Architecture Review Methodology based on ATAM

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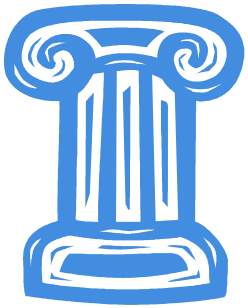
Services & Solutions Group

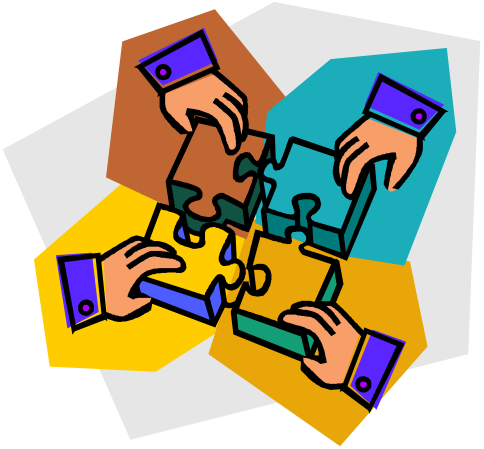
Architecture



*The **software architecture** of a program or computing system is the structure or structures of the system, which comprise software components, the externally visible properties of those components, and the relationships between them.*

Bass, Clements, Kazman

Architectural vs Non Architectural

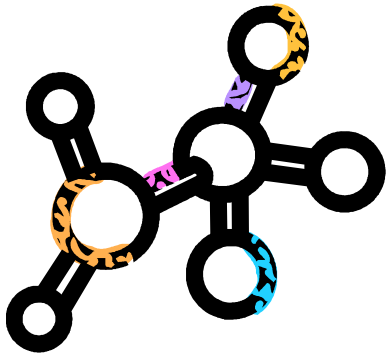


Algorithms are not architectural ?

But its complexity could impact performance

and performance is system quality attribute !

Architectural vs Non Architectural



Data Structure is not architectural?

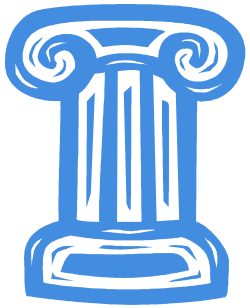
Its support for concurrent access has impact on performance

and performance is system quality attribute!

Architectural vs Non Architectural

So this means all aspects are architecturally significant !

So what is Architectural?



To be architectural is to be the most abstract depiction of the system that enables reasoning about the critical requirements and constraints all the subsequent refinements

- Kazman

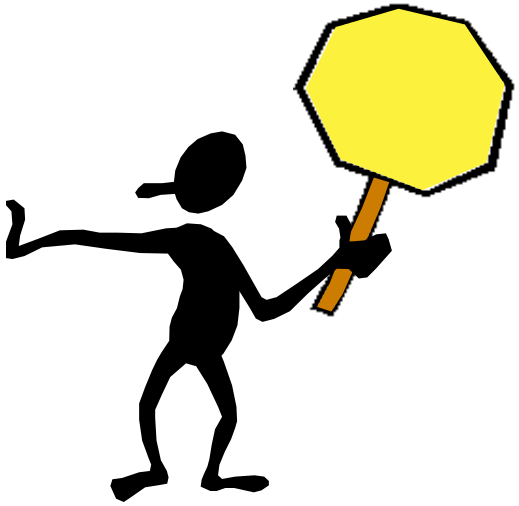
Do not try to identify all the aspects of your system which are architectural upfront. It should evolve over time

Why do we need architectural review?

Earlier one finds architectural issues, easier and cheaper to fix it. Otherwise it will escalate cost . Sometimes in the worst case, it may be needed to scrap the system.

