FACIN: The Brazilian Government Enterprise Architecture Framework

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Abstract: The United Nations point that to raise the efficiency and quality of public services is not just a matter of cutting-edge technologies, but also adopting practices to connect and interoperate governments, which requires a holistic approach. An Enterprise Architecture (EA) initiative is a consistent feature of strategic planning, which assists organizations in understanding how processes/services are automated, as well as helping to reduce organizational complexity and to improve communication, driving organizational change. We describe FACIN, the Brazilian Government EA Framework to support interoperability and digital governance among governmental organizations. FACIN aims to foster intra and inter organizational alignment, and also to provide a basis for the development of methods and best practices to improve the efficiency of public administration and services. In this paper we present the first results and perceptions.

1 INTRODUCTION

Public Organizations are increasingly seeking ways to automate their processes and services to society (citizens, governments, organizations and companies), which is known by e-government (e-gov) (UNPACS, 2016). The need for integrating technology into public services also evidence the need to better integrate the work system (processes, data, technology and people), by improving understanding, communication, reuse and sharing which is one of the aims of the Brazilian Strategy of Digital Governance (EGD, 2016).

Accordingly to ePING - Interoperability Standards for Electronic Government initiative (EPING, 2016), interoperability can be understood as the ability of different systems and organizations to work together and interact to exchange information in an effective and efficient manner.

Industry (and government) has responded to these challenges through collaboration and integration mechanisms (Panetto et al., 2016), it is not sustainable in a long term. The main reasons reside on: rapid growth in the variety of system architecture and the number of e-gov; the enormous amount of interrelated data; the need to increase information sharing; and the open data demand. So, governmental organizations have to decide where to focus their efforts and finite budget to attend societies` priorities in an agile and dynamic way.

Such demands require not only knowledge about how data is to be shared, exchanged and reused but also what are the concepts related to them, how they interrelate and what is their context considering the three pillars that constitute a socio-technical perspective of computing: people, technology and organizational processes. It requires a discipline that unites the diverse government views in different levels.

Therefore, the EA paradigm has been employed to integrate organizations through the alignment between business and technology (Banaeianjahromi and Smolander, 2016) in a goal oriented approach.

Brazilian Government, with the participation of expert citizens, academia, organizations and private companies, is developing FACIN, the Brazilian Government Enterprise Architecture Framework to support Governance and Interoperability. FACIN aims to support the EGD, increasing collaboration among governmental organizations and improving the efficiency and transparency of e-gov services and investments to society. This paper aims to present FACIN foundation and structural proposal, the Content Framework, which represents the first FACIN product under development, and first results and perceptions.

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2 HISTORICAL CONTEXT

The Brazilian Government is composed of organizations that operate independently. However, a lot of services transcend the frontiers of each organization demanding collaboration. Therefore, the use of a common architectural framework was justified in order to leverage reuse, interoperability and unified management of common elements. The main drivers involves public organizations, experts from civil society, academy and the following disciplinary entities are: the Brazilian Association of Technical Standards, the Brazilian Institute of Corporate Governance, the Brazilian Institute of Public Governance, Data Management Association Brazil, Association of Business Process Management Professionals, the Open Group, the International Institute of Business Analysis and the Court of Auditors of the Union.

FACIN dynamics guard similarities with other initiatives, where we highlight the Singapore Government EA (eWave, 2016), the Australian Government Architecture Framework (AGA, 2016), the Government EA for New Zealand (GEA-NZ, 2016) and the US Federal EA Framework (FEA, 2016). Those countries were chosen, when this project began, due to their level of success according to the 2014 UN Survey (UNPACS, 2014).

We identified common standards adoption such as: an integrated and shared e-gov strategy among organizations; the adoption of common architectural structures to improve efficiency in offering e-gov; and the intensive use of interoperability and integration standards strongly supported in the respective EA models. We believe that we have the opportunity to learn from those experiences.

