

INTEGRATION AND TESTING PROCESS OF THE ERTMS/ETCS LEVEL 2 IN THE CZECH REPUBLIC PILOT PROJECT

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The contribution describes the Integration and Testing Process applied by Ansaldo STS for the realization of the ERTMS/ETCS Level 2 systems, and it is particularly focused on the Czech Republic Pilot Project, the first ERTMS/ETCS Level 2 application in Czech Republic.

Starting from the context of the Czech Pilot Project, its technical features, the scope of supply and the main functionalities of this application, in order to focus the aims of the project, the contribution goes to the description of the Integration and Testing process that Ansaldo STS applies on the ERTMS L2 projects, that is an incremental approach, from laboratory environment to real plant, and the contribution gives details about what each step foresees and implies in terms of results.

Then the contribution focuses on the application of this incremental approach to the Czech Pilot Project, and on the peculiarities of this application, which requested special additional integration and test procedures.

The attention is focused on particular test architectures, starting from Ansaldo STS laboratory architecture, which uses both simulators and target equipments, but also focusing attention on some tests that have been performed between different laboratories located in different countries (Czech republic, France, Italy), using ISDN connection.

The test phase continued then on Velim test ring, a test site in Czech Republic, and, finally, on the real Pilot Project line, where two different test architectures were applied, between Poříčany and Kolín.

This integration and test procedure allowed Ansaldo to perform all the functional tests reducing as much as possible the use of the line and the impact on the existing traffic.

The contribution ends underlining the current status of the Pilot Project, the results that are reached, and its importance for future applications of ERTMS Level 2 in Czech Republic.

Key words: ERTMS/ETCS L2, system integration, system architecture, testing process

The pilot project Poříčany – Kolín, the first installation of ETCS Level 2 in Czech Republic, is part of the Trans European corridor IV.

The contracting authority is SŽDC.

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1 Technical features



The Poříčany - Kolín pilot section, 22 km long, represents a ERTMS/ETCS Level 2 system application, according to the UNISIG SRS version 2.3.0 (Subset-108 version 1.0.0).

Also the Velim test Ring, near to the pilot section, is equipped with Level 2, and is used for preliminary tests.

Trackside part of the system is equipped with 3 (existing) IXL ETB type: Poříčany, Pečky and Velim.

A new Interlocking-RBC Interface (IRI) has been developed, and the Subset-098 safe protocol has been implemented for the communication between IRI (Interlocking-RBC interface) and RBC.

The on-board part of the project foresees the installation of the mobile part of the equipment (On Board Unit) on two locomotives of different type and one trainset, and also the development of STM National with the functionality of the national ATP LS.

2 Scope of supply

ASTS is the supplier of the ETCS L2 for the Pilot Project, so is responsible for the delivery of Radio Block Centre, Eurobalises, ETCS On-board, and also of performing the on-board relevant tests, trackside tests, V&V activities and System Integration.

The modifications to existing trackside, the development of Interlocking-RBC Interface (IRI), STM LS, Construction and Installation activities are carried out by the Czech Company AZD, that is also the supplier of the existing IXLs.

3 Main functionalities

The pilot project Poříčany – Kolín realizes the management of mixed traffic on the same line: ETCS equipped trains running according to ETCS rules and ETCS-non equipped trains running according to lateral signals and national ATP.

The Functional Requirements Specifications include the specific functionalities of the pilot project. The on-board and the RBC fulfil the pilot project FRS ensuring full ERTMS interoperability.

4 Ansaldo Integration and Testing Process

Ansaldo applies an incremental approach, from laboratory environment to real plant.

The equipments involved in the different test phases are IXL, RBC, OBU, IXLs and RBCs Simulator (IXL/RBC SW running on commercial hardware, if needed), Balise Groups (real or simulated).

Also some simulation tools are used, such as IXL and RBC Emulators, Onboard Interface Emulator, Running Train Simulator / Line Status Simulator.

The first step of the integration and testing process foresees to run RBC SW on commercial hw, and the external environment is completely emulated.

Step 2 foresees RBC SW running on target HW, and again emulated external environment.

Proceeding with incremental steps, the last one is reached, with RBC SW running on target HW and real external environment.

