



EULYNX



ANNUAL REPORT

2022

CONTACTS

Mirko Blazic, EULYNX Technical Lead:

mirko.blazic@eulynx.eu

Franco Tomassoni, EULYNX Representative:

franco.tomassoni@reseau.sncf.fr

Michael Leining, Liaising Contracts:

michael.leining@nextrail.com

Anastasiia Hrytsyshyna, EULYNX Consortium Office:

anastasiia.hrytsyshyna@eulynx.eu

Nico Hurman, EULYNX Consortium Office:

nico.hurman@eulynx.eu

TABLE OF CONTENTS

Foreword	4
Introduction.....	6
Progress and status.....	8
Financial report	12
Communication activities: InnoTrans 2022.....	13
Member activities	14

FOREWORD



For EULYNX, 2022 has been the year of collaboration.

Cooperation with industry has been intensified, EULYNX Baseline 4 has been launched and the EULYNX Consortium has started deployment support activities. Ties with ERTMS Users Group were also strengthened.

The most impactful step in the collaboration arena was the formation of Europe's Rail, and in particular, the System Pillar. Starting from the first initiatives, EULYNX and EUG have worked closely with DG MOVE to shape the further harmonisation and standardisation of the modular rail infrastructure of the future. EULYNX has thus been recognised by the European Commission as the standard for rail infrastructure.

Originating in 2014 as an initiative of several European Infrastructure Managers, EULYNX has evolved into a mature component of the harmonisation and standardisation of the European rail network. This achievement is a testament to the diligent work of all members involved. Everyone involved can take pride in the results achieved. In collaboration with industry stakeholders and the European Commission, we look forward to taking the next step energetically in the coming year.

Paul Hendriks,
Chairman of the EULYNX Steering Committee



EULYNX remains committed toward achieving deeper harmonisation and advanced standardisation in the signalling domain. EULYNX was formed with a vision for a standardised, modular, and pan-European CCS system. Today, that vision is materialising with full sector support within the recently established Europe's Rail System Pillar.

With a constant focus on harmonisation, efforts have been increased to align requirements among EULYNX members. The results are visible in Baseline set 4, which features fully harmonised requirements for field element subsystems and interfaces. Operational harmonisation is a prerequisite for further steps toward full CCS harmonisation, and the System Pillar's successful initiation and mandate provide the means to the CCS sector to achieve these ambitious goals. From perspective of EULYNX, further harmonisation brings the opportunities for deeper harmonisation of more complex system interfaces such as SCI-ILS, SCI-RBC or SCI-CC.

EULYNX specifications stand as a future-proof solution, providing a basic cornerstone of the future CCS system developed within the System Pillar. One of the first System Pillar publications will be a combined publication of EULYNX Baseline set 4 Release 2, published together with EULYNX. EULYNX ensures a stable foundation for migration from today's state-of-the-art technology to the target vision of the System Pillar.

The future clearly brings more standardisation in railway signalling, and EULYNX is proud to be an active participant and supporter on this exciting journey.

