D4.11 Moving Abroad – Initial Running Phase

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List of Acronyms

Abbreviation / acronym	Description
AHA	Active and Healthy
AMA	Administrative Modernization Agency
CA	Consortium Agreement
CTIE	Luxembourg IT Center
DE	Data Evaluator
DO	Data Owner
DR	Data Requestor
DT	Data Transferor
DoA	Description of Action
Dx.y	Deliverable number y, belonging to WP number x
EC	European Commission
EESSI	Electronic Exchange of Social Security Information
GA	Grant Agreement
GDPR	General Data Protection Regulation
IDK	Information Desk
KPI	Key Performance Indicator
MA	Moving Abroad
MOR	Multilingual Ontology Repository
MVP	Minimum Viable Product
MS	Member State
OOP	Once-Only Principle
OOTS	Once Only Technical System
PC	Project Coordinator
PM	Person-month
PoA	Power of Attorney
PSC	Point of Single Contact
PST	Pilot Supervisory Teams
QA	Quality Assurance
QM	Quality Manager
RP	Reporting Period
SDGR	Single Digital Gateway Regulation
SMP	Service Metadata Publisher
TL	Task Leader
UC	Use Case
USI	User Supported Intermediation (Pattern)
WP	Work Package
WPL	Work Package Leader

Executive Summary

The Moving Abroad (MA) pilot of the DE4A project implements electronic procedures for moving and living abroad in Luxembourg, Portugal, Romania, Slovenia and Spain. It improves currently available cross-border procedures by implementing the Once Only Principle (OOP), going from weeks of work to hours or at most a few days.

Piloting solutions to these highly complex processes are an important step in breaking down barriers in the European single market. Ultimately, people should be able to move to other Member States as easy as they do nationally. The MA pilot highly values experience from piloting real eProcedures.

The MA pilot addresses some of the most important questions for successfully implementing the SDGR and SDGR-related processes. Besides validating the OOP Technical System for evidence exchange in real use cases it goes beyond the technical and semantic service aspects to support people being more mobile thus generating citizen-focused value. Furthermore, the MA pilot demonstrates several related functions, like Explicit Request and Preview, based on original and multi-lingual evidence forms in addition to canonical evidence, according to Once-Only Principle and record matching.

This deliverable is the first of a series of two reports which describes the implementation and customization of Member State specific solutions where common DE4A components have been deployed and their integration tested as part of preparatory activities towards the first iteration of the real-life piloting. It also provides preliminary conclusions and lessons learned from piloting the cross-border exchange of evidence for citizen-oriented procedures in the context of the Single Digital Gateway.

There is a mixed approach to the piloting phase in DE4A where it is necessary to accommodate both a policy agenda as well as a technical agenda (based on an Agile approach). Each MS has very different needs and actions based on their national side requirements and system updates. The best examples are maybe Slovenia and Portugal. They see huge benefits with the pilots, but they are working very hard to change their national side systems that are highly integrated to the pilot in both real and test environments mimicking the real world.

This leads to different paces in agendas and planning. Nonetheless, with the Agile approach and other approaches (e.g. flexible testing environment, different certificates etc.) DE4A is able to accommodate the schedules of several areas of interoperability based on the actual progress of different activities. While some MS did not plan to participate in the first iteration (i.e. Romania and Slovenia) and will only pilot in the second iteration, they are already testing some use cases with the others.

The first iteration pilots with a Minimum Viable Product (MVP) approach the use cases on changing domicile address and civil status in base registries: Use Case #1 "Registering a change of domicile address" and Use Case #2 "Request of extract or copy of civil status (Birth and Marriage) certificates". This iteration's use cases were both implemented over the User-Supported Intermediation (USI) pattern, which was selected as it provided features in the scope of requirements in the domain of online procedures for citizens provided by the MS in the pilot and a highly user-centric experience.

This deliverable describes the journey from plan to live services in three member states: Spain, Portugal and Luxemburg as Slovenia and Romania will join in the second iteration. It also reflects joint work with other DE4A work packages and is a valuable source of learning for other MS regarding the experienced difficulties and how they were overcome.

The main achievements are:

▸ Common Canonical evidences tested in real services.
▸ Connection of National side infrastructures based on specifications and common components.

‣ Understanding of the full Use Case (Deregistration need for multiple evidences, mandates/delegation, etc.)
‣ Legal compliance, EU and National side, also GDPR compliance.

The main characteristics of the MA pilot management are summarised below.

‣ The DE4A project identified two pilot iterations: the first pilot iteration and the second pilot iteration. The User Supported Intermediation (USI) pattern will be piloted in the first iteration, being the minimum viable product for piloting MA.
‣ The DE4A project ended up adopting a mixed phased and agile approach, using weekly meetings, specific workshops and bilateral meetings with other work packages and recurrent Connectathons involving developers that were also interacting directly in Slack channels.
‣ The MA pilot introduces both revised and new national solutions to cross-border evidence exchange.
‣ Due to the nature of the eProcedures to pilot, the frequency of the eProcedures is relatively low. There is only a limited number of people from each Member State moving to another Member State. The pilot Member States tried to involve these people as much as possible, but focus was to involve known testers of all walks of life. The pilot does not expect to gather high volume quantitative metrics even in the second iteration.

The main challenges are summarized below:

‣ Only one Data Evaluator (DE) in Luxembourg made the pilot sensitive to delays
‣ Thoroughly working through national side administrative procedures
‣ Definitions of technical and organisational terms and conditions
‣ Real Integration into national infrastructures and portals

1 Introduction

1.1 Purpose of the document

This document is the report on the initial pilot running phase of the DE4A Moving Abroad (MA) pilot. It is to be considered the first and intermediate report on the status of the DE4A MA-pilot, up until January 2022. This document covers the status of the pilot in January 2022, covers the lessons learned until that moment and provides a preliminary evaluation of the User-Supported Intermediation (USI) pattern that is piloted in this first iteration. Because the pilot first iteration is still being executed, the final report on the pilot will be resubmitted with additional content (conclusions and lessons learnt from the actual pilot) later in 2022 and then covers all preparatory and piloting activities, including the planned scope of additional functionalities and interaction patterns that will be piloted later in 2022.

