



EIRA Support Series.

How does the EIRA support interoperability?

EIRA

**EUROPEAN
INTEROPERABILITY
REFERENCE
ARCHITECTURE**

Change control

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Table of Contents

1. INTRODUCTION	5
1.1 PURPOSE OF THIS DOCUMENT	5
1.2 AUDIENCE.....	5
2. INTEROPERABILITY	6
2.1 WHAT IS INTEROPERABILITY?	6
2.2 THE EUROPEAN INTEROPERABILITY FRAMEWORK.....	6
2.2.1 <i>Legal interoperability</i>	7
2.2.2 <i>Organisational interoperability</i>	7
2.2.3 <i>Semantical interoperability</i>	8
2.2.4 <i>Technical interoperability</i>	8
2.2.5 <i>The European Interoperability Framework compared to other models</i>	9
2.3 INTEROPERABILITY FROM AN ENTERPRISE ARCHITECTURE POINT OF VIEW	9
3. EUROPEAN INTEROPERABILITY REFERENCE ARCHITECTURE	10
3.1 WHAT IS THE EUROPEAN INTEROPERABILITY REFERENCE ARCHITECTURE?	10
3.2 HOW DOES THE EIRA SUPPORT INTEROPERABILITY?	10
3.2.1 <i>A controlled vocabulary</i>	10
3.2.2 <i>Building Blocks</i>	10
3.2.3 <i>Specifications</i>	12
3.2.4 <i>Views</i>	15
4. CONCLUSION	20
APPENDIX – GLOSSARY	21
APPENDIX – EIRA VIEWS	22
LEGAL VIEW	22
ORGANISATION VIEW	23
SEMANTIC VIEW.....	24
TECHNICAL VIEW – APPLICATION.....	25
TECHNICAL VIEW – INFRASTRUCTURE	26
INTEROPERABILITY SPECIFICATION UNDERPINNING VIEW.....	27
APPENDIX – REFERENCES.....	28

1. INTRODUCTION

With the growing amount of information exchanges between public services (across borders and sectors), the need for interoperability in Europe is higher than ever. The ISA² Action 2.1 (EIA)¹ introduced the European Interoperability Reference Architecture² (EIRA) to guide public administrations in their work to provide interoperable European public services to businesses and citizens.

1.1 Purpose of this document

This document provides definitions of interoperability, explains its challenges in the context of European eGovernment and how the EIRA supports interoperability in the very specific context of providing European public services.

1.2 Audience

The content of this document relates mainly to enterprise architecture, having a background knowledge of matter is recommended in order to correctly understand it.

This document is intended for the following audience:

- Enterprise architects as well as solution architects that are responsible for the design of solution architectures.
- Business analysts responsible for assessing and studying the impact of changes within the (external) environment on information systems.
- Portfolio managers responsible for maintaining the catalogue of assets related to the design and implementation of e-Government solutions and for making investment decisions related to these assets.

¹ http://ec.europa.eu/isa/actions/index_en.htm

² <https://joinup.ec.europa.eu/asset/eia/description>

2. INTEROPERABILITY

This chapter will introduce the notion of interoperability and how the European Interoperability Framework addresses it.

2.1 What is interoperability?

Interoperability can be defined in many ways. The simplest way could be: “The ability to exchange information”.

To address interoperability issues at national, regional or local level, many public administrations already have, or are in the process of developing, interoperability frameworks. The scope of these frameworks is restricted to the jurisdictions within which they have been developed. However, European public administrations must be ready to work together to deliver cross-border public services to meet the needs of businesses and citizens. It is important that interoperability frameworks used by public administrations, both national and European, are aligned to achieve interoperability at European level. In June 2002, European heads of state adopted the “eEurope Action Plan 2005”³ at the Seville summit that calls on the European Commission “to issue an agreed interoperability framework to support the delivery of pan-European eGovernment services to citizens and enterprises”.

2.2 The European Interoperability Framework

The “eEurope Action Plan 2005” led to the creation of The European Interoperability Framework⁴ (EIF) having as purpose:

- to promote and support the delivery of European public services by fostering cross-border and cross-sectoral interoperability;
- to guide public administrations in their work to provide European public services to businesses and citizens;
- to complement and tie together the various National Interoperability Frameworks (NIFs) at European level.

The EIF defines interoperability, within the context of European public service delivery, as the ability of disparate and diverse organisations to interact towards mutually beneficial and agreed common goals, involving the sharing of information and knowledge between the organisations, through the business processes they support, by means of the exchange of data between their respective ICT systems⁵.

This EIF describes four levels of interoperability, respectively “Legal”, “Organisational”, “Semantic” and “Technical”.

³ <http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=URISERV:I24226&from=GA>

⁴ <http://ec.europa.eu/idabc/servlets/Docd552.pdf?id=19529>

⁵ http://ec.europa.eu/isa/documents/isa_annex_ii_eif_en.pdf

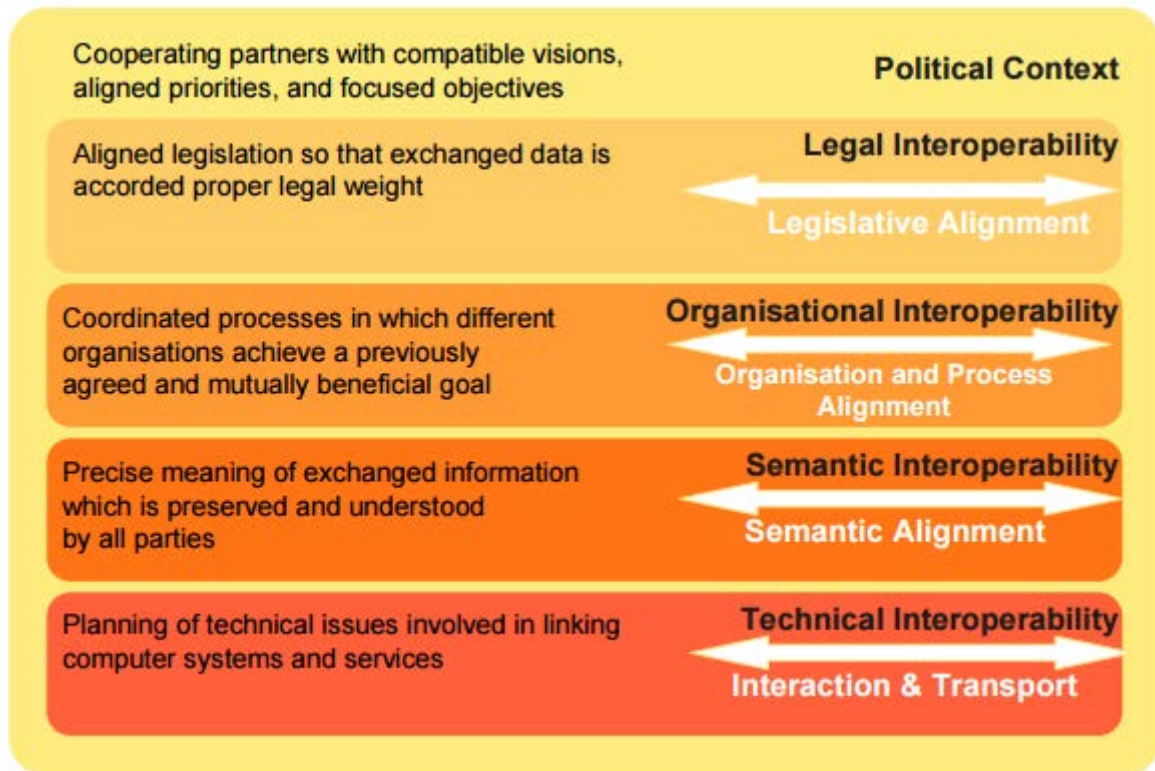


Figure 1: EIF Levels of interoperability

Each deserves special attention when a new European public service is established. The practical implementation of the conceptual model for cross-border/cross-sectoral services requires each of these levels to be taken into account.

2.2.1 Legal interoperability

Each public administration contributing to the provision of a European public service works within its own national legal framework. Sometimes, incompatibilities between legislation in different Member States make working together more complex or even impossible, even where such legislation is the result of transposing European directives into national law. Legal initiatives may be needed to remedy such situations. When information is exchanged between Member States to provide European public services, the legal validity of such information must be maintained across borders and data protection legislation in both originating and receiving countries must be respected.

Legal interoperability covers the broader environment of laws, policies, procedures and cooperation agreements needed to allow the seamless exchange of information between different organisations, regions and countries.

2.2.2 Organisational interoperability

This aspect of interoperability is concerned with how organisations, such as public administrations in different Member States, cooperate to achieve their mutually agreed goals. In practice, organisational interoperability implies integrating business processes and related data exchange. Organisational interoperability also aims to meet the requirements of the user community by making services available, easily identifiable, accessible and user-focused.

