



D1.5 Baseline EU Building Blocks supporting Once Only and standard data sharing patterns

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List of Acronyms

Abbreviation / acronym	Description
ADMS	Asset Description Metadata Schema
API	Application programming interface
AS4	OASIS Applicability Statement 4
BDXL	OASIS Business Document Metadata Service Location
SMP	OASIS Service Metadata Publisher
BReg-DCAT-AP	Business Registry DCAT-AP
CCCEV	Core Criterion and Core Evidence Vocabulary
CEF	Connecting Europe Facility
CERB	Criterion & Evidence Type Rule Base
CPSV-AP	Core Public Service Vocabulary Application Profile
DCAT	Data Catalogue Vocabulary
DCAT-AP	DCAT Application profile
DE4A	Digital Europe For All
DESI	Digital Economy and Society Index
DG DIGIT	European Commission's Directorate-General for Informatics
DG GROW	European Commission's Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs
DG JRC	European Commission's Directorate-General for Joint Research Centre
DSD	Data Service Directory
DSI	Digital Service Infrastructure
Dx.y	Deliverable number y, belonging to WP number x
EBP	European Blockchain Partnership
EBSI	European Blockchain Service Infrastructure
EDM	Exchange Data Model
EEA	European Economic Area
eID	Electronic Identity
eIDAS	Electronic Identification, Authentication and Trust Services
EIF	European Interoperability Framework
EIRA	European Interoperability Reference Architecture
ELI	European Legislation Identifier

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Abbreviation / acronym	Description
ESSIF	European Self-Sovereign Identity Framework
EU	European Union
EC	European Commission
eID	Electronic Identity
EUPL	European Union Public Licence
GDPR	General Data Protection Regulation
ICT	Information and Communication Technologies
ISA ²	Interoperability Solutions for Public Administrations, Businesses and Citizens
MT@EC	European Commission's machine translation service
OASIS	Organization for the Advancement of Structured Information Standards
OOP	Once Only Principle
PEPPOL	Pan European Public Procurement Online
SDG	Single Digital Gateway
SDGR	Single Digital Gateway Regulation
SEMPER	Secure Electronic Marketplace for Europe
SML	PEPPOL Service Metadata Locator
SSI	Self-sovereign identity
TESTA	Trans European Services for Telematics between Administrations
TOOP	The Once Only Project
TRR	Test Registry and Repository
WP	Work Package
WS-REST	Work Service REpresentational Data Transfer

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Executive Summary

The project Digital Europe for All (DE4A) was launched in January 2020 as a result of collaboration of 27 organizations from 11 countries of the European Union. The project is funded by the EU Horizon 2020 research and innovation Framework Programme and is aimed to create an inclusive digital Environment in Europe ensuring the Single Digital Market rights of citizens and businesses by building on secure, privacy-preserving and trustworthy realisation of fundamental once-only, relevant-only and digital by default principles. The DE4A large-scale pilot reinforces the connectivity of national digital endeavours and, building upon the existing infrastructure, it attempts to contribute to an overarching eGovernment network for Europe supporting parallel efforts from the EC and the Member States to realise the Once-Only Principle Technical System in compliance with Single Digital Gateway and aligned with EU eGovernment Action Plan 2016-2020, Tallinn Declaration and EIF Implementation Strategy.

“D1.5 Baseline EU Building Blocks” is one of the formal outputs of WP1 “Inventory of current eGovernment landscape” for the DE4A project. This workpackage which aims to take stock of the existing situation of the deployment of cross-border integrated Digital European Public Services in the Member States participating in DE4A, has produced four deliverables in the first period of the project:

- D1.1 Member state eGovernment Baseline (June 2020)
- D1.3 Member State Once Only and data strategy Baseline (June 2020)
- D1.5 Baseline EU Building Blocks supporting Once Only and standard data sharing patterns (June 2020)
- D1.7 Legal, technical, cultural and managerial barriers (August 2020)

All four documents are conceived as stand-alone documents. This facilitates reading the document of interest but leads to some level of repetition between documents, in particular regarding the sections on theoretical background and methodology.

The purpose of “D1.5 Baseline EU Building Blocks” is to take stock of the existing reusable Building Blocks supporting data sharing, Once Only Principle and interoperability, enabling the implementation of services for citizens and business in the European Union. This study is one of four studies designed to chart the current landscape of digitalisation in Europe. The other studies in this series are: D1.1 Member State eGovernment Baseline (June 2020), which elaborates on the current advancement of the existing eGovernment landscape, D1.3 Member State Once Only and data strategy baseline (June 2020), which takes stock of the existing Once Only capabilities at regional and national level, Once Only capabilities related to cross-border services, and data strategy and generic access to base registry services and D1.7 Legal, technical, cultural and managerial barriers (August 2020), which elaborates on the benefits of, barriers to and general willingness towards implementation of OOP.

Together these deliverables serve as an input for designing project architecture (cfr. WP2) and development of pilots on Studying Abroad, Moving Abroad and Doing Business Abroad (cfr. WP4).

The EU programs ISA² [1] and CEF [2] are the main contributors of generic building blocks, supplemented with results from the EU projects “The Once Only Project” (TOOP) [3] and SEMPER [4]. TOOP is developing and piloting building blocks intended to support the SDGR [5] implementation actions and SEMPER is developing and piloting extension to eIDAS [6] support “Powers and Mandates”.

