Comparison Between Architecture Trade-off Analysis Method (ATAM) and Software Architecture Analysis Method (SAAM)

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1. INTRODUCTION

Software architecture evaluation method could happens more than once in a Software Development Life Cycle (SDLC). This paper will discuss the details of Architecture trade-off analysis method (ATAM) and Software Architecture Analysis Method (SAAM) before discussing the comparison between both evaluation methods.

Among the attribute that being evaluate are maintainability, performance, testability, performance, modifiability, robustness, portability, extensibility, integrability and functional coverage.

Category of Architecture evaluations

The idea of evaluating an architecture is to detect its possible risk and strength of that particular architecture. This evaluation brings numerous good effects in a SDLC as its save cost of possible maintenances which usually cost more. In a SDLC, maintenance is the of having longest timeline even after user acceptance test happens. This is why, reducing these cost is crucial to preserve a business nature.

Software architecture evaluation methods can be divided into four main categories such as experience-based, simulation-based, mathematical modelling based. (Maurya & Hora, 2010) These categories are not necessarily independence and each have their own uniqueness.

Experience-based evaluations strongly rely on experts experience in developing the architecture of systems. These experts usually senior consultants in any software development business. Experts of their fields, would share and guide the new systems based on previous experience with the same architecture styles. (Maurya & Hora, 2010)

Simulation-based evaluations depends of how the components of the software being used in the system heavily. It simulates the quality requirements such as modifiability and portability of the system. Some researchers suggested that simulation best combined with prototyping of the system to be developed. (Maurya & Hora, 2010)

Mathematical modelling, as the name suggest, uses mathematical equations in evaluating and calculate how possible the systems to works or breaks. These mathematical modelling could be done perpendicular along with simulation based evaluation to form much accurate answer. (Maurya & Hora, 2010)

Scenario-based architecture evaluation calculate risk of components of an architecture by creating possible scenario that would happens based on all the quality attribute, the scenarios are then arrange according to their fatality risk or based on other factors. (Maurya & Hora, 2010)

2. Architecture Trade-off Analysis Method

INTRODUCTION

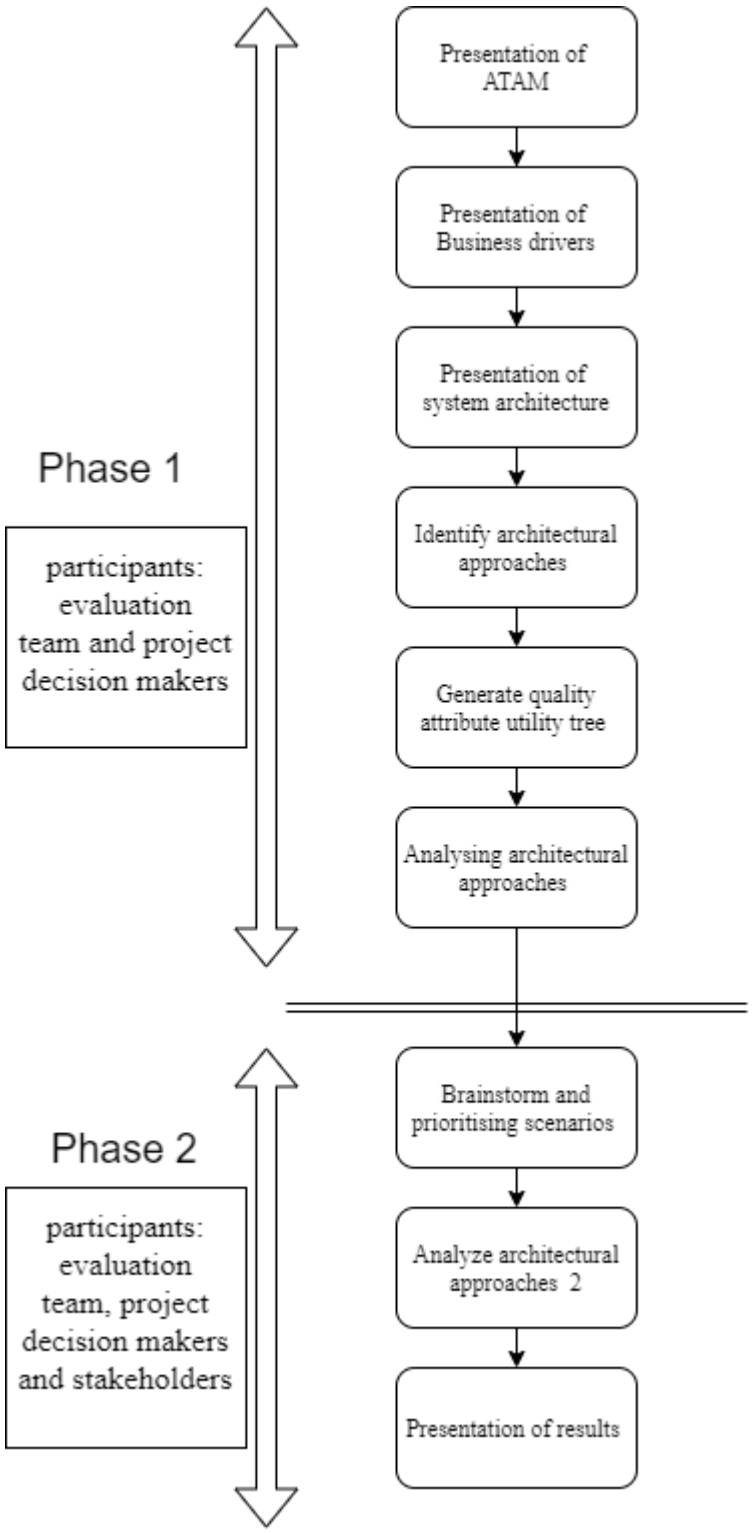
Architecture trade-off analysis method (ATAM) is a method of finding and gauge a software system in a software development life cycle (SDLC). IN SDLC, there's specific functional and non functional requirements which are being us for users to know and evaluate the expected outcome of a system. (Kazman, Klein, & Clements, ATAM: Method for Architecture Evaluation , 2000) These requirements are being counted to evaluate the risks or side effect it would bring to the system. Thus, ATAM normally being implemented at the early stage of SDLC, in order to reduce the cost of building the system. The main idea of ATAM is to find the risk of implementing a particular architecture relative to the goals of the system.

