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Enterprise Architecture as a service-oriented model to sustainably support IT Management

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Master Thesis

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Dedicated to everyone who accompanied me in this incredible journey

Abstract

The software's ubiquity in today's reality challenges companies to use technology in a differentiated manner, empowering competitive advantages. Consequently, Enterprise Architecture and its four main dimensions - Business, Data, Application and Technology - aim to aid in the decision-making process, guaranteeing a clear vision of how a company can grow its systems without losing focus on the strategically defined business goals.

Since the industry is an ever-changing environment that requires agility and responsiveness in order to thrive and quickly adapt to new trends, it is crucial that the undertaken decisions are supported by quality, up-to-date data that assertively represents the current state of the business and how well its progressing to the devised end-state. Thus, the work at hands aims to leverage Enterprise Architecture as a service, being supported by a sustainable, de-centralized governance model and to introduce financial dimensions to critically analyze the company's landscape, a paradigm not contemplated on the discipline's scope on the traditional frameworks.

Considering the Service Dominant Logic's human-centered approach, a qualitative study was conducted, permitting a full understanding of the customer experience. Through the achieved results, the project's scope was defined, focusing on producing actionable changes to the business domain, outlining a communication model to sustain the new service catalog for both self and full services. Subsequently, Service Experience Blueprints were outlined, structuring the service encounters and defining a collaborative governance process between teams with different scopes within Enterprise Architecture.

Regardless of the discipline's ability to deeply influence decision making, the way it integrates the enterprise's data assets crucially depends on the way it collaboratively integrates its people. The quality and maturity of each layer profoundly relies on the know-how of whom works them, as they are the foundation of its success. As such, Enterprise Architecture should always be the vessel that extracts value from the organization's information, integrating it in a holistic manner in order to empower the cornerstone of every company: people.

Acknowledgments

During this incredible journey, a lot of people poured a little bit of their heart into this project. As such, thank you to the IT Strategy & Enterprise Architecture team for all of given support throughout these months. Bruno, Paula and Carlos, you are as much reason for this project's success as I am. Thank you to the entire IT Office for the daily, heart-warming friendship and happiness. To Sonae and BIT, thank you for giving me the opportunity to walk among so many giants, these experiences will surely accompany me throughout my life.

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To my family and friends, a big thank you for walking beside me for the last 24 years. Words cannot express everything you did to me.

Finally, thank you Joana. Not only for constantly providing me with care and love, nor the immense happiness that it is our relationship, but also thank you for pushing me to grow even further. You truly are an inspiration and, above all, my biggest pride. Until my dying breath, I love you.

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List of abbreviations

LAC – Logical Application Component

PAC – Physical Application Component

EA – Enterprise Architecture

IT – Information Technology

ERP – Enterprise Resource Planning

APQC – American Productivity & Quality Center

PCF – Process Classification Framework

API – Application Programming Interface

CAPEX – Capital Expenditure

OPEX – Operating Expense

WMS – Warehouse Management System

BI – Business Intelligence

TCO – Total Cost of Ownership

BIT – Business Information Technology

QMI - Quality Maturity Index

CMDB – Configuration Management Database

MSD – Multilevel Service Design

SEB – Service Experience Blueprint

IaaS – Infrastructure as a Service

PaaS – Platform as a Service

SaaS – Software as a Service

1 Introduction

Technology is becoming increasingly ubiquitous, being present in every company in the modern days. Ranging from simple solutions to complex, cutting edge systems, it has been a factor that greatly influenced the way business is conducted across all industries.

Nevertheless, taking into account this very own technological proliferation and the uprising concern of companies to distinguish themselves from each other in a sustainable, inimitable, way, we can consider that "what makes a resource truly strategic – what gives it the capacity to be the basis for a sustained competitive advantage – is not ubiquity but scarcity" (Carr, 2003).

This increased accessibility tempted several companies to make large investments in pursuing new opportunities. Consequently, system complexity started rising without properly assuring the solidification of an established and well-thought foundation. As stated by Carr (2003), "It is unusual for a company to gain a competitive advantage through the distinctive use of a mature infrastructural technology, but even a brief disruption in the availability of the technology can be devastating".

Therefore, considering that technology is currently viewed as an order qualifier for most industries and that its utilization alone doesn't provide any sort of predominance to companies, we can consider that the main influencing factor relies on the way that this reality is used to leverage the business itself. Consequently, a main concern prevails in IT management: how to extract maximum business value from IT, while reducing costs and complexity (Sessions, 2007).

In an attempt to respond to the aforementioned question, companies adopted Enterprise Architecture methodologies to "improve alignment with and support of the business strategy" (Colville & Adams, 2011). By considering four main dimensions (Business, Data, Application and Technology), this multidisciplinary approach aims to aid in the decision-making processes, guaranteeing a clear view of how a company can grow its systems without losing focus on its strategically defined business goals.

1.1 Project Background

Enterprise Architecture as a discipline aims to both holistically and proactively guide the enterprise decisions by aligning it with the business' vision (Gartner, 2017). As such, it is imperative to extract maximum value from the obtained information, in order to empower stakeholders to efficiently contribute to IT Management.

Enterprise Architecture pivots between the different realities of an organization, ensuring the realization of the strategic initiatives and swaying its roadmap. To achieve this ambitious goal, the concerning stakeholders, their corresponding job to be done and their inherent profiles should really be understood, adapting the way the information is communicated to each one's specificities.

1.2 Problem Description

Having just been introduced in recent years, Enterprise Architecture is still maturing inside the company, not only as a project, but mainly as a process. Although possessing a wide array of artifacts that represent the different realities inherent with its activity, the outgrowing

complexity of the group and of its brands is proving to be a difficult challenge to sustainably manage.

Additionally, the four main Enterprise Architecture methodologies embody several success and failed case studies (Sessions, 2007), lacking a generic formula for a correct implementation. As such, the way the discipline is integrated in a company should take into consideration its corresponding operating model, its dimension and its people. The main issue arises on how Enterprise Architecture is meeting its stakeholders, lacking a proper understanding of each profile and what information can be used to leverage their efficiency. To achieve this involvement, extensive resources were dedicated, aiming to empower a better customer experience through the implementation of a service-oriented model.

Even though some work has already been done to solidify the alignment between business and technology, there is neither a clearly defined communication model in which different stakeholders can view essential information, nor a well-defined, sustainable process to support the management of different layers through a decentralized governance model.

Finally, considering the main objective of this discipline to influence decision making, it is crucial to embody the financial motivations behind IT management. Through the integration of these dimensions that aren't contemplated in the traditional frameworks, we will be able to empower the decisions in a more realistic and efficient manner.

1.3 Research Questions

In order to properly sustain the study at hands and to outline smaller objectives within the presented scope, it is crucial to define well-thought research questions. Therefore, taking into account the two main dimensions intended to be explored within Enterprise Architecture – potential financial aspects and EA's service-orientation – four main research questions were defined:

- How to make Enterprise Architecture more service-oriented for internal stakeholders?
- What information, regarding the software solutions, has value for the relevant stakeholders and should be maintained within Enterprise Architecture's scope?
- What financial variables should be introduced in Enterprise Architecture's scope in order to support the decision-making process?
- How can we govern Enterprise Architecture with a sustainable, agile process?

Thus, by splitting the research problem into smaller bits, the project gained additional focus throughout its development, presenting the uncovered results in the following chapters.

1.4 Study and Project Development at Sonae BIT

The present work was developed within BIT, the Information System department for Sonae MC and Sonae SR. Although conducted within the IT Strategy & Enterprise Architecture team, the project relied on extensive collaboration of the internal teams, as Sonae's Enterprise Architecture is built upon a de-centralized governance model.

Thereupon an exploratory qualitative research was adopted, being crucial to understand that this project was developed in Sonae's context, thus the interviews sample size is not going to allow to establish generalized conclusions

1.5 Report outline

The report at hands is divided into eight main sections: Introduction, Literature Review, Problem Categorization, Methodology, Results, Conclusions, References and Appendix.

While the first section aims to give a general overview of the conducted project, drilling down the discipline's status within the industry until the Problem Specification, the second one deepens the current state of art of the different methodologies and respective areas inherent to the project.

Afterwards, the Problem Categorization intends to contextualize where the work took place, presenting Sonae, its corresponding holdings and its brands, specifically detailing BIT and its operating and organizational models.

Subsequently, the chosen Methodology is presented and sustained by its rationale, describing in detail the followed steps in each iteration.

Then, the achieved Results are depicted, being sub-divided according to the achieved milestones to improve readability.

Finally, the general Conclusions are drawn, summarizing the project's achievements and the remaining future work and ambitions.

Complementary to the aforementioned sections, the report contains both References and Appendix sections, where the reader can find the consulted sources and supporting artefacts, respectively.

2 Literature Review

The close symbiosis established in the latest years between business and IT urged for an integrated approach for both dimensions (Jonkers et al., 2006). Thus, Enterprise Architecture was introduced as a mean to define the guidelines inherent to the business itself, that will ultimately impact on the technological decision making process (Jonkers et al., 2006). Moreover, Enterprise Architecture's own nature focuses on impacting the "long-term view of a company's processes, systems, and technologies so that individual projects can build capabilities – not just fulfil immediate needs" (Ross, J. W., Weill, P., & Robertson, 2007).

Nevertheless, to fully take advantage of the usage of this discipline in an organization we should consider the business' scale. According to Forbes' report on the top 2000 global companies for 2016, by weighting in "revenue, profits, assets and market value", it is possible to verify that Portugal only has five companies that fit the established criteria (Schaefer & Murphy, 2016). Additionally, by deep diving into the retail industry and, specifically, Deloitte's report for the "Global Powers of Retailing 2017", there are only two Portuguese organizations that were included in the list (Deloitte, 2017). Among both lists lies Sonae as one of the main Portuguese players. Bearing in mind that Enterprise Architecture is crucial to contain business complexity in a structured and informed way and that this intricacy is a consequence of the business' dimension, it is possible to conclude that there aren't that many companies in Portugal able to relevantly sustain this field.

2.1 Enterprise Architecture Frameworks

Since its birth with the Zachman Framework in 1987, Enterprise Architecture encompasses four main methodologies that were developed and introduced to the market: the aforementioned Zachman Framework, The Open Group Architecture Framework (TOGAF), the Federal Enterprise Architecture Framework (FEAF) and the Gartner Methodology (Sessions, 2007).

The Zachman Framework was developed by John Zachman, recognized as the main precursor of Enterprise Architecture as a studied scientific area ("The field of enterprise architecture essentially started in 1987, with the publication in the IBM Systems Journal of an article titled "A Framework for Information Systems Architecture" (Sessions, 2007)). Zachman devised a framework based on traditional architecture, laying down as a foundation the process of envisioning a house. This process involves the conciliation of different perspectives that, ultimately, result in distinct artefacts generated throughout the stages. Although progressively specified, each one of the phases serve a different purpose that complement each other with diverse views, being equally important to the success of the project (Zachman, 1987). Thus, identically to the rationale followed by the architect, Zachman proposed a taxonomy that encompasses a holistic approach of the system by categorizing several artefacts *per* their targeted stakeholder and the dimension that it addresses. This ontology catalogues these artefacts according to the match between six main questions – 'What?', 'How?', 'Where?', 'Who?', 'When?', 'Why?' – and six distinct perspectives – Executive, Business Management, Architect, Engineer, Technician and Enterprise – with corresponding models – Scope Context, Business Concepts, System Logic, Technology Physics, Tool Components and Operation Instances. The relationship between these concepts can be seen in Figure 1.

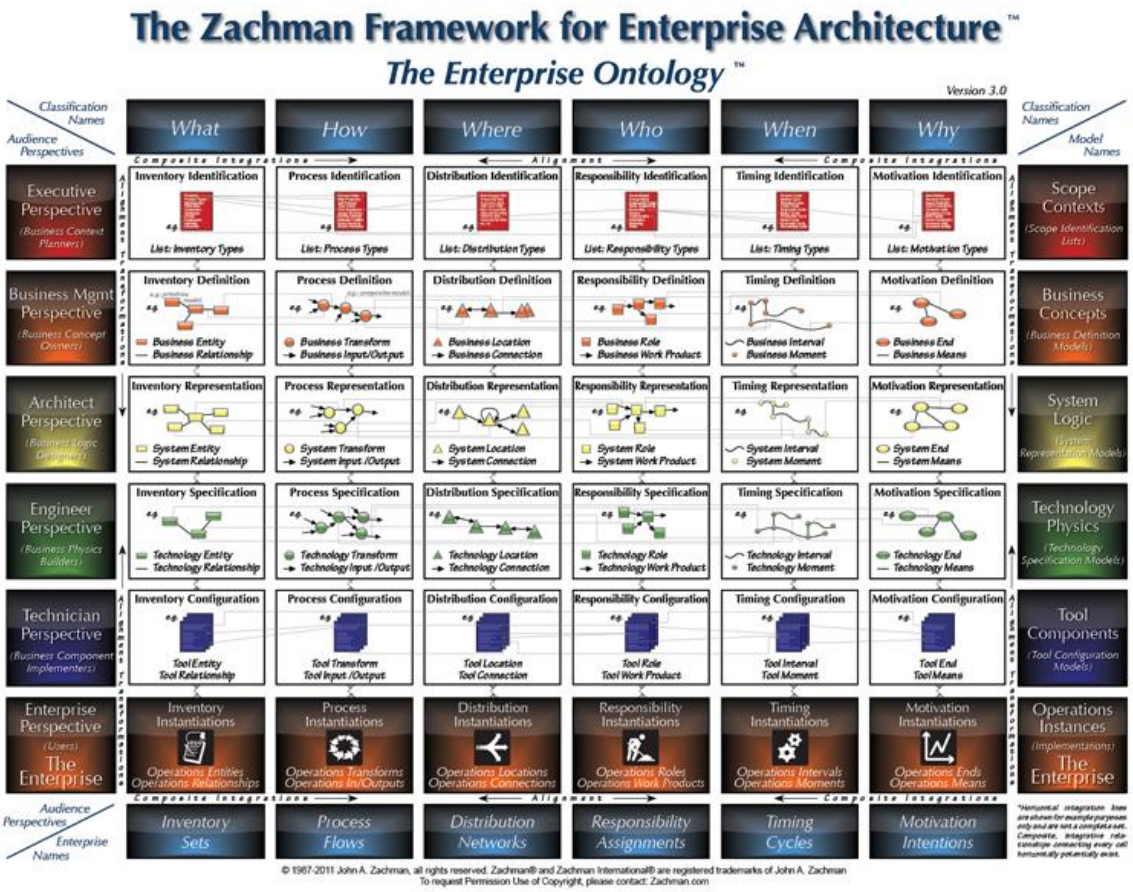


Figure 1 - Zachman Framework (Zachman, 2008)

The Open Group, a consortium that focuses on establishing standards for Information Technology that are aligned with business objectives, firstly developed TOGAF in 1995, a free framework and industry standard that supports organizations to develop an effective Enterprise Architecture (Leist & Zellner, 2006). This early version was based in the Technical Architecture Framework for Information Management (TAFIM) of the United States Department of Defense, being systematically reviewed and consequently published until the present date.

According to the Open Group, TOGAF divides Enterprise Architecture's scope into **Business Architecture** – the definition of the business strategy, processes and of the organization's structure, **– Data Architecture** – the structure and management of data as an asset, – **Application Architecture** – representation of the relationship between the different solutions with the business processes and the corresponding applicational landscape, – and **Technical Architecture** – the lower, technical layer that supports the deployment of the previous concepts through both software and hardware capabilities.

These four dimensions can be increasingly/decreasingly specific according to its Enterprise Continuum (Sessions, 2007). This concept encompasses both the **Architecture Continuum** and the **Solution Continuum**. While the first one is a representation of the evolution of generic architectures to specific, tailormade, architectures shaped to the business' own nature, the later one illustrates the preceding flow on a solution level, providing the architect and the organization with a holistic view of their IT structure and how well its being leveraged to fulfill its capabilities on the utmost capacity (The Open Group, 2011). As such, the Enterprise Continuum establishes a foundation for the Architecture Development Method (ADM) (Figure

2) which, according to the Open Group, is an iterative process that "describes a method for developing and managing the lifecycle of an enterprise architecture"(The Open Group, 2011).

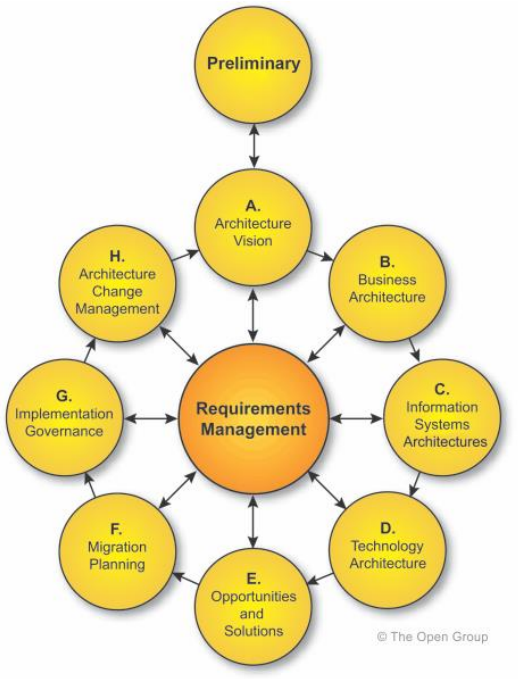


Figure 2 - TOGAF's Architecture Development Method (The Open Group, 2011)

Additionally, the Open Group developed and maintains a modeling language that has a close symbiosis with TOGAF, Archimate. Aside from providing a framework that encompasses the different concepts inherent to Enterprise Architecture, Archimate is used to represent and communicate the Enterprise Architecture to different stakeholders, dividing the four previously described dimensions into further detailed layers, as seen in Figure 3, representing them separately or integrated as needed. Through this holistic view, the architect can design a metamodel (Appendix A) that determines the basis of the Enterprise Repository,

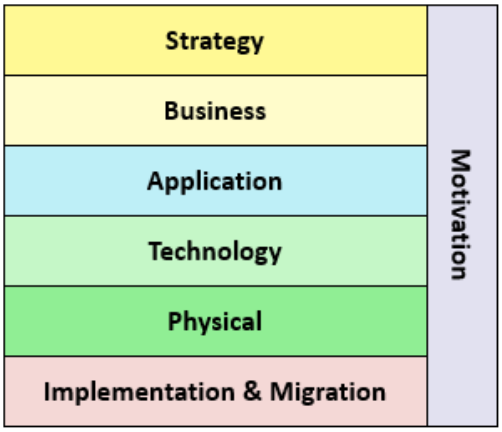


Figure 3 - Archimate Layers

In order to mold the United States Government to provide a unified set of customer-centric services, the United States of America Congress approved a federal law called Clinger-Cohen Act in 1996. With it, Chief Information Officers across the United States of America Federal Agencies were required to "develop, maintain, and facilitate integrated systems architectures"

(Schekkerman, 2006). Through this collaboration, the Federal Enterprise Architecture Framework (FEAF) was devised, aiming to facilitate interoperability and managerial analysis, as well as identifying "duplicative investments, gaps, and opportunities for collaboration" (Schekkerman, 2006). Being one of the most recent developments in the area (Sessions, 2007), FEAF constitutes a much broader approach to it, providing a full methodology to conceive, implement and analyze the Enterprise Architecture. It also encompasses three main partitions – core mission-area segments, business-services segments and enterprise services – that represent specific activities of a company, actions performed transversely but adapted by each business, and services that are used in a common manner across all of them. According to the practical example of the United States Agencies in "FEA Practice Guidance", Figure 4 represents the way these representations are connected.

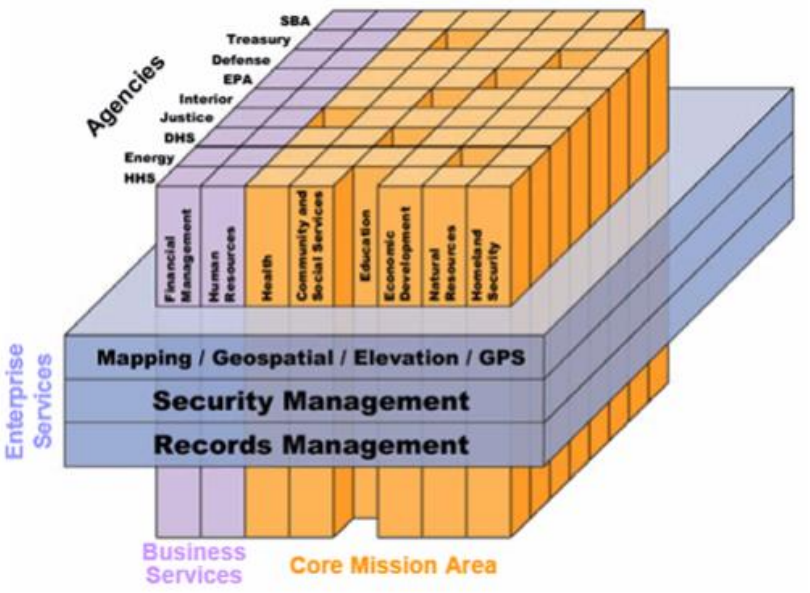


Figure 4 - US FEA Segments (FEA, 2007)

Additionally, FEAF comprehends five reference models – Performance Reference Model, Business Reference Model, Service Component Reference Model, Data and Information Reference Model and Technical Reference Model – each one taking into account different dimensions that, ultimately, impact the organization (Schekkerman, 2006).

