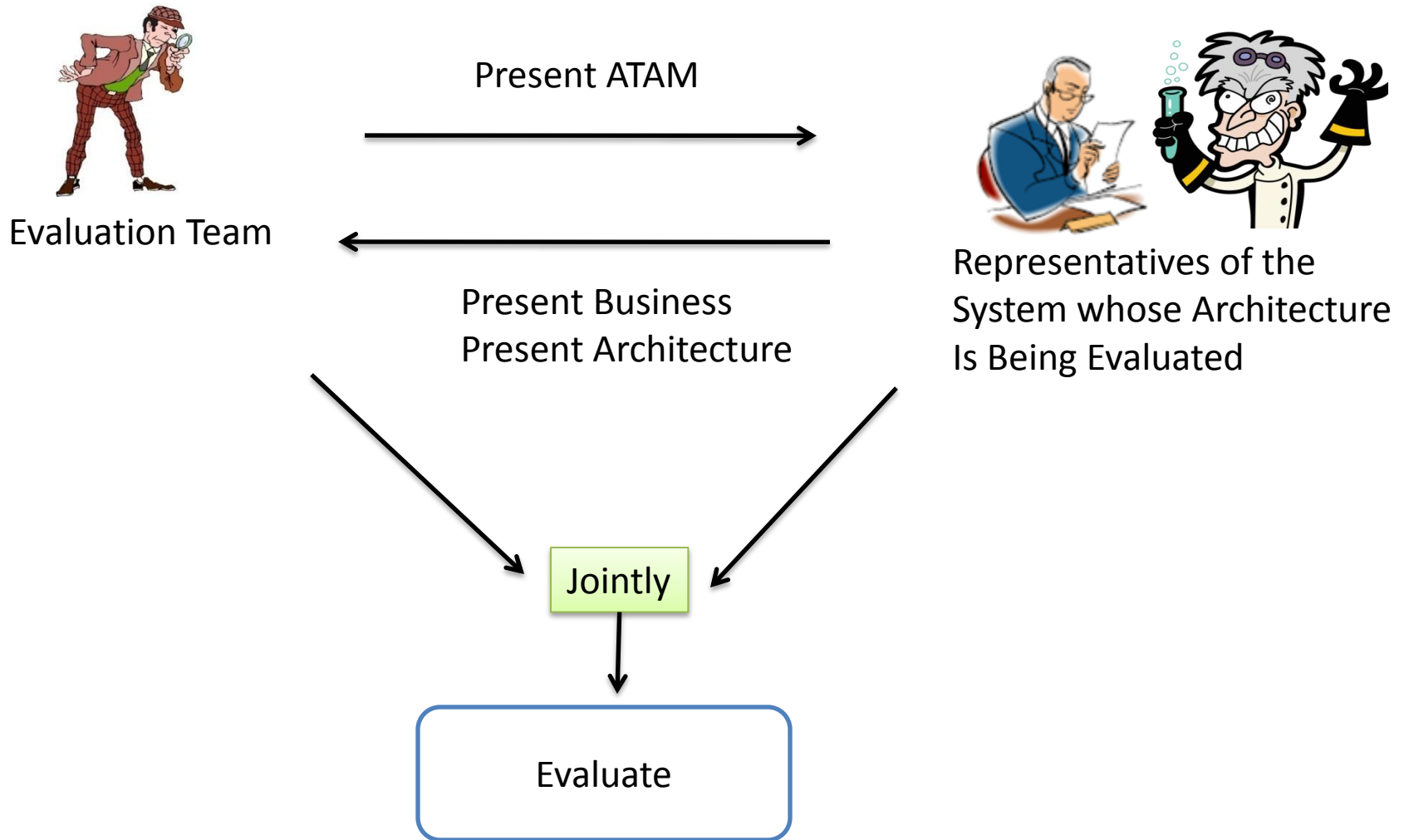# The ATAM

Architecture Trade off Analysis Method
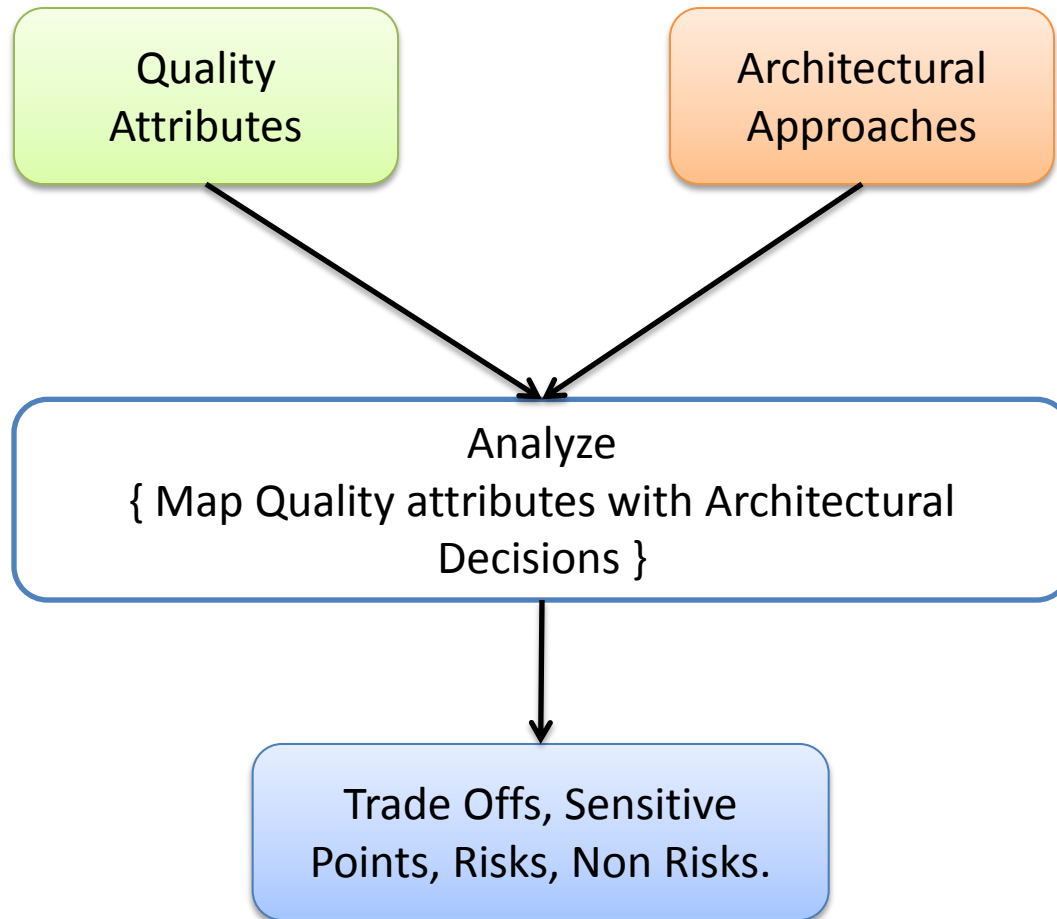An Approach to Architecture Assessment

ATAM – Cost/Benefit

- Cost
  - 1 – 2 weeks of time for 8 – 10 highly paid people, 2 days for another 10-12 people (for full formal process!)
  - Delays project start
  - Forces development of architecture up front

- Benefit
  - Financial – saves money
  - Forces preparation / documentation / understanding
  - Captures rationale
  - Catch architectural errors before built
  - Make sure architecture meets scenarios
  - More general, flexible architecture
  - Reduces risk

Present ATAM

Evaluation Team

Present Business
Present Architecture

Representatives of the
System whose Architecture
Is Being Evaluated

Jointly

Evaluate

ATAM assessments are too often executed when it becomes clear
that the project can not be delivered

Quality Attributes

Architectural Approaches

Analyze
{ Map Quality attributes with Architectural Decisions }

Trade Offs, Sensitive Points, Risks, Non Risks.

Evaluation Team

Offering mitigation strategies is *not an integral part of* the ATAM.
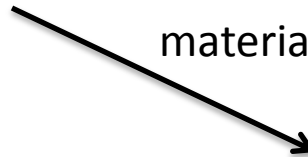ATAM is about locating architectural risks.

