



# Using License Exempt Spectrum for Wireless Broadband

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**Note: The views expressed in this presentation are those of the author and may not necessarily represent the views of the Federal Communications Commission**



# Unlicensed Devices: Part 15

- Part 15 provides for operation of low power radio transmitters without a license
- Operating conditions:
  - **May not cause harmful interference**
  - **Must accept any interference received**
- Part 15 minimizes likelihood of interference by:
  - **Identifying permissible frequencies**
  - **Limiting power very low levels**
  - **Requiring equipment approval to ensure compliance**



# Part 15 Device Examples



**Garage Door Opener Controls**



**Radio Controlled Toys**



**Security Alarm Systems**



**Cordless Telephones**



**Anti-pilferage Systems**



# Technical Requirements

- Almost any spectrum can be used except certain restricted frequency bands
- On most frequencies, operation is limited to  $< 100$  mW; duty cycle applies in some cases
- Three (ISM) bands allow 1 W transmitter power:
  - 902-928 MHz
  - 2400- 2483 MHz
  - 5725 – 5875 MHz
- Power reduction for antenna gain  $> 6$  dB



# Equipment Authorization Required

- Equipment must be authorized by FCC or telecommunications certification body
- Equipment may not be imported or marketed until certificated
- Check label for FCC ID
- Grants of certification available on FCC web site

## Equipment Authorization (EA)



Office of Engineering and  
Technology (OET)

See  
<http://www.fcc.gov/oet/ea/>

FCC Id: XXXYYYYY





# Wi-Fi

- **Wi-Fi: Wireless Fidelity**
- **Wi-Fi is synonymous with IEEE 802.11**
- **IEEE Committee 802.11 developed a family of standards for unlicensed wireless data networks within the framework of the Part 15 rules**

<u>Standard</u>	<u>Frequency Band</u>	<u>Modulation</u>	<u>Data Rate</u>
<b>802.11(b)</b>	<b>2.4 GHz</b>	<b>DSS</b>	<b>11 Mb/s</b>
<b>802.11(g)</b>	<b>2.4 GHz</b>	<b>OFDM</b>	<b>54 Mb/s</b>
<b>802.11(a)</b>	<b>5.8 GHz</b>	<b>OFDM</b>	<b>54 MB/s</b>



# Wi-Fi: MiMo Technology

- A new generation of consumer Wi-Fi products is being introduced based on MIMO technology
- MIMO: Multiple Input Multiple Output
- Based on IEEE 802.11 TG N standard
- Allows greater range and data throughput