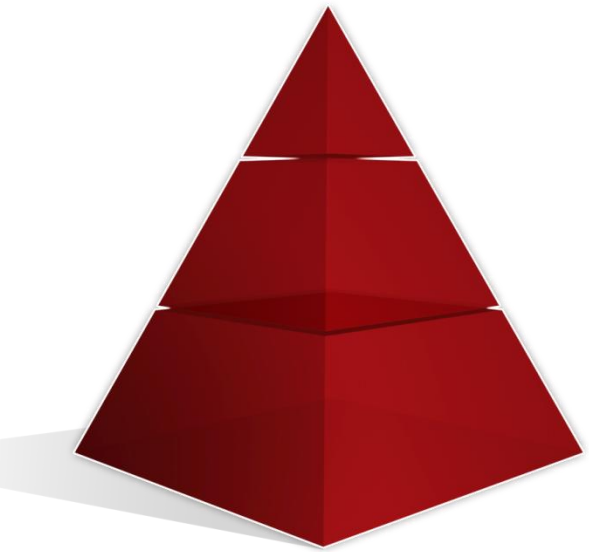
But Review is not

- an evaluation of architect's performance
- code review
- audit for project cancellation



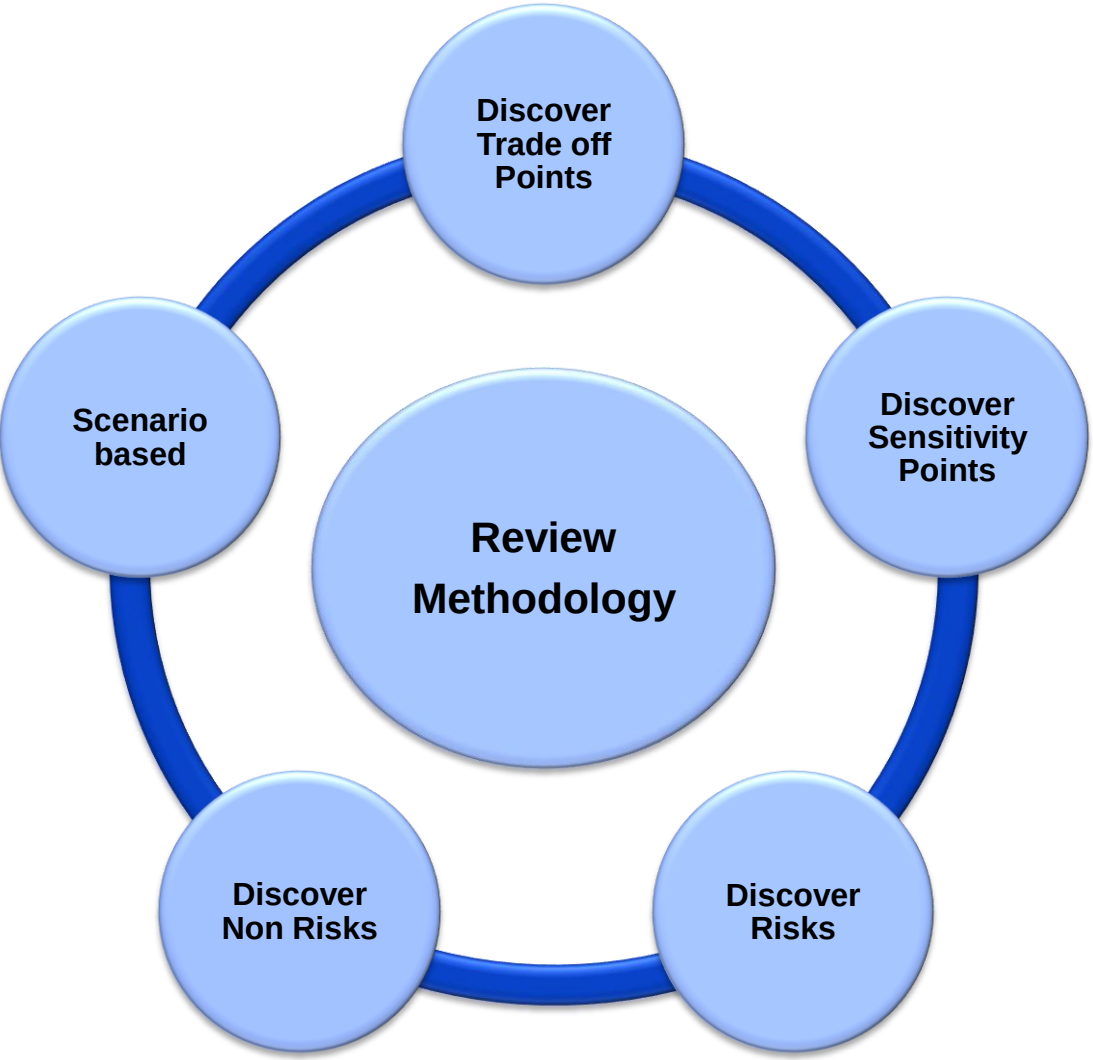
Evaluate only what you need to know!

