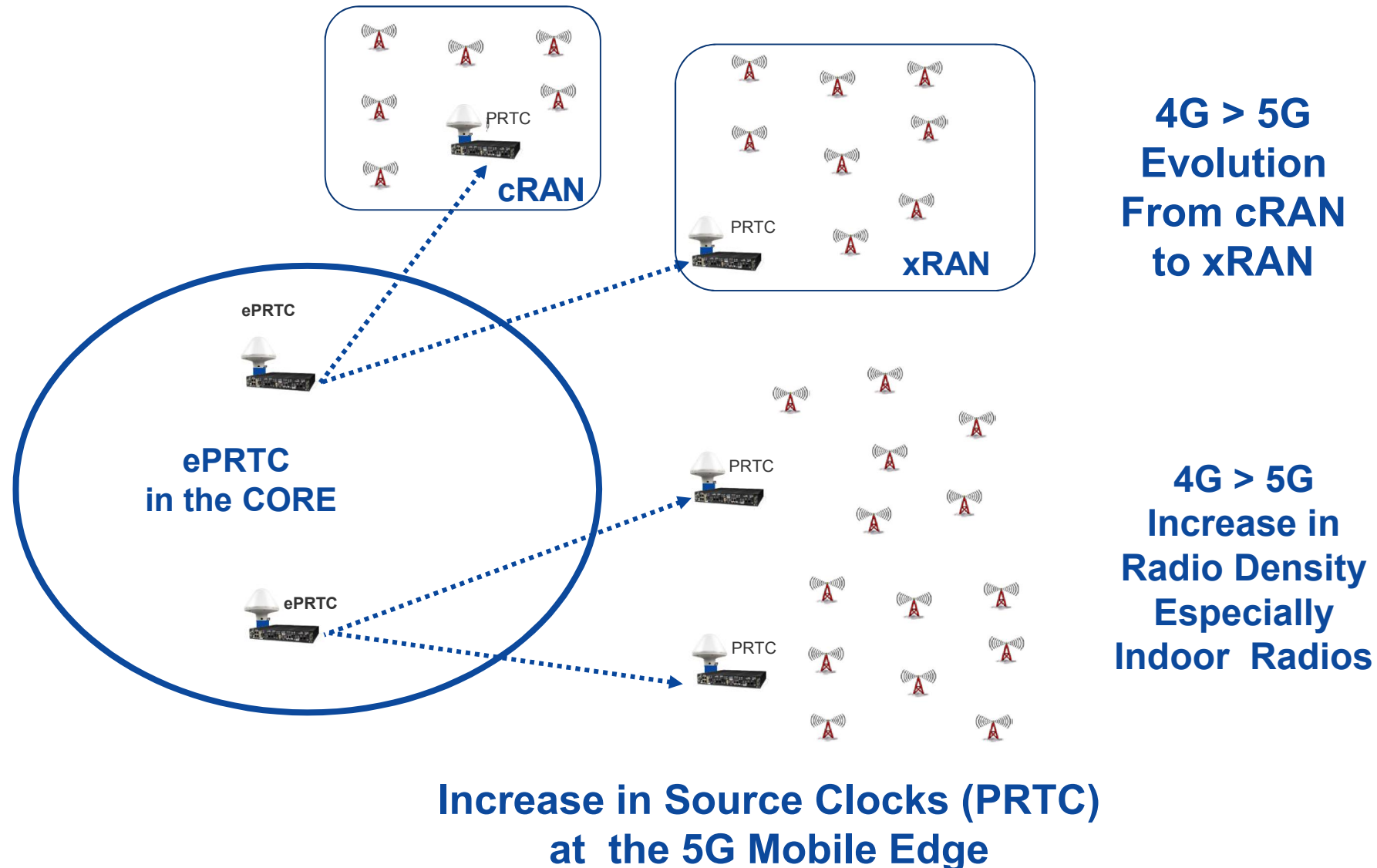




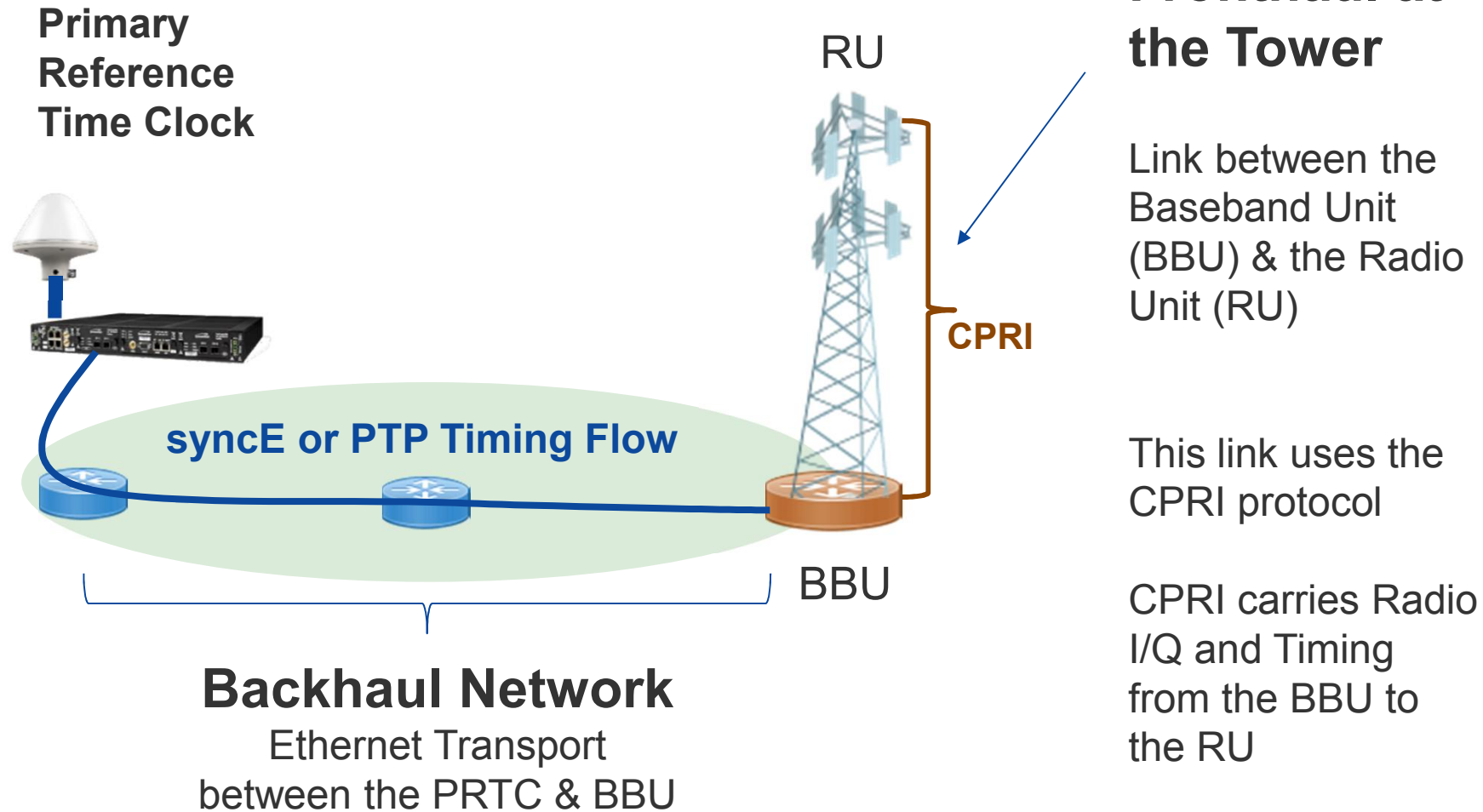
# Synchronization Services For The 5G Fronthaul

Japan Interop, Tokyo, June 2018.

