



Annual Report 2019



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FOREWORD

2019 was an important year for cooperation of infrastructure managers in the domain of signalling. The 13th member, ÖBB, joined the EULYNX consortium. The cooperation between the ERTMS Users Group and EULYNX accelerated the emergence of the common cooperation in Reference CCS Architecture (RCA). At Aspect 2019 in Delft, the Netherlands, it was observed that EULYNX was the subject of an impressive number of papers. Last but not least, clear signals are being received from the European signalling suppliers that they are increasingly agreeing with the direction of Infrastructure Managers regarding modularisation and standardisation. It has also been demonstrated outside of Europe that the application of EULYNX can have added value there.

All the more reason to maintain the stability that can be achieved with the results of standardisation in the form of Baseline set 3, which is now at a mature level. Application of this Baseline is provided for at least three projects respectively in Norway with the BaneNOR national program for implementation of ERTMS combined with EULYNX, in the Netherlands with the migration of ProRail's signalling (starting in Amsterdam) and in Germany with follow-up applications (Stuttgart).

By setting a first standard with EULYNX interfaces and object controllers, a definitive start is made with centralisation, modernisation and digitalisation of signalling. Migration starts with each infrastructure manager with different versions of legacy systems, but they can move toward standardisation in combination with higher ambition levels, which will also be further shaped in an RCA context with the ultimate goal of introduction of “game changers”.

Paul Hendriks, Chairman of the EULYNX Steering Committee

INTRODUCTION

The development of EULYNX specifications is reaching the final phase, as Baseline set 3 specifications provide a complete and mature basis for product developments. EULYNX stands determined on the path toward standardised technical interfaces for signalling systems, leading to lower life cycle costs, more commercial off the shelf products and increased availability of the infrastructure for the member infrastructure managers (IMs).

The past year was dedicated to completing the outstanding requirements specifications, especially focusing on the model-based specifications with state machine models, providing the simulation of the behaviour on the interfaces and thereby giving a powerful validation tool to the member IMs. Baseline set 3 Release 4 has been published in December 2019, and it is planned to finalise and close the Baseline set 3 in 2020.

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. Further architectural updates were implemented, considering also feedback from ongoing projects, as well as feedback from industry.

Interfaces

Each functional interface SCI is developed by a dedicated cluster, specifying the Requirement specifications and Interface specifications for that interface. All requirement specifications are model-based. For all subsystems, also the diagnostics interfaces SDI and maintenance interfaces SMI are specified.

A change in the system definition was introduced, separating the level crossing system into a subsystem Level Crossing and an External Level Crossing System. The subsystem Level Crossing is specified as a fully harmonised subsystem with an interface SCI-LC, and is especially focused on supporting ETCS applications. The External Level Crossing System covers conventional applications with a dedicated interface SCI-LX.

Data Preparation

Data Preparation cluster is preparing an exchange data format for exchanging signalling engineering data between IMs and market parties. Modelling work is ongoing, as the data preparation UML model provides the basis for XML schema of the exchange format. References to topology rely on the RailTopoModel.

Due to massive amounts of data across multiple IMs, the work on the data preparation model is not yet complete – it is planned to deliver a full model by the end of 2021. To allow for monitoring of developments and insight into the modelling work, periodic snapshots of the model will be publicly available.

Assurance

EULYNX aims to deliver assured specifications that will be acceptable by all member organisations and their corresponding National Safety Authorities. To facilitate this crossborder approach, the assurance process is following the principles of CSM, tailored to the scope of delivering assured specifications rather than assured products. EULYNX assurance demonstrates that hazards and threats within the scope of the EULYNX work have been identified and that suitable mitigations are in place.

Certification

EULYNX Certification will provide a formal confirmation that a product demonstrates required compliance to EULYNX specifications. Testing and certification processes are in development, focusing on open testing procedures and establishing a network of testing facilities. The processes are developed in close cooperation with DLR (German Aerospace Center).

Modelling and Testing

Modelling and Testing cluster provides the system engineering process and modelling methodology for development of EULYNX model-based specifications. The modelling methodology will also form the basis for RCA development work as a recognised system engineering approach in the CCS sector.

Several IMs are taking the modelling approach further.

For the purpose of validating and verifying EULYNX specifications and requirements, DB Netz is working on formal models using UMLB/EventB language to verify formally the safety requirements on generic requirements, SCI-LX and lately SCI-P. In addition, PDI/RaSTA are being implemented during a project called Model-in-the-loop concept for testing EULYNX SysML models inside a real hardware environment.

