Architectural Representation of the Portuguese Government Interoperability Platform

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Abstract

With technological evolution, there is an increasing need for communication and the exchange of electronic information between Public Entities. In public administration, the trend continues, along with the need to improve and centralize the services provided to citizens, facilitating their approximation. Achieving these goals requires that public administration be more interoperable. Thus, it is necessary to develop an electronic Government Interoperability Framework. This framework is a government corporate architecture that portrays how a government is structured and determines how government agencies can achieve their goals. In this way, the public administration developed the public administration interoperability platform. This platform enables the provision of shared services between entities and allows to simplify the provision of services between the various stakeholders. This interoperability platform allows the public administration to be more efficient, more effective, more transparent, and able to provide public services with a higher level of quality. The *Agency for Administrative Modernization* manages the interoperability platform.

This dissertation aims to understand what an interoperability platform is and assist in decision-making for those who have governance responsibilities and for future users. In this way, we intend to model a description architecture of the platform and create relevant views. For the development of the dissertation, it is necessary to analyze the main concepts and references of enterprise architecture as well as the state of the art of relevant enterprise architecture initiatives. The most important initiatives are those that make clear references to the capabilities of the Government Interoperability Framework. Subsequently, an analysis of the universe of discourse is handled, which allowed finding two audiences, the employees of the *Agency* and entities outside the *Agency*. For the employees of the *Agency*, a more detailed view of ArchiMate has developed. For external entities, a view in ArchiMate and natural language with general information is developed. Through the analysis, three application services are found, the integration service, the payment service, and the messaging service. For each service, a view is modeled, which is composed of application services. Integration services are divided into six application services, payment service into five application services, and messaging service into two application services. Subsequently, misalignments are sought between the public discourse of the *Agency for Administrative Modernization* and the rigorous classification of the concepts in question in the ArchiMate language. The identified misalignments are based on the interpretation of the information obtained, presenting concepts that can improve the discourse of the *Agency for Administrative Modernization*, not meaning that the concepts currently used are wrong.

Keywords: Enterprise Architecture, Public Administration, Interoperability Framework, Architecture Description

Resumo

Com a evolução tecnológica, cada vez mais existe uma crescente necessidade de comunicação e de troca de informação eletrónica entre as Entidades Públicas. Na administração pública a tendência mantém-se juntamente com a necessidade de melhorar e centralizar os serviços prestados aos cidadãos facilitando a aproximação dos mesmos. Para alcançar estes objectivos é necessário que a administração pública seja mais interoperável. Desta forma foi necessário desenvolver uma *Government Interoperability Framework* eletrónica. Esta framework é uma arquitetura corporativa governamental que retrata os planos gerais de como o governo está estruturado e determina como as agências governamentais podem atingir os seus objetivos. Desta forma a administração pública desenvolveu a plataforma interoperabilidade da administração pública. Esta plataforma permite disponibilizar serviços partilhados entre várias entidades, tendo o intuito de simplificar a disponibilização dos serviços entre os intervenientes. Esta plataforma permite que a administração pública seja mais eficiente, eficaz, transparente e que seja capaz de prestar serviços públicos com um nível superior de qualidade. A *Agência para a Modernização Administrativa* gere a plataforma de interoperabilidade.

Esta dissertação tem como intuito entender o que é a plataforma de interoperabilidade e auxiliar a tomada de decisão da mesma, tanto para quem tem responsabilidades na sua governação como para eventuais futuros utilizadores. Desta forma pretende-se modelar uma *description architecture* da plataforma e criar views relevantes. Para o desenvolvimento da dissertação é necessário analisar os principais conceitos e referências de arquitetura empresarial bem como o estado de arte das iniciativas relevantes de arquitetura empresarial. As iniciativas mais importantes, são aquelas que fazem referências claras às capacidades da *Government Interoperability Framework*. Posteriormente é realizada uma análise ao universo de discurso, esta permitiu encontrar duas audiências, os funcionários da *Agência para a Modernização Administrativa* e as entidades externas à *Agência*. Para os funcionários foi desenvolvido uma view em ArchiMate mais detalhada, para as entidades externas foi desenvolvido uma view em ArchiMate e linguagem natural com informação generalista. Através da análise são encontrados três serviços aplicacionais, o serviço de integração, o serviço de pagamentos e o serviço de mensagens. Para cada serviço foi modelada uma view, sendo os mesmos compostos por serviços aplicacionais. O serviço de integração é decomposto por seis serviços aplicacionais, o serviço de pagamento por cinco e o serviço de mensagem por dois. Com as views modeladas procuraram-se desalinhamentos entre o discurso público da *Agência para a Modernização Administrativa* e a classificação rigorosa dos conceitos em causa da linguagem ArchiMate. Os desalinhamentos identificados são baseados na interpretação das informações obtidas, apresentando conceitos que podem melhorar o discurso da *Agência para a Modernização Administrativa*, não significando que os conceitos usados actualmente se encontrem errados.

Palavras-Chave: Arquitetura Empresarial, Administração Pública, Estrutura de Interoperabilidade, Descrição da Arquitetura

Table of Contents

List of figures

List of Tables

List of Acronyms

ABBs	Architectural Building Blocks
ACP	Automobile Club de Portugal
ACSS	Central Administration of the Health System, IP.
AD	Description Architecture
ADSE	Public Institute of Participated Management
AMA	Agency for Administrative Modernization, IP
ANSR	National Road Safety Authority
ARM	Application Reference Model
ASI	Information Systems Architecture
ATT	Tributary and customs authority
BPMN	Business Process Modeling and Notation
BRM	Business Reference Model
CGA	General Retirement Fund
CVCC	Life Cycle of the Citizen's Card
DGEEC	General Directorate of Education and Science Statistics
DGES	General Directorate of Higher Education
DRM	Data Reference Model
DUC	Single Billing Document
EA	Enterprise Architecture
EAP	Enterprise Architecture Planning
EDP	Energies of Portugal
EEG	Energy and Gas Companies
e-GIF	Government Interoperability Framework
EIF	European Interoperability Framework
EIRA	European Interoperability Reference Architecture
EPAL	Portuguese Free Water Company
GMAAC	Office of the Minister of Environment and Climate Action
GRA	Azores Regional Government

GRM	Madeira Regional Government
GSEA	Office of the Secretary of State for the Environment
GSEAE	Office of the Assistant Secretary of State and for Energy
GSECNFOT	Office of the Secretary of State for Nature Conservation, Forests and Spatial Planning
GSEM	Office of the Secretary of State for Mobility
iAP	Interoperability in Public Administration
ICT	Information and Communication Technologies
FI	Financial Institution
IEEE	Institute of Electrical and Electronics Engineers
IEFP	Institute of Employment and Training
IF	Interoperability Framework
IRM	Infrastructure Reference Model
IS	Integration Service
ISA²	Interoperability solutions for European public administrations
IT	Information Technology
MF	Ministry Finance
MJ	Ministry of Justice
MS	Messaging Service
MS	Ministry of Health
OCC	Order of Certified Accountants
OMB	Management and Budget
PA	Public Administration
PRM	Performance Reference Model
PS	Payment Service
SDG	Single Digital Gateway
SGMA	General Secretariat of the Ministry of Environment
SGMAI	General Secretariat of the Ministry of Internal Administration
SGMDN	General Secretariat of the Ministry of National Defense
SPMS	Ministry of Health Shared Services
SI	Information Systems

SRM	Security Reference Model
SS	Ministry of Labor Solidarity and Social Security
TOGAF	Open Group developed the Open Group Architecture Framework
TOGAF ADM	TOGAF Architecture Development Method
UML	Unified Modeling Language
UoD	Universe of Discourse

1. Introduction

The development of electronic government (*e-Government*) and the creation of electronic Public Administration are concerns and priorities for action for governments in different countries (Almeida, 2019). Government officials have an interest and need to transform the Public Administration (PA). The aim is to make the PA more effective, more efficient, more transparent, to be more centered and oriented to the citizen, and to be able to offer services of higher quality. To achieve this transformation, policymakers began to focus their attention on developing interoperability strategies (Almeida, 2019) (Madureira, 2020).

Interoperability is by, definition, "an ability to exchange information and use the information exchanged with one another" (Guijarro, 2009).

The PA professionals use information technology (IT) as a primary tool. ITs are a relevant tool since it is through these that it is possible to obtain interoperable e-government while modernizing and transforming the public sector (Almeida, 2019).

From the moment the PA adopted IT, it was possible to develop PA systems and processes that are more autonomous and independent (Heeks, 2001). These systems and processes are created by each public body, with the sole purpose of meeting their internal needs. Each organism used different technologies. There was no concern with communications between various systems or in the exchange of information, which made it impossible to achieve desirable e-government.

In recent years, governments have started to give more importance to IT, which has allowed the development of e-Governments to start. Therefore, a new operating paradigm was created for the PA, allowing it to be more oriented to the needs of the citizen. With this new e-Government paradigm, it became possible to provide transversal public services, allowing several organizations to get involved (Madureira, 2020). This new paradigm aims to have public services always available on different channels (Madureira, 2020) (Unidade de Missão Inovação e Conhecimento, 2003) (Almeida, 2019).

In Portugal, as of the 1990s, PA was reformed (Madureira, 2020), thus giving rise to interoperability systems. In 2003, the development of an interoperability model, the e-Government Interoperability Framework (e-GIF) (Unidade de Missão Inovação e Conhecimento, 2003), was initiated. And in 2007, the Public Administration Interoperability Platform (iAP) was created (República Portuguesa, 2020). iAP has a platform that facilitates management and improves communication between services (República Portuguesa, 2020). This platform aims to provide an easy and integrated method of providing electronic public services more easily and transparently for citizens and entities (iAP, 2011) (Unidade de Missão Inovação e Conhecimento, 2003) (Almeida, 2019). The iAP guarantees the safe exchange of information between the different entities. (iAP, 2011)

The life cycle of the Citizen's Card (CVCC) is an example of the exchange of information between different organisms. It is the iAP that handles CVCC communications safely and efficiently.

It is through the services and communications that iAP has that the objective of this dissertation originated.

1.1. Objectives

Due to the growing complexity of the exchange of information between different entities and the little information available about the interoperability platform, this dissertation aims to compare views and verify if there are misalignments between the information that AMA generates internally and that it exposes to the public. Another objective is to model the iAP AD. To help stakeholders understand the value of the iAP to the business, to be able to make management decisions around the iAP.

To obtain the objectives, it is necessary to answer a set of questions:

❖ Who are the main classes of stakeholders relevant to the iAP?
❖ What main concerns do these classes have concerning the iAP?
❖ What are the main views to consider for supporting these stakeholders:
    ❖ Promote an informed understanding of the iAP?
    ❖ Make informed decisions about the future of the iAP?

For these last two questions, it is necessary to keep in mind another set of questions:

❖ Who are the iAP platform actors? What roles do they have?
❖ What services and processes does iAP have?

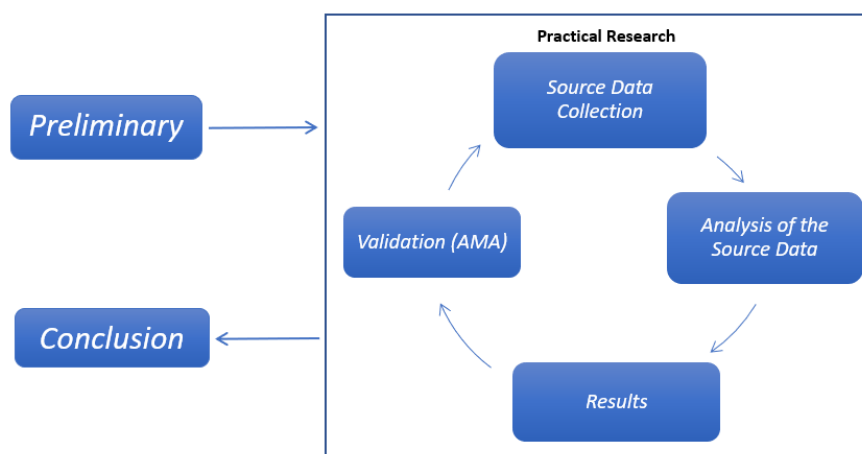## 1.2. Research methodology

Figure 1: Dissertation Research Methodology (The Open Group, 2015)

The paper is based on the *preliminary* phase of TOGAF ADM[1]. It is at this stage that it is possible to determine the organizational context that allows conducting AD. This methodology consists

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[1] More About *preliminary* phase - https://pubs.opengroup.org/architecture/togaf91-doc/arch/chap06.html

of three parts, the "*preliminary*", the practical research, and the conclusion. The practical research is comprised of a set of sprints, which are iterated until a clearer understanding of the iAP is gained.

Dissertation organization:

- ❖ *Preliminary* Step – This step corresponds to the description of the work context, motivation, objectives, and theoretical research developed.
- ❖ *Practical Research* Step:
  - o *Source Data Collection Step* – In this step, information is collected to analyze the universe of discourse.
  - o *Analysis of the Source Data* Step – In this step, it intends to objectively analyze the universe of discourse and model this analysis in ArchiMate and in natural language.
  - o *Results* Step – In this step, possible misalignment between Agency for Administrative Modernization (AMA) public discourse and the rigorous classification of the concepts in question in the ArchiMate language is identified. This section aims to detect concepts that can improve AMA discourse.
  - o *Validation (AMA)* Step – This step corresponds to the feedback obtained by the AMA about misalignment.
- ❖ *Conclusion* Step - This step mentions limitations, contributions, and future work.

1.3. Document structure

The dissertation is divided into eight chapters:

- ❖ **Chapter 1** – This chapter introduces the work context, motivation, objectives, and structure of the dissertation
- ❖ **Chapter 2** – This chapter explores theoretical concepts such as ISO 42010, frameworks such as Zachman Framework, and modeling languages such as ArchiMate, which are used to develop iAP AD.
- ❖ **Chapter 3** – This chapter presents the existing interoperability initiatives at the European and the national level.
- ❖ **Chapter 4** – In this chapter, information is collected to create the universe of discourse. The research is carried out using the documentation provided by the AMA, the documentation available to the public, and the documentation found.
- ❖ **Chapter 5** – This chapter corresponds to the modeling of the universe of discourse. The modeling is done both in ArchiMate and in *natural language*.
- ❖ **Chapter 6** – This chapter corresponds to the identification of misalignment, and the feedback obtained by AMA.
- ❖ **Chapter 7** – Corresponds to the conclusion of the dissertation.
- ❖ **Chapter 8** – Bibliographic references of the dissertation.

Chapters 1, 2, and 3 correspond to the first part of the methodology, *the preliminary*. Chapters 4, 5, and 6 correspond to *the practical research*.

Finally, chapter 7 corresponds to the third and last part, the *conclusion* of the dissertation.

2. Enterprise Architecture

This chapter is divided into four subchapters that are fundamental to understanding the research work of this dissertation. Sub-chapter 2.1 describes ISO/IEC/IEEE 42010 together with the definition of AD. This chapter allows the understanding of how to define an iAP AD. Sub-chapter 2.2 presents the Zachman Framework and layers that are "common" in Enterprise Architecture (EA). From the Zachman Framework, it is possible to understand the business context of iAP, namely the stakeholders and their concerns. Sub-chapter 2.3 briefly mentions frameworks and reference methods, namely the TOGAF ADM that has a set of support tools that allow assisting in the development of an AD. Sub-chapter 2.4 introduces different modeling languages, more specifically, the ArchiMate language. The ArchiMate modelling language allows to model AD.

2.1. Conceptual Modeling Core Concepts (ISO/IEC/IEEE 42010)

ISO / IEC / IEEE 42010[2] is a standard that defines, analyzes, and describes system architectures. This standard defines a set of concepts, relationships, and properties that must be used to create an AD for a system. Essentially it allows a process to realize to satisfy the concerns of a stakeholder. The execution of this process allows obtaining a set of information that is represented coherently and uniformly. Through this set of information, it is possible to extract models that inform the respective stakeholders.

Figure 2 depicts the conceptual model proposed by ISO/IEC/IEEE 42010 (The Open Group, 2019).

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[2] More Information - http://www.iso-architecture.org/ieee-1471/cm/
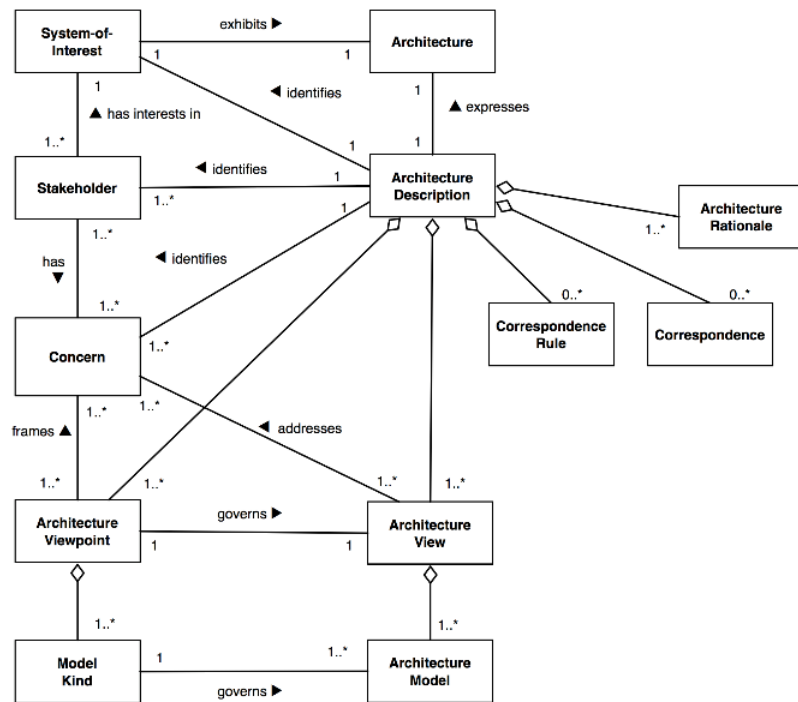
Figure 2: The Core of AD

2.2. On core Enterprise Architecture Viewpoints and Layers

This chapter covers the concept of "**viewpoint**" and "**layer**".