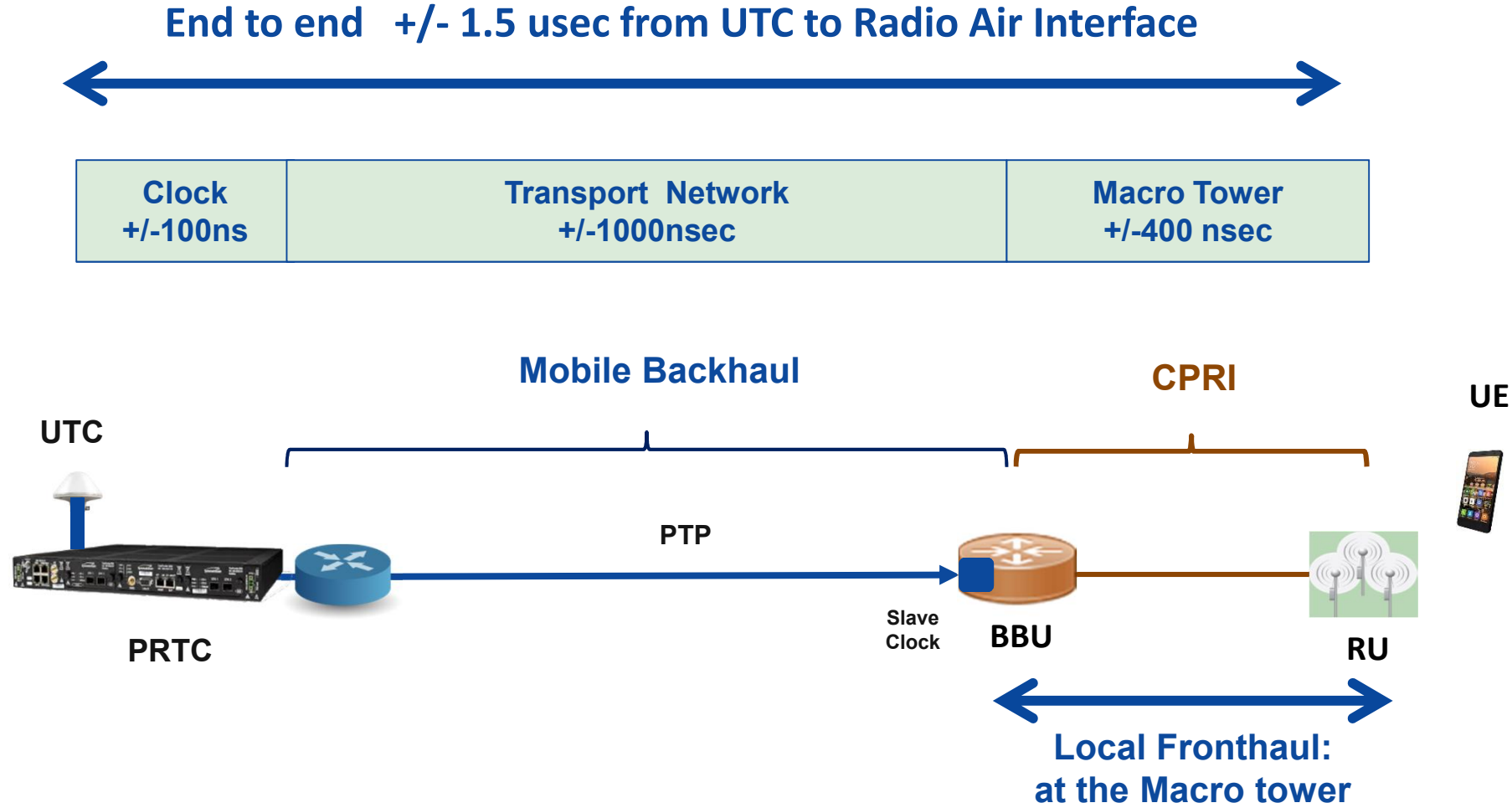
# 5G xRAN Mobile Edge Computing and Radio Densification Will Require New Fronthaul & Timing Architectures



# 3G & 4G Was Focused on Engineering Mobile Backhaul 5G Will Be Focused on Engineering Mobile Fronthaul



# Synchronization = Engineering Timing on the Network from UTC to RU Fronthaul is Included in The Time Error Budget for LTE/5G Macro Services