2.2.3 Semantical interoperability

Semantic interoperability enables organisations to process information from external sources in a meaningful manner. It ensures that the precise meaning of exchanged information is understood and preserved throughout exchanges between parties.

In the context of the EIF, semantic interoperability encompasses the following aspects:

- Semantic interoperability is about the meaning of data elements and the relationship between them. It includes developing vocabulary to describe data exchanges, and ensures that data elements are understood in the same way by communicating parties.
- Syntactic interoperability is about describing the exact format of the information to be exchanged in terms of grammar, format and schemas.

2.2.4 Technical interoperability

This covers the technical aspects of linking information systems. It includes aspects such as interface specifications, interconnection services, data integration services, data presentation and exchange, etc. While public administrations have specific characteristics at political, legal, organisational and, partly, semantic level, interoperability at the technical level is not specific to public administrations. Therefore, technical interoperability should be ensured, whenever possible, via the use of formalised specifications, either standards pursuant to EU Directive 98/34⁶ or specifications issued by ICT industry fora and consortia.

Technical interoperability means the ability of two or more information and communication technology applications, to accept data from each other and perform a given task in an appropriate and satisfactory manner without the need for extra operator intervention.

⁶ <http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A31998L0034>

2.2.5 The European Interoperability Framework compared to other models

Those EIF levels can be compared to other standards like The Basic Reference Model for Open Systems Interconnection⁷, commonly called OSI model, or other models.

Although the OSI model primarily focuses on the interconnection at technical level, Bruce Schneier⁸ and RSA⁹ introduced three human related layers namely “Individual, Organisation, Government/Legal compliance”. The following matrix provides a brief overview of the layers of commons models and EIF.

OSI Layer	Deployment Layer	SOA /OSA	EIF
10 Government	User	SOA	Legal
9 Organisation			Organisational
8 Person			
7 Application	Services		Technical (EIRA Technical – Application)
6 Presentation			Semantic
5 Session	Middleware		OSA
4 Transport			
3 Network	Operating System		
2 Data link			
1 Physical	Hardware		

2.3 Interoperability from an enterprise architecture point of view

The Open Group Architecture Framework¹⁰ (TOGAF) defines interoperability as “the ability to share information and services”. Sharing services implies that information exchange can actually happen between either a human or a machine and either another human or another machine, giving the following exchange matrix.

FROM / TO	Machine	Human
Machine	M2M	M2H
Human	H2M	H2H

Figure 2: Interoperability exchange matrix

According to TOGAF®, to cover all those exchanges, many companies, when talking about enterprise architecture, categorize interoperability as follow:

- Operational or Business Interoperability defines how business processes are to be shared.
- Information Interoperability defines how information is to be shared.
- Technical Interoperability defines how technical services are to be shared or at least connect to one another.

⁷ http://www.iso.org/iso/catalogue_detail.htm?csnumber=20269

⁸ https://en.wikipedia.org/wiki/Bruce_Schneier

⁹ https://en.wikipedia.org/wiki/RSA_Security

¹⁰ <http://www.opengroup.org/subjectareas/enterprise/togaf>

3. EUROPEAN INTEROPERABILITY REFERENCE ARCHITECTURE

Interoperability, as discussed in the previous chapter, is quite a challenge, especially at national and international level. To guide public administrations in their work to provide interoperable European public services to businesses and citizens, the European Commission, by the Action 2.1 of the ISA Programme developed, amongst others, the European Interoperability Reference Architecture (EIRA).

3.1 What is the European Interoperability Reference Architecture?

The European Interoperability Reference Architecture (EIRA), is an architecture content meta-model defining the most salient architectural building blocks (ABBs) needed to build interoperable e-Government systems.

The EIRA uses (and extends) the ArchiMate®¹¹ language as a modelling notation and uses service orientation as an architectural style. The EIRA is aligned with the European Interoperability Framework (EIF) and complies with the context given in the European Interoperability Strategy (EIS)¹².

The EIRA has the following main components:

- A common terminology: The EIRA defines a controlled vocabulary.
- Architectural Buildings Blocks: Being based on TOGAF®¹³, the EIRA defines architectural building blocks relevant to interoperability.
- ArchiMate® views: The EIRA defines seven ArchiMate® views.

3.2 How does the EIRA support interoperability?

The EIRA, and all its components, is meant to support interoperability. This chapter details each component of the EIRA and its support to interoperability. The

3.2.1 A controlled vocabulary

Communication between people, services, organisations, administrations or countries can't be achieved if one doesn't understand another. Communication being the cornerstone of interoperability, the EIRA defines a controlled vocabulary¹⁴ helping parties to communicate clearly and unambiguously when designing, assessing, documenting and discovering solution used to deliver interoperable digital public services.

3.2.2 Building Blocks

TOGAF® defines a building block¹⁵ as a package of functionality defined to meet business needs.

The way in which functionality, products, and custom developments are assembled into building blocks will vary widely between individual architectures. Every organization must decide for itself what arrangement of building blocks works best for it. A good choice of building blocks can lead to improvements in legacy system integration, interoperability, and flexibility in the creation of new systems and applications.

¹¹ <http://www.opengroup.org/subjectareas/enterprise/archimate-overview>

¹² http://ec.europa.eu/isa/documents/isa_annex_i_eis_en.pdf

¹³ <http://www.opengroup.org/subjectareas/enterprise/togaf>

¹⁴ https://joinup.ec.europa.eu/svn/eia/taxonomy/EIRA_SKOS.rdf

¹⁵ http://pubs.opengroup.org/architecture/togaf8-doc/arch/chap32.html#tag_33_02

3.2.2.1 Architectural Building Block

Based on the TOGAF® definition¹⁶, an architecture building block is an abstract component that captures architecture requirements and that directs and guides the development of solution building blocks (see following chapter).

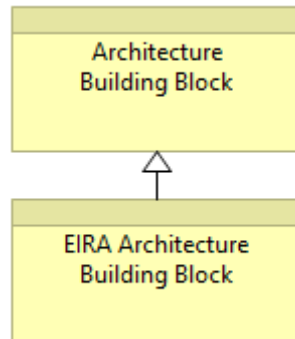


Figure 3: EIRA Architectural Building Block

The EIRA identifies the most relevant ABBs related to interoperability. The EIRA ABBs are specialisations of TOGAF® ABBs. Each ABB represents a (potentially re-usable) component of legal, organisational, semantic or technical capability that can be combined with other architecture building blocks. Each architecture building block of the EIRA describes generic characteristics and functionalities.

3.2.2.2 Solution Building Block

Based on the TOGAF® definition¹⁷, a solution building block is a concrete element that implements the required capabilities of one or more architecture building blocks.

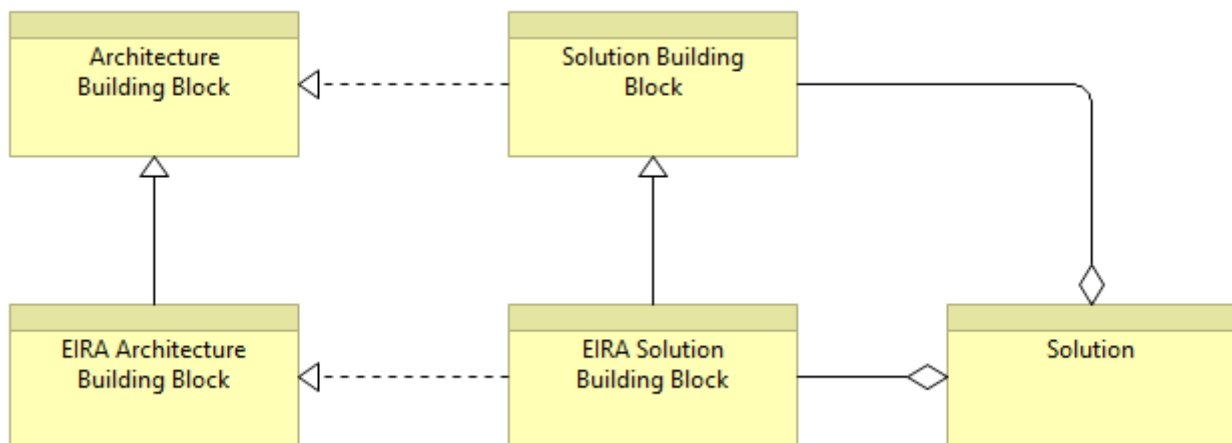


Figure 4: EIRA Solution

An EIRA Solution Building Block is a realisation of an EIRA Architecture Building Block and a specialization of a TOGAF® Solution Building Block.

A solution consists of EIRA Solution Building Blocks and TOGAF® Solution Building Blocks.