Review should tell you where you are at RISK!



Methodology

Methodology



Scenario based evaluation process based on ATAM, industry standard methodology, to identify the required quality attribute of the system and validating the ability of the proposed architecture to support the same.

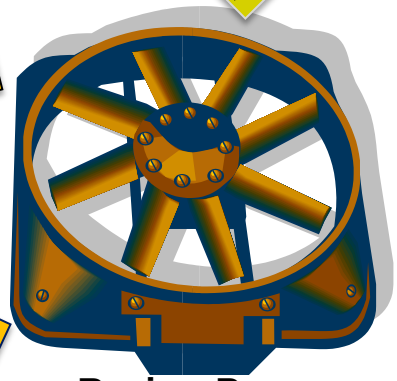
Methodology

Business driver

Input

Intermediate O/P

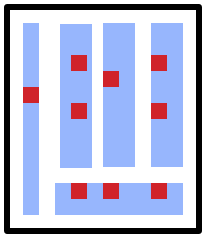
Quality Utility Attribute Tree



Review Process

Output

Review Report



Architecture

Input

Intermediate O/P

Prioritized Scenario List

Methodology

Phase 1: Initial Evaluation

Discover

1. Present Review Process
2. Identify Business Drivers
3. Determine Architecture

Investigate

4. Identify Architectural Approaches
5. Create Quality Attribute Utility Tree
6. Analyze Architecture Approaches

Phase 2: Complete Evaluation

Analyze & Validate

7. Brainstorm & Prioritize Scenarios
8. Analyze Architecture Approaches

Report

9. Present Results

Prerequisites for review

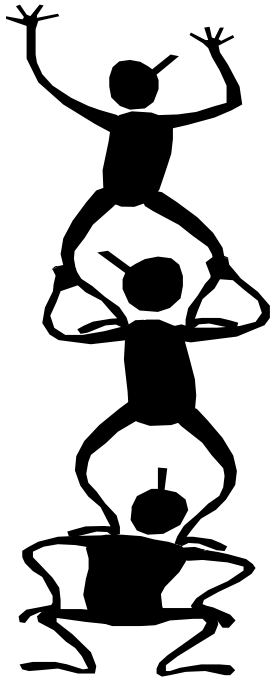
- Well documented Business Goals & Architecture

- Review team should validate artifacts from the client to check if it is ready for review.

Benefits

•Help in identifying the risks early in the life cycle of the program/project.
•Ensures that rationale for architectural decision are fully documented.
• Ensures that quality attributes are clearly articulated and conflicting goals are prioritized properly
• Provides the platform for stakeholders to explain their goals & motivations which in turn improves the communication aspect.
•Improve the quality of the architecture documentation
•Explication of architecture to team outside architecture group.
•Improves architecture practices in organization
•Evaluation team & stakeholders outside project gets an opportunity to discover reuse potential from the project being reviewed.

Evaluation Team Composition

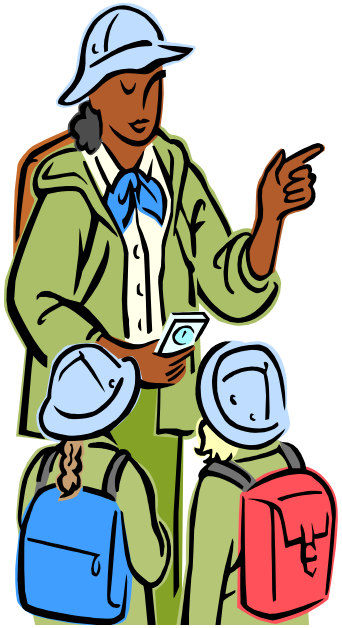


- Team size of two to five based on the size of review work.
- Led by experienced Architects who has good communication & facilitation skills.

