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Re:	Call for Technical Proposal regarding IEEE 802.16j (IEEE 802.16j-06/027)
Abstract	Proposes to allocate a dedicated control channel between an MMR-BS and an RS for the purpose of transporting control messages from the RS to the MMR-BS. By periodically allocating uplink bandwidth to an RS, the RS can transmit control messages necessary for the management of an MMR network to the MMR-BS without having to request bandwidth whenever there is a control messge to transmit.
Purpose	Adoption in the IEEE 802.16j specification
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Dedicated Interface Between MMR-BS and RS

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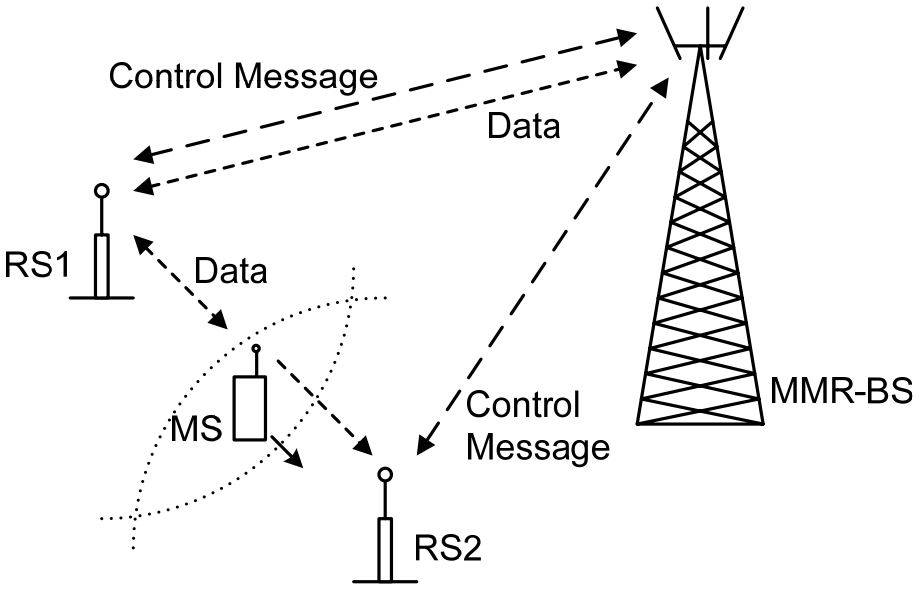
Background

The objective of the mobile multi-hop relay (MMR) is to improve the performance and service coverage of the I EEE 802.16 networks by introducing relay stations (RSs) to the network. The introduction of RSs implies extra delay in delivery time of not only the data packets but also the control or management messages. Since the time delay in delivery of the management messages has an immediate impact on the performance of the network syst em, it is essential to have an efficient means to exchange management messages between the MMR-BS (MMR base station) and the RSs to achieve the goal of MMR.

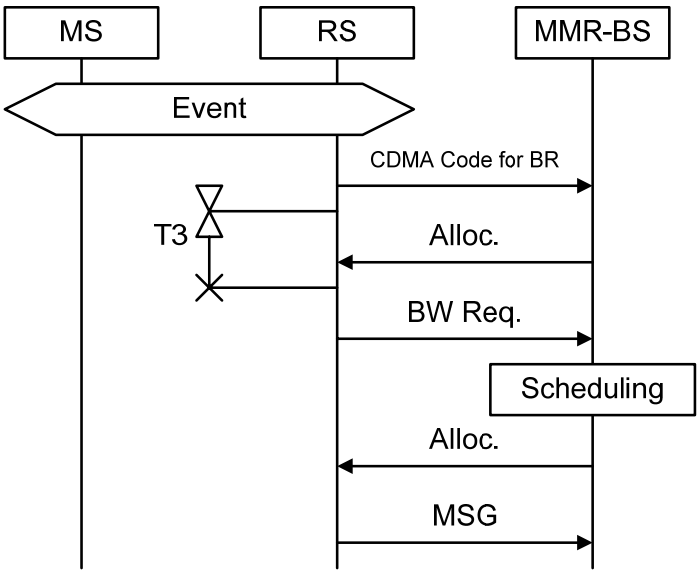
The information exchanged between an MMR-BS and RSs using management messages includes the channel q uality information between an RS and a mobile station (MS), topology change information, ranging information , and many others whose delay can cause adverse effect on the performance of the network. For smooth operati on of the network (e.g., efficient handover, improved throughput, seamless backward compatibility with legacy MSs, etc), RSs should be able to deliver these information to the MMR-BS in a timely manner.

