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Re:	IEEE802.16j-06/027: “Call for Technical Proposals regarding IEEEP802.16j”
Abstract	This contribution proposes a shared RS system for 802.16j networks.
Purpose	Text proposal for 802.16j Baseline Document
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A proposal for introducing a shared RS system in MR

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Introduction

This contribution proposes a shared RS system for 802.16j aware mobile WIMAX networks.

Details

The following assumptions are made:

- The RS is not required to relay message and data within the current frame. The message and data are delayed for one or more frames due to the related relay processing in RS.

- The RS is positioned in the overlapping service area of BS1 and BS2.

- Both BS1 and BS2 have MR capability (MR-BS1 and MR-BS2).

- The proposed system could also provide an enhanced coverage or an enhanced throughput for each one of the cells presented in Fig. 1

Shared RS system for MR

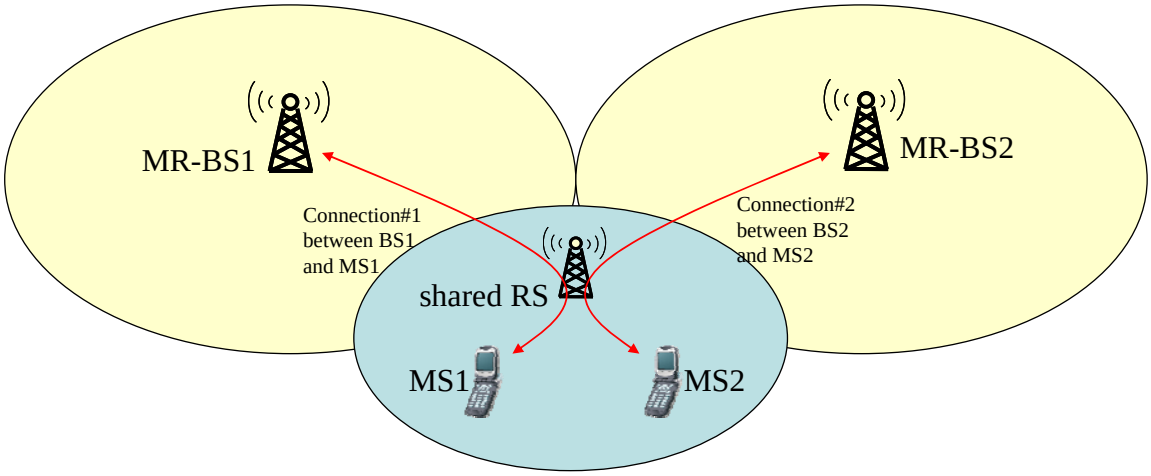


Fig. 1 Shared RS system for MR.

As shown in Fig.1, the Shared RS system can be considered in 802.16j aware networks. The system provides load-balancing between the two adjacent cells, optimizes the RS bandwidth throughput and also improves the network reliability.

In the shared RS system, one RS could be connected to two or more MR-BS within the same frame. Each connection from a mobile station is relayed to the related MR-BS by RS. As shown in Fig.1, Connection #1