The concept of *viewpoint* is associated with ISO 42010 and the Zachman Framework. Since both may represent an organization or system, this representation allows creating different viewpoints for the various stakeholders and their concerns.

The concept of *layer*, in this work, is associated with the innumerable layers or sub-architectures that the EA has. It is possible to describe an EA through the viewpoints of the Zachman Framework.

In this work, both concepts have the same meaning.

2.2.1. Zachman Framework

John Zachman defined the Zachman Framework for EA. This framework allows to organize and categorize the descriptions of an organization. The Zachman Framework provides a context that permits understanding who the stakeholders are and their concerns. It also allows understanding the relationship between the different architectures of the company.

The development, change, and maintenance process allow the different architectural representations to be used by various participants and purposes through different viewpoints. These

representations, although integrated, are seen from different perspectives (horizontal axis). Each of these perspectives is classified according to six approaches "What, how, when, who, where and why" (vertical axis) (Ferreira Ferrão Couto e Vasconcelos, 2001). The answers to these questions allow obtaining a set of representations relevant to the description of a company. These answers allow to divide complex ideas into simpler ones (Lankhorst, 2009). The Zachman Framework has some advantages which, it is easy to understand. Like it addresses the company as a whole. However, this framework also has disadvantages. It is composed of many cells, which sometimes makes it hard to apply a structure in practice. It also does not have many details between the different cells (Spewak, Zachman, & Hill, 1992).

Figure 3 represents the Zachman Framework. In this figure, it is possible to observe the intersection of the two classifications.
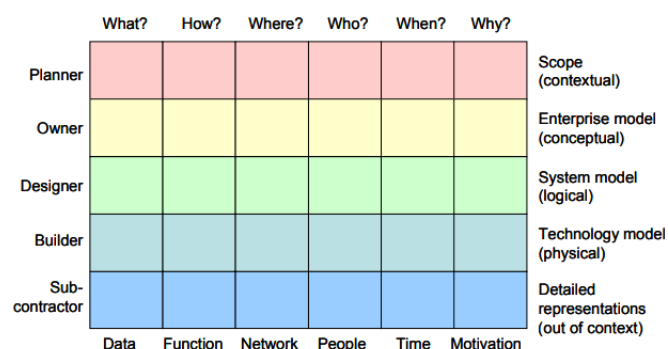

Figure 3: Representation of the Zachman framework (Jeannot, 2017)

2.2.2. Enterprise Architecture Common Layers

EA is composed of a set of viewpoints. These viewpoints are also known as EA sub-architectures. The sub-architectures that exist in EA are **Business Architecture** and **Information Systems Architecture.** The latter comprises **Information Architecture**, **Application Architecture**, and **Technological Architecture** (Caetano, Gama, Silva, & Tribolet, 2007).

- **Business Architecture**: The basis of this sub-architecture is the definition of the strategy, processes, and functional requirements of the business process, which allows the identification of the requirements of the information systems (IS) that support the business activities. These activities be a sequence of inputs and outputs that interact with the people who contribute to the achievement of the business objectives (Caetano, Gama, Silva, & Tribolet, 2007).

- **Information Systems Architecture (ASI)**: This aims to represent the structure of the IS components, their relationships, principles, and guidelines to support the business (Ferreira Ferrão Couto e Vasconcelos, 2001). Being divided into three levels, starting with **Information Architecture**, this sub-level represents and identifies the main types of data that support the development of an organization's business (Ferreira Ferrão Couto e Vasconcelos, 2001). **Application Architecture** identifies the main applications required for data management and supports the organization's business (Ferreira Ferrão Couto e Vasconcelos, 2001).

Technological Architecture defines the technologies that provide support for the operation of applications (Ferreira Ferrão Couto e Vasconcelos, 2001).

2.3. Frameworks and Reference Methods

Frameworks are references that include methods and techniques of representation that serve to express the views of an organization. These frameworks and reference methods are used to:

❖ The conception and realization of an organizational structure,

❖ Information systems,

❖ A company's infrastructure.

In this way, EA contains two types of processes. The first is the process of keeping the information up to date. The second is the process of extracting from the models to inform the interested parties.

To understand these concepts, this chapter presents a reference framework, FEAF, and two reference methods, Enterprise Architecture Planning by Steven Spewak and TOGAF.

2.3.1. Enterprise Architecture Planning

Steven Spewak developed the Enterprise Architecture Planning (EAP) framework. This framework is based on and complements the Zachman Framework. EAP is a process that allows the definition of architectures. This process ensures that the information system (SI) supports the business and the implementation plan for these architectures. EAP focuses on the top two levels of the Zachman Framework. Which can happen because Spewak considers that these levels are linked to what the company is. And the remaining levels are focused on design, development, and implementation (Spewak, Zachman, & Hill, 1992). The first stage is the "start of planning", which defines methodologies, tools, and stakeholders. At the second level, AS-IS is specified through the models of business, technologies, and current applications (Ferreira Ferrão Couto e Vasconcelos, 2001). The third level begins with the definition of the information model and the information that is used by the organization. This level consists of a sequence of phases. The first phase starts with **Data Architecture**, then the **Application Architecture,** and finally the **Technology Architecture**. (Spewak, Zachman, & Hill, 1992). Finally, the fourth level consists of the implementation and the migration process (Ferreira Ferrão Couto e Vasconcelos, 2001).

The EAP aims to ensure the alignment between the different architectures and the business. Then the levels and representation of Spewak's process are presented in Figure 4:

❖ **Level 1**: Initial planning of the architecture, focusing on the scope, objectives, functions, responsibilities, and methodology to be used, allows leading to the creation of a work plan for the EAP.

❖ **Level 2**: AS-IS modeling. It involves the modeling of existing businesses, technologies, and systems. This level makes a summary inventory of application systems and technological platforms.

❖ **Level 3**: TO-BE modeling. Models the architecture vision for the future "Where do we want to be in the future?". The **Data Architecture** identifies and defines the main types of data that support the Business Processes defined in the Business Model. The **Application Architecture** defines the applications required for data management. The **Technological architecture** defines the types of technology, which platforms support the business.

❖ **Level 4**: "How do we get to where we want to be in the future?" - Creates a migration and implementation plan for the new architecture. This plan includes the applications to which they are implemented, the migration plan, costs and benefits, success factors, and recommendations.
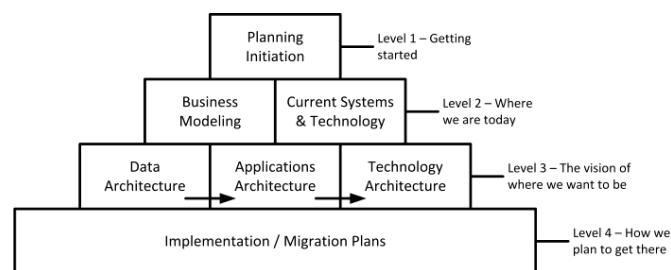

Figure 4: Representation of the four levels of the EAP

2.3.2. TOGAF

The Open Group developed the Open Group Architecture Framework (TOGAF). This framework is based on IEEE (Ferreira Ferrão Couto e Vasconcelos, 2001). TOGAF is a method that owns a set of support tools, which allow assisting the development of an AD. This framework can be used freely by any organization that wants to develop an EA (The Open Group, 2015). TOGAF has four architectural domains (The Open Group, 2015) :

❖ **The Business Architecture**: defines the business strategy, governance, and the organization. It also describes the main business processes.

❖ **The Data Architecture:** Describes the structure of an organization's logical and physical data assets and data management resources.

❖ **The Application Architecture**: It provides a blueprint for the applications deployed, their interactions, and their relationships to the organization's core business processes.

❖ **The Technology Architecture**: It presents the logical software and hardware resources needed to support the deployment of business services, data, and applications.

These concepts are executed in a repetitive and iterative process that realizes their content. This process is known as the Architecture Development Method (ADM). ADM is the core of TOGAF to describe a method to develop an EA (The Open Group, 2015). Figure 5 shows the TOGAF ADM.
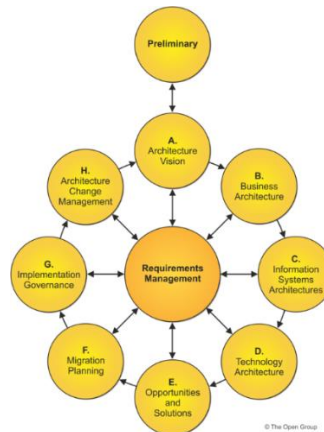
Figure 5: Phases of the TOGAF ADM

2.3.3. Federal Enterprise Architecture Frameworks

The Secretariat for Management and Budget (OMB) develops and maintains the FEAF. This framework offers a business model that covers the entire federal government. The FEAF consists of a set of interrelated reference models that are designed to facilitate analysis between agencies, the identification of duplicate investments, gaps, and opportunities for collaboration within and between agencies. These models are organized into six reference models (Executive Office of the President of United States, 2012):

- ❖ **Performance Reference Model (PRM)** - Performance Reference Model (PRM) - Measures the performance of huge IT investments, as well as their contribution to performance.
- ❖ **Business Reference Model (BRM)** - It focuses on the functional and organizational aspects of commercial operations carried out by the Federal Government.
- ❖ **Data Reference Model (DRM)** - It provides a standard by which data is described, categorized, and shared.
- ❖ **Application Reference Model (ARM)** - Categorizes the system, standards, and application-related technologies that support and enable the delivery of components and service features.
- ❖ **Infrastructure Reference Model (IRM)** - Categorizes the network or cloud-related standards and technologies. To offer support and allow the delivery of voice, data, and video.
- ❖ **Security Reference Model (SRM)** - Provides a common language and methodology for discussing security and privacy in the context of federal agencies' business.

2.4. Modeling Languages for Enterprise Architecture Modeling

A modeling language allows the 'Architect' to model a representation of an organization's or system's viewpoints. This subchapter covers different modeling languages. This subchapter mainly focuses on ArchiMate since it is through this that the models of the views develop.

2.4.1. ArchiMate

Due to the increasing complexity of modern organizations and the lack of modeling languages that allow the representation of the organization, it gave rise to the ArchiMate modeling language. Through ArchiMate, it is possible to overcome the existing difficulties in the analysis and communication between stakeholders. This allows for a simpler representation of business architectures. This language is divided into different layers (The Open Group, 2019) (Ferreira Ferrão Couto e Vasconcelos, 2007):

❖ **Business Layer**: This layer offers products and services to external customers. And that is realized by the organization through business processes carried out by actors and business functions.

❖ **Application layer**: Supports the business layer using application services performed by software applications.

❖ **Technology layer**: It offers a set of infrastructure services that are performed by the network's software and services.

❖ **Motivation Elements**: These motivation elements model the motivations or reasons, which allows guiding the design or the change of an Enterprise Architecture.

❖ **Physical Elements:** These elements are included as an extension of the Technology Layer to model the physical world.

❖ **Strategy Elements:** These elements are used to model a company's strategic direction.

The solution is developed using two layers, the business layer, and the application layer.

2.4.2. Other Relevant Modeling Languages

BPMN[3] allows furthering the detail of **ArchiMate's** process concepts. The main objective of **BPMN** is to bring a notation that is easy to understand for everyone in an organization faced with a business process. The **BPMN** can be composed of one or more levels of detail, depending on its purpose (White, 2004). **ArchiMate** allows the representation of application concepts in the same way as the **UML**[4] language. **UML,** in turn, allows to help design and describe software systems

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[3] BPMN - https://www.omg.org/spec/BPMN/2.0/
[4] UML - https://www.uml.org/what-is-uml.htm

(applications). Finally, for the representation of a cybernetic system, **SysML** [5] is used. The **SysML** reuses parts of the **UML.** Additionally, **SysML** offers new language elements.

To obtain more information about each of the modeling languages, follow each reference mentioned above.

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[5] SysML - https://www.omgsysml.org/what-is-sysml.htm

3. Enterprise Architecture in Public Administration

This chapter presents some adoptions of e-government initiatives. These initiatives are divided into two the National Initiatives and the European Commission's Initiatives. Sub-chapter 3.1 introduces the national initiatives (EAs and FIs) that some countries have created or adapted for their UCs. Sub-chapter 3.2 presents the European initiatives. The European initiatives comprise the programs and initiatives that the European Commission has been developing for PA interoperability. Through these programs and initiatives, the exchange of information and the transparency of public services are facilitated.

3.1. National Initiatives

This chapter addresses the national initiatives, EA, and Interoperability Framework (IF). For each one, it presents its definition and its purpose (Guijarro, 2009) (Oliveira Lisboa, 2012). The interoperability framework is the central concept of this dissertation. As such, this subchapter addresses this concept in greater detail. At the end of this subchapter, a comparison between the two initiatives is presented.

3.1.1. Enterprise Architecture

The concept of EA refers to an AD. EA covers all the principal elements and relationships that constitute an "Enterprise". The definition of enterprise can be a company or an institution. It is concluded that an EA aims to align the business processes, the objectives of a company and the applications and systems that build its technical infrastructure (Guijarro, 2009) (Oliveira Lisboa, 2012).

3.1.2. Interoperability Framework

Governmental interoperability allows several public entities to be able to provide cross-cutting services in a simple way to citizens and other entities. It is also possible to increase the capacity for data sharing between different agencies. In this way, they can improve government decision-making, which allows the levels of transparency to improve between government, citizens, and organizations (Guijarro, 2009).

The IF is generally composed of three levels of interoperability, organizational, semantic, and technical interoperability. Each level of interoperability is based on the previous level, that is, the semantic level is based on the technical level, and the organizational level is based on the semantic level. Figure 6 represents this structure.

The **Technical Interoperability** represents the ability of systems and devices to exchange data reliably and without added costs. The **Semantic Interoperability** makes it possible to keep the meaning of information in circulation. Information is obtained through the use of terminology, taxonomies, and data schemas. The **Organizational Interoperability** represents the capacity for cooperation between different organizations (Novakouski & A. Lewis , 2012).
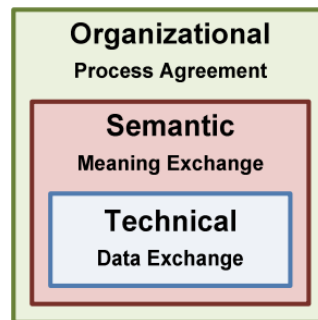
Figure 6: Interoperability Levels

In addition to these three concepts, there is one more, **legal interoperability**, but it is more common for IF structures to have only the three levels. The **legal interoperability** of the IF ensures that entities operate under different legal structures, policies, and strategies can work together.

A country aims to create and adopt an IF in its public bodies to achieve a higher level of interoperability between the different services and bodies. In this way, the government can have services that behave in an integrated manner, managing to obtain better public services for its customers and make governance decisions more simply.

The benefits of adopting an IF are numerous:

❖ **Increased transparency** - through the continuous flow of information, governments are more easily able to promote their services to citizens and entities.
❖ **Better coordination between different entities and services** - information and data is easier to obtain.
❖ **Improvement of services** provided to citizens and entities
❖ **Cost reduction** - due to simple communication between systems, reducing the costs of redundant systems.
❖ **Greater cooperation internationally** - interoperability between the governments of different countries facilitates the exchange of information.

Currently, there are already several countries with the IF implemented or with the creation of the IF for the PAs. The European Commission itself created its version of the IF, the European Interoperability Framework.

This dissertation focuses mainly on three layers, **the legal layer**, the **semantic layer**, and the **organizational layer**. In *chapter 4* these three layers are presented in greater detail.

The IF countries *Annex I – Initiatives* contains a list of some of the countries that have developed and published information and documentation on the IF.

3.1.3. Conclusions

With these two concepts, it's possible to conclude that EA is a great way to achieve the interoperability of e-government. EA helps to align the models of the organizations that want to align. The definitions of EA and IF are not far from each other. The main difference is that EA allows it to be used in any type of system and organization, as previously mentioned. In turn, the IF focuses only on its use in systems for exchanging information and data (Guijarro, 2009) (Oliveira Lisboa, 2012).

3.2. European Initiatives

For European initiatives in recent years, there has been a change in the e-government paradigm (in other words, in the Open Government). Open Government facilitates the transformation of public administrations into a digital governance system by optimizing the flow of processes and open data.

Governments intend to do away with public entities that operate individually. They want to start working on a cross-border basis, which allows them to reduce costs and increase the ease of transferring information. The European Commission has developed structures and initiatives to promote interoperability in PAs, like:

- ❖ The ISA² Programme
- ❖ The Single Digital Gateway

3.2.1. The ISA² Programme

The European Parliament and the Council of the European Union adopted the ISA² program (Interoperability solutions for European public administrations). ISA² provides a framework that allows the Member States to work together and create efficient and effective cross-border and intersectoral electronic public services. This program develops solutions that support interoperable digital services. These solutions are available to all interested PAs in Europe (European Commission, 2017) (Katja, Martin, & Jukka, 2007), containing the following actions (European Commission, An introduction to the European Interoperability Reference Architecture (EIRA), 2017):

- ❖ Exchange of reliable information.
- ❖ They have accompanying measures such as communication activities, evaluation of the evolution of the program's implementation.

