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Why is downlink asynchronous and uplink synchronous in HARQ?

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1 Answer

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Answered May 13, 2017

Before answering your question i will give some brief overview of harq in LTE :-

There are 2 types of HARQ:-

- Synchronous HARQ – Used by uplink transmission.
- Asynchronous HARQ – Used by downlink transmission.

Synchronous HARQ:

Here receiver has knowledge of the packet which is about to come in this subframe i.e. eNb knows exactly which HARQ no. and RV ue is going to send. eNb determines them from transmission time.

Asynchronous HARQ:

Here, the sender provides details about which HARQ process it is using. This gives flexibilty because retransmissions does not have to be scheduled during every subframe but it increases signalling overhead because sender has to send the information on a channel.

Asynchronous and synchronous HARQ wrt dl and ul is explained below.

Retransmissions are also of 2 types:-

- Adaptive retransmission,
- Non-adaptive retransmission.

Adaptive Retransmission:

Here, the transmission attributes like MCS, RV, subcarrier on which transmission is going to occur, does not remain same during each retransmission but are notified by the sender. These attributes can be changed according to radio channel conditions, hence, it again provides flexibilty but increases overhead.

Non-adaptive Retransmission:

Here, the transmission attributes remains same during each retransmission.

During Downlink Transmission-

When eNb sends data to UE through PDSCH, UE determines it's correctness by checking CRC and report it to eNb through ack/nack bit. If UE also has data to send and it gets a grant, it'll send ack/nack on PUSCH alongwith data, otherwise it'll send it on PUCCH. eNb can use 8 HARQ processes in any order(asynchronous HARQ) i.e. retransmissions can occur any time relative to the initial transmission. Therefore, it needs to send HARQ id for the UE to determine the original transmission corresponding to which the retransmission is happening. HARQ id is sent in PDCCH. Downlink supports adaptive transmission i.e. resources are allocated afresh each time and sent on PDCCH. RV, MCS are notified in DCI 0. RV values are predefined in specifications (0.2.3.1). CURRENT_IRV is an index into this sequence

Work of HARQ entity includes-

- Maintain a number of HARQ processes.
- Analyze search space to find a downlink grant on PDCCH.
- Send HARQ information to UE through PDSCH , send HARQ Process Id and RV on

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