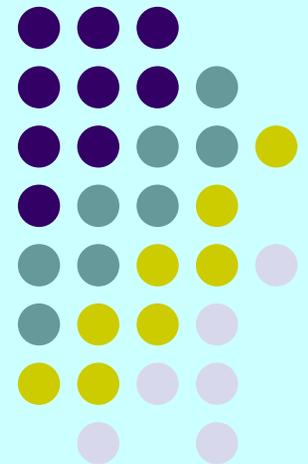


Spectrum Allocation for Municipal Wireless Mesh Networks

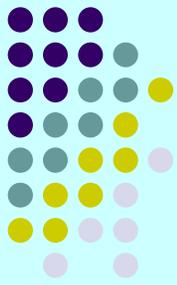
M. Hassan-Ali

H. Jones

H. Matsunaga

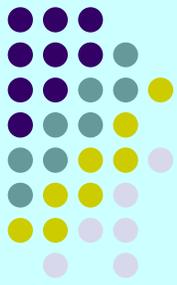


Agenda



- Project topic
- Introduction
- Motivation/justification for Municipal WMN
- Issues with current WiFi spectrum
- Recommendations for spectrum
- Conclusion

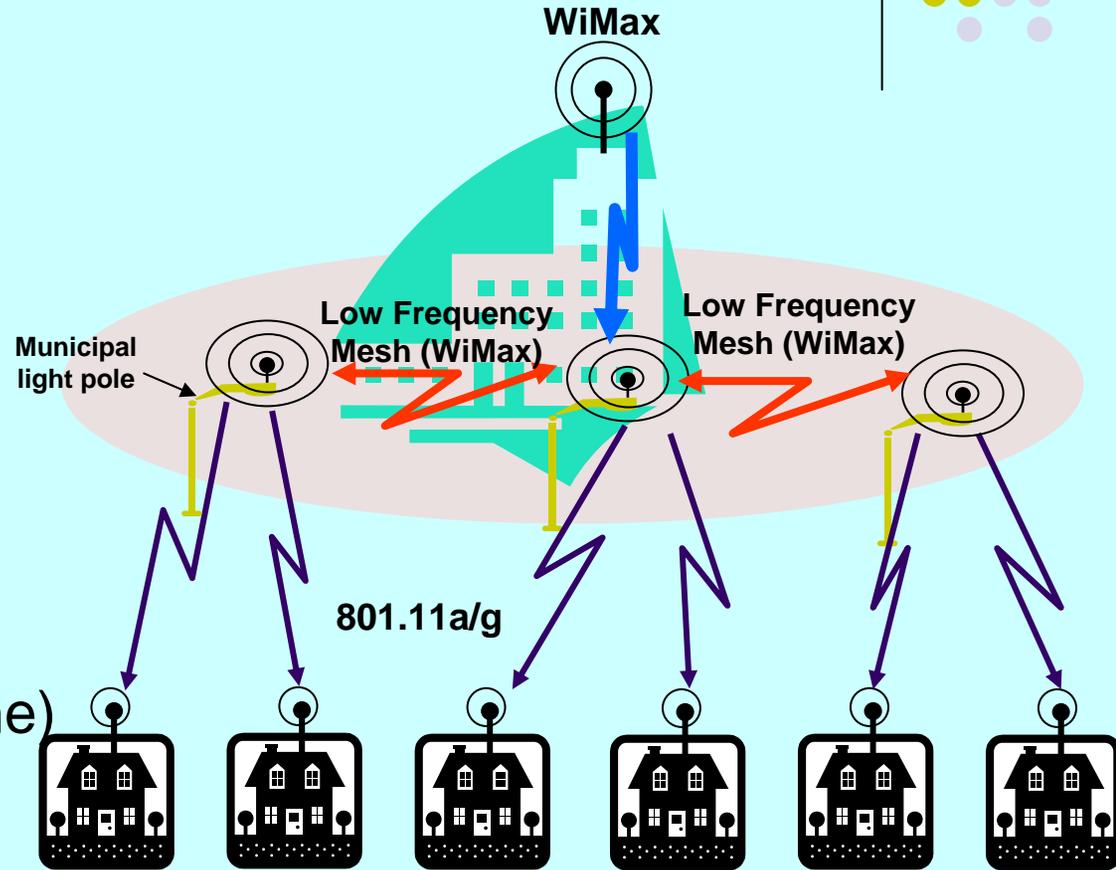
Project topic

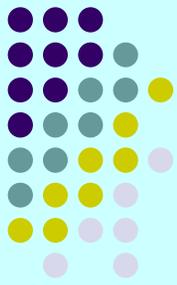


- Issue:
 - Spectrum policy with Municipal Wireless Mesh Network
- Main results:
 - FCC should allocate Low Frequency dedicated spectrum for Municipal Wireless Mesh Backbone
