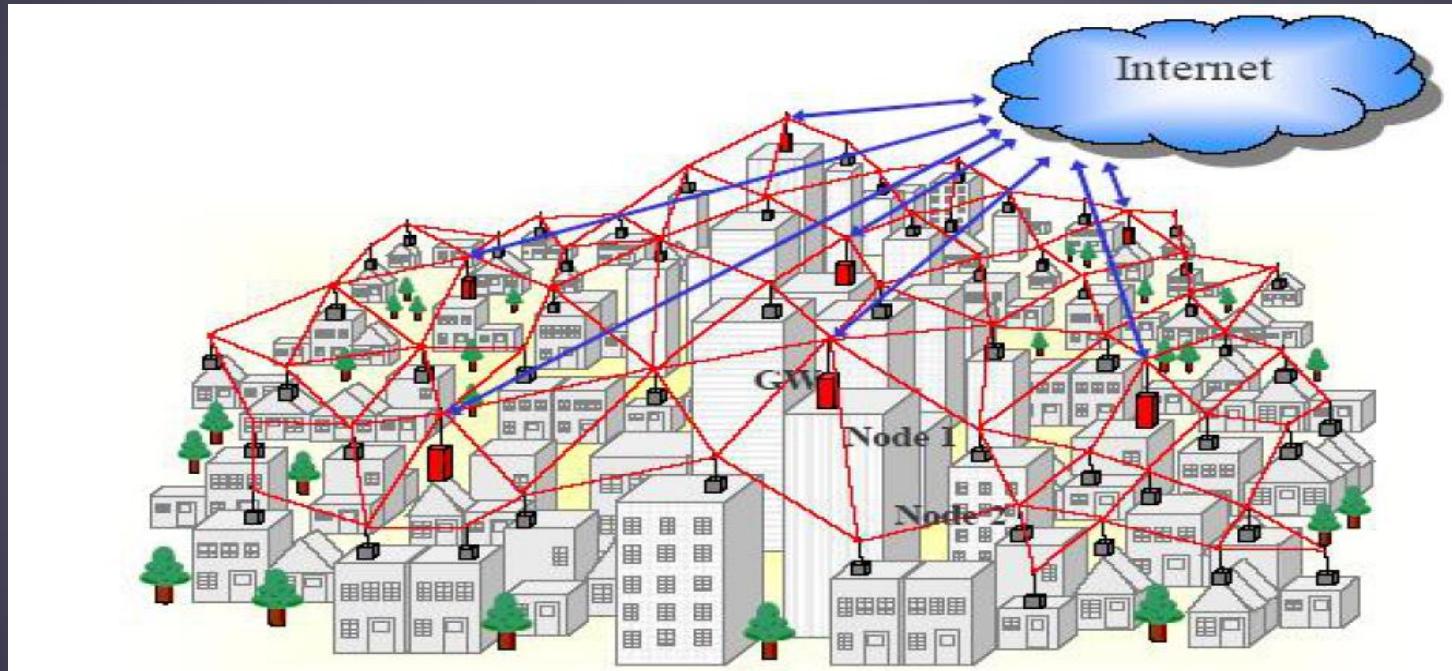


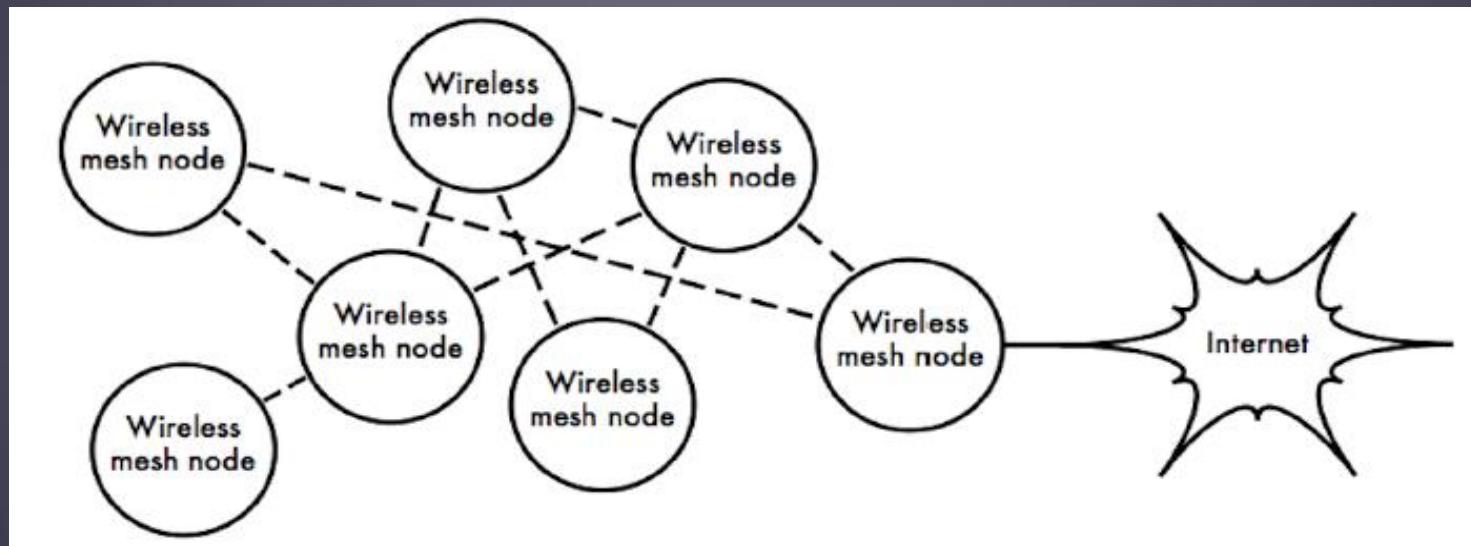
# Hamnet

## High Speed Multi-Media MESH Network (HSMM-MESH)



# Hamnet Architecture

- A MESH network is a set of “nodes” that pass packets to each other. Each node can forward packets to other nodes.
- Every node can reach every other node directly or indirectly.
- There is no “central control;” all nodes are peers.
- If a node goes down, the network routes around it.



# Hamnet Fundamentals

- Operates on three bands:  
900 MHz, 2.4 GHz and 5.6 GHz.
- Higher frequency = More channels and less interference but less ability to penetrate obstacles such as foliage.
- 2.4 GHz is the most popular band, because 802.11 Wi-Fi routers and antennas can be used.
- Speed depends on frequency and equipment, but 15 Mb/s is typical for each link using 2.4 GHz.
- Capable of streaming real-time video, audio, file transfers, web browsing, chat, e-mail, etc.

