Submitted to the EC on 24/05/2016

COMPETITIVENESS AND INNOVATION FRAMEWORK PROGRAMME
ICT Policy Support Programme (ICT PSP)

Project acronym: e-SENS
Project full title: Electronic Simple European Networked Services
ICT PSP call identifier: CIP-ICT-PSP-2012-6
ICT PSP main theme identifier: CIP-ICT-PSP-2012-6-4.1 Basic Cross Sector Services
Grant agreement n°: 325211

D6.6 e-SENS European Interoperability Reference Architecture

Deliverable Id :	6.6
Deliverable Name :	e-SENS EIRA n°3
Version :	V2
Status :	Final
Dissemination Level :	Public
Due date of deliverable :	31.3.2016
Actual submission date :	30.4.2016
Work Package :	WP6
Organisation name of lead partner for this deliverable :	DIFI, LIST, Tubitak
Editors:	Cagatay Karabat, Eric Grandry, Klaus Vilstrup Pedersen
Partners contributing :	TUBITAK, ICI Bucharest, INOV, ILIM, ANAC – AVCP, IT-Polito, UPRC, EISA, ERSL, SSI, Fraunhofer, Governikus GmbH, JM NRW, ARGE e-SENS.AT, Tiani Spirit GmbH, LIST, DIFI

Abstract:

This Deliverable contains a generic set of ICT Building Blocks, (e-SENS EIRA), that support the creation of cross border interoperability solutions. This 3rd iteration (of 4) focuses on the ones in the 1st and 2nd Wave of WP5 Pilots, including Life Cycle management of Building Blocks and Deployment support for the Pilots.

History

Version	Date	Changes made	Modified by
0.50	23.02.2016	Initial version of the report based on the report part of Deliverable 6.3	Klaus Vilstrup Pedersen
0.60	07.03.2016	Update section 4 and section 5	Eric Grandry
0.70	21.03.2016	Update section 7.2	Eric Grandry
0.80	29.03.2016	Update section 6	Elif Ustundag Soykan Melis Ozgur Cetinkaya Demir
0.90	01.04.2016	Finalization for review	Klaus Vilstrup Pedersen
0.93	18.04.2016	Corrected after 1st review	Klaus Vilstrup Pedersen
0.95	21.04.2016	Final review by QA team	Patrick Hall
0.98 0.99	30.04.2016	Finalization (incl. 2nd review cycle)	Klaus Vilstrup Pedersen
1.00	24.05.2015	Final editorial amendments	WP1
1.01	03.08.2016	Correction of links	Klaus Vilstrup Pedersen
2.00	23.08.2016	Final editorial amendments	WP1

Contributors

Deliverable 6.6 Contributors

Name	Surname	Organisation	Country	Report	EIRA Governance	WP6 Management (Architectural Board)	SGCC 6.A - Deployment	Pilot deployment support	BB LCM Process definitions and setup	BB LCM execution	Conformance and Interoperability testing	Development of Conformance testbed	SGCC 6.B - Architecture	EIRA Metamodel and Governance	EIRA BB Development	BB LCM execution
Elif	Üstündağ Soykan	TUBITAK	Turkey	■				■	■	■				■		■
Burcin	Bozkurt	TUBITAK	Turkey	■				■	■	■				■		■
Edona Fasllija	Fasllija	TUBITAK	Turkey						■							
Muhammet	Yildiz	TUBITAK	Turkey						■							
Melis	Cetinkaya	TUBITAK	Turkey						■							
Cagatay	Karabat	TUBITAK	Turkey	■		■	■									
Borka	Jerman-Blazic	JSI	Slovenia											■		■
Carmen	Rotuna	ICI Bucharest	Romania					■		■						■
Carmen Elena	Cirnu	ICI Bucharest	Romania											■		■
Radu	Boncea	ICI Bucharest	Romania					■		■						■
Rui	Maia	INOV	Portugal											■		
António	Leal	INOV	Portugal											■		
Elisabete	Carreira	INOV	Portugal											■		
Tomasz	Kawecki	ILiM	Poland													■
Erland	Bergheim	DIFI	Norway					■			■					
Steinar	Cook	DIFI	Norway					■			■					
Anna-Lis	Berg	DIFI	Norway	■		■										
Klaus Vilstrup	Pedersen	DIFI	Norway	■	■	■	■		■				■	■		
Jon	Ølnæs	DIFI	Norway					■								
Francois Xavier	Fontaine	LIST	Luxembourg	■	■									■	■	■
Eric	Grandry	LIST	Luxembourg	■	■	■							■	■	■	■
Uwe	Roth	LIST	Luxembourg											■		■
Jean Francois Merch	Merche	LIST	Luxembourg							■				■		■
Andrea	Atzeni	IT-Polito	Italy												■	■
Giovanni Paolo Sellitt	Sellitto	AGID	Italy					■								■
Diana	Berbecaru	AGID	Italy											■		■
Gretar Thor Gretarss	Gretarsson	Advania	Iceland												■	
Sigurdur	Masson	Advania	Iceland												■	
Jerry	Dimitriou	UPRC	Greece					■		■				■		
Panagiotis	Nicolaou	UPRC	Greece													■
Flora	Malamateniou	UPRC	Greece					■						■		■
Athanasios	Siachoudis	AUTH	Greece								■					
Ioannis	Pangalos	AUTH	Greece						■							
Sören	Bittens	Fraunhofer	Germany						■						■	
Olaf	Rode	Fraunhofer	Germany												■	
Jörg	Apitzsch	Governikus	Germany					■		■					■	■
Gregor	Thomas	JM NRW	Germany			■										
Pim	Van der Eijk	JM NRW	Germany													■
TUGraz		TUGraz	Austria					■		■					■	■
Austria A-SIT		A-SIT	Austria							■					■	■
Masi	Massimiliano	Tiani Spirit	Austria					■							■	■

A detailed overview of the contributors of previous versions i.e. Deliverable 6.2 and 6.3 can be found in Annex I.

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Glossary

See: http://wiki.ds.unipi.gr/display/ESENS/Glossary

Executive Summary

The e-SENS project - Electronic Simple European Networked Services - focuses on strengthening the Single Market by facilitating public services across borders. The previous and on-going Large Scale Pilots (LSPs), STORK, PEPPOL, e-CODEX, SPOCS, epSOS, have already proven that the provision of electronic cross-border services is achievable and feasible. In numerous domains, technical building blocks have been developed and piloted, which enable seamless cross-border services respecting all the various challenges and requirements that were faced. e-SENS aims at consolidating and extending the work done by the previous Large Scale Pilots, Production maturing the ICT Building Blocks and extending their potential to new domains.

The e-SENS WP6 Building Block Provision aims to provide consolidated re-usable building blocks for the implementation of digital services in Europe, supporting the overall goal of e-SENS.

The objective of this deliverable is to present the 3rd iteration of the e-SENS European Interoperability Reference Architecture (e-SENS EIRA).

The objective of the **e-SENS European Interoperability Reference Architecture (e-SENS EIRA)** is to provide an integrated solution for the project domain:

- Defining a coherent ICT Architecture for e-SENS interoperability.
- Containing or referencing generic and domain specific ICT interoperability Building Blocks (specifications and software) and related ICT Artifacts (guidelines, methodologies, whitepapers and reports).
- Making e-SENS ICT Interoperability Building Blocks and related ICT Artifacts easily accessible.

The deliverable is composed of two parts: This report and the e-SENS EIRA electronic repository:

e-SENS EIA :
http://wiki.ds.unipi.gr/display/ESENS/eSENS+Generic+Architecture+Repository

The report describes the Background, Structure and Use of the e-SENS EIRA and gives transparency into the work in WP6 Building Block Provision.

The e-SENS EIRA electronic repository gives access to a number of Solution Architecture Templates (SAT), Architecture Building Blocks (ABB), Specifications, Implementation Guidelines (IG) and Solution Building Blocks (SBB) that may be used in the WP5 pilots.

With this deliverable, the relation between the WP6 and the other WPs has been realigned, with expected impact on the objectives and milestones of the 3rd iteration (Deliverable 6.6 (M36)) and 4th iteration (Deliverable 6.7 (M48)) of the e-SENS EIRA.

1 Introduction

1.1 Scope and Objective of Deliverable

The objective of this deliverable is to present the 3rd iteration of the e-SENS European Interoperability Reference Architecture.

This deliverable is the conclusion of the 3rd iteration of the e-SENS European Interoperability Reference Architecture (e-SENS EIRA). It is aligned with the milestones in the Technical Annex (TA) and **Milestone 6.8** in particular.

- **Milestone 6.1 (Month 4)** Business Modelling Consolidated
- **Milestone 6.2 (Month 6)** Inception phase ended
- **Milestone 6.3 (Month 18)** 1st iteration of the e-SENS EIRA
- **Milestone 6.4 (Month 24)** 2nd Iteration of e-SENS EIRA Construction phase ended
- Milestone 6.5 (Month ~~32~~ 46) e-SENS Architecture Evaluation
- Milestone 6.6 (Month ~~34~~ 48) Operational Transfer of Operation and Ownership phase ended
- Milestone 6.7 (Month ~~36~~ 48) Transfer consolidated i.e. finalizing e-SENS Transfer of Operation and Ownership including governance
- **Milestone 6.8 (Month 36)** 3rd Iteration of e-SENS EIRA
- Milestone 6.9 (Month 48) 4th Iteration of e-SENS EIRA

The objective of the **e-SENS European Interoperability Reference Architecture** is to create a repository:

- That contains a coherent ICT Architecture for e-SENS interoperability.
- That contains or references generic and domain specific ICT interoperability Building Blocks (specifications and software) and related ICT Artifacts (guidelines, methodologies, whitepapers and reports).
- That makes the e-SENS ICT Interoperability Building Blocks and related ICT Artifacts easily accessible.

The objective of the **1st iteration** on the e-SENS EIRA (Deliverable 6.2 (M15)) was to:

- Create a coherent ICT architecture that supports the 1st wave pilots (Deliverable 5.2).
- Focus on the Business modelling, Requirements, Analysis and Design of Generic Building Blocks (Phases: Inception and Elaboration).
- Focus on Solution Architecture Templates and Architectural Building Blocks.
- Prioritize Building Blocks from the stock taking Deliverable 6.1.
- Align with the 1st wave pilots Building Block work through cooperation and transparency.

The objective of the **2nd iteration** on the e-SENS EIRA (Deliverable 6.3 (M24)) was to:

- Extend the ICT architecture to support the 2nd wave pilots and other cross border interoperability areas.
- Focus on Analysis and Design, Implementation, Test and Deployment (Phase: Construction)
- Support the implementation / deployment of 1st Wave Pilots.
- Map Building Blocks into the technical part of the e-SENS Maturity model
- Get an alignment with the 2nd wave pilots through cooperation and a transparency into the work on the Building Blocks.

The objective of this **3rd iteration** on the e-SENS EIRA (Deliverable 6.6 (M36)) is to:

- Use experiences from the pilots to mature a coherent ICT architecture.
- Support 1st and 2nd Wave Pilots in Implementation, Test, and Deployment
- Define and implement Life Cycle Management (LCM) i.e. incident-, change- and release management.

The objective of the **4th iteration** on the e-SENS EIRA (Deliverable 6.7 (M48)) will be to:

- Use experiences from the pilots to finalize a coherent ICT architecture to be ready for Transition into full scale production.
- Support e-SENS Pilots in Implementation, Test and Deployment.
- Support other LSP Pilots e.g. STORK 2.0 in Deployment (Life Cycle Management).

In addition the following remarks from 1st and 2nd Year review has been taken into account in scoping the work in the 3rd iteration of the e-SENS EIRA:

EC: Architecture and conformance testing activities should be well coordinated and aligned with other related EU activities and projects.

0. systematic follow-up, orderly feedback to the EIRA

EC: Cooperation with

- CEF in progress on e-SENS EIRA
- Cooperation with ISA continued on alignment with ISA EIRA
- Cooperation on Minder Testbed as basis for CEF e-Delivery Conformance testing – ISA GITB assessment by ISA, Technical assessment by CEF
- Coordination with BRIS, EUCISE
- Planning and prioritization of Minder development in cooperation with CEF and ISA
- See chapter 6.3 and chapter 7

0. Creating SGCC 6.A – Deployment with responsibility to institutionalize the learnings from the Pilots and hand over to SGCC 6.B

- See chapter 5.1

1. Complete architecture and engage CEF in preparing BBs for use in other domains of and impacts on existing relevant BBs and the LSPs

1. Cooperation with CEF on gap analysis and the prioritization and planning of maturing the e-SENS EIRA content
   - See chapter 7

1. Creation of SGCC 6.B – Architecture with the focus of finalizing the Architecture
   - See chapter 5.1

1. Cooperation with WP5 on the extension into and learnings from other domains
   - See chapter 6

2. Step up on technical assessment, testing and compliance, support and maintenance

a. Refer to our comments and recommendations on conformance and interoperability testing in the previous review report, and please now also specifically indicate the precise nature and level of testing to be deployed

b. Develop and document all the processes and procedures required to execute the above

c. Provide clear disclosure of working relationships with CEF expert group or others in connection with any or all of the above

2. Creation of SGCC 6.A created for the purpose of addressing these tasks

- See chapter 5.1

2.a. Direction of work on Conformance and test is influenced by the ISA and CEF reports. Clear distinction between types of testing. Plans for how to engage in the above testing types.

- See chapter 6

2.b. Institutionalize support and maintenance processes has been defined as tasks in SGCC 6.A. Test strategy being developed.

- See chapter 6

2.c. Cooperation with CEF on Conformance testing and Transfer of ownership and operations of Minder testbed

- See chapter 6

3. Further strengthen technical coordination with ISA

a. Confirm the relationship between the e-SENS EIRA and the ISA architecture

b. Identify the differences (if any) with the ISA architecture and the possibility of a joint evolution towards the future

3. Make the description in Deliverable 6.6 – e-SENS EIRA no 3 clearer on this issue

- Cooperation with ISA continued on alignment with ISA EIRA
- See chapter 4

4. Identify adaptations of and impacts on existing relevant BBs and the LSPs

4. Addressed in:

- Deliverable 6.4 –Evaluation
- WP3 deliverables

The Target Audience of this deliverable is:

- Domain experts (in part) – to be able to understand the architectures at a high level.
    - See and review the link from Domain Requirements to Generic Requirements to Generic Building Blocks and back again to Domain specific solution architectures.
    - To contribute with legal and business insight to the discussion on Domain specific solution Architectures.
- ICT architects – to be able to understand the architectures in details.
    - See and review the Architectures from a technical perspective.
    - As Solution Architects, to be able to design and implement Domain specific solution Architectures from the Generic Building Blocks.

1.2 WP6 General Objectives and Vision

In the Technical Annex, the Goals of WP6 are:

- To facilitate the project goals of creating consolidated and extended solutions for cross border and cross domain pilot applications, by taking on board existing solutions and components from the participating LSPs and other relevant sources to create coherent, generalized and open components and specifications for solution implementation.
- To provide the building blocks according to the functional requirements of WP5 and support their deployment in the WP5 pilots.
- To move forward with the development of sustainable European Interoperability Architecture for cross sector services, by means of the provision of a set of building blocks and their underlying technical specifications, which will act as its foundation, in alignment with the work carried out in WP3.

The Work Package will focus on providing architecture driven solutions and Building Blocks (BB) that fulfil pilot requirement in the target domains. The Work Package will use state of the art technologies in close incorporation with pilot domains with the aim of creating generic ICT Building Blocks that can be profiled and reused in use cases in multiple domains.

1.3 Methodology of Work

WP6 uses an e-SENS version of the Unified Process (UP) methodology [1] where phases and tasks are mapped into the project environment. ICT Building Blocks (BB) are mapped into the UP model, where the phase placement i.e. Inception, Elaboration, Construction1, Construction2 and Transition, is dependent on technical maturity (see chapter 3).

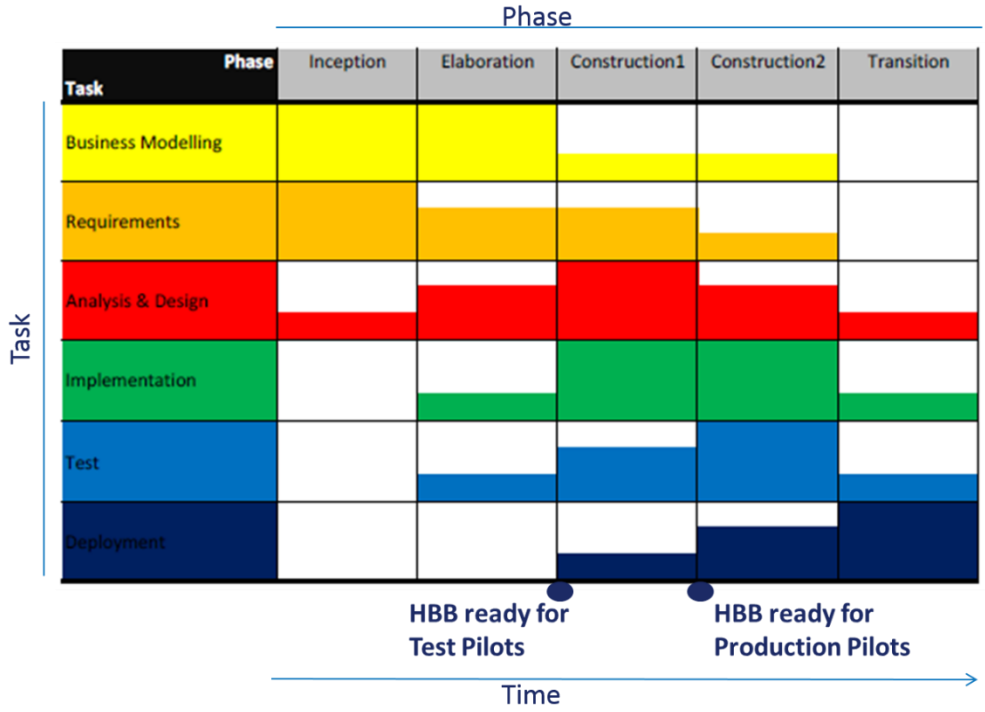


Figure 1: Unified Process

As an example, the e-Signature BB could be placed in Elaboration, based on technical analysis on technical maturity and the estimation of generality, thereby giving the type and priorities of tasks to be performed before moving into Construction1.

By e-SENS definition, a BB is ready for Test Pilot deployment when a Building Block enters into the Construction1 phase. The Test Pilots can give valuable information on additional work to be performed in order to raise the technical maturity and generalisation of a Building Block. By e-SENS definition, a BB is ready for production Pilot deployment when entering the Construction2 phase, which enables fine tuning of the Building Block from the response of Production environment. The transition is a full scale production rollout of the Building Block and is out of scope of the e-SENS project.

[1] http://en.wikipedia.org/wiki/Unified_Process

All Building Blocks have been subject to the following process, where UP tasks: Business modelling, Requirements, Analysis & Design, Implementation, Test and Deployment have been used to structure the process for cooperation with WP5.

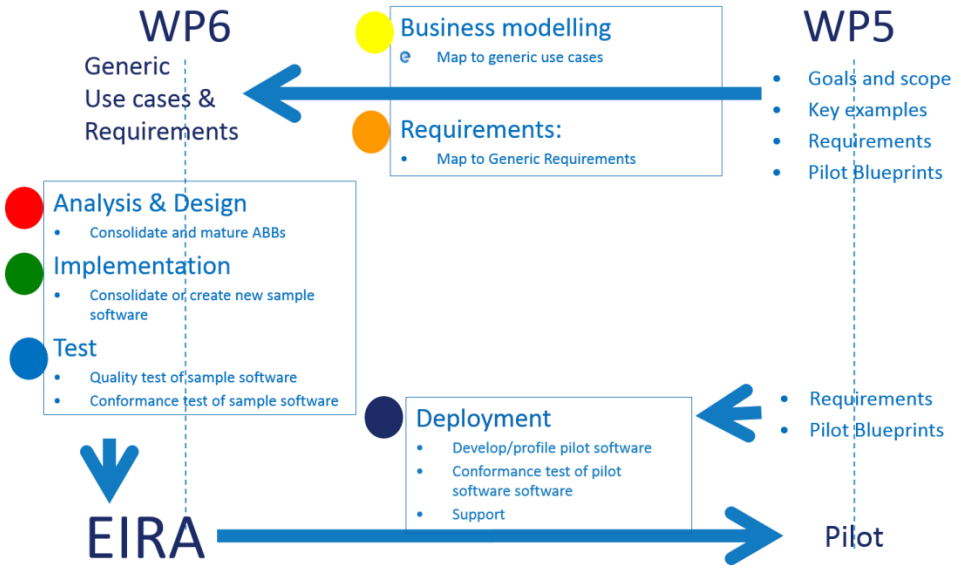


Figure 2: Mapping WP5-WP6 process to Unified Process

The type of task and amount of work that has been put into these tasks depends on the phase of the Building Block.

The **Business Modelling** and **Requirement** are tasks which are used in cooperation with WP5 domains to map and consolidate the WP5 use cases and requirements to generic use cases and requirements. WP6 is performing and has performed in cooperation with WP5 a requirements gathering in the different domains, this is elaborated further in chapter 2.1 and Deliverable 5.7.

Analysis & Design, Implementation and **Test** are WP6 tasks aimed at populating the e-SENS EIRA with Solution Architecture Templates (SAT), Architecture Building Blocks (ABB), Specifications, Implementation Guidelines (IG), Solution Building Blocks (SBB) and other artifacts, which make it possible and easy to implement interoperability Solution Architectures in Pilots.

The tools for the above tasks were discussed in Deliverable 6.1, which was a stock taking of ICT Building Blocks from CIPA, Large Scale Projects and other EC projects in Member States; together with Generic Use cases and Requirements, this gave a good background for discussions, consensus building and prioritization of Building Blocks.

The generalized requirements together with the Building Blocks "on the table" have been discussed, analysed, structured, prioritized and used to create Target Architectures in the form of Solution Architecture Templates (see Chapter 3).

A major part of the work was carried out in Year 1 and Year 2 in Sub-Group Competency Clusters (SGCCs) and cross-SGCC Task Forces with clear development focus:

- SGCC 6.1: e-Delivery and e-Interaction
- SGCC 6.2: Semantics, Processes and Documents
- SGCC 6.3: ID, Security and Trust
- SGCC 6.4: Conformance and Test

Deployment is the WP5 Pilot implementation of Solution Architecture Templates into Solution Architectures. The main task for WP6 is to support the WP5 process in creating Solution Architectures, software development, tests and transfer into operation. An organisation with processes that span WP5 and WP6 has been set up for this purpose. This elaborated further in Chapter 4.

A major part of this work was and will be carried out in Year 3 and Year 4 in new Sub-Group Competency Clusters (SGCCs) and cross-SGCC Task Forces with focus on Life Cycle Management (LCM) and Support for Pilots:

- SGCC 6.A: Deployment
- SGCC 6.B: Architecture

1.4 Relations to Internal e-SENS Environment

The primary collaboration has been with WP5 - Piloting. Cooperation between WP5 and WP6 is currently (month 14-24) on the project critical path, where priorities on maturing and consolidating the Building Blocks need to be aligned with the pilot plans and areas, in order to pilot for at least a year (see Technical Annex).

In the months 24-36 WP6 and WP5 have cooperated on aligning the following:

- Consolidating Generic Requirements in relation to Domain Requirements
- Building Block architectures and Pilot Solution Architectures
- Planning of Building Block readiness (see chapter 9.1) and Pilot implementation plans
- Setup of Life Cycle Management
- Cooperation on Conformance and Interoperability testing

The cooperation with WP4 - Project Legal Expertise Centre, has been indirect through the Domain Pilot alignment with the work in WP4. This cooperation moves into a direct alignment, since the findings done by WP4 will be incorporated into the e-SENS EIRA, giving a clearer relationship between the Legal-, Organizational-, Semantic- and Technical Interoperability layers.

WP6 has provided input to WP3 - Sustainability and Long-Term Governance, on the Sustainability and Standardization assessment of Building Blocks (see deliverable 3.1 and 3.2). The results of the assessments have been used in the internal WP6 work to target technical maturity gaps and prioritise Building Blocks. Deliverable 6.6 has clearer priorities and structuring of Building Blocks and will therefore provide a new set of Building Blocks for Sustainability and Standardization assessment.

The cooperation with WP2- Communication and Marketing, has increased in this iteration of the e-SENS EIRA, since the priorities and structure of Building Blocks now allow for better understanding of the Building Blocks, their context (i.e. pilots) and how they create added value.

This deliverable forms the baseline for collaboration within WP6 on consolidating and maturing Building Blocks into coherent Architectures. It will also be used with other WPs including Pilot requirement mapping (WP5), Maturity assessment of selected Building Blocks and sustainability efforts (WP3) and consultation of some legal aspects (WP4).

