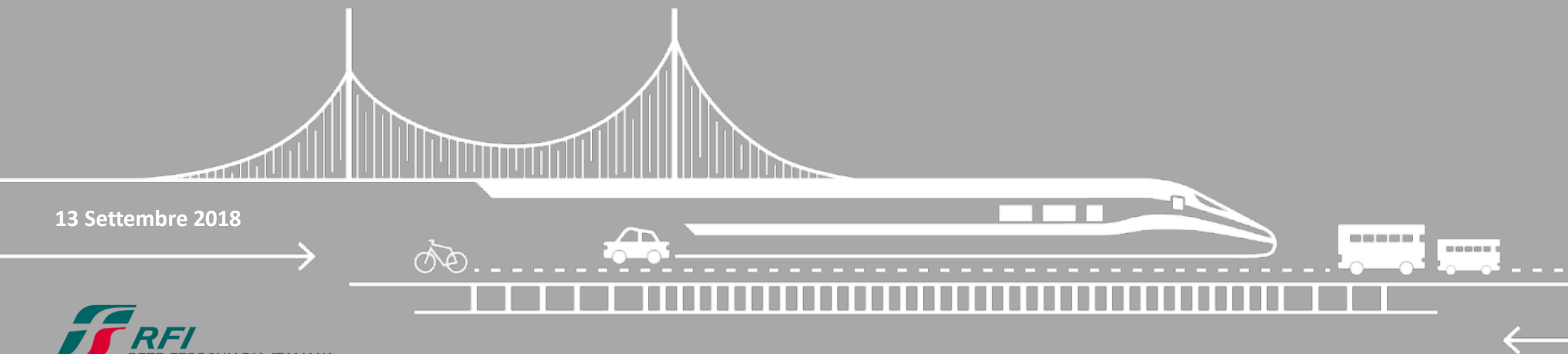


Rete Ferroviaria Italiana Presentation

IWES 2018

13 Settembre 2018

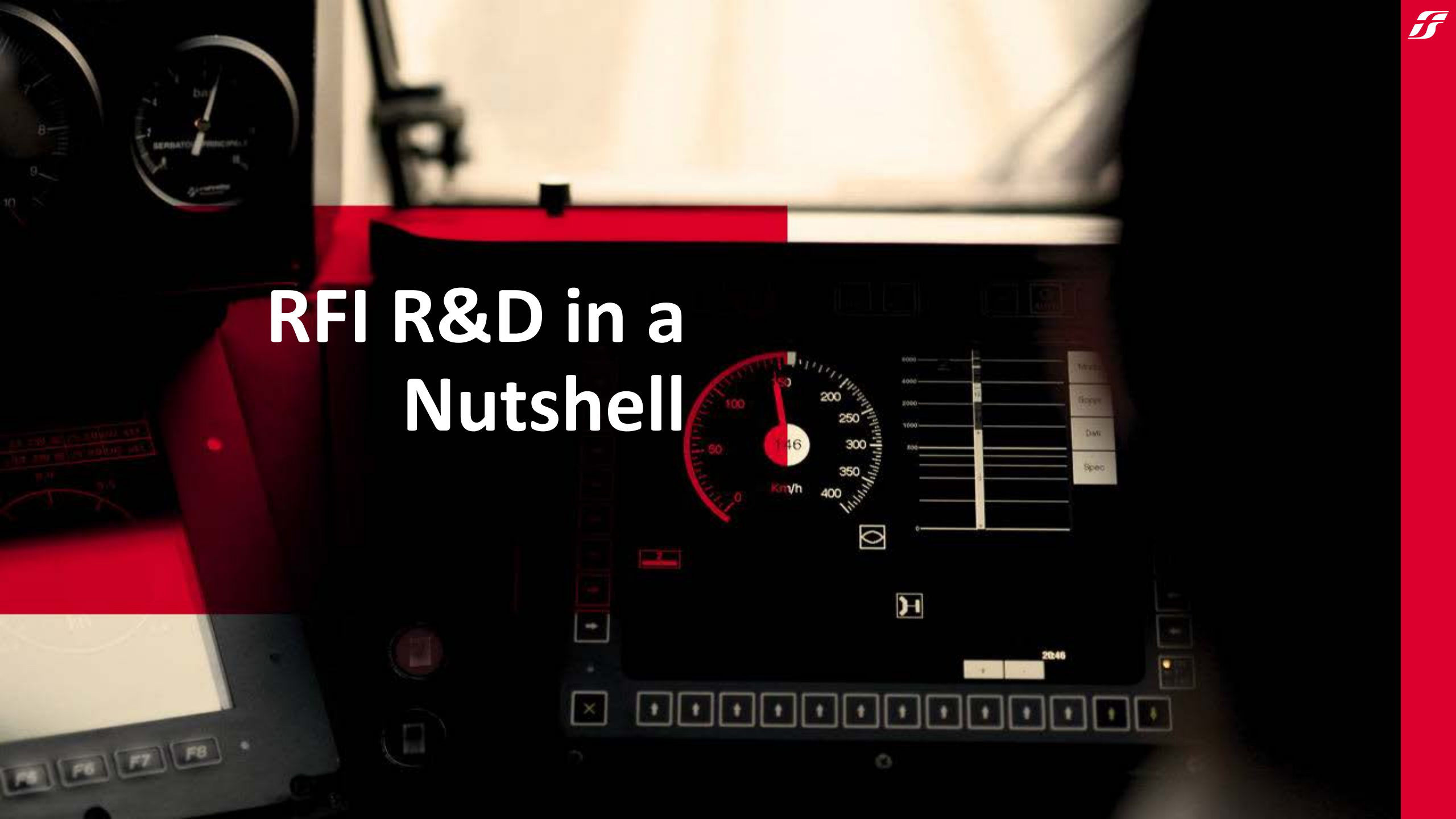


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RFI R&D in a Nutshell



RFI Missions and Activities

RFI, The Infrastructure Manager

- Born in 2001 as an infrastructure company of the Ferrovie dello Stato Group to respond to the Community Directives implemented by the Italian Government on the separation between the infrastructure operator and the transport service provider.
- The main activities of RFI are:
 - Safe management of railway traffic;
 - Railway Infrastructure maintenance, improvement, design and creation;
 - The annual definition of the railway timetable based on the requests made by the railway companies;
 - Train station Access Management;
 - Assistance for people with reduced mobility at the station;
 - Management of maritime connection to ensure the territorial continuity of rail services;
 - The integration of the Italian rail network in the trans-European transport networks.

RFI in numbers



Total Rail Network 16.788 km



Power Supply:

- Electrified Line 12.023 Km
- Diesel 4.765 Km



Railway Premises:

- Railway Station: 2.195
- Ferry Services: 3



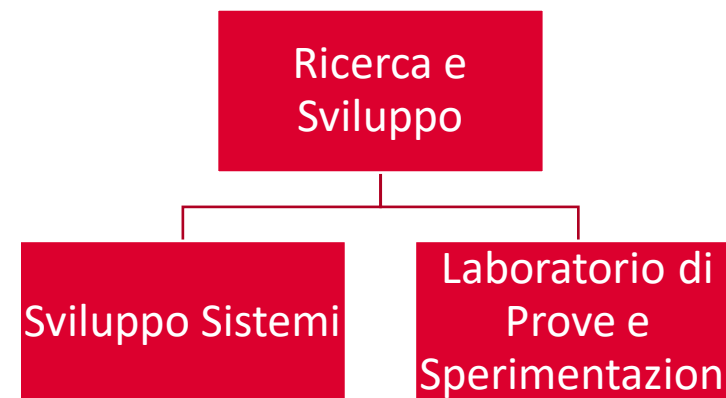
Innovative Technologies for Train Protection:

- SCC/CTC+DPC: 12.626 Km
- SCMT: 12.083 Km
- SSC: 4.014 Km
- ERTMS: 709 km

RFI in numbers

R&D Department Missions

- Study, research and development of new concept railway systems;
- evaluation of innovative solutions proposed by the industry, as well as the definition and management of an innovation network with universities, research centers and industry players;
- creation of test environments inside the laboratory and their use for testing, measurements, research and experimentation aimed at research and development activities;
- development of an Integrated Technological Prototype of the railway system for the experimentation and testing of systems and subsystems;
- verification and validation activities, until the release of the Safety Case, of the developed systems, in compliance with safety standards and current legislation;
- coordination of activities related to research and development projects (SHIFT2RAIL, ERTMS, MORANE, etc.) of international initiative;



Partners



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FEDERICO II



R&D

Polo Ferroviario di Firenze Osmannoro



Laboratori di Elettronica e prototipazione

Postazioni di Sviluppo Hw e Sw

Laboratori ACC/ACCM Innovativi

Laboratorio Sistemi di Manovra Innovativi

Simulatore Circolazione Formazione Innovativa (SEDE Roma)

Laboratorio per SSB ERTMS a Subset 094 (*)

Laboratori per Prove Ambientali, EMC, Elettriche (*)