Mirko Blazic,
EULYNX Technical Lead

INTRODUCTION

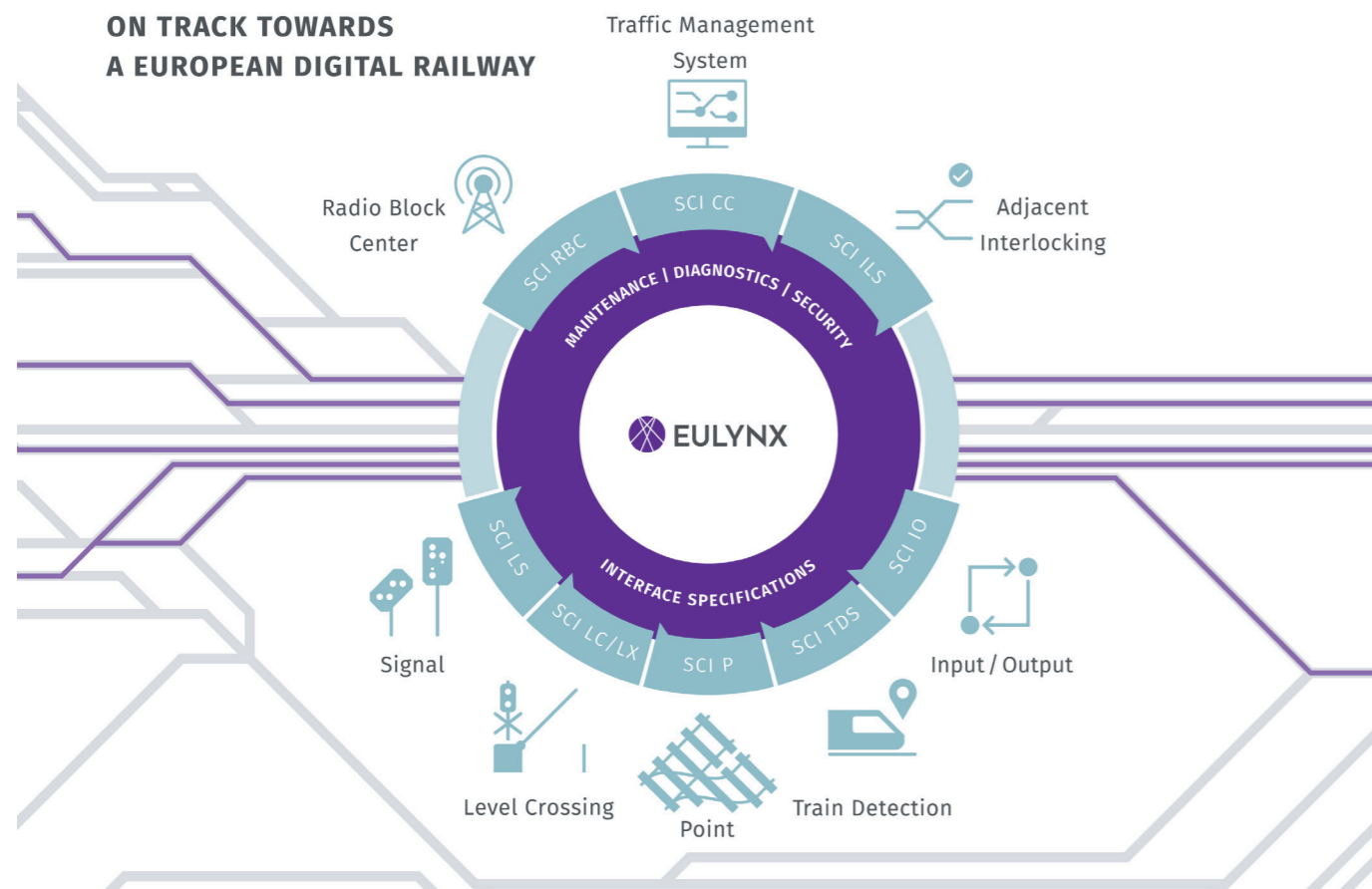
The past year has seen a concentrated focus on the enhancements planned for Baseline Set 4. Building upon the groundwork established in Baseline Set 3, vital extensions and refinements have been incorporated to improve the overall EULYNX system. Collaboration with industry provided important feedback, strengthening further after the start of the System Pillar with close collaboration with experts from UNISIG.

The first release of Baseline Set 4 Release 1 was successfully published in May 2022, marking a significant milestone. The release encompassed not only formal specifications but also supporting

artifacts, contributing to a comprehensive user experience. A full model export has been made available, facilitating simpler visualisation of the modelled requirements, and enabling users to reapply the model in model-based environments. Additionally, executable simulators, developed by EULYNX for internal verification and validation of requirements, have also been delivered, allowing users to simulate subsystem and interface behaviour.

The work on enhancing and refining the Baseline Set 4 continues, building on past results and lessons learned to specify a comprehensive and sector agreed system.

ON TRACK TOWARDS A EUROPEAN DIGITAL RAILWAY



PROGRESS AND STATUS

Architecture

EULYNX Reference Architecture defines the complete EULYNX system, describing the overall architecture, cross-cutting architectural concepts and all generic functions of the system. The majority of the developments in Baseline 4 were related to the generic functions of the field element subsystems. Significant extension to the generic functions now allows for implementation of field element subsystems in form of multi element controller platforms. Focus now shifts towards fine tuning diagnostic and maintenance functionality.

