

The IEEE 802.16 WirelessMAN Standard for Broadband Wireless Metropolitan Area Networks

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<http://WirelessMAN.org>

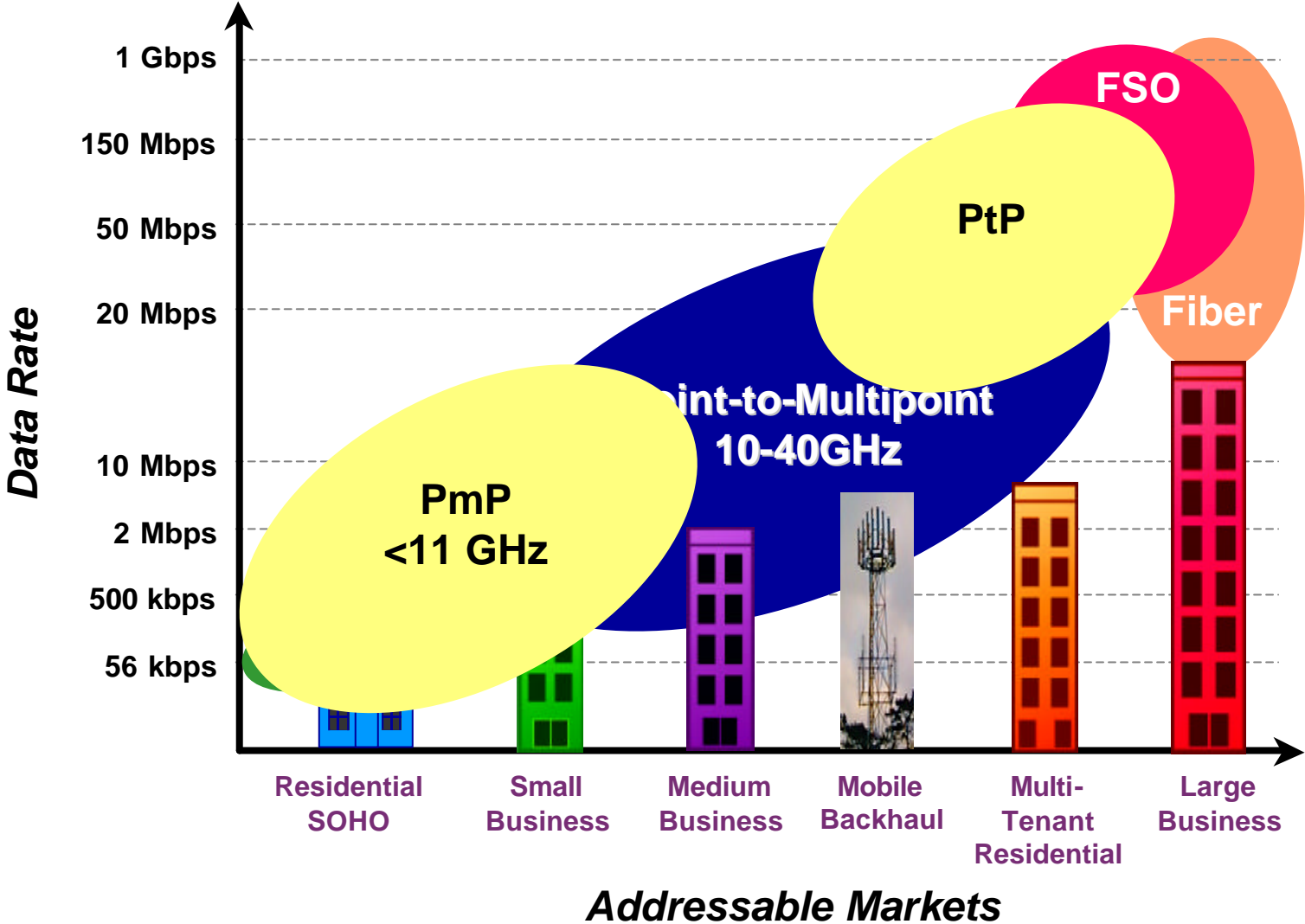
Broadband Wireless Access

The Problem to Solve

The World Wants Access

- All over the world:
 - ▶ Users want access to networks
 - ▶ Network operators want access to customers
 - ▶ Users want diverse media simultaneously
- Broadband Wireless Access flourishes where:
 - ▶ Many users are dissatisfied with their access
 - ▶ Network operators need to reach customers