Fig. 1 illustrates the control messages created during an intra MMR-BS handover, where an MS is traveling fro m the communication range of one relay station (RS1) to another. When RS2 detects the MS entering its cell bo undary, RS2 needs to communicate with the MMR-BS and report a number of PHY measurements such as the r eceived signal strength to the MMR-BS. Based on the reports from RS1 and RS2, the MMR-BS determines whe ther and when to perform an intra MMR-BS handover. In this case, excessive time delay of the control message s (i.e., the PHY measurements) can cause temporary outage for MS.



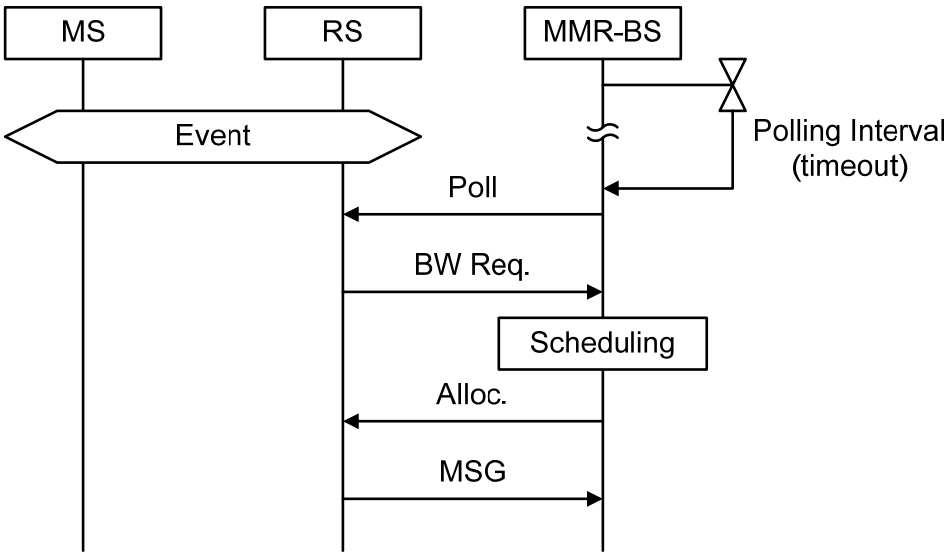
[Figure 1. Intra MMR-BS handover and control messages.]

The transport mechanisms for control messages currently provided by the IEEE 802.16e are adequate for the op eration of single hop networks, but are inappropriate for the purpose of MMR. Fig. 2 shows a message flow cha rt between an RS and an MMR-BS, where the RS is trying to transmit a management message created by an eve nt between the RS and an MS using a contention based transmission mechanism.



[Figure 2. Contention based packet transmission.]

Contention based packet transmission scheme is event driven, and thus is very efficient in terms of resource util ization. However, contention based packet transmission is not an option in many cases for reliable and efficient operation of relay networks due to the possibility of collision and excessive time delay; T3 is set to 200msec. w hich corresponds to 40 frames.

