

Project 617: Replacement Interface Computer

Market consultation 1: New interfaces between NX'68 train security systems and ICT control systems

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1 Market consultation 1: new interfaces between NX'68 train security systems and ICT control systems'

Are you thinking along with us about the replacement of the Interface computer?

1.1 Introduction

ProRail B.V. is responsible for the railway network of the Netherlands: construction, maintenance, management and safety. Employees ensure that every day, 24/7, 1,200,000 passengers and 100,000 tons of goods arrive at their destination, with 6550 trains over more than 7,000 kilometers of track. The railway network is the beating heart of the mobility of the Netherlands.

ProRail is working on the accessibility of the Netherlands by ensuring an optimal rail network.

We distribute the capacity on the track, arrange all train traffic, build and manage stations and build new tracks. ProRail also maintains existing infrastructure such as track, switches, signals and level crossings.

Within the Traffic Control Train Control chain, the Infra Control Systems (IBS), specifically ASTRIS, are responsible for controlling and translating orders to the Security Systems and the transmission of status messages from the Security Systems. Primarily for the train control chain, and therefore for the benefit of Process management (PRL) and TROTS.

With the NX'68 protection, an Substation (remote system) is used for remotely transmitting the status and controlling the B relay.

Due to the VOC project, in addition to the realization of the communication about the OC Network, the Substation has been equipped with a new processor card. With this replacement, a lifespan extension of 15 years is intended. The implementation of this started in 2010, reaching the end of the lifecycle in 2025.

New installations and mutations to B-relay protections (NX'68) are still taking place. We must be able to control these B-relays until they are replaced by electronic security. AM-Train Protection indicates that B-relay installations will be used until well after 2040.¹

ProRail intends to issue a tender for the development of a new Substation in which the aim is to replace ProRail's own protocols with a, to be selected, generic interface that will be applied to the new Substation. This market competition focuses specifically on the protocol issue. In order to prepare a final tender, ProRail must take a decision on this.

1.2 Purpose

This market consultation is a preparation for a possible tender for a new Substation. ProRail wishes to gain insight into all possibilities for rationalization of the system landscape in the connection of ASTRIS with the underlying security systems.

This document contains all relevant information for this first market consultation: the process of the consultation, the conditions and the questions asked by ProRail.

¹ Assuming the fastest possible ERTMS deployment and replacement of train protection installations.

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ProRail wants to clearly indicate that no parties will be selected in this phase. No rights can be derived from this document and/or participation in this market consultation in the context of any future tender. You are requested to answer the questions, see Chapter 3, when participating, but neither answering nor not answering will lead to admission or exclusion in any future tender procedure.

1.3 Scope

The scope of the intended tender consists of the development of an Substation based on Commercial off-the-shelf (COTS) hardware, delivery of the solution, system integration, 3 e-line & configuration management and possibly other supporting products and services.

The scope of this first market consultation is to conduct a market survey for the renewal of the interfaces between NX'68 train security systems and ICT control systems into an industry standard interface.

In the second market consultation, ProRail wants to conduct further research into the hardware aspects solution, system integration and support.

1.4 Identifying problems or dilemmas

Astris is a generic application that communicates towards security on the basis of the Bev NL protocol developed by ProRail. The NXA forms an intermediate layer to be able to do a translation towards protections that do not provide an interface option based on the BEVNL protocol.

The BevNL protocol is element oriented. In order to be able to give contact-driven assignments, a conversion also takes place within the NXA from element to contact control.

The NXA offers us flexibility but extends the chain. This is obviously detrimental to availability, increasing cost and complexity. A system landscape in which the NXA can be cancelled (as much as possible) is preferable. The BEVNL protocol will then have to support contact control, which is part of the original specifications but which has yet to be realized.

The standard EN 50159 applies when communicating with a security system over a network, which is the case here. The TCS network, which is used, is classified as a CAT-2 network. Table B.2, of EN 50159, indicates which defensive measures should be taken against possible threats (all with the exception of Masquerade).

How this can be achieved is also described in EN 50159.

The protocol applied over the WAN (the cloud in [Figure 2]) must comply with this standard (for BevNL, RaSTA and this is the case).

A solution based on BevNL, RaSTA and also SCTP is possible. However, the RaSTA protocol is still in full development and has not yet proven itself in practice. In order to convince ProRail of this solution direction, this option must be well-founded.

The current RTP Substation uses the RTP protocol. This complies with the EN 50159 standard, but this proprietary protocol is no longer supported by the supplier in this form and therefore not suitable. When replaced by a new Substation, the RTP protocol will be phased out gradually.