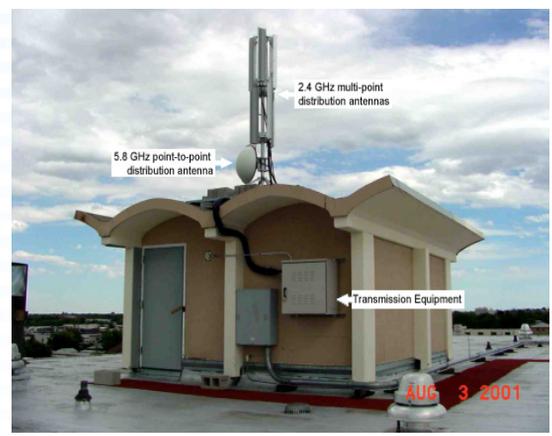




# Wi-Fi Applications



**Business & home networking**



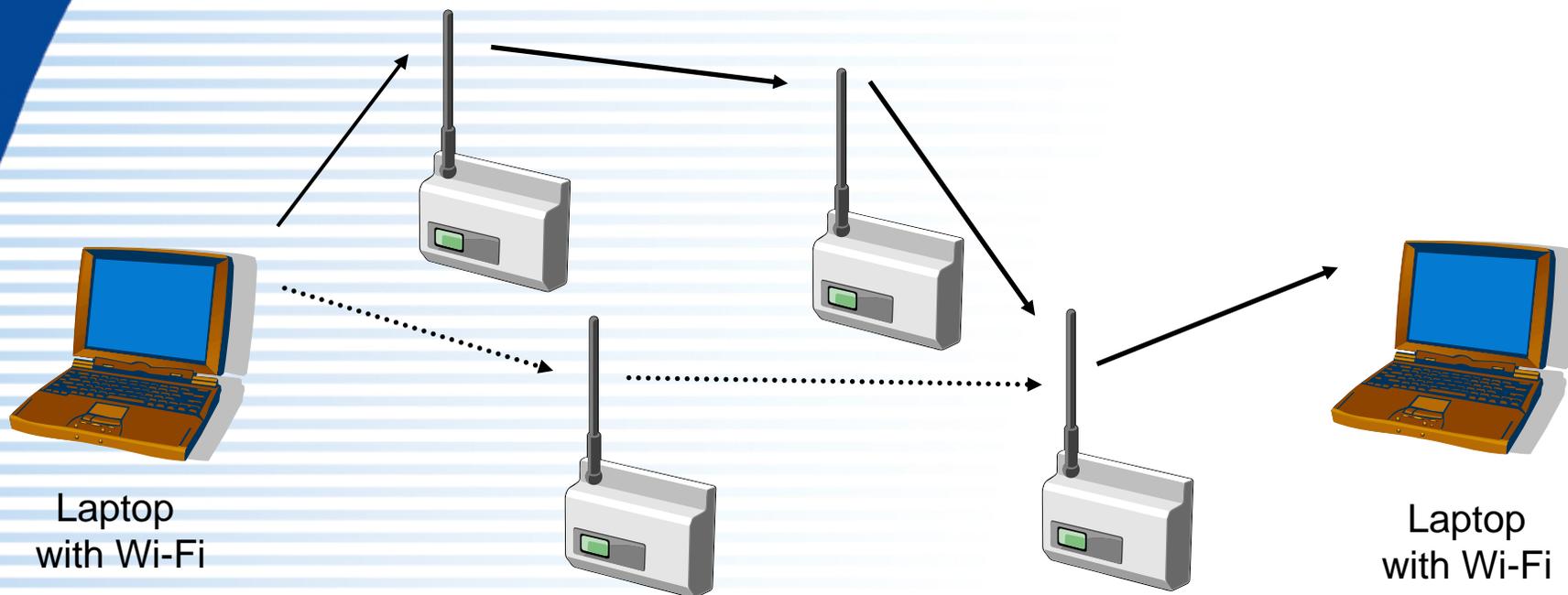
**Metropolitan & Community Networks – WISPs**



**“Hot Spots” at coffee shops, hotels, airports, etc.**



# Wi-Fi Mesh Networks

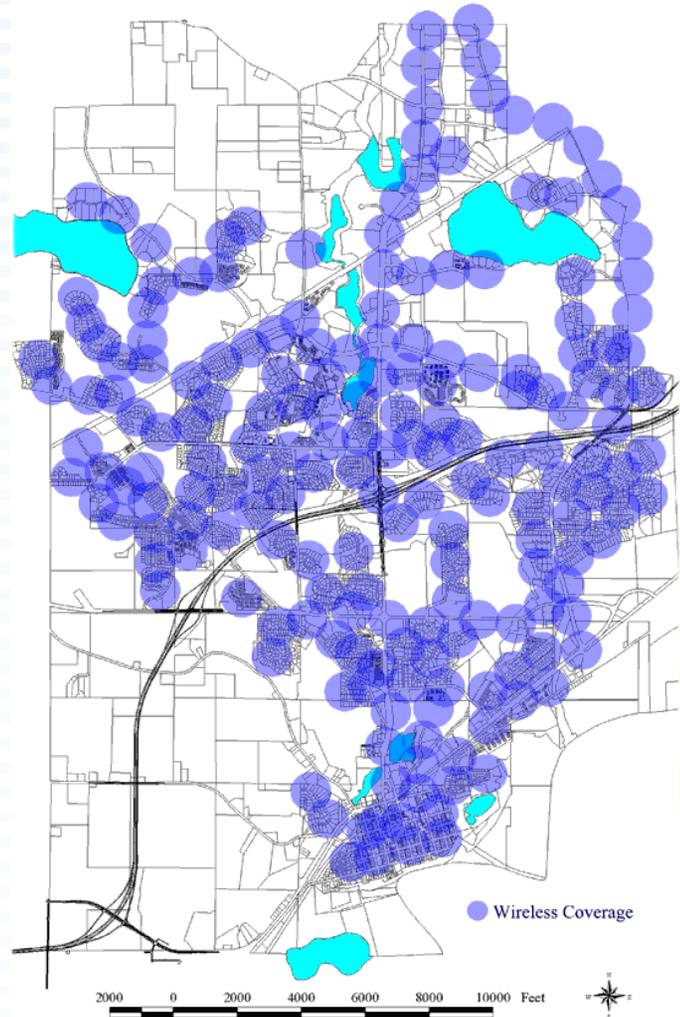


Mesh networks use each transmitter/receiver as a relay point to provide service wide areas. They are self-forming and provide numerous communication paths- - same principle as the Internet