Step 1

Architect

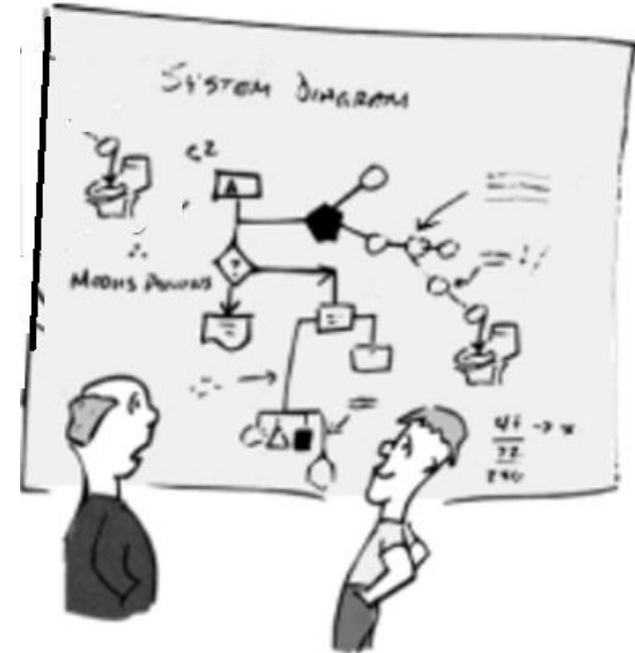1. Presents the Architecture, focusing on how it addresses the business drivers.

2. Interviews the architect to identify major approaches used

4. Validates the material gathered

3. The architecture is distilled into a list of architectural approaches

Evaluation Team

Architectural Approaches

Architectural Strategy	Quality Attribute
1. The Client-server approach is used heavily since this is data-centric system.	Maintainability
2. Distributed objects with location transparency are used to achieve modifiability in a distributed setting.	Modifiability
3. SSL is used to secure data on the wire.	Security

Step 2

Scenarios

Generates

Representatives of the System whose Architecture Is Being Evaluated

helps

Evaluation Team

ATAM evaluates scenarios not quality attributes.

Scenario Refinement for Scenario N	
Scenario(s):	When a garage door opener senses an object in the door's path, it stops the door in less than one millisecond.
Business Goals:	safest system; feature-rich product
Relevant Quality Attributes:	safety, performance
Stimulus:	An object is in the path of a garage door.
Stimulus Source:	object external to system, such as a bicycle
Environment:	The garage door is in the process of closing.
Artifact (If Known):	system's motion sensor, motion-control software component
Response:	The garage door stops moving.
Response Measure:	one millisecond
Questions:	How large must an object be before it is detected by the system's sensor?
Issues:	May need to train installers to prevent malfunctions and avoid potential legal issues.

Step 3

Scenarios

Architectural Approaches

Analyze
{ Map Quality attributes with Architectural Decisions }

Trade Offs, Sensitive Points, Risks, Non Risks.
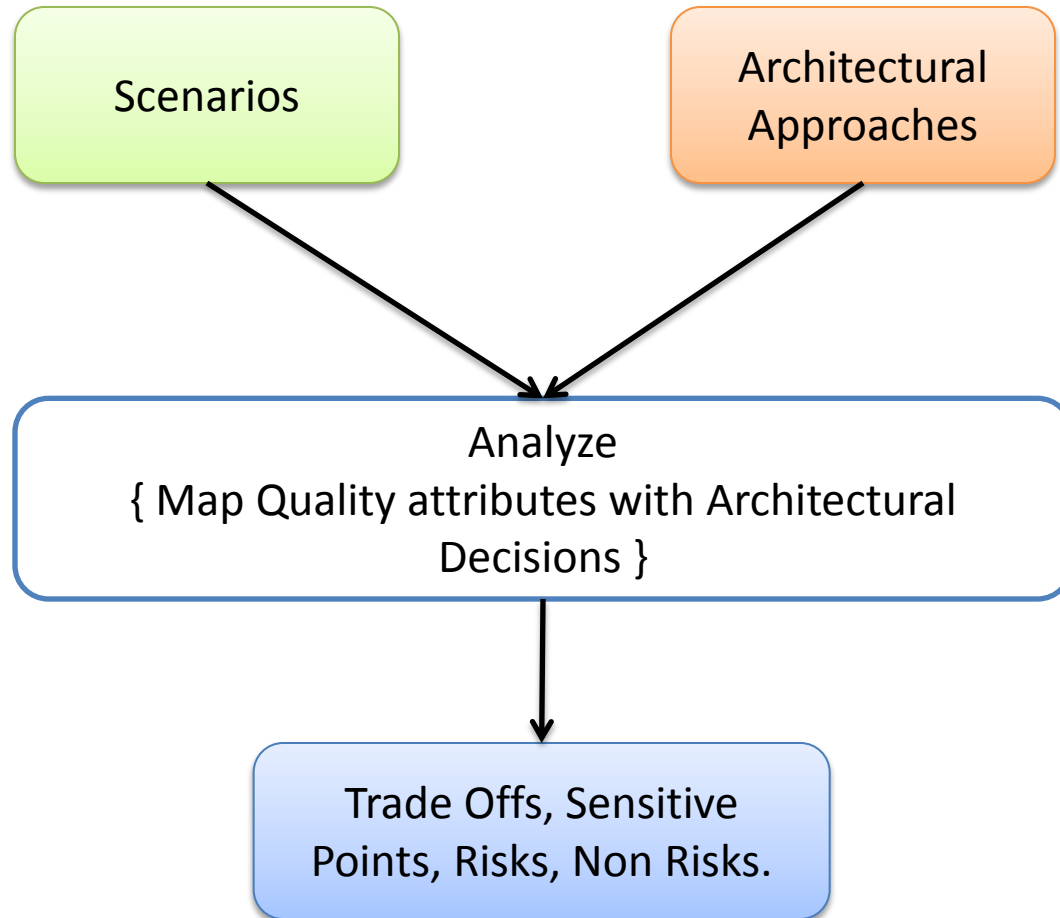
Evaluation Team