This approach allows to test as much as possible the RBC and EVC functionalities in lab, before going to the real line, focusing, at different stages, on functionalities, configuration, performances and so on.

The described incremental approach is applied to all the ASTS L2 applications, as it has been done on the Italian High Speed Lines.

5 Ansaldo Integration and Testing Process for Czech Project

A similar approach to Italian High Speed Lines has been used, but some particular aspects of the Czech Project have conditioned some different steps, especially the fact that the subsystems were developed in different countries and, above all, the line is already in operation with the traditional signalling systems.

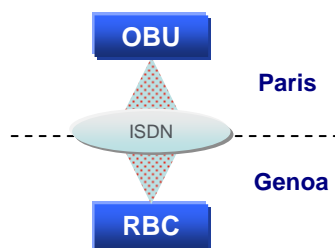
So additional steps have been added to the described incremental approach.

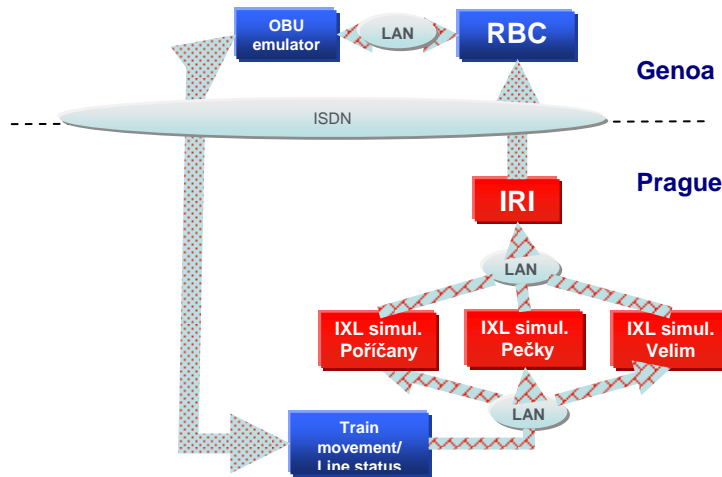
Testing Process from “remote” laboratories

Some tests via ISDN, between Genoa and Paris laboratories, were carried out, above all about Euroradio communication protocol (RBC-EVC) and the Communication Session activation.

In the same way tests via ISDN Genoa-Prague were performed, testing the Subset-098 protocol (RBC-IRI) and also configuration and management of data transmitted from IRI to RBC.

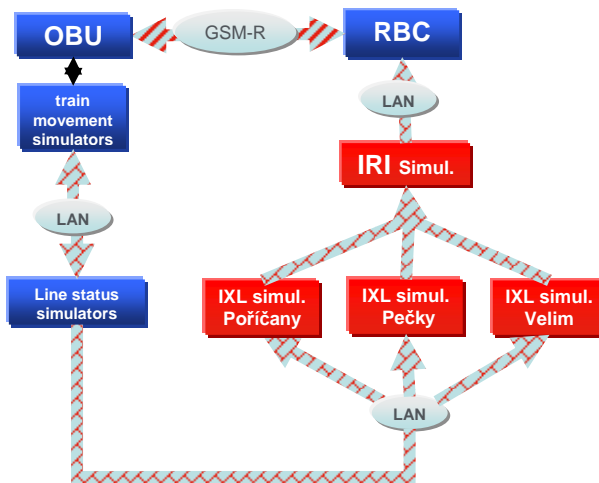
This step allows to test the basic level integration between subsystems before having them in the same lab.





Ansaldo integration test laboratory in Genoa

After the tests between remote laboratories, all the equipments (target RBC and target EVC by Ansaldo, and IXL and IRI simulators by AZD), were installed in Genoa lab, for performing a complete set of functional tests.