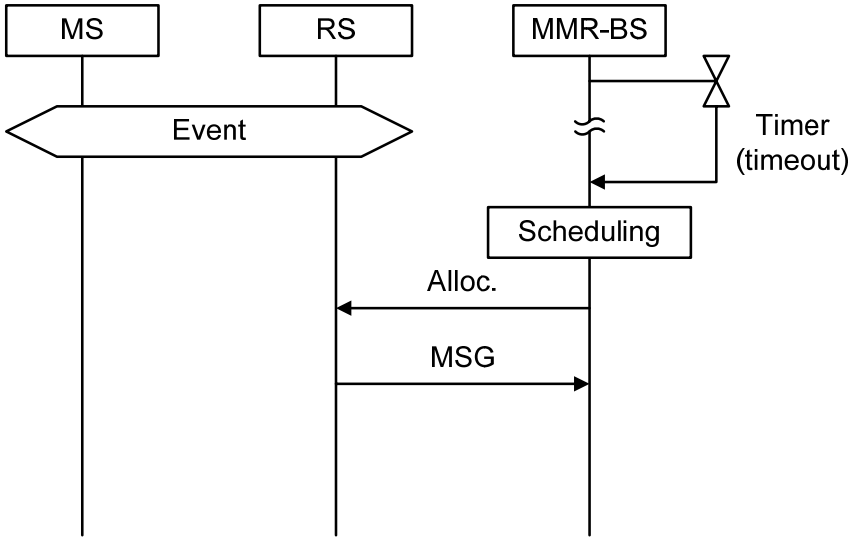


[Figure 3. Polling based packet transmission.]

Fig. 3 illustrates a message flow of a packet transmission mechanism based on polling. Polling is a reliable met hod to allocate bandwidth to relay/mobile stations, but it still requires a polling followed by a bandwidth reques t before the actual bandwidth allocation. When a relay station needs to transmit a lot of control messages occurr ing periodically or randomly in time to the MMR-BS, needing to send bandwidth request for every single contr ol message is highly inefficient.

Proposed Solution

The proposed solution to the problem is to allocate a dedicated control channel between an MMR-BS and an RS for the purpose of transporting control messages from the RS to the MMR-BS. By periodically allocating uplin k bandwidth to an RS, the RS can transmit control messages necessary for the management of an MMR networ k to the MMR-BS without having to request bandwidth whenever there is a control message to transmit.



[Figure 4. Dedicated control channel between MMR-BS and RS.]