Scenario:	E-connector looses connection with SAP
Attribute:	Availability
Stimulus:	Temporary network fault
Response:	The system has an overall availability of 99,25% (max 2 hour down/ month)

Architectural decision	Sensitivity	Trade-off	Risk	Non-risk
DCTM content server runs on a clustered environment with 2 nodes	Common mode failure can not be handled			Probability of common mode failure is low
Integration relationship between SAP and Documentum is 'data consistency' and is not protected	Human user must report malfunction		From complaint to resolution > 2 hours	

Scenario:	Invoice poster needs e-document for data entry in SAP/R3
Attribute:	Perfomance-Latency
Stimulus:	Document request to Documentum
Response:	Document is available for processing in less than 10 s

Architectural decision	Sensitivity	Trade-off	Risk	Non-risk
E-documents are scanned in color at 200 dpi	Size of document is sensitive to quality of scanning	Usability vs Performance	Document too large for roundtrip in 10 s.	
E-documents are not cached	Every document must be fetched from DMTM	Development cost vs bandwidth cost	Document roundtrip time exceeds 10 s.	

Output of ATAM

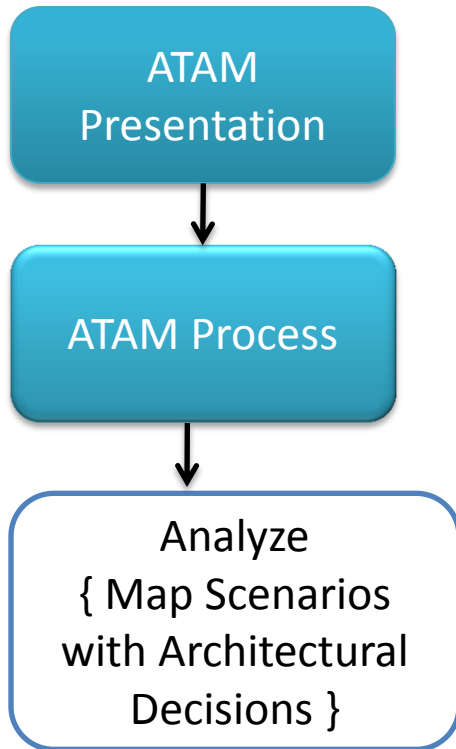1. R*isks/non-risks -- decisions that might create* future problems in some quality attribute

