

Reference Information Systems Architectures for Multi-channel Service Delivery in the Public Administration

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Abstract. Public Administrations face the challenge of meeting their customers, citizens and businesses, high expectations in the way service is delivered to them, while at the same time making this service delivery cost effective. It is in this context that, this paper addresses the topic of multi-channel service delivery, whose inherent issue relates to the difficulty of managing multiple contact points available to customers throughout the organization, while maintaining at the same time, a single and consolidated customer point of view, coherent through the multiple service channels available. In addition to this problem intrinsic to this service delivery paradigm, the context surrounding Public Administrations adds difficulty in consolidating and standardizing the way information technology support multichannel service delivery through the various agencies of the Public Administration. So, in order to engage the previously stated problem, this paper proposes a reference ISA to support multichannel service delivery in Public Administrations, doing so, by addressing a set of case studies of public organizations and best practices for multi-channel support, as well as, the concept of EA and alignment to define such an architecture, that is intended to guide the implementation of this paradigm in government service, thus helping them to do so, in accordance with best practices, while supporting it in the same manner along the different organisms that compose the Public Administration.

Keywords: Enterprise Architecture, Information Systems Architecture, Customer Relationship Management, Multi-channel Service Delivery, Business/Information Technology Alignment

1 Introduction

Nowadays most organizations, as well as Public Administrations, face the challenge of meeting the high expectations of their customers, with respect to the way they manage the relationship with them, while at same time, making it

effectively in terms of the resources necessary for that purpose. This fact, coupled with the increasing development of Information Technology, enables the implementation of new paradigms of service delivery that enable organizations to meet this challenge. In addition to the problems intrinsic to this service delivery paradigm, the context surrounding Public Administrations adds difficulty in consolidating and standardizing the way information technology support multi-channel service through the various agencies of the Public Administration. Since each body, with such service delivery paradigm, supports it in an independent and heterogeneous way in terms of the technologies used. In order to comply with customer demand, as well as, the need to deliver services in a more effective and efficient manner, this research focuses on the problem of supporting the multi-channel service delivery paradigm in the Public Administration context. This leads to a more specific problem identified by this work relating this subject, the problem is related to the high complexity inherent to managing multiple organizational contact points with the customer, while at the same time, maintaining a unique and consolidated customer point of view. Thus this work proposes that this complexity can be reduced by applying an IT based solution to this problem, by defining a Reference Information Systems Architecture (ISA) that supports this service delivery paradigm.

In order to define the Reference ISA a set of three Public Institutes were studied. Using Spewak's Enterprise Architecture Planning (EAP) [15], to identify the organization, business, information and information systems architectural dimensions, and analyzing them with respect to a set of evaluation metrics based on the architectural alignment heuristics defined in [13] and [14]. This made possible the definition of best practices for multi-channel service delivery. It was taken into account the concept of Enterprise Architecture (EA) [6], using it as a tool to derive a ISA that reflects the best practices obtained by the research done on both the case studies and on CRM. To formally define the Reference ISA, for multi-channel service delivery support, this work resorts to the ArchiMate EA framework and modeling language [9].

2 Research Questions

In order to help clarify the research problem addressed by this work, next follows a list of the main research questions that this research proposes to help respond with its contributions.

1. What is multi-channel service delivery, what are its main concepts and how does it fit in the Public Administration?
2. What are the desirable characteristics of a ISA for multi-channel service delivery, what are its objectives and goals?
3. What are the best practices in terms of processes, information and systems regarding multi-channel service delivery?
4. What are the steps to follow in order to achieve such an architecture?
5. How to measure and infer about the quality of the proposed ISA?

3 Related work

This section addresses the most relevant concepts and related research done in, CRM, multi-channel service delivery, EA, ISA, used to build a knowledge base to support the research done by this work.

3.1 Customer Relationship Management (CRM) and Multi-channel Service Delivery

According to [12], CRM is a management approach that aims to achieve value, develop and enhance the relationship to target customers, as to maximize their value, the enterprise's profit, as well as, increase shareholder value. In [5] CRM is described as the core business strategy that integrates processes and internal functions along with external networks, aiming to create and deliver value to target customers with the purpose of obtaining profit. Its basis is high quality information about the customers and it is made possible through the use of Information Technology (IT). This is the CRM view considered by this research. CRM's central aspect is that a organization must obtain a single and consolidated customer point of view throughout all its departments and personnel.