In [Figure 2] a red circle indicates for which system chains a new protocol to be applied is sought when replacing the current Substation.

The OPCE protocol developed by ProRail was originally intended for communication over multidrop lines. When replacing the copper connections with the (current) fiber optic network, the protocol is maintained and messages are sent as a UDP packet. In order to be able to interface with the legacy security systems, a Westermo converter is used. This converts the message in the UDP packet back to an RS-232 message.

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Strictly speaking, the OPCE protocol does not comply with the EN 50159 standard, which also leads to the necessary problems in practice. It is therefore ProRail's wish to comply with the standard here. The limiting factor here are the possible interfaces of the existing systems. The interfaces that these protections provide are:

(i) VPI

- OPCE over RS-232,
- DataTrain VIII Protocol,
- Genisys Slave Protocol
- MODBUS TCP Master & Slave.

PLC-IXL

- OPCE over RS-232 or TCP,
- OPC DA and OPC A&E,
- MODBUS TCP Master & Slave,
- MODBUS RS485 Master & Slave
- PROFIBUS DP Master & Slave
- PROFINET IO Controller & Device,
- Send & Receive TCP,
- HEART
- ComUserTask, programmable protocols,
- HIMA SafeEthernet.

The RTP-Substation and the Westermo converter belong to the domain of the AM department. This is the desired situation but organizationally not yet a reality. Equipment in the AM domain is decentralized and should be easy to manage. In practice, this means that function recovery can easily take place by exchanging equipment. Remote configuration and management features are desirable with the restriction that these features are not a prerequisite for continuity.

DOSS stands for Discrete Level Crossing Signaling. With DOSS2.0, the level crossing status is transmitted to ASTRIS via the MODBUS protocol, via the NXA. DOSS is not a security system and does not formally have to comply with the EN 50159 standard. In order to better guarantee the integrity of the data, a checksum has been added to the message. MODBUS does not provide for this by default and that is why we refer to this as MODBUS+.

DOSS1.0 is now, just like the (i)VPI and the PLC-IXL, connected to the NXA. The intention is to have the communication of DOSS1, in accordance with DOSS2, via the DOSS Server. In [Figure 2] this is already assumed.

The controls and alerts, in the case of element-controlled (modern) protections, are exchanged over the WAN via the BEVNL protocol. SCTP is used for transport. This offers the benefits of UDP (fast) and TCP (guaranteed delivery) and provides the required protection measures against potential threats. The application layer BEVNL also provides this in order to be able to comply with the EN-50128 standard.

A SIL level includes measures that you must take during the development of the software. The measures associated with software development for the railway under SIL-1 are described in EN-50128. For example, there are organizational measures, requirements for knowledge and skills of the personnel who develop the software, requirements for documentation, quality assurance and testing,

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software development and requirements for tools and programming languages (an open standard does not meet this in principle).

For the solution, it is sufficient if, in the application **or** transport layer, adequate security measures have been taken against possible threats.

The word safety in this context means: railway safety, not to be confused with security: ICT safety. Safety then means: not running unacceptable risks in the field of life, health or the environment. In particular, European standards EN-50126-2 and EN-50128 deal with this. In the former standard there is a SIL level.

Process management (PRL), the control and signaling system, has so far been given Safety Integrity Level 0 (SIL-0). However, in order to renew those matters that are in direct contact with train safety and must give a reliable (truthful) picture of reality 'outside', ProRail has determined that these parts must be given a higher SIL level.

Because for certain functions of PRL (e.g. the revoke button and the signalling image) the TFFR is between 10^{-6} and 10^{-5} /h, the SIL level of those parts of PRL has been set at SIL-1 for the future. This is in accordance with the ASTRIS system, which is positioned as an intermediate layer with PRL and the SIL-4 train protection systems. It will be clear that a new Substation, which is located in the chain towards the security, must therefore comply with SIL-1.

1.5 Reading guide

Chapter [2] contains more detailed content on the subject of the market consultation; in chapter [3] we explain the market consultation procedure.

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2 New Substation (background)

2.1 Context

To set up a train path, Rail-Infra elements must be able to be set in the desired position. For this purpose, the process management system gives orders that are given by the Substations processed become switching instructions that by controlling relays put the rail-infra elements right one by one.



Figure 1, Operating chain

The solution thus supports the following business processes of Traffic Control (VL, the user of PRL):

- Making infrastructure available to trains,
- Withdrawing infrastructure from the train service.
- Controlling and signaling the B-Relay protection.