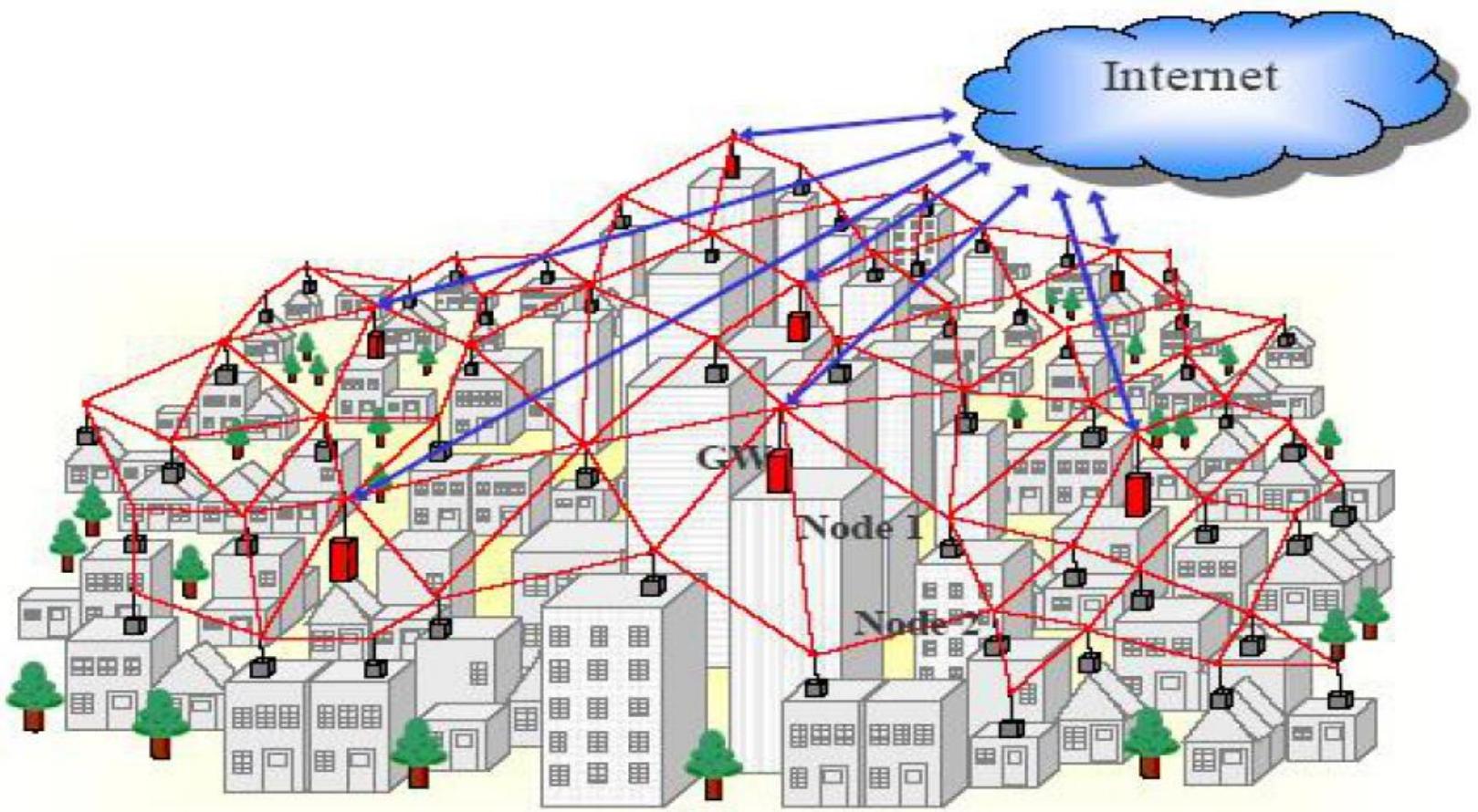
# More Hamnet Fundamentals

- If one or more nodes have Internet connections, all other nodes can access the Internet. A network can operate with or without Internet connections.
- Hamnet radio signals are weak, and they have short range unless you use a high-gain antenna.
- Omni antennas are used around a location for the local mesh. 20+ dB antennas are used for long hops spanning up to 15 or more miles. 50 miles is possible.
- Line of sight is essential. Trees and hills block signals.
- This is *not* like putting a repeater on a tower to cover an area. Multiple nodes or gain antennas are needed.

