

Wireless Technologies

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Outline

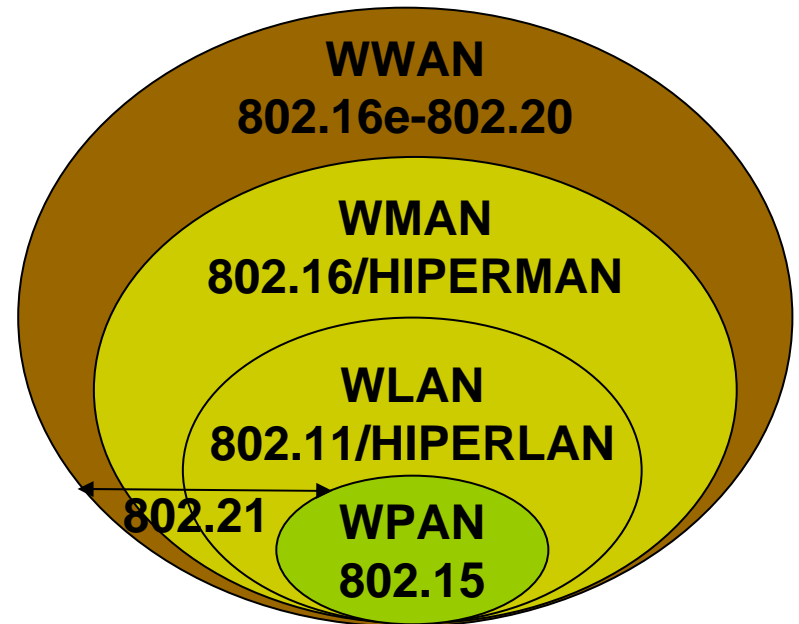
- Wireless Technologies and Standards
- Spectrum regulations