Multi-channel Service Delivery is part of CRM, nowadays being a central issue in CRM, the manner in which a organization manages a relationship with its customers in a multi-channel environment. According to [12], the Multi-channel Integration Process is one of the five core CRM processes. In [5] there are two main challenges regarding multi-channel service delivery:

1. The technological challenge of managing multiple channels supported by heterogeneous technologies.
2. The challenge of managing multiple organizational contact points with the customer.

This work addresses the second challenge mentioned. In order to fulfill a customer request throughout multiple possible channels, various people in the organization from different departments must coordinate their actions, share information, communicate with the customer and all this must be done in a seamless manner to the customers. This means that there must be a business process re-engineering, because the processes regarding customer relationship management and service delivery must be focused on the client and not the structure of the organization, these processes must be transverse to the organization and there must be alignment between them and the information they need, as well as, with the information systems that support them. In [10] this re-engineering is pointed out as being the most difficult topic in obtaining a successful multi-channel service delivery strategy.

3.2 Customer Relationship Management Architecture

As this work main contribution aims at being a reference ISA to support and guide the development of multi-channel service delivery in the Public Administration, we refer the vision of a CRM support architecture as described in [5].

CRM systems architecture is a key issue in its efficiency, also according to [11] a CRM strategy never considers an isolated perspective in terms of the information systems that support it. Due to the level flexibility demanded by these systems it is best to use the concept of architecture to manage the complexity and to have a principle to guide implementation, maintenance and development in order to reduce the costs. According to [5] there are three main systems in a CRM support architecture, the CRM system itself, a Document and Knowledge Management System and a Workflow Management Systems.

- Document and Knowledge Management System, this systems is responsible for managing all the information regarding to customers, storing and organizing all the information gathered trough the various contact channels available. It must ensure that this information is shareable, migratable, precise and available when needed to those who needed in a timely manner.
- Workflow Management System, used to define and automate the business processes that support the CRM related activities, they respond to certain pre-programed events by triggering a processes that responds to it. It is trough this system that the integration between the CRM, Document and Knowledge Management system and the core business systems is assured.

3.3 Multichannel Service Delivery Studies

In the course of this research work three initiatives to implement multichannel service delivery were studied, namely a Knowledge Based Approach [19], Dutch Municipalities [8] and a study by a European committee named ISA [7]. In the scope of the research done by our work we will mention the key aspects from these studies:

1. The aim of a Multichannel Service Delivery paradigm is the improvement of the service quality while at the same time reducing the cost of the service delivery.
2. The channels and business processes wich support them should be integrated.
3. There is a need to restructure and re-engineer business process around the needs of citizens and companys oposing a structure guided by department organization.
4. The Organization, Business and IT architectural dimensions must be aligned to each other.
5. There is a need to define a architecture to support this service delivery paradigm in order to support its maintenance and guide its evolution.
6. There should be decoupling between service delivery channels and the business processes wich support them.

4 Case Studies

This section describes the results achieved by analyzing a set of three case studies conducted in Public institutes wich compose the reference model referred in the

previous section used to derive the reference ISA. The public institutes studied where the Pombal and Sintra Municipalities and the National Portuguese Health Service Call Center. The description of these studies will consist of the assessment of the processes, information and information systems that compose the multi-channel support and the key points in this dimensions which will be identified through a evaluation method which will be described bellow. For the complete modeling of the ISA of the case studied the reader is referred to [2,4,3].

4.1 ISA Evaluation Methodology

The methodology defined by this research in order to define the Reference ISA proposed is based on a set of architectural alignment heuristics defined by the work described in [13,14], this methodology uses this heuristics to define a set of metrics which are intended to quantify the architectural alignment level of the proposed ISA. This research states that the most relevant metric to quantify and evaluate our proposed ISA is architectural alignment, this is due to the fact that the problem addressed by this work, which can be summed to how can IT minimize the complexity of managing multiple organizational touch-points, can only be achieved if the proposed Reference ISA is aligned with the business which it is intended to support. The metrics defined resorting to the heuristics referred previously, consider three alignment vectors which the heuristics refer to, these are Business Architecture/Information Architecture, Business Architecture/ISA and Information Architecture/ISA, these metrics are as follows:

$$AlinBA_IA = \frac{H1.1 + H1.2 + H1.3}{\#HeurAlinBA_IA} \quad (1)$$

$$H1.x, \exists x, H1.x \in \mathbb{N} : x \subset [1, 3] \wedge H2.x \subset [0, 1]$$

