Chapter 6
Discussion and
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This chapter discusses about the future of software architecture and project management, future role of software architects and project managers. In addition, this chapter also discusses about the direction of future of project management. As the software evolves over time, there is also a discussion on the future enhancement of software architecture. Finally, an overall conclusion will follow to summarize this research paper.

6.1 Software Architecture in Future

As software evolves over time, software process is also being influenced by architecture-centered development. Architecture-centered development is utilizing architectural design on the development activities. This approach also ensures that the project management and implementation of system conforms to the architectural design.

In the future, there will be more or higher abstractions with more decomposition involved. This scenario will affect the software development process, which results more practicable to use software architecture as it allows more reusability of existing connectors and components.

By having common and standardized notation, it pictures the architectural design and makes the software architect's and project manager's task easier and more efficient. With the integration of Unified Modeling Language (UML) into architectural design, there is higher expectation on more utilization of UML that makes the support more explicitly.

In an organization, the importance of software architecture is already well known and recognized as a vital process in designing phase. Software architecture is acknowledged as valuable company asset as competitive advantage. Thus, it is not just a normal business
reengineering process but it covers much advantage and revolutionizes the task and pattern of project manager as a whole. Therefore, the incorporation of software architecture is known as a worthwhile investment into an organization.

With more usage of software architecture throughout most organization, there is an anticipation where more specific and sophisticated tool, technique and technology in designing software architecture. Thus, handling a large and complex project will not be a major challenge to a project manager where architectural design acts as a blueprint to assist. In the situation, the job of software architect will be easier. Software architecture will be a catalyst to bring more reusability level to software development.

6.2 Project Management in Future

In the increasingly use of software architecture in the designing process, project management especially on system has dramatically changed over time. Shorten time-to-market has greatly challenged project management. The compression of product life cycle is recognized as the major driving force of process in managing project.

Besides handling shorter product life cycle with increased number of projects, project management will definitely face more risk such as scarce resources and multiple conflicts. However, as the software architecture comes into the project management picture, it revolutionizes the culture of project management process.

Managing project interfaces will acquire a greater significance. Project manager will no longer manage project alone but instead he/she will emphasize more on managing the interface between the project and the rest of organization. The project manager will face the challenge of not only meeting project requirement but also the stakeholders' decision, thus
preserve the integrity of the project. Hence, software architecture performs as a vehicle communication among the stakeholders in an organization.

Globalisation emerged recently as a result of information explosion for the last decade as Internet being commercialized. Computation is never the same for the last ten years. Global competition touches every organization in the world either directly or indirectly. In order to stay competitive, software architecture becomes the answer. Software architecture is well known of giving an organization competitive advantage. By incorporating software architecture in project management, project management becomes more effective and efficient in whatsoever areas especially in managing risk and estimating cost of the project. Eventually, the performance and productivity of project manager increase.

6.3 Future Role of Software Architect

This research paper is trying to map the role of software architecture into the project management process. Thus, software architect becomes the key technical consultant to the project manager. Software architect involved in making a number of major technical decisions after considering the stakeholders’ decision.

In handling a large and complex project, the role of a software architect must be differentiated from a project manager so that their duties are not neglected. Architect plays an important role in coaching the development team in designing and implementation tasks associated with the architectural design. While a project manager is obliged for the organization of the project and managing the resources, budget, risk and schedules. Table 6-1 below are the different roles played by the software architect and project manager:
Software architecture will definitely emerge to be compulsory just as the presence of customer requirements in software development. Without architectural design of software system is a body without bone, which means no foundation in the development. Therefore, software architect requires having a vision of the product to be developed. After vision being conceived, the vision needs to be communicated effectively.

As the software architect becomes the pioneer in capturing the requirements into pictorial representation, the architect is meant to be the key technical consultant of the project. The architect will manage dependencies, review and negotiate requirements, track the quality design and ensure that the architecture conforms to design goals. He/she is the person who will make decision and identifies any risk involved.

The task of software architect does not finish here. The architect also acts as a coach where establishing conversation with team members, teaches them and listens to feedback. Architect also coordinates activities that influence the architecture and maintains the integrity of the design where the architectural design needs to be followed.
Finally, software architect is also an implementor. He/she may look into low level detailed design, explore and evaluate design decisions. Architect may implement vertical to minimize implementation risk and may implement components as an implementation for developers.

4 Future Role of Project Manager

A project manager will work with others to formulate schedules, organize project development team, track the progress of project and announce tasks to carry out. Besides these fundamental responsibilities, project manager also expedites activities, finds out ways to solve technical problems, serves as peacemaker and decides appropriate trade-off among time, cost and quality of the project.