Ambiente di sviluppo e testing piattaforma RFI

Laboratorio sistemi ERTMS/ETCS

(*) **Certificati ACCREDIA**

Polo Ferroviario di Bologna S.Donato



Piazzale
Innovativo
Sperimentale per
sistemi
ACC/ACCM

Circuito di prova
sperimentazioni IS
ERTMS/ETCS,
GPRS, ATO over
ETCS

Impianto per Sistemi
di Manovra AV

R&D Activities



2018-2019
2019-2020
2020-2021

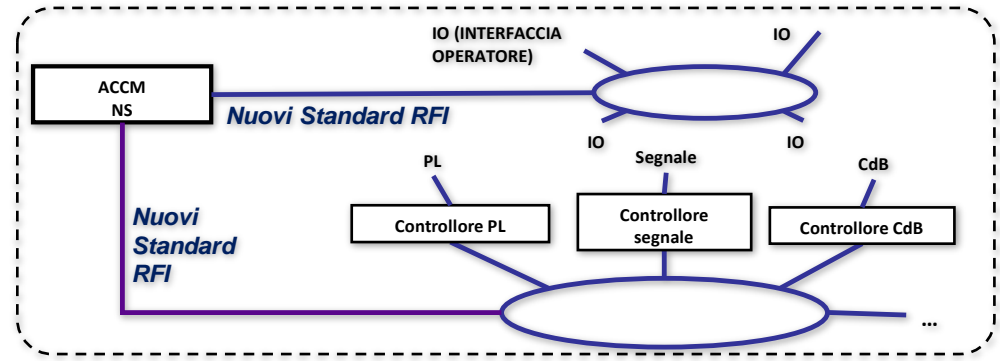
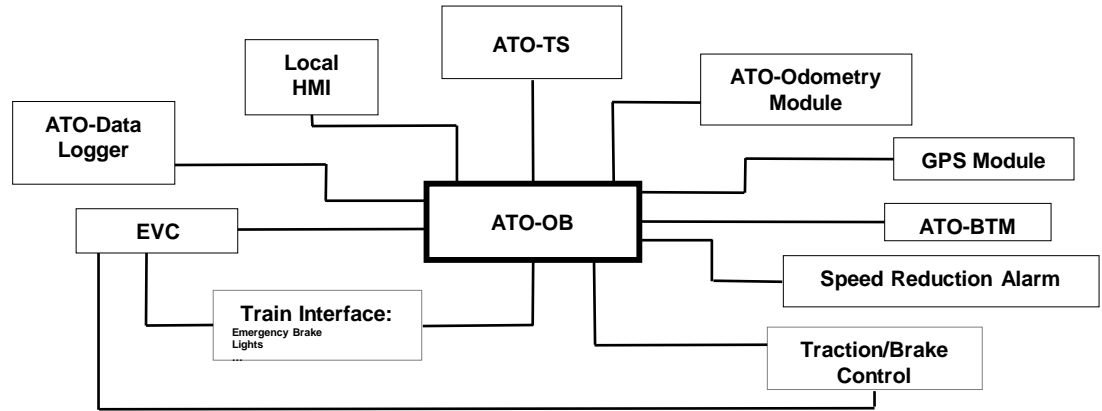
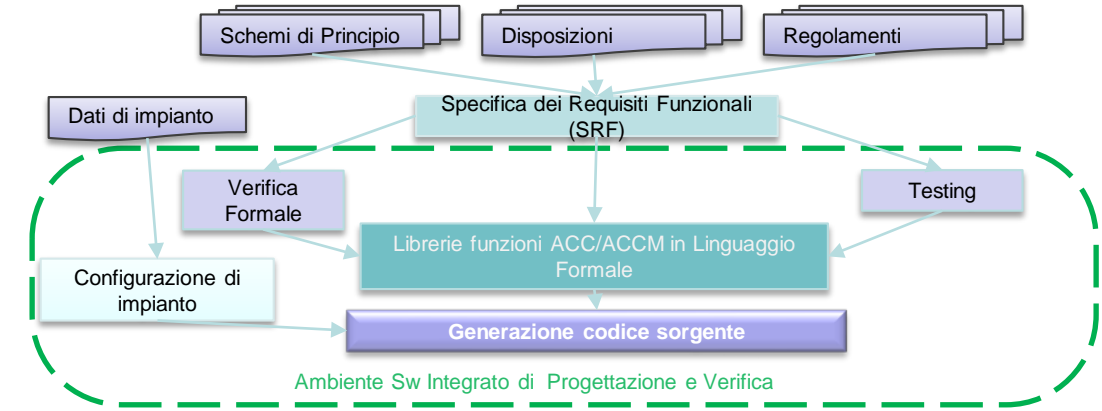
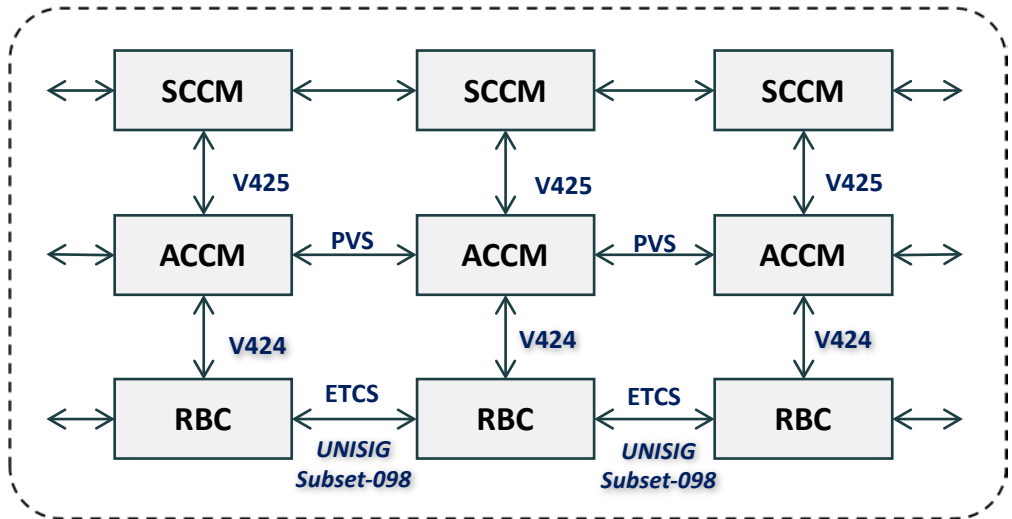
2018-2019
2019-2020
2020-2021