Finally, Gartner, one of the industry's leaders in Information Technology consulting, focused on defining an approach that impacted an organization's mindset towards Enterprise Architecture. By gathering their vast experience and by analyzing the several success (and failure) cases, Gartner concluded that the most "successful EA programs are process-focused" (Bittler & Kreizman, 2005). Thus, the Enterprise Architecture Process Model (Figure 5) was devised, not as an attempt to provide an additional alternative from the previously mentioned frameworks, but to complement them and raise the discipline's effectiveness.

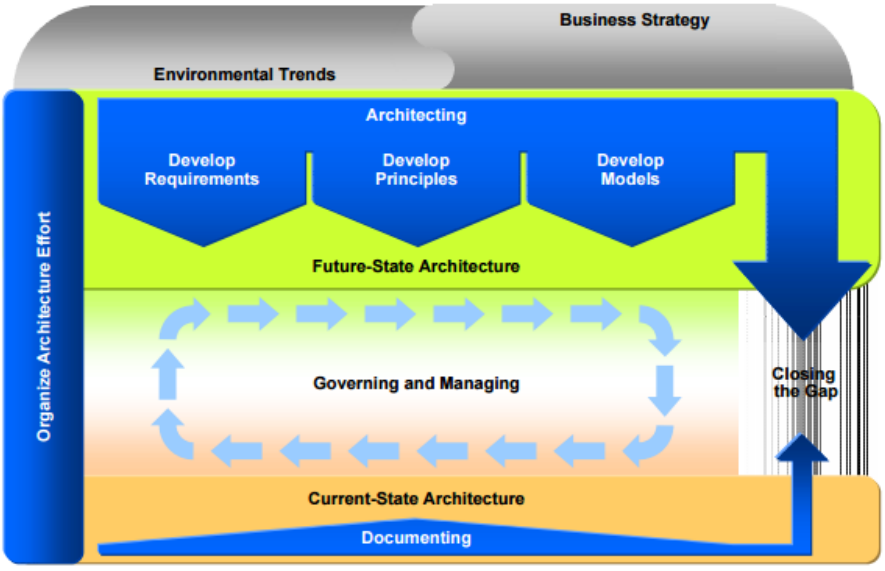


Figure 5 - Gartner's Enterprise Architecture Process Model (Bittler & Kreizman, 2005)

Although being technically-oriented in its infant stage (1996), Gartner's EA Process Model embodies a holistic approach, bridging the gap between IT and the business-oriented nature. Moreover, this methodology focuses on assessing and categorizing (cultural, structural or functional) the gap between the current state and the devised future architecture, facilitating portfolio management and recommendations that would, ultimately, help the organization to reach the envisioned status (Bittler & Kreizman, 2005). It encompasses four main dimensions within Enterprise Architecture – Enterprise Business Architecture, Enterprise Information Architecture, Enterprise Technical Architecture and Enterprise Solution Architecture – that complement each other and increase the organization's flexibility to an invariably dynamic environment. Lastly, Gartner suggests to emphasize the end target and not to extensively document the as-is situation, defining requirements, principles and models for the future state architecture and to allow the review board to govern current decisions (Bittler & Kreizman, 2005). By aligning the previously mentioned concepts, an organization is then capable of considering "the implications of this vision on the business, technical, information, and solutions architectures of the enterprise" (Sessions, 2007).

In order to align itself with the Information Systems Audit and Control Association's (ISACA) COBIT5 (Control Objectives for Information and Related Technology) and due to its flexibility obtained by the wide acceptance in most marketed solutions, Sonae chose TOGAF as a standard internal practice. Additionally, besides being vendor-agnostic and open-source, this framework is regularly revisited and updated according to the community's feedback.

2.2 Process Classification Framework

Enterprise Architecture's nature as an evangelist enables the company to establish a strong foundation for strategic execution, building and managing IT capabilities to leverage key initiatives (Ross, J. W., Weill, P., & Robertson, 2007). This paradigm embodies a close symbiosis between solutions, business capabilities and processes, as this relationship empowers both the decision-making process, regarding areas to strengthen or new opportunities to explore, and an efficient implementation of the devised strategy. As such, the previously mentioned framework is complemented with the American Productivity & Quality Center's (APQC's) Process Classification Framework (PCF).

As described by APQC, the Process Classification Framework intends to provide a "high-level, industry-neutral enterprise process model that allows organizations to see their business processes from a cross-industry viewpoint", as well as establishing a common language inside the organization. Besides encompassing the mentioned transversal perspective, this framework also details a plethora of industry-specific reference models, such as Retail, Consumer Electronics, Education and Healthcare. PCF incorporates five different levels – category, process group, process, activity and task – hierarchically related, providing a high-level view at the category level and achieving finer grain as we drill down through the levels. In the current version of the Retail PCF – version 6.1.1 – the twelve categories are subdivided into two main group: Operating Processes (Figure 6) and Management and Support Services (Figure 7)

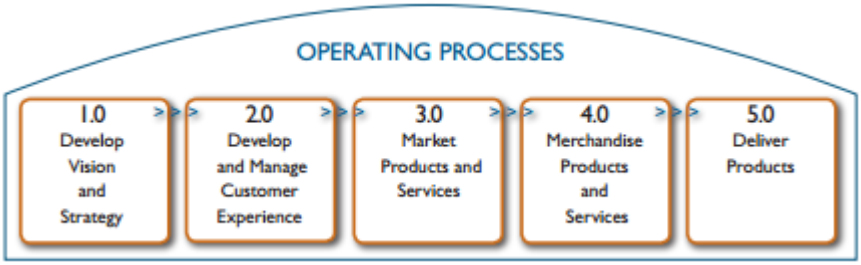


Figure 6 - APQCs Operating Processes (APQC, 2015)

Figure 7 - APQCs Management and Support Services (APQC, 2015)

Through the exploration of the subsequent levels, this framework encompasses industry-wide standard processes and practices, allowing the company to introduce a solid base to articulate with the business itself. By leveraging these advantages, Enterprise Architecture can connect the existing solutions to their business applicability and potential, allowing the organization to make capability-oriented decisions regarding IT.

2.3 Financial practices

Financially, software solutions are considered intangible assets that will serve their purpose for a defined lifetime, as described by the Portuguese Financial Normalization Committee in the Accounting and Financial Reporting Standard. During this period, the purchase cost of the

solution is amortized during a demarcated number of years, having different impacts in both accounting and financial dimensions. Although this purchase negatively impacts cash flow and raises capital expenditure (CAPEX) when the solution starts to be used, an acquired software values a company's total assets. Additionally, the software's intangible nature requires some caution when discontinuing existing applications, since the remaining value that still is not amortized must be assumed as cost in that year, impacting its operating expense (OPEX), unless it can be apportioned to another asset, as described in the article 95º in the Accounting and Financial Reporting Standard (Financial Normalization Committee, 2016). As such, it is critical to understand that, since EBITDA (Earnings Before Interest, Taxes, Depreciation and Amortization) disregards CAPEX but encompasses OPEX, discontinuing a software solution that still is not fully amortized, and that it can't be associated to another existing asset, can directly impact the company's earning potential and the business' latent value (Brealy, Myers, & Allen, 2014).

This consideration introduces an important constraint when identifying more efficient opportunities that maximize our capabilities and business processes. When an architect is able to introduce critical thinking in the analysis of a company's applicational landscape, it becomes possible to detect some potential improvements like, for example, business processes that, possibly, are being fulfilled by several applications in an unnecessary manner. In this scenario, discontinuing some of the solutions could be seen as a cost-efficient measure. Nevertheless, when contemplating the financial considerations introduced earlier, this scenario can, in fact, deeply impact one of the most important indicators of financial performance for a company in the stock market: EBITDA.

2.4 Service Design

Society is shifting from Product to Service Dominant Logic, increasingly focusing on people, processes, the physical environment itself and technology (Patrício & Fisk, 2013). This paradigm positions services as human-centered activities, delivering and co-creating their value through the interaction between organizations and customers. In contrast with the tangible nature of products, services rely on the provided customer experience to achieve differentiation from the existing offerings, thus thriving to gain a competitive advantage. Thereupon, there is a higher focus on the value proposition itself, rather than the pre-produced offering that characterized the Product Dominant Logic (Patrício & Fisk, 2013). As stated by the referenced authors, "customer experiences cannot be designed, but services can be designed for the customer experience".

Bearing the above in mind, it is crucial to empathize with the customers, in order to produce a value proposition that satisfies their needs. To do so, the Multilevel Service Design (MSD) approach aids on designing integrated service offerings at three distinct levels: Service Concept, Service System, and Service Encounters (Patrício, Fisk, Falcão e Cunha, & Constantine, 2011). According to the authors, this process starts with an extensive study of the customer experience, by identifying the Value Constellation Experience, the Service Experience and the Service Encounter Experience. Through the reached conclusions of the aforementioned stage, the Customer Value Constellation - a set of provided offerings and their corresponding relationships - is then outlined, supporting the design of the Service Concept. Subsequently, both the Service System Architecture and the Service System Navigation are drawn. While the first one provides an integrated overview of the offering and its supporting processes, the second one "maps the alternative paths customers may take across different service encounters

in the service experience" (Patrício & Fisk, 2013). Finally, the Service Experience Blueprint (SEB) is used to define the different Service Encounters between the customer and the service provider. Accordingly, this holistic view of services empowers companies to really get in touch with their consumers, focusing on their experience and overall satisfaction.

3 Problem Characterization

3.1 The Company

Since the foundation of the *Sociedade Nacional de Estratificados* in August 18th 1959 and with the ingress of Dr. Belmiro de Azevedo in the company, Sonae progressively started to shape into the colossal organization that we know today. In the 1980's crucial steps were taken into the organization's current reality, with the creation of Sonae Investimentos, SGPS, SA, and consequent entry in the stock market, as well as the construction of the first hypermarket in Portugal, through a joint-venture with Promodés, a former French retailer.

The following years were dedicated to consolidating the company's position in the market, as well as branching to new business' like, for example, Sports with the creation of Sportzone, Electronics with Worten's launch, or even Telecommunications with Optimus.

Nowadays, the organization encompasses seven different holdings: Sonae Modelo Continente (MC), Sonae Specialized Retail (SR), Sonae Retail Properties (RP), Sonae Financial Services (FS), Sonae Investment Management (IM), Sonae Sierra and maintains equity in NOS, a Portuguese Telecommunication company that resulted from the merger between Zon Multimédia and Optimus. Although the aforementioned businesses are all a part of Sonae, Efanor contains two additional holdings, Sonae Capital and Sonae Indústria, as seen in Figure 8.

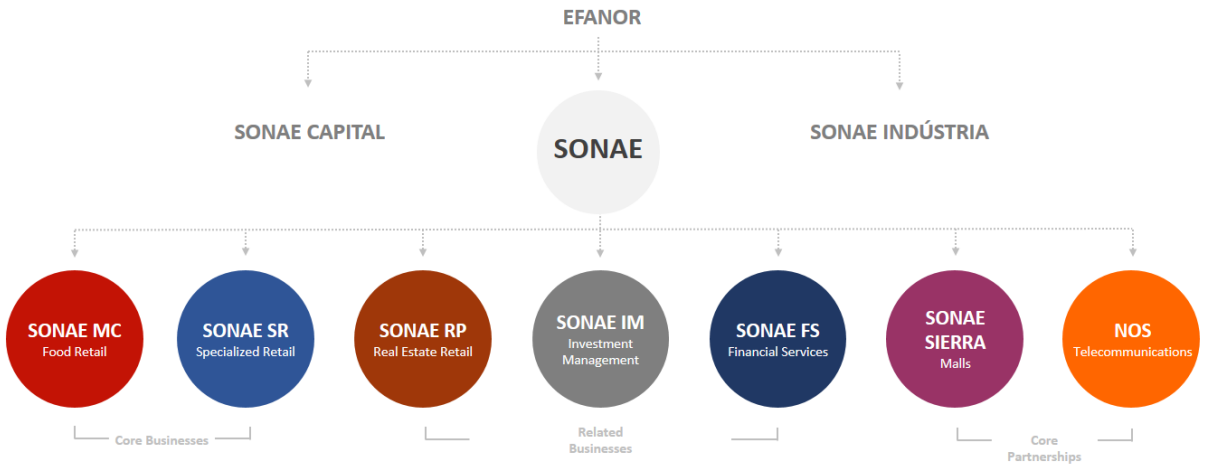


Figure 8 – Group's Organogram

Within Sonae, BIT (Business Information Technology) serves as the supporting Information System Department to all of the group's retail insignias, serving both Sonae MC and Sonae SR (Electronics and Sports & Fashion). Nonetheless, during the development of the work at hands, some internal movements were made in order to increase autonomy and flexibility, as well as providing different paces to the businesses, possibly resulting on separated IT structures in the near future.

As a mean to provide valuable support to the retailers and to promote inter-area collaboration and dynamic adaptation to trends and lifecycles, sustained by bimodal IT (Gartner, 2017b) and business-oriented technological agility, BIT defined an operating model based on four main pillars: think, build, run and cross-functional activities (Figure 9).

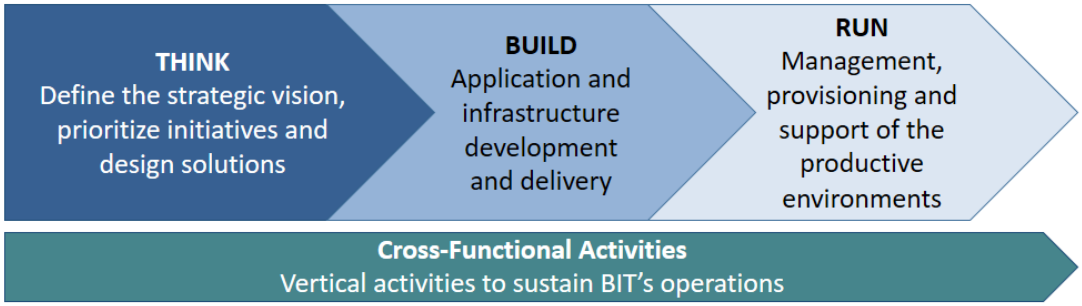


Figure 9 - BIT's Operating Model

Consequently, built upon the preceding operating model, six main departments guide BIT's everyday work, as seen in Figure 10.

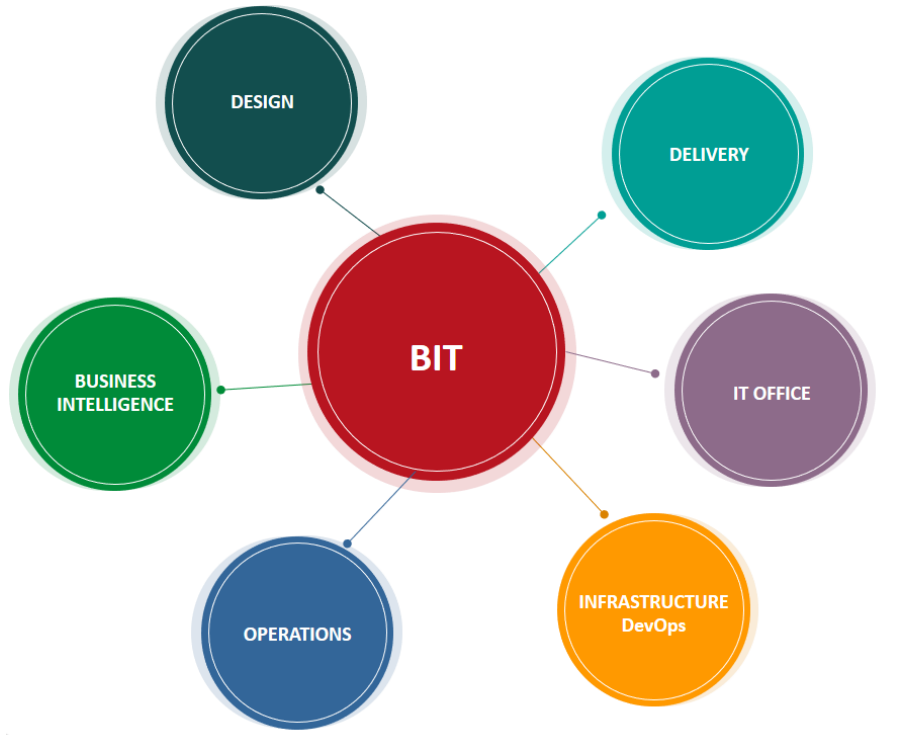


Figure 10 - BIT's Organogram

Each department impacts the operating model in one or more phases in a collaborative manner. The backbone of the three previously mentioned main stages, **Think**, **Build** and **Run** are, respectively, the Design, Delivery and Operations divisions. Additionally, both the Business Intelligence and the Infrastructure DevOps departments embody the three main stages within the same organizational structure. Finally, the IT Office integrates the **Cross-Functional Activities** stage, serving as a supporting pivot to the remaining areas, encompassing teams like, for example, Finance Control & IT Value, Strategic Partnerships and Culture & Communication.

It is in this context that IT Strategy & Enterprise Architecture operates, supporting BIT's decentralized governance model as an orchestrator (Figure 11) responsible for maintaining a holistic overview of the alignment between information systems and business. Additionally, the team is responsible for both evangelizing best practices in the company and support the decision-making process by providing relevant insights.

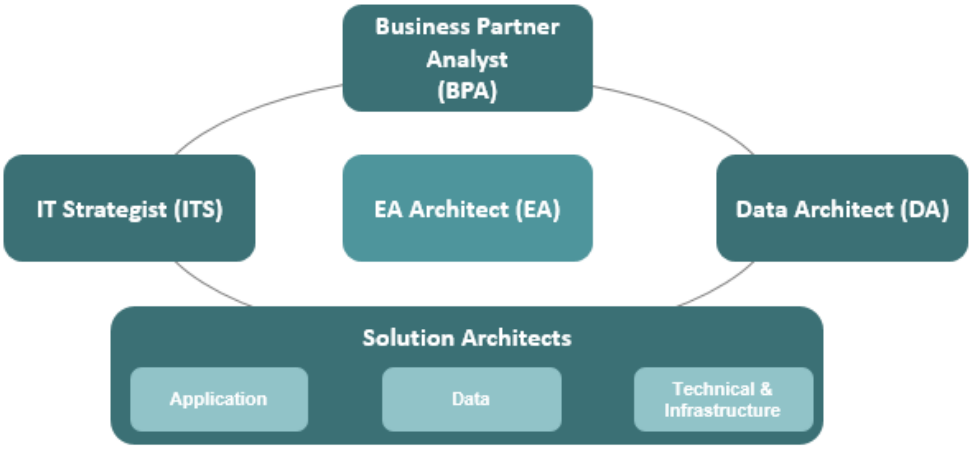


Figure 11 - EA positioning

3.2 The Problem

Due to the industry's dynamics, Sonae's business is an ever-changing environment that requires agility and responsiveness from the entire organization. Moreover, the decision-making process has to be supported by quality, up-to-date data that assertively represents the current state of the business and how well its progressing to the devised end-state. As the Information System department for Sonae MC and Sonae SR, BIT must ensure that Sonae's technological structures allow the much-required robustness to run the business and to facilitate a prompt response to new expansions, business changes or paradigm shifts, without compromising its agility and flexibility.

This alignment between business and technology must be governed by Enterprise Architecture, ensuring that the solutions used by thousands of employees are serving the organization to its utmost capacity. Consequently, seven guiding principles were outlined to properly sustain the everyday work and the conducted decisions, being defined as it follows:

1) **Enterprise Architecture management and reference model usage**
    a. The planning and management of our Enterprise Architecture must be unified through a central function. Reference Architecture Models shall be used to guide solution designs within the context of current business goals and needs.
2) **Maximize benefit to the organization**
    a. Information management decisions are made to provide maximum benefit to the business as a whole, attending to the available effort.
3) **Design for global use, availability and reliability**
    a. All solutions should be designed with the expectation to be global, performant and supportive of internationalization issues.
    b. The design must attend to user experience and support continuous operation within expected business requirements and service level agreements.
4) **Information as a valued and secured asset**
    a. Information is an asset that has value to the organization and must be designed, managed and protected accordingly.
    b. Information confidentiality, integrity and availability must be adequately preserved, reducing the risk to an acceptable level.
5) **Drive standardization, interoperability and technology independency**

   a. All solutions should conform to common enterprise interoperability standards that promote system integration and security compliance. Whenever possible, these solutions should be independent of specific technological choices and, therefore, operate on a variety of technological platforms.

6) **Reusable systems and simplicity**
   a. Solutions must be designed to be simple, to be used across the organization wherever feasible and built over low-coupling, reusable, modular components that implement services.

7) **Solution life cycle architecture**
   a. All solutions should be architected with the life cycle of the solution in mind. Equal emphasis must go in to design, building and running of the solution, planning for changes and terminating the solution at the end of its life cycle.

As a consequence of the rapid growth of the organization and nearly 400 different software solutions, Sonae's Enterprise Architecture team struggles to find a suitable solution to manage efficiently the colossal amount of information generated each day by businesses with completely different scopes. Moreover, the team's legacy in the company required a major overhaul to improve its agility and information quality, as well as lacking a suitable, collaborative tool to facilitate inter-area communication throughout the governance process.