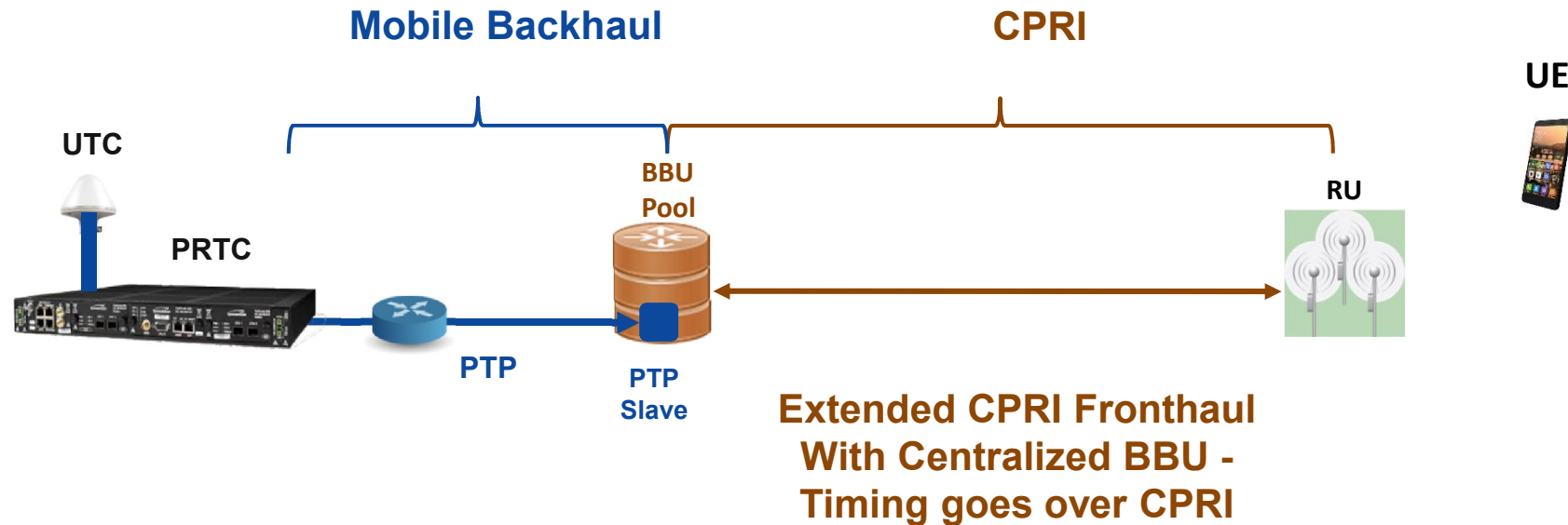


# The Time Error Budget for CPRI / cRAN Fronthaul is same as Local Fronthaul - CPRI / Fiber cRAN has Problems of Scale and Cost

End to end +/- 1.5 usec from UTC to Radio Air Interface



Clock +/-100ns	Backhaul +/-1000nsec	Fronthaul Dedicated Fiber +/-400 nsec
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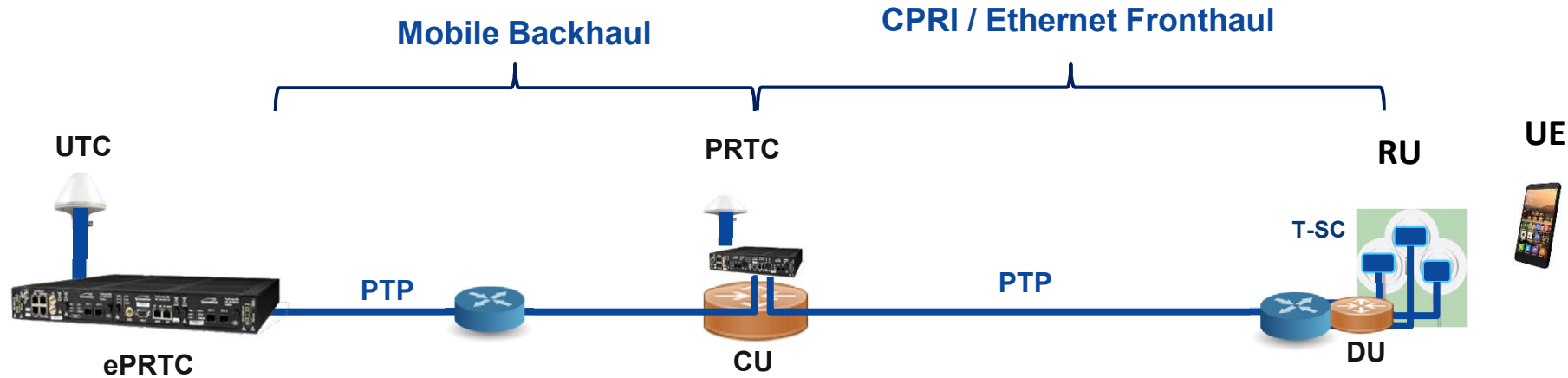


# Time Error Budgets for 5G Fronthaul: Determined by Radio Requirements – Especially Carrier Aggregation for High Bandwidth Services to the UE

