Reviewing Architecture Documents Using Question Sets

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Abstract

This paper proposes a structured approach for reviewing architecture documents using question sets. Given the critical importance of architecture to software project success, it follows that the architecture cannot be effective unless it is captured in documentation that allows the stakeholders to understand and use the architecture in the way it was intended. The approach does not assume a particular architecture methodology or documentation approach, although it was conceived in the context of ISO/IEC 42010 and the SEI Views and Beyond approach to documenting software architectures. Like both of them, our approach is centered on the stakeholders of the artifact, utilizing them in a focused, guided way to assure that the documentation carries sufficient quality to enable them to do their jobs. Our approach is not intended as a complete framework for architecture evaluation; rather it is meant to be used within such a framework, when one is available.

1. Introduction

This paper proposes a structured approach for reviewing architecture documents. To be clear, we are not discussing how to evaluate an architecture; there are several existing methods for that already [2]. Rather, we are evaluating the documentation of an architecture (one purpose of which may be to support an architecture evaluation exercise).

The need for architecture documentation (AD) reviews arises throughout the life cycle of a system all involving using the documentation for some specific purpose, including: using the architecture as the basis for downstream design or implementation; checking to see if design or implementation conforms to the architecture; seeing if the architecture is ready to support a formal evaluation for fitness of purpose; and using the documentation to support project planning.

2. Steps of the procedure

This is a six-step procedure. The first step establishes the “why, when, and who” of the review. Subsequent steps provide the “what” and “how.”

Step 1: Establish the purpose of the review. An AD review establishes whether the AD is fit for some specific purpose by a set of identified stakeholders. Stating that purpose will focus the review participants and direct the review. The questions you’ll ask about the document will be different depending on the purpose you have in mind.

It is likely that any AD will need to be fit for more than one purpose, and hence the review will be multifaceted. The alternative is several smaller reviews, each with a single purpose.

Knowing the “why” will help you identify the “who.” As part of establishing the purpose, identify the stakeholders of the AD who should be represented in the review.

Knowing the “why” will also tell you the “when.” Various review purposes align with certain project stages or milestones. Of course, the particular life cycle model your project uses will lead to different phases, activities, and reviews. Carry out the review with enough spare time to allow the AD to be modified after the review to serve its purpose.

Step 2: Establish the subject of the review. Establishing the subject involves identifying the types of artifacts, their version, the sources, and the degree of completeness of the artifacts necessary to conduct the review.

Use the purposes laid out in Step 1 to establish the artifact collection required and then gather them for the review. For example, if the AD is being reviewed for conformance to a standard or to a framework, the normative requirements of the standards/framework should also be available. In all cases, make sure that all reviewers are working from the same versions of the artifacts.
Step 3: Build or adapt the appropriate question sets. If you already have a set of questions that meets the purpose of your review, you can use it (perhaps with some modification). If not, you will have to construct it. Organizing questions as question sets allows them to be reused by providing contextual information about the purpose and stakeholder concerns that need to be addressed as well as guidance for obtaining and interpreting the results. We present example question sets in [4], each designed to serve a review purpose.

If you chose to use existing question sets, they need to be tailored for the purposes of the review. Questions that are not relevant can be omitted. General questions can be made more specific according to the technology of the project. The question sets that you pick will suggest a particular approach, and the questions need to be formulated appropriately. For example, will you use the Active Design Review technique [5], a questionnaire or checklist given to stakeholders, some sort of automated or measurement-based analysis, or some other approach?

Step 4: Plan the details of the review. Planning involves setting a date for the review, as well as deciding on the timeframe and the basic format of the review. The timeframe might allow as much time as needed to answer questions or only a limited amount of time, which case the questions need to be prioritized. Time and resources will affect the format and “weight” of the review. How the results will be communicated needs to be determined and could affect the format and weight of the required answers.