1.5 Relations to External e-SENS Environment

In Deliverable 6.1, the external e-SENS Environment was the main contributor to an internal WP6 process of prioritization, maturity assessment and structuring of Building Blocks.

Deliverable 6.2 was the outcome of a process, where Building Blocks were prioritized, put into architectures, aligned with WP5 Pilots and matured. This gave a structured insight into the proposed Architectures and their directions. This has created a foundation for further cooperation with CEF, eIDAS, ISA, European Commission (DG CONNECT, DG DIGIT, DG MARKT), Member States and other Large Scale Projects. For WP6 especially the Cooperation with CEF and ISA has been prioritized. The cooperation with ISA EIRA is described in chapter 7.1 and with CEF is described in chapter 7.2.

1.6 Quality Management

This deliverable has been developed in close cooperation with the QA team. The objective of the deliverable, and the structure (report and electronic EIRA repository) and objectives of parts of the deliverable have been discussed and decided with the QA team. The QA team consisted of:

Name	Surname	Organisation	Country
Martin	Lutz	EESTI	Estonia
Reet	Tallo	EESTI	Estonia
John	Murray	ERSL	Ireland
Gary	Walsh	ERSL	Ireland
Declan	Geaney	ERSL	Ireland
Patrick	Hall	ERSL	Ireland

Table 1: QA team

1.7 Risk Management

The following is an aggregation of the top 5 risks of WP6 on April 1st 2016:

Risk description	Status*	Mitigation measures	Owner
Not a clear view on key stakeholders actual ability to contribute in Year 4. Can influence the ability of WP6 to deliver in key areas		Close cooperation with key stakeholders. Adjust expectations for deliverables. Find other sources of contributions	WP6M HoBs
Budget not in line with participant expectations		More explicit and detailed planning, monitoring and coordination	WP6M SGCC6.AL SGCC6.BL HoBs
Transfer of Ownership and Operations: Not a clear view on the receiving organizations and a timeline for transfer		Cooperation with WP3 to identify organizations, make stakeholder analysis and plan transfer	WP6M SGCCL WP3
Alignment between WP6 and ISA, CEF and external projects e.g. EUCISE, BRIS		Keep close contact with key programmes and -projects	WP1TA WP6M SGCC6.AL SGCC6.BL
Integration of Requirements and Solutions from Pilots into the e-SENS EIRA delayed		Work in progress	WP6M SGCC6.BL WP5M

Figure 3: WP6 Risks

Impact / Probability	1. Low	2. Medium	3. High
1. Low			
2. Medium			
3. High			

Table 2: Risks mapping

1.8 Legal Issues

Legal issues have been identified in cooperation with WP5 and the pilots. The issues have been solved using WP4 expertise and input from previous Large Scale Projects.

The cooperation with WP4 - Project Legal Expertise Centre is moving into a direct alignment, since the findings done by WP4 will be incorporated into the e-SENS EIRA, giving a clearer relationship between the Legal-, Organizational-, Semantic- and Technical Interoperability layers.

1.9 Structure of the document

This Deliverable is divided into two parts: The first is a report that states the background of the e-SENS EIRA, and the second part is the repository of the e-SENS EIRA.

The report consists of four parts: Methodology, Architecture, Transfer of Ownership and Operations and last the Project insight on the e-SENS EIRA.

Methodology

The methodology of Work is using an e-SENS WP6 version of the UP Methodology. Chapter 2, 3, describes the methodology of work leading to the e-SENS EIRA.

Architecture

Chapter 4, 5 describes the theory behind the Architectural work and the e-SENS EIRA.

Deployment

The deployment support to Pilots incl. Conformance and Interoperability testing is described in Chapter 6.

Chapter 7 deals with alignment with EC initiatives.

2 Business Modelling and Requirements

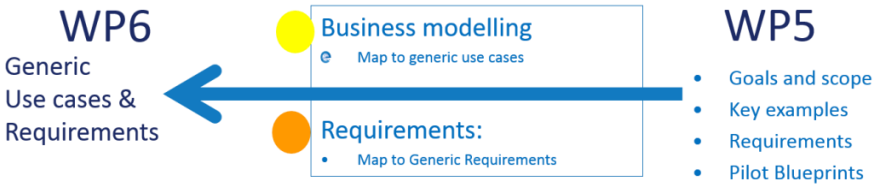


Figure 4: Business Modelling and Requirements

2.1 Requirement Modelling Methodology

In cooperation with WP6, WP5 has created the e-SENS Requirement Modelling Methodology. The methodology is used in WP5 to guide the e-SENS Domains and their use case-specific work groups on how to capture goals and requirements relevant for a pilot scenario. The proposed method is an iterative process where the domain experts start with describing:

- goals and scope
- key examples
- requirements for BBs

The work has been carried out using moderated workshops and the results and findings can be elaborated and further evolved in smaller task teams using the project's collaborative working tools for threaded discussions, or online conference facilities.

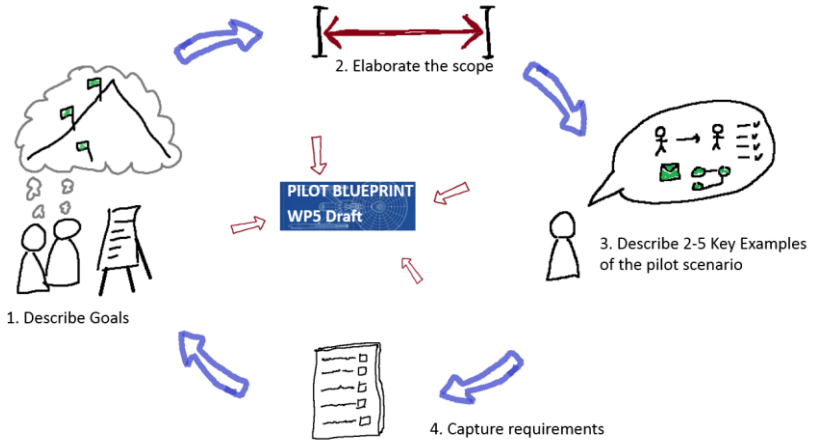


Figure 5: Overview of the requirements modelling methodology

The result of the process is documented in the so-called "Pilot Blueprint". The intention of the pilot blueprint is to provide a clear top-down description of the chosen pilot scenario. The "Pilot Blueprint" should offer a clear picture of the involved actors, and requirements for necessary BBs. The methodology is described in detail in Deliverable 5.7.

The requirement methodology view on bridging and mapping the Pilot requirements into Generic requirements is shown in the following figure.

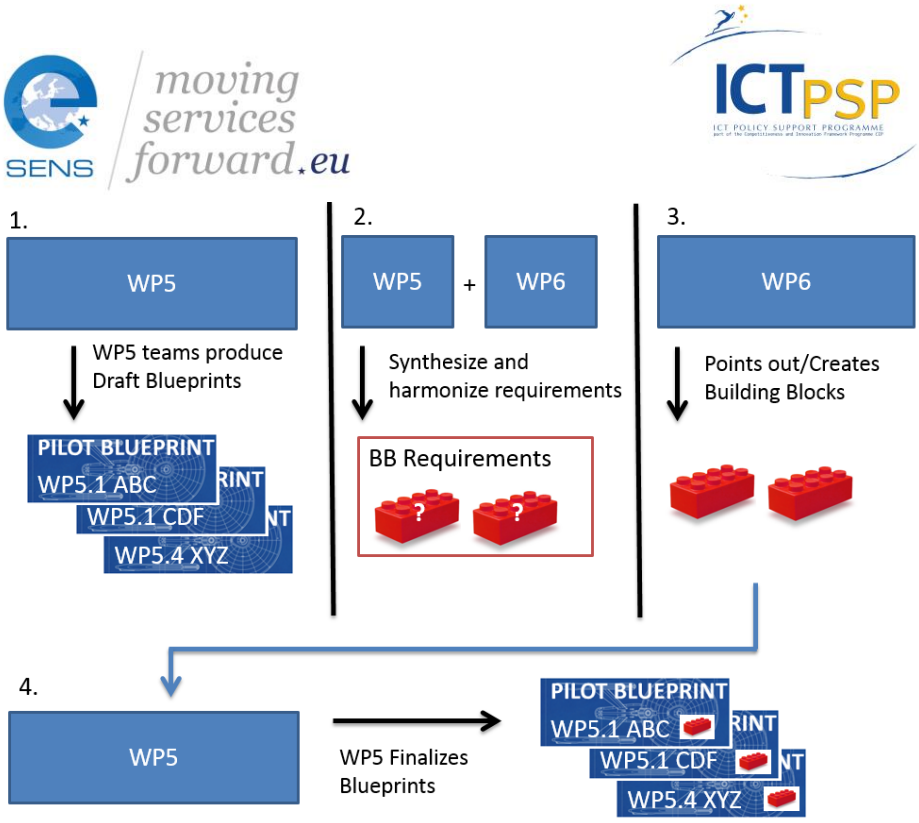


Figure 6: Cooperation of WP5-WP6 in the context of overall requirements modelling methodology

The Pilot blueprints (step 1) are used as a foundation for synthesizing and harmonizing the Pilot requirements into Generic requirements (step 2), that are categorized according to the *ISO/IEC 25010:2011 Systems and software engineering* framework and mapped into Building Block related Generic requirements. Step 2 corresponds to the Business Modelling and Requirement tasks in the UP as mapped into the e-SENS use in figure 2.

2.2 Requirement descriptions

The requirements associated to each building block are structured according the following description:

Requirement ID	**Requirement description**	**Compulsory?**	**Source**
R-*short name of BB-Type1**	*Clear and to the point description of the requirement*	*Yes/No*	*Should reference the source of the requirement e.g. from WP5 or SAT*
R-*short name of BB-Type2**			

Table 3: Requirements Description

**ID*

- *R=Requirement*
- *Short name of BB is 3 letters of the name(s) e.g. "Service Location" becomes "SerLoc"*
- *Type*
  - *P=Political – requirement coming <u>from</u> political issues e.g. interoperability legacy in domains*
  - *L=Legal – requirement coming <u>from</u> legal interoperability issues*
  - *B=Business – requirement coming <u>from</u> business value proposition perspective*

- *S=Semantics – requirement to the semantics parts of the foundation architecture (can be derived from the P, L, B requirements)*
- *T=Technical – requirement to the technical parts of the foundation architecture (can be derived from the P, L, B requirements)*

2.3 Integrating the Requirements into the e-SENS EIRA

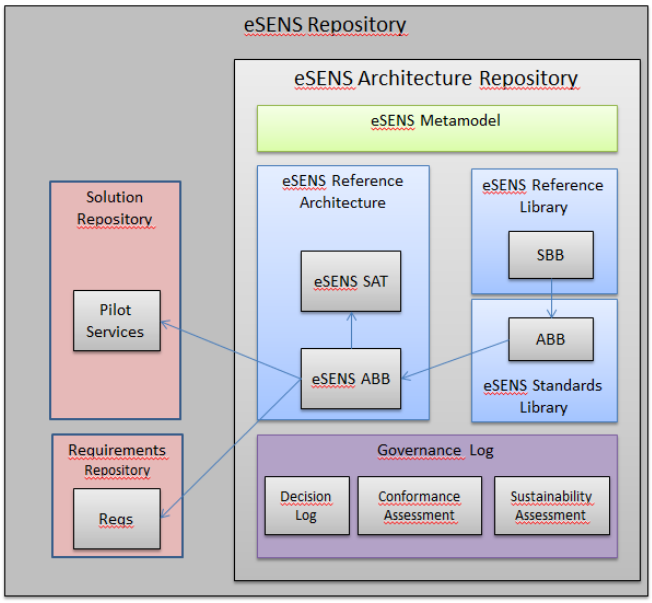


Figure 7: Analysis & Design, Implementation and Test

The Legal Requirement Repository in the e-SENS EIRA (see 0) will be used to integrate Requirements from WP4 and WP5 (Deliverable 5.7) into the e-SENS EIRA, thereby create the explicit link and traceability between the Requirements and the Building Blocks. With Deliverable 6.3, deliverable 5.7 and work done by WP3, four dimensions of Requirements have been identified:

1. Domain requirements and Generic Requirements
2. Legal, Business, Semantic and Technical Requirements
3. Functional and non-Functional Requirements
4. Binding and non-Binding Requirements

The vision is to use the methodology and structure from ISA EIRA and LIST (Legal-URN) to establish the metamodel for the Requirement Repository.

2.4 Next steps

Integrate Requirements in the e-SENS EIRA:
Integrate Domain requirements into the EIRA to secure traceability of Generic BB requirements along four dimensions:

- Domain requirements and Generic Requirements
- Legal, Business, Semantic and Technical Requirements
- Functional and non-Functional Requirements
- Binding and non-Binding Requirements

3 Analysis and Design, Implementation and Test

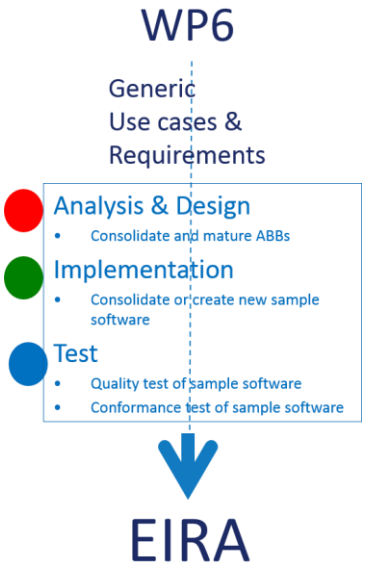


Figure 8: Analysis & Design, Implementation and Test

3.1 Analysis and Design

At the start of e-SENS (1.4.2013) the BBs had various degrees of maturity and had been developed with different focus, this meant that they were mapped into the UP development model at various phases (Inception, Elaboration, Construction1, Construction2). The methodology to analyse and design the BBs has depended on the phase, resource availability and best practice, so the SGCCs and Task Forces were given the freedom to choose what they saw as the best approach for these tasks, usually choosing an agile approach e.g. Scrum based.

3.2 Implementation

Because of lack of technical resources, e-SENS has only produced a minimal set of Software, but are relying on external Software providers i.e. other LSPs, CEF, CIPA, DGs, Open Source Software and off-the-shelf Software.

3.3 Test

Since WP6 has only created a minimal set of software, but are relying on external Software providers i.e. other LSPs, CEF, CIPA, DGs, Open Source Software or off-the-shelf Software, there has not been a need to establish and implement a test methodology.

Though using the V-test model:

- Unit test is not performed
- Integration test is not performed
- System test is not performed
- Acceptance test is performed through the Conformance test described in Chapter 6.3.
- Outcome

The analysis, design, implementation and test tasks produce building blocks. These building blocks are part of the overall e-SENS Architecture, and are therefore incorporated in the e-SENS EIRA. The incorporation within the e-SENS EIRA is done according to the e-SENS Architecture framework, explained in the next chapter.

3.4 Next steps

- Clarify remaining gaps in cooperation with WP5 pilots
- Clarify remaining gaps in cooperation with CEF (DSIs)
- Clarify remaining gaps in cooperation with ISA
- Clarify remaining gaps in cooperation with external projects i.e. EESSI and EUCISE

4 e-SENS EIRA

This chapter describes the main work product of the architecture capability: the e-SENS Reference Architecture. The e-SENS Reference Architecture is designed according to architecture principles and identifies the Building Blocks. The Building Blocks are described along common dimensions, which are captured in the e-SENS Metamodel: it is the language used to describe the Building Blocks. All these concepts and their relationships are part of the e-SENS Architecture Framework, described in this chapter.

4.1 Basic vocabulary

The definitions of ICT architectural terms and concepts in e-SENS are based on vocabulary from the following sources:

e-Sens Baseline Architecture (Deliverable 6.1): Provides a foundation for work on an e-SENS Reference Architecture to support Solutions Architectures in the e-SENS domains. A repository of Architecture- and Solution Building Blocks collected through stocktaking from LSP projects (SPOCS, e-CODEX, EPSOS, PEPPOL and STORK) as well as other initiatives.

TOGAF9: is an Enterprise Architecture Framework that is produced by The Open Group and is considered a de facto EA framework in Europe. http://www.opengroup.org/togaf/ and especially its glossary http://pubs.opengroup.org/architecture/togaf9-doc/arch/chap03.html are used.

European Interoperability Framework (EIF[2]) and European Interoperability Architecture (EIA[3]): is a Framework and Reference Architecture, created by EC (ISA) to facilitate interoperability and re-use when developing cross-border public services. It is based on the TOGAF9 framework. http://ec.europa.eu/isa/actions/02-interoperability-architecture/2-1action_en.htm

Asset Description Metadata Schema (ADMS[4]): is a vocabulary to describe interoperability assets making it possible for ICT developers to explore and search for interoperability assets. https://joinup.ec.europa.eu/asset/adms/home

The e-SENS Vocabulary can be found at: http://wiki.ds.unipi.gr/display/ESENS/Glossary

4.2 e-SENS Architecture Framework

According to ISO/IEC 42010[5], «an **architecture framework** establishes a common practice for creating, interpreting, analyzing and using architecture descriptions within a particular domain of application or stakeholder community».

The e-SENS Architecture Framework is specifically designed to create, understand and use the e-SENS Reference Architecture. It is made of the following concepts:

- the **e-SENS Metamodel**, which describes the **e-SENS Language** and integrates the **e-SENS Architecture Principles**;
- the **e-SENS Reference Architecture**, which conforms to the e-SENS Metamodel, and contains **e-SENS Building Blocks**; the Building Blocks are described according to the metamodel;
- **e-SENS Architecture Viewpoints**, which are used to describe the e-SENS Reference Architecture

[2] http://ec.europa.eu/isa/documents/isa_annex_ii_eif_en.pdf

[3] http://ec.europa.eu/isa/actions/02-interoperability-architecture/2-1action_en.htm

[4] https://joinup.ec.europa.eu/asset/adms/description

[5] http://www.iso-architecture.org/ieee-1471/cm/

The e-SENS Architecture Framework is represented in the model below. Each of its elements is further detailed in the next sections of this chapter.

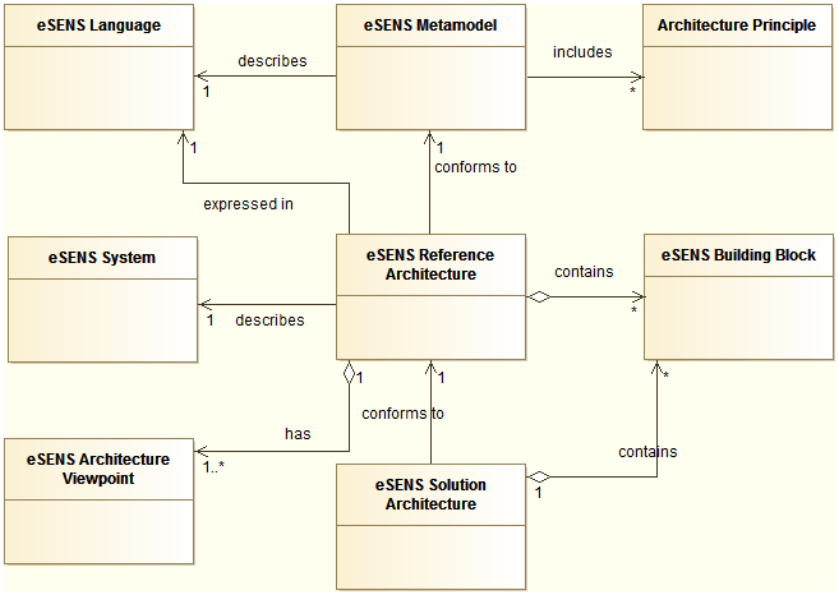


Figure 9: e-SENS Architecture Framework

It should be noted that the e-SENS Solution Architecture, developed by the pilot architects, is also related to the architecture framework:

- an e-SENS Solution Architecture conforms to the e-SENS Reference Architecture;
- an e-SENS Solution Architecture contains e-SENS Building Blocks.

4.3 Building Blocks

4.3.1 Concept of Building Block

e-SENS adopts the TOGAF concepts of building blocks, and more specifically Architecture Building Block (ABB) and Solution Building Block (SBB). It also uses the concept of Solution Architecture Template introduced in ISA-EIRA, and adopts the ISA-EIRA model of these concepts, represented below (extracted from the ISA-EIRA):

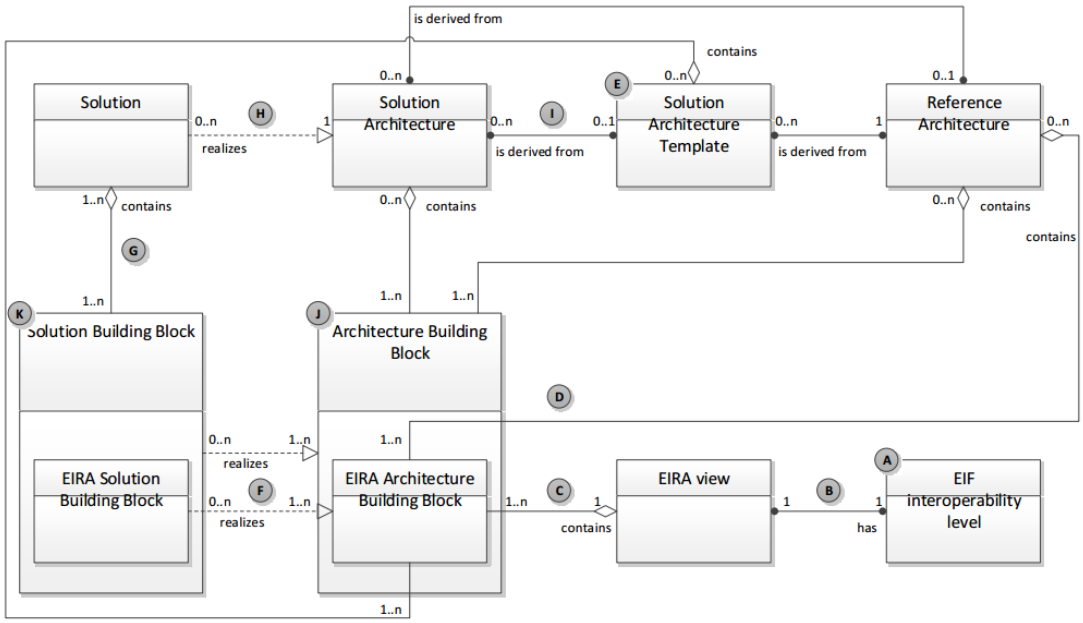


Figure 10: ISA-EIRA BB Model

Architecture Building Block (ABB): Based on the TOGAF definition, an architecture building block is an abstract component that captures architecture requirements and that directs and guides the development of solution building blocks. An architecture building block describes generic characteristics and functionalities. Architecture building blocks are used to describe reference architectures, solution architecture templates or solution architectures.

Solution Building Block (SBB): Based on the TOGAF definition, a solution building block is a concrete element that implements the required capabilities of one or more architecture building blocks. On the technical view, a solution building block is a specific product or software component.

Solution Architecture Template (SAT): According to EIRA, a solution architectural template (SAT) is a sub-set of architecture building blocks (of the EIRA). Acting as a template for solutions (and their specific architectures), it guides the development of a certain kind of solutions (and their specific architectures).

4.3.2 e-SENS Building Blocks

In e-SENS, a Building Block represents a (potentially re-usable) component of business, IT, or architecture capability that can be combined with other building blocks to deliver architectures and solutions (Source: TOGAF9).

Building blocks have generic characteristics as follows (TOGAF9 refined by e-SENS):

- A building block is a package of functionality defined to meet the business needs across a domain.
- A building block has a defined boundary and offers services that are generally recognizable by domain experts.
- A building block may interoperate with other, inter-dependent building blocks.
- A good building block has the following characteristics:
    - It considers implementation and usage, and evolves to exploit technology and standards.
    - It may be assembled from other building blocks.
    - It may be a subassembly of other building blocks.
    - Ideally a building block is re-usable and replaceable, and well specified.

In e-SENS, a **Building Block** can be of the following type:

- Solution Architecture Template (ISA)
- Architecture Building Block (TOGAF9)
- Solution Building Block (TOGAF9)

Solution Architecture Template (SAT) consist of (Source: ISA EIA):

- A goal and description,
- A set of ABBs,
- A set of requirements & recommendations (linked to ABBs).

Architecture Building Blocks (ABB) capture architecture requirements (e.g., business, data, application and technology requirements), and perform its capabilities through services. The ABB is a component in the SAT and directs the development of SBBs. (e-SENS definition)

A **Solution Building Block (SBB)** is a sample Design and/or Software Component that is an implementation of (part of) an Architectural Building Block. A sample Design and/or Software Component is conformant to (part of) the ABB specification. (e-SENS).

