Project	**IEEE 802.20 Working Group on Mobile Broadband Wireless Access <http://grouper.ieee.org/groups/802/mbwa>**	
Title	**Selected topics on Mobile System Requirements and Evaluation Criteria**	
Date Submitted	**2003-05-12**	
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Re:	**Contribution C802.20-03/58**	
Abstract	Presentation accompanying C802.20-03/32	
Purpose		
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Requirements

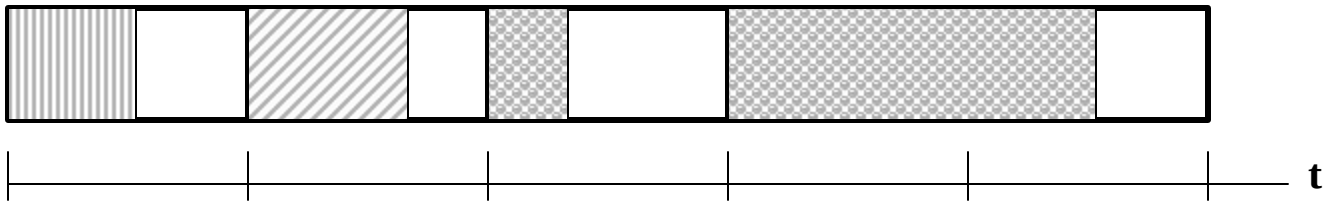
1. The PHY and MAC protocols shall support IP both real-time and non-real-time services, and the associated QoS, according to IETF recommendations.
2. The PHY and MAC protocols shall support both Ipv4 and Ipv6
   - Adaptation layer
3. The PHY and MAC protocols performance shall be maximized to support:
   a. IP Voice
      - Specify possible traffic characteristics, payloads
   b. Video conference
      - Specify possible traffic characteristics, payloads
   c. Multi-media streaming, both down-link and up-link
      - Specify possible UL/DL traffic characteristics, payloads
   d. Inter-active services
      - Specify possible UL/DL traffic characteristics, payloads
   e. Non real-time services
      - Specify possible UL/DL traffic characteristics

Statistical multiplexing in wireless protocols

4. The PHY and MAC protocols shall be optimized for statistical traffic multiplexing, in both up-link and down-link

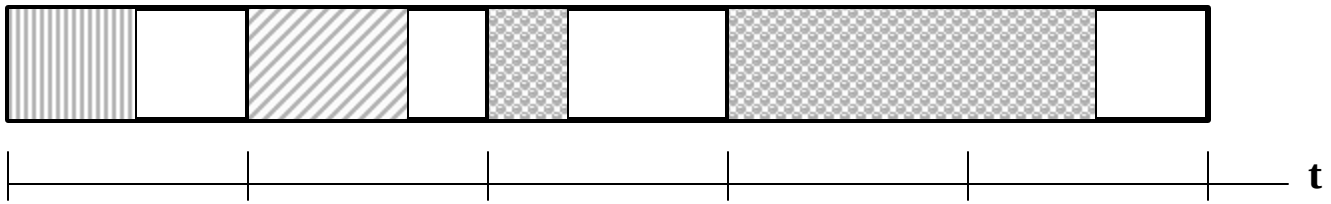
- **Examples to understand**
  - **Time-slotted approach**
    - For every time-slot, other power levels / modulation rate / coding rate / etc.
    - High granularity
  - **Alternative approach**
    - No time-slots, concatenated traffic, DL map for giving pointers to different PHY bursts
    - Low UL allocation granularity