ATAM is the extension of SAAM method of evaluating a software architecture, where it's main objective to handles trade-off between different quality attribute. (Maurya & Hora, 2010) ATAM analysis are much more details compare to SAAM. The evaluationers consist of stakeholders of the system, technical staff, evaluation team, and decision makers of the projects. (Muhammad Ali Babar I. G., 2004)

ATAM PROCESS

ATAM process flows is where stakeholders discussing business drivers of a system which then create scenarios of non-functional requirements or quality attribute of the systems. These scenarios use to create analysis trade-offs which include the risk of the systems, based on proposed architecture design of the system. (Maurya & Hora, 2010) The results stated the risk and implication it has on the systems and the process repeated at every cycle in SDLC. (Kazman, Klein, & Clements, ATAM: Method for Architecture Evaluation , 2000)

ATAM method consists of nine steps:



Despite having 9 steps, the method divided into 2 steps. Phase 1 study and evaluate all quality attribute of the architecture, and at phase 2, where trade-off happens, when stakeholders prioritizing the quality to suit the architecture. (Muhammad Ali Babar I. G., 2004)

ATAM BENEFITS.

Stakeholders are those who benefits the most from ATAM. As ATAM would reduce the cost of maintenance of the architecture of the system once there's modification to be done, as possible risk had been layout at the first place. This preserve the resources which is the cost of production of the system application. Plus, ATAM also improves stakeholders communication in deriving requirements. (Software Engineering Institute, 2001)

Besides that, ATAM also clarified all components of architecture in details manner. This would made the architecture documentation becomes better and easy to be revised in the next changes.

Thus, the systems output would be better and a better quality product able to be delivered to clients. This would increase clients satisfaction and trustiness towards the business. (Kazman, Klein, & Clements, ATAM: Method for Architecture Evaluation , 2000)

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OUTPUTS OF ATAM

At the end of ATAM process, few things are expected, such as accurate architecture layout, deep understanding of business goals, a collection of scenarios of quality attributes, a set of risks and non-risks of quality attributes and the system architecture, a set of identified sensitivity and trade-off points, and a set of risk themes. (Kazman, Klein, & Clements, ATAM: Method for Architecture Evaluation , 2000) (Software Engineering Institute, 2001) (Marczydło, 2017)

