Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Frame Structure for Transparent Relay**
Date Submitted	**2007-01-08**
Source(s)	Jae Hyung Eom , Kyu Ha Lee, Changkyoon Kim, Samsung Thales San 14, Nongseo-Dong, Giheung-Gu, Yongin, Gyeonggi-Do, Korea 449-712 Voice: +82-31-280-9975 Fax: +82-31-280-1562 jh.eom@samsung.com Byung-Jae Kwak, Su Chang Chae, Young-il Kim ETRI 161, Gajeong-Dong, Yuseong-Gu, Daejeon, Korea 205-350 Voice: +82-42-860-6618 Fax: +82-42-861-1966 bjkwak@etri.re.kr
Re:	Call for Technical Proposal regarding IEEE Project P802.16j
Abstract	The document contains technical proposals for IEEE P802.16j that provides a frame structure.
Purpose	This is a response to Call for Technical Proposals regarding IEEE Project P802.16j.
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Frame Structure for Transparent Relay

1. Introduction

This contribution proposes a frame structure to support backward compatible to the frame structure in IEEE Std .802.16.

The following assumptions are made:

- No changes are required for a IEEE802.16e-2005 MS operation;
- It enables efficient and flexible relay link operation by extension of IEEE802.16e-2005 frame structure;
- The impact upon the current IEEE802.16e frame structure is minimized
- The relay link delay is minimized;
- Only centralized scheduler is supported for transparent RS
- Only TDD frame is considered in this contribution

The proposed frame structure has the following advantages:

- It enables RS nodes to relay data between BS and MS for both uplink and downlink, regardless of th e number of hops.
- It is transparent frame structure, but it transmits preamble, DL-MAP, and UL-MAP using “amplify a nd forward” method.
- It supports multi-hop relay.

Frame structure this contribution proposes is an extension of IEEE Std. 802.16 OFDMA TDD frame structure.

2. Proposed Frame Structure

A frame structure in IEEE Std. 802.16 is divided into two subframes for a downlink and a uplink transmission. I n this proposal, a frame structure is extended to support a relay link. The proposed frame structure is illustrated in Figure 1.

Based on Figure 1, the frame structure is composed of:

- A downlink subframe, a uplink subframe, a TTG, and a RTG.
- The downlink subframe is composed of preamble, FCH, DL-MAP, UL-MAP, 1-hop region, and multi-hop region.
- In the downlink, the 1-hop region includes the MMR-BS → MS related traffic and the MMR-BS → RS related control and traffic. The multi-hop region includes the RS → MS related traffic and the RS → lower RS related control and traffic.
- The uplink subframe is composed of a ranging subchannel, 1-hop region, and multi-hop region.

- In the uplink, the 1-hop region includes the MS → MMR-BS related traffic and the MS → RS related co ntrol and traffic. The multi-hop region includes the MS → RS and the lower RS → RS related control a nd traffic.
- The boundary between 1-hop region and multi-hop region is logically divided.
- RS related control includes the data to control next hop related traffic and RS related traffic includes the traffic data of next hop.

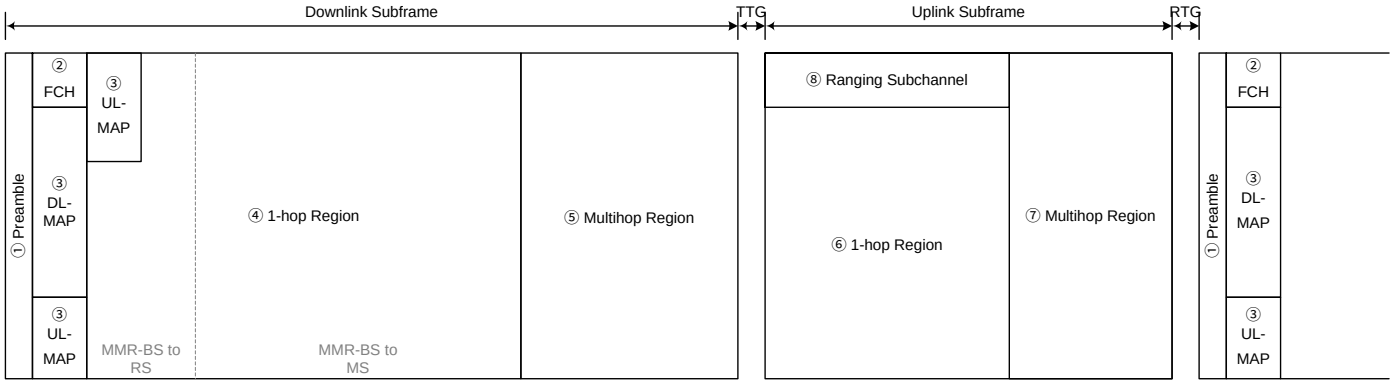

Figure 1. Frame structure

The RS receives a downlink subframe from the MMR-BS. And then RS retransmits the region ① ~ ③, and MM R-BS to RS region of ④ using “Amplify and Forward” method. Because the size of MAP can vary, MMR-BS t o RS region of ④ is retransmitted by RS. Simultaneously RS acquires control information by decoding FCH an d DL-MAP and decodes data for MS or lower RS at the region ④. In next frame, RS transmits decoded data to MS or lower RS after performing coding and modulation. Therefore it should consider the frame delay, modulat ion order, code rate, and etc of each hop when BS makes up MAP. Figure 2 shows the example of downlink and uplink transmission using RS.

