Bahrain National Enterprise Architecture Framework: a Platform towards a GCC EA Initiative

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Abstract - The eGovernment Authority (eGA) of the Kingdom of Bahrain embarked on a three year eGovernment program aimed at improving service delivery to citizens through seamless integration and connected governance. In order to achieve this objective, eGA realized the need for a Kingdom wide strategy and holistic guiding plans, and hence decided to design and develop National Enterprise Architecture Framework (NEAF). NEAF is an aggregation of models and Metamodel, governance and compliance mechanisms and technology standards and guidelines put together to guide effective development and implementation of Enterprise Architecture by different government bodies across Kingdom of Bahrain. This paper highlights the experience of Kingdome of Bahrain in developing NEAF, its outcomes and key initiatives resulted from the project. The rich experiences gained from this project, enabled a clear set of objectives and roadmap to expand it towards a regional initiative to develop a Gulf Cooperative Council (GCC) Enterprise Architecture Framework. It is anticipated that Enterprise Architecture (EA) would bring to the members of these countries a great technological, economical and social benefits. A preliminary study reviled that there are number of areas that GCC countries would benefit from such initiative, which will reflect greatly on their countries in terms of cost saving, flexibility and enhanced citizen services. These benefits are already being realized in Bahrain as a result of implementing NEAF.

Index Terms - Enterprise Architecture Framework, Gulf Cooperation Council, TOGAF

I. INTRODUCTION

Governments around the world are leveraging advances in Information and Communication Technologies (ICT) to enhance their service delivery mechanism so as to improve citizen satisfaction towards government as well as gain competitive advantage over other nations in attracting investments.

Building on the believe that there exists a positive correlation between the desired level of e-government capability and maturity and the required level of architectural maturity, The eGA embarked on a three years eGovernment program aimed at improving service delivery to citizens through seamless integration and connected governance. In order to achieve this objective, eGA realized the need for a Kingdomwide strategy and holistic guiding plans, and hence decided to design, develop and implement National Enterprise Architecture Framework (NEAF) for Kingdom of Bahrain.

Aspirations for economy, government and society in accordance with the guiding principles of sustainability, competitiveness and, fairness have been described in "Economic Vision 2030" of Kingdom of Bahrain. NEAF was also designed and developed in alignment with this vision.

A. What is NEAF?

NEAF is an aggregation of models and meta-models, governance and compliance mechanisms and technology standards and guidelines put together to guide effective development and implementation of Enterprise Architecture by different government bodies across Kingdom of Bahrain.

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NEAF would help in managing complexity, Manage IT portfolio, deliver road map for changes, support system development, support business & IT budget prioritization. Different issue in any organization like legacy transformation, business changes, infrastructure renewal, Application renewal and Business IT alignment can be resolve by designing Enterprise Architecture.

The Open Group Architecture Framework (TOGAF), an industry standard architecture framework, was adopted to develop NEAF. NEAF was designed to be an extensible and scalable framework, one that would be able to adapt to the changing environments and needs of the Kingdom. [1] [2]

B. Project Objective and Scope

EA is practiced in many industries; private and public sectors, such as Telecom, Banking, and various eGovernment authorities. It is very important before embarking an EA project that the objectives to be achieved are defined clearly. As a trend, EA could serve different objectives; to lower the cost of IT, fix its effectiveness, fix its strategic value, use IT to generate new strategic value or in many cases to transform the business with IT. For instance EA could help with coping legacy complexity and cost, reintegrating the supply chain, integrating public services, enhancing channel capabilities or even delivering a better customer services.

The main objective of NEAF is to assist the Kingdom of Bahrain to design, develop, deploy and use enterprise architecture for better strategies, processes, plans, structures, technologies and systems across the government for successful implementation of e-Government. Specifically, in case of Bahrain, the focus was to

- Simplify and speed up services deployment to citizens
- Diversify services delivery channels
- Ease and improve integration between various ministries and government authorities.
- Achieve cost benefits of consolidation and standardization. Hence, reinvest the savings into modernizing the service delivery and provide more innovative services to citizens

Used as a guiding tool, NEAF was believed to provide a structured and comprehensive process for evaluating the impact and consequence of changes in business direction, business processes, avoiding silo base IT decision making and achieving the required alignment in the acquisition and implementation of technology tools.

