Applications of Common Feedback channel for 802.16m E-MBS

IEEE 802.16 Presentation Submission Template (Rev. 9)

Document Number: IEEE S802.16m-08/1102
Date Submitted: 2008-09-12

Source:

Eldad Zeira
Ron Murias
InterDigital Communications LLC E-mail: eldad.zeira@interdigital.com
*<http://standards.ieee.org/faqs/affiliationFAQ.html>

Venue:

IEEE 802.16m-08/033 Call for papers "Any parts of Section 11 (PHY) that are incomplete, inconsistent, empty, TBD, or FFS."

Base Contribution:

IEEE C802.16m-08/1102r1 or later revision

Purpose:

To be discussed and adopted by TGm

Applications of Common Feedback channel for 802.16m E-MBS

Eldad Zeira
Ron Murias

InterDigital Communications LLC

Overview

- The Denver version of the SDD, 80216m-08/003r4 specifies that an e-MBS feedback be provided to one or more cells but no details
  - *“E-MBS feedback provides information for DL MBS transmission to one or multiple cells. Details are TBD.”*
- This contribution outlines potential feedback mechanisms based on a common feedback channel and their application
- Proposes text changes to the SDD.
- These mechanisms can drastically reduce the feedback requirements

Applications of feedback channel to E-MBS

- Low overhead HARQ ACK/NAK
  - Useful to reduce number of HARQ repetitions for low subscriber count per service
  - Without requiring a specific feedback channel
- Estimating success of service delivery
  - Allows the network to correctly provision network resources
  - Approximate but robust estimate for very large number of subscribers with little overhead
- Estimating number of subscribers
  - Allows the service providers to gauge advertisement rates for the service

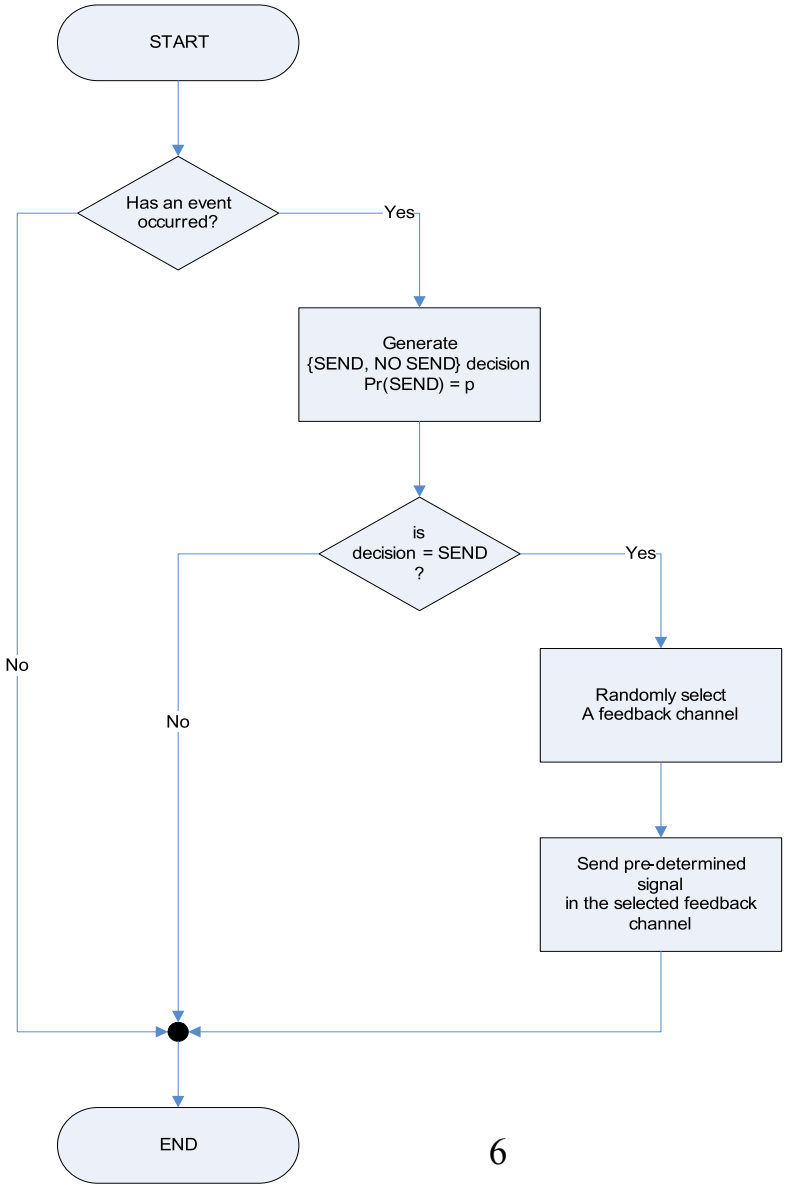
- Note that it is never necessary to know the subscribers' ID, just to count them!