End to end +/- 1.5 usec from UTC to Radio Air Interface

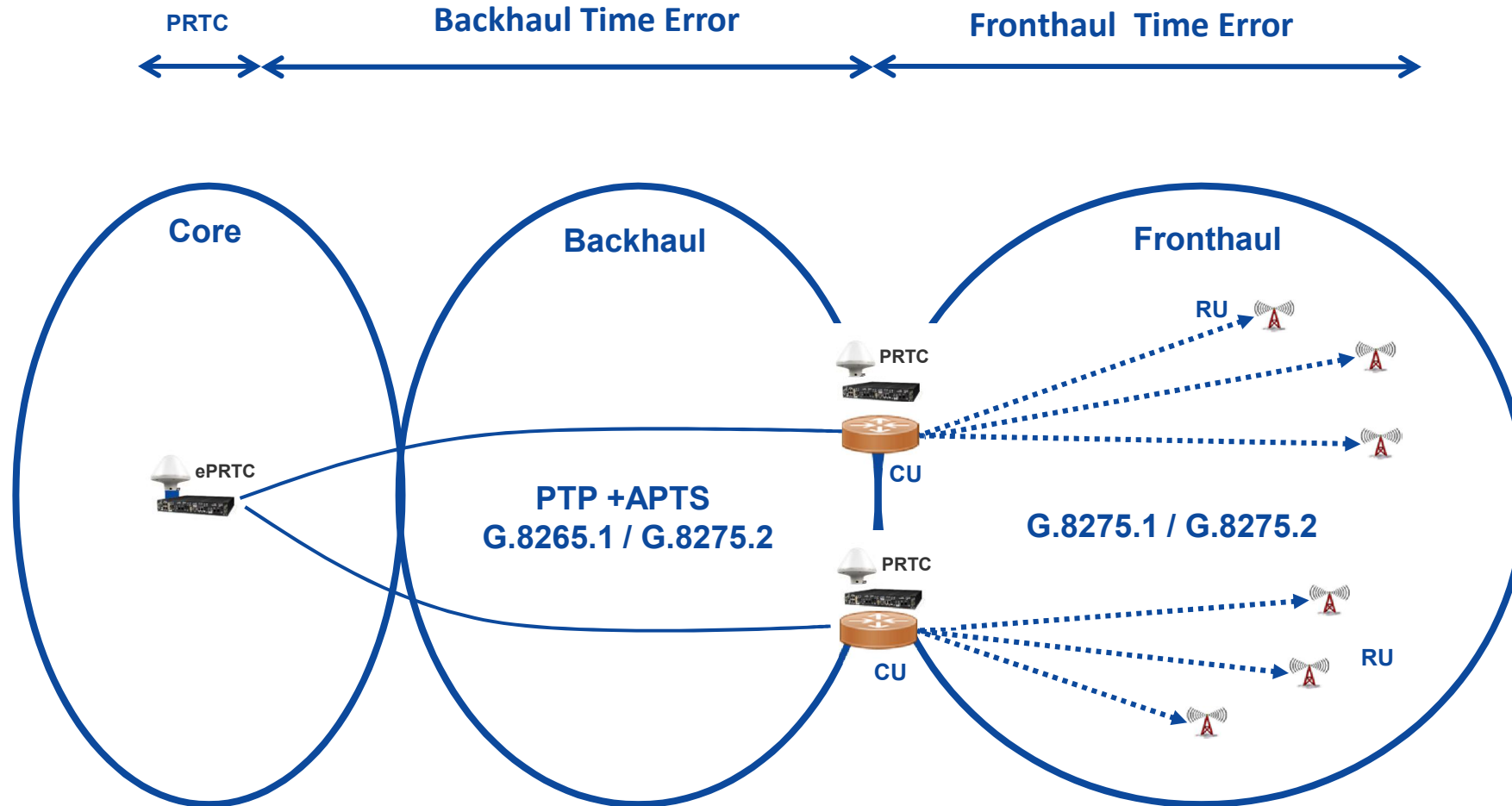


Clock +/-100ns	Backhaul +/-1.1usec – +/-1.325usec	