Annual
Report
2021

EULYNX

Contacts

Mirko Blazic, **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, **Consortium Office:** anastasiia.hrytsyshyna@eulynx.eu

Nico Huurman, **Consortium Office:** nico.huurman@eulynx.eu

David Shipman, **Assurance Expert:** david.shipman@eulynx.eu

Randolf Berglehner, **Modelling Expert:** R.Berglehner@neovendi.com

Table Of Contents

Foreword

In 2021, the EULYNX Consortium has taken important steps towards the future. The consortium members have decided to develop the specifications toward Baseline 4. This baseline makes it possible to develop multi-object object controllers and aims to further harmonise and standardise the interfaces related to object controllers. The collaboration with ERTMS Users Group has been further intensified and together with ERTMS Users Group, the consortium has made a distinctive contribution to the ramp-up of Europe's Rail System Pillar. The deliverables of the EULYNX Consortium will become part of the European harmonisation and standardisation process, which will be further shaped within the System Pillar. In addition, the consortium sees that the members are increasingly applying the EULYNX specifications and migration strategy in the development of their future infrastructure. The EULYNX architecture and products fit well with the ambitions to develop faster and cost-effective toward Digital Rail.

The results of 2021, the support from EC and the excellent collaboration with various stakeholders give confidence for the future. We expect 2022 to be an important year, as major steps will be taken in further integration all harmonisation and standardisation activities in Europe's Rail and the strong support from EC.

Paul Hendriks
Chairman of the EULYNX Steering Committee

The EULYNX Consortium is committed to deeper harmonisation and further standardisation in the signalling domain. A vision of a modular standardised European wide CCS system was laid out several years ago by the members of the ERTMS Users Group and the EULYNX Consortium in the white paper on a future Reference CCS Architecture. Today, this vision is embedded in the upcoming Europe's Rail System Pillar. ERTMS and EULYNX will provide the basic cornerstones for the future system.

The commitment toward harmonisation, with the future vision in mind, led to increased efforts to further harmonise requirements among EULYNX members. The first results will be visible in the upcoming Baseline set 4, where the requirements for field element subsystems and interfaces are fully harmonised. There are more opportunities ahead for harmonisation of adjacent system interfaces such as SCI-CC or SCI-RBC, however the precondition for next steps is operational harmonisation, another area where there are high expectations from the System Pillar activities.

EULYNX already works closely with the signalling industry in a formal cooperation with the UNIFE CCS Platform group. During the development of Baseline set 4, the collaboration was intensified by forming several common working groups on dedicated functional topics. The positive experience from this cooperation model also paves the way for close collaboration with industry in the upcoming System Pillar.

The upcoming Baseline set 4 will deliver enhanced and mature specifications, increasingly used in tenders by EULYNX members and other infrastructure managers, forming a basis for wide industry development. EULYNX specifications are future proof, as they will be applied also in the future CCS system developed in the System Pillar. EULYNX will facilitate migration from today's state of the art technology to tomorrow's vision.

The future will bring more standardisation in the signalling domain, EULYNX is proud to support this journey.