Furthermore, the company's maturity level and its leadership status in the Portuguese market motivates Sonae to optimize its investments and scale both its points of difference and its point of parity, in order to create new synergies with innovative businesses while maintaining and further developing its competitive advantage. As such, conducive to the previous consideration, there is a growing necessity to sustain business decisions with something not yet contemplated in Enterprise Architecture's traditional frameworks: financial dimensions. Besides being used to apportion costs between different business units these are, in fact, one of Sonae's main strategic drivers, conferring critical insights to the management of the applicational landscape.

Finally, the traditional Enterprise Architecture responsibilities are scattered across several internal units. On one hand, the Business Partners bridge the gap between BIT and the distinct businesses, being responsible for designing and maintaining the corresponding business processes. On the other hand, BIT also contains a set of teams of Solution Designers for both applications (SADA) and infrastructure (SADI), detaining the fine-grained knowledge of these dimensions and the responsibility to design the architectural diagrams of software solutions and supporting infrastructure, respectively. Finally, the Business Intelligence department manages the Data scope in an end-to-end manner, from conception to operationalization.

This concedes a unique position to Enterprise Architecture within BIT as an orchestrator, maintaining a holistic view of the organization, while relying on a critical mind and on a business and service-oriented perspective. As such, it is imperative to fine-tune and to make our strategic vision and mission both actionable and communicable, in order to efficiently support the different teams with clear and objective information, something not yet accomplished internally.

Bearing all of the above in mind, the present work aims to boost Enterprise Architecture as a service for Sonae's users, providing real-time insights adapted to each stakeholder's needs, all maintained in a common centralized space for informational reliability and stakeholder accessibility. Additionally, the emphasis on business orientation is going to allow the project to achieve higher depth in terms of capability and business process analysis, as well as providing a critical view of the applicational landscape through the integrated financial metrics and

through the introduction of assessment methodologies for each solution. With the accomplishment of this challenge and through the design of a new and collaborative governance process, we are going to be able to respond to the business' needs using an agile and flexible paradigm.

4 Methodology

The inquisitive mind is a second nature for most living things, specially Humans. The thirst for knowledge and understanding of our surroundings molded our actions since the beginning of time. As Humanity evolved, so has research itself as an academic activity, having matured to a structured process that grants us better and more assertive conclusions about the world (Kothari, 2004).

As such, Kothari defines research as a "systematic method" that progresses from several stages – problem enunciation, hypothesis formulation, data collection, data analysis and conclusion – until it is possible to either devise a solution or a theoretical deduction for the studied problem (Kothari, 2004).

This method is further decomposed as a metaphor, using the components of a tree – roots, trunk, leaves and fruit – as a representation of the different dimensions inherent to the research process (Easterby-Smith, Thorpe, & Jackson, 2012). As explained by the authors, the roots represent the background research conducted in a given area, constituting the foundation for the investigation at hands. Secondly, the trunk – responsible for granting a strong structure to the tree, whilst transporting the nutrients to the leaves and fruits – symbolizes the four main traits of research design, as seen in Figure 12.

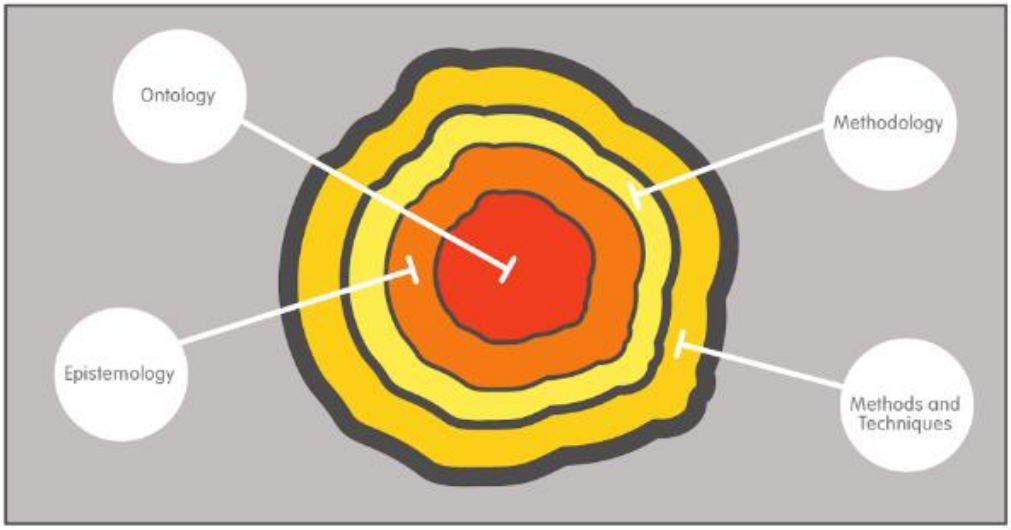


Figure 12 - Research design traits (Easterby-Smith et al., 2012)

Through these four layers, this analogy mimics the structure and strength that the research itself needs during data collection and analysis. The ontology – represented as the heartwood – embodies the inferences about the reality, being complemented by the epistemology – the sapwood – that personifies the researcher's discernment of how to inquire what he perceives to be true. The third ring – the cambium layer – encapsulates the fourth – the tree's bark – as a set of techniques and methods used to collect and analyze data – the leaves. Finally, the fruit represents the way the research is communicated, in a structured manner, to the community. (Easterby-Smith et al., 2012)

4.1 Reason of choice

In order to properly sustain the project's research design and to personify Easterby-Smith, Thorpe and Jackson's tree, an exploratory qualitative research was chosen. Although there was

a significant research effort to grasp the best practices outlined in the literature and applied to the market, it is imperative to understand that this project was developed within Sonae's context, thus the interviews sample size is not going to allow the establishment of generalized conclusions.

Nevertheless, the findings fully translate the experience that several stakeholders underwent when communicating with us, which was crucial to, qualitatively, identify the core focus of the present work. Additionally, aside from acquiring background information on the area and adapting it to the new, agile, paradigm that was envisioned to drive Enterprise Architecture in the year of 2017, it is projected that the conducted work helps integrating financial dimensions in Enterprise Architecture and to adapt it in a service-oriented manner, aiding on the management of the company's applicational landscape through a new hypothesis.

4.2 Method used in the project

Considering the complexity introduced with the decentralized governance model sustained by different types of stakeholders, it is imperative to devise an approach that satisfies the distinct perspectives, merging them in a solid and unified vision. Moreover, although the team steadily improved in 2016 according to the parameters presented in Figure 13, it still functioned in a reactive way, based on *ad-hoc* requests, lacking a standard service catalogue, a clearly outlined governance process and an efficient communication model.

Figure 13 - Team Assessment

Consequently, we focused on two main moments: positioning Enterprise Architecture as an internal service provider and the definition of sustainable support processes (both in terms of information governance and of how it is communicated), as a mean to provide the data as accurately and as updated as possible.

Firstly, both the main stakeholder groups and the corresponding provided services were identified, according to the previous projects developed by BIT's EA. The subjects were chosen according to several variables – company seniority, frequency with which they interacted with EA and stakeholder profile, ranging from technically-oriented to managerial profiles. Afterwards, having chosen a representative for each one of the groups, informal interviews

were conducted in order to grasp their perspective of the interactions with us, similar to Service Design's study of the Customer Experience (Patrício et al., 2011).

Having compiled and critically analyzed the results from the interviews, both generic and area specific goals were defined. While the first ones were determined as to be fulfilled regardless of the chosen specialization for the project, the later aimed to describe specific pains felt by each one of the stakeholder groups. This allowed us to consciously define a narrower path for the conducted project, due to its limited duration and the need to make actionable implementations that are only achieved through a deep dive. Nevertheless, the ambition for a multidisciplinary scope wasn't compromised on a shallower level, although the in-depth exploration of the remaining areas is scheduled to be conducted on a later moment.

As such, a metamodel was conceived as a mean to translate the flows between Enterprise Architecture's different concepts, conferring a full stack view of its broad scope. Encompassing disciplines that range from technical to strategic concepts, this metamodel intended to represent, for example, the connection between Sonae's strategic initiatives, business processes and the corresponding software solutions, also known as Logical Application Components (LACs). As defined by the Open Group (2011), a LAC represents applications that augment the business' capabilities, whilst remaining abstract from any particular implementation. As an instantiation of this concept we have, for example, a Customer Relationship Management (CRM) solution or an Enterprise Resource Planning (ERP) software.

Considering all of the above and by analyzing our current possibilities, we decided to focus on exploring the Business and Applicational layers and their corresponding connections. This choice was additionally strengthened by the company's ongoing initiatives and the opportunity to generate actionable value to Sonae's daily operations on a short term.

Thereupon, the information that was made available only through a difficult to use Excel file, was centralized in a database easily accessible to all stakeholders. This database was created using SQL Server, in order to remain compliant with the company's standard technologies, directly feeding the information to Microstrategy's (a Business Intelligence tool) dashboards. Each dashboard was created by taking into consideration the job to be done by each stakeholder, highlighting the different fractions of the information are consumed with different purposes, as proven by the results obtained in the qualitative interviews.

Finally, similarly to the last phase of Multilevel Service Design (Patrício et al., 2011) the dashboards were taken back to the field and validated as service offerings with the stakeholders, in both formal and informal meetings, receiving an immediate positive feedback and adoption requests, as well as identifying improvements opportunities that were seized during the execution of the current work.

Furthermore, the developed project would quickly become obsolete if it was handled like a one-shot effort, since one of the biggest issues was the unsustainability of the current governance process and the lack of a communication model for Enterprise Architecture. The software solution creation tool didn't fit our current needs and followed a painful administrative process. Additionally, the Enterprise Architecture's portfolio was maintained separately in an Excel file, requiring a duplicate registry of information spread through several sheets. Finally, the information regarding the LACs was updated only on a yearly basis, which required a colossal effort to analyze almost 400 applications with the Solution Designer teams and to update both Sonae's Configuration Management Database (CMDB) and EA's portfolio. Considering all of the above and parallelly to the previously mentioned phases, a new, sustainable and collaborative governance process was devised, being supported by a more effective

communication model that gave additional visibility to the information that the stakeholders need. Nevertheless, despite designing it and having approached the teams regarding the new governance process, it wasn't implemented during the current work, since the limited duration of the project wouldn't allow an organic (and consequently feasible) implementation. Nonetheless, we thrive to implement it in the short to medium term.

5 Results

The following section describes, in further detail, the accomplished work, being sub-divided in three sub-chapters: Qualitative Research, Goal Adjustment and Achieved Results.

While the first section contains the conducted interviews, their supporting rationale and respective conclusions, the second one compiles the respective adjustments done to the previously outlined goal. Finally, in the Achieved Results sub-chapter, it is presented how the chosen objectives were satisfied through actionable changes.

5.1 Qualitative Research

Considering Enterprise Architecture's broad scope and multidisciplinary stack, and taking into account the focus on producing value through actionable outputs, the success of the present work depended on the efforts to delimit a well-defined problem. As such, in a preliminary stage, we positioned BIT's Enterprise Architecture as an internal service provider, identifying our main customer groups (Figure 14).

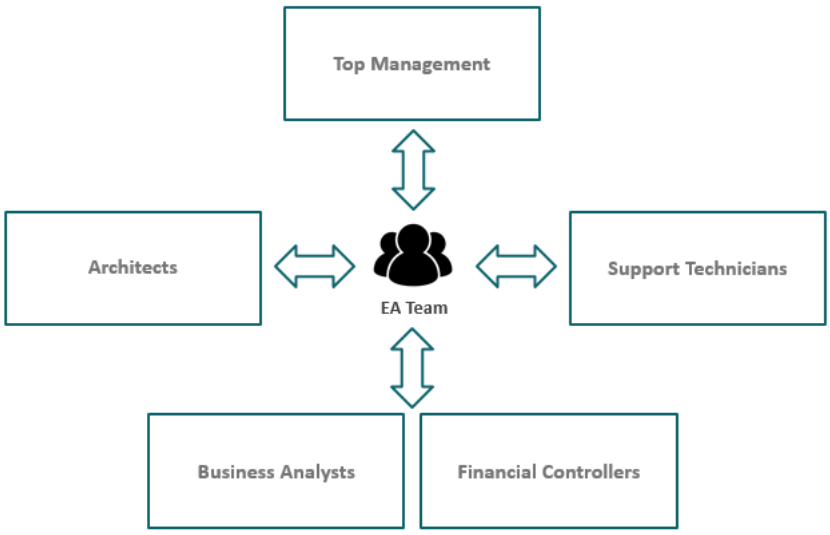


Figure 14 – Enterprise Architecture's Customers

Afterwards, considering the projects conducted previously by the team and the identified stakeholders, a service catalogue was outlined, as seen in Figure 15. Crossing three main dimensions – applications, business processes and infrastructure – this catalogue ranged from business-oriented to more technically-oriented services, producing distinct deliverables respectively. Nevertheless, they presented different maturity levels according to the Enterprise Architecture's grasp in each one of the inherent layers.

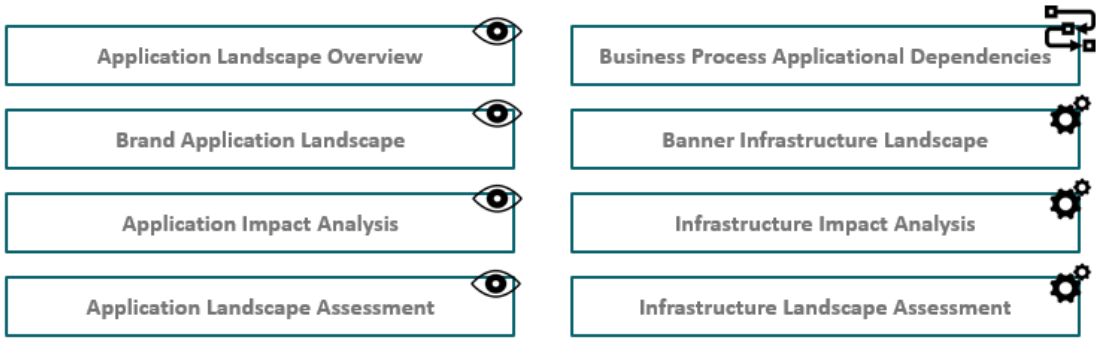


Figure 15 - BIT's EA Service Catalogue

From the outlined Service Catalogue resulted a set of different, and differently matured, deliverables. Although the artefacts produced for the Business/Application layers were the most mature and, consequently, regularly updated, the deliverables from the Infrastructure layer, on the other hand, were a result of a pilot conducted for two of Sonae's critical software solutions in the Configuration Management Database's pre-production environment. As such, the deliverable list was defined as it follows:

Business/Applicational artefacts

- LAC List
- LAC Insights
- LAC - Project Heat Map
- LAC – Cost Map
- Applicational Landscape
    - Capabilities – Applications – Business Functions
    - Capabilities – Applications – Brands
- Capabilities – Business Processes Map

Infrastructural artefacts

- Infrastructural List
- Infrastructural Insights
- Infrastructural Impact Analysis
- Infrastructural – Project Map
- Infrastructural – Cost Map

Subsequently, a judgement sample (Marshall, 1996) was selected based on the identified stakeholder groups, in an attempt to capture different specializations and experience levels, from low to high number of interactions with us and from shallow to deep knowledge about the work developed by Enterprise Architecture. Additionally, considering that Sonae is a traditional, hierarchical company, we thrived to make contact with both operational and top management interviewees.

As such, a series of informal interviews were conducted where, in a first stage, the interviewee was given some context about the team's responsibilities (Figure 16), the purpose of the meeting and EA's new service value proposition.

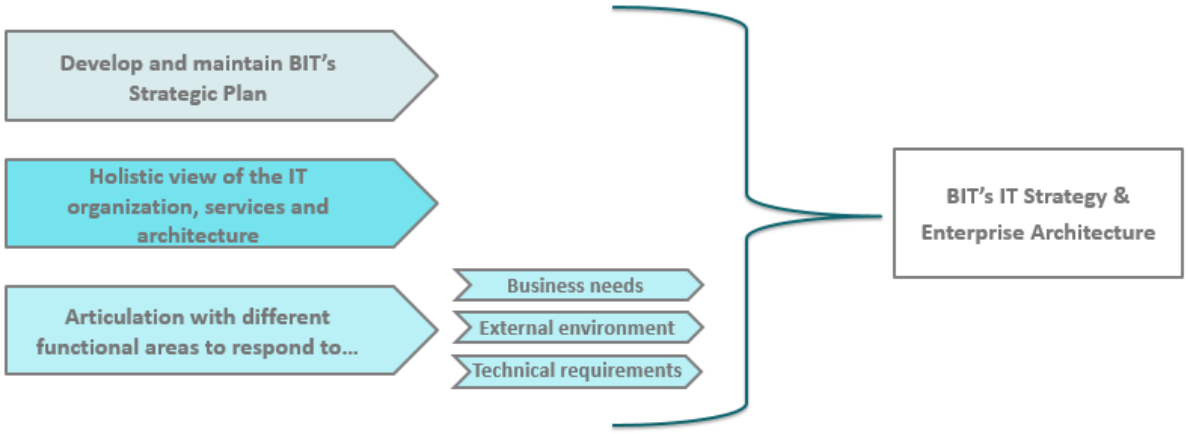


Figure 16 - IT Strategy & Enterprise Architecture's responsibilities

Throughout the interview, we sought to answer six main questions (presented below) supported by a full list of the available artefacts, as validation of their produced value (or not) and to identify potential improvements that could be introduced.

- How do you currently get your information?
- Do you get the appropriate information (no more, no less)?
- What are your current pains with Enterprise Architecture?
- What information/artefacts do you need?
- What are you trying to achieve with that information?
- In which format would it serve you better? Why?

5.1.1 Interview 1

The first interviewed stakeholder group were the Support Technicians, specifically BIT's Service Desk Administrator, a stakeholder with low interaction with the team that is in charge of controlling the critical failures that impact Sonae. The interviewee produces and sends daily major incident reports with the affected structures, both software and hardware, using an internal communication tool to coordinate efforts and minimize down times.

Nevertheless, this could only be achieved through the interviewee's long experience with the company, as there wasn't a formal specification of what, and who was being affected by a reported major incident. The group's dependency of its complex legacy systems prevented them to accurately establish a connection between its infrastructure, software and the impacted business processes and brands.

Additionally, the interviewee lacked visibility of who was the owner of each application, an important requirement for the stakeholder since they were the communicational pivots during a major incident. Consequently, the unavailability of the communication tool could significantly impair BIT's response measures, which raised a substantial concern on the interviewee's mind.

Although the interviewee was pleased with the resulting deliverables from the Infrastructure pilot, it still lacked scale to fully take advantage of it in an everyday basis. Nevertheless, since one of the mapped software solutions was Sonae's Retail ERP, one of the Service Desk's main

focus due to its dimension and usage, the interviewee used it to support her impact analysis process.

In conclusion, as a suggestion for future collaborative artefacts, the interviewee suggested a Heat Map that translated major incidents *per* software solutions (Figure 17), as a way to sustain both the reporting process and critical analysis of our landscape.

Figure 17 - Suggested Deliverables for the Support Technicians

5.1.2 Interview 2

The second interview targeted the Business Analysts (BAs), specifically the coordinator for the Health & Wellness section. Within the organization, both BAs and the Solution Designers are organized by functional areas, consequently responding to different phases of the value chain or even different businesses. This interviewee previously had regular contact with the team, showing a great deal of maturity within Enterprise Architecture's scope. Acting as a pivot between BIT and Sonae's retail businesses, this stakeholder felt that there wasn't a clear outline between the distinct areas in terms of LACs, capabilities and business processes, lacking area-specific landscapes to sustain strategic decision-making.

Additionally, due to the plethora of existing software solutions, there was a proven necessity to improve their functional transparency and purpose, as the usage of some of the LACs was unclear to most Business Partners, according to the interviewee. This increased detail would also help in sorting grey areas between the different divisions, another issue expressed by the stakeholder.

Furthermore, an opportunity was identified with the usage of additional models of the Process Classification Framework, since the specific nature of the Health & Wellness area could be better responded with the APQC's Healthcare reference model, since internally the Retail model was implemented transversally. Finally, the interviewee stated that the previous Enterprise Architecture knowledge aided in the analysis of the available data, but that the interviewee's colleagues wouldn't be able to easily extract value from the way the information was being communicated.

The information was mainly consumed through the LAC list, serving as the foundation for the subsequent analysis, although the available applicational landscape aided the interviewee in drawing the boundaries of the Health & Wellness business area. Nevertheless, although there was a close contact between the stakeholder and Enterprise Architecture, some unfamiliarity with the produced artefacts was noted, since some of the identified improvement opportunities were already being addressed, as seen in Figure 18.