Time-slotted approach - DL



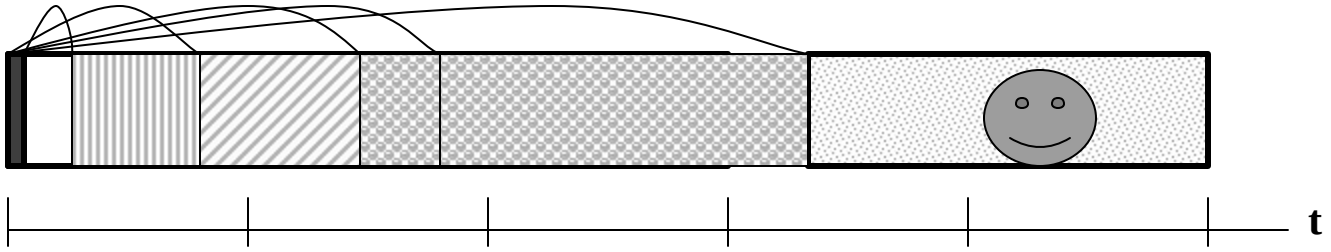
Disadvantage: not optimal bandwidth utilization for variable payload traffic, with pre-defined time-slots

Time-slotted approach – up-link



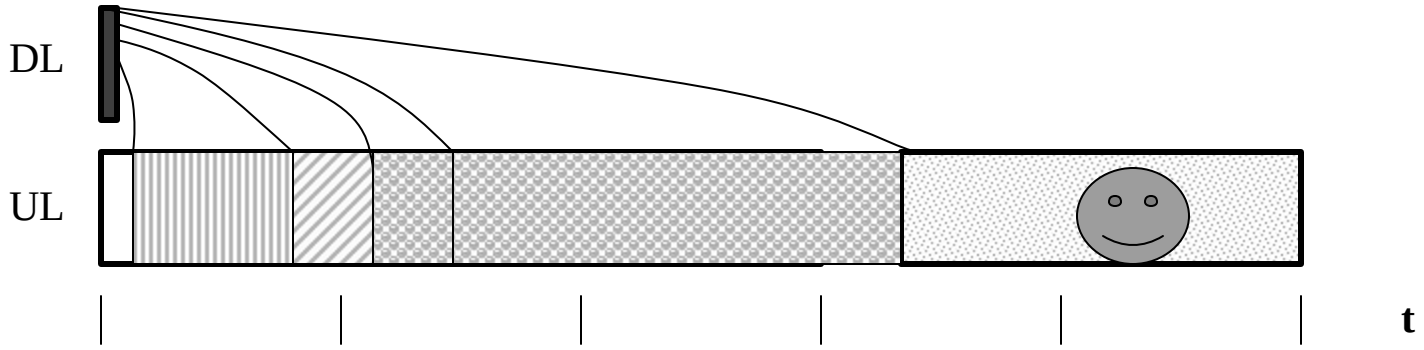
- Disadvantages:
  - Limits the subscriber number per Base Station
    - Pre-defined number of slots
  - Not optimal spectrum utilization

Alternative approach - DL



- Traffic concatenation (connection oriented approach)
- Low granularity possible
  - Limited by the coding / interleaver block size in symbols (for TDMA)
- Significantly increased capacity

Alternative approach - UL



- BW allocation: low granularity
  - Limited by the coding / interleaver block size in symbols (for TDMA)
- Significantly increased capacity

Header compression

5. For efficient transport of IP voice/video, the MAC protocol shall allow for header compression.
   - IPv4 IP+UDP+RTP header: 40 bytes
   - 30ms G.729 voice: 30 bytes

   - **Solution: 1byte for header compression**
   - **Use the sub-header (concatenated headers principle**)
   - Condition for improvement:
     - Low granularity coding / interleaver block size

More requirements - 1

- The MAC protocols shall support IP multicasting.
  - Optimal capacity utilization
- The PHY and MAC protocols shall optimally transmit variable length IP packets.
- The PHY and MAC protocols shall permit peak down-link / up-link data rate delivery to / from any subscriber terminal.

More requirements - 2

- The PHY and MAC protocols shall provide for multi-rate support.
- The same PHY protocol shall support both FDD and TDD.
  - Easy to achieve for a new standard; MAC issue
- The same PHY protocol shall optimally support Advanced Antenna techniques, in both FDD and TDD.
  - For OFDM systems, was achieved by 802.16 and the design is now well understood
- The channel spacing shall be 1.25MHz and 5MHz.