The document should be considered a continuation of previous deliverables (D4.9 Use Case Definition[2] and D4.10 Pilot Planning[3]) and expects the reader to be somewhat familiar with the content of these deliverables as more definitions and details on use cases, architecture and pilot objectives have been provided there. This report also provides occasional updates on these previous deliverables, by describing the scope and planning of activities for the second iteration of the pilot in more detail.

1.2 Structure of the document

This document is divided into four main sections:

▶ Chapter 1 – Introduction – The current section that describes the purpose and structure of the document
▶ Chapter 2 – Current Status of the Pilot -– It describes the current pilot status, in particular the Data Evaluators and Data Owners, strategies used to mitigate infrastructure delays, current cross-border interoperability status and updates of the metrics since
▶ Chapter 3 – Pilot Success Criteria related to pilot dimensions - Here, the pilot goals and success criteria are linked to actual take-up by pilot stakeholders, verified benefits, and lessons learned in the first running phase.
▶ Chapter 4 – Pilot Procedures – description of pilot procedures of the initial running phase, such as cross-border interoperability testing and end users engagement. Planned improvement for the second iteration is also presented.
▶ Chapter 5 – Conclusions and Major Achievements of the Initial Iteration - The main body of the document concludes with an overview of the main conclusions reached in the document, and description of the future steps.

2 Current status of pilot

2.1 Catalogue of services and status

The number of services available for piloting in the first iteration in Moving Abroad has not progressed as expected during the last months, mainly due to the Pilot only having one Data Evaluator (DE) in Luxembourg. This data evaluator has been hampered by major organisational issues related to its national IT-centre demanding procedures around security and privacy. The first combination of mocked DE and DOs was successfully tested across borders at a Connectathon in October 2021. In spite of delays caused by different factors the Moving Abroad pilot has reached three technically ready MS combinations in use cases 1 and 2, but the DE has not been allowed to open up for real pilot services.

The main reasons of the delays include national side administrative procedures as well as long procedure of obtaining CEF certificates for connectors and SMPs and MS prioritization of activities, delays in security audits, unexpected events such as log4J vulnerability (especially for Portugal), and the difficulties in moving the solutions into the preproduction and production environment involving complex coordination among different national teams with limited resources.

2.1.1 Data Evaluator

Table 1 summarises the current status of the data evaluators in the pilot.

Table 1: Data evaluators in the Moving Abroad pilot

Data evaluator	Use case	URL	Note	Launch date
LU-CTIE	UC#1	Myguichet.lu	Based on phase4	2022Q1
LU-CTIE	UC#2	Myguichet.lu	Based on phase4	2022Q1

LU-CTIE is in the process of finalising the implementation of the connector/AP, i.e. Data Requestor (DR) (corner 2), using phase4. The DR should be in place and work beginning of March 2022. A webpage allowing to simulate the request of evidences at LU DE (corner 1) side will be provided directly afterwards.
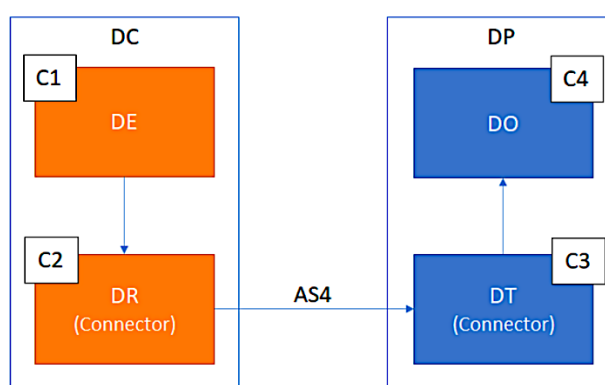
Figure 1: 4 Corner model of eDelivery

The connection between DR and DE will not yet work in March 2022. Therefore, these temporary, provisional webpages will be created to allow for testing of the exchange of evidences with the other partners, i.e. PT and ES in the first iteration. It will be replaced as soon as possible (April 2022) by the

MyGuichet test environment webpage, i.e. a page from the Point of Single Contact (PSC) portal which will provide the administrative procedure.

2.1.2 Data Owners

The following table summarizes the situation of the Data Owners (DE).

Table 2: Data Owners in the Moving Abroad pilot

Data Owner	Use case	URL	Note	Launch date
ES-	UC#1	https://pre-as4gw-dt-de4a.redsara.es/de4a-pid-owner/welcome		Q4 2021
ES-	UC#2	https://pre-as4gw-dt-de4a.redsara.es/de4a-pid-owner/welcome		Q4 2021
PT-AMA	UC#1	https://pprwww.autenticacao.gov.pt/	(Includes previewer portal)	Q1 2022

Integration of DEs and DOs with the help of the playground and use of central SMP: Tests were executed in the playground to facilitate DEs and DOs integrations by having available tools to validate the components integration by replicating the behaviour of the real components and providing processes to accomplish the different test cases.

The aim for setting-up a central SMP on the playground was to have a central component while MS developed their own distributed SMPs. Also, the services metadata was handled in this central SMP for stability, scalability and consistency reasons.

Until production environments were in place and also production certificates available, preproduction common components such as the DE4A Connector were implemented in order to facilitate the different setups, configurations and testing as much close to the real final infrastructure as possible.

Catalogue of Evidences and Entities: Portugal extended the existing catalogue of evidences, that can be previewed and authorized in the previewer portal, to include both the Domicile of Registration evidence and the Higher Education diploma evidence from Studying Abroad Pilot. For the second iteration Portugal plans to also add the Pension, Unemployment and Working Life evidences.

Portugal created an infrastructure to catalogue both the entities that are authorized to provide for cross-border evidences and also the entities that are authorized to request evidences across borders. On the second iteration Portugal plans to look up and retrieve more information on those entities (address, contact information, VAT number), from DE4A common component Information Desk, so as to present it to citizens, during the Preview.

Previewer, Authorization and Authentication national common infrastructure: Portugal chose to provide a common national infrastructure where Data Owners and Data Evaluators can plug into. That common infrastructure provides them with: a Previewer, an Authorization and log mechanisms, an access point to eDelivery and DE4A Connector and an access point to the Portuguese eIDAS node.
On top of that, Portugal provides a (national and eIDAS) authentication component plug-in, which portals can use to provide citizens trustworthy authentication mechanisms to access their services.

Previewer and Authorization Portal: Portugal extended its authorization services to enable for a Preview, in a web portal, of the attributes being exchanged in an asynchronous way. Also, it enables for the authorization to be done and logged in that portal. Users can check what of his/her data was shared when, from where and to whom.