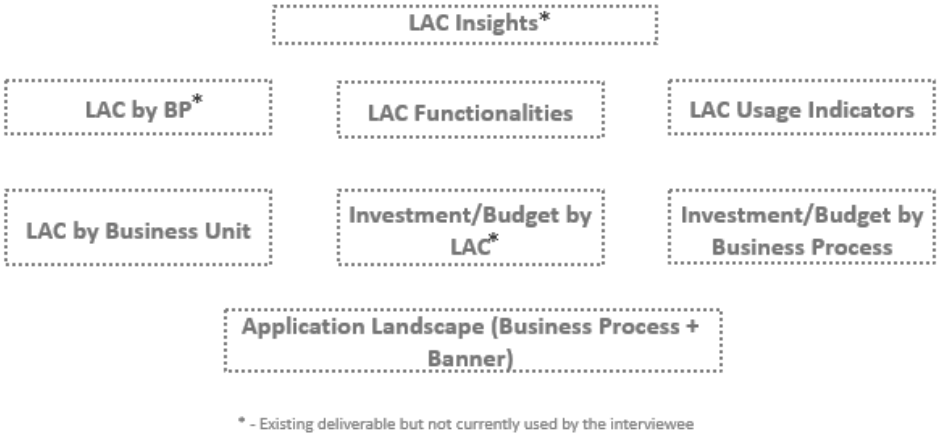


Figure 18 - Suggested Deliverables for the Business Analysts

5.1.3 Interview 3

The contact with the Architect's stakeholder group was divided in several moments. Firstly, the Head of Solution Architecture Design for Applications (SADA) was interviewed, a stakeholder with systematic contact with EA through the distinct governance forums.

Although being recently appointed to this function, the interviewee felt that there were two main topics to be addressed: Improve the way we collaborative work the financial aspects in a more efficient manner and to guarantee standardization in practices and terminology between teams, as a natural process.

Additionally, and considering the recent move within the company to substitute traditional integration methodologies with an API centric paradigm, the interviewee proposed us to collaborative think on how to translate API Management in Enterprise Architecture, something to be accomplished as future work.

Regarding the presented deliverables, the added value for the SADA operational teams was yet unclear, having later on scheduled a meeting where we presented each artefact and its corresponding advantages and disadvantages, resulting in a positive feedback for both the applicational landscapes and the implemented APQC's framework for business processes. The articulation with these teams constitutes a crucial exercise for Enterprise Architecture, since the Solution Designers are one of the main producers of information in the applicational area.

Moreover, this exercise triggered both an extensive portfolio revision for nearly 400 solutions (conducted outside the scope of the current project) and the design of a new governance process where the solution architects are responsible for updating periodically the information of each LAC, avoiding the colossal effort applied by both teams during the revision periods and maintaining the information up-to-date during the entire year. This process is presented and explained subsequently on this chapter, being sustained by a new concept of LAC ownership attributed to each SADA area.

5.1.4 Interview 4

The fourth interview addressed Top Management, being conducted with an interviewee sensible for both IT and financial aspects. Acknowledging the differences in the analysis of

BIT's landscape from the operational and managerial standpoint, the interviewee laid down the key questions that sustain decision-making:

- Which LAC's serve a specific business process?
- Are there any LACs exclusive, or not, to a specific business? Which ones?
- Which LAC serves which capability?
- Are there any issues that need to be addressed in a LAC?
- What should be considered a LAC and a PAC (applicational components that sustain software solutions)?
- What characteristics and principles does a LAC have?
- Lack of a robust process to manage LACs: When/which to discontinue? When should new ones come in? When to update?
- What LAC's does a holding (or brand) use?
- What drivers are influencing the cost distribution of a LAC?

While some of these issues were being addressed by our LAC list and the delivered applicational landscapes, it was clear that there was an opportunity to significantly improve the way the information is treated to clearly answer the presented questions. According to the interviewee, most of the produced diagrams weren't friendly from the managerial perspective, as some of his colleagues without IT specific formation felt difficulties when interpreting them. Moreover, the unclear border between LACs and PACs constituted a problem, since these concepts were sometimes used ambiguously and the company's financial model was established on top of the LACs.

Furthermore, the difficulty in mapping the usage of each LAC with the corresponding holding/brand constituted a bottleneck on the cost apportionment exercise, also crippling the businesses ability to benchmark both their CAPEX and OPEX against other companies. These issues were later on sorted with the extensive revision process and the phase-out initiative, where we successfully identified which brands (of the entire Sonae group) used which solutions, constituting a strong foundation for the new financial model and facilitating its objective to go live during June of 2017.

Yet again, the inaccessibility of information and the absence of the corresponding maintenance process through ownership attribution was an expressed concern, lacking a clear, sustainable, communication model adapted to each stakeholder's interests. Additionally, our current model didn't allow us to keep historical records of how the architecture was evolving, for the assessment of both the strategic plan and its corresponding impacts and to keep track of the past investments (Figure 19).

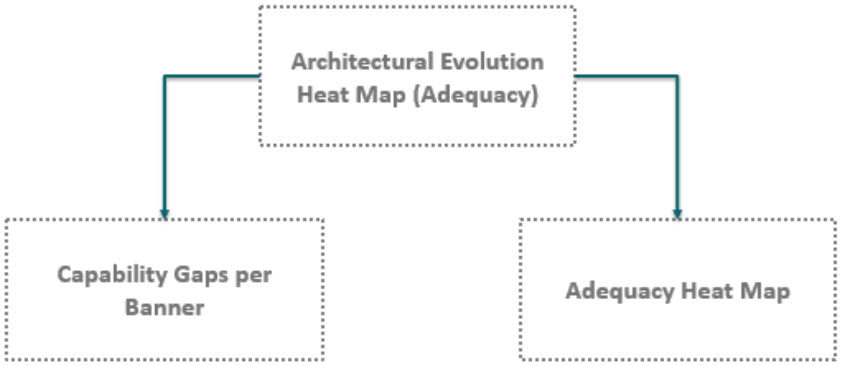


Figure 19 - Suggested Deliverables for Top Management

Bearing all of the above in mind, the interviewee's usage of both the LAC list and the applicational landscape for business processes and capabilities was remarked, although both could improve the way they were transmitted.

5.1.5 Interview 5

The final interviewed stakeholder belonged to the Financial Controller group, having close contact with both IT Strategy, for the strategic budget, and Enterprise Architecture, for the organization's new financial model.

Using EA's information as the foundation, the financial model intends to distribute LAC costs between different holdings and/or brands, increasing transparency between the IT services and the group's businesses. As such, costing criteria are allocated for each solution, depending on its type, that can range from number of used licenses to number of database requests. The cost is not only determined by its acquisition value, as it also bears into account new developments or updates conducted in internal projects.

The interviewee's main concern regards the level of detail currently in scope, as the apportionment exercise only functions at a LAC level, due to the difficulty of determining the exact costs of the supporting infrastructure of each solution. Although there were some deliverables regarding infrastructure, it was still insufficient for the intended exercise, as it lacked maturity and dimension. Another identified issue concerned the percental contribution of each solution in the realization of a certain business process, especially due to its strategical value added. Finally, the absence of LAC ownership and visibility of which holding or brand used which software solution, were two expressed topics that were later on solved through the portfolio revision process.

Considering all of the above, the interviewee consumed our information proficiently, working primarily with the LAC List. Nonetheless, as illustrated in Figure 20, she suggested that we improved both our connection with the strategical/financial exercise, giving visibility of its impacts on our architecture, and to determine percental contributions of each LAC to the internal business processes.

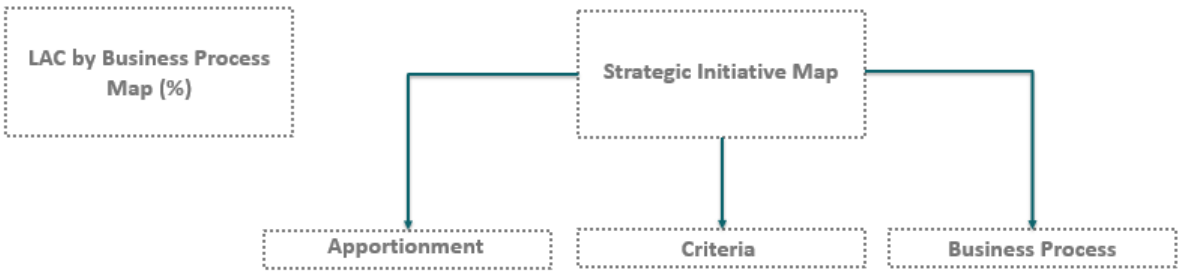


Figure 20 - Suggested Deliverables for Financial Controllers

5.1.6 Interview Results

Having concluded the interviews, the results were compiled in order to devise the next steps for the project at hands. Considering the MSD service-oriented paradigm, its crucial to fully understand the customer experience by analyzing the rich results obtained by the qualitative studies (Patrício et al., 2011).

Two main conclusions could be extracted from this qualitative study: the role of Enterprise Architecture isn't yet clear for most of the teams and, consequently, people don't really know what we produce.

From the 11 offered deliverables, only three were creating value to most stakeholders (Figure 21). Although the existing artefacts responded to some of the enunciated needs, we failed to give them visibility or to present in an efficient manner.

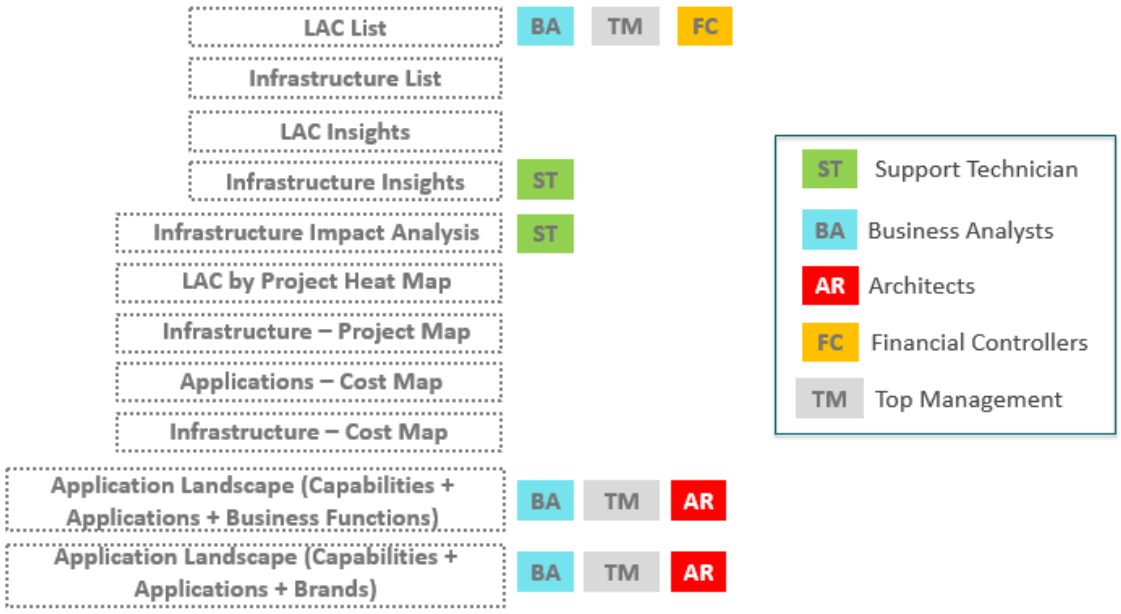


Figure 21 - Used Deliverables

Maintaining the focus on making actionable improvements that could really impact the organization on a short-term basis, both generic and area-specific goals were outlined. The rationale that sustained this division was based on the need to sort issues felt by all stakeholders, having a direct impact on the project's success rate, and to focus the work at hands in specific layers, since each of them required a deep dive and the project had a limited duration. However, regardless of the chosen specialization, we didn't lose sight of how it could integrate with EA

in a holistic manner. To keep this in mind, a full stack metamodel (Appendix A) was conceived using the Archimate standard, facilitating the identification of the different components of each layer and how they interact with each other.

5.2 Goal Adjustment

Due to the sparse insights obtained during the interviews, we felt the need to categorize the findings and to adapt the outlined objectives, identifying both common pain points and issues that were specific to a certain Enterprise Architecture layer.

Consequently, in order to translate this division in a clear manner, the current sub-chapter is split in both generic and area-specific goals.

5.2.1 Generic goals

In order to bring some clarity to the different stakeholders and to their expressed discomfort with Enterprise Architecture's concepts, we started by elucidating their definitions. The literature defines a Logical Application Component as a solution functionality agnostic of any specific implementation and a Physical Application Component as a "application, application module, application service, or other deployable component of functionality" (The Open Group, 2011). Internally, LACs are considered to be the software solutions themselves and PACs their corresponding components, ranging from applicational binaries to the specification of device-oriented versions (such as mobile and desktop applications).

Nonetheless, historically this was not always the case, due to several exceptions that rose throughout the years within Sonae. Consequently, there are decomposed LACs to give visibility to their different modules (for example, an ERP's financial module and its human resources module), as they constitute enormous solutions that serve multiple capabilities. In contrast, there are also some examples where this principle wasn't applied and the solution was registered as a single LAC (the company's WMS, serving both the Value Chain Management and the Merchandise Products and Services capabilities).

Although the Enterprise Architecture's service catalogue was a concept introduced with this project, the unfamiliarity of the stakeholders with the produced artefacts limited our ability to aid them in making more assertive decisions, sustained by BIT's principles and architecture. Consequently, a service catalogue should be made available in a transparent and easily accessible way.

Moreover, as previously demonstrated, the stakeholders mainly consume the LAC list and the applicational landscapes. As such, they constituted our primary focus during the development of this project, as the LAC list (made available through our portfolio) wasn't tailor made and adapted according to the job to be done.

Finally, in order to organically sustain our informational foundation, there is an imperative need to define a new EA government process, as the information is being sparsely updated. Seeing that the portfolio is kept in an Excel sheet, thus requiring each stakeholder to download it in order to consult it, we should also focus on making the information available more easily, migrating it to a database and making it available in a more friendly and intuitive way using a BI exploration tool (Figure 22).

Although requiring significant effort and time as the dashboard have to be jointly validated by the different stakeholders, this would allow the information to be reliably kept in a centralized

space, preventing further generation of unmaintained versions of the portfolio on personal computers and facilitating its self-service.

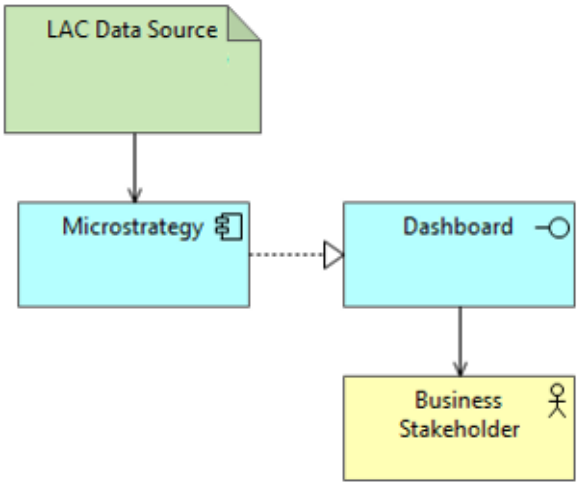


Figure 22 - Remote Access to the Portfolio

Although an Enterprise Architecture tool wasn't developed during the course of this project, these measures allow the company to take sustainable steps into a new way of working, since it wouldn't be wise to implement such big changes in such a short term. Additionally, the collaboration and articulation between the different teams, based on an open, bi-directional relationship is absolutely imperative for the success of the work at hands, since Enterprise Architecture should be the link between people, process and technology.

5.2.2 Area-specific goals

Due to the different nature of each Enterprise Architecture layer and by taking into consideration the aforementioned interview results, the corresponding findings were divided into three possible orientations (Figure 23).

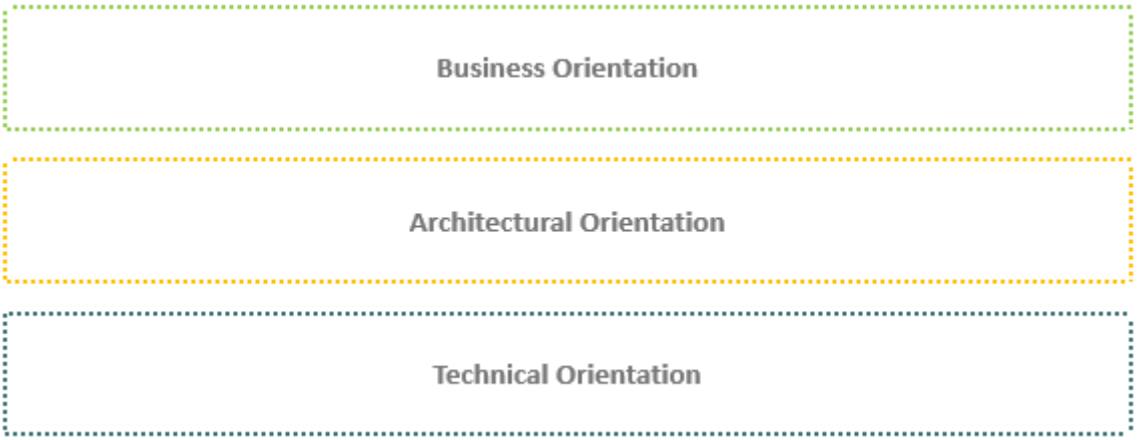


Figure 23 - Possible project orientations

BUSINESS ORIENTATION

The first orientation targeted business-related stakeholders: Business Analysts, Financial Controllers and, consequently, Top Management. Although having a good maturity in the

relationship between the Business and Application layers, there was a pronounced necessity to take advantage of this information in a way that better supported strategic decision-making.

Additionally, considering that these decisions are sustained by financial data and taking into account that there is an increasing pressure to introduce the new financial model into the company, we concluded that EA should support the inherent concepts. As the literature doesn't specify this relationship, we were going to need some time to mature ideas of what should be introduced into the area's scope and of what should remain strictly within the financial team.

Traditionally, Sonae's developed projects were extremely oriented to the delivery of new solutions. Nonetheless, considering the company's concern of going lean, it is imperative to guarantee that every solution is performing at its utmost capacity and usefulness. As such, discontinuing LACs is an exercise that could clearly benefit from these new financial dimensions, as phasing-out a solution doesn't necessarily imply saving costs, as further explained.

Finally, the exploration of the connection between the LACs and the Business Processes could be further explored through the PCF, possibly exploring additional models for each business area.

ARCHITECTURAL ORIENTATION

Focusing on the coordination between Enterprise Architecture and the Solution Architecture Design for Applications, this orientation targeted the specification of a shared repository. Although sustained by the previously mentioned governance process, the aim was to facilitate inter-team collaboration through a new tool.

Through this specification and requirements elicitation, BIT would be able to implement an Enterprise Architecture tool that would be collaboratively used by different teams.

Furthermore, we would have the opportunity to explore the API paradigm and its integration with Enterprise Architecture's traditional scope.

TECHNICAL ORIENTATION

Lastly, we defined more technically-oriented goals to collaborate directly with BIT's infrastructure teams. Previously mentioned, the organization still lacks a transparent and precise connection between the software solutions and the supporting technological components. Consequently, getting a holistic view of the impact of each major incident becomes a challenging task.

Considering TOGAF's LACs and PACs as two core concepts for the applicational layer, there are also two core notions on the technological level: Logical Technology Component (LTC) and Physical Technology Component (PTC). According to the Open Group, while a LTC represents an agnostic infrastructure component, such as a generic server, the PTC instantiates that concept, specifying it into a concrete technological piece used indoors. In Appendix B lies one of the results of the previously mentioned infrastructural pilots, showing how a specific solution decomposes into distinct modules that are respectively stored in separate servers, while potentially using different databases within a certain cluster. Although the complexity and structure of the presented diagram were maintained, the designations and details were hidden for its inclusion in this report.

This level of detail becomes crucial when conducting impact analysis, allowing the organization to critically review its supporting technological components, establish precise incident logs *per*

LAC and aiding the overall reporting exercise that feeds the everyday jobs of BIT's support teams.

REASON THAT SUSTAINED THE CHOSEN ORIENTATION

By taking into consideration the interview results, the outlined objectives for the project that were initially proposed and the capacity to make relevant and actionable changes, the business-oriented challenge was embraced.

Nevertheless, during the course of this project, there was the need to improve the EA-SADA collaboration, consequently resulting on the new governance process and on higher alignment and delivered value through the produced deliverables. Regardless, the implementation of API Management in Enterprise Architecture and the tool specification weren't conscientiously conducted in the work at hands, due to its limited duration and disparity with the outlined objectives.

Additionally, the technological orientation still lacked some maturity that is only now acquiring. The previously conducted pilot for two LACs took approximately two to three months to develop, rendering it impossible to deliver results with enough dimension to sustain Sonae's operations. Moreover, the organization launched an internal project to substitute its Configuration Management Database (CMDB) and Service Desk by a new solution until September 2017, introducing auto-discovery mechanisms. Through network sniffing techniques, the new system is able to find thousands of technological components and establish the corresponding connections between them, linking them with the LACs and empowering impact analysis.

As such, we decided to take advantage of its most mature layer, introducing the much-needed financial dimensions and working on delivering real value to the stakeholders through actionable reporting, empowering the group on going financially lean and to sustainably manage its IT.

5.3 Achieved Results

As Enterprise Architecture positions itself as an orchestrator between distinct areas of the company, there is a colossal amount of information that could leverage the way decisions are made, empowering both their efficiency and effectiveness. Consequently, our primary concern during the development phase of the project at hands was not to introduce further entropy to our scope, but to maximize the created value from the existing foundation.