Another approach by ProRail and DB Netz is to investigate the use of formal methods is FormaSig. This project is based on the mathematical semantics: two universities of Eindhoven and Twente work together to further develop a toolset suitable for analysing the quality of system design and introduce model-based testing. The project that officially started in 2019 will last four years, with intermediate results presented on a regular basis.

COOPERATION ACTIVITIES

Reference CCS Architecture (RCA)

The IMs organised in EULYNX and ERTMS Users Group (EUG) agree on a common goal to guide the developments in the CCS sector towards life cycle cost reduction, improved capacity and increased deployment speed.

RCA defines standardised, evolvable interfaces for all major components of the future railway CCS, and brings in new technology and technological progress from other sectors to railway CCS. Interfaces to trackside assets, as specified by

EULYNX, remain also in the RCA target architecture. There is no separate development between EULYNX and RCA – thereby long-term compatibility is ensured.

The development of the RCA is progressing, delivering updated releases Beta and Gamma with informative RCA documents. RCA work is getting more operational, individual clusters have been started. RCA relevant specifications, developed by EULYNX, will be introduced in the next major documentation release, EULYNX Baseline set 4.

Formal cooperation with UNIFE

EULYNX has invited the signalling industry to formal cooperation. Cooperation with signalling industry has been set through UNIFE as the representative organisation of the European rail supply industry. The UNIFE CCS Platform group is responsible for cooperation with EULYNX.

UNIFE supports formal cooperation, confirming that rail industry involvement should be considered as instrumental for the success of the EULYNX initiative. Industry aims to contribute actively to the definition of the specifications, not only as a reviewer of them. The cooperation has been set at the change control board level, where industry representatives present industry's views and elaborate specifications, not only for the specifications, but also for approval and homologation processes for products and applications.

The cooperation is now fully operational, UNIFE CCS Platform members are active in the change control board. In addition to the change control work, UNIFE provides valuable feedback and recommendations to specific technical queries from the EULYNX consortium.

COMMUNICATION ACTIVITIES

Articles:

- Signal & Draht, “ProRail and industrial partners build the first EULYNX demonstrator”
- Signal & Draht, “Validation and verification of model-based specifications”
- Signal & Draht, “Achieving Digital Rail faster with COTS components”
- International Railway Journal, “Standardising interfaces to reduce signalling costs”
- RailTech, “EULYNX replaces mosaic of national signalling interfaces”

Conferences:

- Rail & Digital Mobility User Conference, Annaberg-Buchholz
- Intelligent Rail Summit 2019, Utrecht
- Safety-Critical Systems Symposium 2019, Bristol

Papers:

- Aspect 2019: Bob Janssen, EULYNX Data Preparation

Videos:

- EULYNX Data Preparation, ProRail



Signalling | standardisation



EULYNX was launched by 10 European infrastructure managers (IMs) in 2014 to standardise signalling interfaces and elements. The and maintaining adds to that, given that most of the IMs have the same problem: 10 to 20% of their staff will retire in the next 5-10 years. Finding replacements is when the interlocking core is replaced while the field equipment is retained, the opportunity should be taken to break the so-called vendor lock where a

FINANCIAL REPORT

For the financial year 2019, available budget for consortium activities was 1.240.250 EUR. Annual contribution fees of the 13 members amounted 650.000 EUR, according to following fee apportionment: category small size network at 31.707 EUR, category medium size network at 47.561 EUR and category large size network at 63.415 EUR.

Principal outgoings were the costs of the management and technical coordination, technical support to central clusters and assurance activities. Financial year 2019 closed within planned target with amount of 1.238.800 EUR.

For the financial year 2020, work will be focused on completion of Baseline set 3 and setting up the certification process. New activities toward Baseline set 4 will be started. A number of dedicated RCA clusters will get operational. The consortium budget for financial year 2020 is forecast at 1.989.500 EUR.

MEMBER ACTIVITIES



ProRail

For ProRail, 2019 was the year in which the implementation of EULYNX in the Netherlands actually started. EULYNX has become a permanent part of the ProRail strategy: new, EULYNX-suitable projects will be tendered with EULYNX specifications. At the same time, it was decided in 2019 that EULYNX will be part of the ERTMS specifications. ProRail's active participation on management and expert level in international cooperation pays off because European standards in the field of EULYNX, ERTMS and Procurement can and will be applied.

