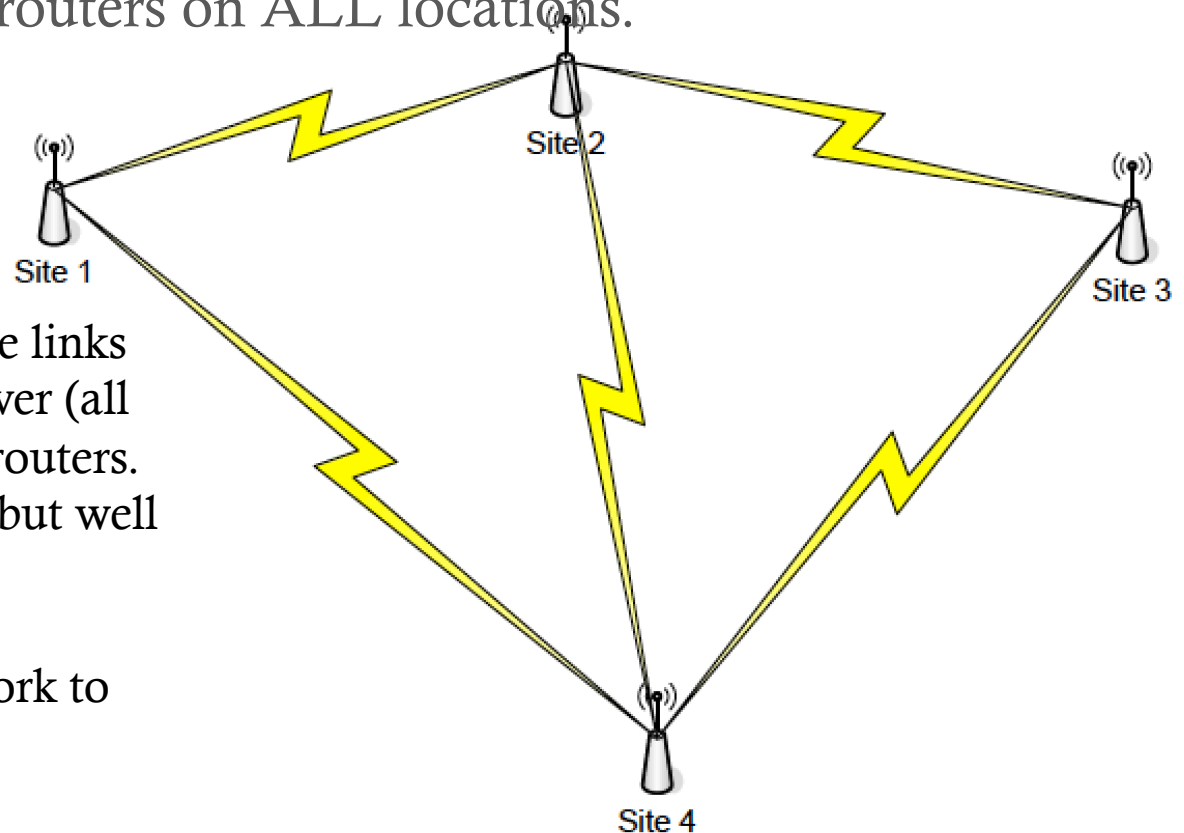
This will need to be routed for maximum efficiency.

- Do I need to go outside of the network?
- Where is the internet and how do I get there?
- Are there any possibilities of needing failover?
- Do you have to go elsewhere from here?

Multiple Sites with Failover

- ◆ Failover requires routers on ALL locations.

- The addition of two more links allow for automatic failover (all done with OSPF) in the routers.
- Not simple to configure, but well worth the time.
- Routers allow for interconnection off-network to additional places.



Configuration

- ◆ Lets start with some basics to configure
- ◆ Configure the PC to talk to the radio
- ◆ Configure the radio!

