

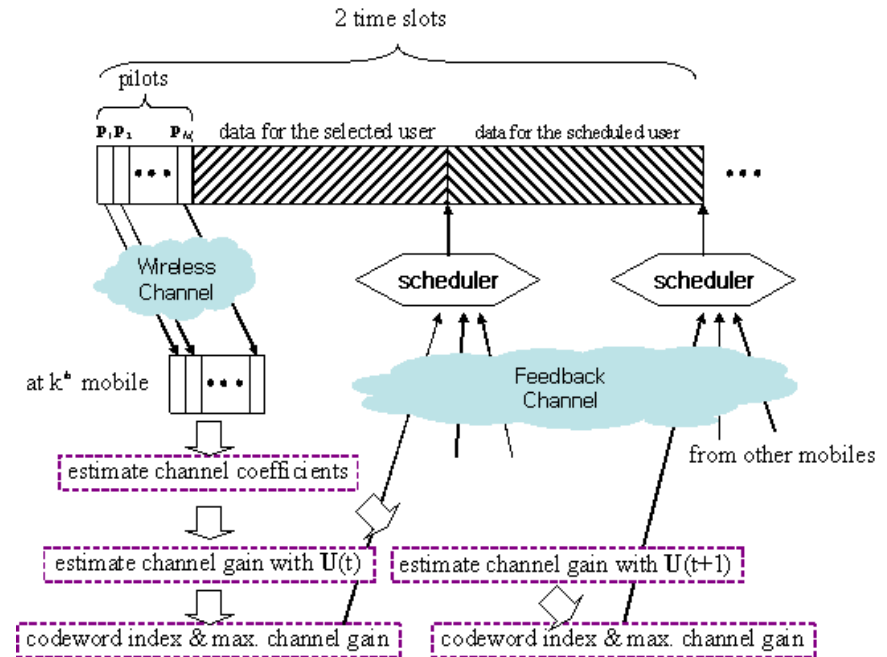
Project:	IEEE 802.16 Broadband Wireless Access Working Group < http://ieee802.org/16 >	
Title:	Codebook-based Opportunistic (Multiple) Beamforming for DL MIMO schemes	
Date Submitted:	2008-05-05	
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Re:	IEEE 802.16m-08/016r1: Call for Contributions on Project 802.16m System Description Document (SDD) (2008-03-20), downlink MIMO schemes.	
Abstract:	This contribution proposes codebook-based opportunistic (multiple) beamforming for downlink MIMO schemes in IEEE 802.16m systems.	
Purpose:	For discussion and approval by TGM	
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Introduction

- One of the most attractive DL MIMO for supporting multiple users
 - MU-MIMO exploiting *multiuser diversity*
- Channel knowledge for DL MU-MIMO at the BS
 - *Partial feedback vs. full feedback*
- More practically favorable type of feedback
 - Partial feedback (CQI, codebook index) for low-overhead and simplicity
- Proposal: Consider use of *Codebook-based Opportunistic (Multiple) BeamForming* (COBF/COMBF) with partial feedback for DL MIMO schemes