How is it done?

- A set (one for ACK/NAK) of common channels is defined per task
- Each common channel carries a single pre-defined payload bit
- MSs transmit upon pre-defined conditions
  - And then with probability ***p***
- Randomly selecting one of the set of ***N*** channels
- The physical characteristics of the channels are such that collisions (“2 or more”) are interpreted as “one or more”
- BS counts number of channels occupied ***t*** and estimates the number of MS ***M*** that have actually transmitted

The Procedure

- Event could be based on a timer, polling, or a reception failure (single or statistical)



Specifically:

- For HARQ ACK/NAK:
  - Single common channel per service
  - MS sends NAK after unsuccessful packet reception
- For counting subscribers:
  - MS sends a “counting” bit with probability p_c when polled or by timer
  - Selecting one of a set of common channels
- For service provisioning:
  - MS sends a “NAK” bit with probability p_N when polled or by timer
  - IF service quality is “bad” (e.g. m / n failures)
  - Selecting one of a set of common channels

- All parameters can be controlled by the BS

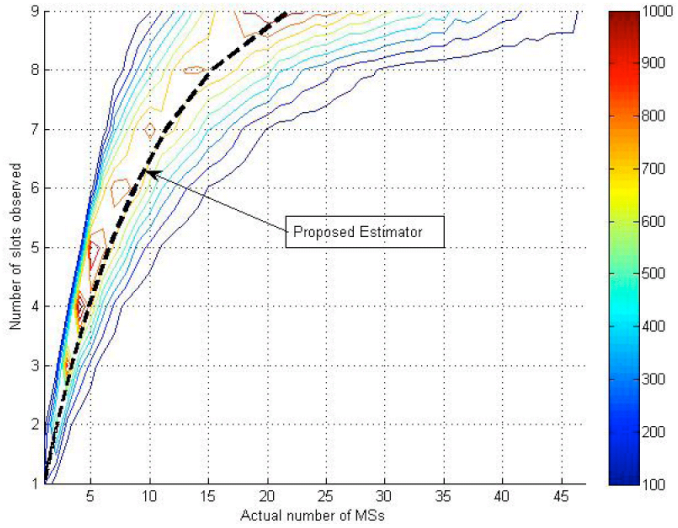
How many channels are needed?

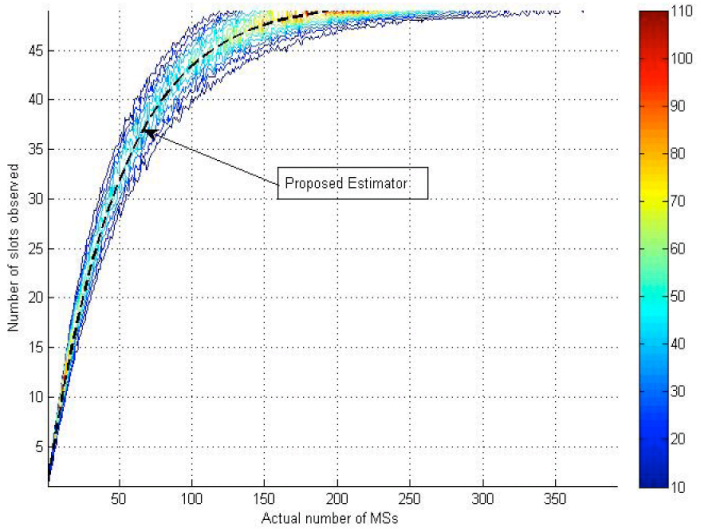
- HARQ NAK: One per service
- Counting and QoS: Depending on expected number of transmitting MSs per instance
- Assuming BS uses estimator $\hat{M}(t) = -\frac{N}{p}\ln\left(1 - \frac{t}{N}\right)$
- Then the useful range of number of transmissions that can be counted is $\alpha N \ln(N)$
  - With α~0.75 significant error probability < ~±30%
- Note that system is robust: a “too high” number of MSs will register as such
  - And system can take action

