Quality Attributes Overview

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Iasa Spain Chapter President
IASA Skills Taxonomy

Enterprise Architecture

Specializations

Foundation Pillars

1) Design
2) Human Dynamics
3) Quality Attributes
4) IT Environment
5) Business Technology Strategy
Quality Attributes

Pillar Focus Areas

- Balancing and Optimizing Quality Attributes
- Usage Related
  - Usability, Localization, Accessibility, Personalization/Customizability
- Development Related
  - Manageability, Maintainability, Supportability, Extensibility and Flexibility
- Operations Related
  - Performance, Reliability, Availability, Scalability, Monitoring and Management, Packaging, Delivery, Post Deployment
- Security
- Tools for using effectively
Quality Attributes

**Definition**
- Non-functional characteristic of a component or system
- Represents cross-cutting architectural concern for a system

**Concerns for using in design**
- Have a cost to implement
- Must be balanced against business value
- Involve tradeoffs
## Quality Attributes Survey

<table>
<thead>
<tr>
<th>Quality Attribute</th>
<th>Essential</th>
<th>Very important</th>
<th>Priority for Career Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Quality Attribute skills (category rating)</td>
<td>22.0% (87)</td>
<td>50.8% (201)</td>
<td>73%</td>
</tr>
<tr>
<td>Quality Attribute Monitoring and Management</td>
<td>21.3% (85)</td>
<td>50.9% (203)</td>
<td>72%</td>
</tr>
<tr>
<td>Security</td>
<td>54.5% (217)</td>
<td>37.7% (150)</td>
<td>92%</td>
</tr>
<tr>
<td>Balancing and Optimizing Quality Attributes</td>
<td>29.6% (118)</td>
<td>54.6% (218)</td>
<td>84%</td>
</tr>
<tr>
<td>Performance</td>
<td>40.9% (164)</td>
<td>48.4% (194)</td>
<td>89%</td>
</tr>
<tr>
<td>Reliability, Availability, Scalability</td>
<td>59.1% (237)</td>
<td>37.2% (149)</td>
<td>96%</td>
</tr>
<tr>
<td>Manageability, Maintainability</td>
<td>44.2% (176)</td>
<td>45.2% (180)</td>
<td>89%</td>
</tr>
<tr>
<td>Extensibility, and Flexibility</td>
<td>44.1% (177)</td>
<td>50.1% (201)</td>
<td>94%</td>
</tr>
<tr>
<td>Usability, Localization, Accessibility, Personalization</td>
<td>31.3% (123)</td>
<td>44.0% (173)</td>
<td>75%</td>
</tr>
</tbody>
</table>
Balancing and Optimizing Quality Attributes

- Quality attributes have a cost to implement a given level of service. How do you tie the QA’s to business value?
- How do you describe the trade-off’s between quality attributes?
- How do you justify the trade-off?
- What effect do these trade-off’s have on human factors?
- How do these trade-off’s affect the non-functional requirements?
Quality Attributes – Usage Related

Usability, Localization, Accessibility, Personalization/Customizability

[Understand usability and human factors]

• What is the difference between localization and internationalization?
• What is an outcome from a usability study and how can it help an architect?
• How should the system help users recover from errors?
• What does user friendly mean?
Manageability, Maintainability, Supportability, Extensibility and Flexibility

[Demonstrate knowledge of the items listed]

- How do you measure supportability?
- What is an example of tradeoff against a Usage related QA?
- How do you balance all of these with the need to deliver on time and on budget?
- Quantify the value of flexibility?
- Which is more important – flexibility or extensibility?
Quality Attributes – Operations Related

Monitoring and Management

*Problem Analysis, Capacity Planning, SLA’s*]

- What is more important in your design – the number of 9’s or the ability to monitor meeting the goal?
- How would you integration your solution into the existing environment?
- What is the difference between an SLA and an OLA?
- Who monitors and manages SaaS, PaaS and IaaS?
- What are some assets that must be monitored?
- How do you monitor for configuration changes of the designed system?
Quality Attributes – Operations Related

Performance, Reliance, Availability, Scalability

[Demonstrate management/mitigation of issues]

- If the CEO says he needs 5 9’s, do you accept that without challenge?
- How do you design/describe HA/DR plan?
- How do you design adequate initial capacity and sound growth?
- How do you describe the performance requirements and how to achieve them?
- Describe the 3, 4 or 5 9’s discussion?
- How do you measure scalability vs load?
- How do you determine adequate performance?
Quality Attributes – Operations Related

Packaging, Delivery, Post Deployment
[Process and management following development and prior to normal day-to-day operations]

- How do you design the package and delivery of an application?
- How does your design include user training, helpdesk functions and operations?
- How do you determine when/how to decommission your solution?
- What are some issues with targeting and deploying to mobile platforms?
- How does your design implement data access for reporting and regulatory compliance after decommissioning/retirement?
Quality Attributes - Security

Security

[Understand security, privacy, authentication, etc.]