Mirko Blazic
EULYNX Technical Lead
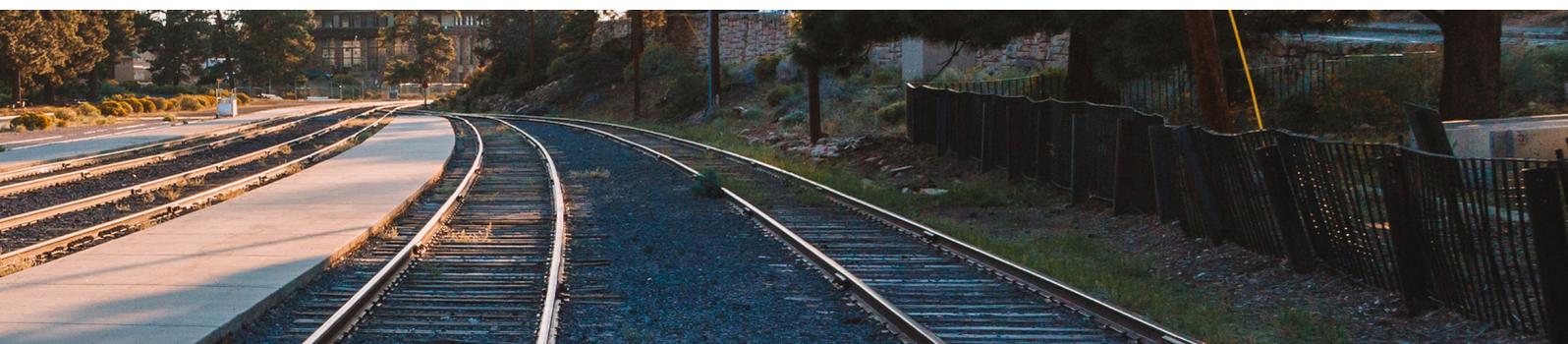
Introduction

The focus during the past year has been on developments scheduled for Baseline set 4. These developments continue on the foundation laid out by the work during Baseline set 3, integrating important extensions and improvements. The collaboration with suppliers provided important feedback, which led to closer cooperation with experts from UNIFE CCS Platform during the development phase.

The completion of first release of Baseline set 4 has been extended into 2022. Publication of Baseline set 4 Release 1 will be completed in May 2022. Baseline set 4 publications will in addition to formal specifications include also supporting artefacts. A full model export will be available, allowing easier visualisation of the modelled requirements, and also providing an opportunity to reapply the model in model-based environments. In addition, the executable simulators, developed by EULYNX for internal verification and validation of requirements, will be made available. The users of specifications will be able to simulate the subsystem and interface behaviour.

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 are related to the generic functions of the field element subsystems. Several functional extensions were added to the maintenance functionality, extending the handling and loading of configuration and software updates. Important extension to the generic functions now allows for implementation of field element subsystems in form of multi element controller platforms. On communications, category 3 (EN50159) networks are supported, and TCP has been added as a transport layer. Point of Service-Signalling requirements have been extended to enable wireless/FRMCS communications.

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.

As continuation of harmonisation efforts, 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 cluster develops the exchange data format for exchanging signalling engineering data between IMs and market parties. The data preparation UML model provides the basis for XML schema of the exchange format. References to topology rely on the RailTopoModel. The data preparation model has been completed in December 2021. The model is openly available on the EULYNX website: https://www.eulynx.eu/index.php/dataprep and will be updated twice per year.

The IMs involved in data preparation have started with deployments, initially focusing on pilot projects and toolchain developments. First development projects and parallel design engineering in form of shadow planning have been started. The cluster will organise dedicated workshops to onboard further users and developers.

Assurance

EULYNX delivers assured specifications that can be accepted by all member organisations and their corresponding National Safety Authorities. To facilitate this cross border 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. An Assurance Justification report follows each baseline release.

> The IMs involved in data preparation have started with deployments, initially focusing on pilot projects and toolchain developments. First development projects and parallel design engineering in form of shadow planning have been started.

Certification

EULYNX Certification provides a formal confirmation that a product demonstrates required compliance to EULYNX specifications. The process is focusing on open testing procedures and establishing a network of testing facilities, both independent or supplier based test facilities. The certification process has been prepared in close cooperation with the signalling industry. The basis for testing will be the EULYNX certification test case catalogue, which will accompany 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 methodology is fully aligned with RCA methodology, together providing a recognised and proven system engineering approach in the CCS sector.