Selection criteria for including building blocks in this deliverable include the following criteria in the assessment of relevance and value to the project execution: EIF [7] alignment, domain neutral design and maturity status.

Identified relevant areas for adopting reusable building blocks in DE4A are:

- ▶ Identity management and trust services
- ▶ Secure data sharing cross border and cross-domain
- ▶ Semantic and technical interoperability

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The study has identified more than 30 domain neutral building blocks, relevant for further study and assessment in DE4A. These building blocks cover all levels of the EIF model [8]. In a significant part of building blocks are currently undergoing design and implementation activities leading to further maturity and applicability will be needed. This is also the case in some of the more advanced data sharing building blocks supporting API-based data sharing and blockchain technologies.

Both CEF [9] and ISA² [10] is in the last year for program execution and the findings indicate that a continuation of efforts to maintain and evolve the work supporting cross border and cross sector building blocks is required to improve interoperability and the ongoing digital transformation process.

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1 Introduction

1.1 Purpose of the document

The present report is conducted under the Digital Europe For All (DE4A) project and constitutes the deliverable “D1.5 Baseline EU Building Blocks supporting Once Only and standard data sharing patterns”. The purpose of this study is to take stock of the existing reusable Building Blocks supporting data sharing, Once Only and interoperability. Enabling the implementation of services for citizens and businesses in the European Union (EU).

In order to establish a firm foundation for the DE4A-project, e.g. the architecture and pilots, this study is one of four studies designed to chart the current landscape of digitalisation in Europe. This study is complemented by the following deliverables:

- ▶ D1.1 Member State eGovernment Baseline (June 2020), which elaborates on the current advancement of the existing eGovernment landscape
- ▶ D1.3 Member State Once Only and data strategy baseline (June 2020), which takes stock of the existing Once Only capabilities at regional and national level, Once Only capabilities related to cross-border services, and data strategy and generic access to base registry services.
- ▶ D1.7 Legal, technical, cultural and managerial barriers (expected July 2020), which elaborates on the benefits of, barriers to and general willingness towards implementation of the Once Only Principle (OOP).

Describing the existing infrastructure, practices, expected benefits and barriers, the reports aim to provide helpful insight for DE4A and serve as input for the subsequent development of the pilot projects. They are designed as stand-alone documents, and so necessarily contain some repetition regarding background and methodology.

Each of the studies will be updated during the course of the project.

1.2 Structure of the document

This document is divided into four main sections:

- ▶ Chapter 1 gives introductory context to the matter of the research;
- ▶ Chapter 2 elaborates on the utilised methodology and data sources for the analysis;
- ▶ Chapter 3 presents the compiled catalogue of Building Blocks;
- ▶ Chapter 4 discusses the obtained results in an aggregated format;
- ▶ Chapter 5 provides conclusion remarks on the research.

1.3 Background

Rapid development of Information and Communication Technologies (ICT) has given a significant impetus to transformation of public administration, bringing eGovernment in the front of the political agenda of the EU.

The formulation of the first large scale eGovernment Action Plan 2011-2015 [11] articulated the necessity for political engagement to promote digital transformation and became one of the milestones for the establishment of collaborative initiatives of the EU Member States in the area of government digitalisation. The termination of the Action Plan coincided with the adoption of the Digital Single Market Strategy, which put forward the necessity to establish seamless functioning of the public administration in a cross-border manner, facilitating the access to public services for the

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citizens and businesses. Building upon the previous achievements in cross-border eGovernment solutions, the new eGovernment Action Plan 2016-2020 [12] underpins user-centricity as one of its main objectives and sets the strategic frame for the current digital initiatives in Europe. The Tallinn Declaration on eGovernment [13] from 2017 complements the undertaken strategy and elaborates on the principles of digital transformation of public administration. Reinforcing the reduction of administrative burden on citizens and businesses, the adopted strategies and declarations establish the Once-Only Principle (OOP) as one of the central elements for the development of the Digital Single Market.

As different studies on eGovernment suggest, there is an uneven level of eGovernment advancement across the EU Member States. Despite the evolution and extension of the common EU regulatory frameworks and the launch of large-scale cross-border projects, reports on eGovernment Benchmark demonstrate some countries having a higher rate of electronic Identity (eID) adoption and availability of public services, from a cross-border perspective. The Digital Economy and Society Index (DESI) [14] depicts a similar unequal coverage of internet connectivity and availability of public digital services across Europe. Realising these differences are essential for comprehension of the current European eGovernment landscape.

In light of the goal of creating a single digital space of Europe, the DE4A project aims to create an inclusive digital environment for the EU citizens and businesses, ensuring the exercising of their Single Market rights. Supporting the EU Public Administration in addressing the existing challenges in the implementation of the digital cross-border initiatives, the DE4A contributes to the realisation of the Single Digital Gateway Regulation (SDGR), EU eGovernment Action Plan 2016-2020, Tallinn Declaration and European Interoperability Framework (EIF) Implementation Strategy [15]. As articulated in the project proposal, the goal of the DE4A is to:

«reinforce trust in public institutions and to unleash multiple measurable positive impacts in terms of efficiency gains and reduction of current administrative burden and costs, rooted on a Toolkit for extended semantic interoperability and on secure, privacy-preserving and trustworthy realization of fundamental Once-Only, relevant-only and digital by default principles, through state-of-the-art, usable and high-quality fully online procedures accessible through the Single Digital Gateway (SDG)»

The present report will examine the availability of reusable building blocks, reusable for implementation of public services both nationally and cross border between Member States. The building blocks can be an important enabler of interoperability of services and efficient secure data sharing infrastructures supporting the Once-Only Principle (OOP).