Regarding the market practice, existing EA Frameworks were analyzed due to their extensive use and continuous evolution. We considered two of the most well used and discussed frameworks: TOGAF (The Open Group Architecture Framework (TOGAF, 2016) and Zachman Framework (Zachman, 2016). TOGAF ia an open standard collaborative EA methodology and framework used around the world to improve business efficiency. The Zachman Framework, a proprietary standard, establishes a total set of descriptive representations relevant for describing an organization, from strategic to infrastructure.

The development of FACIN used as a foundational base these two frameworks (which are also used by other Governments such as AGA), as well as successful experiences and recommended actions by the previously cited countries, taking into consideration Brazilian administrative, technical and political organization and goals.

3 FACIN

The main goals of FACIN are: (a) to be the reference model to be adopted at the federal, state or municipal level; (b) define the structural blocks to enable a holistic view; (c) promote interoperability, management and governance standards; (d) enable the development of innovative and integrated e-gov; (e) raise the sharing and reuse of services and assets; (f) facilitate integration of organizations through unified models from strategic to infrastructure; and (g) contribute to the implementation of the EGD.

Some of the principles organizations are to be adherent when adopting FACIN are: (a) be focused on society's needs and expectations; (b) common infrastructure and interoperability to encourage and enable information sharing; (c) integrated design of public services; and (d) transparency and open government.

FACIN consists of four interrelated parts, as shown in Figure 1: (i) **FACIN Architecture Governance**: Describes mechanisms of control and monitoring of the design and development of organization's EA ensuring its efficient and effective evolution. It also aims to structure resources and skills; (ii) **FACIN Architecture Development Method**: Describes a guide for organizations to develop and implement models. It aims to propose directions and guidelines for the development, implementation and maintenance of organizations' EA; (iii) **FACIN Content Framework**: Describes the structure of concepts that represents the different organizations' point of views and the relationship among them. It also organizes and classifies the common concepts to unify common knowledge; and (iv) **Standards and Reference Models**: Describes technical and managerial standards, guidelines and best practices – from the government and the market – for the development and management of organizations' EA.
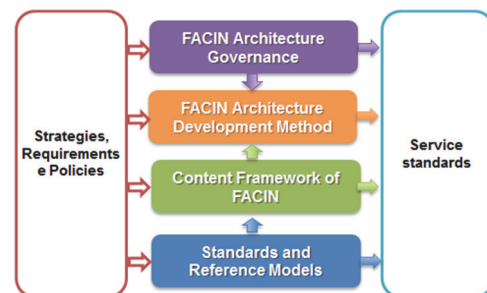

Figure 1: FACIN Structure.

The development of FACIN is been undertaken in the following phases: (1) We began developing the Content Framework, to establish what are the

most relevant EA concepts for the government. We have been discussing it inside internal forums. By December 2016 it is going to be released to public consultation; (2) The Architecture Development Method is expected to be started in November 2016; (3) The Architecture Governance is to be developed in the first semester of 2017; and (4) The standards and references are being defined accordingly, to which part of FACIN they are required.

4 THE CONTENT FRAMEWORK

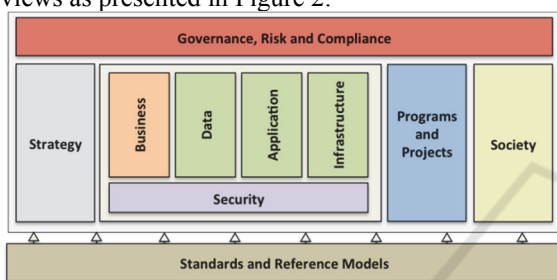FACIN Content Framework was divided into 9 views as presented in Figure 2.

Figure 2: FACIN Context Framework.

The Content Framework was conceived so as to provide analysis of investments in technology, information and process development in relation to organization's **Strategy** and **Society**'s needs. It was established three views that govern FACIN: **Society** that guides and are also the main focus of **Strategy** definition and monitoring and the definition of how the **Governance**, Management of **Risks and** Management of **Compliance** of the EA are to be performed. Thenceforth, **Business**, **Data**, **Application**, **Infrastructure** and **Security** views outline the major components that governmental organizations should consider and use in business transformation initiatives through the realization of **Programs and Projects**.

