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An Integrated Framework for Efficient Implementation Of Enterprise Systems

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Abstract

The today's enterprise systems usually form a system of sub-applications, each being responsible for a particular functionality. Hence, the design and maintenance of such a complex system is not a simple task. In addition, the user requirements can change and the affected parts need to be identified and evolved. Similarly, new components or even whole system may need to be integrated. Companies in order to build and sustain competitive advantage have to rely more and more on their IT systems in virtually every aspect of their business operations. In spite of this and despite their critical operational, tactic and strategic role, many new and old IT systems have either not offered what they were created for, or have failed outright. Many of these failures and inadequacies result from a poorly executed development process. The development processes used employ either inadequate development models or flawed implementation due, in part, to the lack of proper frameworks and effective collaborative mechanisms between the development and integration functions. This puts forward high requirements on information systems and in turn, raises a great challenge to software developers. In order to build and sustain such systems, an integrated framework is needed for building and implementing business applications to automate business processes and support the business functions of the enterprise. The method adopted for the design is the Iterative Design Method. An integrated architecture framework was developed as a tool for efficient implementation of enterprise system as the end objective. Comprehensive system frameworks are necessary to capture the entire complexity of such systems. The architecture framework provides the conceptual foundation that includes Business, Information, information system, infrastructure and governance and security views necessary for building and managing the integral business system and all its components and also provides an integrated description of enterprise information systems in terms of the instantiation of the architecture framework.

1. Introduction

In the early days of computing, technology simply automated manual processes with greater efficiency. As technology evolved, new innovations enabled new capabilities and processes in the enterprise were driven by IT. Gradually, IT changed the business but not necessarily in alignment with the business strategy. This lack of alignment resulted in significant waste of resources and missed opportunities, and placed the organization in a competitive disadvantage in the market. Over the years, IT has evolved from delivering point solutions to a complex, interrelated landscape of

applications, interfaces and infrastructure that support the business processes of an organization and the productivity of its people. More recently, this has started to include an architectural view of business change, so that Business and IT function seamlessly to deliver the goals of the business. Architecture has always played a role in the development of systems. However, until the early to mid 90's (Capgemini, 2007), it was almost exclusively used in technical infrastructure, and commonly referred to as Systems Architecture. As applications and systems increased in number and complexity, the need for a clear and consistent view of the complete picture, together with a structured approach to integration, became apparent. Gradually, the term architecture was extended to include all areas involved; initially ranging from technical infrastructure to information systems, and then towards information, processes and business. More recently, the differences between architecture at an Enterprise level and at a Solution (or project) level have become more clearly recognized and defined: Architecture at the Enterprise level is oriented to the overall business, information and systems landscape, whereas at the project or Solutions level, architecture is more focused on a definition of solution direction and high level design (Capgemini, 2007).

Uncontrolled growth of information systems and technology in the late 1990s (often as a result of decentralized decision making) resulted in information and systems landscapes becoming complex, costly and difficult to manage. As a result, responding quickly and efficiently to new business challenges has become increasingly difficult. Changes in the business affect various aspects of operations: operational scenarios, business processes, policies and important business metrics. All these changes, in turn, have an impact on the systems that are used to automate business operations. Often changes in the company's technology infrastructure that underpins its business systems are needed to achieve the desired shifts in business model and operations. Managing change of enterprise scale and complexity requires a structured approach that can holistically cover all impacted areas of the business and plan for major changes in business capabilities to achieve strategically relevant outcomes. Architecture is critical to managing this complexity (Pessi, 2010).

The word "architecture" is among the words, which nowadays has been using much in the world of information technology. According to Pessi and Magoulas (1998) the word "architecture" is going to replace of the word "structure" in overall terms. Hugoson et al (2008) mentioned that since 1970's, organizations are spending huge amount of money for building new information systems. Yet there have been seen some obstacles in that respect which are:

1) The fast growing amount of systems which in most cases are integrated in ad hoc manner have been expected to increase the cost and complexity of information systems.
2) Organizations were finding it more and more difficult to keep these information systems in alignment with business needs.

