Closing Remarks and Future Steps on NG-TCMS

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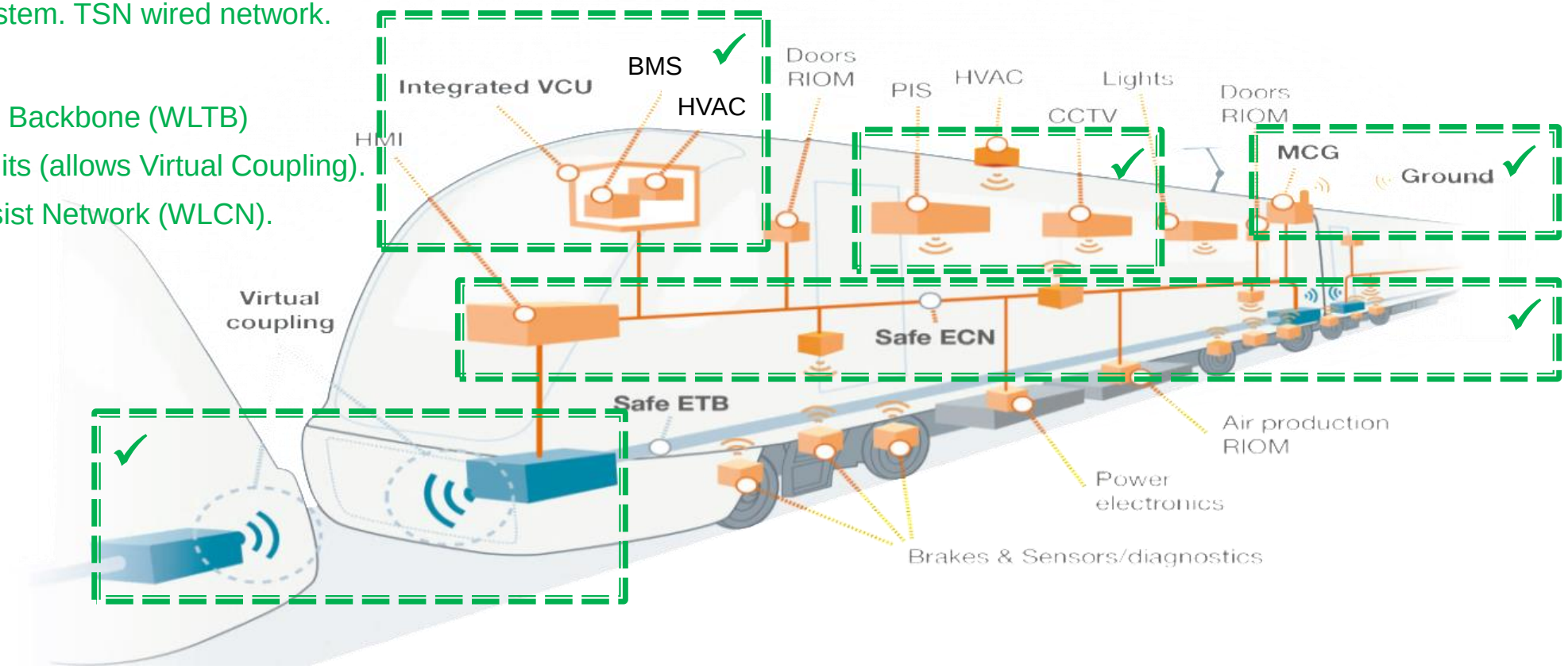
Technical Seminar on Advanced Architectures and Components for Next-Generation TCMS

January 21st 2020, Brussels

The projects CONNECTA-2 and Safe4RAIL-2 have received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 826098 (CONNECTA-2) and No. 826073 (Safe4RAIL-2) respectively. The information and views set out in this document are those of the author(s) and do not necessarily reflect the official opinion of Shift2Rail Joint Undertaking. The JU does not guarantee the accuracy of the data included in this article. Neither the JU nor any person acting on the JU's behalf may be held responsible for the use which may be made of the information contained therein.

Summary of results until now

- Integrated VCU with Functional Distributed Framework (FDF).
- SIL4 ready system. TSN wired network.
- No train lines.
- Wireless Train Backbone (WLTB) for coupled units (allows Virtual Coupling).
- Wireless Consist Network (WLCN).



Next steps within CONNECTA-2 & Safe4RAIL-2 (2020-2021)

