



# High Speed Multimedia in Albuquerque

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# What is HSMM?

HSMM, or High Speed Multimedia, is the name of an ARRL sponsored technical project to introduce high speed data radio (56 kbps & higher) to amateur radio.

HSMM generally provides a link for standard internet protocols. Regular applications such as web, ftp, email, voip and other applications can run over it without modification.

The popular license free 802.11a/b/g services operate on bands that overlap amateur frequency allocations, giving us cheap hardware that can be used in in part 97 operation... but with complications.

HSMM is intended more for operational networks rather than contesting, though distance contests are common. Persons interested more in experimentation will have plenty of room for fun.



# Why HSMM?

## ■ We need it

- Amateur radio continues to develop more internet compatible services
- IRLP, Echolink, Winlink, APRS
- We can deploy those systems where it makes sense from an engineering standpoint, not where internet connections are available
- This lets us put broadband connections where the radio equipment should be

## ■ It is good for us

- It helps us sharpen our technical skills on current subjects
- It lets us provide more, better, faster services

## ■ Technology marches on

- Widely available, broadband data will become even more engrained in everyday life
- 802.16, data delivered by cell phone
- Attractions for new hams decrease if the things we can do are more restrictive than what is commonly available to the consumer

## ■ HSMM is in its infancy

- But the technology is common in commercial use
- We are behind in this area.



# How Does HSMM Work

- HSMM is generally intended to connect computer networks
  - But not always...
- Uses packet techniques
  - Standard TCP/IP is prevalent
- Can use larger than normal bandwidths
  - up to 25 MHz
  - Down to 10 KHz
- Uses various modulation schemes
  - OFDM – BPSK – QPSK - Etc...
- Equipment can often dynamically switch modulations to get the lowest bit error rate for current conditions
- To get the wide bandwidths necessary, HSMM equipment often operates in the UHF and above bands.
- QRP operation is typical, with xmit powers from 20mw and higher. Amateurs can use amplifiers.



# How Can We Use It?

- We can connect up existing amateur digital services
  - Connect existing Echolink, IRLP, APRS, Winlink nodes
  - Put those nodes where RF coverage is best, not just where internet service is available
  - Provide geographical redundancy in the event of a land line internet failure
  - Let clubs, operators share the cost of an internet connection\*
- We can provide high speed connections to remote locations where land lines do not exist
  - Space Shuttle recovery event
  - Field Day
  - Special events
  - 2mi - 5mi hops easy, 15mi - 20mi hops possible
  - Mountain Locations work well

\*If ISP acceptable use policy allows



# HSMM Challenges

- Covering large areas is problematic
  - Hardware on Ham-specific freqs either does not exist or is very expensive
  - Commercial equipment is jammed with part 15 users, creating a massive interference situation
    - Try war driving with Net Stumbler and you'll find dozens of Part 15 access points in your neighborhood
  - 802.11a/b/g equipment isn't designed for it
    - It can only support about 20 users per node
    - Possibly less for cheap equipment