4.4 Architecture Principles

The overarching Principles applied in the design of the e-SENS Architecture are taken from the European Interoperability framework v2.0 (EIF 2.0)[6].

1. Subsidiarity and proportionality
2. User-centric
3. Inclusion and accessibility
4. Security and privacy
5. Multilingualism
6. Administration simplification
7. Transparency
8. Preservation of Information
9. Openness
10. Reusability
11. Technological neutrality and adaptability
12. Effectiveness and efficiency

Most of these principles are principles for Solution Architectures, but especially principle 9, 10 and 11 are applicable to the e-SENS EIRA. These are inherent in the e-SENS Reference Architecture design principles and standards that are based on the Service Oriented Architecture (SOA) Paradigm.

The Open Group defines SOA as:

Service-Oriented Architecture (SOA) is an architectural style that supports service-orientation.

Service-orientation is a way of thinking in terms of services and service-based development and the outcomes of services.

A service:

- Is a logical representation of a repeatable business activity that has a specified outcome (e.g., check customer credit, provide weather data, consolidate drilling reports)
- Is self-contained
- May be composed of other services
- Is a "black box" to consumers of the service[7]

4.4.1 Architecture characteristics

Using the SOA Paradigm has the potential to lead to the following Interoperability Architecture characteristics[8]:

- Increased Intrinsic Interoperability
- Increased Federation
- Increased Vendor Diversification Options
- Increased Business and Technology alignment

[6] http://ec.europa.eu/isa/documents/isa_annex_ii_eif_en.pdf

[7]Service Oriented Architecture: What Is SOA? SOA Definition team of The Open Group SOA Working Group 2014-11-05. Available from Internet: http://www.opengroup.org/soa/source-book/soa/soa.htm

[8]Thomas Erl. 2005. Service-Oriented Architecture: Concepts, Technology, and Design. Prentice Hall PTR, Upper Saddle River, NJ, USA.

- Increased Return of Investment
- Increased Organizational Agility
- Reduced IT Burden
- Reduced Business concerns of underlying solution logic design and implementation details
- Increased opportunities to use a piece of solution logic for multiple interoperability purposes
- Increased opportunities to combine units of solution logic into different interoperability configurations

4.4.2 Architecture design principles

Design principles revolve around a software engineering theory known as the separation of concerns. This is used in connection with Architecture Building Blocks where:

- An ABB is a (collection of) **Capabilities** that are exposed to the architecture as **Services**.
- The services are defined through a **Service Contract** that contains the description of Business purpose and capability together with a specification of the technical interface.
- ABBs should be **Loosely Coupled** with **high Autonomy** of ABBs, thereby securing low interdependency and bigger potentials for generality and reusability.
- ABBs should be designed to secure Service **Composability** i.e. that ABBs and their services can be composed with other ABBs and their services to provide interoperability.
- The **Coherence** of the architecture is secured by composing ABBs into templates for Interoperability Solution Architectures (SAT) i.e. higher level generic reference architectures.
- The SATs created are **Business related** through an abstraction of Business functionality and information and with a clear Business value.

4.4.3 Architecture design standards

The Architectural work, using the SOA principles, is restricted by the following Design standards (technical Annex):

- It is D&D (Development and Deployment) not R&D (Research and Development)
- Must be aligned with the ISA EIF, EIA and EIRA initiatives
- Based on Open standards and Open source technologies
- Create architectures that are generic and applicable in multiple domains
- Create Building Blocks, that are usable in the Pilots (Use Case driven)
- Create Building Blocks, that have pan-European usage
- Create Building Blocks, that can be sustained
- Reuse ICT Building Blocks from existing or former LSPs
- Reuse ICT Building Blocks from CIP projects (A and B)
- Reuse ICT Building Blocks from MS national solutions, where an ICT Building Block is scalable to pan-European usage
- Production ready i.e. Building Blocks are ready to be adapted in production settings
- Not mandating internal MS architectures

4.5 e-SENS Metamodel

The e-SENS Metamodel identifies the constructs required to describe the components of the e-SENS Reference Architecture, i.e. the Building Blocks. Defining a metamodel has several benefits: share a common language; share a common definition of the elements of the architecture. The e-SENS reference- and solution architectures conform to both the e-SENS Metamodel and Architecture design principles.

4.5.1 Metamodel design process

The e-SENS Metamodel focuses on the identification of the concepts required to describe the internals of the main components of the architecture, i.e. the Building Blocks. As the description of the Building Blocks is intended to serve purpose of multiple stakeholders, the e-SENS Metamodel has been collaboratively and iteratively designed. The following stakeholders have actively participated in the design process:

- BB Experts/Architects from WP6;
- Domain Experts/Architects from WP5;
- Sustainability Experts from WP3;
- CEF DSI Architects;

Additional comments/inputs have also been integrated from the following sources:

- Project reviewers;
- ISA EIRA

Two dedicated workshops have been organised in the last year of the project to finalize the design and validation of the metamodel. The consensus has been built with the participating stakeholders, and the outcome has been verified with instances of the various Building Blocks. Usage scenarios exploiting the designed models have also been designed to validate the resulting metamodel.

4.5.2 Metamodel overview

The final version of the e-SENS Metamodel is represented below:

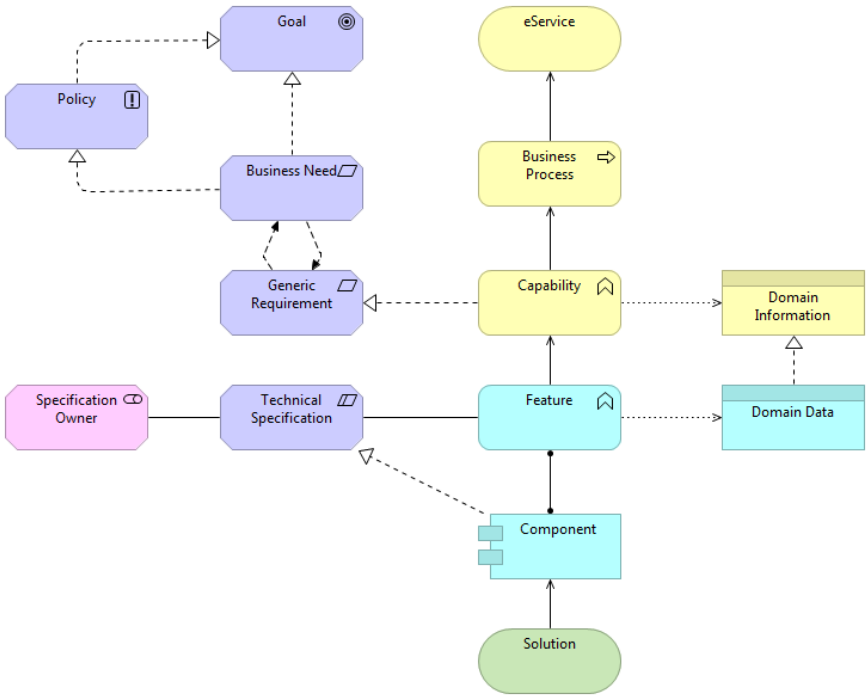


Figure 11: e-SENS Metamodel

The metamodel should be understood the following way:

- A Building Block provides Capabilities that are leveraged in cross-border (business and/or public) eServices. The Capabilities of Building Blocks are assembled in Business Processes to realize the eServices.
- A Capability represents the ability and capacity of the Building Block, which enables to achieve Generic Requirements (generic in the sense they are not specific to the domain of application). The couple Capability-Generic Requirement represents the **Intention** of the Building Block: what is intended to be achieved.
- A Capability is described in terms of Features it provides. Each Feature is specified with Technical Specifications. A Component is a logical grouping of related features: a Component implements the Technical Specifications associated with the Features it does support. The couple Feature-Technical Specifications represents the **Internal Specifications** of the Building Block: how the Capability is architecturally realized.

The Capabilities, in the e-SENS context, are all technical capabilities of the Building Blocks: Message Exchange, Authentication Exchange. Although they are technical in nature, Capabilities are modelled from as business elements, as they capture the business perspective of the Building Block.

The link between the different kinds of e-SENS Building Blocks and the metamodel is represented below and should be understood the following way:

- ABB's are described from multiple perspectives:
    - Intention: Capability and associated Generic Requirements;
    - Specifications: set of supported Features and associated Technical Specifications; Component (when relevant);
- SBB's are described as Solution realizing the logical Component
- SAT's are described as Business Process assembling a set of ABB's (from a Capability perspective) in order to meet Business Needs.

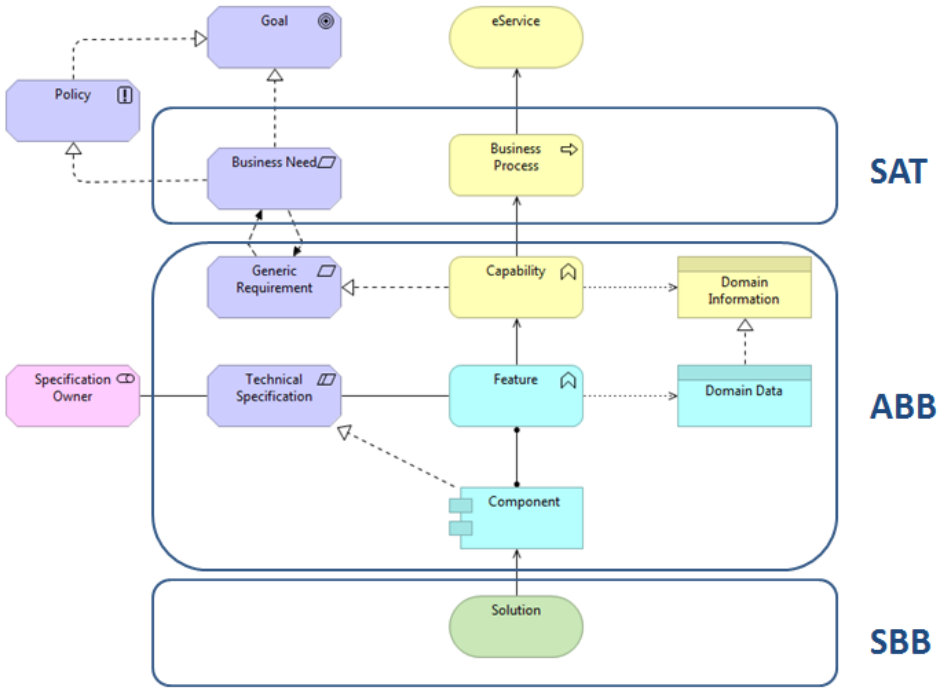


Figure 12: Metamodel and BB

The metamodel not only defines the concepts required to describe the Building Blocks, but also introduces the context in which the Building Blocks reside, through links with additional concepts: Specification Owner, relating the BB's to the cloud of standardization organizations; Policy, relating the BB's to the legal context. Further extending the metamodel can be envisaged in order to support additional contextual aspects without affecting the internal description of the Building Blocks.

4.5.3 Metamodel concepts

The e-SENS Metamodel is expressed in ArchiMate language. The choice of the ArchiMate language is motivated by the following aspects:

- ArchiMate is a lightweight and scalable language
    - its architecture framework is simple but comprehensive enough to provide a good structuring mechanism for architecture domains, layers, and aspects;
    - the language incorporates the concepts of the "service orientation" paradigm;
- ArchiMate is an open standard developed and maintained by The Open Group: its evolution is closely aligned with the development of the TOGAF standard;

- ArchiMate is supported by both commercial and open source model editors; Archi open source tool is used in e-SENS.

The e-SENS metamodel is a specialization of ArchiMate as it defines additional concepts atop the standardized language. It however fully conforms to ArchiMate specifications, as only the allowed extension mechanisms are used.

The table below defines each of the e-SENS Metamodel construct, and identifies the mapping to the ArchiMate type.

Name of Construct	Definition	ArchiMate Type
Conceptual Architecture		
Capability	The ability and capacity to achieve a goal in the context of a specific e-SENS cross-border domain [FP7-CaaS]. The Capability addresses what is being achieved (the purpose) by the Building Block, rather than how it is achieved.	Business Function
Domain Information	Piece of business data or a group of pieces of business data with a unique business semantics definition in a specific business context [ISO15000-5, UN/CEFACT CCTS]. Domain Information is used by a Building Block to meet its objectives. Domain Information may have association, specialization, aggregation, or composition relationships with other Domain Information. They are always realized by data objects, as Building Blocks are fully automated in e-SENS.	Business Object
Generic Requirement	A statement of generic need that must be realized by an e-SENS Building Block. The Generic Requirements are architecture requirements. They are generic in the sense they are not specific to any domain of application.	Requirement

Logical Architecture		
Feature	A distinguishing characteristic of a software item (e.g., performance, portability, or functionality) [IEEE-829]	Application Function
Technical Specification	An established norm or requirement in regard to technical systems. It is usually a formal document that establishes uniform engineering or technical criteria, methods, processes and practices. A Technical Specification is a generalization of the Technical Standards, as e-SENS might adopt Technical Specifications that are not standardized yet.	Constraint
Specification Owner	The owner of the Technical Specification. The Specification Owner is a generalization of the Standards Developing Organization (SDO) and Standards Setting Organization (SSO).	Stakeholder
Component	A logical module that encapsulates a set of related Features. A Component realizes the specifications associated to the Features it does encapsulate.	Application Component
Domain Data	A passive element suitable for automated processing. It is the realisation of the domain information through standard data object. It is part of the logical data model.	Data Object
Physical Architecture		
Solution	The physical representation of the solution implementation. It is the physical representation of the application component. It might be an Open Source Implementation, a Commercial Product, a Reference Implementation, …	Infrastructure Service

Table 4: Metamodel Concepts

The core metamodel is extended with additional concepts required to support extended perspectives on the e-SENS Architecture:

- The Business Needs perspective, capturing the motivational aspects of the e-SENS Building Blocks, i.e. why the Capabilities are designed;
- The Service perspective, capturing the usage aspects of the e-SENS Building Blocks, i.e. how the Capabilities are assembled to serve;

The following constructs are used in the metamodel to cover these aspects:

Name of Construct	Definition	ArchiMate Type
Motivation Architecture		
Goal	The high-level objectives an organization can achieve by adopting a Building Block. Goals are usually expressed in the following terms: Interoperability, Security, Privacy, Scalability and Performance, Legal Assurance and Compliance. [CEF]	Goal
Policy	Whole of actions under a policy domain taken by a public authority to bring about social change in the medium and long term. It is based on certain values and objectives and is implemented using a variety of methods. It applies on the territory within which the authority is authorised to act [Eurovoc]	Principle
Business Need	The detailed business needs, linked to the goals, which can be satisfied through the adoption of Building Blocks. [CEF]	Requirement
Usage Architecture		
eService	A service delivered via the internet, or an electronic network, where supply is essentially automated, or involves only minimal human intervention, and impossible to ensure in the absence of information technology. [EC Implementing Regulation 282/2011]	Business Service
Business Process	A business process is defined as a behavior element that groups' behavior based on an ordering of activities. [ArchiMate] The Business Process in e-SENS details how a eService is realized in terms of required BB Capabilities.	Business Process

Table 5: Extension Concepts

4.6 e-SENS Architecture Viewpoints

The e-SENS Reference Architecture is organised in viewpoints, according to ISO/IEC 42010 perspective: a viewpoint is a mean to focus on specific aspects of the architecture, according to specific stakeholder's concerns. Each e-SENS Architecture viewpoint is defined along the following dimensions:

- Stakeholder: the target of the architecture view; e-SENS architecture targets especially, but is not limited to, the following stakeholders: Solution architects, Domain architects and Application architects.
- Concerns: the concerns that the viewpoint cover;

Any viewpoint might be defined when needed. Currently, the project has defined and uses the viewpoints described in the following subsections.

4.6.1 eService Realization Viewpoint

The **eService Realization Viewpoint** is used to show how an eService uses the Capabilities of the Building Blocks (through Business Processes) to realize its finality.

It provides a view on what Building Blocks are assembled/required in an eService.

eService Realization Viewpoint	
Stakeholders	Domain and application architects, portfolio managers, business analysts
Concerns	Added-value of capabilities, consistency and completeness
Layer	Business layer (application layer)
Aspects	Behaviour, active structure, passive structure

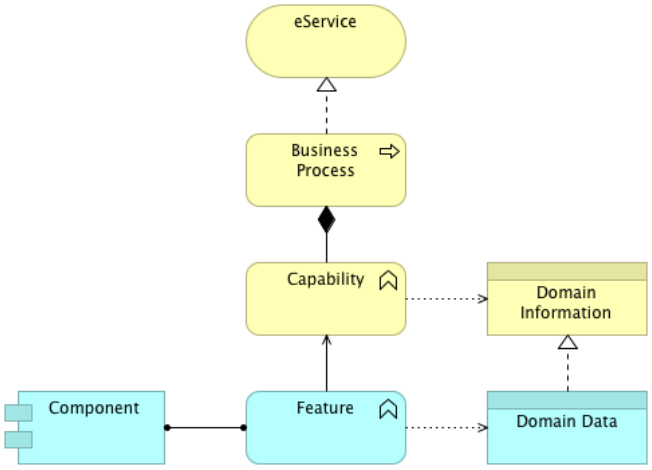


Figure 13: eService Realization Viewpoint

4.6.2 Capability Realization Viewpoint

The **Capability Realization Viewpoint** describes what features are used to realize a Building Block Capability.

Its primary use is to support impact and gap analysis: what is the difference/overlap in terms of features of two similar capabilities.

Feature Usage Viewpoint	
Stakeholders	Domain and application architects, portfolio managers, business analysts, operational managers
Concerns	Consistency and completeness, reduction of complexity
Layer	Business and application layers
Aspects	Behaviour, active structure, passive structure

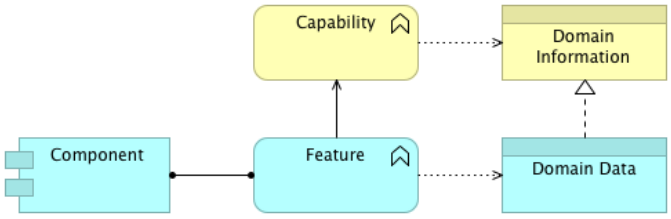


Figure 14: Capability Realization Viewpoint

4.6.3 Specification Realization Viewpoint

The **Specification Realization viewpoint** allows the designer to model the realization of features specifications by the components and the association with its owner.

It typically supports impact analysis in terms of specifications evolution, but also directs the software implementation of the component.

Specification Realization Viewpoint	
Stakeholders	ICT and application architects, portfolio managers, business analysts
Concerns	Relationships and dependencies between specifications and features, responsibilities, motivation
Layer	Motivation, and Application layers
Aspects	Motivation

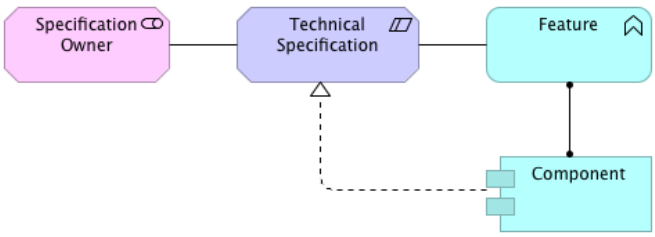


Figure 15: Specification Realization viewpoint

4.6.4 Requirement Realization Viewpoint

The **Requirement Realization viewpoint** allows the designer to model the realization of generic requirements by the Building Block capabilities, but also to relate the architecture requirements associated with Building Blocks to higher-level business needs and goals.

It can be used to manage requirements traceability and coverage, but also to select required Building Blocks to meet specific business needs.

Requirement Realization Viewpoint	
Stakeholders	Organization and ICT architects, business analysts, requirements managers
Concerns	Architecture strategy and tactics, motivation
Layer	Motivation, and Business layers
Aspects	Motivation

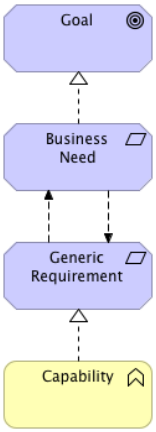


Figure 16: Requirement Realization viewpoint

4.7 e-SENS Reference Architecture

The e-SENS Reference Architecture is made of Building Blocks and conforms to the e-SENS Metamodel: each of the component of the Reference Architecture is described according the concepts of the metamodel. The e-SENS Reference Architecture is a target architecture, as it is the state targeted from the baseline architecture defined at the beginning of the project.

The reference architecture is designed in ArchiMate language, and represented along any of the e-SENS views. The model is maintained as an ArchiMate model in the Architecture Repository. In this report, a list of the main elements and relations is given, as well as extracts of the model as illustration.

4.7.1 Catalogue of Building Blocks

The table below lists the Capabilities of the Building Blocks, grouped per SAT:

SAT	ABB Capability
e-Delivery	Message Exchange
	Capability Lookup
	Service Location
	Addressing of End Entities
	Backend Integration
eID	Cross-Border Authentication
	Cross-Border Attribute Provision
	Local Attribute Provision
	eID-Mobile
eSignature	eSignature Creation
	eSignature Verification
	eSignature Mobile
Traceability and Non Repudiation	Timestamping
	Evidence Emitter
Trust Establishment	Trust Network MRC
	Trust Network PKI
	Trust Network Trustlist
	Web Service Trust Model
eDocument	Document Container
	Document Business Envelope
	Document Provisioning Methodology
Semantics	Semantic Mapping Service
	Terminology Service

Table 6: e-SENS Capabilities

The Architecture Repository (see 5.3) contains the description of each Building Block not only in terms of the provided Capabilities, but also in terms of

- supported Features;
- associated Technical Specifications and Specification Owner;
- logical Component (when relevant) and available implemented Solutions.

4.7.2 Capability Realization view

The figure below illustrates what Features are used by each Capability of the e-Delivery SAT, as well as the packaging of the Features into logical Components (all Features are not represented for clarity reason):

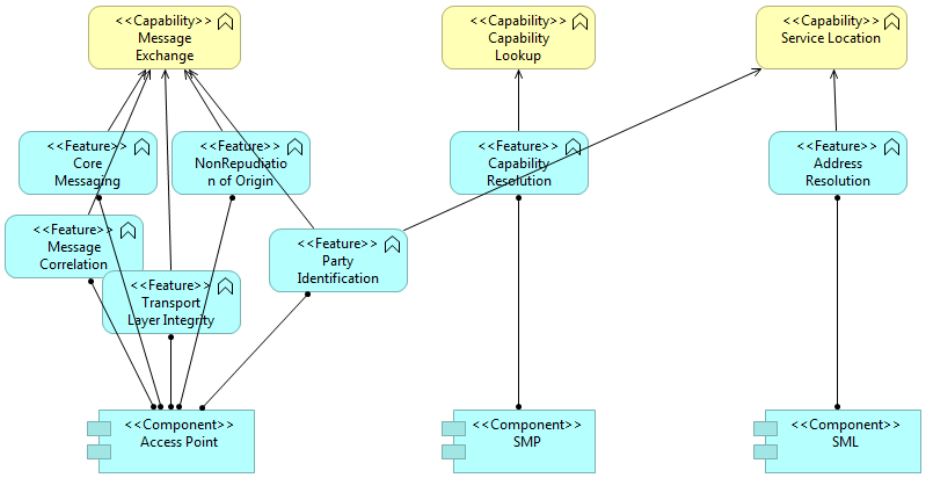


Figure 17: e-Delivery Capability Realization View

It is interesting to note that "Party Identification" is a feature used by several e-Delivery Capabilities. This Feature is not designed as an independent Capability because it is never used independently, but always in combination with other features.

