

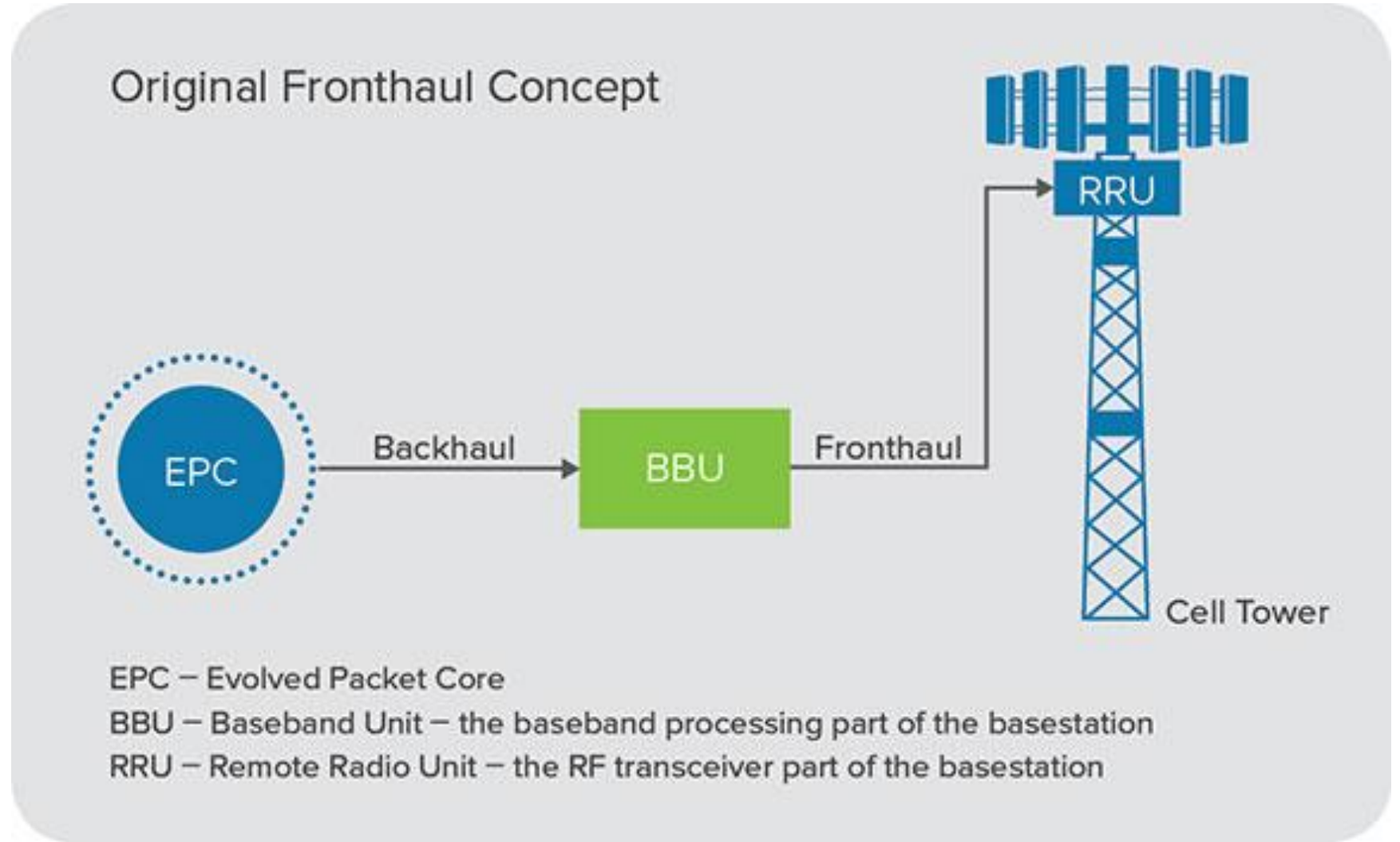
Tim Frost

A close-up, dark-toned photograph of an owl's face, focusing on its large, yellowish-green eye and the intricate patterns of its feathers. The owl is looking slightly to the right of the frame.