COBF

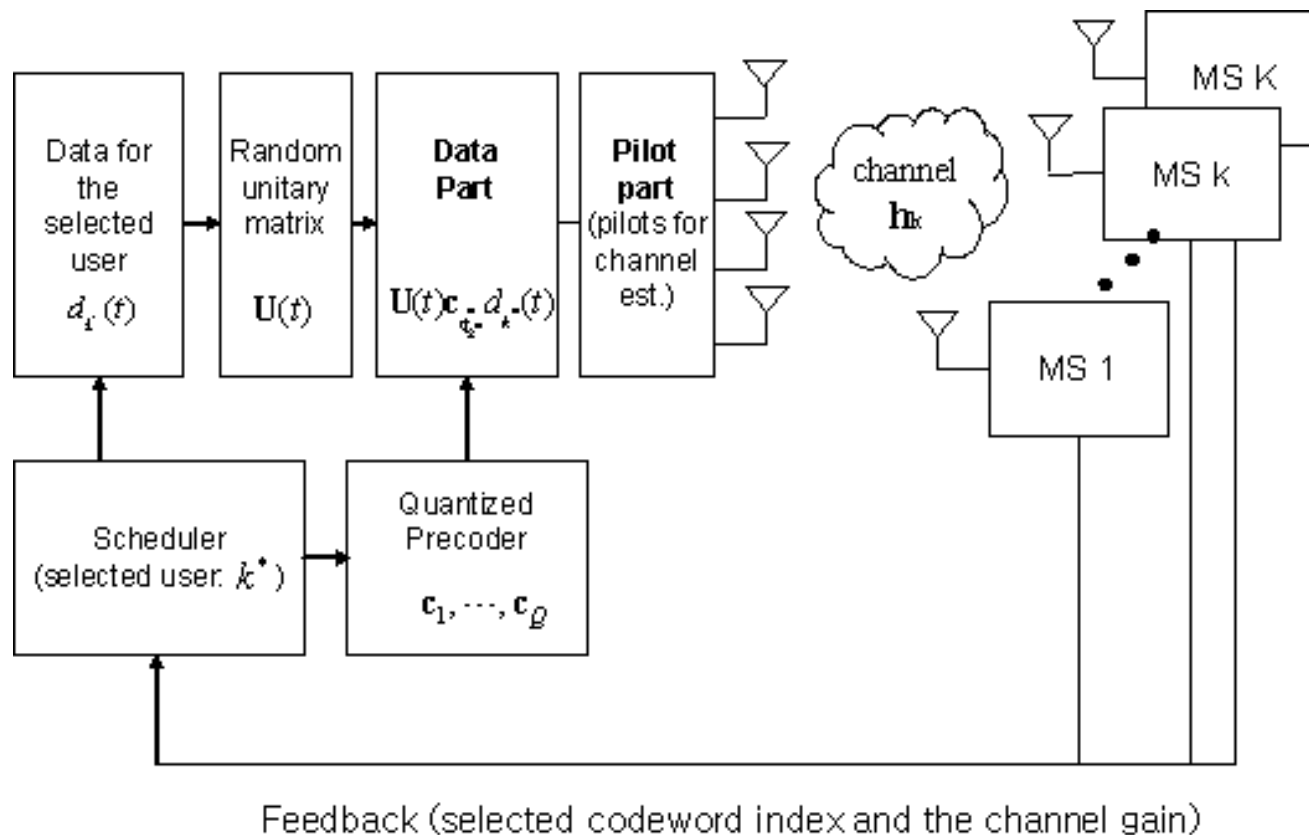
- Estimate the DL channel with N_T pilots
- Find the best codeword for each user for given a random unitary matrix and a quantized codebook



- Random unitary matrix for OBF effect
- Quantized codebook for selection diversity
- For each user, feed back the selected codeword and the corresponding CQI (e.g., channel gain or SINR)

COBF

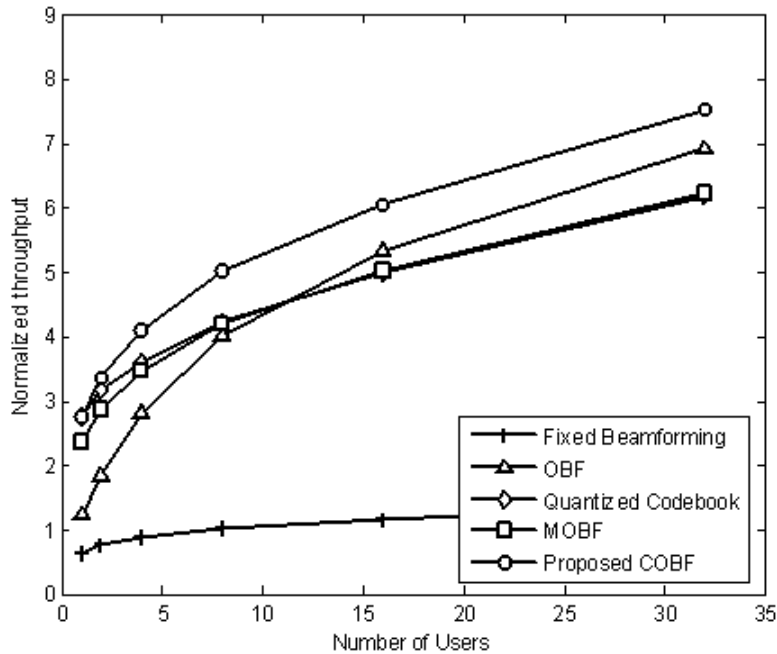
- At the BS, select the best user and its codeword based on the CQI feedback and the scheduling algorithm



