Project	**IEEE 802.16 Broadband Wireless Access Working Group** <http://ieee802.org/16>
Title	Cooperative Communications with Relays
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Re:	[Cite the specific document number of the appropriate Call for Contributions, the ballot number, etc. Contributions that are not responsive to this section of the template, may be refused or assigned a low priority for review.]
Abstract	Two broad categories of cooperative relaying techniques are cooperative diversity (C-DIV) and cooperative spatial multiplexing (C-SM). In C-DIV each relay can be considered as an antenna element in distributed antenna array. In C-SM each relay is responsible to detect a subset of transmitted information (data stream) from the source. We propose a unified architecture that can support C-DIV and C-SM by forming subgroups with relays and adjusting the number of subgroups and the number of relays in the subgroup, respectively.
Purpose	To be discussed and adopted by TGm for use in the 802.16m SDD
Notice	
Release	
Patent Policy	

Unified Architecture and Method for Cooperative Spatial Multiplexing (C-SM) and Diversity (C-DIV)

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Suggested ToC Topic for IEEE 802.16m SDD: Cooperative Transmission with Relays

Title: Unified Architecture and Method for Cooperative Spatial Multiplexing (C-SM) and Diversity (C-DIV)

Description: Two broad categories of cooperative relaying techniques are cooperative diversity (C-DIV) and cooperative spatial multiplexing (C-SM). In C-DIV each relay can be considered as an antenna element in distributed antenna array. Cooperation at the relays is done such a way to provide increased reliable reception through the diversity gain at the destination. A typical example is space time block code (STBC) encoding at the relays, e.g., Alamouti encoding. In C-SM each relay is responsible to detect a subset of transmitted information (data stream) from the source. For example, consider that the source transmits 16 QAM signal and 4 relays are in the system. Each relay can detect one bit information out of incoming 16 QAM signal and transmits extracted one bit information using BPSK signal. All relays forward their low-rate sub-streams simultaneously to the destination over the same physical channel. It can reduce the required transmission power by reducing the transmission rate per relay while maintaining the same E_b/N_0 requirement. Reduced transmission power provides less interference, thus increased capacity.

We propose a unified architecture that can support C-DIV and C-SM by adjusting the number of subgroups and the number of relays in the subgroup, respectively. We consider a general relay network architecture where the source and destination communicate through a group of *N* (even or odd) relays. Each relay belongs to a subgroup consisting of the subset of *N* relays. Consider two subgroups of relays as an example: relays 1 and 2 belong to subgroup 1 and relays 3 and 4 to subgroup 2. Relays in the same subgroup share the information necessary for cooperative forwarding of received subset of transmitted data to the destination. The destination may be equipped with more than one antenna elements. Figure 1 shows the proposed architecture that provides C-DIV and C-SM gains. Each subgroup is responsible to reproduce the subset of transmit data from the source and cooperative is confined to the relay elements in the same subgroup.

Related Area(s) in SRD: Section 8.1: Support for multi-hop relay, Appendix A.2.2: Deployment with multi-hop relay networks.

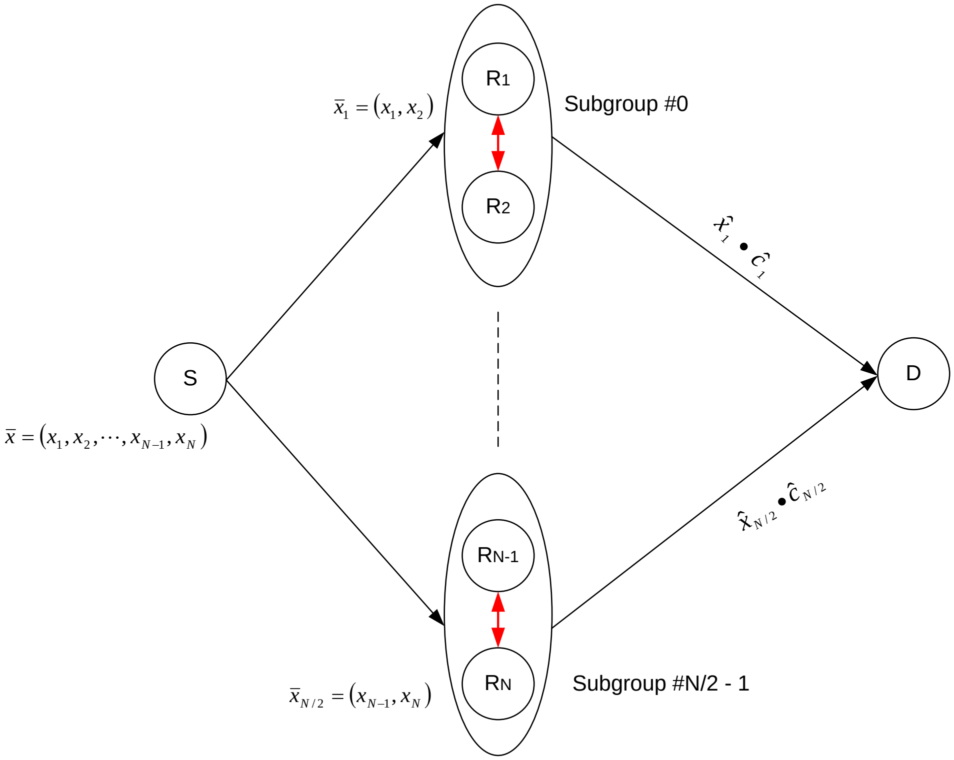

Figure 1: Proposed Architecture for Cooperative Spatial Multiplexing and Diversity