F5 F6 F7 F8



Some R&D Projects

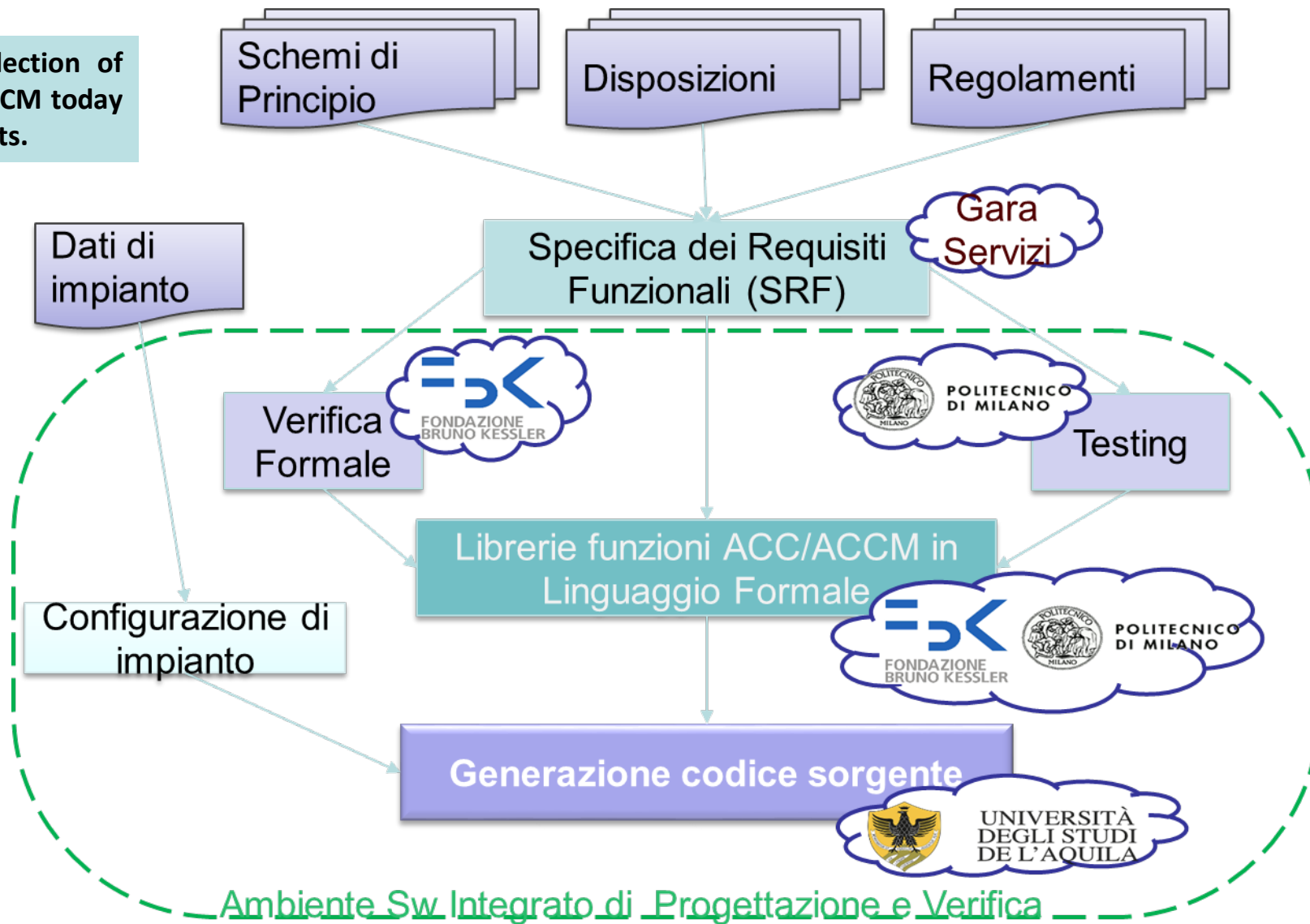
1. Design and Verification of ACC/ACCM logics with Formal Methods;
2. EVC and ATO development with Formal Methods;
3. ATO over ETCS GoA2/GoA4 functions and architecture;
4. Standardization of CCS Subsystems Interfaces;
5. Sistema di Elaborazione Centrale (SEC) (Central Processing System);
6. SCC, ACCM, RBC Integration;



