

# ARQ Operation for IEEE 802.16m

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Venue:

Re: MAC: Data Plane; in response to the TGm Call for Contributions and Comments 802.16m-08/033 for Session 57

Base Contribution:

N/A

Purpose:

To discuss and adopt the proposed text in the next revision of the 802.16m SDD

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# Introduction

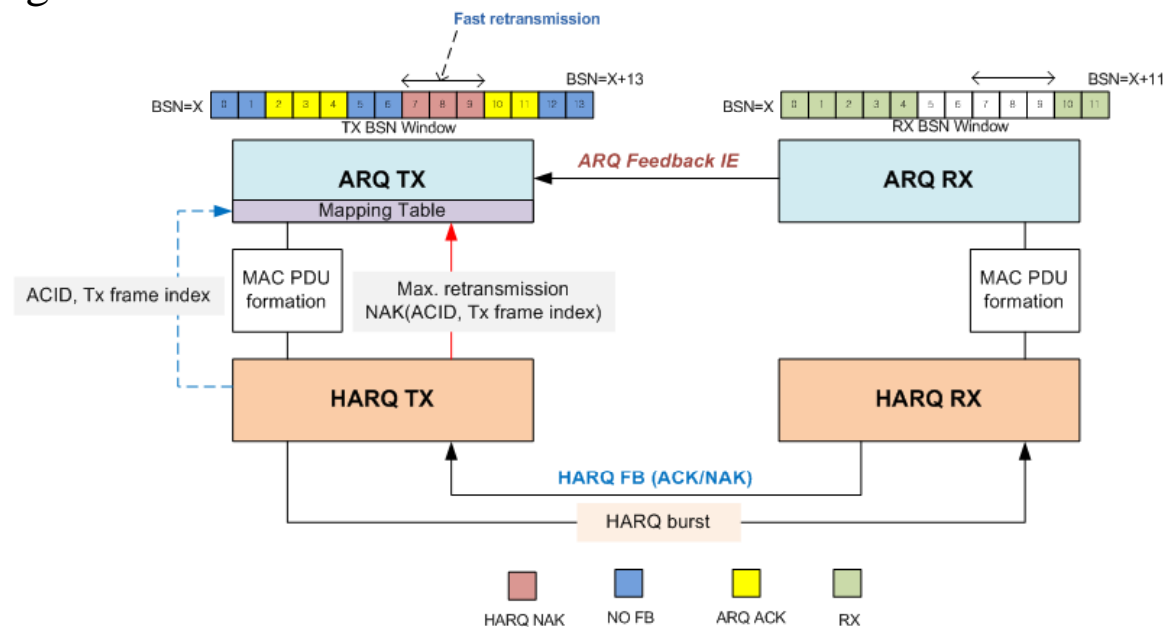
- ARQ operation in legacy system
  - Selective repeat ARQ with selective/cumulative ACK.
  - ARQ Block concept for high radio efficiency.
  - ARQ sliding window control at both TX and RX.
  - Large delay and overhead owing to ARQ feedback.
- Approach to the cross-layered design
  - Trade off between complexity of inter-layer operation and performance enhancement.
- ARQ and HARQ
  - HARQ is essential to the wireless access system.
  - Duplicated feedback information between ARQ feedback and HARQ feedback.
  - Dedicated HARQ FB channel with fixed delay.

# ARQ over HARQ

- Approach 1
  - ARQ scheme in legacy system.
- Approach 2
  - ARQ scheme in legacy system + Fast retransmission using HARQ feedback.
  - Management of a mapping table between HARQ and ARQ Feedback.
- Approach 3
  - Modified ARQ scheme in legacy system + HARQ-assisted Self-ARQ operation.
  - Management of a mapping table between HARQ and ARQ feedback.
  - No ARQ feedback
- Approach 4
  - Modified ARQ scheme in legacy system + HARQ-assisted Self-ARQ operation.
  - Management of a mapping table between HARQ and ARQ feedback.
  - Control of Timer for recovery of HARQ Feedback error.