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 several working groups in the railway domain, including EULYNX, RCA, OCORA and S2R Cyber Security. The EULYNX Security concept has been extended with further documentation, including Security Threat and Risk Analysis and EULYNX Security specification. The architecture now includes a new interface type SSI (Standard Security Interface) and a new Security Services Platform to serve the required security function.
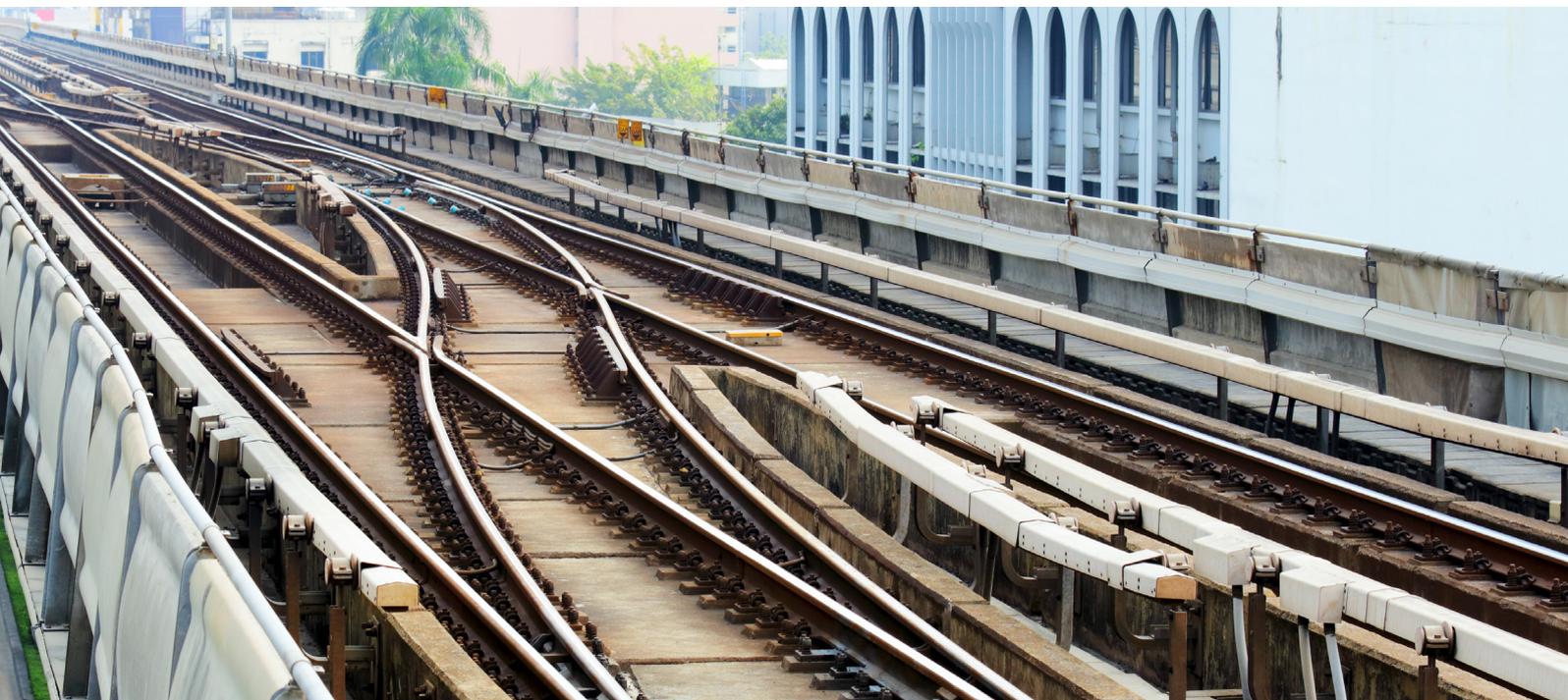
Migration

Migration cluster has worked on migration strategies for EULYNX and RCA. A final migration report has been produced, 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.

Reference CCS Architecture and Europe's Rail System Pillar

The IMs organised in EULYNX and ERTMS Users Group (EUG) agreed on a common goal to guide the developments in the CCS sector towards life cycle cost reduction, improved capacity and increased deployment speed. This led to the start of the work on Reference CCS Architecture, and will now continue within the framework of the Europe's Rail System Pillar.

