

Applications of Common Feedback channel for 802.16m E-MBS

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Eldad Zeira

Ron Murias

InterDigital Communications LLC

E-mail: eldad.zeira@interdigital.com

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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

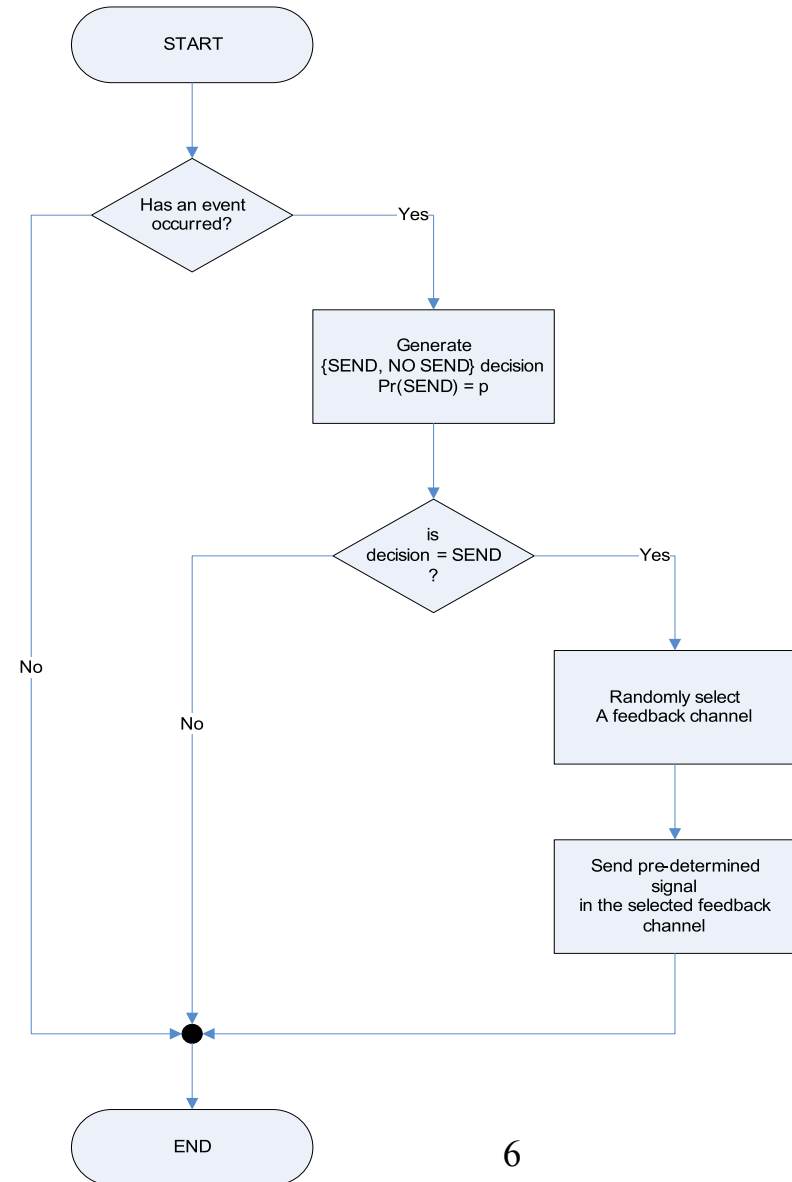
- Note that it is never necessary to know the subscribers' ID, just to count them!

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

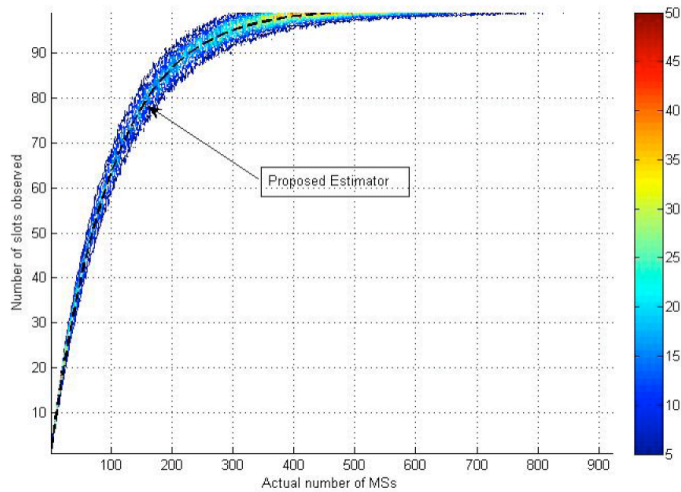
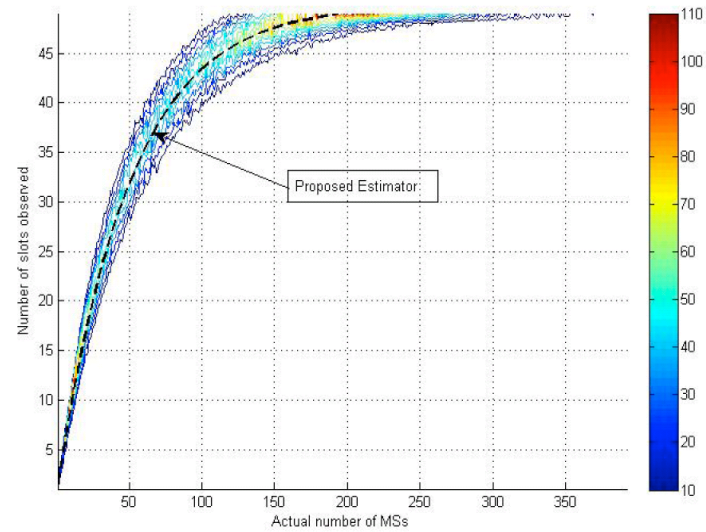
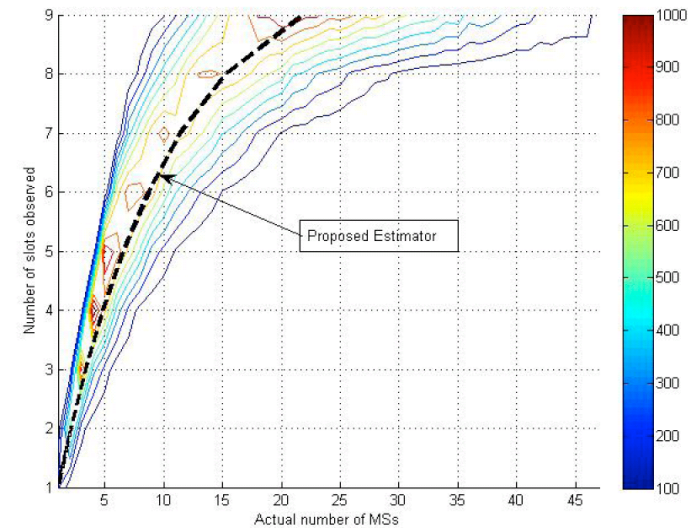
How many channels are needed?