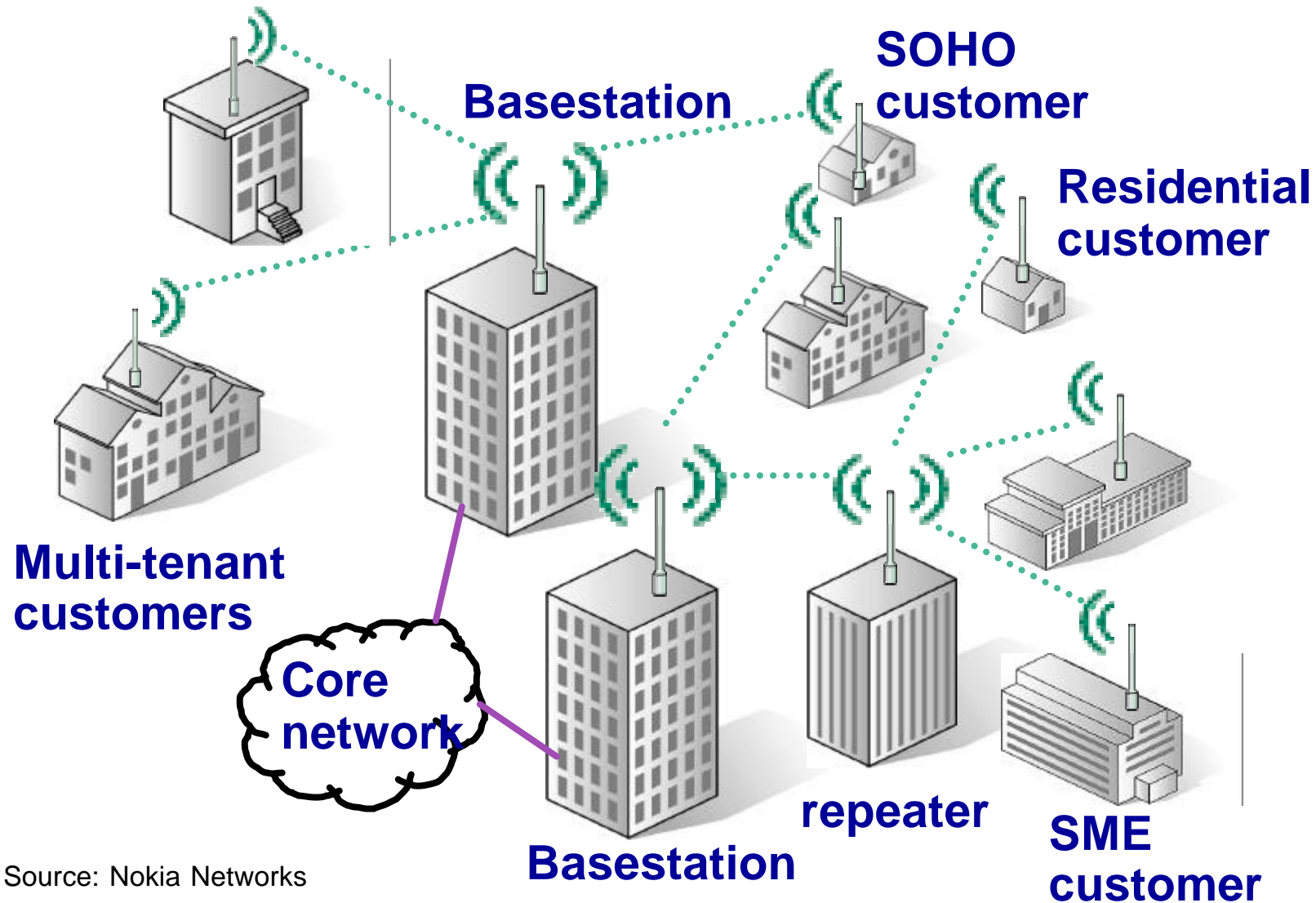
Market Segments for Wireless Access



Broadband Access to Buildings

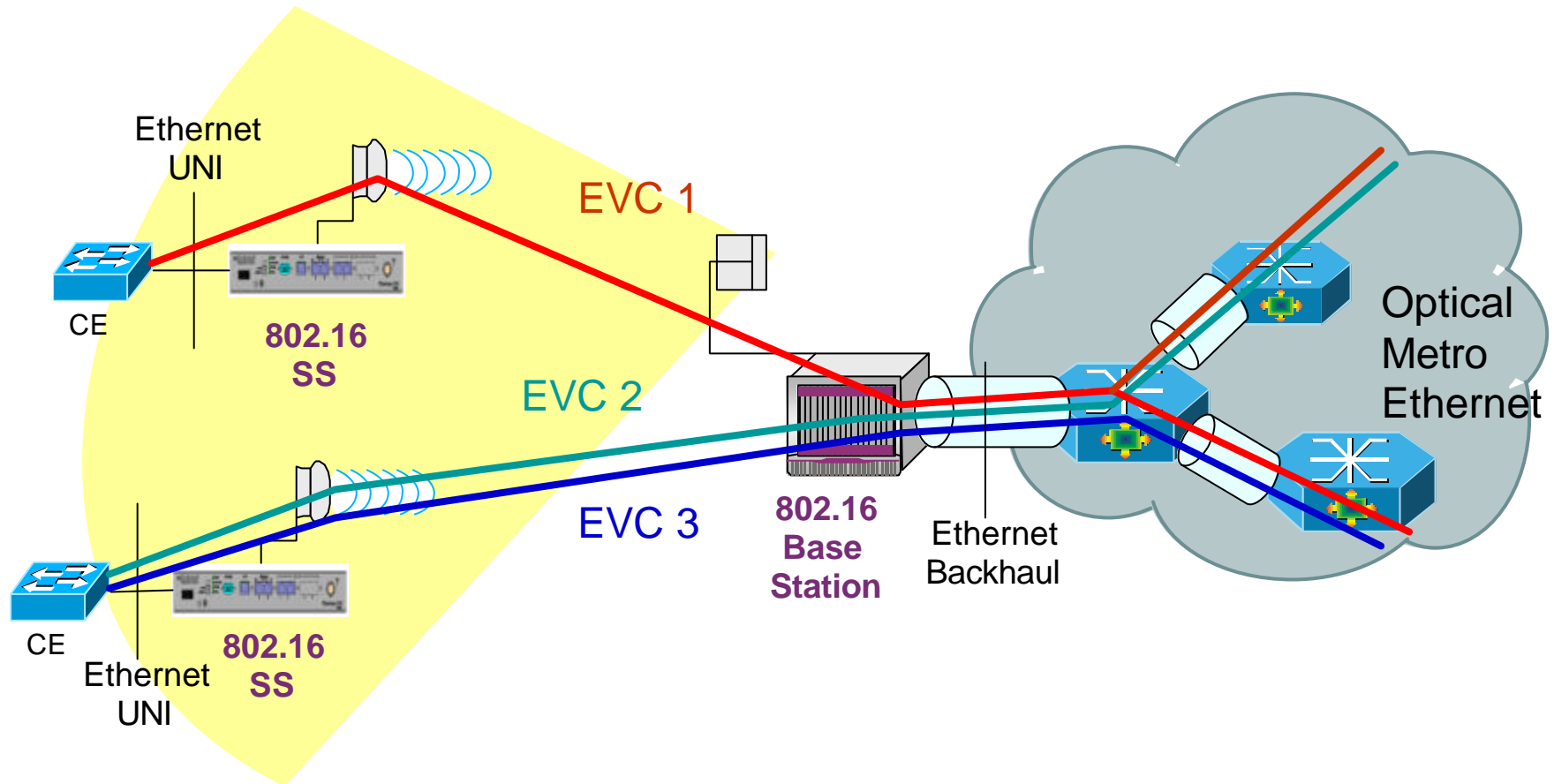
- The “Last Mile”
 - ▶ Fast local connection to network
- Business and residential customers demand it
 - ▶ Data
 - ▶ Voice
 - ▶ Video distribution
 - ▶ Real-time videoconferencing
 - ▶ Gaming applications
- Network operators demand it
- High-capacity cable/fiber to every user is expensive
 - ▶ Construction costs do not follow Moore’s Law