Firstly, the internal LAC categorization and its corresponding attributes were reviewed. Although the literature advises it to remain agnostic from any specific implementation, and considering the maturity that Enterprise Architecture gained over the years within the organization, it is imperative to keep in mind the area's positioning as a facilitator of information. Bearing in mind that EA's portfolio currently serves as the basis for discussions regarding Sonae's solutions, we find it crucial that people recognize what solution is being discussed.

As such, the designation of each LAC should follow the way that its known internally, else it significantly jeopardizes the value obtained from applicational landscape discussions or artefact analysis. Nonetheless, it is also important to recognize the possibilities that an abstract designation can empower, especially in situations where Sonae doesn't want to disclose its

internal solutions like in, for example, partner negotiations. Bearing this in mind, a field was kept in order to register this agnostic name.

Moreover, considering the results obtained in the interviews and from further contacts with different stakeholders, the original 46 attributes that were being stored lacked usefulness and the portfolio itself wasn't user-friendly. As such, besides having moved the portfolio's data exploration to a business intelligence tool, focusing on accessibility and usability, the number of attributes associated to the LAC entity was reduced to 17.

Secondly, the users felt difficulty in understanding the border between LACs and PACs. Thereupon, during the portfolio revision process, we conducted small sessions with the different SADA teams to clarify these concepts. We also conducted an on-boarding meeting with the coordinators of each area, explaining both our frameworks and standards and the rationale that supported their choice, in order to collaborative devise the future strategy for the applicational layer. However, we consider this to be insufficient, as these concepts extend way beyond the Solution Designers. This requires both a critical analysis of its definition and a consequent evangelization to the internal collaborators, making it easily accessible and understandable to everyone. Although it couldn't be achieved during the project at hands, we want to tackle this issue as soon as possible, being one of the first transmissions of the new communication model.

As for the Enterprise Architecture's services, there was an outspoken necessity to improve the way we met our BIT costumers needs. Services are based on value co-creation through interactions that provide a good customer experience and, although we approached and grasped what the stakeholders had to say, we needed to change the way the corresponding service was delivered. Bearing in mind the MSD model (Patrício et al., 2011), we had to change our entire service encounter.

On one hand, we failed to effectively communicate with our stakeholders, lacking a though-out communication model to sustain the encounter touchpoints and bridge the gap between the available information and the right people. Consequently, in order to accurately tackle the identified issues, a new communication model (Figure 24) was devised, intending to pass-down two main messages: demystify Enterprise Architecture, making it approachable for the organization, and structurally communicate important information with core stakeholders. To do so, four central question were outlined:

- **What** do we want to communicate?
- **Who** do we want to communicate with?
- **How** are we going to reach our customers?
- **When** are we communicating?

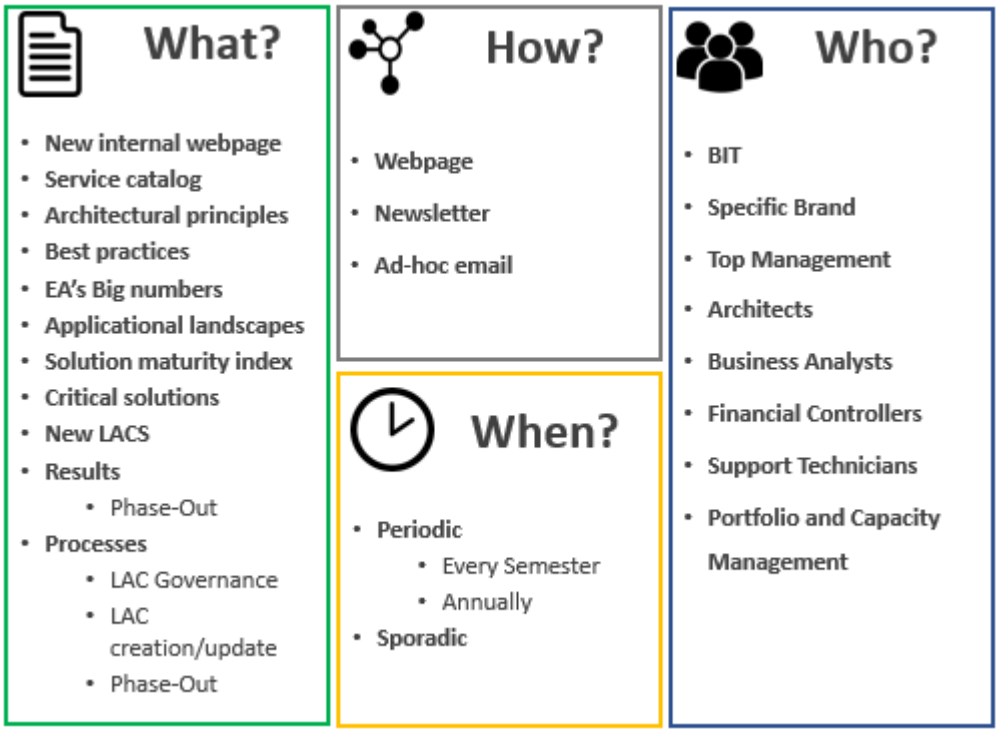


Figure 24 - EA Communication Model

In addition to eliciting regularly communicated reports, such as EA's overall yearly statistics for BIT (encompassing all stakeholders), the communication of sporadic information was also considered to be core, especially in the first stages of this new model giving visibility, for example, to the organization's architectural principles. The full matrix between the produced content and the existing stakeholders can be found attached in Appendix C. As a mean to drive this information to the appropriate service customer, three possible channels were outlined, operating as the service touchpoints.

Additionally, besides the interviewed stakeholders at the beginning of the work at hands, new ones were identified due to recent internal projects that opened the possibilities for further collaborations, such as the Portfolio and Capacity management team and the uprising, brand specific, IT departments in Sonae SR.

On the other hand, there was a need to introduce an organic governance process to sustain both the lifecycle of our current primary unit, LACs, and to match the intended service levels. As such, after defining the communication model and, consequently, the service touchpoints, the Service Experience Blueprints (SEB) were designed to support them.

Considering BIT's operating model, the natural expertise of each solution lies with the Solution Designers, as they are the first architectural touchpoint when a new project takes place. Currently, every LAC that is either being created or updated by the Enterprise Architects, requires a meeting with the Solution Designers in order to grasp the intrinsic details like, for example, hosting (on-premises or cloud solution) or its applicational components.

This workflow can be significantly improved if both the LAC creation (Figure 25) and update (Figure 26) processes are triggered by the Solution Designers and governed by the Enterprise Architects, as a mean to control the entropy in the overall applicational landscape, to guarantee the operational strategic alignment and to empower their efficiency. The aforementioned SEB for these two moments are presented in Appendix D and Appendix E, respectively, in order to improve their readability.

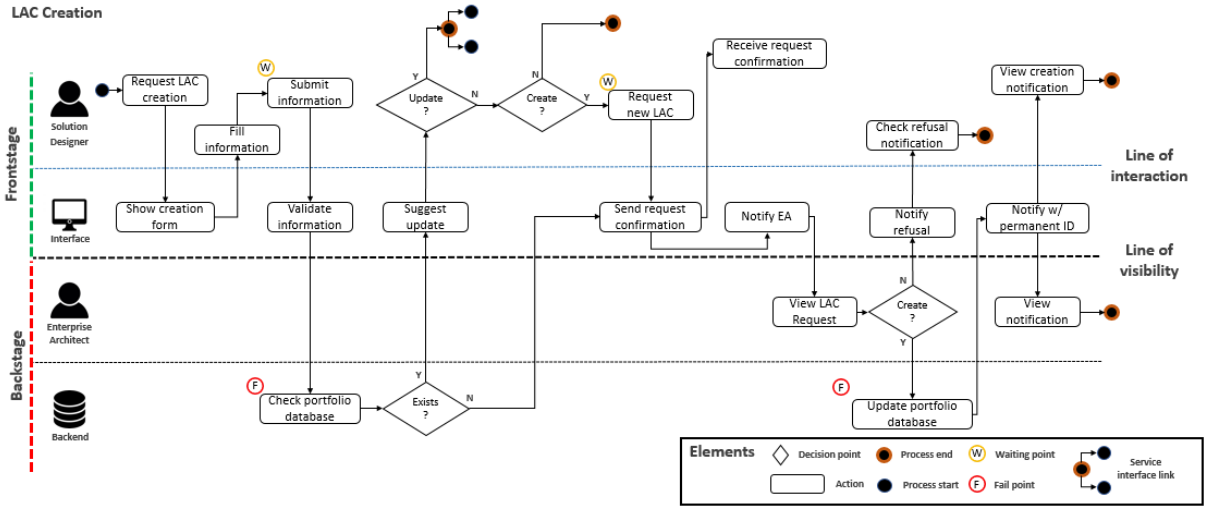


Figure 25 - LAC Creation - Service Experience Blueprint

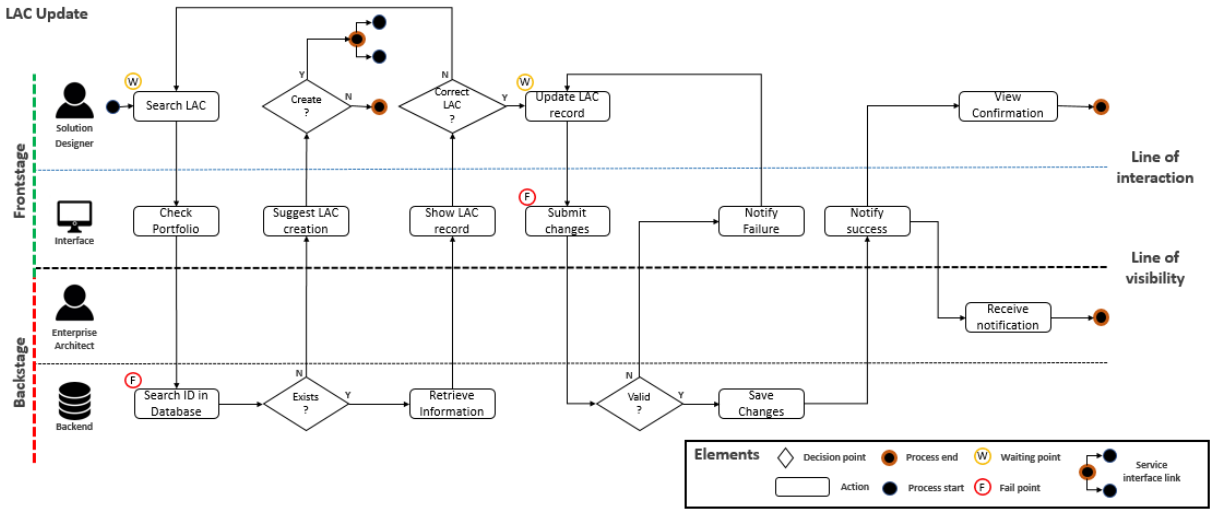


Figure 26 - LAC Update - Service Experience Blueprint

Nevertheless, as previously mentioned, the remaining processes required a major overhaul on how Enterprise Architecture was responding to the incoming requests. By splitting the service catalogue into both self and full-services, we could better serve our customers on an everyday basis, while empowering its capacity to respond to more complex requests.

The first one is sustained by the data exploration tool, offering distinct views that drill-down Sonae's portfolio, presenting the corresponding SEB in Figure 27. By communicating in real-time with the created database, internal stakeholders are able to easily access updated information, being adapted to their needs.

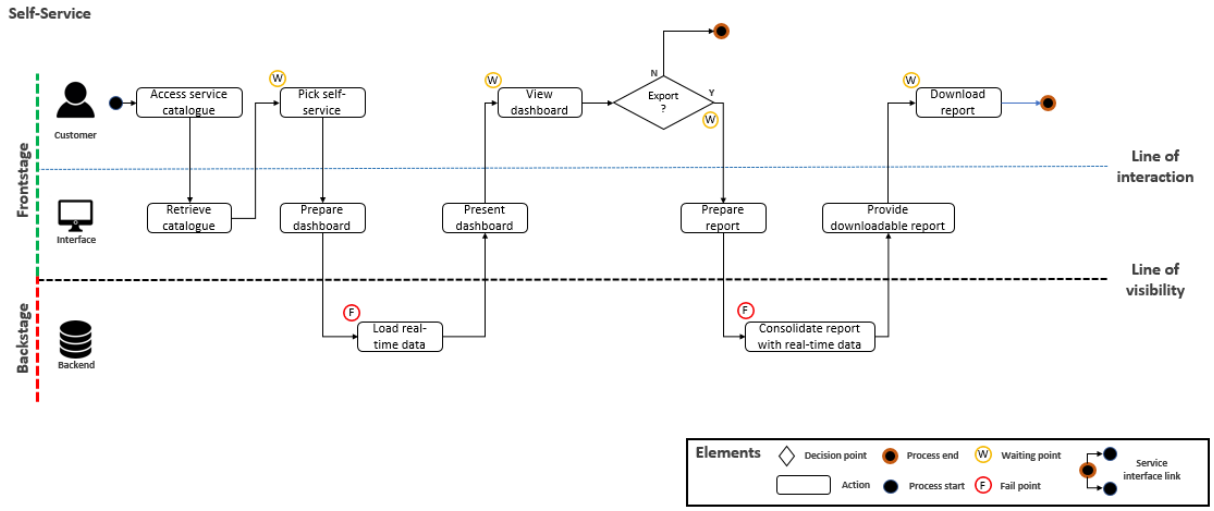


Figure 27 - Self-Service - Service Experience Blueprint

The later one defines a standard way in which incoming requests are responded, as presented in Figure 28. This clear distinction gives the opportunity to assess usual requests and their opportunity to be converted to a self-service, while increasing the catalogue's transparency.

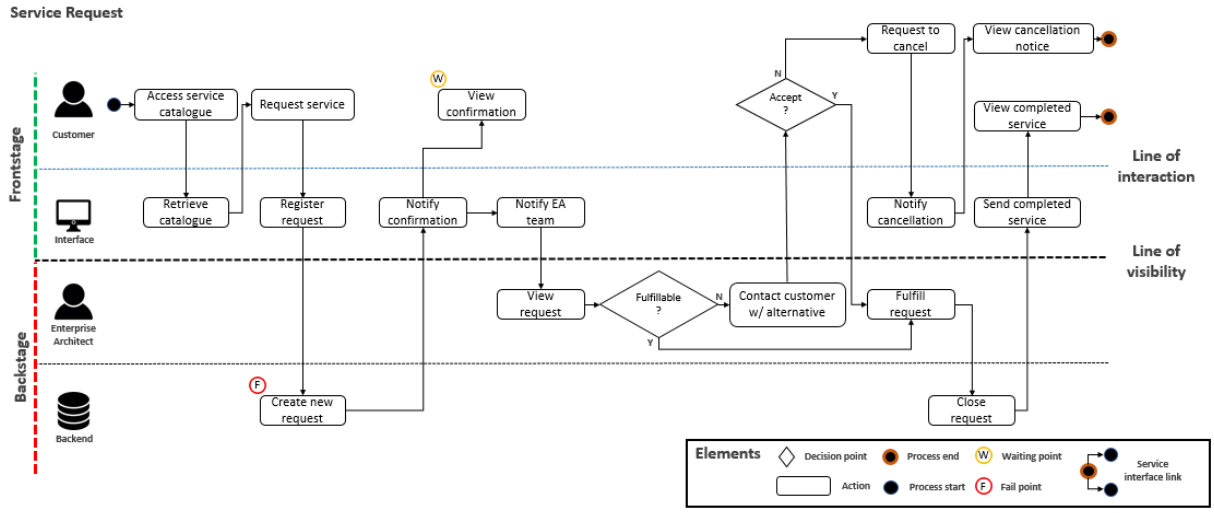


Figure 28 - Service Request - Service Experience Blueprint

Both the previous images can be consulted in Appendix F and Appendix G, respectively, for an enlarged version.

Although the self-service was created during the work at hands, the remaining SEB weren't implemented due to lack of an appropriate tool that supports the designed workflows. Nevertheless, the LAC oriented services were articulated with the Solution Designers, being scheduled to begin their implementation in the near future.

The newly introduced data exploration module that supports the self-service consists of two key aspects: the developed BI dashboards and their supporting database. In order to make the information accessible to all stakeholders, a Microsoft SQL Server database was devised and launched into production. Its technology was chosen based on the company's standard toolset, having a direct integration with MicroStrategy, the BI solution used to create the dashboards.

The databased was designed based on the existing software solution principle, allowing it to further scale through its modular schema. Different types of information – applicational,

business processes and financial data – are stored separately but analyzed together. The normalized domain model, presented in Figure 29, established the rationale for the class diagram in Appendix H, connecting the LAC entity to its corresponding business processes, Sonae's insignias, the evaluation conducted using the Quality Maturity Index (QMI) and, finally, both its financial dimensions and the historical records of its revisions.

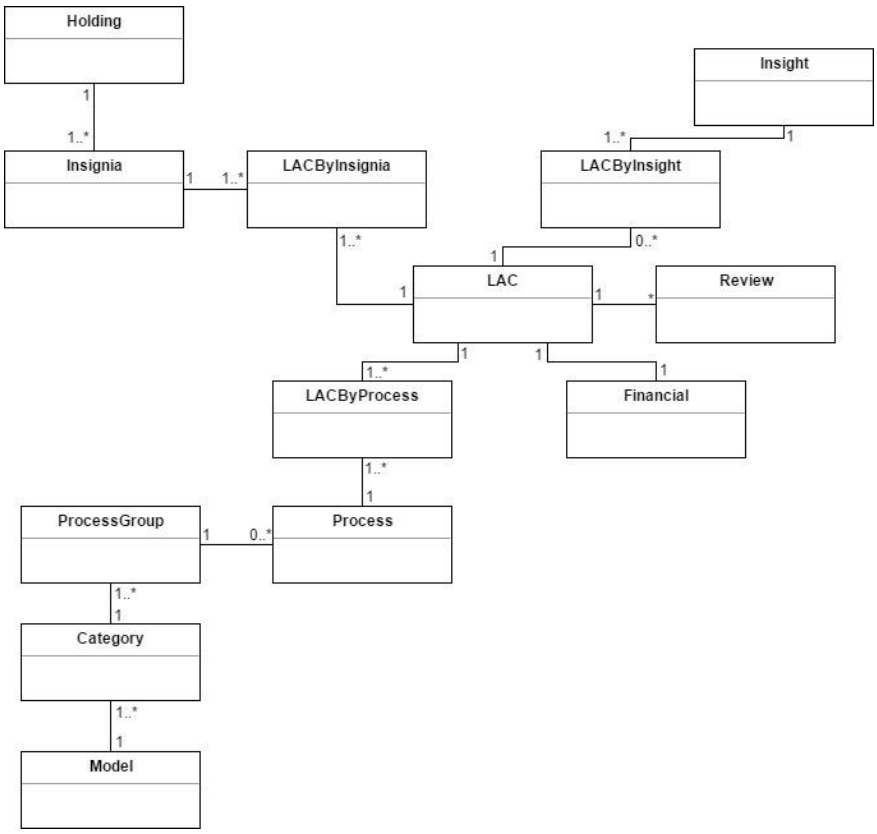


Figure 29 - Domain Model

These concepts establish the basis for the applicational landscapes, providing valuable insights on what capabilities is the company developing, or using for its operations, and how well are the strategic investments being made, as further explained in this section. Leveraging the advantages of the developed database, a set of BI dashboards were produced, empowering EA's self-service orientation using real-time information. The dashboards can be found in the Appendix section due to their dimension, but they enormously contributed to the success of the project at hands.

As seen in Appendix I, the customers are able to check the organization's overview of its Enterprise Architecture, quickly consulting the number of active solutions, how many are pending registration in the CMDB and the quantity of LACs scheduled to be phased-out. Additionally, a full list of the phasing-out solutions is provided, presenting the predicted retire date, its internal code and designation, the solution's description and the corresponding responsible area within Solution Design. Finally, the total number of newly registered LACs throughout the years, noticing the uprising trend since 2015.

In turn, Appendix J was structured to allow the users to quickly drill down and filter the applicational landscape with the required detail (Figure 30), either selecting specific instances or getting the general overview of Sonae's status. In the mentioned appendix lies an applicational landscape of Well's, a Sonae MC brand, specifically showing which solutions are serving its Develop and Manage Human Capital (Human Resources) capability.