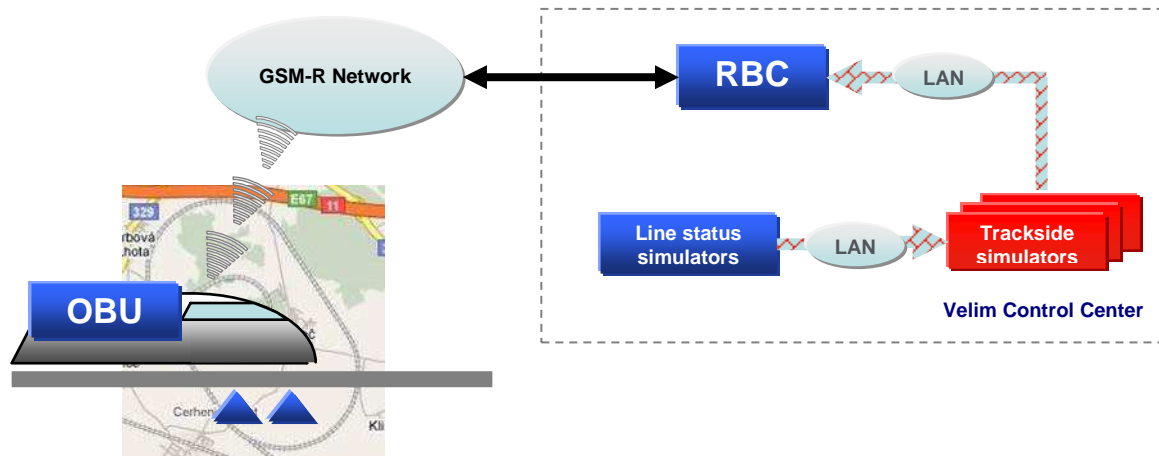


Velim Ring integration tests

A part of the Pilot Project line configuration has been reproduced on the Velim test ring (balise with the same content of the balises of the line were installed), in order to simulate a part of the real line.

Partial functional tests have been performed, according to the fact that routes, level crossing, signals for the exit from L2 area referred to that part of Pilot Project line are simulated by the IXL emulators.

This step is very relevant since it allows the first tests with real train, and the integration between RBC and EVC, without occupying the Pilot Line



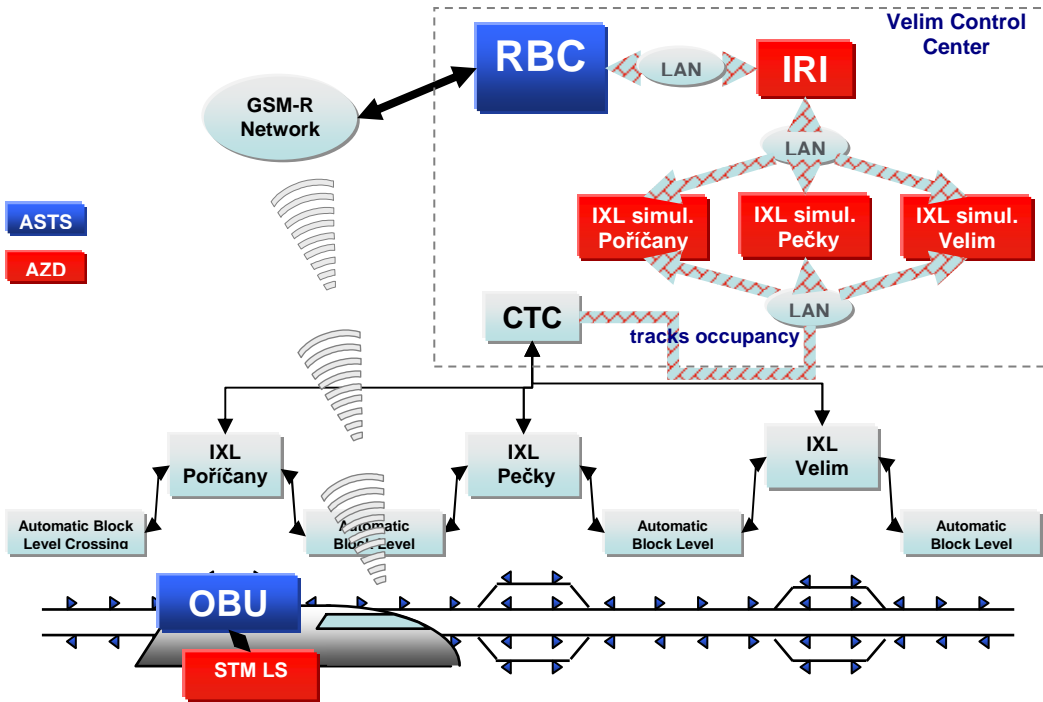
Real line integration tests – “shadow IXLs”

Aim: to allow integration test in line, when the “upgraded IXLs” were not certified yet.