$$AlinBA_ISA = \frac{H2.1 + H2.2 + H2.3}{\#HeurAlinBA_ISA} \quad (2)$$

$$H2.x, \exists x, H2.x \in \mathbb{N} : x \subset [1, 3] \wedge H2.x \subset [0, 1]$$

$$AlinIA_ISA = \frac{H3.1 + H3.2 + H3.3 + H3.4 + H3.5 + H3.6 + H3.7}{\#HeurAlinIA_ISA} \quad (3)$$

$$H3.x, \exists x, H3.x \in \mathbb{N} : x \subset [1, 7] \wedge H2.x \subset [0, 1]$$

$$Alin = \frac{AlinBA_IA + AlinBA_ISA + AlinIA_ISA}{\#VectsAlin} \quad (4)$$

4.2 Case Studies Result Evaluation and Analysis

The TO-BE ISA for the case studies is obtained by applying a set of rules that define information systems based on a CRUD matrix [17,15]. As we can observe from tables 1 and 2, we obtain a overall gain of 11.6% of alignment, which shows that this method is relevant to this research. The overall gain over the IA/ISA alignment vector is 23.83% which is quite positive because information is one of the most important issues in CRM and we are defining a ISA to support also that, so to obtain 23.83% of alignment gain is a good result.

| | AlinBA_IA | AlinBA_ISA | AlinIA_ISA | Alin |
|-------|-----------|------------|------------|-------|
| C.M.P | 66.6% | 66.6% | 42.8% | 58.6% |
| CASNS | 66.6% | 100% | 100% | 88.6% |
| C.M.S | 66.6% | 100% | 71.4% | 79.3% |

Table 1. ISA AS-IS Evaluation for the set of Case Studies

| | AlinBA_IA | AlinBA_ISA | AlinIA_ISA | Alin |
|--------------|-----------|------------|------------|--------|
| C.M.P | 66.6% | 100% | 85.7% | 84.1% |
| CASNS | 66.6% | 100% | 100% | 88.6% |
| C.M.S | 66.6% | 100% | 100% | 88.8% |
| Overall Gain | +0% | +11.14% | +23.83% | +11.6% |

Table 2. ISA TO-BE Evaluation for the set of Case Studies

4.3 Case Studies Learnings/Best Practices Reached

The set that follows was derived from the analysis performed to this case studies and the causes for alignment or lack of it and consequent issues that result in alignment gain.

1. A ISA for multi-channel support must have three key information systems: a CRM, Document Management and Workflow Management Systems.
2. All the systems stated above must be integrated with each other and to the core business systems of the organization.
3. The business processes that support multi-channel must be customer oriented as oppose to organization structure orientation.
4. The customer requests should be all sent to a central department which collects them and redirects them to the correct departments.
5. There should be a logical separation in three layers as to the ISA, front-office, Middle-Office and back-office.
6. The service delivery channel should be supported by the central department that supports the service requiring for all available service channels.

5 Proposed Solution

This section intends to introduce the Reference ISA for Multi-channel Service Delivery in the Public Administration, by describing its components and how they relate to each other, i.e., what are their dependencies. For the complete Reference Architecture description and modeling the reader is referred to [1].

The methodology followed in order to achieve the proposed reference ISA is based on the more mature area of Software Engineering, which describes the relationship between reference models (in this research, the case studies), architectural patterns (in this research, the middle office pattern), reference architectures and software architectures. So adapting this reference architecture definition our methodology consists of taking in the input from the reference model, as well

as, the architectural pattern at hand (mid-office pattern), and derive an Reference ASI. This Reference ASI is then meant to be instantiated by the public institutes by analyzing their information systems landscape, i.e., legacy systems and make it compliant to the best practices reflected by the Reference ASI for Multi-channel Service Delivery.

Having followed this methodology to achieve the proposed Reference ASI, considering our reference model(learnings/best practices from the case studies) and the knowledge background gained by the study of the related work we arrived at the ISA described by table 3.

| Systems | Dependencies |
|---------------------|--|
| CRM | Workflow Management;Document Management |
| Workflow Management | CRM; Document Management |
| Document Management | CRM;Workflow Management |
| Core Business | CRM;Workflow Management; Document Management |

Table 3. Proposed Reference ISA Components and their Dependencies

This ISA applies the Middle-Office Architectural Pattern, because of its application to the problem at hand, as we could verify by the study of [7,19,8] and also as stated by [10].