The first iteration of NEAF (development phase) covered 167 services across 26 government entities (ministries and authorities). The aim was to move the government entities from business silos state towards standardized technology and rationalized data and applications. The output of the first iteration of the initiative was:

- Target Architecture for government service delivery
- Technology Standards and Guidelines
- Initiation of EA Maturity program
- Governance and Compliance Framework to guide all the above

Apart from the above initiatives, the project also identified a set of projects to be implemented to achieve the Target Architecture. Several awareness building sessions and training workshops for all involved Government entities were also conducted under this initiative.

II. ENTERPRISE ARCHITECTURE: A THEORETICAL BACKGROUND

Enterprise Architecture defines the business, the information necessary to operate that business, the technologies necessary to support the business operations, and the transitional processes necessary for implementing new technologies in response to the changing needs of the business. [3][4]

As illustrated in Figure 1, EA is simply defining the four layers of Business, Information, Application and Infrastructure architectures. These layers are usually called domains and can be described as follows:

Business domain: represents the functions and processes that support the business, the organizations that perform the business processes and the locations where the business is performed, and the factors that could cause the business to change

Information domain: identifies the major types of information needed to support the business functions. It identifies and defines the information model, data sets, metadata repositories, and their relationships to the business functions and to application systems.

Application domain: identifies and describes applications and modules, as well as their

relationships to business processes and other applications systems and modules. The application architecture identifies the major applications needed to support the crosscutting business processes of the enterprise.

Infrastructure domain: identifies the major technologies, or *platforms*, necessary to support the enterprise's applications and data systems, and associates those platforms with the various applications in the architecture.

In every EA project, the above current domains (As-Is architecture) are first defined to measure their EA maturity of the organization. Then and based on a comprehensive study of the organization, the target architecture (To-Be) organization's current to target architecture with sets of action plans is called the transitional plan. Finally and order to complete the circle such

transitional plan would be possible without a management and a governance process. These

would be developed. The journey of moving the

processes provide policy guidance, advice and assistance in the definition, design and implementation of the enterprise architecture discipline and practice throughout the company, an understanding of the process for making cooperative and collaborative IT investment decisions and designate who within Flabella is responsible for making these decisions. [5][6]



Fig. 1. EA Layers and Definitions

III. DEVELOPING NATIONAL EA FRAMEWORK

Built on the pillars of business, data, application and technology, design and development of NEAF involved following steps:

- 1. Creation of awareness about the EA initiative amongst the government bodies.
- Collection of data for the government bodies' vision, goals, business processes, IT organization, skill sets, capabilities and system and infrastructure deployment and IT planning and budgeting.
- 3. Validation of data collected with the stakeholders from the government bodies. Missing data wherever identified was also collected.
- 4. Based on the data collected, assessment of the Baseline Architecture of the individual

government bodies and also the Kingdom as a whole. This assessment shed light on the EA readiness of the government bodies (measured on EA maturity model developed specifically for the project), technology and scope across the government bodies, IT planning and governance and policy related issues such as data sharing, source code management, documentation of systems and IT ownership.

- 5. Development of Target Architecture to address the requirements of Integrated Service Delivery for government bodies.
- 6. Comparison of the Target Architectures visà-vis the Baseline Architectures to identify the gaps between the two states.
- 7. Preparation of the Migration Plan, spanning over three years, identifying the projects and initiatives to be undertaken by the

government bodies to migrate from Baseline to Target Architecture. The projects were prioritized based on the readiness of the government bodies, business alignment and functional and data dependency.

8. Discussion regarding the migration plans with the individual government organization to align the projects to their plans and requirements.

The NEAF initiative is designed to be dynamic in nature. The Target Architectures and the Migration Plan have to be periodically evaluated and refined to align them to the constantly changing environment, priorities and requirements of the Kingdom. This will ensure that the NEAF initiative will drive the government bodies in the direction of achieving the Economic Vision 2030.

IV. THE CURRENT ARCHITECTURE ASSESSMENT

The findings of the Baseline Architecture assessment (As-Is) provided crucial insights into the Architectural landscape of the government bodies. The assessment identified factors that were either conducive to or impeding the movement towards Target Architecture. A few favorable factors identified include:

- 1. Employing Balanced Scorecard systems to ensure alignment between Visions, Objectives & Business Services,
- 2. Defining and implementing different layers of access controls in information systems, and
- 3. Taking initiatives in improving the reliability and availability of services.