This is not a change from the current function of the Substation. The solution therefore serves to guarantee the Continuity of the function of the remote system

The current insights and standards set the following innovation goals:

1. The chain from Control & Signaling to security is based on SIL-1 integrity level.
2. The new Substation meets the requirements set by the information security policy.²

The current Substation communicates with its NX'68-like systems in the following way:

- Towards the NXA based on logical (map) contacts. The proprietary RTP protocol is used here. (in [Figure 1], Infra beheersing (Infracontrol))
- Direction Security based on physical contact controls and notifications. (In [Figure 1]: Relais (Relays))

In NXA, a transformation takes place from objects from the TCS-BEVNL domain to contacts in the NX domain and vice versa. Modern protections communicate on the basis of objects. A transformation, and therefore the NXA, is then not necessary.

For the Substation to be developed, consideration will have to be given to which protocol stack we want to apply. A precondition that we want to set is that existing NX'68-like systems can also be communicated on the basis of this interface (the two circled left columns from [Figure 2]).

In [Figure 2] elaborated in more detail.

² Information security policy Manual classification ICT information security needs, Stoffel Bos, June 2016, version 2.1, [IBB-3.1](#)

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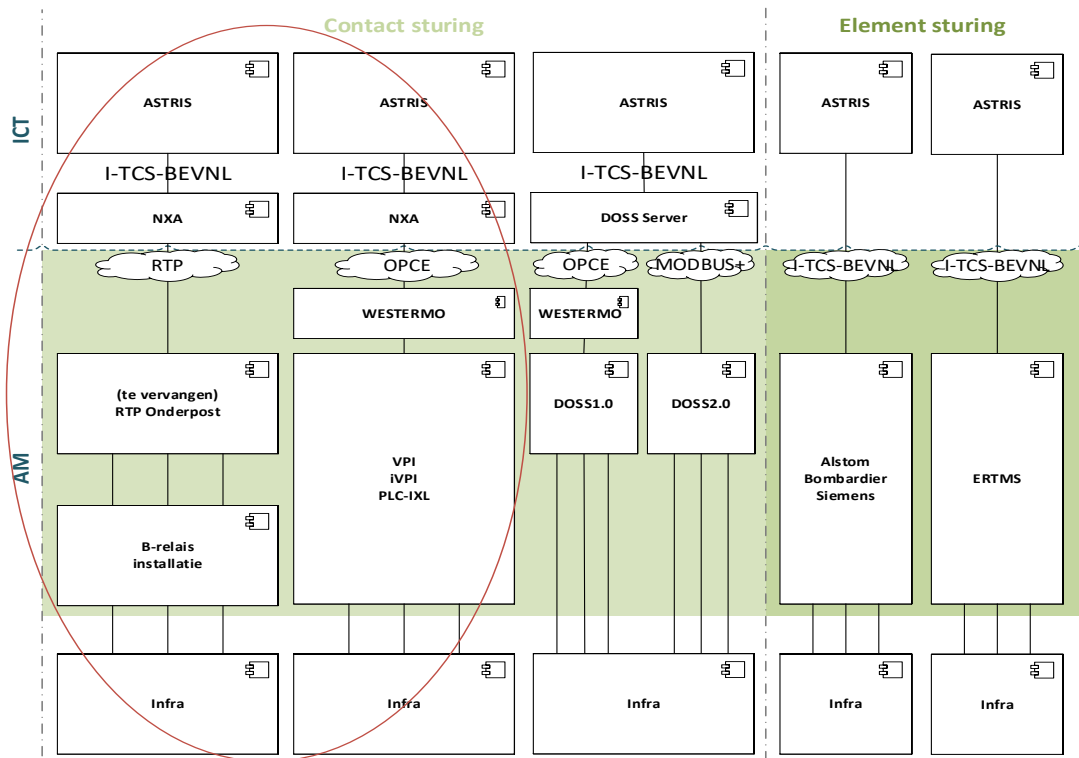


Figure 2, System landscape

Astris

The generic software layer that unlocks all types of protections to PRL in a uniform way, both for operation and signaling. This component is active on ProRail's Regional Linux Platform, which is placed regionally in a computer room.

Nxa

Adapter (part of ASTRIS) that converts the proprietary RTP protocol of the Substation or the OPCE protocol of the other NX'68 systems to the BEVNL protocol as spoken by ASTRIS. This component is active on the Regional Linux Platform, which is placed regionally in a computer room. (13x in the Netherlands)

Substation

The Substation, which reads and sends the contacts of the security, and links them to the Post21 systems. The Substation (approx. 385 computers) is located in the relay house (at approx. 240 locations).