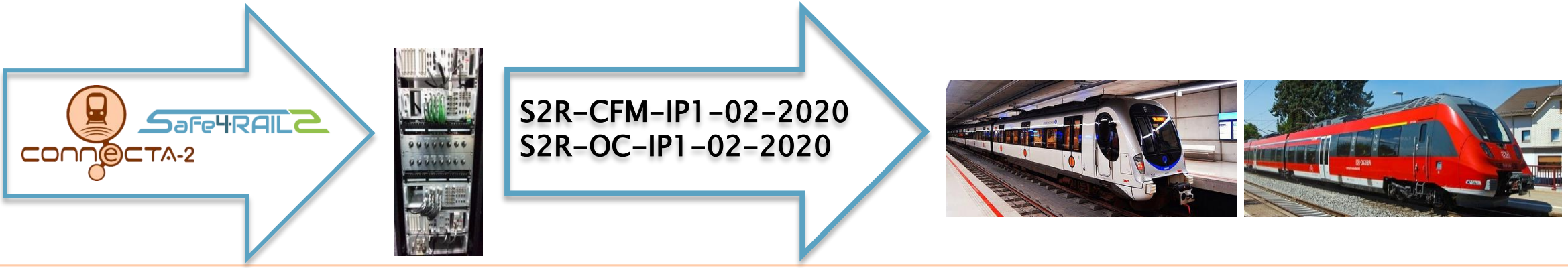
- Tests Definition for Urban and Regional lab demonstrators.
- Build the demonstrators with all the prototypes:
  - DbD Network elements (CS, ETBN, TSN NICs) -> **Safe4RAIL-2**.
  - CCUs with FDF -> **CONNECTA-2 & Safe4RAIL-2**.
  - Applications based on AP on top of FDFs -> **CONNECTA-2 & Safe4RAIL-2**.
  - Simulation Frameworks -> **CONNECTA-2**.
  - Wireless TCMS (AETBN, RDs, WED, WAP) -> **CONNECTA-2 & Safe4RAIL-2**.
- Validation of technologies over the lab demonstrators.

Next steps within CONNECTA-2 & Safe4RAIL-2 (2020-2021)

- Continue the specification of a standardized ATO (up to GoA4) and NG-TCMS.
- Continue alignment between OCORA and NG-TCMS.
- Strengthen collaboration with New braking system (TD1.5) and Innovative doors (TD1.6) to allow them to remove train lines.
- Advance in the interoperability with TD2.1 ACS for T2G and T2T wireless communications.

Upcoming projects for NG-TCMS (2020-2022)

- NG-TCMS from TRL 4/5 to TRL 6/7.
- Validation of technology from Laboratories to real trains.
- Independent safety and security assesments.
- Benchmarking of proposed NG-TCMS.
- Integration of NG-TCMS with other TDs (i.e. ACS, Doors, Brakes…)



Upcoming projects for NG-TCMS (2020-2022)

- New topics in S2R-CFM-IP1-02-2020:
  - Low-level specification of the Application Profiles for train-level communications, this is over the Functional Open Coupling
  - Further studies in the **Application Profile for ATO GoA3/4** functions together with CFM-IP2-01-2019, continuing the work made by CONNECTA-2
  - Additional function definition for the **Functional Open Coupling**, taking as a reference the UIC 556, e.g. **Traction, Braking, Lighting**
  - Extension of the work made by CONNECTA-2 regarding the visualization of **Functional Open Coupling functions in DMI**, providing the definition of more functions
  - Specification of **additional functions for T2G communications** not covered by the IEC 61375-2-6, such as the CCTV
  - Specification of the full interface for the **interoperability** with the **Adaptable Communication System**
  - **Benchmarking** activity of such activity **outcome** with regard the **current IEC 61375 series** and other **upcoming standards from different industries**

Upcoming projects for NG-TCMS (2020-2022)

- Topics to be covered by S2R-OC-IP1-02-2020:
  - Workstream 1:
    - **Antenna installation** study to optimize transmission/reception in Wireless TCMS which includes the consist-to-consist transmissions, train-to-ground transmissions and internal consist wireless transmissions. Under the framework of complmentarity, the action stemmed form this toic is expected to take as a reference the output in the field of the project S2R X2Rail-3.
  - Workstream 2:
    - Subsystem functions adapted to **Application Profiles with a TRL** 6.
    - Support for **FDF integration in the FDF Hardware architecture**.
    - **Conformance tests** of the standard **Application-FDF** interface defined by CONNECTA-2 and the adaptation of **DbD in the FDF** (integrated in the FDF FW architecture).
    - Deployment of a **centralized configuration tool for Drive-by-Data (DbD)** network equipment compliant to IEEE **802.1Qcc standard**.

Upcoming projects for NG-TCMS (2020-2022)

- Topics to be covered by S2R-OC-IP1-02-2020:
  - Workstream 2:
    - **DbD network equipment**: ETBN-TSN (Ethernet Train Backbone for Time Sensitive Networking), CS-TSN (Consist Switch for Time Sensitive Networking), NIC-TSN (Network Interface Controller for Time Sensitive Networking) final products products with a **TRL 6/7**.
    - **FDF HW platform** and development environment with a **TRL 6/7**.
    - Time Sensitive Network Configuration Tool with a **TRL 6/7**.
    - **Wireless Train Backbone equipment**, such as the Wireless Train Backbone Node and Antennas with a **TRL 6/7**.
    - **Wireless Consist Network equipment** with a **TRL 6/7**.
  - Workstream 3:
    - **Independent Safety and Cyber security studies** for DbD, FDF and Wireless TCMS.
    - Development of a **methodology to develop SIL4 functions for the FDF** and the tools to support a SIL4 application development provided by the complementary CFM.
    - Study on the **integration of** Time Sensitive Networking (**TSN**) **transmission slots calculation** (e.g. via a Centralized Network Configuration tool**) and the FDF execution** in order to achieve very low latencies.

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