The EU programs “Interoperability solutions for public administrations, businesses and citizens” (ISA²) [16] and “Connecting Europe Facility” (CEF) [17] are the main contributors of generic building blocks, together with the EU projects “The Once Only Project” (TOOP) [18] and “Secure Electronic Marketplace for Europe” (SEMPER) [19]:

The ISA² Programme supports the development of digital solutions that enable public administrations, businesses and citizens in Europe to benefit from interoperable cross-border and cross-sector public services. ISA² is running from 1 January 2016 until 31 December 2020. ISA² is a successor to the Interoperability Solutions for European Public Administrations programme conducted under the previous EU budget period.

CEF is a European Union fund for pan-European infrastructure investments in transport, energy and digital projects that aim to improve connectivity between EU Member States (2014–2020). It operates through grants, financial guarantees and project bonds. CEF Digital supports the completion of the Digital Single Market by connecting Europe through 'digital bridges' (Digital Service Infrastructures) for the benefit of citizens, businesses and public administrations. It promotes the vision of public services

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being not only digital by default but also cross-border by default. There are two types of Digital Service Infrastructures (DSIs):

- Sector-specific DSIs deploy complex trans-European digital services based upon mature technical and organisational solutions: eProcurement, Cybersecurity, eHealth, eJustice, Online Dispute Resolution, Europeana, Safer Internet and Open Data.
- The DSIs known as building blocks provide basic and re-usable digital services. Building blocks can be integrated into other DSIs and IT projects and can be combined with each other.

TOOP was launched by the European Commission in January 2017 as an initiative of about 50 organisations from 20 EU Member States and associated countries. The main objective of TOOP is to explore and demonstrate OOP across borders, focusing on data from businesses. By doing that, TOOP aims to enable better exchange of business related data or documents with and between public administrations in order to reduce administrative burden for both businesses and public administrations. TOOP is prolonged and is currently designing new building blocks to be piloted in the project.

The SEMPER project provides a solution with an add-on to the Electronic Identification, Authentication and Trust Services (eIDAS) [20] to authorise a natural person with its powers in a company. Its goal is to achieve harmonised definition of e-mandates and to enhance the eIDAS Interoperability Framework with appropriate elements on protocol level and integration modules for connecting national mandate management infrastructures.

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2 Approach and methodology

2.1 Approach and objectives

The present study is carried out under the DE4A, which aims to contribute to practical realisation of the European Digital Single Market. Underpinning the necessity to guarantee the enforcement of Single Market rights of citizens and businesses, the DE4A is a proponent of delivery of better public services that are fully digitalised, user-centric, data-driven, trustful and cross-border.

Deploying a comprehensive and holistic approach towards implementation of the large-scale EU project, the DE4A recognises the current level of eGovernment advancements in the EU and takes the existing solutions of the EU Member States as an input for further service and infrastructure development. In the endeavour to bring all the EU Member States on the same level in the context of the eGovernment development, the DE4A takes the state-of-art as a commencement point for further digital transformation of the eGovernment environments across Europe. Derived from this approach, the aim of this study is threefold.

The study primarily investigates the availability of generic building blocks from the EU programs and projects to facilitate the design of advanced services provisions and data sharing solutions.

Secondarily, the present study contributes to the implementation of the pilot projects under the DE4A initiative. Serving as an input to the project team, the Catalogue of building blocks gives insight into the existing services and solutions, providing a solid starting ground for their further development within the project.

Finally, the results of the study will serve as a point of reference for assessing progress throughout the project lifetime. Scheduled for early 2021, the project will analyse iteratively the evolved availability of the employed building blocks, taking stock of the advancements in interoperability solutions and infrastructure building blocks.

2.2 Scope

The study covers the main European programs supporting digital interoperability building blocks, ISA² and CEF Digital. In addition, the EU projects TOOP and SEMPER are included, given the subject of these projects and the relevance of the expected outcome.

For all of the programs and projects included in the study, priority is to identify generic reusable building blocks that support specific functions or capabilities relevant across domains and use cases, which focus on providing building blocks enabling interoperability and reusable implementation of services. This approach excludes some building blocks that are domain specific, such as the CEF domain specific DSIs.

2.3 Data collection and analysis

For assessing the current availability of reusable building blocks relevant for the DE4A pilot implementations, the study relies on the following data sources:

- ▶ *Desk research.* Analysis of available information from CEF Digital and ISA2 including online documentation and the annual work programme, covering current activities, have been the major source of input. In addition, available information from TOOP and SEMPER have been taken into account.
- ▶ *Consultations and project presentations.* The insights derived from the desk research have been supplemented by consultations with project participants in TOOP and SEMPER, as well as

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presentations in the context of the coordination with TOOP, the CEF SDG preparatory action and SDG working groups.

For both desk research and in consultations, candidate building blocks have been considered according to criteria of relevance to the DE4A project goals and relevance for reuse on the DE4A in the following areas:

- ▶ Architectural design
- ▶ Development of software components and solutions
- ▶ Execution of project pilot use cases

Examples of relevance for the DE4A project includes support for generic user interaction components, trust services (eID, eSignature etc.), data sharing patterns and interoperability at all levels of EIF.

