IEEE Std 802.1CM Time-Sensitive Networking for Fronthaul

An Overview

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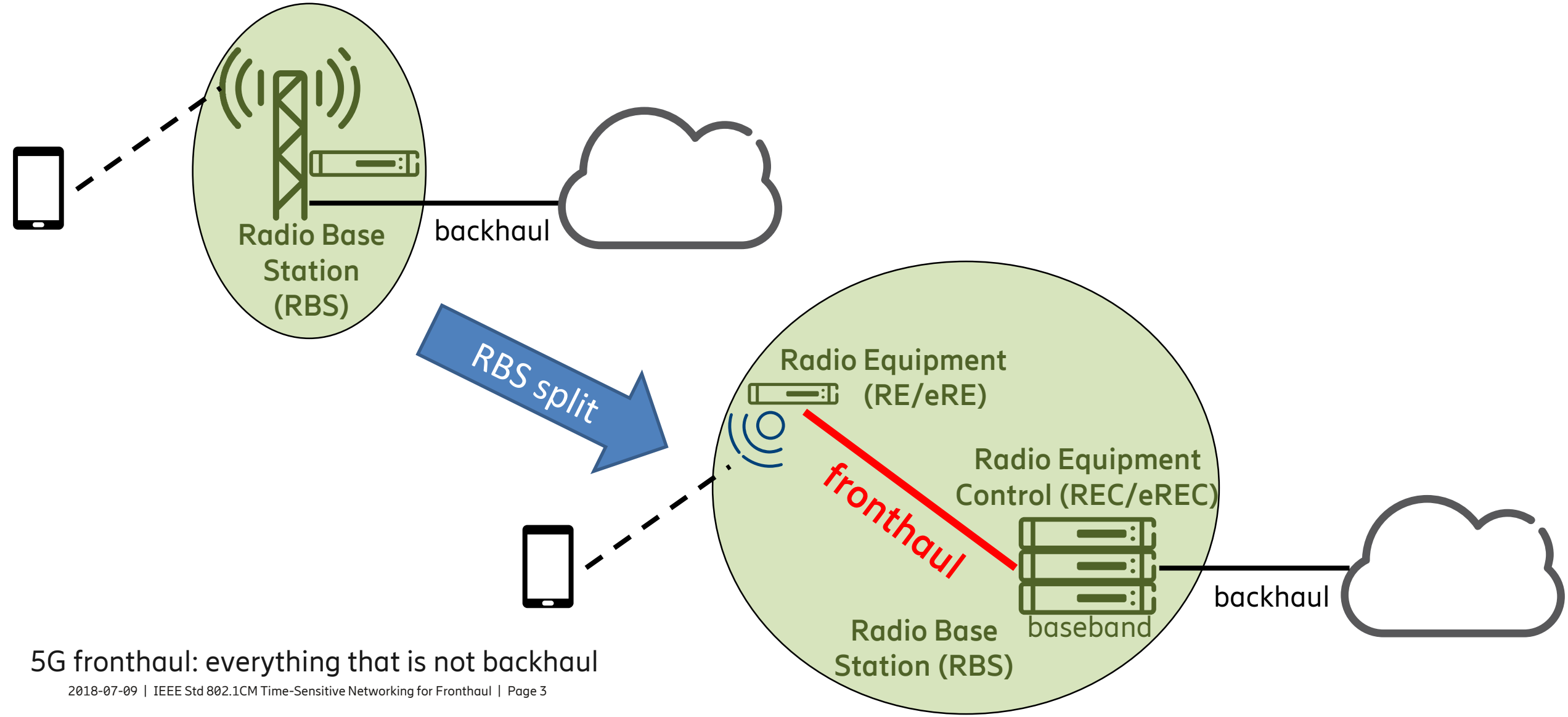
Outline