4.7.3 Capability Specifications view

The figure below illustrates what Technical Specifications do actually specify the Features of the e-Delivery Capabilities:

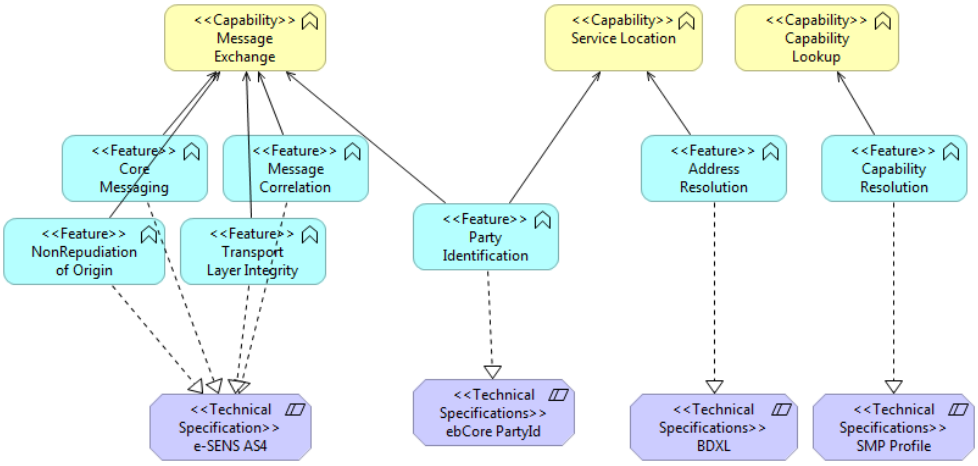


Figure 18: e-Delivery Capability Specifications View

4.7.4 Component Specifications view

The figure below illustrates the Technical Specifications associated with each Component of the e-Delivery SAT:

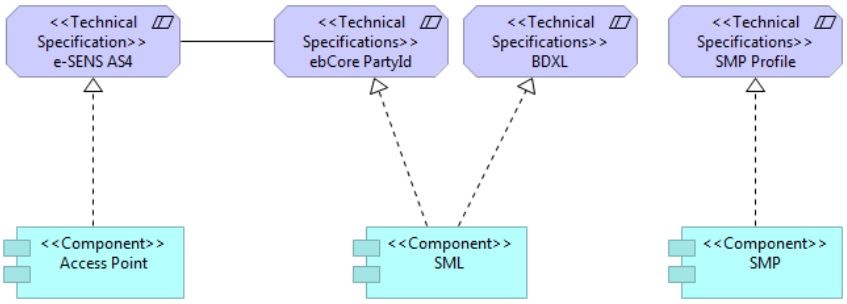


Figure 19: e-Delivery Component Specifications View

The SML component is specified by both ebCorePartyId and BDXL technical specifications. The Access Point component is specified with the e-SENS AS4 Profile, which contains the ebCore PartyId technical specifications.

4.8 Next steps

- Expand Metamodel and EIRA to:
    - Incorporate Domain profiles
    - Incorporate Pilot Solution Architectures
    - Incorporate Domain requirements

5 Architecture Governance and Management

The architecture capability produces a large volume of various architectural work products, as illustrated in the previous chapter. A mature architecture capability requires the management of these work products, as specified in ISO/IEC 15504: capability level 2 (managed process) is indeed measured through the work product management process attribute.

A common general practice to manage architectural work products is to introduce an architecture repository: a system that manages the data of an enterprise architecture, including data and process models and other enterprise information (TOGAF 9).

5.1 Organization

The original organization with 4 Sub Group Competency Clusters (SGCC):

- SGCC1 e-Delivery and e-Interaction
- SGCC2 Semantics, Processes and Documents
- SGCC3 Identity, Security and Trust
- SGCC4 Conformance and Test

With a clear development orientation, was changed in July 2015 to a more operations oriented orientation with 2 SGCCs:

- SGCC A – Deployment (1.7.2015 – 31.3.2016)
    - The objective of this sub-group is to strengthen the support and cooperation with the WP5 Domain pilots by institutionalize the deployment support and capture learnings in a structured way. This includes the continued work on a Conformance and Interoperability Test from SGCC 6.4 and offering of Conformance and Interoperability testing to the Pilots.
- SGCC B – Architecture (1.7.2015 – 31.3.2016)
    - The objective is to finalize the development work of SGCC 6.1, 6.2, 6.3 (the descriptions of the SGCC 6.1, 6.2, 6.3 is inherited by SGCC 6.B) to create a coherent e-SENS EIRA that is aligned with ISA EIRA. This includes an evaluation of the Building Blocks to support the Transfer of ownership and operations to a sustainable organization.

5.2 e-SENS Architecture Repository

The e-SENS Architecture Repository is a TOGAF architecture repository: it allows the effective management of the various architectural work products issued during the architecture process. The e-SENS Architecture Repository is depicted in the following picture:

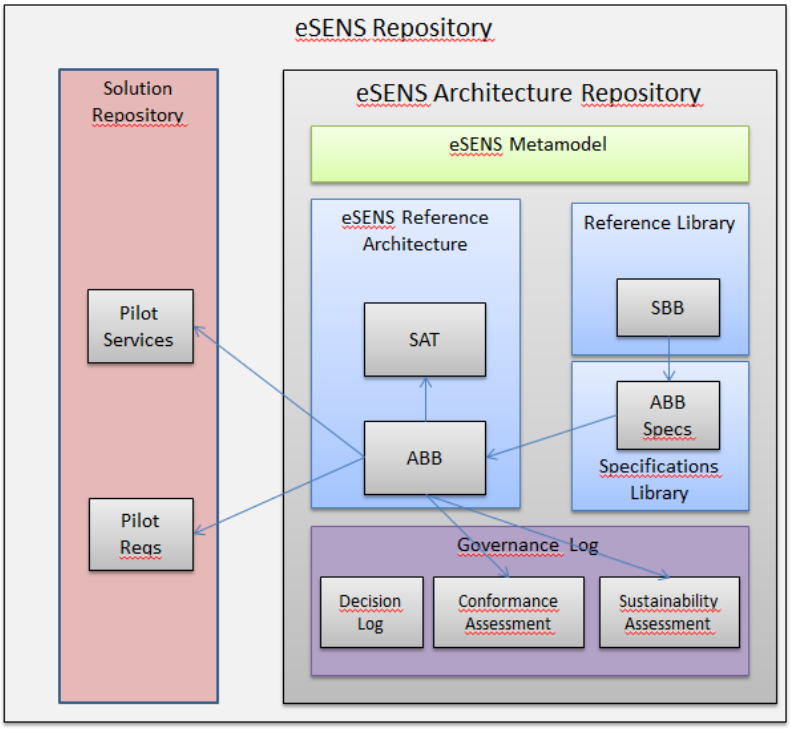


Figure 20: e-SENS Repository as TOGAF Repository

The e-SENS Architecture Repository more specifically contains:

- an architecture metamodel, mainly in the form of a content metamodel: this is the **e-SENS Metamodel** introduced in the previous chapter; from a governance and management perspective, the metamodel identifies the manages entities, i.e. the entities that the architecture capability needs to manage;
- an architecture landscape that represents the e-SENS assets: this is the **e-SENS Reference Architecture** introduced in the previous chapter; the reference architecture conforms to the e-SENS Metamodel, and identifies the e-SENS Capabilities as architecture building blocks; the set of ABBs are all stored in the e-SENS ABB Repository, for further use in solution development;
- a specifications library which captures the various technical specifications and standards that have been adopted by e-SENS; they are stored in the **e-SENS Specifications Library**;
- a reference library, containing the reference implementations that are provided by e-SENS for each ABB; these SBBs are stored in the **e-SENS Reference Library**;
- a governance log, providing a record of governance activities: architecture decision (Decision Log), conformance assessment of the Solution Building Blocks against the related standard specifications, sustainability assessment of the standard specifications associated with each Architecture Building Block;

The e-SENS Architecture Repository is not only made of the listed repositories, but it also maintains the relationships between the entities of the different repositories, as described in the metamodel: an e-SENS Capability (in the e-SENS Reference Architecture Repository) requires technical specifications (in the e-SENS Standard Library) and may be implemented with an SBB (in the e-SENS Reference Library). The Repository is designed in conformance with the metamodel, as illustrated below:

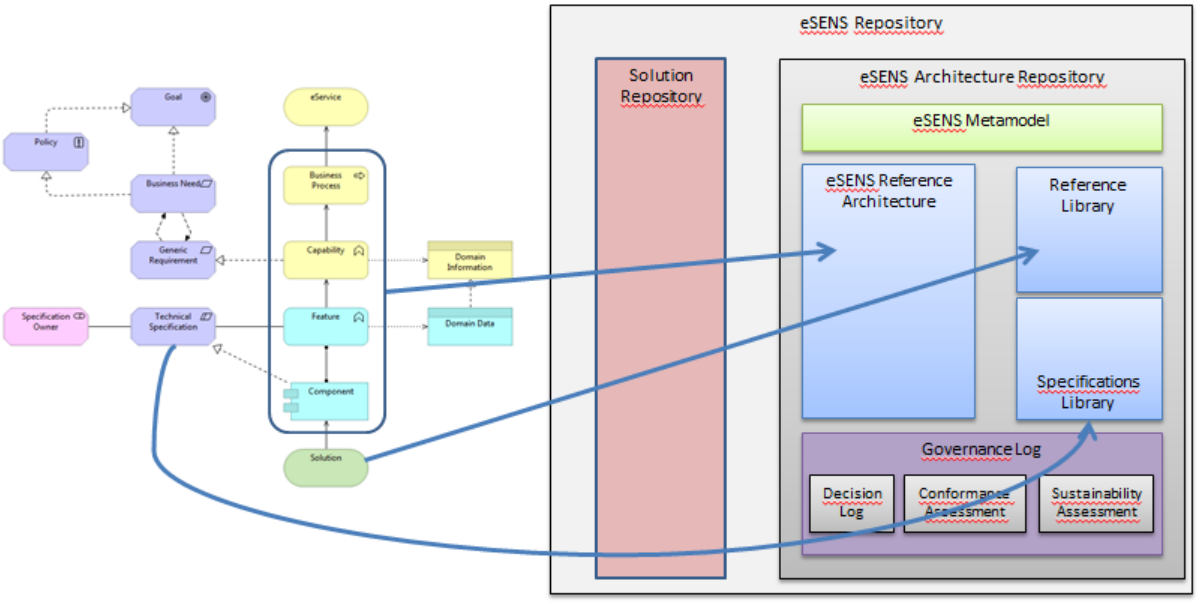


Figure 21: e-SENS Repository and Metamodel

5.3 e-SENS Generic Architecture Repository

The repository can also be viewed from the enterprise continuum perspective:

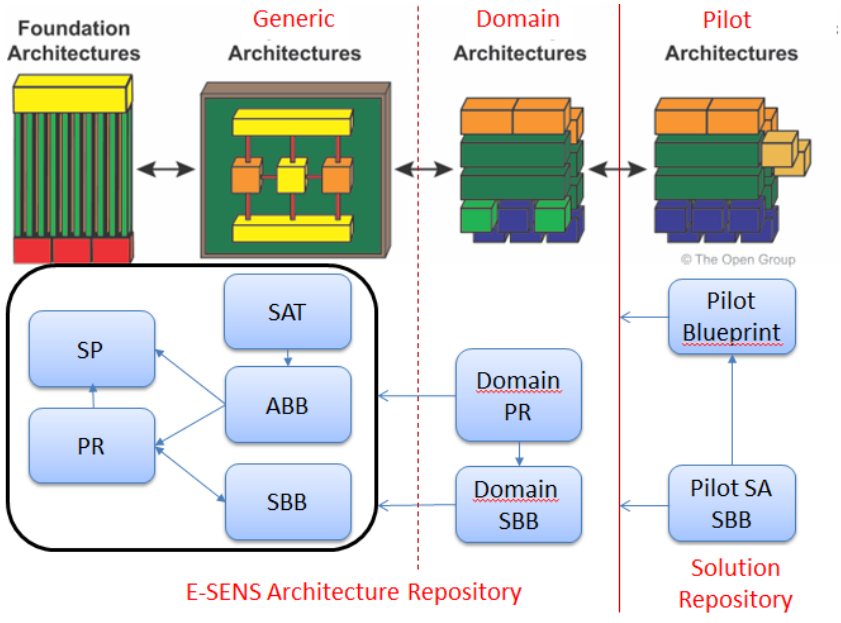


Figure 22: e-SENS Repositories

The e-SENS Architecture Repository is made of two parts:

- The generic architecture repository, containing the generic architecture assets, i.e. the assets that are domain independent;
- The domain architecture repository, containing the domain architecture assets, i.e. the assets that are domain specific.

The current version of the e-SENS Architecture Repository covers the generic architecture and is stored in a Wiki along the following structure:

Figure 23: Repository Structure

e-SENS EIRA (Current version):
http://wiki.ds.unipi.gr/display/ESENS/eSENS+Generic+Architecture+Repository

The repository contains ArchiMate models (e-SENS Metamodel and e-SENS Reference Architecture) and Wiki pages describing the elements of the Building Blocks (assets of the reference architecture). The common structure for the asset descriptions in the wiki is presented in a separate section.

5.3.1 Reference Architecture Repository

The e-SENS Reference Architecture repository is made of:

- Archi models: the actual reference architecture conforming to the e-SENS metamodel expressed in ArchiMate and produced in Archi modeling tool;
- Asset descriptions associated with the SAT and ABB elements of the generic architecture landscape.

The description of the assets is stored on the e-SENS Wiki. The ArchiMate model is maintained as an Archi model, produced with the open source Archi tool and stored on a git repository (stash).

5.3.2 e-SENS Specifications Library

The e-SENS Specifications Library is made of

- Profiles of standard technical specifications that have been adopted as specification of e-SENS Building Blocks;

- Technical specifications specifically developed in e-SENS (when the principle of standard cannot be applied).

The description of these assets is stored on the e-SENS Wiki.

5.3.3 e-SENS Reference Library

The e-SENS Reference Library is made of

- Asset description of SBB that implement the specifications of the e-SENS Building Blocks;

The description of these assets is stored on the e-SENS Wiki.

5.3.4 e-SENS Governance Log

The e-SENS Governance log covers the architecture Decision Log, which stores the main architecture decisions that have been taken in e-SENS, as well as the Change Log.

5.4 Asset description

The elements of the repository stored on the wiki are all described according a common structure.

5.4.1 Solution Architecture Template (SAT) description

Each SAT is described according the following template:

Name of SAT: SAT-*ProductName-version (SAT-eID-1.0.0)*

Objective: *A description of the purpose of the SAT, i.e. what cross-border service this SAT is a template for*

- *Target group: ICT Architects*
- *Must be written in a technology neutral way*
- *Must be short and straight to the point*
- *Must contain the e-SENS specific constraints to the definition*

Generic Requirements: a table listing the generic requirements associated with this SAT

Requirement ID	Requirement description	Compulsory	Source
R-*short name of SAT-Type1**	*Clear and to the point description of the requirement*	*Yes – requirement is applicable to all domains of use* *No – requirement is domain specific and is only applicable to some domains of use*	*Should reference the source of the requirement e.g. from WP5*
R-*short name of SAT-Type2**			

Table 7: SAT Requirements

**ID*

- *R=Requirement*
- *Short name of SAT is 3 letters of the name(s)*
- *Type*
  - *P=Political – requirement coming from political issues e.g. interoperability legacy in domains*
  - *L=Legal – requirement coming from legal interoperability issues*
  - *B=Business – requirement coming from business value proposition perspective*
  - *S=Semantics – requirement to the semantics parts of the foundation architecture (can be derived from the P, L, B requirements)*
  - *T=Technical – requirement to the technical parts of the foundation architecture (can be derived from the P, L, B requirements)*

The target group is non-technical domain experts and ICT architects.

Use cases and Scenarios: The objective is to give domain experts and ICT Architects an understanding of applicability of the architecture of the SAT, through generic and/or domain specific use cases and scenarios.

Use Case	*Objective of the use case*
Description	*Description of the use case*
Actors	*Actors involved*
Goals	*The goal of the use case i.e. business purpose*
Assumptions	*Assumption made in this use case e.g. domain specific*
Artifacts	*Description of artifacts that are being used in the use case*

Table 8: SAT Use case

Architecture patterns and variability: A solution architecture template might enforce a specific architecture pattern (such as 4 corner model). A solution architecture template might support some variability (such as direct addressing of message or addressing through SMP).

Pattern	Variation	ABB Configuration
Name of the pattern solution	*Potential variations*	*What ABB are used in this specific configuration of the solution architecture*

Table 9: SAT pattern and variability

Orchestration and topology of ABBs

- Orchestration = How the different ABB (services) are assembled (orchestrated) to provide a solution architecture. Orchestration is not always required.
- Topology = where each ABB sits in the architecture of the solution

Contributors

Name	Organisation	Country
Name of Contributor as stated in Timelog	*Name of organisation as stated in the Technical Annex and Timelog*	*Name of Country*

Table 10: SAT Contributors

History

Version	Date	Changes made	Modified by
9.9.9	*dd.mm.yyyy*	*Description of changes*	*Name of author*

Table 11: SAT History

5.4.2 Architecture Building Block (ABB) description

Each ABB should have the following sections.

Name: ABB-*name of AB-version (ABB-LocationLookup-1.1.0)*

- Must be a name that covers the functionality of the ABB
- Must not conflict with any other HBB or ABB names

Interoperability level

One of the following figures must be included to show the placement of the ABB in the EIF interoperability levels:

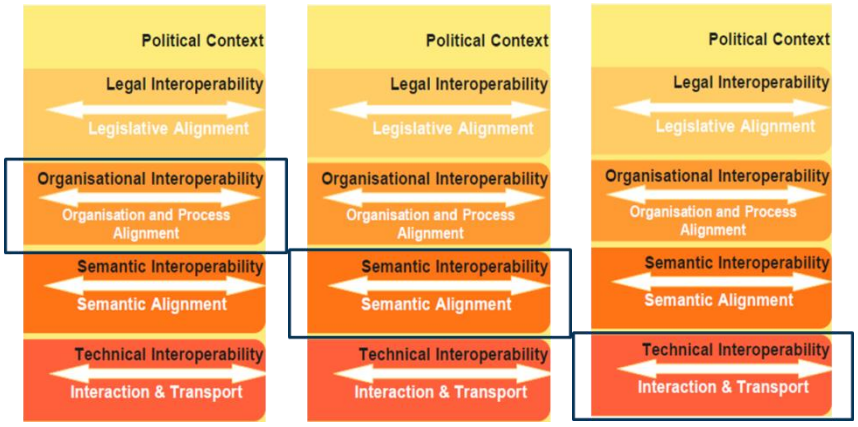


Figure 24: EIF Levels

Objective

A conceptual description of the purpose (WHAT the ABB is doing) and scope of the ABB. The target group is ICT architects.

Generic Requirements

Requirement ID	Requirement description	Source
R-*short name of ABB-Type1**	*Clear and to the point description of the requirement*	*Should reference the source of the requirement e.g. from WP5 or SAT*
R-*short name of ABB-Type2**		

Table 12: ABB Requirements

**ID*

- *R=Requirement*
- *Short name of ABB is 3 letters of the name(s) e.g. "Service Location" becomes "SerLoc"*
- *Type*
  - *P=Political – requirement coming from political issues e.g. interoperability legacy in domains*
  - *L=Legal – requirement coming from legal interoperability issues*
  - *B=Business – requirement coming from business value proposition perspective*
  - *S=Semantics – requirement to the semantics parts of the foundation architecture (can be derived from the P, L, B requirements)*
  - *T=Technical – requirement to the technical parts of the foundation architecture (can be derived from the P, L, B requirements)*

Provided Services

For each Service that the ABB provides, what are the domain objects manipulated and the outcome (the net effect) in terms of domain objects

Provided Service	Purpose	Outcome
Authentication Request Creation	*Create an authentication request from identity attributes*	*Authentication Request is created*

Table 13: ABB Provided Services

Related ABBs

- List of ABBs (if any) that this ABB depends upon

ABB Capability Realization

- Description of the possible and adopted specifications and profiles to this ABB

When different solutions are adopted, explain when to use which. When a specific solution is chosen, justify the choice (potential link to decision log).

Specification	Reference	Sustainability assessment	
Name and version	*Link to specification*	*Link to maturity status from WP3*	
e-SENS Profile		**Choice criteria**	**Status**
Name and version	*Link to Specification Profile*	*When to choose this Profile*	**Work in progress** – The artifact is not yet ready to be used, but is publicized because it gives some information on the direction for the community **Phase in** – The artifact is replacing another (phase out) artifact **In use** – The artifact is the official e-SENS artifact to be used **Phase out** – The artifact is in use, but is being replaced by a new (phase in) artifact **Abandoned** – The artifact is not used anymore
Name and version	*Link to Specification Profile*	--	--

Table 14: ABB Specifications

Contributors

Name	Organisation	Country
Name of Contributor as stated in Timelog	*Name of organisation as stated in the Technical Annex and Timelog*	*Name of Country*

Table 15: ABB Contributors

History

Version	Date	Changes made	Modified by
9.9.9	*dd.mm.yyyy*	*Description of changes*	*Name of author*

Table 16: ABB History

5.4.3 Specification Profile (PR) description

Each Specification Profile should have the following sections.

Name: PR – *SpecificationProfileName-version (PR-BDXL-1.0.0)*

Specification	Reference
Name and version	*Link to specification*

Table 17: PR Specifications

Profile choice criteria

When to choose this Profile

Ownership

Description of ownership (IP) and licence of both the specification and the profile.

Implementation Guideline

Either a link to an external implementation guideline or the implementation guideline description

Test assertions

Link to test assertions

SBB

SBB	Reference
Name and version	*Link to SBB*
Name and version	*Link to SBB*

Table 18: PR Implementations

Contributors

Name	Organisation	Country
Name of Contributor as stated in Timelog	*Name of organisation as stated in the Technical Annex and Timelog*	*Name of Country*

Table 19: IG Contributors

History

Version	Date	Changes made	Modified by
9.9.9	*dd.mm.yyyy*	*Description of changes*	*Name of author*

Table 20: IG History

5.4.4 Solution Building Block (SBB)

Each SBB should have the following sections.

Name: SBB-*name of SB-version*

Must be a name of the product/SW

Must not conflict with any other SBB names

Reference

Reference to Product/SW

Owner and License

Ownership (IP) and License of Product/SW

Profiles implemented

Implementation Guideline	Reference	Release date
Name and version	*Link to implementation guideline*	
Name and version	*Link to implementation guideline*	
Name and version	*Link to implementation guideline*	

Table 21: IG Specifications

Conformance

Implementation Guideline	Test Wrapper	Test Cases	Conformance Status
Name and version	*Link to test wrapper*	*Link to test cases*	*Status of conformance testing*
Name and version	*Link to test wrapper*	*Link to test cases*	*Status of conformance testing*

Table 22: IG Conformance Testing

Contributors

Name	Organisation	Country
Name of Contributor as stated in Timelog	*Name of organisation as stated in the Technical Annex and Timelog*	*Name of Country*

Table 23: SBB Contributors

History

Version	Date	Changes made	Modified by
9.9.9	*dd.mm.yyyy*	*Description of changes*	*Name of author*

Table 24: SBB History

5.5 EIRA Release Management

The EIRA repository is maintained in conformance with the global e-SENS Change Management Process. The EIRA Release Management process implements the change process as far as EIRA management is concerned.

As the EIRA repository is versioned, there is a need for a specific release management process, described below:

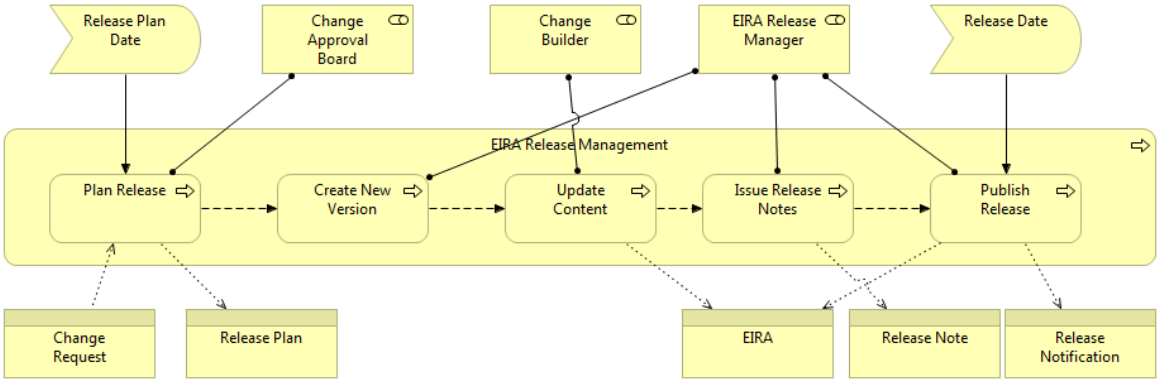


Figure 25: EIRA Release Management Process

5.5.1 Requesting Changes

Requests to modify the content of the EIRA repository are managed as JIRA CR. The Change Management process is applied to actually analyse and approve the CR. As soon as the CR is approved, it is included in the EIRA Backlog, available for inclusion in subsequent releases.

