Interoperable ATO over ETCS Level 2

Early Implementation - Mexico-Toluca Interurban Line

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Summary

1. Background
   - Key elements for Automation
   - Grades of Automation
   - Benefits of ATO
   - Metro VS Mainline
   - Operational Interoperability

2. UNISIG approach
   - Proposed Architecture
   - AoE: the road to maturity

3. AoE early implementation
   - Mexico-Toluca Interurban Line
   - Requirements
   - Architecture

1. Background: Key elements for Automation

- **Automatic Train Operation (ATO)**
  - Provides the Automation functions

- **Automatic Train Protection (ATP)**
  - Provides the Safety functions

1. Background: Grades of Automation

Grades of Automation	Type of train operation	Setting train in motion	Stopping train	Door closure	Operation in event of disruption
GoA 1	ATP with driver	Driver	Driver	Driver	Driver
GoA 2	ATP and ATO with driver	Automatic	Automatic	Driver	Driver
GoA 3	Driverless	Automatic	Automatic	Train Attendant	Train Attendant
GoA 4	Unattended Train Operation	Automatic	Automatic	Automatic	Automatic

1. Background: Benefits of ATO

- **Punctuality:** More regular and predictable run times between stations, eliminating the variations inherent with manual driving.

- **Capacity:** achieved by decreasing the operational headway

- **Energy consumption:** trains are driven according to optimum speed profile that minimizes the energy consumption.

- **Passenger Comfort:** smother and homogeneous driving, providing more uniform ride quality.

- **Wearing:** reduces the wear-and-tear on train propulsion and braking systems and required less maintenance operations.

1. Background: Metro vs Mainline Conditions

| METRO	MAINLINE
Single Operator	Multiple Undertakings
Limited types of train	Different types of train "Interoperable" trains needed
Closed Infrastructure	Open infrastructure
Single vendor for Signalling (trackside / onboard)	Multiple vendors for Signalling

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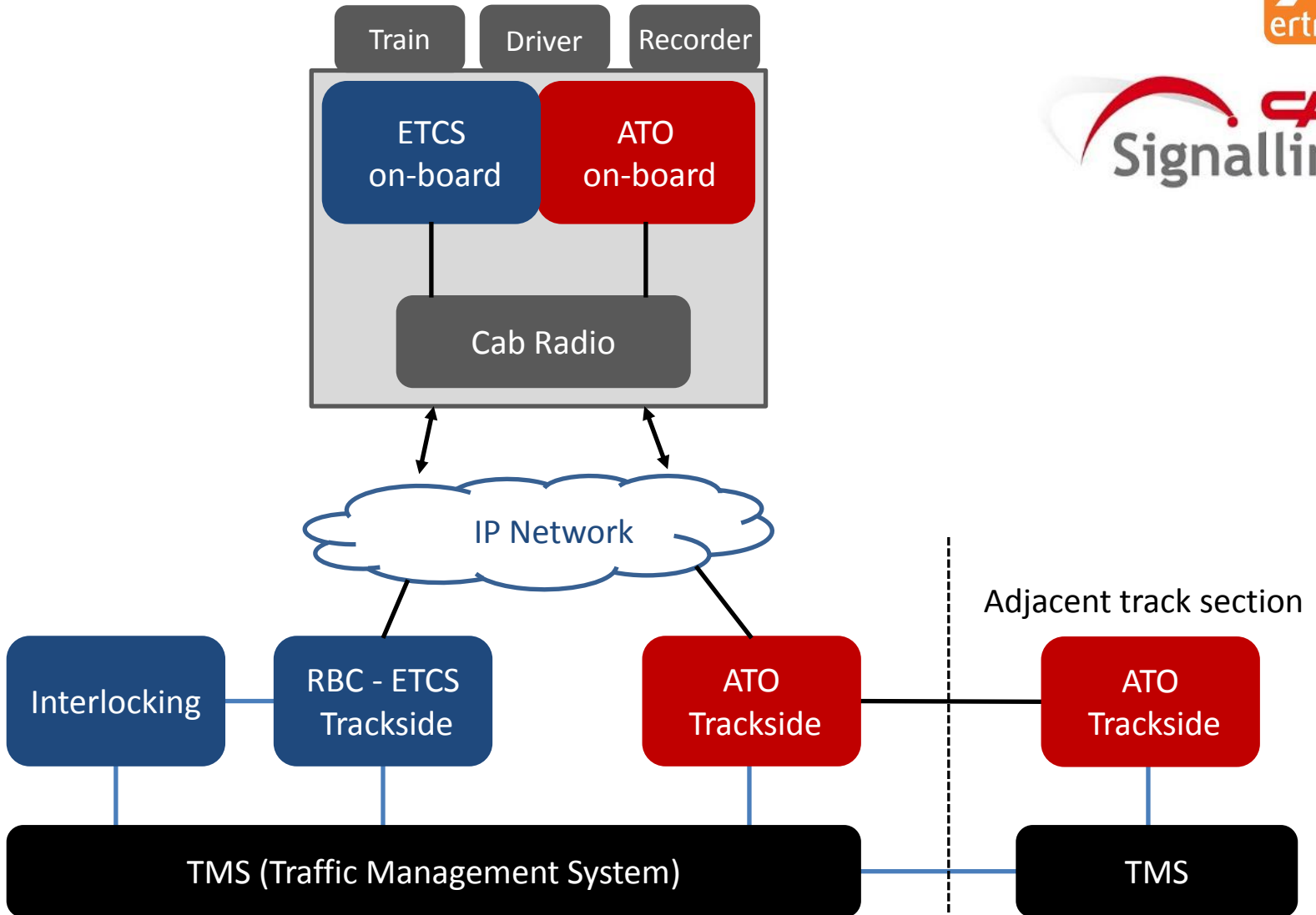INTEROPERABILITY NEEDED