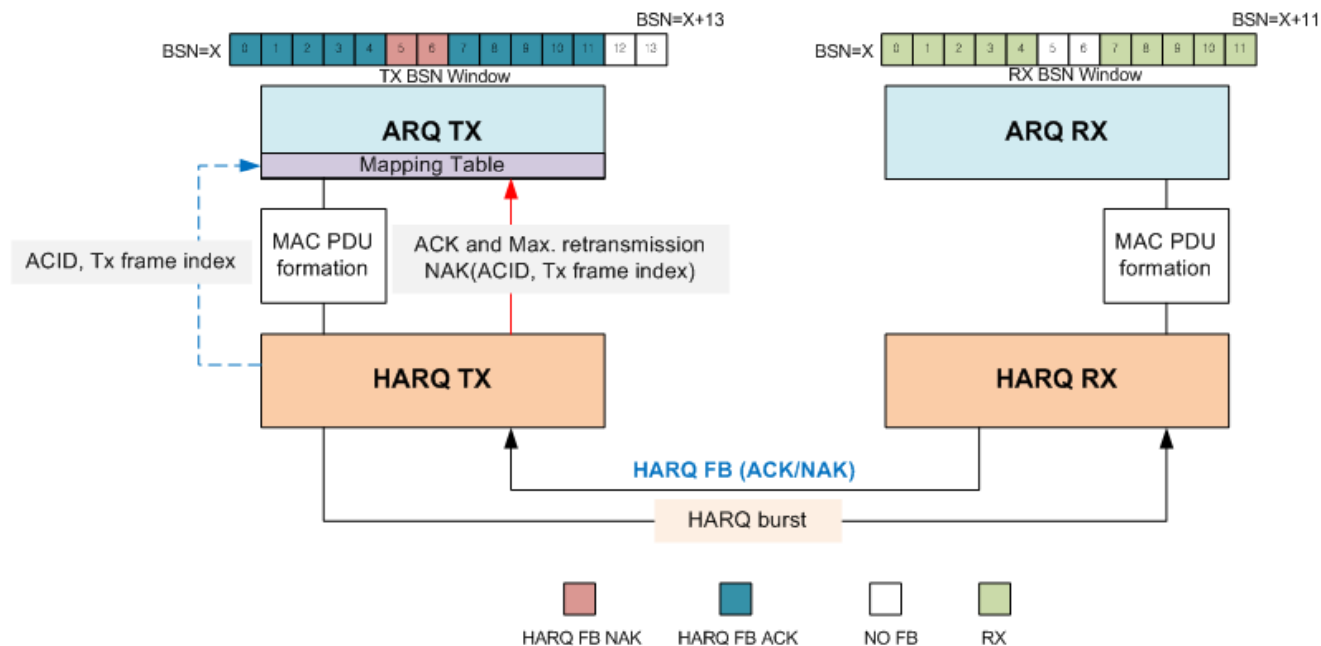
# ARQ operation (1/3)

- Fast retransmission using HARQ Feedback (approach 2)
  - Selective-repeat ARQ & 100% ARQ ACK/NAK using conventional ARQ Feedback IE.
  - ARQ-TX side shall keep a mapping table between ARQ block and HARQ transmission info. (for example, ACID and frame index).
  - HARQ FB information(NAK after maximum retransmission) is used to retransmit the corresponding ARQ block before reception of ARQ feedback message → **fast retransmission**.



