



Comparison of X-Road and Cybernetica UXP®

White Paper

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1 Introduction

This document compares X-Road software with its commercial counterpart Cybernetica UXP[®] (Unified eXchange Platform). These two platforms have similar architecture and implement compatible protocols. In practice, UXP components such as the security server and the registry server can be substituted for the corresponding X-Road components without problems. However, they are developed based on a different development models and UXP offers many features that make it more suitable for implementation outside Estonia. In addition, Cybernetica offers full support for the UXP product, including version updates, training, installation and integration support.

In Section 2 we detail the interoperability between X-Road and UXP. In Section 3 we compare the two platforms with regards to their development approach, features and support.

2 Interoperability of X-Road and UXP

The X-Road/UXP architecture is built on separate components that communicate with each other using clearly defined protocols. The protocols are based on established standards, such as Transport Layer Security, HTTP, MIME, OCSP and TSP.

UXP has full protocol-level compatibility with X-Road. In particular:

- A UXP security server can be substituted for an X-Road security server (i.e., it can inter-operate with X-Road security servers and an X-Road central server).
- A UXP registry server can be substituted for an X-Road central server (i.e., it can inter-operate with X-Road security servers and UXP security servers).

The following table lists the protocols used in the X-Road infrastructure and describes the level of compatibility between UXP and X-Road.

Document ID	Title	Description	UXP Compatibility
PR-MESS	Message Protocol v4.0	Used by client and service information systems to communicate with security servers. This is an X-Road application protocol.	<p>Fully compliant.</p> <p>Information systems developed according to this specification work both with X-Road and UXP.</p> <p>In addition, UXP extends the protocol and supports standard SOAP services (without X-Road specific headers) and SOAP 1.2 (X-Road only supports SOAP 1.1). The standard SOAP services are converted to X-Road compatible services by UXP security servers.</p> <p>Together with SOAP, UXP has native support for REST protocol.</p>
PR-MESSTRANSP	Message Transport Protocol	Used between security servers to exchange messages between the client and the service.	<p>Fully compliant.</p> <p>UXP security servers can interoperate with X-Road security servers.</p> <p>In addition, UXP implements optional message-level encryption that can be used to encrypt messages using advanced cryptographical algorithms (such as post-quantum encryption).</p>
PR-META	Service Metadata Protocol	Services provided by security servers to information systems to discover X-Road members and the services that they provide.	<p>Fully compliant.</p> <p>UXP security servers support all the specified services.</p> <p>UXP security servers support additional services to simplify</p>

			development of service clients.
PR-MSERV	Protocol for Management Services	Services provided by the central server and are used by security servers for tasks such as registering and removing organizations.	Fully compliant. The UXP registry server and UXP security servers use an unmodified version of the protocol.
PR-GCONF	Protocol for Downloading Configuration	Specifies the format of the global configuration and the protocol used by security servers to download the global configuration from the central servers.	Fully compliant. UXP uses an unmodified version of the protocol.
RFC 6960	Online Certificate Status Protocol - OCSP	Used by security servers to query the validity information of certificates.	Fully compliant. UXP uses the OCSP protocol in exactly the same manner as X-Road.
RFC 3161	Time-Stamp Protocol (TSP)	Used by security servers to time-stamp message logs.	Fully compliant. UXP uses the OCSP protocol in exactly the same manner as X-Road.

3 Comparison of X-Road and UXP

3.1 Development Approach

X-Road code is maintained by Nordic Institute for Interoperability Solutions (NIIS) in accordance with cooperation agreement of governments of Estonia and Finland.

UXP is a product developed by Cybernetica, the original developer and maintainer of the X-Road software since the first version was released in 2001. In addition, Cybernetica has extensive experience in developing mission-critical systems to governments around the world. The following are the main differentiating factors of the UXP development.

- A very strong development team employing people who created the first version 15 years ago and continued the development over time. Thorough knowledge of the internals and rationale behind each design decision.
- A strong emphasis on stability, security, usability (including installation, usage and interfacing). From internal quality point of view, very strict code quality control and comprehensive automated test suites are implemented.
- Regular security testing; both internal and external penetration testing is used.
- Frequent, thoroughly tested releases.
- A clear development road map that reflects the needs of our clients.
- Development of client specific functionality – modifying the product (or developing add-ons) according to the requirements of a particular deployment.
- UXP is a closed-source product, but the source code can be made available for audit and escrow (the source code is stored by a third party and is released under certain conditions, for example, if Cybernetica discontinues the product).

3.2 Product Features

UXP is compatible with X-Road system on a protocol level. This means that UXP components, such as the security server and the registry server can be substituted for the corresponding X-Road components. However, UXP contains several enhancements and additions compared to the base X-Road. The additional components make the UXP a complete e-government solution that does not depend on existing Estonian infrastructure. The following is an (incomplete) list of UXP product features not supported by X-Road.

- Numerous security, performance and stability improvements.
- Where X-Road requires the service developers to modify the services and WSDLs to comply with X-Road SOAP profile, UXP natively supports all existing SOAP 1.1 and SOAP 1.2 services. UXP does not restrict the encoding style as the X-Road does. This means quicker integration as existing web services can immediately connect to the UXP framework without any additional work.
- UXP has native support for REST web services and JSON protocol. UXP supports creating and consuming of services that employ the full REST toolset (e.g., HTTP verbs).
- UXP supports the Ubuntu 16.04 LTS operating system, support for Ubuntu 18.04 is under development. X-Road supports only Ubuntu 14.04 LTS.
- UXP leverages distributed ledger blockchain technology to add an additional layer of

security to the system.

- UXP has good support for localization. Localized versions of user interfaces can be maintained and installed as additional packages.
- UXP has native support for cloud deployments, making it easy to implement either parts or the whole infrastructure on cloud platforms and using cloud native services to scale.
- UXP supports deployment in configurations that employ several unconnected networks (such as the public Internet and a separate government network).
- UXP contains a monitoring system that collects both system status (health) data and transaction statistics. The statistics can be viewed and analyzed using built-in dashboards and graphs.
- UXP Portal is a universal client software that allows connected organizations to access services without any software development effort.
- UXP SQL Connector can be used to quickly create a web service that is backed by an SQL database. With Connector, the service can be created using a web user interface without writing any code.
- UXP Certification Authority and UXP Timestamping Authority implement trust services that are used to secure the messages exchanged between organizations.

3.3 Support

X-Road can be downloaded from Github and used under an MIT-style license. However, for quick and reliable deployment and maintenance this is often not enough.

- Support is only available to organizations connected to the Finnish and Estonian X-Road installations. Support response time in such situations are not defined.
- There is no warranty associated with the publicly available software.
- There is no clear consultancy partner for implementation, customization and integration.
- Training is not available.

UXP is supported by Cybernetica directly and through cooperation with local partners.

- Cybernetica offers support agreements with predefined response times. Both first and second level support is available.
- Cybernetica provides a warranty for the product.
- Cybernetica offers consultation (including legal consultation) and customization services.
- Cybernetica offers installation support and installation services. Leveraging our experience dramatically decreases the time needed for setting up the system and also provides a predictable cost structure.
- Cybernetica offers on-site training for end users, systems administrators and developers as part of the implementation plan.