Interfaces

Each functional interface SCI is developed by a dedicated cluster, specifying the Requirement specifications and Interface specifications for that interface. For all field element subsystems, also the diagnostics interfaces SDI, maintenance interfaces SMI and security interfaces SSI are specified.

Baseline set 4 provides harmonised specifications for EULYNX field element subsystem and interface specifications. The dedicated IM codes are no longer applied in specifications for these interfaces. In addition, Baseline 4 introduces functional packages, which can be used to delimit the required scope of the functionality of a product, either in the context of tenders for specific implementation projects or in the context of generic product development, testing and/or certification.

Data Preparation

Data Preparation focusses on the exchange data format for exchanging signalling engineering data between infrastructure managers and market parties. The data preparation UML model provides the basis for XML schema of the exchange format. The data preparation model has been updated in December 2022. The model is openly available on the EULYNX website: <https://www.eulynx.eu/index.php/dataprep> and continues to be updated.

Assurance

EULYNX continues to deliver assured specifications which can be accepted by all member organisations and their corresponding National Safety Authorities. The EULYNX assurance process is following the principles of CSM, tailored to the scope of delivering assured specifications rather than assured products. The process demonstrates that hazards and threats within the scope of the EULYNX work have been identified and that suitable mitigations are in place. An Assurance Justification report follows each baseline release.

Certification

EULYNX Certification provides a formal confirmation that a product demonstrates required compliance to EULYNX specifications. The process is focusing on open testing procedures. The process can be applied both by independent and supplier-based test facilities. The certification process has been prepared in close cooperation with the signalling industry. The basis for testing is the EULYNX certification test case catalogue, which accompanies each baseline release.

Modelling and Testing

Modelling and Testing cluster provides the system engineering process and modelling methodology for development of EULYNX model-based specifications. The modelling experts are involved in the System Pillar Central Modelling Service, to contribute with the expertise and proven methodology for specifying model-based requirements. The EULYNX modelling methodology has been nominated as a System Pillar standard method for detailed subsystem and interface specifications.

Security

Security cluster defines a security architecture for EULYNX and provides best practice guides for a complete security of the railway systems. The developments are shared between multiple working groups in the sector and have been proposed as inputs to the security related work of the System Pillar. The past year focussed on quality improvements of the specifications, and on completion of the new interface type SSI (Standard Security Interface).

Migration

The migration strategies of the infrastructure managers are captured in a migration report, analysing how the system architectures of 10 different infrastructure managers can evolve, starting at the legacy situation and following the whole period of migration towards the future target system architecture, taking into account both train systems and rail infrastructure. Migration strategy involves defined migration plateaus, which can be reached by individual infrastructure managers according to their starting situation and migration plans. Once a certain migration plateau is reached, the evolution steps can be done together with multiple infrastructure managers in a standardised way. The migration strategy has been brought forward to the System Pillar. EULYNX is the enabler of a future-proof migration strategy, ensuring that investments in trackside assets are protected and maintain both backward and forward compatibility.

Deployment support

A new activity has been launched within EULYNX, designed to support the needs of infrastructure managers and accelerate EULYNX tenders. The Deployment cluster is composed of two main components: the Deployment Support Programme and the EULYNX Certification and Integration Facility.

The Deployment Support Programme, designed in a modular format to cater to multiple railways, is expected to be driven together with the railways preparing for tenders. Main modules include general trainings on methodology, and technical support for railways and suppliers, which covers EULYNX documentation structure, integration of national specifications and rulebooks, preparation for marking of IM codes, and additional tendering requirements. This program aims to build up a growing team of experts, ready to support future infrastructure managers and suppliers. For infrastructure managers with ambitions to integrate model based systems engineering in their own environment, a dedicated MBSE training is available.

A proposal for a common EULYNX Certification and Integration Facility is also underway to enhance EULYNX product deployment. The objective is to consolidate current lab activities across Infrastructure Managers and create an accredited, non-profit facility for EULYNX certification. This facility would offer hardware-in-the-loop testing for product compliance and integration testing.

