CEA FRAMEWORK: A SERVICE ORIENTED ENTERPRISE ARCHITECTURE FRAMEWORK (SOEAF)

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ABSTRACT

Enterprise architecture (EA) is a new approach that organizations should practice to align their business strategic objectives with information and communication technology (ICT). Enterprise Architecture encompasses a collection of different views and aspects of the enterprise which constitute a comprehensive overview. Such an overview cannot be well-organized regardless of incorporating a logical structure called Enterprise Architecture Framework (EAF). EAF presents a comprehensive and transparent map of an organization showing how all organization elements (business and IT) work together to achieve defined business objectives. It clarifies the way in which these elements support the business processes of the organization.

Several distinctive EAF have been proposed till now, the main challenges any of these EAF faced are (1) defining process is heavy, prolonged and tedious (2) Keeping EA artifacts up-to-date is an awkward work. These challenges make the artifacts of EA useless and unreliable.

A number of researchers and practitioners try to eliminate these challenges by using Service Oriented (SO) paradigm with common and famous EAF like Zachman and FEAF. But none of them completely clarify how SO practices with EA concepts combination may be realized and what are the important elements of it, they just show an abstract mapping between these two concepts and state that this combination can be possible. In this article we try to present a service oriented EAF (SOEAF) to eliminate aforementioned challenges and elaborated this framework in details. CEA Framework involves a SO Roadmap that is completely compatible with ITIL and a Classification Schema that cover all aspects of organization, these aspects categorize according to **Purpose**, **Pattern or Practice**, **Policy**, **Stakeholder** and **Resource.**

We believe that by using the proposed SOEAF referred to as CEA Framework, created enterprise architecture is flexible and agile enough to define rapidly and sense the environment quickly then, adapt and adopt business and information changes appropriately.

Keywords: *Enterprise Architecture, Service Oriented Enterprise Architecture (SOEA), Service Oriented Enterprise Architecture Framework (SOEAF), Enterprise Architecture Framework (EAF),* Information Technology Infrastructure Library *(ITIL), Agile Enterprise Architecture (AEA), Agile Enterprise Architecture Framework (AEAF),*

1. INTRODUCTION

Although many organizations utilize information and communication technologies to achieve their business goals, a few of them felt they received extraordinary value from IT, These firms had designed IT and business process capabilities in accordance with an enterprise architecture.

Motivation scenario: Enterprise architecture (EA) is a new approach that organizations should practice to integrate their business with ICT. it specify: what is processed, who does what, where everything is, how and why everything is done[1].EA apply a comprehensive and rigorous method for describing a current and future structure and behavior for an organization by employing a logical structured which constitute a comprehensive collection of different views and aspects of the enterprise when put together. This logical structure called Enterprise Architecture Framework (EAF). EAF presents a comprehensive and transparent map of an organization that shows how all organization elements work together to achieve defined business objectives, and what is the way in which these elements support the business processes of the organization. The organization elements include both business and IT resources and assets such as staff, processes, business rules, information, financial and etc.

EAF brings transparent map of an organization to us. This transparent map aids the manager of organization to reduce organization cost, eliminate process/data redundancy and enhance consistency, efficiency and effectiveness of organization activities.

Problem: Several distinctive EAF have been proposed[2, 3], but as the process of defining this transparent map takes too long and are heavy nature, many organizations are struggling with using these framework. The main two challenges any of these EAF faced are (1) defining process is prolonged and tedious (2) maintenance the EA artifacts up-to-date is an awkward work. These challenges make the artifacts of EA useless and unreliable.

Related Works: To eliminate these challenges a number of researchers try to use SO paradigm with EA for generating EA artifacts. They believe that this paradigm makes the Defining process of EA agile and the artifacts created by this way is more flexible and easy changeable. By using this paradigm, organization should sense the environment rapidly and adapts itself to change business challenges and opportunities quickly.

Although The scope and coverage of these frameworks[4-15] differ extensively, they do not completely clarify how SO practices with EA concepts combination may be realized and what are the important elements of it, they just show an abstract mapping between these two concepts and has stated that this combination is possible.