For each view the following items were proposed: (i) a description of the view with its purposes and benefits; (ii) the value of the view in relation to the others; (iii) critical success factors; (iv) roles and responsibilities; (iv) policies and guidelines; (v) associated patters and best practices; and (vi) elements that represent a set of useful description of the view. These items compose the Reference Model (RM) of each view of FACIN and are to be used for all governmental organizations.

The elements comprises: (a) a conceptual metamodel that defines and relates the main concepts; (b) a set of common artifacts (documents,

sheets) that are to be maintained by the organization; and (c) a taxonomy of the common terms.

FACIN Content Framework is composed of 9 Reference Models: Strategic Reference Model (SRM); Governance, Risk and Compliance Reference Model (GRM); Business Reference Model (BRM), Data Reference Model (DRM); Application Reference Model (ARM); Infrastructure Reference Model (IRM); Security Reference Model (SecRM); Programs and Projects Reference Model (P2RM); and Society Reference Model (SocRM).

Next section we describe SRM as an example.

4.1 Strategic Reference Model (SRM)

SRM aims to reflect the organization's strategy, forms of evaluation and corresponding initiatives in a unified view promoting sharing and reuse of strategic analysis and experiences.

SRM goals are to: (i) promote strong alignment between the initiatives and strategies of governmental organizations in relation to the processes, data and technology carried out and their intended results; (ii) support the development of cost models for ICT services and capabilities; (iii) serve as a mechanism to evidence the linkage of the strategy decisions and the impact on services; and (iv) promote transparency and accountability in government.

The expected benefits are: (i) to increase effectiveness and efficiency of investments; (ii) to increase effectiveness of the results produced by governmental organizations in relation to desired goals; (iii) to increase the efficiency and effectiveness of organizations in the implementation of actions and delivery of governmental programs; (iv) to promote interoperability among governmental organizations; and (v) to increase transparency.

It allows the setting of goals and government strategies in a uniform view. Each organization must map their actions, programs, projects, IT and data assets and measure the alignment to their respective intended goals and the goals of the Government as a whole. Governmental organizations can adopt common capabilities, share services and collaborate with each other to improve the overall experience of its customer service, increase the impact of public policies and reduce costs. When creating a consolidated view of government transformation, it is possible to identify new opportunities to improve and share government services in all governmental organizations and boost the efficiency, effectiveness and transformation across them.

SRM promotes values to other views by setting goals a strategic vision of goals, targets and indicators: (i) GRM: to guide the governance model,

performance monitoring, risk and compliance management; (ii) BRM: to guide the definition, management and improvement of processes and services; (iii) DRM: for governance, sharing and quality assurance of data and information; (iv) ARM: for governance, investment, sharing and quality assurance of applications and IT services; (v) IRM: to guide the governance, investment, sharing and quality assurance of the IT infrastructure assets; (vi) SecRM: to guide the actions and investments in security; (vii) P2RM: to guide investments, governance and quality assurance of governmental programs and projects; (viii) SocRM: oriented to the concerns and interests of society.

4.1.1 Conceptual Model

The main concepts to represent the strategic architecture of a governmental organization is presented in Figure 3 (first version), and it was based on the concepts defined in the 2016-2019 Multi-Year Brazilian Governmental Plan (PPA, 2016) and in the National Program for Public Management and Debureaucratization (GesPública, 2016), that supports the development of solutions that enable continuous improvement of management systems of public organizations. Table 1 presents the definition of each concept. The concepts' instantiation is carried out at a Federal level and are to be deployed and specialized for each governmental organization, which allows for uniformity and consistency within the government.
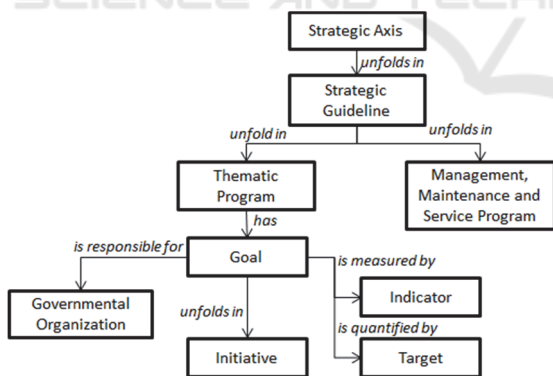

Figure 3: SRM Conceptual Model.