3) The role of information systems has changed during this time, from automation of routine administrative tasks to a strategic and competitive weapon and the nature of applications has evolved dramatically, from the simple batch systems of the 1960s to today's networked distributed apps, which are capable of handling much higher transaction volumes.
4) Enterprises have not only demanded more applications but, increasingly, faster time to market and responsiveness as well as greater agility and flexibility — often to support dynamic business evolution where requirements are not as well defined as previously. In other words, business has demanded that IT get off the critical path of business change and evolution.
5) To support and enable new kinds of applications on far more complex hardware configurations, middleware has grown from almost nothing to today's high-performance, high-capability middleware products.

For answering all these obstacles, a new field of research was born that soon become known as Enterprise Architecture. Enterprise architecture is defined as the process of translating business vision and strategy into effective enterprise change by creating, communicating, and improving the key requirements, principles, and models that describe the enterprise's future state and enable its evolution (INCOSE 2005). During this developments in the field of Enterprise Architecture, some frameworks were created like Zachman, The Open Group Architecture Framework (TOGAF), and Federal Enterprise Architecture Framework (FEAF). The expressed reason for having Enterprise Architecture is that it provides blueprints for organization, for those who own, construct and maintain the building with the clear understandable picture of buildings uses its features and characteristics, and supporting systems. This includes relevant building components that govern the construction process. Enterprise architecture supplies to people at all organizational level an explicit, common, and meaningful structural frame of reference. Furthermore, it allows an understanding of important facts such as:

1) What the Enterprise does;
2) When, where, how and why it does that;
3) What it uses to do it.

In general view and regarding modern organization, Magoulas et al (2011) mentioned that having enterprise architecture as a blue print is not just limited to improve competiveness, but also reduce complexity, increase changeability and provide a basis for evaluation. Enterprise architecture is a relatively new concept that has arisen from the ashes of many failed attempts to construct increasingly complex information technology (IT) systems. Borrowing from the disciplines of brick and mortar architecture, software engineering, software architecture, and systems engineering, the enterprise architecture discipline is struggling to define itself and to demonstrate that it is a very worthwhile endeavor

that is capable of producing measurable benefits. While a few prescient individuals such as Vannevar Bush and Martin Greenberger foretold the amazing capabilities that information technology has given us, no one was so prescient as to foresee just how difficult and expensive managing, developing and exploiting information technology would be (Bush 1945, Greenberger, 1964). The rate of change has resulted in a dramatic increase in the level of complexity facing the poor developer, and the distinct enterprise architect role evolved as a major aspect of the strategy to handle this complexity and to gain a grip on the torrent of market-driven technology innovation. And that's to say nothing of the fast-changing business environment, where subject matter experts in the business require IT to deliver increasingly complex business logic. To this end, we have developed framework and guidance on how development projects should address such technical issues as scalability, transactional integrity, security, application modularization, performance, data handling, interface design, and so forth.

The focus of this paper is the design an integrated framework for the implementation of enterprise system as an instantiation of an Enterprise Architecture (EA) in terms of a set of software modules, computer platforms, network components, and databases assembled in such a way as to be able to automate business processes and thus meet all the system requirements specified in that Enterprise Architecture. This will in turn reduce enterprise IT system complexity, create a better alignment between business strategy and information technology and enables the realization of real value from IT systems implementation.

2. METHODS AND MATERIALS

The method of research used is iterative design method, combined with a systems approach to assist in the development of the framework. This study was divided into five phases as shown in fig 1. Although all of these phases are not explicitly covered in this article it provides a background of the research conducted.