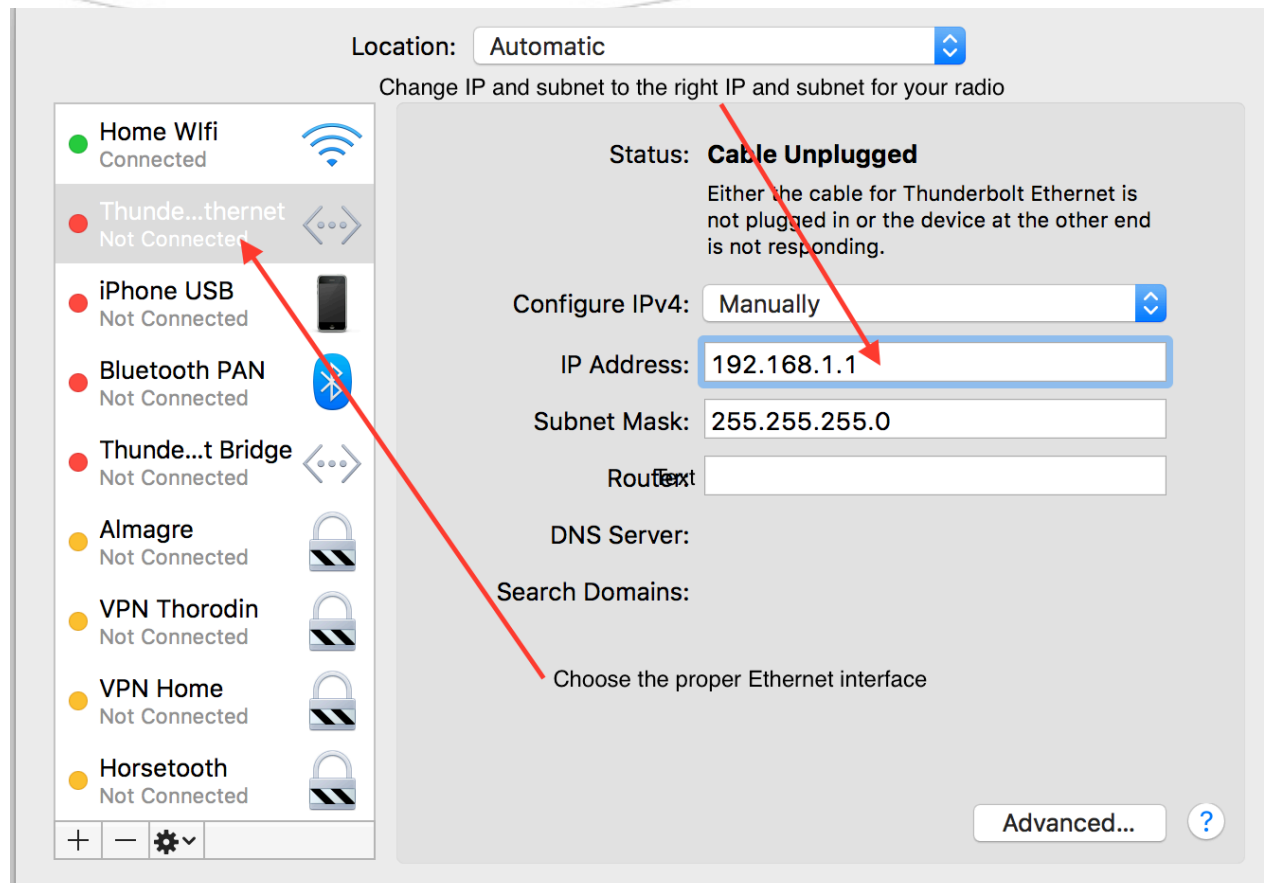
Config Based on Ubiquiti

- ◆ We will teach basic configuration for Ubiquiti radios due to the complexity of Mikrotik. If you want to learn Mikrotik, we can do a future netmeeting to go over configuration options.
- ◆ Configuration of Ubiquiti, Engenius and Mimosa are VERY similar.

Computer Configuration

- ◆ You must have a PC with an hardwired Ethernet port to configure these style devices properly
- ◆ Set PC to match the default network address of the device to be configured
- ◆ Ubiquiti default IP 192.168.1.20
- ◆ Ubiquiti default subnet 255.255.255.0

Configuring Mac



Split into groups

- ◆ 4 Groups
- ◆ Each group needs a PC with a hardwired ethernet port
- ◆ 2 Ethernet cables
- ◆ Power over ethernet adapter and power
- ◆ Ubiquiti radio

Set up to configure the radio

- ◆ **NEVER CONFIGURE ANY RADIO WITHOUT AN ANTENNA INSTALLED!!!**
- ◆ Plug in power injector
- ◆ Plug radio into the “POE” port
- ◆ Plug computer into “ETH” or “LAN” port



Begin to Configure Radio

- ◆ On a Ubiquiti, Browse to 192.168.1.20
- ◆ One end must be a master or Access Point, one end must be the slave or station.

Configure Frequency

- ◆ Choose the proper transmit frequency on the master. Slave usually follows.
- ◆ On Out-of-Band radios, *you may have to explicitly specify the receive frequencies* or it can't find the master.
- ◆ Configure the channel width. Remember that the channel width usually centers on the listed frequency. A 20mhz channel centered on 5920 will put the emissions 5mhz outside of the amateur band!!! (5650-5925)

Encryption on Amateur

- ◆ You cannot legally add any encryption on amateur radio frequencies. DO NOT USE WEP, WPA/WPA2 etc on amateur links.
- ◆ You can use MAC Address filtering to keep unwanted rif-raff out and secure your network.

Set the SSID

- ◆ This is a somewhat critical point. You need to name your radio SSID by the amateur radio call if in use in the Amateur Bands. N0SZ-10 would meet this criteria. Both ends need to match this to link and transmit it's information.
- ◆ Radio name should be something that is descriptive that means something to you and includes the HAM CALL.

Configure output power

- ◆ Generally on most configurations, pick the highest power available. This will get you the highest fade margin possible.
- ◆ The levels on these radios is so low, all available output power is an advantage.

The radio should pass traffic!

- ◆ Test it by pinging to/from both ends.
- ◆ Do a speedtest and see what you get
- ◆ Step through some configuration options

Questions?

- ◆ If you have questions, or comments, please ask!