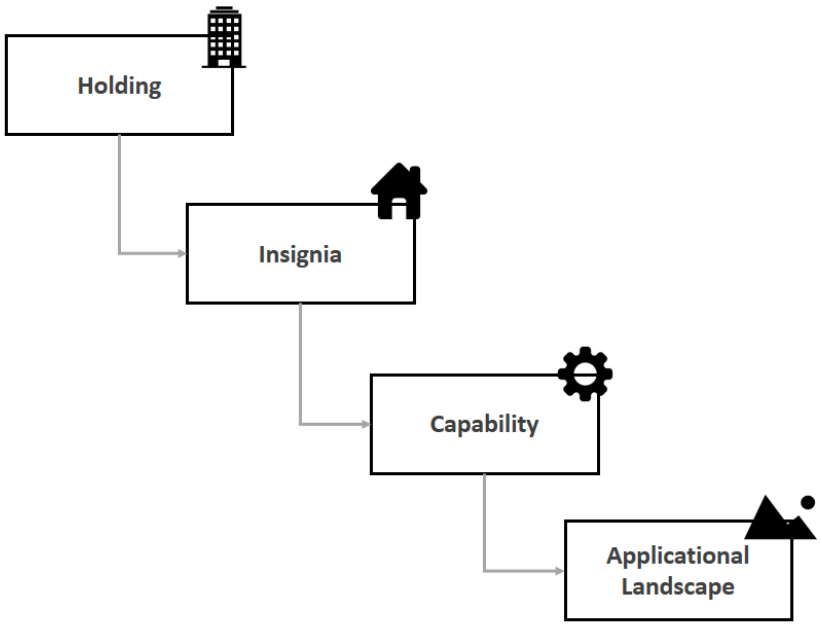


Figure 30 - Applicational Landscape Drill-Down

Although Appendix K shows a similar view for the SAD areas, the results are presented in the PCF's second level, the process groups, as the Architects require this level of detail when analyzing their applicational landscape. This example illustrates BIT's Digital & Customer area and their corresponding LACs for developing and managing customer experience, detailing if a solution is either being used on the floor level (Operate Retail Store process group) or leveraging its digital channels (Operate Digital Channels process group).

Appendix L translates a necessary view for both Architects and Top Management, as it shows the conducted evaluation for a set of internal solutions, and their gap analysis, according to seven dimensions: The LAC's architecture, its deliverability, the expected evolution roadmap, the respective functional and technological adequacy, its performance/reliability and total cost of ownership (TCO). For the evaluated solutions, both an as-is score and a to-be score were outlined according to the predicted internal projects that are in course, measuring its delta score to quickly understand if the solution is foreseen to be improve, to maintain or to downgrade in the current year.

Moreover, Appendix M establish a heatmap of the solutions scheduled to be phased-out, dimensioning them according to its value still to be amortized. Through this valuable insight, the financial team and top management are able to develop appropriate tactics to handle the identified CAPEX and to critical analyze if the solution should really be discontinued.

Finally, Appendix N encompasses the current analysis of the portfolio, presenting a clearer view of which business processes a solution is impacting and in which brand its used. Either by searching the intended name or by scrolling and selecting the list, the stakeholders are able to quickly grasp the details of a certain LAC in a user-friendly way.

As for the business-oriented goals, further sessions with the Financial Controllers were conducted in order to fully grasp what could be integrated in EA's scope. From the realized interviews, there were three core concepts to be taken into consideration: IT Value, IT Cost and, complementary to both, Lifecycle Status.

On one hand, IT Value represents the investment made in a certain LAC. This value is calculated by considering a solution's acquisition cost and consequent associated projects, being either implementation, maintenance or phasing-out projects. As previously mentioned, the capital expenditure represents costs that are going to be amortized during the asset's predicted lifecycle, having to be assumed as cost if the company plans to discontinue it without fully amortizing the associated cost, directly impacting the company's financial performance.

On the other hand, IT Cost represents LAC-specific OPEX. Complementary with the previous concept, a solution's TCO also relies on determining how much it costs to the company to maintain it operational by considering, for example, licensing costs. This constitutes a precious variable to take into account when managing the company's IT, as it can directly map with the cost of conducting the business.

Finally, when acquiring a LAC, the organization predicts it usage during a seven-year lifecycle, consequently amortizing its costs during that period. As such, it provides additional insight to how, and how well, the organization is investing on its IT, since solutions that are discontinued after the first years can indicate poor investment choices. The LAC's evolution throughout the mentioned period can be further measured by gap analysis techniques and, in BIT's context, through the QMI.

In order to take advantage of the strengthen financial analysis capability, two dashboards were created. The first one, Appendix O, contemplates Sonae's expenditure with solutions hosted on the cloud (discriminating IaaS, PaaS and SaaS) and on-premises, allowing managerial stakeholders to verify how the architecture is distributed. The second one, Appendix P, illustrates both the total cost and investment made in each capability, according to the PCF's first level, disclosing a more strategical insight on how the company's investments are impacting its business processes.

Although further financial dimensions could be introduced and potentially bring added value - such as the apportionment rationale for each solution - they constitute much more volatile information that is still currently being developed with the new financial model. Moreover, the introduced variables intend to empower higher quality decision-making, not to completely absorb the financial area.

Finally, the classification between business processes and LACs was refined, approaching the respective Solution Designers for guaranteeing the optimal alignment with the solution's functionalities. Besides establishing a high-level impact analysis on the company's operations, potential new analyses arises, such as the total invested value on a certain capability or their respective operational costs.

6 Conclusion and Future Research

Enterprise Architecture is a multidisciplinary area that translates the enormous complexity inherent to the organizations, ranging its scope from the technical details until the company's strategic vision. Its holistic approach allows this discipline to influence the decision-making process by providing relevant insights. Although strategy defines a long-term direction in which the company should be steered, EA facilitates its assessment and adjustment, maximizing its efficiency and effectiveness.

As such, Enterprise Architecture shouldn't take control of the natural owners in each enterprise layer but instead integrate their vision as the gear that supports the strategic drivers, orchestrating the colossal amount of generated information to the organization's benefit. Bearing this in mind, and considering the **first research question**, its positioning should be evaluated as a service directed to internal stakeholders, meeting their necessities with the right information, connecting different teams in a unified vision and boosting their collaboration through common understanding, empowered by well-defined set of principles and best practices. Considering this service orientation, we approached our customers to understand how could a better service experience be provided, eliciting both cross-area and area-specific issues. Although focusing on the transversal and on the business-oriented problems, the achieved results can virtually impact all of the stakeholders positively.

Moreover, despite previously accomplishing valuable inputs to support the business' decisions, we failed to approach its stakeholders in a way that embodies the customer-centric paradigm. Notwithstanding the fact that this is a continuous activity, by outlining the new communication model, by conceiving the service experience blueprint and by collecting precious feedback from the people, we manage to take a step on the right direction.

Considering the area's broad scope, it is also imperative to consider the vast scope of customer profiles and needs. Focusing on the **second research question**, although only actionable, or potentially actionable, information should be stored, the focus should always be on the way its transmitted to the stakeholders. Even the massive organization's applicational landscape is barely valuable at its own, as the analysis will require a drill-down process to acquire finer-grain required for sustaining strategic decisions, as different stakeholders will look for different aspects related to it. Intrinsically, the communication process should be sustained with valuable information and the way it is communicated shouldn't constitute a bottleneck to create value for the stakeholders.

Nevertheless, it is imperative to guarantee both data quality and freshness, which in turn relies on maintaining either control over the information or to collaboratively manage it with another team. The later one relies on a well-defined governance process, that should always be organically implemented with the cooperation of the impacted teams. In conclusion, the information scope depends on these two variables, - deciding on how broad, or how narrow the data model should be, - depends on the team's capacity and on the company's operating model.

This rationale is further sustained when contemplating which financial dimensions should be introduced, the **third research question**. In BIT's reality, there is a close contact between the Enterprise Architecture and the Financial Controllers, allowing the information to easily flow bi-directionally. As such, and bearing in mind the area's target as a discipline, it is crucial to understand a solution's impact on the business' operations.

On one hand, the IT Value helps to analyze if the company is investing on the right places, according to its strategic plan. It also directly assesses the company's ability to invest in its IT,

since something that seems so simple as, for example, discontinuing software solutions, can drastically impact the company's EBITDA.

On the other hand, IT Cost gives transparency on how much the company is spending in order to keep a certain solution running. This variable provides valuable insight when analyzing a solution, since a LAC can satisfy the imposed functional requirements but excessively drain the existing resources.

Finally, the Lifecycle Status complements the aforementioned dimensions, conferring a time frame context to the investment, including the prediction of the longevity until the full amortization of the pending cost. New projects intending to update or increment features increase the solution's IT Value and, consequently, its longevity or amortization cost. This empowers the critical analysis when, for example, new solution-oriented projects arise for LACs that are scheduled to be phased-out.

When considering the complexity of the phasing-out process, these dimensions gain significant relevance, since some solutions cannot simply be turned off, as a company can be legally obligated to maintain a solution for data accessibility reasons, and thus continuing to have associated costs. Nevertheless, the increased visibility of the IT Value empowers a more efficient asset management, aiding on the alignment between a solution's financial and real-life cycle within the company.

Regarding the governance model and the **fourth research question**, considering that within the company the teams operate in a decentralized manner, it is essential to collaboratively involve the surrounding actors in the discipline at hands. Furthermore, although it is critical that each area takes responsibility for their corresponding information, it is Enterprise Architecture's role to integrate it in a holistic vision. To conclude, although giving the stakeholders a sense of ownership, achieved through their crucial involvement, they have to be able to draw forth value from the both the what and way is being communicated.

On the near future, we intend to study the additional PCF models and if the uprising businesses can extract value from this specification. Moreover, this analysis can either result on a Sonae specific framework that combines processes from the existing models or on the adoption of a specific model *per* business unit. Additionally, the outlined objectives for both Architects and Technical Supporters have to be addressed, although a lot of work conducted during this project significantly improved the Architect's experience. Besides developing more ways to extract value from the existing information, we intend to improve our work in both the Data and Technical layer, as most of the existing work is still focused on the Business and Applicational areas. Finally, we also feel the need to get closer to Sonae's businesses/brands, establishing a closer contact with them to identify further opportunities for collaboration.

Regardless of Enterprise Architecture's ability to deeply influence decision making, the way it integrates the enterprise's data assets crucially depends on the way it collaboratively integrates its people. The quality and maturity of each layer profoundly relies on the know-how of whom works them, as they are the foundation of its success. As such, Enterprise Architecture should always be the vessel that extracts value from the organization's information, integrating it in a holistic manner in order to empower the cornerstone of every company: people.

References

APQC. (2015). Retail Process Classification Framework ver. 6.1.1 overview.

Bittler, R. S., & Kreizman, G. (2005). Gartner Enterprise Architecture Process: Evolution 2005. *2005*, (October), 12. Retrieved from https://www.gartner.com/doc/486246/gartner-enterprise-architecture-process-evolution

Brealy, R. A., Myers, S. C., & Allen, F. (2014). *Principles of Corporate Finance*. *Book*. https://doi.org/10.1016/0378-4266(82)90040-1

Carr, N. G. (2003). IT Does not Matter. *Harvard Business School*, *June*(1), 12. https://doi.org/10.1109/EMR.2004.25006

Colville, R. J., & Adams, P. (2011). The Value of Integrating Configuration Management Databases With Enterprise Architecture Tools, (January).

Deloitte. (2017). Global Powers of Retailing 2017 - The art and science of customers. *Deloitte*. Retrieved from https://www2.deloitte.com/uk/en/pages/consumer-business/articles/global-powers-of-retailing.html

Easterby-Smith, M., Thorpe, R., & Jackson, P. R. (2012). *Management Research*. SAGE Publications. Retrieved from https://books.google.com.pk/books?id=ahbhMb-R7MQC

FEA. (2007). FEA Practice Guidance. *Federal Enterprise Architecture Program Management Office*, (November), 63. https://doi.org/10.1136/bmj.39286.700891.AD

Financial Normalization Committee. (2016). Accounting and Financial Reporting Standard 6.

Gartner. (2017a). Enterprise Architecture - EA - Gartner IT Glossary. Retrieved June 18, 2017, from http://www.gartner.com/it-glossary/enterprise-architecture-ea/

Gartner. (2017b). What is Bimodal IT? Retrieved May 17, 2017, from http://www.gartner.com/it-glossary/bimodal

Jonkers, H., Lankhorst, M. M., Ter Doest, H. W. L., Arbab, F., Bosma, H., & Wieringa, R. J. (2006). Enterprise architecture: Management tool and blueprint for the organisation. *Information Systems Frontiers*, *8*(2), 63–66. https://doi.org/10.1007/s10796-006-7970-2

Kothari, C. R. (2004). *Research Methodology: Methods and Techniques*. New Age International (P) Limited. Retrieved from https://books.google.pt/books?id=hZ9wSHysQDYC

Leist, S., & Zellner, G. (2006). Evaluation of current architecture frameworks. *Proceedings of the 2006 ACM Symposium on Applied Computing*, 1546–1553. https://doi.org/10.1145/1141277.1141635

Marshall, M. N. (1996). Sampling for qualitative research. *Family Practice*, *13*(6), 522–525. https://doi.org/10.1093/fampra/13.6.522

Open Group. (2011). Content Metamodel. Retrieved April 5, 2017, from http://pubs.opengroup.org/architecture/togaf9-doc/arch/chap34.html

Patrício, L., & Fisk, R. P. (2013). *Serving Customers: Global Services Marketing Perspectives*.

Patrício, L., Fisk, R. P., Falcão e Cunha, J., & Constantine, L. (2011). Multilevel Service Design: From Customer Value Constellation to Service Experience Blueprinting. *Journal of Service Research*, *14*(2), 180–200. https://doi.org/10.1177/1094670511401901

Ross, J. W., Weill, P., & Robertson, D. C. (2007). Enterprise Architecture as Strategy. *Center for Infor Mation Systems Research, MIT …*, (August 2016), 1–10. https://doi.org/10.1016/S0923-4748(08)00049-0

Schaefer, S., & Murphy, A. (2016). The World's Biggest Public Companies. Retrieved February 27, 2017, from https://www.forbes.com/global2000/

Schekkerman, J. (2006). *How to Survive in the Jungle of Enterprise Architecture Frameworks: Creating or Choosing an Enterprise Architecture Framework*. *Architecture* (Vol. 480017). Trafford. https://doi.org/10.1016/j.bdr.2016.02.001

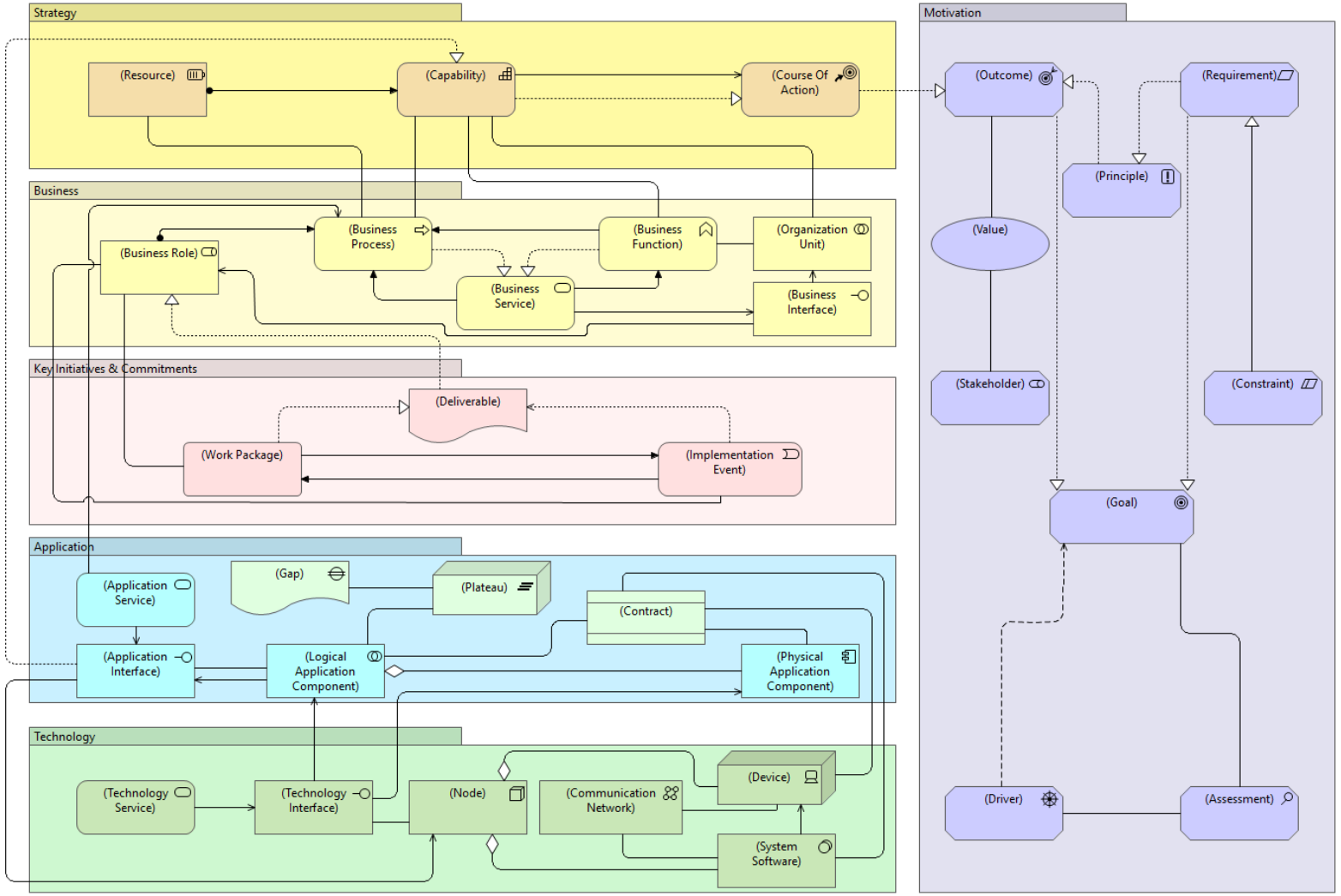
Sessions, R. (2007). A Comparison of the Top Four Enterprise Architecture Methodologies. *Msdn*, *466232*, 1–31. Retrieved from http://msdn.microsoft.com/en-us/library/bb466232.aspx

The Open Group. (2011). TOGAF 9.1. Retrieved March 9, 2017, from http://pubs.opengroup.org/architecture/togaf9-doc/arch

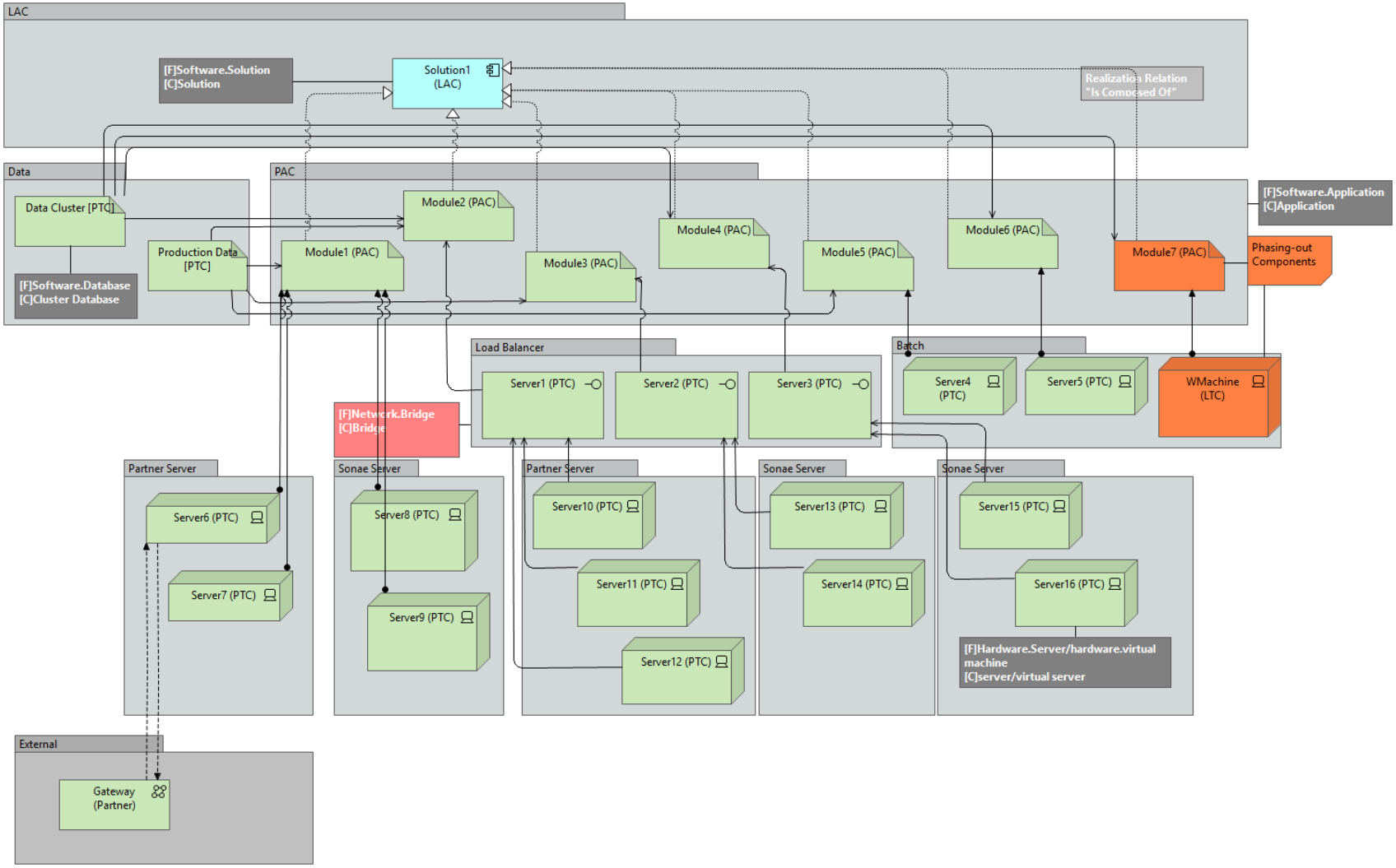
Zachman. (2008). About the Zachman Framework. Retrieved June 26, 2017, from https://www.zachman.com/about-the-zachman-framework