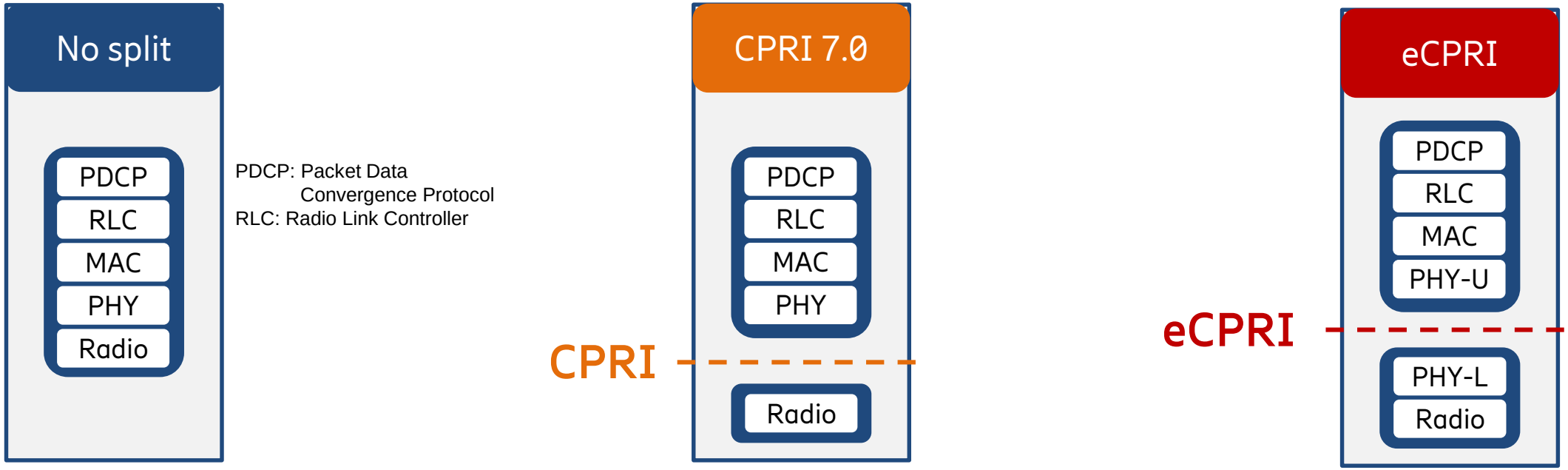
- Introduction
- Ethernet-based fronthaul approach
- Goals and objectives of 802.1CM
- Top Down Approach
- Fronthaul Profiles
- Summary

5G Fronthaul – Simplified Architecture



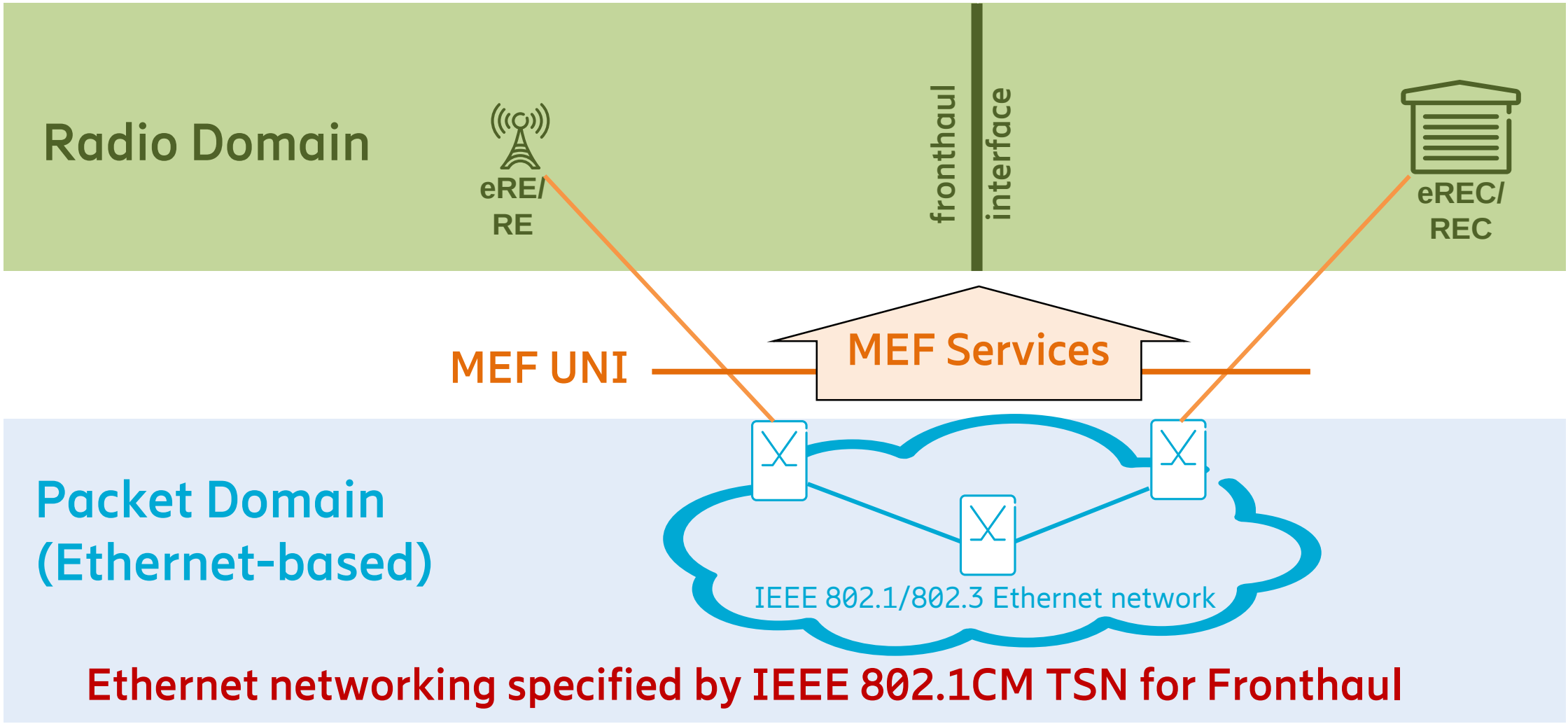
5G fronthaul: everything that is not backhaul