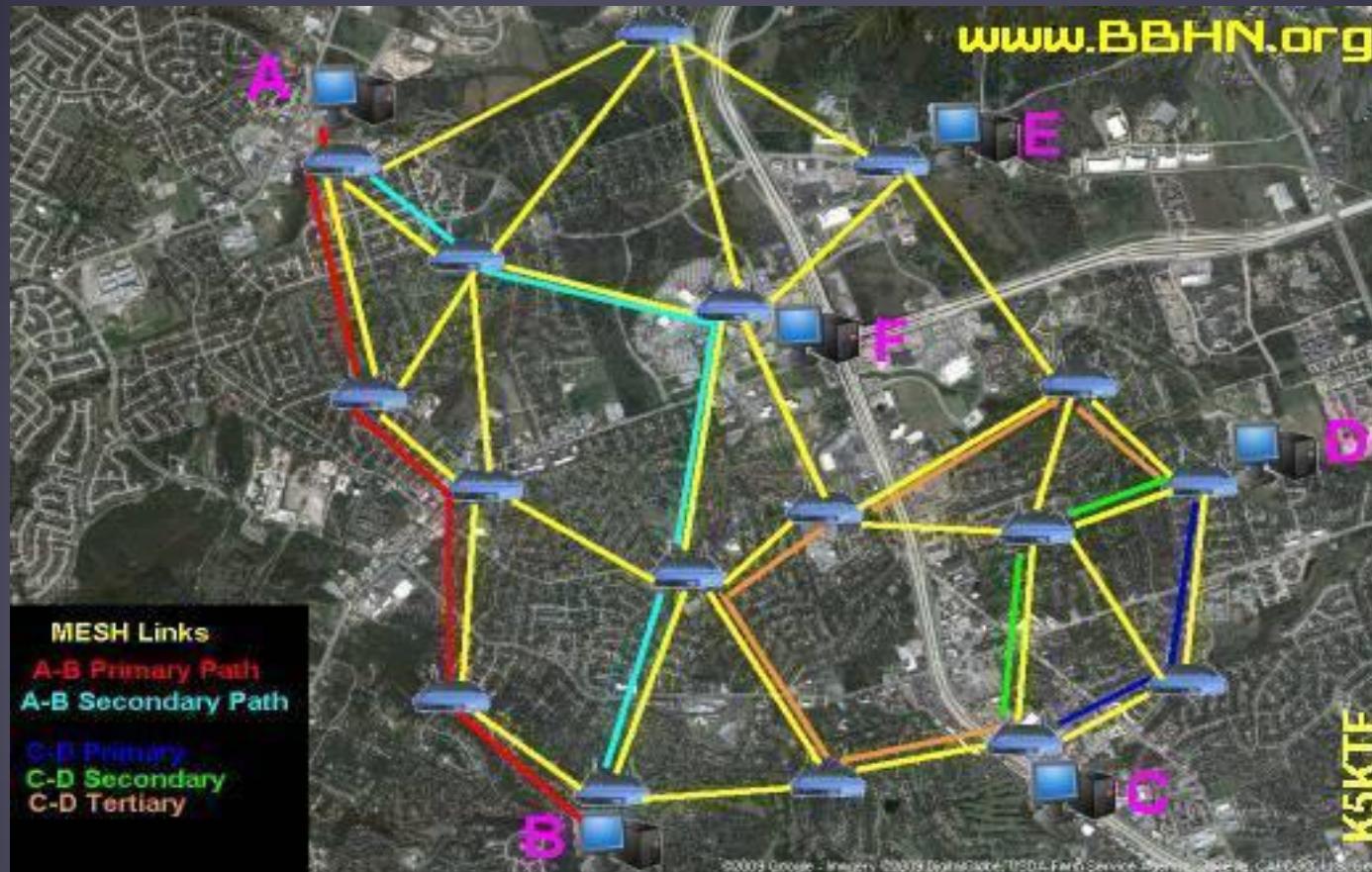
# Hamnet Use

- Wi-Fi channels 1-6 can operate as ham channels under Part 97, or as standard, unlicensed Wi-Fi connections under Part 15. Channels 5-7 operate under Part 15 only.
- Under Part 15 (unlicensed Wi-Fi):
  - Can carry commercial traffic.
  - Can broadcast music
  - Can use encryption
  - No restrictions on third-party traffic
- Part 97 (ham) operation allows higher power and puts no limits on antenna gain. Amps usually not needed. Part 15 limits total power and power density.