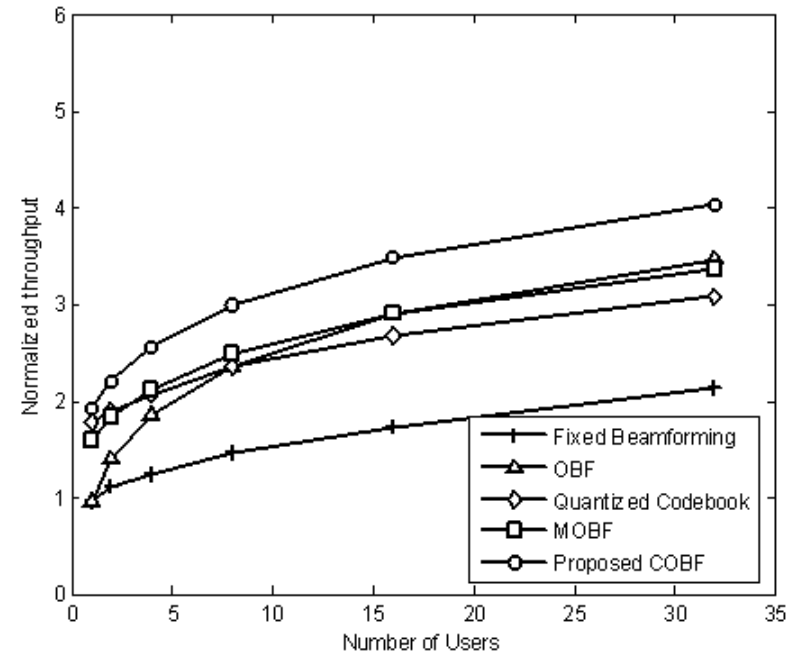
Performance Comparison

- Simulation Assumptions
 - Number of transmit antennas: 4
 - Number of receive antennas for each mobile: 1
 - Codebook: 3-bit DFT-like codebook
 - Mobility: 1km/h
 - Scheduling: PF
 - Comparison with fixed BF, OFB, Multiple-pilot-based OBF, quantized codebook

Performance Comparison (Cont'd)



(a) High spatial correlation

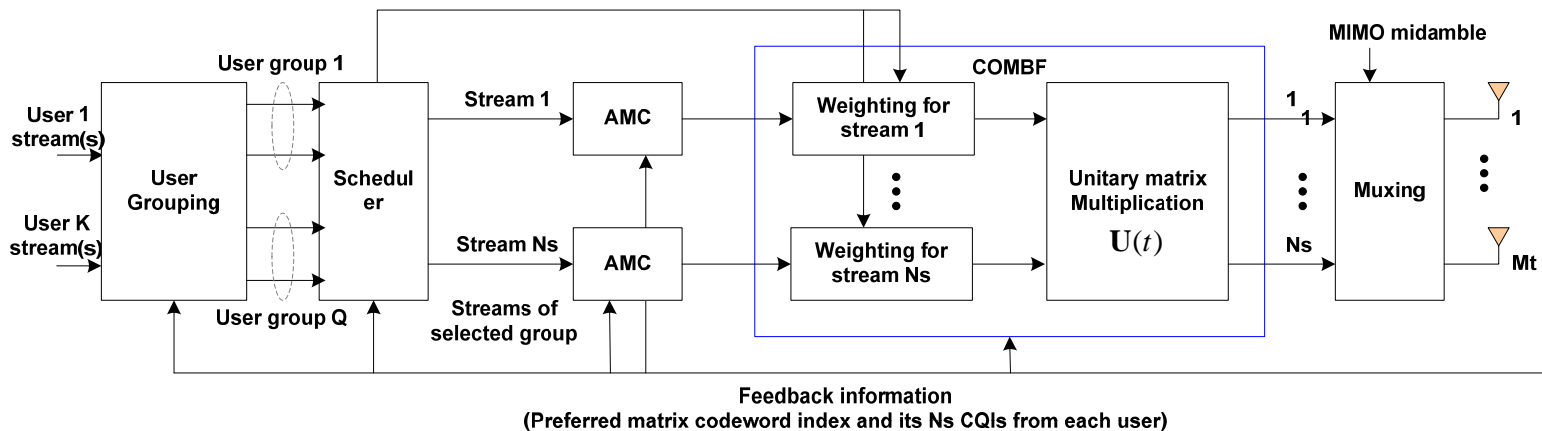


(b) Low spatial correlation

- COBF superior to the others in all corr. scenarios
- Performance gain larger at high corr.

