Architecturing large integrated complex information systems: an application to healthcare

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Abstract The global enterprise-wide approaches help organizations to model and understand the enterprise key components and their relationships and manage the organizations’ transformations and change. However, many of these approaches lack of insights into how to manage complexities related to the multitude of applications developed in silos such as the various systems in health organizations that were designed independently from each other. This paper contributes to the solutions addressing this issue by proposing a methodology and tools to create foundations based on key components to help develop the information architecture at the heart of the enterprise architecture that can guarantee the evolution of the organization. These core components are a set of reusable Field Actions representing the non-contextual persistent information, a common canonical Corporate Conceptual Data Model capturing all the vital data in the organization, and Views or sub-schema of this global data model that represent information for different stakeholders in the organization. To show the effectiveness of the proposed approach and to gain more insights into its practical value, the architecturing approach is applied in the healthcare domain to create the information architecture and the enterprise architecture for the Quebec healthcare network.

Keywords Enterprise architecture · Information architecture · Field actions · CCDM · Views · Business processes · Two track model · Health informatics
1 Introduction

Many organizations today recognize the importance of investing in information technology (IT) to face competition and to respond quickly to new business opportunities and changing environments while meeting their business objectives [1,2]. These organizations have been continually transformed to adapt to environment demands and to meet their strategic goals. The transformation very often involves adjusting business processes along with changing environments [3] to reply to evolving needs while maintaining competitiveness therefore creating new information requirement for decision making process. Each transformation is generally performed without considering its impact on the organization as a whole. In fact, the increasing need to integrate and use IT in those organizations has gradually created this environment of heterogeneous applications leading to the need of an Enterprise Architecture (EA) to overpass the lack of integration and sharing of information and resources. The ANSI/IEEE Std 1471-2000 [4] defines EA as “The fundamental organization of a system, embodied in its components, their relationships to each other and the environment, and the principles governing its design and evolution”.

Transformations in organizations pose a number of new challenges and opportunities for enterprises to quest for solutions that are expected to help represent, understand and respond properly to these transformation-related complexities [5]. In addition, these solutions are expected to allow managing the evolution of the multitude of applications while getting the control over the organization’s global model of information. Over the years, enterprise modeling [6] has emerged as a wide approach to represent and understand transformation-related complexities. Global approaches of enterprise architecture that attempt to coordinate the evolution of transformation of organizations, including a description of its static and dynamic parts, provide formal descriptions of the enterprise and its transformations. These global approaches, such as Framework-based architectures [7–9], Urbanization of information systems [10], and Project-based techniques [11–13], describe how organizations operate and how their transformations can take place in line with the strategic objectives and constraints. Moreover, to address the transformations within specific silos, many approaches have placed the focus on the development of an integrated and stable information architecture [14–16] bringing an enterprise-wide solution especially for medium and large organizations. The global enterprise-wide approaches, which provide a holistic view that enables organizations to represent and understand transformation-related complexities across the enterprise, can help those organizations translate that understanding into effective policies and processes. However, these approaches have not shed the light on how to manage complexities related to the multitude of applications in silos.

This paper contributes to the solutions addressing these issues by proposing a methodology to create foundations based on key components to help develop the information architecture (IA) at the heart of the enterprise architecture that can guarantee the evolution of the organization. These core components are a set of reusable Field Actions (FAs) representing the non-contextual persistent information, a common canonical Corporate Conceptual Data Model (CCDM) capturing all the vital data in the organization, and Views or sub-schema of this global data model that represent information for different stakeholders and usage in the organization. To show the effectiveness of the proposed approach and to gain more insights into its practical value, the results are applied in the healthcare domain to create the information architecture and the enterprise architecture for the Quebec healthcare network [17,18]. While recognizing the fact that the Quebec healthcare system must live with the many existing applications, the approach shows how to identify the stable pivot on the common part of the information architecture of this highly complex network. The