# City-Wide Network



# Austin Texas Network



# Stations in North America

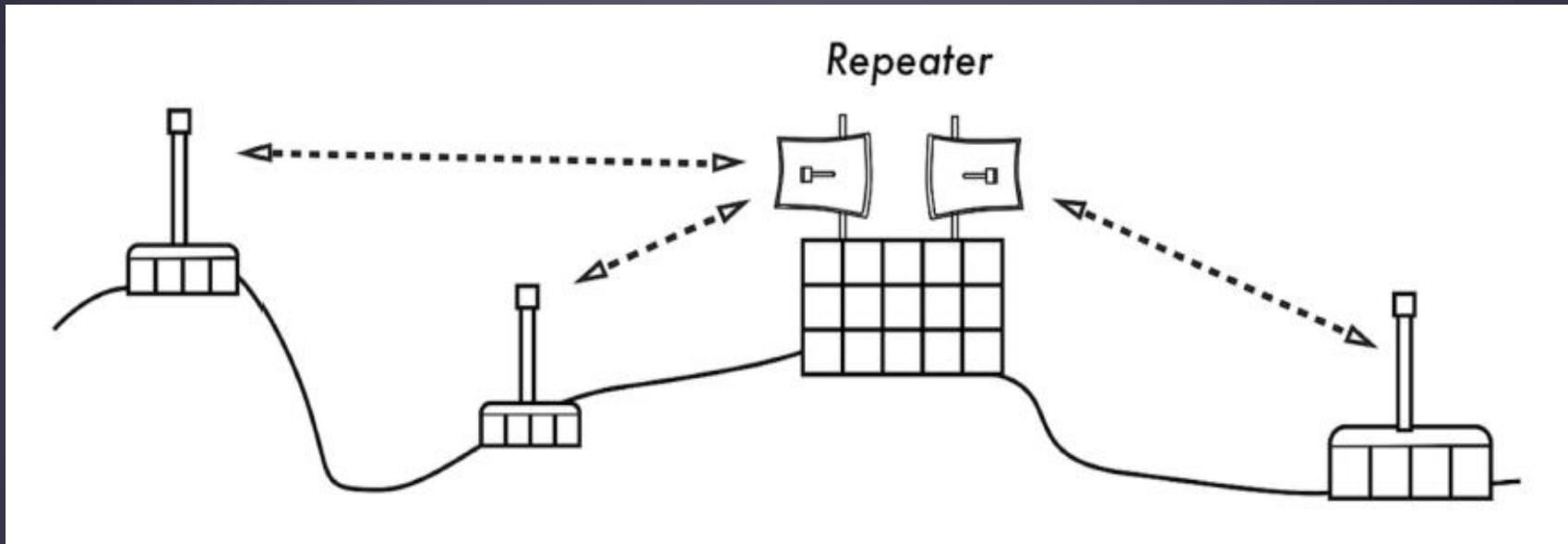


# MESH Nodes are Not Access Points

- Wi-Fi devices cannot connect directly to MESH nodes.
- The Ethernet port on a MESH node is like a connection to a LAN switch. Connect a computer or a conventional 802.11 access point for Wi-Fi access.



# Using a Repeater to Cross a Hill



# Linksys Hamnet Hardware

- Linksys WRT54G versions 2–4 or current “L” model.
- A new WRT54GL costs about \$48.
- Used WRT54G routers cost about \$25 on eBay.
- Okay for short-range network around a facility.



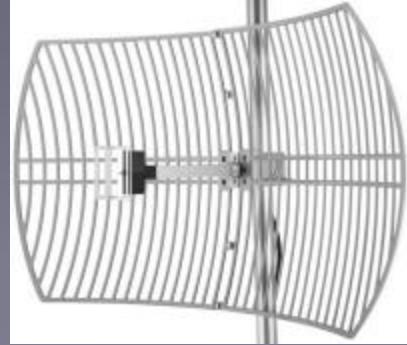
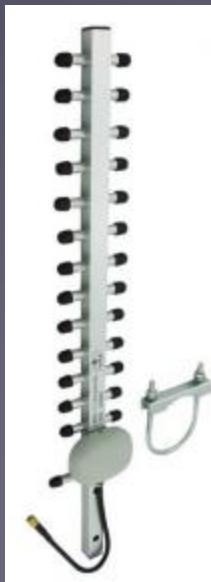
# Ubiquiti Hamnet Hardware

- Ubiquiti Bullet, NanoStation and NanoStation Loco.
- Rugged units for permanent outdoor installation.
- CAT5 cable provides network and power (PoE).
- Bullet \$80, NanoStation \$80, NanoStation Loco \$49.