¹⁶ <http://pubs.opengroup.org/architecture/togaf9-doc/arch/index.html>

¹⁷ <http://pubs.opengroup.org/architecture/togaf9-doc/arch/index.html>

3.2.3 Specifications

According to ISO standard (ISO 9000:2005¹⁸), a specification is a document that states requirements. A specification can be related to activities (e.g. procedure document, process specification and test specification), or products (e.g. product specification, performance specification and drawing).

To be interoperable, two building blocks need to comply with the same requirements, the interoperability requirements. The EIRA states those requirements with Interoperability Specifications. The Interoperability Specifications are the cornerstone of the EIRA support to interoperability.

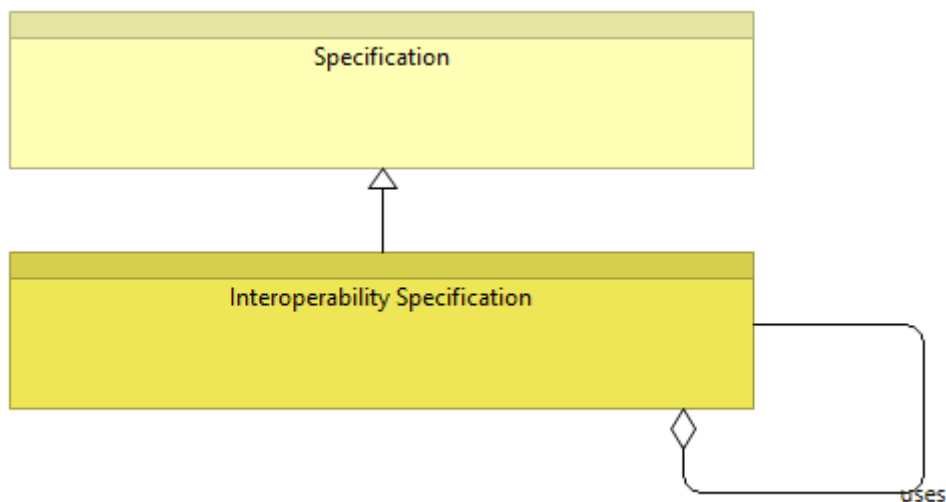


Figure 5: Interoperability specification building block

An Interoperability Specification is a document containing agreed normative statements for solution building blocks used in an information exchange context. It can refer to existing standards or specifications.

An Interoperability Specification, as solution building block (SBB), can be associated to an architectural building block (ABB) or a SBB for different reasons:

- **Associated to an ABB**

An Interoperability Specification provides the most salient specification to which any SBB implementing the ABB should be compliant to.

- **Associated to a SBB**

An Interoperability Specification provides the most salient specifications to which the SBB is compliant to.

The following picture shows the links between solution, building blocks and interoperability specification.

¹⁸ <https://www.iso.org/obp/ui/#iso:std:iso:9000:ed-3:v1:en:term:3.7.3>

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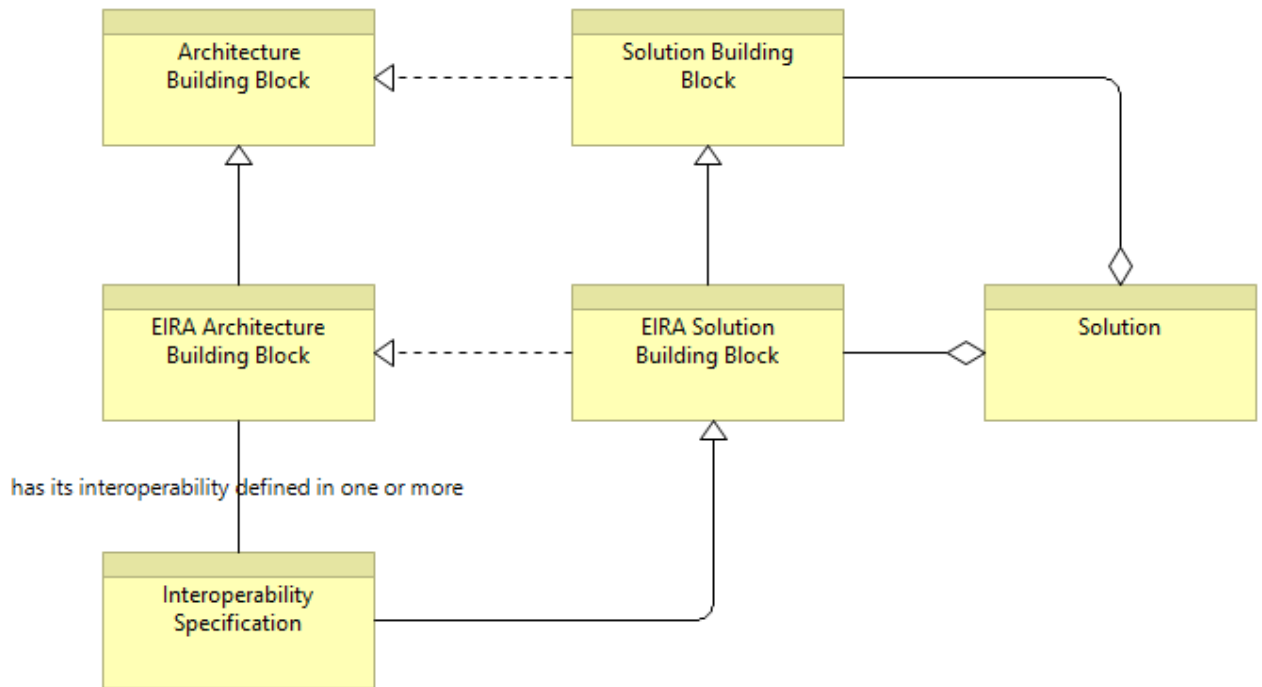


Figure 6: EIRA Interoperability Specification

To describe the interoperability requirement precisely, The “Interoperability Specification” building block is defined by the following attributes¹⁹:

Attribute name	Description
ID	Internal key used to identify an architecture building block
dct:type	The type of the architecture building block (expressed using EIRA controlled vocabulary)
dct:publisher	The name of the individual or organisation that is documenting the current building block
dct:modified	The date that the information documented for this building block was last modified
url	The URL at which the specification can be referenced online
identifier	The identifier is unique. It identifies univocally the specification in the Cartography
interface	The interface identifies the type of business information exchange to which the specification is applicable. It informs on the constituents involved in the association agent-to-agent exchanging business information whereas: An agent is described by the tuple <agent_type&principal_type>, the agent belongs to an agent_type {human, machine}, the agent acts on behalf of a principal who belongs to a principal_type {citizen, business, PA}

¹⁹ “dct:” fields refers to Dublin Core Metadata Initiative vocabulary (<http://dublincore.org/>)

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domain	The domain can be either domain-neutral (not related to any public policy domain) or domain-specific to a given set of public policy domains. It informs on the public policy domain of application of the specification
scope	The scope is either a set of EIRA ABBs (on the proposed mode) or a set of SBBs supporting EIRA ABBs (on the descriptive mode). ABBs (or SBBs) might be in different EIF views. It informs on the scope of the specification
modality	The modality can be either proposing (i.e. to be used) or describing (i.e. actually used). It informs on the mode of the specification
body	The body contains statements on one or several Building Blocks. It informs either (i.e. proposed mode) on the proposed specification at the ABB level to achieve interoperability for its SBBs or (i.e. in solution descriptive mode) on a specification to which an SBB is actually compliant to achieve interoperability

EIRA, being aligned with the EIF, specializes its “Interoperability Specification” building block by four specialized building blocks.

