ARCHITECTURE EVALUATION

EVALAUATION FACTORS

Evaluation usually takes one of three forms:

- Evaluation by the designer within the design process
- Evaluation by peers within the design process
- Analysis by outsiders once the architecture has been designed

CONTEXTUAL FACTORS For peer reviews or outside analysis, there are a number of contextual factors that must be considered when structuring an evaluation. These include the artifacts available, whether the results are public or private, the number and skill of evaluators, the number and identity of the participating stakeholders, and how the business goals are understood by the evaluators.

What artifacts are available? To perform an architectural evaluation, there must be an artifact that describes the architecture. This must be located and made available. Some evaluations may take place after the system is operational.

Who sees the results? Some evaluations are performed with the full knowledge and participation of all of the stakeholders. Others are performed more privately. The private evaluations may be done for a variety of reasons, ranging from corporate culture to (in one case we know about) an executive wanting to determine which of a collection of competitive systems he should back in an internal dispute about the systems.

Who performs the evaluation? Evaluations can be carried out by an individual or a team. In either case, the evaluator(s) should be highly skilled in the domain and the various quality attributes for which the system is to be evaluated. And for carrying out evaluation methods with extensive stakeholder involvement, excellent organizational and facilitation skills are a must.

Which stakeholders will participate? The evaluation process should provide a method to elicit the goals and concerns that the important stakeholders have regarding the system. Identifying the individuals who are needed and assuring their participation in the evaluation is critical.

What are the business goals? The evaluation should answer whether the system will satisfy the business goals. If the business goals are not explicitly captured and prioritized prior to the evaluation, then there should be a portion of the evaluation dedicated to doing so.

ARCHITECTURE TRADEOFF ANALYSIS METHOD (ATAM)

The Architecture Tradeoff Analysis Method (ATAM) has been used for over a decade to evaluate software architectures in domains ranging from automotive to financial to defense. The ATAM is designed so that evaluators need not be familiar with the architecture or its business goals, the system need not yet be constructed, and there may be a large number of stakeholders.

Participants in the ATAM

The ATAM requires the participation and mutual cooperation of three groups:

The evaluation team: This group is external to the project whose architecture is being evaluated. It usually consists of three to five people. Each member of the team is assigned a number of specific roles to play during the evaluation

Project decision makers: These people are empowered to speak for the development project or have the authority to mandate changes to it. They usually include the project manager, and if there is an identifiable customer who is footing the bill for the development, he or she may be present and The architect is always included.

Architecture stakeholders: Stakeholders are the ones whose ability to do their job hinges on the architecture promoting modifiability, security, high reliability, or the like. Stakeholders include developers, testers, integrators, maintainers, performance engineers, users, builders of systems interacting with the one under consideration. Their job during an evaluation is to articulate the specific quality attribute goals that the architecture should meet in order for the system to be considered a success.

OUTPUTS OF ATAM

As in any testing process, a large benefit derives from preparing for the test. In preparation for an ATAM exercise, the project's decision makers must prepare the following:

1. A concise understandable presentation of the architecture.
2. Articulation of the business goals. Frequently, the business goals presented in the ATAM are being seen by some of the assembled participants for the first time, and these are captured in the outputs.
3. Prioritized quality attribute requirements expressed as quality attribute scenarios.
4. A set of risks and nonrisks. A risk is defined in the ATAM as an architectural decision that may lead to undesirable consequences in light of stated quality attribute requirements. Similarly, a nonrisk is an architectural decision that, upon analysis, is deemed safe. The identified risks form the basis for an architectural risk mitigation plan.
5. A set of risk themes. When the analysis is complete, the evaluation team examines the full set of discovered risks to look for overarching themes that identify systemic weaknesses in the architecture or even in the architecture process and team. If left untreated, these risk themes will threaten the project's business goals.
6. Mapping of architectural decisions to quality requirements. Architectural decisions can be interpreted in terms of the qualities that they support or hinder.
7. A set of identified sensitivity and tradeoff points. These are architectural decisions that have a marked effect on one or more quality attributes.