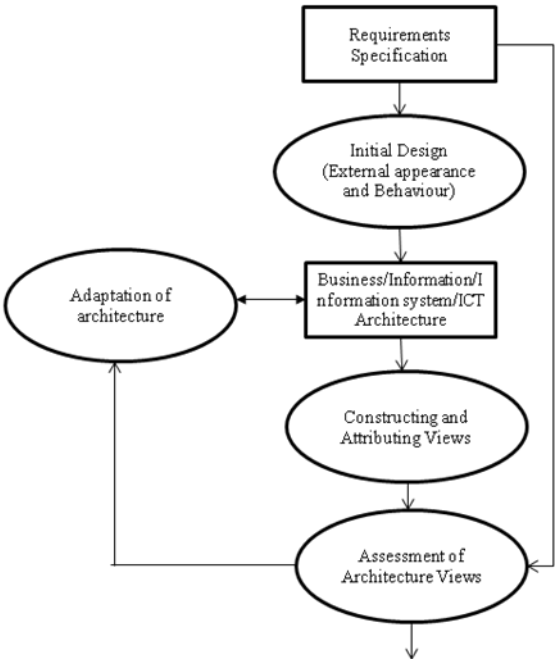

Fig. 1 Iterative Design Method

The first phase is the requirement specification, describing the need for an integrated framework for efficient implementation of enterprise system. Initial design is done for the architecture views and their organizational context is the focus of phase two. The third phase is actual design of the architecture views. Phase four deals with constructing and attributing views. The fifth phase focuses on the assessment of the architecture views to be sure of quality and capability for the design of enterprise system. The types of research used in the study and how they relate to the various phases of the study are discussed in this section. Each type contributes uniquely to the mix of research approaches needed to successfully produce an integrated framework for efficient implementation of enterprise systems. The materials used include the business processes, applications, content, hardware, people, documents and facilities.

3. Results

The integrated architecture framework has been designed and developed for managing system complexity in the enterprise. The integrated framework is broken down into sub-architectures, each covering a different area and working together to achieve a single point of authority. This is based on the concept of breaking down a complex problem into two or more sub-problems of a similar type until they become simple enough to be solved directly. The integrated framework is divided into business view, enterprise information (operation) view, information system view, infrastructure and resource view and Governance and security view. This is based on information requirements as applied to an organisation.

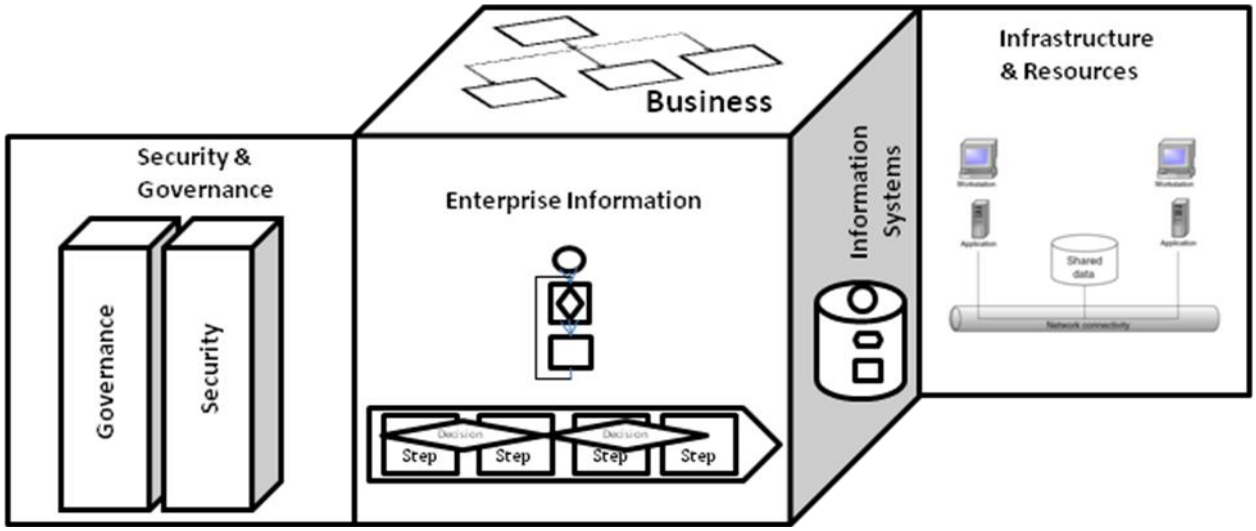

Fig. 2. An Integrated Framework for Efficient Implementation of Enterprise Systems

4. Discussions

The conceptual integrated framework has been designed as a tool for efficient implementation of enterprise systems. To achieve this, we look at enterprise as a whole and designed an architecture framework that shows a holistic view of the enterprise comprising business processes, information(operations), information system, technology (infrastructure) and Governance and enables to understand the relationships between these elements and their environment to better facilitate change and for proper development and implementation of business processes and instantiation into the desired enterprise information system.