WirelessMAN: Wireless Metropolitan Area Network

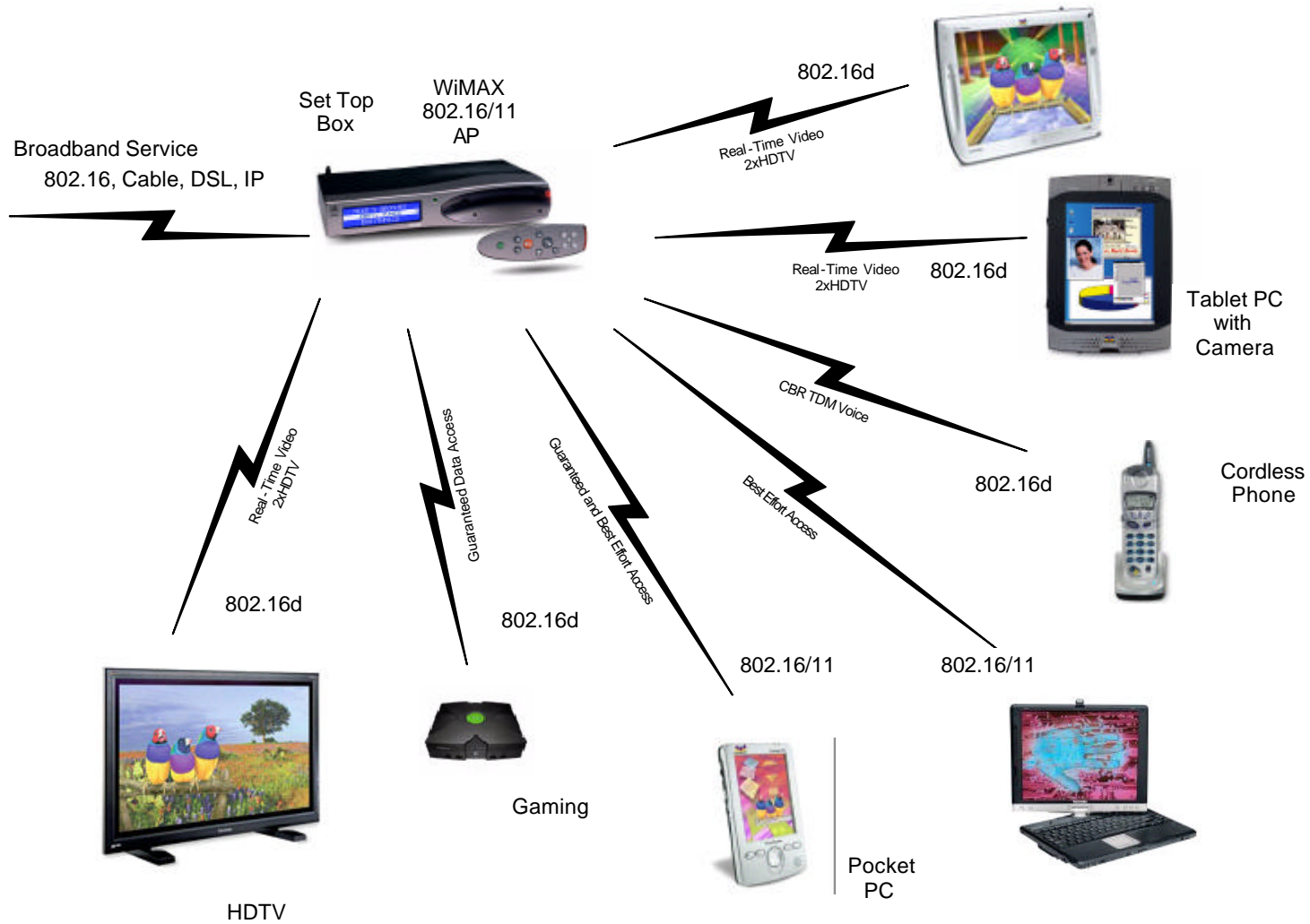


Source: Nokia Networks

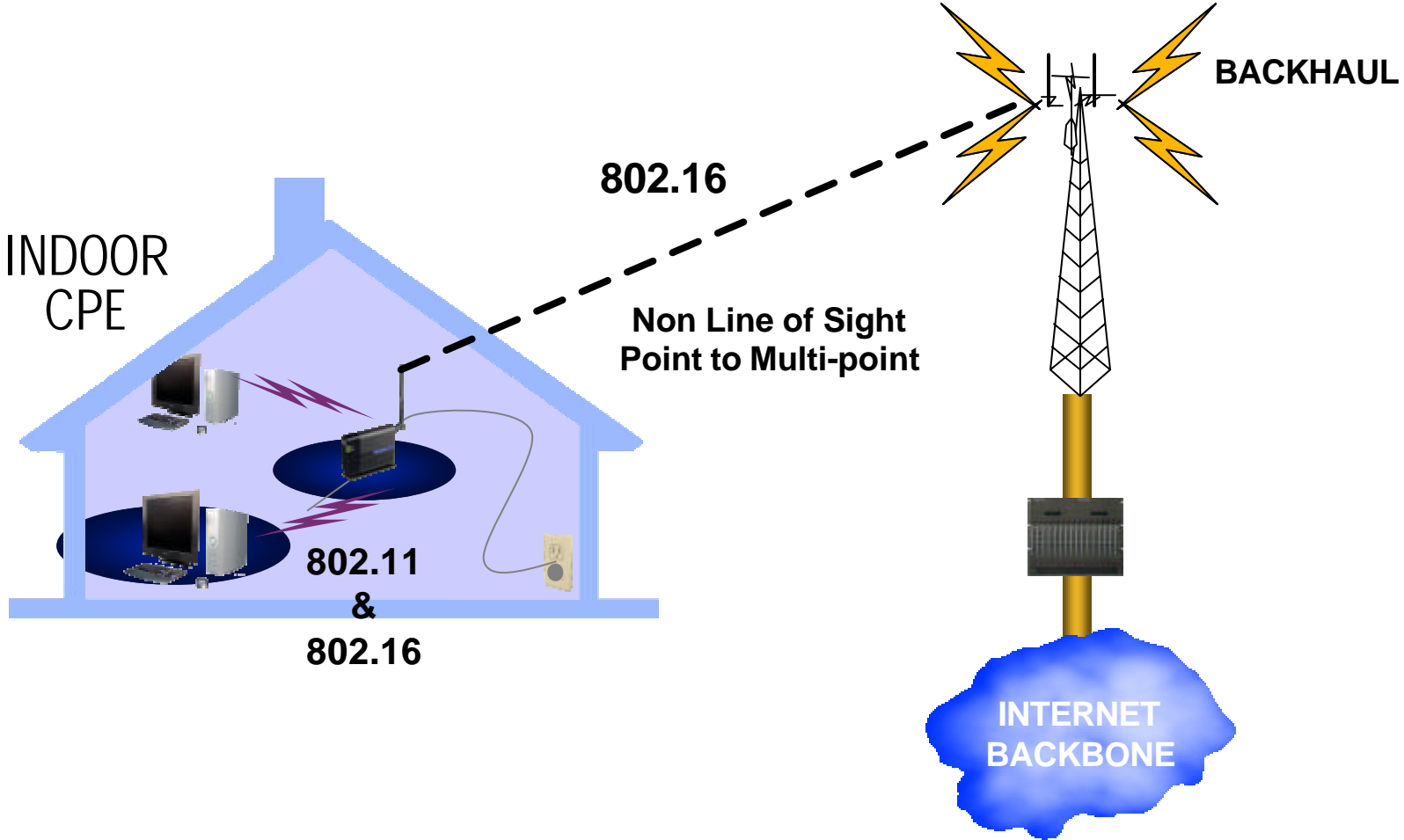
802.16 in Metro Ethernet



Vision - Wireless Multimedia Distribution



Hierarchical Systems



Why 802.16 for Multimedia Wireless Networks?

- 802.16 provides **True** QoS
- Allows more efficient use of available spectrum than other wireless technologies
- Better security, authentication, and protection against theft of service
- Possibility to use both licensed and unlicensed frequencies

