# Common Public Radio Interface

## CPRI functional decomposition requirements

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# Introduction

- CPRI requirements given in this document are based on the assumption of a base station using CPRI functional decomposition between REC and a RE exchanging IQ data in time domain.

- CPRI does not want to provide requirements on the TSN network architecture but only on the access point to this network: the TSN network is seen as a black box.

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# Introduction

CPRI Basic System Architecture reminder

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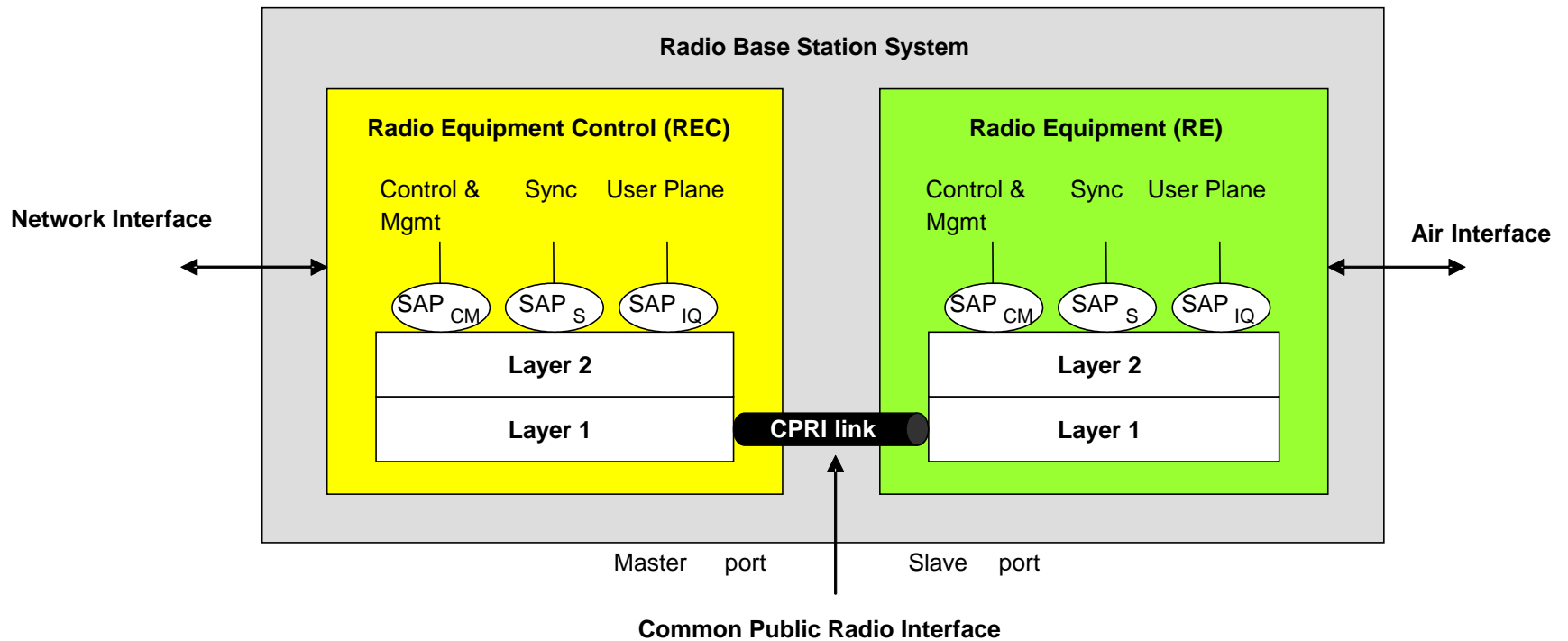
# Informative CPRI background

|  | Synchronization Stream | IQ Data | C&M Data |
|---|---|---|---|
| Traffic type repartition | - | > 90% | < 10% |
| Traffic pattern | - | Constant Bit Rate | Burst |