Integration with Europe's Rail System Pillar

The infrastructure managers collaborating within EULYNX and the ERTMS Users Group (EUG) have committed to a shared objective of guiding developments in the CCS sector towards cost-effectiveness, increased capacity, and expedited deployment. The initial work, called Reference CCS Architecture, has evolved into a broader European vision for a unified CCS architecture within the framework of the Europe's Rail System Pillar. This effort commenced in 2021 with a pre-project named «Ramping up of the System Pillar,» resulting in a sector-agreed high-level CCS/TMS/CMS target architecture.

In October 2022, the Europe's Rail System Pillar was officially initiated. EULYNX experts have been collaborating closely with the EUG to create an infrastructure manager workbench for the System Pillar, primarily contributing to Trackside Assets and Transversal Systems domains. As EULYNX transitioned into the System Pillar, clusters responsible for field elements were integrated into their respective workbenches and continued active development within the System Pillar. Efforts have been concentrated on the completion of EULYNX BL4 Release 2 within the System Pillar, enabling the release of sector-agreed Trackside Assets interface specifications. The development focus was on high-priority functional change requests and addressing all review comments and associated change requests from UNIFE issued against EULYNX BL4 Release 1 or older baselines.

Formal cooperation with industry

EULYNX has been engaged in a formal collaboration with the signalling industry through UNIFE, the representative organisation of the European rail supply industry. The UNIFE CCS Platform group has been responsible for collaborating with EULYNX. This collaboration was managed on several levels, included providing technical feedback, participating in shared working groups, reviewing deliverables, and being part of the Change Control Board.

With the formal commencement of the System Pillar, the cooperation with the UNIFE CCS Platform ended and has been transferred to UNISIG. The current collaboration with UNISIG within the System Pillar has been both productive and constructive, paving the way for future developments and integrations within the rail system. The current joint working mode ensures effective communication in advances our shared goals.

FINANCIAL REPORT

For the financial year 2022, available budget for EULYNX Consortium activities has been set at

1.353.500 EUR.

Annual contribution fees of the 13 EULYNX members amounted

750.000 EUR,

according to the following fee apportionment:



category small size network at
36.364 EUR,



category medium size network at
54.545 EUR



and category large size network at
72.727 EUR.

Principal outgoings were the costs of the management and technical coordination, technical support to the EULYNX clusters and organisation of InnoTrans.

Financial year 2022 closed on target, with no carryover to the financial year 2023.

ERTMS Users Group remains a service provider for the EULYNX Consortium, handling the organisational and commercial issues related to the activities of the consortium.

COMMUNICATION ACTIVITIES: INNOTRANS 2022

InnoTrans 2022 was a big success for the whole team. EULYNX showed its own maturity, demonstrated the ongoing implementations, and indicated the outlook to the future with CCS+ target architecture.

The promotion of EULYNX ready hardware, provided by Thales, Pilz, Siemens, Relesoft Oy, Alstom, Frauscher and Scheidt & Bachmann, was a big attraction for the audience. In addition, the interlocking cabinet (ProRail/Movares) was displayed to indicate an architecture and connections to interfaces.

