Radio over Ethernet Motivation, scope, timeline

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Motivation

The NG Mobile Network: Factors of 10+

	Today (LTE Rel-12)	Next Generation (5G)
Base Station Uplink	1G+	10G+
Channel Bandwidth	20 MHz 100MHz with CA	200 MHz+
Antennas / Sector	<10	100+
Fibers / Base Station	<100	1,000+

Today's platforms cannot scale to meet these requirements.

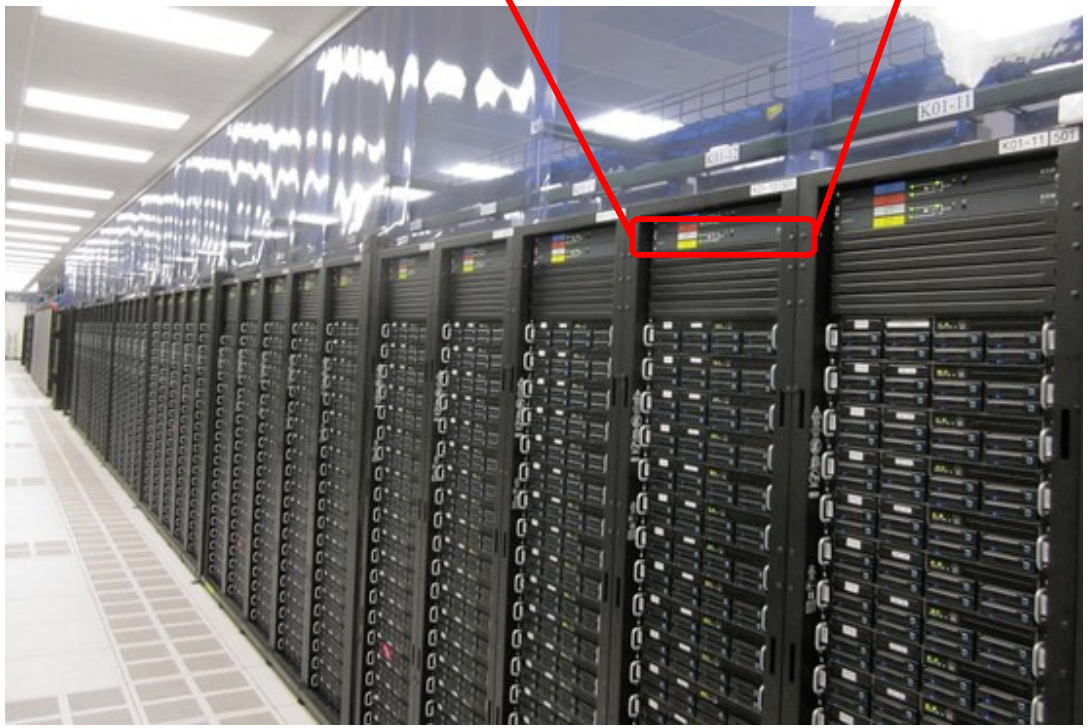
A networked solution is required to enable:

- Load balancing / resource pooling
- Cooperative-mode operation (MIMO, beam-steering)
- Dynamic power management

Data-Center Market is Driving Ethernet Speed and Capacity Growth

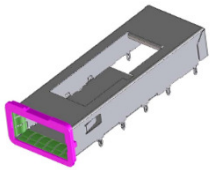
Multi-Terabit Switch in a 1-RU Box

High Volume Market



Optics are Keeping Pace:

- Faster,
- Smaller form-factor,
- Lower power.

Mass Market	 QSFP		 SFP	
Now	4 x 2.5G	QSFP	GE	SFP
Now	4 x 10G	QSFP+	10GE	SFP+
2015*	4 x 25G	QSFP-28	25G	SFP-28
2017*	4 x 50G	QSFP-50	40G / 50G	SFP-50

