



Nordic Institute for
Interoperability
Solutions

YEARBOOK **2021**

2021 marked another year of effective development and cooperation for NIIS, despite the circumstances affecting the global operating environment.

Our team continued developing the X-Road® data exchange layer software and ecosystem solution. Also, Harmony eDelivery Access® was introduced as a new NIIS product, providing a free and open-source solution for joining eDelivery networks.

The time of pandemic highlighted the importance of international cooperation, and NIIS participated in several projects with partners, including the World Health Organisation.

We were delighted to welcome Iceland as a new NIIS member country. Also, the X-Road Community kept growing, and new X-Road Technology Partners joined the programme to support X-Road user organisations worldwide.

NIIS team will keep working on digital government solutions in the spirit of open source and digital public goods. We thank all community members, enterprises providing services and partner organisations for their cooperation.

Ville Sirviö, CEO
Twitter: @sirvioville





Co-working day in Iceland at the end of 2021.

Digital Iceland and NIIS teams in Reykjavik:
Hrefna Lind Ásgeirsdóttir, Vigdís Jóhannsdóttir,
Aldís Stefánsdóttir, Marit Mikson, Ville Sirviö,
Raido Kaju, Petteri Kivimäki, Fríða Rut Hallgrímsdóttir,
Gunnar Ingi Reykjalín Sveinsson and Vigfús Gíslason.





Table of Contents

X-Road® Data Exchange Layer	5
• Major events in 2021	6
• Sustainability initiatives 2021	7
• Use cases worldwide by the end of 2021	8
X-Road Community	9
X-Road Technology Partners program	11
Harmony eDelivery Access	13
• Product Description	14
• Future plans	14
Design Overview	15
Procurement Overview	16
Corporate Governance	19
Annual Report	22



X-Road[®] Data Exchange Layer

- Major events in 2021
- Sustainability initiatives 2021
- Use cases worldwide by the end of 2021

Major events in 2021

In 2021, NIIS delivered two new X-Road core releases during the year. Both releases were special since version 6.26.0 was the last planned release for X-Road 6, while X-Road 7.0.0 was the first release of X-Road 7 “Unicorn”.

- [6.26.0](#) (03/21)
- [7.0.0](#) (11/21)

X-Road 6 was initially released in 2015, and it has experienced several significant changes during its lifecycle, but the core principles have remained the same. Over the years, X-Road 6 has proven to be secure, reliable, and scalable. Therefore, it was decided to use it as a basis for the next major version. Thanks to the solid foundation, there wasn't a need to reinvent the wheel. The aim was to keep all the good in X-Road 6 and eliminate the bad and the ugly. In other words, X-Road 7 has all the strengths of X-Road 6 with numerous improvements in various areas. All in all, X-Road 7 is an evolutionary version of X-Road 6.

The long-awaited X-Road 7 “Unicorn” saw daylight in 2021. All the changes were not included in the first production version, but they will be introduced one by one over time in various X-Road 7 minor versions.

The development of X-Road 7 is divided into multiple high-level focus areas. Each focus area consists of several topics that will be turned into features. The high-level focus areas and their main topics are:

- messaging patterns
- message logs
- onboarding process
- architecture
- operational insights
- sustainability.

In version 7.0.0, the focus is on the Security Server, and there are only a few minor changes on the Central Server side. The Security Server has a new visual style that implements the X-Road 7 visual style guide, while the Central Server still has the version 6 visual style. Here's a summary of changes included in version 7.0.0:

- New X-Road 7 look and feel for the Security Server UI.
- Security improvements on the Security Server:
 - Encrypt backup files (opt-in)
 - Verify the integrity of backup files on restore.

- Improvements in Security Server message logging:
 - Encrypt message payload in message log database (opt-in)
 - Encrypt message log archives (opt-in)
 - Group message log archives by member or subsystem (opt-in)
 - Support for fully disabling message logging.
- Change the PIN code on the Security Server.
- Return REST API type (OPENAPI3 / REST) and API endpoints in REST metaservice responses.
- Run the Security Server on Java 11 by default.
- Make the Security Server more modular by enabling installation without a local Postgres server.
- Version compatibility check for version upgrades - updating from an unsupported version is no longer possible.
- Official Docker support for the Security Server with the Security Server Sidecar images.
- Other enhancements and bug fixes.