Zachman, J. A. (1987). A framework for information systems architecture. *IBM Systems Journal*, *26*(3), 276–292. https://doi.org/10.1147/sj.263.0276

APPENDIX A: Enterprise Architecture Metamodel



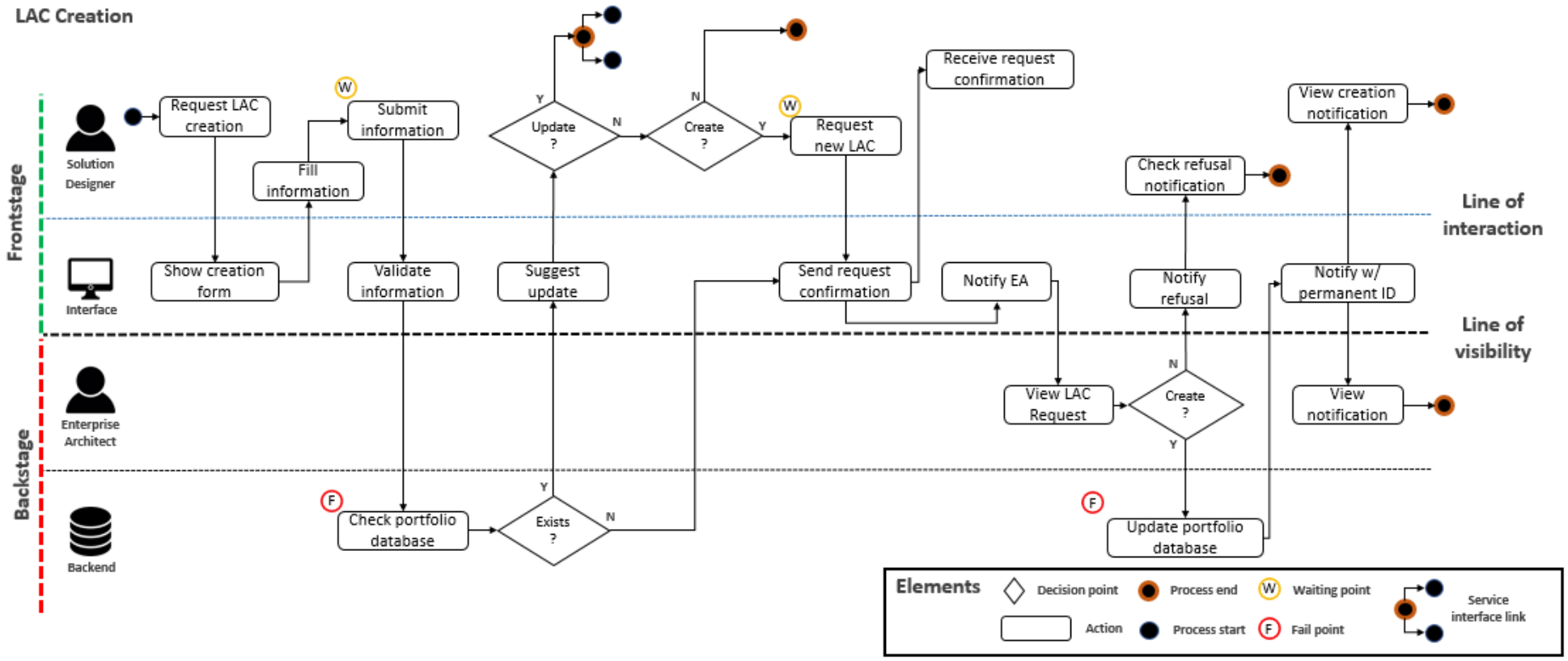
APPENDIX B: Solution-Infrastructure Map Example



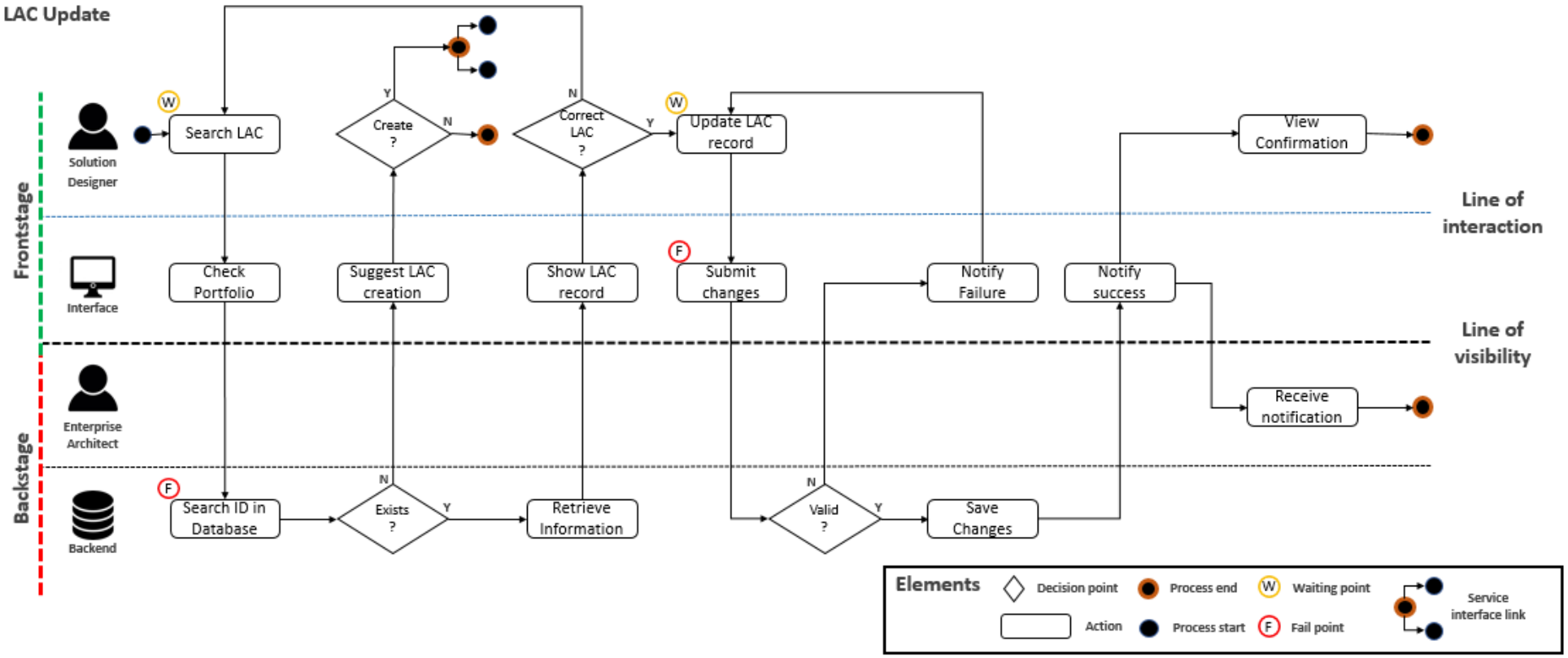
APPENDIX C: Content x Stakeholder Matrix

	BIT	Specific Brand	Top Management	Architects	Business Analysts	Financial Controllers	P&C Management	Support Technicians
New internal webpage	Sporadic		Sporadic	Sporadic	Sporadic	Sporadic	Sporadic	Sporadic
Service catalog	Sporadic		Sporadic	Sporadic	Sporadic	Sporadic	Sporadic	Sporadic
Architectural principles	Sporadic		Sporadic	Sporadic	Sporadic	Sporadic	Sporadic	Sporadic
Best practices				Sporadic	Sporadic			
EA's Big numbers	Annually		Annually	Annually	Annually	Annually	Annually	Annually
Applicational landscapes		Sporadic	Sporadic	Sporadic	Sporadic			
Solution maturity index		Annually						
Critical Solutions			Sporadic	Sporadic	Sporadic			
New LACS	Every Semester			Every Semester	Every Semester	Every Semester	Every Semester	Every Semester
Phase-Out Report	Annually	Annually		Annually	Annually	Annually	Annually	Annually
LAC Governance				Sporadic				
LAC Creation/Update	Sporadic		Sporadic	Sporadic	Sporadic	Sporadic	Sporadic	Sporadic
Phase-Out Process	Sporadic		Sporadic	Sporadic	Sporadic	Sporadic	Sporadic	Sporadic

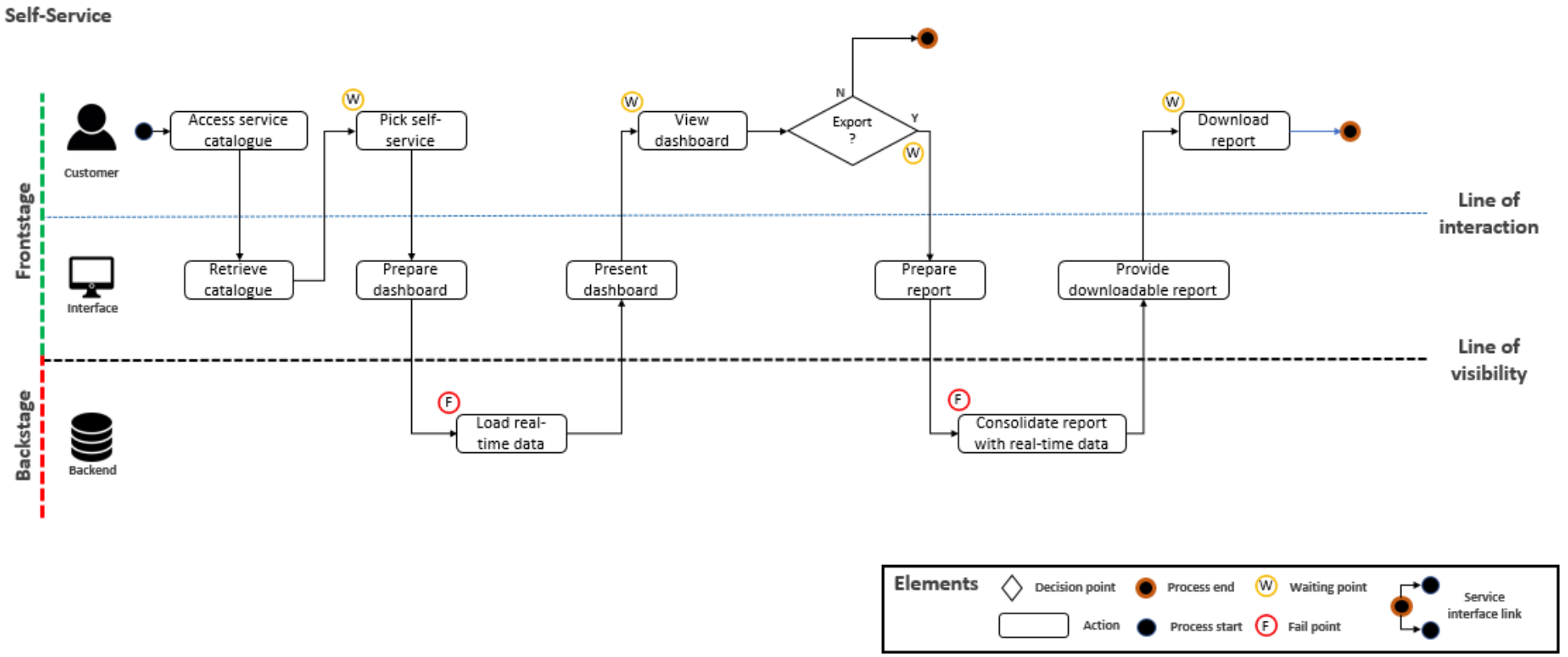
APPENDIX D: LAC Creation – Service Experience Blueprint



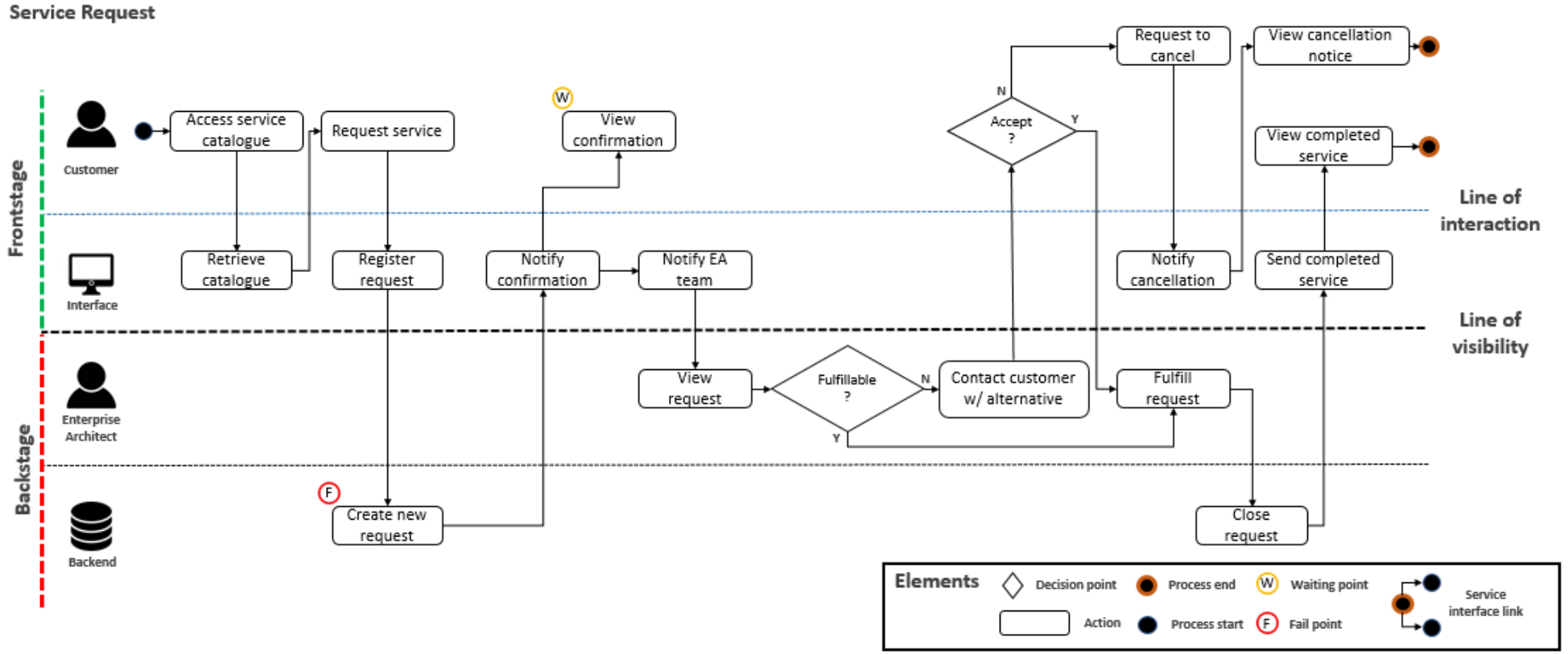
APPENDIX E: LAC Update - Service Experience Blueprint



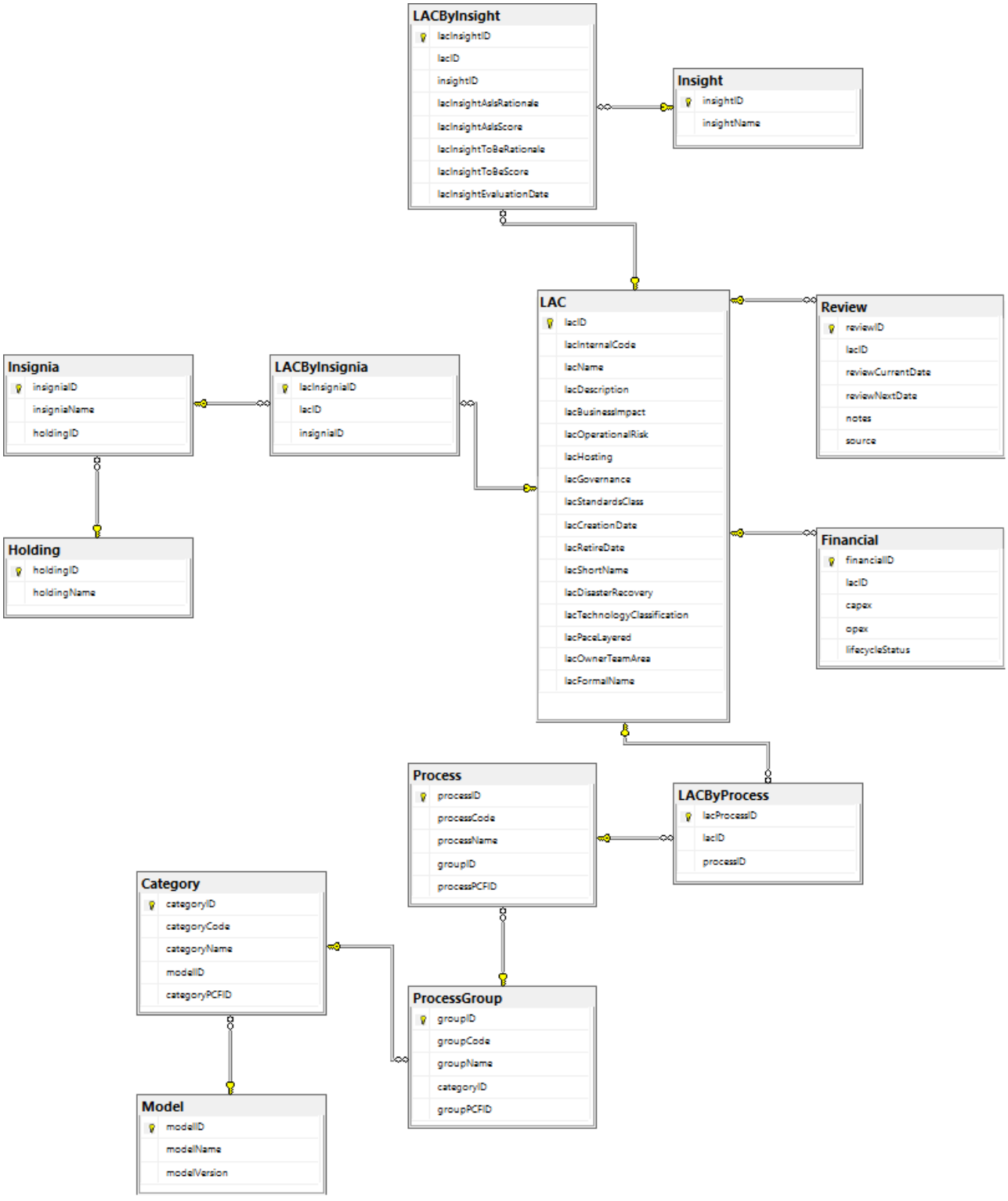
APPENDIX F: Self-Service - Service Experience Blueprint



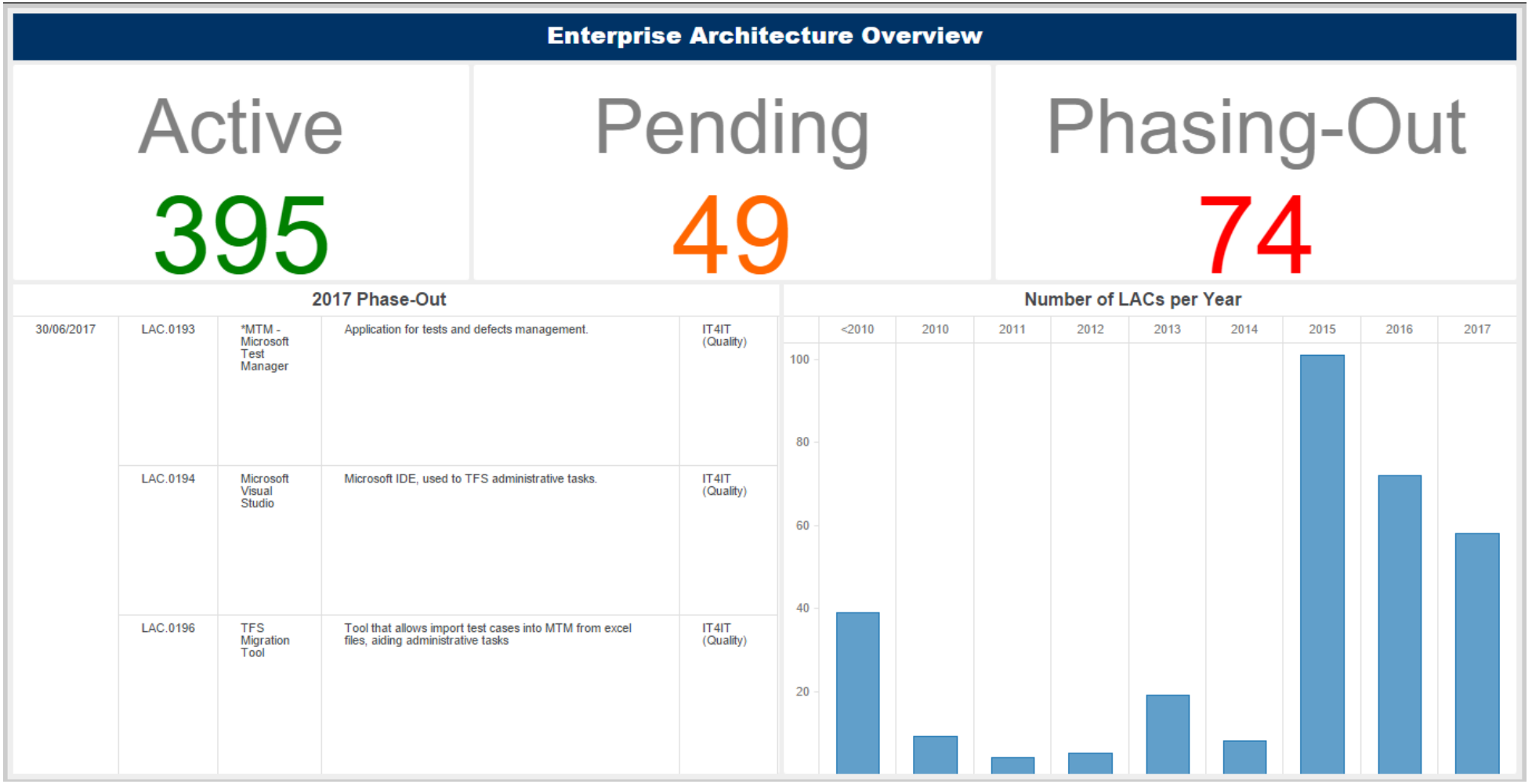
APPENDIX G: Service Request - Service Experience Blueprint