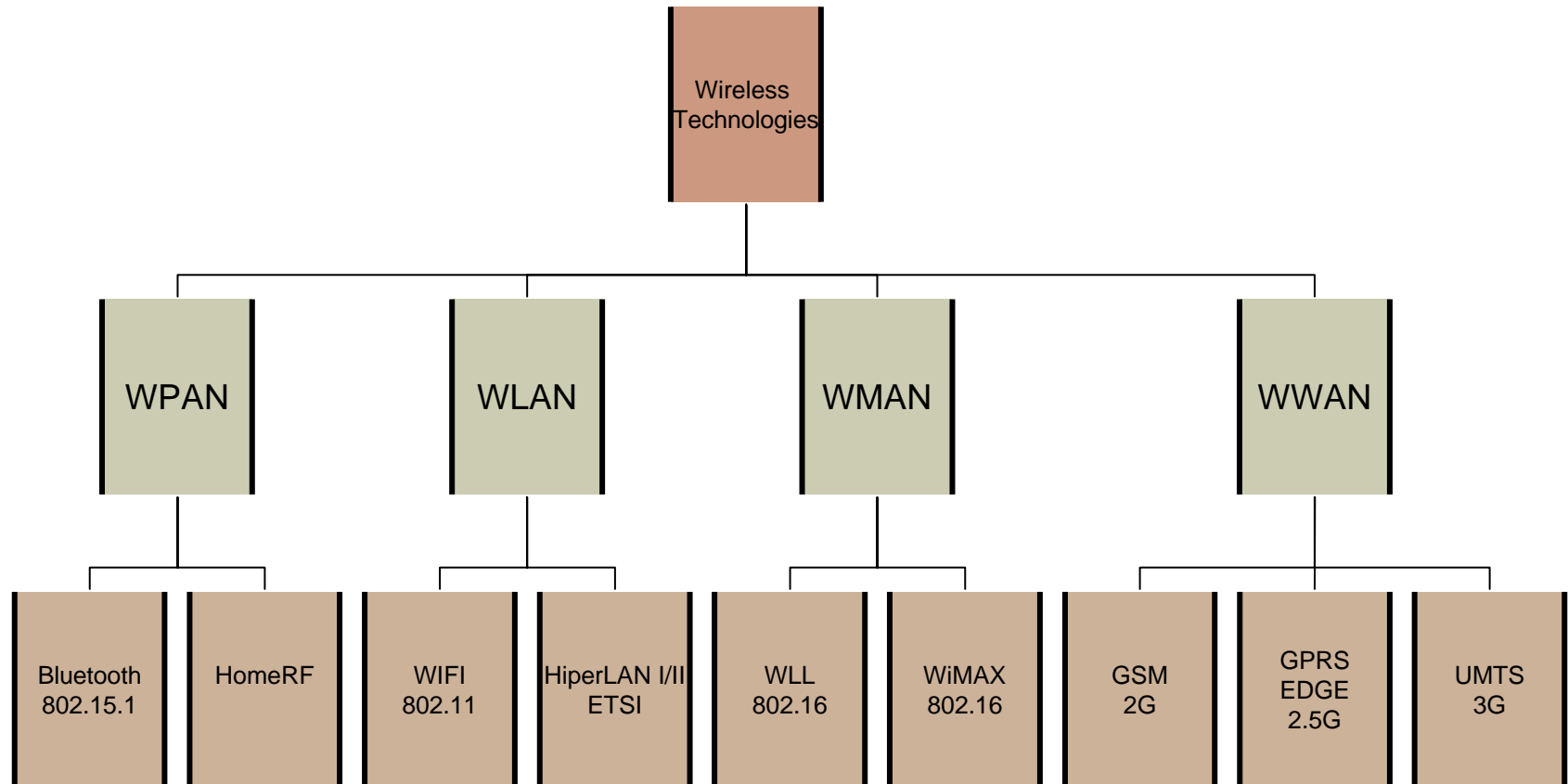
Wireless Technologies

- ❑ Wireless Body Area Networks
- ❑ Wireless Personal Area Networks
- ❑ Wireless Local Area Network
- ❑ Wireless Metropolitan Area Network
- ❑ Wireless Wide Area Network

- ❑ Varies in terms of transmission range
 - Up to 1m
 - from 1m to 10m
 - From 10 to 500m
 - From 500 to 20-50 km
 - Beyond 50km