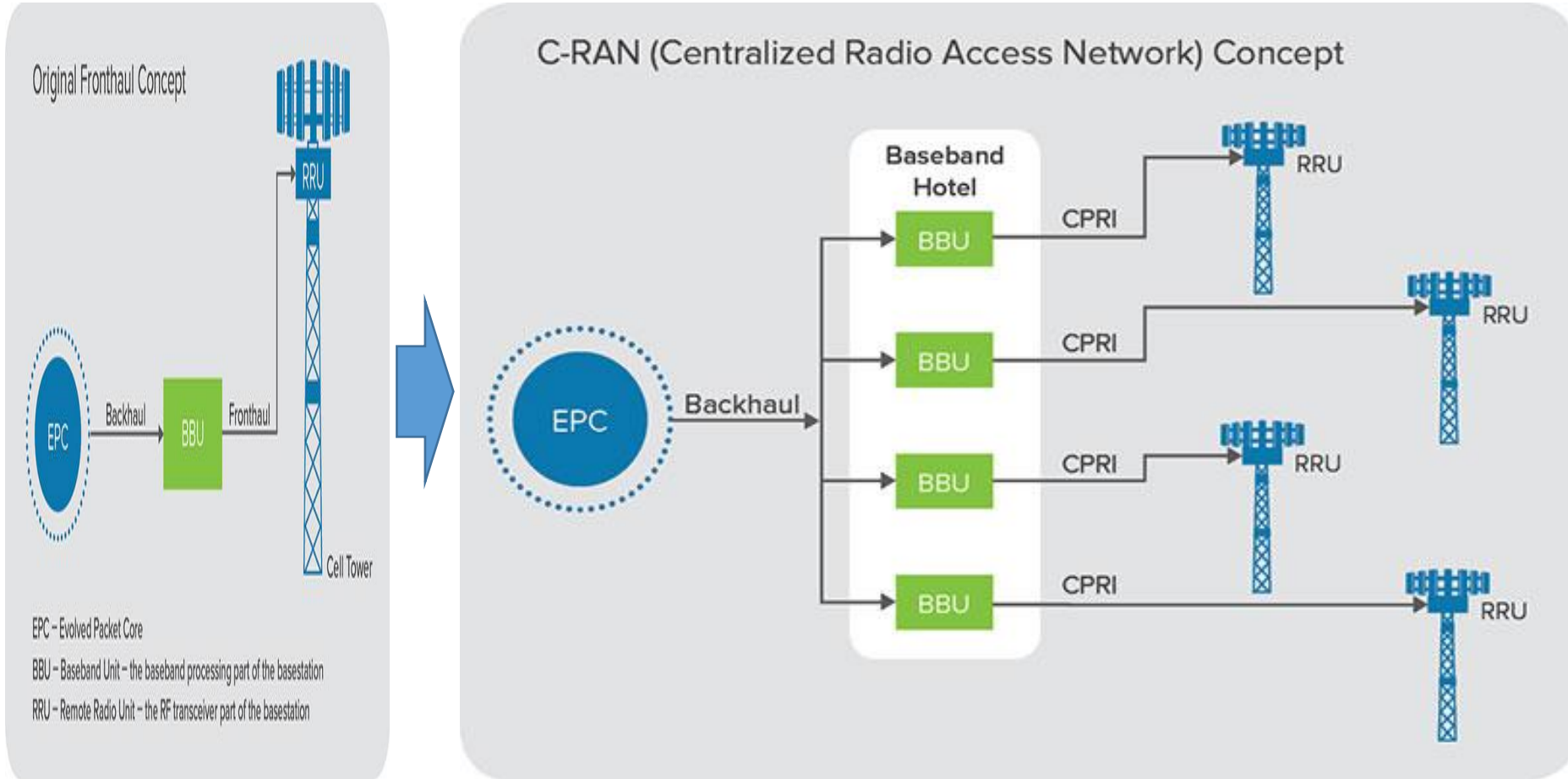
Synchronization for Fronthaul and O-RAN Timing Architectures