i.. Requirements: The requirement stores the entire baseline of functional and nonfunctional (i.e., performance) system requirements. As the architecture evolves in function and shape, all artifacts in the logical and physical design, including business processes, business activities, business rules, and test cases must be traced back to this set of system requirements.

ii. Business View: This view answers the question of 'What business are we enabling?' The Business view aligns an organization's operating model, strategies, and objectives with IT; it also creates a business case for IT transformations and provides a business-centric view of the enterprise from a functional perspective. This part of the framework provides the following three key areas of information about the business:

(i). **Business Strategy**: Key business requirements, objectives, strategies, key performance indicators, business risks, and the business-operating model (how processes and systems are centralized versus decentralized across the business).

(ii). **Business Function**: The key business services, processes, and capabilities that will be affected by the enterprise architecture effort.

(iii). **Business Organization**: The high-level nature of the organizational structures, business

roles (internal audiences, external customers and partners), the decision-making process, and the organizational budget information..

iii. Enterprise Information View: This is a view answers the question 'What capabilities are needed to support the business?' The Information view describes all of the moving pieces and parts for managing information across the enterprise, and the sharing of that information to the right people at the right time to realize the business objectives stated in the business architecture. The key components for describing the information architecture are:

(i). **Information Strategy:** The information architecture principles, information governance and compliance requirements, canonical data models, and industry data model support strategy and a set of reference information exchange as well as dissemination patterns and reference models.

(ii). **Information Assets:** A catalog of critical business data types and models (such as customer profile, purchase order, product data, supply chain, etc.) and the relationships between those business data types and all the services and processes that interact with that data.

The Information view provides an information- and data-centric view of an organization, focusing on key information assets that are used to support critical business functions.

iv.. Information System View: The Information System view answers the question 'What applications and tools will be needed to support the business processes?' The information system view provides an application- and services-centric view of an organization that ties business functions and services to application processes and services to application components in alignment with the application strategy. The information system's scope, strategy, standards are a consequence of the Business Architecture. The information system is composed of the following content categories:

(i). **Application Strategy:** The key application architecture principles (Build versus Buy, Hosted versus In-House, Open Standards versus .NET, etc.), application governance and portfolio management, and a set of reference application architectures relevant to the customer.

(ii). **Application Services**: An inventory of the key application services exposed to internal and external audiences that support the business services.

(iii). **Application Processes:** A series of application-specific processes that support the business processes in the Business Architecture.

(iv). **Logical Components:** An inventory of the relevant product-agnostic enterprise application systems that is relevant to the stated business objectives.

(v). **Physical Components:** The actual products that support the logical application components and their relationships to the relevant components and services in the information and technology architectures.

v.. Infrastructure and Resource View: The ***Infrastructure and resource*** view answers the

question ‘What technology and resources (people and processes) will be used to enable the applications and tools?’ adds knowledge about types and structure of components that support the information systems and actors. These may be hardware or network related. They may include fundamental services such as databases, etc. and key security and other commodity shared services. The infrastructure view provides a framework for specifying the technology elements of the organization's infrastructure. It includes: Platforms (hardware and software combinations supporting execution of applications), Networks, Data Storage and Management, Security, Internal Software Architecture of Applications, Middleware, User Interfaces, User/Function Interaction Models and Development Tools and Environments.

vi.. Governance and Security View: The ***Governance*** view answers the question ‘What standards and procedures will guide the implementation of the architecture?’ This view focuses on the manageability and quality of the architecture implementation (both business and IT) that is required to satisfy the services levels required by the business for its processes and systems. The artifacts for this area are all fundamentally defined within the core views (Business, Information, Information Systems and Technology Infrastructure and Resource), although the outcome from this view will be new specialized Services and Components to deliver the governance. The ***Security*** view focuses on the mitigation of known risks to the architecture implementation (both business and IT). The artifacts for this area are also all fundamentally defined within the core aspect areas (Business, Information, Information Systems and Technology Infrastructure and Resource). The outcome from this view will be new specialized Services and Components to deliver the required security.