ISA² promotes and maintains the European Interoperability Framework (EIF) in close cooperation between the Member States and the Commission. This framework calls for the establishment of interoperable trans-European networks that will allow citizens to take advantage of a European internal market. The EIF owns three pillars, the Principles, Layers, and the Conceptual Model.

Principles of interoperability are fundamental behavioral aspects to promote intolerable actions. The **Conceptual Model** guides the development and management of public services by the Member States (European Commission, 2017). The **EIF** comes from the **IF**, so the **EIF Layers**[6] are four layers of interoperability (European Commission, New European Interoperability Framework.) (European Commission, DLV02.02 – Architecture, 2018).

- ❖ **Legal** - This ensures the organizations that operate under different legal structures, policies, and strategies can work together.
- ❖ **Technical** - Connect computer systems by agreeing on standards for presenting, collecting, exchanging, processing, transporting data.
- ❖ **Semantic** - Ensures that the transported data shares the same meaning.
- ❖ **Organizational** - Organizes internal organization business processes and structures to improve data exchange.

ISA² developed the European Interoperability Reference Architecture (EIRA). This architecture makes it easier to exchange information between public services and between companies and citizens. The EIRA is a metamodel that defines more prominent architectural building blocks (ABBs). The ABBs are needed to build an interoperable e-government system. Figure 7 represents the EIRA layers. It is relevant to mention that EIRA is aligned with EIF.
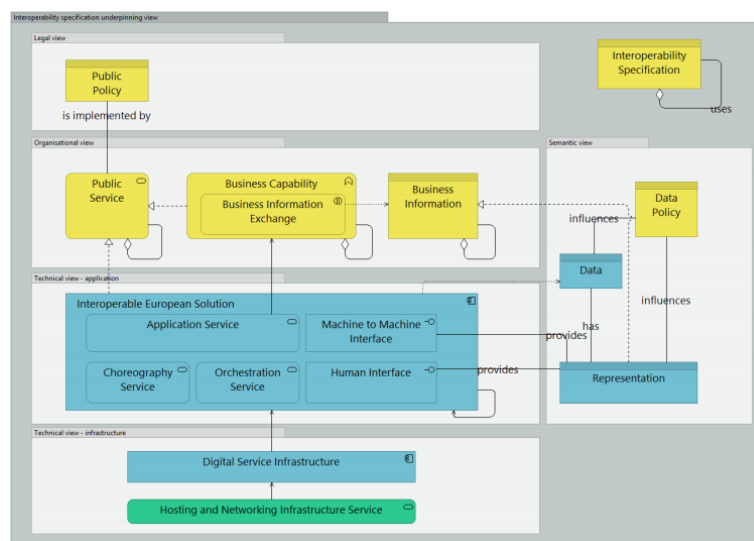
Figure 7: High-level overview of the EIRA

3.2.2. The Single Digital Gateway

The European Parliament and the European Council decide about European portals, sites, and services should be expanded, integrated, and linked to different national solutions, creating a single point of entry for European PAs. The Single Digital Gateway (SDG) allows the integration of national and EU services with an interface accessible through a centralized portal. The SDG facilitates access

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6   EIF   -   https://joinup.ec.europa.eu/collection/nifo-national-interoperability-framework-observatory/eif-european-interoperability-framework-0

to the information, administrative procedures, and assistance services that citizens and businesses need to live or operate in another EU country. The access point to the SDG is the "*Your Europe*" portal and gives access to (Commission, 2017):

❖ **Information**: "Citizens will be able to easily find reliable, qualitative information on EU and national rules that apply to them when they want to exercise their internal market rights".

❖ **Procedures**: "Citizens will find out exactly how to carry out administrative procedures and what steps they need to follow".

❖ **Support services**: "If users are still confused about which rules apply or have problems with a procedure. Users are directed to the most appropriate national or EU helpdesk to solve their problem".

Based on EIRA, it is possible to create the SGD architecture. The SGD consists of five layers, each of which corresponds to a level of interoperability. However, the SGD has one more **Technical view**, the **Technical view - Interoperability Enablers**, compared to EIRA. This visualization allows traceability between architecture building blocks (ABBs) at different levels (European Commission, 2018).

3.3. Communications

Promoting initiatives with stakeholders allows for higher adhesion, which increases the efficiency of the initiative.

The stakeholder communication process includes a two-step sequence. The first starts with the establishment of a global communication strategy. The second is the implementation of the first step, through workshops, print publications, conferences, audiovisual material, and presence in print and electronic media (social media) (European, 2016) (Commissions, 2018).

The (European, 2017) is an example of the communication plans of the ISA² program. To promote this program, internal and external communications are carried out.

Internal communication covers the different units in the Commission's offices is made through:

❖ Online channels, for example, "MY INTRACOMM".
❖ Campaigns on social networks, LinkedIn, Facebook, Twitter, Yammer.
❖ Lectures, webinars, workshops, and online training sections.

External communication to the Commission's offices is made through:

❖ Campaigns on social networks, LinkedIn, Facebook, Twitter.
❖ Annual conference.

4. Source Data Collection

This chapter mentions the information that currently exists in the universe of discourse (UoD) in question. Sub-chapter 4.1 introduces interoperability in public administration. Sub-chapter 4.2. mentions the covered interoperability aspects of iAP.

The source data comprises a set of documents provided by AMA and public information in websites, which resulted in the UoD for the purpose of this work.

4.1. Interoperability in Public Administration

AP, to focus on the service provided to the consumer, citizen, or entity, defined, and implemented the Public Administration Interoperability Platform. This platform aims to provide an easy and integrated method for the provision of transversal electronic services between the various entities, to simplify the integration between the different players. [7]

iAP is a necessary platform in the process of administrative modernization of the Portuguese State, as it allows simplifying the provision of services.

iAP has the following principles (iAP, 2011):

❖ Promote and facilitate interoperability in PA at the technical, functional, and organizational level.

❖ Allow an easy and integrated provision of cross-cutting electronic services centered on the citizen.

❖ Facilitate and minimize effort and cost in the development of new electronic processes and maintenance of existing electronic services.

❖ Provide authentication mechanisms. Securely, they facilitate the identification of the citizen before the entities that are registered on the platform.

❖ Greater security and confidentiality when exchanging data and documents.

❖ Provide a single Back-office for the integrated management of available and consumed services, allowing for integrated management of the various transversal electronic services.

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[7] More about iAP - https://www.iap.gov.pt/web/iap/inicio

Figure 8: iAP Homepage[8]

According to the iAP website (Figure 8), there are currently five services:

- ❖ **Integration Platform**[9] (PI)
- ❖ **Payment Platform**[10] (PPAP)
- ❖ **Messaging Platform**[11] (GAP)
- ❖ **Document Interoperability**[12]
- ❖ **Opening a Dematerialized Account**[13]

PI deals with the exchange of data and documents between entities, both public and private. **PPAP** provides and manages the integration of various digital payment methods according to the different service channels. **GAP** enables the exchange of messages between public entities and citizens[14]. This platform makes it possible to expand the number of contact channels available for managing stakeholder relationships.

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[8] More about iAP - https://www.iap.gov.pt/web/iap/inicio

[9] More about PI - https://www.iap.gov.pt/web/iap/plataforma-de-integracao

[10] More about PPAP - https://www.iap.gov.pt/web/iap/plataforma-de-pagamentos

[11] More about GAP - https://www.iap.gov.pt/web/iap/plataforma-gateway-de-mensagens

[12] More about Dematerialized Account Opening - https://www.iap.gov.pt/web/iap/abertura-conta-desmaterializada

[13] More about Document interoperability - https://www.iap.gov.pt/web/iap/interoperabilidade-documental

[14] More information - http://historico.simplificar.gov.pt/sites/default/files/uma_so_vez_manual_de_procedimentos_1.0.pdf
and https://www.iap.gov.pt/web/iap/inicio

Document interoperability allows for the dematerialized exchange of documents between Public Administration systems. **Opening a dematerialized account** makes it possible to open an account in banks and financial institutions and keep the customer's identification elements always up to date.[15]

Currently, iAP has two ADs, Figure 9 and Figure 10. Figure 9 shows some of the services that iAP has, and Figure 10 exposes the existing communications.
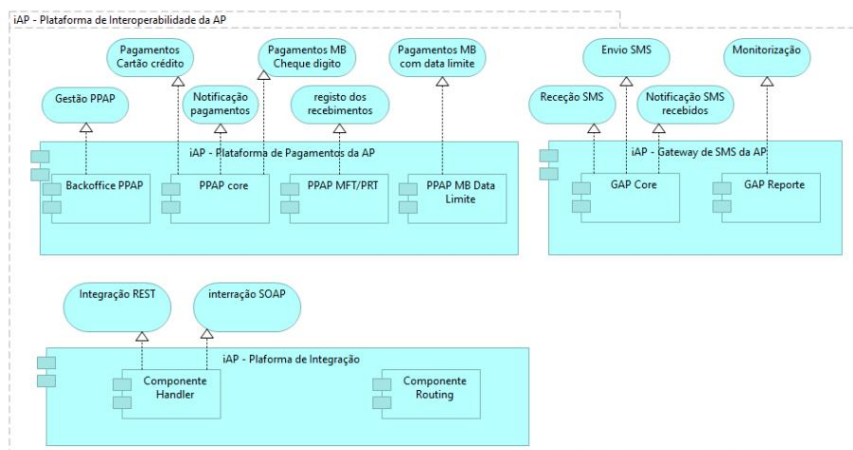
Figure 9: Interoperability Platform Services (Services)[16]
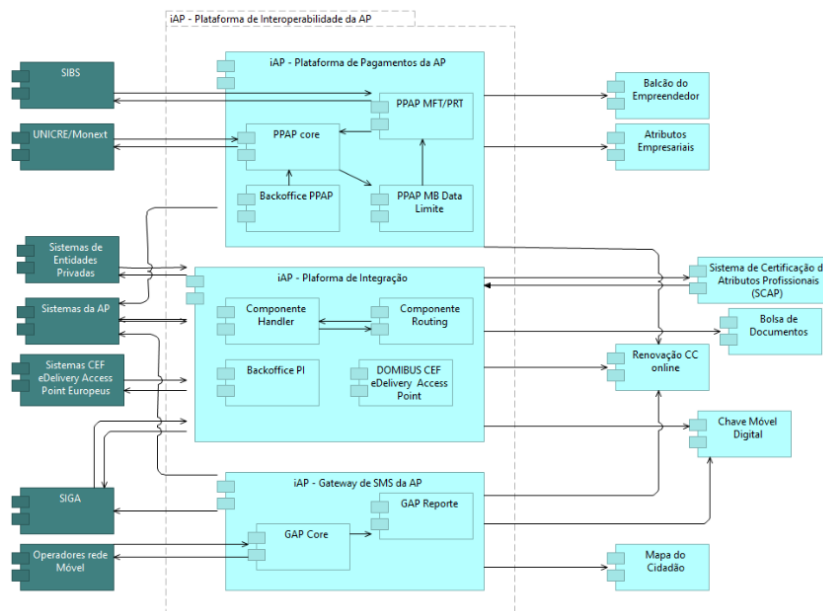
Figure 10: Interoperability Platform Services (Communications)[17]

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[15]More information - http://historico.simplificar.gov.pt/sites/default/files/uma_so_vez_manual_de_procedimentos_1.0.pdf and https://www.iap.gov.pt/web/iap/inicio

[16] More about - https://zenodo.org/record/5544542#.YVdt3ZrMKUl

[17] More about - https://zenodo.org/record/5544542#.YVdt3ZrMKUl

4.2. Aspects of Interoperability Approached in the Interoperability Platform

As mentioned in sub-chapter 3.1.2, the interoperability framework consists of three interoperability parts, Technological Interoperability, Semantic Interoperability, and Organizational Interoperability.

Technological interoperability is inherent to iAP since the development of this platform followed the European EIF's recommendations and with open standards (iAP, 2011). **Semantic interoperability** underlies the integration platform through the Canonical Data Model. The Canonical Data Model provides the standardization of platform concepts and provides a Service Catalog. This Catalog has a set of Canonical Services that can be consumed by the Integration Systems (SI) with which it integrates. The Canonical service is the representation and provision of electronic service in the Platform's Service Catalog. Each entity that intends to use an electronic service must define the mapping between its internal format (data model of its SI) and the format contained in the Catalog. Figure 11 and Figure 12 represents the explanation presented (iAP, 2011). **Organizational Interoperability** is implicit in the Interoperability Platform, as it provides electronic services through a privileged contact channel, which allows for the transfer of information and documentation in the PA between entities (iAP, 2011).
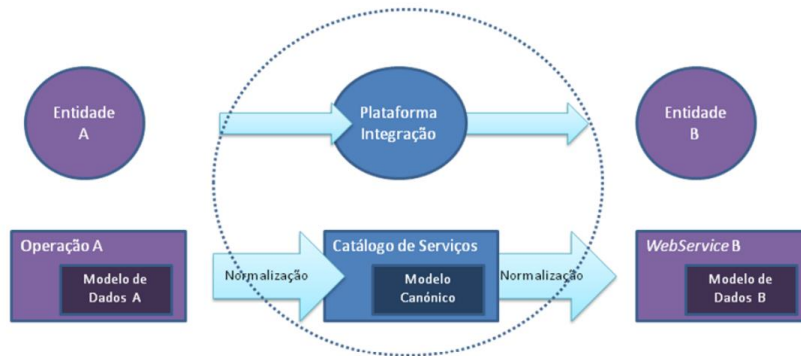
Figure 11: Data normalization in communication between Entities (iAP, 2011)
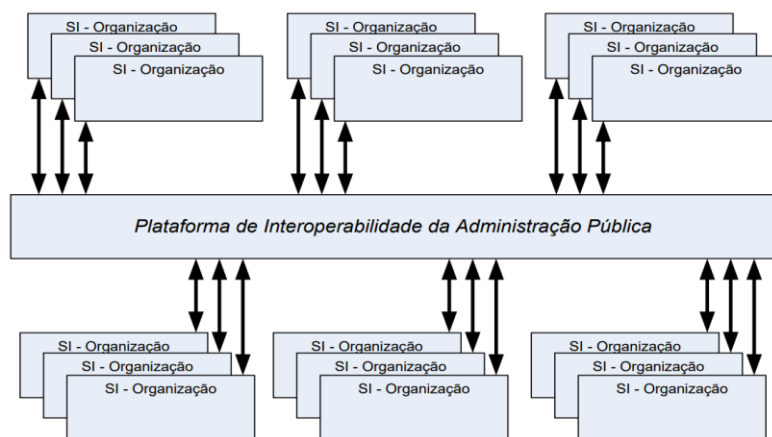
Figure 12: Reference model for integration between organizations (iAP, 2011)

5. Analysis of the Source Data

This chapter aims to analyze and model the UoD to obtain a view of the iAP. The UoD modeling is developed according to the interpretation obtained in the documentation[18] (iAP, 2011). And from the questions asked to the AMA (*Annex II - Questions*).

Annex III - ArchiMate Concepts contains all ArchiMate concepts used in AD modeling.

As mentioned in *Chapter 1*, the first objective is to understand the **stakeholders** relevant to the iAP, and the second is to find out what their **concerns** are. In this analysis, the term audience is used to designate a set of stakeholders.

In this work, there are two types of audiences. The **first type** of audience is those who manage, evolve, and maintain the iAP, have governance responsibilities, and are knowledgeable about the business and technology. The **second type** of audience is those who use the iAP and make decisions, as possible future users but are not knowledgeable about the business and technology.

The **first type** of audience contains AMA employees who hold management positions and make decisions around the iAP. This audience is mainly concerned with having access to detailed and comprehensive iAP modeling. Which in some cases may mean going more profound into technical problems. For this audience, iAP modeling is performed in ArchiMate in a more detailed and comprehensive way.

The **second type** of audience includes entities external to AMA. The Government is one of these external entities. It must have an AMA supervisory role and make high-level strategic or governance decisions. This audience may be more motivated to obtain a high-level view of iAP, focusing on its overall value propositions. For this second type of audience, it is also possible to consider all public administration entities, private entities, and citizens who use the iAP or entities that AMA intends to bring to this context as future users. For this audience, iAP modeling is performed a simplified view in ArchiMate and another view in natural language.

The first type of public is **AMA employees**. And the second type of public is **entities external to AMA**.