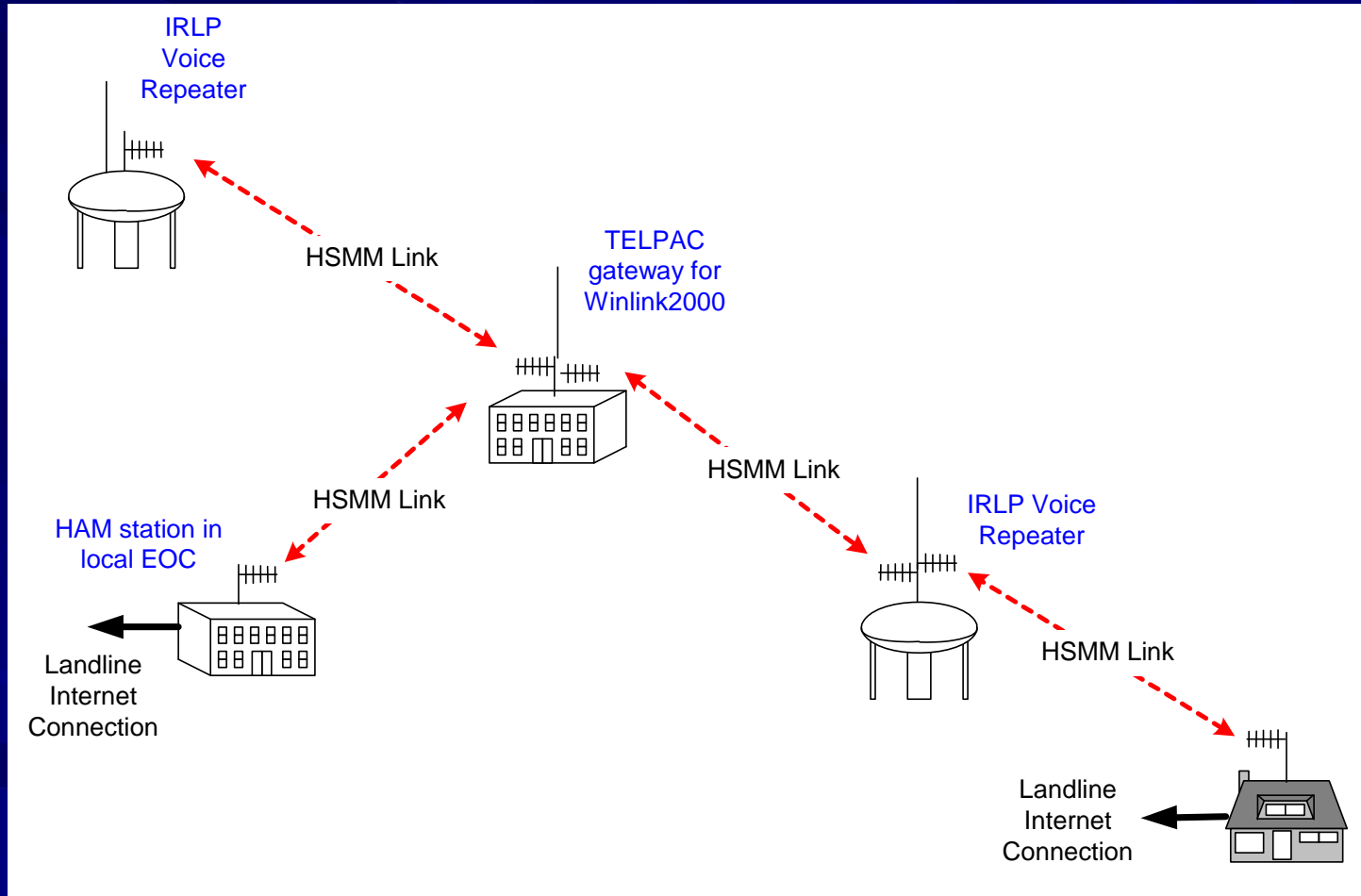


# A Real World Application

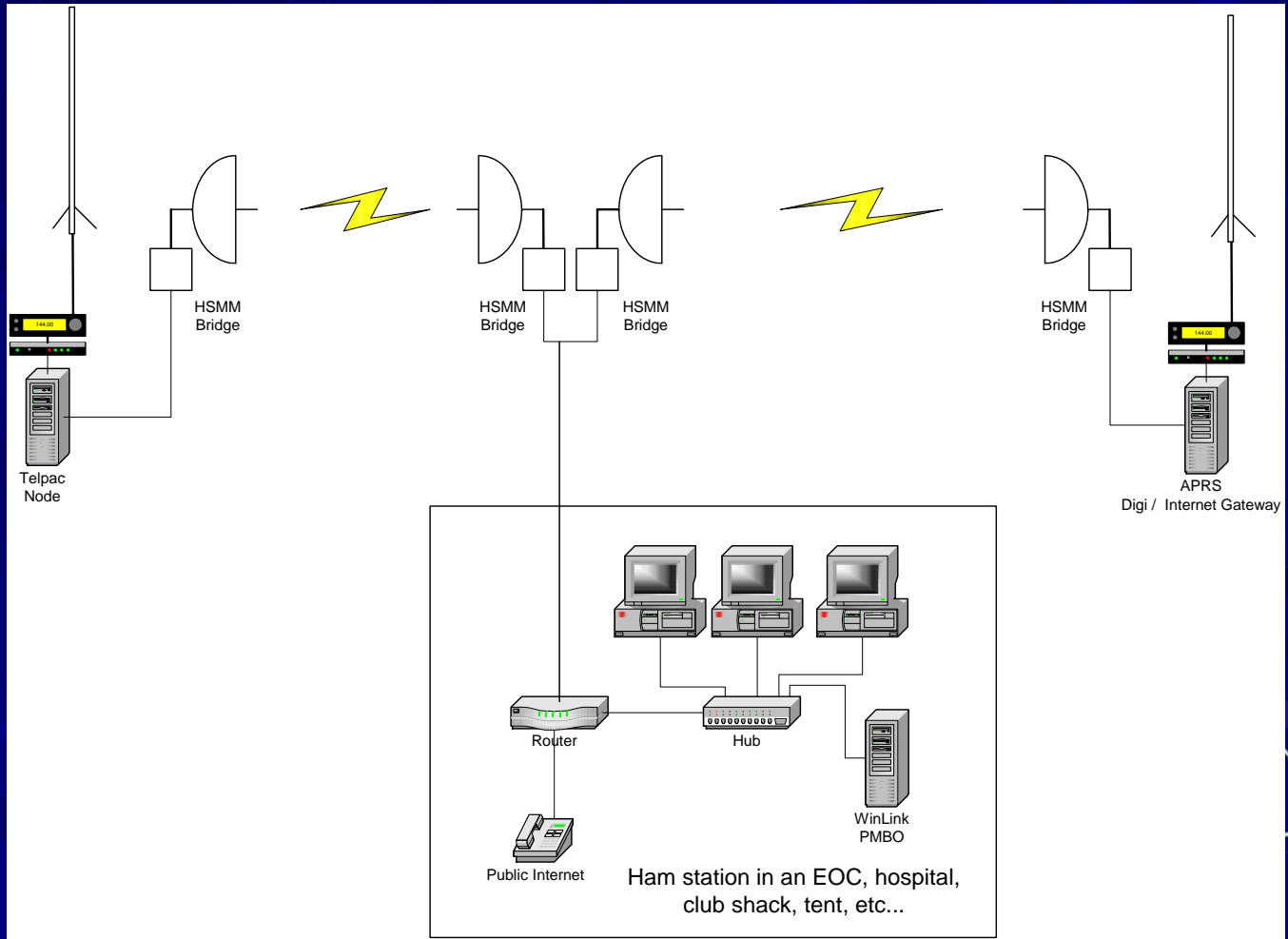
- Downtown Dubuque
  - City wanted WiFi downtown
  - Cable Company provided 802.11 a/g gear
    - 2.4 Gig used for distribution
    - 5.2 Gig used for backhaul
  - 10 Access Points fed by one Internet Connection
    - Radius Authentication
  - Cost: \$500 per location
    - Mikrotik Gear



# HSMM for ARES



# EOC Redundancy





# Using Consumer Gear

- Some consumer / commercial equipment can be pressed into service as ham HSMM gear, particularly 802.11x gear
- 802.11 is an IEEE standard for wireless data networking
  - 802.11 runs in 2.4 GHz provides up to 2mbps
  - 802.11b runs in 2.4 GHz, provides up to 11mbps
  - 802.11g runs in 2.4 GHz, provides up to 54mbps
  - 802.11a runs in 5 GHz, provides up to 54mbps
  - The speed difference is based on modulation
- Consumer 802.11 equipment runs under FCC part 15 rules for “license free” operation
  - But the part 15 freq allocations overlap ham allocations
- Most newer 801.11x radios are backward compatible (within the same frequency band)
- Proprietary connectors (Reverse Polarity N, TNC, SMA, MC, MMCX) per FCC requirement