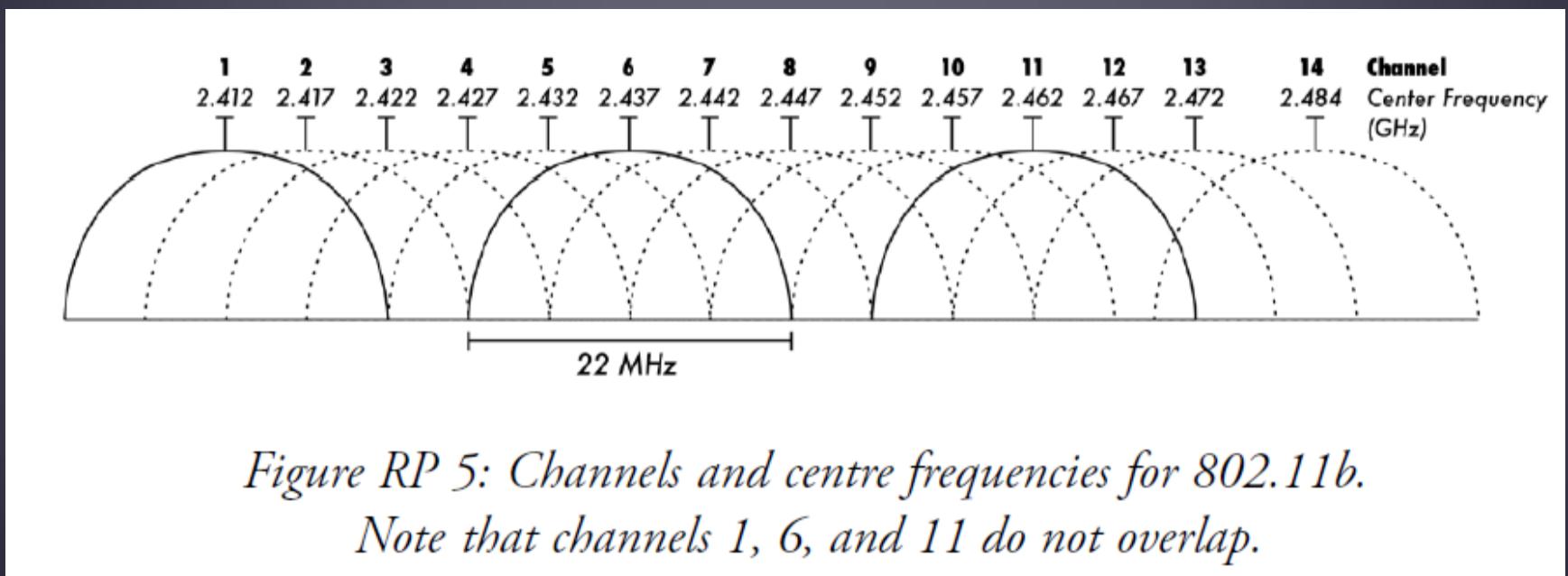
# Antennas

- Use omni for short-range coverage around a site.
- Use patch, dish or Yagi for long-range hops.