Fronthaul +/-130nsec – +/-400nsec including PRTC and RU
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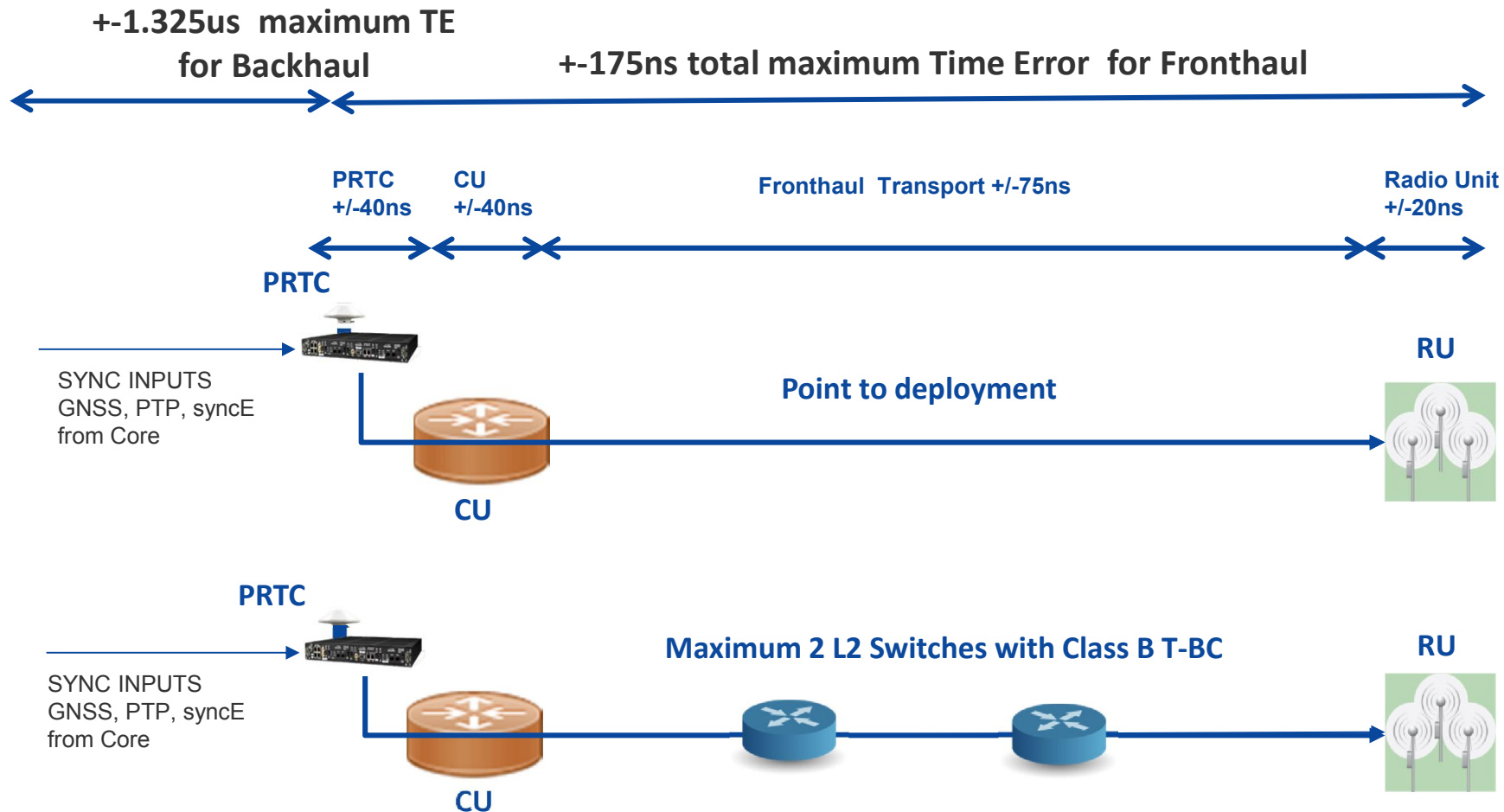