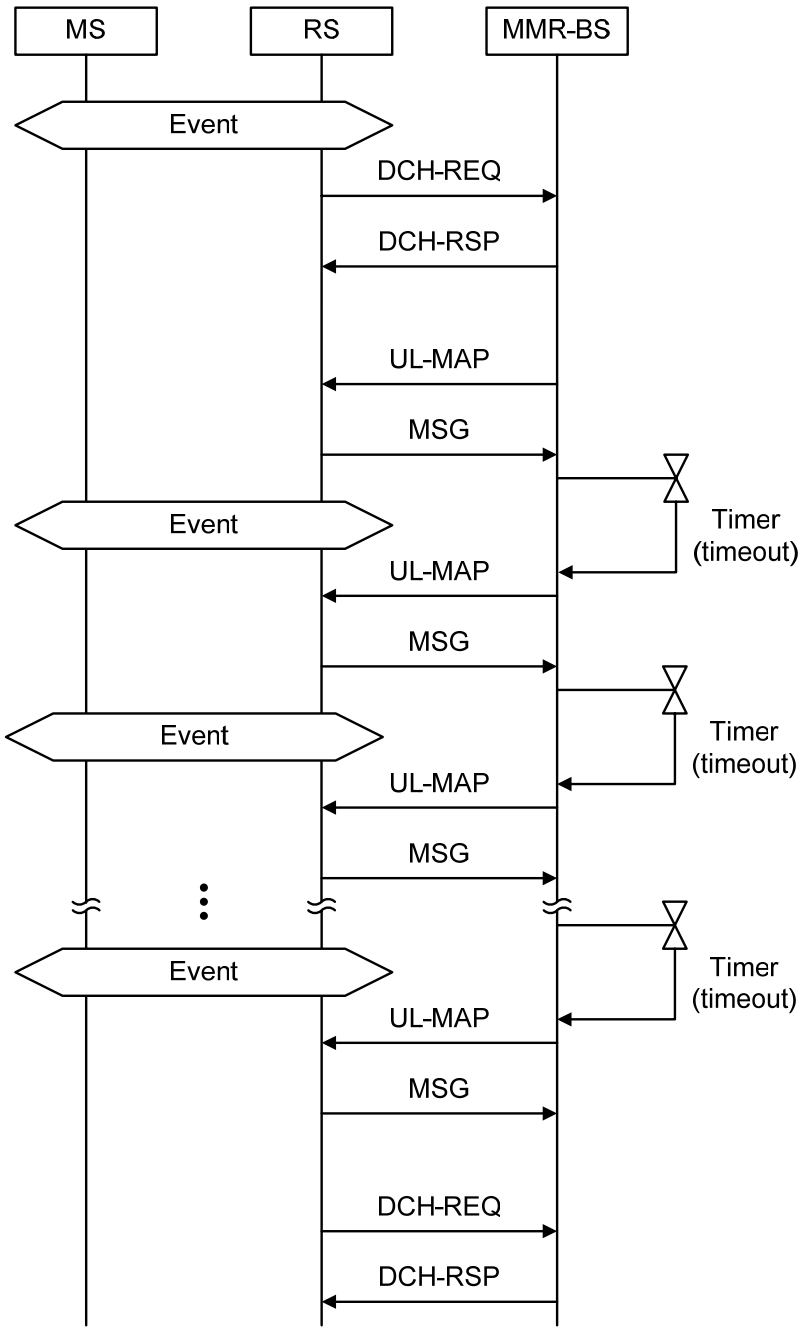
Fig. 4 shows a message flow chart of a control message transmission from an RS to an MMR-BS using a dedica ted control channel. In MMR networks, it is expected that an RS will need to transmit a lot of control messages for relay management to the MMR-BS, and the proposed scheme makes it possible for an RS to transmit control messages with minimal time delay and thus to improve the overall performance of MMR networks.

Example Scenarios

After a network entry procedure of an RS, the MMR-BS may allocate a dedicated control channel to the corresp onding RS without a request by the RS. If the MMR-BS does not allocate a dedicated control channel to an RS, the RS can request an allocation of a dedicated control channel by transmitting a request message. If necessary,

the MMR-BS can terminate or decrease the bandwidth of the allocation of a dedicated control channel without r equest from the RS.

To reduce the overhead of allocating a dedicated control channel to an RS, a dedicated control channel can be al located and released based on the expected demand of the uplink bandwidth. For example, in the case of the intr a MMR-BS handover depicted in Fig. 1, the RS may request an allocation of a dedicated control channel when i t detects an MS entering its communication range, and release the dedicated control channel after the handover procedure is completed. Fig. 5 illustrates a message flow of allocating and releasing a dedicated control channel between a MMR-BS and RS.



[Figure 5. Allocation and release of a dedicated control channel between MMR-BS and RS.]

Text Proposal

6.3.2.3 MAC Management messages

Change Table 14 as indicated:

66	MOB_ASC-REP	Association result report message	primary management
67	DCH-REQ	Dedicated control channel request message	basic
68	DCH-RSP	Dedicated control channel response message	basic
~~67~~69-255		*Reserved*	–

Insert new subclause 6.3.2.3.62:

6.3.2.3.62 Dedicated control channel request (DCH-REQ) message

A DCH-REQ is sent by an RS to an MMR-BS to request, change, or release a dedicated control channel allocation.

Table xxx – DCH-REQ message format

Syntax	Size	Note
DCH-REQ_Message_format() {		
Management Message Type = 67	8 bits	
Frame Number	24 bits	
Bandwidth Request	16 bits	0 = Release request of the allocation
Allocation Interval	8 bits	Set to zero when the bandwidth request field is set to zero.
}		

An RS shall generate DCH-REQ messages in the form shown in Table xxx, including the following parameters:

Frame Number

The frame number of the first allocation of the dedicated control channel. In case the DCH-REQ is a release request, Frame Number indicates the frame from which on the RS requests to release the bandwidth allocation.