Contribution: In this article we try to present a service oriented EAF (SOEAF) referred to as CEA Framework to eliminate aforementioned challenges. We will elaborate this framework in details in this article.

CEA EAF comprises a SO Roadmap that is completely compatible with ITIL and a classification schema that cover all aspects of organization, these aspects categorize according to **Purpose**, **Pattern or Practice**, **Policy**, **Stakeholder** and **Resource.**

The rest of this paper is organized as follows. In section 2, we introduce some EA basic concepts and principles. In section 3 we outline the CEA EAF and give an overview of its component. The CEA EAF SO Roadmap and CEA EAF classification schema will be elaborated in details in section 4 and 5. As it is commonplace to compare any frameworks with Zachman in order to show correctness and usability we compare CEA EAF with Zachman in section 6. Finally, the conclusion is presented in section 7.

2. EA BASIC CONCEPTS

In this section, we briefly introduce some basic concepts and principles. These concept have many definitions that [16, 17] presented a collection of them. As there is no accepted general definition for these concepts we just remark our accepted definition.

a. Enterprise

"A collection of organizations those have a common set of goals and/or a bottom line. In that sense, an enterprise can be a government agency, a whole corporation, a division of a corporation, a single department, or a chain of geographically distant organizations linked together by common ownership"[16].It consists of people, information and technologies; performs business functions; has a defined organizational structure that is commonly distributed in multiple locations; responds to internal and external events; has a purpose for its activities; provides specific services and products to its customers[17].The word enterprise is neither restricted to a business, or even an industry, nor referred to a particular time in the life of an organization[18].

b. Architecture

Architecture is the structural bridge that connected the strategy with the implementation [19]. It is the fundamental organization of a system, embodied in its components, their relationships to each other, the environment, and the principles governing its design and evolution[20].

c. Enterprise Architecture

Any complex enterprise has many types of components including its staff, business functions and processes, organizational structure and physical distribution, information resources and information systems, financial and other resources including technology, and the strategies, plans, management, policies and governance structures that drive the enterprise. An Enterprise Architecture shows how all these components (and others) are integrated in order to achieve the business objectives, both now and in the future.

Enterprise Architecture is the set of descriptive business and IT representations relevant for describing an Enterprise. EA constitutes the baseline for changing the Enterprise once it is created. By use of this Architecture we can achieve the Enterprise so it is as LEAN as possible (minimum possible

complexity and minimum possible costs) and as MEAN as possible [19].

d. Enterprise Architecture Framework

An Enterprise Architecture Framework would be a normalized classification structure or schema of descriptive representations, engineering design artifacts, architectural representations for an Enterprise.[19]

As we mentioned earlier Enterprises are so complex and are changing very fast, then we cannot have a **holistic approach** without a classification scheme that enabled analysis of one variable at a time without losing sense of the Enterprise as a whole[21].

3. CEA EAF SNAPSHOT

As Fig. 1, depicted CEA EAF comprises one SO Roadmap and a classification schema. It's SO Roadmap which is completely compatible with ITIL Roadmap. By using CEA classification schema you are capable of describing different aspects of an organization, these aspects are Purpose, Pattern or Practice, Policy, Stakeholder and Resource. In two next sections we will elaborate these two components of CEA EAF in details.

4. CEA EAF SO ROADMAP:

CEA EAF SO Roadmap is patterned on ITIL SO Roadmap. CEA EAF SO Roadmap just includes the first two phases of ITIL (service strategy and service Design). As Fig 1 is depicted, at the core of this Service Roadmap is Service Strategy and the steps of service design are in a circular manner those are affected by continual improvement. In next sections we elaborated these steps in details.

a. Service Strategy

Service Strategy at the core of the SO roadmap provides a foundation for service management which are useful for designing, developing, implementing and deploying service management policies, guidelines and processes [22]. Organizations should use service strategy guidance to think about why something is to be done before thinking of how does it. We use this guidance to set our business objectives and expectations those reflects what are our services and in which domains they should be offered; in addition, what are the level and warranty can be acceptable for each of the services [22].

