March 2021

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Issue

Safe4RAIL2

Safe architecture for Robust distributed Application Integration in roLling stock

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Message from Coordinator:
Outlook for this year

I hope this new issue of Safe4RAIL-2's newsletter finds you all safe and healthy. It is being a difficult period for everyone, not to mention those suffering directly the impact of the pandemic, so my warmest wishes to all of you in the first place.

These last months have been also very challenging for Safe4RAIL-2, as the limitations brought by the pandemic have led us to change our working procedures: home offices, virtual meetings, and also remote integration workshops have taken place, where partners from Safe4RAIL-2 and CONNECTA-2 have interconnected and tested their devices in different locations. This has allowed a successful continuation of the technical activities, but some delays have been unavoidable and as a consequence the end of Safe4RAIL-2 has been extended until July 31st 2021. This last period has also seen a strong presence of the project in different online services and social media, including scientific publications, videos and press releases, with additional dissemination activities such as podcast and interviews coming in the next few months.

The present newsletter focuses on the description of the different components that Safe4RAIL-2 has developed and are being integrated in CONNECTA-2 Urban and Regional Demonstrators. This includes hardware components, such as TSN-enabled and wireless devices, as well as software components such as the HVAC application integrated on FDF and Simulation Framework environments. Technical details of these components will be provided in this newsletter, so that their potential and technological advantage can be fully assessed.

I hope you find this information useful and it serves also as a nice taster for the next and final issue of the Safe4RAIL-2 newsletter, where the integration of these components in the demonstrators will be presented.

Stay safe, and see you soon.

Aitor Arriola, IKERLAN
Safe4RAIL-2 Coordinator

Safe4RAIL-2 Components for CONNECTA-2 Demonstrators

Safe4RAIL-2 project has developed several components that are being integrated in CONNECTA-2 demonstrators, as detailed in the next figure. These components will be described in the next sections.

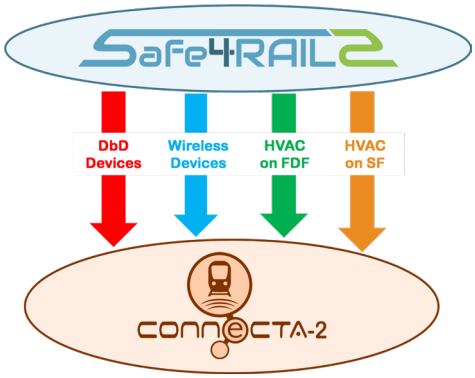

Fig. 1: Safe4RAIL-2 Components for CONNECTA-2 Demonstrators

Drive-by-Data devices:

Next-generation of TCMS powered by the Time Sensitive Network (TSN) technology

TTTech has developed the TSN IP core and associated software for fast and easy integration onto FPGA – enabling open, standard deterministic switching functionality for the rail sector in the in Safe4RAIL-2 project. The TSN IP has been successfully integrated in MOXA's and WESTERMO's switches (i.e. ETBN and consist switches). Additionally, TTTech developed a PCIe card to enable the TSN feature for end devices (i.e. CCU).

Fig. 2: PCIe card to enable the TSN feature for the end devices

Westermo Ethernet Train Backbone Nodes (ETBN) and Consist Switches (CS)

The Westermo device is intended for the proof-of-concept demonstration in the project where the intent is to demonstrate the Next Generation Train Communication Network (NG-TCN) which is envisaged to support data traffic of mixed criticality. The device is powered by the Westermo Operating system, WeOS, which offers an extensive suite of IP networking features for resilient and flexible networks. The NG-TCN concepts have been implemented in WeOS to ensure communication between the backbone and consist networks. The device can be used both in the role of an Ethernet Train Backbone Node (ETBN) and a Consist Switch (CS).

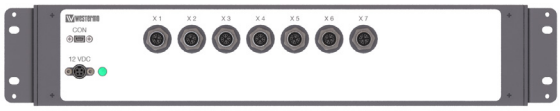

Fig. 3: Westermo device for the NG-TCN proof-of-concept demonstration

Moxa Ethernet Train Backbone Nodes (ETBN) and Consist Switches (CS)

The Moxa TN-G4900 Series ETBN and TN-G6500 Series CS Gigabit switches are designed around the Drive-by-Data concept outlined in the CONNECTA and Safe4RAIL projects. The TN-G4900 acts as an ETBN while the TN-G6500 is used to form a ring in the consist network. Besides both Series supporting TSN technology integral to the Drive-by-Data concept, the TN-G4900 Series is also undergoing rigorous testing to comply with all the necessary safety requirements.