The first work for the System Pillar started in October 2021 as a pre-project "Ramping up of the System Pillar", which is planned to be finished in July 2022, when formal start of the System Pillar is expected. The pre-project includes the development of the first sketch of the operational concept and target architecture for CCS+ (CCS and TMS) and the high level principles for migration from Class B to the target architecture.

EULYNX experts are working together with the EUG to form the workbench for the railway part of the System Pillar. Once the System Pillar formally starts, EULYNX clusters will be integrated as part of the workbench and actively continue developments for the System Pillar.

Formal cooperation with UNIFE

EULYNX works closely with the signalling industry in a formal cooperation. Cooperation 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. The collaboration takes place on several levels, including providing technical feedback papers, working in common working groups, reviews of deliverables and participation in the Change Control Board.

The positive experience from this cooperation model also paves the way for close collaboration with industry in the upcoming System Pillar.

Financial report

For the financial year 2021, available budget for EULYNX Consortium activities has been set at 1.048.250 EUR. Annual contribution fees of 13 EULYNX members amounted 750.000 EUR, according to the following fee apportionment: category small size network at 36.585 EUR, category medium size network at 54.878 EUR and category large size network at 73.171 EUR.

Principal outgoings were the costs of the management and technical coordination as well as technical support to central EULYNX clusters. Financial year 2021 closed within approx. 99% of the planned budget with the amount of 1.039.250 EUR.

The EULYNX Consortium appoints an organisation as the service provider for handling the organisational and commercial issues related to the activities of the Consortium. In 2021, the ERTMS Users Group (EUG) took over the role of the service provider for the EULYNX Consortium.

Member activities

DB NETZE DB Netz AG

At DB Netz, there are several projects based on EULYNX in the implementation phase. Based on EULYNX Baseline 3, high-speed project Zwiesel (Pintsch) is planned for starting operation in 2023, high–speed project Gera–Weischlitz (Hitachi) and high–speed project Lichtenfels - Coburg (Alstom) in 2024 and Digitaler Knoten Stuttgart (Thales) in 2025. Pre-series project Mertingen-Meitingen (Thales), based on EULYNX Baseline 1, is in operation.

In 2021, DB Netz organised a demonstration of EULYNX interfaces with a demonstrator during the Digital Rail Summer School at the Digital Rail Test Field in Scheibenberg. Together with Thales, Bombardier and Movares, DB Netz presented further work on the demonstrator of EULYNX interfaces and migration to RCA during Railway Forum in Berlin.

Ongoing deployment activities, which will enable further adoption of the EULYNX Data preparation model, are progressing. This includes the development of open-source model APlan and adaptation of Engineering tool RailCOMPLETE.

DB Netz continues to make significant contributions to the formal specification and verification of EULYNX specifications, helping to bring formal methods and modelling expertise closer to the railway sector. Current focus is on an automatic transformation of a EULYNX SysML specification model to an Event-B formal model. The transformation was applied to the EULYNX SCI-P requirements specification. In addition, a joint activity between DB Netz and Trafikverket for EULYNX Application and Deployment is planned and aiming to identify harmonization opportunities that will foster common products for the Swedish and German markets based on EULYNX Baseline 4 specifications. It will also fulfil the needs of different Infrastructure Managers at the same time and reduce the differences in the implementations.

SNCF Reseau

EULYNX is a key element of SNCF's signaling strategy. Our next generation of interlockings (called "Argos") shall be able to support EULYNX SCI interfaces whenever necessary and EULYNX specifications have been used as procurement documents for our future axle counter systems.

In 2021 SNCF has also contributed to the definition of EULYNX interfaces for level crossings, track circuits and trackworker safety systems.

Argos interlockings will be deployed with a new process based on a digital representation of the engineered sites. A national signaling data model is currently being defined to perform this task but SNCF has also been participating to the definition of the EULYNX data model, allowing software editors to release engineering tools suitable to all the participating European IMs.