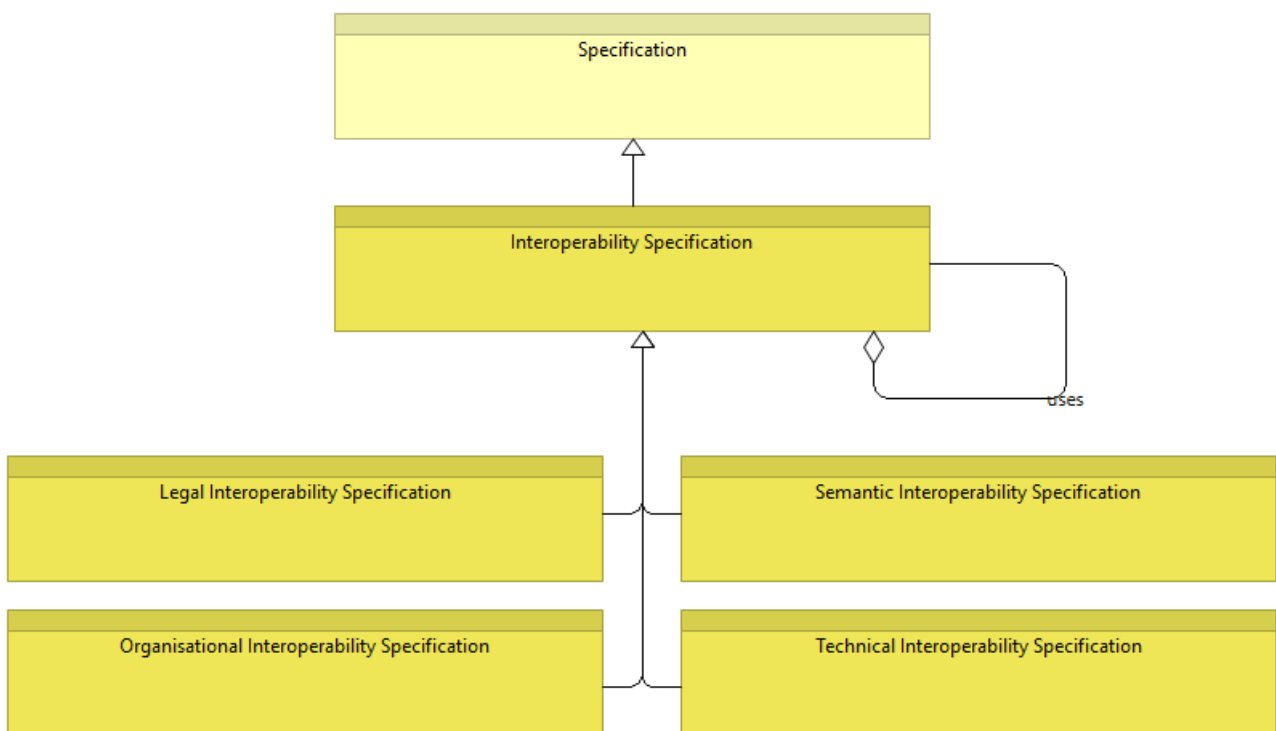


Figure 7: EIRA Interoperability building blocks

Each specialized interoperability specifications serve to define the interoperability aspects of catalogues and registries, addressing both their contents and the respective catalogue or registry as a whole, and this, at each interoperability level.

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3.2.4 Views

The EIRA defines views to help focus on different aspects of interoperability. Being aligned to EIF, it defines a legal, organisation, semantic and technical view. Additionally, it defines a high-level overview view²⁰ and an underpinning view. This chapter will describe those views and how, with the help of interoperability specifications, the EIRA helps support interoperability.

The Legal view models the most salient public policy development enablers and implementation instruments that shall be considered in order to support legal interoperability.

The following picture shows the link between the “Legal Interoperability Specification” building block and the legal catalogues and registries and their content (see Appendix for complete picture of the EIRA view).

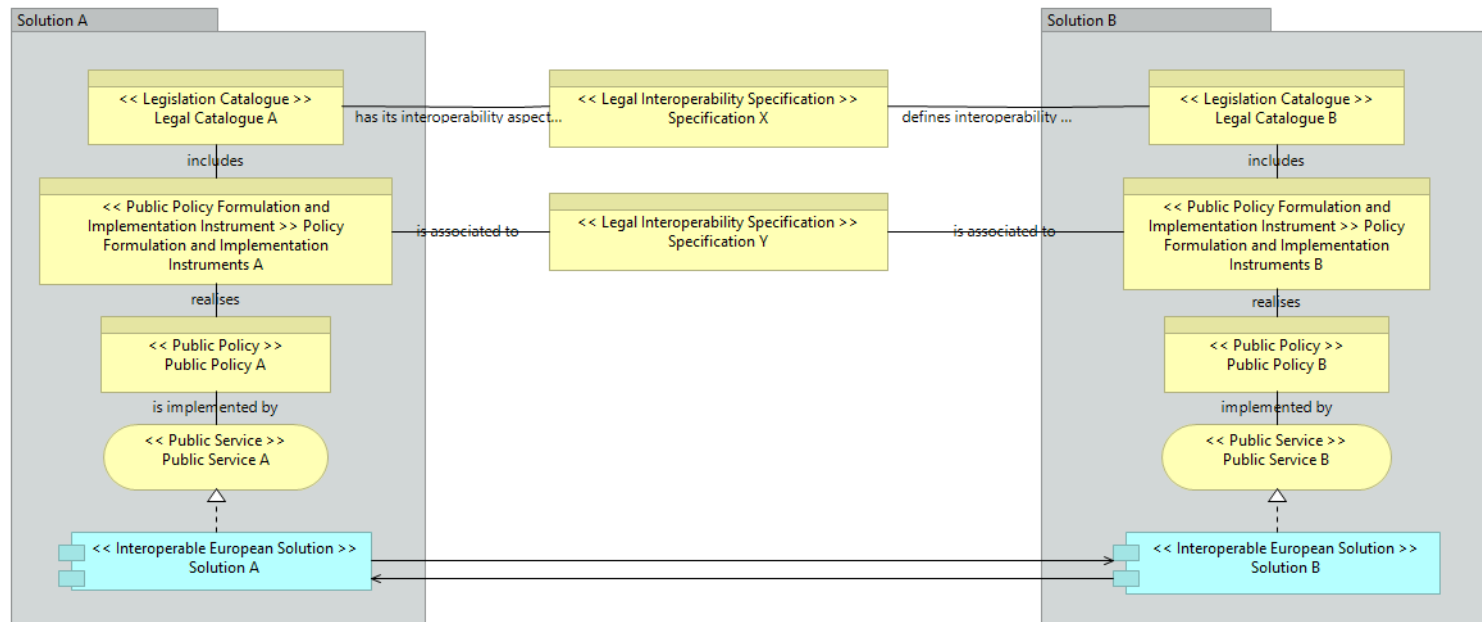


Figure 8: EIRA Legal interoperability

Legal interoperability specifications support interoperability by addressing the core legal interoperability background for solutions. What is this core legal interoperability background? It is constituted by the legal interoperability specifications of the Public Policy Formulation and Implementation Instruments ABB and of the Legal Catalogue ABB. Why these two core legal ABBs? Because legal interoperability requires

²⁰ Not detailed in this document

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legal certainty and access to legal texts. Legal certainty should be supported by Public Policy Formulation and Implementation Instruments ABB and access to legal texts should be supported by Legal Catalogue ABB.

The Organisational view models the most salient building blocks that shall be considered in order to support organisational interoperability among providers and users of a public service.

The following picture shows the link between the “Organisational Interoperability Specification” building block and the organisational catalogues and registries and their content (see Appendix for complete picture of the EIRA view).

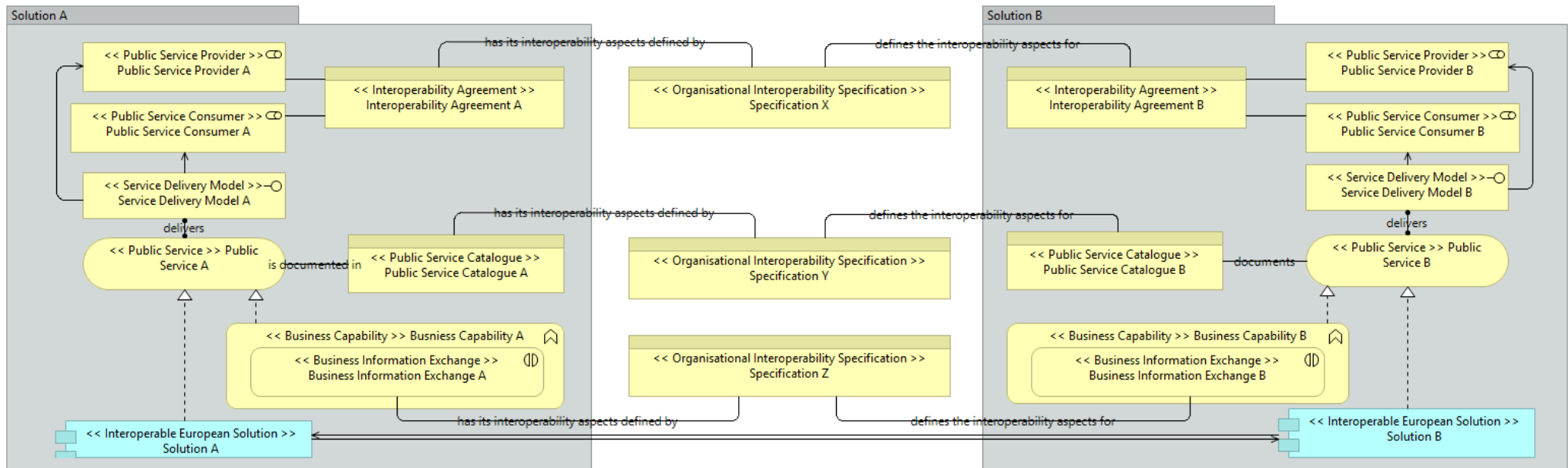


Figure 9: EIRA organisational interoperability

Organisation interoperability specifications support organisational interoperability by addressing the core organizational interoperability background for solutions. What is this core organizational interoperability background? It is constituted by the organizational interoperability specifications of Interoperability Agreement ABB, Public Service Catalogues ABB and Business Information Exchanged ABB. Why these three core organizational ABBs? Because organizational interoperability specifications requires the organisational terms and conditions for the exchange of information, access to public services and a common interpretation of the exchanged information despite the numerous ways the data may be represented. The organisational terms and conditions for the exchange of information should be supported by

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Interoperability Agreements ABB, access to public services should be supported by Public Service Catalogues ABB and common interpretation of the exchanged information should be supported by Business Information Exchanged ABB.

