



Using License Exempt Spectrum for Wireless Broadband

**Ronald Repasi, Deputy Chief
Office of Engineering and Technology**

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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:
 - **Permit operation in non-restricted frequency bands**
 - **Limiting power to very low levels**
 - **Requiring equipment approval to ensure compliance**



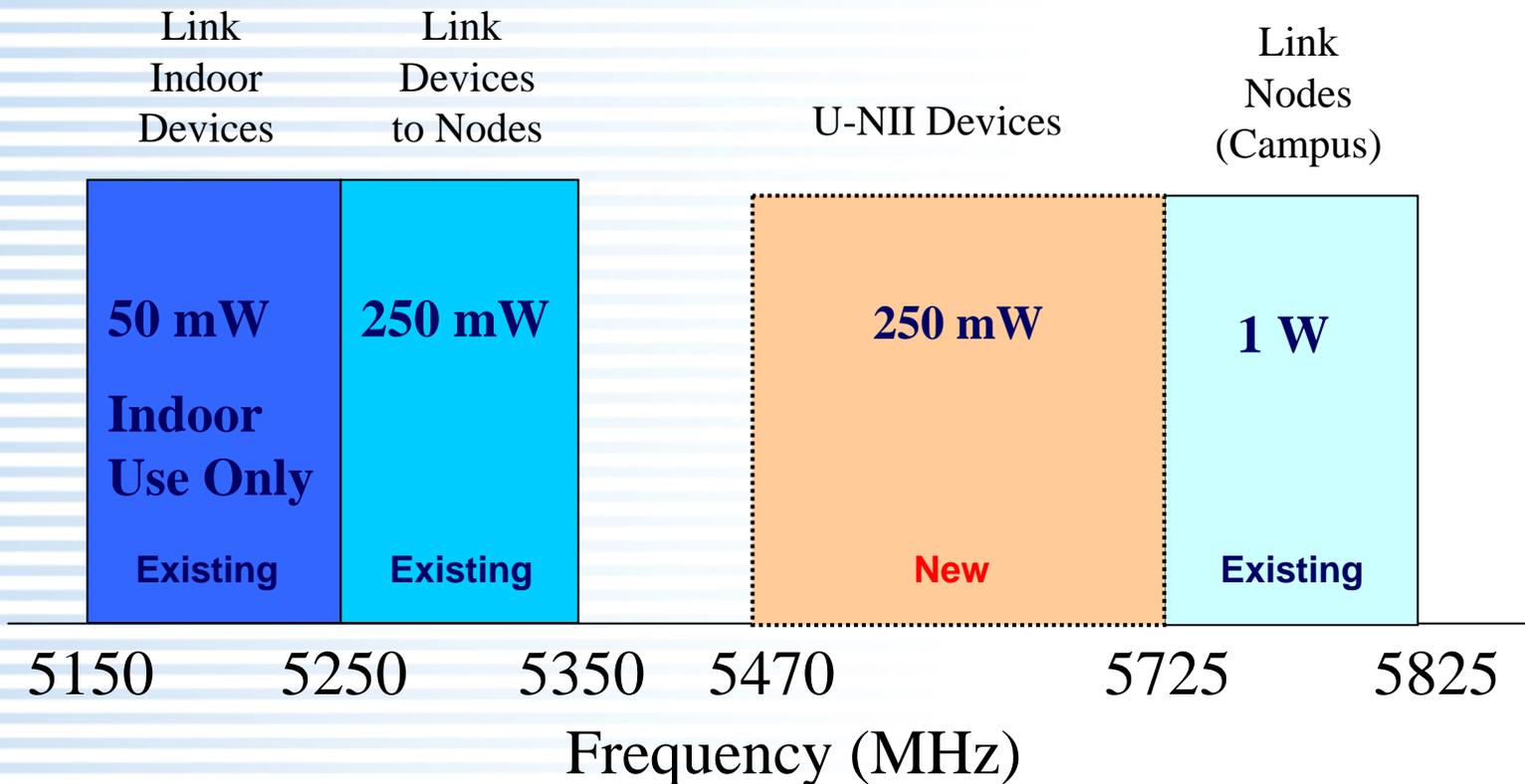
Technical Requirements

- Almost any spectrum can be used except certain restricted frequency bands (Ref. Section 15.205)
- 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



