Views on 802.16m High-Level System Requirements

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Introduction

- This contribution reflects our views on the high-level system requirements for IEEE 802.16m standard.

- 802.16m PAR has envisioned development of a new standard that is compliant with the ITU-R/IMT-advanced requirements (yet to be specified).

- In the development of P802.16m, the vision and the requirements set forth by next generation mobile networks should be taken into account as they represent the expectations of major wireless network operators worldwide.

Objectives

- IEEE 802.16m project offers the 802.16 community of operators and vendors the opportunity to build on the promising future of IEEE Std 802.16 OFDMA based air interface technologies providing high spectral efficiency and flexible deployment options

- Innovate and improve performance while maintaining backward compatibility, as imminent large-scale commercial deployments are expected, with the 802.16e reference system (see slide 6)

- Introduce new functionality with tangible benefits for the next generation converged multimedia applications and services as well as mobile Internet by evolving 802.16e standard towards higher data-rates, higher mobility, lower latencies and higher-capacity.

Key Requirements

- Backward Compatibility with 802.16e Reference System
- Enhanced deployment scenarios
- Improved performance
  - Improved spectral efficiency
  - Significantly increased peak data rates
  - Enhanced cell edge performance
  - Further reduced latency
- Improved mobility
- Improved broadcast, multicast efficiency

802.16e Reference System Definition

- The WiMAX Forum™ has been working toward definition of OFDMA mobile system profiles [1], because the IEEE Std. 802.16 [2][3] comprises of many mandatory and optional features for various deployment scenarios. These profiles serve as the basis for the implementation and deployment of OFDMA based IEEE Std 802.16 compliant mobile systems and enable worldwide interoperability of subscriber and base stations.

- Therefore the _802.16e reference system_ is the mandatory features and a subset of optional features from the IEEE Std 802.16 that comprises the OFDMA mobile system profile [1].

Backward Compatibility with 802.16e Reference System

- 802.16m shall be backward compatible with the 802.16e reference system.
  - A legacy 16e terminal shall be able to operate with a new 16m BS with no degradation of performance and operation.
  - A new 16m terminal shall be able to operate with a 16e BS at a level of performance that is no worse than the 16e terminal

- 802.16m and 802.16e reference system shall be deployable on the same RF carriers.
  - Performance should be appropriate for the mix of 16e and 16m terminals attached to a RF carrier
  - The 802.16m enhancements shall be transparent to 16e terminals and BS.

- Backward compatibility is required in all existing spectrum bands where 16e systems might be deployed.

Enhanced deployment scenarios

- Cell radius and coverage requirements
    - 16m must support legacy cell sizes allowing for co-location of 16m deployments
    - Larger cell sizes
        - 30 km cells would be supported with limited degradation
        - 100 km cells should not be precluded from the standard
        - Support for these larger cell sizes should **not** compromise the performance of smaller cells
- Support for existing bandwidths in both paired and unpaired spectrum
    - Legacy OFDMA bandwidths described 802.16e reference system should be supported
    - Larger bandwidths beyond those in the 802.16e reference system should be considered as a 16m specific enhancement
    - Performance in all bandwidths should be optimized for both TDD and FDD

Performance Requirements

- Improved spectral efficiency
  - State of the art modulation, coding, scheduling and multiplexing should be employed to achieve higher spectral efficiency at a reasonable complexity
  - More transmit and receive antennas may be considered but should not be required of subscriber devices
    - Size and power considerations dictate that no more than two transmit and receive antennas be required of hand-held devices
- Specific performance goals should be specified in terms of relative performance
  - Improvements should be measured relative to that of 802.16e reference systems
- Suggested uplink and downlink throughput performance goals are as follows:
  - User-throughput
    - The average user-throughput in the downlink/uplink should be at least 2x enhancement over 802.16e reference system
    - 95% of users should receive a 2x enhancement over the 802.16e reference system
  - Overall spectral efficiency for unicast services
    - Average downlink/uplink sector throughput should be at least 2x 802.16e reference system
  - Spectral efficiency for broadcast services
    - System wide broadcast performance should be evaluated independently of unicast service
    - A specific performance target of 2x appears appropriate

Latency Requirements

- Reduce latencies for:
  - Air link
  - State transitions
    - Paging mode to fully active state
    - Sleep mode to fully active state
  - Access
  - Handover

Mobility Requirements

- The expectations for performance should tiered based on mobility speeds and prioritized in order to achieve the optimum overall performance

- Include air-interface features that would enable the Seamless Mobility with legacy 802.16e reference systems
  - Handoff with other IMT-2000 standards should be given consideration at the 16m MAC layer
  - Look at requirements beyond what is covered by the IEEE 802.21 working group
  - Specific methods for scanning and system discovery should be considered as part of the 16m MAC

- Define requirements for handoff of broadcast services

References

[1] WiMAX Forum™ Mobile System Profile, Release 1.0 Approved Specification (Revision 1.2.2: 2006-11-17) (see http://www.wimaxforum.org/technology/documents).

[2] IEEE Std 802.16-2004: IEEE Standard for Local and metropolitan area networks Part 16: Air Interface for Fixed Broadband Wireless Access Systems, June 2004

[3] IEEE Std 802.16e-2005: IEEE Standard for Local and metropolitan area networks Part 16: Air Interface for Fixed and Mobile Broadband Wireless Access Systems Amendment for Physical and Medium Access Control Layers for Combined Fixed and Mobile Operation in Licensed Bands, December 2005.