CAF Signalling
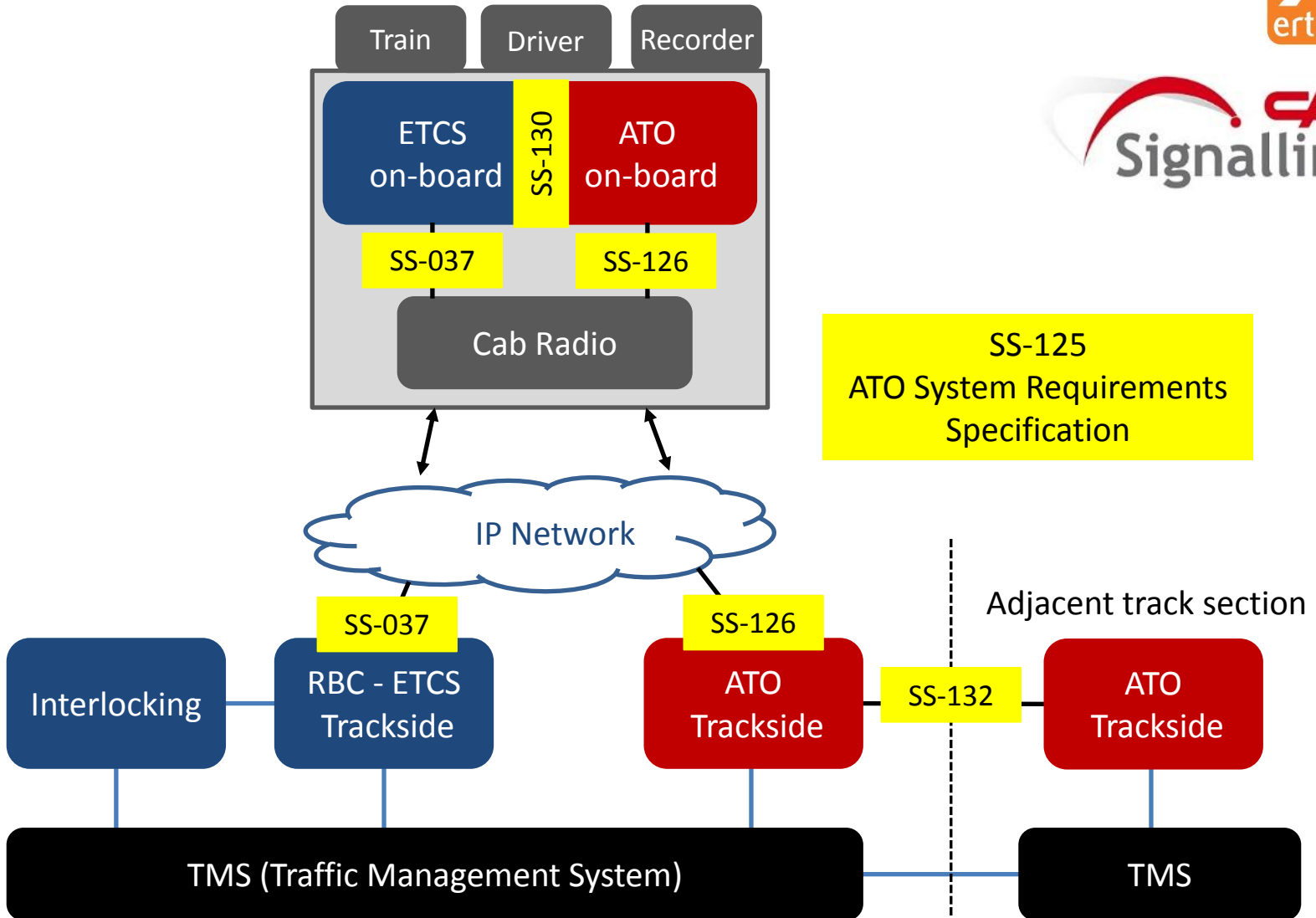
1. Background: Operational Interoperability
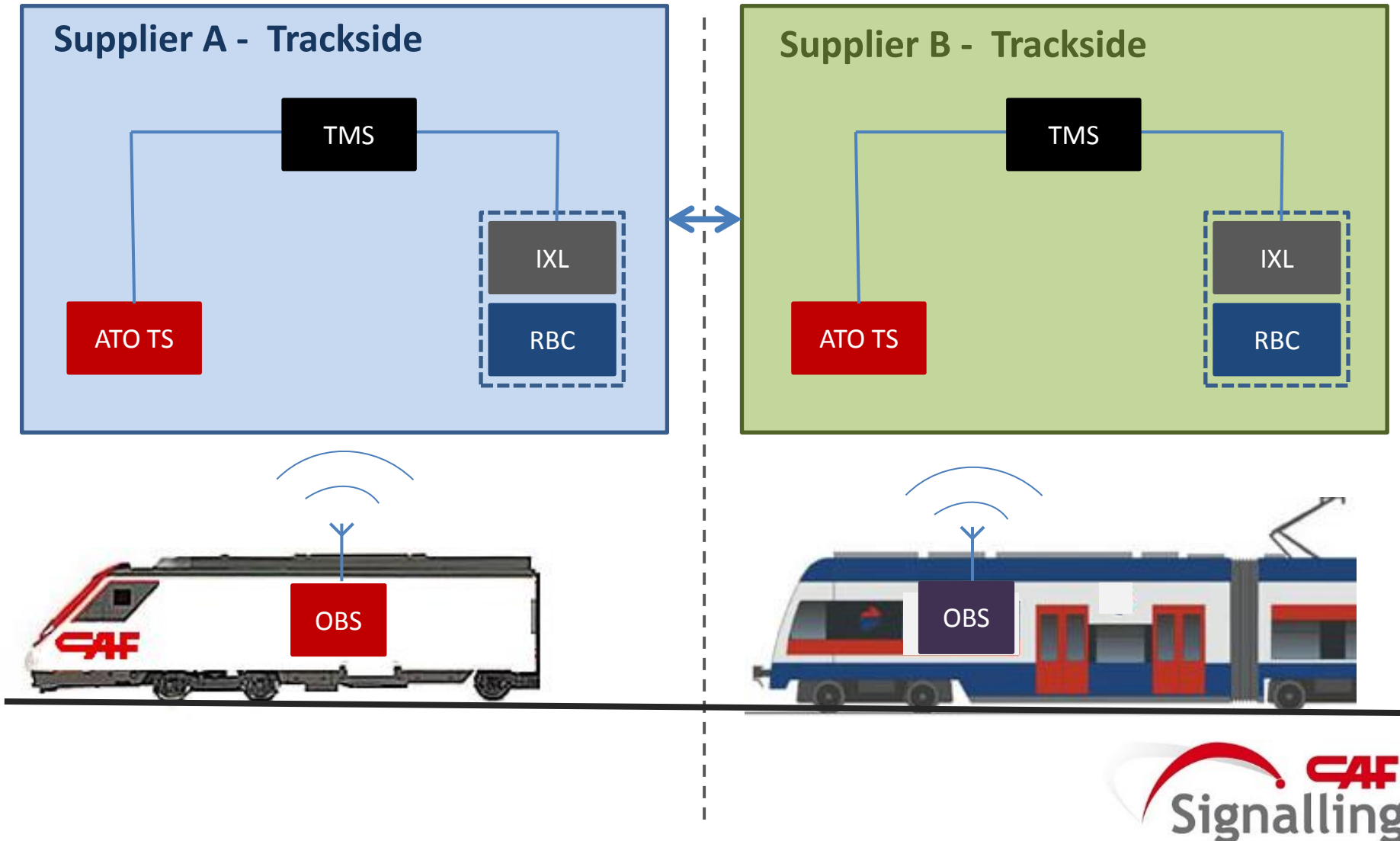