More Spectrum Made Available for Unlicensed Operation

- FCC has recently made available an additional 255 MHz of spectrum for anticipated Wi-Fi growth
- Provides A Total of 555 MHz of Spectrum for unlicensed operations





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: Wireless Fidelity

- **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>
802.11(b)	2.4 GHz	DSS	11 Mb/s
802.11(g)	2.4 GHz	OFDM	54 Mb/s
802.11(a)	5.8 GHz	OFDM	54 MB/s



Wi-Fi: MiMo Technology

- MIMO: Multiple Input Multiple Output
 - New generation of consumer products
 - Based on IEEE 802.11 standard
 - Allows greater range and data throughput





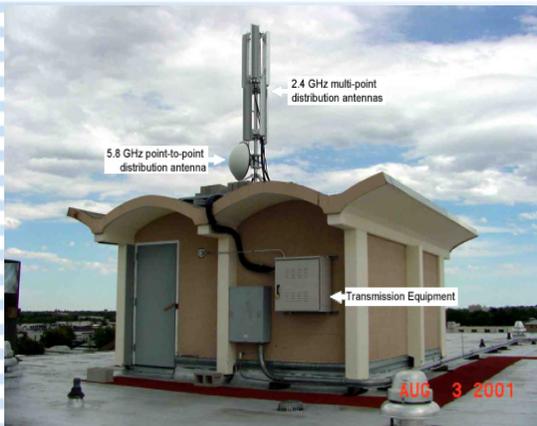
Wi-Fi Applications



Home & Business networking



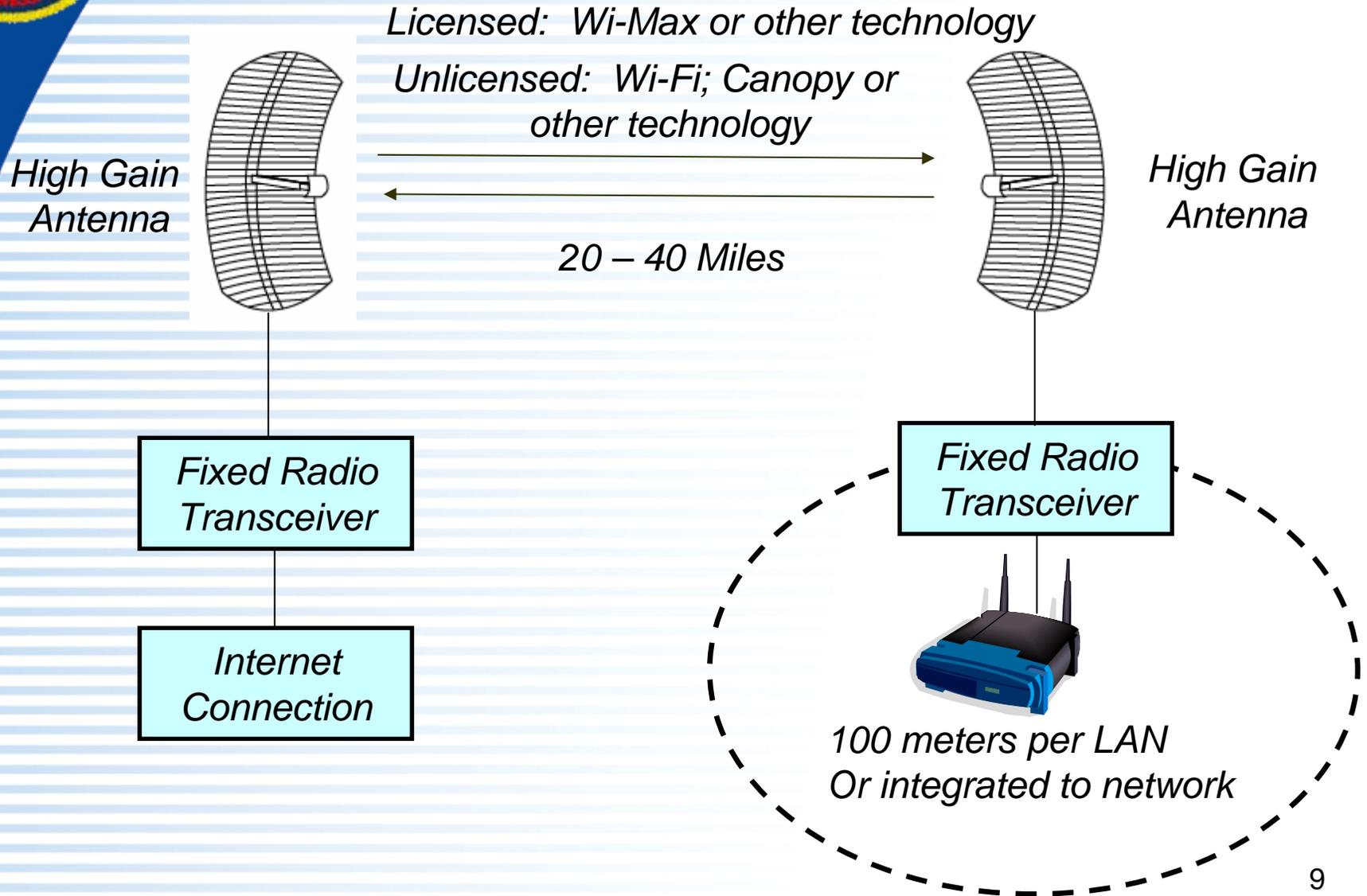
“Hot Spots” at coffee shops, hotels, airports, etc.



