Tailoring a Method for System Architecture Analysis

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Declaration of content

- A method to find architectural drivers, architectural design choices, and to evaluate alternatives
- Use in automotive hybrid system case – one example
- Lessons learned and experience
ProDrive 2

Efficient electrical drive system platform for heavy vehicles
Stakeholder analysis and system boundary

**A drive system platform**
- 29 people/ 11 roles
- 1100 statements
- 200 process related
- Advanced lifecycle
- <10% architecturally significant

Success comes from many other things than drive system design
- The process to offer, simulate and test each system
- The maintenance system is crucial to usefulness
Architecture analysis and methods
Maintenance system

- Support in making decisions among many candidate choices

Architecture analysis method

- Methods for architecture analysis:
  - Identify architectural decisions
  - Identify architectural drivers
  - Analyze relationships
  - Support decisions on architectural alternative
Practitioners define “usable”

• An architecture analysis method
  – Shall support selection of architecture alternatives
  – Low footprint
  – Cover the complete system usage and scope
  – Shall be based on quantifiable entities
  – Analysis results early in development
Available methods

- Firesmith – MFESA
- Kazman – ATAM
- Axelsson – ALCEA
- Muller – CAFCR
- SE guidelines, Incose
Use-case models for all system use
Analysis structure

- Architectural Concern
  - Alternative solution
    - Architectural Risk
      - Frequency
      - Severity
    - Architectural Opportunity
      - Frequency
      - Severity
- Architectural story
  - Architectural use-case
    - Result
    - Scenario
Lifecycle model for the maintenance system
# Architecture Evaluation

- Estimate/Measurement of concrete result
- Unit is money per year

Example: Should the system be equipped with telematics solution 1, 2, or 3?

<table>
<thead>
<tr>
<th>LC Phase</th>
<th>Type of value</th>
<th>Arch 1</th>
<th>Arch 2</th>
<th>Arch 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop Maintenance</td>
<td>Investment</td>
<td>-0.1</td>
<td>-1.5</td>
<td>-7.5</td>
</tr>
<tr>
<td>Perform Maintenance</td>
<td>Cost reduction</td>
<td>1.5</td>
<td>0.35</td>
<td>0.35</td>
</tr>
<tr>
<td>Perform Maintenance</td>
<td>Faster</td>
<td>5</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Deliver spare parts</td>
<td>Correctly</td>
<td>2</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Offer to customer</td>
<td>Quality</td>
<td>1</td>
<td>3.5</td>
<td>0</td>
</tr>
</tbody>
</table>

Sum: 9.4, 22.35, 12.65
Method summary

- Identify stakeholders, lifecycle, system boundary
- Identify architectural decisions and drivers
- Use quantifiable data
- Support evaluation of architecture alternatives
Conclusions

• Method defined, used
• One architectural concern evaluated with candidates
• Usable in case
  – More evaluations to come
  – The progression to find alternatives could be improved
  – The method does allow evaluation of architectural alternatives based on quantifiable measures
• Defining a method takes time! (and iterations)