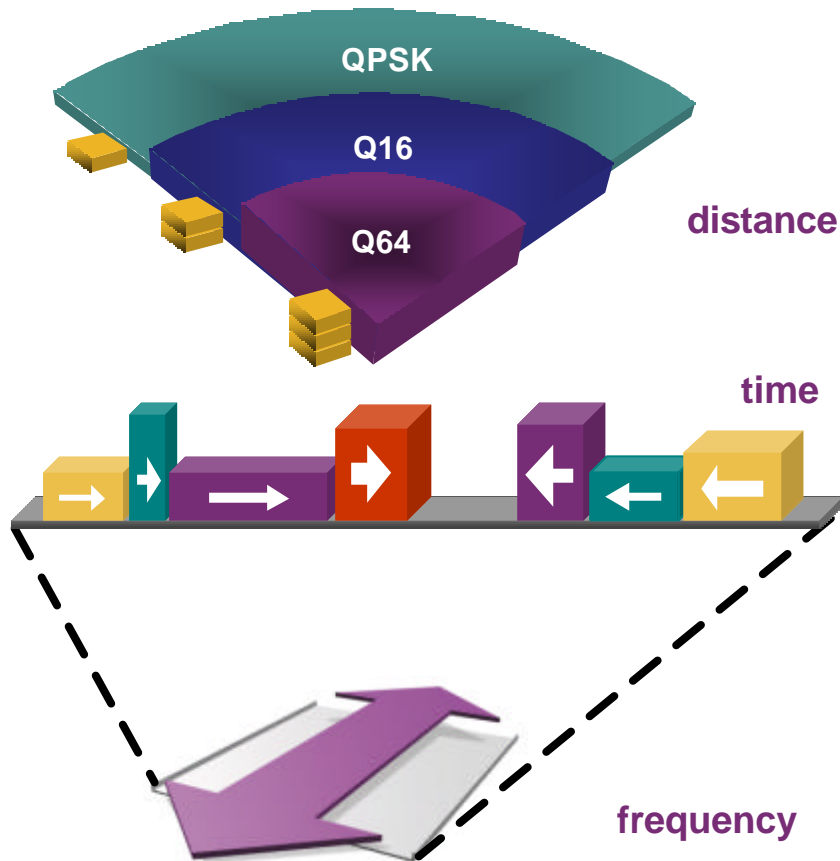
Properties of IEEE Standard 802.16

- Broad bandwidth
 - ▶ Up to 96 Mbps (>70 Mbps throughput) in 20 MHz channel (in WirelessMAN™-OFDM air interface)
- Supports multiple services simultaneously with full QoS
 - ▶ Efficiently transport IPv4, IPv6, ATM, Ethernet, etc.
- Bandwidth on demand (frame by frame)
- MAC designed for efficient use of spectrum
- Comprehensive, modern, and extensible security
- Supports frequency allocations from <1 to 66 GHz
 - ▶ OFDM and OFDMA for non-line-of-sight applications

Properties of IEEE Standard 802.16

- TDD and FDD
- Link adaptation: Adaptive modulation and coding
 - ▶ Subscriber by subscriber, burst by burst, uplink and downlink
- Point-to-multipoint topology, with mesh extensions
- Support for adaptive antennas and space-time coding
 - ▶ Beamforming and MIMO
- Extensions to mobility are coming next.