Selection criteria for including building blocks in this deliverable include the following criteria in the assessment of relevance and value to the project execution:

- ▶ Support interoperability at one or more levels of EIF
- ▶ Following the principles of EIF to support cross border implementations of use cases
- ▶ Building blocks should be domain neutral in order to be relevant for a broader set of use cases, supporting also cross domain use cases
- ▶ Maturity in terms of robustness of implementations and adoption in production implementation and schemes for maintenance and support.

The DE4A project is expected to contribute to the SDGR Once Only implementation in its initial phase, but also to extend architecture and pilot solutions to go further regarding use of innovative technology and data sharing patterns. In this regard, attention is given to building blocks that can enhance architecture design and pilot solutions in the following areas:

- ▶ Identity management and trust taking into account the implementation of eIDAS
- ▶ Secure data sharing cross-border and cross-domain
- ▶ Semantic and technical interoperability.

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3 Catalogue of Building Blocks

This part of the report contains the identified building blocks organised by source program with the following information:

- ▶ Building block name
- ▶ Description
- ▶ Reference for further information

3.1 CEF – Connecting Europe Facility

The CEF program supports the digital transformation in Member States and the provision of digital services for citizens and businesses by providing reusable building blocks and cross border digital infrastructures and services. CEF offers a number of building blocks and infrastructure services that support the implementation of interoperable key digital enablers, such as electronic identity management as well as Trust and secure data sharing services. The following building blocks have potential for deployment in the context of generic enablers for digital service provision and support for OOP implementation and data sharing.

3.1.1 eID – electronic Identity

CEF eID supports secure cross border use of eID schemes through the network of eIDAS nodes to access services and connection of Identity/attribute providers in accordance with the eIDAS regulation and defined governance procedures [21].

Relevant to DE4A for identification and authorisation of user.

3.1.2 eSignature

CEF eSignature supports creation and verification of electronic signatures in line with European standards. eSignature supports paperless, end-to-end digital business processes engaging EU institutions, public administrations, businesses and citizens to complete transactions digitally, at any time and on any device. Electronic signatures and seals can protect documents and reduce the risk of duplication or alteration of the document itself by ensuring that signatures and seals are verified, authentic and legitimate [22].

Relevant to DE4A for verification, authenticity and integrity purposes.

3.1.3 eTimestamp

Electronic time stamps is an eIDAS regulated trust service aimed a providing data in electronic form that binds a transaction to a particular time establishing evidence for the transaction at the time of execution. Qualified time stamps must comply with the eIDAS requirements including that it must be based on an accurate time source linked to Coordinated Universal Time [23].

eTimeStamp is not defined as an independent CEF building block, but the trust services are relevant for use in building blocks such as eID, eSignature and eDelivery.

For more information, please consult eIDAS and CEF building blocks using eTimeStamp.

Relevant to DE4A for recording and auditing purposes.

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3.1.4 eDelivery Access Point

The CEF eDelivery Building Block implements a network infrastructure to exchange electronic data and documents between users in a reliable and trusted way. It is based on a distributed model called the “4-corner model”. In this model, the back-end systems of the users do not exchange data directly with each other but do this through Access Points. These Access Points are conformant to the same technical specifications and therefore capable of communicating with each other [24].

The CEF eDelivery Access Point implementation is based on the OASIS Applicability Statement 4 (AS4) data exchange protocol and support certificate based trust models including Public Key Infrastructure models.

The data exchange between Access Points is supplemented by dynamic lookup distributed registry services (BDXL/SMP) and the eDelivery API (application programming interface) profile which is currently under development.

Relevant to DE4A for secure data sharing, sending data pattern.

3.1.5 eDelivery BDXL/SMP

CEF eDelivery BDXL/SMP (Business Document Metadata Service Location/Service Metadata Publisher) implements a distributed registry supporting capability lookup for recipients in an eDelivery network such as Business Process support, message-type and technical endpoint information. The specifications are OASIS Standards. BDXL is a successor to the CEF/PEPPOL SML (Service Metadata Locator) [25].

Relevant to DE4A when implementing data sharing and resource location.

3.1.6 eDelivery API Profile

CEF eDelivery API is a generic WS-REST profile-based building block that extends eDelivery with new communications patterns, technology and support for mobile devices. This building block is currently under development in context of the ISA² WP 2020 Action: Innovative Public Services (2018.01) in collaboration with CEF eDelivery Team and the European Commission’s Directorate-General for Joint Research Centre (DG JRC) [26].

Relevant to DE4A for possible synchronous data lookup patterns.

3.1.7 EBSI Blockchain

The European Blockchain Service Infrastructure (EBSI) is a joint initiative from the European Commission and European Blockchain Partnership (EBP) to deliver EU-wide cross-border public services using blockchain technology. The EBSI will be materialised as a network of distributed nodes across Europe (the blockchain), leveraging an increasing number of applications focused on specific use cases. In 2020, EBSI will become a CEF Building Block, providing reusable software, specifications and services to support adoption by EU institutions and European public administrations [27].

Initial use cases include Notarisation, Diplomas, European Self-Sovereign Identity and Trusted Data Sharing.

The SSI eIDAS Bridge is a building block based on EBSI.

Relevant to DE4A for possible support for identity management and new data sharing patterns.

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3.1.8 SSI eIDAS Bridge

Self-sovereign identity (SSI) is the next step beyond user-centric identity. Both concepts are based on the idea that a user must be central to the administration of his/her digital identity, which requires not only a user's ability to use an identity across multiple locations, but also full control over that digital identity, creating user autonomy [28].