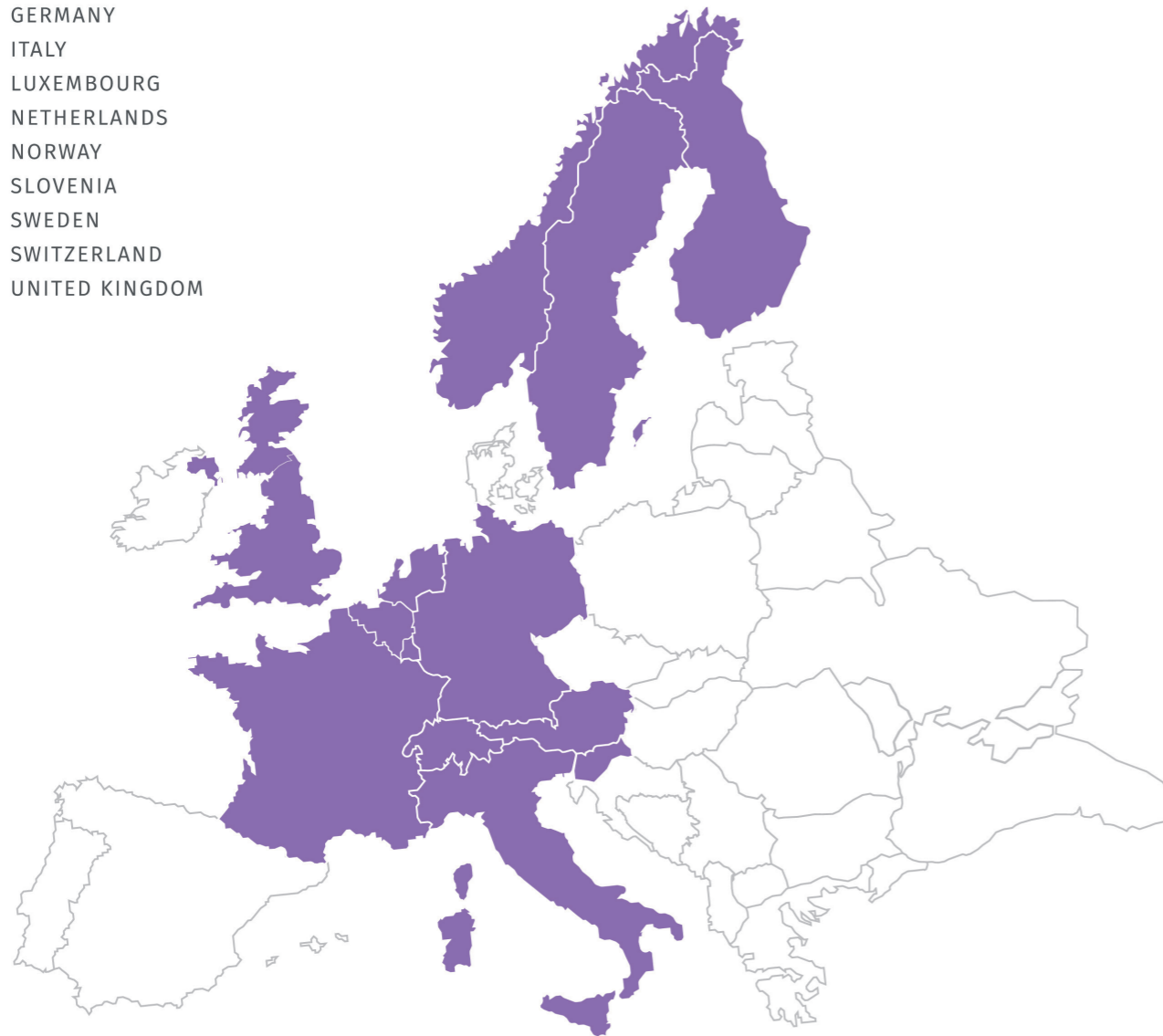
Another achievement is the number of attendees, among which were 20+ railway companies and lots of suppliers from Europe and beyond.



MEMBER ACTIVITIES

The EULYNX Members

AUSTRIA
 BELGIUM
 FRANCE
 FINLAND
 GERMANY
 ITALY
 LUXEMBOURG
 NETHERLANDS
 NORWAY
 SLOVENIA
 SWEDEN
 SWITZERLAND
 UNITED KINGDOM



Austrian Federal Railways (ÖBB)

Release of Baseline 4 was a major milestone for ÖBB. Building up on this baseline, ÖBB will tender digital Interlockings based on EULYNX Baseline 4, where all specifications for the tender were written in full accordance with EULYNX.

Enhancements can be integrated in the future architecture of ÖBB. Compliant products are expected from suppliers as the EULYNX specifications are further developed under Europe's Rail. EULYNX specifications should be part of the TSI in a mid-term period.



Bane NOR

In Norway, system testing is ongoing, based on EULYNX architecture: the first line was planned to go into operation in November 2022, but was delayed due to shortage of rolling stock with ERTMS onboard equipment.

The following EULYNX interfaces are implemented and tested:

- SCI-CC: Currently we use a slightly modified SCI-CC to fulfil our functional needs. Coordination is ongoing with SCI-CC cluster to ensure that all relevant change requests are integrated in the upcoming releases of SCI-CC. The interface is used both between two different suppliers (Thales for TMS and Siemens for IL/RBC) and internally in the test system of RBC/IL supplier Siemens. This interface therefore is also actively used in all testing in our test lab.
- SCI-TDS: Used in trackside application and tested during field tests.
- SCI-P: Used in trackside application and tested during field tests.
- SCI-IO: Used in trackside application and tested during field tests.
- SCI-LS: Used in trackside application and tested during field tests.