2. S*ensitivity points -- decisions for which* a slight change makes a significant difference in some quality attribute

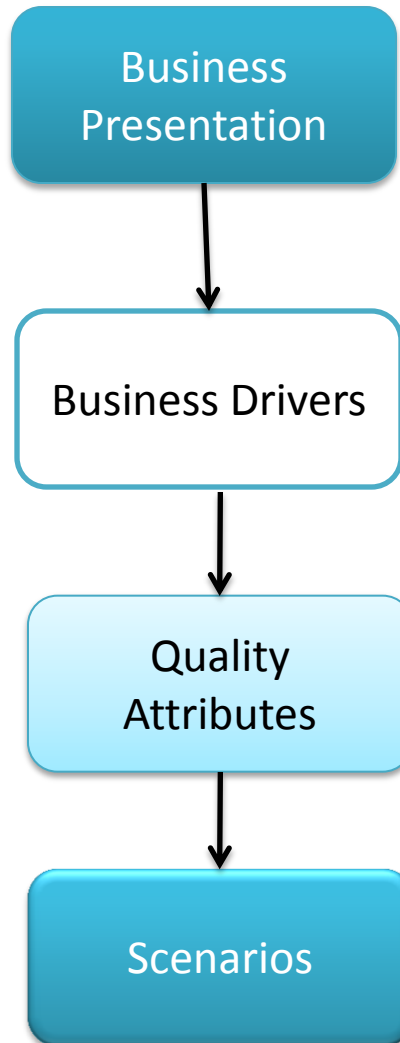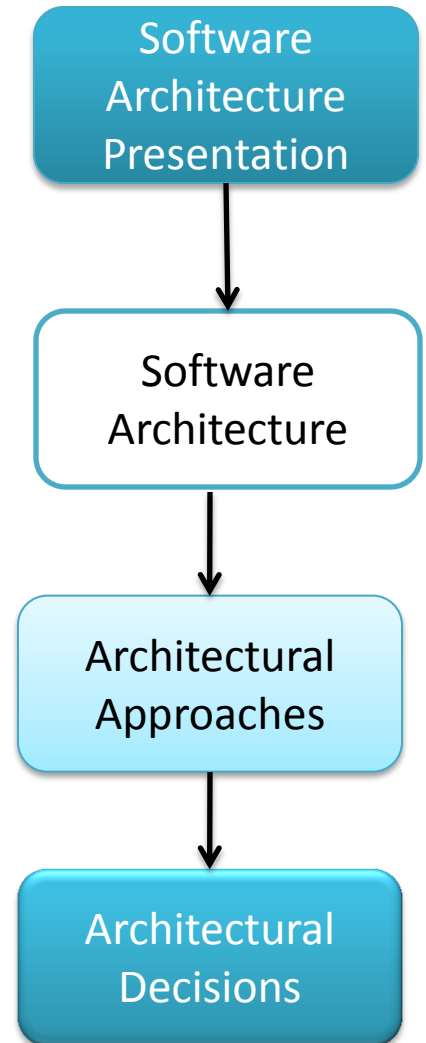3. T*radeoffs -- decisions affecting more than* one quality attribute

Evaluation Team

ATAM Presentation

↓

ATAM Process

↓

Analyze
{ Map Scenarios with Architectural Decisions }
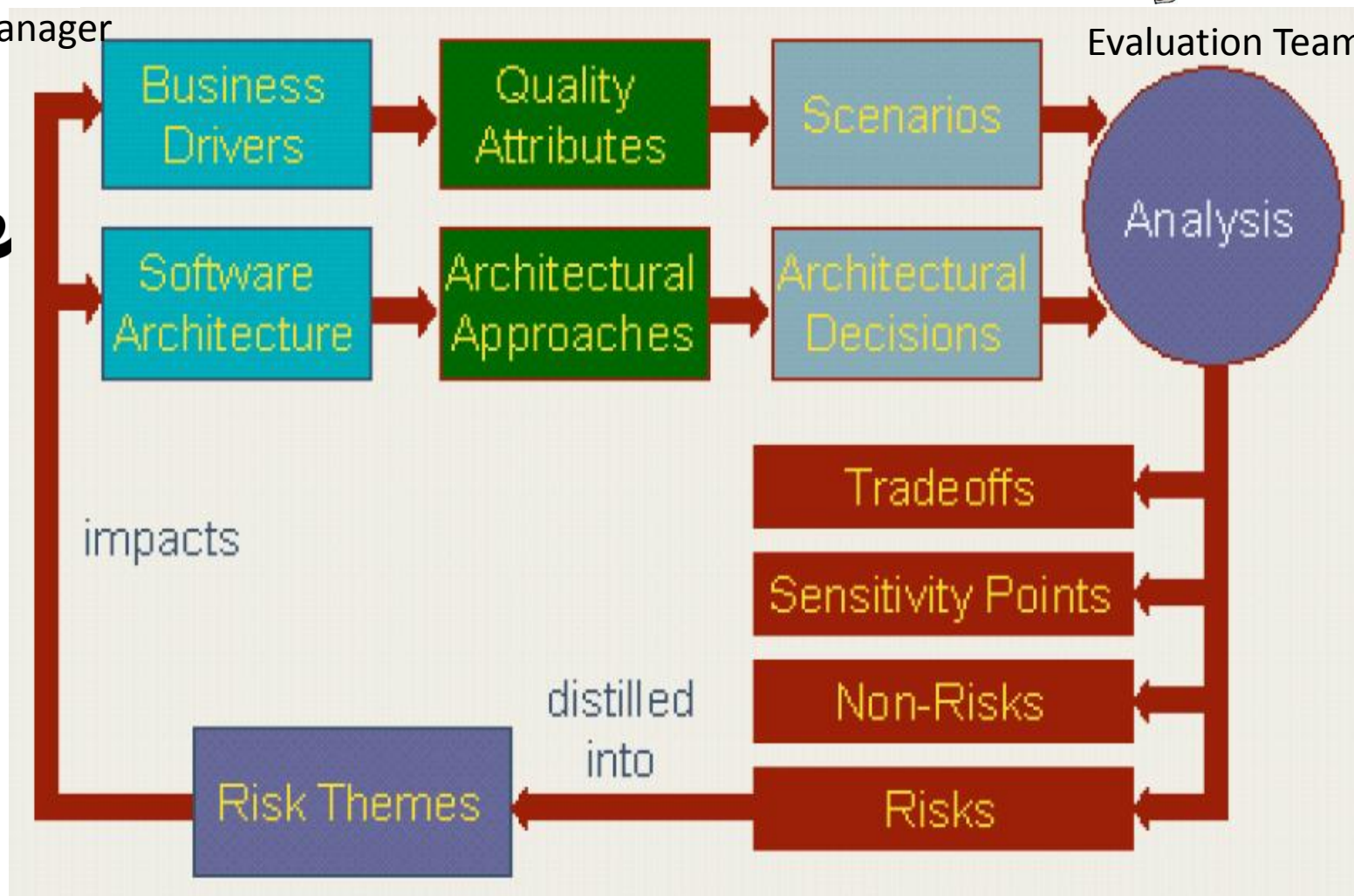
Representatives of the System