***Projections**

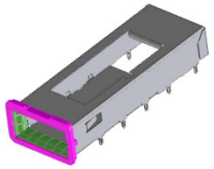
Ethernet & Optical-Module Roadmap

Optical Modules

SFP Family
- Single fiber
- Single λ pair

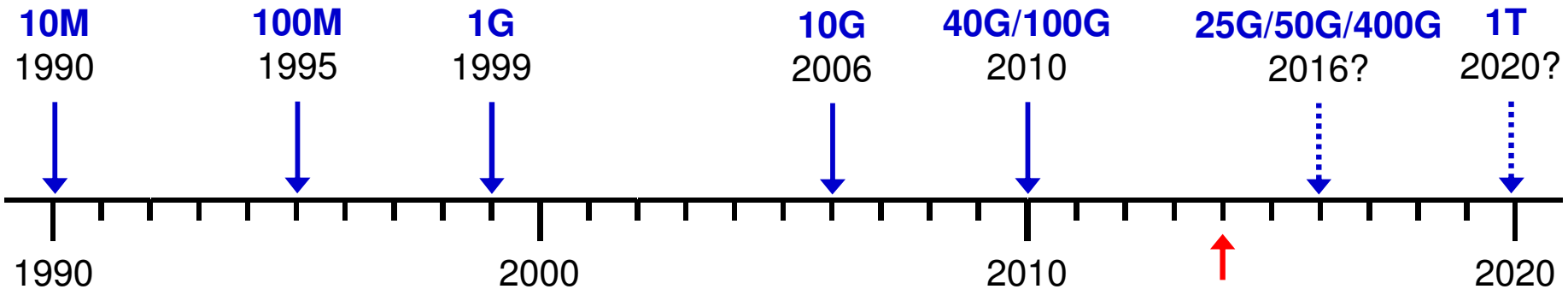
1G → 10G → 25G (2015?) → 40G/50G (PAM-4) (2017?)

QSFP Family
- Four fibers
- Four λ pairs



10G → 40G → 100G (2015?) → 200G (PAM-4) (2017?)

Link Speeds

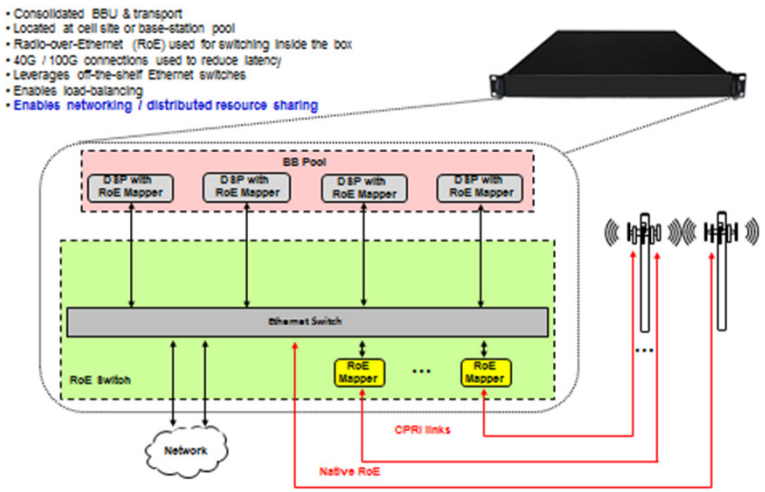


Benefits in brief…

- Unified transport based on Ethernet - Scalability!
- Capitalize enterprise and data-center market driven Ethernet developments for Radio over Ethernet based solutions:
  - Ethernet speed and capacity growth 25/40/100Gigs.
  - Flexibility for transport and load balancing.
  - High volumes push costs down.
- Better utilization of deployed fiber infrastructure for remote radio head connectivity.
- Allow utilizing existing copper cabling for indoors deployments of remote radio heads / small cells.

Use Case examples..