Metropolitan & Community Networks – WISPs

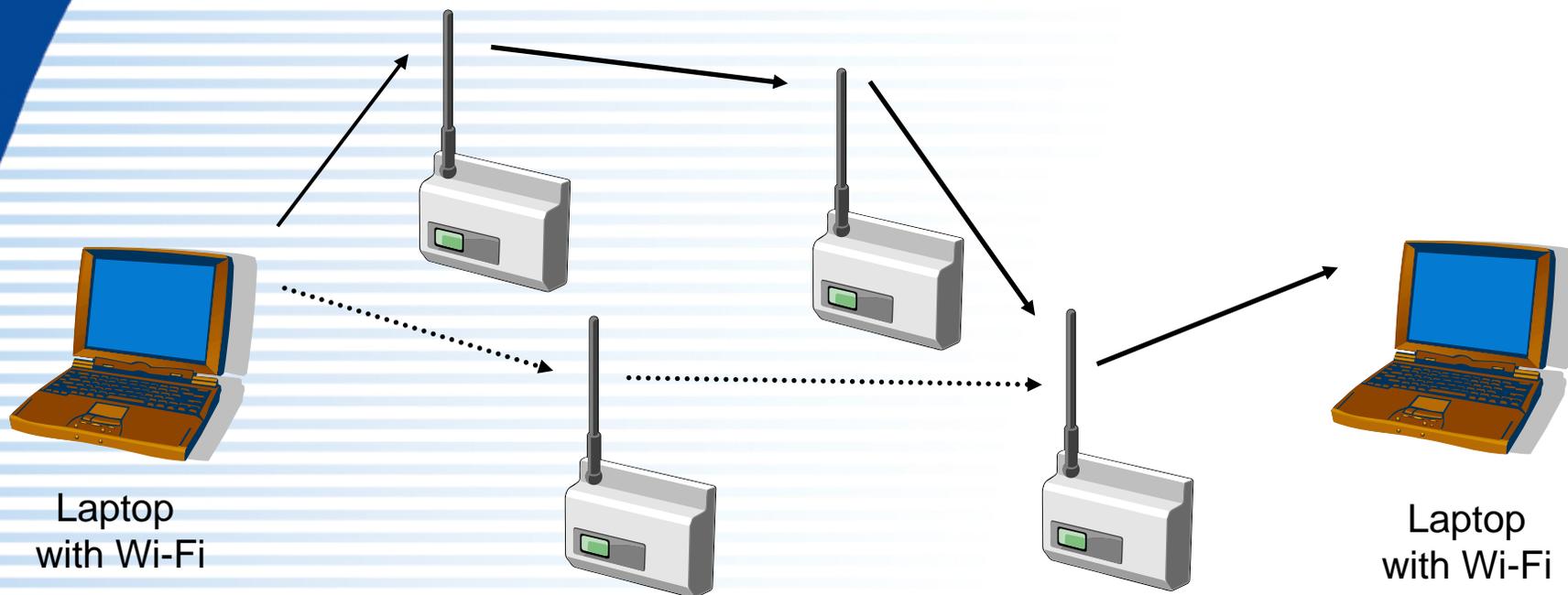


Basic Network Architecture