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# Requirements summary

| | Synchronization Stream | IQ Data | C&M data |
|---|---|---|---|
| Traffic QoS type | Very High | High | Best Effort |
| Security | Under study | Under study | - |
| End-to-End Latency | - | <100µs | - |
| FDV | - | Not specified | - |
| FLR | - | $<10^{-7}$ | $<10^{-6}$ |
| Synchronization timing error | Class A+[1]: $\lvert TE \rvert <$ 10 ns<br>Class A[1]: $\lvert TE \rvert <$ 45 ns<br>Class B[1]: $\lvert TE \rvert <$ 110 ns<br>Class C[2]: $\lvert TE \rvert <$ 1.36 µs<br>Class D[3]: $\lvert TE \rvert <$ TBD | - | - |
| Synchronization frequency error | -[4] | - | - |

- 1) To a common GM (or common TC/BC)
- 2) To any GM
- 3) To any GM , mobile network without  radio interface timing  requirements
- 4) see CPRI Open Issues

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# End to end latency



Reference points for « End to End network latency » requirement

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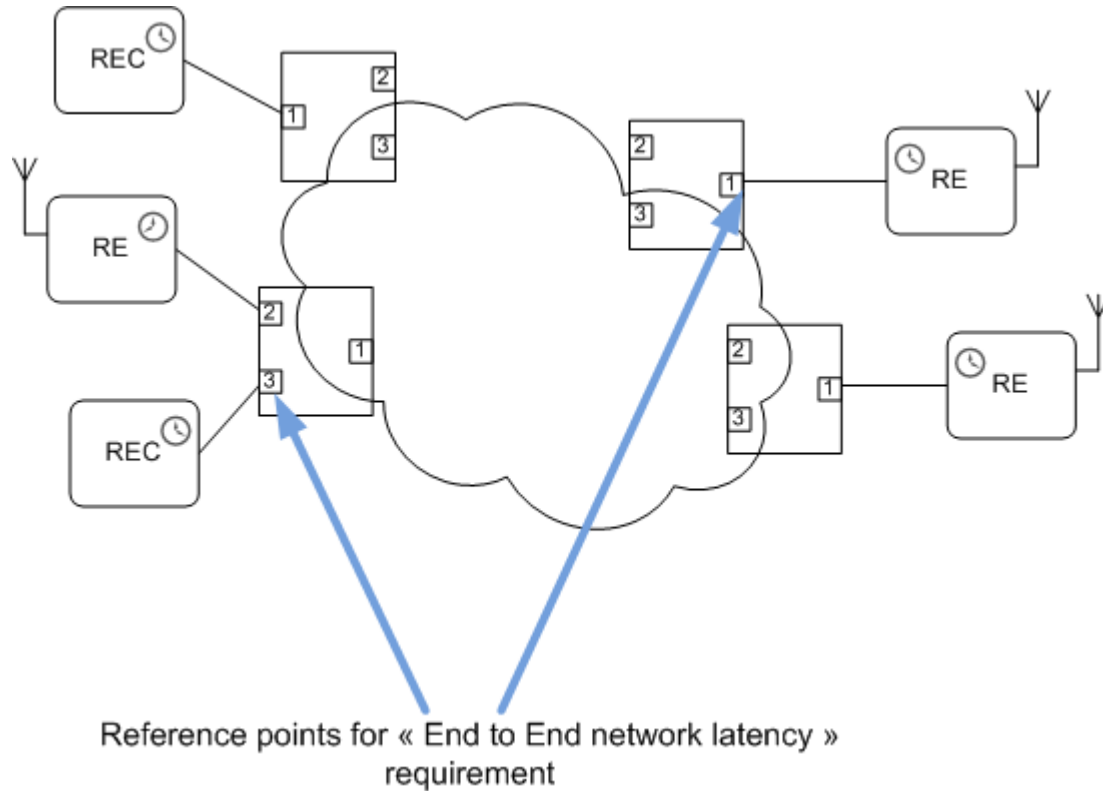
# Synchronization timing error

- Class A+: |TE| < 10 ns          Nice to have
  - **MIMO, Tx-diversity**
- Class A:   |TE| < 45 ns          Must have
  - **CA Intra Contiguous.**
- Class B:   |TE| < 110 ns          Must have
  - **CA Intra Non-Contiguous, CA Inter**
- Class C:   |TE| < 1.36 µs          Must have
  - **LTE TDD**
- Class D:   |TE| < TBD          Must have
  - **LTE FDD**

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# Synchronization timing error

- Class A+, A and B: The timing error of the slave clock in the RE compared to a common GM clock.
  *(No REC need to fulfill Class A+, A or B)*

- Class C and D: The timing error of the slave clock in the RE or REC compared to any GM clock.