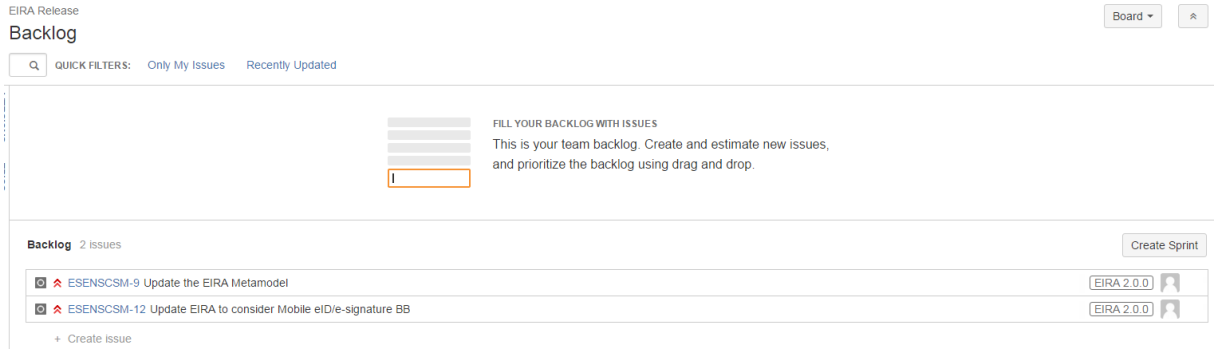


Figure 26: EIRA Backlog

5.5.2 Release Planning

At *Release Plan Date*, the Change Approval Board does **Plan Release**:

- analyse current CRs
  - prioritize the items;
  - accept/reject the requests;
  - assign resource to the implementation;
  - assign them to a release;
- Update the Release Plan in JIRA, to reflect that items have been planned to a release

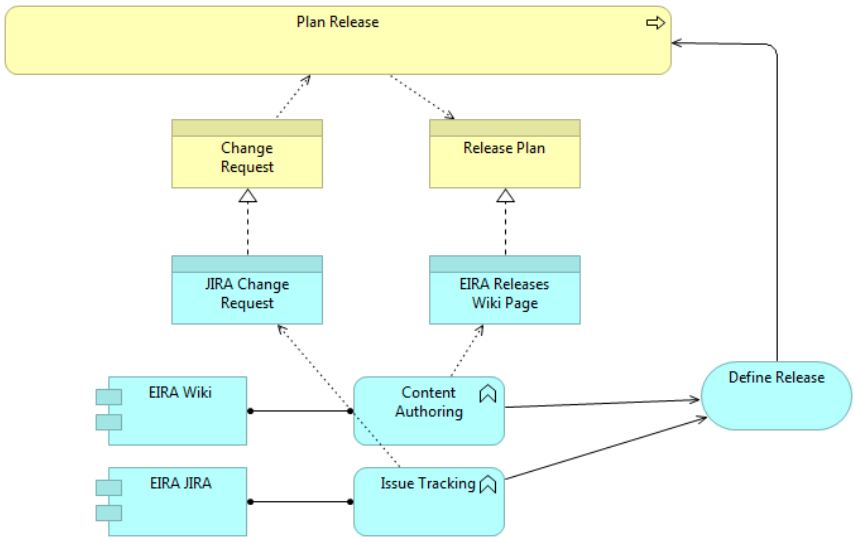


Figure 27: Release Planning Process

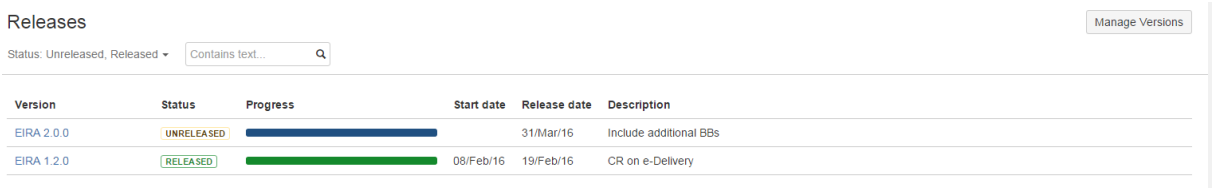


Figure 28: Release Plan

5.5.3 Change Implementation

As soon as the Release Plan is updated, the EIRA Release Manager does **Create New Version** for the EIRA content. The EIRA is versioned according 3 digits, and the following rules are applied as for the versions numbers

- *Revisions*: to be used for correcting faults and defects, clarifications and in case of minor corrections. In this case, the version number should be changed on the second digit: e.g. 1.0.0 to 1.0.1
- *Minor version changes*: to be used for adaptations and extensions that are backward compatible. In this case, the version number should be changed on the first digit: e.g. 1.0 to 1.1
- *Major version changes*: to be used for major adaptations, extensions and changes that may break backward compatibility. In this case, the main version number should be changed: e.g. 1.0 to 2.0

The Change Builder that have been assigned a CR do **Update Content** of the EIRA accordingly: the contributor should carefully select the release version the change relate to, when editing a BB page.

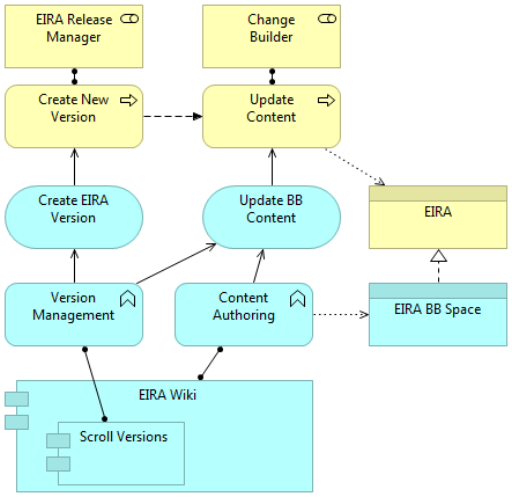


Figure 29: Release Implementation Process

5.5.4 Publishing Release

The Release Manager does **Issue Release Note** by describing the content of the release in JIRA: the release note contains the CR that are part of the released version.

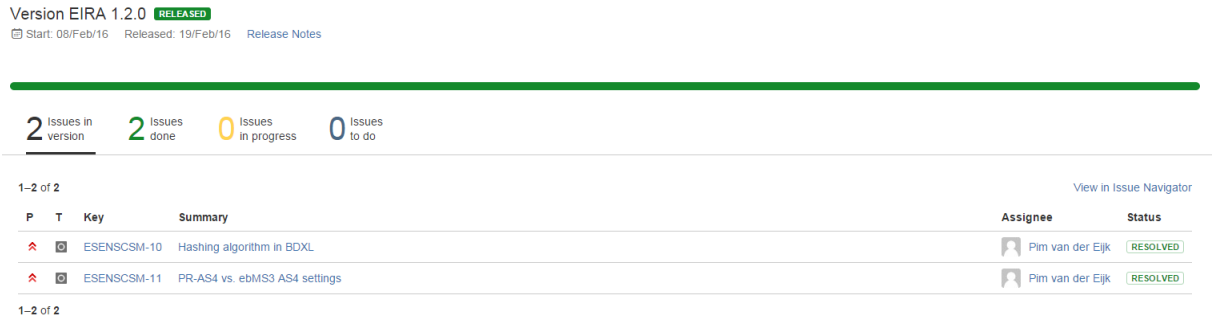


Figure 30: Release Note

At *Release Date*, the Release Manager does **Publish Release**, making it publicly available, and notifies the availability of the release through Basecamp. The published version is made unavailable for any further change: the EIRA Release Manager hides the version (through the Scroll version management interface).

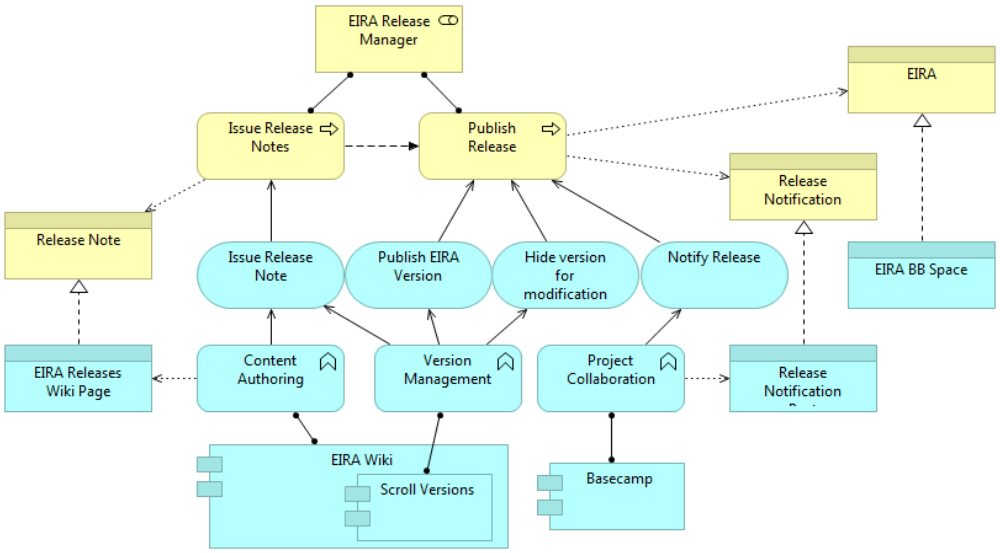


Figure 31: Publish Release Process

6 Deployment of Building Blocks

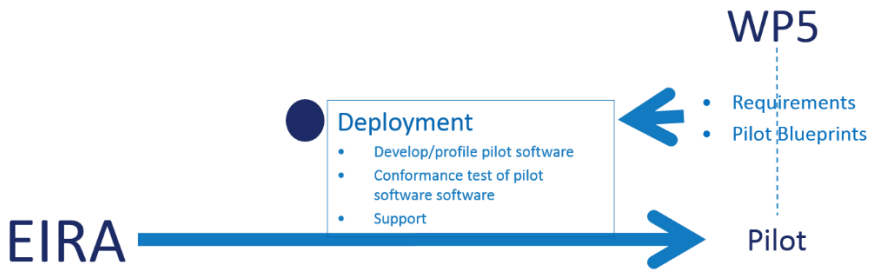


Figure 32: Deployment

The creation of the Interoperability Solution Architecture within a domain requires the deployment of generic Building Blocks into an implementation of domain usable Building Blocks.

Coherent and consistent implementations across domains require support from WP6 to WP5 coordination between WP6 and WP5 as well as coordination across WP6.

After Pilot implementation and Pilot deployment there'll be a need for stability in terms of well-defined life cycle management of e-SENS EIRA Building Blocks.

6.1 Implementation Support

The support for WP6 deployment into WP5 Pilot implementation is performed through the BB-Pilot Board. Each Pilot will set up a BB-Pilot Board, which consists of a **BB Architect** per BB (SAT/ABB), a **Pilot Solution Architect** and a **Participant Solution Architect** per Pilot participant.

The **BB Architects** have the responsibility to:

- Secure that BBs are implemented in a Solution Architecture in such a way that they are conformant to the generic BBs
- Coordinate with other BB Architects to create a coherent Solution Architecture
- Support Solution Architects in designing a Solution Architecture
- Coordinate with BB Architects in other Pilot implementation in such a way that consistent implementations of a BB is maintained across Pilots
- Give feedback to WP6 on how maturity of BBs can be improved

The **Pilot Solution Architects** have the responsibility to:

- Secure that the Pilot requirements are fulfilled in the overall Pilot Solution Architecture

The **Participant Solution Architects** have the responsibility to:

- Design and implement the participants Pilot Solution

Tools

- Telco and F2F meetings as needed, usually initiated by the Pilot
- Basecamp for discussions during Pilot implementation
- JIRA for tracking issues

6.2 Building Block Life Cycle management

Formalized BB Life Cycle management (LCM) processes and procedures have not yet been defined regarding the Transfer of Ownership and Operations i.e. which stakeholders will be involved and aligned with their LCM processes and procedures. On the other hand, change and support management of BBs are defined in a process that covers addition, modification, or removal of an e-SENS BB and/or its associated elements including software implementations within the scope of e-SENS WP6.

The purpose of the Change and Support Management adoption in e-SENS WP6 is to ensure that standardized methods and procedures are used for efficient and prompt handling of all changes associated with e-SENS BBs and EIRA in order to minimize the number and impact of any related incidents. Changes in the e-SENS BBs may arise reactively in response to problems, or proactively from seeking improved efficiency and effectiveness. Change Management can ensure standardized methods, processes, and procedures facilitate efficient and prompt handling of all changes, and maintain the proper balance between the need for change and the potential detrimental impact of changes, thus contributing to piloting objectives of the e-SENS project.

The Change Management Process begins with the identification, recording, and classification of the change, and continues with its approval, test, and staging for implementation. Once the completed implementation has been measured and reported, the Change Process is complete.

Overall Process

When WP6.A receives an incident (via JIRA or e-mail) from e-SENS partners, e-SENS work-packages (including WP6.A itself) or external stakeholders, the change or support management process is triggered. The process follows the identification of the change request, which is deciding whether the request creates a change request or support procedures.

In case of a request for change, a change request form, which is detailed description of the proposed change, is prepared by the submitter in order to evaluate appropriateness of the request. Then, the change request form is evaluated and an analysis report including impact assessment is created by WP6.A. The next step is to submit the analysis document and optionally change request form to the WP6.A receives the support requests then assigns (see e-SENS Technical Annex for organizational setup of e-SENS) for the approval. After the approval, the changes are implemented, tested and released. Release management will be handled by WP6.B except the cases where the change is directly related WP6.A (e.g. deployment work, test). To complete the cycle, review process is performed then the cycle is closed if change is successful. WP6.A manager is responsible to manage and apply change and support management procedures.

In case of support request WP6.A receives the support requests then assigns the request to the corresponding BB Expert(s).

6.2.1 Role Descriptions for Change Management Process

Role	Description
Change Requester	Change Requester is the role that requests a change due to problems encountered or new functionality requirements; this can be from WP5, WP6 (WP6.A, WP6.B itself) or external stakeholders like CEF or CEN.
Change Manager	Change Manager is a role that receives the requests, identifies then routes the requests to the responsible experts.
Change Approval Board (CAB)	Change Approval Board is a group of persons that decide if a change is approved or not (go/no-go decision). The Architectural Board acts as a change approval board.
Change Builder	The change builder is the role who plans and implements the change.

6.2.2 Change Management Process

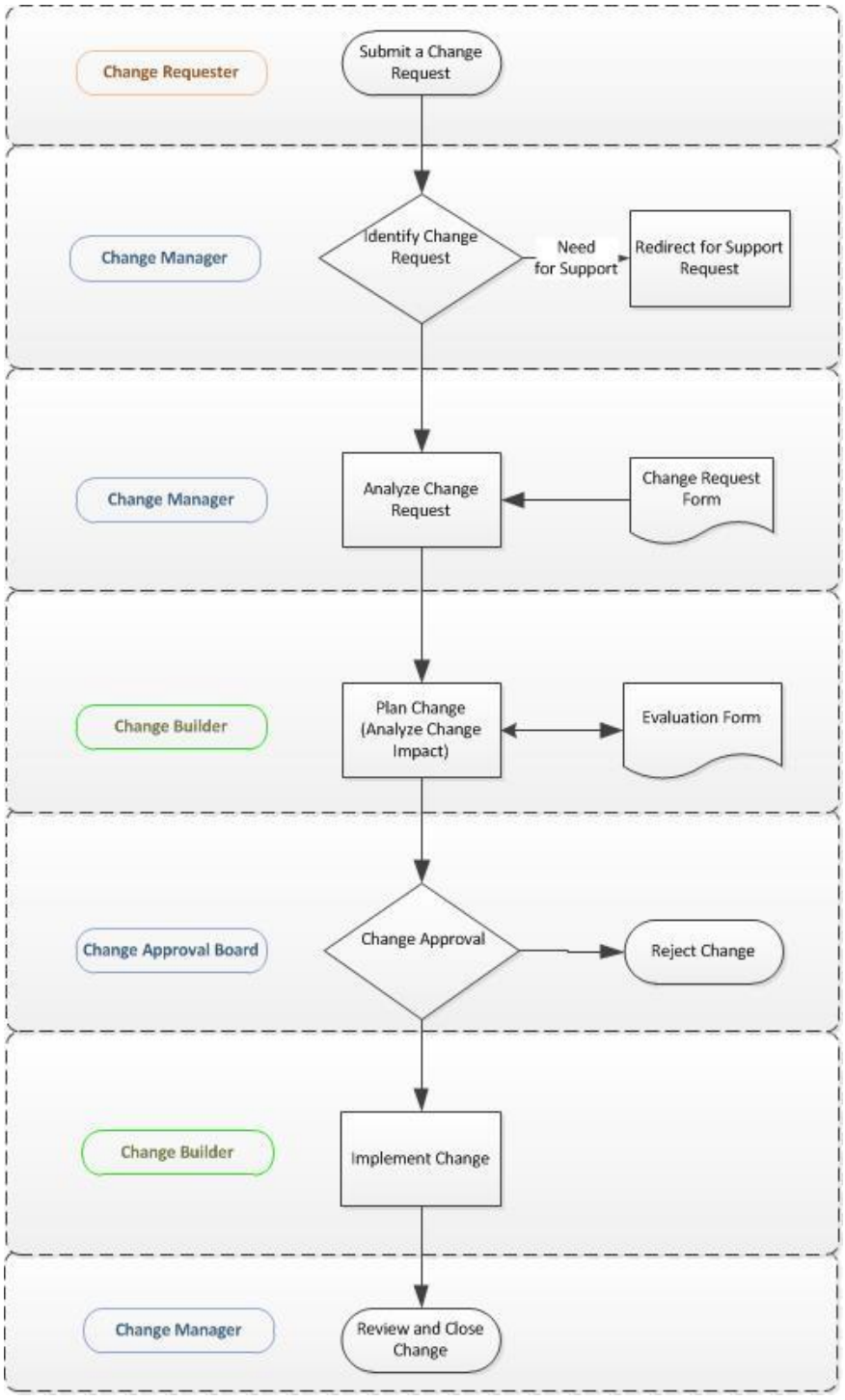


Figure 33: Change Management Process

Submit a Change Request

Changes should be submitted via e-SENS Jira by Change Requester. Change Requester must fill the required fields after choosing Change Request option from the Issues drop-down menu. Change Requester must also prepare a Change Request Form and attach it to the Change Request Issue.

Identify Change Request

After receiving change request, Change Manager conducts a first review process. This process includes deciding if the request is appropriate to handle in change management process. If the request is more appropriate for support request than it is redirected to

Support Management Process. The change manager can request additional information for the identification of the change request. Then, he/she can return to the change requester. In addition, the change manager can delay the change request after the first analysis and inform the change requester.

Analyse Change Request

This activity contains analysing technical feasibility of the proposed change request and also determining costs and benefits. This task is performed by mainly Change Manager role and with the support of BB expert(s) if needed. Change Request Form is used as input for the necessary evaluations.

Plan Change (Analyse Change Impact)

The extent of the change is analysed in this activity, namely change impact analysis is conducted in order to do accurate planning. This activity is generally conducted by Change Builder.

The following questions must be answered at this stage:

- Who will be affected from the requested change?
- What will the potential impact of the requested change?
- What will be potential risks and their possible mitigation measures?

Change Plan should be shared with Change Manager so that (s)he can consume it during review and close activity.

Change Approval

Based on the previous evaluations, the Change Approval Board (CAB) makes the go/no-go decision. The Architectural Board acts as a change approval board. It delivers support to the clusters by providing approving requested changes. The Architectural Board may decide in one of the below three options:

1. Approve
2. Partially approve
3. Reject
4. Delay

The architectural board members should be ensured that the requested changes are thoroughly checked and assessed from both technical and piloting perspectives.

Implement Change

Change implementation is made by Change Builder. The activity is composed of the following steps:

- ***Execute and Propagate Change:*** The planned change is implemented. If the change has to be adapted to other BBs (or other parts of the system) then change needs to be propagated.
- ***Test Change (if applicable):*** When the change request is regarding with software defect/bug, the change builder tests whether what (s)he has built actually works and satisfies the change request.
- ***Update Documentation (if applicable):*** The documentation is updated to reflect the applied changes. If the change request is related with EIRA or Wiki, this activity can be skipped since it is performed in Execute and Propagate Change step.
- ***Release Change:*** A new release is made public in order to reflect the applied change.

When a change fails during implementation, or cannot be completed within the approved implementation period, it must be either backed out within the planned time frame or an extension may be requested.

Review and Close Change

The change manager reviews the implementation of the change in the new release for the last time. If the change request is completed successfully according to the criteria given below, change manager closes the change.

The criteria for a successful change

- The change is implemented in accordance with the implementation plan
- The change is implemented within the planned implementation timeframe
- The change do not cause unexpected impact
- The change meets the anticipated objectives defined in the Change Request

If a change was not completed and backed out, all parties impacted by the unsuccessful completion of the change must be notified.

Timing and Exceptions

Cut-off Dates

There will be a single release for each month in WP6. The dates are given in the below.

- **Release Date:** Every first week of the month
- **Announcement Date:** Every third week of the month

WP6 will collect all change requests and process them. Then, the architectural board will make a decision on the change request(s) and make an announcement on expected changes of the month. Some of the change requests may require more time to be processed and they will be handled in one of the next iteration. The current status will be announced (reject, accept, in progress) by WP6.B - Architecture at the announcement date of each month.

Emergency Changes

There can be some cases, which need emergency changes due to, high-impact on piloting. In such cases, the architectural board can decide to apply change management procedures without taking into account cut-off dates.

6.2.3 Support Management Process

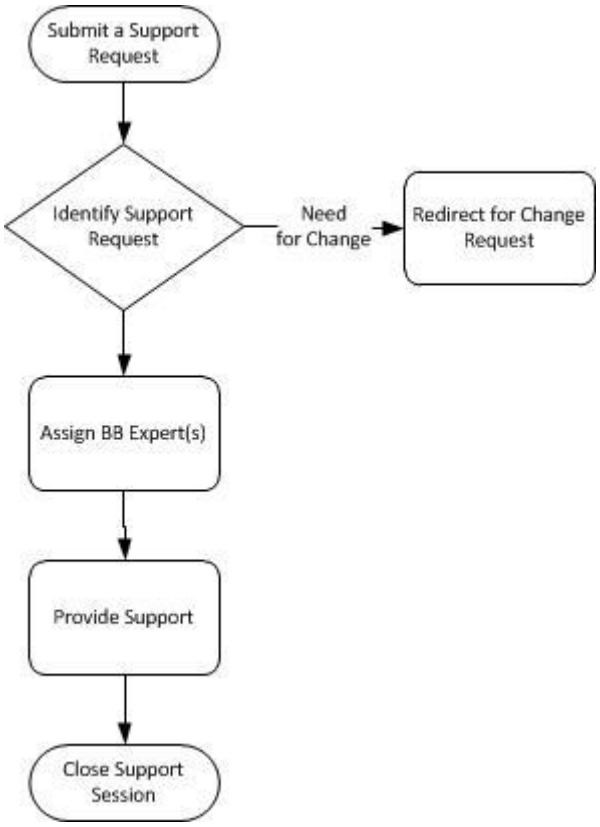


Figure 34: Support Management Process

When a Change request is identified as a Support item, it is re-directed to support management process. The process can also be started independent from the change management process.

This process is basically processed providing support to the incidents raised by WP5. WP6.A is responsible for receiving the support requests then assigning the request to the corresponding BB Expert(s). The communication medium can either be JIRA or e-mail.

6.3 Testing

e-SENS Conformance and Interoperability SAT provides an assortment of Architectural Building Blocks (ABB) that together aim to construct common, efficient and effective way for conformance and interoperability testing of the products against the e-SENS specifications. The SAT creates reports on conformance of the e-SENS SBBs. All the e-SENS WP6 ABB specifications are the targets of the e-SENS testing activities. Any SBB that implements the specifications emitted from these ABB's is a Subject/System Under Test (SUT) for this SAT. There are two kinds of testing activities under the e-SENS: Conformance Testing and Interoperability Testing.

e-SENS Conformance Testing is the process of verifying that a solution/system conforms with the requirements of an e-SENS ABB Specification. On the other hand, e-SENS Interoperability Testing verifies the ability of two or more solutions/systems, which claim conformance to a target e-SENS ABB specification, to work together properly. This SAT provides a set of software architecture, platform,

tools, supplementary testing assets and methodologies to facilitate and standardize the testing procedures in order to make the process reusable and sustainable.

6.3.1 Testing Strategy

In order to have clear understanding of testing strategy of e-SENS, the considered testing types are outlined in this section along with e-SENS testing strategies for each building block. Items to/not to be tested sections identify the products to be involved in the tests within the context of conformance and interoperability testing in e-SENS. Since end-to-end testing is conducted by WP5 it is not covered here in detail, however for the sake of completeness the definition is given.

6.3.1.1 Testing Activities in e-SENS

In e-SENS, testing activities are performed in three ways: Conformance Testing, Interoperability Testing and End-to-End testing. There are other types of testing like performance testing, usability testing etc. as well. However, they are out of scope for e-SENS.

Conformance Testing

Testing conducted to verify that an implementation conforms to a formal specification (typically one defined by a standards organization).