Design and Verification of ACC/ACCM logics with Formal Methods

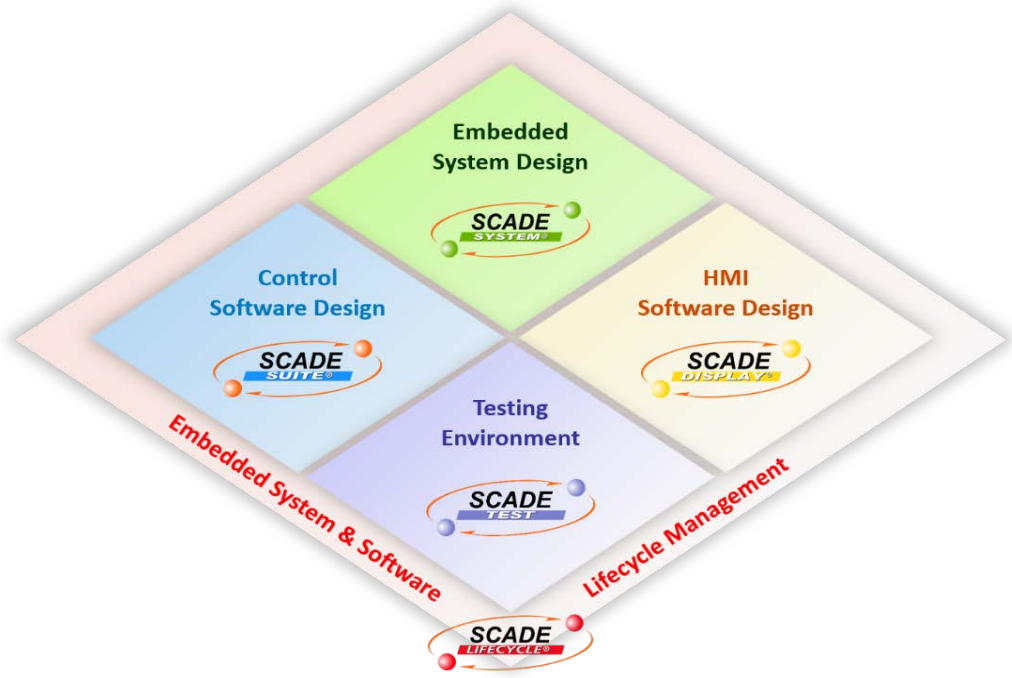
Functional Requirements Specification: collection of the functional requirements of the ACC / ACCM today disseminated in heterogeneous RFI documents.

Automatic Code Generation from UML models.



EVC and ATO development with Formal Methods (SCADE Design and Verification Environment)

EVC and ATO applications are planned to be implemented with formal methods and Ansys SCADE environment.



SCADE Customers in Rail Transportation

«more then 50% Cost & Time Reduction through code generation, documentation generation, Simulation Environment for testing»

«15X productivity increase per line of code»

«SIL 4 application achieved»

«more then 50% Cost & Time Reduction through code generation, documentation generation, Simulation Environment for testing»

«15X productivity increase per line of code»

«SIL 4 application achieved»

Automatic Train Operation (ATO) over ETCS GoA2/GoA4 functions and architecture

Normative Requirements:

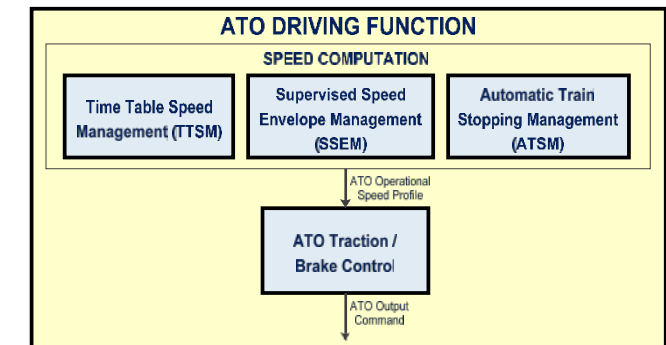
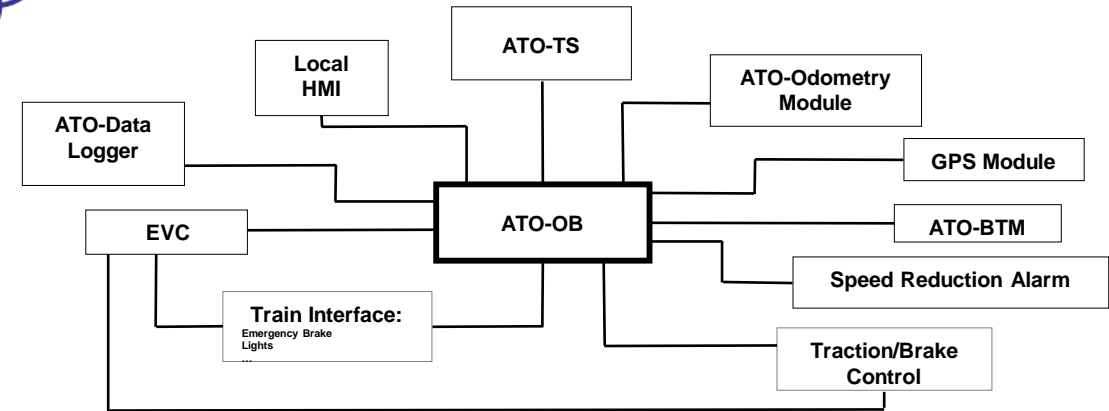
- GoA2 functions (SUBSET 126);
- Customized GoA4 functions.

ATO-TS

- Embeds the ATO Operators Interface (GoA2)
- Acquires Railway Lines status from TMS (GoA2)
- Transmits to ATO-OB:
 - Journey Profile e Segment Profile (GoA2)
 - TSR e Stopping Point (GoA2)
 - Speed Commands on “Remote Driving” Operational Mode (GoA4)

ATO-OB

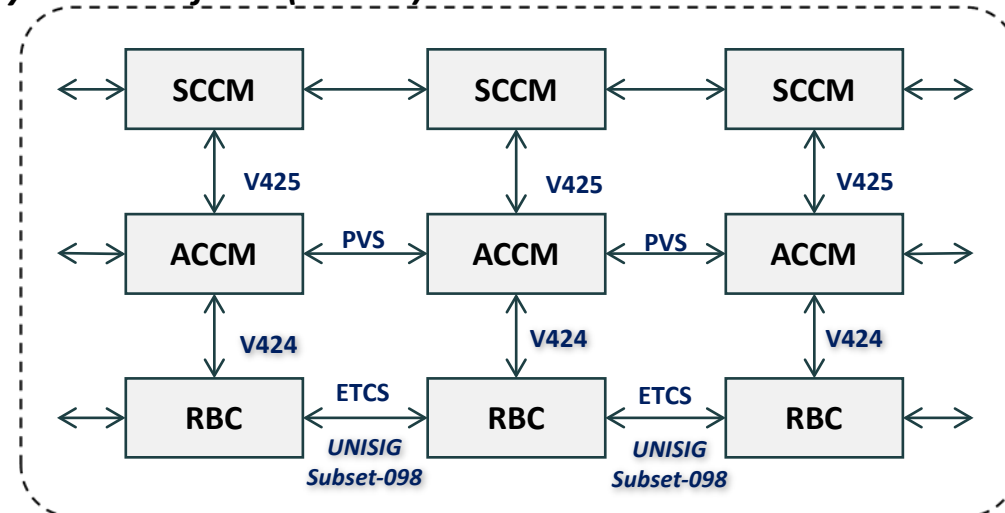
- Executes Speed Computation and Speed Tracking (GoA2), under EVC supervision, with optimization algorithms of:
 - Performance (timetable)
 - Power Consumption
- Computes and transmits to ATO-TS the train position (GoA2);
- Interacts with on-board equipments (train bus) (GoA2);
- Uses GPS and BTM data in order to compute the train positions on “Remote Driving” Operational Mode (GoA4).