Topics covered in service strategy include defining service market spaces, characteristics of internal and external service providers and service assets. Those are articulated in the service portfolio [22].

Deigning Service Strategy at first step ensures that organizations are in position to handle the costs and risks associated with their service portfolios, and are set up not only for operational effectiveness but also for distinctive performance[22].

i. Service Design

Service Design turns service strategy into the blueprint for delivering the business objectives. Service Design provides guidance for the design and development of. Strategic goals realize by cooperation and chorography of designed services. This step covers design principles and methods for converting strategic goals and desires into real services those are compatible with service portfolio. The scope of service design includes both analysis and design. It starts from capturing business requirements and then designing a service solution to handle these requirements. It is not only considering new services but also including the changes and improvements in current services. [23].We design services in three levels Process, Business and IT which are explained in next paragraph.

Process services are services that represent long-term workflows which contains macro flow of business process. This kind of services is implemented by an orchestration of business services [24].

Business services are component of process services. These services contain business micro logic. These services are meaningful from business viewer of systems [24].

IT services are services handle the technical view of system. These types of services include the technology solutions and IT constraints to design services[24].

5. CEA FRAMEWORK CLASSIFICATION SCHEMA

As I mentioned earlier the CEA Framework comprises two critical constituents: SO Roadmap and Classification Schema. We detailed the SO Roadmap in previous section and in this section we will elaborate classification schema in details. This classification schema is a 5*5 matrix (fig 2) that its rows are completely mach with steps of

SO Road map and its columns categorize the organization as different aspects. These aspects defined in the remainder of this section are Purpose, Pattern or practice, Policy, Stakeholder and Resource.

a.   Column1: Purpose

In first column named Purpose, the goals we want to be achieving by leveraging the remainder columns are enumerated. These goals will define in various levels tracking each step of SO roadmap, range from the most abstract depiction of the business to more detailed and measurable set of objectives. This column reveals cascading between these different types of goals from strategy down into business and IT Types.

Fig 4 shows the hierarchically tree between different types of goals defined in this column, At first level this column refer business philosophy, the manner in which, services are provided, the governing set of beliefs, values and a sense of purpose shared by the entire organization as vision, mission and strategic headlines. As Fig 3 depicted through remainder cells of this column, we defined three more specific types of goals to achieving strategic headline defined in first cell these types of goals are business goals, engineering objectives and IT targets.

Business goals are realistic translation of abstractive strategic headline .These type of goals are like a mountain peaks should be achieved in long term. Achieving these goals insure us to accomplish strategic mission.

 Engineering objectives are quality format of Business goals. These are measurement views of strategic goals providing us to achieve business goals.

 IT Targets are quantity goals declared for each quality objectives defined in previous cells. This hierarchically views of goals helps us to warrant achieving our strategic goals and mission headline by accomplishing more reality and measurable targets.

b.   Column 2: Policy

Second column is about policies of organization. Although each references define policies in different scope [7, 9, 25, 26], all of them imply that policy is a significant and mandatory factor and must be considered to accomplish strategic mission.

   A policy is management expectation, intention and condition used to ensure consistent and appropriate decision, design and development of goals, responsibilities, resources and processes.

As fig.3 shows CEA EAF policies defined in four levels: strategy policies, orchestration policies, business and IT policies. All of these types of policies are about constraints and quality of services but in different level.

  In first cell of this column strategic policies are defined. Strategy as a policy describes when and how transitioning occurs. It defines governing rules that drive the strategic decision and should be considered to accomplish strategic mission through well understood steps by an agreed date and budget. In this level we focus on business drivers that affect our business strategy. In this column we take into account any risk, constraint and limitation which specifies the level and quality of service delivered.

   In second cell orchestration policy is defined. Orchestration policies address any constraint exists for composition and integration of business services together.