For the next version of the signaling system, Bane NOR intends to implement SCI-RBC, which will be tested in 2023. For the subsequent version, to be tested in 2024 and 2025, Bane NOR plans to implement SCI-ILS and aims for implementation of SCI-LX/SCI-LC. Level crossing systems are currently controlled using SCI-IO.



DB Netz AG

EULYNX is gradually and steadily implemented in all on-going and upcoming digital interlocking projects in Germany. Still with EULYNX Baseline 3 as the reference, the projects in Zwiesel (2023, supplier: Pintsch), Gera – Weischlitz (2024, supplier: HITACHI), Lichtenfels – Coburg (2024, supplier: Alstom) and Digital node Stuttgart (2025, supplier: Thales) are getting ready for starting operations.

Already close to starting operations is the pre-series project Mertingen – Meitingen (supplier: Thales) as the most recent digital interlocking going live. This project had been started on EULYNX Baseline 1 and is the biggest project based on EULYNX since the first digital interlocking of DB Netz went into service on begin of 2018 (Annaberg-Buchholz Süd, supplier: Siemens). Significant lessons have been learned since then and reflect the evolution in EULYNX where the focus expanded from specification to testing for supporting implementation. This does not work in sequence but in loops: Testing and implementation create valuable experiences that are taken up for the further amendments of the EULYNX standards. DB Netz experiences strongly supported the evolution of the EULYNX specifications toward next joint publication of Europe's Rail System Pillar and EULYNX.

Increased focus on testing resulted 2022 in launching an independent accreditation of the EULYNX lab in Frankfurt as part of common EULYNX Certification and Integration Facility to enhance EULYNX product deployment. This activity will serve also as a blueprint for accreditations of further EULYNX labs all over Europe and facilitate connecting and collaboration in a future network of EULYNX labs.

Finally, DB Netz is very active in Europe's Rail both in System and Innovation Pillar, where EULYNX is at the heart of the System Pillar in dedicated domains, and important projects in the Innovation Pillar work on evolving EULYNX standards for breakthrough innovations up to automated authorisation. Collaboration with SNCF Reseau on formal methods applications support the approach of reducing human judgement in approval processes and setting mathematical methods as the foundation of a robust and rigid safety proof in digital interlocking solutions.



Finnish Transport Infrastructure Agency (FTIA / VÄYLÄ)

The Finnish Transport Infrastructure Agency (FTIA) is modernising a CTC system in Northern Finland. The area of the new CTC contains among electronic interlockings also around 30 relay-based interlockings. To provide a uniform interface to control the relay-based interlockings, it was decided to create an interface module which can communicate with a modern EULYNX SCI-CC protocol to CTC and thus control the existing legacy interlockings. The progress in POKA CTC project has been positive and the implementation of EULYNX protocol SCI-CC is progressing. In late 2022 the FTIA has started to investigate the possibility to implement EULYNX architecture based diagnostic network and get a diagnostic and event logger to POKA region interlockings. The implementation is expected to happen in 2023-2024. During 2022 the architecture vision of independent EULYNX object controllers has become clearer at FTIA. It is expected to see a multi-vendor solution available for the future ERTMS/ETCS-level 2 first commercial line in Tampere-Pori/Rauma. In Finland a company Relesoft Ltd has started the development of the EULYNX architecture based on EULYNX/ERTMS test system including all relevant subsystems needed for full scale simulations with EULYNX compatible equipment. The FTIA has published an article on EULYNX progress on its website: Modularity of railway signalling equipment will soon be a reality – saving money and creating new opportunities for companies - Finnish Transport Infrastructure Agency (vayla.fi).



INFRABEL

Currently INFRABEL is working on internal working groups concerning the mid-term and long-term vision until 2040. For interlockings, INFRABEL intends to follow the European initiatives and plans to base the next generation of interlocking on EULYNX and the System Pillar.