To make eIDAS available as a trust framework in the SSI ecosystem, the European Commission developed under this project, the eIDAS Bridge. The eIDAS Bridge assists the issuer in the process of signing a verifiable credential, and the verifier, in the credential verification process, to assist in identifying the issuer (a legal person in the scope of this project) behind an issuer's decentralised identifier. By "crossing" the eIDAS Bridge, a Verifiable Credential is proven trustworthy.

SSI eIDAS Bridge is currently under development in the context of the European Self-Sovereign Identity Framework (ESSIF), one of the use cases selected by the EBP and the European Commission which is developed under the EBSI, a CEF Building Block.

Relevant to DE4A for integration of Blockchain technologies to eIDAS trust framework.

3.1.9 Context Broker

The Context Broker Building Block supports the ability to analyse, share, manage and use data in real time at the right time. Context Broker is an API that can integrate data from multiple systems, creating a holistic view of information [29].

By providing the layer that describes each type of data, the Context Broker makes it possible to create an interface that makes it possible for anyone to view and interpret big data.

Using the Context Broker, organisations can monitor their metrics in real time through live updates. You can share the context information you choose with third parties, enabling process improvements and innovation across the whole data value chain.

CEF Context Broker is build using Future Internet platform (FIWARE) specifications that enable applications to provide real-time updates and access to information that contextualises data being displayed. Typical examples might include updates, queries and notifications.

Relevant to DE4A for new data sharing patterns.

3.1.10 eInvoicing

CEF eInvoicing supports Electronic invoicing as the exchange of an electronic invoice document between a supplier and a buyer. An electronic invoice (eInvoice) is an invoice that has been issued, transmitted and received in a structured data format, which allows for its automatic and electronic processing, as defined in Directive 2014/55/EU [30].

CEF eInvoicing is based on International standards including CEN EN16931 and makes it possible for suppliers to public sector entities to develop and deploy a single solution in all European Member States.

Electronic invoicing is the exchange of an electronic invoice document between a supplier and a buyer. An electronic invoice (eInvoice) is an invoice that has been issued, transmitted and received in a structured data format which allows for its automatic and electronic processing, as defined in Directive 2014/55/EU

The CEF eInvoicing building block aims at promoting the uptake and accelerating the use of eInvoicing in respect of the European standard, amongst both public and private entities established in the EU, as well as in participating European Economic Area (EEA) countries.

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The CEF eInvoicing building block serves to support public administrations in complying with EU eInvoicing legislation, and helps service & solution providers adapt their services accordingly. The eInvoicing building block therefore foresees Business to Government. However, eInvoicing can also be used to enable Government to Government communication.

OpenPEPPOL are supporting cross border eInvoicing based on this CEF Building Block and eDelivery. Relevant to DE4A for financial processes related to charges.

3.1.11 eTranslation

eTranslation is a CEF Building Block. Its main goal is to help European and national public administrations exchange information across language barriers in the EU, by providing machine translation capabilities that will enable all DSIs to be multilingual. Public administrations, citizens and businesses in the EU will thus be able to use digital services in the language they choose [31].

CEF eTranslation builds on the European Commission's earlier machine translation service, MT@EC, which was developed by the Directorate-General for Translation (DGT).

The eTranslation service provides the ability to translate formatted documents and plain text between any pair of EU official languages, as well as Norwegian (Bokmål) and Icelandic, while preserving to the greatest extent possible the structure and format of those documents.

It provides a web user interface for direct use by individuals (human-to-machine use) as well as machine translation capabilities for digital services through an API (machine-to-machine use).

Relevant to DE4A for multi-language interoperability.

3.1.12 eArchiving

eArchiving provides the specifications, sample software, training and user community support necessary to develop a digital archiving solution. A very wide brief, covering public and private sector organisations, citizens, researchers, etc., and eArchiving ecosystem are extensible to cover the many different types of digital material in use today. The E-ARK specifications and software were co-developed by the EC and EU national archives, and thus can be trusted to provide reliable long-term preservation of digital material [32].

eArchiving Standards & Specifications were originally developed in the E-ARK project and are maintained by the Digital Information LifeCycle Interoperability Standards, Digital Information LifeCycle Interoperability Standards Board.

Relevant to DE4A for logging and archiving.

3.2 ISA² – Interoperability solutions for Administrations

3.2.1 EUPL - European Union Public Licence

The European Union Public Licence (EUPL) is a Free Open Source Software licence with equal legal value across the EU and in 23 EU languages. It reconciles the strength of the copyleft licence with interoperability needs of the modern software [33].

EUPL is designed to be fully compliant with the EU law. It enables the widest possible software dissemination while maintaining the source code open. The EUPL protects the covered software from third party appropriation and has equal value in all Member States. It offers people the right to freely use and distribute software, including modified versions, with the stipulation that the same rights be preserved in all copies or adapted works.

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3.2.2 Core Vocabularies

Core Vocabularies are simplified, reusable, and extensible data models that capture the fundamental characteristics of an entity, such as a person or a public organisation, in a context-neutral manner. Public administrations can use and extend the Core Vocabularies in the contexts of information exchange, data integration, data publishing and development of new systems [34]. The Core Vocabularies covers:

- ▶ Core Person
- ▶ Core Business
- ▶ Core Location
- ▶ Core Criterion and Core Evidence
- ▶ Core Public Organisation

Relevant to DE4A for semantic interoperability.