Interoperability Testing

Testing to verify that two or more software products are capable of interacting with each other, perhaps via a communications or messaging protocol, or by exchanging data through some other means. Note that conformance to specifications does not guarantee that two systems to be interoperable. However it is beneficial to perform conformance testing to pave the way for interoperability testing.

End-to-End Testing

End-to-end testing is a methodology used to test whether an integrated system is performing as designed from start to finish with respect to the desired business level use cases. The technical level of integration, communication protocols, configurations and other low level details are not so relevant, yet affected by this kind of test. Depending on the definition on the business level use case, end-to-end testing scenarios might also be domain agnostic.

6.3.1.2 Items to Be Tested

Conformance and interoperability testing verifies whether a product performs (or an artifact is) in conformance with defined specifications or profiles (E.g. ETSI, OASIS etc.) addressed in WP6 ABBs and interoperable with the other products which are in the same manner.

The following criteria are used to identify the items to be subject to conformance/interoperability testing:

1. When a software product (aka. SUT) is used as an SBB, Pilot Domain Experts & Solution Providers (as in the role of Test Developer) must provide a software developer who knows the

provided SW and develop/reuse an adaptor for Minder. After developing/reusing the Minder adaptor for that SUT, both conformance testing against an ABB and interoperability testing with other SBBs for the same ABB can be done automatically using Minder.

2. When a pilot adapts an ABB where only the artifacts are significant (i.e. *SBDH, ASiC, etc.*) and the software is out of scope, then the conformance and interoperability tests can be performed by providing the artifacts as *test assets to Minder* and performing content validation.

It is important to note that *the systems to be tested* are expected to be stable and have robust releases. The releases are taken as versions and each test cycle is traced according to these releases.

6.3.1.3 Items Not to Be Tested

Unit/functional/integration/system/performance/load testing activities that are performed for verification and validation of products/modules/reference architectures during their development lifecycle, or their usage in production are out of scope of the conformance and interoperability testing.

Throughout the whole conformance and interoperability testing, the basic assumption is that, the products that are to be tested have already completed the unit/functional/system/integration tests and the stable releases have been published. This is because of the fact that conformance and interoperability testing is not a development phase testing. Therefore, the versions like *beta, snapshot, alpha, pre-release and any other statement that implies a non-release version is under the responsibility of the vendor*. The vendors are welcome to align their development calendars with the conformance testing plan but the quality assurance and conformance and interoperability testing team will reject any responsibility on the effects of the delays in the conformance tests cycles on the development-release calendar of the vendor.

6.3.1.4 e-ID Testing Strategy

e-SENS e-ID SAT has three BBs named “Authentication Exchange Protocol”, “Authentication Exchange Forward” and “Quality Authentication Assurance”. The specifications of these BBs have been inherited from STORK2.0 specification. (Note that STORK1.0 is not in the scope of e-SENS e-ID BB.) It’s because of this one to one relation between the solution and its specification that no conformance testing on STORK2.0 has been considered. On the other hand, the eIDAS Node specifications are not specific to a certain product and multiple implementation candidates are likely to occur. Consequently, all the three tests are required for the eIDAS Node specifications.

As a prerequisite to conformance testing against the candidate eIDAS Node implementations, a set of test assertions[9] must be derived from eIDAS Node specifications. Generally, BB experts generate these assertions. Subsequently, conformance tests must be applied on the candidate eIDAS Node implementations by using the test assertions.

9 e-SENS test assertion template is compatible with OASIS Test Assertions Guidelines
http://docs.oasis-open.org/tag/model/v1.0/testassertionsmodel-1.0.html

eIDAS Node Interoperability testing aims to verify compatibility between different eIDAS Nodes. In order to accomplish this, testing scenarios must be generated in collaboration with BB experts and implementation vendors.

Member states, which use the e-SENS eIDAS Node implementations or the STORK 2.0 system, may apply end-to-end testing for business level scenarios to ensure all the integrated systems work together properly. In order to perform an end-to-end testing in the e-ID pilot, the national systems must be connected to each other via the eIDAS or STORK2.0 Nodes.

Adaptor Approach

A study has been going on for developing an adapter to make STORK2.0 and eIDAS Node implementations interoperable. This interoperability aims to ensure a STORK2.0 system deployed with an adapter behaves like an eIDAS Node.

Therefore, for a "STORK2.0 with adapter" solution, conformance testing against eIDAS Node specifications and interoperability testing with other eIDAS Node can be applied. Similarly, end-to-end testing may be applied with a "STORK2.0 with adapter" solution that connects to the eID interoperability architecture.

Again note that, adaptor approach does not consider STORK1.0 either.

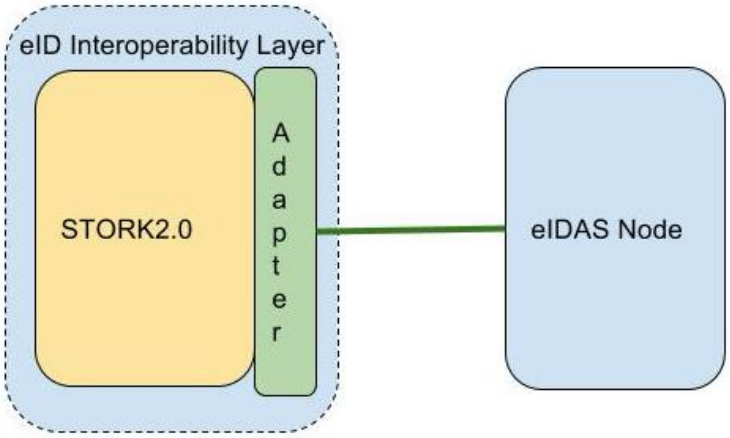


Figure 35: The testing approach for "STORK2.0 with Adapter" solution

e-SENS Attribute Provider SAT and their ABBs are inherited from STORK2.0 project. Therefore e-ID testing strategy also applies to Attribute Provider SAT.

6.3.1.5 e-Delivery Testing Strategy

e-SENS e-Delivery SAT defines BBs, namely "Message Exchange", "Addressing of End Entities", "Capability Lookup", "Service Location" and "Backend Integration", and their specifications for secure electronic delivery. For "Backend Integration" BB, neither conformance nor interoperability testing is considered since i) the specification "Connector" is inherited from the solution "Connector" itself and ii) the specification "REST SMP" defines simple functions of a RESTful web service. However, for all BBs

including “Backend Integration BB”, Member States may apply end-2-end testing for technic and business level scenarios to verify all integrated systems work together properly.

For the profile “e-SENS AS4” of BB “Message Exchange”, CEF and e-SENS e-Delivery teams, collaboratively, generated 48 Conformance Test Assertions from the profile and Minder team from TUBITAK scripted all test cases using Minder testbed. Minder testbed is developed by TUBITAK team and is selected by the CEF programme as the testbed for the e-Delivery DSI. The success story of e-SENS AS4 Conformance Testing is given in the section e-SENS AS4 Conformance Testing Event – in detail. e-SENS AS4 profile Conformance and Interoperability Testings are handled by using the Minder AS4 Conformance Bridge “Kerkovi”[10] which is also the starting point for a new AS4 implementation.

CEF e-Delivery team is currently working on Conformance and Interoperability Test Assertions of “Addressing of End Entities”, “Capability Lookup” and “Service Location” specifications namely, by order, “ebCore Party ID”, “SMP” and “BDXL”. After finalising this study, related test cases will be scripted in Minder and run for applied vendor’s products by CEF e-Delivery team.

6.3.1.6 Non-Repudiation and Traceability Testing Strategy

e-SENS Non-Repudiation SAT defines BBs “Timestamping” and “Evidence Emitter” with their specifications. e-SENS traceability team are currently working on e-SENS Timestamping standards Conformance Test Assertions for timestamping service that is implemented according to RFC 3339. On the other hand, ETSI Plug Test results are accepted for trusted timestamping service that is based on RFC 3161 and ETSI standards[11]. “Evidence Emitter” BB has two specifications called “ETSI REM” and “ATNA”. For “ETSI REM” specification, first Conformance Testing Test Assertions will be generated, then test scripts will be written and run in Minder. Gazelle Results are accepted by e-SENS as conformity proof to “ATNA”. No interoperability testing activity is planned for this BB since it is not applicable. However, for all BBs of this SAT, Member States may apply end-2-end testing for technic and business level scenarios to verify all integrated systems work together properly.

6.3.1.7 e-Documents Testing Strategy

e-SENS e-Documents SAT defines BBs “Document Provisioning”, “Document Business Envelope” and “Document Container” with their specifications. “Document Container” BB specification is based on the ETSI TS 102 918 ESI ASIC Specification. “Document Container” BB should satisfy the specifications extended from ETSI TS 102 918 ESI ASIC Specification. Conformance testing test assertions have been generated. Test cases will be generated from the test assertions and test scripts will be written and run in Minder. “Document Provisioning” BB includes W3C XSL, XSLT, Open Annotation (OA) Data Model, Schematron specifications. No conformance and interoperability testing activity is planned for this BB since it is not applicable. However, for “Document Provisioning” BB, Member States could apply end-2-end testing for technic and business level scenarios to verify all integrated systems work together properly. “Document Business Envelope” BB specification is based on the SBDH Profile. The

[10] https://mindertestbed.org:15000

[11] http://wiki.ds.unipi.gr/display/ESENS/SP++-+Timestamping+Standards+1.1

conformance testing approach for SBDH Profile includes two steps for SBDH conformance testing: Upper and Lower Level Testings.

1) Upper Level Testing: An e-SENS SBDH pilot profile schema/schematron is verified against e-SENS SBDH profile schema/schematron. Instead using schema and schematrons, test assertions are created and the pilot profile can be verified against these clauses. Once the pilot profile's compatibility is verified with e-SENS SBDH profile, lower level test will be applied. Up to now, WP6.A has created and finalized SBDH TA document.

2) Lower Level Testing: An SBDH document received from pilot will be verified against e-SENS SBDH pilot profile we have verified in the following step. This step includes the verification based on XSD/schematron validation. The XSD/schematrons that profiled by each pilot and -for each pilot profiling- a sample SBDH document should be provided. They are requested from the pilots and some sample xml and excel sheets are delivered. But, what is really expected is, xsd and/or schematron of "profile of e-SENS SBDH profile" for each pilot. These xsd/schematrons must include the value constraints for your domain.

6.3.1.8 Semantics Testing Strategy

e-SENS Semantics SAT defines BBs "Semantic Mapping Service", "Terminology Service" and "Domain Knowledge Management System" with their specifications. Conformance or interoperability testing activities are not planned for this BB since it is not applicable. However, for all BBs of this SAT, Member States may apply end-2-end testing for technic and business level scenarios to verify all integrated systems work together properly.

6.3.1.9 e-Signature Testing Strategy

The e-Signature Creation and Validation ABBs relies on the EU e-Signature legislation (Signature Directive 1999/93/EC, Format Decision 2011/130/EU and the Trust List Decision 2009/767/EC, 2010/425/EU, respectively and also e-IDAS Regulation) as the legal backbone, the EU e-Signature Standards Framework which is described by the ETSI "Rationalised Framework for Electronic Signature Standardisation" as the interoperability backbone, respectively.[12] Hence, if an SBB is already performed the ETSI Plugtests and succeeded it is accepted as they it is conformant to e-SENS specifications when proved by some means.

Note from e-SENS WP4:

Regulation 910/2014 of 23 July 2014 on electronic identification and trust services for electronic transactions in the internal market will repeal Directive 1999/93/EC, from beyond 1 july 2016, so it must be thought on the near future compliance with the requirements set in the mentioned Regulation and the new legal framework such as:

a) Commission Implementing Decision (EU) 2015/296 of 24 February 2015 on procedural arrangements for MS cooperation on eID: Member States shall cooperate in order to reach interoperability and security of electronic identification schemes. The decision establishes the methods for exchange of information and creates the Cooperation Network to facilitate cooperation on the subject.

[12] http://wiki.ds.unipi.gr/display/ESENS/SP+-+e-Signature+Standards+for+Creation+and+Validation-+1.2

b) Commission Implementing Regulation (EU) 2015/1501 of 8 September 2015 on the interoperability framework: The regulation creates the platform enabling practical connectivity between eID means from different Member States, to foster interoperability.

c) Commission Implementing Regulation (EU) 2015/1502 of 8 September 2015 on setting out minimum technical specifications and procedures for assurance levels for electronic identification means: The main goal of the eID mutual recognition is to enable EU citizens to do cross-border interaction with their own national eID means. Since each Member State has a separate system to manage electronic identities, a mechanism is needed to make them comparable and interoperable. The Commission Implementing Regulation on levels of assurance includes detailed criteria which allow Member States to map their eID means against a benchmark (low, substantial and high) and thus to compare each other.

d) Commission Implementing Decision (EU) 2015/1984 of 3 November 2015 defining the circumstances, formats and procedures of notification: Notification of electronic identification schemes by Member States is a prerequisite of mutual recognition of electronic identification means. The decision ensures uniform use of the notification form.

6.3.2 Testing Guideline

In this part, a testing guideline is defined including Operational Roles and Responsibilities, Coverage of Testing Types, Test Methodology and Testing Assurance Profile.

6.3.2.1 Operational Roles and Responsibilities

The roles and the responsibility of the entities that participate in the conformance and interoperability testing activities are listed below:

1. **Test Designer**: is responsible for creating test scenarios according to the test assertions, which are supposed to be obtained from WP6 or the providers of the inherited specification. After creating test scenarios, TS can also run the test cases. TS can communicate with Minder Server via a web interface.
2. **Test Developer:** is responsible in creating the bridge between the SUT and the testing environment. He knows all the communication interfaces of the SUT. A TD is responsible to implement the adapter interface provided by Minder. If the SUT uses a standard communication interface (i.e. AS4, Rest Calls. etc), the TD might also reuse an existing minder adapter from the Minder Repository.
3. **Pilot Domain Experts & Solution Providers:** are responsible to provide solutions to be deployed in the pilot domains. Therefore, they provide technical support for the implementation of the SUT-Minder adapter (or reuse of an existing one) as Test Developer. Preferably, they may also be in the role of Test Designer and create test scenarios.
4. **BB Experts**: are responsible to give support for the generation of the test assertions and give support for the preparation of the test cases generated from assertions. Circumstantially, BB Experts might also be in the role of Test Designer and create test scenarios.

6.3.2.2Coverage of Testing Types

Conformance testing is the process of verifying that a product, system or artifact/complies with the requirements of a specification. On the other hand, Interoperability Testing verifies the ability of two or more products/systems as which implement a target specification, to work together. Conformance testing does not cover the interoperability of two systems and interoperability testing cannot be a substitute to conformance testing. However, studies show that applying conformance tests at first reduces the cost and increases the successes of interoperability testing.[13]Therefore, it is recommended to conduct the conformance test for an SBB prior to interoperability testing.

When there are multiple implementations that realize the relevant part of an ABB specification, each implementation (e.g. eIDAS node) must be tested with all the candidate implementations that realize its role in the interoperability architecture. This might lead the testing environment to an exponentially growing size that is unmanageable. Therefore, it is recommended to devise ways to apply automated interoperability testing in order to succeed future sustainability.

Due to the general testing notion that, the modules working fine individually do not tend to work together correctly for the first time, end-to-end testing has an important role in testing the domain specific business level workflows over the integrated various systems. It is important not to confuse interoperability testing with end-to-end testing. Interoperability testing has a target specification/standard and aims to verify interoperability of the system components with respect to that specification. End-to-end testing, on the other hand, does not have a target specification and rather deals with the whole system architecture deployed with respect to the business requirements. Therefore multiple specifications, indirectly, may be covered under a fully deployed end-to-end testing environment.

6.3.2.3Test Methodology

When a system is subject to conformance test, the test assertion version and SUT/Asset version are taken as unique test iteration labels and testing will be performed in a test cycle (see 6.3.2.10).

In each cycle, test results will be generated and delivered in the end of the cycle. If any major defects/bugs that affect the operation of the system, are found; they are reported to the vendor and considered as *stoppers*, and no further conformance testing will be performed on that product until those stopper defects/bugs are fixed. In the next cycle, it is assumed that the defect/bug is fixed and the conformance test is repeated.

Conformance testing methodology specifies how to evaluate if a product meets the necessary requirements of a specification, contract or regulation. In e-SENS, conformance testing verifies whether the e-SENS products perform in compliance with the defined e-Delivery, e-Document, e-ID and Security standards proposed in WP6.B.

Interoperability testing methodology specifies if a set of products work together properly. In e-SENS, interoperability testing verifies whether all the e-SENS modules, that are candidate to be used in piloting in all domains, exchange and use information properly in terms of syntactic (Communication and exchanging data) and semantic (Interpreting the information exchanged meaningfully) aspects.

Test methodology is composed of the following activities:

[13] https://wiki.oasis-open.org/tab/TestingPolicy

- Creation of Test Assertions
- Creation of Adapters
- Creation of Test Cases
- Execution of the Tests
- Reporting (Test Deliverables)

6.3.2.4Creation of Test Assertions

OASIS Test Assertions Specification[14] defines test assertions as follows:

"A test assertion is a testable or measurable expression for evaluating the adherence of an implementation (or part of it) to one or more normative statements in a specification".

Test assertions (TAs) state the testable logics of a system under test. e-SENS test assertion template is compatible with OASIS Test Assertions Guidelines.

The methodology is composed of steps that will be executed on Minder. For details, please see the e-SENS Test Assertion Guide[15].

1. For conformance testing, BB experts or providers of the inherited specification provide OASIS compliant test assertions based on the specifications or profiles of WP6 ABBs.
2. For interoperability testing: WP5 pilot domain experts determine the specific (non-generic) uses of the specification with respect to the target domain and generates OASIS compliant test assertions. These scenarios must include the interaction between the SBBs

Conformance test does not guarantee the interoperability of two systems and interoperability test cannot be a substitute to conformance testing. However, studies show that applying conformance tests at first reduces the cost and increases the successes of interoperability testing.[16] Therefore, it is recommended to conduct the conformance test for an SBB prior to interoperability testing.

6.3.2.5Creation of Adapters

When a WP5 pilot domain adopts an SBB, which has not been conformance tested yet, and if it cannot reuse an existing adapter (i.e. has a completely new/proprietary communication interface), then Pilot Domain Experts & Solution Providers (as in the role of Test Developer) must provide an adaptor implementation in order to be plugged into the conformance testing architecture. WP6 Conformance and Interoperability testing team provides all the necessary documentation to guide developers through the integration of SBBs to the conformance test environment. Moreover, the team may provide technical help for adapter development in terms of Minder connection.

6.3.2.6Creation of Test Cases

After creating TAs and adapters, test designers can write test cases on Minder. Test cases represent either the whole or a part of a test assertion predicate interpreted in the MTDL that can be run on a concrete target (SUT). TAs that are related to each other are grouped under a *Test Group* (the testAssertionSet in OASIS TAML[17]) .

[14] http://docs.oasis-open.org/tag/model/v1.0/testassertionsmodel-1.0.html
[15] https://www.jol.nrw.de/bscw/bscw.cgi/d6002637/Test%20Assertion%20Guidelines_v0.1.docx
[16] https://wiki.oasis-open.org/tab/TestingPolicy
[17] http://docs.oasis-open.org/tag/taml/v1.0/testassertionmarkuplanguage-1.0.html

6.3.2.7 Execution of the Tests

After the creation of test cases and mapping to actual SUTs, test cases are executed from the Minder management GUI. After each execution Minder creates logs and reports for that specific execution.

6.3.2.8 Reporting (Test Deliverables)

Test deliverables are the artifacts that are generated and given to the stakeholders participating in the conformance tests. (WP1/5/6 Leader, etc.) The deliverables can be listed as follows:

1. ***Test Execution/Summary Report:*** After test cases are executed on Minder, the results of the test cases are documented in a report. On the report, the details of the test assertion, test run status, the total result of the test, etc. information is included. The template of the report can be taken from "e-SENS common test report template[18]"
2. ***Test Results:*** Error and Execution Logs that are generated after executing test cases on Minder
3. ***Test Cases:*** Test cases that are derived from test assertions to be executed on Minder for compliance.

Test deliverables can be published by **WP6.A Deployment cluster** on Basecamp and/or BSCW server and can be classified as public or confidential. In case the document is classified as confidential, it will be a restricted publication.

6.3.2.9 Test Criteria

Test criteria include pass/fail, suspension and resumption criteria. The criteria are taken from OASIS TAM[19]

The completion criterion for conformance test iteration is the execution of the all test cases generated from test assertions in a test cycle. Test cases should cover all the test assertions and they should be in written in a sufficient level of detail. Test Assertions Guideline[20] should be referenced to write assertions.

Each test case execution can have two possible results: **Pass (***success***)** or **Fail**. Any additional warning will be logged in the report.

The overall ***PASS*** criterion for a test cycle is the *success* of all the ***mandatory*** test cases. The mandatory states of the test cases are derived from the *prescription level* field of the test assertions. There are three prescription levels defined in the OASIS TAM: i) mandatory, ii) permitted and iii) preferred. The *permitted* and *preferred* test assertions are considered as optional, and the **FAIL** state of their test cases cause the test cycle to ***PASS with warnings***.

6.3.2.10 Traceability

The conformance and interoperability activities produce results that need to be accessible to all the observers. In order to achieve a long-term sustainability of the test deliverables, an identification pattern for the test results is proposed.

[18] Reference will be provided when the reporting template study is finalized. Currently under construction

[19] http://docs.oasis-open.org/tag/model/v1.0/testassertionsmodel-1.0.html

[20] Reference to test assertions guideline.

Each test cycle takes test assertion details and SUT information (name, version) as an input. In order to achieve traceability for testing events, each testing activity must be labelled with the following identifiers:

- Test assertion set version
- Test assertion ID
- SUT/asset name and version
- Short result (success/fail)
- Report Reference
- Date

6.3.2.11 Testing Assurance Profiles

A testing assurance profile is the expression of the requirements to comply with the building block in order to work seamlessly within the context of pilots. The assurance profile of MSs piloting systems is determined with respect to the combination the tests that have been performed on those systems.

An assurance profile typically used as part of a regulation from a specific regulatory entity like eIDAS, who will only allow a specific type of Service to be used if it matches the assurance profile.

In this section four levels for grouping the assurance profiles (TAP #) for testing are defined. The high level assurance contains one profile (TAP 1) that includes all the three test types. The mid level assurance contains three profiles (TAP 2-4), where each profile is a pairwise combination of the three test types. In the basic level assurance, there are also three profiles (TAP 5-7), where each profile corresponds to one test type. It is crucial to note that all these types of testing are not substitutable but complementary to each other.

High Level Assurance

TAP 1: Conformance & Interoperability & End-to-End Testing

Mid Level Assurance

TAP 2: Conformance & Interoperability Testing

TAP 3: Interoperability & End-to-End Testing

TAP 4: Conformance & End-to-End Testing

Basic Level Assurance

TAP 5: Interoperability Testing

TAP 6: Conformance Testing

Low Level Assurance

TAP 7: End-to-End Testing

Testing Assurance of an implementation also affects the level of trust one has that the system correctly meets its functional specifications, and does not perform unintended functions that compromise its reliability. The relations and effects of the testing assurance is depicted in figure 36.

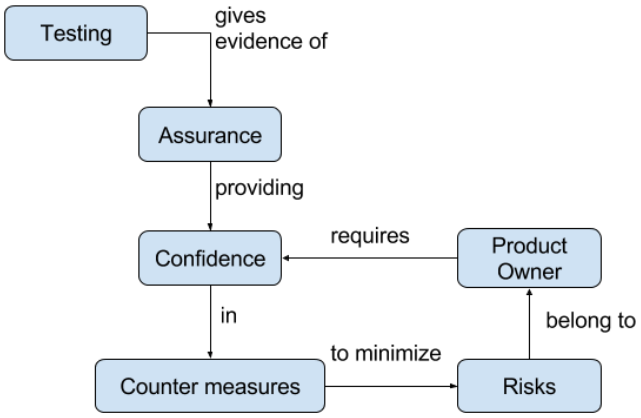


Figure 36: Testing Assurance Relations

6.3.3 Minder testbed

e-SENS Conformance and Interoperability tests will be performed on **Minder**, which is a generic online programmable flow control engine based on the Oasis Test Assertion Model. It provides a set of software architecture, platform, tools, supplementary testing assets and methodologies to facilitate and standardise the testing procedures in order to make the process reusable and sustainable.

Minder enables the interconnection of different systems under test (SUTs) in one node and performs complex communication operations on those interconnected systems. Programmers can create, group, edit and execute test cases implemented from test assertions and inspect and publish reports and logs about the results.