With regards to **eIDAS authentication in the Previewer and Authorization Portal**, Portugal extended its Previewer portal authentication mechanisms to allow for eIDAS authentication. Also, it extended its authorization mechanisms to allow for eIDAS authorization.

2.2   Strategy followed to mitigate infrastructure delays

Generic for all MS

Integration of DEs and DOs with the help of the playground and use of central SMP: many more steps and tests were executed due to issues around certificates handling. The rich testing environment of the playground consisting of Connectors, Data Owner and Data Evaluator mocks and transaction monitoring tools allowed to organisations managing online procedure portals and data services to test their customizations before actual Connectors are ready in their countries and to test cross-border exchanges early on (even when counterpart endpoints are not yet ready). Also the central SMP of the playground has been used to mitigate delays with national SMP deployments. This will change in second iteration as each Member State will have their own SMP deployed.

Use of DE4A certificates in live services: it was considered but discarded to use also the preproduction DE4A certificates for the live services. This was discarded by some MS due to security considerations. In any case, the DE4A public key certificates proved useful in the playground and Connectathons.

Use of simulated procedures in some cases: given the complexities involved in integrating real procedures for the first iteration we chose to start with simulated procedures and real users who were informed of this setup and that the exchanged evidence would not be used with real consequences. The test users were all entirely new to the system though the first time they tested the services.

Log4J vulnerability: all pilots were affected by the vulnerability and the teams worked well in bringing out new updates. A MS decided to change the component for others, and this caused approximately 3 weeks of delay as it needed to be properly exchanged not only for the MA-pilot but for many other national services.

Reuse of available infrastructure: such was the case for the SMP in the first iteration.

Establishment of a Minimum Viable Product: the focus has been to get an MVP up and running in the real infrastructures focusing on the hard tasks to solve. Adding only more functionality in the second iteration.

Portugal

Mocked Data Owners on the previewer portal: while the VPN connection to Data Owners was not available or stable enough, the Portuguese team used national mocked Data Owners to run system integration tests.

Fictitious evidences and authentication credentials for testing: similar to Spain, the Portuguese team requested the Portuguese Data Owners for fake evidences (Domicile Registration evidences) and fake authentication credentials for using in the preproduction environment and in cross-border system integration testing. Those credentials were also shared with cross-border partners for their cross-border testing. The Portuguese team also shared a preproduction authentication mobile app for increased flexibility on the use of the test physical cards: while they did not arrive at the destination or for sharing the same test physical cards between colleagues in different physical locations.

2.3   Achieved interoperability status

Taking the Data Owners and Data Evaluators into account, a few DE/DO combinations remain available for piloting. The table below displays the interoperability status for the OOP Technical System domain. Although many partners were involved in this pilot, not all the partners had the ownership of all the roles in their country: some only pilot for DO or DE and others for some of the Use Cases. So, fewer than all the possible combinations were possible among the partners.

Besides, partners had different national pre-existing infrastructures or relied in third party subcontracting to be formalized, therefore it took them different times to accomplish the necessary piloting implementation requirements.

During the DE4A project, three partners left the Moving Abroad pilot due to internal reconsiderations which resulted in three less MS participating in the pilot: BE and DK at first and then a more recently SE.

Also, the Portuguese partner SEF only joined later. In summary, from the few possible left combinations some would only be ready for the second iteration.

Table 3: Interoperability status between DO and DE, using the OOP TS for UC#1 and UC#2

		MS acting as DP			
		LU	ES	PT (only UC#1)	SI
MS Acting as DC	LU				Second Iteration

Green = Connection established and confirmed in extensive tests

Yellow = Connection partially established and confirmed in extensive tests

Red = Connection not established or confirmed in extensive tests

The table above display the connectivity status as established in January 2021. The situation is all but static, and connectivity is being extended continuously so tables may not represent the actual situation when reading this document at a later moment.

2.4   Updates in Metrics

The pilot goals, success criteria and metrics as defined in the previous deliverable (D4.10 Pilot Planning)[3] remain the same.

As the customization and integration phase for the second iteration progresses, minor adjustments in metrics are expected to be introduced in view of extended piloting scope and evaluation recommendations from the first iteration.

One additional questionnaire is introduced to evaluate aspects of the pilot in the technical domain see Annex I.

3 Pilot Success criteria related to pilot dimensions

3.1   Introduction

The analyses conducted with regards to challenges that the implementation of the SDGR introduces, as well as the realization of the infrastructure implementing the SDGR and conclusions of these analyses, proved very valuable. This chapter summarizes the lessons learned from these activities and provides suggestions for the implementation and adoption of the SDGR implementation. The Moving Abroad pilot's main objective is to lower barriers (paper-based processes, language challenges etc.) for citizens wanting to move abroad. The goals that were first described in D4.9 [2] have been refined in D4.10 [3], and achievements are displayed in the table below.

The chapter is structured along initial feedback collected from MS public administration representatives and the lessons learnt per phase and per interoperability area.

3.2   Pilot dimensions

3.2.1   Use

In this section, the take up of the pilot services by stakeholders and the first feedback provided by them is analysed. With the delay of the pilots the focus is on qualitative description of the value of the Pilot to our different stakeholders. Also preliminary conclusions on these dimensions, based on metrics, questionnaires and interviews have been included. The dimensions target the scope of the piloted functionality and patterns.

Initial feedback: This section provides a summary of the first results gained from the practical use of the pilot. The results are currently based on the feedback of a representative but limited number of representatives from MS public administrations. More detailed information from focus group and real users will be given in the final report.

The usefulness of DE4A patterns and components related to internal stakeholder's take-up: Pilot partners involved in customization, implementation, deployment or testing of DE, DO or DE4A connectors have provided first feedback on the common components and specifications. The following results are based on received questionnaires.