Use case - NG Base Station

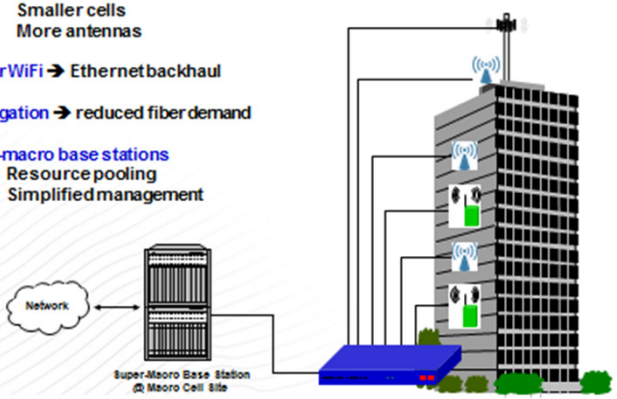


Use cases - RoE for Front-Haul Aggregation

Trends

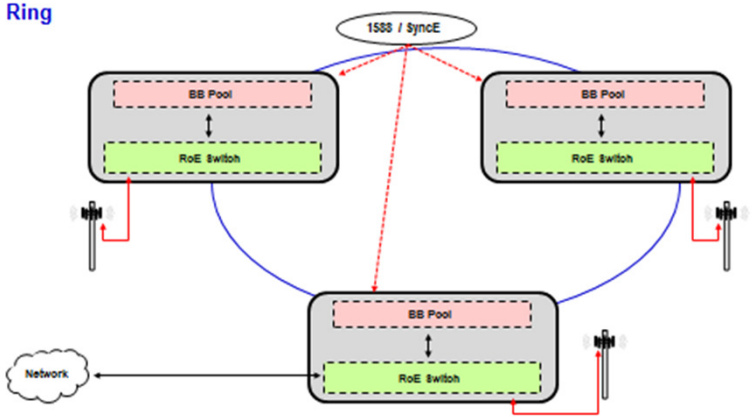
- Densification for increased capacity
  - Smaller cells
  - More antennas
- Carrier WiFi → Ethernet backhaul
- Aggregation → reduced fiber demand
- Super-macro base stations
  - Resource pooling
  - Simplified management

Radio Types
- Macro
- Small / Nano



Many Topologies are Possible

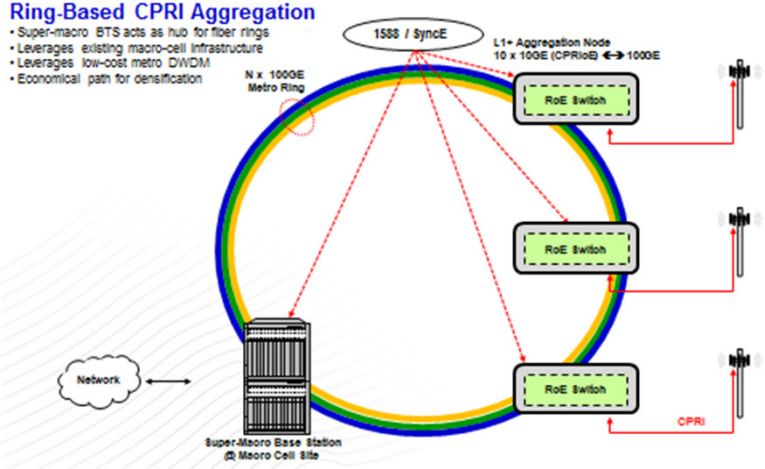
Ring



Many Topologies are Possible

Ring-Based CPRI Aggregation

- Super-macro BTS acts as hub for fiber rings
- Leverages existing macro-cell infrastructure
- Leverages low-cost metro DWDM
- Economical path for densification