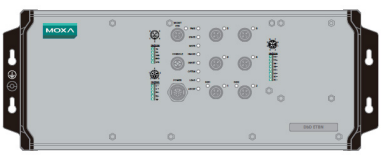

Fig. 4: Moxa Ethernet Train Backbone Nodes (ETBN) and Consist Switches (CS)

Wireless devices:

EURECOM LTE V2X Wireless Train Backbone (WLTB) radio device

EURECOM WLTB radio devices are based on the 3GPP LTE V2X rel.14 specification, enhanced with an original B.A.T.M.A.N Mesh mechanism to support the concepts outlines in the CONNECTA-2 and Safe4RAIL-2 projects. The WLTB radio devices are based on the open-source OpenAirInterface (OAI) Software-Defined Radio (SDR) technology and enable to transmit wireless ETBN data over 1-hop or multi-hops between consists either during train inauguration or operation phases.

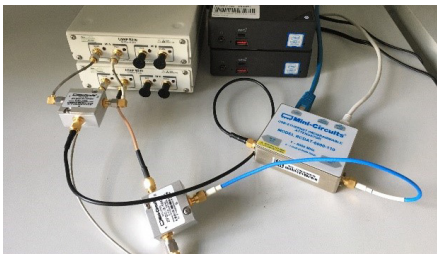

Fig. 5: WLTB radio devices in laboratory settings

HVAC Subsystem Application Profile integrated in FDF:

The HVAC Application Profile defined by CONNECTA-2 and developed together with Safe4RAIL-2 has been integrated in two different FDF implementations, one for each CONNECTA-2 demonstrator, showing the abstraction capabilities of the FDF:

- A proprietary FDF of CONNECTA-2 for the Urban Demonstrator, based on GreenHills Integrity operating system.
- The AUTOSAR Adaptive Platform-based FDF from ETAS for the Regional Demonstrator, based on RTA-VRTE

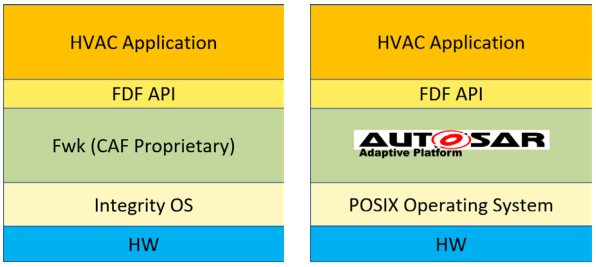

Fig. 6: Integration of the HVAC subsystem provided by Safe4RAIL-2

HVAC subsystem integrated in simulation environments:

Liebherr HiL simulation environment

To validate and optimize design at an early stage of rail vehicle development, the Hardware-in-the-Loop (HiL) testbench at the Liebherr site in Austria allows rail vehicle manufacturers to run train-level system tests with the physical Liebherr MACS 8.0 compact HVAC unit, even before other train subsystems exist in reality. This front-loading approach allows savings in development time and costs. The HiL testbench is composed of the HVAC unit itself and the climatic vehicle segment mock-up (CMU). Both are controlled remotely via internet. A project-specific thermal vehicle simulation controls electric heaters and air humidifiers to impose loads to the CMU. A number of air temperature and humidity sensors provide the feedback to the simulation model. Depending on test cases, the overall setup can be operated in a climatic chamber.

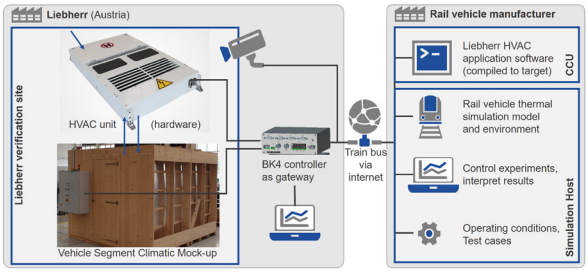

Fig. 7: Hardware-in-the-Loop (HiL) testbench

Public Deliverables Submitted

From the beginning of the 2nd project period in M19 one public deliverable has been released on our project **website:**

Deliverable D2.3 "LTE Equipment under Challenging Wireless Sce-narios" (interim version) includes a detailed study of the impact of LTE D2D for wireless Train Backbone Communications in challenging conditions.

Past Meetings and Workshops

Joint Urban pre-Integration workshop

online
1st July 2020

Joint Regional Integration Workshops

3 Sessions, online
July/August 2020

3rd Executive Board Meeting

online
14th September 2020

Drive-by-Data Integration workshop with CTA2

online
30th September 2020

General Assembly Meeting

online
16th November 2020

WP2 Integration Workshop

online
26th November 2020

WP1 Integration Workshop

online
18th December 2020

2nd CTA-2/S4R-2 Joint Advisory Board Meeting

online
23rd February 2021

Planned Activities

Joint Final Conference CTA-2/S4R-2

2021

S4R-2 General Assembly Meeting

2021

4th S4R-2 Executive Board Meeting

2021

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