Business policy declared in third cell is the service level agreement for each service. A service-level agreement is an agreement about level of services offered to the stakeholders. This policy specifies constraints, standards and business rules regarding the operation of services [26]. The last type of policy explained in forth cell is IT policy. IT policy is about the quality of IT services. Quality of IT service addresses all features and characteristics of an IT service bear on its ability to satisfy stated or implied its objectives. It covers all types of the non functional requirements like performance, efficiency, security, availability, reliability.

c.   Column 3: Pattern or Best Practice

The third column which is about patterns and best practices specifies **how** we can achieve defined goals. In this column the organization specify a solution pattern that is consist of a set of activities and practices that solve common problems in a given context and system of forces which is critical to business success [7].

One question raises here is why we name this column pattern and not process, the reasons of this naming is two characteristics of pattern, **First:** As Alexander believed "Pattern can exists in different scale". The possibility to design and develop patterns for all aspects of organization is the important advantages. The point to be considered is that the scope of a single pattern may range from a high-level view of how business services are offered to a more-detailed view of a specific portion of a software process. **Second:** "Each pattern describes a problem which occurs over and over again in our

environment, and then describes the core of the solution to that problem, in such a way , it is possible to use a solution a million times over, without ever doing it the same way twice" [27].This pattern characteristics help us to take advantages of other organization best practices. As patterns do not specify how to perform a given task, they can be used as reusable building blocks which tailored a software process that meets the specific needs of the organization from it. Like the other columns, there are three levels of patterns. In the strategic level, we define the well-understood decisions, common management technique and e-business patterns of an enterprise. The patterns for e-business leverage best practices along with a collection of proven architectures used in different domains that organization offer services in these domains. The services either are common in different domain or exist only in one domain are emerged in this level.

In second to forth cell of this column, design level, we define the service oriented patterns in three levels, Process, Business and IT, in a coherent and consistent manner.

The process pattern declares process services and the interaction between them. This pattern defines the model of orchestration between different services. The process services must do its responsibility stand alone.The patterns presented in this level shows how strategic mission realize by interaction and collaboration of different services. Each process service includes the workflow of business services defined in business sub level. It includes phase, stage and task pattern [28].

Business pattern includes the patterns match business service scenarios. Each business service scenario is minimally mapped to the activities it supports, the rules it abides by, the messages it transfers, the data warehouses it retrieves data from and the information it captures, processes, stores and accesses. In this level we focus on business terms and the best way of interaction between business services to achieve business goals.

In IT level we focus on IT solution to realize business services. Each IT services is the technical translation of business services. It exposes a realistic model of business services by consideration of IT capabilities and constraints. In this level we use technical patterns to cover business scenarios.

d. Column 4: Stakeholder

Forth column describes different players of the organizations. In this column we focus on stakeholder management to realize organization stakeholders, categorize them, understanding their needs, expectations, responsibilities, authorities and decision rights. We defined two types of stakeholders: Internal and External. The internal ones are all of organization workers that participant in defining EA and the external ones are all of the organizations and peoples that affect our business and our organization activities.

By focusing on Players we can clarify: (1) the changes needed in organization structure, chains of responsibility, authority and communication. (2) Training and skills enhancement was needed for personnel and communication management (3) New roles and responsibilities should be defined and (4) the boards, committees and governance structure must be established.

e. Column5: Resource

Through earlier columns we defined our goals and perspectives, the level of services we can offer to our stakeholders, the pattern and ways we must follow to achieve the goals and the human resources needed to accomplish goals. The only thing which is remaining is other resources such as Environment resources, technical resources and financial resources. These kind of resources should be considered in this column.

6. COMPARISON CEA WITH ZACHMAN FRAMEWORK (ZF)

As it is commonplace to compare any frameworks with ZF in order to show correctness and usability of new born framework, we compare CEA with ZF in this section. The comparison factors are extracted from the critical factors collected in [3].In this section at first we define the comparison factors and then describe how CEA accomplish these factors better than ZF.

a. Comparison factors

i. Holistic in scope:

An EAF must address all aspects of an enterprise. These aspects comprise business structure, business activities, business process, information flow, information systems, standards, infrastructure and policies.

ii. Support Extended Enterprise[1]

An EA framework must not only consider the all aspects of an enterprise but also take into account the external stakeholders and the extended value net members. It must think about extended enterprise and how their business does better by incorporation of all of business partner.

