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Qualitative characteristics of enterprise architecture

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Abstract

Constant changes in information technology (IT) and business environments have made the demand for a powerful management for IT systems more pressing. Enterprise architecture is a framework to develop and maintain IT, to achieve organizational goals and to manage resources of this technology. Enterprise Architecture (EA) quality is a multi-dimensional content which is not easily distinguishable and measurable. To determine this content more exact, the qualitative models have been presented in which different aspects of this matter are investigated. This paper attempts to introduce mentioned about determine EA qualification and its qualitative characteristics more clearly. This article can be used as a reference to investigate EA qualification and its models. Also, it can help stakeholders to explain the qualitative requirements more exactly.

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1. Introduction

Today, IT management in organizations is more important than managing software and hardware systems. In that it must include all parts and activities of an organization. Any IT management system must be suitable for the organization in achieving its strategic goals and missions. Therefore, we should have a holistic approach of IT systems in order to have a better evaluation of outcomes of the decisions. Lack of such a plan or an existence of a weak design cause several problems like inconsistency and resource wasting [1, 2, 3] and this rises from the fact that business environments are changing and information systems are growing inevitably.

Information technology enterprise architecture, in short enterprise architecture (EA), has been developed with the aim of increasing IT manageability and removing the above mentioned in efficiencies. Enterprise architecture gives a holistic specification about the strategy, key activities, information and organizational technologies and functions and their effects on business processes.

The domain of enterprise architecture affects not only internal resources such as IT elements, processes and personnel, but also organizational external relations. So, before it is being performed, it must be evaluated precisely in order to estimate its practicality. We should pay attention to the fact that performing an unsuitable architecture does not help to meet the organizational goal, causes disorder in business processes and imposes many expenses on the organization. Main purpose of enterprise architecture evaluation is to determine this point: in terms of good architecture, what properties dose the considered design has?

Answer to the above question has defined weak and strong points of architecture and so, has helped to manage of organization IT systems to make decisions like: choosing architecture from among several proposed architectures

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and investing to strengthen the existing of weak points.

Most of the researches performed to determine the properties of good enterprise architecture are based on qualitative models [4,5,6]. The main purpose of this paper is to determine the quality properties and characteristic of enterprise architecture

The rest of this paper is organized as follows. In Section 2, characteristics of qualitative software architecture are described. In section 3, in order to determine the purpose behind enterprise architecture, some of the main definitions of this concept are reviewed. Then, based on them and also based on qualitative characteristics of software systems quality characteristic; a quality model for characteristics of enterprise architecture is presented. In section 4, the proposed model is compared with some of the existing model. Section 5 includes the conclusion.

2. Qualitative Characteristic Of Software Architecture

To explain and determine qualitative properties and characteristics of the software, some quality models [7, 8, 9] such as McCall, Boehm, FURPS, IEEE, and ISO are used. These models are presented as tree constructions of qualitative properties and their relations. The first stage properties are called quality characteristics. Features such as efficiency, reliability, maintainability, portability, usability and functionality exist in most of the models. ISO/IEC 9126 gives a quality model which, in terms of coverage of quality characteristics, has more expansion than other models and determines software quality more [10].

The aim of evaluating software architecture is to predict and determine qualitative properties of a final product (Fig. 1). In the majority of methods used to evaluate and analyze architecture of software, the qualitative characteristics determined in quality models are used. Went before one of the most promising and comprehensive quality models in this field is ISO/IEC 9126 [11].

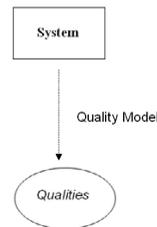


Fig. 1. Relation of Software Architecture and Quality model

In all models, software quality, or product usefulness is described in terms of several quality characteristics which are defined through several sub_characteristics in order to become more tangible. Most of these characteristics and sub_characteristics are qualitative and are not directly measurable. Like characteristics, sub_characteristics need to be described as precisely as possible in order to become concrete and tangible. This refinement is continued until it achieves a series of measurable metrics which are directly compatible with the considered characteristics. Some characteristics after a refinement stage turn to metrics.

3. Qualitative Model For Enterprise Architecture

We can determine the enterprise architecture properties based on two fundamental concepts. First, based on the determined purposes and definitions for enterprise architecture qualitative properties are tried to be illustrated. Then, regarding the quality theory in software architecture and its similarity with enterprise architecture, other necessary properties are defined. Therefore, to determine these properties, first some of the most famous definitions for enterprise architecture are reviewed:

Enterprise architecture is a base of strategy informational possessions which includes business mission, necessary data and technology needed to perform those missions and processes to serve modern technologies in replying to variable requirements of the mission [12].

Exhaustive and descriptive enterprise architecture about strategies provides key activities, information, organizational technology, function, and their effect on business processor. This method considers business processes and organization of construction and shows which technology is used to

perform such processes [13].

Informational architecture is a collection giving descriptive models about describing an organization in a way in which it can be in accordance with the established management requirements and be suitable and maintainable [3].

Clinger-Cohen law: A solid framework to develop and maintain the existence informational technology and achieving the new informational resource management is called organizational information architecture [12].

Enterprise architecture is a major view to organizational missions and functions, working processes, existing information, relational net, order of work performing which has the aim of making the data systems solid and efficient [16].

Enterprise architecture includes processes, mediums and necessary constructions to use informational technology solidly and harmoniously in the domain of organization to protect operations of the organization cycle in the present and in the future [15].