# Using Consumer Gear

## ■ Cheap Stuff

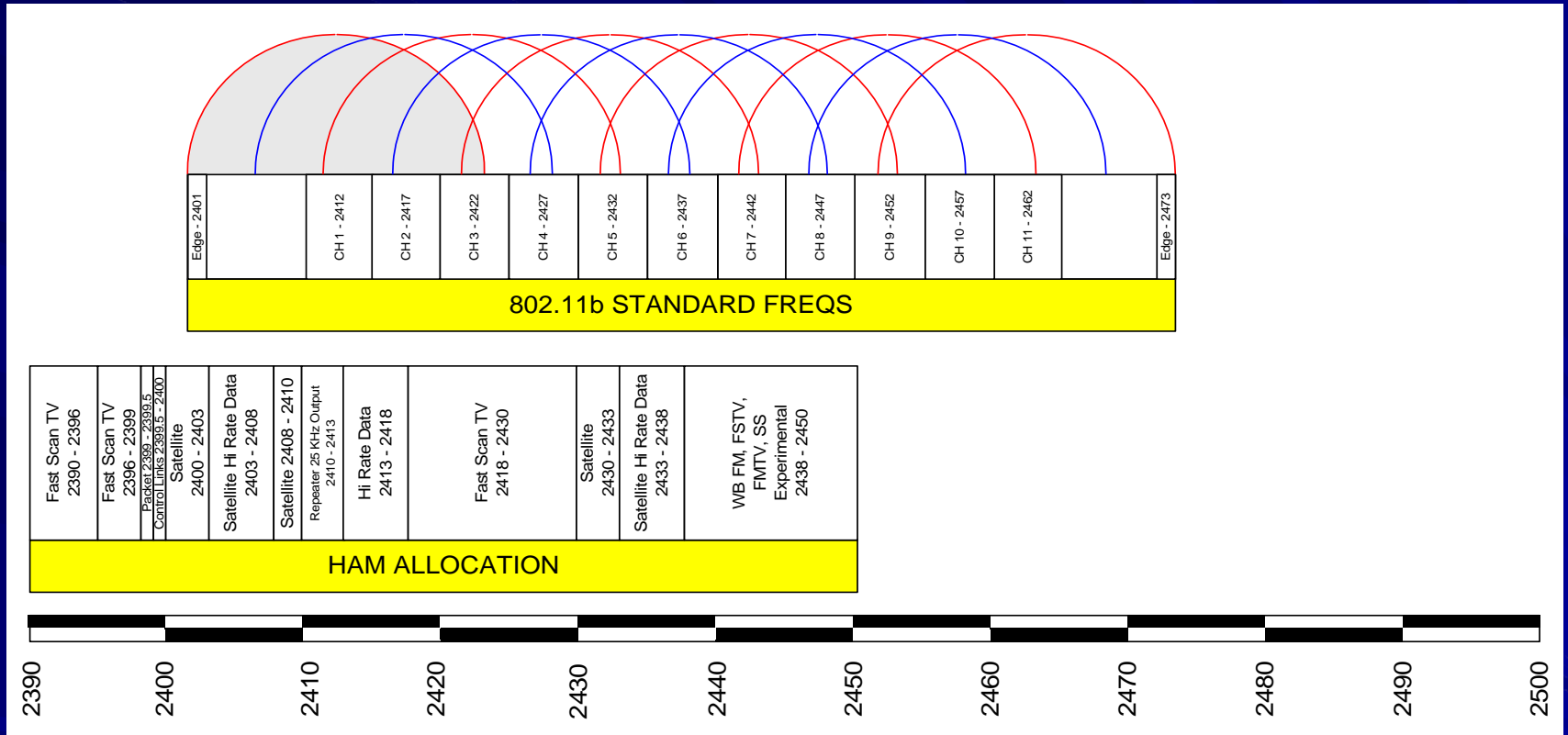
- Linksys WRT54G
  - Around \$50 - \$70
  - Solid 3<sup>rd</sup> party firmware
  - Can add serial ports!
  - Good for hacking
- Senao Enginus
  - Around \$120
  - High xmit pwer (200mw)
  - Better receive sensitivity
  - Some with POE built in
- DLink (various)
  - Some power, PoE hacks
  - Some software hacks

## ■ Expensive Stuff

- Orinoco APs
  - AP1000, etc
  - Wide range of associated products, antenna
  - \$150 up
- Cisco, Mikrotik others



