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The Principle of Architecture First in Software Project Management Minimizes the Cost of Software Development Process: A Review

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Abstract: ***Software architecture involves the structure and organization by which modern system components and subsystems interact to form system and the properties of systems that can best be designed and analyzed at the system level. This paper provides a review of the principles of architecture first approach in software project management and its effect on cost of software development process. This paper reviews the literature and practitioners' experiences relating to architecture first approach, and advantages of architecture first approach in cost of software development process. This paper also reviews related works about factors that may reduce the cost of software development process. Weobserved parameters related to software architecture that may affect the cost of software development process.The parameters are software (product) delivery time, defect prevention, risk mitigation, and change management. After this, the parameters show that they have their own effect on the software development process. Finally, the paper concludes by describing how those parameters affect the cost of software development process***.

Keywords— Software architecture, Architecture-first,softwaredevelopment cost, Project Management.

I. INTRODUCTION

The term software architecture is not new and it has been the main research area for the last three decades by many researchers and practitioners. It is the structure or structures of the software product, which comprise software elements, the externally visible properties of those elements, and the relationships among them [2, 3]. Software architecture includes the set of significant decisions about the organization of a software system including the selection of the structural elements and their component to connect each other; behavior as specified in collaboration among those elements; composition of these structural and behavioral elements into larger subsystems; and an architectural style that guides this organization[4]. Software architecture also involves functionality, usability, resilience, performance, reuse, comprehensibility, economic and technology constraints, tradeoffs and aesthetic concerns[4, 5].

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In the 1990s, Rational Software Corporation began evolving a modern process framework to capture the best practices of iterative development more formally [6]. At that time the concept of architecture first is began to appear. In modern software project management, there is a principle called architecture first, this means before starting implementation (coding) of the software architectural design must be completed. In other word, the software development team must have to do the process of defining a structured solution that meets all of the technical and operational requirements, while optimizing common quality attributes such as performance, security, and manageability[7].In architecture first approach, to start the software development, the development team must first thoroughly identify the requirements then chooses the significant design decision. Before start the development, process check the selected resources are sufficient for complete software development. Second establish iterative lifecycle process that tackle risk early [8].

In this paper I would like to discuss related works on software architecture, the effects of architecture first approach in different parameters for example its effect on product delivery time, in defect or error prevention, on risk mitigation, and on how changes are managed after implementation. Moreover, detailed description of the architecture first approach with its effect on cost of software development process presented in the next subsequent subtopics.

II. LITERATURE REVIEW

Even though there are good, bad, and elegant architectural designs are there in the software industries, at the heart of every well-engineered software system there is a software architecture that means the set of principal design decisions that gives detail description about the system[9]. Walker Royce shows that by applying proper engineering practices before starting the implementation, modern principles result in less total failure and rework during the lifecycle of the software development[10].

According to Grady Booch's paper about the economics of architecture first, some peoples who have experience on agile software development believed that using architecture first approach is undesirable because they think that system architecture should emerge over time.

On the other hand, agile projects often start by assuming a given requirement and environment context together with a set of design patterns for the problem area[7].

Grady Booch also discusses his experience on his paper which is called The Architect's journey, every reasonably interesting software-intensive system uses a couple or dozens of architectures[11].

III. EFFECT OF ARCHITECTURE FIRST APPROACH

In this section parameters related to software architecture that will affect the cost of software development process will be described. Here I have described four parameters that may affect the cost of project development process, and they are Delivery time, Defect prevention, Risk mitigation, and change management. All the parameters described below are observed from related works and they have direct and/or indirect effect on software development process.

On delivery time

Architecture first approach gives structural view of the software and its components for the development team simply by looking the diagrams. This will give common understanding for all the team members. By focusing on the software architecture provides a means of intentional simplification[7]. It sometimes used as a medium for communicating aspects of the software system to the different individuals in the team for both those specialists and non-specialists in the area [12]. Therefore, this helps the project manager to save time that will spend for the training and helps the project to start early. If the project is started early by the schedule, the chance of late delivery will be minimized.

On defect prevention

Well-architected software's are easy to find out errors and defects early. If the architecture is there the software development team have their own understanding where and when defects will be appearing and they know how those defects are prevented. On the other hand, if defects are prevented early, software maintenance costs can be reduced significantly. If the software architecture is well defined, clearly documented, and creates an environment that promotes design consistency through the use of guidelines and testing quality [13]. This clearly shows that the cost of maintenance and defect prevention will beminimized.

On Risk

Risks on software development projects must be successfully mitigated to produce successful software systems [14]. In this case, in order to build successful software system architecture must be defined in early phase of software development, i.e. before starting implementation. Many development processes focus directly on software architecture in order to build a quality software solution according to the defined requirements [10]. In each phase of architecture, different diagrams (for example, use cases) are assigned and risks are identified and attacked [7]. In this manner, architecture first approach helps to mitigate risk before causing high impact of the software product.

On change

As Grady Boochconductedthat, a software developed by using architecture first approach is often resilient to change[7]. Change is always happening in the environments or business logic of organization that uses software system. Poorly architected systems are usually taken high cost for change management when we compare to the well-architected systems. Therefore, we can understand that if we are using architecture first approach it will helps us to manage changes in the software product easily.

On Cost

The cost of software development process depends on all of the parameters listed above. If the software product is delivered on time, we are minimizing the cost of software development process because most projects now a day are running out of time and most projects are aborted because of late delivery [15]. When I come to the second parameter which is defect prevention it is obviously known that when we prevent defect the cost of maintenance will be reduced. Risk mitigation also has its own effect on software development cost. The other parameter is change management as I described above well architected systems are resilient to change. If change is needed it is easy to perform the change depending of the architecture of the system.

IV. CONCLUSION

The software architecture of a program or computing system is the structure or structures of the system, which comprise software elements. Architecture first approach is an approach in software project management or in software engineering and it states that before implementing any software the architectural design part must be completed. As I observed in related works about architecture first approach it has a lot of advantages in the software industry today.Using architecture first approaches have a positive impact of the cost of software development process. In this paper I have discussed some parameters like product delivery time, Risk mitigation, Defect prevention and change management which may affect the cost of software development process. Finally, I would like to conclude that those parameters listed above have a greater and positive impact on software development process. Therefore, we can minimize the cost of software development process by using the principle of architecture first approach.

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