COMBF

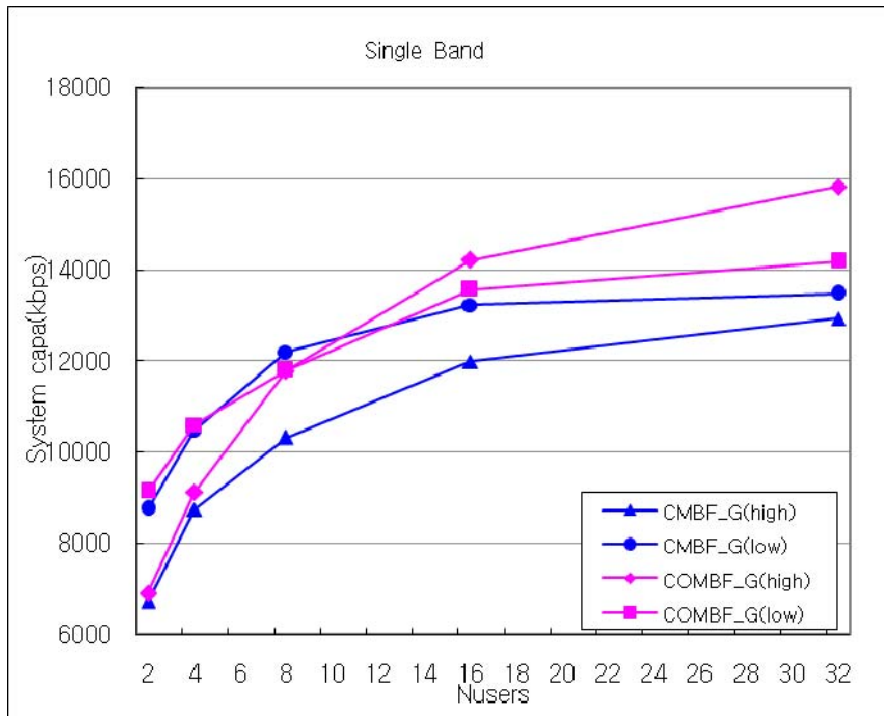
- Extension of COBF to multiple beamforming
- Group users based on the codeword feedback
 - Users in the same group have the same codeword
- Select the best user with the largest CQI for each stream in each group
- Calculate sum-capacity for each group and select the best group with the largest capacity and its codeword



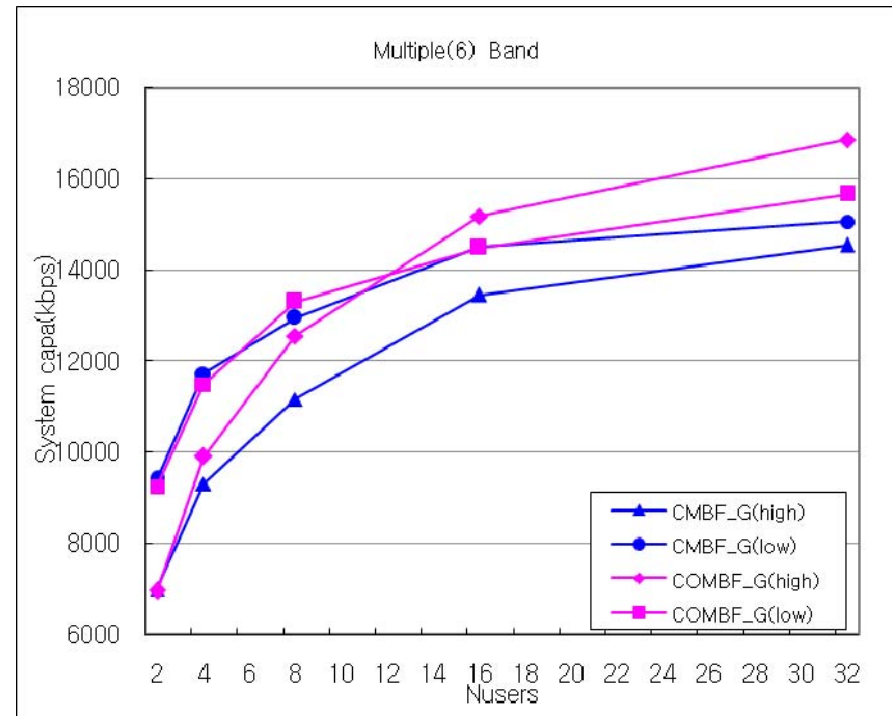
Performance Comparison

- Simulation Assumptions
 - Number of transmit antennas: 4
 - Number of receive antennas for each mobile: 2
 - Sampling frequency: 10 MHz (FFT size: 1024)
 - Effective number of subcarriers: 864
 - Frame length: 5 ms, number of DL symbols: 24
 - Number of subcarriers per subchannel: 48
 - Subchannelization: AMC 2 bin x 3 symbol
 - Mobility: 1km/h, Scheduling: PF per band
 - Codebook: 3-bit codebook in IEEE 802.16e
 - Goodput comparison with *Codebook-based Multiple BeamForming (CMBF)* (R1-0603353, GPP TSG RAN WG1 Meeting #44, Denver, USA, 13 – 17 February, 2006, “Downlink MIMO for EUTRA”)

Performance Comparison (Cont'd)



(a) Single-band



(b) Multi-band

- COMBF better than CMBF at high spatial corr.
- For small # users, better performance at low corr. (COMBF)
- Better performance with multi-band

Proposed Text into SDD

11.x. DL MIMO Schemes

11.x.y. Multiuser MIMO

Use of codebook-based opportunistic (multiple) beamforming with partial feedback shall be considered in order to exploit multiuser diversity.