Wireless Technologies

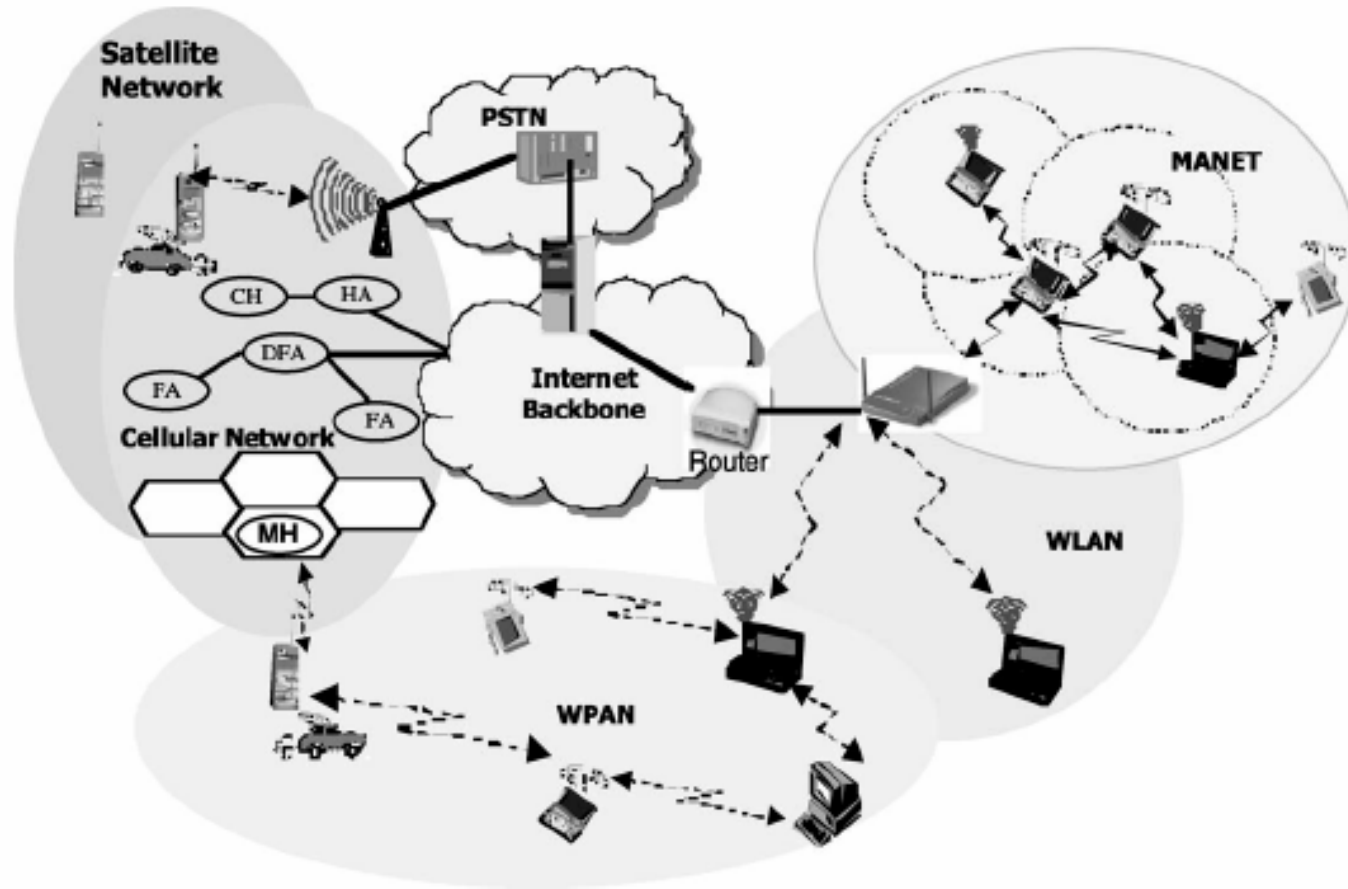


Wireless Technologies [hoebeke]

Technology	Theoretical bit rate	Frequency	Range	Power consumption
IEEE 802.11b	1, 2, 5.5 and 11 Mbit/s	2.4 GHz	25–100 m (indoor) 100–500 m (outdoor)	~30 mW
IEEE 802.11g	Up to 54 Mbit/s	2.4 GHz	25–50 m (indoor)	~79 mW
IEEE 802.11a	6, 9, 12, 24, 36, 49 and 54 Mbit/s	5 GHz	10–40 m (indoor)	40 mW, 250 mW or 1 W
Bluetooth (IEEE 802.15.1)	1 Mbit/s (v1.1)	2.4 GHz	10 m (up to 100 m)	1 mW (up to 100 mW)
UWB (IEEE 802.15.3)	110 – 480 Mbit/s	Mostly 3 – 10 GHz	~10 m	100 mW, 250 mW
IEEE 802.15.4 (for example, Zigbee)	20, 40 or 250 kbit/s	868 MHz, 915 MHz or 2.4 GHz	10–100 m	1 mW
HiperLAN2	Up to 54 Mbit/s	5 GHz	30–150 m	200 mW or 1 W
IrDA	Up to 4 Mbit/s	Infrared (850 nm)	~10 m (line of sight)	Distance based
HomeRF	1 Mbit/s (v1.0) 10 Mbit/s (v2.0)	2.4 GHz	~50 m	100 mW
IEEE 802.16 IEEE 802.16a IEEE 802.16e (Broadband Wireless)	32 – 134 Mbit/s up to 75 Mbit/s up to 15 Mbit/s	10–66 GHz < 11 GHz < 6 GHz	2–5 km 7–10 km (max 50 km) 2–5 km	Complex power control



