EENGM4221:
Broadband Wireless Communications

Lecture 19: 802.16 WiMax Overview

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802.16-2001

- Originally conceived as a wireless broadband access technology (Wireless 'Local Loop'/'Last Mile')

- The original 802.16 standard was released in 2001

- It specified a PHY and MAC for Fixed WMAN operating at frequencies between 10 and 66GHz and assumed the use of highly directional, professionally installed antennas (e.g. 'Satelite' Dish)

- The MAC was specifically designed to achieve a Centrally Controlled Point-to-Multipoint (star topology) network

- The PHY was relatively basic given the benign channel facilitated by the use of high gain fixed antennas and line of sight (LOS)

  – This specification received little commercial interest

Ref:

# 802.16a, 802.16-2004 and 802.16e

- The 802.16a group extended the use of 802.16 to consider the use of consumer installed non-line-of-sight antennas
    - This necessitated the use of lower operating frequencies (<11GHz)
    - 3 New PHY specifications were added to accommodate the more severe fading in this scenario
    - Some changes were made to the MAC including the addition of features to enable 'Mesh' networks
        - Allows Mesh as well as Star topologies
        - Allows Multihop as well as Single hop
- 802.16d modified 802.16a slightly and merged it with 802.16 to produce 802.16-2004
- The 802.16e group further extended 802.16 to consider mobile terminals and completed their standard in 2006

WiMax and WiBro

- WiMax is an international commercial alliance supporting 802.16
  - It is to 802.16 what WiFi is to 802.11
- It adopted one of the four PHYs from 802.16-2004 and 'championed' it as a fixed WMAN technology
- It also adopted the 802.16e spec and championed it as a mobile WMAN technology
- WiBro is a Korean entity equivalent to WiMax and champions a version of 802.16e
- During 2005/6 WiMax and WiBro shifted positions slightly to be compatible

WiMax Evolution
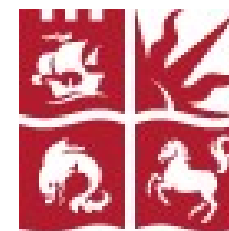
- Much like the other standards we have used for case studies there was further evolution
  - Look at the IEEE 'Grouper' site for more details
  - We won't cover them in detail in this course
- Ultimately, in the mobile arena at least, WiMax 'lost' to 3GPP's LTE mobile standard
- Now somewhat deprecated but still used
  - An excellent example to contrast with WiFi and Bluetooth
    - Has both similarities and differences to both of these

# The PMP MAC – Design Assumptions

- The 802.16 MAC was designed from the outset for QoS provision. With this in mind, the following were assumed:
  - Centralised Scheduling
  - Star Network Topology
  - Link Adaptation Capabilities
  - Explicitly defined connection types with differing QoS profiles – traffic classes
- In 802.16 terminology, the central node is the Basestation (BS) and all other nodes are termed Subscriber Stations (SS)

The PMP MAC – Duplex Agnostic

- The 802.16 MAC is designed to be 'Duplex Agnostic'

  – This is a fancy way of saying that it can use either FDD or TDD

  – In the FDD case, SSs may be either half-duplex or full-duplex.

  – One BS may support a mixture of both full- and half-duplex SSs

  – An FDD Basestation must be full-duplex in order to support any full-duplex SSs

Review of Lecture 19
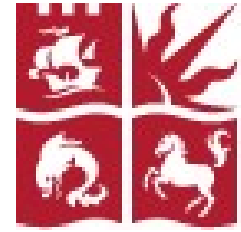
- We briefly reviewed the concept of 802.16

- Summarised key steps in its history

- Reviewed key assumptions in its design:

  - Star, Centralised, Link Adaptive, Explicit Traffic Classes

- Discussed the concept of Duplex Agnosticism and the motivation underlying that