Project	**IEEE 802.16 Broadband Wireless Access Working Group** <http://ieee802.org/16>
Title	**Performance Evaluation of Radio Resource Scheduling Using Mobility Information**
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Re:	IEEE 802.16m-07/040 - Responds to Call for Contributions on Project 802.16m System Description Document (SDD)
Abstract	This contribution investigates the potential advantage of using mobility information in radio resource scheduling. There are two basic subcarrier permutations, that is the adjacent sub-carrier permutation and the distributed sub-carrier permutation in the in the legacy IEEE 802.16 OFDMA system. Through computer simulations, we show that system capacity can be improved by properly using the mobility information in scheduling radio resource.
Purpose	For 802.16m discussion and adoption
Notice	
Release	
Patent Policy	

Performance Evaluation of Radio Resource Scheduling Using Mobility Information

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Summary

Through computer simulations we show that the permutation method has to be selected carefully according to user mobility so as to obtain the best system performance. It is beneficial to use AMC permutation for low-mobility users with mobility less than 3 Km/h. otherwise PUSC should be used.

Proposed Text

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X. Mobility information for scheduler

The user's mobility should be made available to the scheduler so as to improve overall system capacity.

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1. Introduction

In the IEEE 802.16m system requirement document (SRD) [1], it has been agreed that 802.16m shall enable advanced RRM (radio resource management) for efficient utilization of radio resources. Also, the subscribers with different levels of mobility should be supported. In this contribution, we show through computer simulations that system capacity can be improved by properly using the mobility information in scheduling radio resource. Therefore, mobility information should be made available to the scheduler in IEEE 802,16m for a better performance.

2. Simulation Setup

The simulation parameters follow those defined in the Evaluation Methodology Document [2] with additional parameters listed in Table 1. The simulation procedure is the one specified in Section 11 of [2].

Table 1 – Simulation parameters

Frequency reuse	1x3x1
Link	Forward link
Test Scenario Antenna Configuration	Baseline configuration in Table 3 in [2] SISO
Channel Model	Modified power delay profile in Table 23 VehA for subscriber speed >= 30 km/h PedB for subscriber speed <= 3 km/h
Mobility	The same speed for each subsriber
Speed Estimation	Ideal
Traffic model	Full buffer
AMC Logical Bands	24
AMC Band Allocation Rule	1 subscriber / 1 band

Max. Assigned Bands to One Subscriber		24
AMC Reported CQI from subscriber	Format	Quantized Band SINR
	Number	24
	Overhead	120 bits
PUSC Reported CQI from subscriber	Format	Selected MCS by subscriber
	Number	1
	Overhead	4 bits
CQI Reporting Period		1 frame
Scheduler	AMC	Proportional fair defined in Subsection 2.1
	PUSC	Proportional fair in Appendix F in [2]
Hybrid ARQ		Chase combining
Link to System Mapping		MMIB
Throughput Measure		Physical layer

2.1 AMC Proportional Fair Scheduler

The scheduling algorithm for PUSC is the one defined in [2]. Here, we detils the used AMC PF scheduler which is slightly different from the PUSC one as follows,. Suppose that a total of $N = 25$ bands are available for scheduling with 36 sub-carriers in each band. Users are scheduled on a band-by-band basis, that is the scheduling metric on a particular band for each user is updated after each scheduling. The scheduling metric for subscriber i at time t on band n is defined as

$$M_{i,n}(t) = \frac{T\_inst_{i,n}(t)}{T\_average_i(t)}$$

where $T\_inst_{i,n}(t)$ and $T\_average_i(t)$ are the instant , and average data rate, respectively. A subscriber with the maximum metric on band n is assigned with this band, and then the scheduling metric is updated. Assuming that user i is allocated band n at time t, its $T\_average_i(t)$ is then updated by

$$T\_average_i(t) = \frac{1}{N_{PF\_AMC}} \times T\_inst_{i,n}(t) + (1 - \frac{1}{N_{PF\_AMC}}) \times T\_average_i(t-1)$$

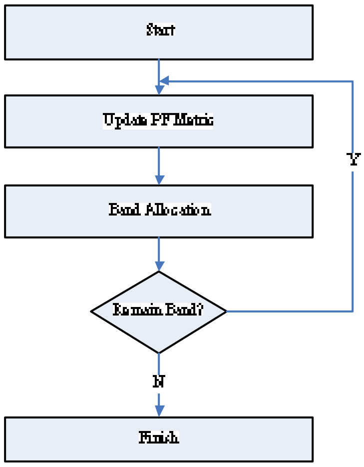
Otherwise, for other users

$$T\_average_j(t) = (1 - \frac{1}{N_{PF\_AMC}}) \times T\_average_j(t-1),\ j \neq i,$$

where N_{PF_AMC} is the latency scale for AMC, given by

$$N_{PF\_AMC} = T_{PF} N_{Band} / T_{Frame}$$

with T_{PF} being the latency time scale that defined in Table 1of [2]. N_{Band} denots the number of bands and T_{Frame} the frame duration of the system. The frequency bands will be assigned to subscribers one by one until there is no one left. The scheduling procedure is summarized in Figure 1.