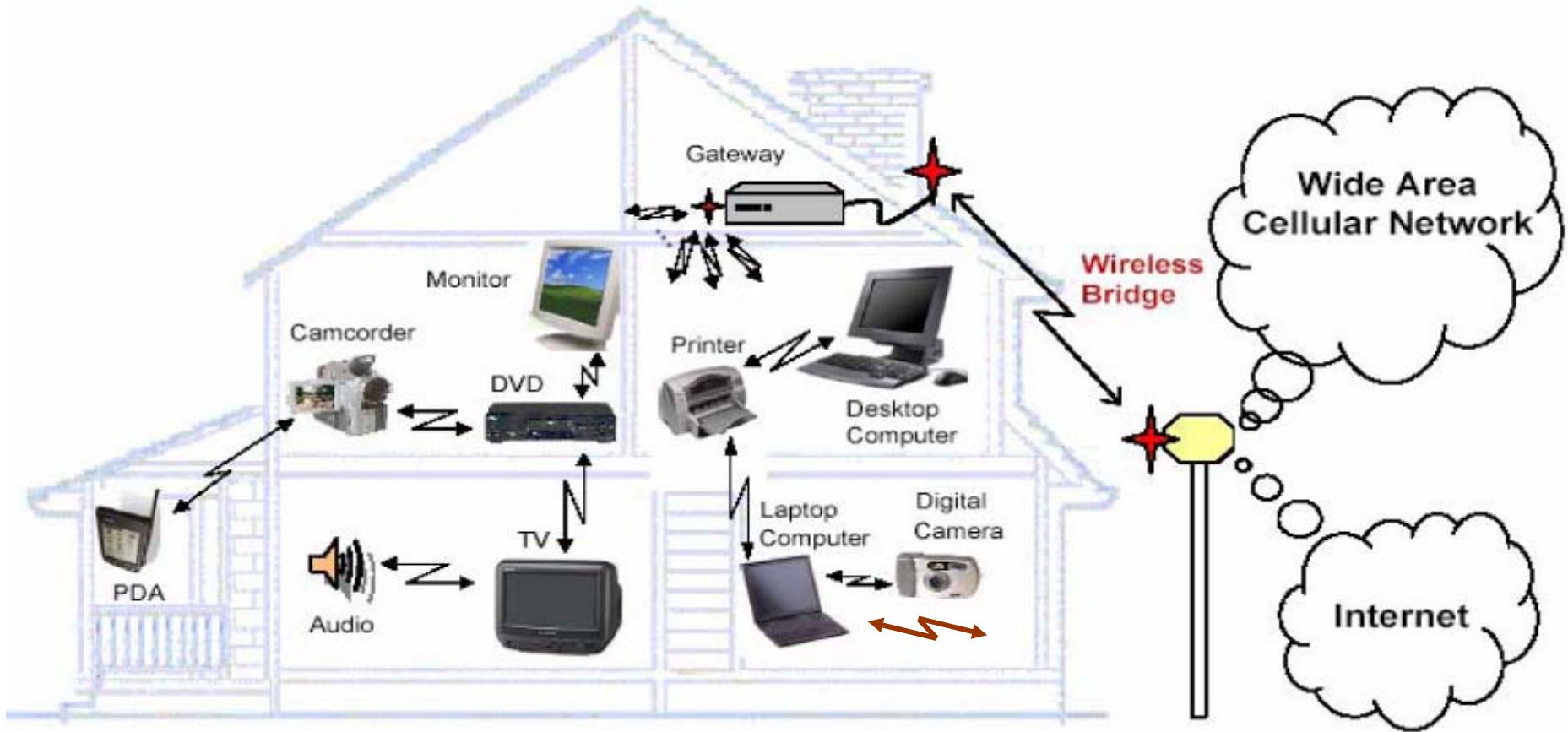
4G Networks View [chlamtac03]



WBAN and WPAN

- A WBAN provides the connectivity among various devices of wearable computers whose components are distributed on the body
 - E.g. microphones, earphones, etc.
- A WPAN connects one-person's BAN with the environment around it (devices around the person)
 - Bluetooth is an example of a wireless PAN that allows devices within close proximity to join together in an ad hoc fashion to exchange information.
 - Many cell phones have two radio interfaces: one for the cellular network and one for PAN connections.