# HSMM Frequencies

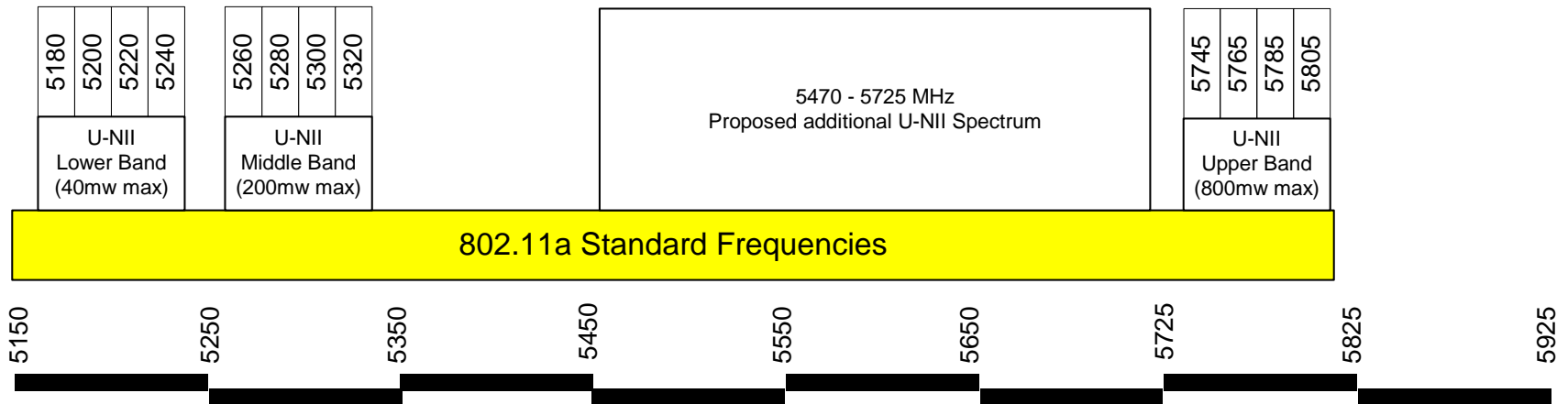
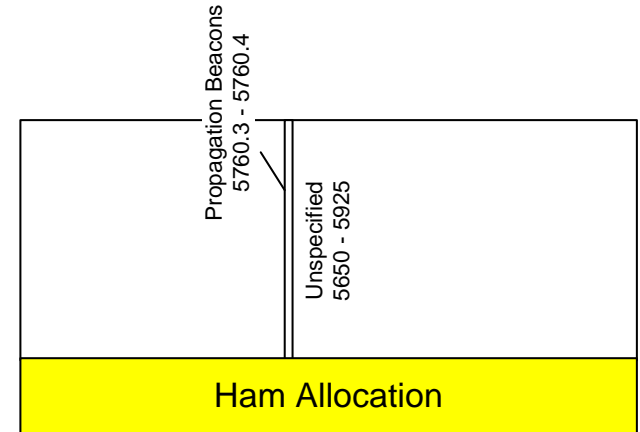


- 802.11b channels 1-6 overlap amateur allocations
- AMSAT requests not to use ch 1 due to sat interference



# HSMM Frequencies

- 12 non-overlapping 802.11a channels
- 20 MHz wide each
- 3 sets of 4 channels
  - 4x40mw ch for indoor
  - 4x200mw ch for indoor, outdoor
  - 4x800mw ch for outdoor
  - Power specified at the IR
- More bandwidth requested



# In Short

- HSMM can provide:
  - Reliable High Speed Communications
  - Quickly deployed broadband infrastructure
  - Redundancy – “When all else fails..”
- ABQ is ripe for HSMM
  - 10,000 foot tower site
  - Excellent line of sight
  - Lots of potential enthusiasts



# Resources

- ARRL HSMM Group
  - The group that started this mess
  - <http://www.arrl.org/hsmm/>
  - <http://listserv.tamu.edu/archives/arrl-80211b.html>
- NTMS HSMM email list
  - <http://groups.yahoo.com/group/ntms-hsmm/>
- HAMCOM HSMM Presentations
  - <http://www.n5oom.org/hsmm/>
- Seattle Wireless
  - Large equipment reference list
  - <http://www.seattlewireless.net/>
- O'Reilly Books
  - Standard books on 802.11x networking, security
  - <http://www.oreilly.com/>
- eBay
  - Lots of cheap networking gear and antennas (search on WiFi)
  - <http://www.ebay.com>





# Questions & Thanks