3.2.3 eDocuments Reference Architecture

The e-Documents reference architecture is meant for documents used in administrative procedures. It is organised in the form of ArchiMate diagrams, based on the European Interoperability Reference Architecture (EIRA). These diagrams, displayed as an interactive website, allow users to navigate through e-Document lifecycle and find solutions associated with each step [35].

The diagrams contain the most important processes and building blocks to help architects of e-Document solutions make informed decisions when designing a new system. In addition, the diagrams include interoperability requirements as well as the corresponding standards and specifications for many of the building blocks.

Relevant to DE4A for organizing and handling of data to be processed or exchanged.

3.2.4 Re3gistry

The Re3gistry is an open source solution for managing and sharing reference codes developed by the European Commission's Joint Research Centre, within the ISA² programme through the ARE3NA project. Re3gistry allows a central access point to be set up where labels and descriptions for reference codes can be easily checked by humans or retrieved by machines. It provides the consistency and support organisations need to manage and share their reference codes [36].

Exchange data cross-border and cross-sector using reference codes. These can be used in data exchange between applications, making sure that the parties involved understand univocally the key concepts to which the data refer. They can be used to define sets of permissible values for a data field, or to provide a reference or context for the data being exchanged. Examples are enumerations, controlled vocabularies, taxonomies, thesauri or, simply, 'lists of things'.

Re3gistry provides a central access point that allows labels and descriptions for reference codes to be easily looked up by humans or retrieved by machines. It supports organisations in managing and updating reference codes in a consistent way, so that all versions of a code remain traceable and properly documented, and do not change or disappear over time.

Relevant to DE4A for semantic interoperability.

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3.2.5 Interoperability Test Bed

The Interoperability Test Bed is a platform providing interoperability and conformance testing [37]. It is a reusable service for:

- ▶ Simulation of a web service for clients to test against
- ▶ Validation of content sent or received through various channels
- ▶ Conformance testing against a message exchange protocol
- ▶ Verification of a complex message exchange as one complete conversation

The Test Bed allows users to execute predefined test cases on their systems. Test results are provided in a standardised, machine-readable format. The Test Bed also offers a test registry and repository (TRR) to store test artefacts (assertions, test cases, validation schemas, etc.) and compile test services (validation services, simulator services, etc.).

The documentation describes how to integrate the Test Bed in the existing IT environment. Specifically, it describes the available resources, services and usage options and highlights what is needed to get started. The Test Bed is available as a cloud-based service. Alternatively, it can be installed and run on user's premises.

Relevant to DE4A for testing and life cycle management of solutions.

3.2.6 E-Certis

e-Certis is a free online tool, mapping documents requested in public procurement procedures across borders. The system identifies and links certificates necessary as proof of compliance with tender criteria in various areas of administrative verification (e.g. tax, social security obligations, criminal records, etc.). This helps bring clarity to the cross-border bidding process. Information provided by e-Certis is inserted by national public entities in charge and updated regularly [38].

Relevant to DE4A for semantic interoperability.

3.2.7 CCCEV - Core Criterion and Core Evidence Vocabulary

The Core Criterion and Core Evidence Vocabulary (CCCEV) has been developed as part of the e-Government Core Vocabularies solution under the ISA² programme. The CCCEV supports the exchange of information between organisations that define criteria and organisations that respond to these criteria by means of evidences [39].

Opening up national databases implies that the different systems need to be interoperable to allow effective exchange of information. A semantic model helps define information in such a way that it enables the seamless transfer of data. Ultimately, the OOP can be implemented in a cross-border context. For instance, when citizens consume public services, they often have to provide evidence that they are entitled to such services, e.g. in the form of certificates, which they would need to request from other public administrations. In practice, the OOP requires administrations to exchange this information directly between each other, after having received consent from the citizen. The CCCEV data model supports this exchange. It defines in a generic way the structure of a criterion, for example, having a driving license. It also specifies the different types of evidence that citizens and businesses can provide as proof. The advantage of CCCEV is that it can be universally applied for any kind of criterion and evidence.

Relevant to DE4A for organizational interoperability and business process alignment.

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3.2.8 CPSV-AP - Core Public Service Vocabulary Application Profile

The Core Public Service Vocabulary Application Profile (CPSV-AP) provides a common data model for describing public services offered in your administration. The CPSV-AP will standardise the semantics of personal milestones, including having a child, beginning education, looking for a new job, as well as professional changes such as starting or financing a company and hiring an employee. The descriptions will make data on these events structured, easier to capture and machine-readable [40].

With the CPSV-AP, you can:

- ▶ provide information on public services in a user-centric way, grouped logically around business or life events and other ways of classifying;
- ▶ map different data models to a common model requiring only one single description. In turn, Points of Single Contact and eGovernment portals can federate and share information;
- ▶ federate and publish information on Points of Single Contact and eGovernment portals in a more efficient and interoperable way.

Relevant to DE4A for organizational interoperability and service discovery as well as semantic interoperability.

3.2.9 TESTA – Trans European Services for Telematics between Administrations

The Trans European Services for Telematics between Administrations (TESTA) network service provides a European backbone network for data exchange between a wide variety of public administrations [41].

The network uses the Internet Protocols (IP) to ensure universal reach but is operated by the European Commission separately from the internet. It provides guaranteed performance and a high level of security and has connections with all the EU Institutions and national networks. It caters for the exchange of both unclassified and classified information.

