

Some thoughts for the New Concepts forum

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Purpose:

To share some thoughts on potential future improvements and evolution of IEEE 802.16.

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Some thoughts for the New Concepts session

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Introduction

- This presentation is a compilation of ideas which can improve the 802.16 standard
 - MAC and above issues
 - PHY improvements

MAC and upper layer issues

UL Allocation Container

- “Macro” UIUC which replaces several UIUC elements to different stations
 - Reduces map overhead for many small payloads
- Base station decides how often to invoke
- Needs primitives for establishment, reliable changes (addition, deletion), teardown
- Suitable for
 - streaming apps (UGS)
 - group polling

TDM extensions in the MAC

- $TDM = N \times T1(E1) \mid FT1(E1)$
- Clock recovery problem
 - TDM frame synchronization
 - TDM Clock transfer
- Efficiency problem
 - Payloads are typically small
 - Map elements in each frame incurs large overhead
 - UL map per user, DL MAC header, UL MAC header
 - Can use the previously described group allocation

TDM extensions in the MAC (2)

- Should be a new Convergence Sublayer
 - Signaling (e.g. V5.x) needs to be encapsulated in regular data connections
 - Specify format of MAC SDUs carrying TDM traffic
- Scheduling (UGS)

ARQ

- Problem: Current ARQ is not suitable to varying channel conditions (e.g. mobility)
 - SS may suffer degradation => small number of subchannels allocated => low data rate => max. fragment size should be small to fit into MAC frame => high MAC overhead
- Solution: return to block-based ARQ (802.16-D1) where block size [not fragment size] is small enough to fit into MAC frame at the lowest possible data rate
 - Allows re-fragmentation

Hybrid ARQ

- The re-TX request needs to identify the failed TO
- Each UIUC needs a “shadow UIUC” describing how to send the supplemental information
 - Define the coding and interleaving method for the supplemental information in Hybrid ARQ
- Easier on UL
 - BST knows who is the sender, what UIUC was used, how much airtime is needed for the supplemental information

Upper layer interface between VoIP (multimedia) terminal/gateway and BS

- Converting VoIP signaling to request for service addition or change
- Similar to Packet Cable (DOCSIS, <http://www.packetcable.com>):
 - PacketCable™ Audio/Video Codecs Specification
 - PacketCable™ Dynamic Quality-of-Service Specification
 - PacketCable™ Network-Based Call Signaling Protocol Specification
 - etc.

Integration with Mobile IP

Repeater support

- Extension to P-MP rather than a generic mesh
- Dead zone coverage
- Centrally scheduled in the BST
 - Takes into account duplex restrictions etc.

PHY issues

MIMO on DL

- Doubles the data rate to high-end stations
- 2-antenna training on DL is defined already
- Define how data is conveyed

DL OFDMA encapsulation

- Mainly for AAS
- Most messages are unicast – no aggregation mechanism to reduce granularity loss
- OFDMA reduces overhead per message

Hybrid ARQ

- Hybrid ARQ has significant implications on the PHY
- Need to define the coding and interleaving method for the supplemental information in Hybrid ARQ

Summary

- A collection of ideas presented for potential improvements to the IEEE 802.16 air interface
 - MAC enhancements
 - PHY enhancement
 - Convergence layers to services