WSTS, March 2021

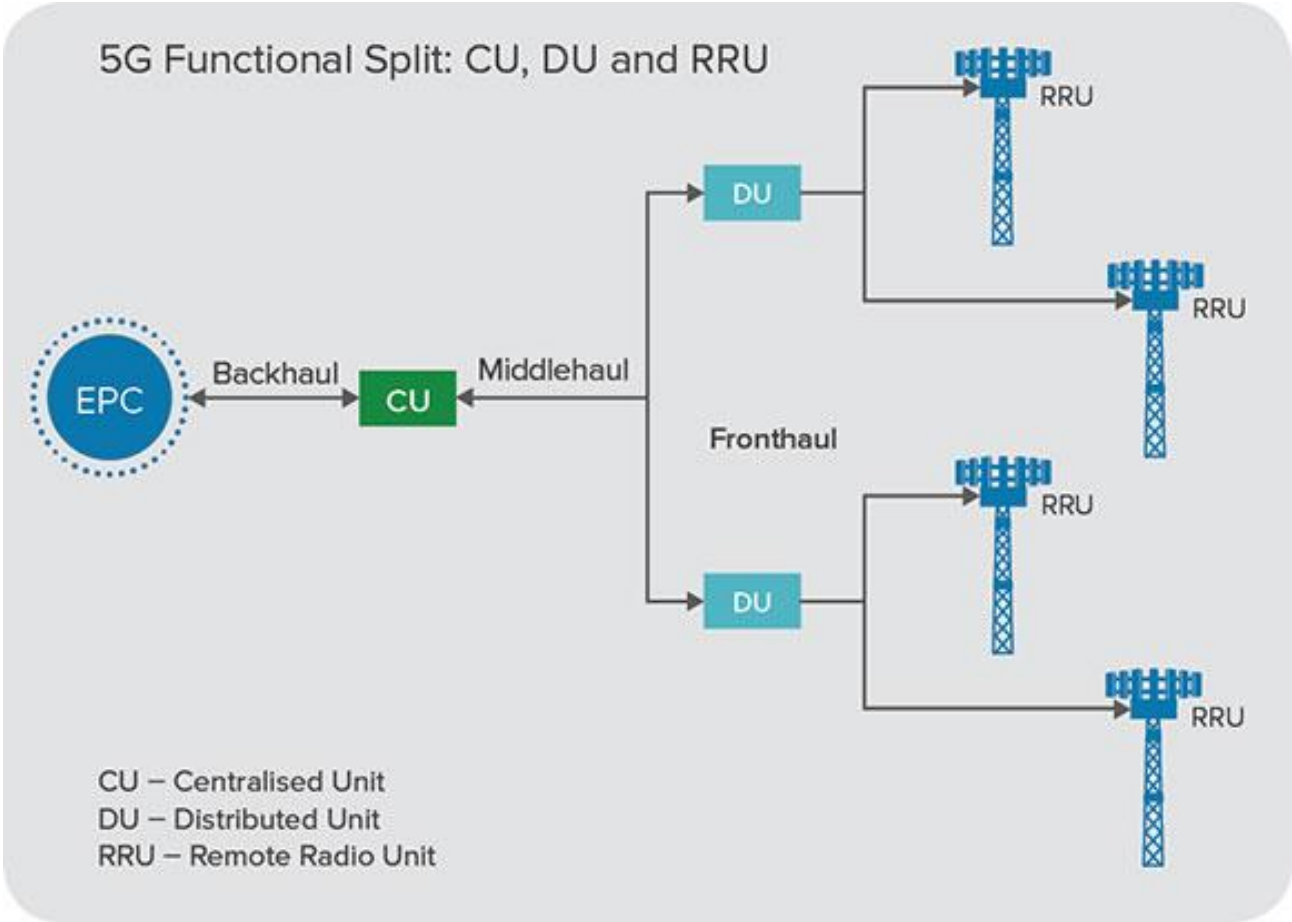
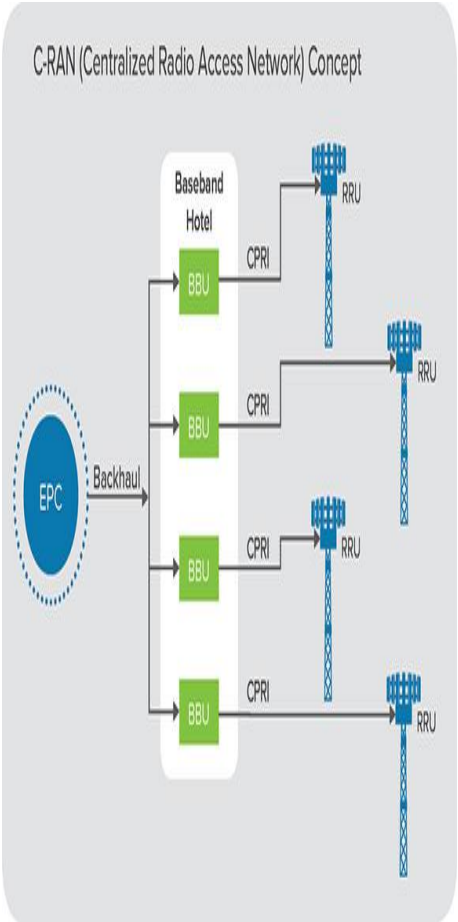
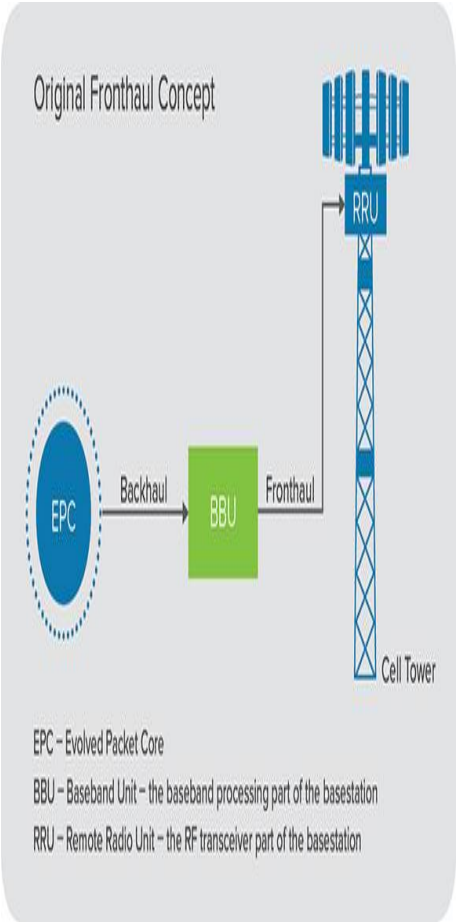
Fronthaul Evolution