Table 4: Usefulness of components Spain

Components	Perceived quality of specs/ software	Ease of integration	Potential to include in sustainability plan	Adequacy for pilot purpose	Overall assessment
Solution architecture	Very high	High	High	Very High	High
Information exchange model	High	High	Neutral	Very High	High
Canonical data model	High	High	High	Very High	High
DE4A connector	High	Very high	High	Very High	High
Mock DE	Very high	High	Neutral	Very high	High
Mock DO	Very high	High	Neutral	Very high	High
Central SMP	Very high	High	High	Very high	High
Kafka server	Very high	High	High	Very high	High

Table 5: Usefulness of components Portugal

Components	Perceived quality of specs/ software	Ease of integration	Potential to include in sustainability plan	Adequacy for pilot purpose	Overall assessment
Solution architecture	High	Medium	Medium	Very High	High
Information exchange model	High	High	Neutral	Very High	High
Canonical data model	High	Medium	Medium	High	High
DE4A connector	Medium	Low	Medium	High	High
Mock DE	Very high	High	High	Very high	Very High
Mock DO	Very high	High	High	Very high	Very High
IDK	Medium	N/A	Low	Medium	Medium
Central SMP	Very high	High	High	Very high	High
Kafka server*	N/A	N/A	N/A	N/A	N/A

*Still awaiting local implementation, logging locally only currently, with domestic log.

Table 6: Usefulness of components Luxembourg

Components	Perceived quality of specs/ software	Ease of integration	Potential to include in sustainability plan	Adequacy for pilot purpose	Overall assessment
Solution architecture	Very High	High	High	High	High
Information exchange model	High	High	High	High	High
Canonical data model	High	High	High	High	High
Connector	Very High	High	High	Very High	Very High
Mock DE	Very high	High	Neutral	Very high	High
Mock DO	Very high	High	High	Very high	Very High
Central SMP	High	High	Very Low	High	High
Kafka server	High	High	High	High	High

Comments on the usefulness of components, specifications and technical documentation

Solution architecture
▸ Multiple coexisting complementary patterns (User-supported Intermediation pattern, Intermediation pattern) allow for a flexible approach suitable for each situation.
▸ Both User-supported Intermediation and Intermediation patterns are useful for SDG OOTS.
▸ The end of the registration eProcedure, should trigger a cross-border update of the new address in the "coming from" MS (and eventually other MSs that require or wish to be notified).
▸ The previewer and authorization system used in DE4A are also useful implementations for national and SDGR use.
▸ Portugal has built an out-of-the-box component, easily integrated in any Data Consumer portal, closely connected to the eIDAS node, that allows for synchronous previewing, requesting user permission and exchanging of attributes in a seamless user experience.

Canonical Data Model

▸ Suitable common structure for the Moving Abroad evidences.

▸ However, there is a potential need in some MS to consider to further standardize schema structure where possible across pilots, so as to leverage in a common infrastructure, previewer and even related evidence in different life events (e.g. outcome of university registration procedure to prove the motive for living in a new country).

▸ While DE4A enables already validation of exchanged evidences against the predefined schemas (syntax check for well-formedness and XML validation to check data types, allowed attributes and elements and their order and cardinality as well as simple dependency checks), some partners recommend to consider an extended mechanism by enabling at the DOs and optionally at DEs more complex validations (i.e. Schematron) on business rules which can be specific to each pilot (applicable to the very broad, flexible and encompassing schemas DE4A is providing), validations across document boundaries, syntax checks over certain field values that tend to change and easier management of code lists that also tend to change.

Mock DE and Mock DO

▸ The mocks have been very useful. First, to test when DE and/or DO was still not available. Later, to debug problems anytime anything is changed or updated. If more complex validations were to be implemented in the future, they would also have to be included in such playground components.

IDK

▸ IDK has been very useful. For each evidence type and Member State, it indicates the correct data owner.

▸ However, in the second iteration, IDK could allow for more user input parameters, besides selecting the country, such as the selection of the previous university of studies, when the student is collecting the evidence of the former diploma.

Strategy on pilot use until final report

Given the considerations described above, partners will make even greater efforts to maximise the usage. No real users have used the services so far in the first iteration due to the delay in launching combinations in operational environments. In this iteration, only local users and focus groups will use the services. In the second iteration, which is expected to take longer than the first, unknown but reachable users and unknown users will also be targeted, as described in D4.10[3].

3.3   Learning towards adoption

3.3.1   Lessons learned from analysing and designing integration of cross-border OOP

Table 7: Lessons learned from analysis and design

ID	Topic	Suggestions for adoption	Lessons learned
1	Design process	MA advises Member States to invest time to bring together the eIDAS and OOTS knowledge. This requires organising and prioritising as this knowledge is scarce.	Designing national integration required in-depth knowledge of both eIDAS and OOTS. This knowledge (specifically the combination of both) is not broadly available in Member States. Knowledge of both domains should be brought together in order to prevent designs based on false assumptions of the other domain.

ID	Topic	Suggestions for adoption	Lessons learned
2	Scoping	MA advises the European Commission and Member States not to solve all user scenario's at once, but to focus on the most frequently used ones. One should first focus on core functionality only. And at the same time organise follow-ups on improvements and additions to address later on.	The project encountered many complex issues and topics that needed to be solved in the pilot design phase. The pilot lead has organised a series of meetings to address these topics. To keep focus at the core research questions and to limit resources needed, the pilot partners agreed to simplify whenever adequate, e.g. focussing at the most important evidence type instead of all possible types, accepting request for one single evidence type at the time (instead of allowing requests for multiple evidence types). The pilot secured progress and focus by scoping strictly.
3	Explicit request	MA advises data evaluators to integrate (1) request to consent and (2) explicit request into one joint question to the user to prevent adding to the confusion - of course in case both are applicable at the same time.	In some cases, users need to express consent for the retrieval of attributes (GDPR). In almost all cases when using the OOTS, the user needs to express explicit request (SDGR). Although legally sound, in practise the difference between both is difficult to understand for data evaluators. DEs furthermore expect that users will ignore such requests and just click "ok".
4	Multiple-MS scenario's	MA advises Member States to make an early start with the analysis of the SDG-implementation where data exchange involves more than 2 Member States.	The pilot involved 2 Member States in the exchange of evidences about citizens. The level of complexity for analysis increases vastly with each additional Member state that is involved in the exchange of information on representatives and companies. An example of a 3 MS-scenario could be a father from MS A, Mother from MS B and Child MS C (adopted). Such an analysis introduces a level of complexity that exceeded the constraints of the pilot.
5	eIDAS non-notified eID	MA advises The European Commission and the Member States without notified eIDs to agree on a temporarily solution for using non-notified eIDs in SDG-procedures.	Some of the participating Member States do not operate a notified eID (SI, RO). On a bilateral basis non-notified eIDs will be accepted for piloting purposes, although pilot partners expressed their doubts regarding acceptance of non-notified eIDs for large scale SDG. Notification of eIDs is a strong prerequisite for implementing SDG. Mandatory eID-notification as expected under the new eIDAS regulation (eIDAS revision) will not be available in time for SDG-implementation.
6	Sector specific systems	Integration of the OOTS with sectoral systems (ESSI in this pilot) has proven to be not so straight forward as many expected at the start of the project.	For the MA pilot alignment to - or integration with - ESSI has been an important topic from the start of the project. Much time has been spent on workshops, desk research and analysis. In the end, re-use of ESSI has been limited to some semantics. Re-use of information flows, building blocks, etc. was not possible due to difference in legal framework, governance, authorities involved, solution implemented, etc. The solutions have been