One of the first projects to be realised is Amsterdam, where capacity increase is the main goal. The signalling part of the project concerns 1200 elements (signals, points, etc.) and extends over a geographical distance of more than 10 km. A necessary development of remote control for signalling could be converted into the application of the EULYNX standard. Application of EULYNX can save many millions of euros by replacing copper cables with sustainable fibre optic cables; the number of interlockings can be limited at the same time. An important modification of the existing relay interlocking in the old station building in Amsterdam can be avoided because the system architecture according to EULYNX can meet the

requirements for business continuity management in Amsterdam. With the application of new electronic interlockings the project anticipates on the migration to ERTMS. The development costs for the new system architecture can be written off over a long period, taking into account facilitation of future application of similar Game Changers such as Hybrid Level 3, FRMCS, TMS, etc. in cooperation with other IMs in RCA.

The development team is working on the implementation of requirements in the existing ProRail environment, so that early 2021 a start can be made with the implementation of EULYNX in the Amsterdam project. The migration to the new system architecture will also bring innovations in the field of power supply and IT technology, with the aim to do cost effective investments on the project level, which will make the later switch to ERTMS faster and cheaper.

ProRail continuously support the development of EULYNX specifications with significant quantity of resources. To illustrate the meaning and advantages of different EULYNX activities, ProRail was glad to support the making of several video films, published by EULYNX.

By setting a first standard with EULYNX Object Controllers, a definitive and irreversible start is made with a new approach in centralisation, modularisation, modernisation, digitalisation and procurement of signalling in the Netherlands.

SNCF Réseau

SNCF Réseau has launched an innovation partnership called ARGOS with the goal to renew the old-generation interlockings. Industrial partners have been working with SNCF engineers and developed technical proposals. In mid-2020, at the end of the evaluation period, SNCF Réseau will choose its suppliers and start a new development phase for the next 3 years. The ARGOS interlocking system will be able to interact with object controllers via an IP network using EULYNX interfaces. Adaptability will be reinforced: the ARGOS interlocking platform shall be suitable to implement a line block system or an RBC as well. The first commissioning of an ARGOS interlocking is expected in 2023.

One of the major objectives of the new generation of interlockings is to improve the overall RAM performances thanks to preventive diagnostics. Object controllers shall

be able to send appropriate information to diagnostics servers. EULYNX SDI interfaces are seen as a suitable solution to allow the interoperability of subsystems provided by different suppliers.

A new generation of level crossing systems is currently investigated by SNCF engineers: the new systems may employ EULYNX object controllers and rely on the interlocking to activate and deactivate the level crossing protection facilities.

SNCF Réseau aims to launch a tender in 2020 to replace the existing old-generation axle counters with new systems, capable to interact with interlockings from different suppliers. As a consequence, the requirements from SNCF have been included in the EULYNX SCI-TDS specifications.

SNCF Réseau engineers are working on a R&I project involving a new trackworker safety system with dependency to the interlocking to activate the protection. Also in this case, the EULYNX SCI-TSS interface, already including the SNCF requirements, is seen as a possible solution to manage the interoperability.

SNCF Réseau is strongly involved in EULYNX Data Preparation activities: SNCF considers that having a common signalling data model is very important to allow software editors to release engineering tools suitable to European IMs. A common data model is also a good opportunity to share good practices for data preparation among EULYNX partners.



Network Rail

Network Rail through our Target190 Research and Development programme are working collaboratively with other Infrastructure Managers on the Reference CCS Architecture (RCA) which includes EULYNX.

In considering possible migration steps to RCA, EULYNX can provide continuity between existing systems architecture and RCA and hence provide whole life cost benefits for all future applications. In addition to the whole life cost benefits above, EULYNX also facilitates the consistent use of trackside CCS equipment in specific maintenance areas even if central CCS equipment is supplied by different suppliers.

For these reasons it is envisaged that EULYNX will feature in Network Rail's future CCS procurement strategy for schemes to be delivered from 2024 onwards.

Trafikverket

During 2019, Trafikverket increased their participation in EULYNX work. One of the main goals was to integrate EULYNX interfaces in the Functional Product FP5.4, being the initial requirement base for the ERTMS system releases to be commissioned 2023 on ScandMed East (Stockholm – Malmö, approx. 480km).

Trafikverket is planning to include EULYNX SCI-TDS and SCI-LC specifications in the Functional Product FP5.4 (a Functional Product comprises the complete requirements for the system releases). The FP5.4 corresponding system releases are planned to be commissioned 2023, within the 3-year window.