4.1.2 Taxonomy

The standardization by means of a unified taxonomy provides a baseline for all governmental organizations to describe their measurement practices. This strengthens interoperability between them, as their strategic visions can be easily understood by all organizations and society.

Table 1: SRM Concepts Definition.

Concept	Definition
Strategic Axis	It represents the strategic lines defined by the government for the 4 year Plan.
Strategic Guideline	Represents the guidelines that drive the main agendas for the next 4 years. They dictate the strategic alignment required for the preparation of the Thematic Programs. Ex.: Combating poverty;.
Thematic Program	The 54 Thematic Programs' scope represents the challenges and guides the management and monitoring of the Plan. Ex.: Social Security; Agrarian Reform;
Mgmt., Maint. and Serv. Prog.	It represents the actions destined to the support, management and maintenance of government actions.
Goal	It guides tactically the actions for what must be done in relation to the challenges, demands and opportunities. Ex.: Promoting Education for transit.
Governmental Organization	It represents the governmental organizations responsible for a goal.
Indicator	It represents the set of parameters that allows the following of different aspects of the evolution of a goal.
Target	It represents the goal range of measurement.
Initiative	It represents the means that enable the goals and its targets, explaining the "how to" performed by organizations.

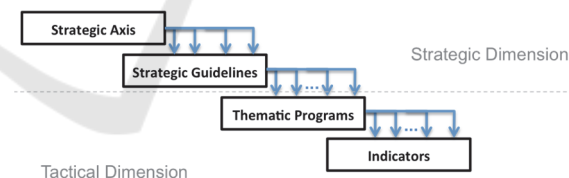Following the concepts previous defined, we proposed the taxonomic decomposition presented in Figure 4.

Figure 4: SRM Taxonomy.

Each one of the four Strategic Axis unfolds into one or more Strategic Guidelines and vice-versa. Each Strategic Guideline unfolds into one or more Thematic Programs and vice-versa. Each Thematic Program can be measured by or more indicators. PPA 2016-2019 detailed and unfolded all the concepts but the indicators.

4.1.3 Artifacts

Table 2 describes the set of common artifacts that are to be generated, maintained and publicized by

the organizations in order to promote collaboration and sharing between them and with society.

Table 2: SRM Artifacts.

Artifact	Definition
Multi-Year Plan (PPA)	It describes the strategic planning at the Federal level for the period of 4 years.
Organizational Strategic Planning	It describes the governmental organization's strategic planning in a short, medium and long-term.
Taxonomy of indicators	It describes the structure of the reference taxonomy of indicators.
Organization´s goals and targets model	It describes the organization´s goals hierarchy and respective target.
Organization´s Initiative Portfolio	It describes programs, projects and organizational actions to be undertaken.
Business Model	It describes how the organization operates presenting the services and how they interrelate to meet organizational goals.

5 DISCUSSIONS

During FACIN development, its main purposes and relation with EGD challenges were presented and publicized as well as FACIN's structure (Figure 1). A public consultation was performed from January to June of 2016 (http://www.participa.br). All opinions were in favour of the initiative. Some suggestions have been taken in consideration in the development of the Content Framework and others will be used for the next pieces of FACIN.

Meanwhile, on November 2015, a first EA training course was realized by the Federal Data Processing Service and cosponsored by The Open Group. We discussed EA concepts under FACIN and the TOGAF Framework in the Brazilian context. Participants discussed their specific problems and developed an architecture proposition for their solution. A Forum to present and discuss the Content Framework with Society was performed on October 20th 2016 been freely broadcasted. Adjustments were taken and the Content Framework was under public consultation until 31th December of 2016.