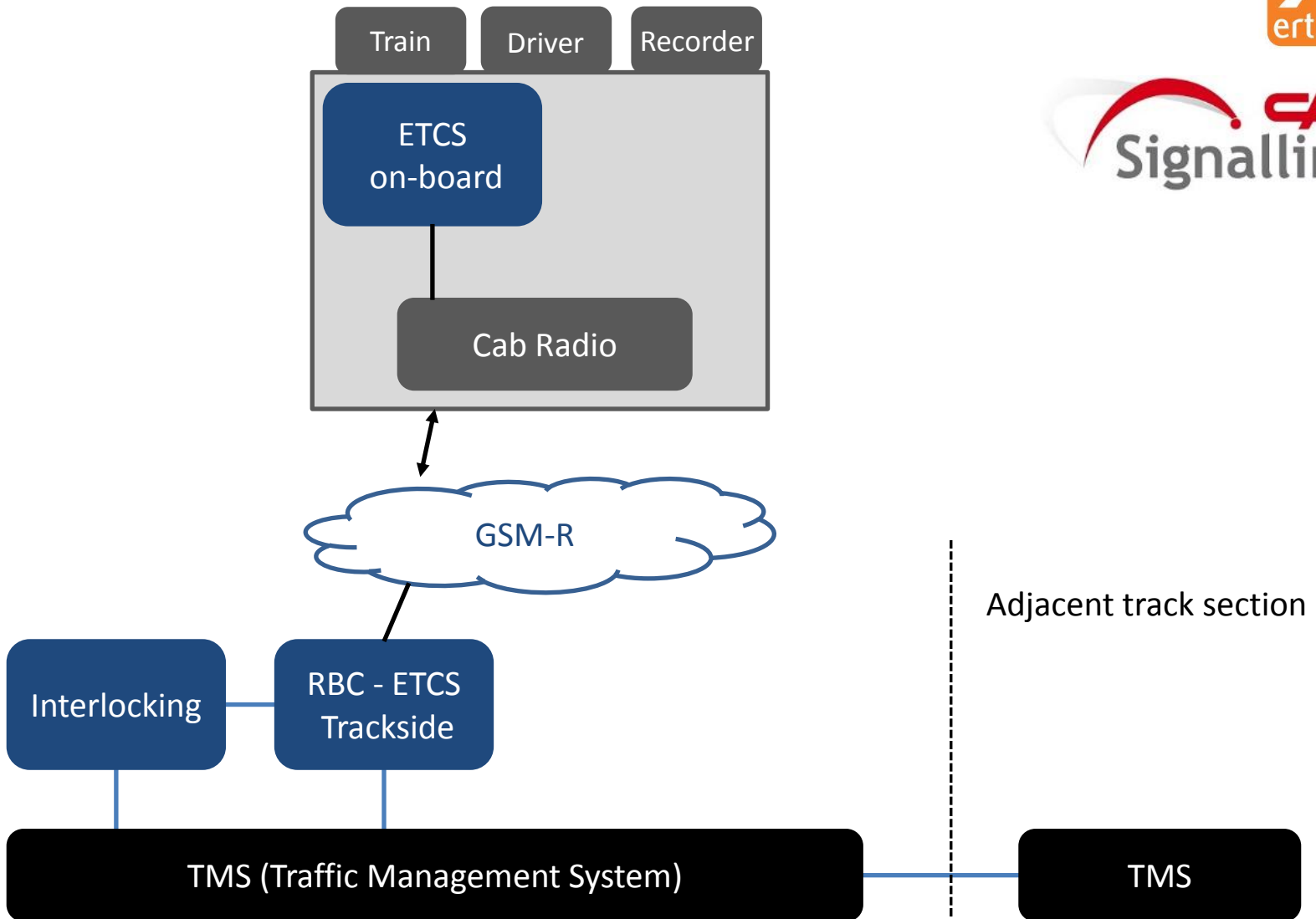