 - The soon-vacated analog TV channels (700MHz) would be ideal for this purpose

Introduction

- Wireless broadband
 - Mesh type
- Topologies
 - Mesh
 - Resiliency
- Spectrum allocation
 - User side
 - Network side (Backbone)

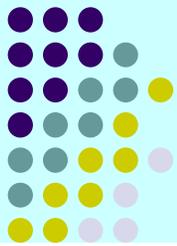




Motivation for MWN

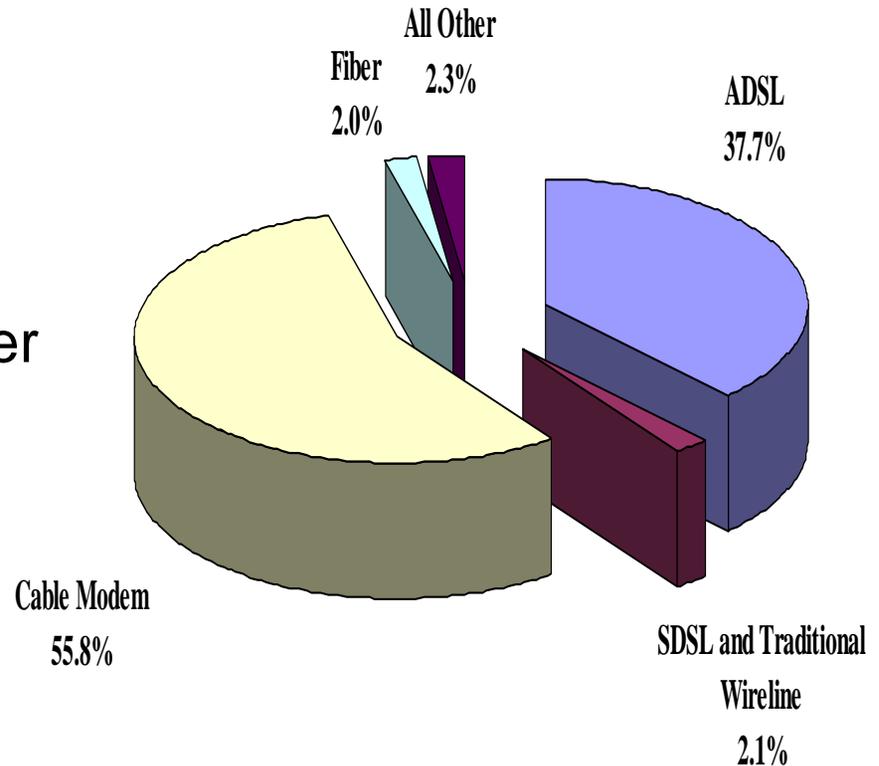
- Digital divide
- Public applications
- Increase competition
 - *Baller's "birch rod in the cupboard"*

FDR, Baller notes, called municipal power systems “, to be taken out and used only when the child gets beyond the point where more scolding does any good.”