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[18] More information - http://historico.simplificar.gov.pt/sites/default/files/uma_so_vez_manual_de_procedimentos_1.0.pdf, https://www.iap.gov.pt/web/iap/inicio and https://zenodo.org/record/5544542#.YVdt3ZrMKUl

Considering the audiences, it is possible to determine the actors. AMA employees have the actor "AMA Employees". Entities outside the AMA have the following actors:

- ❖ Public Entity
- ❖ Private Entity
- ❖ Citizens
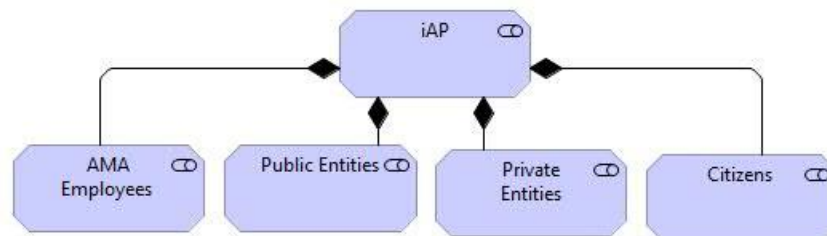
Figure 13: iAP Context Diagram

AMA assumes the role of infrastructure manager and can also assume the role of a service provider. The public entity can play the role of supplier or consumer. The private entity and the citizen always have the role of consumer. The supplier and consumer entity can be divided into two roles:

- ❖ Entity registered in the service
- ❖ Candidate for entity registered in the service

Once the actors and their roles have been defined, it seeks to analyze the services and processes that the interoperability platform has. The concept of service allows representing a behavior that is defined by a stakeholder. The concept of the process allows the representation of a sequence of behaviors, which allows obtaining a set of services. In iAP there are two types of services, the **business service**, and the **application service**. **Business service** describes behavior defined by a supplier. The **application service** represents a behavior defined by the AMA. Application services support the business services as well as the existing business processes in iAP.

iAP currently has three application services:
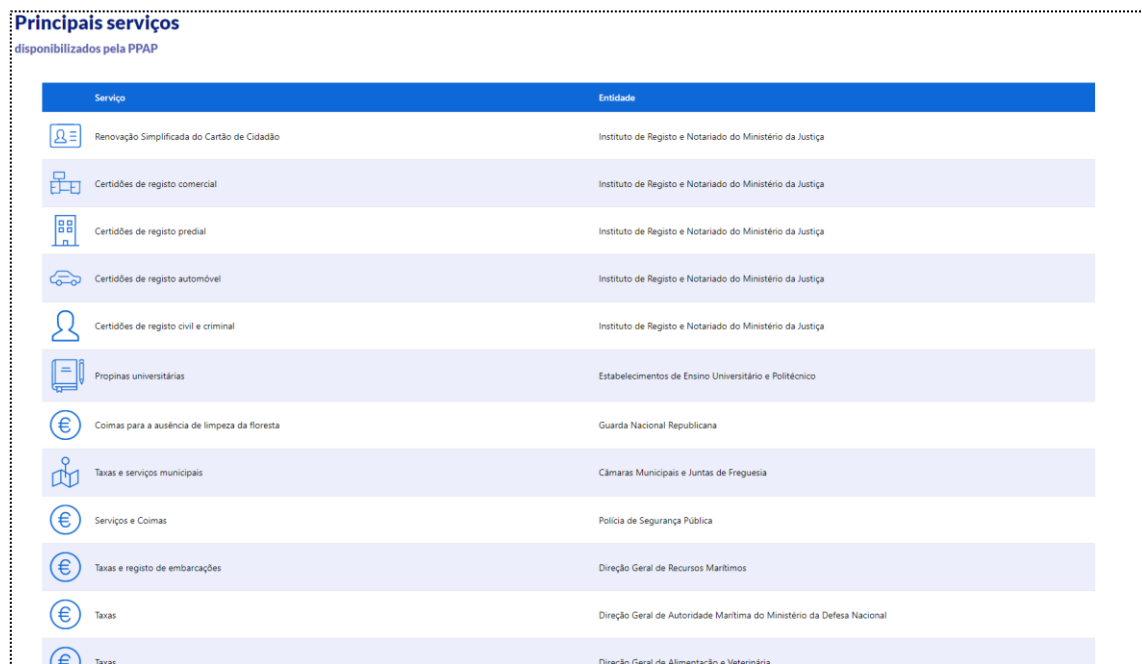
- ❖ **Integration Service (IS)** - Allows handling the exchange of data and documents between entities.
- ❖ **Payment Service (PS)** – Allows making payments between entities and the citizen.
- ❖ **Messaging Service (MS)** – Allows the exchange of messages between entities and the citizen.

Table 1: iAP Application Services

ID	Service	Provider
1	IS	AMA
2	PS	AMA
3	MS	AMA

Each application service (IS, PS, and MS) decomposed into application services, service processes, and service businesses. Application services belong to iAP. These are services that iAP has to offer to protocol providers. Figure 15 represents the IS application services. Business services are the services that registered providers have to offer to registered consumers. Figure 14 represents PS business services.

For each platform, an explanation is given, and its modeling is presented.

Figure 14: iAP website screenshot of "core services" (PS)

Note[19]: *All models in ArchiMate can be found in the link reference.*

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[19]More about modeling - https://zenodo.org/record/5544587#.YVd8MprMKUk

5.1. Integration Service

In IS, the role of the registered supplier is associated with a public entity. The role of the registered consumer is associated with a private or public entity. Figure 15 represents the application services that IS has to offer to protocol suppliers. These application services allow entities to communicate with each other and share data and documents.
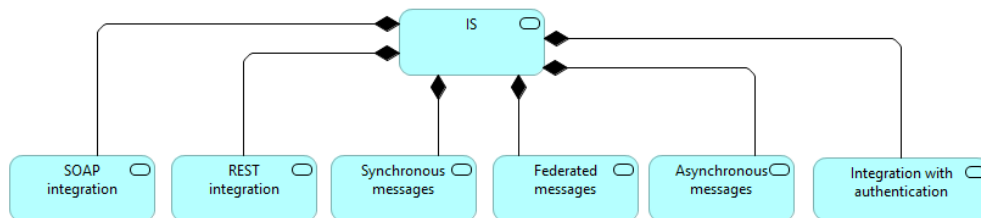
Figure 15: IS Application Services

The Integration Service has three processes, the **process of registering the service**, the **process of registering the entity**, and **the process of using the service**. IS provides through each process an easy and integrated method of providing services. In this way, it can provide accessible shared services to all registered entities.

The **process of registering a service** involves registering the supplier (if this is not yet registered in the IS) and registering that service. The **process of registering an entity** involves registering a consumer entity in a previously existing service. The **service utilization process** is the orchestration process. This process allows a consumer entity registered in the IS to use the services provided by the supplier entities registered in the IS.

The **process of registering a service** begins with a supplier entity (protocoled or not in the IS) to make a formal request to AMA. In case the supplier entity is not registered in the IS, the registration process involves first registering the supplier entity and only then the service. In case the supplier is already registered with IS, the registration process involves registering only the service. Once the service and the supplier entity are registered, the necessary operations are carried out for the development of the service at the supplier, as well as with the quality tests and the transition to production. This process takes place between the supplier entity and the IS Manager.

The **registration process an entity** registers the consumer entity in the service. After registration, the technical operations necessary for the development of the customer service are handled. And finally, the transition to production takes place. This process is handled between the consumer, supplier and IS Manager.

The supplier and the consumer entity must be registered in the business service and in the IS to perform the **orchestration process**. The orchestration process starts with the consumer entity requesting to use a service. IS processes the data and communicates it to the provider of this service.

Finally, the supplier receives the information from the IS and makes the service request to the consumer.

5.1.1. Integration Service Views (Intended for the AMA employees)

The views modeled in this subchapter have detailed and comprehensive information. There are three views:

- ❖ IS detailed view
- ❖ View with registration processes
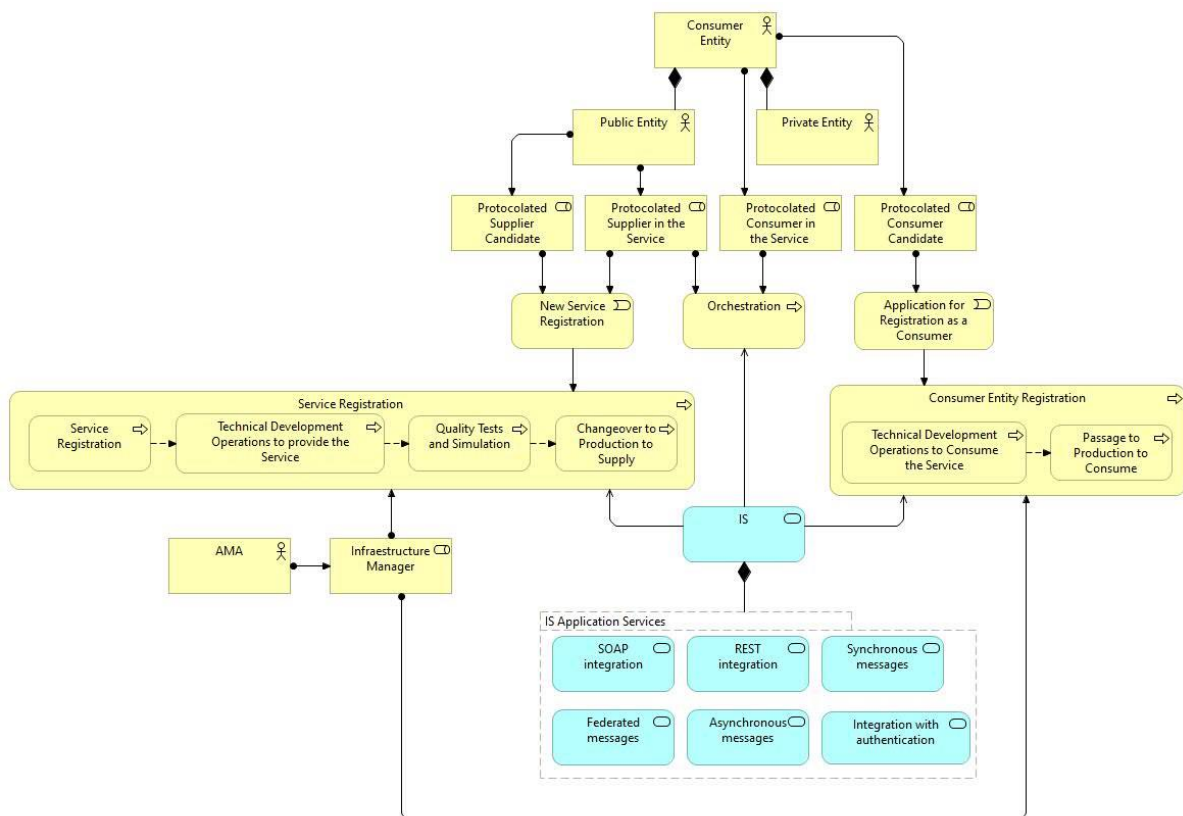- ❖ View with service orchestration process.
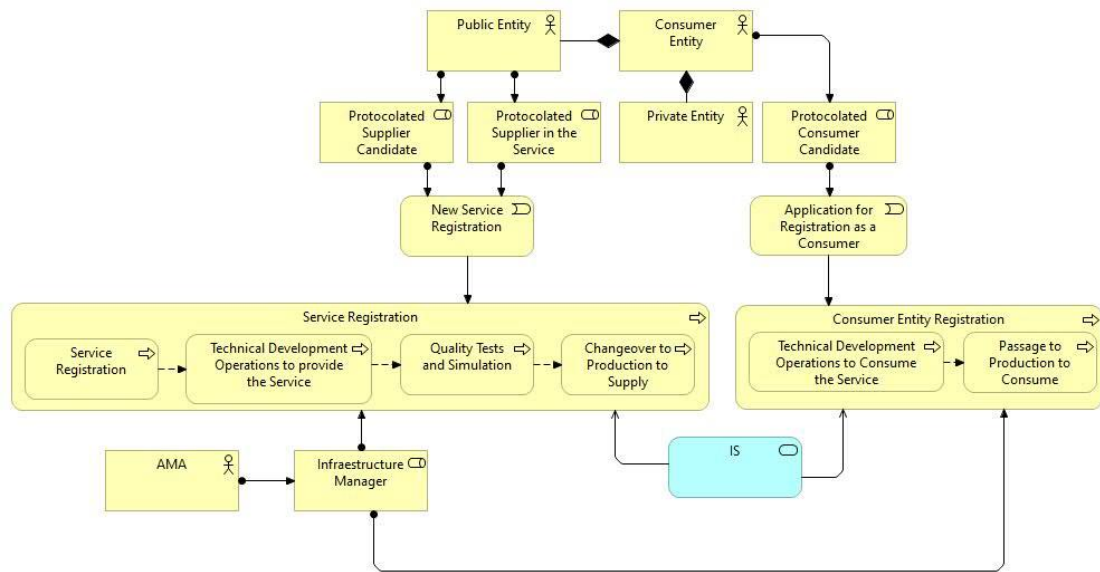

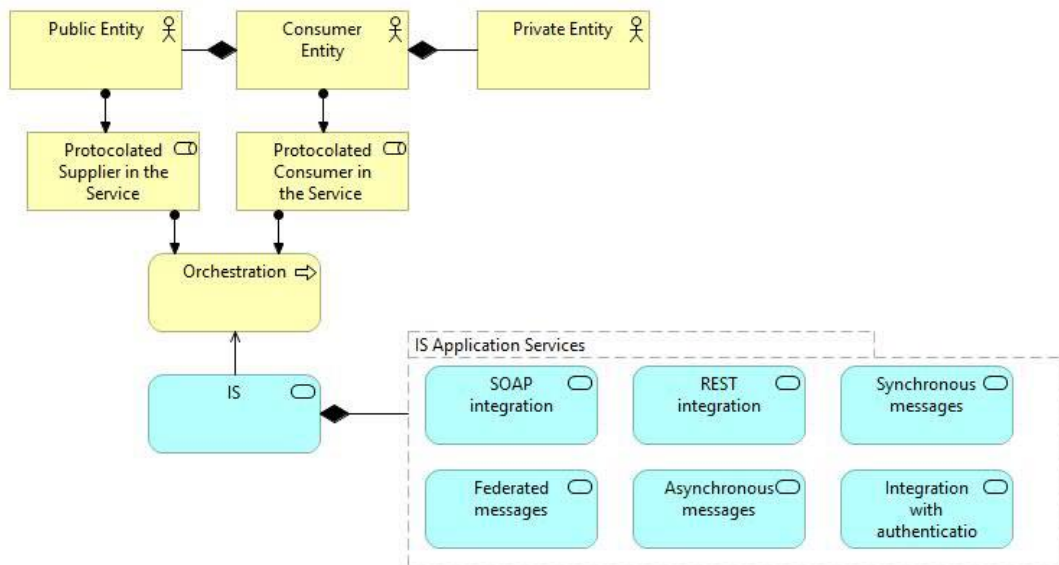*Figure 16: IS Detailed View*

Figure 17: View of IS Registration Processes

Figure 18: IS Service Orchestration Process View

5.1.2. Integration Service Views (Intended for entities external to AMA)

The views modeled in this subchapter have more general information. For the simplified IS modeling, three views are developed:

- ❖ Simplified IS View
- ❖ View with registration processes
- ❖ View with service orchestration process
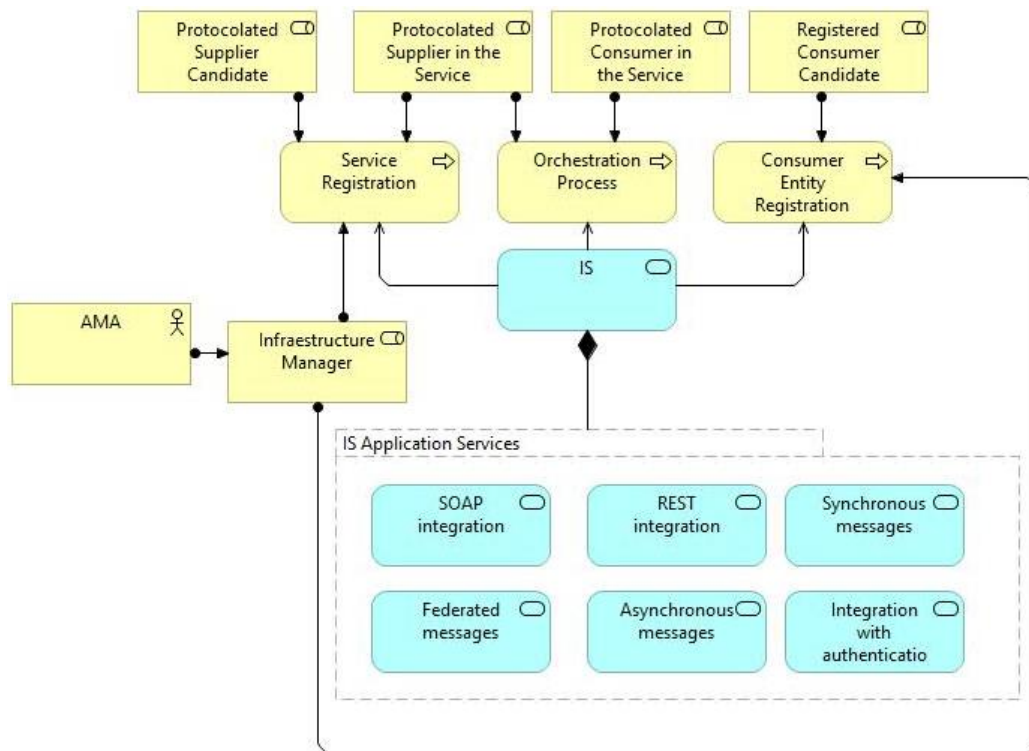
Figure 19: Simplified View of IS in ArchiMate
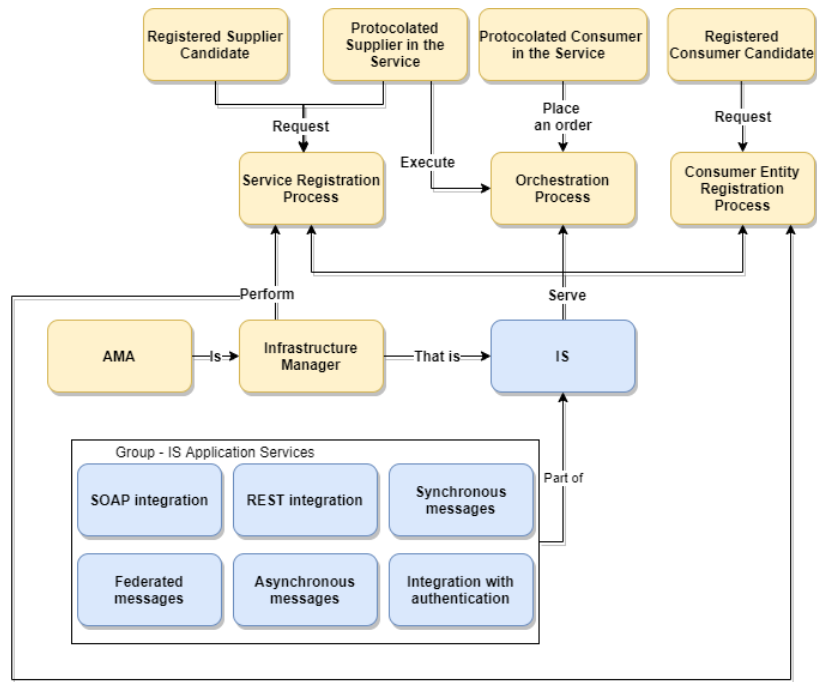
Figure 20: Simplified View of IS in "Natural Language"
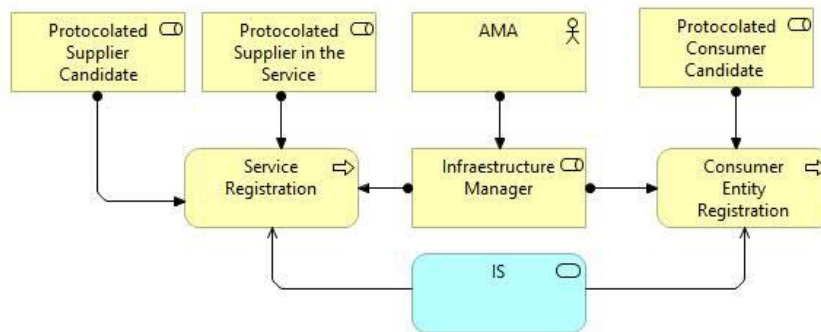
Figure 21: Simplified View of IS Registration Processes in ArchiMate
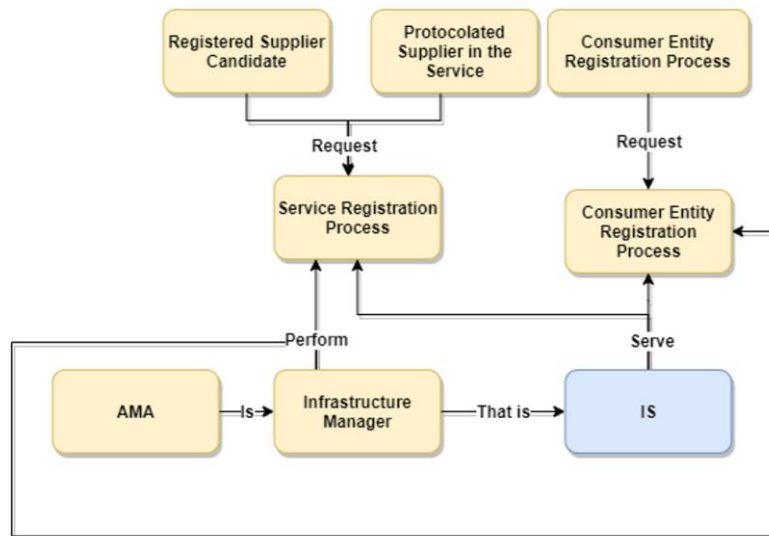
Figure 22: Simplified View of IS Registration Processes in "Natural Language"
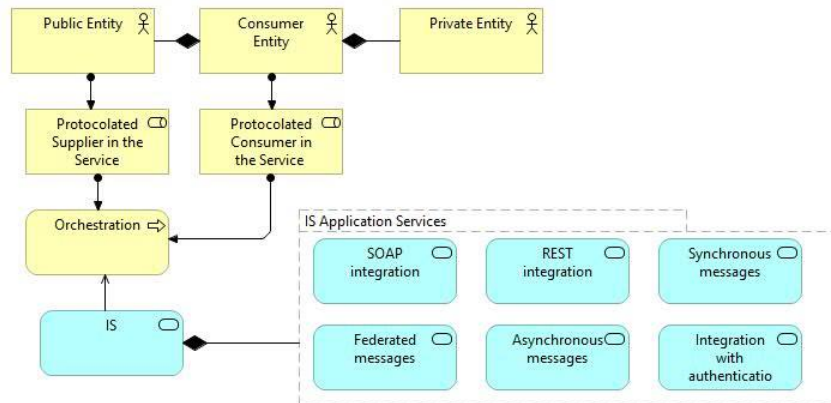
Figure 23: View of IS Service Orchestration Process in ArchiMate
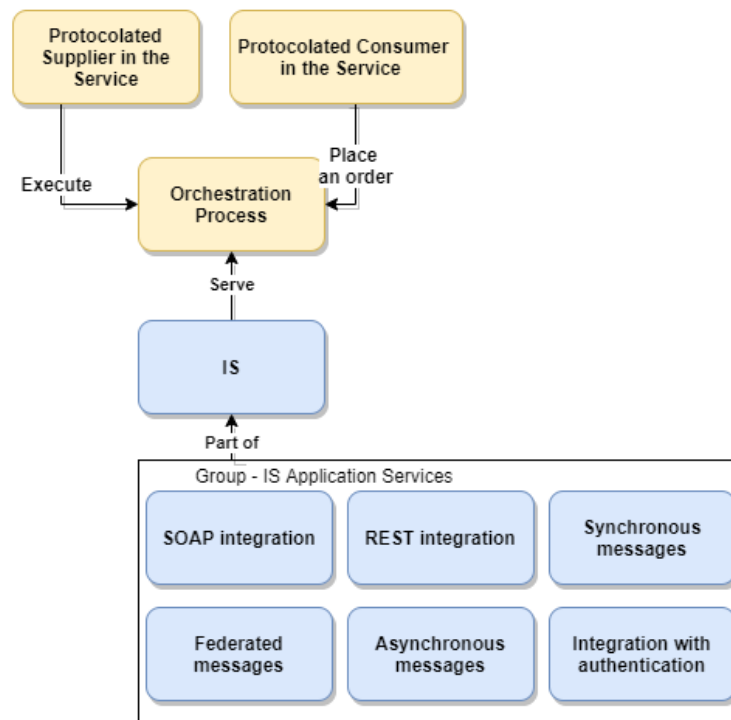
Figure 24: View of the IS Service Orchestration Process in "Natural Language"

Table 2 contains the business services of each supplier filed in IS.

Note: *Each service in the "Consumer" column of Table 2 is made up of another table (Annex IV - Consumer Tables), the remaining tables are attached. For example, the line "Public Entities – Beneficiary" contains another table (*Table 10*).*

Note: *In the "Consumer" column of Table 2, services that contain a "*" are services that can be consumed by any entity, both public and private.*

Table 2 - Business Services filed in IS

Id	Service	Provider	Consumer
1	Beneficiary Information Query	ADSE	Public Entities - Beneficiary
2	Notification of Change of Address	AMA	Public and Private Entities
3	Professional Attributes Certification	AMA	Professional Attributes
4	Document Bag	AMA	*
5	Document Interoperability	AMA	*

Id	Service	Provider	Consumer
6	Electronic Notifications	AMA	*
7	IRS Proof	ATT	Public Entities - IRS
8	Invoice Validation	ATT	*
9	Get Beneficiary Data	ISS	Public Entities - Beneficiary
10	Existence of Debt to Finance	ATT	Financial Institution
11	Get Personal Data Contributor	ATT	*
12	Consult Heritage Information	ATT	*
13	Publish Contest	BEP	*
14	Obtaining Data Professional Status	CGA	Public Entities - Ministries
15	Get Driving License Data	IMT	Finance
16	Publication / Base Portal Consultation	IMPIC	Base Portal Entities
17	Change of Address	IRN	Public and Private Entities
18	Address Validation	IRN	Public and Private Entities
19	Sharing Citizen Card data	IRN	Public and Private Entities
20	Death Notice	IRN	Public Entities - Death
21	Citizen Card Issuing Services	IRN	CVCC
22	Income Data Information Query	ISS	Public Entities - Professional
23	Contribution Status	ISS	Public Contracting
24	Installment Status	ISS	Financial Institution
25	School Data	ISS	Public Entities - Schools
26	Obtaining Data Professional Status	ISS	Public Entities - Professional

Id	Service	Provider	Consumer
27	Medical Certificates	SPMS	Medical Entities
28	Sending Documents	AMA	Interop. Doc.

5.2. Payment Service

In PS, the registered suppliers are the public entities, and the registered consumers are the citizens. Figure 25 represents the application services that PS has to offer to protocol suppliers. These application services allow payments to be made.
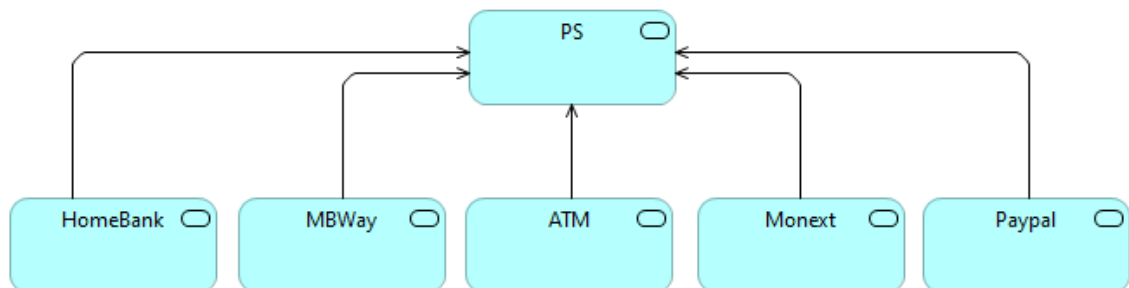
Figure 25: PS Application Services

The Payment Service has three processes, the **supplier registration process**, **the payment order issuance process**, and the **payment order settlement process**. The **process of registering an entity** involves registering a supplier entity in the PS. For **payment order issuance and settlement processes**, this service provides references for the payment order issuance and provides consumers with several methods to settle the payment order. Entities such as PayPal, IGCP, SIBS, and Redeunicre issue various payment order references. This way:

Table 3: Each entity generates a certain reference

Entity	Reference
PayPal	PayPal
IGCP	DUC
SIBS	MBWay and Bank
Redeunicre	Bank

PS obtains the references through the payment network and issues these same references to each supplier entity. To facilitate PS, it previously asks for a range of DUCs and bank references to be used later in its services. PayPal and MBWay referrals are generated in real-time. When the consumer receives a payment reference, they can use one of the PS services (PayPal, Monext, ATM, MBWay, HomeBank). PS informs the supplier when payment is made.

For the representation of views, the analysis mentioned above is considered and Figure 26.
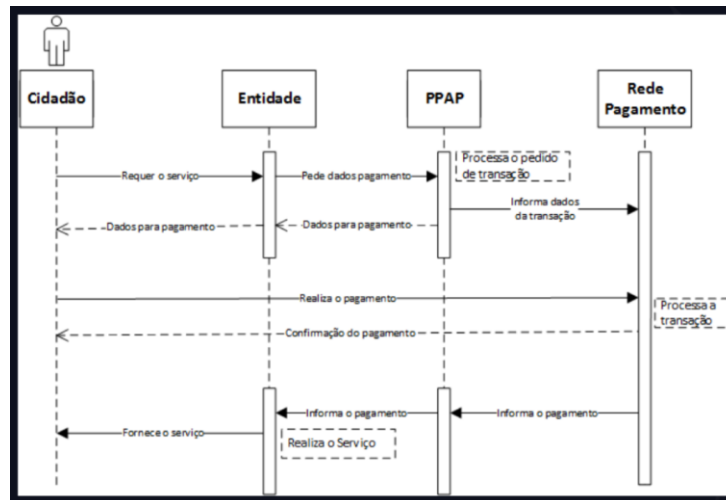
Figure 26: PS information flow behavior[20]

5.2.1. Payment Service Views (Intended for the AMA employees)

The views modeled in this subchapter have detailed and comprehensive PS information. There are three views:

- ❖ PS Detailed View
- ❖ View with the registration process
- ❖ View with payment processes

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[20] More about - https://zenodo.org/record/5544542#.YVdt3ZrMKUl
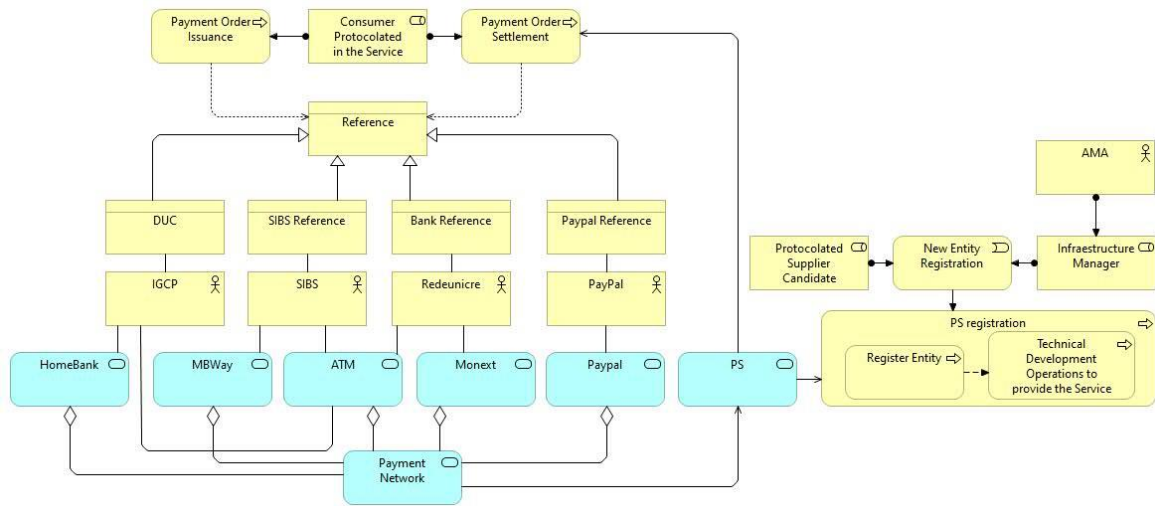
Figure 27: PS Detailed View
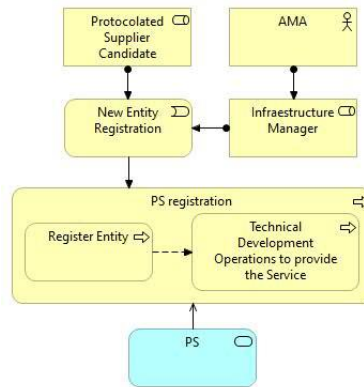
Figure 28: View of the PS Registration Process
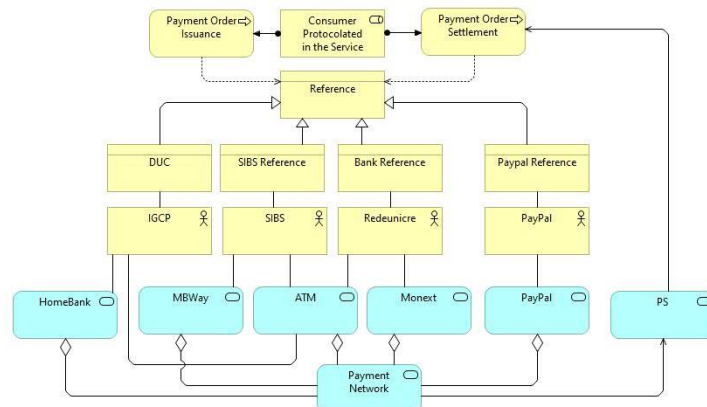
Figure 29: PS Payment Process View

5.2.2. Payment Service Views (Intended for the entities external to AMA)

The views modeled in this subchapter have more general information. For the simplified PS modeling, three views are defined:

❖ Simplified view of PS
❖ View with the registration process
❖ View with payment processes
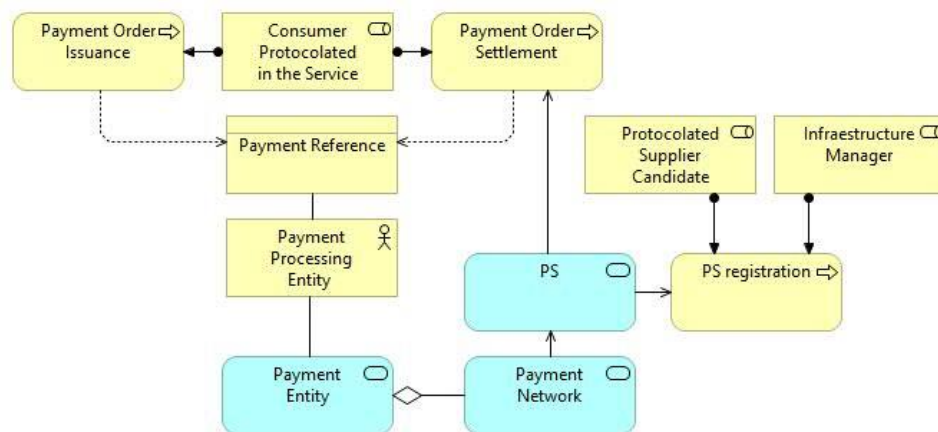
Figure 30: Simplified view of PS in ArchiMate
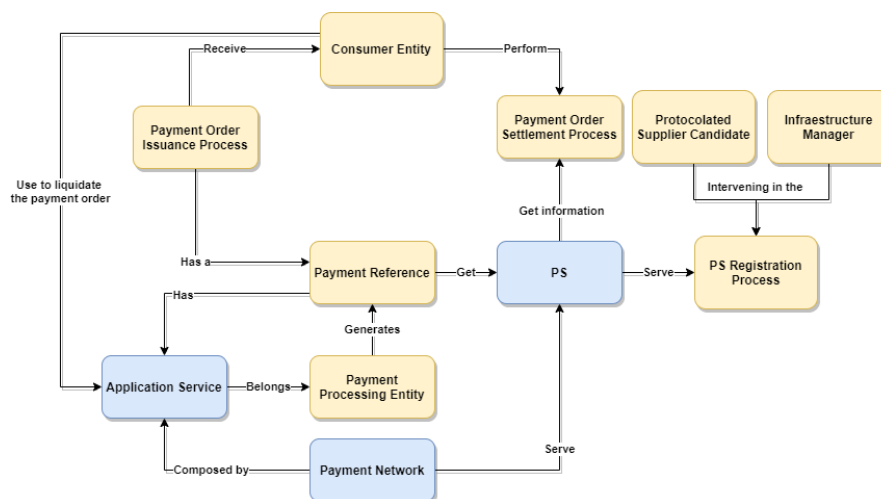
Figure 31: Simplified view of PS in "Natural Language"
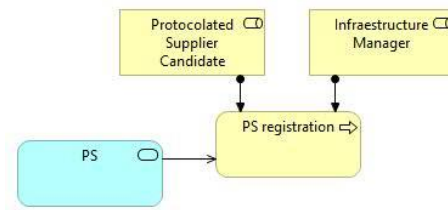
Figure 32: Simplified View of PS Registration Process in ArchiMate
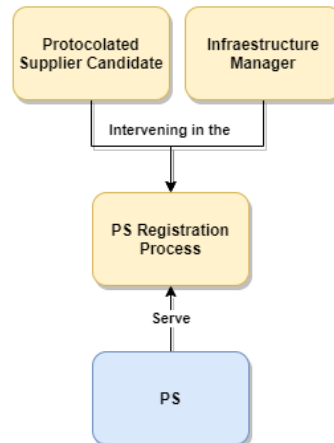
Figure 33: Simplified View of the PS Registration Process in "Natural Language"
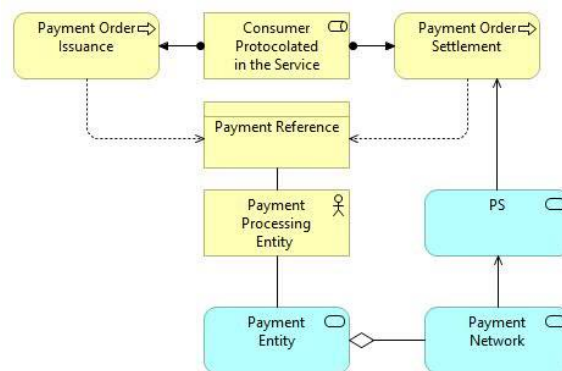
Figure 34: Simplified View of PS Payment Process in ArchiMate
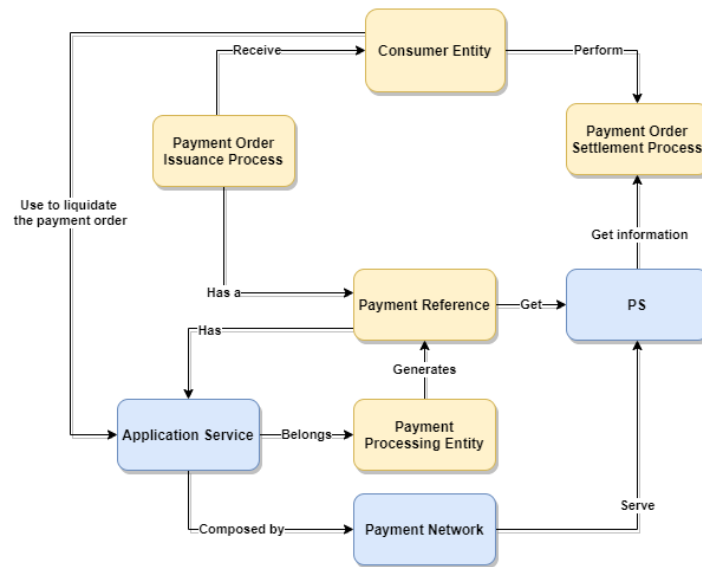
Figure 35: Simplified View of PS Payment Process in "Natural Language"

Table 4 contains the business services of each supplier registered in the PS. These are the services that can issue a payment order to the registered consumer.

Table 4: Business Services filed in PS

Id	Service	Provider	Consumer
1	Business Registration Certificates [8]	IRN	Citizen
2	Simplified CC Renewal [9]	IRN	Citizen
3	land Registration Certificates [10]	IRN	Citizen
4	Car Registration Certificates [11]	IRN	Citizen
5	Civil and Criminal Record Certificates [12]	IRN	Citizen
6	University Fees	University and Polytechnic Teaching Establishments	Citizen
7	Fines for the Absence of Forest Clearing	GNR	Citizen
8	Municipal fees and services	City Councils	Citizen
9	Services and Fines	PSP	Citizen

Id	Service	Provider	Consumer
10	Fees and Vessel Registration	DGRM	Citizen
11	Fees	General Directorate of Maritime Authority of the Ministry of National Defense and/or General Directorate of Food and Veterinary	Citizen

5.3. Messaging Service

At Messaging Service, the registered suppliers are the public entities, and the registered consumers are the citizens. Figure 36 represents some of the application services that MS has. The information service allows sending messages or notifications to recipients. The transactional service sends and replies SMS.
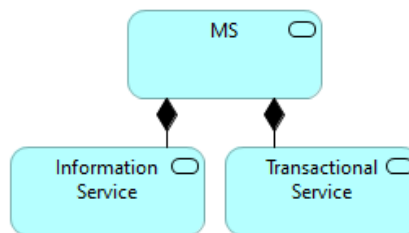
Figure 36: MS Application Services

The Messaging Service has three processes, **the entity registration process**, the **SMS issuing process,** and the **SMS reception process**. The process of registering an entity involves registering a supplier entity in the MS. When a public entity intends to send an SMS, the issue process emits a UUID and a GUID and forwards the SMS through the "public SMS network". If an MS receives an SMS, it is forwarded via the "public SMS network" to the intended public entity. The citizen is an actor outside MS who sends and receives SMS through the "public SMS network".

For the representation of views, the analysis mentioned above and Figure 37, Figure 38, and Figure 39 are considered.
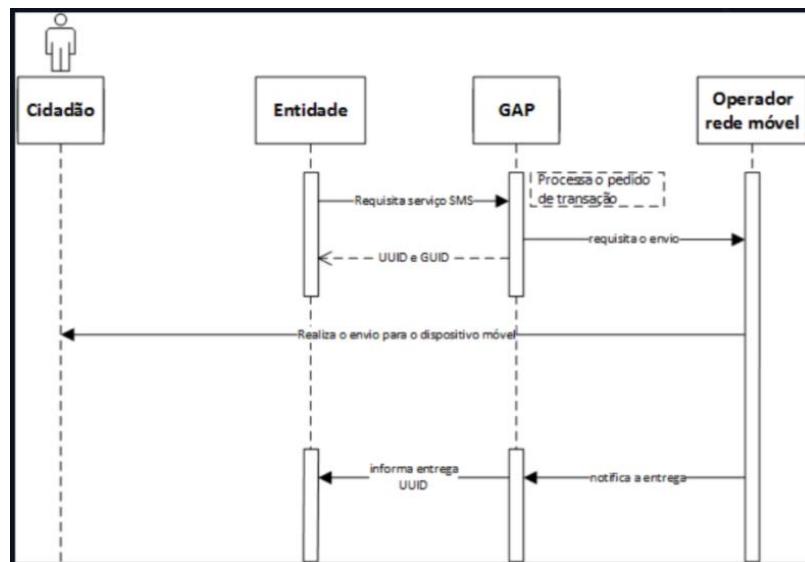
Figure 37: Flow diagram in informative SMS
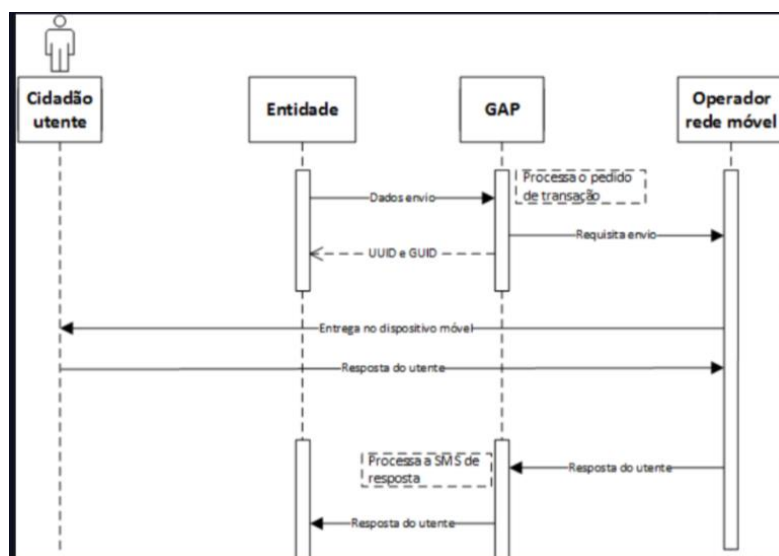
Figure 38: Transactional SMS starting at the service promoter
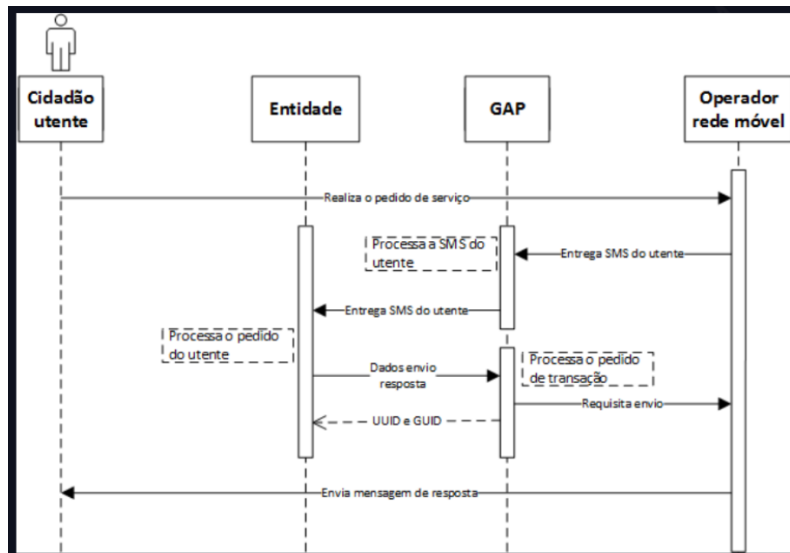
Figure 39: SMS flow behavior starting with the Citizen

The reference for each figure is found in the reference.21

5.3.1. Messaging Service Views (Intended for the AMA employees)

The views modeled in this subchapter have detailed and comprehensive information on the MS. Three views are defined:

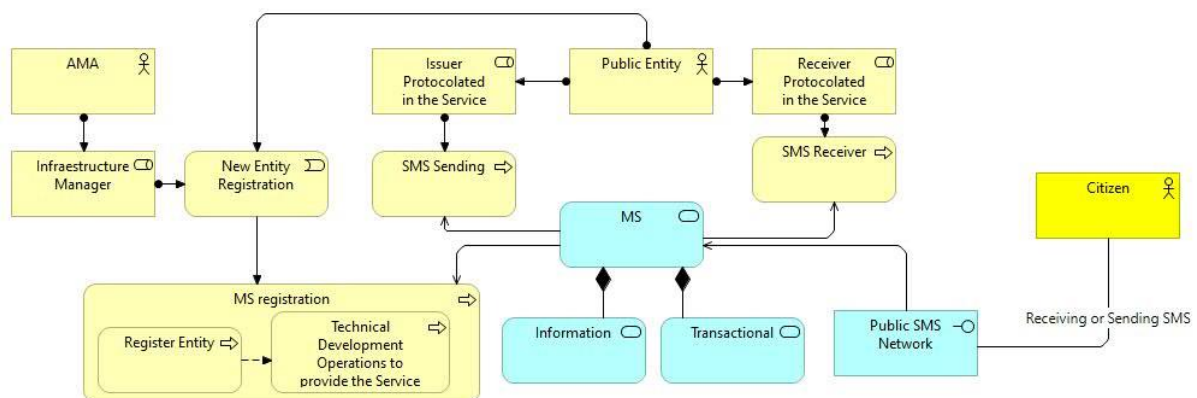- ❖ MS Detailed View
- ❖ View with the registration process
- ❖ View with SMS processes

Figure 40: MS Detailed View

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21 More about - https://zenodo.org/record/5544542#.YVdt3ZrMKUl
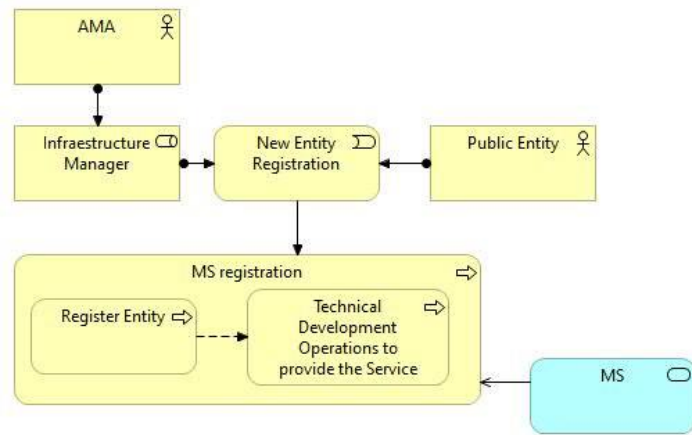
Figure 41: View of the MS Registration Process
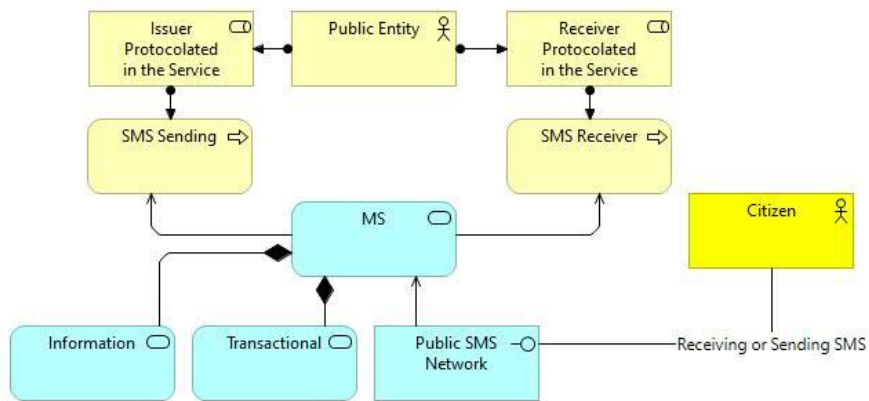
Figure 42: MS SMS Process View

5.3.2. Messaging Service Views (Intended for the entities external to AMA)

The views modeled in this subchapter have more general information. For the simplified MS modeling, three views are defined:

- ❖ Simplified view of MS
- ❖ View with the registration process
- ❖ View with SMS processes
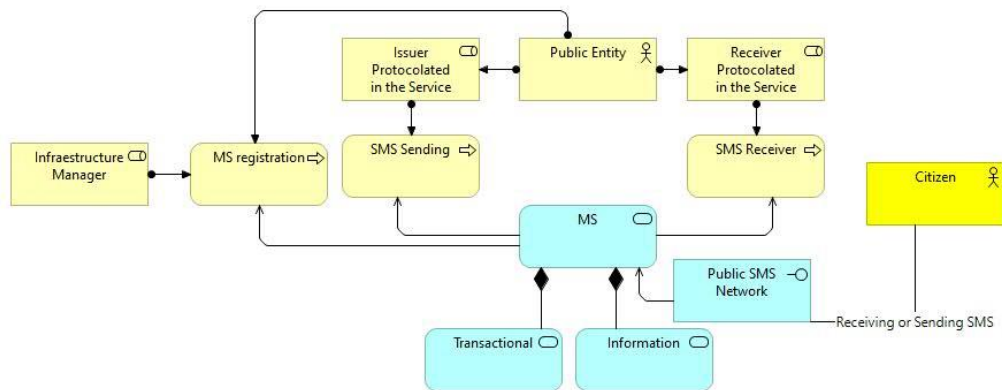
Figure 43: Simplified view of MS in ArchiMate
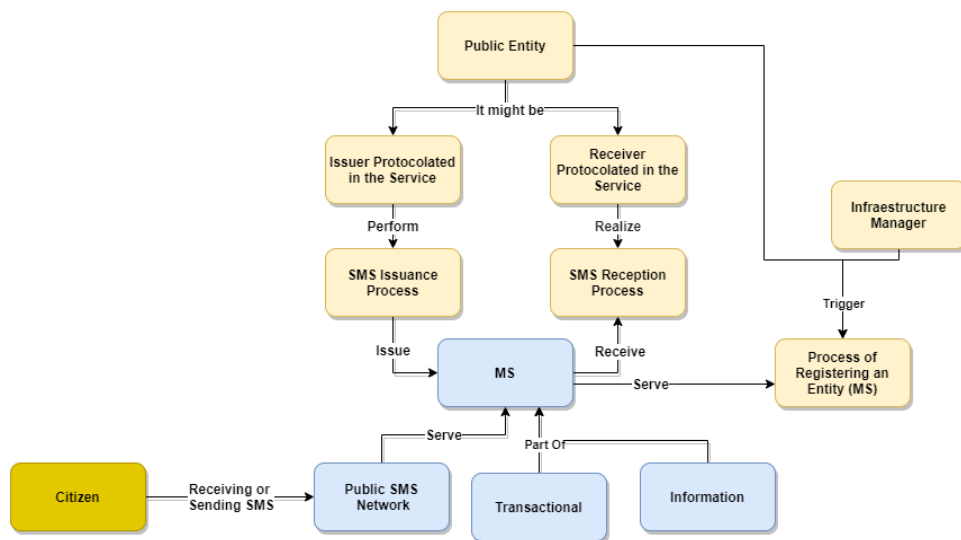
Figure 44: Simplified view of MS in "Natural Language"
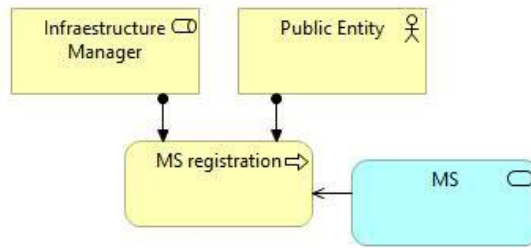
Figure 45: View of the MS Registration Process in ArchiMate
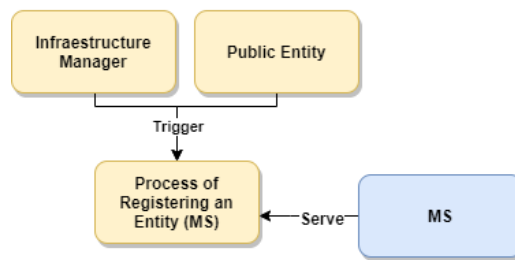
Figure 46: View of the MS Registration Process in "Natural Language"
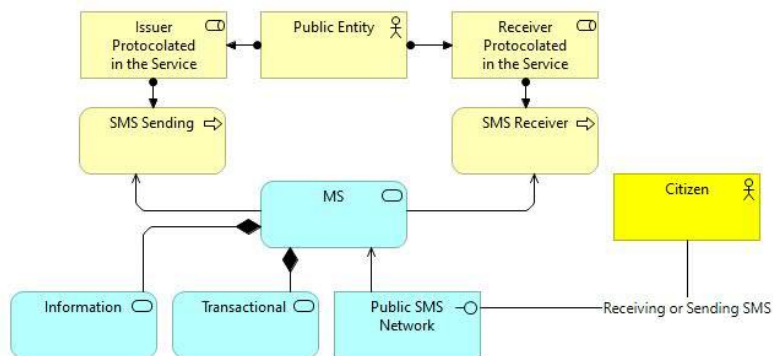
Figure 47: View of the MS Registration Process in ArchiMate
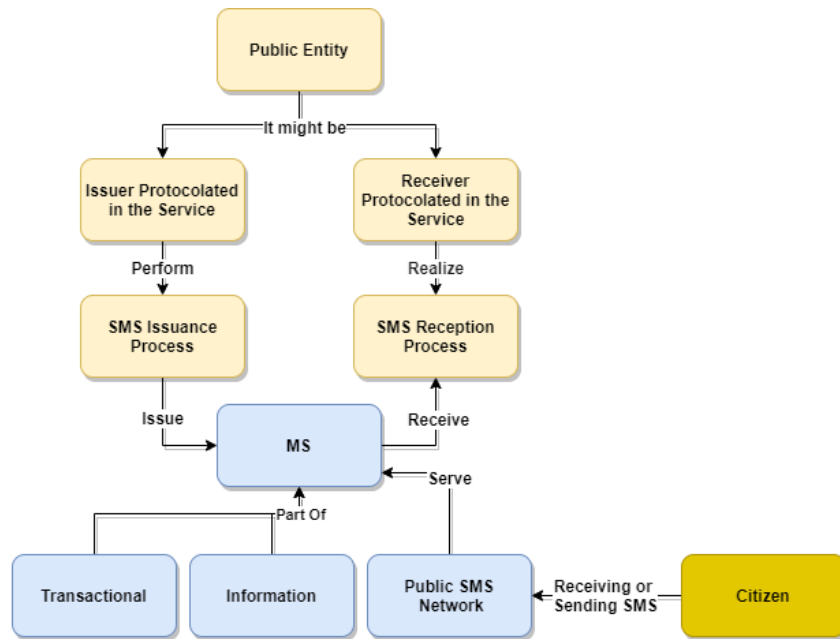
Figure 48: View of the MS Registration Process in "Natural Language"

Note: *In the views, the citizen, as an actor outside the MS, is thus presented with a different yellow.*

Table 5 contains the provider's business services filed in the MS. These are the services that allow send and receive SMS.

Table 5: Business Services filed in MS

Id	Service	Provider	Consumer
1	Information about the place of voting during election period [13]	SGMAI	Citizen
2	Vaccination site information	MS	Citizen
3	Information on towed cars in the metropolitan areas of Lisbon and Porto [14]	SGMAI	Citizen
4	Electronic Medical Prescription (SMS Prescription) [15]	MS	Citizen
5	OPP	AMA	Citizen
6	CMD	AMA	Citizen
7	Simplified Renewal of the	MJ	Citizen

Id	Service	Provider	Consumer
	Citizen's Card [16] [17]		
8	Waiting Information for Customer Service at Citizen Stores	AMA	Citizen
9	Scheduling in Attendance	ISS	Citizen
10	Emergency Occurrence Information [18]	National Emergency and Civil Protection Authority	Citizen
11	Appointment Scheduling	Ministry of Health Hospital Centers	Citizen

6. Results

Chapter 6.1 presents misalignments between AMA public discourse on iAP and the rigorous classification of relevant concepts in the ArchiMate language. Misalignments are based on the interpretation made of the information obtained. These misalignments present concepts that can improve AMA discourse, not meaning that they are necessarily wrong. Sub-chapter 6.2. presents the conclusion of the feedback obtained by the AMA.

6.1. Misalignment

Each misalignment is divided into five points:

- ❖ **Currently** – What currently exists in iAP.
- ❖ **Analysis** – Summary of the analysis that is carried out and the explanation of the misalignments is made.
- ❖ **Conclusions for the future** – Modifications that can be made so that the iAP has a clearer understanding.
- ❖ **Employees AMA feedback:** The misalignment is presented to a small group from AMA, who then provided feedback.

6.1.1. iAP Services

Currently: On the iAP website its mention the word *services* at various points.[22]

Analysis: According to the analysis, there are two types of services in iAP, business services (Table 2, Table 4, and Table 5) and application services (Figure 49). Business services allow representing the behavior defined by the supplier. Applicational service represents a behavior defined by the AMA. The application services allow support of existing iAP services and business processes.

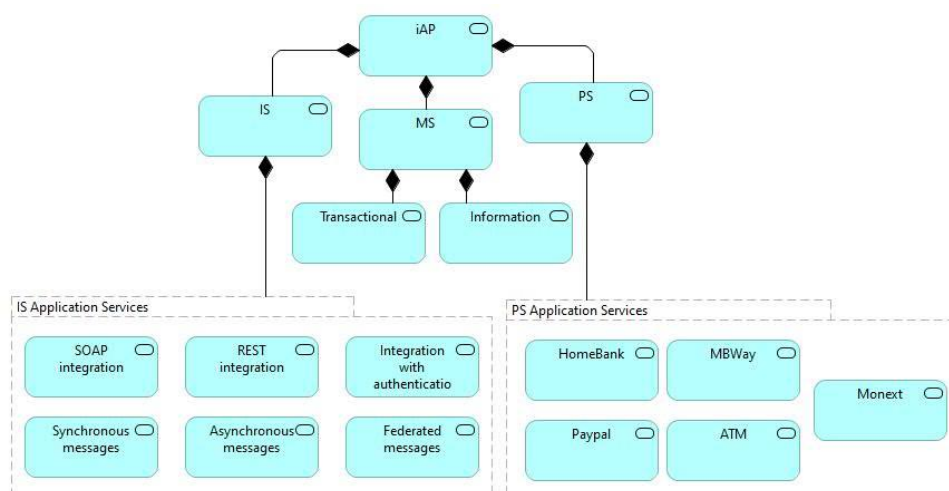[22] More information - https://www.iap.gov.pt/web/iap/inicio

Figure 49: iAP application services

The business services do not belong to iAP. They belong to the supplier entities registered in IS, MS, or PS. However, for business services to work, they need the intervention of application services (Figure 50).
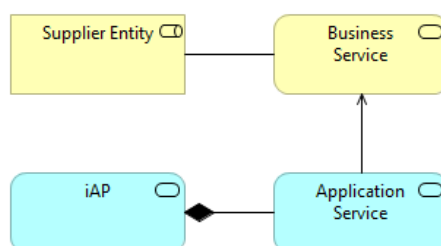

Figure 50: Application and Business Services

Conclusions for the future: Clearly distinguish the existence of two types of services, application, and business.

Employees AMA feedback: The iAP website is a commercial communication tool, and therefore it is designed to demonstrate all the services present in iAP. However, AMA agrees that distinguishing between the two types makes understanding clearer.

6.1.2. Integration Services

Currently: On the IS page, they mention the same concept of "service" twice, Figure 51 and Figure 52.[23]

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[23] More information - https://www.iap.gov.pt/web/iap/plataforma-de-integracao

Serviços

○ Transformação – permite a transformação de diferentes dados e estruturas noutro formato de informação ou formatação à medida das necessidades pretendidas;

○ Orquestração - permite implementar facilmente processos de negócios de forma coordenada e integrada utilizando a linguagem BPEL (Business Process Execution Language), permitindo mapear e organizar o fluxo de troca de dados entre webservices;

○ Transmissão\Comunicação – Transmissão de dados usando protocolo SOAP em XML e REST em json. Possibilidade de ter serviços síncronos ou assíncronos (utilizando WS-Addressing).

Figure 51: iAP website screenshot (IS)

Figure 52: Image of IS's "Main Services"

Analysis: Figure 51 represents the **transmission\communication, transformation,** and **Orchestration. The Transmission\communication** allows data communication, which represents an access point. **Transformation** permits the transformation of different data and structures into another format or information formatting. In this way, **transmission/communication** and **transformation** are application services. They are present in the iAP services catalog. Business service providers consume these application services. (iAP, 2011) **Orchestration** is triggered by an event, for example, when a consumer makes a service request. **Orchestration** represents a business process, which is intended to produce a defined set of business services. (iAP, 2011) In Figure 52, when the "orchestrating" business process is triggered, the business service is executed. Provider entities (currently registered with IS) provide business services (iAP, 2011)**.**

Conclusions for the future: AMA must distinguish between application and business services.

Employees AMA feedback: The IS page is a commercial communication tool, and thus it is designed to demonstrate all the services present in IS. However, AMA agrees that distinguishing between the two types of service makes the understanding of IS clearer.

6.1.3. Payment Services

Currently: On the PS page, they mention the same concept of "service" twice, Figure 53 and Figure 54.[24]

Serviços

○ Documento único de cobrança (DUC) – Permite a geração de referências de autoliquidação. Disponível para serviços digitais on-line, mas também disponível como serviço off-line, e disponível para pagamento em qualquer uma das entidades cobradoras certificadas pelo IGCP;

○ MBWay – Para pagamentos digitais imediatos através de dispositivo de comunicações móvel;

○ Multibanco - Permite a emissão de referências para pagamento de serviços, através de homebanking ou na rede de serviços ATM. Método disponível para serviços digitais on-line, mas também disponível como serviço off-line, nas seguintes modalidades de uso:

  ○ Referências MB imediatamente disponíveis e sem data limite de pagamento;

  ○ Referências disponíveis até 24 horas após a emissão e com data limite pagamento (desde 2019);

  ○ Referências imediatamente disponíveis para pagamento, com data limite e valor predefinido.

○ PayPal - Permite a realização de pagamentos de serviços digitais a cidadãos que não dispõem de conta bancária domiciliada em entidade financeira nacional;

○ TPA - Permite a integração e gestão centralizada, dos dispositivos físicos e dos pagamentos realizados através dos terminais de pagamento automático;

○ Cartão de crédito - Permite a realização de pagamentos de serviços digitais on-line através de cartões de crédito das redes internacionais Visa e Mastercard:

  ○ Pagamento realizado em TPA virtual. A Entidade pública não tem acesso aos dados do cartão o que previne qualquer acesso ilegítimo e reduz a possibilidade de fraude.

  ○ Para quem está atualmente no estrangeiro e não tem conta no sistema financeiro português é este o único método disponível para o pagamento de serviços públicos.

Figure 53: iAP website screenshot (PS)

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[24]More information - https://www.iap.gov.pt/web/iap/plataforma-de-pagamentos

Figure 54: Image of PS "Main Services"

Analysis: Figure 53 represents the PS application services. These services are consumed by business service providers (iAP, 2011).

Figure 54 represents business services. These services belong to the provider entities currently registered with MS. Consumers, in turn, can consume these services (iAP, 2011).

Conclusions for the future: AMA must distinguish between application and business services.

Employees AMA feedback: The PS page is a commercial communication tool, and thus it is designed to demonstrate all the services present in PS. However, AMA agrees that distinguishing between the two types of service makes the understanding of PS clearer.

6.1.4. Messaging Services

Currently: On the MS page, they mention the same concept of "service" twice, Figure 55 and Figure 56.[25]

Figure 55: iAP website screenshot (MS)

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[25] More about MS - https://www.iap.gov.pt/web/iap/plataforma-gateway-de-mensagens

Figure 56: Image of MS "Main Services"

Analysis: Figure 55 represents the MS application services. These services are consumed by business service providers (iAP, 2011).

Figure 56 represents business services. These services belong to the provider entities currently registered with MS. Consumers, in turn, can consume these services. (iAP, 2011)

Conclusions for the future: AMA must distinguish between application and business services.

Employees AMA feedback: The MS page is a commercial communication tool, and thus it is designed to demonstrate all the services present in MS. However, AMA agrees that distinguishing between the two types of service makes the understanding of MS clearer.

6.1.5. Main Services

Currently: In the IS, PS, and MS its mention the table "Main services". In the case of IS, it has two columns, "service" and "source" (Figure 52). In the case of PS and MS, there are columns "service" and "Entity" (Figure 54 and Figure 56)[26].

Analysis: The "Source" column of the IS represents the entities providing the services from the "Services" column. In the case of PS and MS, the "Entity" column is the entity that provides the services in the "services" column.

Conclusions for the future: To make it clearer in (Figure 52), change the name of the column "Source" of the IS to "Supplier" and in (Figure 54 and Figure 56) change the column "Entity" of the PS and MS to "Supplier".

Employees AMA feedback: However**,** AMA agrees that in this way it is clearer to understand who the consumer and supplier entities are.

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[26] More information - https://www.iap.gov.pt/web/iap/inicio

6.1.6. Document Interoperability and Dematerialized Account Opening

Currently: At iAP, they present the Document Interoperability and Dematerialized Account Opening in two different moments. They are represented in the IS as business services, which belong to the supplier entities registered with the IS. And both have their page.

Analysis: As Document Interoperability is responsible for exchanging documents. And the IS concept is also responsible for exchanging information/documents. Document Interoperability should be mentioned only in IS. (For example, in the AMA "document bag" service, this service does not have its page and is a service registered with the IS.) The same happens for opening a dematerialized account.

Conclusions for the future: Not having a specific page for a Document Interoperability. The same happens for opening a dematerialized account.

Employees AMA feedback: As a commercial communication tool, the site intends to communicate to a wide audience. AMA has created a separate page for both services to market these services.

6.1.7. iAP Platforms

Currently: According to the iAP website, there are currently five application services [27]:

- ❖ Integration Platform (PI)
- ❖ Payment Platform (PPAP)
- ❖ Messaging Platform (GAP)
- ❖ Document Interoperability
- ❖ Dematerialized Account Opening

Analysis: As already mentioned, iAP has three application services. Since Document Interoperability and the Opening of a Dematerialized Account are business services, these two services belong to entities registered in the IS.

Conclusions for the future: Mention that the iAP website has IS, PS, and MS.

Employees AMA feedback: The answer isn't obtained.

6.1.8. Adhesion Process

Currently: Each platform has its own membership process.[28] (iAP, 2011)

Analysis: Considering the additional consumption of the PS and MS services, the adhesion processes should be carried out by integrating the IS. (iAP, 2011)

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[27] More information - https://www.iap.gov.pt/web/iap/inicio
[28] More information - https://www.iap.gov.pt/web/iap/inicio

Conclusions for the future: The adhesion processes of PS and MS are carried out through the integration of IS and not individually.

Employees AMA feedback: Currently, each platform has its membership process. However, according to AMA, there is an additional expense currently for the processes of joining the PS and MS services. By integrating these two processes into the IS service, it allowed minimizing these expenses. In this way, AMA agrees with the misalignments.

6.2. Conclusion AMA Feedback

In conclusion, the feedback obtained by AMA employees is positive. Considering that the AMA justified and agreed with most of the misalignments found.

7. Conclusion

In subchapter 7.1, the limitations that existed during the research of the dissertation are presented. In subchapter 7.2, it is verified whether the objectives are achieved or not. In subchapter 7.3, the work that can be developed in the future is addressed based on this dissertation.

The success of the proposed solution depended on the development of AD for iAP. AD allows help in platform decision-making.

In this dissertation, two types of stakeholders are found. Each of these types has its view. The first type of audience is AMA employees, those who manage, develop, and maintain the iAP, have governance responsibilities, and know the business and technology. For this audience, iAP modeling is performed in ArchiMate in a more detailed and comprehensive way. The second type of audience is entities outside the AMA, those who use the iAP and make decisions, as potential future users but who do not know the business and technology. For this audience, a simplified view is modeled in ArchiMate and natural language.

The actors of iAP services and their roles are analyzed to identify the most suitable views for each stakeholder. It is possible to identify the following actors:

- ❖ AMA Employees
- ❖ Public Entity
- ❖ Private Entity
- ❖ Citizens

The AMA can have two roles, either as infrastructure manager or service provider. The public entity can play the role of supplier or consumer. The private entity and the citizen have the role of consumer. Suppliers and consumers are divided into two roles, candidates to register for the service and those registered for the service.