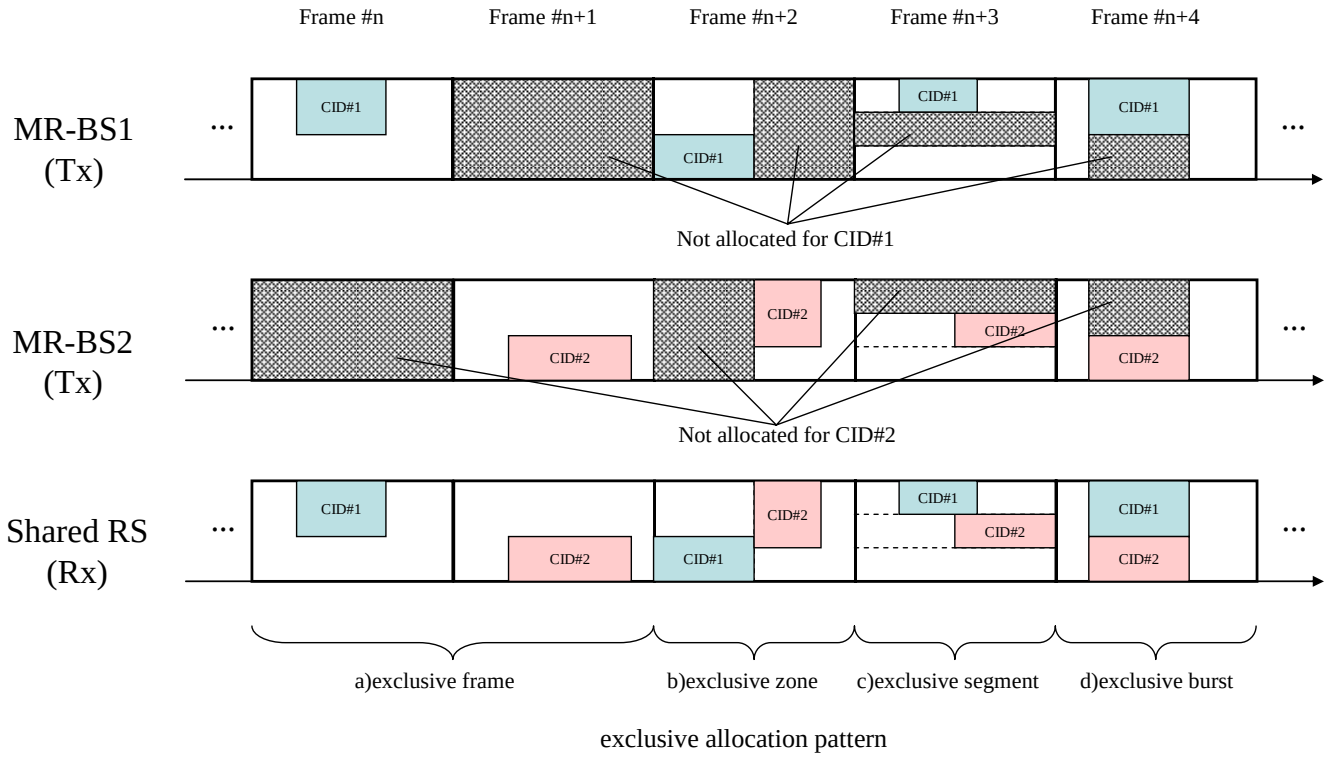
from MS1 is connected to MR-BS1 via RS. Also Connection#2 from MS2 is connected to MR-BS2 via the same RS.

In the shared RS system, the RS behaves like a MS performing a Macro Diversity Handover (MDHO) , as described by 802.16e[1]. In MDHO, MS receives from and transmits to multiple BSs at the same time. The Base Stations need to synchronously allocate the same region of slot in a frame in order to provide a diversity effect. On the other hand, in a shared RS system, the RS also receives from and transmits to multiple BSs in the same way as the MDHO. However, the BSs need to synchronously allocate exclusive slots in order to avoid collisions at the RS side.

Requirements for scheduling of shared RS system

In order to realize a RS shared mode of operation, the scheduler of the MR-BS is required to take into account the collision avoidance. The scheduling mechanism itself and its implementation in the RS are beyond the scope of the 802.16j standard. However the MR-BS and the RS that support a shared RS mode of operation are required to comply with the following set of rules.

Each MR-BS needs to schedule a resource allocation without allocating the same resource simultaneously to RS. Each MR-BS should use different frames / zones / segments / bursts exclusively for the same shared RS without any collision.



Note: For convenience, this example shows image of DL subframe only. The idea for UL subframe is basically same as DL.

Fig. 2 Exclusive resource allocation for shared RS.

In Fig.2, CID#1(for Connection#1) and CDI#2(for Connection#2) are the same as shown in Fig.1. Fig.2 shows an image of DL subframe only. It should be mentioned that the UL concept subframe is basically the same as the DL case.

a) Allocation by exclusive frame
Fig.2 (Frame #n and #n+1) shows an example of exclusive allocation pattern by frame. Within Frame #n, BS1 allocates burst to CID#1, but BS2 doesn't allocate any burst to CID#2. BS2 may allocate resources to other MSs that would be connected directly to BS2. On the other hand, in Frame #n+1, BS2 allocates a burst to CID#2, but BS1 doesn't allocate any burst to CID#1.

b) Allocation by exclusive zone
Frame #n+2 shows an example of exclusive allocation pattern by zone. In this example, two zones are defined in the DL subframe. Within the first zone, BS1 allocates a burst to CID#1, but BS2 doesn't allocate any burst to CID#2. BS2 may allocate resource to other MSs that would connect directly to BS2. On the other hand, within the second zone, BS2 allocates a burst to CID#2, but BS1 doesn't allocate any bursts to CID#1.

c) Allocation by exclusive segment
Frame #n+3 shows an example of exclusive allocation pattern by segment. Within the first segment, BS1 allocates burst to CID#1, but BS2 doesn't allocate any burst to CID#2. BS2 may allocate resource to another MS that will connect directly to BS2. On the other hand, within the second segment, BS2 allocates burst to CID#2, but BS1 doesn't allocate any bursts to CID#1.

d) Allocation by exclusive burst
Frame #n+4 shows an example of exclusive allocation pattern by burst. In this case BS1 and BS2 will need to exchange more information, the size and the mapping position of burst for CID#1 and CID#2. BS1 and BS2 allocates burst to CID#1 and CID#2 respectively without any duplication of slot usage.
Note that this allocation scheme will be applicable to downlink.