However it was identified that such factors were restricted only to few government bodies.

The hindering factors, which were more prevalent amongst the government bodies include:

- 1. Lack of a policy framework for defining and governing ICT investments in the Kingdom (resulting in poor utilization of government funds and investment in redundant IT systems), data sharing and system interoperability.
- 2. Absence of defined standards and guidelines

- 3. Duplication of work due to lack of definition and availability of reusable components.
- 4. Lack of an application integration framework

These factors led to delayed and poor quality of services delivered to citizens.

V. THE TARGET ARCHITECTURE

In this stage the findings of the baseline architecture along with the kingdom's economic vision 2030, eGovernment strategy and other business requirements and current planned initiatives will be used as an input to developing the target architecture (To-Be). To achieve this the architecture vision, principles, requirements and constraints were defined; service delivery architecture was developed, which consisted of Business, Data, Application and Technology architectures; conducted an architecture trade-off analysis, to decide what items from the current identified architecture to be reused, and what are obsolete and have to be changed when developing the target architecture. The final outcome of this stage, as shown in Figure 2, was prioritized into 65 initiatives across the 26 ministries ranging between enhancements, consolidations and introducing new systems. They also included few national level initiatives that will be elaborated in the coming sections.

The outcome also included shared services initiatives such as Human Resources Management system and Financial Management Information system; which were identified and recommended as systems to serve all government entities. The roadmap also included two management initiatives; the EA Maturity program that will raise the EA skills and maturity of government entities, and developing the IT financial framework, that will enable the governing body to track and monitor the IT investment at national level, which was lacking currently. Finally, two more important deliverables were the outcome of this stage; the definition of architecture Governance and Compliance and the design of Standards and Guidelines. These are described in detail in the following sections.



Fig. 2. NEAF Evolution over 3 years

A. Architecture Governance

Architecture governance provides a practice and orientation by which architectures can be effectively managed and controlled at an enterprise level. During the assessment of the Baseline Architectures of the government bodies, it was observed that a major factor that has resulted in lower values of architecture maturity in these government bodies is lack of an Architecture Governance Framework. This led the NEAF team to propose the formation of an Architecture Governance Body and the design and development of Architecture Governance Framework. The exercise described and recommended a four step governance process model (Enable, Ensure, Evolve and Enhance) and a supporting governance structure. The governance structure was proposed to be comprised of the Governance Council, which is the decision making arm and the Execution Arm. Under the guidance of the Governance Council, the execution arm of Governance Authority led by Chief Architect would play a key role in successful implementation of the roadmap identified in NEAF. [7] [8]

B. Technology Standards and Guidelines

Technology standards and guidelines across fifty nine technology areas have been defined under NEAF. These standards and guidelines would be adopted by the government bodies of Kingdom ensuring that the technology

is used in a standardized manner to support the services being provided. The fifty nine technology areas were categorized under seven technology domains, Application, viz. Collaboration and Productivity, Data, Enterprise IT Management, Network, Platform and Security. These standards and guidelines would provide direction and technical requirements to govern the acquisition, use and management of IT resources for the IT initiatives undertaken by the government bodies of the Kingdom of Bahrain. These standards and guidelines would help in reducing the technology risks, improve interoperability, optimize technological diversity and provide increased opportunities for sharing and collaboration between the government bodies. To ensure adoption these standards and guidelines will be regularly reviewed and assisted by the compliance framework defined under the Governance Authority. [9] [10]

C. Critical Nationwide Initiatives

The Migration Plan established as a part of NEAF definition identified a number of critical initiatives that should be undertaken for enhancing the setup at the Kingdom as well as the government body level. Prioritized on the basis of business alignment, dependency of government bodies on each other (for functionality and data) and readiness of government bodies, these initiatives have been distributed for implementation over a period of 3 years. The nation-wide initiatives would be aimed at improving the interoperability of the Information systems, ensuring availability of accurate data and information across government bodies and providing improved returns on IT investments.