Network Rail

EULYNX continues to be an important part of Network Rail's overall signalling migration strategy and is a key part of Target190plus program of works.

In 2022 Network Rail contributed to the EULYNX interface development for points, train detection, interlocking, control systems and trackworker safety systems along with support to the Data Preparation, Architecture, Assurance and Certification clusters.

Network Rail's Target190plus program has issued its first Migration strategy that supports implementation of EULYNX interfaces and aligns with Future-CCS Strategy Reference CCS Architecture and ETCS Long-Term Deployment Plan.

As part of this strategy the Target190plus Generic Interface and Boundaries project has continued to work with industry partners to develop EULYNX migration plans specifically for train detection, points and interlocking. Network Rail specifications have been produced that align with BL4R1 for these interfaces, including level crossings, to support trials and Proof of Concept activities, with the aim that standardised products become available Mid 2024.

Work is well underway in Target190plus on the development of requirements for the F-CCS Synthetic Environment, with EULYNX DataPrep model being at its core to form CDM as a part of an integrated Design and Validation Process for F-CCS systems and products.



ProRail

In 2022 ProRail continued preparing the rollout of the EULYNX specifications in the Dutch signaling system. EULYNX is still an important part of the overall signaling migration strategy within the CCS domain towards ERTMS in the Netherlands and beyond.

The Dutch ERTMS program prepares for use of EULYNX interfaces in one of the following releases. In addition, within the legacy system ProRail integrates EULYNX interfaces to help extend the lifetime of the legacy equipment and prepare for a smooth upgrade to the ERTMS and connect with the ERTMS central safety system. ProRail plans on developing an open EULYNX interlocking and object controllers for the trackside assets, following the specifications of EULYNX Baseline 4. Communication and architecture follow hereby the constraints of the ERTMS systems. The tenders for EULYNX in the legacy systems shall be published 2023/2024.

Since 2018, ProRail and DB Netz have been collaborating on a project in which national systems with EULYNX specifications are formally specified, verified and used for product testing. This brings automated testing within reach. This project will finish in 2023 and shows formal methods can add significant value to engineering and testing of signaling systems. The results will be shared within Europe's Rail. All partners are now preparing for following projects, focusing more on the agenda of Europe's Rail.

In 2021 ProRail asked the market to help increasing the speed of ERTMS rollout with innovation. End of 2021 a contract was signed with Pilz about developing and testing of an adapter, using EULYNX interfaces. The adapter will connect a legacy relay interlocking with the fiberoptic signaling network, communicating with EULYNX object controllers. It can help reduce blocked tracks during building activities.

These and other activities show that the policy that is being pursued at European level can be applied in practice. The Netherlands actively contribute to activities in the European approach in line with the goals of the Europe's Rail System Pillar. The ProRail architecture is fully aligned with the higher objectives in accordance with the European railway strategy.

Rete Ferroviaria Italiana (RFI)

During 2022, RFI has been mainly interested and involved in the System Pillar preparation activities, working in synergy with EULYNX.

Starting from 2023, RFI is preparing the path to carry out the due diligence of RFI Interlocking Digital Platform (and main Supplier's Platforms in operation in Italy) versus EULYNX Baseline, as RFI intends to use future EULYNX Baseline and its evolution by System Pillar (toward future TSI).

ProRail



Slovenian Railways (SŽ-Infrastruktura)

In May 2022, harmonized specifications were released in form of EULYNX Baseline 4. Slovenian Railways are aware of the importance to have harmonised standards in the field of interfaces between individual signaling and safety devices. Consequently, SŽ-Infrastruktura have been actively participating in the working groups of EULYNX for several years and closely monitoring the growth and development of specifications through individual releases and editions. At the same time, activities are underway to properly modify national specifications so that the first possible use of EULYNX specifications will ensure good integration.

SŽ-Infrastruktura recently decided to include EULYNX specifications in the tender documentation for the next set of updates to signaling and safety devices on three lines of the central part of the railway network. The start of the mentioned upgrade is planned for 2024. With the use of EULYNX interfaces, the main focus will be on the connectivity of trackside devices (signals, points, and track vacancy detection).