ID	Topic	Suggestions for adoption	Lessons learned
			developed for different purposes and hence are not easily aligned.
7	User interaction design	MA advises the European Commission to provide wireframes in order to have generic steps (like Explicit Request and Preview) implemented in a similar way by all MS.	Several data evaluators needed to implement the same logic in their specific systems, including user interaction (general explanation, explicit request, preview). The user interaction design across participating Member States turned out to show some differences in informative texts, detail of explanation, use of buttons, etc. This may lead to confusion for the user that deals with multiple data evaluators as well as a slow learning curve. MA decided to provide a pilot-wide reference in the form of wireframes to allow for more uniformity across the pilot.
8	USI pattern	MA advises to consider use of USI pattern in the context of evidence exchange for online procedures and data services holding citizens data	MA Pilot chose to pilot the USI pattern considering a number of important MS requirements and guarantees that would be satisfied thanks to user interactions at DP side including reduced errors in record matching, increased user control and transparency of the process having Preview at DP side. Given the fact that USI pattern also reuses, as far as possible, the same specifications and standards as the intermediation pattern, it would allow, beyond this fact, to reuse more of the building blocks that are already available on national level (e.g. Preview implemented in many data service portals) and lead to less complexity by avoiding the duplication, only for cross-border needs, of such solutions.
9	USI pattern	MA advises to build on existing sectoral Regulations such as Public Documents Regulation in order to leverage existing solutions that are beneficial in cross-border contexts	DE4A Information Exchange Model has been particularly useful for this pilot as it allows to exchange structured evidence (canonical) but also original evidence and multilingual forms that are compliant with the Public Documents Regulation (EU) 2016/1191 and which were considered together with ISA2 models for the pilots' canonical evidences.

3.3.2   Lessons learned from implementing and testing

Table 8: Lessons learned from implementation and test

ID	Topic	Suggestions for adoption	Lessons learned
1	Planning and organising tasks	MA advises to allocate a multi-month phase for establishing alignment, priorities, financial means etc. for all organizations involved.	The components to be used (in the pilot) were distributed over several authorities in a Member State, requiring the commitment from all authorities. This commitment is not obvious and must be secured beforehand. Also, as the systems are distributed, the teams working on the systems are distributed as well. Collaboration took more

ID	Topic	Suggestions for adoption	Lessons learned
		Furthermore, it is necessary to have a coordinating team (equipped with sufficient knowledge about the solution) in each Member State to make sure that legal, semantic, technical and managerial issues are being resolved in a timely manner.	time and in each team, keeping DE4A with high priority became challenging.
2	Handing over	MA advises the European Commission to put additional efforts in explaining the workings of the SDG OOTS components to public authorities involved. The better the solution is understood by all, the smoother the SDG implementation will be. The national complexity that the SDG imposes on Member States (e.g. record matching) is easily underestimated.	Design documents and specification have sometimes been interpreted by different pilot partners in different ways. During the preparation of the pilot or during interoperability testing such differences surfaced. It would be better to have a detailed common understanding of all the design details prior to the testing phase. Take the time for handing over Solution Architecture to other work packages in the DE4A programme, and make sure that everything is understood.
3	Documen-ting	MA advises the European Commission to invest in proper and clear documentation for developers in Member States, so they can get the OOTS up and running with the least amount of effort. Documentation should not be too cryptic and short, but definitely must not be too extensive. Feedback on the documentation from first movers has proven to be very useful in the MA pilot. Additionally, installing a small central team of technical experts providing support technical experts in Member States, could be considered.	For developers of the common components, there's a lot of logic behind its internal routines, structure, configuration, etc. Deploying these components by the Member States in the MA pilot raised several questions regarding the use of Docker images, configuration items that needed to be set correctly, required firewall and DNS settings, etc.
4	Configu-ring	MA advises Member States to prepare for the steps to be taken to request the certificates needed to operate the OOTS. MA advises the European Commission to investigate whether the process for acquiring the OOTS certificates can be simplified.	The components needed for SDG rely heavily on use and exchange of certificates for server authentication, signing, etc. The process of acquiring the certificates turned out to be time-consuming and error-prone (all details must be in place when requesting the certificates). Furthermore, the procedure of requesting certificates is regulated in a way it requires signatures of responsible people within the requesting institution that do not on a daily basis

ID	Topic	Suggestions for adoption	Lessons learned
		MA advises the European Commission to design a procedure for communication between Member States in case of change of certificates and to provide for certificate-rollover to guarantee OOTS-connectivity.	work with - and understand the use of - certificates. Or people that are not available immediately (company executives).
5	Integrating DE and DO	MA advises Member States to take the impact on existing systems into account. Including existing items on backlogs that might need to be resolved before being able to connect to the OOTS.	When integrating to the DT/DR, expect to run into existing problems in the DO/DE systems that need resolving as well. This will involve extra work, although the work is not directly being created due to integration with the DT/DR. The problems in the DE/DO systems were existing already, but were not causing real issues until then (problems were accepted) but might need to be resolved in order to achieve good integration to the DT/DR.
6	Interoperability testing	Wider OOTS implementation requires more inter-Member State coordination regarding exchange of connectivity details, configuration and cross-border interoperability testing. Planning of these activities requires much attention and flexibility from the Member States. MA advises to take this into account when connecting the decentralised SDG OOTS components. eIDAS lessons learned with regards to exchange of certificates for example, are also relevant.	The speed of development varies per Member State. Therefore, readiness for cross-border testing (and piloting, for that matter) is also distributed in time. Member State A can have their DE ready months before Member State B has (due to several national impediments). Testing on fixed moments in time for all DEs and all DOs has proven not realistic so going for a phased pilot launch has been proven as the right approach.
7	Interoperability testing	Establish clear readiness criteria for the DE/DO and the DE4A Connector before starting Connectathons.	The MA pilot has proven that a lot of settings need to be configured correctly to allow successful cross-border evidence exchange. During interoperability testing (Connectathons) Member States sometimes had different views on what components or parameters had to be set in order to start testing. As a result, not in all cases the complete flow could be tested at once.
8	Interoperability testing	MA advises the European Commission to coordinate exchange of test credentials between Member States. Many-to-many "requesting and sending of eID's on a bilateral basis" should be prevented.	Proper interoperability testing is only possible with the required test eID means. These national eID means have not always been easily available (depending on the MS-specific situation - dependencies on IdP's may exist). This hindered cross-border interoperability testing at some occasions. The effect of lacking test credentials will be much greater in case of large scale implementing the SDGR.