Business Presentation

↓

Business Drivers

↓

Quality Attributes

↓

Scenarios

Architect

Software Architecture Presentation

↓

Software Architecture

↓

Architectural Approaches

↓

Architectural Decisions

Project Manager

Architect

Evaluation Team

Business Drivers → Quality Attributes → Scenarios → Analysis

Software Architecture → Architectural Approaches → Architectural Decisions → Analysis

impacts

Analysis → Tradeoffs

Analysis → Sensitivity Points

Analysis → Non-Risks

Analysis → Risks

Risks distilled into Risk Themes

Scenario Utility Tree

- ➢ Utility
  - Performance
    - ▪ Data latency
      - — Minimize storage latency on customer DB to 200 ms
      - — Deliver video in real time
    - ▪ Transaction throughput
      - — Maximize average throughput to authentication server
  - Modifiability
    - ▪ New Product Categories
    - ▪ Change COTS
      - — change web user interface in < 4 person weeks
  - Availability
    - ▪ Hardware Failure
      - — power output at site 1 requires traffic redirect to site 3 in < 3 s
      - — network failure is detected and recovered in < 1,5 min
  - Security
    - ▪ Data confidentiality
      - — customer database authorisation works 99,999% of time

Scenario Brain Storming

Sc#	Description	Quality Att.	Votes
4	Dynamically replan a dispatched mission within 10 minutes.	Performance	28
27	Split the management of a set of vehicles across multiple control sites.	Performance, Modifiability, Availability	26
10	Change vendor analysis tools after mission has commenced without restarting system.	Integrability	23
12	Retarget a collection of diverse vehicles to handle an emergency situation in less than 10 seconds after commands are issued.	Performance	13
14	Change the data distribution mechanism from CORBA to a new emerging standard with less than six person-months' effort.	Modifiability	12