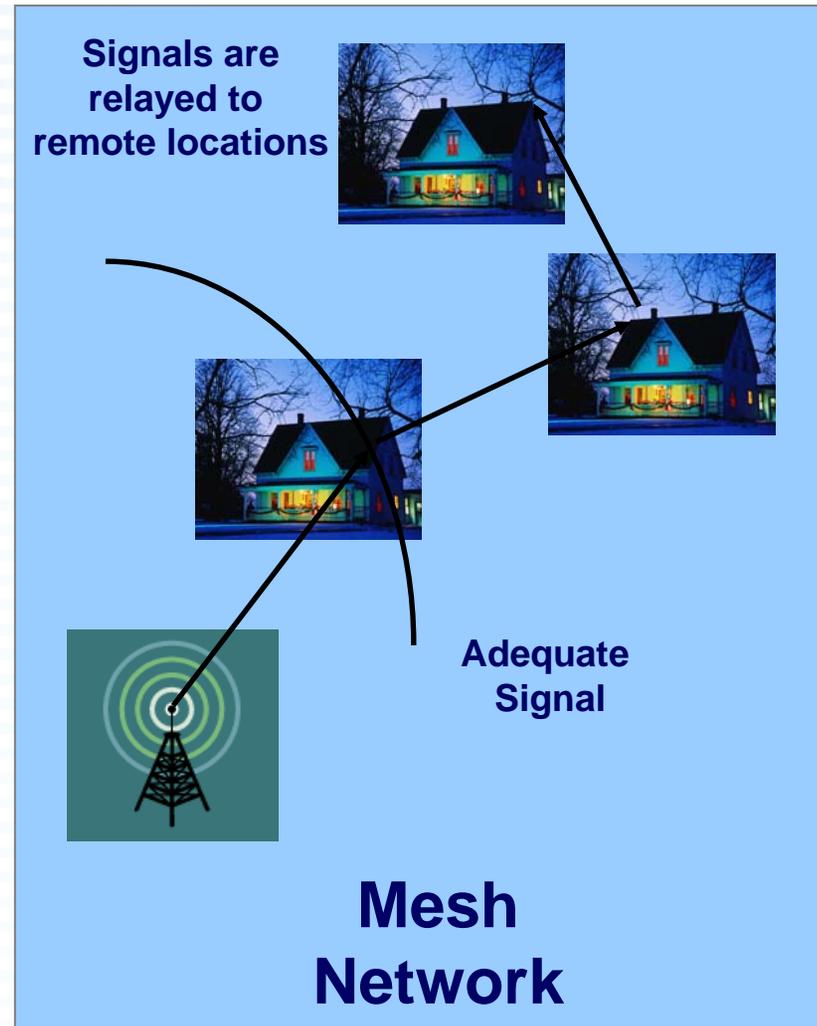
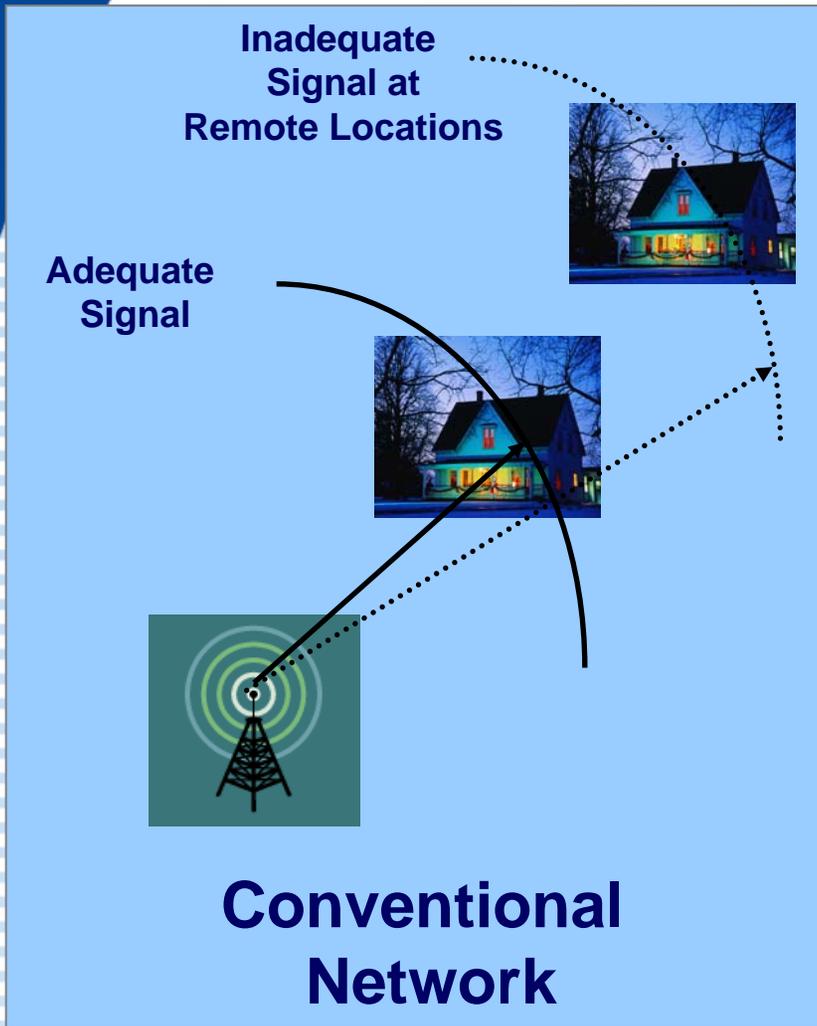
Wi-Fi Mesh Networks