The main features of the Minder Testbed are listed below:

- Is compliant with the OASIS Test Assertion Model
- Allows Test Assertion grouping and coding in the form of Test Cases using MTDL (Minder Test Definition Language - based on SCALA). Multiple Test Cases For a Test Assertion are possible.
- Complex flow logic between Systems Under Test is based on the Riveting mechanism. Rivets consist of Signals arriving from SUT's and one target SLOT (going to an SUT).
- Allows observation and manipulation of messages that flow between systems
- Handles synchronous and asynchronous messaging
- Allows multiple users with three Roles: Test Designer, Test Developer, and Test Observer
- Contains built-in support for xml schema and schematron verification, and xpath
- Supports library resolution using maven dependencies
- Enables Test Result Logging and Reporting

The general architecture of the test environment is given in figure 37.

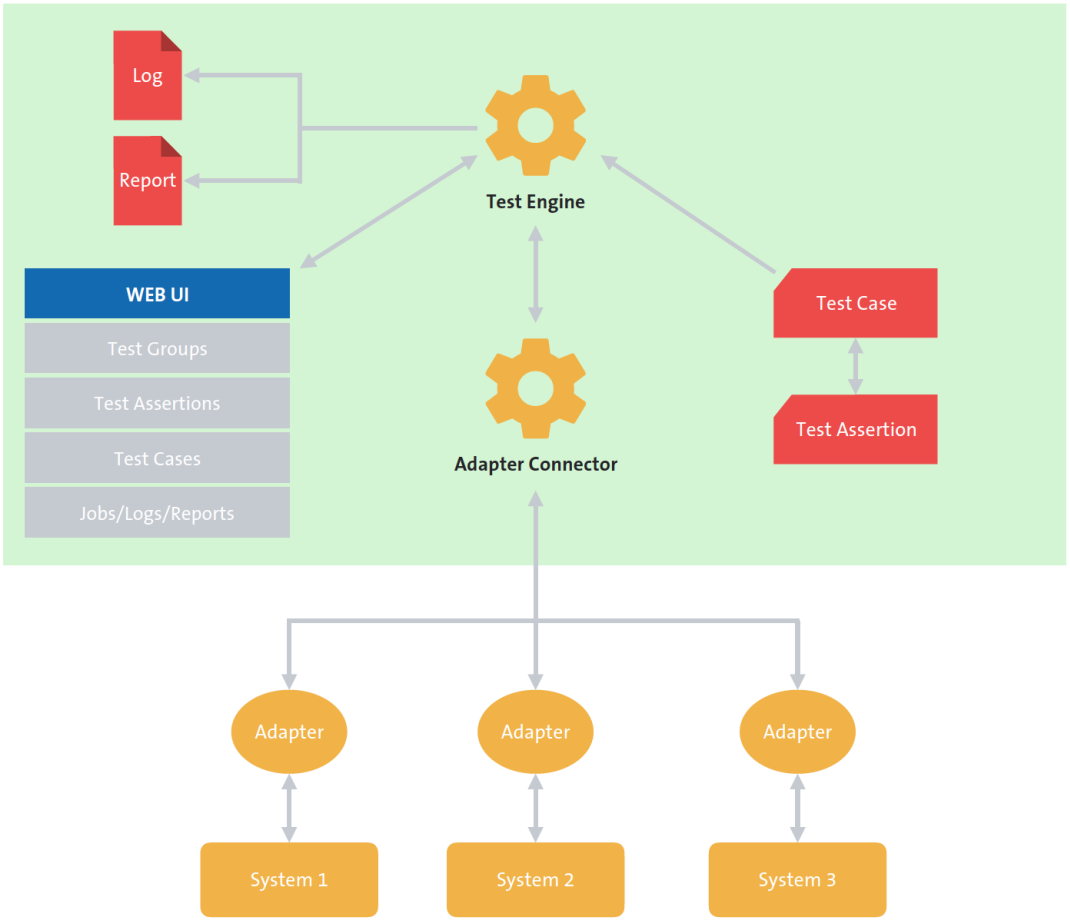


Figure 37: Minder Applied Architecture.

For more details please refer to "e-SENS Minder Test Engine Server Installation and Administration Guide"[21], "e-SENS Minder Test Developer API Guide"[22], "e-SENS Minder Test Designer Guide"[23].

6.3.4 e-SENS AS4 Conformance Testing Event – A Success Story

e-SENS Testing Methodology defines the steps of applying conformance and interoperability testing independent from the context of a specification. Each testing activity starts with creation of Test Assertions followed by, in order, creating adapters to connect an SUT to Minder Engine, writing test cases in MTDL, executing tests and gathering the reports. Therefore, the same process had been applied for e-SENS AS4 profile successfully. Also, e-SENS AS4 Conformance Tests have an important role to show how powerful engine and flexible test scripting language that Minder has. Because e-SENS AS4 profile includes a whole information flow from one gateway to another, requires document

[21] https://www.jol.nrw.de/bscw/bscw.cgi/d6623517/minder-setup_and_administration_guide-3.pdf

[22] Document Under Construction

[23] https://www.jol.nrw.de/bscw/bscw.cgi/d6623506/minder-test_designer_guide_v0.7.pdf

validation, signature validation, encryption and more for positive and negative scenarios. The section tells about this success story on performing all tests in detail.

In August 2015, e-SENS WP6, e-SENS WP5.1 and CEF e-Delivery team collaboratively initiated the study about the creation of e-SENS AS4 Conformance Test Assertions from e-SENS AS4 profile. After several cycles of reviews and many discussions, an OASIS Test Assertion compliant version, which includes 48 Test Assertions, has been released on 20th of August, 2015.

Afterwards, Minder team started to develop adapters between Minder and Domibus gateway developed in collaboration with e-SENS and e-CODEX projects. An adapter composed of two sides naming *Generic side* and *SUT specific side* (See 38). Generic side of an adaptor is responsible for connecting SUT to Minder and requires Minder expertise. Aside from SUTs that are only assets, a SUT, like an AS4 gateway, takes inputs and produce outputs. Hence, SUT specific side of an adapter need SUT experts who declare inputs/outputs and know communicating with the SUT.

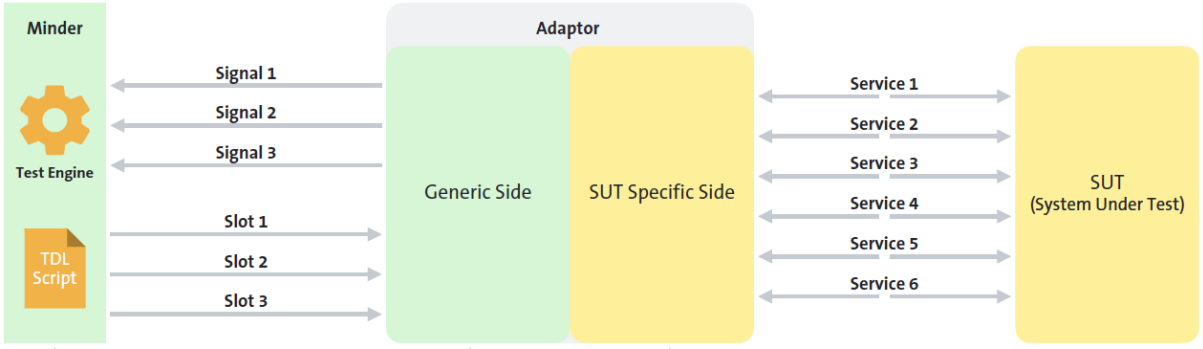


Figure 38: Connecting an SUT to Minder over an Adaptor

An AS4 gateway has a backend end-point, which is implementation specific and receives/sends documents from/to backend system and an AS4 end-point, which is implemented according to the e-SENS AS4 profile, sends/receives AS4 messages to/from other AS4 gateway. For this reason, two adaptors needed to connect AS4 gateway to Minder: Backend Adaptor, which is implementation specific; AS4 Adaptor, which is common for all e-SENS AS4 profile implementations (See 39).

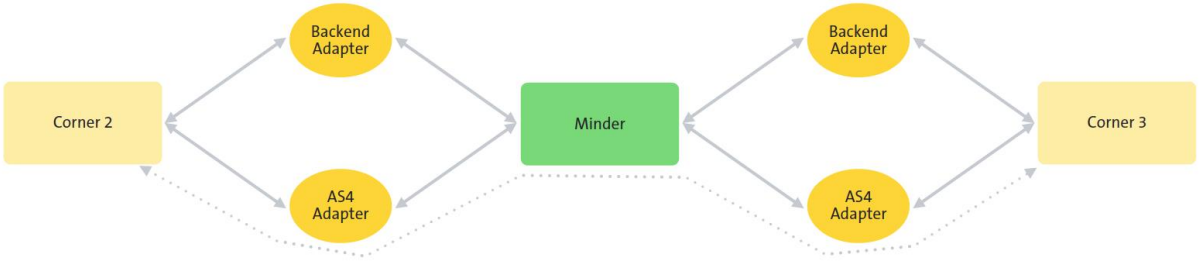


Figure 39: Connecting an e-SENS AS4 gateway to Minder over Backend Adaptor and AS4 Adaptor.

Corner 2 and Corner 3 implies an e-SENS AS4 Gateway implementation. For Conformance Testing, both Corner 2 and Corner 3 are the same AS4 implementation; whereas for Interoperability Testing Corner 2 and Corner 3 are two different AS4 implementations.

After finalising the developments of adaptors, Minder team wrote test case scripts in Minder Test Definition Language (MTDL) according to the e-SENS AS4 Test Assertions using Minder Web interface. In addition, Minder team deployed two Domibus AS4 GW instances as Corner 2 and Corner 3; connected them to the Adapters, and ran test scripts for Domibus implementation. The first conformance test results was generated for Domibus and it was also a proof to show the abilities of Minder.

In July 2015, an internal discussion had been started on developing more generic AS4 adaptors for upcoming vendors, in order not to code implementation specific Backend Adaptors which may take one or two weeks. Since all gateway implementations are common to understand an AS4 message, just for testing, implementations would communicate with a backend system over AS4 too. According to this idea, each implementation would need to configure a pre-defined pMode and a shell script that is used for receiving backend messages in AS4 format from AS4 end-point, converting this AS4 message to implementation specific backend message and forwarding to the backend end-point of the implementation. As a result, an intermediary product called Kerkovi was implemented by Minder team as an e-SENS generic AS4 Conformance and Interoperability Bridge that achieves connectivity between Minder and vendor's AS4 implementations in a very simple manner (See figure 40)

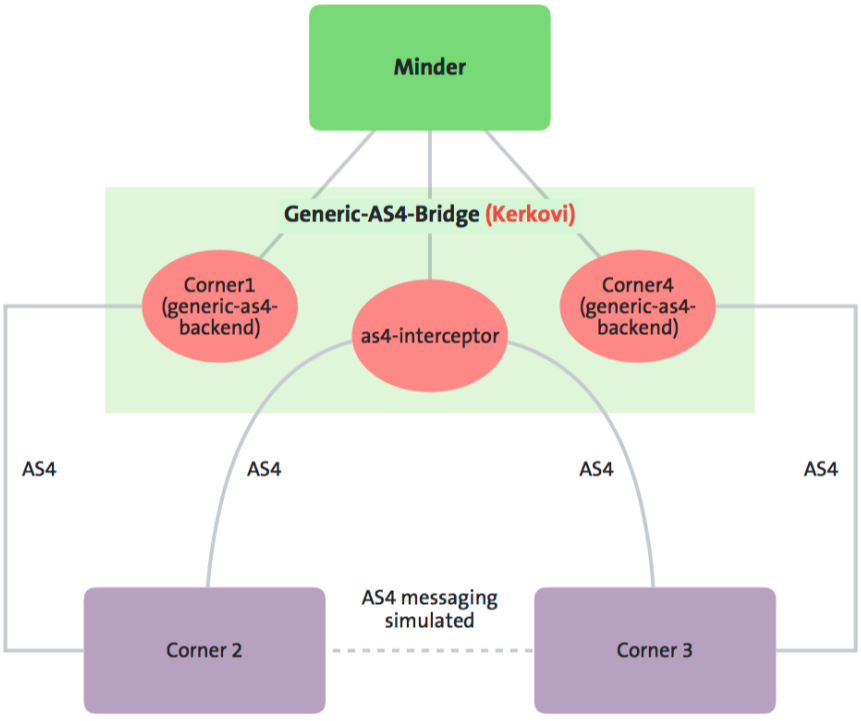


Figure 40: Connectivity between Minder and an AS4 implementation using Kerkovi

Kerkovi consists of three adapters; two generic national backend simulators and one AS4 interceptor. The backend adapters are capable of sending AS4 messages as backend submission messages to the AS4 gateways. They can also receive delivery, submission result and notification messages. Kerkovi is responsible for tracking the addresses of the gateways with respect to the party ID's and perform forwarding of messages with respect to the addresses it resolves from the party ID's. In this way,

Kerkovi removes the adaptor development effort on implementation specific backend adapters for each new implementation. As a result, an AS4 implementation can be easily connected to Minder just by i) configuring pMode according to the pre-determined pModes definitions and ii) writing a shell script that receives backend messages from AS4 end-point of the implementation as an AS4 message, convert this AS4 message to implementation specific backend message and forwards to backend end-point of the implementation. Once an AS4 implementation is connected to Minder using Kerkovi, both conformance and interoperability testing activities are handled easily and automatically using Minder. Detailed information can be found in Kerkovi web site[24].

After the completion of the AS4 Conformance Tests of Domibus in August 2015, e-SENS made the first call for e-SENS AS4 conformance testing in December 2015. Two external vendors applied with their products, namely "Holodeck B2B AS4 GW" and "Flame Message Server".

Conformance testing was successfully completed for these vendors in Minder, while the conformance testing of the "IBM Advanced Communication Gateway" product of the project partner IBM is still in progress. For this BB, Interoperability Test Assertions have been created for the most common usages of the e-SENS AS4 specification by BB experts and applied for the aforementioned products of vendors. The future cycles of conformance and interoperability testing are going to be applied in Minder and managed by CEF.

6.4 Next steps

Continued Deployment support for pilots:

- Support in Domain profiling the generic BBs
- Support in configuring the architectures
- Retrieve learnings from Pilots
- LCM of Building Blocks
- For transfer of ownership and operations, Integrate and handover LCM processes

Continued Conformance- and Interoperability testing:

- Conformance- and interoperability testing of Pilot implemented Building Blocks
- Offer conformance testing of CEF DSI e-Delivery to external implementers of e-Delivery incl. vendors.
- Finalize testing strategies

[24] https://mindertestbed.org:15000

7 Alignment and cooperation with EC initiatives

7.1 STORK2.0

STORK 2.0 ended in September 2015 and key artifacts was transferred to e-SENS for Life Cycle Management. A gap between CEF eID and STORK 2.0 Building Blocks is handled in cooperation with WP5, by developing a software bridge between implementations of STORK 2.0 PEPS and CEF eIDAS Nodes. WP6 will support CEF in testing the eIDAS nodes and the planning of migration of implemented STORK 2.0 PEPS to CEF eIDAS nodes.

7.2 ISA - European Interoperability Reference Architecture

The European Interoperability Reference Architecture (EIRA) is a four-view reference architecture for delivering digital public services (across borders and sectors).

It defines the required capabilities for promoting interoperability as a set of **Architecture Building Blocks (ABBs)**.

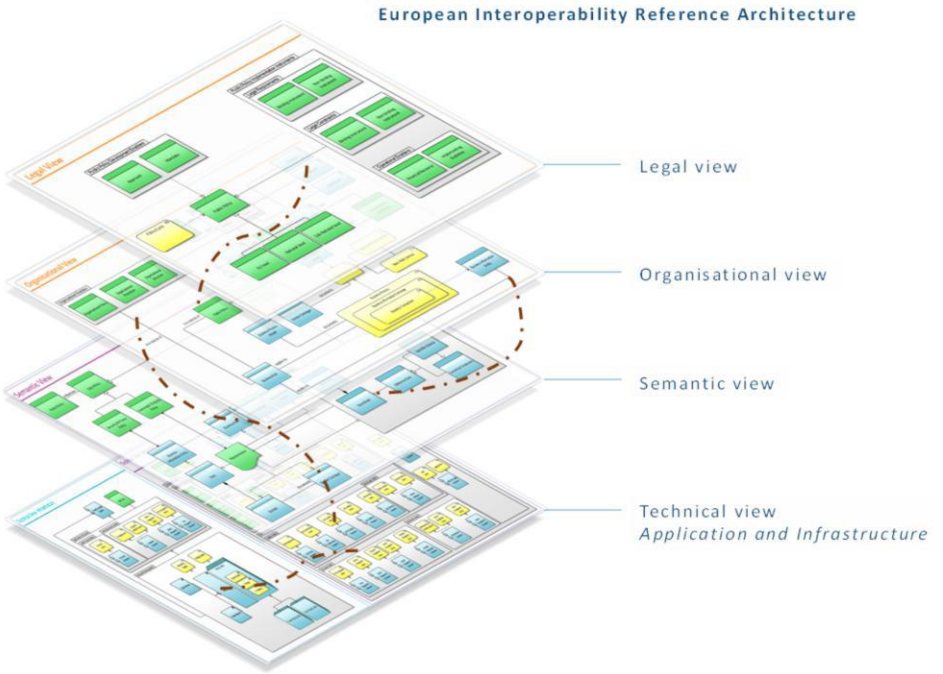


Figure 41: EIRA Views

A **Solution Architecture Template (SAT)** is a specification containing a sub-set of ABBs of the EIRA. It focuses on the most salient building blocks needed to build an interoperable solution addressing a particular interoperability need. A SAT consists of (Source: ISA EIRA – e-SENS WP6 pilot kick-off meeting on the 7.1.2015):

- A goal and description,
- A set of EIRA ABBs,
- A set of requirements & recommendations (linked to ABBs).

The ambition of e-SENS WP6 is to be fully compliant with the ISA EIRA. With the kick-off of ISA Action 2.1: European Interoperability Architecture, it is possible to align the work in WP6 and the ISA EIA project.

The following are issues, concerning the cooperation with ISA EIA project, which can influence on WP6 work:

- Alignment of definitions of artifacts e.g. ABB, SBB, SAT – this needs further analysis before adapting to the ISA EIRA vocabulary. In this Deliverable, the e-SENS definitions of SAT, ABB and SBBs are used.
- The current Cartography Tool (repository) for the description of artifacts is not publicly accessible, and the ISA EIA project is analysing licensing issues and other possibilities - for this Deliverable, a simple tool of WIKI technology has been chosen. The e-SENS EIRA will move its content into the ISA Cartography Tool, when the issues have been resolved in the ISA EIA project.

The ISA EIA project can be followed on JoinUp: https://joinup.ec.europa.eu/asset/eia/description

7.2.1 Compatible and Complementary Views

The following view is an excerpt of the model representing the most important elements of the ISA-EIRA, as well as their relations (version 0.9.0_beta)

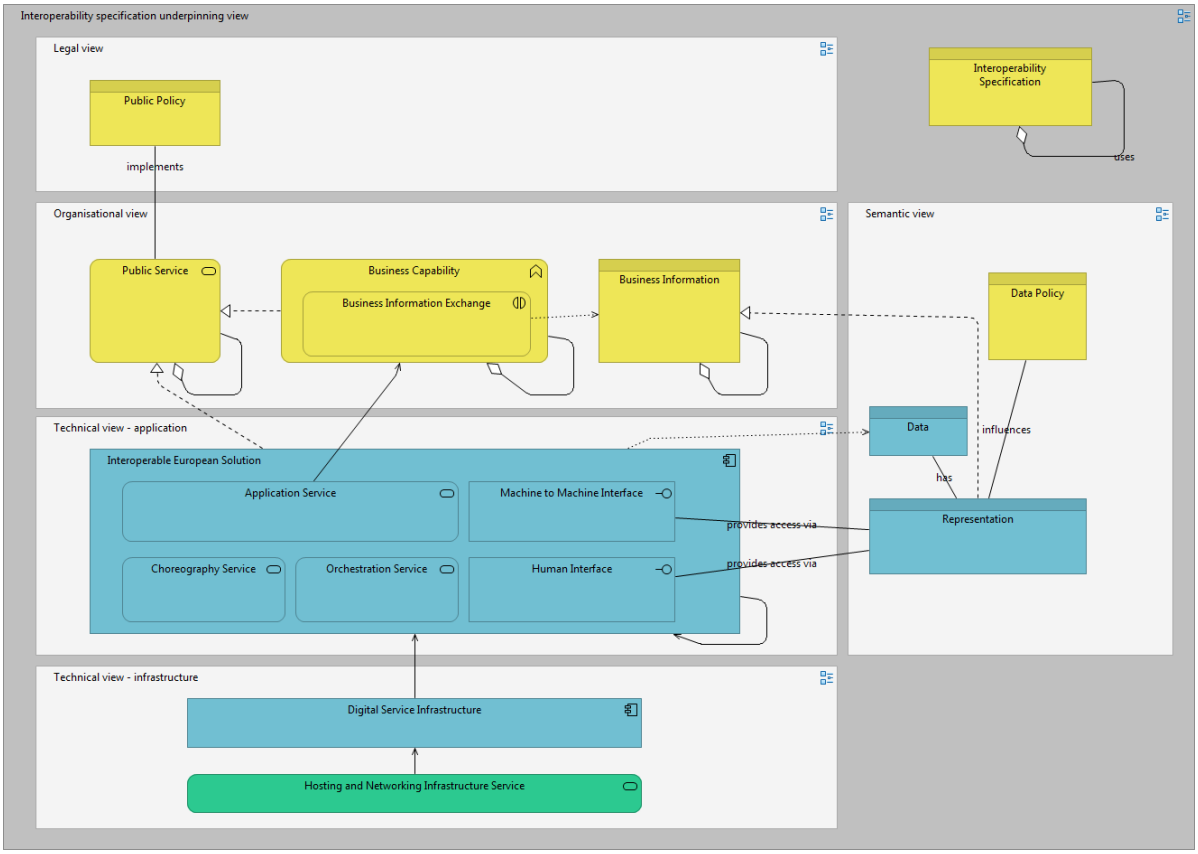


Figure 42: EIRA Main Abstractions

The ISA-EIRA main abstraction is the Interoperable European System (IES): an IES is an application component (i.e. a modular, deployable and replaceable part of a software system). The IES realizes

Public Services by providing application services, which are used to realize the Business Capabilities required by the Public Service. The IES is supported by the Digital Service Infrastructure (DSI).

The ISA-EIRA identifies a set of components that any interoperable European system should/could contain: it targets software systems that directly realize public services. The scope of e-SENS is not to provide actual solutions, but building blocks that can be assembled to design IES.

An e-SENS Building Block, although very technical in nature, is modelled from different viewpoints (as defined in ISO/IEC 42010) according to the concepts defined in the metamodel. From that perspective, there is a **strong alignment** between e-SENS and ISA-EIRA. However, the goals of the e-SENS Architecture and of the ISA-EIRA are different (although they complement each other): while ISA-EIRA concentrates on how the building blocks are used, e-SENS targets the architecture specifications of the building blocks. The views on the building blocks are therefore different: ISA-EIRA considers the **external interface** (provided services) of the building blocks, while e-SENS considers the **internal specifications** of the building blocks. These two complementary views on the same object (building block) can be integrated, so that it is easily possible to switch from one view to another.

