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Educational data in OOTS using EMREX

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Abstract

As part of the Single Digital Gateway regulation, the European Commission and the Member States of the European Union are required to implement a Once-Only Technical System for the automated exchange of evidence between competent authorities. SDG requires support for three procedures requiring exchange of educational data. This paper shows that institutions that implemented the EMREX system for student data exchange can successfully use a proof-of-concept implementation of a so-called "bridge" to connect to OOTS without any of the two systems imposing changes on the other. Deployment of a potential future production version of this bridge would greatly decrease the cost and impact of connecting to the OOTS for educational institutions that use EMREX.

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1 Introduction

The regulation for a Single Digital Gateway (SDG, REGULATION (EU) 2018/1724)[1] calls for a harmonised way for citizens to interact with authorities in different states within the EU. According to the regulation a citizen should not be forced to show proof of their identity and attributes connected to them more than once.

The attributes should seamlessly travel between countries by connected systems.

Three procedures regarding the life event "Studying" concerns the higher education area:

- Applying for a tertiary education study financing, such as study grants and loans from a public body or institution.
- Submitting an initial application for admission to a public tertiary education institution.
- Requesting academic recognition of diplomas, certificates or other proof of studies or courses.

The regulation specifies a technical solution, a Once-Only Technical System (**OOTS**) that links in with national or sectoral systems to provide the proof or manifestation needed transnationally.

EMREX is a system for transferring educational data between two parties, for instance but not limited to, two universities during a study exchange period. It is used in production in a number of countries in Europe for several years. It was discovered that the data flow in EMREX and OOTS are rather similar and that there might be advantages to collaborate. This paper describes this collaboration and its results.

2 EMREX

EMREX is a solution for transferring student data internationally in a machine-processable way. It originated as an EU-funded project 2015-2017, aiming to simplify and increase the quality of the credit transfer process after a student exchange. The EMREX service network went into production before the successful project ended and has been in production ever since. EMREX is not limited to the EU i.e. it can be used worldwide. At present, EMREX is operational in a number of countries in Europe. It is a technical solution used to securely exchange educational data between students or former students and third parties, for example higher education institutions (HEIs) and potential employers.

The technical solution is extremely flexible, the only requirement is that participating clients (EMREX Client – **EMC**) and EMREX data access point (**EMP**) follow the ELMO standard. ELMO is the data standard used in the EMREX network to describe student achievements and supporting data. It is used also by other projects and organisations (such as Erasmus Without Paper[2]). Any actor can be behind an EMP, for instance a single HEI, an organisation or a national data provider. The requirements for participation for data providers and consumers are low – anyone can easily build an EMREX client and any local system that delivers data upon request can be connected to an EMP. Security is maintained in an adaptive manner, from initially a basic solution to coming technologies. More information on this can be found on the EMREX website[3]. All specifications and software are open source and can be found in Github[4]. It is an easy and cost-efficient solution for implementing transfer of student records between institutions.

In the beginning the scope of EMREX was only to include Transcript of Records related to student exchanges within Europe but it was soon discovered that the tool can be useful in many more ways.

[1] See https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32018R1724
[2] Erasmus Without Paper website – www.erasmuswithoutpaper.eu
[3] EMREX website – www.emrex.eu
[4] EMREX in GitHub, repository for specifications and software – https://github.com/emrex-eu/

Admission, recruitment systems, university partnerships, and qualifications are examples of applications that would benefit from EMREX.

3 Single Digital Gateway legislation, SDG

EU citizens and businesses, especially those operating in another EU country, often struggle to understand the rules that apply to their situation, or the steps required to carry out simple procedures. Many procedures are still paper based only or require queuing in an office, which can be a waste of time and money. All these obstacles hold back the consolidation of a genuine Single Market where the freedom of goods, services, capital, and people is fully ensured. It also hampers the establishment of a digital single market by building unnecessary online barriers between people in different EU countries. The Single Digital Gateway Regulation (Regulation (EU) 2018/1724) (SDGR) is a multifaceted EU-wide initiative that strives to create the digital infrastructure required to overcome these challenges. It aims to help citizens and businesses make best of the Single Market.

4 OOTS

The SDGR provides the legal framework for the creation of a European data space for public administrations to share information in a trusted way. By December 2023, this government-to-government data space, known as the Once-Only Technical System (OOTS), went live in the Member States. It will significantly ease and speed up the cross-border administrative procedures covered by the SDGR. Thanks to the OOTS, it will be easier for citizens to study, move, work, retire or do business across the EU. The OOTS will connect public authorities across the EU, so they can exchange official documents and data at the citizen's request.