ID	Topic	Suggestions for adoption	Lessons learned
9	Reliance on eIDAS	MA advises the Member States to setup and test national eIDAS deployment prior to implementing the SDGR in order to prevent delays.	MA piloting - just as SDG implementation - relies on use of eIDAS. Unfortunately, eIDAS is not fully up and running in all Member States. In interoperability testing, several eIDAS related setup-issues needed to be solved.
10	SDG implementing acts	MA advises the European Commission and Member States to be aware no such thing as 'a final version' exists in the area of inter-Member State information exchange. Moving forward step-by-step with versions currently available is crucial to progress. Note that continuous alignment with all European initiatives during single steps is not feasible and will delay each initiative started.	MA pilot implementation has been delayed by numerous discussions (within Member States and between Member States) on alignment with the SDG OOTS that was being sketched at the same time. Although this approach had been deliberately chosen and agreed upon at the start of the MA project (to enable real piloting and provide input to SDG), in practise discussions were raised over and over again and caused prioritization challenges for the pilot activities of partners.
11	Coopera-tion	MA advises to facilitate technical experts of the Commission and the Member States to easily ask each other questions, respond, etc. using a tool for this purpose, e.g. Slack.	Slack seems to be a good means to have developers of different MS / WPs collaborate.

Pilot partners have also estimated the required effort for various steps, such as integrating the DE4A Connector or implementing the Preview functionality. Effort for USI pattern is summarized in the following tables based on answers from Portugal, Luxembourg and Spain.

Table 9: Estimation of effort for the USI pattern

Phase	Mean effort (in person days)	Deviation
Setting up and deployment of DE4A Connector	4-5 days	
Setting up and deployment of SMP	5-7 days	
Integration of the portal with an eIDAS node	5-7 days	0 day
Integration with DE4A Connector	4-5 days	
Implementation of explicit request	2-3 days	
Implementation of preview	2-3 days	0 day
Transformation to canonical format and provision of the requested evidence	3-4 days	Higher
Transformation from canonical format and use of the received evidence	3-4 days	
UI internationalization	2-3 days	Higher
Overall effort for DE	11-15 days	
Overall effort for DO	11-15 days	

The mean efforts are described based on the implementation in two DO and one DE based on different levels of integration and are rough estimations at this point in time.

3.3.3 Technical, semantic, organizational and legal knowledge shared with others

Table 10: Lessons learned from semantic, technical and organizational/legal activities

ID	Topic	Suggestions for adoption	Lessons learned
1	Communi-cation	Use visual tools to show the benefits of OOP to users, e.g. presentations and videos. Prepare the creation of an animation by setting up a good storyline and slides that illustrate the flow of the animation.	Implementation of the Once-Only Principle might be interpreted as abstract by users / companies that might benefit from it. From a user perspective, there's not too much to see in the OOP-process. OOP might be interpreted as 'not a big deal' by the user. Large parts of the solution are "complexity under the hood". Hence, additional efforts are needed to explain in an understandable way the huge difference that OOP makes.
2	Legal	Start early with legal Mockups	Discuss in detail the meeting of different regulations and languages to get a good understanding of the cross-border implications of legal basis and complete purposes.
3	Legal	Simplify national side administration	Cumbersome and difficult bureaucracy to satisfy some legal requirements, such as the signing of the Power of Attorney (PoA) document.
4	Semantics	"Deregistration" still needs to be understood better in second iteration but may be interesting also for other services.	What may seem like a simple step to complete a procedure may in reality turn out to be quite complex depending on cultural and regulatory implications in 2 or more countries.
5	Organisational	Ensure project participants are also those that will finally audit the before go-live.	Anticipate for the need of formal required national security auditing processes that need to go through all solution components.
6	Technical	Expect different domain identifiers to have to interact in one Service.	An identified future need relates to implementation of advanced identity linking mechanisms, that will work around the lack of persistence of some eIDAS eIDs, across Member States or even across portals in the same Member State. That workaround would allow for the Previewer and Authorization portal to correctly identify the same citizen that previously registered in a Data Owner portal.

3.3.4   Pilot learning for sustainable impact and new governance models

Table 11: Lessons learned on new governance models

ID	Topic	Suggestions for adoption	Lessons learned
1	Stabilization	Some MS have added further reaching security requirements than expected from the start. This should be harmonized and adopted by all.	There needs to be a minimum level of common agreed security measures for all to build trust, especially over time.
2	Organisational	Early and detailed planning, sharing of plans to avoid making the same mistakes.	Adjustments required to cope with different levels of progress in the partner's developments/ deployments.
3	Organisational	Simplification and harmonization of deployment procedures.	Deployment delays due to the complexity of the internal IT department structure.
4	Policy	Quicker Member state decisions and redecisions.	Different sustainability goals across partners with a consensus emerging to either deploy or keep pilot services in production or use DE4A infrastructure to keep exchanging messages until the SDGR OOTS is in production. Need of quicker and clearer cost/effort estimates.

4 Pilot Procedures

4.1 Cross-border pilot testing approach

4.1.1 General approach

A connectathon-like approach has been used to allow to, both to validate development and integrations and to track progress for all parties in the project. The project has tested connectivity of the Member states and cross-border interoperability between data consumers and data providers at several DE4A Connectathons where developers from all pilot partners participated.