7.2.2 Conceptual alignment

A conceptual alignment has been realised according to the metamodel integration approach proposed by Zivkovic, and the resulting concept mapping can be found below:

From: e-SENS Construct	e-SENS ArchiMate Type	To: EIRA Construct	EIRA ArchiMate Type	Mapping
eService	Business Service	Public Service	Business Service	Equivalence
Capability	Business Function	Business Capability	Business Function	Equivalence
Domain Information	Business Object	Business Information Entity	Business Object	Equivalence
Generic Requirement	Requirement			Extension
Feature	Application Function			Extension
Technical Specification	Constraint	Technical Specification	Business Object	Association
Component	Application Component	IES	Application Component	Equivalence
Domain Data	Data Object	Data	Data Object	Equivalence

Table 25: Mapping e-SENS to EIRA

The mapping is graphically represented below:

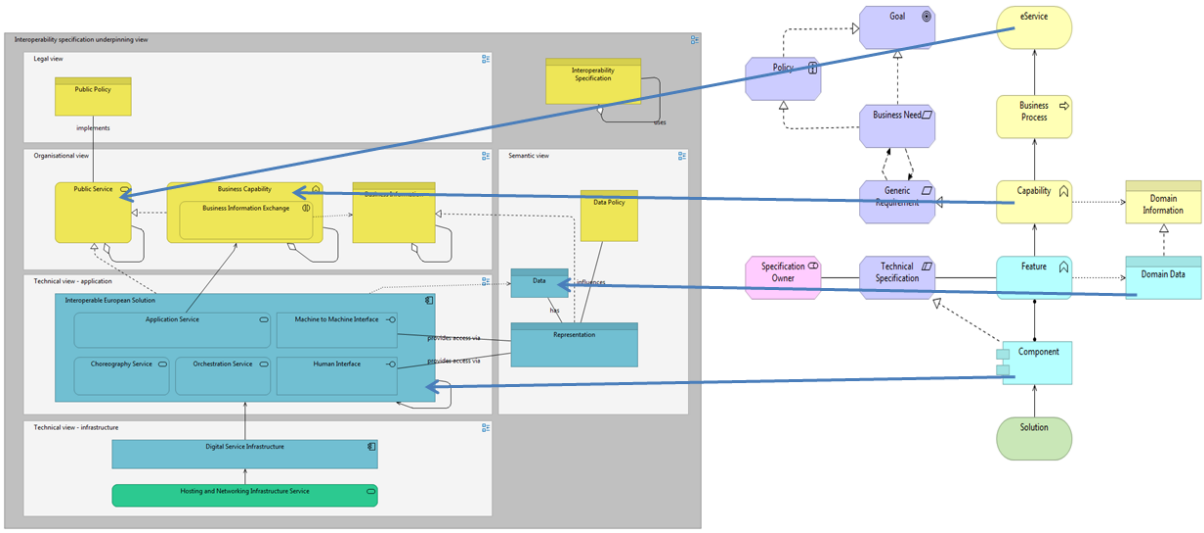
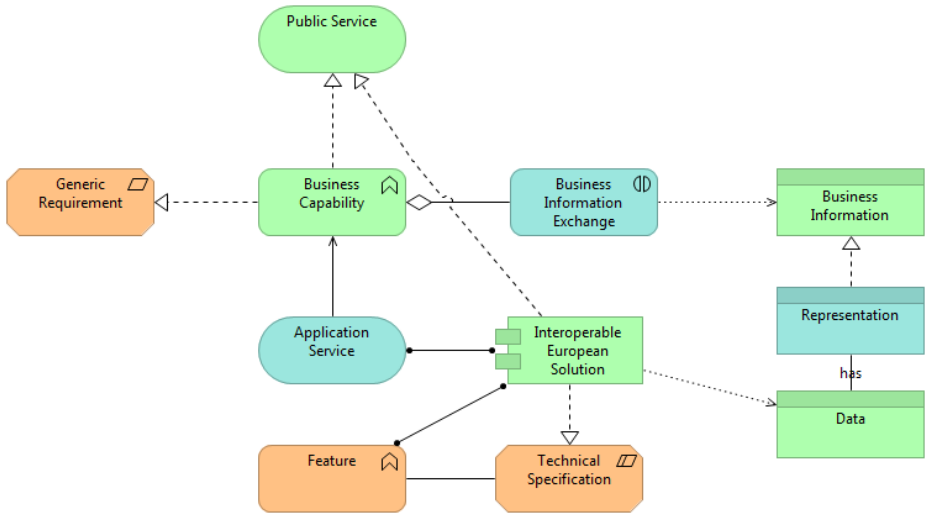


Figure 43: Mapping e-SENS to EIRA

The integrated model clearly shows that the e-SENS metamodel complements the ISA EIRA with additional information concerned with the design aspects of the component: the requirements, the features and the associated specifications.



Green: Shared concept
Blue: only in ISA EIRA
Orange: only in e-SENS

Figure 44: Mapping e-SENS to EIRA

7.2.3 e-SENS EIRA as ISA EIRA Pilot

From 7.1.2015 e-SENS WP6 has piloted the ISA EIRA with the following objectives:

Demonstrate that the usage of the EIRA and/or Cartography Tool provides value

- The benefit(s) of the use case is documented and understood;
- The outcome is in line with the expected benefit(s) of the use case;

- The pilot participant's perception of the EIRA's and/or Cartography Tool's value during the pilot.
- The pilot participant's perception of the EIRA's and/or Cartography Tool's value beyond the pilot.

Test EIRA and/or Cartography Tool use cases

- The use case documentation (including its expected result) is available and, if needed, updated with the gained insight from the pilot;
- A pilot participant was able to execute the different use case steps:
    - Each use case step is documented and understood;
    - Sufficient resources, tools and support were provided to apply the use case;
    - Each use case step was performed;
- The outcome is in line with the expected use case result.
- All feedback with regard to the usability, enhancement or non-existence of the applied uses case, the EIRA and the CarTool has been captured and, if applicable, managed as change requests.

Further contribute to the enhancement of the EIRA and Cartography Tool based on the pilot experiences

- The importance of the feedback on the EIRA and CarTool is understood;
- All desired changes or features to the EIRA and CarTool are captured and managed as change requests;
- All feedback is processed and, if applicable, all necessary change requests are initiated and managed

Current outcome has been:

- Documented e-SENS e-Delivery in the CarTool
- Documented e-SENS e-Document in the CarTool
- Documented e-SENS e-Invoicing in the CarTool
- Documented e-SENS e-Signature in the CarTool
- Documented e-SENS e-ID in the CarTool
- Good understanding of the meta data associated with the ISA EIRA Architecture Building Blocks
- Input to further work on incorporating ISA EIRA meta data attributes into e-SENS EIRA
- Feedback to ISA EIA project on findings in using the CarTool and its content
- Alignment of e-SENS EIRA Metamodel with the ISA EIRA

7.3 ISA – Testing

ISA Interoperability Test Bed action selected Minder as the first TestBed to be piloted for GITB compliance and sent e-SENS an assessment of GITB service compliance of Minder. TUBITAK developed GITB service compliant services, which are not coded directly in Minder code, instead, opened as services through an intermediary adaptor called Minder GITB Bridge. This adaptor includes a "Content Validation Service" which exposes the schema/schematron abilities of Minder, a "Messaging Service" which provides network application layer service interfaces and a "TestBed Service" which is supported by Minder Bridge as SOAP services. Minder GITB Compliance study has been recently finalized and put on Join-Up and should be validated by ISA.

7.4 CEF

An in-depth description of CEF can be found at: http://ec.europa.eu/digital-agenda/en/connecting-europe-facility.

A more specific description in the context of e-SENS WP6 cooperation i.e. collaboration community in the area of reusable building blocks provided by the Connecting Europe Facility (CEF), can be found at https://joinup.ec.europa.eu/community/cef/home .

Throughout the 2nd half of 2014, WP6 has participated in a series of meetings organized by CEF in order to find a common ground for cooperation. WP6 has, together with other external stakeholders, presented and discussed e-Delivery, e-Signature and e-ID with CEF. This has resulted in a close cooperation with CEF Architecture Management with biweekly net meetings.

The first task in the cooperation has been to make a gap analysis on Building Blocks between CEF Architecture Management and e-SENS WP6. This gap analysis is the foundation for future prioritization and direction on work on the Building Blocks. This deliverable plays an important role in the gap analysis and has been used to get a clear picture on cooperation on BBs between CEF Architecture Management and e-SENS WP6. Closing the gaps might induce either changes in the e-SENS Repository (to align with CEF), or a change on the CEF plans. The changes in e-SENS are managed through the Change Management Process, and the EIRA Release Management Process.

The continuous gap analysis is logged on a collaborative environment hosted by the EC.

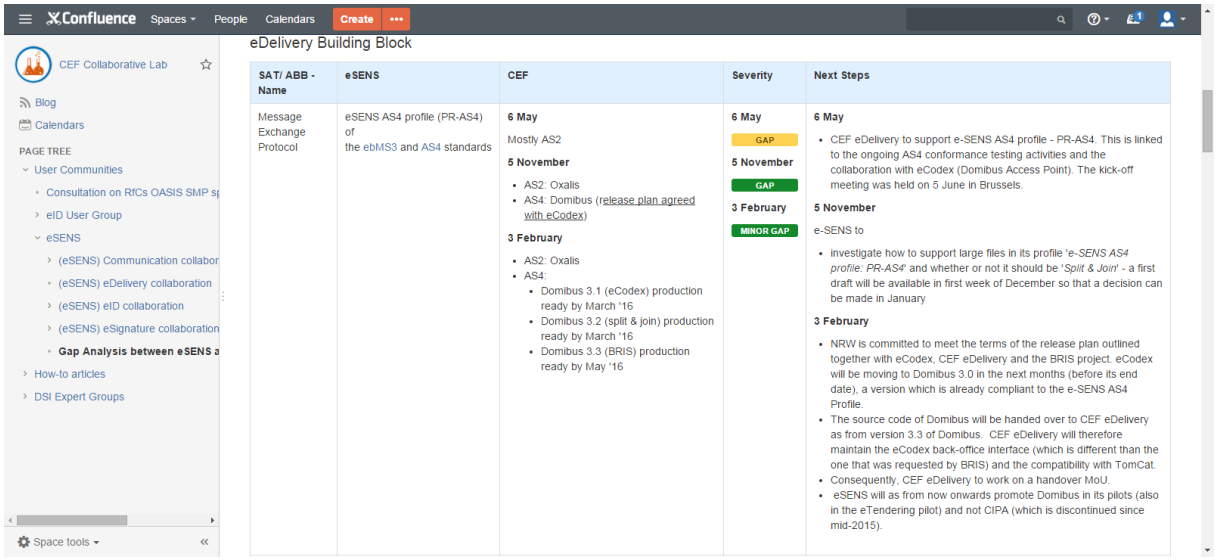


Figure 45: CEF Gap Analysis (illustration)

The second task has been to make a gap analysis on the activities carried by CEF Architecture management and e-SENS WP6. CEF has a list of Activities, classified into Disciplines, which they need to prioritize:

DISCIPLINE	ACTIVITY
PROMOTE Alignment	Develop and promote the adoption of common DSI principles (aligned with the EIF)
	Develop and maintain a common vocabulary for all DSIs to use
	Guide DSIs in the alignment of policy objectives, legal constraints and technology choices
	Together with architects of Member States, create and evolve an overall CEF target architecture based on the CEF building blocks (taking into account the eSENS architecture based on the EIRA project of ISA)
STIMULATE Synergies	Continuously create DSI blueprints in a common modelling language such as Archimate 2.1
	Develop and maintain a publicly available 'CEF reuse registry'
	Continuously develop best practices based on the experience of the DSIs and Member States
	Help identify further opportunities for the building blocks to spread across the EU
DRIVE Interoperability through Standardisation	Maintain a DSI standards database
	Maintain a catalogue of CEF building blocks and put standards and specifications at its core
	Continuously promote collaboration between DSIs, Standards developing organizations (SDOs) and the 'European Multi Stakeholder Platform on ICT Standardisation'
	Help resolve issues where interoperability/ standards conflicts arise amongst DSIs
	Monitor the market's adoption of standards used by the DSIs and support their promotion

Figure 46: CEF Disciplines and Activities

Currently this is work in progress with a close cooperation and coordination with CEF that makes synergies in the different activity areas.

7.5 CEF e-Delivery

In December 2015, e-SENS made the first call for e-SENS AS4 conformance testing; and during January 2016, e-SENS AS4 profile conformance tests were performed for the applicant vendors' implementations "Holodeck B2B AS4 GW", "Flame Message Server" and "Domibus" successfully in Minder. After a successful Conformance Testing event using Minder, CEF programme selected Minder as the TestBed for e-Delivery DSI and WP6.A Conformance and Interoperability Task Force received an assessment that includes 8 change requests on Minder. WP6.A Conformance and Interoperability Task Force planned to apply and release these changes in two versions. The first release has been issued at the end of the March 2016 by TUBITAK and the second one is planned to be issued at the end of 2016. Moreover, Minder is planned to be used for automated e-SENS AS4 profile interoperability tests in the near future against e-SENS AS4 Interoperability Test Assertions between all applicant implementations.

Recently, CEF e-Delivery team started to create e-SENS SMP profile Conformance Test Assertions and, in parallel, to write the related test case scripts in Minder with the guidance of TUBITAK. After finalizing

these studies, CEF e-Delivery team will use Minder to perform conformance and interoperability tests of all e-SENS e-Delivery BBs on applied public and/or private vendor's products.

7.6 CEF eID

After the recent release of the eIDAS technical specification on eID, WP6.A Conformance and Interoperability Task Force worked with the CEF eID team in order to collaborate on the eIDAS node tests. More specifically, WP6.A Conformance and Interoperability Task Force analysed the CEF eID Test tool, the eIDAS Node Validator, and gave feedback on its possible improvement areas and drawbacks. A lot of fruitful discussions have been made during the F2F meeting that was held in Brussels. It was pointed out that, even though negative test cases are covered in the test assertions, they are not present in the eIDAS Node.

WP6.A has raised the need for the creation of testing assurance profiles which define the extent to which an implementation complies with the building block specifications in order to work seamlessly within the context of pilots. Then WP6.A initiated Testing Assurance Profiles document around this idea collaboratively with CEF eID team. After a couple of reviews and exchanges of comments between CEF and the WP6.A, the first version of the document has been finalized. The organisational and operational aspects of testing assurance profiles are currently in progress.

Conclusion

This deliverable has provided a structured overview of SATs, Specification Profiles, ABBs and SBBs provided by e-SENS WP6 for WP5 Pilots. This was done by creating a (EIRA) repository that supports the availability of the different Building Blocks and Artifacts.

The objective of this deliverable has been formed by its creation and alignment with other WPs (see chapter 1). This, in turn, will impact on the future direction and the next (4th iteration) of this e-SENS EIRA deliverable.

The objective of the 4th iteration of the e-SENS EIRA (Deliverable 6.7 (M48)) will be to:

- Use experiences from the pilots to finalize a coherent ICT architecture to be ready for Transition into full scale production.
- Support e-SENS Pilots in Implementation, Test and Deployment.
- Support other LSP Pilots e.g. STORK 2.0 in Deployment (Life Cycle Management).

Annex I – Contributors

Deliverable 6.3

Name	Surname	Organisation	Country	Report	eInteraction	eDelivery	Addressing of End Entities	Message exchange protocol	Capability Lookup	Location Lookup	Backend Integration	End-to-End Services	eDocument	Document Profiling	Document Provisioning	Processes	Semantics	Semantic Mapping Services	Terminology Server
Elif	Üstündağ Soykan	TUBITAK	Turkey	■				■				■							
Edona	Fassllija	TUBITAK	Turkey	■				■											
Burcin	Bozkurt	TUBITAK	Turkey	■									■	■	■	■			
Vural	Celik	TUBITAK	Turkey	■															
Muhammet	Yildiz	TUBITAK	Turkey	■	■	■	■	■	■	■	■	■							
Melis	Cetinkaya	TUBITAK	Turkey	■	■	■	■	■	■	■	■	■							
Cagatay	Karabat	TUBITAK	Turkey	■															
Oktay	Adalier	TUBITAK	Turkey																
Borka Jerman	Blazic	Ljubljana University	Slovenia																
Carmen	Rotuna	ICI Bucharest	Romania		■	■	■	■					■	■	■				
Radu	Boncea	ICI Bucharest	Romania										■						
Rui	Maia	INOV	Portugal	■															
Tomasz	Dębicki	ILIM	Poland													■	■		
Tomasz	Kawecki	ILiM	Poland	■									■	■			■	■	
Giovanni Paolo	Sellitto	ANAC - AVCP	Italy														■	■	■
Andrea	Atzeni	IT-Polito	Italy																
Antonio	Lioy	IT-Polito	Italy																
Stephanie	Brichant	Escher group	Ireland		■	■					■								
Damien	Magoni	Escher group	Ireland		■	■					■								
Cristian	Olariu	Escher Group	Ireland		■	■					■								
Jerry	Dimitriou	UPRC	Greece	■															
Panagiotis	Nicolaou	UPRC	Greece										■	■	■				
Heiko	Vainsalu	EISA	Estonia		■	■													
Margus	Värton	EISA	Estonia		■	■													
Riin	Saermae	EISA	Estonia		■	■													
Mads	Hjorth	SSI	Denmark														■	■	■
Sören	Bittens	Fraunhofer	Germany		■	■						■							
Jörg	Apitzsch	Governikus GmbH	Germany		■	■						■							
Torsten	Niedzwetski	JM NRW	Germany		■	■						■							
Iva	Milutinovic	JM NRW	Germany		■	■	■	■	■	■									
Pim	Van der Eijk	JM NRW	Germany		■	■	■	■	■	■		■							
Thomas	Zefferer	ARGE e-SENS.AT	Austria																
Bojan	Suzic	ARGE e-SENS.AT	Austria																
Herbert	Leitold	ARGE e-SENS.AT	Austria																
Masi	Massimiliano	Tiani Spirit GmbH	Austria		■							■							
Klaus Vilstrup	Pedersen	DIFI	Norway	■	■	■			■										
Contribution																			
Review																			

Name	Surname	Organisation	Country	eSignature	Signature-Creation	Signature-Verification	EU e-signature standards framework	Mobile eSignature	eID	eID-Mobile	eID-SAML	eID-QAA	Mobile eID	Attribut provider	Attribute Provider - Format	Attribute Provider - Protocol	Tracebility	Auditing and Logging	Timestamping	Trust Services	Trust Network - MRC	Trust Network - PKI	Trust Network - Trust List	Web Service Trust Model
Elif	Üstündağ Soykan	TUBITAK	Turkey																					
Edona	Fassllija	TUBITAK	Turkey																					
Burcin	Bozkurt	TUBITAK	Turkey																					
Vural	Celik	TUBITAK	Turkey																					
Muhammet	Yildiz	TUBITAK	Turkey																					
Melis	Cetinkaya	TUBITAK	Turkey																					
Cagatay	Karabat	TUBITAK	Turkey																					
Oktay	Adalier	TUBITAK	Turkey																					
Borka Jerman	Blazic	Ljubljana University	Slovenia																					
Carmen	Rotuna	ICI Bucharest	Romania																					
Radu	Boncea	ICI Bucharest	Romania																					
Rui	Maia	INOV	Portugal																					
Tomasz	Dębicki	ILIM	Poland																					
Tomasz	Kawecki	ILiM	Poland																					
Giovanni Paolo	Sellitto	ANAC - AVCP	Italy																					
Andrea	Atzeni	IT-Polito	Italy																					
Antonio	Lioy	IT-Polito	Italy																					
Stephanie	Brichant	Escher group	Ireland																					
Damien	Magoni	Escher group	Ireland																					
Cristian	Olariu	Escher Group	Ireland																					
Jerry	Dimitriou	UPRC	Greece																					
Panagiotis	Nicolaou	UPRC	Greece																					
Heiko	Vainsalu	EISA	Estonia																					
Margus	Värton	EISA	Estonia																					
Riin	Saermae	EISA	Estonia																					
Mads	Hjorth	SSI	Denmark																					
Sören	Bittens	Fraunhofer	Germany																					
Jörg	Apitzsch	Governikus GmbH	Germany																					
Torsten	Niedzwetski	JM NRW	Germany																					
Iva	Milutinovic	JM NRW	Germany																					
Pim	Van der Eijk	JM NRW	Germany																					
Thomas	Zefferer	ARGE e-SENS.AT	Austria																					
Bojan	Suzic	ARGE e-SENS.AT	Austria																					
Herbert	Leitold	ARGE e-SENS.AT	Austria																					
Masi	Massimiliano	Tiani Spirit GmbH	Austria																					
Klaus Vilstrup	Pedersen	DIFI	Norway																					
Contribution																								
Review																								

Name	Surname	Organisation	Country	Report	Architecture	eDelivery	Addressing of End Entities	Message Exchange	Capability Lookup	Service Location	Backend Integration	eDocument	Document Provisioning	Document Business Envelope	Document Container	Processes	Business Process Methodology	Business Rules Definition Methodology	Semantics	Semantic Mapping Service	Terminology Service	eSignature	Signature Creation	Signature Validation	eSignature/eID Mobile
Elif	Üstündağ Soykan	TUBITAK	Turkey	C																					
Burcin	Bozkurt	TUBITAK	Turkey	C								C	P	P	C	C	C	C							
Muhammet	Yildiz	TUBITAK	Turkey	C		C		C	C	C	C														
Melis	Cetinkaya	TUBITAK	Turkey	C		C	C	C	C	C	C														
Cagatay	Karabat	TUBITAK	Turkey	C																		C	C	C	C
Oktay	Adalier	TUBITAK	Turkey	C																		P	P	P	P
Carmen	Rotuna	ICI Bucharest	Romania					C				C	P	C	P										
Radu	Boncea	ICI Bucharest	Romania									C	C	C	C	C	C	C							
Rui	Maia	INOV	Portugal		C																				
Tomasz	Kawecki	ILiM	Poland													C	C	C	C	C	C				
Giovanni Paolo	Sellitto	ANAC - AVCP	Italy																C	C	C				
Andrea	Atzeni	IT-Polito	Italy																						
Antonio	Lioy	IT-Polito	Italy																						
Jerry	Dimitriou	UPRC	Greece								C								C	C	C				
Panagiotis	Nicolaou	UPRC	Greece									C	C	P	P										
Yiannis	Salmatzidis	AUTH	Greece																						
Ioannis	Rekanos	AUTH	Greece																						
Ioannis	Pangalos	AUTH	Greece																						
Athanasios	Migdalas	AUTH	Greece																						
Achilleas	Papoutsis	AUTH	Greece																						
Sören	Bittens	Fraunhofer	Germany																						
Olaf	Rode	Fraunhofer	Germany																						
Jörg	Apitzsch	Governikus GmbH	Germany																						
Iva	Milutinovic	JM NRW	Germany			C	C	C	C	C	C														
Pim	Van der Eijk	JM NRW	Germany			C	C	C	C	C	C														
Thomas	Zefferer	ARGE e-SENS.AT	Austria																						C
Bojan	Suzic	ARGE e-SENS.AT	Austria																						C
Herbert	Leitold	ARGE e-SENS.AT	Austria																						C
Johannes	Feichtner	ARGE e-SENS.AT	Austria																						C
Sandra	Kreuzhuber	ARGE e-SENS.AT	Austria																						C
Alexander	Marsalek	ARGE e-SENS.AT	Austria																						C
Masi	Massimiliano	Tiani Spirit GmbH	Austria																						
Francois Xavier	Fontaine	LIST	Luxembourg	C	C	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Eric	Grandry	LIST	Luxembourg	C	C	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Klaus Vilstrup	Pedersen	DIFI	Norway	C	C	P	P	P	P	P	P	P	P	P	P	C	C	C	P	P	P	P	P	P	P

Contribution
Participation

Name	Surname	Organisation	Country	eID	Authentication Exchange Protocol	Quality Authentication	Authentication Exchange Forward	FutureId	Attribut provider	Attribute Exchange Protocol	Attribute Exchange Forward	Traceability and Non-Repudiation	Timestamping	Evidence Emitter	Trust Establishment	Trust Network - Mutual recognized Certificates	Trust Network - PKI	Trust Network - Trust service Status List	Web Service Trust Model	Conformance and Interoperability Testing	Conformance and Interoperability Testbed	Content Validation Provider	Test Asset Classification and Registry	Test Assertion Provisioning
Elif	Üstündağ Soykan	TUBITAK	Turkey																					
Burcin	Bozkurt	TUBITAK	Turkey																					
Muhammet	Yildiz	TUBITAK	Turkey																					
Melis	Cetinkaya	TUBITAK	Turkey																					
Cagatay	Karabat	TUBITAK	Turkey																					
Oktay	Adalier	TUBITAK	Turkey																					
Carmen	Rotuna	ICI Bucharest	Romania																					
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Giovanni Paolo	Sellitto	ANAC - AVCP	Italy																					
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Panagiotis	Nicolaou	UPRC	Greece																					
Yiannis	Salmatzidis	AUTH	Greece																					
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Ioannis	Pangalos	AUTH	Greece																					
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Sören	Bittens	Fraunhofer	Germany																					
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Francois Xavier	Fontaine	LIST	Luxembourg																					
Eric	Grandry	LIST	Luxembourg																					
Klaus Vilstrup	Pedersen	DIFI	Norway																					

Contribution
Participation

Name	Surname	Organisation	Country	Report	eInteraction	eDelivery	Addressing of End Entities	Message exchange protocol	Capability Lookup	Location Lookup	Backend Integration	End-to-End Services	eDocument	Document Profiling	Document Provisioning	Processes	Semantics	Semantic Mapping Services	Terminology Server
Elif	Üstündağ Soykan	TUBITAK	Turkey																
Edona	Fassllija	TUBITAK	Turkey																
Burcin	Bozkurt	TUBITAK	Turkey																
Vural	Celik	TUBITAK	Turkey																
Muhammet	Yildiz	TUBITAK	Turkey																
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Masi	Massimiliano	Tiani Spirit GmbH	Austria																
Klaus Vilstrup	Pedersen	DIFI	Norway																
Contribution																			
Review																			

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Klaus Vilstrup	Pedersen	DIFI	Norway																					
Contribution																								
Review																								