Regarding the EA definitions and other quality models, the following main properties must be included in any enterprise architecture:

Alignment: as mentioned in all descriptions, the main purpose of using information and communication technologies in organizations is to ease all management activities of that organization. Based on them, management designs strategies to reach the mentioned goals. Performing these strategies is defined by means of organizational functions. Information and communication technologies in this way must be developed and used in all levels of the organization. Business alignment is defined by illustrating coverage rate and providing goal requirements and functions by means of application systems.

Convergence: regarding the increase in use of elements of information technology in organizations and the wide variety in such elements their same direction must be paid attention to in design architecture. Those element involved in design architecture must be convergent and have the same direction to provide the goals more efficient. Control of accordance and converge process of an architecture is evaluated through this feature. Sub_characteristics of these properties are coverage rate of different layers of enterprise architecture.

Maintainability: Regarding the rapid variations in business environment conditions and necessities, organizations must adapt their business processes and strategies to new conditions and decisions. So the mediums and means of performing business processes must be flexible enough to make new decisions and perform them. Law variables, competitors, and new technologies are driving forces and an organization must have a good reaction towards them. Enterprise architecture in addition to having controllability of accuracy of current functions must adapt itself to new variables rapidly. This is called maintainability of a system [8, 9]. This property is defined by sub_characteristics such as analyzability and changeability.

Integrity: In recent years, regarding the fact that IT is new and unfamiliar for many and the fact that its use is quite costly, each organizational unit in different times provide an informational system based on its needs. In fact, each unit independently has provided a system for its own requirements. Therefore, different purchase demands in different times, have led to a collection of different information systems by different providers in the organization; this is like a collection of islands which lack an easy relationship and suitable relation with each other. Integrity is a feature which is introduced to prevent such problems. When this property is at the highest This property is considered in three aspects which are integrity in frameworks, integrity in data, and application integrity. Integrity at the application system stage is called interoperability. It means the ability to exchange the information or interoperate the process between two or more systems [2, 8, 9].

Fundamental elements of enterprise architecture are informational systems that perform considerable affairs. So, the software architecture properties are used to complete the necessary properties in enterprise architecture plans. These properties are in fact those properties, which are designed in every good product and are of a long term life cycle.

Reliability: It shows the accessibility range of services of enterprise architecture elements. This property is evaluated based on element function in time of architecture performing. Metrics like the average distance between faults, the ratio of times in which the service is active to the operation time duration are used to evaluate this property. But in architecture and before performing based on a series of properties, we can

predicate the reliability range of architecture. Fault tolerance and recovery are two sub_characteristics through which we can estimate and evaluate the reliability [8].

Efficiency: It shows the best use of IT systems of organizational resources. This property is defined by sub_characteristics such as time behaving and resource behaving. Undoing of unnecessary affairs and avoiding the strong of repeated or unnecessary information are examples of efficiency in systems. In this property regarding the importance of time, useful times to give services in a sub_characteristic are investigated and other useful resources such as memory in other sub_characteristic are evaluated [8].

Security: Today information and related technology have been one of the most important resources in any organization and security is very important in IT. Security must not only protect, but also provide legal accessibility. The issue of protection of information and application systems from unauthorized access, use, disclosure, disruption, modification and destruction in order to provide confidentiality, integrity and availability are considered here [5].

Usability and Implementability: If an enterprise architecture plan is new and suggested to implement in organization, usability and implement ability must be considered. Necessary time and expense for performing and compatibility of a design with position and possibilities of organization are related sub_characteristics.

In Fig. 2, all qualitative characteristics and sub_characteristics of enterprise architecture are shown and summarized.



Fig. 2. Quality Model of Enterprise Architecture

4. Comparison With Other Methods

In this part, the proposed model is compared with several model that presented for analysis and evaluation methods of enterprise architecture. Comparison is done in many aspects.

1) The first point concerns the depth and exactness of the quality model. If quality characteristics tree is multilevel regarding the one level model, it will have more exactness. That is the result of more dividing properties to more sub_characteristics.

2) Another point is investigating the number of proposed model properties with other models. Dose the proposed model covers all their properties and have more characteristics?

The model used in the reference [4] was a level qualitative characteristics tree and in comparison with the proposed method, in which characteristics are categorized in several levels has less a depth, accuracy, and all its characteristics are covered by the proposed model. Convergence, reliability, integrity especially interoperability and

usability in this model have not been considered.

The second model presented in [5] uses a one-level model too. All of its characteristics are covered by the proposed model; however, integrity and usability are not included in it. Usability is mentioned in this model but it does not mean to investigate the problems of performing and implementing the proposed architecture.

The third model is presented in [6]. This model is multilevel and in this approach is according to proposed model in this paper. All of its properties have been covered by the proposed method, but convergence and administratively have not been considered and alignment and integrity are considered briefly by this model. Integrity has been considered based on interoperability.

5. Conclusion

Enterprise architecture can be a practical tool to increase the management power on information technology of any organization. It has the aim of creating harmony between the elements of information technology to achieve organizational goals.

This paper, regarding the goal of enterprise architecture, tries to give a model for define a good enterprise architecture that can use in evaluating. This model is defined based on the characteristics of good enterprise architecture and its organization in a quality model. This model can use in analysis of weak and strong points of an enterprise architecture design. This way, management in using the suggested enterprise architectures obtains a strong tool. At the end of this paper, the proposed model is compared to some other methods and its weak and strong points, as well as its advantages are shown. This paper can be considered as a reference for qualitative models of enterprise architecture. This paper tries to help stakeholders to have a correct comprehension about enterprise architecture. Based on this matter, they can express their qualitative requirements well and follow them in software production cycle correctly.

As future works, this research can be as an introduction qualitative models design, particularly in special purpose enterprise architecture. Also, it can make a good basis for designing the qualitative metrics of enterprise architecture.

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