Radio Base Station Split

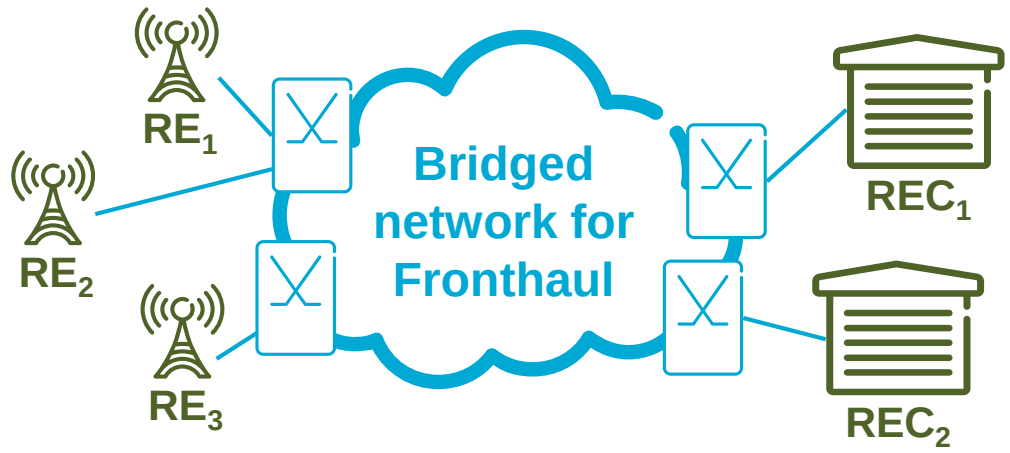


- These splits are in scope of 802.1CM
- Further splits can be addressed by an amendment to 802.1CM

Ethernet-based Fronthaul Approach



Goals & Objectives of 802.1CM



- Standard TSN Profiles for fronthaul
  - Enable the transport of fronthaul streams in a bridged network
- A TSN Profile
  - Specifies aspects of bridge operation
  - Set of feature and option selections
  - Configuration guideline

Top Down Approach

1. Collecting requirements
   - CPRI Cooperation provided use cases and requirements
   - Class 1: RBS split is according to CPRI specification
   - Class 2: RBS split is according to eCPRI specification
   - Synchronization: same for both Class 1 and Class2
2. Collecting the packet networking and synchronization features to address requirements
   - Bridging features and characteristics
   - Time-Sensitive Networking features
   - Synchronization solutions and approaches
     - ITU-T Q13/15 contributions (e.g., how to leverage the Telecom profile of IEEE 1588)
3. Specifying solution details
   - Profiles specify how to meet the fronthaul requirements in an Ethernet network