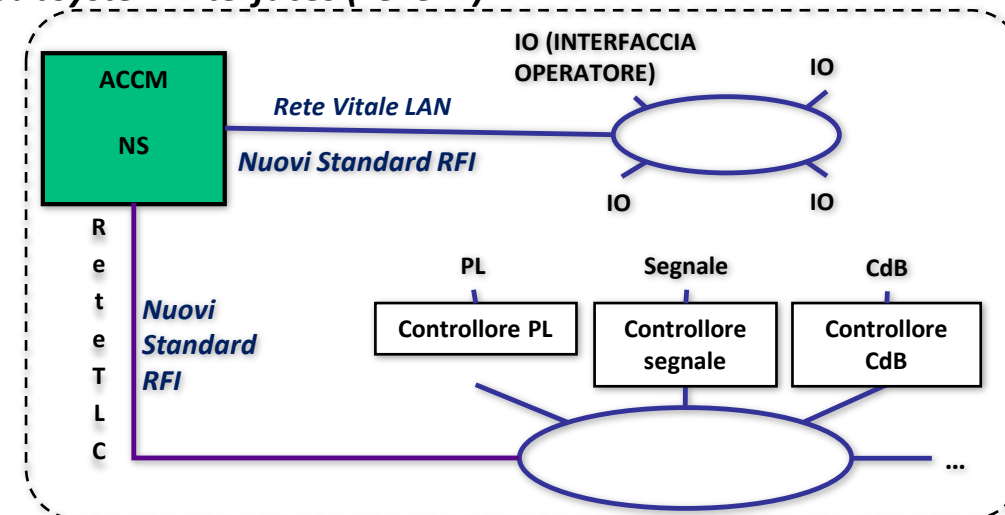
Standardization of CCS Subsystems Interfaces

- It consists of two levels:
 - System Interfaces (Level 1)
 - SubSystem Interfaces (Level 2)
- It aims to:
 - Make systems homogeneous even if provided by different manufacturers;
 - Make subsystems interchangeable;
 - Add RFI Platform into Provider systems;
 - RFI Subsystems hot-pluggable.

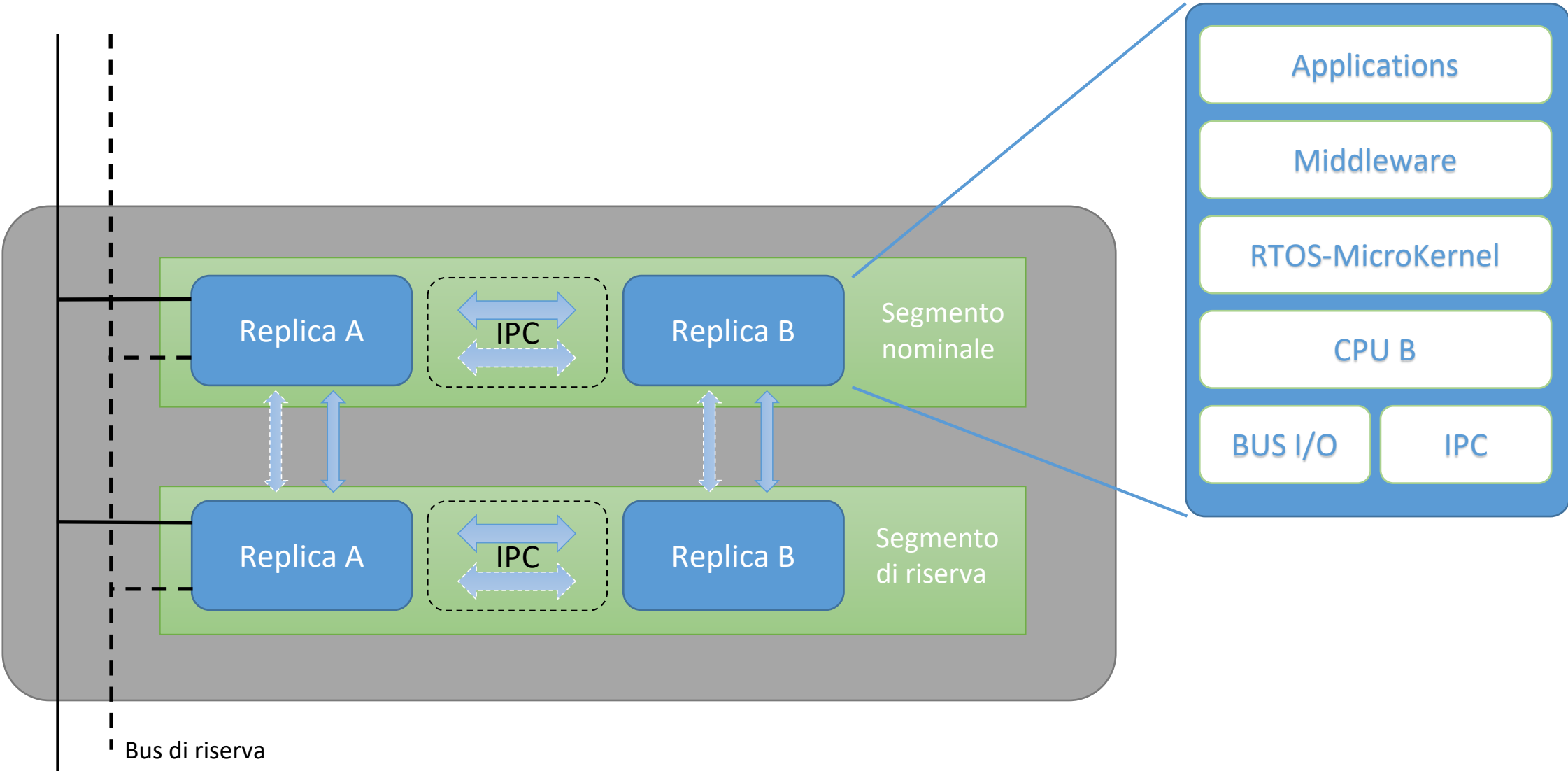
System Interfaces (Level 1)