Infrabel

Infrabel has finally started several internal working groups about the mid-term and long-term vision (2040), where the EULYNX requirements are planned to be used.

Within the next two years, Infrabel is going to define vision 2040 more in detail, but for the interlocking, it is intended to follow the European initiative. Infrabel aims to base the next generation of interlockings on the EULYNX program and on the System Pillar.

Trafikverket

For Trafikverket, EULYNX is an important and necessary step towards more flexible and cost effective solutions. In the coming procurement, the requirements, specified in the Functional Product FP6.0.0, will to a large extent be based on EULYNX supported functionality.

Also, Trafikverket and DB NETZ have started a project together with its signalling system suppliers, Alstom and Hitachi. The purpose is to enable the use of common products for Swedish and German market based on EULYNX Baseline 4. The ambition is to foster harmonisation of requirements, as far as possible, in order to share common products hence reducing costs at both buyer and supplier.

ProRail

In 2021 ProRail continued preparing the rollout of the EULYNX specifications in the Dutch signaling system. EULYNX is an important part of the overall signaling migration strategy within the CCS domain towards ERTMS in the Netherlands. ProRail is ensuring to implement the EULYNX specifications in the future ERTMS equipped lines. In addition, ProRail also chose to develop EULYNX interfaces within the legacy systems to help extend the lifetime of the legacy equipment and prepare for a smooth upgrade to ERTMS. From a certain release, ERTMS systems are prepared for EULYNX, developed in the ERTMS program with a planned roll out in 8 national corridors until 2030.

Introducing the EULYNX specifications in the Dutch legacy signaling system will take place with the realisation of a large project to increase its capacity as a railroad hub. Therefore, ProRail is developing an open EULYNX interlocking and object controllers for the lineside assets, following the specifications of EULYNX Baseline 4. Once in the field, the whole system will be easily upgradable to ERTMS due to the use of the same interfaces and the fiber optic network. This development plays an important role in the nationwide rollout of ERTMS as it will already implement the most important parts of the ERTMS architecture.

Since 2018, ProRail and DB have been collaborating on a 4-year 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 shows how young engineers and scientists can apply modern specification methods in the field of signaling.

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

Österreichische Bundesbahnen (ÖBB)

After the successful onboarding to EULYNX in 2020, ÖBB contributed to the Baseline 4 development and is proud of the upcoming release in 2022. With perspective to digitalisation initiative and the System Pillar activities, EULYNX interfaces will be the solid foundation for the ÖBB future signalling architecture which they bindingly plan to procure.

Rete Ferroviaria Italiana (RFI)

During 2021, RFI has been mainly interested and involved in EULYNX Data Preparation activities, practically using the principles defined herewith in the BIM system of RFI. In addition, RFI is preparing the path towards the RCA migration with specific reference to the ERTMS and the New Interlocking development plan.

RFI very much appreciated the work carried out so far in the above-mentioned areas. Such activities are placed in practice in several projects RFI is deploying in Italy.

SBB CFF FFS Swiss Federal Railways (SBB)

In 2021 SBB has published a Request for Information called "Implementation of FOT ERTMS strategy for signalling installations". FOT is the Swiss Federal Office of Transport. In this context, signalling installations comprise interlocking systems (signalling logic systems and control units for external components; EULYNX BL4 compatible object controllers in the future), radio block centres (RBCs) and their overall integration as well as connection and embedding in the overall environment, including rail process control technology and scheduling. In June and July SBB has organized several hearings with numerous suppliers. The RfI findings have been published in October and have been taken into account for the further design and strategy of the future interlocking and RBC tenders. Due to the need to have a contractual base for new interlockings with commissioning starting in 2028, and taking into account the FOT requirement of an evolutive development, the tender has been designed in two steps.