The development focus will shift to the Central Server in 2022 when it gets a new user interface and a management REST API. Also, the new Central Server will include several architectural changes, making X-Road more extensible and easier to operate.

Also, due to NIIS and Amazon Web Services (AWS) collaboration, a [guide](#) providing best practices for deploying X-Road Security Servers on AWS was prepared and published on GitHub in May.

Sustainability initiatives 2021

In 2021, NIIS set a long-term goal to make X-Road the most sustainable data exchange solution of its kind. The first steps for reaching the goal were to understand the factors that affect the environmental footprint, how to measure them and recognise potential improvements.

NIIS conducted a study with Gofore and the Stockholm Environment Institute (SEI) to better understand the current situation. The study was divided into three phases:

1. Define an emissions boundary and map the leading causes of X-Road's environmental impact.
2. Build an X-Road Carbon Footprint calculator.
3. Define recommendations for improving the sustainability of X-Road.

The project developed a model that can be used to estimate X-Road's environmental footprint. An X-Road Carbon Footprint calculator – a concrete tool to calculate a single Security Server's or an entire X-Road ecosystem's environmental footprint – was built based on the model. The calculator is configurable and can be used to calculate X-Road's environmental footprint anywhere in the world. In the project, the calculator was used to calculate the environmental footprint of the Estonian and Finnish X-Road ecosystems. [The full results of the study](#) are publicly available on the NIIS website.

The project was the first step in making X-Road more sustainable. The following steps include implementing recommendations recognised in the project and integrating ESG in the X-Road development process. The first improvements have already been implemented, and they were included in X-Road 7.0.0, e.g., fully disabling message logging and enabling Security Server installation without a local Postgres server.

Use cases worldwide by the end of 2021

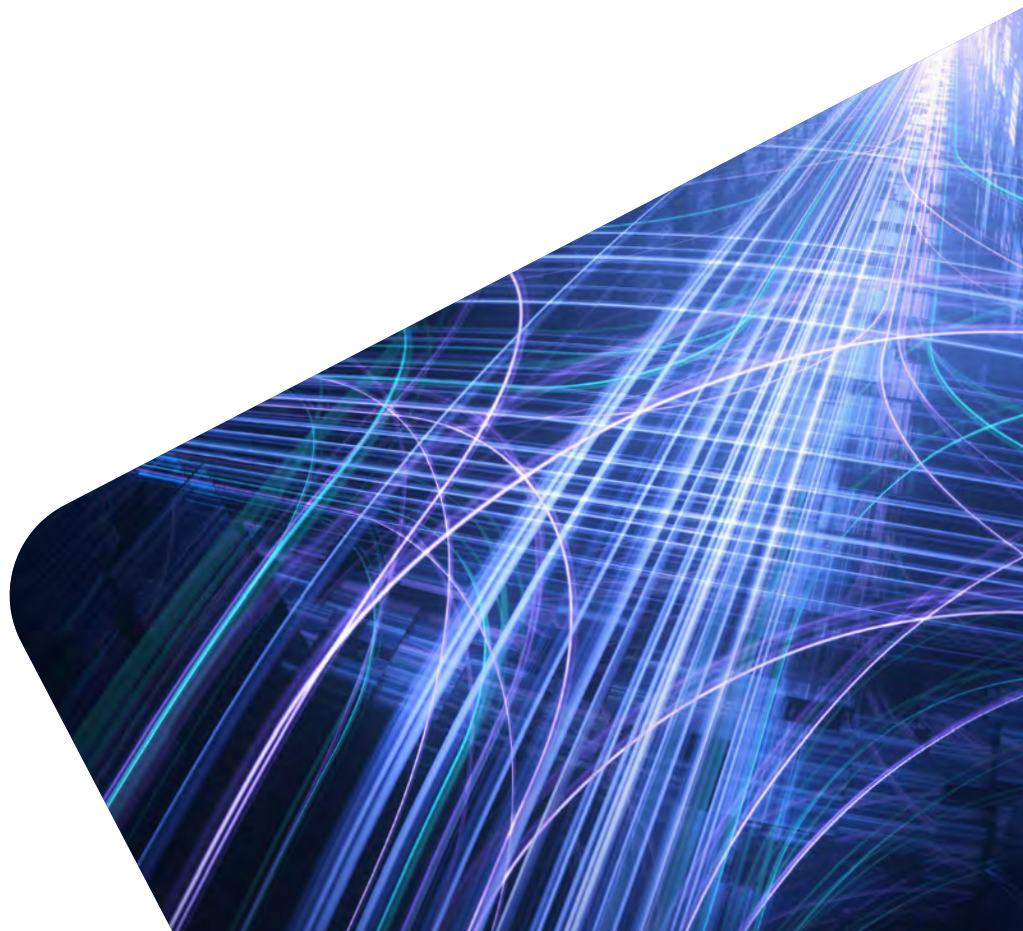
At the end of 2021, X-Road was implemented in at least 19 countries worldwide. The number of countries may be higher since the list includes only the implementations that NIIS is aware of. The countries where the known X-Road implementations are:

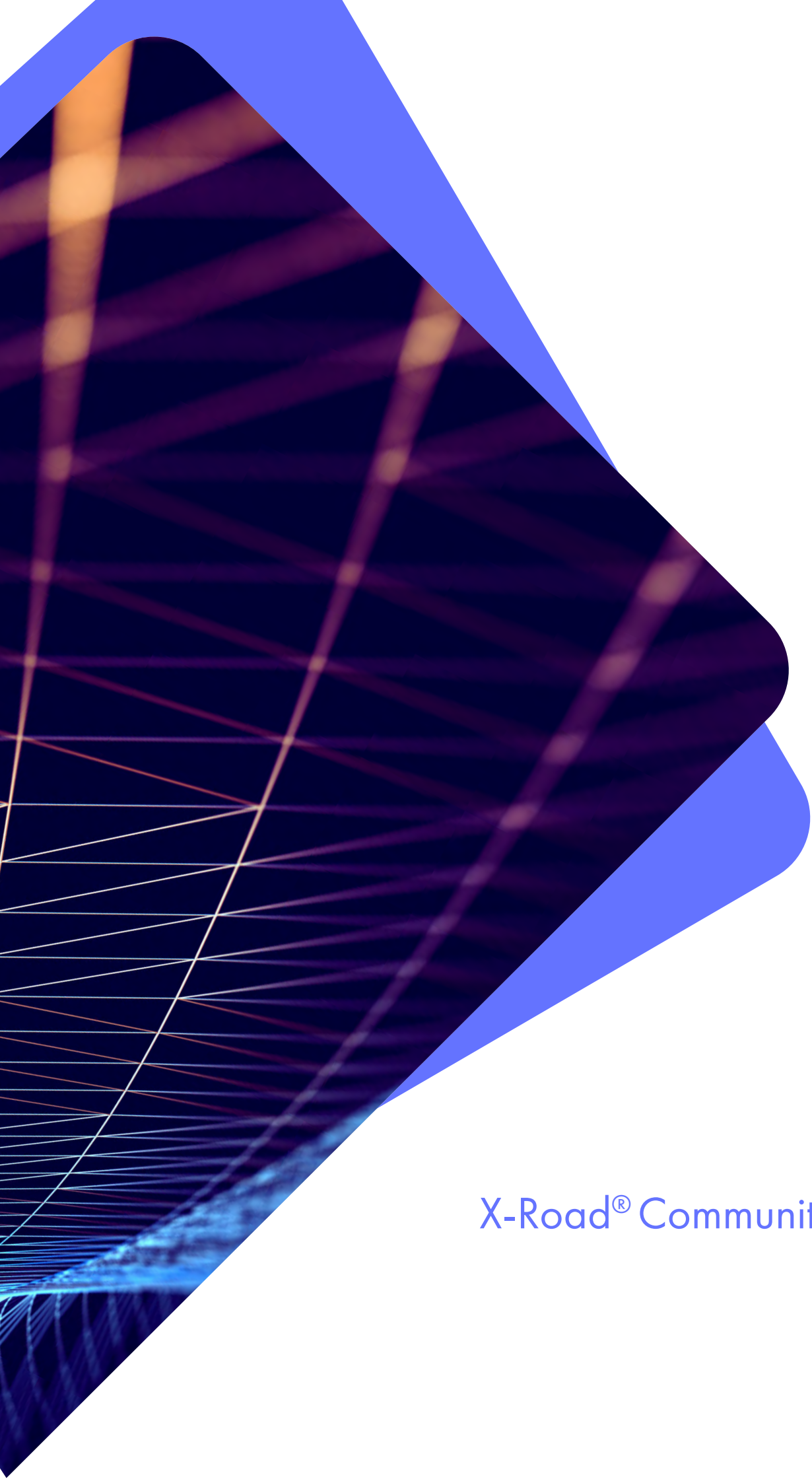
- Argentina
- Azerbaijan
- Barbados
- Brazil
- Cambodia
- Cayman Islands
- Colombia
- Djibouti
- El Salvador
- Faroe Islands
- Estonia
- Finland
- Germany
- Iceland
- Japan
- Kyrgyzstan
- Mexico
- Palestine
- Vietnam.