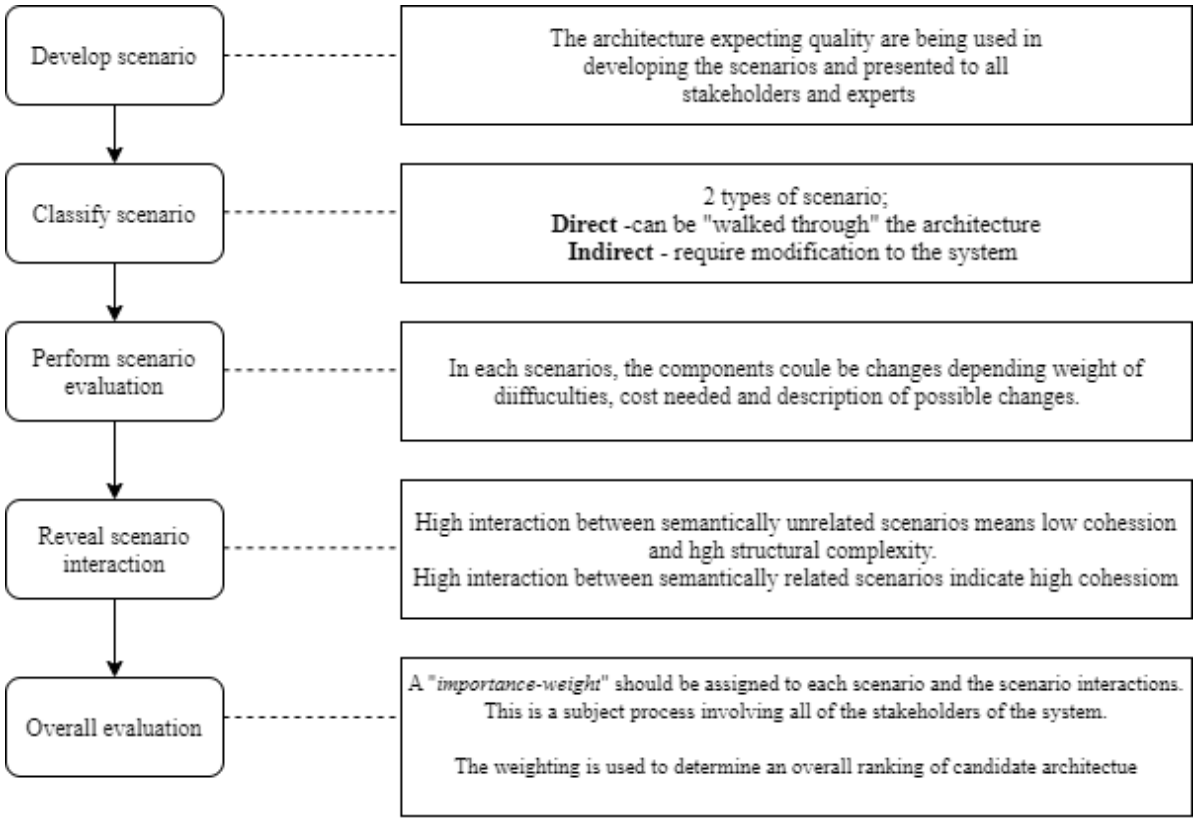
3. Software Architecture Analysis Method

INTRODUCTION

SAAM is the first scenario-based software architecture analysis method. The original focus was on distinguishing the difference of the component of an architecture. As time change, Software Architecture Analysis Method (SAAM) is a scenario-based software architecture evaluation method where analysis are made using coupling metrics between components of an architecture of a system. (Maurya & Hora, 2010) During the evaluation, the quality attributes of multiple architecture are being studied by using case-study method in most cases. These analysis is to determine how good the quality attributes being implemented and the possible changes it could affect the system architecture. (Kazman, Len Bass, & Webb, SAAM: A Method for Analyzing the Properties of Software Architectures, 1994) The stakeholders that involves in SAAM are architect, developer, maintainer and product manager. (Muhammad Ali Babar I. G., 2004) (Marczydło, 2017)

SAAM STEPS PROCESS

The process step of SAAM is describes below. Where these 5 steps are being done in single or multiple architecture, as stated before. At the last step, 'Overall evaluation' is where all architecture are being evaluate within each other to find the one that suit the requirement of the system. (Muhammad Ali Babar I. G., 2004) (Kazman, Len Bass, & Webb, SAAM: A Method for Analyzing the Properties of Software Architectures, 1994) (Merit, 2013)



SAAM BENEFITS

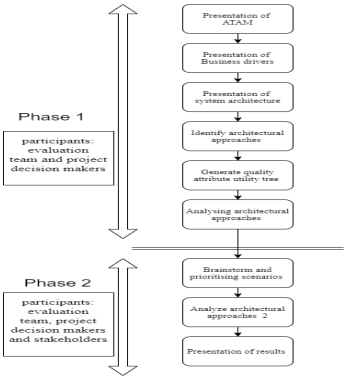
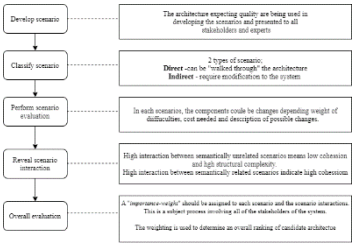
Among the benefits of SAAM are problems get detected at early stage of development. This problems get documented for future changes reviews and also to increase the stakeholders understanding of the issues. SAAM has a few technique that ATAM don't have such as characterising, eliciting and classifying od scenarios. These method the reasons why SAAM had become successful in evaluating an architecture details.