iii. Collaboration based

A suitable EAF must include all key stakeholders in different level of making decision, it must cover all range of stakeholders include business domain, senior management, business partner and customers.

iv. Alignment driven

A good EA approach must align business and IT in a comprehensible way that is completely transparent and traceable to all key stakeholders. It must bring us the potential to can trace any items from strategy to technology.

v. Based on best practice:

A good EAF must support the mechanism to leverage business solutions that bring us business value[2].

vi. Live Process

An appropriate EA must support flexible and dynamic methods for developing EA. By using these methods EA sense environment changes rapidly and then adapt and adopt these changes.

vii. Normative result

"It must provide the ability to define solution sets can be measured, validated and map to real world solution [27]" .

viii. Non- prescriptive

An implementation approach is out of scope of EAF and the EAF must not assume any tools and implementation constraint.

b. Comparison

In this section we will show that the defined factors are achieved better by CEA EAF in comparison ZF.

i. Holistic in scope:

ZF provide a comprehensive, logical structure pertinent to EA, it demonstrate a framework to cover all organization aspects by ask the 6 W questions (What, How, Where, Who, When and Why).but there exist some aspect of enterprise that ZF does not imply them e.g. security[29] and cost[30].

CEA EAF does not have this shortcoming of ZF because it addresses all types of non functional requirements in Policy column.

ii. Support Extended Enterprise

Although ZF consider the EA players in Who column but in this column it address just the Internal player and does not take into account the external stakeholders and extended value net members.

CEA EAF mitigates this shortcoming by two issues:

1. The player column address two types of stakeholders internal and external

2. As this framework is based on services and a service is an independent capsule that can easily provided and consumed across organizational (internal and external) boundaries[7] this framework is suitable for supporting Extended Enterprise.

iii. Collaboration based

Both CEA and ZF include different participants' perspectives in building enterprise architecture from strategic viewpoint to builders. But as I mentioned earlier unlike CEA, ZF does not address business partner and customers.

iv. Alignment driven

ZF state that his framework bridge strategy to implementation and business to IT [19].It is completely true because the top two rows are intensively business oriented whereas the bottom four rows are explain by IT vocabulary[2].But the vague point remaining is how these levels connect and relate to each other. ZF does not suggest anything about this matter.

In CEA EAF we demonstrate one map for each column these hierarchical maps shows how every element in one column related to each other e.g. business goals, objects, rules, constraints links to corresponding in IT domain.

v. Based on best practice:

The spirit of SO is sharing – not only share services but also devote the lessons learned, the practices that have worked and the best solution

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[1] In [27] this factors and the previous one stated together but we split these two factors two emphasize the extended enterprise concept as a critical factor.
[2] In [27] this factor is named **Dynamic**

that examined abstract from implementations to reference architectures[7].As CEA is based on services it can take more advantage of best practices more than ZF.

c. Live Process

One of the main advantages of adopting SO as a modernization approach is the fact that it is an incremental and evolutionary approach; it has the ability to rapidly innovate, reconfigure and add new capabilities.

Because of this characteristic of services, CEA adopts new business processes, much faster and more cheaply than traditional EAF.

i. Normative result

CEA involves a progressively more detailed and specific set of models. These models range from the most abstract depiction of the business, to technological solution from which code can be generated. The technical view of EAF demonstrate in last level of CEA realize all type of abstraction defined in above levels.

ii. Non- prescriptive

As I mention before KSRA EAF does not assume any implementation issue.

7. CONCLUTION:

In this paper we try to introduce a comprehensive EAF which uses services as key elements. This framework comprises two critical constituents: SO roadmap and classification schema. The SO roadmap is compatible with ITIL roadmap. The classification schema shows a holistic view of any organization by five aspects: Purpose, Policy, Pattern or Best Practice, Stakeholder and Resource. We believe that EA projects are accelerated by using CEA Framework and the results that created is flexible and easy changeable.