The European Commission’s Directorate-General for Informatics (DG DIGIT) has organisational and contractual control over the execution of the TESTA contracts. The TESTA network is controlled and supported by a central support and operation service, and is responsible for all operational issues, including the security management of encryption devices.

Relevant to DE4A for secure network operations and data exchange.

3.2.10 DCAT-AP - Application Profile for Data Portals in Europe

The Application Profile for Data Portals in Europe (DCAT-AP) is a specification based on the Data Catalogue Vocabulary (DCAT) developed by W3C [42].

DCAT-AP provides a common specification for describing public sector datasets in Europe to enable the exchange of descriptions of datasets among data portals. DCAT-AP allows:

Data catalogues to describe their dataset collections using a standardised description, while keeping their own system for documenting and storing them.

Content aggregators, such as the European Data Portal, to aggregate such descriptions into a single point of access.

Data consumers to more easily find datasets from a single point of access.

DCAT-AP has an extension GeoDCAT-AP for describing geospatial datasets, dataset series and services.

Another extension StatDCAT-AP aims to deliver specifications and tools that enhance interoperability between descriptions of statistical data sets within the statistical domain and between statistical data and open data portals.

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Relevant to DE4A for semantic interoperability and data discovery.

3.2.11 BReg-DCAT-AP - DCAT Application profile for base registries

The BRegDCAT-AP application will enable cross-border interoperability between Base Registries and Registries of Base Registries, defining a semantic model to describe registries and their contents, facilitating data discovery and exchange of data, reducing redundancy by supporting the OOP. This set of recommendations will enable a mechanism for the update of EU base registries and their content, reducing technical, organisational and multilingual barriers [43].

The Application Profile specified in this document is based on the specification of the latest of DCAT Application Profile for data portals in Europe. Public services representing base registers are based on the CPSV-AP model. The legal information regarding the implementation of services is represented through the European Legislation Identifier Ontology.

Relevant to DE4A for semantic interoperability, discovery and access to base registries.

3.2.12 ELI - European Legislation Identifier

The European Legislation Identifier (ELI) offers a consistent and elaborated mechanism to identify, reference and reuse legal information on the web. Consequently, it sets out good conditions for developing sustainable added value for legislation related services. By promoting linking and reuse of legal data, ELI provides cost-saving solutions for publishers while simultaneously increasing the quality and reliability of data. On top of that, ELI contributes to improving transparency and accountability within public administrations as the exchange of data becomes greater and interconnections between different sources of information domains develop faster [44].

ELI is built on three pillars:

- ▶ assignment of universal resource identifiers
- ▶ description of metadata elements
- ▶ sharing of metadata in machine-readable format

This ensures flexibility in using ELI as a tool for legislation data exchange globally. Thanks to its flexibility, not only can ELI be adjusted to various regional, national and EU legal systems, but also to modified resources, such as codes, amendments, consolidations and repealed acts.

Relevant to DE4A for supporting legal interoperability.

3.2.13 ADMS - Asset Description Metadata Schema

The Asset Description Metadata Schema (ADMS) is a simple specification used to describe interoperability solutions helping everyone to search and discover them [45]. ADMS allows:

- ▶ Solution providers, such as standardisation organisations and public administrations, to describe their interoperability solutions using the standardised descriptive metadata terms of ADMS, while keeping their own system for documenting and storing them;
- ▶ Content aggregators, such as Joinup, to aggregate such descriptions into a single point of access;
- ▶ ICT developers to more easily explore, find, identify, select and obtain interoperability solutions from a single point of access.

Relevant to DE4A for in order to discover additional sources of reusable building blocks.

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3.3 TOOP

The TOOP project pilots Once Only use cases and contributes to the CEF OOP Action with specification, software and pilot implementation of building blocks, supporting central interoperability services as well as data exchange model and system integration components. The TOOP architecture is building on eIDAS services and embeds CEF eDelivery for data exchange and routing of messages. The TOOP Building Blocks are currently subject to software implementation and Pilot execution that may lead to changes and development of new functionality.

3.3.1 CERB - Criterion & Evidence Type Rule Base

The Criterion & Evidence Type Rule Base (CERB) is a central service that publishes which types of evidence Member States can provide to prove a particular requirement is met. It provides metadata on the criteria applicable in a procedure and which evidence can be used by the user to proof fulfilment. Using the mapping from criterion to possible evidences the data consumers can find the kind of datasets that can prove that the User fulfils the requirements of the procedure [46].

CERB implementation is based on the European Commission's Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs' (DG GROW) eCERTIS.

Relevant to DE4A for organizational and semantic interoperability.

3.3.2 DSD - Data Service Directory

The Data Services Directory (DSD) is a central service that maintains a catalogue of data providers with the datasets they are able to provide upon request. It is used in the evidence exchange process by the data consumers, to discover the data providers that can provide the evidences they require [47].

The information data model is a profile of the BREG-DCAT-AP specification, an application profile of DCAT, profiled by ISA² for use in "Access To Base Registries", in order to achieve both organizational and semantic interoperability. The service API is implemented using the OASIS Regrep v4 Query Protocol with the WS-REST API Binding.

Relevant to DE4A for semantic interoperability, discovery and access to base registries.

3.3.3 RoA - Registry of Authorities

To comply with the EU General Data Protection Regulation (GDPR), data services in Member States are required to determine whether a particular public administration in another Member State is allowed to ask for a certain requested type of evidence in a particular context. A central registry of authorities that lists, for public administrations in EU Member States, the procedures for which these administrations are authorised to request which types of evidence, facilitates this [48] [49].