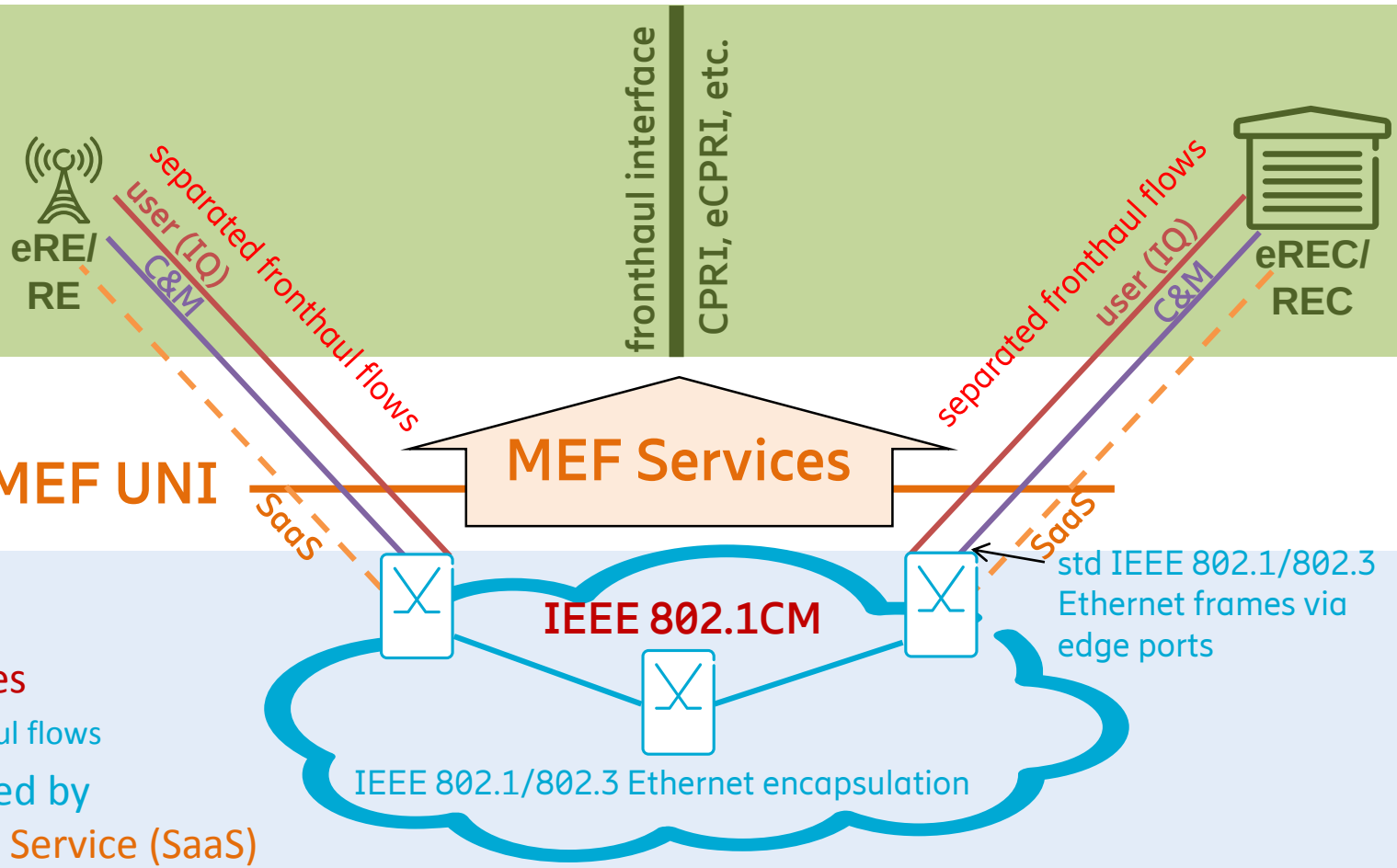
Fronthaul Profiles

- Profiles are engineered taking into account the worst-case
- The two 802.1CM Profiles are applicable to both Class 1 (CPRI) and Class 2 (eCPRI)
- **Profile A**
  - Keep it as simple as possible
  - Based on strict priority
    - User data (IQ data) → high priority traffic class
    - C&M data → lower priority traffic class
  - Max frame size for all traffic: 2000 octets (IEEE Std 802.3)
- **Profile B**
  - Leverage a simple TSN feature: frame preemption (802.3br & 802.1Qbu)
  - Strict priority + frame preemption
    - Fronthaul traffic → high priority traffic class; express traffic
    - Non-fronthaul traffic → lower priority traffic class; preemptable traffic
  - Frame size maximized for fronthaul traffic (2000 octets)
  - Frame size is flexible for non-fronthaul traffic

Ethernet-based Fronthaul Details

Radio Domain

- fronthaul flows are separated, e.g., by priority, VID
- synchronization is separated from fronthaul data flows



Packet Domain

- IEEE 802.1CM Fronthaul Profiles
  - meet the requirements of fronthaul flows
- Synchronization can be provided by packet network, e.g., Sync as a Service (SaaS)

Summary

- IEEE Std 802.1CM specifies TSN Profiles for Fronthaul
- It has been developed via a collaborative effort between the CPRI Cooperation and IEEE 802.1
- The project took a top down approach: requirements → solution
- Requirements have been provided by CPRI Cooperation
- Two Fronthaul Profiles are specified in 802.1CM
- Both eCPRI and CPRI splits are supported