Bandwidth Request

The number of bytes of the single uplink bandwidth allocation requested by the RS. Zero in this field indicates the DCH-REQ is a bandwidth release request.

Allocation Interval

The interval of the periodic bandwidth allocation in number of frame. This field is set to zero when the Bandwidth Request field is zero.

Insert new subclause 6.3.2.3.63:

6.3.2.3.63 Dedicated control channel response (DCH-RSP) message

A DCH-RSP shall be generated in response to a received DCH-REQ, or to terminate a dedicated control channel allocated to an RS..

Table xxx – DCH-RSP message format

Syntax	Size	Note
DCH-RSP_Message_format() {		
Management Message Type = 68	8 bits	
Frame Number	24 bits	
Allocated Bandwidth	16 bits	0 = Indicates release of the allocation
Allocation Interval	8 bits	Set to zero when the bandwidth request field is set to zero.
}		

An MMR-BS shall generate DCH-RSP message in the form shown in Table xxx, including the following parameters:

Frame Number

The frame number of the first allocation of the dedicated control channel. In case the DCH-RSP is the response to a bandwidth release request, Frame Number indicates the frame from which on the MMR-BS stops the bandwidth allocation.

Allocated Bandwidth

The number of bytes of the allocated single uplink bandwidth. When DCH-RSP is a response to a DCH-REQ requesting non-zero bandwidth, zero in this field indicates failing to allocated bandwidth.

Allocation Interval

The interval of the periodic bandwidth allocation in the number of frame. This field is set to zero when the Allocated Bandwidth field is set to zero.

Change subclause 6.3.6 as indicated:

6.3.6 Bandwidth allocation and request mechanism

Note that during network entry and initialization every SS or RS is assigned up to three dedicated CIDs for the purpose of sending and receiving control messages. These connection pairs are used to allow differentiated leve ls of QoS to be applied to the different connections carrying MAC management traffic. Increasing (or decreasin g) bandwidth requirements is necessary for all services except incompressible constant bit rate UGS connection s. The needs of incompressible UGS connections do not change between connection establishment and terminat ion. The requirements of compressible UGS connections, such as channelized T1, may increase or decrease dep ending on traffic. Demand Assigned Multiple Access (DAMA) services are given resources on a demand assign ment basis, as the need arises.

When an SS needs to ask for bandwidth on a connection with BE scheduling service, it sends a message to the BS containing the immediate requirements of the DAMA connection. QoS for the connection was established at connection establishment and is looked up by the BS.

MMR-BS may allocate a dedicated control channel to an RS without an explicit request from the RS.

There are numerous methods by which the SS or RS can get the bandwidth request message to the BS. The met hods are listed in 6.3.6.1 through 6.3.6.6. The method by which an RS request a dedicated control channel is des cribed in 6.3.6.8.

Insert new subclause 6.3.6.8

6.3.6.8 Dedicated control channel between MMR-BS and RS

An RS shall request a dedicated control channel using DCH-REQ message (see 6.3.2.3.62) for the purpose of tr ansporting control messages from the RS to the MMR-BS. A dedicated control channel is a periodic allocation of uplink bandwidth.

To reduce the overhead of allocating a dedicated control channel to an RS, a dedicated control channel can be al located, changed, and released based on the expected demand of the uplink bandwidth.

MMR-BS may allocated a dedicated control channel to an RS without an explicit request from the RS by sendin g a DCH-RSP message to the RS.

If necessary, an MMR-BS can terminate or decrease the bandwidth and/or the allocation interval of the dedicate d control channel without request from an RS.

If the uplink path from an RS to an MMR-BS includes other RSs, the MMR-BS shall allocated dedicated contro l channel for each hop within the path in response to an DCH-REQ.