  - Here we have allocated 100 ns to the error of the GM clock compared to the real absolute time.

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# Synchronization timing error
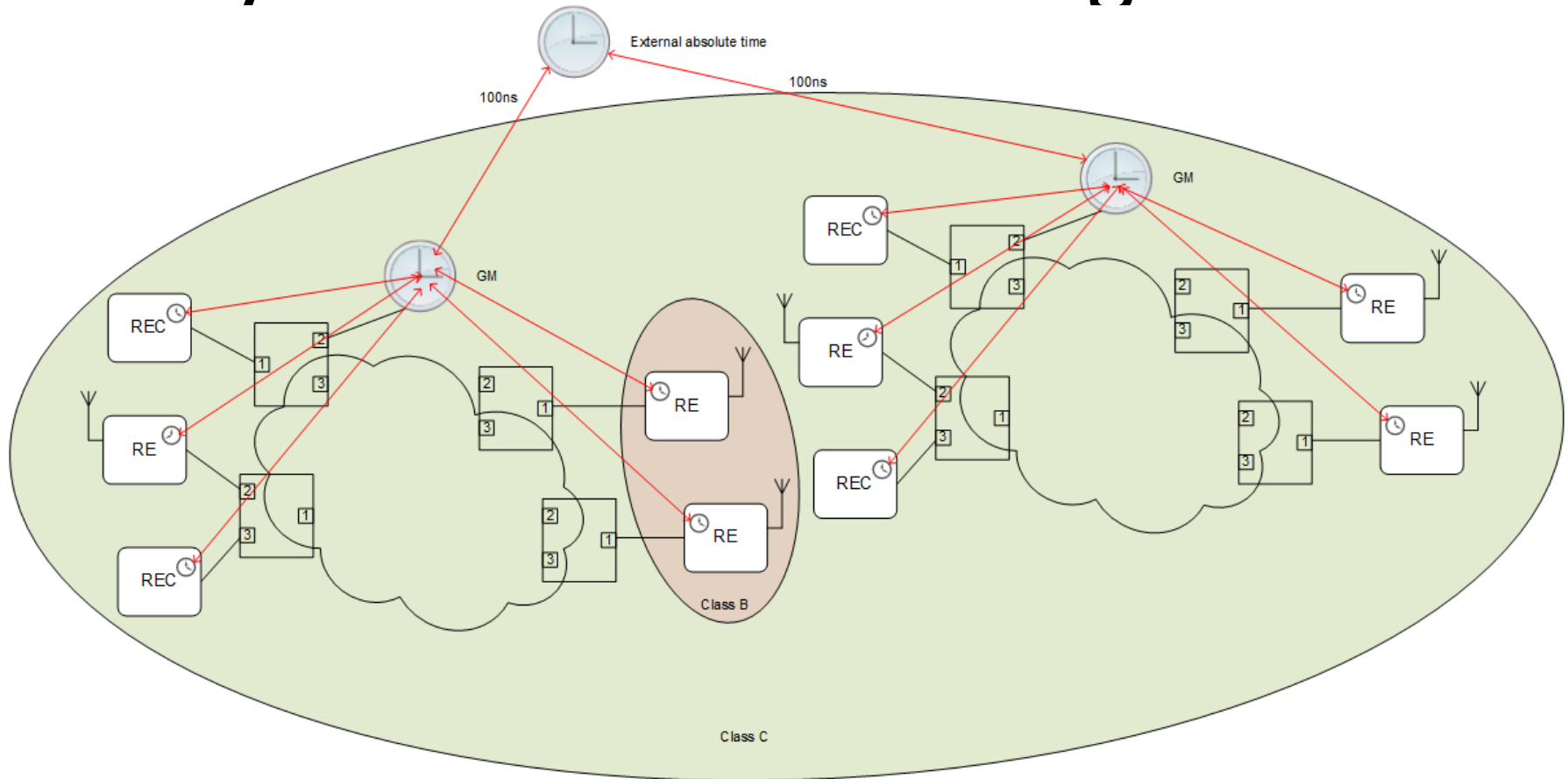


- Example where all REs and RECs need to fulfill Class C and two REs running a feature that require Class B
  - One RE may need to fulfill several classes, see also following slides for an alternative view on Class A+, A and B.