Phase 1: Initial Evaluation

Discovery Phase

Step 1: Presentation



Evaluation Leader

Introduce the evaluation team, their roles and responsibilities

Explain Rules of Engagement

Explain the evaluation process to all stakeholders

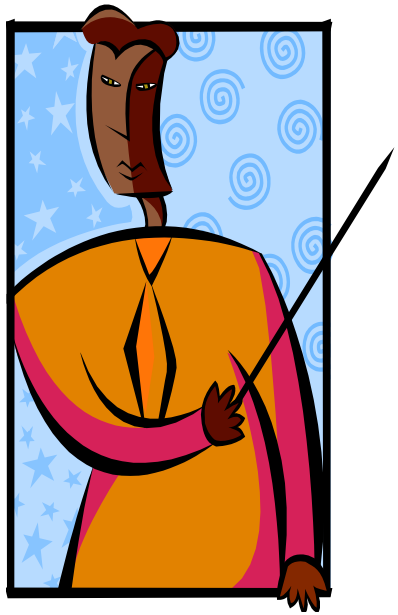
- Techniques to be used for each step
- Outputs of each step
- Q&A Session

Step 1: Presentation Contd

Rules of Engagement

- No side conversion
- No hidden agendas
- No wandering in & out of proceedings
- No value judgment about contribution of others
- During brain storming, all scenarios are fair game-choosing and refining come later.
- During brain storming, don’t propose answers

Step 2:Business Drivers

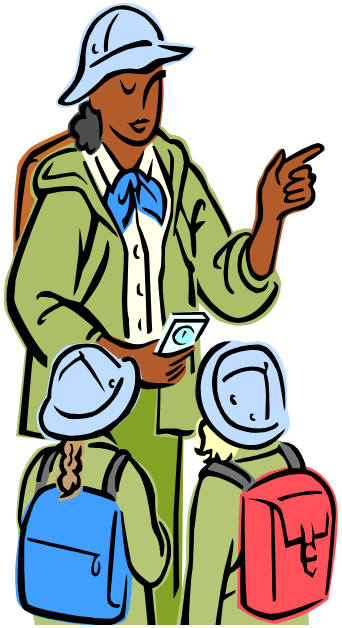


Project Decision Maker
(Project Manager/Customer)

Presents the system from business perspective

- Business environment, history, market differentiators, business objective and how proposed system will address the needs
- Architectural driving factors from business perspective.
- Business constraints in terms of cost, time to market, customer demands plus others
- Technical constraints in terms of usage of COTS solution, hardware/software platform requirements, reuse of legacy code etc
- All major stakeholders and their roles

Step 2:Business Drivers Contd



Evaluation Team

Captures the following information

- List of business goals categorized as primary, secondary and others
- List of quality attributes of interest
- List of stakeholders & their role

Step 3: Present the Architecture

Present different architectural views at appropriate detail for different stakeholders

- •Architecturally Significant Use Cases & Growth Scenarios
- •Architectural Principles & Constraints
- •Architectural approaches, styles, patterns used for addressing quality attributes
- • Details of COTS product if any.
  - •If yes, evaluation process for the same
- • Approaches used for integration with internal & external system if any.
- •Any known issue or risk

Lead Architect/
Architecture Team

Investigation & Analysis Phase

Step 4: Identify Architectural Approach

Evaluation Team

Document all architectural approaches

- Ask the architect to name all identifiable architectural approaches used
- Approaches which was covered in earlier steps

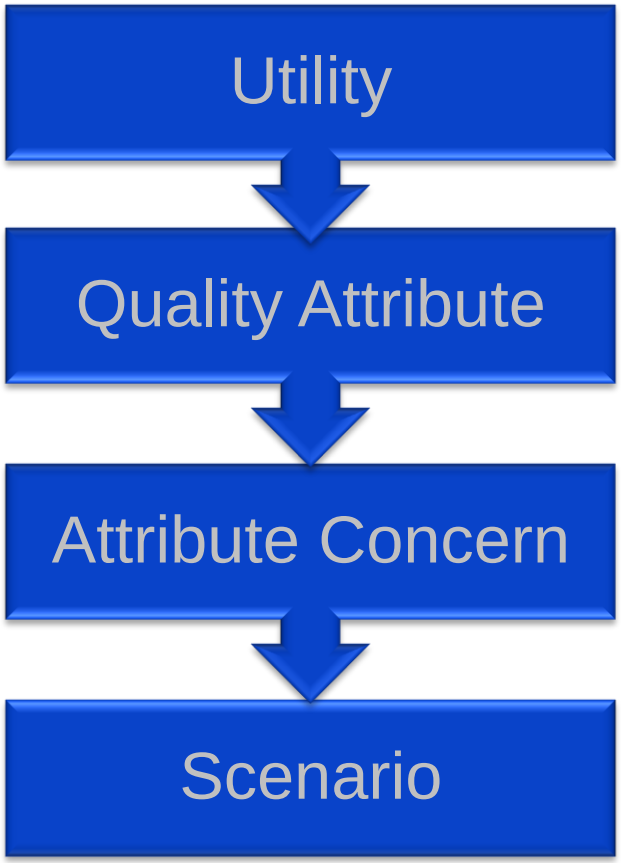
Step 5: Create Quality Attribute Utility Tree