More requirements - 3

- The PHY and MAC protocols shall allow, when operating in FDD mode, the half-duplex subscriber terminal operation.
  - Essential requirement for low-cost CPE
    - No need for diplexer
    - No need for double processing streams
  - Allows higher data rates
    - Diplexer performance
- The MAC protocol shall allow for error correction through retransmission.
- Repeater function shall be supported; the Repeater function shall be transparent to MAC protocols.
- Inter-working functions shall be specified with the upper IP layers.

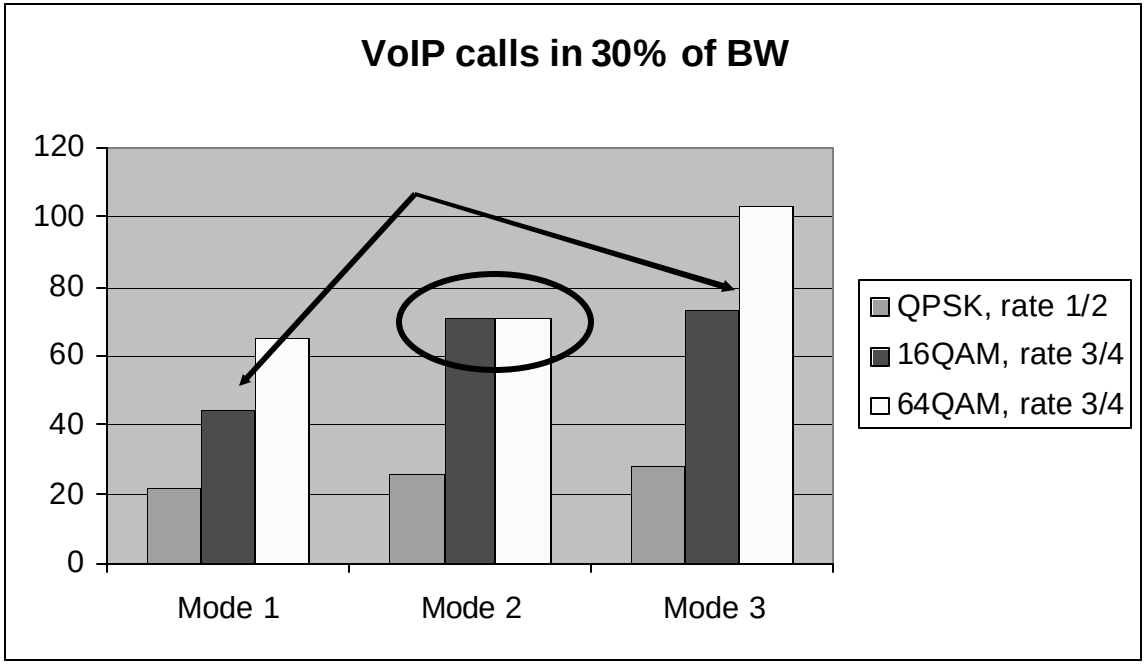
Capacity performance evaluation criteria

- Define evaluation scenarios, having as common parameters:
  - Channel spacing;
  - Modem rate (max, medium, minimum);
  - Coding rate (max, medium, minimum);
  - MAC frame duration.
- Evaluation output: subscriber number

Payloads

- The payloads are essential for assessing PHY/MAC protocols efficiency
  - Simple basic level for assessing PHY/MAC capacity performance
- Examples:
  - 30 bytes for G.729 codec, 30ms and 1...2 bytes for header compression;
  - 1514 bytes for long IP packets;
  - 64 bytes for short IPv4 packets;
  - T.B.C. bytes for video-conference, 64kb/s (specify the average);
  - T.B.C. bytes for video-conference, 384kb/s;
  - T.B.C. bytes for inter-active gaming.

Evaluation results - example



Delay evaluation

- Same criteria as for capacity evaluation
- Traffic statistics, ARQ performance, TCP/IP behavior may be taken into account

Delay evaluation example