To establish and confirm the cross-border connection between Data Owners and Data Evaluators, two tracks were defined in the Pilot Planning Deliverable, which was each divided into several milestones. The milestone sequences were designed to introduce complexity in cross-border communication in a step-by-step fashion, allowing the involved Member States to focus on one challenge at a time and keep the complexity manageable. To summarize, the tracks and milestones that were used are:

Table 12: Milestones as defined in D4.10 Pilot planning

Milestone	eIDAS/OOPTS
1	eIDAS authentication for persons up and running
2	DE4A Connector between 2 Member States
3	Full scale functional testing between all Member States.
4	Ready to start Pilot

These tracks were meant for all Member States to use synchronously. This however, turned out to be unrealistic because all Member States seem to have their own challenges, leading to different speeds of development. The general approach, where tracks and milestones were defined, remained useful, however for each combination of Data Owner and Data Evaluator a separate timeline turned out to be necessary.

4.1.2 Connectathon

First, connectivity of the DE4A connectors was tested with the help of mock DEs and mock DOs from the playground. Then, integration of real DEs and DOs was validated with mock DOs and mock DEs respectively. In the final stage, cross-border interoperability of real DEs and real DOs was partially tested. Both happy and unhappy flows were investigated:

▸ DE4A Connectivity
  - Happy flow, unhappy flow (no evidence, rejected preview etc.)
    - Mock DE – DR (MS A) – DT (MS B) – Mock DO
    - Mock DE – DR (MS B) – DT (MS A) – Mock DO
▸ Integration of endpoints
  - Happy flow, unhappy flow (no evidence, rejected preview etc.)
    - DE (MS A) – DR (MS A) – DT (MS B) – Mock DO
    - Mock DE – DR (MS B) – DT (MS A) – DO (MS A)

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  ▸ Cross-border interoperability of endpoints
    ▪ Happy flow, unhappy flow (no evidence, rejected preview etc.)
      ▪ DE (MS A) – DR (MS A) – DT (MS B) – DO (MS B)

Table 13 lists all Connectathons with participation of the Moving Abroad pilot partners and their main activities or results.

Table 13: Connectathons

No.	Time	Activities/results
1.	2021-10	Tested playground Portugal, Spain and Luxembourg
2.	2021-10	Achieved connectivity Portugal, Spain and Mocked DE
3.	2021-11	Tested connectivity and Previewer of Portugal and Spain against mocked DE
4.	2021-11	Tested connectivity and Previewer of Portugal and Spain against mocked DE
5.	2021-12	Tested connectivity and Previewer of Portugal and Spain against mocked DE
6.	2021-12	Tested connectivity and Previewer of Portugal and Spain against mocked DE
7.	2021-12	Tested connectivity and Previewer of Portugal and Spain against mocked DE
8.	2022-01	Tested connectivity and Previewer of Portugal, Spain and Slovenia against mocked DE
9.	2021-01	Tested connectivity and Previewer of Portugal and Spain against mocked DE
10.	2021-01	Tested connectivity and Previewer of Portugal and Spain against mocked DE

4.2   End users' engagement progress and dissemination/impact activities

The following four user groups are considered for the Moving Abroad piloting:

Local users DO member states

This user group include a few users from the participating MS. Who are somehow connected to the project.

10 Local Spanish users were approached.

10 Local Portuguese users were approached.

Focus group users

The focus groups will include a small number of citizens; elderly users are approached via the Active and Healthy (AHA) program and users from the Studying Abroad-pilot to have both older and younger users. They provide the guarantee that there will be enough end-users to validate the pilots in the end. These users are asked to provide formal feedback through an online evaluation tool to help us understand their views on the pilot.

The selection of known users was defined by each Member State:

For Spain

  ▸ Small number of users from the involved agencies and people in their networks.
  ▸ The users should be information technology literate.

For Portugal

  ▸ Small number of users from the involved agencies and people in their networks.
  ▸ The users should be information technology literate.

▶ Portugal intends to contact European citizens in Portugal via SEF. And intends to contact Portuguese citizens via European embassies.

Unknown but reachable users

Further professional networks from other departments and agencies of the involved entities will be invited via LinkedIN and email to validate the pilot after the focus groups.

Unknown users

All other eligible citizens were recruited via LinkedIN, Twitter and other means.

4.3 Planned Improvements

Before addressing possible improvements, it must be noted that the paragraphs in this section are based on planning and preparation experiences only. Still, feedback is available from the 'customization and integration phase' of the pilot, allowing for some reflection and reporting on possible improvements. It is to be expected that additional feedback from the pilot runs will lead to the identification of more improvements on many aspects of the pilot procedures, as well as technical and functional properties of the OOP TS and SDG implementation.

4.3.1 Canonical Schemas of the MA Evidence

The currently piloted schemas are quite small when it comes to mandatory attributes. The MS will work to include more values in non-mandatory attributes in the second iteration to help with finding more difficulties and further the validation of the evidences.

4.3.2 Functional and technical improvements

It is likely that the running phase may lead to some optimisations for the User-Supported Intermediation pattern e.g. like deferred procedures, an updated mechanism for redirection implemented in the Connector and support to multiple evidences. Although the USI pattern will be used in the second pilot iteration it is not expected that all these optimisations will be implemented in the second iteration.

Looking at the goal of the pilot, the objective is to learn as much as possible. To maximise "learning" the second pilot iteration will direct efforts towards experimenting with the new functionalities defined within scope of the second iteration; Multiple Evidences, IM pattern for "Request Information on Pensions and Labour Status" (former pensions UC), Deregistration and Learning on the MOR-component (Multilingual Ontology Repository).

Balancing the need for MVP and full-blown useable services often leads to discussion between MS side and central work packages. It also shines a light on the architecture and the efforts needed for further updates to the system. In short it needs to be decided by each MS whether they are building a system for the long-term or for the project. This is an important exercise and gives many new requirements for future services or projects.

4.3.3 Pilot procedures improvements

MA pilot decided not to approach any external end users until the services are up and running to avoid unnecessary complaints of delays. Instead, we have planned to reach out via AHA to their ecosystem when we know who (which MS to approach). This differs from the other pilots, but so far it has been the right decision. For the second iteration we may do it differently.

Several considerations for the remaining period of executing the pilot procedures are:

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▸ The procedures for recruiting users should become a continuous process and some MS have reached out to their embassies to support this, in order to offer as many people as possible the opportunity to participate.