- 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 $\alpha \sim 0.75$ significant error probability $< \sim \pm 30\%$
- Note that system is robust: a “too high” number of MSs will register as such
 - And system can take action

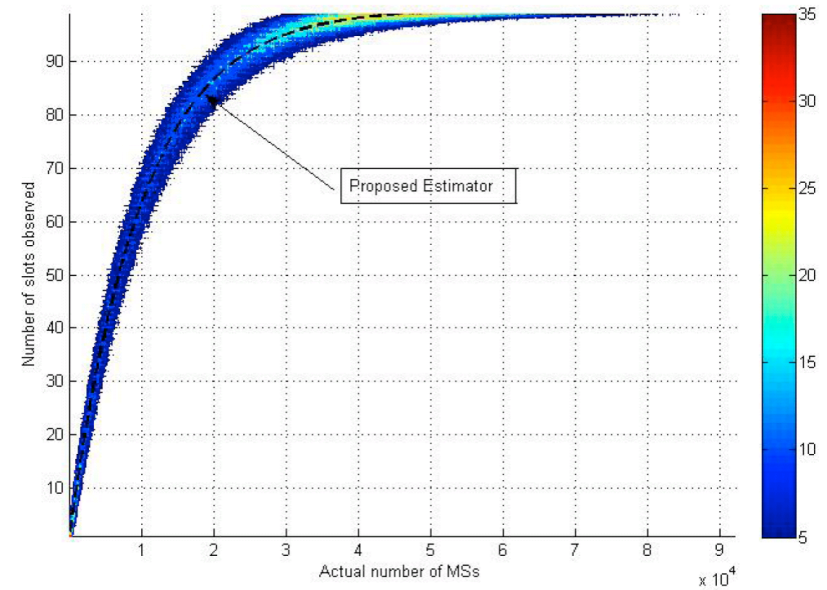
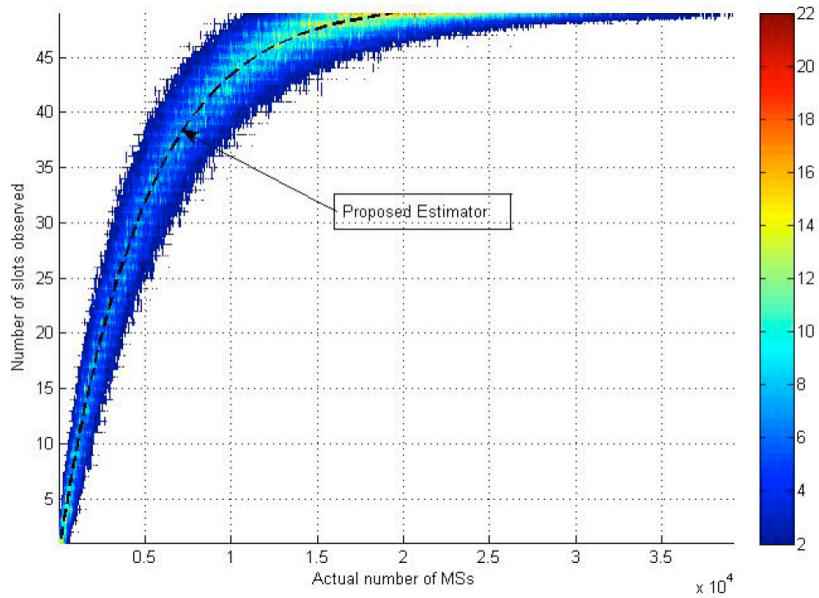
How to create the common channels?

- 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!