- Step 1 includes forming a new contractual basis for the CCS system procurement, with upgradability of the procured systems to the future European Standards, inclusion of the current optimisations in the ETCS L2 functionalities, and the implementation of object controllers with EULYNX BL4. The tender design concept, including a top view scope definition for tender step 1, will be released in February 2022. The tender publication is currently planned in Q4 2022.

- Step 2 of the tender will be one or more tenders and has as a main goal the implementation of a standard European CCS system according to RCA, as defined by the Europe's Rail System and Innovation Pillar. The definition of the common goals to be reached by the new system is the purpose of the ERTMS Forum working group, formed by Swiss Rail suppliers and the Swiss rail operation companies. A first concept is planned by end of 2022.

BANE NOR Bane NOR

Bane NOR's supplier for our ERTMS Signalling system, Siemens, are now in a development phase which includes all relevant EULYNX interfaces. Change requests during the past year have been submitted to EULYNX and processed according to plan. Bane NOR are planning to take into operation the line Gjøvikbanen nord Q4 in 2022 with the use of SCI-CC. In following stages, Siemens will incorporate further EULYNX interfaces.

Väylävirasto (VÄYLÄ)

In late 2021 Finland has its first EULYNX related implementation project, as Finnish Transport Infrastructure Agency FTIA (Väylävirasto) and a Finnish rail construction company GRK Rail Oy have decided a Design & Build contract supporting the POKA project i.e. the Northern Finland Centralised traffic control (CTC) with interfaces. The GRK Rail Oy delivers for the POKA project interfaces for the relay interlockings (types Siemens DrS and GANZ Domino 55). This EULYNX implementation in North Finland is the first commercially designed solution enabling EULYNX SCI-CC for CTC in Finland. The company GRK Rail Oy utilises a subcontractor company Relesoft Oy (relesoft.io) for its EULYNX related tasks. The main supplier for the POKA CTC project is the subsidiary of Siemens Mobility in Finland.

SZ-Infrastruktura

Slovenian Railways are committed to the importance of harmonised standards in the field of interfaces between individual signalling devices. As a result, we have been for several years actively participating in the working groups of the EULYNX project, and we directly support the updates and developments of specifications through individual baselines and releases. At the same time, activities are underway to amend national specifications accordingly, allowing a smooth first possible application of the EULYNX specifications.

Slovenian Railways are facing a period when the modernisation of the central part of the railway network will take place. During these renovations, we expect that there will be room for the EULYNX pilot project in Slovenia. The focus will certainly be on the connectivity of trackside devices, which will have to be designed in accordance with EULYNX standards.

The Société Nationale des Chemins de Fer Luxembourgeois (CFL)

CFL has actively contributed to the evolution and quality of the EULYNX Baseline 3 and Baseline 4 specification sets.

Based on the published Baseline 3 specification set, CFL is currently updating the tender documents for EULYNX compliant interlockings. We have a major renewal project for the interlocking in Bettembourg, which includes the largest marshalling yard on Luxembourg's railway network as well as an important passenger line towards France. The tender is planned to be published in 2022.

Network Rail

EULYNX is becoming a more and more important part of Network Rail's overall signalling migration strategy and is a key part of Target190plus programme of works.

In 2021 Network Rail has contributed to the EULYNX interfaces for Points, Train detection, Interlocking, Control Systems and Trackworker Safety Systems along with support to the Architecture, Assurance and Certification clusters.

As part of Target190plus Network Rail is developing its Migration strategy to support implementation of EULYNX interfaces and align 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 worked with industry partners to develop EULYNX migration plans specifically for train detection, points and interlocking. Production is well underway on Network Rail specifications aligned with BL4R1 for these interfaces plus Level Crossings to support trials and Proof of Concept activities, with the aim that standardised products being available Mid 2024.

Work has also started in Target190plus on the development of requirements for the F-CCS Synthetic Environment, with goal to use EULYNX Data Prep model as part of an integrated Design and Validation Process for F-CCS systems and products. This work is early in development, but Network Rail sees EULYNX Data Prep as an enabler for this activities progress.