Evaluation Team
&
all Stakeholders

Build Quality Attribute Utility Tree to identify, prioritize and refine system's quality attributes

Step 5: Quality Attribute Utility Tree Contd

Mapping from business drivers of the system into concrete quality scenarios

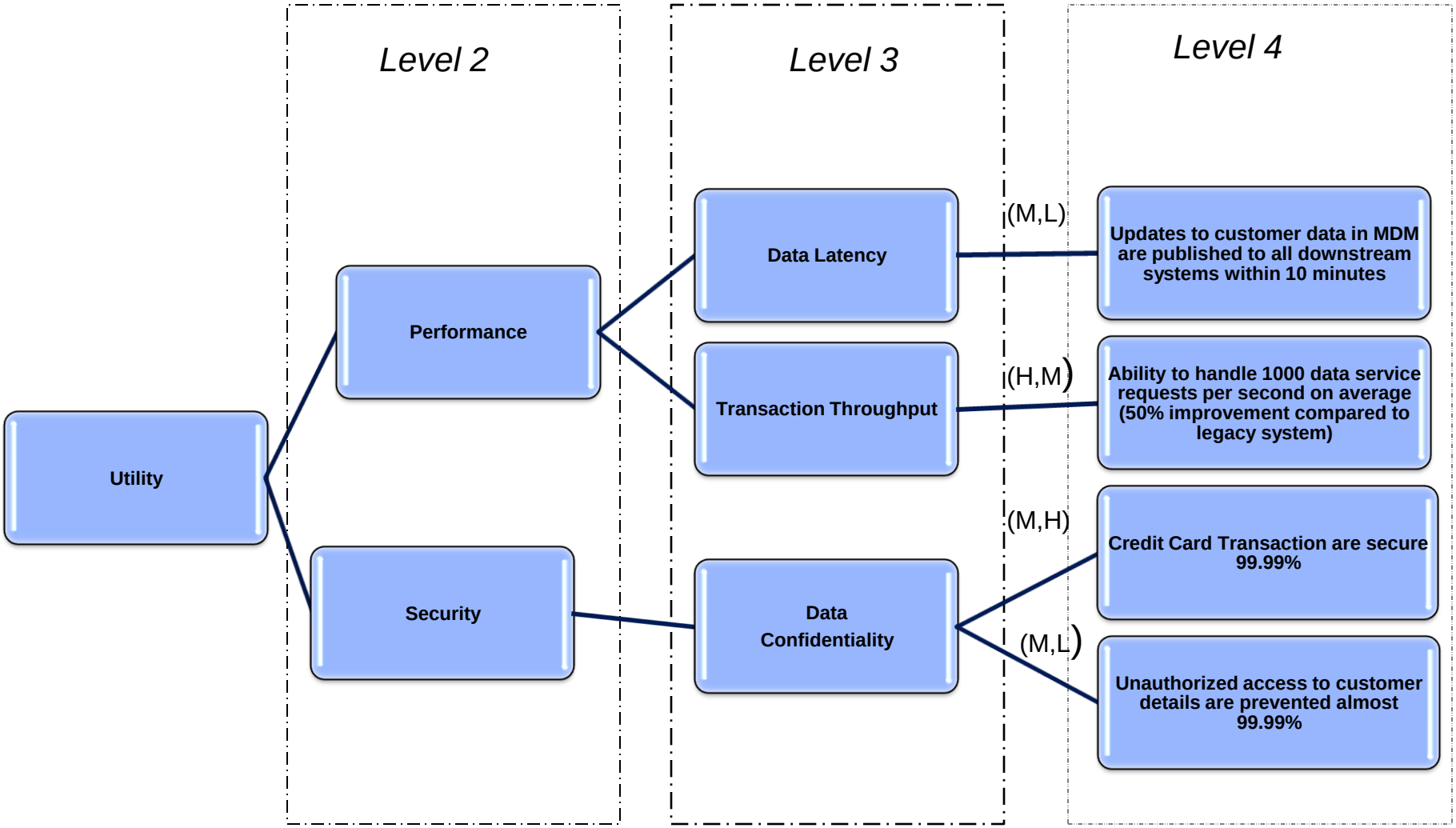


- **Utility :** Root Node
- **Quality Attribute** in terms of NFR like availability, performance, security, scalability etc
- **Attribute Concern**: It is sub factor which further qualifies the quality attribute*. For example credit card transaction are 99.99% secure*.

  Again qualified by *importance to success of system* and *difficulty in meeting the concern.*
- **Scenario**: It is business scenario from which those attribute concern arise. Those concerns could be tested using the scenarios.

  Includes use case, exploratory and growth scenarios

Step 5: Sample Quality Attribute Tree



Step 5: Create Quality Attribute Utility Tree Contd