Centralized RAN



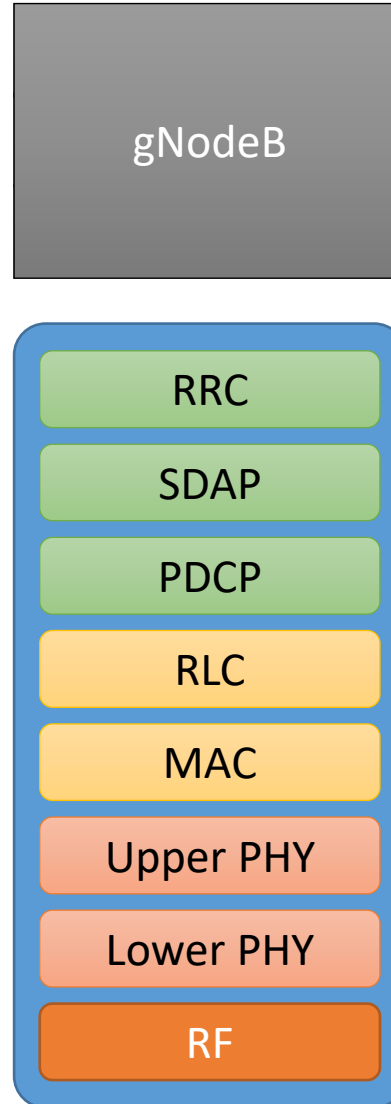
Disaggregated Network



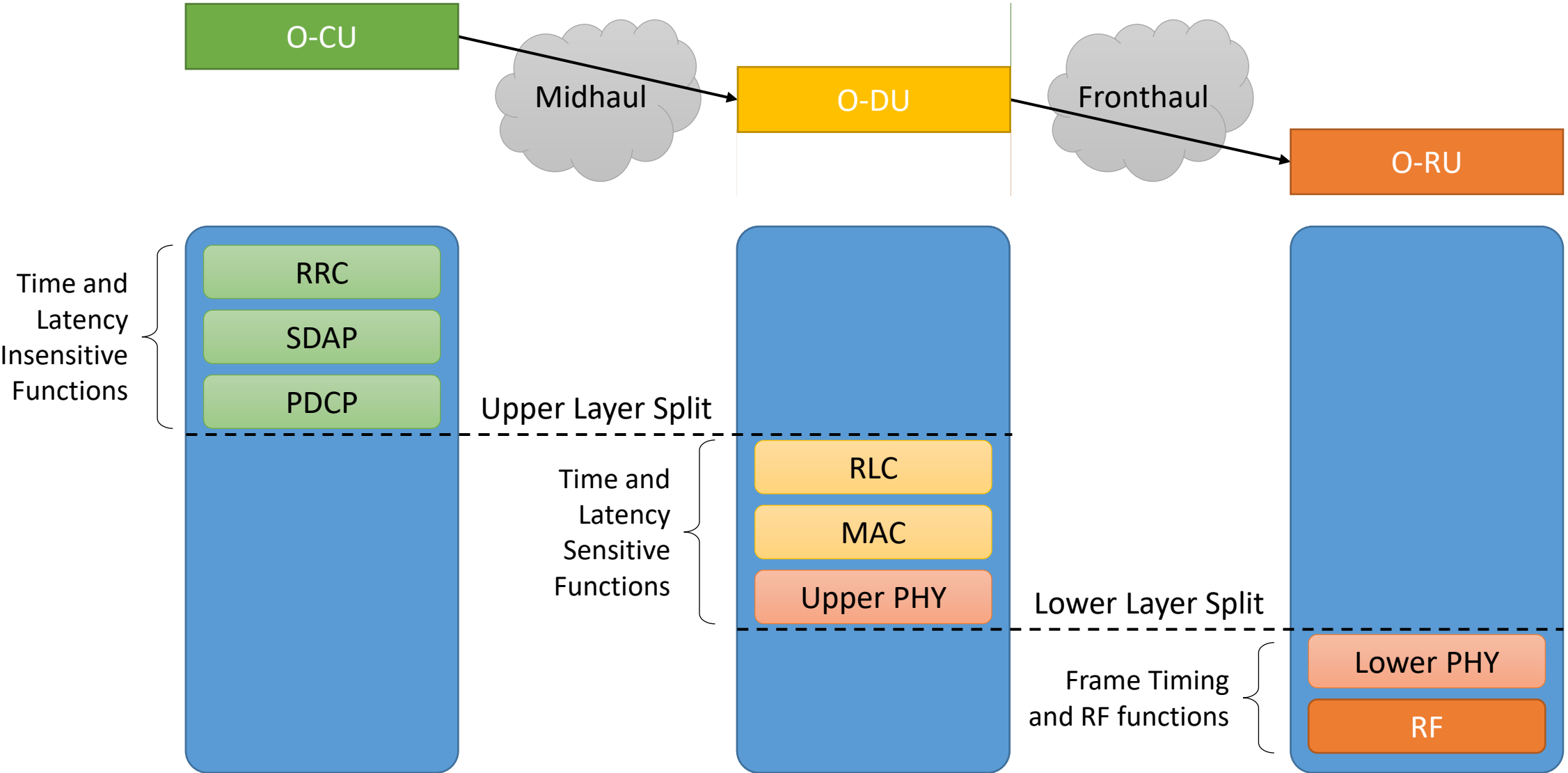
Reasons for disaggregation

- Trend towards virtualization
 - Generic “white box” server hardware
 - Add capacity and services easily
 - Software-based services leading to faster customer turn-on and more bespoke services
- Less hardware out in the field
 - Data centers safer and more secure
- More radio units required to meet 5G capacity
 - Small, simpler, lower-cost units can be deployed
 - Allows high-density deployments
- New standards required from bodies such as O-RAN Alliance and Telecom Infra Project
 - O-RAN Alliance mission statement is ***“Transforming the Radio Access Networks Industry Towards Open, Intelligent, Virtualized and Fully Interoperable RAN”***