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# Synchronization timing error
# Class A+, A and B

- Alternative informative definition for Class A+, A and B: The timing error of the slave clock in the RE compared to the nearest common BC or TC (between the REs that running a feature that require the specific class).

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# Synchronization timing error
# Class A+, A and B
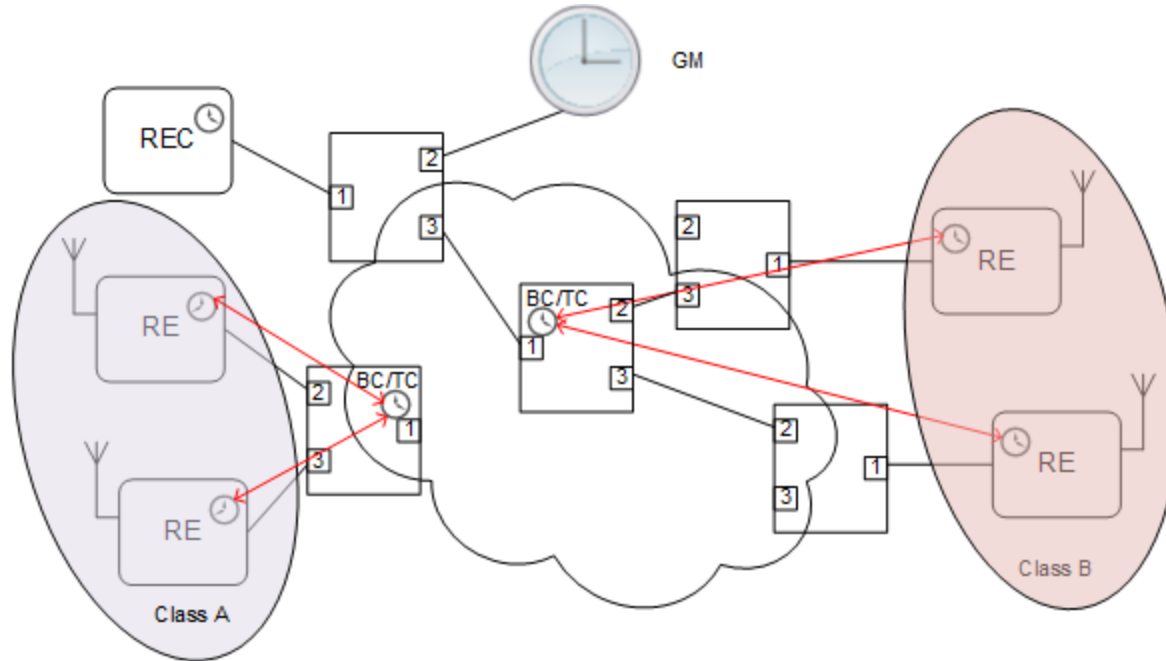


- Two REs running a feature that require Class A but they have a common BC/TC in the first switch
  - This switch is probably located in the same site as the two REs.
- Two other REs are running a feature that requires Class B and have a common BC/TC further down in the network but much closer than the GM.

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# CPRI open issues

- Frequency accuracy
  - required frequency accuracy at air interface is 50ppb (measurement time 1ms)
  - at least one timing accuracy class A(+), B, C has to be fulfilled, i. e. :
    - long term average frequency error relative to GM is 0
    - maximum timing deviation is given by accuracy class limits
    - higher frequency jitter/wander components are filtered
  - are additional requirements for the network (frequency accuracy/jitter/wander/PDV) needed to meet the frequency accuracy at air interface or are existing telecom profiles sufficient?

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# CPRI open issues

- Security
  - Is there any restriction is this domain that may prevent users to ensure data protection and privacy?

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