Modeling and Documenting the Evolution of Architectural Design Decisions

Rafael Capilla, Francisco Nava
Universidad Rey Juan Carlos de Madrid

Juan C. Dueñas
Universidad Politécnica de Madrid

SPAIN
Motivation

- The importance for representing, recording and using architectural design decisions (ADD) has been recognized in recent SA conferences.

- Deciding which knowledge is susceptible to be recorded for a particular organization constitutes a first step for the strategy of the company.

- Not all the information has the same relevance at a given time.

- Models and methods for representing and using architectural knowledge and design rationale are needed.

- Evolution affects to: requirements, systems, architectures and decisions.
Design decisions and its rationale can be characterized by a set attributes which seem relevant for the architect or particular organization.

*Example:* Tyree & Akerman’s approach defines a template of attributes for each DD.

- Relevant items should be specified: DD name, status, motivation, implications, related decisions, etc.
- Representation techniques: (ontologies, networks, hierarchy, etc.)
ADDSS 1.0 (2006) is a prototype web-based tool for recording, managing and documenting DD in an iterative way.

The decisions made for a virtual reality system developed in 2004 were stored using ADDSS.

15 DD were recorded using ADDSS.

Some decisions led to a simulation process before the right decision among several alternatives was made.

The architecture was developed in four iterations.
Design Decisions with ADDSS Tool
Design Decisions with ADDSS Tool

Requirements are related to design decisions

Dependencies between decisions can be defined
Maintenance issues in a VR system

- 3 years after, 12 new requirements led to a maintenance process, which had impact both on the architecture as well on the decisions made.

- Lack of flexibility in some parts of the architecture.

- We are aware that ADDSS 1.0 doesn’t support all the features needed to describe a DD.
Evolving AK

- The initial set of decisions stored with ADDSS constitutes a valuable knowledge asset for re-designing the architecture.

- As new requirements drive the evolution of the system over time, design decisions must evolve accordingly with the changes to be made.

- During the evolution of the system, not all the attributes defined for the decisions have the same relevance at the same time.
Characterization of Relevant AK

There is a lack of agreement for characterizing what attributes should be relevant for describing ADD.

Each company/organization may have different strategies/goals for storing relevant AK.

To reconcile the needs of different users and organizations (as well as other proposals) we propose a flexible classification of the attributes required for describing relevant AK.
Mandatory & Optional Attributes for AK

**: Mandatory att. for AK**: Those attributes that are perceived as fundamental for a particular organization or stakeholder and used to characterize the decisions that guide the “rationale” of any architecting process.

**: Optional att. For AK**: Are attributes that if they are not stored when decisions are made, the decision-making should not be affected.

Each particular organization may define which of the attributes that describe a DD should be optional and which ones mandatory.
Example of Mandatory Attributes

- Decision name
- Constraints
- Dependencies
- Status
- Rationale
- Design patterns used
- Architectural solution
- Requirements related to a particular decision
Alternative decisions: Because decisions reside in architect’s mind, decisions can be made without storing the alternatives.

Pros/Cons: Not recording the implications of a decision being made, is not a barrier to make them.

Responsible/Project/Notes: Are not essential att.

Iteration: Decisions are usually taken under an iterative process in the same way as architectures are built, but this doesn’t affect the decision activity.

Others....
Attributes for evolution

Some attributes may become more relevant for controlling the evolution of the architecture as well as the design rationale that will be recorded.

- Date / version
- Obsolete decisions
- Validity
- Reuse times
- Rating
- Trace links
Meta-model for recording and evolving AK

R. Capilla, F. Nava, J.C. Dueñas, SHARK/ADI’07, Minneapolis, USA
Meta-model for recording and evolving AK

- Mandatory attributes
- Optional attributes
- Processes to store, use, manage, document
- Attributes for evolution

Diagram showing relationships and processes related to architectural knowledge (AK) evolution.
Conclusions

- Flexible approach for characterizing architectural design decisions.

- Adaptable for each particular organization/individual.

- Specific attributes for evolution and maintenance activities.

- Extensible meta-model that integrates AK characterization with those processes that are used for recording, managing, (re)using, and documenting DD.

- Ongoing tool support with the future ADDSS 2.0
Thanks for your time...

**Rafael Capilla**
rafael.capilla@urjc.es

Francisco Nava
francisco.nava@urjc.es

Juan C. Dueñas
jcduenas@dit.upm.es