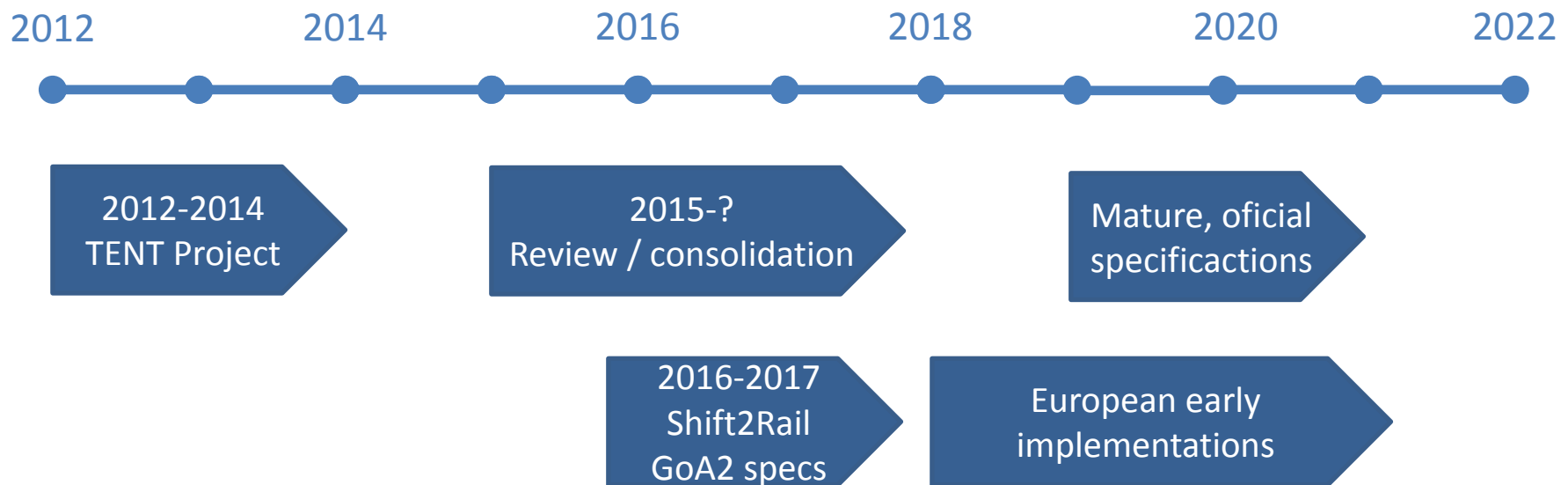
2. UNISIG approach: Proposed Architecture