Just like ATAM, stakeholder's communication would increase greatly besides the mapping of scenarios and quality increase their understandability of the systems. This mapping eventually, reduced the cost of maintenances of the systems as the possible risk already been map out for the stakeholders to be cautious off. (Ionita, Hammer, & Obbink, -)

SAAM OUTPUT

SAAM's strength rely on stakeholder's understanding and vision towards the system. The stakeholders could be the evaluating team or the business partner of the systems. As the scenarios as based on stakeholder's knowledge and indirect vision, the energy needs are little. However, these comes problems, as SAAM doesn't have the proper metric to calculate the scenario attribute and risk into details. (Merit, 2013) (Maurya & Hora, 2010)

4. ATAM VS SAAM COMPARISON

ATAM		SAAM
Scenario-based that evaluate an architecture- level design that considers multiple quality attributes and trade it off to gain insight as to whether the implementation of the architecture will meet its requirements.	**CATEGORY**	Scenario-based that evaluate a single architecture or making several architectures comparable using metrics such as coupling between architecture components
User-based based on stakeholders understanding	**ANALYSIS DEFINITION**	User-based based on stakeholders understanding
9 Step divided into 2 phase that happens to one architecture. Phase 1 discuss all quality attribute and risk it posed at the system. At phase 2, trade off happens where attribute being change according to the architecture. 	**NO OF STEPS**	5 Step that happens to more than one architecture. At the end step, all architecture is being compare within each other to see which one worth the more and has less risk to be implemented in the system. 
Scenario trade-off points based on sensitivity.	**METRICS**	Scenario classification (direct and indirect)
Comprehensively Detail. As ATAM only study one architecture, the quality attribute and	**PROCESS DESCRIPTION**	Not details. As SAAM study more than one architecture, the quality attribute scenario are not define thoroughly. It being study in terms

its impact been specify in details to fully understand the risk.		of how the impact it would bring towards the architecture, if it being implemented in system.
Multiple to allow trade-off between components	**ATTRIBUTE**	Modifiable component attribute.
All quality attribute. ATAM study all quality attribute that would poses risk towards the system architecture.	**APPLICABLE FOR**	All quality attribute. SAAM study all quality attribute that would poses risk towards the system architecture.
• Accurate architecture layout • Deep understanding of business goals. • A collection of scenarios of quality attributes. • A set of risks and non-risks of quality attributes and the system architecture. • A set of identified sensitivity and trade-off points. • A set of risk themes.	**OUTPUT**	• technical results: provides insight into system capabilities. • social results – forces some documentation of architecture – acts as communication vehicle among stakeholders

Based on the category, we can see, the despite being in the same category, the scenario each method evaluate is different. ATAM only study one architecture, and presents all the quality attribute the architecture and trade it off to ensure the requirement of system can be meet. SAAM study multiple architecture and compare each architecture with coupling method, to see if the particular architecture can fulfil the specify requirement or not.

Based on analysis definition, it depends of user's understanding. In both cases, both stakeholders consist of the same party. They consist of stakeholders of the system, evaluation team, and decision makers of the projects.

Based on the metric, despite being in same scenario category, the metric each method has is different. ATAM using trade-off after analysis the risk and benefit of the quality. Any quality that seem to impact the architecture greatly will be trade with other attribute to cover the weakness it has. SAAM based on classification of impact of the attribute towards the

architecture. Architecture that has lower risk directly and indirectly on the architecture system would be chosen.

As discussed above, the tables gives a better view and understanding of differences between ATAM and SAAM. Both are great methods and useful in reducing cost of maintanence of a system. Although both are scenario based analysis, each produce different outcome as the technique used is vary and independence. Both method able to completes the task of locating possible errors in a systems.

5. CONCLUSION

The architecture of a software system has been identified as an important aspect in software development, since the software architecture impacts the quality attributes of a system, e.g., performance and maintainability. A good software architecture increases the probability that the system will fulfil its quality requirements. Therefore, methods for evaluating the quality attributes of software architectures are important.

These evaluation not only has more benefits than harm, but it also increase knowledge of every player in the teams. At the end of the day, a good and quality product is what aimed by every stakeholders, thus, methods of achieving it, do plays big roles.

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