Relevant to DE4A for trust management related to exchange of personal data.

3.3.4 EDM - Exchange Data Model

The TOOP Exchange Data Model (EDM) defines messages supporting Once Only data sharing based on a request/response pattern [50].

The TOOP Request is the message created by the data consumer, containing all the necessary information requirements for requesting datasets, being either structured or concept-based datasets or unstructured, document-based datasets and is sent to the data provider to request certain data or documents. The TOOP Response is the response to a TOOP Request from the data provider to the data consumer, containing the necessary information for the correlation of the TOOP Response with the

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respective TOOP Request, the actual data provided and the metadata of the data provider who is the responder. The TOOP EDM makes use of the functional capabilities that are provided by the RegRep V4 Query Protocol and therefore the data request and response is being modelled in the form of query. Relevant to DE4A for technical interoperability and support for semantic services and trust management in cross border data exchange.

3.3.5 TOOP - Connector

The purpose of the TOOP Connector is to act as a facilitator service providing a simplified interface to the infrastructure (WS-REST APIs and simple objects) by:

- ▶ Taking the responsibility in creating, validating, receiving, and parsing complex message structures like the DSD query messages;
- ▶ To act as a validation service, validating the EDM Messages, using schematrons;
- ▶ To act as an abstraction layer between the AS4 gateway and the Member States, requiring just the necessary metadata and payloads and then properly using the AS4 gateway to submit the message.

Development of the TOOP Connector is work in progress and the documentation is to be updated [51].

Relevant to DE4A for technical interoperability connecting national systems to cross border data exchange.

3.4 SEMPER

SEMPER is an EU Member State pilot project building on eIDAS and coordinating with the ISA² action 2016.12, semantic interoperability of representation of powers and mandates. The project is scheduled to run for 2 years from January 2019 with participation of four EU Member States: AT, SL, ES and NL. The SEMPER Building Blocks and components are currently subject to pilot implementation and may evolve with further developments.

3.4.1 SEMPER extension on eIDAS

The objective of the SEMPER project is to provide solutions for cross-border powers of representation and e-mandates. The project sets the semantic definitions of mandate attributes and enhances the eIDAS Interoperability Framework with elements on protocol-level and integration modules for connecting national mandate management infrastructures [52].

Relevant to DE4A for semantic interoperability (expression of powers to validate) and technical interoperability (the eIDAS extension).

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4 Discussion

The purpose of this report is to give an overview of the available building blocks and their applicability for achieving the goals of the DE4A. The criteria for selecting the building blocks include alignment with EIF and domain neutral scope.

The results of the building block catalogue in chapter 3 show that there are building blocks available supporting functionality for relevant areas of use in DE4A including: identity management and trust, secure data sharing as well as semantic and technical interoperability. For each of these three areas, the following challenges are identified:

- ▶ *Identity management and trust*: A number of building blocks including eID, eSignature, seals and electronic timestamps are supporting the eIDAS regulation. These building blocks are implemented and supported by infrastructure services in many Member States [cfr D1.1], and are expected to be a good foundation for the DE4A project. In the area of “powers and mandates”, including company representation eID, more work is ongoing in the SEMPER project, showing that this area is not mature yet.
- ▶ *Secure data sharing*: Building blocks like eDelivery and TESTA have been implemented and are in production in several projects and use cases. However, these building blocks have support for limited data sharing patterns would need to be extended with more building blocks using new technologies. Such initiatives have been initiated like the eDelivery API and the EBSI Blockchain. These new initiatives may support new data sharing patterns and mobile platforms, but they are still work in progress and the values of the results are not yet clear.
- ▶ *Semantic and technical interoperability*: A number of building blocks support semantic and technical interoperability, but the experience with large-scale implementations in cross-border use cases is limited.

This report does not deliver a maturity analysis addressing the building blocks individually. However, it is noted that a significant number of the building blocks are now in status of work in progress. This includes building blocks from both TOOP and SEMPER. The CEF building blocks such as eDelivery API, EBSI Blockchain and SSI eIDAS Bridge are also work in progress and are not at present considered mature enough. For the ISA² interoperability building blocks, which support semantic interoperability, large scale cross border implementations are limited, so the scalability of such solutions in the present situation is not yet clear.

Further assessment and evaluation of the building blocks including specific functionality, maturity and relevance for use in the DE4A is expected to be undertaken in “WP2 Architecture vision and framework” related to architecture as well as “WP3 Semantic Interoperability Solution” for semantic interoperability, “WP4 Cross-border Pilots for Citizens and Business and Evaluation” related to Pilot execution and “WP5 Common Component Design & Development” for software development.

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5 Conclusions

The purpose of this study was to take stock of the existing reusable building blocks available for developing solutions for service provision and data sharing including support for OOP.

ISA² and CEF Digital are providing a number of building blocks that are useful and provides value through reuse with faster implementation for lower cost and improved interoperability. However, it shows that a significant number of building blocks are yet to be finished, such as the CEF eDelivery APIs and some of the TOOP Once Only services. This is also the case for SEMPER, which points to a lack of harmonisation of basic trust services when a person is representing a business.

In addition, the ISA² and CEF Digital programmes are in their last year of budget and it seems evident that the efforts to facilitate further development of reusable interoperability solutions and components, as well as support and governance to Member States relation to roll-out and deployment, are required also in the next EU budget period.

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