B-relay installation

The actual security installation, performed in B-relays. This installation is located locally near the rail-infra elements, in a relay house.

Infra

The rail-infra elements along the track, such as the switches and the signals etc.

The right three columns are for information. The rightmost column will apply to the roll-out of the ERTMS system.

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2.2 Ambition

The ambition is to integrate the solution, as well as possible, into the existing chain. This as well physically, managerially, as technically. This takes into account the, partly determined by law, conditional requirements for the most favorable total cost of ownership (TCO).

ProRail's starting point is that an interface based on an open (industry) standard must be used. This interface should also be applicable to the existing NX'68 systems (in [Figure 2] the left two columns). This market competition focuses specifically on generic interface with existing and new systems.

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3 Questioning

Below are the questions of ProRail listed in three categories:

- 1 Software (and standards)
- 2 Hardware
- 3 General

3.1 Software (and standards)

Given the ambition that ProRail currently has and the limitations/ obstacles that have been discussed in this document, ProRail has the following questions:

1. Which protocol stack would you like to apply for communication over the WAN? For each possible threat, please indicate how the EN 50159 standard is implemented.
2. In the context of future-proofing and manageability, we as ProRail intend to follow the market in what is possible. We are thinking of the possibility to move certain functionality in NXA and/or ASTRIS to the remote system', where the aim is to minimize the number of protocols used towards Relay-based and electronic protections (standardization in market-based use). How do you view this?
3. Section [1.4] refers to the RASTA protocol. ProRail would like to know whether you are going along with this development and if so, how far along you are in the development of this protocol and what the timeline is when the protocol will be available?
4. What, if any, limitations, opportunities, risks, advantages and disadvantages, etc. do you see when applying proposed solution(s)?
5. Does your solution comply with SIL-1 or are you willing to make adjustments to reach this level? What timeframe do you see for this?
6. How do you see the test process for you (functionality and the RAMS aspects)?
7. With the sketch from existing to new (ERTMS) and the replacement in between, where do you think ProRail can take cost-saving measures?

3.2 Hardware

Given the ambition that ProRail currently has and the limitations/ obstacles that have been discussed in this document, ProRail has the following questions:

8. How do you think the link between the new Substation and the existing systems can best be realized?
9. Are additional developments/products necessary to meet ProRail's wishes?

3.3 General

10. In your opinion, what other aspects are important in this issue and can you explain this further?

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4 Market consultation procedure

4.1 We are looking for your ideas!

In preparation for a proposed tender for the Life Cycle Management RTP Substation, ProRail wishes to gain more insight into the market and the possible market-based solution directions.

With this market consultation, we expect to get a picture of the suppliers who have a the direction to a solution "on the shelf", as well as the developments of the suppliers in this area. If the solutions to be received fit within the image that ProRail has with this replacement, we can describe the functional specifications in the intended tender.

4.2 Approach to market players

This market consultation has been published on TenderNed as a closed market consultation. This means that a select group of market parties has been approached to participate.

Market parties with knowledge and experience with regard to the supply of PLCs, which comply with the Safety Integrity Level 1 (SIL-1), are requested to respond to this invitation. Insight into this market is of great value for any future tender procedure and is highly appreciated.

The market consultation is in writing. You will be asked to submit the attached questionnaire by e-mail before the date mentioned in section 4.4.

If the answers given are unclear or raise follow-up questions, ProRail can ask you questions about this afterwards.

4.3 Procedure

Market parties are requested to register in writing for their participation in this market consultation before the date referred to in paragraph 4.4 at the following e-mail address: arjen.pfundt@prorail.nl. Please include your contact details (company, name, telephone, e-mail address).

Indicate your proven experience and references in the field.

The market consultation consists of two steps:

1. Written: answering questions (see Chapter 3);
2. Individual conversations with (part of) the market parties that have responded.

Re 1: A summary is made of the results of the market consultation in which the most important conclusions are recorded. In any case, no competitively sensitive information will be shared in this report. This document will be shared with all participants at the end and will be attached - if applicable - for information purposes to the tender dossier of a future procurement procedure. The conclusions will be implemented in the tender dossier and/or the tender procedure where ProRail deems it possible and useful.

Re 2: It is expected that a conversation will last about 2 hours. The parties selected for this purpose will receive an invitation for this at a later stage.

In order to make this conversation as efficient as possible, we appreciate it if employees with the right knowledge can participate in this conversation.

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During the discussions, a number of themes will be discussed. These themes are mentioned in Chapter 2. We also welcome the participant to bring in themes during the conversation that can contribute to or influence the objective of this market consultation.