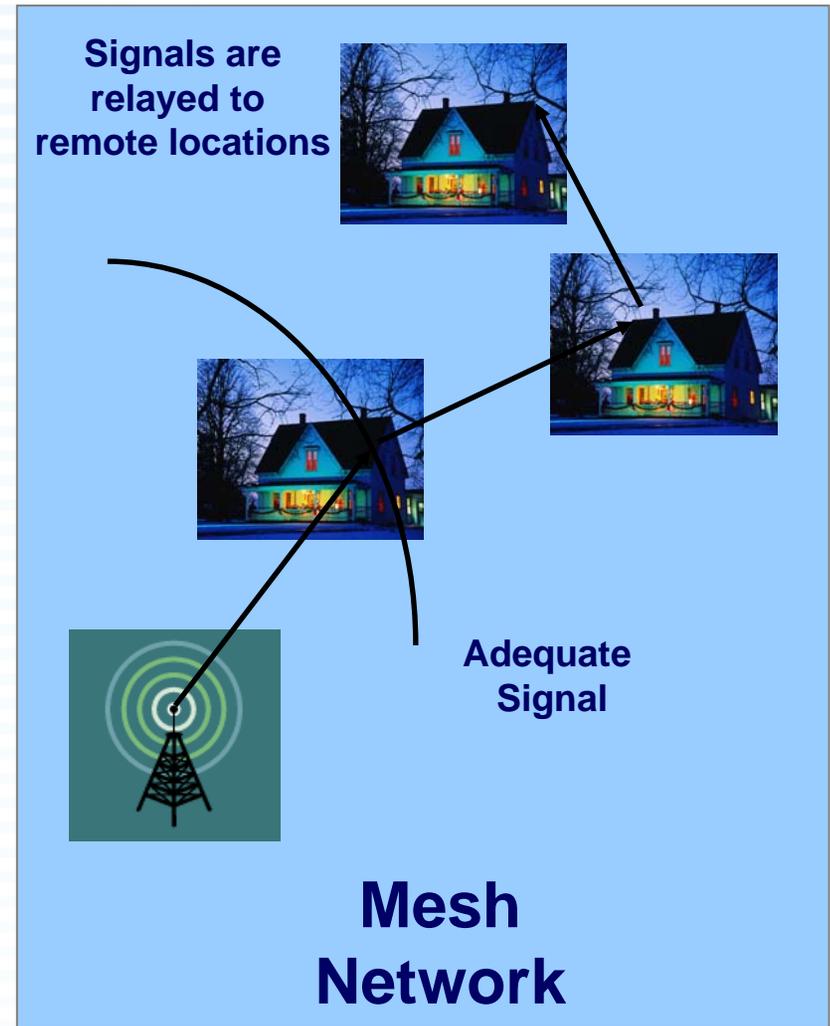
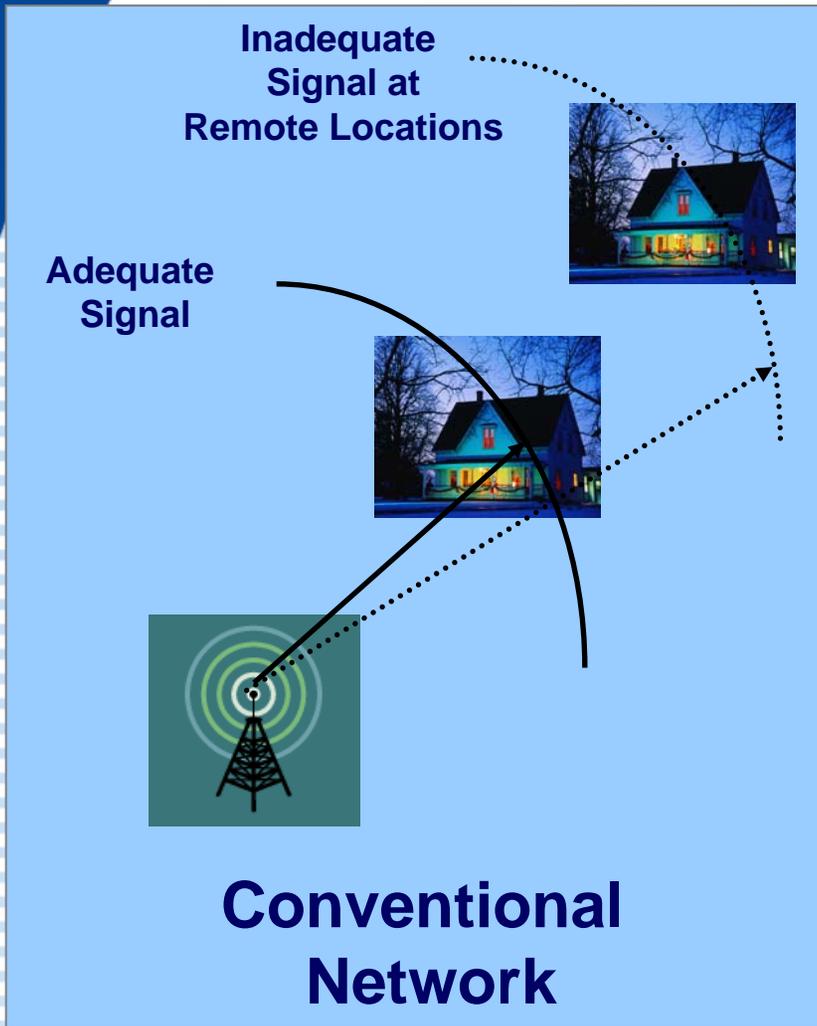
# Example of a Mesh Network