Business Drivers

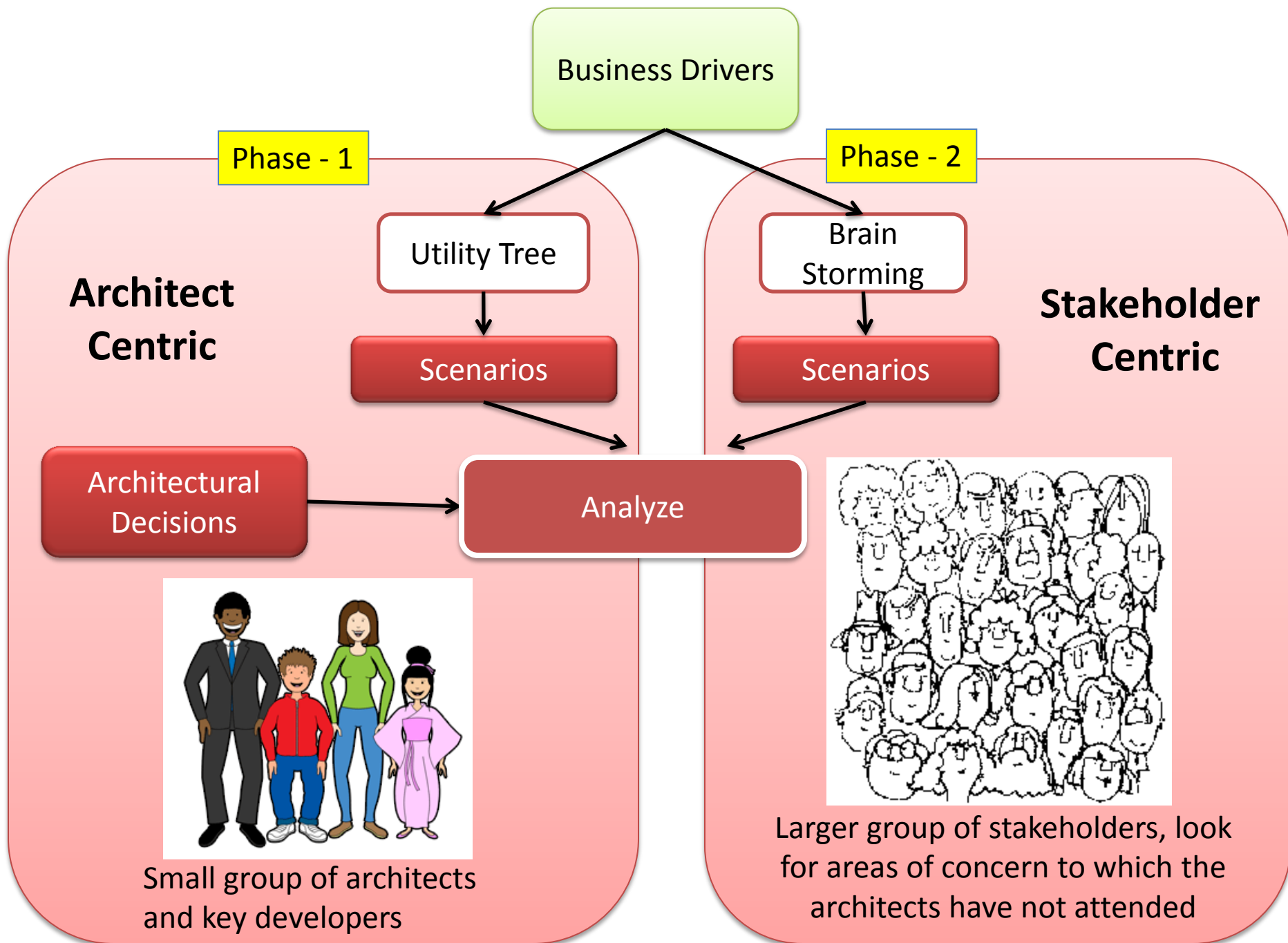Phase - 1

Phase - 2

Architect Centric

Stakeholder Centric

Concentrates on eliciting and analyzing architectural information.
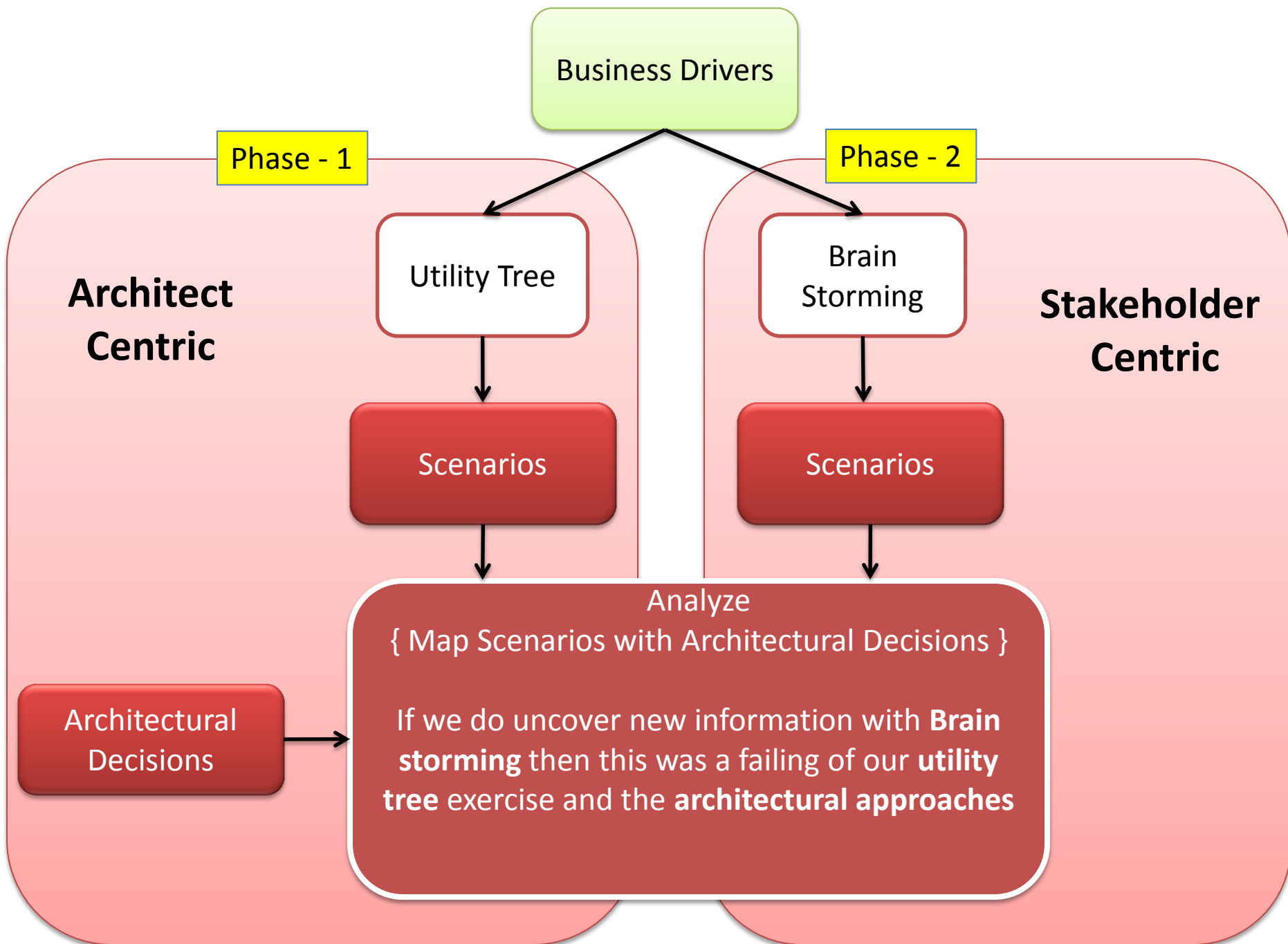