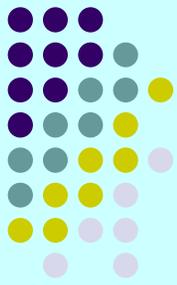


Justification for WMN

- Economically feasible
- Currently less than 50% of US households are connected to BB.
- Nomadic computing enabler
- Who needs help urgently:
 - Rural areas lack BB
 - Impoverished areas

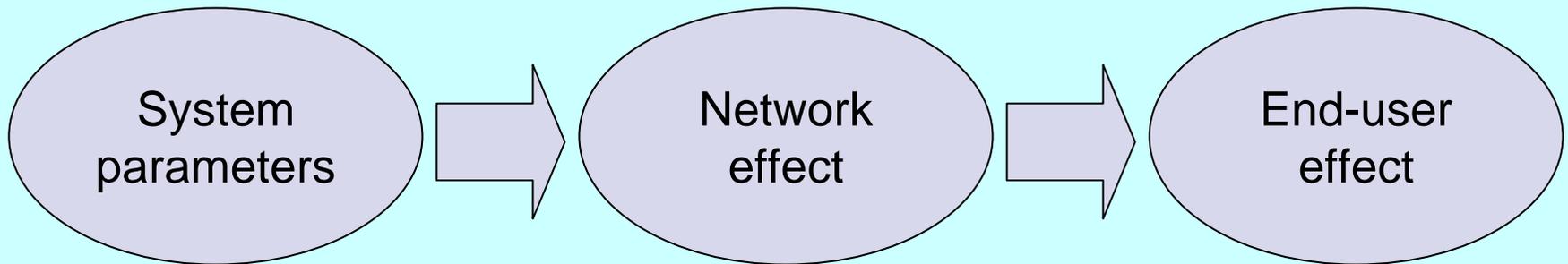
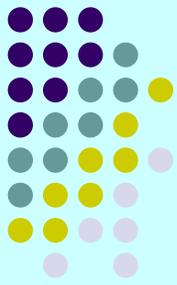


Impact of Muni WMN on economy (Philadelphia view WCA05)

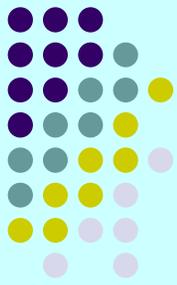


- Broadband availability allows local businesses to remain competitive, operate more efficiently, and access more consumers more quickly and thus grow faster.
- Information businesses can start and locate anywhere they want, and they tend to look for areas with educated workforces, advanced infrastructures and high quality of life. Knowledge workers expect and require advanced telecommunications infrastructure
- Broadband connections can improve education for students.
- The Internet enables entrepreneurship, with wireless broadband empowering smaller players to compete against larger and more established companies.
- The Internet enables government to deliver city and county services at a lower cost.

Analysis Methodology

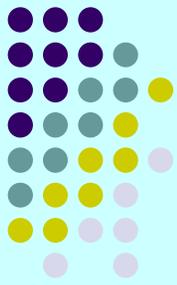


Constraints imposed by WiFi

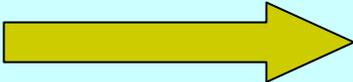


- Limitations of the current version of 802.11:
 - ISM spectrum
 - High operating frequency
 - Power limitation
 - No. users per router

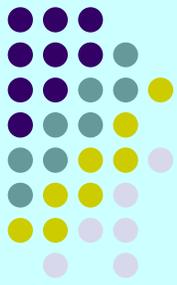
Graph removed for copyright reasons.