- City of Chaska, Minnesota
- 2000 Wi-Fi subscribers over an area of 16 square miles
- Provided by routers mounted on lampposts - - 15 minute install time
- Consumer data speeds of to 1.2 MB/s
- See [www.Chaska.net](http://www.Chaska.net)



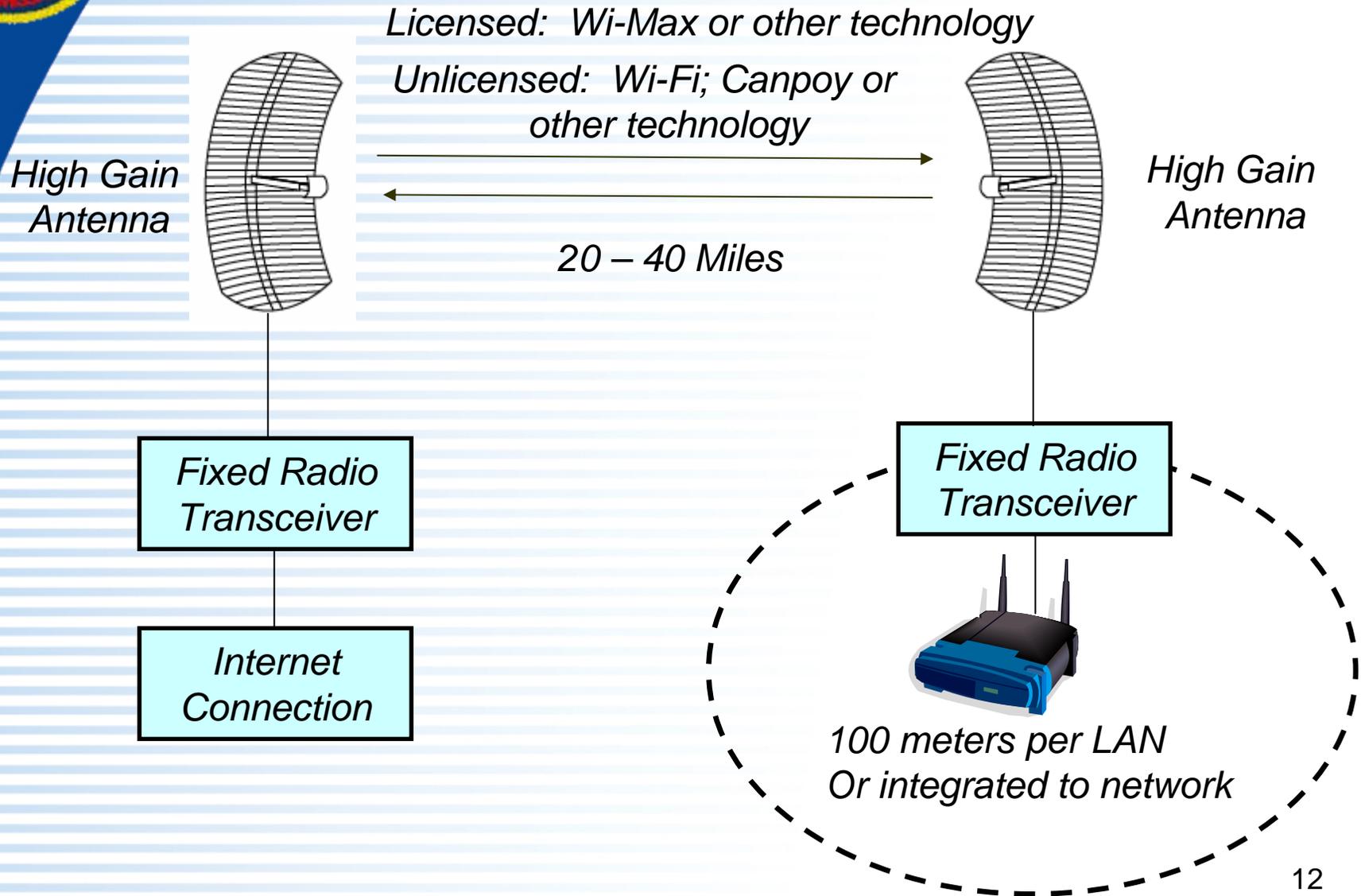


# Mesh Facilitates Rural Coverage





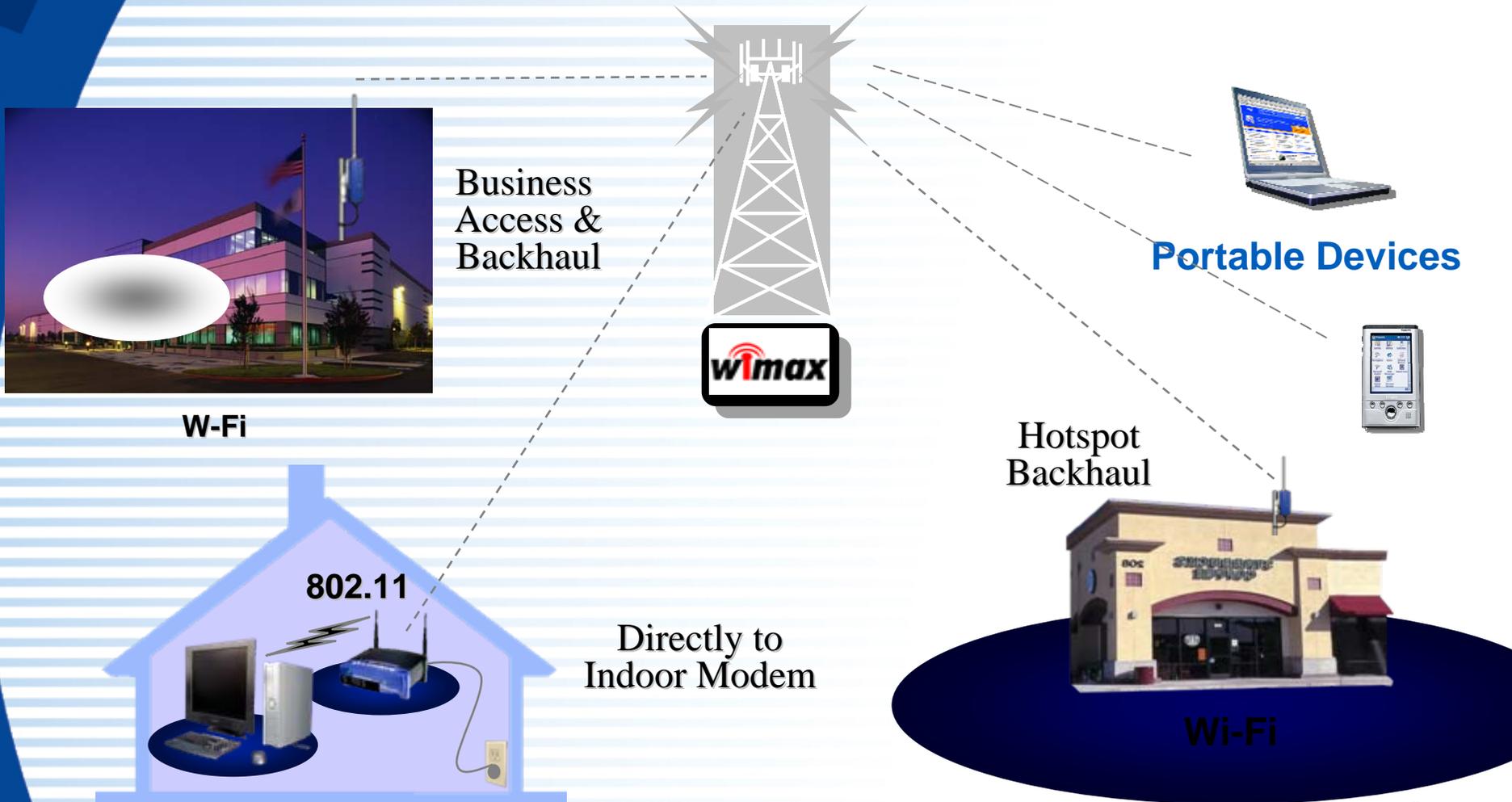