One of the life events in scope for OOTS is the “Studying” life event. More specifically, the legislation requires support for three procedures:

- Applying for a tertiary education study financing, such as study grants and loans from a public body or institution,
- Submitting an initial application for admission to public tertiary education institution
- Requesting academic recognition of diplomas, certificates or other proof of studies or courses.

In these three procedures, the user is usually requested to submit “evidence” that is already held by an institution in another Member State. The purpose of OOTS is to allow the user to explicitly request the exchange of this evidence and to allow her to preview it before it is delivered electronically and securely to the procedure. The preview functionality is to be implemented by the authority that holds the data, meaning there is some redirection of the user between portal and preview space.

Beyond providing a secure exchange mechanism, integration with portals and data sources and preview, OOTS also provides extensive discovery functionality to help competent authorities and users figure out what the matching evidence is in another Member State for a particular information requirement and which authentic data source can provide it.

A specific Implementing Regulation ((EU) 2022/1463) further sets out the technical and operational specifications of the technical system in accordance with Regulation (EU) 2018/1724 on Europe's Single Digital Gateway. In this regulation EMREX is explicitly mentioned as a sectorial system that can be used. The OOTS is heavily based on two existing so-called Building Blocks:

- eDelivery[5], a technical solution for secure and reliable machine-to-machine document and data exchange.
- eID[6], which enables digital services capable of electronically identifying users from across Europe.

OOTS and these Building Blocks are based on open standards and technical specifications that are available in open-source implementations.

5 Connecting EMREX to OOTS

With 1.5 million students studying abroad in Europe, student mobility is one of the key priorities for the roll-out of OOTS. To deploy OOTS, many institutions will need to be connected. One approach to achieve scale in the roll-out would be to take advantage of similar existing electronic solutions and to integrate those solutions into the OOTS in a way that minimizes the changes on the existing procedure portals and data sources. This can be done by implementing the integration logic in an integration component. In the literature, this is referred to as the "bridge" pattern[7]. By deploying an OOTS-EMREX bridge, institutions that today provide an EMREX interface would be able to connect to OOTS at minimal cost and impact. A single bridge could in principle serve any number of OOTS portals and EMREX data services.

Together with the EMREX community, the European Commission designed and implemented a proof-of-concept of an OOTS-EMREX bridge. As any bridge, this bridge needs to address the differences between the two systems in a seamless and automated way without changing either the OOTS or EMREX interfaces. Specific challenges that needed to be addressed include:

- Both systems are based on the concept of a "preview link" which the user accesses the preview space. However, in EMREX this is a static link per institution. In OOTS it is a user session specific link that is linked to state information.
- In EMREX, the data selected by the user is included in the response. In OOTS the data is exchanged using a parallel machine-to-machine channel based on eDelivery. So, for OOTS the EMREX response needs to be intercepted, correlated to the user state information, transformed, repackaged and then forwarded via eDelivery.
- Both systems have a "return URL" concept. But from the EMREX data the user should return to the bridge that does some processing before using another URL to direct the user back to the OOTS portal. This needs to maintain the correlation between the two links.
- EMREX uses an XML format called ELMO[8] which is a hybrid mix of structured and unstructured content. In OOTS, some portals may be able to use ELMO, but others might

[5] https://ec.europa.eu/digital-building-blocks/sites/display/DIGITAL/eDelivery
[6] https://ec.europa.eu/digital-building-blocks/sites/display/DIGITAL/eID
[7] https://www.enterpriseintegrationpatterns.com/patterns/messaging/MessagingBridge.html
[8] https://github.com/emrex-eu/elmo-schemas

prefer the bare PDF or, in the future, content based on a different format like the Education Learning Model (ELM)[9]. The bridge can do the PDF extraction and, in the future, convert ELMO to ELM and repackage.

- Both EMREX and OOTS have data source discovery functionality using registries. The interfaces and data model of these systems are quite different so OOTS cannot use the EMREX registry directly or vice versa.

In 2023, the European Commission organised a series of events termed Projectathons. A Projectathon is an event where teams from different EU countries connect their systems under one roof and perform a marathon of peer-to-peer interoperability and compliance tests in a structured environment for several days. The tests are supervised and verified by neutral experts acting as Monitors. All EU Member States joined at least one of the three 2023 Projectathons, as either an active participant or an observer.

During the October 2023 Projectathon[10], EMREX participated, covering the testing of a bridge to a related system . However, EMREX is not an EU Member State, so it does not appear in the official statistics. Several Member Status could use their unmodified OOTS systems to retrieve data using the EMREX bridge from several unmodified EMREX test servers and using unmodified eDelivery Access Points. The message exchanges were fully conformant to the OOTS specifications.

A specific 'exploration room' was organised during the Projectathon. Participants discussed and viewed a demonstration of the OOTS-EMREX proof-of-concept implemented by the Commission that allows OOTS evidence requesters to retrieve diplomas from EMREX-based evidence providers.

