

Reliable Multicasting with Selective Acknowledgement for IEEE802.16j

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Purpose:

For discussion and approval of inclusion of the proposed text into the P802.16j baseline document.

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Introduction

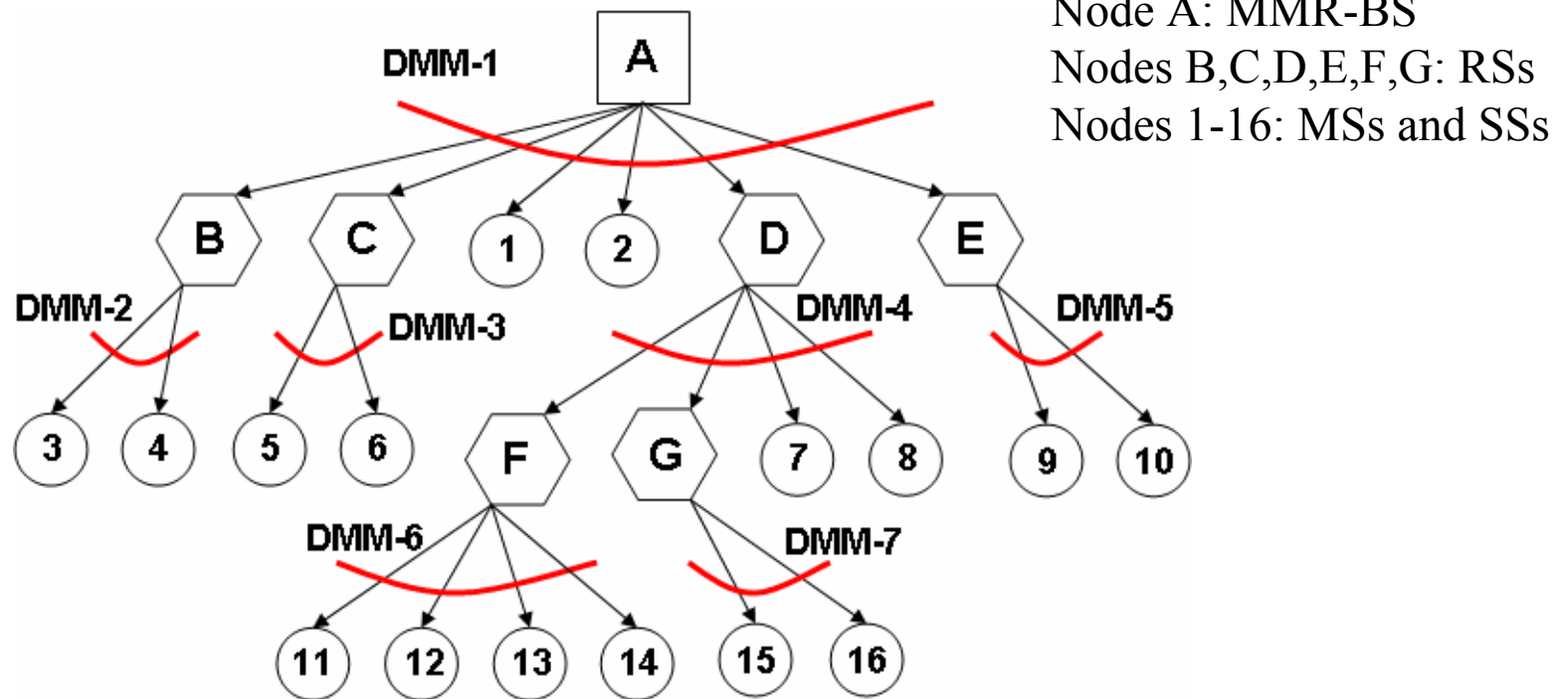
- ARQ is not applicable to multicast/broadcast connections in IEEE 802.16-2004 and IEEE 802.16e standards
- The relay-based IEEE 802.16j network topology has some unique aspects in which, by allowing ARQ for a subset of relay stations (RSs) may considerably improve the reliability of multicast transmissions
- The proposed contribution provides a reliable layer-2 multicasting for a subset of intended receivers in a selective fashion.

Purpose

- To improve the reliability of the information transmitted to the critical RSs by allowing ACK/NACK messages in the link layer multicasting in a selective fashion.
- To specify the required ARQ mechanism for implementing reliable multicasting.
- To provide an example mechanism for the selection of critical RSs for implementing reliable multicasting (implementation dependent).