The up-to-date list of countries is available on the [X-Road website](#).

Since X-Road is exceptionally flexible, it enables multiple different implementation models. Therefore, the implementation model of X-Road varies between different countries. Some countries have a national X-Road environment (e.g., Estonia, Finland, Iceland), some countries have one or more regional environments (e.g., Argentina, Brazil), some environments are business domain-specific (e.g., Germany), and others are corporate environments (e.g., Japan).

More information about different use cases and case studies is available on the [X-Road website](#).





X-Road® Community

The X-Road Community is for anyone interested in X-Road. It's about learning from others and sharing the skills and experiences of creating better digital services, both technically and business-wise.

Since 2018 the X-Road Community member count has increased from around 50 members to almost 1300 members by the end of 2021. In 2021, the community got over 360 new members.

At the same time, the community has become global. The X-Road Community Event 2021 was organised online, with over 200 participants from more than 30 countries.

NIIS launched a public bug bounty program for X-Road in March on the Intigriti platform. The program is open to anyone and will pay for each found vulnerability that meets the program criteria.

In the future, NIIS wants to increase the community's role in the X-Road development activities. Instead of just using the X-Road open-source product, the community will have a more significant role in its design and development. NIIS welcomes all the community members to participate and contribute to the X-Road development.





X-Road[®] Technology
Partners program

X-Road Technology Partners are enterprises providing consultation services, e.g. deploying independent instances, developing extensions and compatible services, integrating information systems.

By the end of 2021, the following companies were members of the X-Road Technology Partner programme:



aktors.ee



andes.is



bestsolutions.ee



cyber.ee



digia.com



fujitsu.com



gofore.com



nortal.com



opinkerfi.is



origo.is



planetway.com



roksnet.com



rw3tecnologia.com



solita.fi



thinknetgroup.com.ar



tietoevry.com



Harmony eDelivery
Access

Product Description

Harmony eDelivery Access by NIIS is a free and actively maintained open-source component for joining one or more eDelivery policy domains. Harmony eDelivery Access provides a unified technology stack, an automated installation and upgrade process for selected platforms, and step-by-step installation and upgrades instructions. The security of Harmony eDelivery Access is assured by a third-party security assessment. Harmony eDelivery Access is based on the Domibus and the SMP open-source projects by the European Commission.

Harmony eDelivery Access consists of two components: the access point and the service metadata publisher (SMP). Harmony eDelivery Access supports both data exchange senders and receivers with the minimum viable implementation that requires only the sender's and receivers' access points.

The access point implements the AS4 message exchange protocol according to the CEF eDelivery AS4 profile. The access point securely enables payload-agnostic data exchange between sending and receiving eDelivery access points. Therefore, organisations must install or utilise an access point hosted by a service provider on their behalf to exchange information. The access point is the backend system's connection point to the eDelivery network.

The Service Metadata Publisher (SMP) component implements the CEF eDelivery SMP profile. The SMP is a register of receivers' location and message exchange capabilities. Organisations that only send data are not required to be registered in an SMP; only an access point is sufficient. An SMP may be necessary for an organisation to receive data depending on the discovery model (static/dynamic) used.

Future plans

Harmony eDelivery Access 1.0.0 was released in December 2021. Future versions will provide minor improvements to the installation and configuration process. Also, additional improvements are implemented based on the feedback from Harmony eDelivery Access users.

NIIS is looking for organisations to pilot Harmony eDelivery Access. Additional development items will be defined based on the experiences provided by the pilots.