The Semantic view models the most salient building blocks that should be considered in order to support semantic interoperability of information exchanges between administrations, businesses and citizens.

The following picture shows the link between the “Semantic Interoperability Specification” building block and the semantic catalogues and registries and their content (see Appendix for complete picture of the EIRA view).

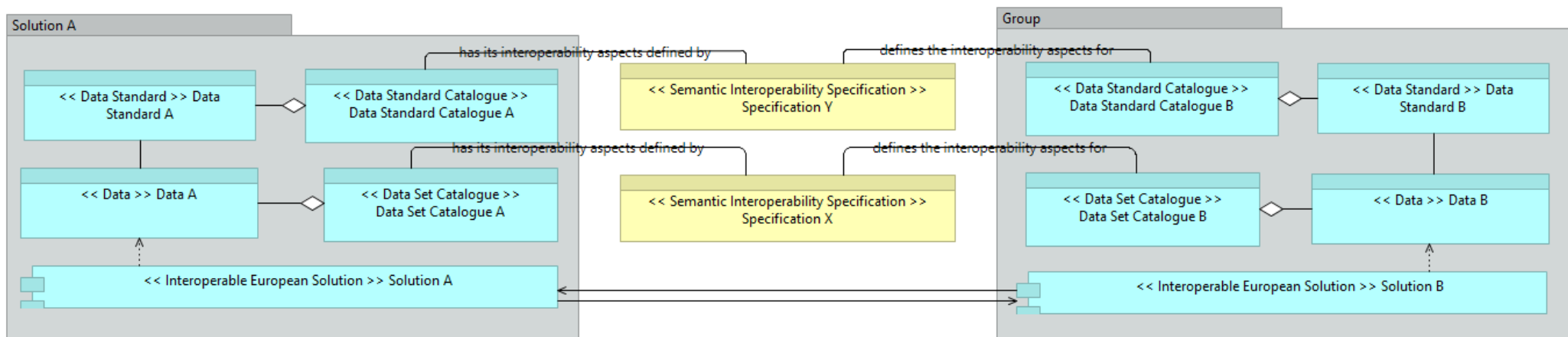


Figure 10: EIRA semantic interoperability

Semantic interoperability specifications support semantic interoperability by addressing the core semantic interoperability background for solutions. With semantic Interoperability. What is this core semantic interoperability background? It is constituted by the semantic Interoperability Specifications of Data Standard Catalogue ABB and the Data Set Catalogue ABB. Why these two core semantic ABBs? Because semantic interoperability requires that the data and metadata of the business information exchanged be processed. Data should be supported by the Data Set Catalogue ABB and metadata should be supported by the Data Standard Catalogue ABB.

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The Technical - Application view contains the most salient application building blocks that need to be considered in order to support technical interoperability when building an Interoperable European Solution. An Interoperable European Solution can support one or more public policies (see Appendix for complete picture of the EIRA views).

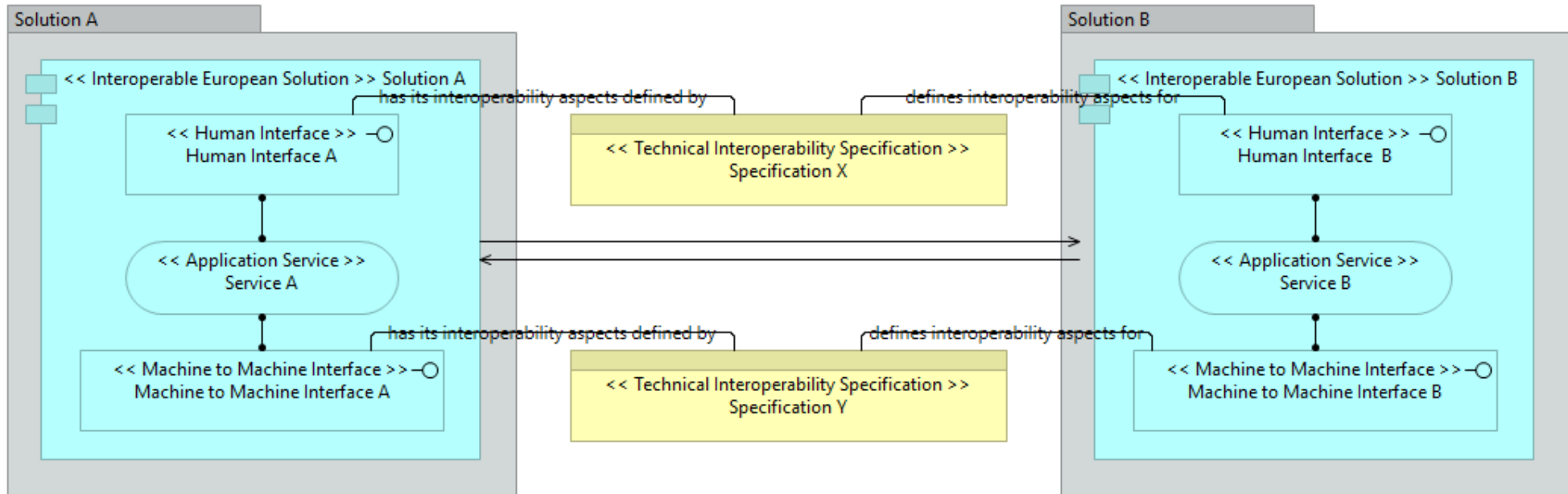


Figure 11 EIRA technical (application) interoperability

Technical interoperability specifications support technical interoperability, at the application level, by addressing the core technical application interoperability background for solutions. What is this core technical application interoperability background? It is constituted by the technical interoperability specifications of Human Interface ABB and Machine to Machine Interface ABB. Why these two core technical ABBs? Because technical application interoperability requires the exchange of data. Data exchanges should be supported by both Human Interface ABB and Machine to Machine Interface ABB.

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The Technical - Infrastructure view provides an architecture content meta-model for the most salient cross-sectorial infrastructure services, along with the supporting hosting and networking facilities, which shall be considered in order to support technical interoperability when building an Interoperable European Solution. The difference with the application part of the Technical view is that the building blocks in the infrastructure view are considered to be relevant for solutions in any sector of government (see Appendix for complete picture of the EIRA views).

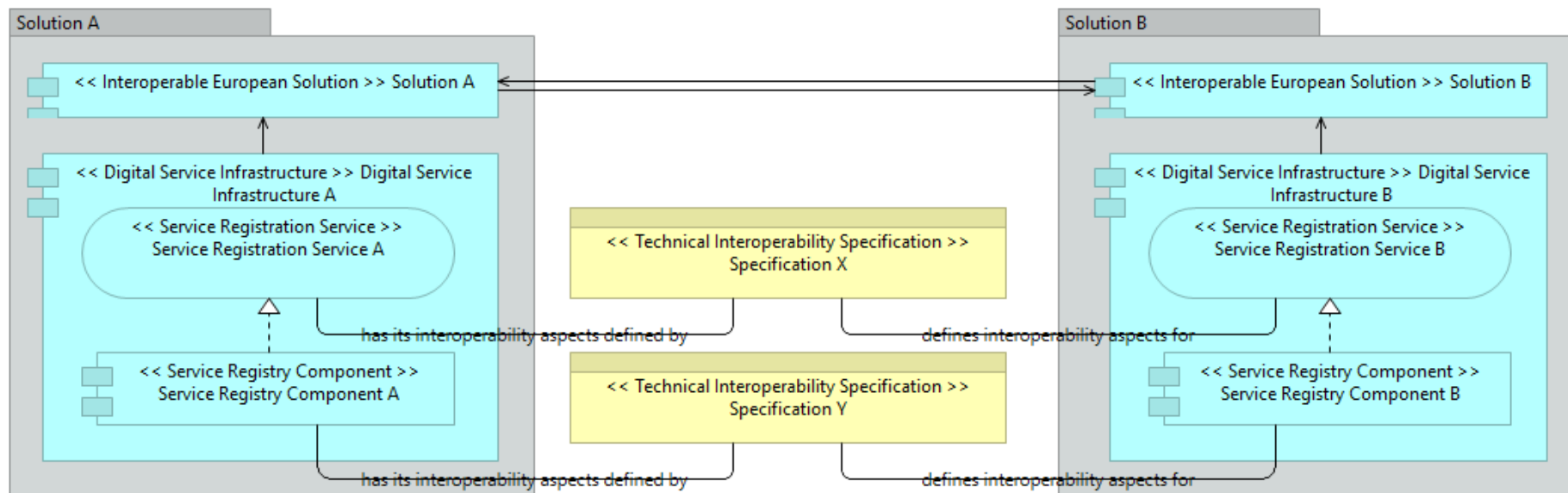


Figure 12: EIRA technical (infrastructure) interoperability

Technical interoperability specifications support technical interoperability, at the infrastructure level, by addressing the core technical infrastructure interoperability background for solutions. What is this core technical infrastructure interoperability background? It is constituted by the technical interoperability specifications of Service Registry Component ABB and Service Registry Service ABB. Why these two core technical ABBs? Because technical infrastructure interoperability requires the provisioning and consumption of services. Services should be supported by both Service Registry Component ABB and Service Registry Service ABB.