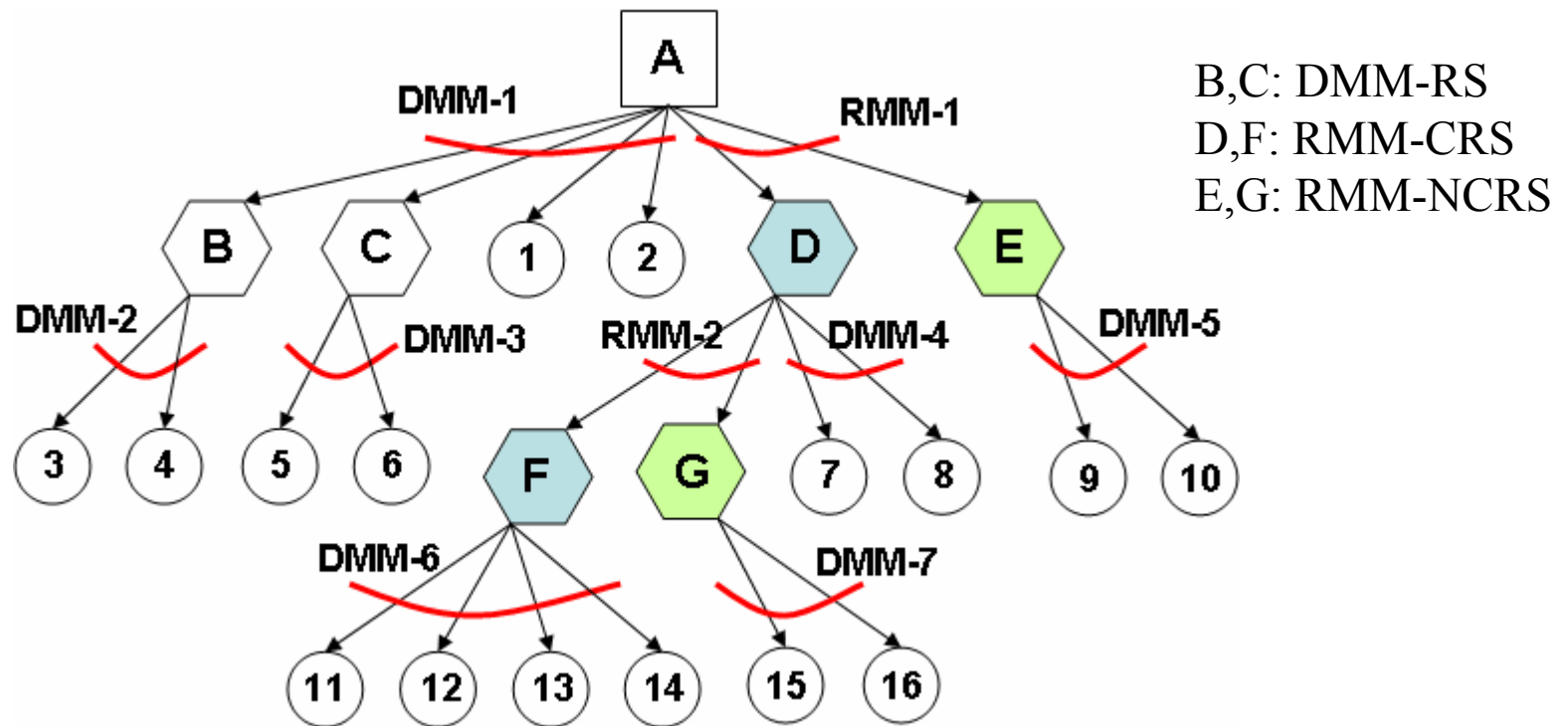
Default Multicast Mode (DMM)

- No ACK/NACK messages are allowed
- Hence multicast transmissions are unreliable at the link layer level
- Unreliable transmission to critical RSs (e.g., RS D) may impact large number of SSs



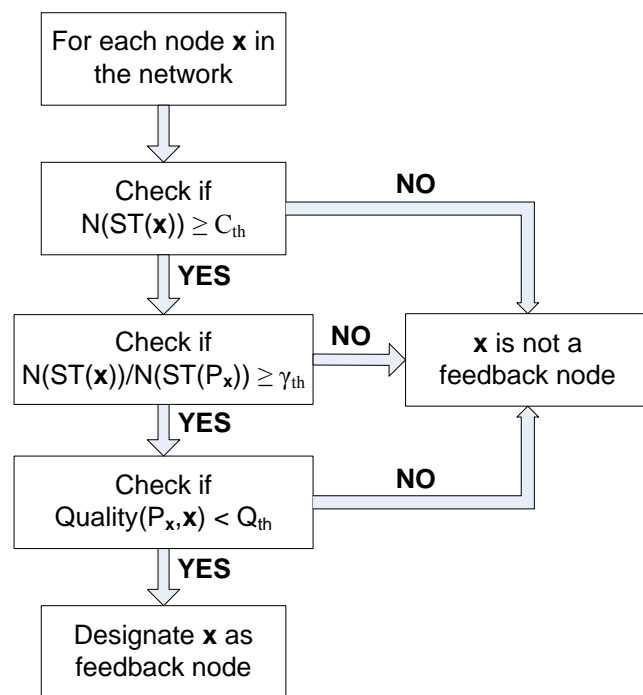
Reliable Multicast Mode (RMM)