X-Road® Design Overview

X-Road® Design Overview

User interface, user experience and service design:

- The visual consistency of the X-Road user interface (UI) throughout the design, UI style guide and application was improved.
- The X-Road architecture diagrams library was updated.
- Various X-Road user flows were updated.
- Central Server views such as management requests, members, internal and external configurations.
- Security Server views such as diagnostics, keys and certificates.
- The Security Server API keys management flow was redesigned.
- A new design for the Security Server error pages was implemented.



Procurement Overview

Procurement Overview

A procurement plan sets out the public procurements of NIIS only if they exceed the statutory limit¹. All the public procurements of NIIS are public and available without charge at the public procurement environment eRHR and the NIIS website.

In 2021, the total value of public contracts was 1,5M euros. The vast majority of 71% has been invested in X-Road core software development and others in testing, developing NIIS eDelivery Solution and X-Road extensions, like MISP2 and operational monitoring.

Most of the public contracts were under the reopening of the competition in ongoing framework agreements: 1) "X-Road core development"² and 2) "X-Road Core Development Related Testing"³, and are respectively related to the X-Road core software development and testing. X-Road extensions were developed under the dynamic purchasing system (the DPS) "X-Road Software Development"⁴: 1) MISP extension⁵ and 2) operational monitoring⁶. The DPS is a fully electronic procurement approach for setting up and maintaining a list of tenderers. This DPS is 36 months and is open throughout its duration for the admission of any tenderers that satisfy the qualification requirements.

2021 started with public procurement for the "**Design Services for X-Road**"⁷, where a framework agreement was awarded to **NOPE OÜ**.

NIIS also published "**Productisation and development of the NIIS eDelivery Solution**"⁸ procurement. The aim was to develop the NIIS eDelivery Solution that provides free, productised and actively maintained open-source components for joining one or more eDelivery policy domains. The contract was awarded to **Gofore Oyj**.

In the last quarter of 2021, NIIS published new resource procurement for **X-Road core software development and maintenance** with a similar approach to previous resource procurements. The first procurement⁹, was terminated without a contract, but the second public procurement, "X-Road Software Core Development"¹⁰, was successful, and the contract was awarded to **Nortal AS**.

¹Under the Public Procurement Act of Estonia.