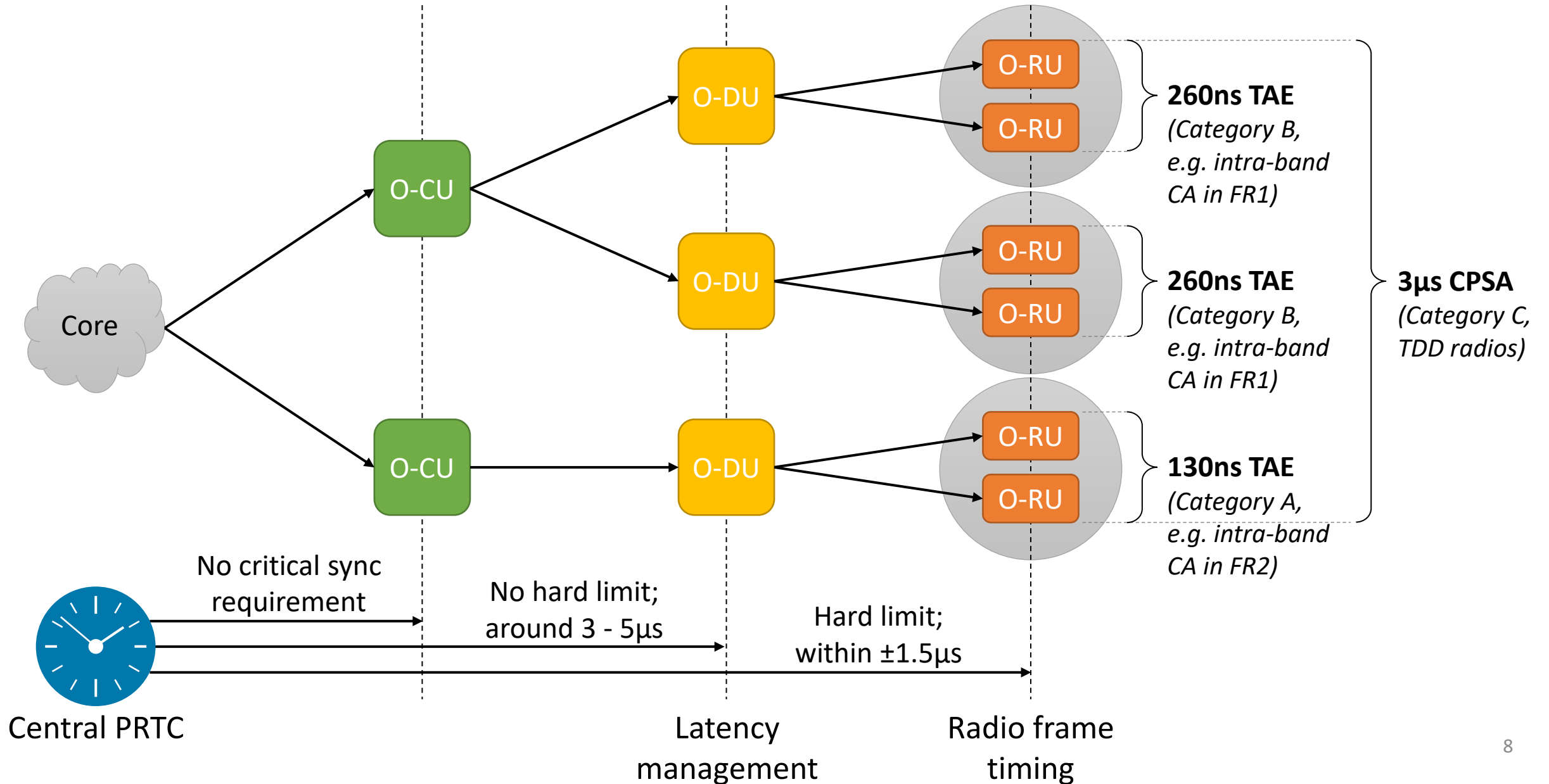
O-RAN gNodeB (*basestation*) Protocol Stack