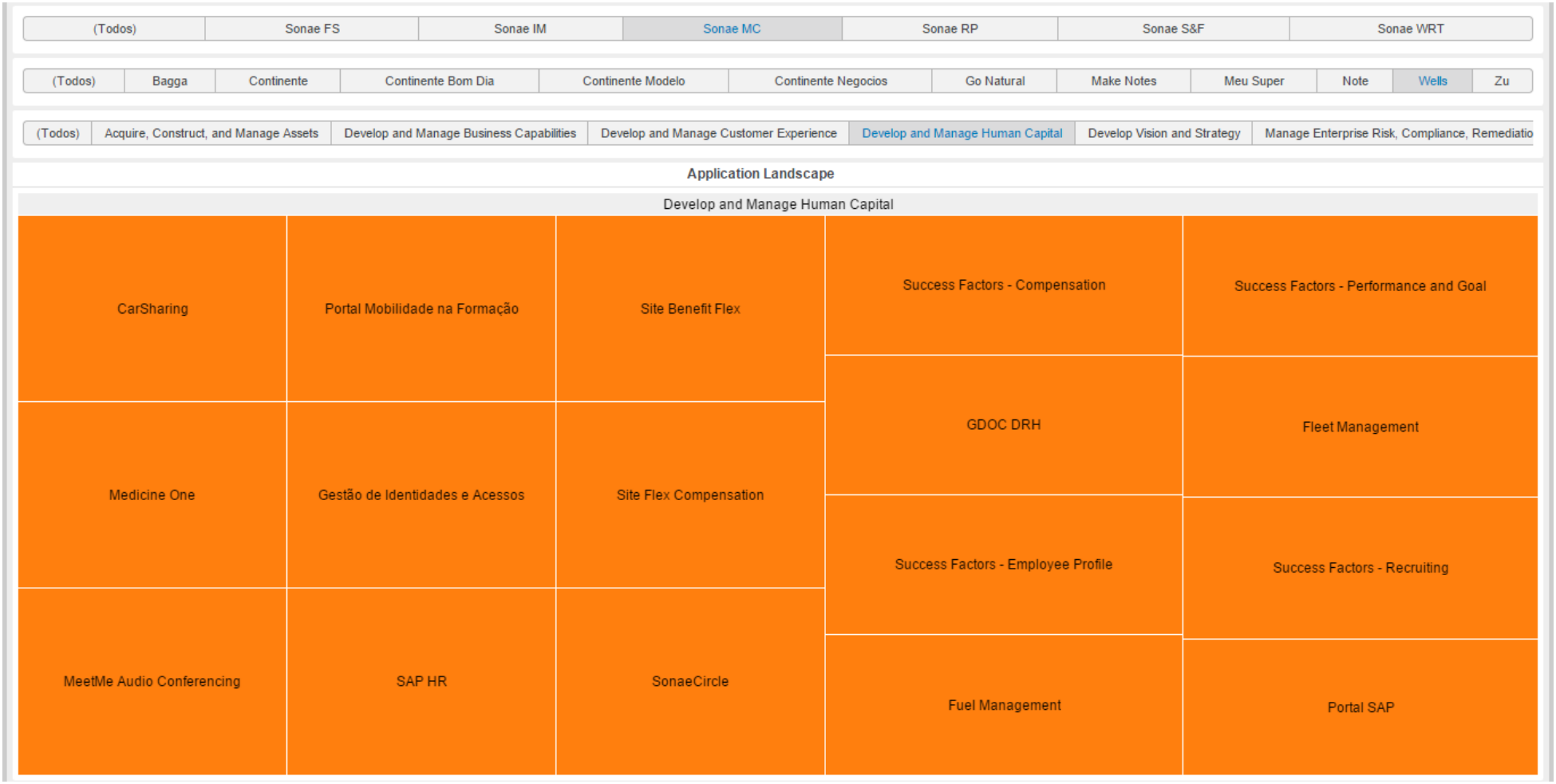
APPENDIX H: Class Diagram



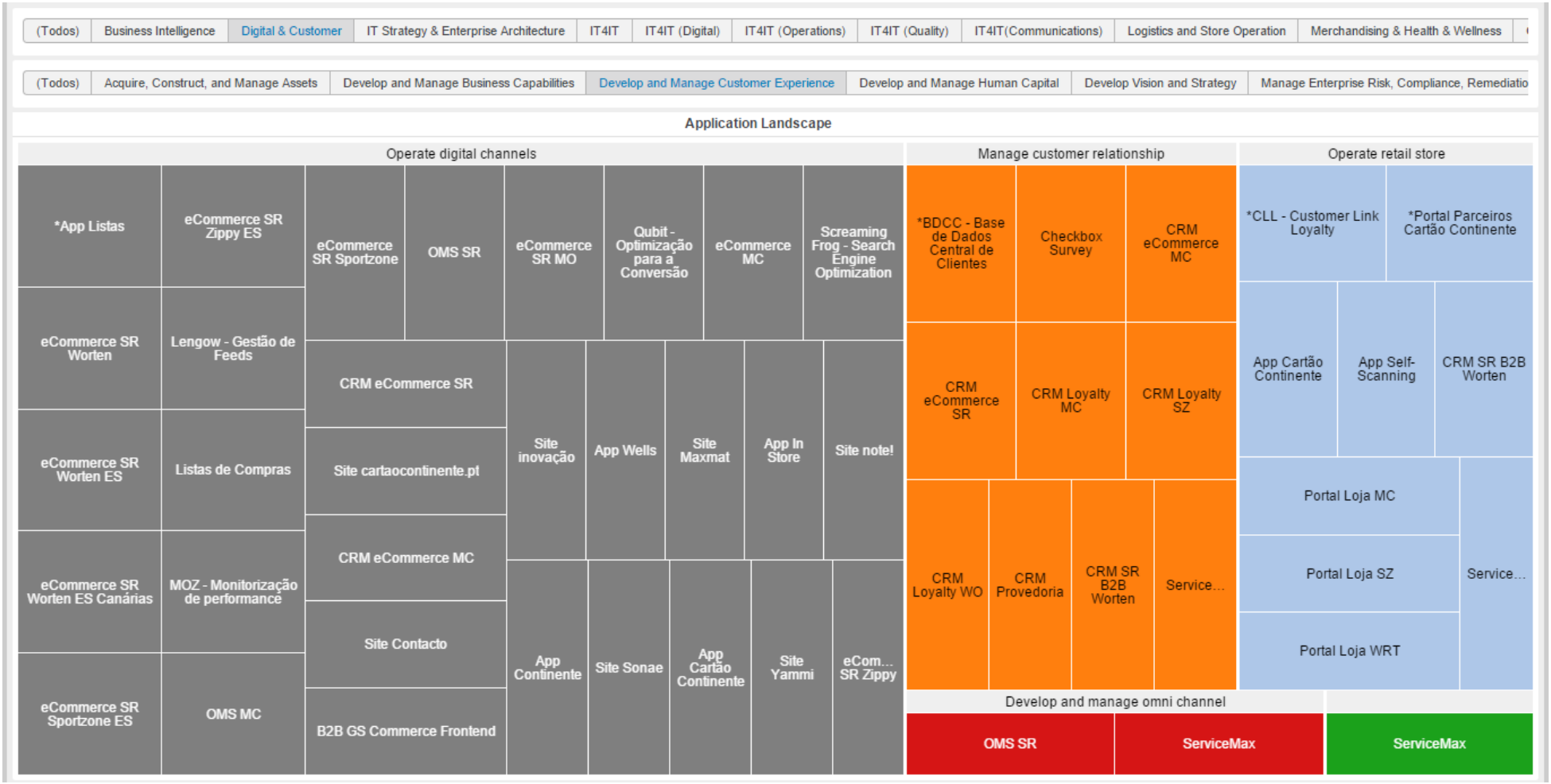
APPENDIX I: Overview Dashboard



APPENDIX J: Holding/Brand Applicational Landscape Dashboard

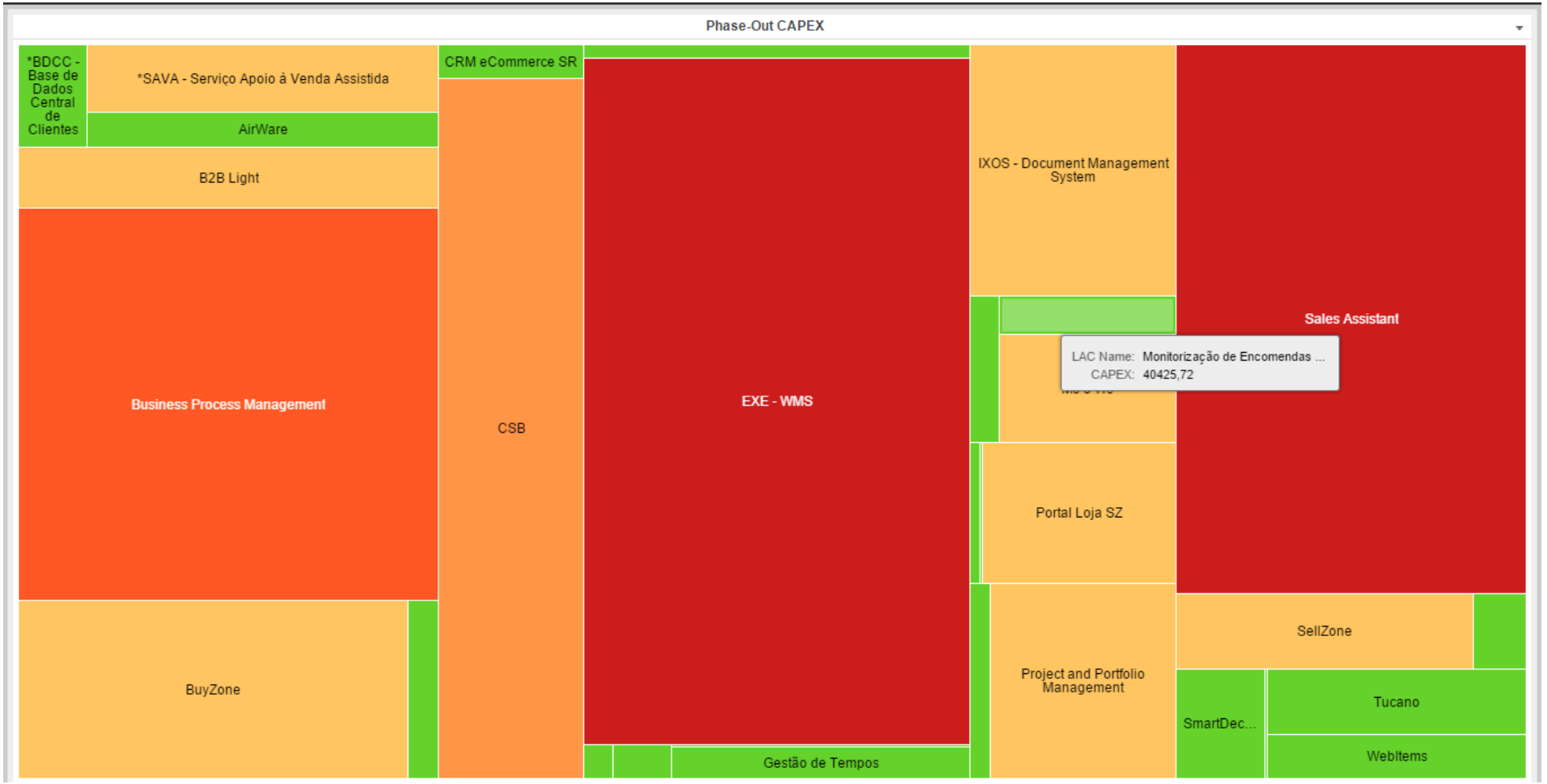


APPENDIX K: SADA Applicational Landscape Dashboard

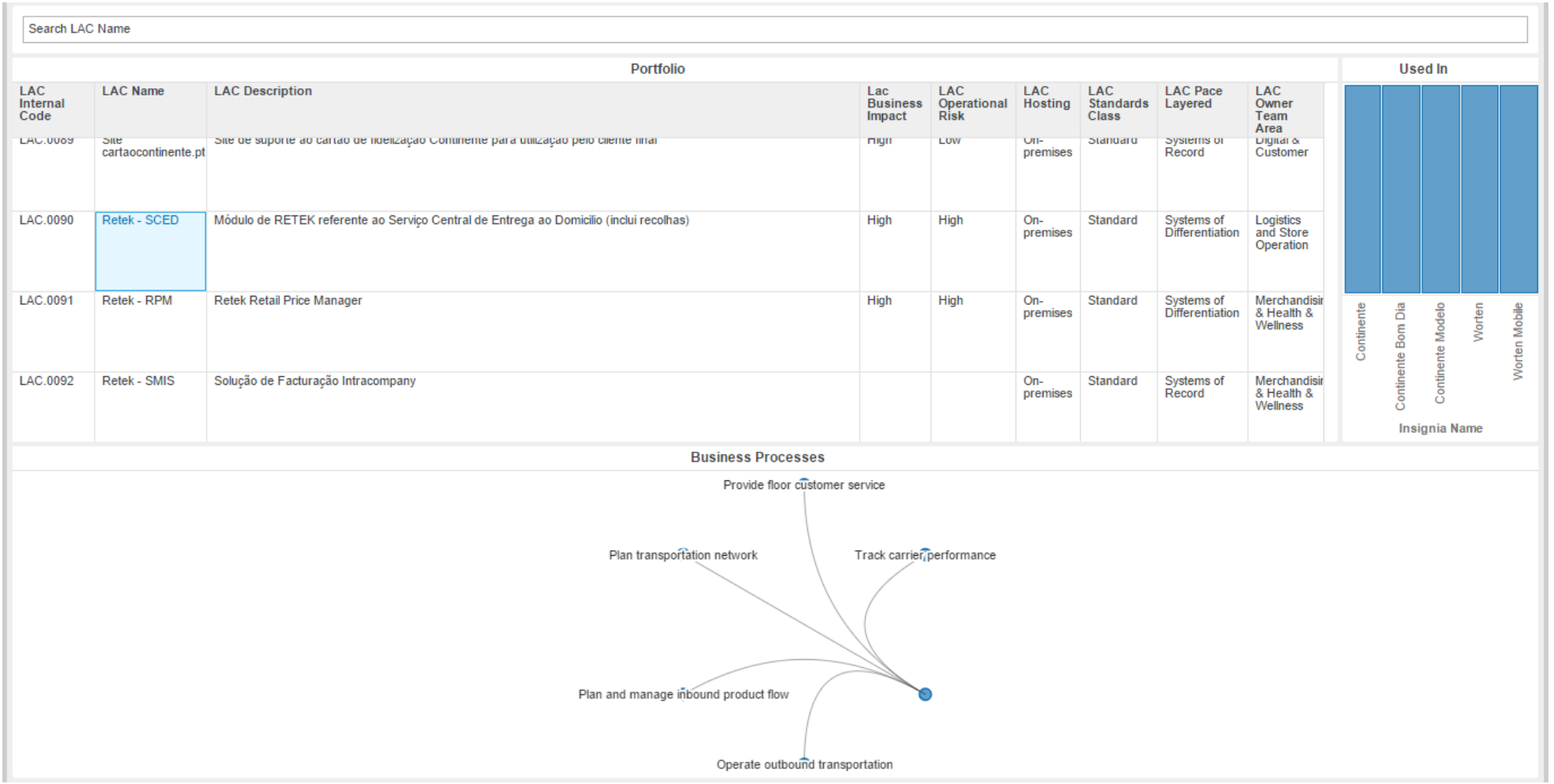


APPENDIX L: Insights Dashboard

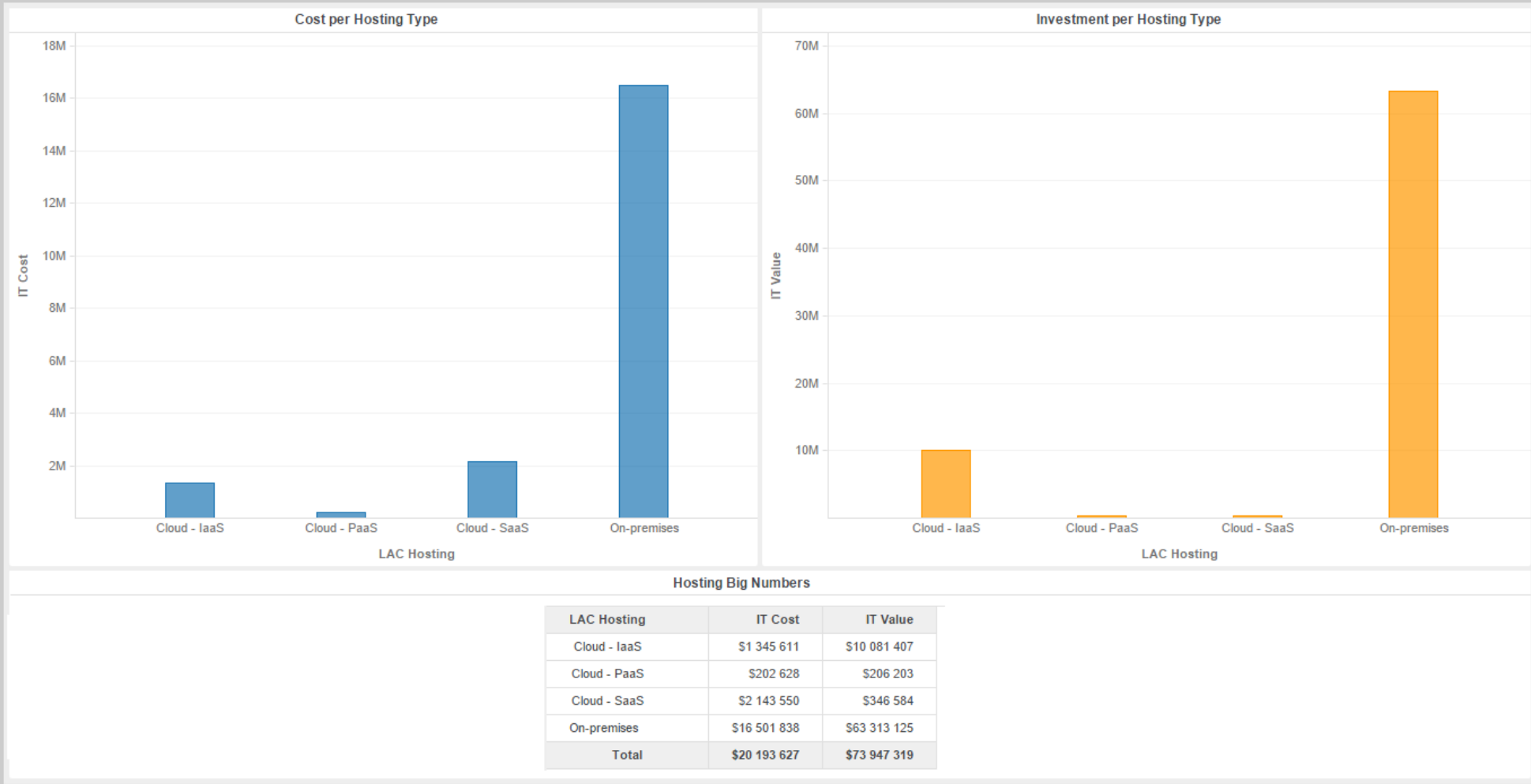
APPENDIX M: Phase-Out Heatmap Dashboard



APPENDIX N: EA Portfolio Dashboard



APPENDIX O: Hosting Financial Dashboard



Hosting Big Numbers

LAC Hosting	IT Cost	IT Value
Cloud - IaaS	$1 345 611	$10 081 407
Cloud - PaaS	$202 628	$206 203
Cloud - SaaS	$2 143 550	$346 584
On-premises	$16 501 838	$63 313 125
Total	**$20 193 627**	**$73 947 319**

APPENDIX P: Capability Financial Dashboard