# Basic Network Architecture





# Integrating Licensed & Unlicensed

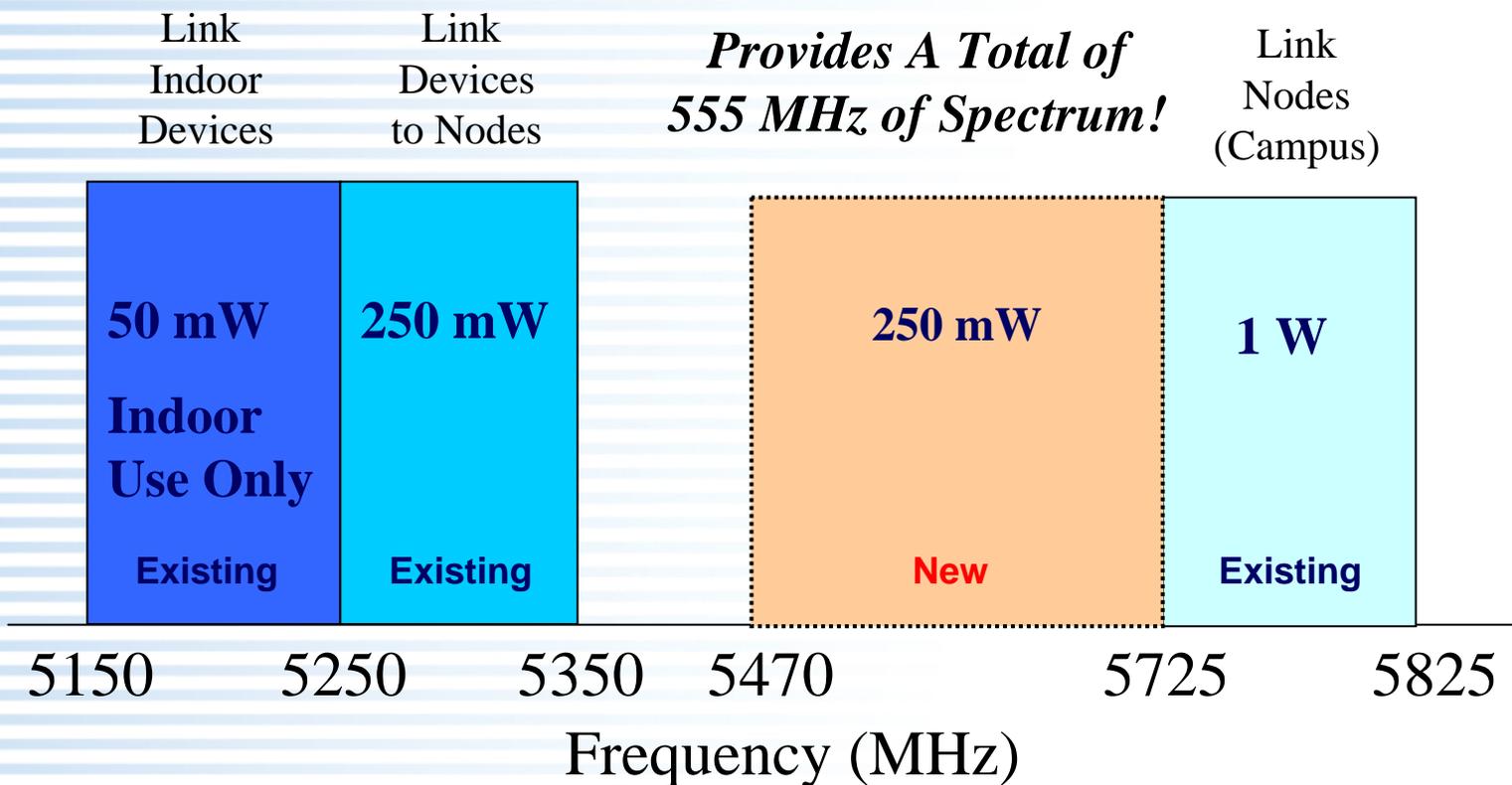
*WiMAX technology can operate in licensed or unlicensed spectrum:*