Thereon we conducted a series of visits into participants' organizations that will be used as pilots for the first version of the Content Framework.

5.1 Related Work

The use of implemented EA practices can avoid efforts to reinvent concepts, without limiting the possibilities of innovation. Therefore, regarding the

Content Framework we analysed the following approaches.

The Zachman Framework is one of the oldest and worldwide used by companies and governments around the world since the mid-80s. It was important for the discussion and definition of the perspective level and detail FACIN should support.

Among collaborative standards, developed by practitioners, suppliers, academics and specialists, TOGAF is the most widely practiced worldwide both in private and public organizations. TOGAF 9.1 Content Framework was important to discuss how to group organizational elements into specific organizational viewpoints. The Open Group Archimate 3.0 Standard was also used as a foundational to discuss the relevant information at enterprise architectural level.

From among the Governmental EA Frameworks we identified that they have a lot in common when it comes to adapt ideas from EA standards and in relation to the high flexibility they propose. They are also very similar. FEA is one of the first EA Frameworks first published in 1999. It was conceived to be implemented in any Agency and to offer transversal services among Agencies and other organizations (public and private). Its structure is used as the basis for several other Government EA Frameworks. AGA, from Australia, has a strong influence from FEA but more focused on e-participation. In its 3rd edition a reference model for each organizational viewpoint is detailed proposing a taxonomy, common artefacts, and a conceptual metamodel (for some viewpoints). The aim is to provide a common language among agencies. GEA-NZ, from New Zealand, has a strong influence from both FEA and AGA but it leverages the two by defining more clearly concepts and artifacts oriented to the government as a whole and to the agency level. eWave, from Singapore, was first published in 2002 focused on technology and since 2007 it has encompassed a business viewpoint. A central repository was created to serve as a single EA repository for the entire government, allowing business and ICT information to be captured in a consistent manner using established standards.

FACIN Content Framework proposes to leverage from those approaches mainly in three items: GRC, Security and Transparency. It proposes a viewpoint to represent GRC aspects through specific concepts, a global taxonomy and artefacts to unify the communication about GRC over each organization. The SecRM is to be more focused on reliability rather than traditional aspects such as secrecy or confidentiality. It goes in line with transparency

initiatives, which is cited by all four government frameworks presented, but not in a systematic way. FACIN intends to present information and actions to support de development and management of transparency actions as an integral part of the EA (Nunes et al, 2016).

5.2 Next Steps

Currently all 9 views are available (https://www. governoeletronico.gov.br/eixos-de-atuacao/governo/ interoperabilidade/governanca-e-interoperabilidade). So far, its main ideas have been accepted and public organizations recognize its value. During 2017 each Reference Model will be under a detailed development and evaluation congregating a larger group of participants and considering ideas from the Public Consultation and the Forum. Afterwards, pilots aiming at evaluating FACIN's Content Framework will be performed. The aim is to identify how it can help answering or supporting visualization of current and urgent questions internal to organizations and among them.

6 CONCLUSIONS

The management and effective use of information through the use of ICT is the key to the success of public organizations in offering better services to society. FACIN aims to meet this need by providing a strategic point of view for the development of ICT. Its establishment is a key element to leverage the Brazilian e-gov program based on best practices to promote the integration of processes, systems and information, with maximum stability and flexibility. In addition, it serves as a conceptual framework for defining interoperability standards in technical, semantic and organizational dimensions, to support organizations in collaborating with each other.

Governments around the world are currently investing efforts and resources in this regard, seeking in the digital governance the needed discipline to make this synergy and in the EA the foundation to achieve it, i.e., a pattern that can be implemented as common sense, responsible for effective interoperability in scale, as it provides transparency about the responsibilities, operations, resources and results obtained. As a reference model, FACIN aims to integrate architectures from the various organizations, enabling interoperability across the government. From its adoption, we intend that the interested parties will refer their architectural models to the views of the framework, promoting alignment and ensuring the progress of their initiatives based on this new discipline.

ACKNOWLEDGEMENTS

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