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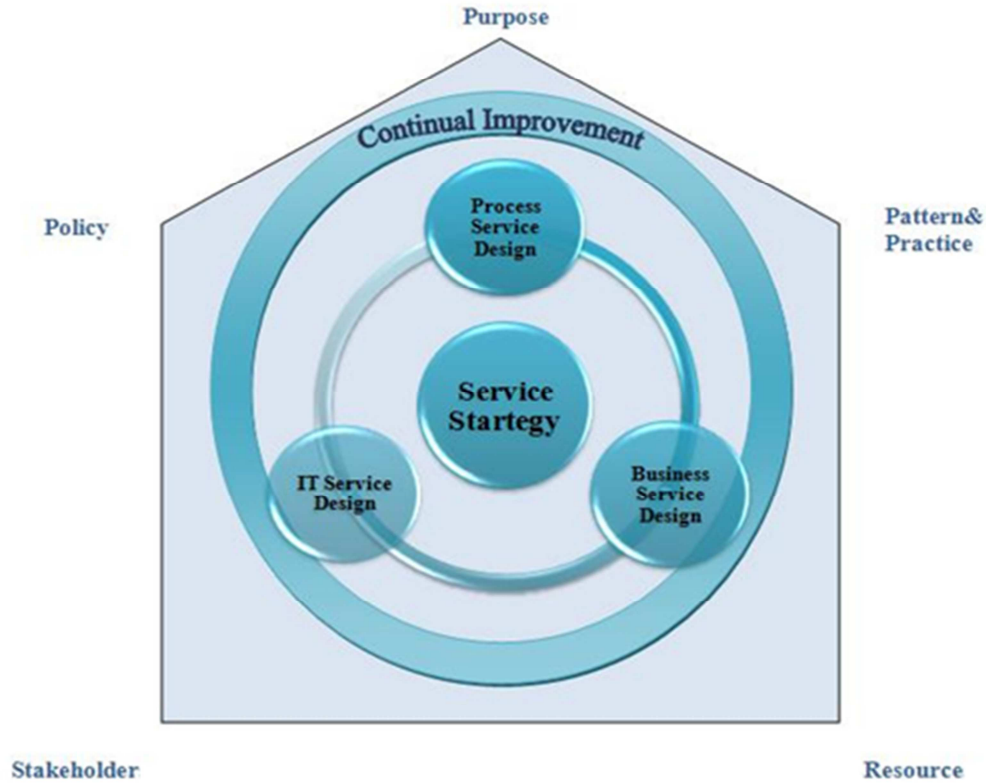[29] a. Mahjooriyan, "a method for service oriented enterprise architecture to support zachman framework," in *electrical and computer engineering department*. Vol. M.sc iran-tehran: shahid beheshti, 2007.
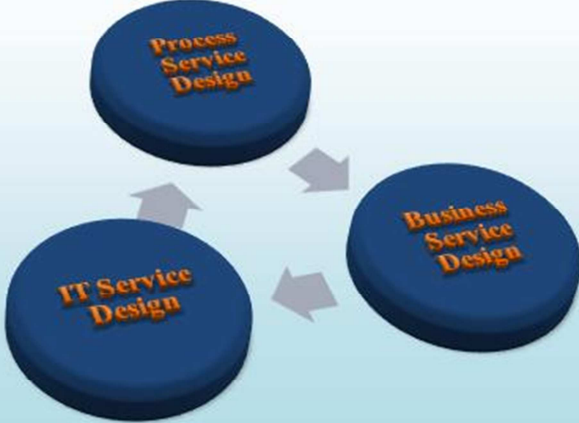
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Figure 1: CEA EAF

Figure 2: CEA EAF Classification Schema

| | | Purpose | Policy | Pattern & Practice | StakeHolder | | | | | Resource |
					External	Internal				
Service Strategy		Strategic Mission	Strategic policy	Strategic pattern	Partner, Providers Competitor			Owner CEO Top Manager		Technology resources / Finance resources / Supporting resources / Environment resources
Service Design	**Process**	Business Goal	Orchestration policy	Process pattern						
	Business	Business objectives	Business policy	Business pattern		Personal Customer & Cooperative Customer			Middle manager Supervisor User	
	IT	IT targets	IT policy	IT pattern						

Figure 3: CEA EAF Cells

Figure 4: Goals hierarchically map