6 Evaluation

This section presents the results of applying the evaluation methodology defined and described on subsection 4.1 of this paper.

| Alin/ISA | C.M.S | CASNS | C.M.P | Reference ISA |
|----------|-------|-------|-------|---------------|
| BA/IA | 66.6% | 66.6% | 66.6% | 100% |
| BA/ISA | 100% | 66.6% | 100% | 100% |
| IA/ISA | 71.4% | 42.8% | 100% | 100% |
| Overall | 79.3% | 58.6% | 88.6% | 100% |

Table 4. Comparison between the Proposed ISA alignment level and the ISA from the Public Institutes studied.

As we can observe from table 4, the overall alignment level of the proposed Reference ISA is 100%, although this is the result achieved we have to take in account that this metrics are defined resorting to a set of alignment heuristics, and this alignment level refers to the fulfillment of those heuristics. We were able to achieve these results, by applying the learnings/best practices from the

case studies, as well as, because the algorithm applied to derive the information systems that compose this ISA is focused in meeting the heuristics for the architectural alignment.

| ISA/Gain | BA/IA | BA/ISA | IA/ISA | Overall |
|--------------------|--------|---------|--------|---------|
| Ref ISA/C.M.S | 33.4% | 0% | 28.6% | 20.7% |
| Ref ISA/C.M.P | 33.4% | 33.4% | 57.2% | 41.4% |
| Ref ISA/CASNS | 33.4% | 0% | 0% | 11.4% |
| Total Average Gain | +33.4% | +11.13% | +28.6% | +24.5% |

Table 5. Gain Relative to the Reference ISA in relation to the ISA of the Case Studies.

7 Conclusions and Future Work

The main conclusions of this work are that:

- A ISA for multi-channel service delivery support should have three main components, CRM, Document Management and Workflow Management Systems.
- These systems should be integrated in the manner described in table 3.
- By applying the algorithm for information systems definition based in a set of rules over a CRUD matrix, described in [17], we obtain a relevant increase of the alignment level between architectural dimensions.
- The application of this research was in the context of the Public Administration, nevertheless, in the scope of supporting multi-channel service delivery by applying an IT based solution, the public and private contexts are valid. This means that there is coherence in applying the proposed ISA to the private sector.

In the rest of this section, the main conclusions of this research are described, the limitations of the proposed solution, as well, as the most relevant future work to be addressed.

7.1 Contributions

The main contributions to the problem given by this research are:

- Identification of the best practices for multi-channel service delivery in terms of processes, information and information systems.
- Reference ISA for Multi-channel Service Delivery in the Public Administration.
- Modeling of the Reference ISA resorting to the ArchiMate modeling language and framework for EA, [16].
- Evaluation Methodology for ISA based on a set of heuristics and the work done by [13,14].

7.2 Limitations of the Proposed Solution

The limitations of the proposed solution are as follows:

- Organizational Architecture (OA): this limitation has to do with the fact that the vision of EA adopted by this work, [6], refers the importance of OA, this work only addresses this subject in a light way, only proposing a organizational structure for the central client service desk and giving a description of assigning processes and information to actors. By addressing this architectural dimension one can consider new alignment heuristics that will augment the Business/IT alignment thus minimizing further more the complexity of managing multiple organizational touch-points.
- Evaluation Metrics for Compliance with the Reference ASI: like explained in [18], there are two types of alignment evaluation, between architectural dimensions (used in this research) and level of alignment of a Reference ISA to a ISA. This work does not define this type of evaluation and by doing such we could increase the value of this Reference ISA.
- Technology Architecture (TA): addressing this dimension one would engage on the problem of how to support multiple contact channels supported by heterogeneous technologies, thus augmenting the scope of the problem to consider the other problem referred by [5], and not addressed by this work.

7.3 Future Work

In order to face the limitations described above we refer that the future work of this research should be to engage the three aspects referred. Thus OA should be taken into account and a new set of alignment heuristics should be defined in order to improve the Business/IT alignment.

Research should be done in order to define a evaluation methodology and metrics to measure the level of compliance of the ISA of a public institute and the Reference ISA.

In order to engage the big picture in terms of the problem of applying multi-channel service delivery as described by [5], and also address the technological issue of integrating and supporting multiple contact channels supported by heterogeneous technologies.

These summarize the main course that this research should follow.

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