3rd Gen. Technology in 802.16

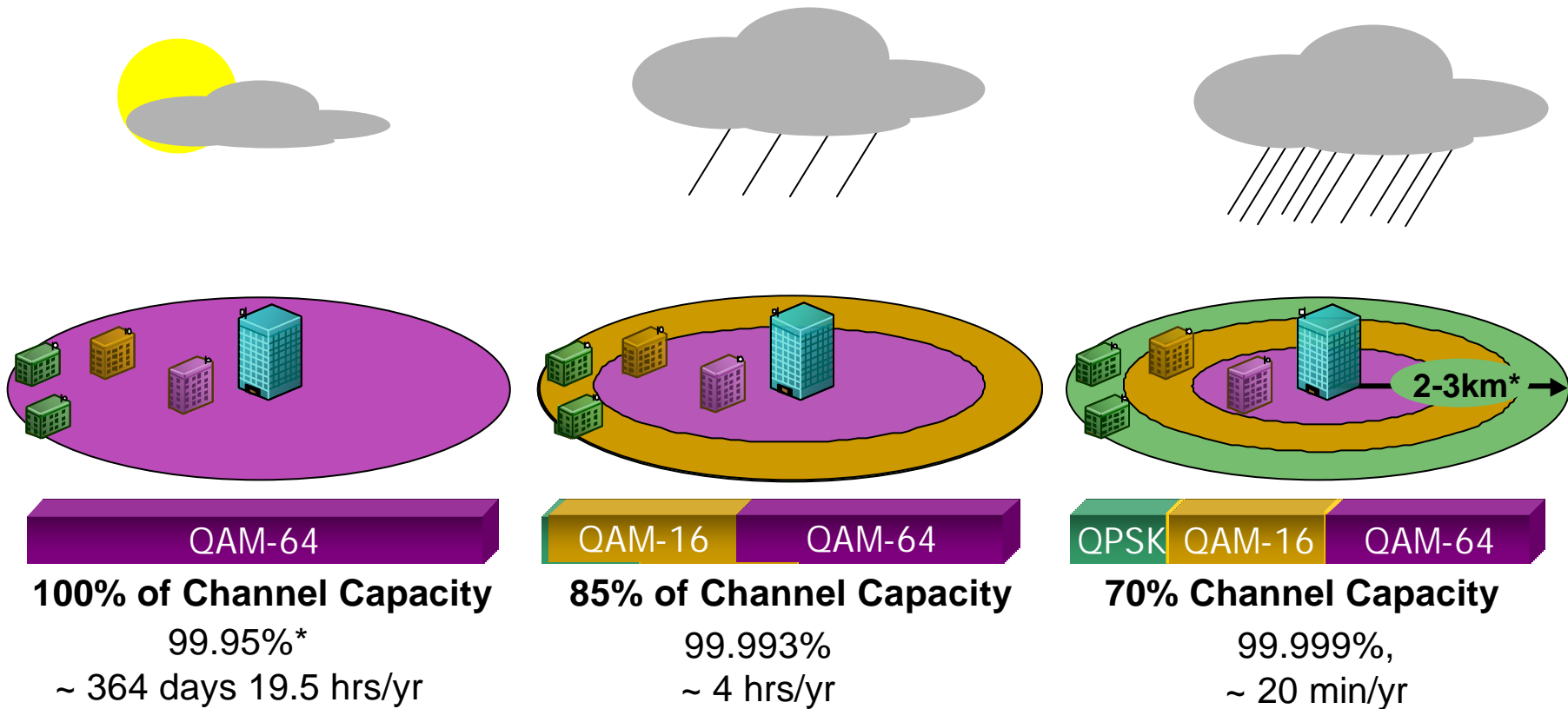


Adaptive Modulation
variable modulation maximizes
both air-link capacity and coverage

Adaptive TDMA
True bandwidth on demand and
variable packet sizes provide
differentiated, bursty services
to multiple users

Adaptive TDD
variable asymmetry in a single
broadband channel best matches
bandwidth to demand

Coverage/Capacity Advantage of Adaptive PHY

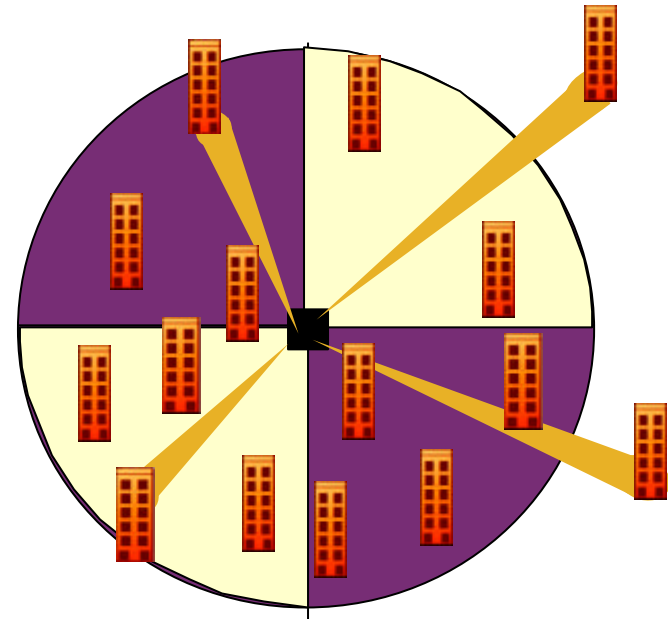


Modulation changes dynamically to match propagation path conditions

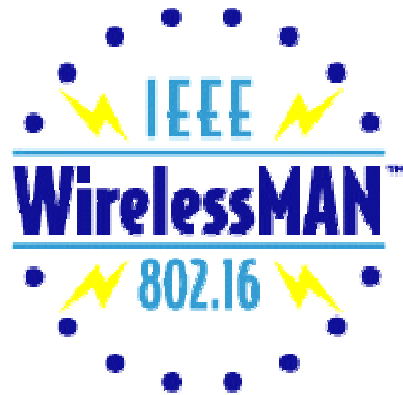
* Typical for .01% rain rate 40-50 mm/hr at 28GHz (egg. Chicago. SFO is about 35mm/hr)

802.16 Supports Beamforming and MIMO

- High system gain for maximum coverage and availability
- Use for extended range or increased capacity