This way is possible to determine that the iAP has three application services, IS, PS, and MS. For each one, nine views are modeled for each application service (Table 6).

For IS, six application services are identified, SOAP integration, REST integration, synchronous messages, federated asynchronous, integration with authentication. The IS has three processes, the **process of registering the service**, the **process of registering the entity**, and the **process of using the service**. And a list of business services (Table 2).

For PS, five application services are identified, PayPal, Monext, ATM, MBWay, HomeBank. PS has three processes, the **supplier registration process**, **the payment order issuance process**, and the **payment order settlement process.** And a list of business services (Table 4).

For MS, two application services are identified, informational and transactional. MS has three processes, the **entity registration process**, the **SMS issuing process,** and the **SMS reception process**. And a list of business services (Table 5).

Application Services	Audience	Views
IS	AMA employees	❖ IS detailed view ❖ View with registration processes ❖ View with service orchestration process.
IS	Entities outside the AMA	❖ Simplified IS View ❖ View with registration processes ❖ View with service orchestration process
PS	AMA employees	❖ PS Detailed View ❖ View with the registration process ❖ View with payment processes
PS	Entities outside the AMA	❖ Simplified view of PS ❖ View with the registration process ❖ View with payment processes
MS	AMA employees	❖ MS Detailed View ❖ View with the registration process ❖ View with SMS processes
MS	Entities outside the AMA	❖ Simplified view of MS ❖ View with the registration process ❖ View with SMS processes

After the evaluation, eight misalignments are presented, with positive feedback from AMA for most misalignments.

In conclusion, this dissertation allows contributing to assist the audience's decision-making. Highlighting the existence of three application services, IS, PS and MS. Each of them is composed of a set of application services that belong to the platform. And for business services that belong to entities registered on the platform.

7.1. Limitations

This subchapter presents the limitations that occurred during the dissertation.

The first limitation is due to lack of information. It is not possible to obtain a complete list of all application services. Also, due to the limited information available, more views could have been modeled for the audiences.

The second limitation is due to the subchapter on the evaluation of a dissertation. In this dissertation, this subchapter is replaced by the analysis of misalignment. The misalignment chapter presents the misalignment and AMA officials' assessment of each misalignment.

7.2. Contributions

This subchapter analyzes which objectives from chapter 1.2 are achieved. One of the objectives of the dissertation is to compare views and verify if there are any misalignments between the information that AMA manages internally and that they expose to the public. The other objective is to model the iAP AD. To achieve it is necessary to answer the following set of questions.

The first question *"Who are the main classes of stakeholders relevant to the iAP?".*

As already mentioned in chapter 5.1, there are two classes of audiences (two classes of stakeholders). The first class of the audience is AMA employees who contain knowledge of the technology. The second class of audience is external entities that are not knowledgeable about the technology.

The second question is, "*What main concerns do these classes have concerning the iAP***?".**

The first audience is concerned with obtaining information to manage and make decisions around the iAP. The second class is concerned with being able to obtain information to make decisions.

To answer the third question, it is first necessary to answer another set of questions:

- ❖ **Who are the iAP platform actors? What roles do they have?**
- ❖ **What services and processes does iAP have?**

In response to the first question, "Who are the iAP platform actors? What roles do they have?" there are four actors, AMA employees, the Public Entity, the Private Entity and Citizens. AMA employees has the role of iAP manager and can assume the role of supplier. The public entity can perform the role of supplier or consumer. The private entity and the citizen are always consumers. The supplier and consumer entity can be divided into two roles:

- ❖ Entity registered in the service
- ❖ Candidate for entity registered in the service

In response to the question, "*What services and processes does iAP have?***".**

iAP has three application services, IS, PS, and MS. IS has six application services, SOAP integration, REST integration, synchronous message, asynchronous messaging, federated messaging, and integration with authentication. The integration service has three business processes, the process of registering the service, the process of registering the entity, and the process of using the service.

PS has five application services, PayPal, Monext, ATM, MBWay, and HomeBank. The payment service comprises three business processes, the supplier registration process, the payment order underwriting process, and the payment order settlement process.

MS has two application services, transactional and informational services. The messaging service also has three processes the entity registration process, the SMS issuing process, and the SMS reception process.

For each of the three application services (IS, PS, and MS), there is a table of business services (that provided by the protocol providers – Table 2, Table 4, and Table 5).

In this way, it is possible to answer the last question, "*What are the main views to consider for supporting these stakeholders?"*. However, to answer this question, it needs to pay attention to the following:

❖ **Promote an informed understanding of the iAP?**
❖ **Make informed decisions about the future of the iAP?**

For this dissertation, the main views are those that have complete information about each service, in this case, Figure 16, Figure 27, and Figure 40. These main views have the business layer and the application layer.

Considering the ArchiMate viewpoints[29] list, this dissertation follows "Business Process Cooperation Viewpoint". This viewpoint represents the dependencies that exist in the business. It models the business processes between itself and its environment and the relationships of the actor and its role. From this point of view, the iAP business context is modeled.

For the modeling of views, care is always taken to promote an informed understanding of the iAP. Thus, being able to assist in decision-making about the future of the iAP for each audience. Through the modeled views, it is possible to develop the iAP AD, obtaining the main objective of the dissertation. Thus, it is possible to conclude that this dissertation managed to achieve the objectives defined initially.

7.3. Future Work

In the next iteration of the work, the iAP AD could be represented in a proper tool (e.g., ATLAS). Based on this, relevant viewpoints could be defined, according to each audience, for example:

- "Viewpoints for technical management" (for those with technical and technological training)
- "Viewpoints for political sponsors" (for members of the Government, who make high-level decisions, with knowledge of public services and business, but with limited technological training)
- "Viewpoints for public communication" (anonymous citizens)

Taking these viewpoints into account, the iAP AS-IS modeling could be tested and validated. And finally, you could produce a new value modeling on the iAP TO-BE and use these models to support future decision-making processes.

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[29] More information - https://pubs.opengroup.org/architecture/archimate3-doc/apdxc.html

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Annex

Annex I – Initiatives

Table 7: National EA Initiative

Countries	EA Name	References
Canada	Government of Canada Enterprise Architecture (GC EA)	(Government, 2017) https://www.canada.ca/en/treasury-board-secretariat/services/information-technology/strategic-plan-2017-2021.html
Finland	Finland Government Enterprise Architecture (GEA)	(Katja, Martin, & Jukka, 2007) https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.468.9598&rep=rep1&type=pdf (European Commission, Digital Government Factsheet: Finland, 2019) https://joinup.ec.europa.eu/sites/default/files/inline-files/Digital_Government_Factsheets_Finland_2019.pdf
Iran	Iran National Enterprise Architecture Framework (INEAF)	(Aliee, et al., 2017) https://www.ieaf.ir/en/iran-national-enterprise-architecture-framework-2018-report
Kingdom of Bahrain	Kingdom of Bahrain National Enterprise Architecture	(Saha, 2012) https://www.researchgate.net/publication/293298773_National_Enterprise_Architecture_Framework_Case_Study_of_EA_Development_Experience_in_the_Kingdom_of_Bahrain
The United Kingdom	Cross-government business architecture (xGEA)	(Katja, Martin, & Jukka, 2007) https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.468.9598&rep=rep1&type=pdf (e-Government Unit , 2005)
USA	Federal Enterprise Architecture	(European Commission, New European Interoperability Framework.) https://obamawhitehouse.archives.gov/sites/default/files/omb/assets/egov_docs/common_approach_to_federal_ea.pdf (Katja, Martin, & Jukka, 2007) https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.468.9598&rep=rep1&type=pdf

Table 8: National IF Initiatives

Countries	IF Name	References
Austria	Austrian Interoperability Framework (AIF)	(Katja, Martin, & Jukka, 2007) https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.468.9598&rep=rep1&type=pdf (Commission, Digital Government Factsheet: Austria, 2019) https://joinup.ec.europa.eu/sites/default/files/inline-files/Digital_Government_Factsheets_Austria_2019_3.pdf
Belgium	Belgium's National Interoperability Framework (BelgIF)	(Katja, Martin, & Jukka, 2007) https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.468.9598&rep=rep1&type=pdf (Commission, Digital Government Factsheet: Belgium, 2019) https://joinup.ec.europa.eu/sites/default/files/inline-files/Digital_Government_Factsheets_Belgium_2019_1.pdf
Denmark	Framework for Public-Sector Digital Architecture (Danish NIF)	(Katja, Martin, & Jukka, 2007) https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.468.9598&rep=rep1&type=pdf (European Commission, Digital Government Factsheet: Denmark, 2019) https://joinup.ec.europa.eu/sites/default/files/inline-files/Digital_Government_Factsheets_Denmark_2019.pdf
Estonia	Estonian Interoperability Framework	(Katja, Martin, & Jukka, 2007) https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.468.9598&rep=rep1&type=pdf~ (European Commission, Digital Government Factsheet: Estonia, , 2019) https://joinup.ec.europa.eu/sites/default/files/inline-files/Digital_Government_Factsheets_Estonia_2019.pdf
Germany	BundOnline	(Katja, Martin, & Jukka, 2007) https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.468.9598&rep=rep1&type=pdf (European Commission, Digital Government Factsheet: Germany, 2019) https://joinup.ec.europa.eu/sites/default/files/inline-files/Digital_Government_Factsheets_Germany_2019.pdf
Thailand	The e-GIF	(N. Sukasame , 2004) https://www.bu.ac.th/knowledgecenter/epaper/jan_june2004/nittana.pdf (Sulehat & Taib, 2016) https://ieeexplore.ieee.org/document/6991416

Countries	IF Name	References
Wales	e-GIF	(Government, 2019) https://gov.wales/sites/default/files/publications/2019-07/ict-strategy-for-the-public-sector-in-wales.pdf

Annex II - Questions

These questions allowed to help in the realization of the AD.

1. **Is each type of reference (PayPal, DUC, MBWay, and bank reference) generated in real-time or, does PS have a certain number in advance for each type of reference? How is each reference generated for PS? And how does PS manage referrals?**

<u>Feedback provided by AMA</u>: PS receives in advance a certain number of bank references and DUCs. Each pre-generated reference has a set of codes with rules. In the case of ATM references, they have two separate codes, the entity code, and the payment code. In the case of the DUC, the reference is composed of a single code. This code consists of the entity code and the payment code. A service can have a certain reference previously associated. When PS associates a reference (DUC or bank), it must validate the references that are still available in its stack. In the case of PayPal and MBWay, referrals are generated in real-time through tokens.

2. **How are DUCs generated?**

<u>Feedback provided by AMA:</u> DUCs are generated in advance, as mentioned in the previous question. The DUC has a code, which code is composed of service code plus value code.

3. **What interface is used to pay DUCs?**

<u>Feedback provided by AMA</u>: To make a DUC payment, several payment methods can be used, both online and in person.

Online Methods:

- ❖ Home banking, through the APP or the web
- ❖ ATM

In Person Methods:

- ❖ Check
- ❖ Money
- ❖ Automatic TPAs

4. **Figure 26 is divided into two parts. The first, that of issuing the payment order. And the second, that of communication between PS and consumer and supplier entities. Regarding the first part, the question arose: Can PS interfere in the payment order issuance process?**

<u>Feedback provided by AMA</u>: PS issues the order and payment on behalf of the registered public entity.

5. **In the misalignments of Document Interoperability and Dematerialized Account Opening, what are the differences so that both Document Interoperability and Dematerialized Account Opening have a page just for themselves? Since both are services that are registered in the IS and both are from the same provider, in this case the AMA**.

Feedback provided by AMA: As the website is a commercial communication tool, it allows communication of what can be done at iAP to a wide audience. AMA has created a separate page for both services to market these services.

6. **Does each platform have its own membership process? Or is the adhesion process solely in the IS?**

Feedback provided by AMA: Currently, each platform has its membership process. However, due to the expense that currently exists for the PS and MS services, the membership processes for both platforms should be done through integration in the IS.

7. **How does the membership process work? (If there is one for each platform, how does each platform handle its membership process?)**

Feedback provided by AMA:

When registering a new service (It only happens in IS):

1. Check if the Entity is already registered in the IS as an interested entity
2. If not registered, AMA "Registers the Interested Entity" – Creating a Supplier entity.
3. Register Service

When registering an entity (it happens on all platforms):

1. Register as an interested entity (Entity Creation)
2. Register as a supplier

Annex III - ArchiMate Concepts

This document presents definitions of the mentioned ArchiMate concepts. There are two layers to be taken into account. The business layer and the application layer. In the reference literature, each of the layers can be defined as:

- ❖ Business layer - "depicts business services offered to customers, which are realized in the organization by business processes performed by business actors."
- ❖ Application layer - "depicts application services that support the business."

Each of the layers can be translated as:

- ❖ Business layer - describes the business services. That is offered to consumers and is carried out in the organization by business processes performed by business providers.
- ❖ Application Layer - describes the application services that support the business services.

For each of these layers, there are relevant concepts such as "business actor", "business role", "business event", "business service", "business process", "business object", "application service", "application function" and "application interface".
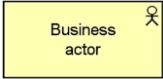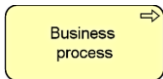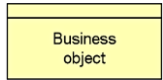
In the reference literature, each of the concepts can be defined as:

- ❖ **Business actor** – "A business actor represents a business entity that is capable of performing the behavior."
- ❖ **Business role** – "A business role represents the responsibility to perform a specific behavior, to which an actor can be attributed, or the part that an actor plays in a specific action or event."
- ❖ **Business event** – "A business event represents an organizational state change."
- ❖ **Business service** – "Represents explicitly defined behavior that a business role, business actor, or business collaboration exposes to its environment."
- ❖ **Business process** – "Represents a sequence of business behaviors that achieves a specific result such as a defined set of products or business services."
- ❖ **Business object** – "Represents a concept used within a particular business domain."
- ❖ **Application service** – "Represents an explicitly defined exposed application behavior."
- ❖ **Application Function** – "Describes the internal behavior of an application component. If this behavior is exposed externally, this is done through one or more services. An application function abstracts from the way it is implemented. Only the necessary behavior is specified."
- ❖ **Application interface** - "Represents a point of access where application services are made available to a user."

For each concept, there is the following translation:

- ❖ **Business actor** - An actor represents an entity that can perform a behavior. *Example*: AMA manages the iAP infrastructure. Since it is the AMA that registers the entities and services on each of the platforms.
- ❖ **Business role** – There are three roles: service provider, service consumer, and Infrastructure Manager (is always AMA). Service consumers can be individual entities (citizens), Public Entities, or Private Entities. The Infrastructure Manager can sometimes also be the supplier, as will be seen later. *Example*: AMA can play the role of the infrastructure manager.
- ❖ **Business event** - A business event represents an organizational state change. *Example*: To have data sharing. For example, the address of the citizen card, there is first an event. The service consumer performs an input which is the event that allows them to make a "request to use a business service.", which in turn triggers the data-sharing service.
- ❖ **Business service** – This allows representing the behavior that is defined by a supplier. o *Example*: Business Service - Data sharing, more specifically, the citizen's address, is made available for a given citizen card number (CC). The provider of this business service is the IRN, and the consumer is an entity that wants to obtain this information. AMA manages the infrastructure where this business service is inserted.
- ❖ **Business process** - Allows representing a sequence of behaviors in a business to obtain a set of services. *Example*: As for each business service, there is a supplier and a consumer. There must be a process for registering the supplier and a process for registering the consumer.
- ❖ **Business Object** - Represents a concept used in the business domain. Example: The reference for the settlement of payment is a concept used in the business domain.
- ❖ **Application Service** – Provides a unit of behavior that is useful to consumers. Application services support business services and processes. *Example*: MS serves the SMS reception process. MS receives an SMS and forwards it to the respective public entity.
- ❖ **Application Function** - Describes the internal behavior. Which, when exposed externally, is represented by the execution of services. *Example*: The MBWay interface serves as a point of access for the user to make their payments.

Table 9: Concepts in ArchiMate

Element	Notation
Business Actor	Business actor
Business Role	Business role
Business Service	Business service
Business Process	Business process
Business Object	Business object
Application Service	Application service
Application Function	Application function
Application Interface	Application interface

Annex IV - Consumer Tables

The following tables represent the consumers of each IS service.

Table 10: Public Entities - Beneficiary

Entity
MF
ACSS
SPMS

Table 11: Public and Private Entities

Entity
CVCC
IEFP
CGA
INATEL
Via Verde
EDP
EPAL
ACP
ePortugal

Table 12: CVCC entities

Entity
SS
MJ
MS
MF

Table 13: Professional Attributes

Entity		
Business Attributes		
Attributes of Public Officers		
Other attributes	**ANSR**	
	GRA	
	GRM	
	OCC	
	SGMAI	
	SGMDN	
Local Elected Attributes		

Table 14: IRS Entities

Entity
ADSE
SS
DGES

Table 15: Public Entities - Ministries

Entity
MF
MJ

Table 16: Base Portal Entities

Entity	
ESPap	
GNS	
INCM	
Electronic Public Procurement Platform	ACIN - iCloud Solutions
	ANOGOV
	COMPRASPT
	SAPHETYGOV
	Vortal Gov
Contracting Entities	Article 2, nº1 do CCP

Table 17: Public Entities - Death

Entity
ATT
SGMAI
ISS
CGA

Table 18: Public Entities - Professional

Entity
IEFP
EEG
FI

Table 19: Public Entities - Schools

Entity
DGES
DGEEC
Universities

Table 20: Medical Entities

Entity
SPMS

ACSS

Table 21: Interop. Doc.

Entity
SGMA
GSEA
GSEAE
GMAA
GSECNFOT
GSEM