

Motivation

- Carrier aggregation and dual connectivity are efficient methods for data aggregation to improve user throughput.
 - When CA is deployed, frame timing and SFN need to be aligned across cells that can be aggregated.
 - Dual Connectivity can be deployed if frame timing and SFN are not aligned across cells . However, the UE needs to support at least two UL carriers on PCell in MeNB and PSCell in SeNB respectively.
 - Single carrier has better UL coverage performance than two UL carrier transmissions
 - UE capable of only one UL CC cannot support Dual Connectivity / Carrier aggregation in case of unsynchronized network (i.e. the frame timing and SFN are not aligned across cells)

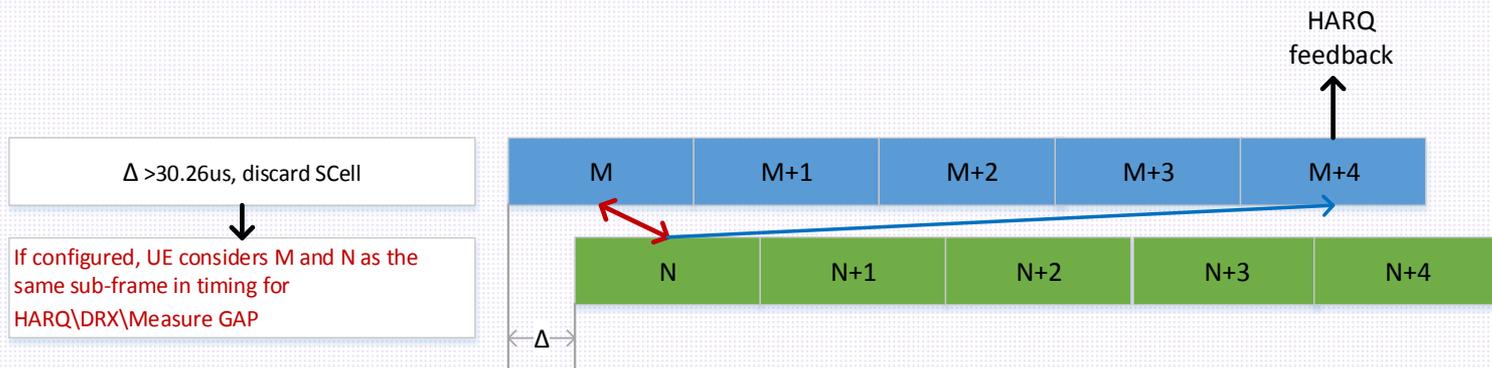
Scenarios	Synchronized Network Ideal backhaul	Unsynchronized network Non Ideal or Ideal backhaul
UE capable of two UL carriers	Carrier aggregation	Dual connectivity
UE capable of single UL carrier	Carrier aggregation	Not supported

- In order to improve user throughput and UL coverage, it is meaningful to support data aggregation for the UE capable of only one UL CC in case of unsynchronized network (i.e. the frame timing and SFN are not aligned across cells).

Enhancements to support Carrier aggregation in unsynchronized networks

- **Main Issue: Subframe timing mapping**

- Since the frame timing and SFN are not aligned between serving cells, the timing difference between PCell and SCell needs to be configured for HARQ timing / DRX / Measurement GAP operations.



- Adjustment of sub-frame mapping may be needed, e.g. due to clock drifting, TA value change, UE processing time

Objective

- In order to improve per-user throughput and UL coverage, data aggregation for the UE capable of only one UL CC in case of unsynchronized network (i.e. the frame timing and SFN are not aligned across cells) needs to be supported, including:
 - Removal of the SFN alignment requirement between serving cells for CA (i.e. 30.26 ms) (RAN2, RAN4)
 - SFN offset and sub-frame time difference acquisition (RAN2, RAN3)
 - Sub frame mapping configuration and adjustment for HARQ timing / DRX operation / measurement GAP operation etc. (RAN2, RAN4, and RAN1)



Thank you !

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