5. Interrelationship of the Architecture Views

The five main architecture views of AIMES are based on a “holistic” view on business and IT system of the IT enabled enterprise. In this view, the business is seen as two interrelated networks (Figure 3.7). The Business and Environment (BE) network consists of communicating and co-operating people in the role of employee, and of organizational units such as teams and departments. The network is organized as one or more supply chains of individuals, organizational units and companies working together in delivering products or services to the customers. The environment of a company is seen as network connecting the company with customers, suppliers and other third parties.

Information and knowledge is an important enabler of the business. The BE network is supported by an Information and Knowledge (IK) network formed by people and organizational units in specific IK supportive roles. These may be the same people and units that already have a role in the BE network.

The IK network enables the business by supporting the creation, exchange, storage and use of information and knowledge. The IK network in

fact acts as the collective memory of the organisation.

The IT system that supports the business is also seen as a network system in two main layers: the information system(s) and the technology infrastructure. The information system(s) encompass a network of communicating and co-operating applications. The applications work together in delivering communication and information services to the people in the IT enabled Enterprise. These automated services enable the data processing, communication and control in the BE network, and the creation, exchange, storage and use of data in the IK network. The technology infrastructure is seen as a network of communicating and co-operating hardware devices and system software and middleware.

The Technology Infrastructure (TI) delivers processing, communication and storage capabilities to the information systems.

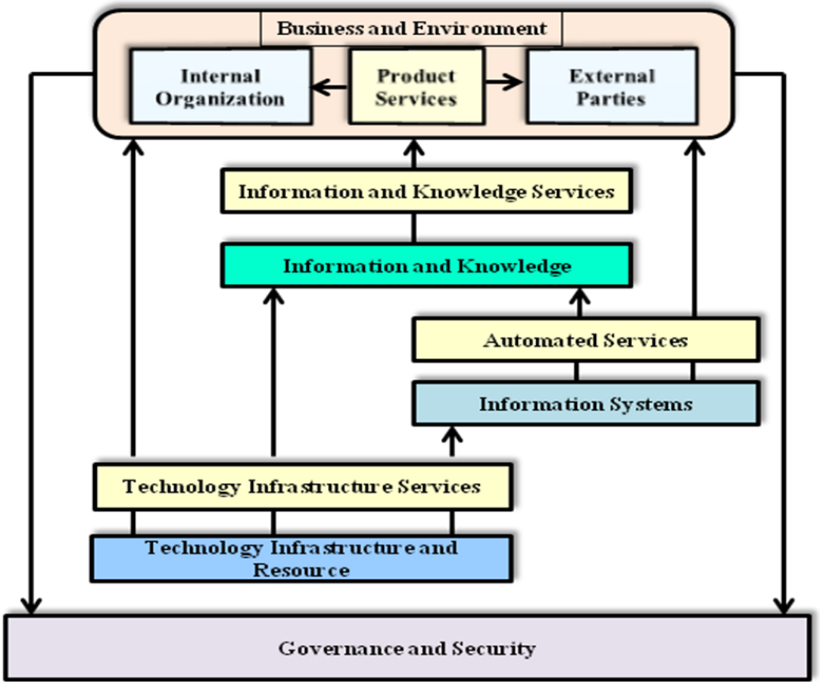

Fig.3. The enabling relations between the architecture views.

The main objective of AIMES is to support an architectural design of an IT enabled enterprise as one coherent co-operation of people, information, knowledge, applications and technology.

6. Conclusion

Advance in development and rapid technological innovations with software crisis has been identified as being major contributing factors to IT system complexity and poor IT/Business alignment. The enterprise architecture framework in this case becomes very useful in the aspect of managing system complexity and better aligning IT with business strategy enabling enterprise business transformation. A structured process has to be in place to align business requirements with the right technical architectures, with a strong connection to business and IT processes.

Integrating business strategies with technical architectures, and implementing associated IT best practices, can go a long way toward enabling enterprise business transformation. It is only by adopting enterprise architecture can enterprises be able to manage this complex system situation. Enterprise architecture framework is a blueprint of an organization's vision and a management framework that includes various business methods and tools to understand and document the structure of an enterprise, and help the enterprise to organize its business processes and Information Systems (IS) / Information Technology (IT) resources to achieve strategic alignment between its business processes and IS/IT capabilities.

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