Subsystem Interfaces (Level 2)

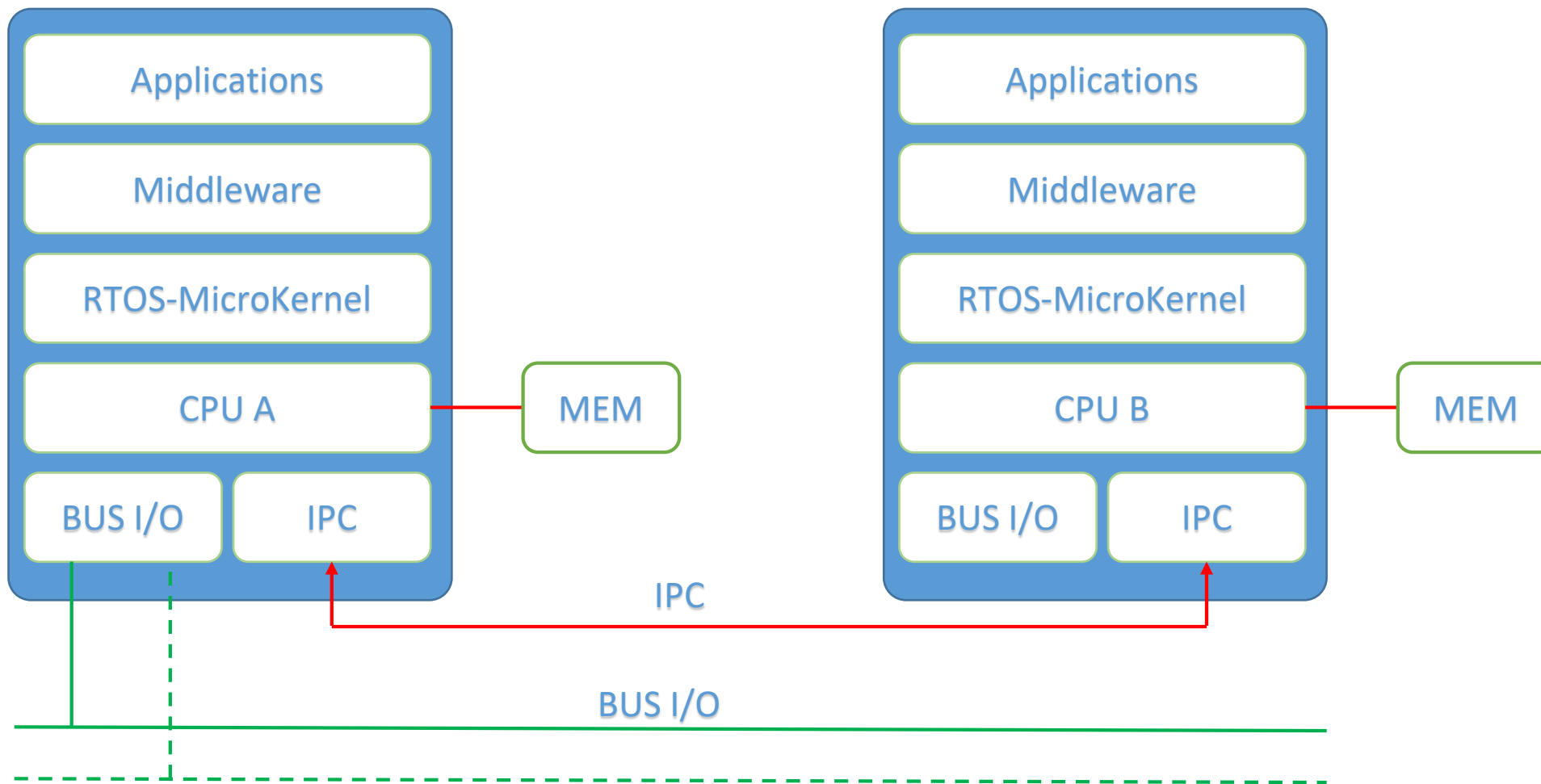


Sistema Elaborazione Centrale (Central Processing System)



Sistema Elaborazione Centrale (Central Processing System)

Segment Overview



Thank You