To achieve such a resource allocation, one of the MR-BS may behave same as an anchor BS and create the DL and UL -MAP on behalf of the other MR-BS, as described in 6.3.22.3. The anchor MR-BS may create the DL-MAP using Data location in another BS IE, as described in 8.4.5.3.6.

For UL-MAP, the new UL-MAP IE corresponding to Data location in another BS IE need to be defined in the section 8.4.5.4 as a new subclause. Detailed information elements of the IE is F.F.S.

According to these methods, the collision on the relay link on the shared RS reception side can be avoided.

Conclusion

The method presented hereby could potentially increase the RS access link related throughput, avoids the related intra-cell interference and improves the network reliability.

It is expected that the related aspect of the relay extension will reflect this shared RS system accordingly.

Suggested Text Changes

Insert the new subclause in 6.1.1 Relaying extension:

6.1.1.x Shared RS system

A shared RS system is defined based on the network topology example presented in Fig. n

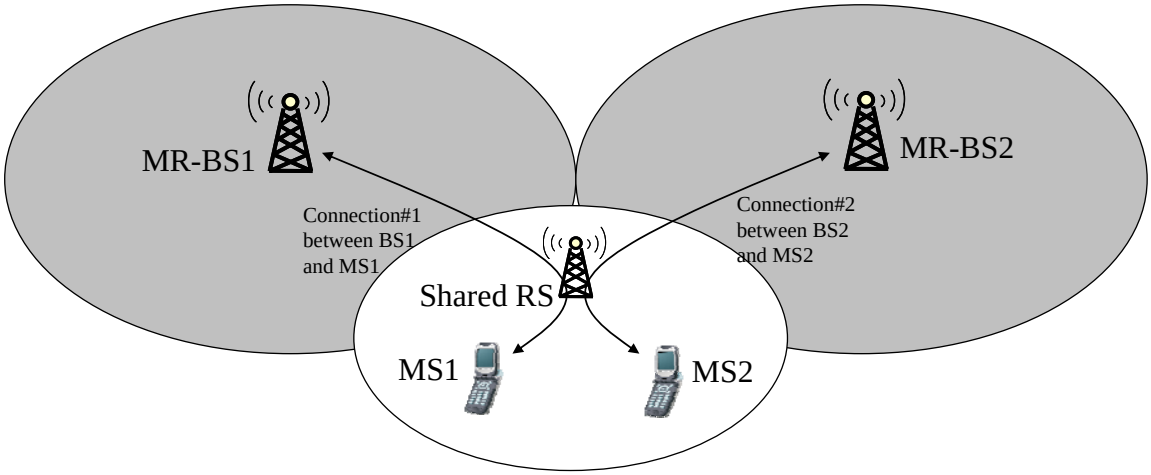


Fig. n. Example of shared RS system

In the shared RS system, one RS could be connected to two or more MR-BS within the same frame. Each connection from a MS is relayed to the related MR-BS by the related RS. As shown in Fig. n, connection #1 from MS1 is connected to MR-BS1 via RS. Also Connection#2 from MS2 is connected to MR-BS2 via the same RS.

Each MR-BS needs to schedule accordingly the related resource allocation without allocating the same resource simultaneously to the related RS. Each MR-BS should use different frames / zones / segments / bursts exclusively for the same shared RS without any collision.

To achieve such a resource allocation, one of the MR-BS may behave as an anchor BS and create the DL and UL-MAP on behalf of the other MR-BS, as described in 6.3.22.3. The anchor MR-BS may create the DL-MAP using Data location in another BS IE, as described in 8.4.5.3.6.

Insert the following text in 8.4.5.3.6 Data location in another BS IE:

For shared RS system, anchor MR-BS may use this IE to indicate that data is transmitted to the shared RS through another MR-BS.

Insert the new subclause in 8.4.5.4 UL-MAP IE:

8.4.5.4.x Data location in another BS UL-MAP IE

References

[1] IEEE 802.16e-2005