²<https://riigihanked.riik.ee/rhr-web/#/procurement/721591/general-info>

³<https://riigihanked.riik.ee/rhr-web/#/procurement/724779/general-info>

⁴<https://riigihanked.riik.ee/rhr-web/#/procurement/1753854/general-info>

⁵<https://riigihanked.riik.ee/rhr-web/#/procurement/2120132/general-info>

⁶<https://riigihanked.riik.ee/rhr-web/#/procurement/2149052/general-info>

⁷<https://riigihanked.riik.ee/rhr-web/#/procurement/2807812/general-info>

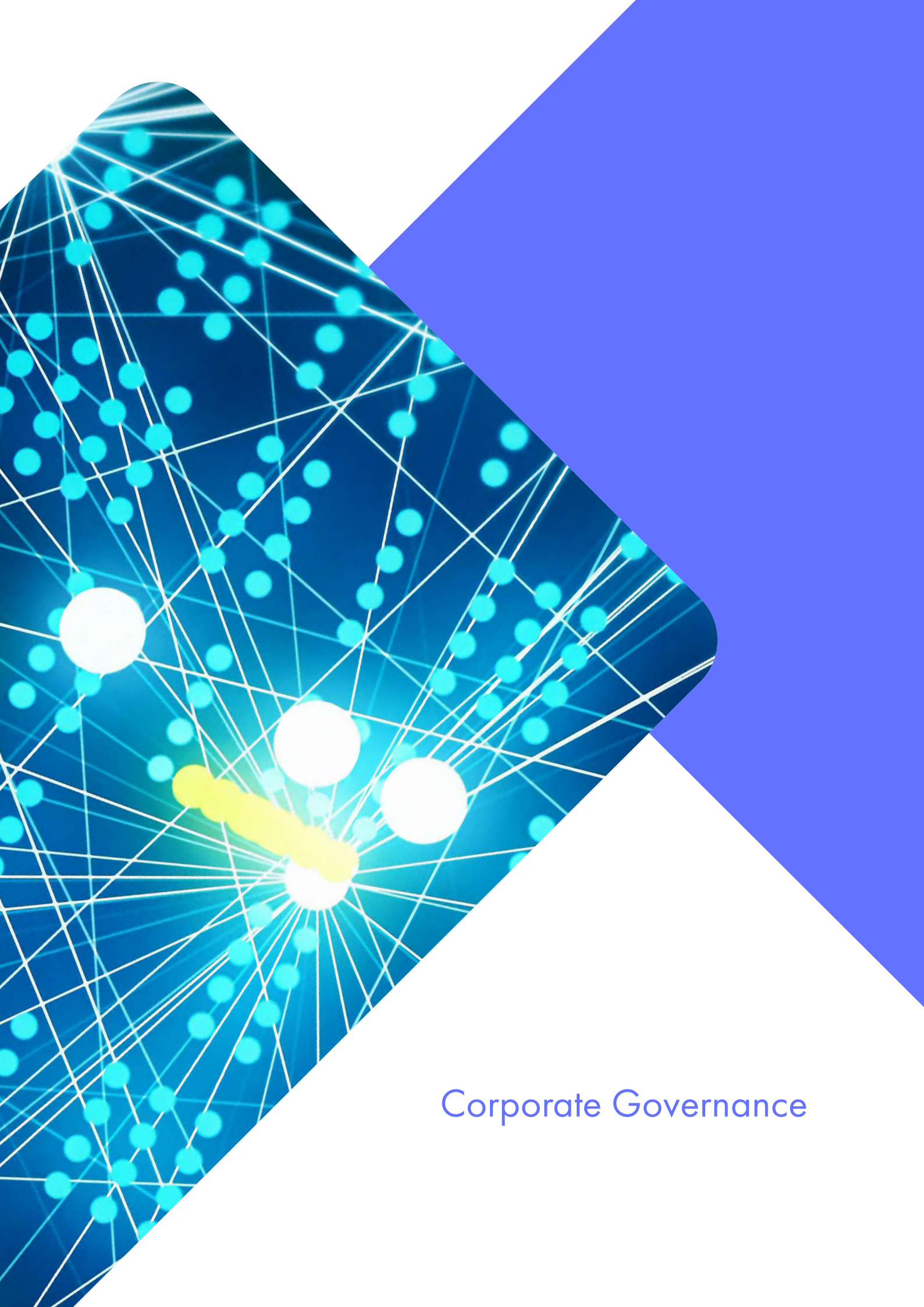
⁸<https://riigihanked.riik.ee/rhr-web/#/procurement/2905152/general-info>

⁹<https://riigihanked.riik.ee/rhr-web/#/procurement/3803331/general-info>

¹⁰<https://riigihanked.riik.ee/rhr-web/#/procurement/3960888/general-info>

In 2021 NIIS had only service type of public contracts in the procurement plan:

Procurement title	Type of the procedure	Estimated deadlines	Technical specification	Estimated cost in 2019 (overall contract period)	Contract duration
Core development team (X-Road core development)	The reopening of the competition in the framework agreement	01.2021 - 12.2021	Petteri Kivimäki	900 680 €	12 months
Testing team (X-Road Core Development Related Testing)	The reopening of the competition in the framework agreement	01.2021 - 06.2021	Petteri Kivimäki	53 997 €	6 months
Testing team (X-Road Core Development Related Testing)	The reopening of the competition in the framework agreement	06.2021 - 12.2021	Petteri Kivimäki	36 836 €	6 months
X-Road Software Development: MISP 2	Procurement is related to DPS / Restricted procedure	01.2021 - 12.2021	Petteri Kivimäki	66 667 €	6-12 months
X-Road Software Development: Operational monitoring	Procurement is related to DPS / Restricted procedure	01.2021 - 12.2022	Petteri Kivimäki	66 667 €	6-12 months
Design Services for X-Road	Open procurement / Framework Agreement	Submission: 02.2021 / Contract: 04.2021	Petteri Kivimäki	75 000 €	36 months*
Productization and development of the NIIS eDelivery Solution	Open procurement / Framework Agreement	Submission: 03.2021 / Contract: 04.2022	Petteri Kivimäki	152 000 €	6 months*
Core development team (X-Road core development)	Open procedure / International procurement	Submission: 05.2021 / Contract: 07.2021	Petteri Kivimäki	2 702 040 €	36 months



Corporate Governance

Administrational Structure

General Meeting (GM)

The highest body of NIIS is the General Meeting of its members, where all members of the association may participate. For clarity, as a non-profit association NIIS doesn't have a supervisory board and the General Meeting consists of representatives of the NIIS members.