6 Conclusions and next steps

The joint work on the proof-of-concept by the EMREX community and the European Commission demonstrated the feasibility and benefits of using a bridge between the OOTS and EMREX data sources. Procedure portal systems could retrieve education data from data sources using only the OOTS interface, without needing to be aware of the EMREX technical specifications. Similarly, EMREX data sources made data available to users without having to be aware of the OOTS technical interface specifications.

In 2024, the European Commission and Member States intend to continue the roll-out of OOTS and the education procedures is a priority issue. A dialog is ongoing with the EMREX community and institutions in Member States to further develop the "bridge" concept and deploy it in production. The intention from the European Commission is to have a substantial critical mass of education data sources in a range of Member States connected to OOTS by the end of the year. The OOTS-EMREX bridge could contribute substantially to achieving that objective. Work is ongoing and it is our hope to be able to show a live demonstration of the bridge at the Eunis conference.

[9] https://europa.eu/europass/elm-browser/index.html

[10] Report from projectathon https://ec.europa.eu/digital-building-blocks/sites/download/attachments/674506672/Once_Only_Technical_System_Projectathon_Event_Report_October_v1.00.pdf

7 References

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3 EMREX website – www.emrex.eu

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10 Report from projectathon https://ec.europa.eu/digital-building-blocks/sites/download/attachments/674506672/Once_Only_Technical_System_Projectathon_Event_Report_October_v1.00.pdf

8 Author biographies

Tor Fridell, M. Sc. in Computer Science and Engineering. Currently Head of Student Information System at Linkoping University and coordinator for international affairs for the national Swedish Ladok Consortium. Previous jobs include Operations manager for the Ladok Consortium, IS manager for Linkoping Institute of Technology, and programmer. Tor has been employed by the university since 1996. Tor has long been involved in international cooperation regarding exchange of student data and is also active in standards work and development of student information systems. Tor has been President of the European Campus Card Association and Chairman of the National Swedish Standards Committee SIS TK450, the national body for CEN TC 353, working with Learning Technologies. Tor has been involved in the EMREX project since the start and is also active in development of student information systems. Tor is currently Chair of the EMREX User Group Executive Committee.

Geir Vangen has more than 20 years' experience in developing nationwide systems within higher education. He is head of development at Sikt – the Norwegian Agency for Shared Services in Education and Research. He participates in national and international standardisation work. He has been member of national committees appointed by the Ministry of Education and Research and has led projects on behalf of the Ministry. Geir Vangen graduated from University of Oslo, Institute of Informatics in 1989.

Janina Mincer-Daszkiewicz graduated in computer science from the University of Warsaw, Poland, and obtained a Ph.D. degree in maths from the same university. She is an associate professor in Computer Science at the Faculty of Mathematics, Informatics and Mechanics at the University of Warsaw. Since 1999, she leads a project for the development of a student management information system USOS, which is used in almost 100 Polish Higher Education Institutions. She has been involved in EMREX, Erasmus Without Paper, European Digital Student Service Infrastructure and European Student Card Initiative projects.

Jan Joost Norder works at the Dienst Uitvoering Onderwijs, part of the Dutch Ministry of Education, Culture and Science. In his role as Product Owner he is responsible for the Dutch Diplomaregister and he also has been Chair of the Executive Committee of EMREX. He has many years of experience in improving the digital enrolment process and exchange of student data in higher education. Since 2016 he has been involved in international projects.

Kimmo Rautio is responsible for EMREX in Finland, and he works with national achievements registry VIRTA as well as with identity access management issues at CSC – IT Center for Science, a non-profit company owned by the Finnish state and Finnish higher education institutes. Before his contract at CSC, Kimmo worked for multiple years in Finnish tertiary and secondary level educational institutions.

Guido Bacharach, Former Head of Strategy and Digitization Unit at the Stiftung für Hochschulzulassung in Dortmund. After his study he had management positions especially in the sales area and in public services. The focus of his work is on strategic digitization, process improvement and project management. He is a member of the Deutsche Gesellschaft für Projektmanagement (GPM e.V.).

Igor Drvodelić is the Assistant Director of the Agency for Science and Higher Education. He is the head of the Central Admissions Office since its foundation in 2009. He actively promotes the introduction of new services into Croatian higher education, such as graduate tracking, recognition of foreign qualifications, student's guidance, electronic data exchange and verifiable credentials.

Pim van der Eijk has been supporting the Directorate-General for Digital Services of the European Commission as an external consultant in its work on the Once-Only Technical System. His team is responsible for working with the Member States on the maintenance of the technical design documents of the system and its alignment with related systems.