- ACK/NACK messages are allowed only for critical RSs (CRSs)
- A non-critical RS (NCSR) may also operate in RMM mode if it has support of RMM mode; but it sends no ACK/NACK messages



An Example Mechanism for the Selection of CRSs

- The critical RS(s) may be determined by the serving MMR-BS and how they are selected is implementation dependent.
- Service capacities, channel qualities, and the overall network topology may be used to determine if a RS is critical or not



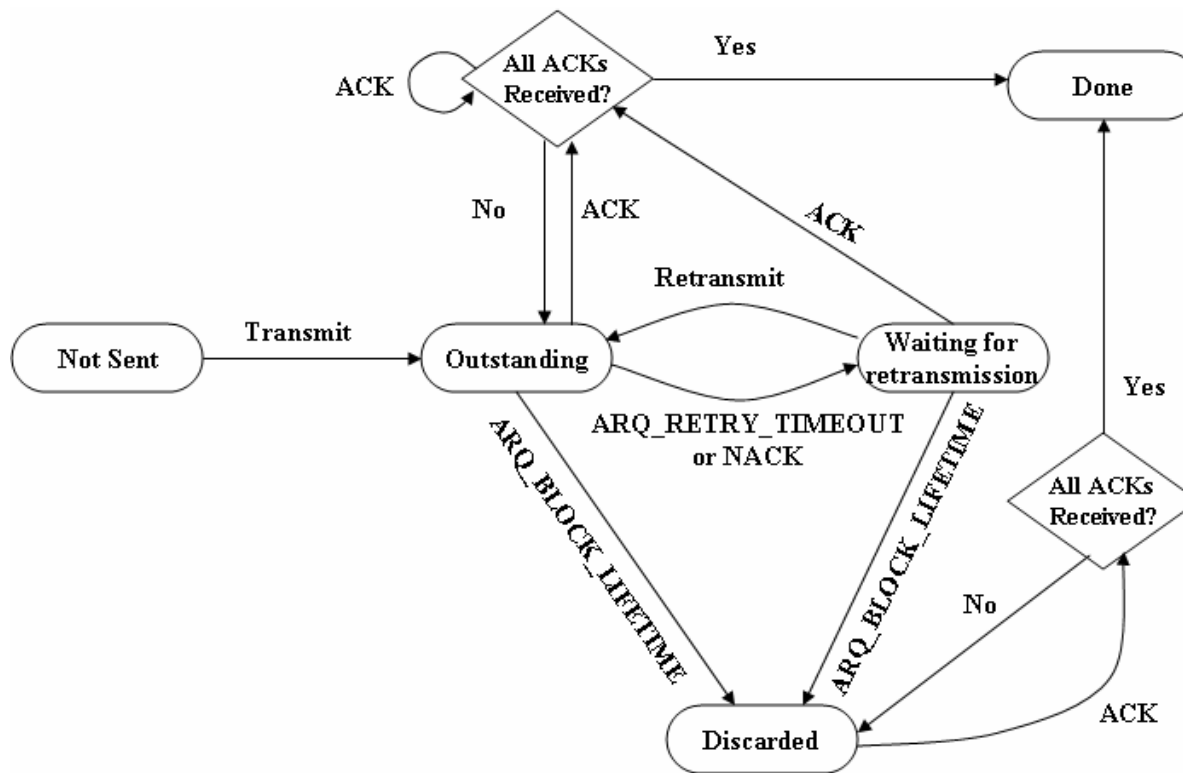
$N(ST(x))$: number of client nodes under the sub-tree with root node x
 $ST(x)$: sub-tree defined by the root node x
 P_x : parent node of node x
 $Quality(y, x)$: channel quality from node y to node x
 C_{th} : service capacity (i.e., number of clients that are served) threshold
 Q_{th} : channel quality threshold

RMM-ARQ mechanism

- The RMM-ARQ can utilize the ARQ feedback IE and ARQ parameters introduced in Section 6.3.4
- However, there needs to be some changes in ARQ operation and transmitter/receiver state machines for proper functioning of RMM-ARQ.