Société Nationale des Chemins de Fer Français (SNCF Réseau)



Last year has been an important year for the deployment of EULYNX based devices in France.

In 2022 SNCF Réseau has awarded a contract to Frauscher for the development, deployment and maintenance of a new generation of axle counter systems implementing the EULYNX BL4 SCI-TDS specifications. The systems will be initially developed with the EULYNX protocol stack based on UDP to have a first system acceptance by the end of 2024. The final version of the system, based on TLS/TCP protocols, is expected to be certified by the end of 2025. The first axle counter systems will be deployed in 2025 on the Marseille-Ventimiglia line.

Frauscher axle counter devices will be connected to Argos interlocking cores supplied by Alstom, Hitachi and Thales who are also implementing EULYNX interface specifications. Generic SCI specifications will be implemented by each supplier to manage SCI-TDS and potential additional EULYNX interfaces in the future.

In 2022 SNCF Réseau actively contributed to the EULYNX interface development for level crossings, train detection and trackworker safety systems. SNCF Réseau has also contributed to the definition of the EULYNX security specifications.

Société Nationale des Chemins de Fer Luxembourgeois (CFL)



In August 2022, CFL put into service a new type of signaling system, that integrates a digital interlocking with ETCS L1 Full Supervision. The combined system allows to significantly reduce lineside signals and provides ETCS-functionality close to an ETCS Level 2 system. As a first step towards standardised interfaces, the new system provides RaSTA communication between different stations (for future SCI-ILS integration) as well as connects dependent level crossings using the SCI-LX interface.



Swiss Federal Railways (SBB)



To implement the ERTMS strategy of the Swiss Federal Office of Transport, SBB AG is procuring railway signalling equipment in two lots by means of long-term framework agreements (timeline 10 years with 3 contract extension options of 5 years per option, the contract includes technical support for 25 years). The tender mainly consists of signalling installations with external light signalling, driver's cab signalling and object controllers (OC) based on EULYNX Baseline 4 Release 1 or higher. In 2022, SBB has prepared the specifications and cooperated in the underlying EULYNX BL4R1.

Lot 1 consists of construction and integration of electronic interlockings, object controllers based on EULYNX BL4R1 or higher and a maintenance, data management system MDM and RBCs, including follow-up support for all systems.

Lot 2 consists of the provision of object controllers based on EULYNX BL4R1 or higher, including follow-up support.

Both lots include several process and technical services, among others technical development, upgrades, security updates, spare parts and logistics, trainings or configuration and obsolescence management.

The procurement will be carried out in a dialogue procedure:

Potential suppliers were invited to submit their requests to participate first in a selection phase for Lot 1 and/or Lot 2 from 30.09. to 02.12.2022. Based on the submitted applications, SBB has selected 5 suppliers for Lot 1: Alstom, GTS, Hitachi, Siemens and Stadler (in alphabetical order) and 3 suppliers for Lot 2: Alstom, GTS and Stadler. End of February 2023, they have received the first version of the SBB specifications. Together with the EULYNX BL4R1 or higher, these form the basis for the dialogues that SBB will conduct individually with each provider from mid-2023 to mid-2024. The aim of this dialogue phase is to involve the industry in concretising the railway signalling equipment requirements and thus sharpen the SBB specifications, giving room for innovation based on the EULYNX standard. At the end of the Dialog and based on a final specification version, the suppliers will deliver their offers in Q4 2024. The signature of the contracts (three suppliers for Lot 1 and one supplier for Lot 2) is planned end of Q1 2025.

Trafikverket



For Trafikverket, EULYNX is considered an important and necessary step towards the more flexible and cost effective signaling system. During 2022, Trafikverket together with DB Netz and system suppliers Alstom and Hitachi, started a project to identify how to foster harmonisation and reduce differences in the implementation of EULYNX at Trafikverket and DB Netz. Going into depth and comparing how to implement each interface offers new findings to use in the implementation of EULYNX as well as suggestions for the next EULYNX Baseline. The project will continue in 2023. In the ongoing upcoming procurement of Trafikverket in 2024, the requirements, will to a large extent be based on EULYNX supported functionality.




EULYNX Consortium

Rue Froissart 123-133

1040 Brussels

Belgium

<https://eulynx.eu>

 eulynx