One the critical initiatives, as shown in Figure 3, is National Gateway Infrastructure (NGI). It provides a crucial integration framework required to connect the services offered by various government bodies and provide a seamless integrated environment to the consumers (citizens and residents). Another initiative, National Data Hub (NDH) is one of the pillars of the Target Data Architecture. The NDH System would be integrated with the data sources in the government bodies. The NGI and NDH would form the core IT components for realizing the unified service delivery. Along with the NGI and NDH important initiatives such as Authentication System, Centralized Email and Short Message Service (SMS) gateways, Payment Aggregation System and Central Enterprise Management systems have also been recommended. These initiatives are primarily aimed at enhancing the functionalities in existing information systems and migrating the systems to next generation of technologies.



Fig. 3. NEAF target system landscape

VI. WHY GCC EA INITIATIVE?

In a sense Gulf Cooperation Council (GCC) is a high level layer of any large international organization that combines the political, economical, social and cultural ecosystems aggregated to achieve long term unity. Going from bottom up in defining and developing an Enterprise Architecture, IS departments/directorates in a country constitute the lowest layer and moving upward when country level (or National level Architecture) is reached. In case of GCC (Bahrain, Kuwait, UAE, Oman, Qatar and Saudi Arabia) it is just the aggregation of Gulf countries Enterprise Architecture.

For the last 20 years, and since the Internet revolution, IS community both academia and industry's lack of long term planning and following certain industrial standards caused the community (countries) billions of dollars. In the recent years, the concept of Enterprise Architecture (EA) showed great benefits to

organizations, in terms, as mentioned earlier, to simplify and speed up services deployment to citizens, diversify services delivery channels, ease and improve integration between various ministries and government authorities, achieve benefits of consolidation cost and standardization. Referring to Figure 1, in every layer of EA, GCC countries share activities, benefit and objectives. For instance, in the Business Architecture, many objectives and activities are being discussed and shred between GCC eGovernment authorities. In the Data and Application Architecture layers, GCC countries share and exchange lots of citizen and commercial data. However, in many cases these countries face number of standards and compatibility obstacles, not because GCC countries are not technological advanced, but because there are no high level views and long term strategies laid down at GCC level, rather every country plays on different frequency. Same issues occur in the lowest layer of Technology Architecture, where interconnectivity between

these countries is as important as the planned inter GCC train system, which has been planned and has already started in some GCC countries.

In the 2nd GCC eGovernment conference and Exhibition in Kuwait [11], the author interviewed more than 20 experts (including eGovernment Authority CEOs) with an objective to identify the key eGov applications and services that could be implemented and shared between the 6 GCC countries. A long list of initiatives and applications were identified, the following are a list of top 10; e-Gate for airports and borders, custom management system, pension fund, eLearning and collaboration, Job market, e-Tendering, Borders and Ports, Import/Export management, tourism information, and Citizen Information system. Not forget the Inter GCC government network that will enable the above systems to operate in a Most of the above secure environment. applications and services are being implemented in every GCC countries and the irony is that these systems are not integrated. Imagine the benefits GCC countries that may gain if they decide to move to a shared service concept or unify the applications layers.

From the above it is obvious that having a GCC level EA would bring great benefits in the long term both economically and socially. Not to forget that would give additional credits to these countries with respect to UN EGovernment readiness index.

VII. CONCLUSION

In this paper, the development lifecycle of the national Enterprise Architecture framework of kingdom of Bahrain was discussed. Starting with objectives and scope of the project, and after a brief theoretical background on EA concept, the approach taken to developing NEAF was described. Each stage of the approach was then discussed and finding and challenges were highlighted. During the architecture assessment stage (As-Is), and with the large number of the data collected from 26 government entities that built a foundation to developing the target architecture along with the design of governance and compliance process, and definition of a set of standard and guidelines to help government entities focus on certain technologies and reduce their cost and interoperability in the long run. The gap identified between the As-Is and To-Be architecture triggered a set of initiatives at national level and specific to government

entities. The outcome of phase I (Development phase) became the objectives of phase II of NEAF (Implementation phase). The experiences gained from these initiatives and their outcome, gave a clear site to explore an Inter GCC EA initiative. A preliminary study reviled that there are number of areas that GCC countries would benefit from such initiative, which will reflect greatly on their countries in terms of cost saving, flexibility and enhanced citizen services.

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