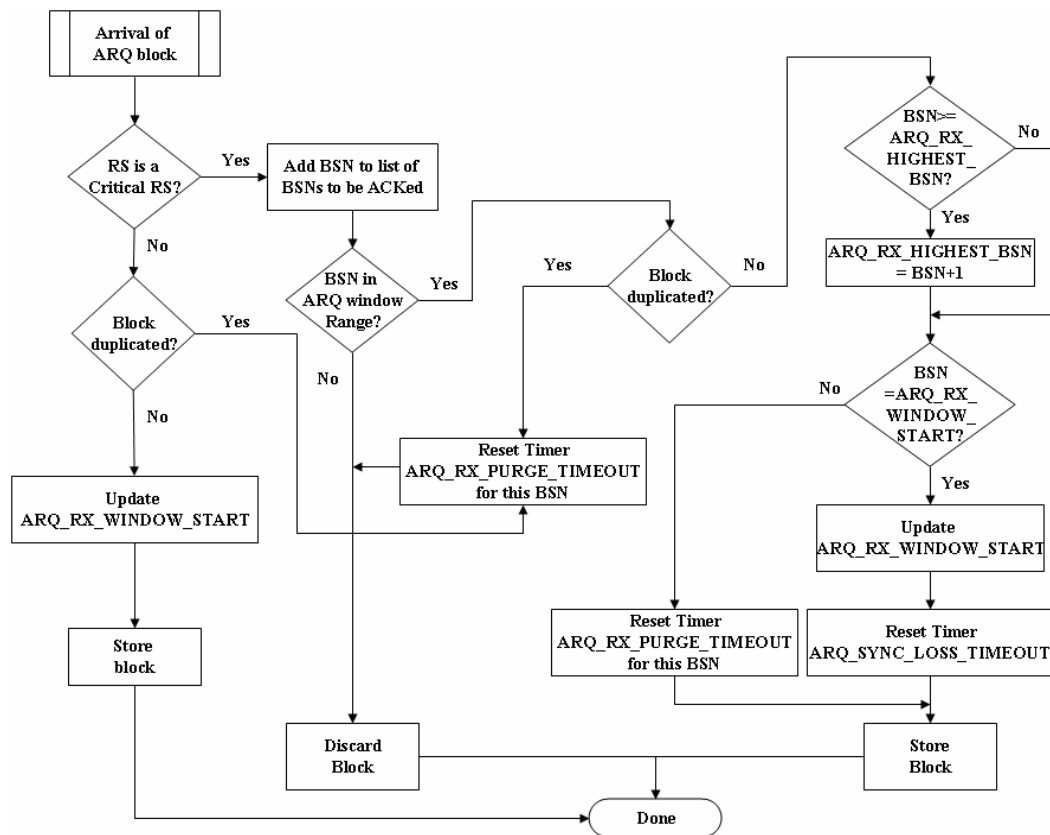
Changes in the Transmitter State Machine

- A packet in the transmitter can not go to “Done” state unless ACKs from all the CRs are received



Changes in the Receiver State Machine

- An RMM-CRS operates as in DMM receiver state machine
- An RMM-NCRS does not send ACK/NACK; but performs duplicate packet detection and keeps track of ARQ_RX_WINDOW_START



Other Changes

- The TLVs for ARQ Support (11.7.8.1) and ARQ Enable (11.13.18.1) are updated to incorporate RMM related information within REG-REQ/REG-RSP and DSA-REQ/DSA-RSP types of messages
- The RMM is specified in a separate section from DMM and no changes in the available ARQ and multicast sections are done (i.e., it is completely orthogonal with the current multicast mode operation in the standard)

Possible Use of RMM in the MBS

- One scenario where RMM can be quite useful happens in the context of MBS specified in Section 6.3.23.
- In MBS, relays and BS must synchronize their transmissions to the Ss and a packet must be pre-transmitted from BS to the RSs for such a synchronization.
- RMM then becomes an ideal transmission mode for pre-transmission since it is more reliable than the default multicasting and more bandwidth efficient than the unicasting

Summary

- RMM is an optional mode which can be used to enhance the reliability of multicast/broadcast transmissions for RSs that support RMM
- It is especially helpful if there are large number of MSs/SSs under a few RSs
- It may be used for pre-transmission in MBS
- Critical RSs may be determined by MR-BS and how to select them is implementation dependent