Project	**IEEE 802.16 Broadband Wireless Access Working Group <**http://ieee802.org/16**>**	
Title	**Relay architecture for 16m SDD ToC**	
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Re:	IEEE802.16m-07/040 Call for contributions on project 802.16m SDD	
Abstract	This contribution proposes Relay Architecture for 16m SDD ToC, presenting mechanisms for improving system performance, such as, power control and network coding.	
Purpose	To be discussed and adopted by TGm for use in the 802.16m SDD	
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Relay architecture for 802.16m

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Suggested ToC Topic for IEEE 802.16m SDD:

Relay Architecture
- Network coding
- Cooperative relaying

Introduction

As the number of communication nodes in a wireless system increases, the operational complexity becomes high [1]. However, the "relaying" architecture introduces a wide range of new benefits to the system [2]. By using the relay architecture, we can save the power consumption and increase the average achievable rate. Furthermore, we may apply an advanced relay architecture that includes Network Coding (NC), Cooperative Relaying, and Power Control (PC). Since these are known to have remarkable performance enhancement, they can be utilized as a good solution to meet the 16m system requirement. This proposal presents some techniques for relay architecture and suggests the relay architecture for SDD ToC.

Network coding

We propose network coding techniques to reduce relay bandwidth consumption and to enhance the battery life for the relaying mobiles. The main idea (shown in Figure 1) is to use relay to relay the same bit stream for both UL and DL, while MS and BS receiving the same stream of information uses its own stored information to derive the relayed information.

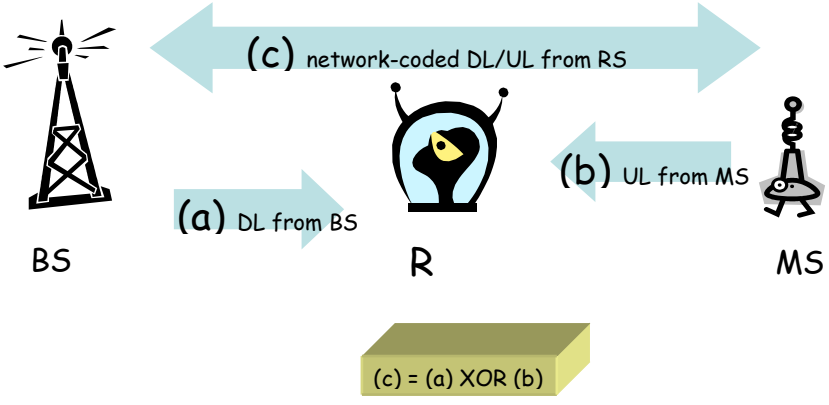

Figure 1

The techniques are categorized to two categories
- Fixed relay
- Mobile relay

Related Area(s) in SRD:

8.1 Support for multi-hop relay

7.4 Cell coverage

Cooperative Relaying

In the cooperative relaying architecture, the destination node usually receives two signals from two cooperating nodes, one is the source node and the other is relay node. If there is more than one relay node, then the number of signals will increase accordingly. Since there is more than one communication node that transmits or relay traffic at a certain level of transmit power, the contributions of those power levels to the reception quality at the destination node can be different. That is, some node may have to consume a lot more power than the other(s). For example, consider a simple example with a source node, a relay node and the destination.

As a result, there are two ranges with power wastage.
(1) When the transmit power of the source node, say p1, is greater than p1", it is observed that any increase in p1 generates power wastage (or rate wastage), which amount can be conceptually described by the difference of the two factors (e.g., max achievable rate minus min achievable rate). In this case, it is attractive that the relay node increases the power (some other combinations are also possible).
(2) See the range where p1 is less than p1". In this case, the transmit power of the relay node is, in part, wasted because of the shortage of the other cooperating partner. So, for example, the relay node can reduce the transmit power not to waste (other combinations are also possible).

Related Area(s) in SRD:
8.1 Support for multi-hop relay

7.4 Cell coverage

References:
[1] K.-D. Lee and V. Leung, "Evaluations of achievable rate and power consumption in cooperative cellular networks with two classes of nodes," to appear, *IEEE Trans. Veh. Technol.*, 2008.
[2] J.N. Laneman, D. Tse, and G.W. Wornell, "Cooperative diversity in wireless networks: Efficient protocols and outage behaviour," *IEEE Trans. Info. Theory*, vol. 50, no. 12, pp. 3062-3080, Dec. 2004.