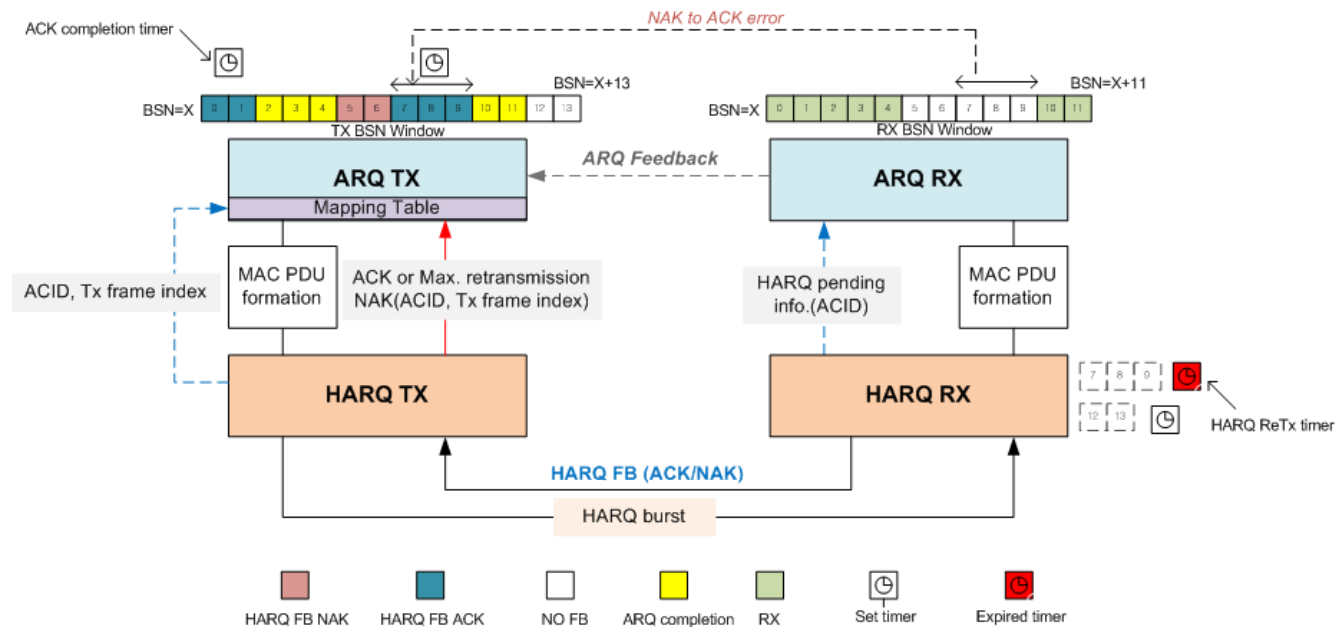
# ARQ operation (2/3)

- HARQ-assisted Self-ARQ (approach 3)
  - HARQ FB information(ACK and NAK after maximum retransmission) is used to update ARQ-TX window.
  - ARQ-RX side does not send a ARQ feedback IE.
  - Fast ARQ & elimination of ARQ feedback overhead.
  - This is proper for the case that HARQ FB error can be neglected.



# ARQ operation (3/3)

- HARQ-assisted Self-ARQ (approach 4)
  - Recovery of HARQ Feedback error (NAK to ACK error case)
  - ARQ-TX side starts a timer for completing ACK of ARQ block if an HARQ ACK FB is delivered to ARQ-TX side. After expiration of this timer, ARQ-TX deletes the corresponding ARQ block.
  - HARQ-RX side triggers a transmission of *ARQ Feedback* if a HARQ retransmission timer is expired.
  - If *ARQ Feedback* is delivered, the corresponding ACK completion timer is stopped and an ARQ retransmission is performed.



# Conclusions

- Internal signaling between HARQ and ARQ, and management of some timers need the low complexity in the implementation.
- Therefore, for fast retransmission of ARQ and small ARQ feedback overhead, we can choose the [approach 4](#) against erroneous conditions.

# Proposed Text

*[In 80216m-08\_003r4, Section 10, add the following text]*

## 10.x. ARQ Operations

### 10.x.1 Basic Principles

In case that HARQ is working, selective-ARQ scheme with HARQ feedback is used for fast ARQ operation. HARQ feedback information(ACK and NAK after maximum retransmission) and ACK completion timer are used to update ARQ-TX sliding window. ARQ-TX side shall keep a mapping table between ARQ block and HARQ transmission info. (for example, ACID and frame index). HARQ-RX side can trigger a transmission of *ARQ Feedback* if a HARQ retransmission timer is expired.

### 10.x.2 HARQ and ARQ Interactions

HARQ-TX provides ARQ-TX with HARQ transmission and HARQ feedback information internally. HARQ-RX provides ARQ-RX with HARQ state information, for example, HARQ RX pending.