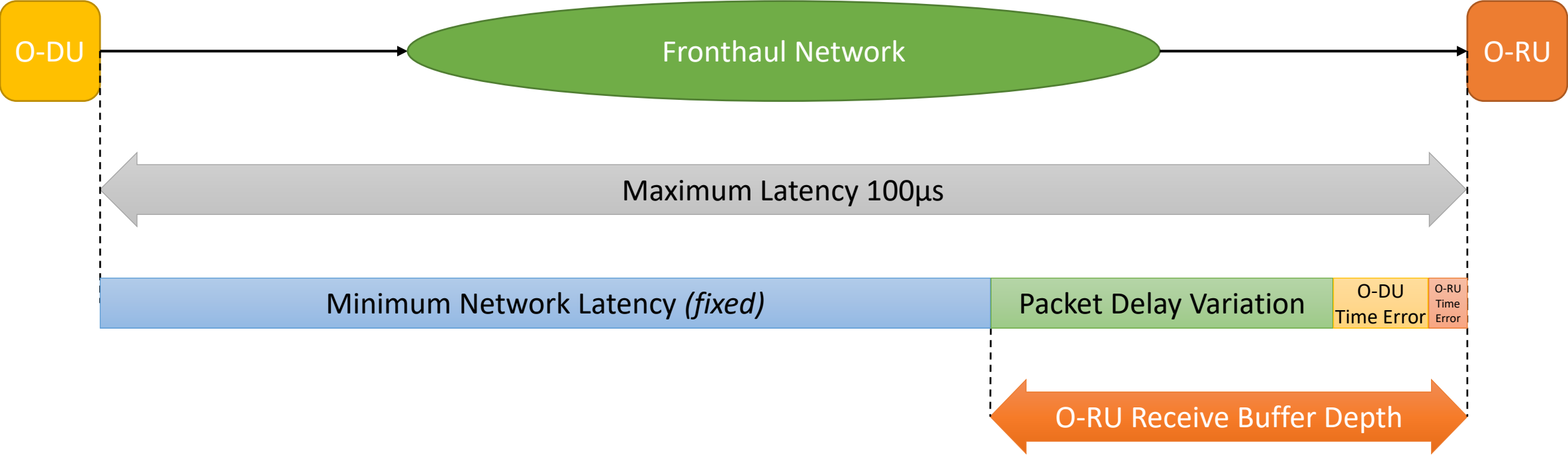
O-RAN 5G Functional Splits



Synchronization Requirements

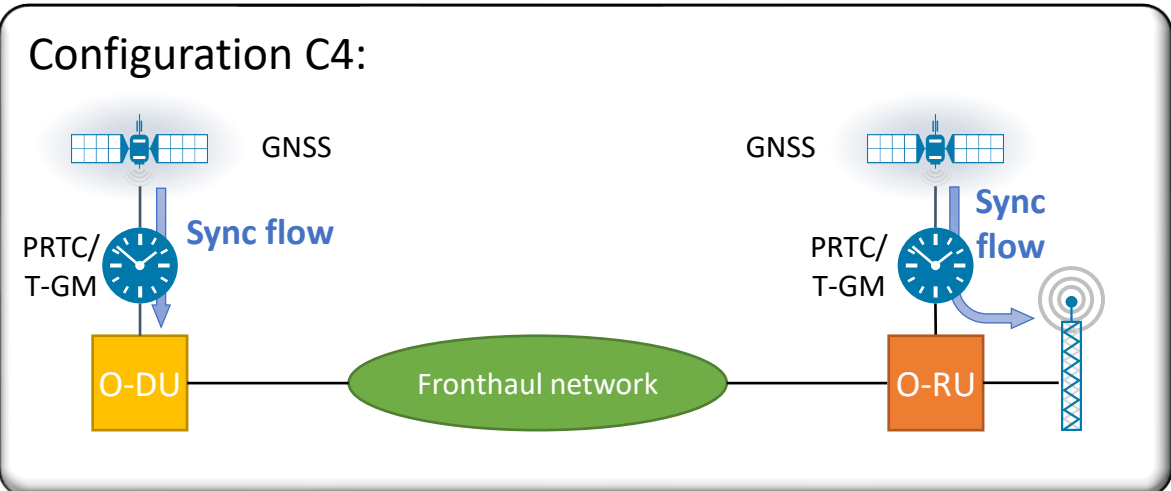