A report will be made of each individual interview and submitted to the participating party for approval. ProRail will then make one integral (anonymized) report of all conversations in which the most important conclusions from the written responses and the conversations will be recorded. In any case, no competitively sensitive information will be shared in this report. This document will then be sent in draft to all participants in the consultation with the request to read the document and to pass on any comments to ProRail. After all participants have had the opportunity to submit comments, the document will be definitively adopted by ProRail. The final document will be attached to the tender dossier of a future procurement procedure for information purposes. The conclusions will be implemented in the tender dossier and/or the tender procedure where ProRail deems it possible and useful.

4.4 Planning

Date	Activity by interested market party	Activity by ProRail
15-08-2022		Publication of the market consultation on TenderNed.
23-09-2022	Deadline for submitting a written response to market consultation.	
30-09-2022		Invitation to individual consultation for selected companies
From 10-10-2022	Individual consultation with the invited market parties.	
24-10-2022		Provision of an anonymized final report to all participants of the market consultation.

4.5 Rules of the game market consultation

ProRail has set the following conditions with regard to this market consultation:

- The market consultation is explicitly not part of any tendering procedure to be held.
- No rights can explicitly be derived from the information provided in the context of the market consultation.
- Participation in the market consultation will not put participants in a preferential position with regard to any procurement procedure to be held, nor will non-participation lead to exclusion in such a procedure.
- The market consultation has a non-binding character and no rights can be derived from the (insights from the) market consultation.
- For the time being, the target group of the market consultation is limited to private market parties that can provide connectivity services over cellular 4G or 5G networks.

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- The following parties are excluded from participation in this market consultation: public parties, interest groups, private individuals, press and knowledge institutions.
- The language of the market consultation is English and/or Dutch.
- By participating in a market consultation, the parties unconditionally agree to the aforementioned conditions.
- Participation in a market consultation is voluntary; no compensation will be provided for participation and no compensation will be provided for expenses arising from participation.
- In connection with the measures related to COVID-19, any consultations will be conducted with the help of Microsoft Teams.
- All communication regarding the market consultation and the submission of answers and/ or answer forms must take place via the following contact:

Arjen Pfundt, tender manager ICT

Mail: arjen.pfundt@prorail.nl

Phone: 088-231 6317

4.6 Contact

For questions about and registration for this market consultation, please contact:

Arjen Pfundt, tender manager ICT

Mail: arjen.pfundt@prorail.nl

Phone: +31 6 39309018

4.7 Sign up now!

If you are enthusiastic about our project and are interested in exchanging ideas with us or expressing your opinion, please register by e-mail before the date mentioned in section 4.4.

4.8 Open and honest

Participation in the market consultation is entirely voluntary and will not lead to any privileges in a tender. Similarly, not participating in the market consultation will not lead to exclusion from a possible tender.

By participating in this market consultation, you agree that the information you provide may be used by ProRail in (the preparation of) the tender. Commercial (numerical) information provided by you will be treated confidentially by ProRail.

ProRail attaches great importance to a transparent process. It is not the intention to favor participating market parties in the market consultation or to place non-participating parties at a disadvantage. From this perspective, all relevant information resulting from the market consultation will be made available to all potential tenderers upon publication of the tender or added to the tender dossier.

Any costs for participation in this marketconsultation will not be reimbursed.

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List of abbreviations

Abbreviation	Meaning
Am	Asset Management (department within ProRail)
Astris	Control and Status notification of the RailInfraStructure (application)
B-relays	Protection relays
BevNL	Security Netherlands
COTS	Commercial off-the-shelf
Doss	Discrete Level CrossingStorage Signaling
ERTMS	European Rail Traffic Management System
HEART	Highway Addressable Remote Transducer
Ibs	Infra Control Systems
Modbus	Modicon Communication Bus
NX'68	Relay protection type NX (eNtrance – eXit)
Nxa	NX adapter application
Opce	Substation Control Unit
Opc	Open Platform Communications
Plc	Programmable Logic Controller
Prl	Process management
PROFIBUS	Process Field Bus,
RAMS	Reliability, Availability, Maintainability and Safety
Rasta	Rail Safe Transport Application
Rtp	Real Time Products (Producer current Substation)
Sctp	Stream Control Transmission Protocol
Sil	Safety Integrity Level
TCO	Total Cost of Ownership
Tcp	Transmission Control Protocol
Tcs	Traffic Control System
Tffr	Tolerable Functional Failure Rate
Udp	User Datagram Protocol
Ventilator	Wide Area Network