Use Case Scenario: Ability to support typical uses of the System.

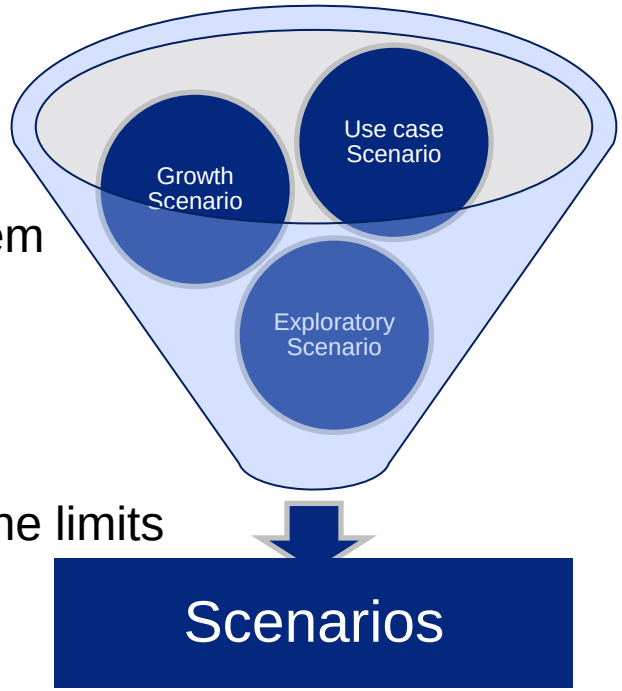
Example- The user wants to retrieve status of his order within 3 seconds at peak hours.

Growth Scenario: Anticipated changes to the system

Example: Ability to support new data format in less than two person week time.

Exploratory Scenario: Scenarios which exposes the limits of the system.

Example: Ability to process request in one micro second, Ability to process terabyte of data in a minute



Step 5: Create Quality Attribute Utility Tree Contd

Quality Attribute Characterization

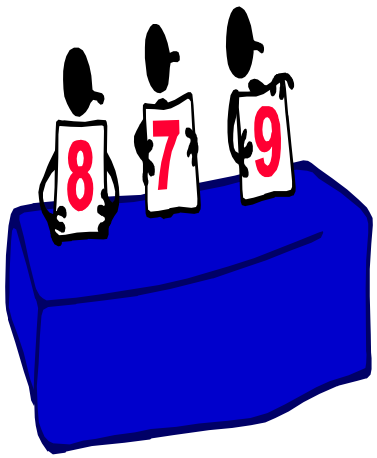
Stimulus : User action which triggers the interaction with system.
Example:- User submits request through web channel

Environment: what is happening at the time of stimulus or state of the system
Example:- Peak load in the system, one of server crashed, Or Normal Condition