Scope

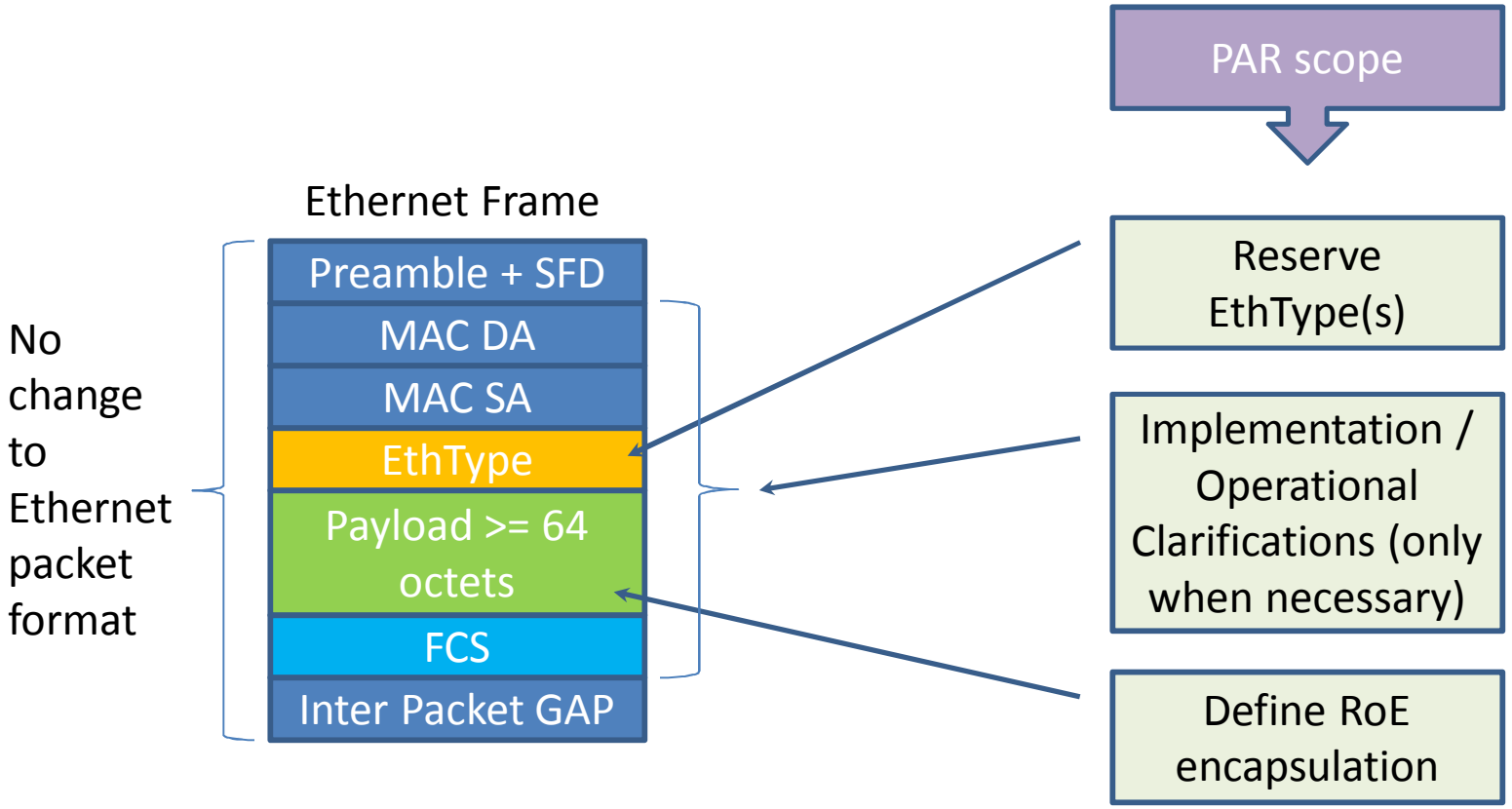
Scope of the Intended Work

1. The encapsulation of digitized radio In-phase Quadrature (IQ) payload, possible vendor specific and control data channels/flows into an encapsulating Ethernet frame payload field:
   -> define a Native RoE Format.