Prior of being approved for further commissioning within the network, all system releases will always undergo a supervised operation (an in-service experience) on one of the pilot lines, where Trafikverket has full commercial operation with ERTMS. These pilot lines are the Ådal/Botnia (approx. 300km) and the Haparanda line (approx. 155km).

DB Netz

2019 was a decisive year for the future of railways in Germany: The breakthrough of transforming the German railway system into the forerunner of digital interoperability at the heart of Europe with the full consent and support of the German government. The target railway system will be based on ERTMS Level 2+ and EULYNX.

For paving the way to the target railway system, the following projects have been launched following the accomplished EULYNX-projects in Annaberg-Buchholz and Warnemünde and the on-going EULYNX-projects Koblenz – Trier, Mertingen – Meitingen and Harz-Weser:

High Speed Line Stuttgart (Wendlingen) – Ulm:

Upgrade of existing contract from conventional electronic interlocking (ESTW) to digital interlocking (DSTW) based on EULYNX - migration to EULYNX BL 3 is foreseen.

Stuttgart 21 Core Section, including central station and adjacent line sections: New tender for digital interlocking (DSTW) and ERTMS equipment based on EULYNX BL 3 specification.

DB Netz significantly contribute to the formal specification and verification of EULYNX specifications, helping to bring formal methods and modelling expertise closer to the railway sector.

For the new digital interlocking (DSTW) Finnentrop, a digital engineering planning blueprint based on EULYNX Data Preparation was elaborated and demonstrated as a pre-process for applying BIM in signaling projects.

Rete Ferroviaria Italiana (RFI)

RFI support the work carried out within the Data Preparation cluster. With the help of the EULYNX data preparation model, RFI plans to implement its own Building Information Modeling (BIM) system that is becoming an EC mandatory requirement for the future tenders.

VÄYLÄVIRASTO, FTIA

In 2019 the Finnish Transport Infrastructure Agency FTIA (Väylä) continued the project to update the Finnish signalling requirements documentation to be in conformity with the EULYNX specifications. FTIA is committed in utilising the EULYNX solutions and in coming years it will first incorporate the EULYNX specifications into its existing Finnish Interlocking Requirements documentation and after that utilise the EULYNX requirements in future bidding.

First competitive bidding utilising EULYNX could be launched in 2021 at earliest. In 2019 FTIA has been in the process of preparing together with the Finnish Ministry of Transport and Communications MINTC a twelve-year investment programme and the interlocking renewal projects within this programme would also contain a EULYNX pilot project in Finland.

Slovenske Železnice, SZ

Slovenian railways are devoting a lot of funds to modernise the railway network. It is anticipated that the EULYNX specifications will be part of the tender documentation as the renovation of the infrastructure in Slovenia is underway. Focus will be on the connectivity of the trackside devices – these will be installed in accordance with EULYNX standards.

BaneNOR

2019 has been a highly interesting and active year for BaneNOR, especially related to the development of our new nationwide ERTMS Level 2 signalling system. Even though most EULYNX interface specifications are by nature oriented towards the Signalling System, the specification of the SCI-CC interface towards the TMS has proven to be extremely important as it is interfacing two different systems from two different suppliers (Siemens and Thales).

Throughout 2019 work has been continuous ongoing on implementing relevant SCI, SDI and SMI interfaces. Our first ERTMS line which will be equipped and taken into operation with this system is the “Nordlandsbanen” planned for operation from 31. October 22. It is a 500 km line in the northern part of Norway. Throughout 2019,

Bane NOR have submitted a number of change requests to EULYNX on the specification as a result of our GA development and feedback from both suppliers and EULYNX has been both positive and constructive.

For 2020 the development work on the system and interfaces is progressing as planned, and we now start to see the contours of what the new signalling system will bring us. IP-based communication over standard EULYNX interfaces and with one national computer center for the complete railways signalling system provides a new world of possibilities which we have named “Build Smart”.

Swiss Federal Railways, SBB

SBB strives to introduce the first EULYNX-based train detection systems to be able to experiment with their capabilities, especially the remote diagnostics and maintenance functionalities. Further, it considers EULYNX-based trackside assets as promising candidates to foster the migration to the Smartrail 4.0 interlocking system defined for the SBB and other railways, consistently with RCA.

SBB recognizes there is a potential and opportunity for more harmonized interface protocols. SBB strongly encourages addressing this issue and striving for harmonised specifications with the necessary flexibility. Smartrail 4.0 strives to have the corresponding adaptations of the EULYNX specifications implemented with Baseline Set 4.



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