2.2 Simulation Results

Figure 2 compares the average cell spectral efficiency of AMC and PUSC permutation, as a function of CQI feedback delay. We assume that all subscribers moves at the same speed. As can be seen, the performance of PUSC is not as sensitive as AMC to the CQI report delay. Basically, the performance of AMC degrades very rapidly with the report delay if user mobility is higher than 30 Km/hr. On the other hand, it is beneficial to use AMC for low mobility users (< 3Km/hr) due to the advantage of frequency-selective scheduling.

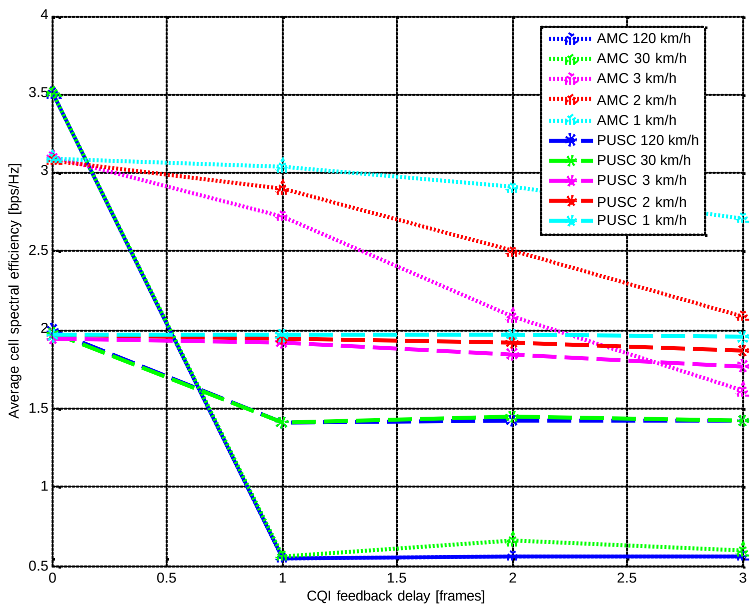
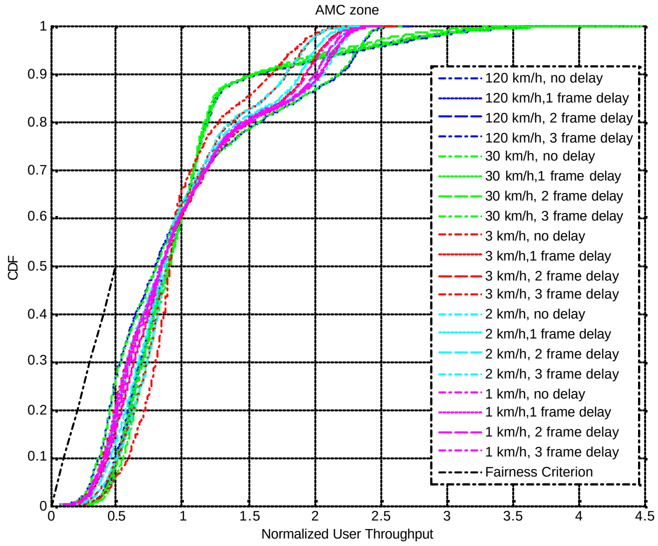
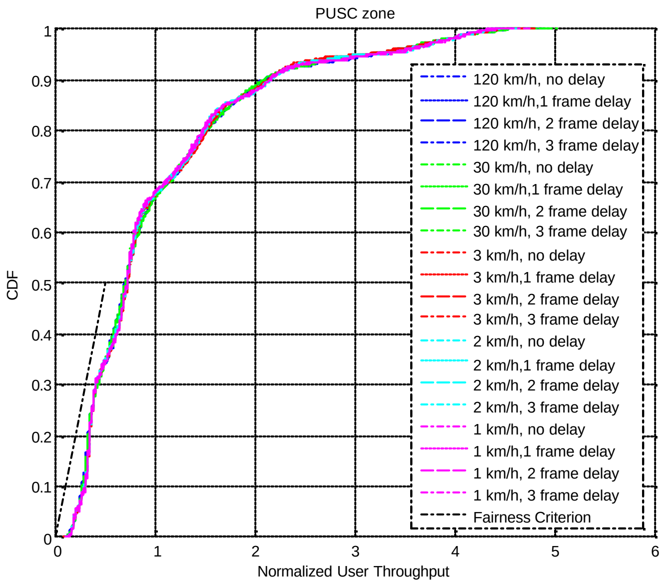


Figure 2 Average cell spectral efficiency as a function of CQI feedback delay with different user mobilities

Figure 3 shows the fairness performance of using AMC and PUSC. Clearly, both of the permutation satisfy the fairness requirement.



(a) AMC



(b) PUSC

Figure 3 — Fairness measurement

3.

4. References

[1] Mark Cudak, “Draft IEEE 802.16m Requirements,” IEEE C802.16m-07/002r3, 13th August, 2007.

[2] R. Srinivasan, J. Zhuang, L. Jalloul, R. Novak, and J. Park, “Draft IEEE 802.16m Evaluation Methodology,” IEEE C802.16m-07/037, 16th October, 2007.