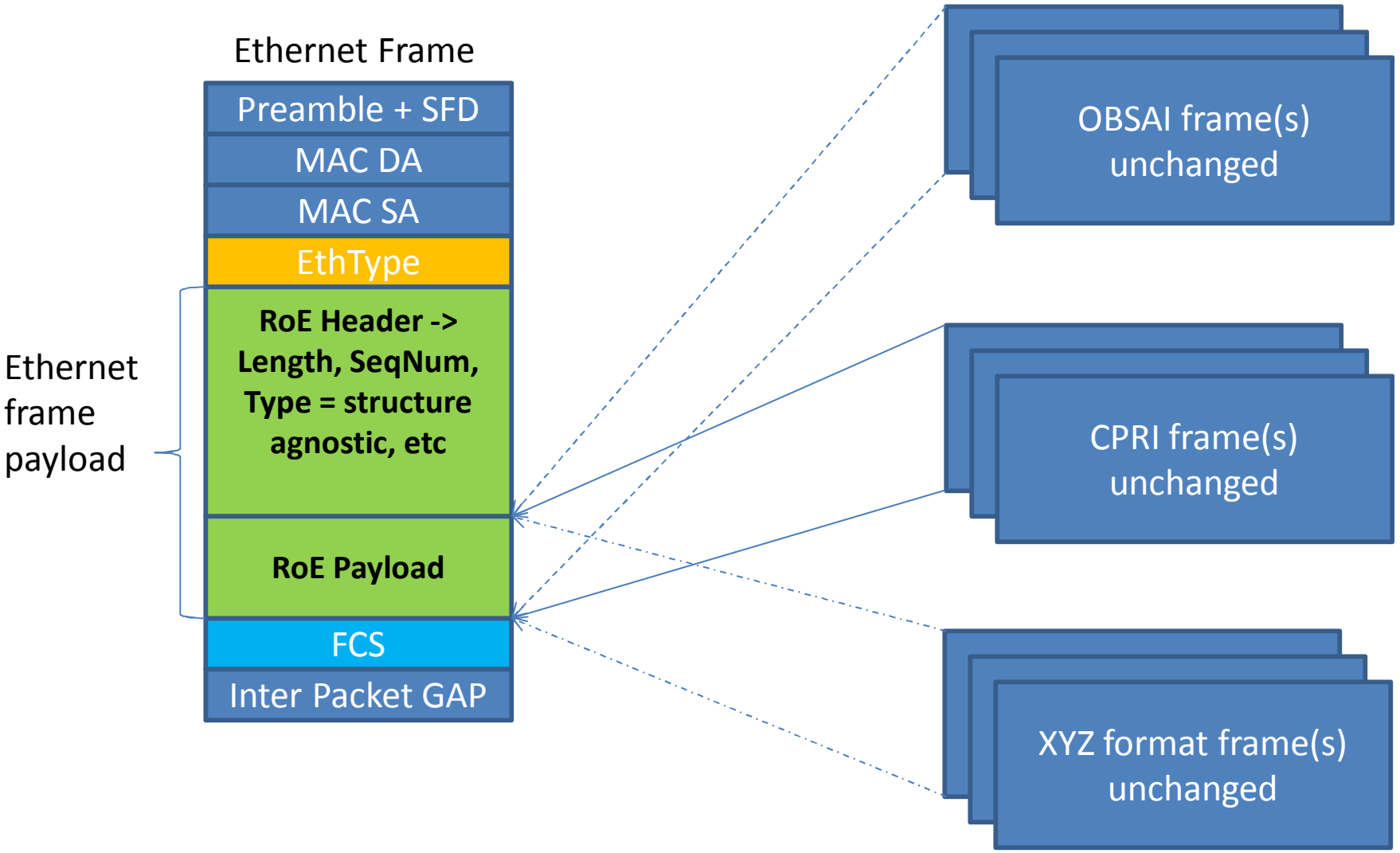
2. The header format for both structure-aware and structure-agnostic encapsulation of existing digitized radio transport formats. The structure-aware encapsulation has detailed knowledge of the encapsulated digitized radio transport format content. The structure-agnostic encapsulation is only a container for the encapsulated digitized radio transport frames:
   -> allow alien format encapsulation and transport.

3. A structure-aware mapper for Common Public Radio Interface (CPRI) frames and payloads to/from Ethernet encapsulated frames. The structure-agnostic encapsulation is not restricted to CPRI:
   -> define a "CPRI to Native RoE Format" mapper.