▸ Additional promotion to involve users will be necessary, and different networks like MyData Global and JoinUp ecosystems will be approached. DE4A has expertise available that will have to be used more extensively and team up with the DE and DO of all DE4A pilot partners.

4.3.4   Canonical scheme of the evidences

The canonical scheme of a Moving Abroad evidence was defined in collaboration with WP3. The data owners from the pilot also prepared examples of the canonical evidence for each MS for the DE4A playground. Following feedback from DOs and DOs, two issues should be considered for the final phase:

▸ *Pensions:* The third use case of MA abroad was always pensions, but it early on got a lower prioritization due to different EU initiatives like an EESSI-Verifiable Credentials project and services in general from EESSI. It rather became clear that the need for the MS was to be able to ensure different "means of living", in MA pilot now called "Pensions and Labour Status" and it can happen in conjunction and help to further assess a change of domicile.

▸ *Pensions and Labour status*: Currently the canonical evidence for Pensions and Labour Status is being prepared based on the availability and needs of the participating MS.

4.3.5   Updates to the final iteration plan

This subsection summarizes updates of the final iteration. Partner SKV (tax authority of Sweden) decided to discontinue participation because of lack of resources.

Further Slovenia has come up as an early tester of first iteration leveraging their experience with the USI pattern in the Studying Abroad pilot to effectively participate in the connectathons. Furthermore, the Member States are also focusing on providing more non-mandatory data to UC1 and UC2 in the second iteration.

4.3.6   Finalizing UC1 process

Discussed mainly based on the UC of Portugal and Luxembourg, canonical evidence for "deregistration" or notification to the former domicile country has been created. Still under discussion is the need for a new "notification with evidence" pattern, for pushing the new address to the former domicile country system, which will follow pragmatic approach that leverages IEM and other approaches to minimize implementation overhead.

5 Conclusions and major achievements of initial iteration

The pilot has not arrived in planned dates at the starting point of actually piloting with real life participants. Pilot partners managed to analyse the most important challenges for the implementation of the SDGR (like record matching, evidence-definition and preview), and developed an international infrastructure for cross-border exchange of personal data evidences by deploying and integrating DE4A common components to national agencies.

This infrastructure was designed, implemented and is currently being extensively scrutinized, to finally allow operation of the infrastructures, tested and proven and reliable to facilitate real-life piloting. It supports the exchange of harmonized datasets about canonical evidences, while the designs and assessments have been completed to extend the Member State infrastructures for cross-border preview. The infrastructure established for the first iteration of the pilot, is expected to provide a good starting point for future extensions.

The exercise of taking the services into operation has uncovered many difficulties on the national sides. This has touched both on infrastructure issues (use of connectors) as well as all legal and organizational barriers with parallel organisation for operations and projects.

Based on frequent connectathons, the User supported intermediation (USI) pattern has proven useful for the procedures as in the SDG Annex II [1]. The need for providing previews at DP about evidences reflecting changes in register entries was validated during analysis and design, regarding both changes in personal- and administrative data.

The availability of an EU-wide operational eIDAS network and notified eID's is a prerequisite for implementing the SDG. As only some of the Member States have notified eIDs, temporary use of non-notified eIDAS were allowed for piloting the MA procedures.

Member States establish their own maximum speed for implementing the necessary infrastructural, legal and procedural changes. Speed differs between Member States because each Member State has a different starting point and therefore faces different challenges. It also varies widely how the beneficiaries have approached the project planning and implementation.

Establishing coordination on Member State level for implementation activities proves to be an important factor for success. A Common European strategy to implement the SDG would allow for individual national timelines at the same time as one can learn from each other.

Having all Member States converge to a clear MVP endpoint at a specific point in time has helped the MS to secure progress and make sure that the solution eventually will become available for European citizens.

It is clear from all use cases that establishing a harmonized datasets that embody the evidences to be exchanged cross-border turns out to be time-consuming. Having the evidence match the needs of Data Evaluators and making sure that this can be provided by Data Owners and aligning with existing or ongoing semantic modelling efforts requires much analysis but is key in making the cross-border exchange of information valuable and durable. It is now important to further extend the availability of all parts of the evidences in all Member States over the coming years.

It is clear that the Member States that set out working with their IT department from the beginning are currently in better shape than those that did not. As there is a learning curve to any new component, it has been a steep learning curve for some Member States while others have chosen to rely on external experienced consultants working to do knowledge transfer.

Some Member States have chosen, to progress faster, to work with other MS-infrastructures and a central SMP, sharing services in the first iteration. To maximize learning and spread expertise, and ensure sovereignty, this should not be continued in the second iteration.

References

[1] Single Digital Gateway Regulation, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.295.01.0001.01.ENG&toc=OJ:L:2018:295:TOC, 22-02-2022

[2] D4.9 https://www.de4a.eu/_files/ugd/2844e6_a07e5bbeac0f404999beb323c82b1416.pdf, accessed 20220304

[3] D4.10 https://www.de4a.eu/_files/ugd/f739c2_594de9341c1d415682b7db53ec3872f5.pdf, accessed 20220304

Annex I – Additional questionnaire on specifications, software and procedures

Components	Perceived quality of specs/software	Ease of integration	Potential to include in sustainability plan	Degree of adequacy for pilot purpose	Overall assessment	Comments (in case very low or low rate)
	(Rates from: Not relevant, No opinion, Very low, Low, Neutral, High, Very high)					
Solution Architecture						
Information Exchange Model						
Canonical data model						
DE4A Connector						
DE4A Playground						
• Mocked DE						
• Mocked DO						
• Central SMP						
• Kafka server						

#	Criteria	Evaluation	
		Rate (*)	Comments
1	(DO) How easy was to implement transformation to canonical evidence? (*)		

#	Criteria	Evaluation		
2	Quality of support and communication channel (Slack) provided by common components WP during the integration and testing (*)			
3	Quality of technical documentation (*)			
4	Contribution of testing methodology and Connectathons for testing with other MS to the successful launch of the pilots (*)			

(*) Rate= Absolutely inadequate, Inadequate, Sufficient, Adequate, Perfectly adequate

#	Criteria	Evaluation
		Comments
5	Please, indicate organizational challenges (or other) that have impacted on the delivery according to plan (free text)	
6	Please, indicate what resulted most complex from your organization point of view	

in terms of pilot activities for launching the pilot (free text)	