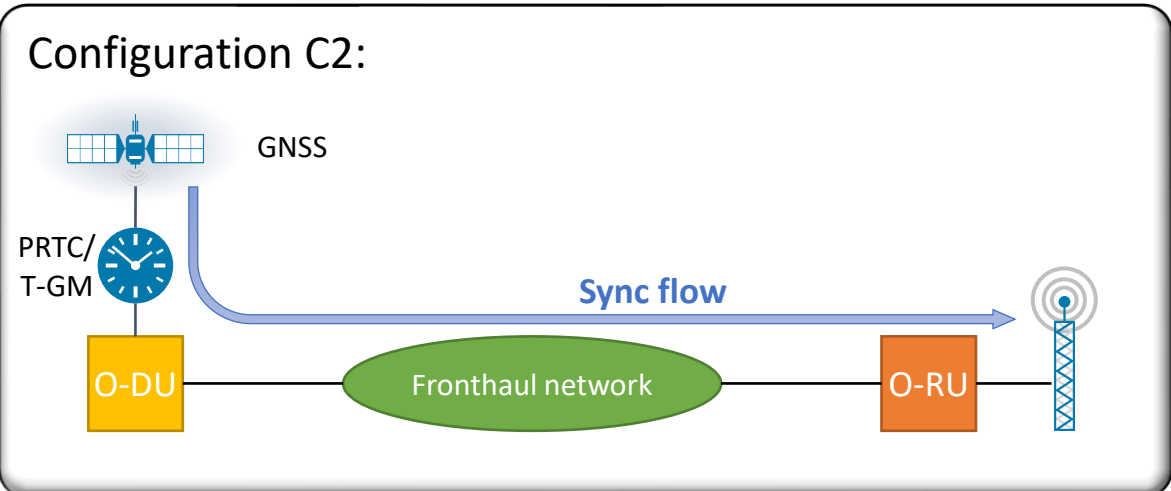
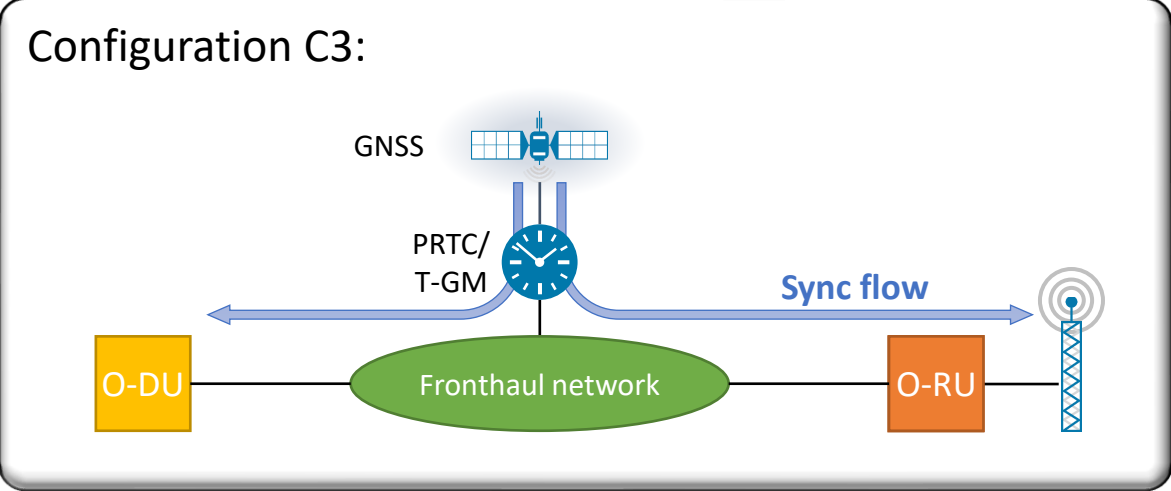
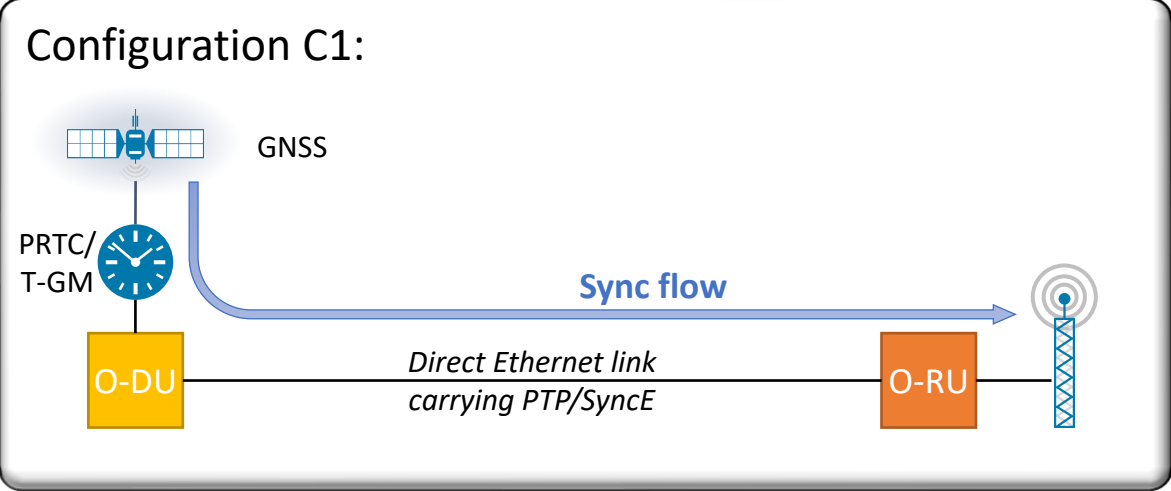