This step also involves identifying the actual review participants (not just abstract stakeholder roles) and securing their participation. An initial assignment of questions to the reviewers responsible for asking them and the stakeholders responsible for supplying the answers can be made at this time. As the review is conducted, the initial priorities and stakeholder assignments may change as a deeper understanding of the documentation is gained and the reviewers probe further into applicable areas.

This step also involves handling the logistics for the review—time and place of meetings, paying for everyone’s time, providing read-ahead materials, etc.

Step 5: Perform review. Performing the review involves posing the questions to the stakeholders involved in the review and gathering their answers. Depending on the specific approach chosen, this might involve an individual objective review where stakeholders also play the role of the reviewer and pose questions to themselves or an inspection where a separate review team poses questions to the stakeholders. Inspections could take the form of an all-hands gathering, a number of one-on-one meetings, or something in between; the meetings could be face-to-face or distributed and remote. After the results are gathered, the evaluation considerations and criteria are applied, as defined by the chosen question sets. Although the reviewers can make some preparations, not all the important issues can be known a priori. These issues need to be determined in the initial part of the review and will influence the questions and artifacts used as the reviewers dig deeper in these areas.

Step 6: Analyze and summarize results. The intent of this step is to aggregate the answers to the questions and then make a qualitative determination of the overall impact of the AD against the stakeholders and concerns. Results are not likely to be a simple pass/fail but rather a more nuanced conclusion concerning specific problems in specific parts of the AD.

3. Question sets for reviewing the AD

Posing and answering questions in a review is the heart of the matter. Our collection of question sets was motivated by the purposes for which an AD is used, based on experiences such as those described in ISO/IEC 42010 (see Table 1). Observing commonality among them, we partitioned them into reusable sets.

This section discusses what is involved in the formation of question sets—groups of questions that, together, address a narrowly focused purpose for an AD review. Besides the questions themselves, a question set must also contain information to allow a user to make sure the question set is appropriate and use it effectively, as shown below:

1. Question set name: Give the question set a name by which it can be referred and reused.
2. Purpose: What review purpose does the question set address?
3. Stakeholders and concerns: Who are the stakeholders, and which of their concerns are being addressed by the questions? Making stakeholders and concerns a first-class dimension of an AD review effectively elaborates the purpose of the question set and informs the formulation of the questions. (While we can’t expect all of an architecture’s stakeholders to participate in a review, we want to make sure that all of the important stakeholder roles are represented.)
4. Questions: This section contains the questions that constitute the question set. Getting good lists of questions is essential. Documentation approaches such as the SEI Views and Beyond and ISO/IEC 42010 provided the concepts and guidelines against which questions could be posed.
For each question, give the following information:

a. **Respondents:** To whom should each question be posed? The questions might be addressed to the person speaking for the AD. Usually this will be the architect. The questions might be addressed to reviewers checking the understandability of the AD by using it to answer questions about the architecture it describes. For instance, if the AD should support project planning (a purpose) and is being reviewed for such (using a “project planning” question set), the respondents would include those concerned with project planning—technical managers. If the AD should support development and is now being reviewed for that, the respondents will certainly include key developers. Questions about the AD itself can be answered by examining the AD or analyzing it with a tool (for example, automatically checking to make sure that every cross-reference is defined).

The persons to whom a question is posed may or may not be the same as the stakeholders whose concern the question addresses. Review participants may be proxies for stakeholders.

b. **Expected answers:** What answers or types of answers are we looking for? A question set will also involve formulating a set of considerations and criteria to help the reviewers evaluate the AD based on the answers they receive. For example, they might wish to understand not just the answers given by the reviewers but also how much difficulty the reviewers had coming up with those answers. They might wish to understand the criteria the stakeholders used for why they answered “yes, we’re happy” or “no, we’re not happy.” The respondents should not be shown the expected answers, to avoid biasing their answers.

c. **Criticality:** How critical is each question? The “wrong” answer to some questions might halt a project until it’s resolved, whereas the “wrong” answer to other questions might merely be something to watch over time. The questions should come with guidance (perhaps a weighting) to help establish their importance.