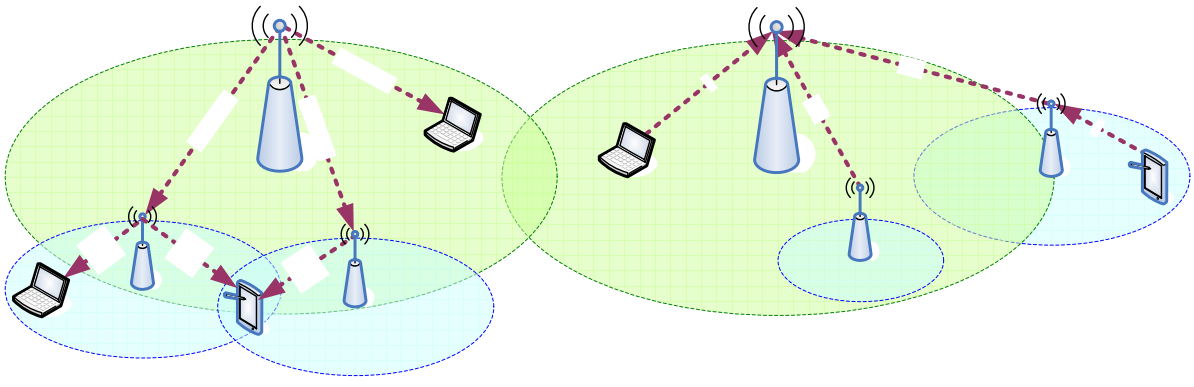

Figure 2. Example of downlink and uplink transmission using RS

When RS is connected 3-hop or more, the region ⑤ is divided into slots for each RS. One frame delay occurs ev ery hop. Therefore BS should have control information for each hop and it is needed to limit maximum number of hops.

3. Conclusion

This proposal provides a extension to the existing frame structure defined in IEEE Std. 802.16 and supports a m ulti-hop relay operation.

4. Proposed Text

++++++++++++ start text proposal ++++++++++++++++++++++++++++++++++

[Change subclause 6.3.7.2 as indicated:]

For the case where MR-BS supports multi-hop relay, the downlink and uplink subframe are divided into 1-hop r elay region and multi-hop relay region. The related frame structure is defined in the OFDMA PHY specific sect ion.

[Insert a new subclause 8.4.4.7.1.1]

8.4.4.7.1.1 MR-BS frame structure
For the TDD mode, an example of the MR-BS frame structure is shown in Figure xxx.

Each MR-BS frame begins with a preamble followed by an FCH, the DL-MAP, and the UL-MAP. The downlin k subframe shall include the 1-hop region and may include the multi-hop region. The uplink subframe may incl ude the 1-hop region and may include the multi-hop region. In each frame, the TTG shall be inserted between th e downlink subframe and the uplink subframe. The RTG shall be inserted at the end of each frame.

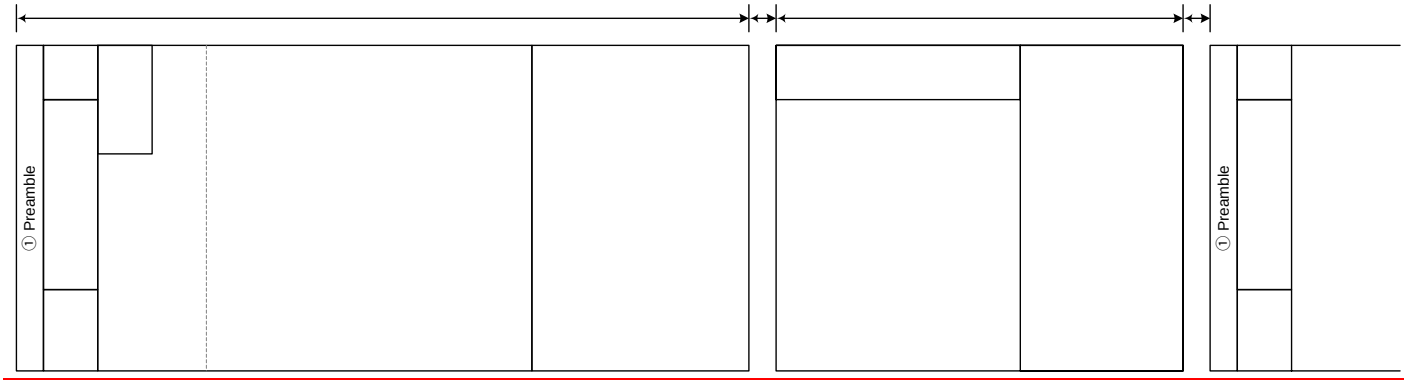

Figure xxxx – MR-BS frame structure (transparent mode)

RS retransmits the region ① ~ ③, and MMR-BS to RS region of ④ using “Amplify and Forward” method. Sim ultaneously RS acquires control information by decoding FCH and DL-MAP and decodes data for MS or lower RS at the region ④. In next frame, RS transmits decoded data to MS or lower RS after performing coding and m odulation. When BS makes up MAP, the frame delay, modulation order, code rate, and etc of each hop is consid ered.

++++++++++++ End of text proposal ++++++++++++++++++++++++++++++++++

References

[1] IEEE S802.16mmr-06/233r8, “Frame Structure to Support Relay Node Operation”.

[2] IEEE C802.16j-06/249, “Frame Structure for Flexible Resource Allocation”.