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2. UNISIG approach: AoE: the road to maturity

2012   2014   2016   2018   2020   2022

2012-2014
TENT Project

2015-?
Review / consolidation

Mature, oficial
specificactions

2016-2017
Shift2Rail
GoA2 specs

European early
implementations

2. UNISIG approach: AoE: the road to maturity

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**2015-2018
Mexico – Toluca Project**
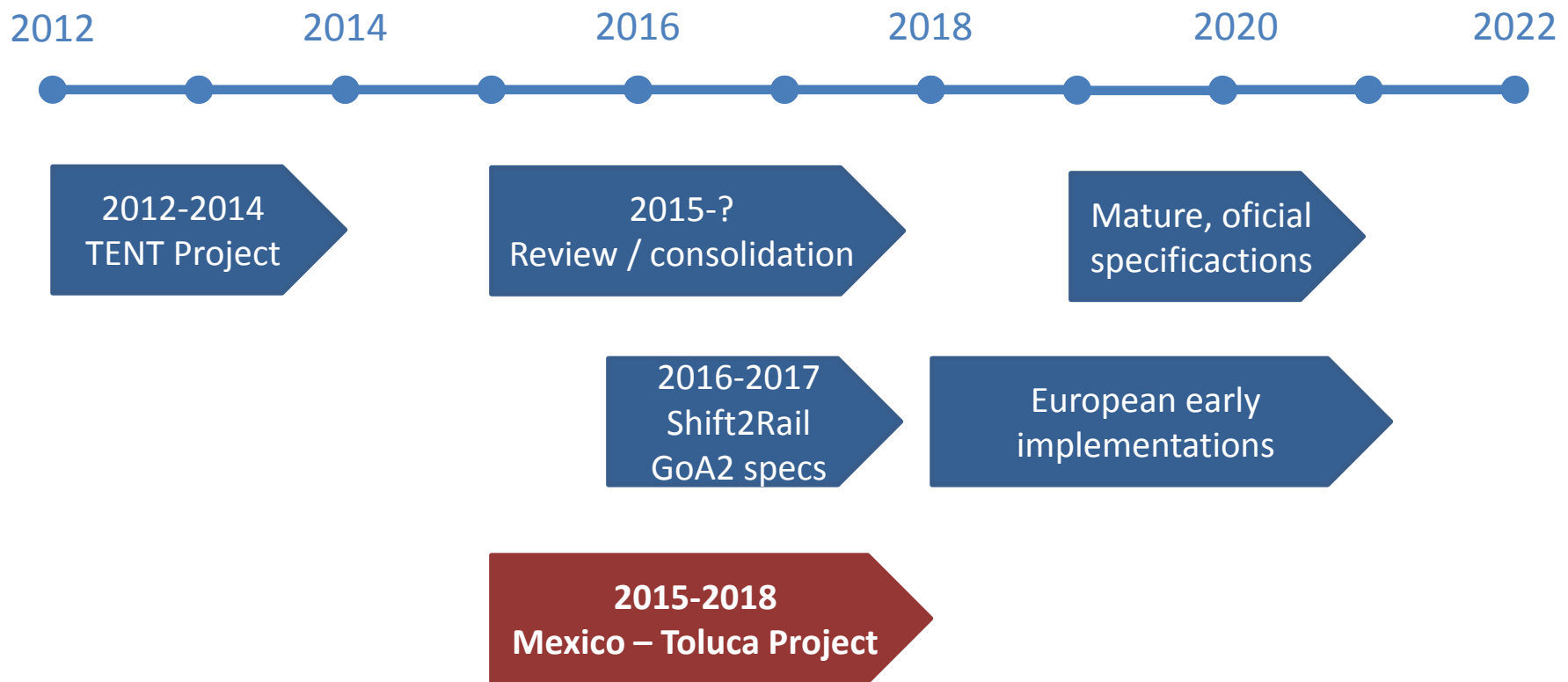
3. AoE early Implementation

MEXICO – TOLUCA INTERURBAN LINE

- Type: passenger / interurban
- Electrification: 25 kV electrified
- Length: 57.7 km
- Stations: 5
- Trains: 30 x Civia (CAF)
- Contract Date: 2014
- Commissioning date: 2018

CAF Signalling

3. AoE early Implementation

MEXICO – TOLUCA REQUIREMENTS

- Max. Speed: 160 km/h
- ETCS Specification: Baseline 2 (2.3.0.d)
- ETCS Level: L2 (OBS prepared for L1)
- Headway   2.5 min.
- GoA: Semi-automatic train operation (GoA-2)
- Subsystems   CAF Signalling: ATO-OB, ERTMS-OB, ATO-TS