The project manager also responsible to integrate assigned resources. During the project progress over the time, he/she will need to track the progress, initiate changes in the plan and schedule if any problem persists. Project manager also innovates and adapts to ever-changing circumstances.

The project manager requires to have both management and leadership skills at the same time in order to become a good manager. A good management skill will drive others to participate to day-to-day schedule and a good leader is a person who is able to inspire people about changes according to his/her vision. In recognizing those criteria, a project manager able to manage project interfaces well and build a good social network.

When a project becomes more and more complex and larger, the responsibility of a project manager definitely becomes heavier. As a result, the risk involved also expand and the constraint of resources also rise up. With the shorten time-to-market product, minimized
budgetary and specific development personnel, the challenge for the project manager is changing from preliminary project requirements into continuous and boundless needs.

In managing a software system project especially, requirements are bound to change dramatically over time. Sometimes, the project manager is not informed correctly regarding to those changes involved especially in technical changes. Thus, the software architect will surely revolutionize the working culture and pattern of the project manager. The project manager needs to incorporate architectural design into the project resources planning and work breakdown structures. As the changes occur in the architecture level, the project manager will recognize and respond effectively to this situation in a better manner.

### 6.5 Future Enhancement

This research paper concentrates on how the application of software architecture on the field of project management. In this paper, architectural design is discussed in terms in project management especially on how it assists project manager to estimate cost, forecast schedules, and predict risk in order to maximize the utilization of the current resources.

Architectural-assisted project management (AAPM) is introduced to map the architectural design from software architecture. Since AAPM is a design notation, therefore, in future enhancement, the design should be supported by graphic user interface (GUI) drawing tools in order to enhance usability and evolution of AAPM.

Besides the drawing tools, there is also suggestion to simulate the estimation for budgetary control, estimation of risk and forecasting of the duration of the project. This simulation should be based upon the architectural level of the AAPM notation. Therefore, any dependency on the notation is followed to ensure preciseness and accuracy.
6.6 Feedback and Comments from the Industry

Since software architecture is a new concept to most of the companies, the practice to incorporate architectural design into the development phase is impractical. The architectural-assisted project management is given to some companies to assess and evaluate. However, different kinds of feedback were obtained, which differ to one another.

In small and medium company, programmers themselves do the design process. Therefore, there is no standard guidelines or design to follow and practice. This practice is due to their simplicity and smaller project. In most of the projects, there is no regular basis to reuse the components and objects that have been developed. However, they agree that if there is a standard way to design in software and project level, the result should be better.

In a larger organization, most of the projects are large and complex. Hence, in most of the time, project is decomposed to different modules or subtasks to develop. For the last decade, they have already practiced to follow a standard way of design according to the industry demand. However, software architecture is still a new concept to some of the companies. They also suggested if there is a body to control the notation either in software or project level, probably, this notation will be widely used in design.

All in all, most of the companies agree that a standard way of design such as software architecture and AAPM notation are useful and beneficial not only for completing project on time and within budget but also act as a powerful tool in strategic plan in an organization. In years to come, all the companies hope that architectural design will assist them in resource planning and management.
6.7 Overall Conclusion

Throughout this research paper, the world of software engineering has been mapped into the world of business. The separation of these two worlds have been pulled together in order to stay ahead of others and this result to become a competitive advantage. The importance of software architecture has been recognized and this paper explains how utilization of architectural design is being met in project management.

In the initial phase where requirements are captured, software architecture is beginning to present in the process of producing architectural design. Software architecture becomes the vehicle of communication among all the stakeholders and represents the early design decision. Besides, software architecture also allows higher level of abstractions and resulting increased reused level of software.

By applying software architecture patterns and styles in the architectural design for all views (conceptual, module, execution, code), it defines the vocabulary of components and connectors that exist in the system. Besides, it also describes the constraints available that define how components can be integrated into a system. Analyzing the software requirements in a project will explore the architecture styles of a system.

Designing software architecture often involves the functionality and the quality attributes that are defined earlier. The design is always based on the architectural styles chosen from the stage before. Architecture transformation will proceed where the design of structure of structures of the system is being decomposed and implemented according to the quality attributes that have been defined.

Visual notation of software architecture, where part of the notation are derived from Unified Modeling Language (UML) notation, it will become the blueprint of the architecture-
centered development. The visual notation is being utilized as a tool to the project manager in the project resources planning, budgetary and risk analysis and management.

All in all, this research paper reveals the importance of software architecture not only to the software architect but also to project manager. Software architecture is well known to handle large and complex projects. In this paper, it discloses architectural design definitely enhance the effectiveness and efficiency of the performance of the project manager. Project management becomes more challenging, as the project becomes more complex. However, with the incorporation of software architecture into project management, the tasks of the project manager will evolve in this ever-increasingly, changing environment.