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



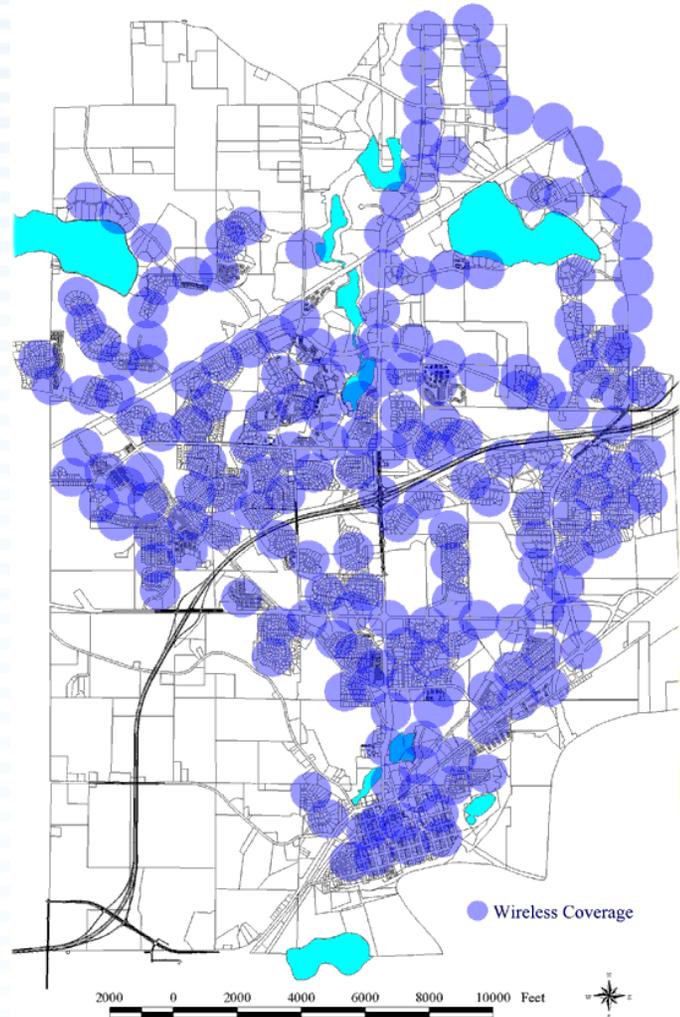
Mesh Network Coverage





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





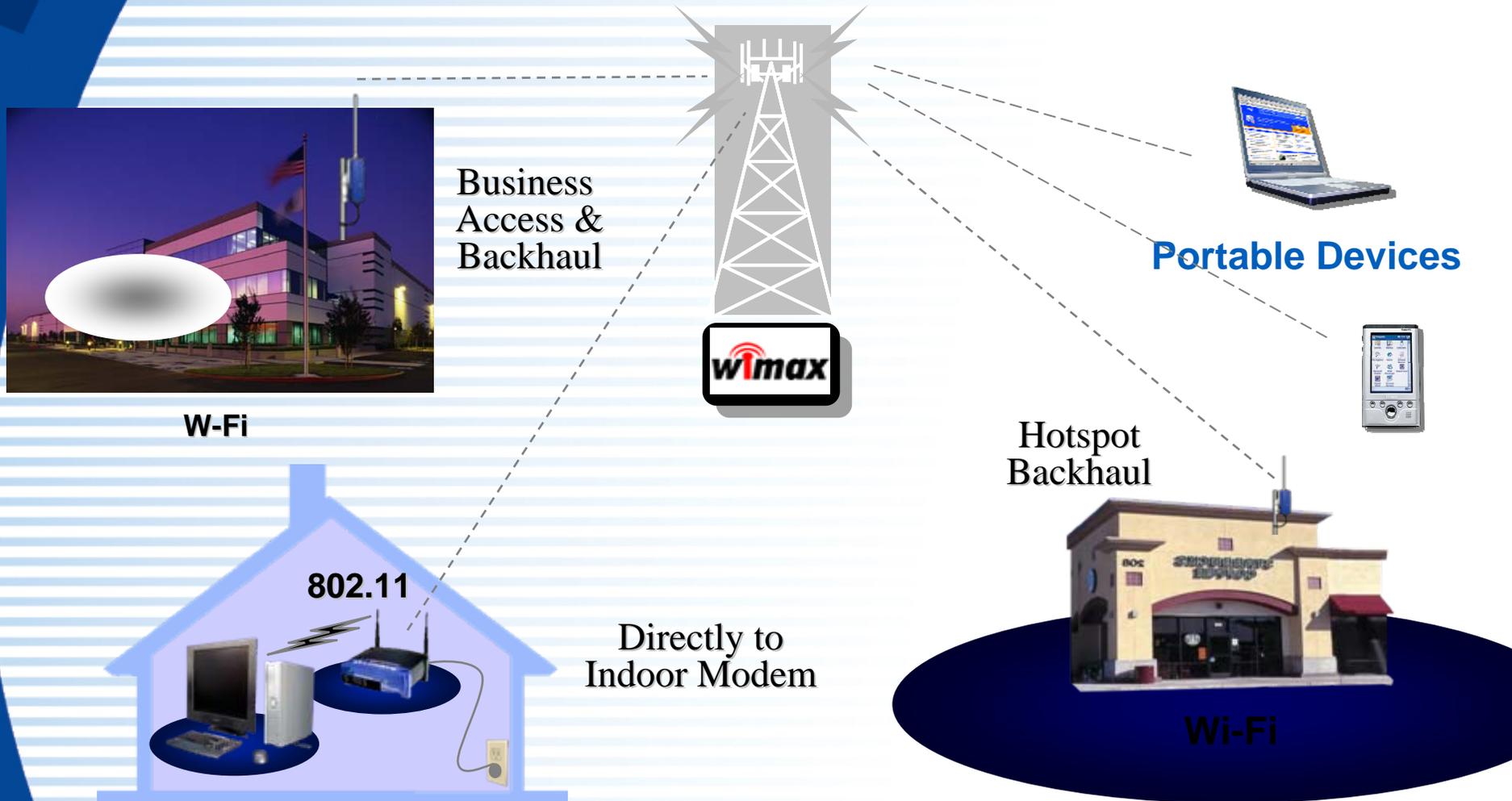
WISP Resources

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



Integrating Licensed & Unlicensed

WiMAX technology can operate in licensed or unlicensed spectrum:





Conclusion

Thank you!

Ronald.Repasi@fcc.gov