To complete the support of the interoperability specifications and to have a quick and complete view of the interoperability constraints a solution complies/should comply to, EIRA provides a specific view named "Interoperability specification underpinning view". This view groups all its Interoperability Specifications (see Appendix for complete picture of the EIRA views).

4. CONCLUSION

Interoperability is the ability to exchange information, and should be considered at different levels in the context of international IT services. To guide public administrations in their work to provide interoperable European public services to businesses and citizens, the ISA² Action 2.1 (EIA)²¹ introduced the European Interoperability Reference Architecture²² (EIRA).

The EIRA is a reference architecture aiming at interoperability. It provides the most salient building blocks to design interoperable solutions and document interoperability specifications needed to maximize interoperability between public services.

A pre requisite to achieving interoperability between solutions is the ability to clearly communicate about those solutions. To do enable such communications, EIRA provides a controlled vocabulary to help document solutions. As reference architecture, EIRA defines a set of building blocks aimed at interoperability. Those building block are used to document, using the vocabulary, the solution, but moreover to document the interoperability specifications of those solutions. To do so, the architectural building block "Interoperability Specification" is specialized in four building block to cover all levels of interoperability, namely Legal, Organisational, Semantic and Technical. Those building blocks describe the specifications, which the building block they are associated to, complies with.

By the mean of its vocabulary, building blocks and specification, the EIRA supports interoperability in at all levels and helps administration to provide interoperable European public services to businesses and citizens.

In essence, to the question how EIRA supports interoperability? The answer is by supporting holistically Legal, organizational, semantic and technical interoperability.

²¹ http://ec.europa.eu/isa/actions/index_en.htm

²² <https://joinup.ec.europa.eu/asset/eia/description>

APPENDIX – GLOSSARY

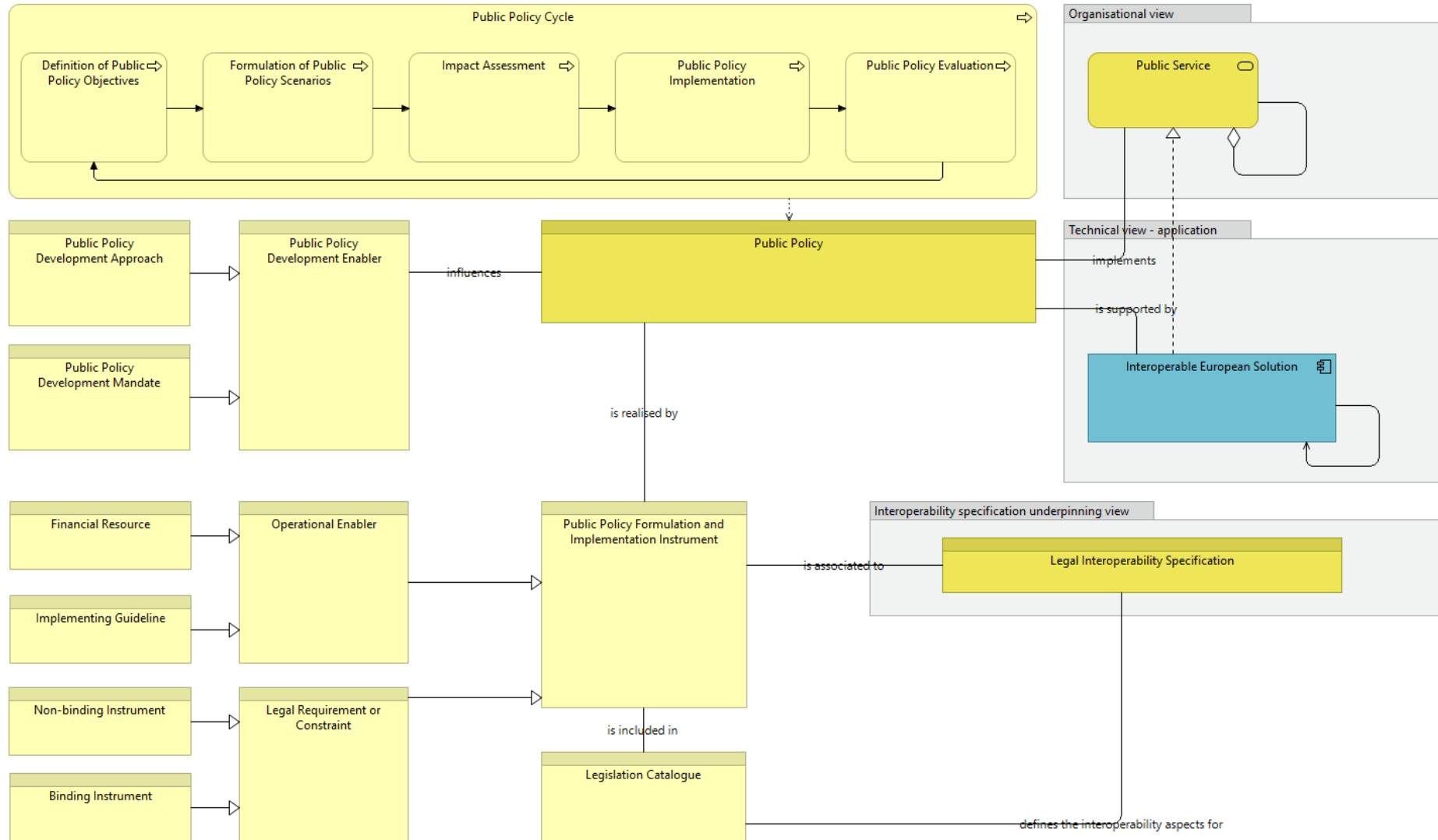
The following table summarises the terms and acronyms mentioned in the document text for ease of reference

Table 0-1

Abbreviation / Term	Explanation
ABB	Architectural Building Block
EIA	European Interoperability Architecture
EIF	European Interoperability Framework
EIRA	European Interoperability Reference Architecture
EIS	European Interoperability Strategy
EU	European Union
HTTP	Hypertext Transfer Protocol
ICT	Information and Communications Technology
ISA	Interoperability Solutions for European Public Administrations
ISO	International Organization for Standardization
NIF	National Interoperability Framework
OSA	Open Services Architecture
OSI	Open Systems Interconnection
SAML	Security Assertion Markup Language
SAT	Solution Architecture Template
SBB	Solution Building Block
SOA	Service Oriented Architecture
SOAP	Simple Object Access Protocol
TOGAF	The Open Group Architecture Framework
URL	Uniform Resource Locator
XML	Extensible Markup Language
XSD	XML Schema Definition