# More Spectrum Made Available for Unlicensed Operation

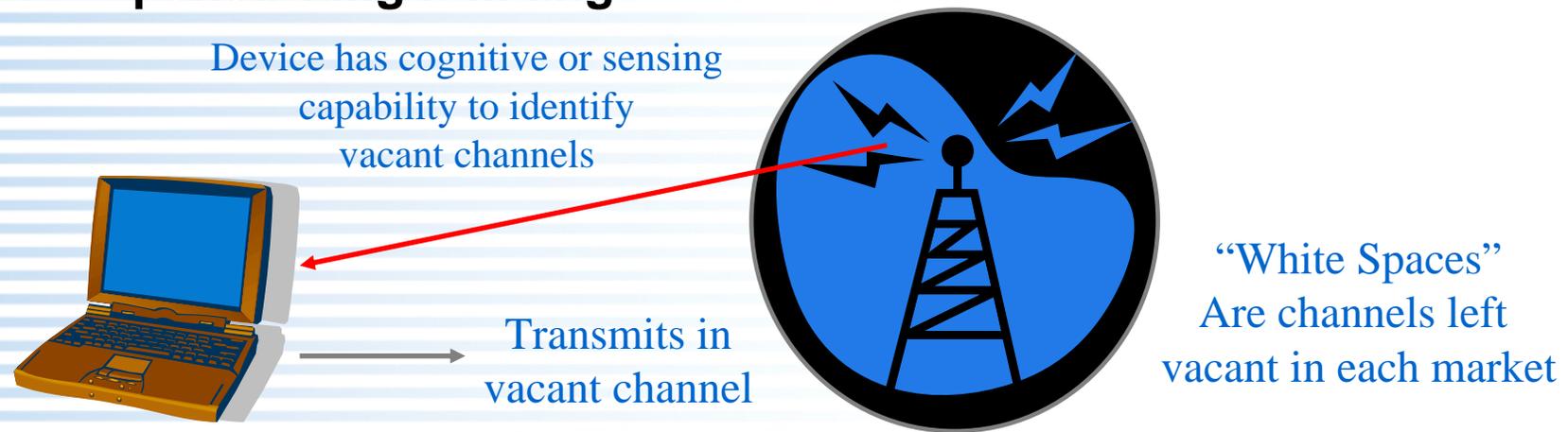
- World Radio Conference provided and FCC has made available an additional 255 MHz of spectrum for U-NII Devices – anticipated growth for Wi-Fi





# TV “White Spaces” Proceeding

- **FCC First R&O and Further NPRM (ET Docket 02-380) adopted 10/12/06**
- **Permits fixed devices on certain TV channels after the DTV transition, explores a number of issues such as whether to permit personal/portable devices and makes proposals towards adopting final rules**
- **Spectrum below 900 MHz is particularly well suited for penetrating buildings**





# TV White Space Testing

- Public Notice in January announced FCC Lab to conducting further tests on TV White Space Device prototypes
- Four devices were submitted: Adaptrum; Microsoft; Motorola and Pillips
- Tests open to the public

*Adaptrum*



*Microsoft*



*Motorola*



*Philips*





# WISP Resources

- Search: Wireless Internet Service Providers
- WISPA.Org – Includes information on how to establish a WISP
- Part-15.org
- Vendor web sites



# Conclusion

Thank you!

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