Broadband Wireless Access (BWA)
- IEEE 802.16 and WiMAX -

A three-day seminar

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Seminar Outline

1.- Access Systems Profiles and Standards

- *Network vs. Access*
- *Networks / access evolution*
- *Wireless access systems profiles*
- *Wireless access systems standards*

2.- Wireless access systems concepts

- *Topologies*
  - Point-to-point
  - Point-to-multipoint
  - Mesh
- *Transmission duplex modes*
  - Half Duplex (HD)
  - Full Duplex (FD)
- *Radio medium sharing modes*
  - Frequency Division Duplex (FDD)
  - Time Division Duplex (TDD)
- *Service flows*
  - Service flows status
    - Provisioned
    - Admitted
    - Active
  - Service flows / CID types

- Management service flows
- Well known CIDs
- Transport service flows

- *Bandwidth requests mechanisms*
  - Polling
    - unicast polling
    - multicast / broadcast polling
    - poll-me bit
- *Bandwidth grant services*
  - UGS - Unsolicited Grant Service
  - rtPS - Real Time Polling Service
  - nrtPS - Non Real Time Polling Service
  - BE - Best Effort Service
- *Transmission scheduling*
  - Point-to-Multipoint
    - Scheduling frame format
    - UL MAP
    - UCD (Uplink Channel Descriptor)
    - DL MAP
    - DCD (Downlink Channel Descriptor)
  - Mesh (overview)
    - Distributed scheduling
    - Centralized scheduling
  - Timing offset
  - Contention resolution

3.- Basic Operation - Network entry and initialization

- *Point-to-multipoint topology*
  - Scanning for DL channel
  - Synchronizing with BS
  - Getting UL parameters
  - Ranging
  - Negotiating basic capabilities

- Authentication and encryption key exchange
- Registration
- Getting IP coordinates
- Getting time of day
- Operational parameters transfer
- Managing connections

4.- IEEE 802.16 - The BWA Standard

- *Parts*

5.- IEEE 802.16 - MAC

- *Service specific convergence sublayer*
  - Classification
  - Payload header suppression
- *Common part sublayer*
  - MAC Payload
  - MAC sub-headers
    - fragmentation
    - packing
  - MAC headers
    - B/W request header
    - generic MAC header
  - MAC management messages
    - UL MAP
    - UCD
    - DL-MAP
    - DCD
    - Other MAC management messages
- *Privacy sublayer*

6.- Radio Technologies - Basics

- *Time domain / frequency domain*
  - Fourier Series
  - Fourier transforms
  - Useful Fourier series

- *Modulation Techniques*
    - Basic techniques
    - Symbols
    - Quadrature Amplitude Modulation (QAM)
        - polar coordinates
        - I/Q coordinates
        - QAM constellations (patterns)
- *Antennas Basics*
    - Definitions
    - Directivity / Gain
    - Radiation Patterns
    - Multi beam antennas (MBA)
    - Cable Attenuation
- *Power Budget Calculations*

7.- Forward Error Correction (FEC) - Basics

- *Convolutional encoding / Viterbi decoding*
- *Reed-Solomon encoding / decoding*

8.- IEEE 802.16 - PHY

- *Synchronization considerations*
- *WirelessMAN - OFDM*
    - *The Basic Idea*
        - Inter-Symbols Interference (ISI)
        - Frequency Division Multiplexing (FDM)
        - Inter Channel Interference (ICI)
        - Orthogonal FDM (OFDM)
    - *Original constraints*
    - *The modulation process*
        - Definitions
        - Graphic representation of transmitted symbols
        - Numerical representation of transmitted symbols
        - Applying Inverse Fourier Transform (IFT)
        - Generating the low frequency (LF) signal

- Generating the radio frequency (RF) signal
- Selecting the symbol duration
- Basic block diagram
- Main parameters values

- *Implementation limitations*
  - Actual symbol rate
  - Actual number of sub-carriers
  - Actual channel capacity
  - Actual amount of data bits
  - Actual data rates
- *Block diagram*
- *OFDM in NLOS*

9.- Capacity calculations guidelines for IEEE 802.16 OFDM systems

10.- IEEE 802.16 - PHY (overviews)

- *WirelessMAN - OFDMA, SC, SCa, HUMAN (overviews)*