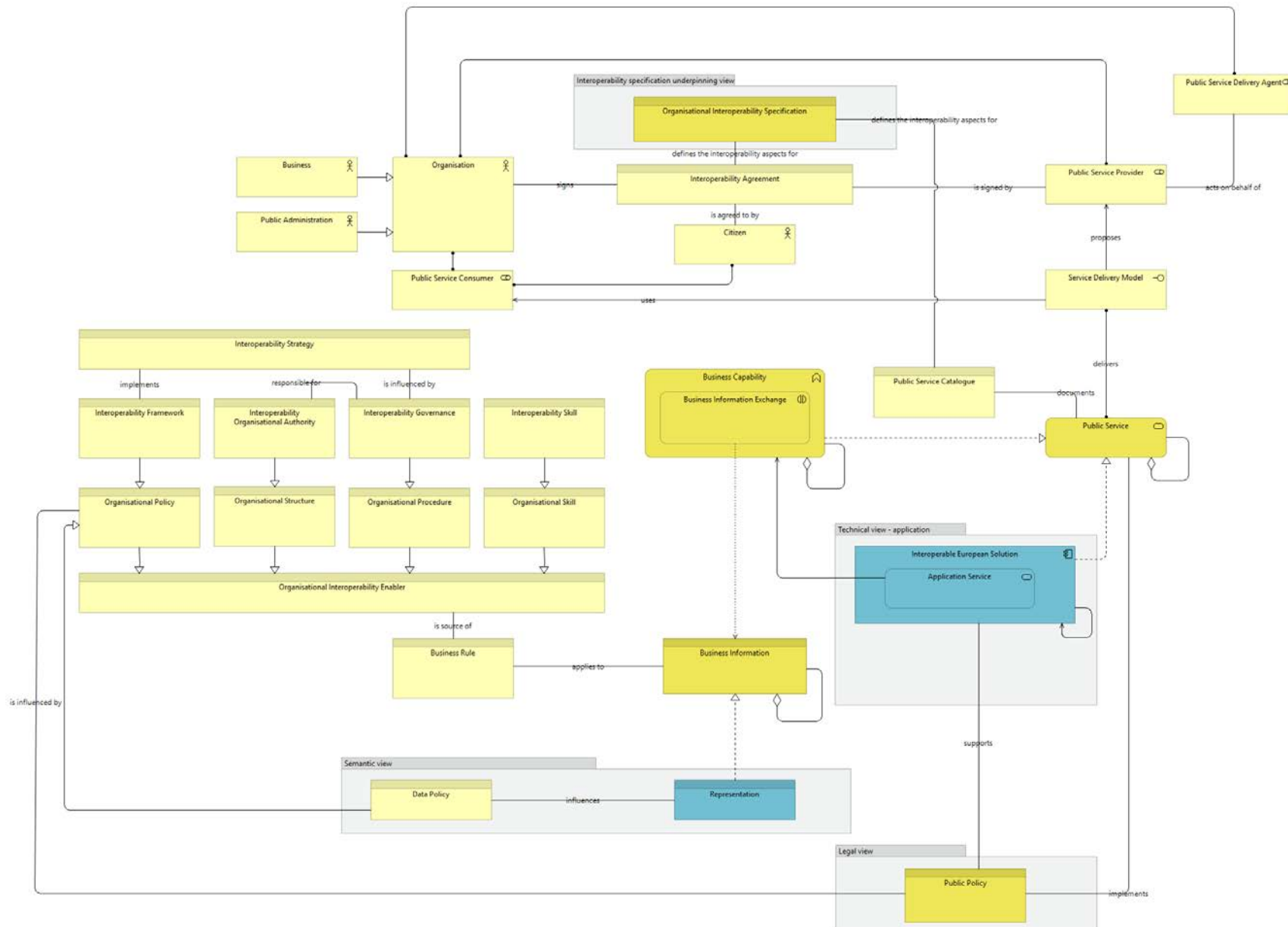
APPENDIX – EIRA VIEWS

Legal view



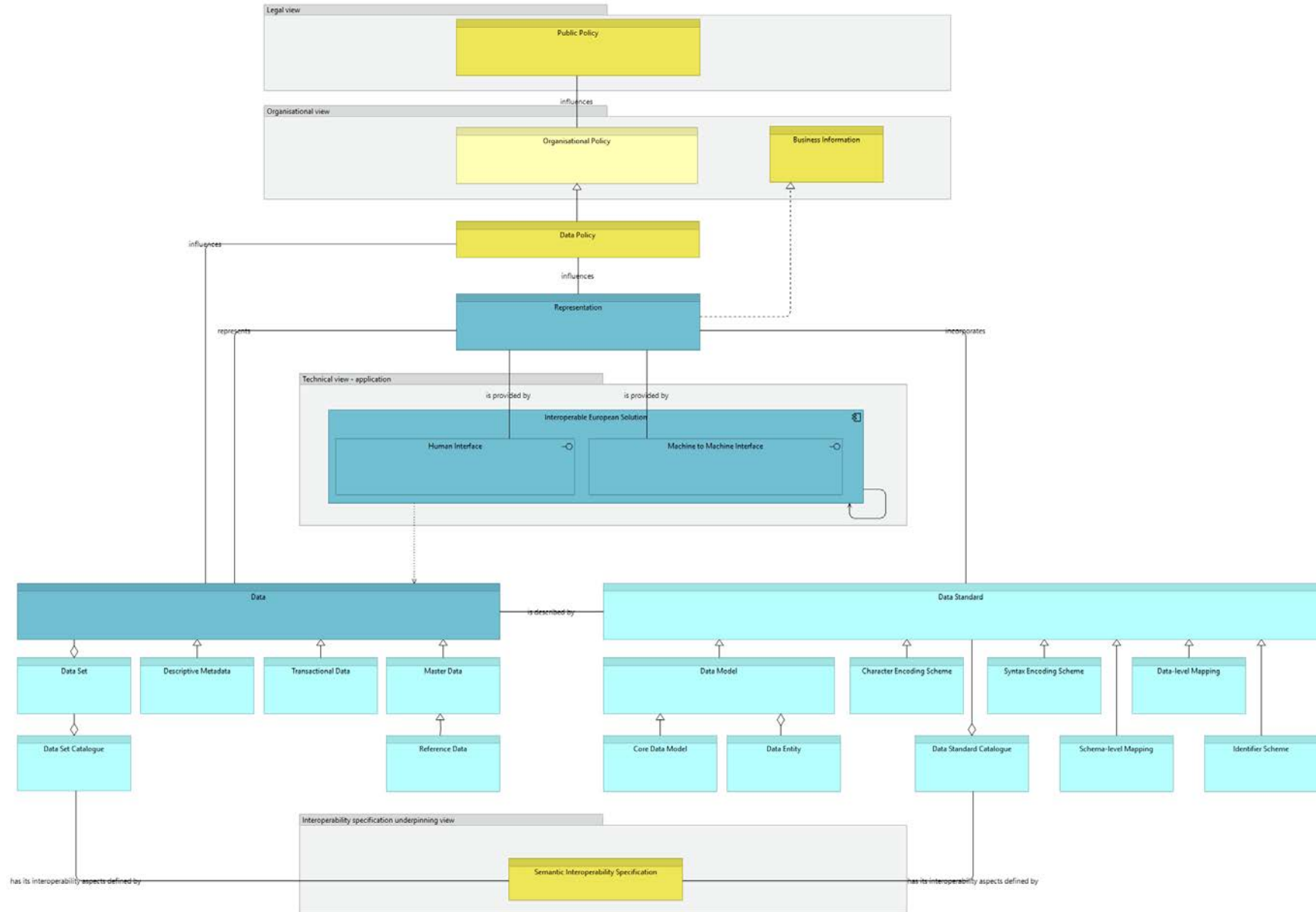
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Organisation view



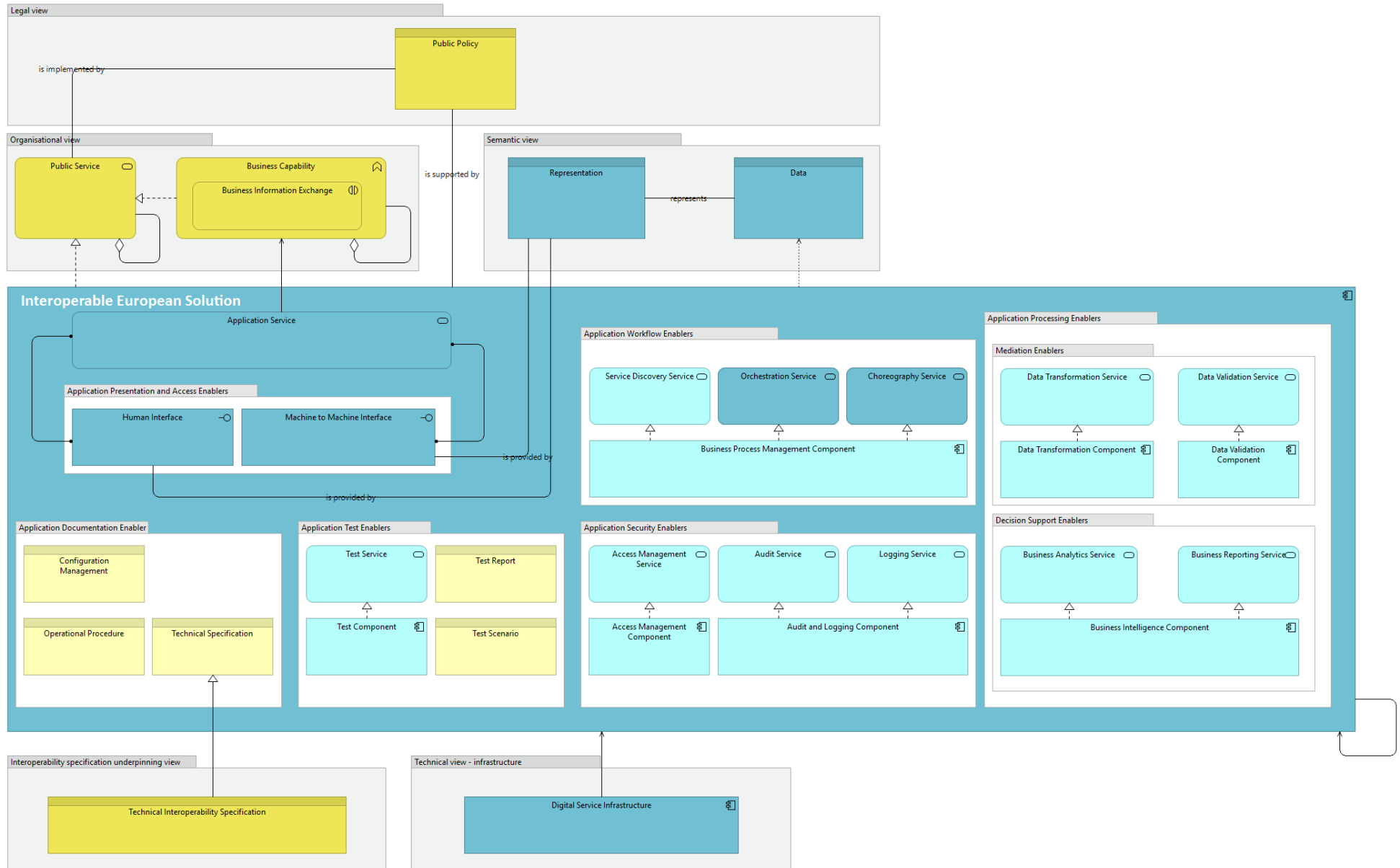
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Semantic view