RoE encapsulation overview – Ethernet packet remains unchanged



RoE Encapsulation Alternatives: Structure Agnostic Encapsulation



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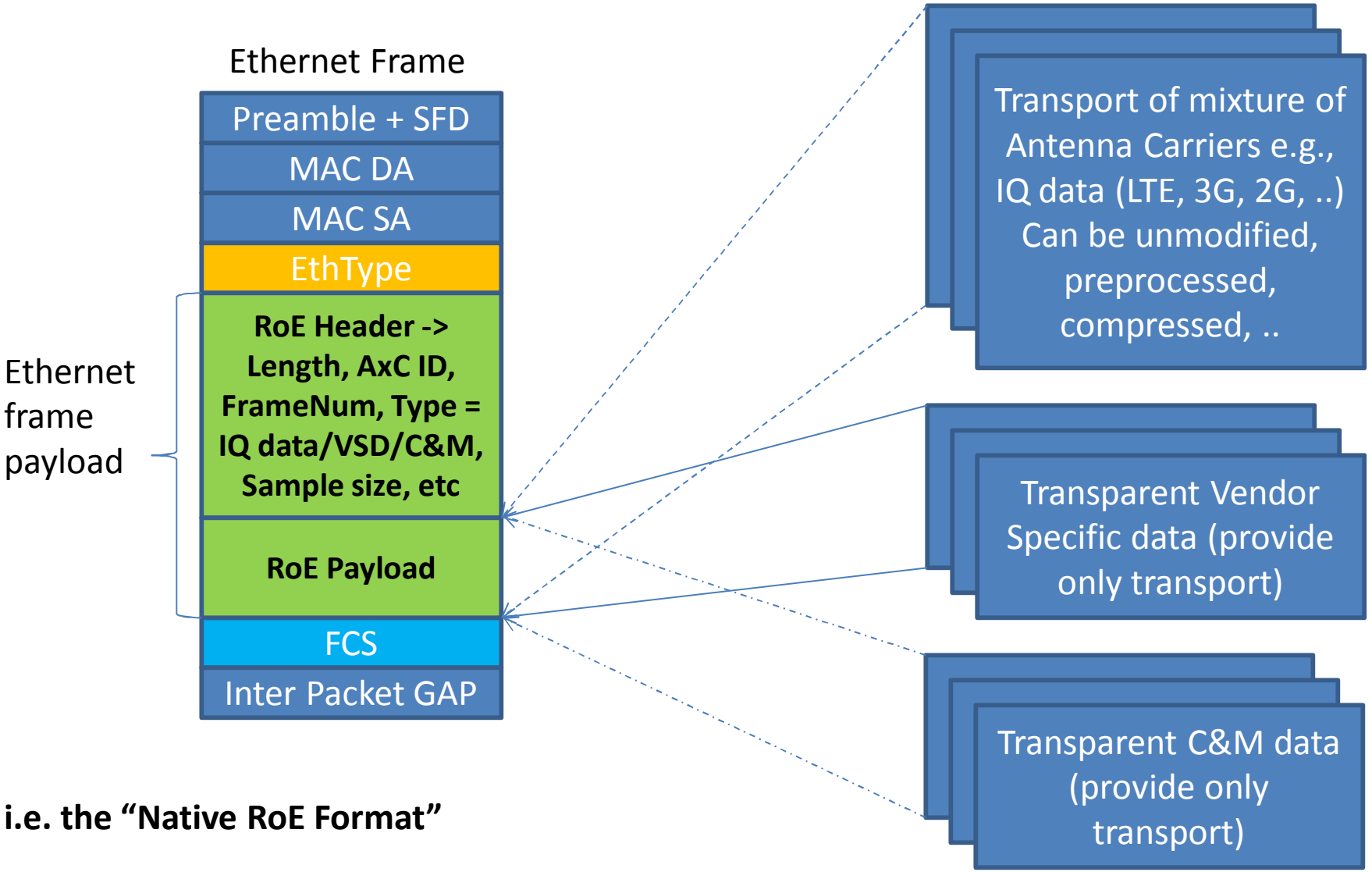

i.e. the "Native RoE Format"

RoE Structure Aware Encapsulation: Definition of a CPRI mapper

- Detail at least one default mapper – for CPRI format.
  - For cases where legacy format is also needed in addition to the native RoE format for transport.
  - Note! Mappers for other formats than CPRI also possible depending on the contributions from proponents.
- Knowledge of Basic Frames and Hyper Frames structure, etc:
  - Allow conversion from CPRI->RoE->CPRI.
- How to decompose and transport CPRI payloads in using RoE:
  - AxC flows and/or AxC Group flows,
  - Vendor Specific data,
  - Slow C&M flows and Fast C&M flows.
- Mapper is still on the transport level, it is not interested in the details of the data or flow content -> application level issue and out of scope of the PAR.

Timeline

Rough timeline

- 2014/10/20 PAR Submission; done
- 2014/11 Approve the RoE TF in 1904.
- 2015/1Q Initiate the RoE TF (pending NesCom etc approvals)
- 2016/11 Initial Sponsor Ballot (well.. We want to complete earlier..)
- 2017/05 Submittal to RevCom (well.. We want to complete earlier..)
- 2017/05 Revisit PAR for future work (well.. We want to do that earlier..)