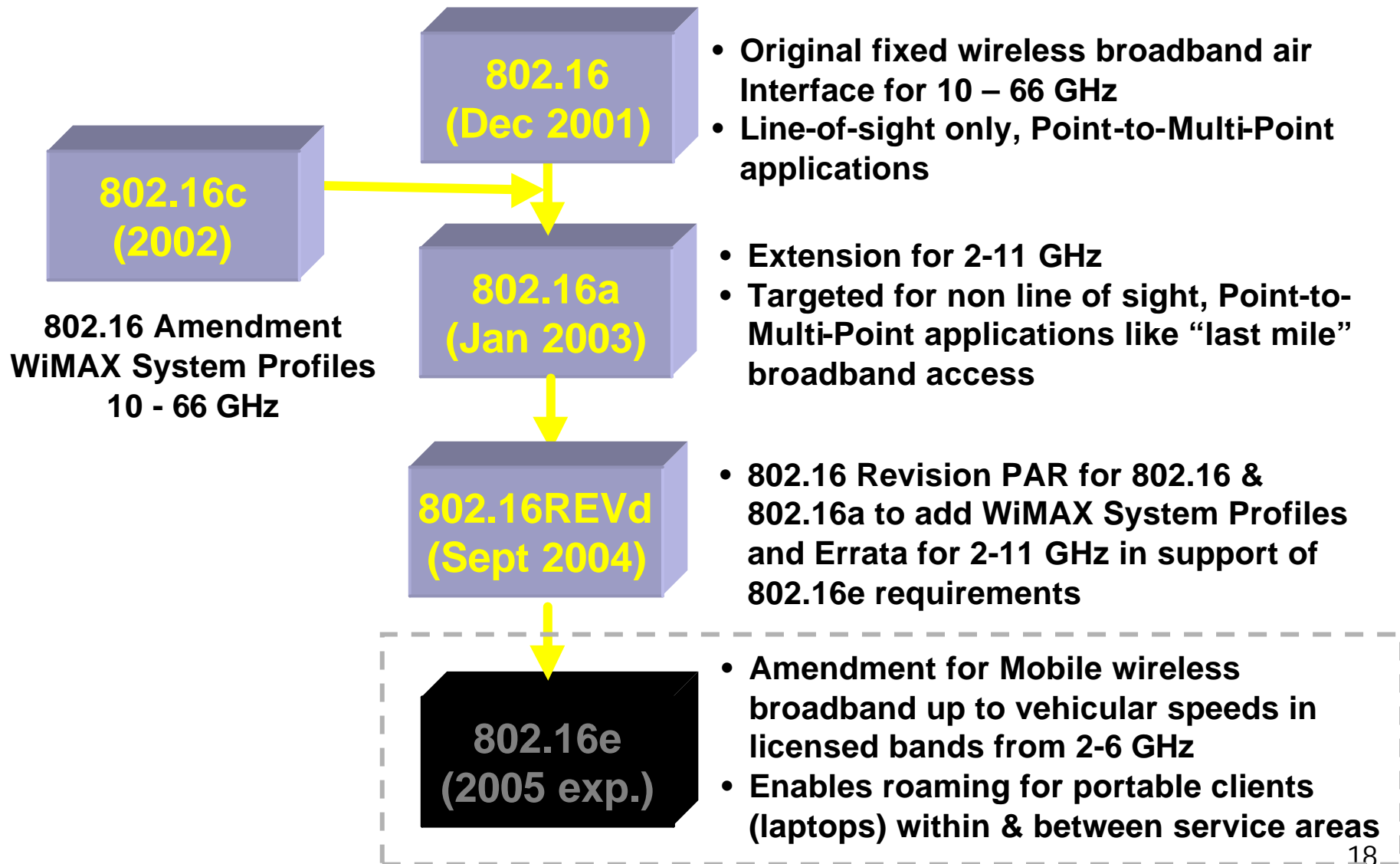
IEEE 802.16 Working Group



IEEE 802.16 Leadership

- Chair: Roger Marks
- Vice Chair: Ken Stanwood
- Secretary: Dean Chang

802.16 Standards Genealogy



802.16 and ETSI

- Over 50 liaison letters between 802.16 and ETSI
 - ▶ (European Telecom Standards Institute)
- ETSI HIPERMAN
 - ▶ Below 11 GHz
 - ▶ Healthy cooperation
 - ▶ Harmonized with WirelessMANTM-OFDM

802.16 and ITU

- ITU-T January 2004:
 - ▶ 802.16 approved as draft recommendation for wireless extension of cable operator footprint.
 - ▶ Included in-home
- ITU-R November 2004:
 - ▶ Liaison statement
 - ▶ Return statement from 802.16
 - ▶ Working towards ITU BWA recommendation

WiMAX Purpose

- To promote a common broadband wireless standard
- To develop reduced scope “profiles” to ease development
- To fill the gaps in the IEEE process relative to the ETSI process
- To create a broadband wireless access conformance and interoperability certification process
- To act as a certification body

Conclusion

- IEEE 802.16 WirelessMAN standards are:
 - ▶ open in development and application
 - ▶ addressed at worldwide markets
 - ▶ engineered as optimized technical solutions
 - ▶ significantly complete
 - With test spec documents in development
 - ▶ being enhanced for expanded opportunities