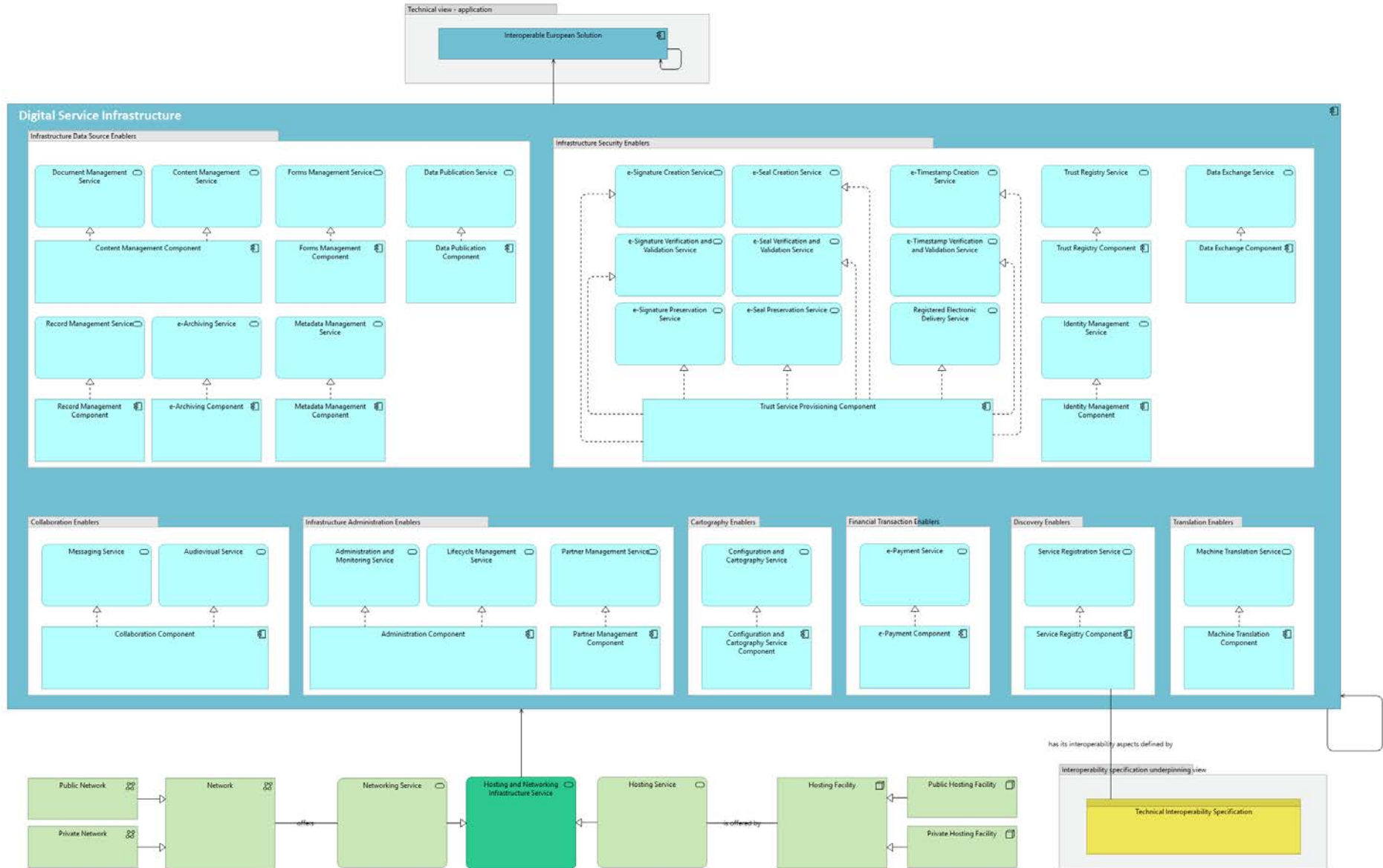
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Technical view – Application



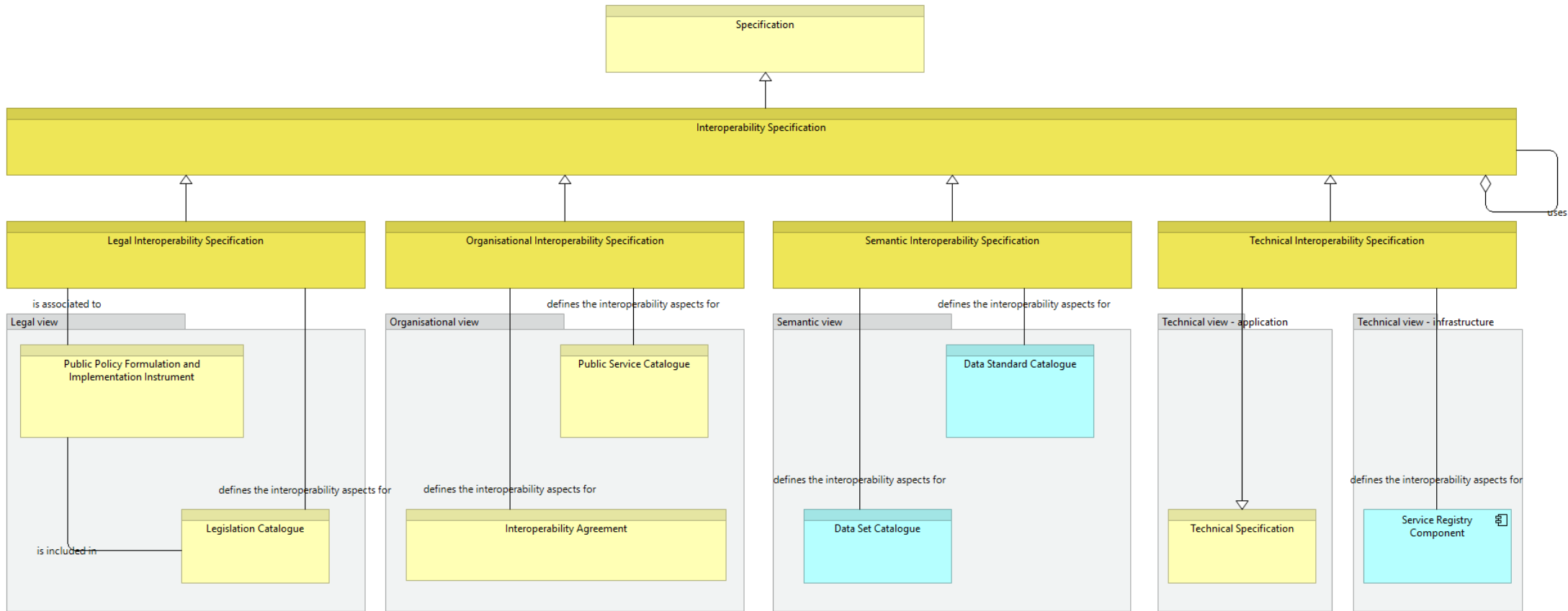
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Technical view – Infrastructure



How EIRA supports interoperability v1.0.0

Interoperability specification underpinning view



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