CPRI over Ethernet Fronthaul  
BBU split into CU & DU  
PTP for timing

# Timing Basics for Core, Backhaul, & Fronthaul



# 5G xRAN V1.01 Fronthaul Topologies



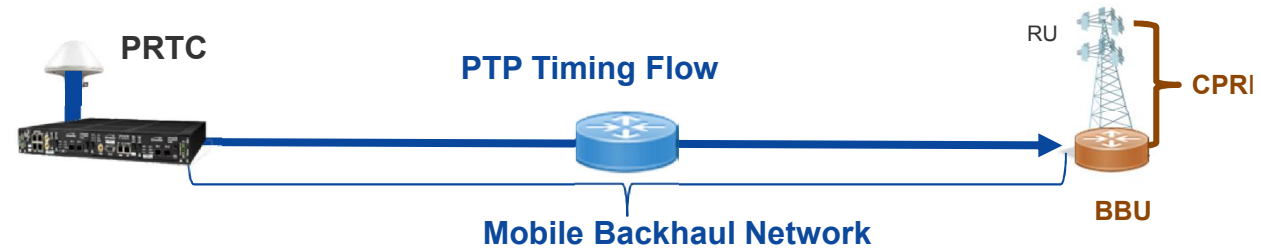
Only these 2 topologies are covered in xRAN version 01.00



# Summary: Local Fronthaul, CPRI cRAN Fronthaul, 5G xRAN eCPRI (CPRI/Ethernet) Fronthaul

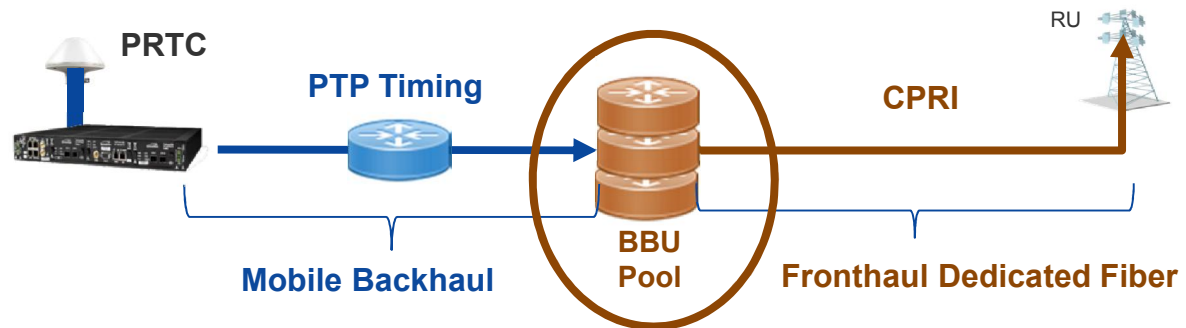
## Macro Tower Fronthaul 3G/4G/5G

- Fronthaul CPRI at the tower for timing



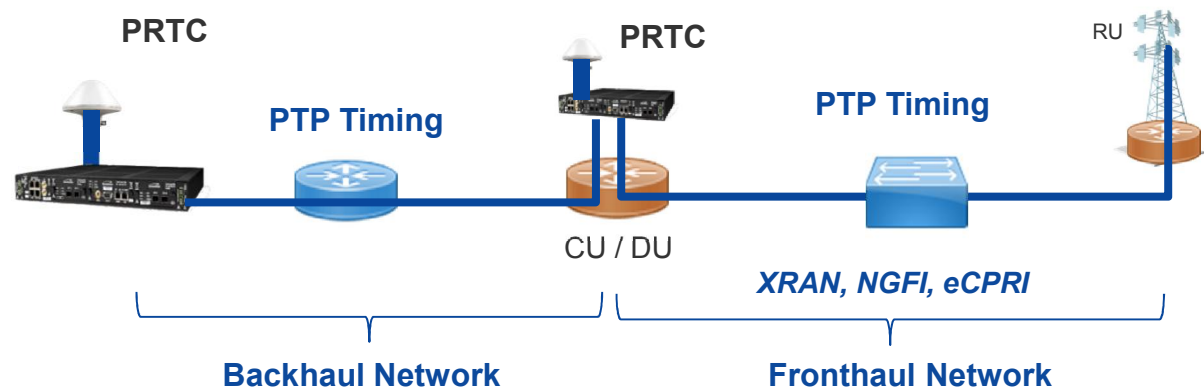
## CPRI cRAN 4G

- Fronthaul from centralized BBU to Remote RU
- CPRI / Dedicated Fiber used for timing



## 5G xRAN

- Fronthaul over Ethernet
- PTP/syncE to RU for timing
- CPRI in PWE for Radio IQ



# Microsemi ePRTC (Core), & PRTC (Mobile Edge)

TC4000  
Or  
5071A



ePRTC

Smart Antenna



TimeSource ePRTC

PRTC



TP5000



TP4100



IGM 1100



# Thank You



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