- How does a company maintain their knowledge of security trends?
- How do you create a threat model?
- Why is non-repudiation a security concern?
- When would an IT system be considered unsafe?
- How do you validate that your solution is secure?
Quality Attributes - Tools

- **Success** = delivering architecture that meets numerous non-functional requirements and is built for the **right** Quality Attributes

- The **influences on which are the right ones to emphasize are not always obvious**. Formal methods such as ATAM and CBAM can help
  - Tradeoff matrix
  - Quality/Utility Trees
  - CBAM
### Quality Attributes - Tools

#### Trade-off Matrix

<table>
<thead>
<tr>
<th></th>
<th>Usage</th>
<th>Development</th>
<th>Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Usability</td>
<td>Personalization</td>
<td>Localization</td>
</tr>
<tr>
<td>Usability</td>
<td>-</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Personalization</td>
<td>X</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Localization</td>
<td>+</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Accessibility</td>
<td>+</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Extensibility</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Manageability</td>
<td>+</td>
<td>+</td>
<td>X</td>
</tr>
<tr>
<td>Maintainability</td>
<td>+</td>
<td>+</td>
<td>X</td>
</tr>
<tr>
<td>Supportability</td>
<td>+</td>
<td>+</td>
<td>X</td>
</tr>
<tr>
<td>Flexibility</td>
<td>+</td>
<td>+</td>
<td>X</td>
</tr>
<tr>
<td>Performance</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Scalability</td>
<td>+</td>
<td>+</td>
<td>X</td>
</tr>
<tr>
<td>Reliability</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Availability</td>
<td>+</td>
<td>+</td>
<td>X</td>
</tr>
<tr>
<td>Security</td>
<td>+</td>
<td>+</td>
<td>X</td>
</tr>
</tbody>
</table>

**Legend**

<table>
<thead>
<tr>
<th></th>
<th>Fosters</th>
<th>Hurts</th>
<th>Neutral</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>X</td>
<td>-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Incomplete Example - these will vary by solution
Example of Utility Tree from ATAM

- Arrange QuAt requirements as scenarios grouped by QuAt in a tree and assign them Complexity and Importance weight
- Concentrate on scenarios with High complexity or importance
- Look for trade-off or sensitivity points
Quality Tree - CoS

Product Quality
- Functionality (M)
- Reliability (L)
- Usability (H)
- Efficiency (M)
- Maintainability (H)
- Portability (M)

Quality in Use
- Effectiveness (M)
- Safety (L)
- Productivity (H)
- Satisfaction (M)

CoS = Conditions of Satisfaction

Legend:
- H High Priority
- M Medium Priority
- L Low Priority
# Quality Tree - Quality Dashboard

<table>
<thead>
<tr>
<th>Quality Characteristic</th>
<th>Priority</th>
<th>Status By Impacted Group</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product Quality</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Functionality</td>
<td>H</td>
<td>On Track</td>
<td>On Track</td>
</tr>
<tr>
<td>Reliability (performance)</td>
<td>L</td>
<td>On Track</td>
<td>On Track</td>
</tr>
<tr>
<td>Usability</td>
<td>H</td>
<td>On Track</td>
<td>On Track (Deployment Tools) Approved of Test (Other tools)</td>
</tr>
<tr>
<td>Efficiency</td>
<td>M</td>
<td>Waiting for Measurement Results</td>
<td></td>
</tr>
<tr>
<td>Maintainability</td>
<td>H</td>
<td>On Track</td>
<td></td>
</tr>
<tr>
<td>Portability</td>
<td>M</td>
<td></td>
<td>Pending of Test (Deployed only in 1 environment)</td>
</tr>
<tr>
<td><strong>Quality in Use</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effectiveness</td>
<td>M</td>
<td>On Track</td>
<td>Pending of Measurement Results</td>
</tr>
<tr>
<td>Productivity</td>
<td>H</td>
<td>Waiting for Measurement Results</td>
<td></td>
</tr>
<tr>
<td>Safety (IP Protection)</td>
<td>L</td>
<td>Pending of Test</td>
<td></td>
</tr>
<tr>
<td>Satisfaction</td>
<td>M</td>
<td>On Track</td>
<td>On Track</td>
</tr>
</tbody>
</table>
Cost Benefit Analysis Method (CBAM)

Steps in CBAM:
1. Prioritize scenarios
2. Assign scenario utility profile
3. Develop arch strategies to meet QuAt response levels
4. Determine ROI of each strategy
5. Calculate the total benefit
6. Select winning strategies

So, you identified Trade-off points: which way should you trade?
Outputs of ATAM

- A concise presentation of architecture
- Articulation of business goals
- QuAt requirements in terms of scenarios
- Mapping of arch decisions to QuAt reqs
- A set of sensitivity and trade-off points
- A set of risks and non-risks
- A set of risk themes
Summary

• In order to create a successful solution, you must deliver architecture that meets numerous non-functional requirements and is built for right Quality Attributes.

• Make sure to have such requirements, or help proactively to define them.

• Making architectural decisions at sensitivity and trade-off points is not a straightforward task. ATAM and CBAM methods can help.

• Wrong architectural choices may severely constrain the application’s Quality Attributes.

• Some architectural decisions may be influenced by various stakeholders and can be motivated by non-technical reasons such as strategic business concerns, political considerations, or by limitations in skill set, capacity and schedules.

You should evaluate the impact of such influences and either accept them as constraints, architecting around them or push back and explain to the stakeholders why such decisions may prevent achieving required level of Quality Attributes, thus averting a disaster at a later time.
¿Preguntas? y Respuestas...
Este grupo esta creado para la comunidad española de arquitectos de software. El objetivo es promover las mejores prácticas, el intercambio de opinión y en definitiva, contribuir al desarrollo de la profesión de Arquitecto de Tecnologías de Información (TI)