Advisory Group (AG)

The Advisory Group is formed for the purpose of supporting the Chief Executive Officer and relaying information and instruction between the operative level and the General Meeting. For clarity, the Advisory Group is not a formal organ of the Institute and has no decision-making power on its own.

Management Board (CEO)

NIIS is managed and represented by the Management Board. The members have agreed that the Management Board shall comprise a single member whoshall act as the Chief Executive Officer of the Institute.



Representatives of the Members:

- **Andri Heiðar Kristinsson**, CEO Digital Iceland, Digital Iceland - Project Management Office, Ministry of Finance and Economic Affairs, Iceland;
- **Jarkko Levasma**, Director General, Public Sector ICT at Ministry of Finance, Finland;
- **Siim Sikkut**, Deputy Secretary General for Communications and State Information Systems, Ministry of Economic Affairs and Communications Republic Estonia, Estonia;

Management Board (CEO)

Ville Sirviö



Representatives of the Members in 2021

Advisory Group Members in 2018-2021;

Active representatives:

- Joonas Heiter, Head of Department of State Data Exchange Department, Information System Authority (RIA), Estonia, (20.09.2018 –);
- Atte Pirttilä, Development Manager, Development Manager, Finnish Digital Agency (DVV), Finland(18.9.2018 –);
- Katja Väänänen, Senior Specialist, Ministry of Finance, Public Sector ICT, Digitalization, Finland (30.4.2018 –);
- Kristo Vaher - Chief Technology Officer, Ministry of Economic Affairs and Communications of Estonia (MKM), Estonia (22.11.2019 –);
- Andri Heiðar Kristinsson, CEO Digital Iceland, Digital Iceland - Project Management Office, Ministry of Finance and Economic Affairs, Iceland (27.05.2021 –);
- Anssi Ahlberg, Product Manager, Digital and Population Data Service Agency, Finland, (DVV) (01.06.2021 –).

Former representatives:

- Andrus Kaarelson, Director of Information System, Information System Authority (RIA), Estonia, (26.10.2017–31.12.2019);
- Miia Mänd, Head of Department of IT Policy, Ministry of Economic Affairs and Communications (MKM), Estonia (26.10.2017–22.11.2019).



Annual Report 2021

Statement of financial position (In Euros)

	31.12.2021	31.12.2020	Note
Assets			
Current assets			
Cash and cash equivalents	1 908 776	2 270 064	
Receivables and prepayments	22 526	26 385	2
Total current assets	1 931 302	2 296 449	
Non-current assets			
Property, plant and equipment	5 661	5 880	
Total non-current assets	5 661	5 880	
Total assets	1 936 963	2 302 329	
Liabilities and net assets			
Liabilities			
Current liabilities			
Payables and prepayments	221 604	226 979	4
Total current liabilities	221 604	226 979	
Total liabilities	221 604	226 979	
Net assets			
Accumulated surpluses (deficits) from previous periods	2 075 350	2 512 954	
Surplus (deficit) for the period	-359 991	-437 604	
Total net assets	1 715 359	2 075 350	
Total liabilities and net assets	1 936 963	2 302 329	

Statement of revenues and expenses (In Euros)

	2021	2020	Note
Revenue			
Fees received from members	2 142 000	1 734 000	5
Other income	640	1 347	
Total revenue	2 142 640	1 735 347	
Expenses			
Other operating expense	-2 041 039	-1 718 603	6
Employee expense	-458 483	-449 742	7
Depreciation and impairment loss (reversal)	-2 968	-3 944	
Other expenses	-332	-950	
Total expenses	-2 502 822	-2 173 239	
Surplus (deficit) from operating activities	-360 182	-437 892	
Interest income	200	288	
Interest expenses	-9	0	
Net surplus (deficit) for the period	-359 991	-437 604	

Statement of cash flows (In Euros)