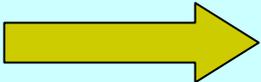
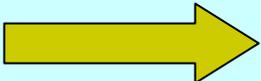


Limitation of the current Mesh

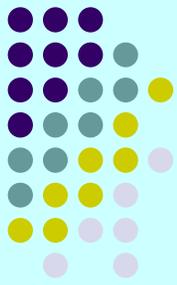
- Throughput 
 - Power limitation
 - Attenuation
 - Noise (ISM)
 - Line-of-sight 
 - High Operating Frequency
 - Range 
- Low bit-rate delivered to users.
 - Scalability
 - More MGRs needed
 - Latency
 - Rural area limitation

Solutions

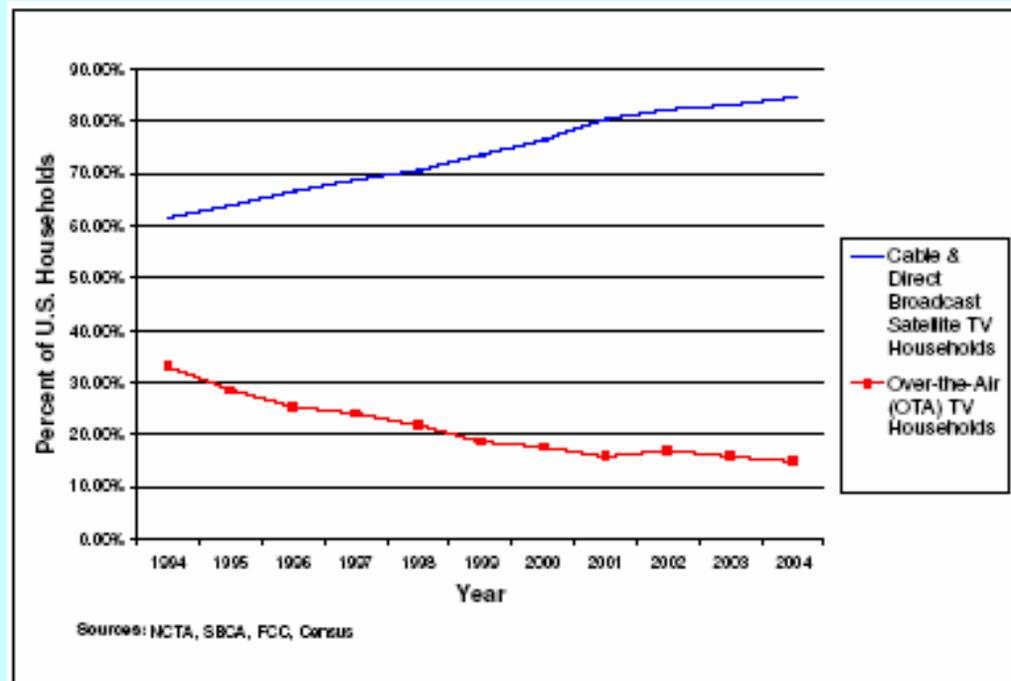


- Lower frequency  • Low attenuation
 - More coverage
 - More bandwidth
 - Lower cost
- Multi-radio  • Low interference
 - Better reliability
 - Low latency
- Dedicated  • Flexibility
 - Power setting
 - Better performance

Recommendation (source)

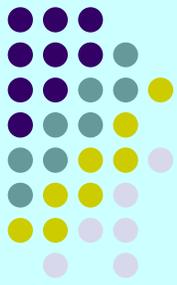


- Allocate Mesh backbone from vacated analogue TV
- Based on the FCC's TV (700MHz) NPRM-2004



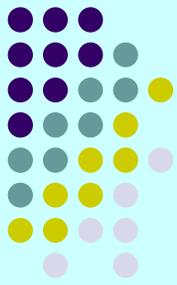
Courtesy of J. H. Snider. Used with permission.

Recommendation (size)

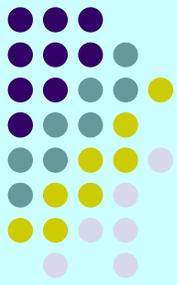


- For 100Mbps WiFi backbone
- Hence, allocation of 8 channels @ 700MHz;
- Or 4 channels with 2x2 MIMO

Recommendation (management)



- Dedicated spectrum model for municipal WMNs
- Initially we recommend the franchised model
 - Reduce risk
 - Efficiency



Conclusion

- FCC should allocate at least 8 channels @ 700MHz (unused TV spectrum) for municipal WMNs.
- This spectrum should be dedicated to municipalities