The outputs of the ATAM are used to build a final written report that recaps the method, summarizes the proceedings, captures the scenarios and their analysis, and catalogs the findings.

STEPS OF EVALUATION PHASES OF ATAM

The ATAM analysis phases (phase 1 and phase 2) consist of nine steps. Steps 1 through 6 are carried out in phase 1 with the evaluation team and the project's decision makers: typically, the architecture team, project manager, and project sponsor. In phase 2, with all stakeholders present, steps 1 through 6 are summarized and steps 7 through 9 are carried out.

Phase 1

Step 1: Present the ATAM

The first step calls for the evaluation leader to present the ATAM to the assembled project representatives. Using a standard presentation, the leader describes the ATAM steps in brief and the outputs of the evaluation.

Step 2: Present the Business Drivers

Everyone involved in the evaluation, the project representatives as well as the evaluation team members, needs to understand the context for the system and the primary business drivers motivating its development. In this step, a project decision maker (ideally the project manager or the system's customer) presents a system overview from a business perspective. The presentation should describe the following:

- The system's most important functions
- Any relevant technical, managerial, economic, or political constraints
- The business goals and context as they relate to the project
- The major stakeholders
- The architectural drivers (that is, the architecturally significant requirements)

Step 3: Present the Architecture

Here, the lead architect (or architecture team) makes a presentation describing the architecture at an appropriate level of detail covering technical constraints such as operating system, hardware, or middleware prescribed for use, and other systems with which the system must interact. Most important, the architect describes the architectural approaches used to meet the requirements.

Step 4: Identify Architectural Approaches

The ATAM focuses on analysing an architecture by understanding its architectural approaches. The team simply catalogs the patterns and tactics that have been identified.

Step 5: Generate Quality Attribute Utility Tree

In this step, the quality attribute goals are articulated in detail via a quality attribute utility tree. The evaluation team works with the project decision makers to identify, prioritize, and refine the system's most important quality attribute goals. These are expressed as scenarios which populate the leaves of the utility tree.

Step 6: Analyse Architectural Approaches

Here the evaluation team examines the highest-ranked scenarios (as identified in the utility tree) one at a time. Along the way, the evaluation team documents the relevant architectural decisions and identifies and catalogs their risks, nonrisks, sensitivity points, and tradeoffs.

Phase 2

In phase 2, step 1 is repeated so that the stakeholders understand the method and the roles they are to play. Then the evaluation leader recaps the results of steps 2 through 6, and shares the current list of risks, nonrisks, sensitivity points, and tradeoffs. Now the stakeholders are up to speed with the evaluation results so far, and the remaining three steps can be carried out.

Step 7: Brainstorm and Prioritize Scenarios

In this step, the evaluation team asks the stakeholders to brainstorm scenarios that are operationally meaningful with respect to the stakeholders' individual roles. Once the scenarios have been collected, they must be prioritized to know where to devote limited analytical time.

Step 8: Analyze Architectural Approaches

After the scenarios have been collected and prioritized in step 7, the evaluation team guides the architect in the process of carrying out the highest ranked scenarios. The architect explains how relevant architectural decisions contribute to realizing each one.

Step 9: Present Results

In step 9, the evaluation team groups risks into risk themes, based on some common underlying concern or systemic deficiency. For each risk theme, the evaluation team identifies which of the business drivers listed in step 2 are affected. Identifying risk themes and then relating them to specific drivers brings the evaluation full circle by relating the final results to the initial presentation, thus providing a satisfying closure to the exercise. The collected information from the evaluation is summarized and presented to stakeholders. Then the following outputs are presented:

- The architectural approaches documented
- The set of scenarios and their prioritization from the brainstorming
- The utility tree
- The risks discovered
- The nonrisks documented
- The sensitivity points and tradeoff points found
- Risk themes and the business drivers threatened by each one