	2021	2020	Note
Cash flows from operating activities			
Surplus (deficit) from operating activities	-360 182	-437 892	
Adjustments			
Depreciation and impairment loss (reversal)	2 968	3 944	
Total adjustments	2 968	3 944	
Adjustments for operating receivables and prepayments	3 859	-5 032	2
Adjustments for operating liabilities and prepayments	-5 375	73 292	4
Interest received	200	288	
Interest paid	-9	0	
Total cash flows from operating activities	-358 539	-365 400	
Cash flows from investing activities			
Purchase of property, plant and equipment and intangible assets	-2 749	-6 944	
Total cash flows from investing activities	-2 749	-6 944	
Total cash flows	-361 288	-372 344	
Cash and cash equivalents at beginning of period	2 270 064	2 642 408	
Change in cash and cash equivalents	-361 288	-372 344	
Cash and cash equivalents at end of period	1 908 776	2 270 064	

Statement of changes in net assets (In Euros)

		Total net assets
	Accumulated surpluses deficits from previous period	
31.12.2019	2 512 953	2 512 953
Net surplus (deficit) for the period	-437 604	-437 604
Other changes in net assets	1	1
31.12.2020	2 075 350	2 075 350
Net surplus (deficit) for the period	-359 991	-359 991
31.12.2021	1 715 359	1 715 359

Notes

Note 1 Accounting policies

Accounting Policies are available through the e-Business Register portal.

Note 2 Receivables and prepayments (In Euros)

	31.12.2021	Within 12 months
Prepayments	22 526	22 526
Deferred expenses	21 466	21 466
Other paid prepayments	1 060	1 060
Total receivables and prepayments	22 526	22 526
	31.12.2020	Within 12 months
Prepayments	26 385	26 385
Deferred expenses	25 157	25 157
Other paid prepayments	1 228	1 228
Total receivables and prepayments	26 385	26 385

Note 3 Tax prepayments and liabilities (In Euros)

	31.12.2021	31.12.2020
	Tax liabilities	Tax liabilities
Value added tax	23 972	23 647
Personal income tax	7 565	8 938
Fringe benefit income tax	210	180
Social tax	3 580	4 391
Contributions to mandatory funded pension	5 550	1 826
Unemployment insurance tax	216	281
Total tax prepayments and liabilities	41 093	39 263

Note 4 Payables and prepayments (In Euros)

	31.12.2021	Within 12 months	Note
Trade payables	133 870	133 870	
Employee payables	46 641	46 641	
Tax payables	41 093	41 093	3
Total payables and prepayments	221 604	221 604	
	31.12.2020	Within 12 months	Note
Trade payables	132 355	132 355	
Employee payables	55 361	55 361	
Tax payables	39 263	39 263	3
Total payables and prepayments	226 979	226 979	

Note 5 Fees received from members (In Euros)

	2021	2020
Fees not intended for specific purposes		
Membership fees Estonia	850 000	850 000
Membership fees Finland	850 000	850 000
Membership fees Iceland	425 000	0
Partnership fees	17 000	34 000
Total fees received from members	2 142 000	1 734 000

Note 6 Miscellaneous operating expenses (In Euros)

	2021	2020
Leases	45 902	45 187
Travel expense	7 362	12 032
Training expense	11 544	9 667
Purchased services	40 948	61 003
Expenses of the X-Road project development	1 259 775	1 226 916
Expenses of the X-Road project testing	107 994	120 591
Expenses of the X-Road project other	491 857	117 966
Marketing expenses	16 186	28 699
Other	59 471	96 542
Total miscellaneous operating expenses	2 041 039	1 718 603

Note 7 Labor expense (In Euros)

	2021	2020
Wage and salary expense	367 008	360 001
Social security taxes	91 475	89 741
Total labor expense	458 483	449 742
Average number of employees in full time equivalent units	5	5

Note 8 Related parties (In Euros)

Number of members by the end of economic year		
	31.12.2021	31.12.2020
Number of juridical person members	3	2

Remuneration and other significant benefits calculated for members of management and highest supervisory body		
	2021	2020
Remuneration	119 390	116 720

Potential gross compensation to Board Member is equal to the 3 months' remuneration.



MTÜ Nordic Institute for Interoperability Solutions

Beginning of financial year: 01.01.2021

End of the financial year: 31.12.2021

Business name: MTÜ Nordic Institute for Interoperability Solutions

Register code: 80419486

Address: Hobujaama tn 4

10151 Tallinn

Harju maakond

Estonia

Phone number: +372 7130800

E-mail address: info@niis.org