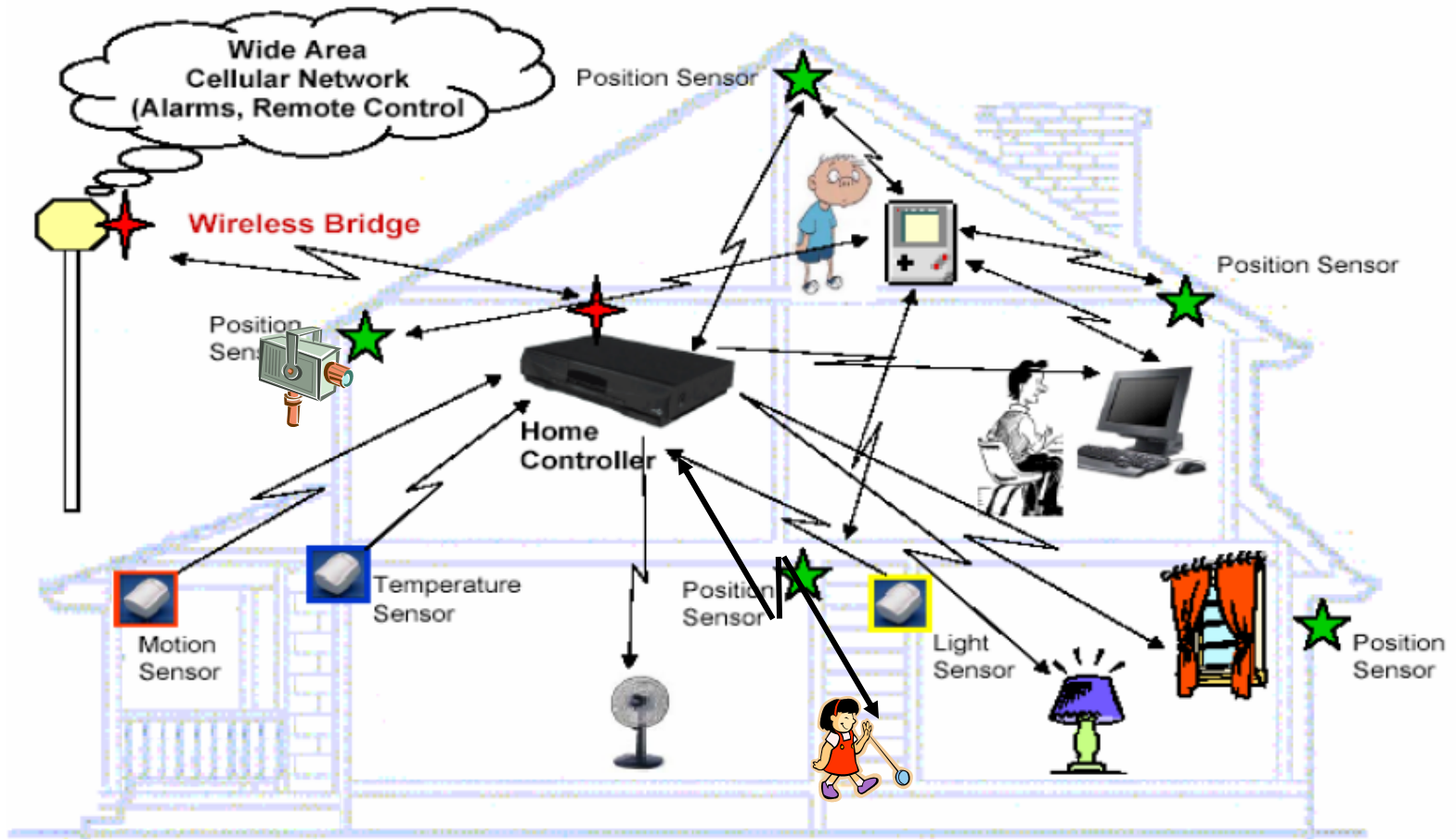
WBAN and WPAN Applications



WLAN

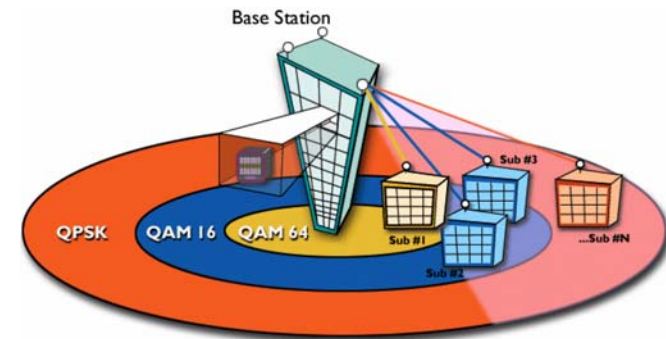
- A WLAN provides a wider range of connectivity with higher data rate than that of WPAN and WBAN
 - Infrastructure mode: requires an AP and provide access to Internet backbone
 - Ad hoc mode: peer-to-peer communication
- Typical applications: hot spots, buildings
- Requirements of a WLAN
 - High capacity
 - Full connectivity of the attached nodes
 - Broadcasting capability
- In terms of standardization
 - In US: IEEE 802.11 and Bluetooth
 - In Europe: HiperLAN II