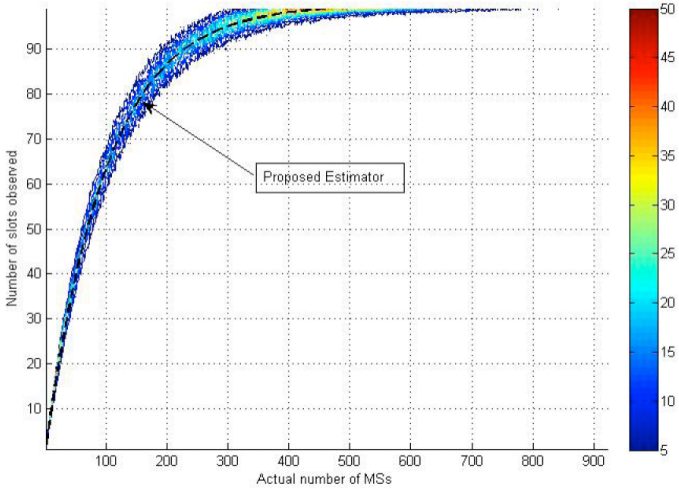
How to create the common channels?

- One good way is to use orthogonal sequences over a group of sub-carriers
- With sequence length of 16 or 32 up to 96 common channels can be accommodated in a single RB

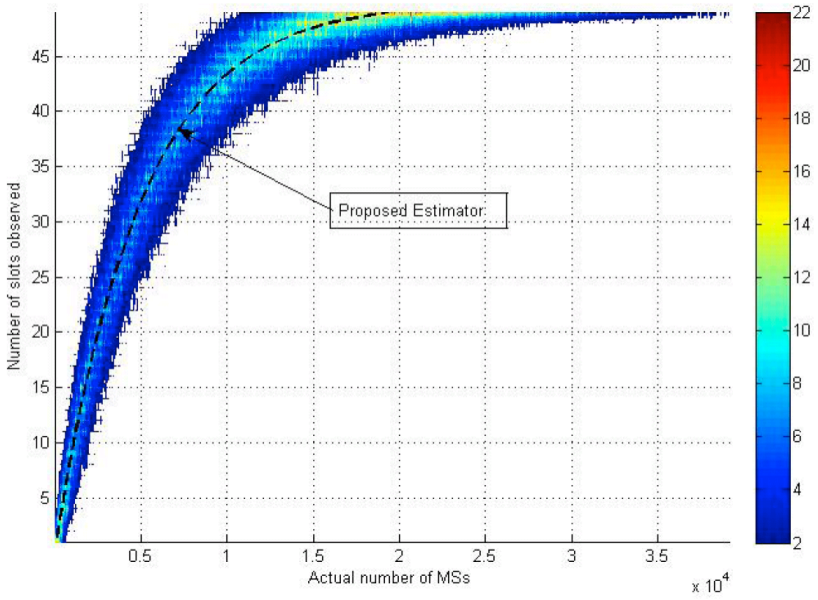
Simulations results (p=1) N=10, 50, 100

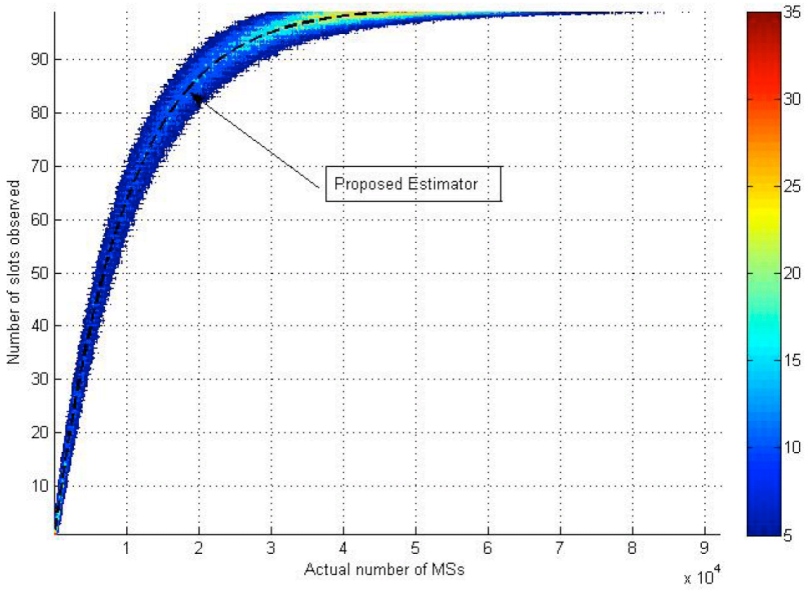






Simulations results (p=0.01) N=50, 100





Thank You!