Response: Response to stimulus.
Example:-process request in 2 seconds

Step 5: Create Quality Attribute Utility Tree Contd

Rating of Scenarios



Based on importance of scenarios

- High (H) -if the scenario is removed, it will make end product unacceptable.
- Medium (M)- the scenario is important but its removal will not make end product unacceptable but reduces its features
- Low (L) – Non core functionality

Based on difficult in realizing the scenario

- High (H) - the solution is unclear and estimated time for implementation is high
- Medium (M)- it is already solved problem but estimated time for implementation is high
- Low- Everything else other than above ones

Step 6: Analyze the architectural approaches

Evaluation Team
&
Architect/Architect Group

Analyze the ability of the architecture to meet major scenarios identified in Step5 by

- Creating quality-attribute specific questions for quality attribute requirements/scenarios
- Ask quality-attribute specific questions to architect group.
- Identify and document ***risks and non-risks, sensitivity points and tradeoffs***

Document the result of analysis

Step 6: Analyze the architectural approaches Contd

Non Risk: Architectural decision which addresses one or more quality attributes

Risk: Architectural decision which negatively impacts the ability to address one or more quality attributes
Example: Availability will be negatively impacted by having just single instance of database.

Sensitivity point : It is architectural decision which involves one or more architectural components that is critical in achieving particular quality attribute. It also conveys a message that if changes to certain property of architecture may negatively impact quality attribute
Example: Increasing the downtime associated with software upgrade increases the risk of upgrade because rollback is difficult

Trade off point : Architectural decision which has positive impact on one or more quality attribute but it is sensitive point to other quality attribute.
Example: Increasing encryption strength will negatively impact performance but positively impacts security aspect

Step 6: Analyze the architectural approaches

Analysis of architectural approach

Scenario : ID No	Scenario description eg-Online registration should not be down for more than 2 hours in a month			
Attribute	eg:-Availability			
Environment				
Stimulus	eg:-Database Server crashed			
Response	eg:-Down time should be less than 2 hours a month			
Architectural Decisions	**Risk**	**Sensitivity**	**Trade off**	**Non Risk**

Phase 2: Complete Evaluation

Analysis & Validation Phase

Step 7: Brainstorm & Prioritize Scenarios

Evaluation Team
&
all Stakeholders

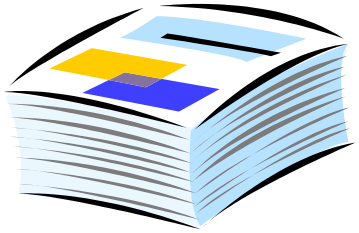
a. Each stakeholder will present architecturally significant scenarios & related quality attribute which are major concern to him
b. Brainstorm on each identified scenario and merge the overlapping concerns/scenarios based on consent of owners of the scenarios
c. Put identified scenarios for voting by providing x number of votes for each stakeholder say 10 votes which can be distributed among one or more identified scenarios.
d. Then prioritize scenarios based on the outcome of voting result.

Step 8: Analyze the architectural approaches

Evaluation Team
&
Architect/Architect Group

Again analyze the ability of the architecture to meet prioritized scenarios. It is repetition of step 6

Document the result of analysis in terms of Non Risks, Risks, Sensitive Points & Trade Off Points



Reporting Phase

Step 9: Present the results

Evaluation Team

Evaluation team presents the outcome of evaluation process to all stakeholders.

Report should contain following details

- Architectural approaches
- Utility tree
- Scenarios
- Risks and “non-risks”
- Sensitivity points and tradeoffs

If there are major gaps, the possible options to address the same should be provided.

Common Pitfalls with Architecture Reviews

Common Pitfalls

Common mistakes which have impact on the effectiveness of review process are following

•Failure to involve all stakeholders in the review process will make it ineffective

• Evaluation team's lack of knowledge on architectural styles and approaches

•Inadequate preparation from customer to provide right of information.

•Failure to incorporate review comments but having review just for the sake for it.

•Review team trying to impose their views.

•Non standard way of providing exceptions to architectural gaps.

Templates

Description	Template
Quality Attribute Utility Tree	Microsoft Office Excel Worksheet
Analysis of Architectural Approaches	Microsoft Office Excel Worksheet
Scenario Voting	Microsoft Office Excel Worksheet
Final Report	Microsoft Office Word Document

Thank You

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