WBAN/WPAN/WLAN Applications



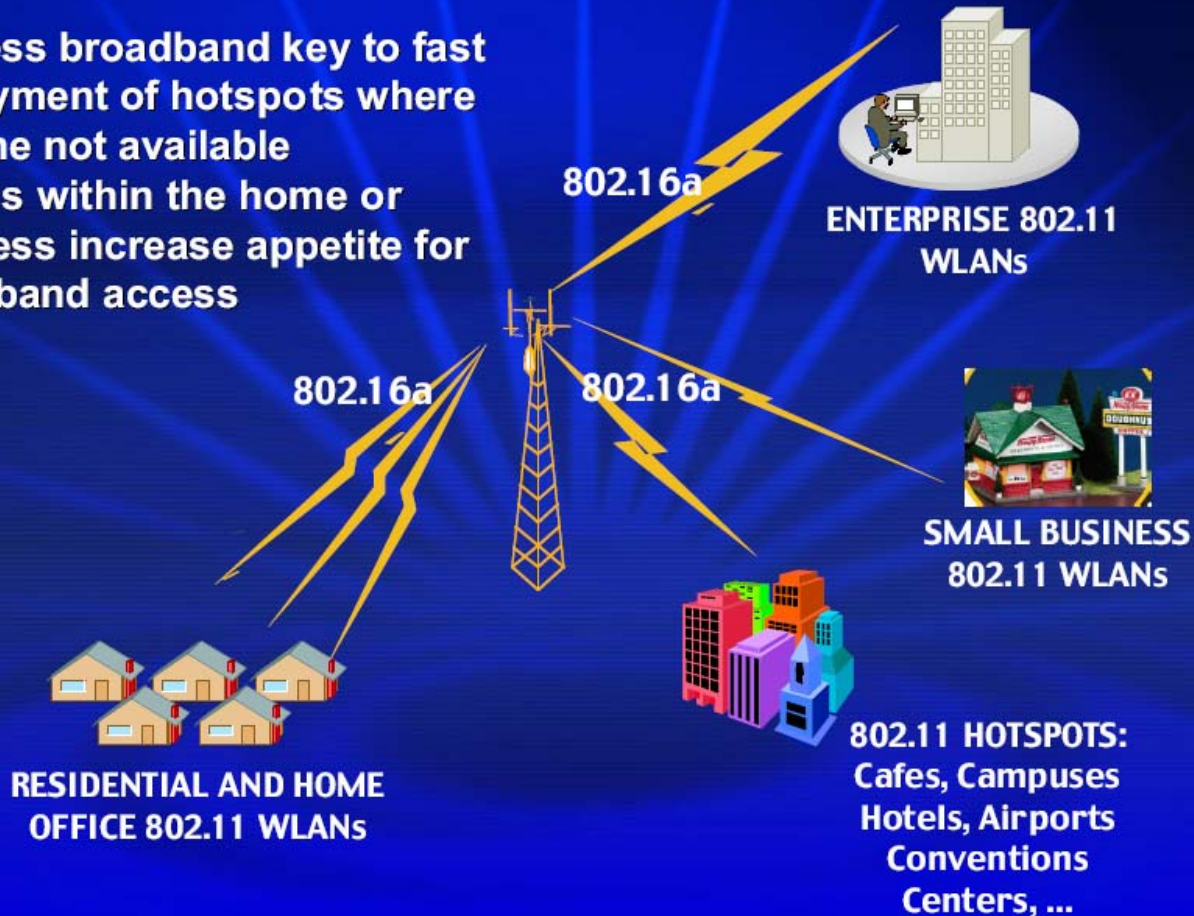
WMAN

- WMAN provides a broadband and fast access (higher data rate) with even wider range than that of WLAN
 - Support multiple services simultaneously with QoS
 - IPv4, IPv6, ATM, ETHERNET
 - Support multiple frequency allocation (2-66GHz)
 - Point-to-multipoint topology with mesh extension
 - BS is connected to public networks
 - BS serves subscriber stations (building, residence)
 - Link adaptation (adaptive coding and modulation)
 - Support for advanced antenna systems
- Standards:
 - In US: IEEE 802.16
 - In Europe: HiperACCESS (>11GHz) and HiperMAN (<11 GHz)
- WiMAX Forum (Worldwide Interoperability for Microwave Access)
 - promotes deployment of BWA (Broad Band Wireless Access) by using a global standard and certifying interoperability of products and technologies
 - Support IEEE802.16