Fronthaul Latency

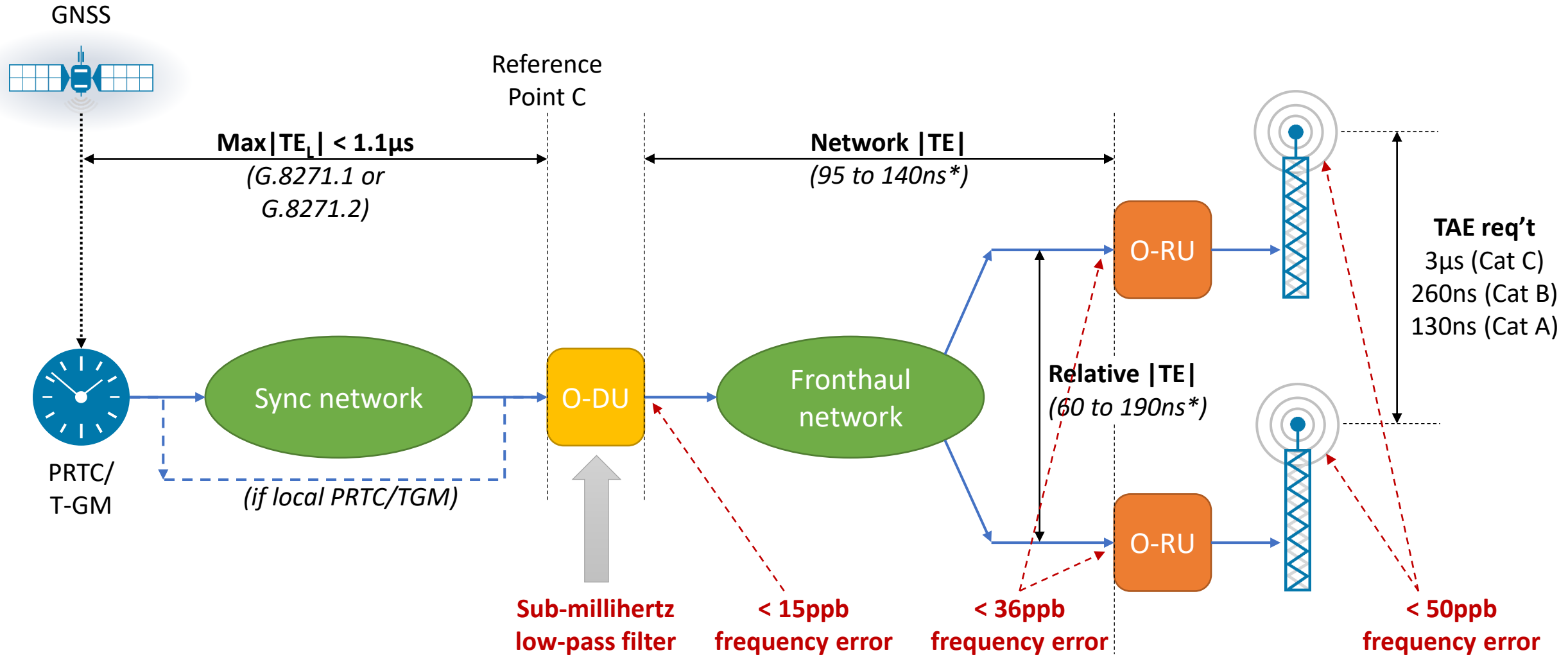


- O-DU estimates one-way latency to schedule traffic on the O-RU
- Relative time error between the O-DU and O-RU causes error in that latency estimate, and must be accounted for in O-RU receive buffer depth
- No hard limit on O-DU time error, but somewhere in the range of 3 to 5µs is reasonable

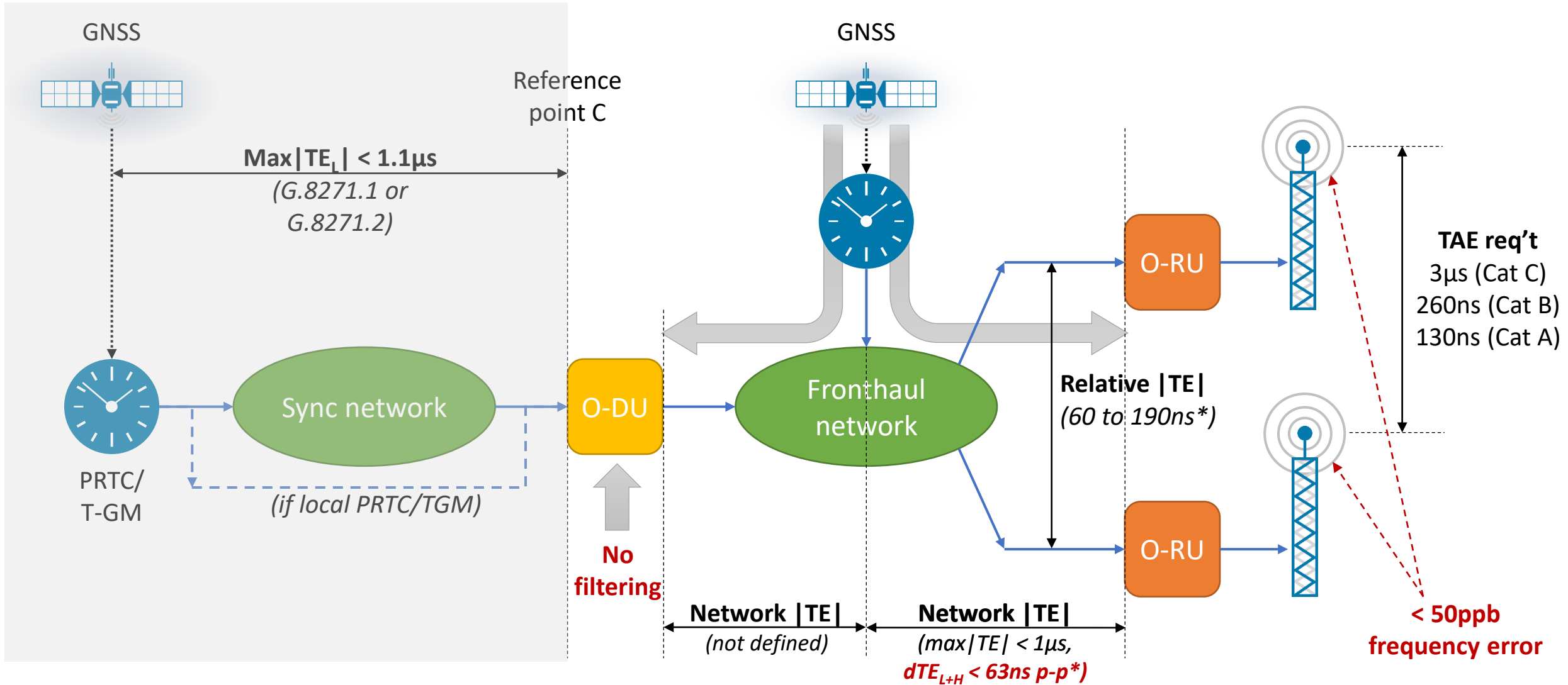
ORAN LLS* Sync Architectures



In detail: O-RAN C2 fronthaul configuration



In detail : O-RAN C3 fronthaul configuration



Tim Frost – Strategic Technology Manager
tim.frost@calnexsol.com

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