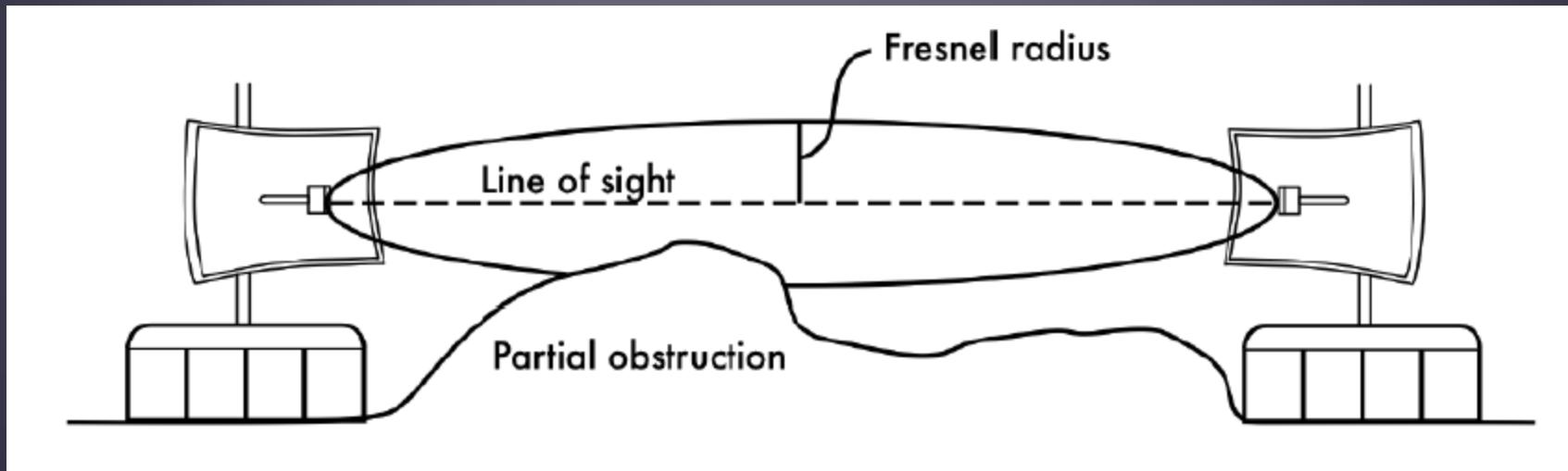
# Interference on 2.4 GHz 802.11

- 2.4 GHz is a crowded band.
- Fortunately, signals have a small footprint.
- 5.6 GHz has less interference. Use 5.6 GHz if 802.11 compatibility is not required such as for long links.



# Line of Site Considerations

- The signal is *not* laser-beam narrow.
- It has the shape of an ellipsoid with the “Fresnel radius” at the center.
- Anything within the Fresnel zone blocks some signal.



# Getting Started

- Find or purchase a suitable Linksys WRT54G (v.2-v.4 or “L” Linksys model) or Ubiquiti product.
- Register your callsign at:  
[www.broadband-hamnet.org/component/user/register.html](http://www.broadband-hamnet.org/component/user/register.html)
- Watch these YouTube videos:  
<https://www.youtube.com/watch?v=hUeW2ju-RZk>  
<https://www.youtube.com/watch?v=pryc8jIl6Xo>
- Download firmware from:  
[www.broadband-hamnet.org/documentation/68-firmware-installation-instructions.html](http://www.broadband-hamnet.org/documentation/68-firmware-installation-instructions.html)
- Install and configure firmware with your callsign and an SSID. For example, W4PHS-01 or W4PHS-home.

# Further Information...

- Main site: [www.broadband-hamnet.org](http://www.broadband-hamnet.org)
- This presentation: [www.dtreg.com/Hamnet.pdf](http://www.dtreg.com/Hamnet.pdf)
- Supported hardware:  
<http://www.broadband-hamnet.org/section-blog/37-hardware-faqs/101-supported-hardware.html>
- Ubiquiti products: [www.ubnt.com/](http://www.ubnt.com/)
- Node map:  
[www.broadband-hamnet.org/googlemapped-mesh-nodes.html](http://www.broadband-hamnet.org/googlemapped-mesh-nodes.html)
- YouTube videos. Search YouTube for “Hamnet.”  
<https://www.youtube.com/watch?v=hUeW2ju-RZk>  
<https://www.youtube.com/watch?v=pryc8jll6Xo>  
<https://www.youtube.com/watch?v=xpMr1VVUbQQ>  
<https://www.youtube.com/watch?v=KWdjuVjTzeE>  
<https://www.youtube.com/watch?v=ZCpMg9wNA4o>  
<https://www.youtube.com/watch?v=zRmOpFtIrwE>