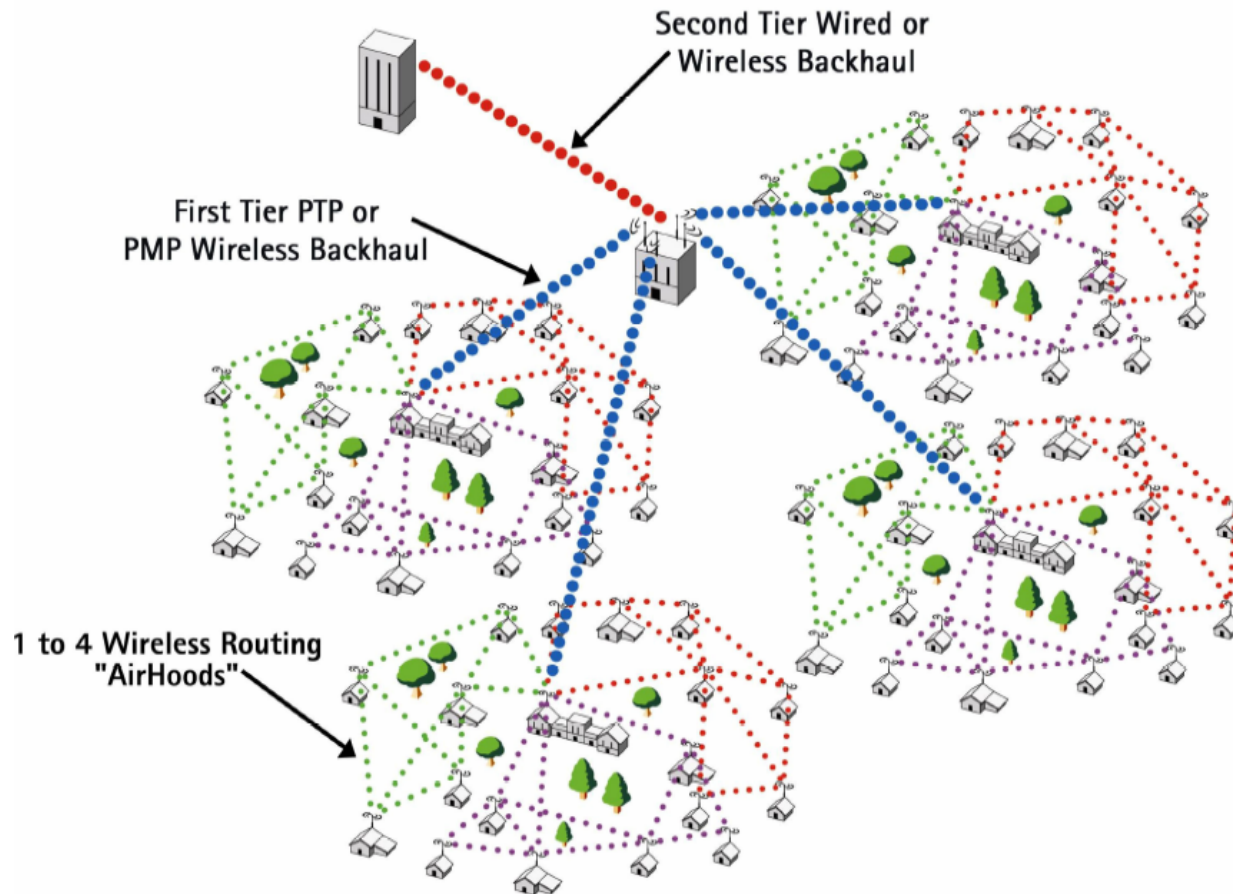


WMAN Applications

- Wireless broadband key to fast deployment of hotspots where wireline not available
- WLANs within the home or business increase appetite for broadband access



Mesh based WMAN



Spectrum Regulation

- Radio spectrum is a scarce resource and are regulated under the responsibility of local Administration
- Licensed or Unlicensed Frequency Allocation
- The ITU divides the world in three Regions for the allocation of frequencies
 - Europe ruled by ETSI
 - America ruled by FCC
 - Asia

Frequency Bands & Applications

- ISM (Industrial, Scientific and Medical): unlicensed
- UPCS (Unlicensed Personal Communication Service)
- UNII (Unlicensed National Information Infrastructure)