5. **Advice:** Provide additional useful information on how and when the review should be conducted. You might relate experience gained through using the question set in a prior review.

4. **Example question set**

The Views and Beyond approach [1] to architecture documentation uses the explicit identification of stakeholders and their concerns to determine which views to include in the AD. Explicitly identifying stakeholders and concerns is also a requirement of ISO/IEC 42010:2007 [3]. Therefore, a useful review of the AD examines its choice of stakeholders and concerns to ensure that the important ones are accounted for. Such a review could be usefully carried out quite early, when the stakeholders and concerns are documented but before the rest of the AD is created. Here we show an excerpt of the question set. The questions are formulated using the Active Design Review technique [5].

| 1. Question set name: Capturing the right stakeholders and concerns |
| 2. Purpose: The purpose of this question set is to gauge the appropriateness of the architect’s list of stakeholders and concerns for completeness, over-completeness, and appropriateness, and to review how well the stakeholders believe their interests and concerns have been captured. |
| 3. Stakeholders and concerns: All those with a substantial stake in the architecture should be involved or have their roles and concerns represented. |
| 4a. Questions |
| **Respondents:** All stakeholders |
| 1. State your stakeholder role. List the set of concerns you have that pertain to the architecture whose AD is being reviewed. |
| 2. Find and record all places in the AD where your stakeholder role is listed as being covered. |
| 3. Find and record all places in the AD where your concerns are listed as being addressed. |
| **Respondents:** Architect |
| 1. Show where in the AD the generic stakeholders and concerns required by the framework in use (if any) have been listed and addressed. |
| 2. State how you produced the list of stakeholders and their concerns. |
| 4b. Expected answers: Each stakeholder should be able to find where in the AD (and framework, if any) their role and concerns are listed and their concerns are addressed. Every relevant stakeholder and concern should be covered; missing ones should be noted. All concerns should be tied to at least one stakeholder. The architect should provide a convincing argument that the process for identifying stakeholders and their concerns was adequate… |
| 4c. Criticality: Questions revealing missing stakeholders or missing concerns are the most critical… |
| 5. Advice: This question set is appropriate for an active design review, in which an all-hands meeting is not required. Individual reviewers representing different stakeholder roles and concerns can be engaged separately, perhaps even by telephone or electronic mail, to make sure their concerns are addressed in the AD… |
5. Building reviews from question sets

Table 1 shows how the example AD question sets defined in [4] can be applied for review purposes. The left column is derived from ISO/IEC 42010, clause 4.4, “Uses of architectural descriptions.” The right column suggests the question sets that might be included in an AD review to be used to support the stated purpose.

AD reviews are not appropriate to answer all of the architectural questions being posed and are often used in conjunction with other assessment techniques. For example, using the AD to facilitate communications between acquirers and developers as a part of contract negotiations and bid assessment, a new technology may be proposed; evaluating the maturity of the technology is difficult or impossible to do with only a description and may be more readily addressed via a prototype.

6. Results and Next steps

A draft of this approach was presented for comment at the Workshop on Reviewing Architecture Descriptions that occurred at the Working IEEE/IFIP Conference on Software Architecture (WICSA 2008). We revised the approach and used it prepare for an Architecture Tradeoff Analysis Method® (ATAM®) evaluation [2] following the guidelines. Feedback reported that the approach did not add much additional effort to the overall evaluation exercise, provided insight into producing a better document, and promotes a desirable goal of guided inspection.

The approach was also used at the University of Groningen in the MSc course on software architecture and at VU University Amsterdam in the Masters course on Advanced Topics in Software Engineering. Feedback from these uses reported that the questions helped to review the architecture in a systematic way.

Next steps include exploring how the concepts could be applied as a part of the Views and Beyond approach to architecture documentation or the ISO/IEC standard 42010 on architecture descriptions of software-intensive systems. This approach was formulated from the perspective of software and software-intensive systems, and we would also like to examine its use for systems and more general (non software/system) architecture descriptions.

7. References


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