Tracks occupancy are acquired by existing IXLs and transmitted to IRI via CTC and “upgraded IXLs”: this configuration allows the tests on real Pilot Project Line with trains equipped with ETCS on board without impact on the existing traffic on the three stations of the Pilot Project.

The train is supervised both by ERTMS system and by the traditional signalling; the driver follows the most restrictive between the two.

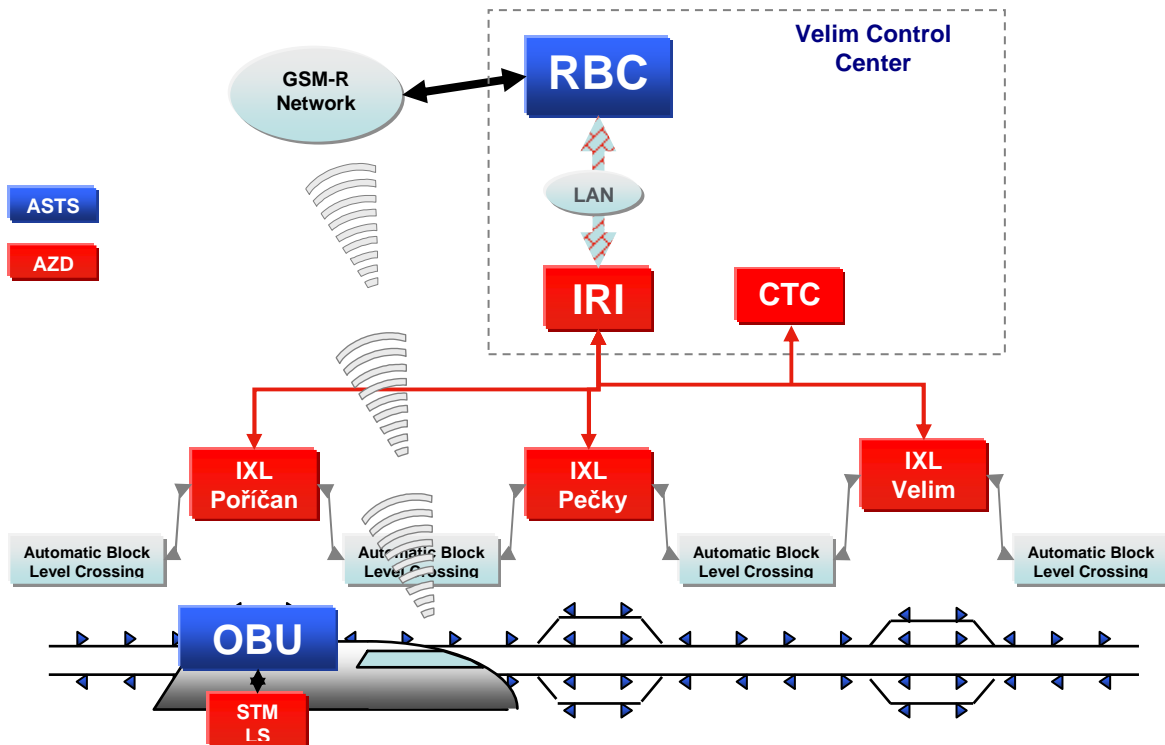
The new IXL SW has been installed in the stations only after this test phase, that shows the correct management of the “traditional part” of the station signalling.



Real line integration tests – real equipment

The last test phase, carried out during the second half of 2009, foresees all real equipments.

This architecture is the one used also for the test activities included in V&V and assessment phases.



6 Conclusions

The described test phases allowed to reduce as much as possible the use of the real line, and the impact on the existing traffic, optimizing the integration activities.

At the end of the described test phases, the acceptance tests are performed, to reach the permission for putting in operation the system.

The pilot projects puts the basis for future enlargement of the ERTMS L2 system in Czech Republic.