                                              Integrated Control Centre

                          Thales: ERTMS-TS, Interlocking

3. AoE early Implementation
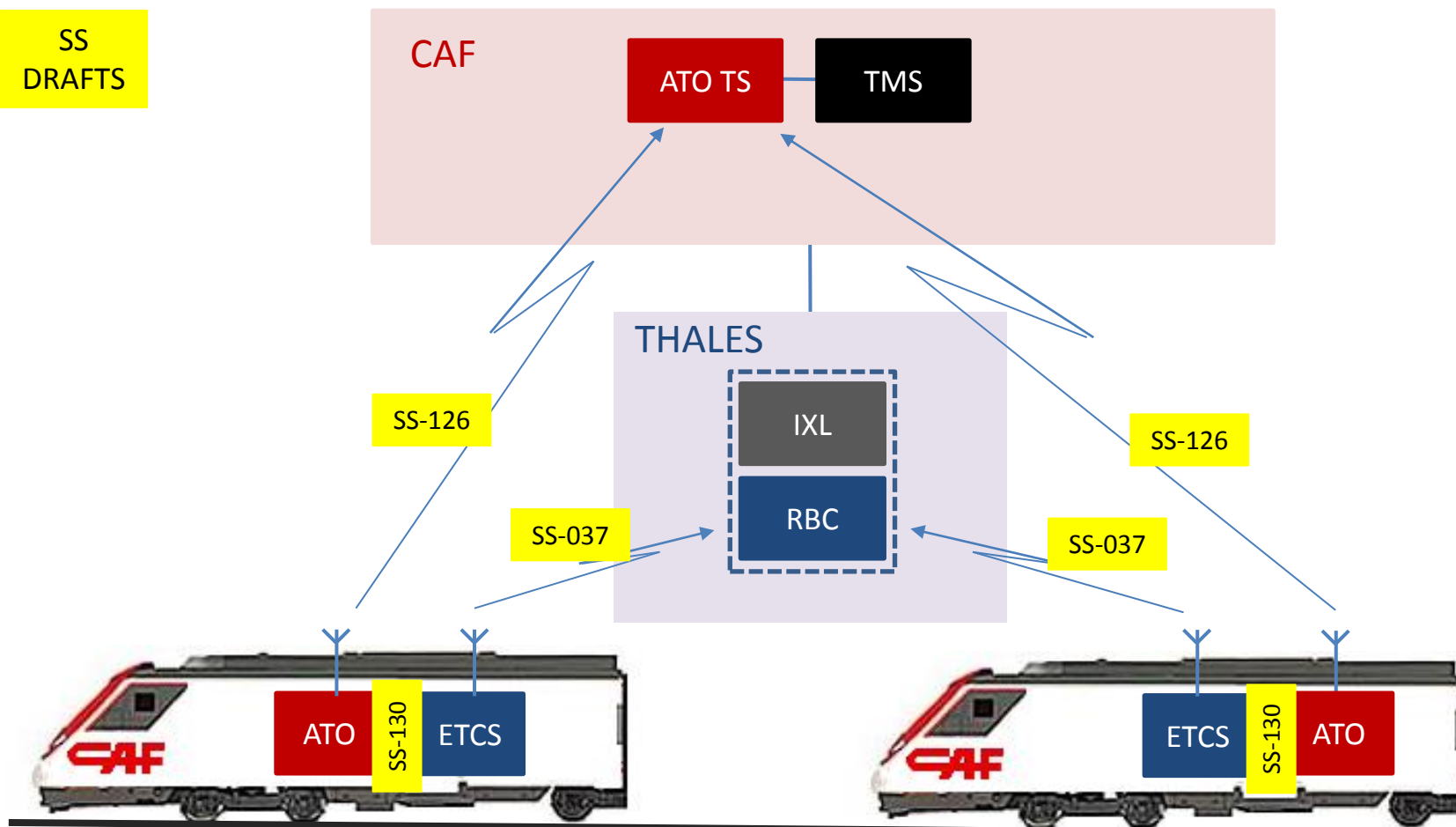
Conclusions

- ATO will deliver valuable benefits to mainline and commuter lines

- Interoperability is required to widely deploy ATO on Mainlines

- The concept of ATO over ETCS is already developed accordingly

- ATO specs require further technical work under Shift2Rail

- An early implementation project in the Mexico-Toluca line is already under execution using AoE concept and draft specs

Thanks for your attention

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