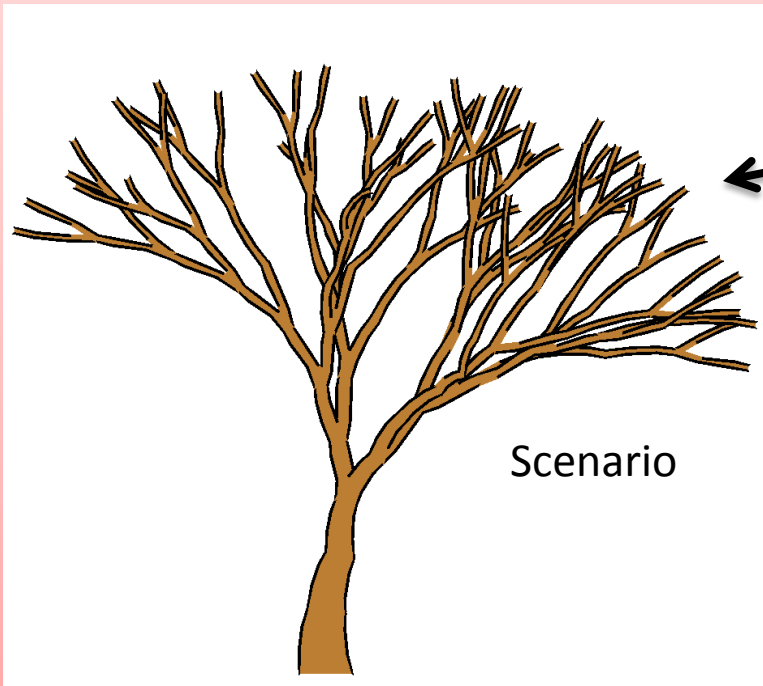
Elicits points of view from a more diverse group of stakeholders, and verifies the results of the first phase

Phase - 1

Architect Centric

Scenario

Utility Tree

Business Drivers
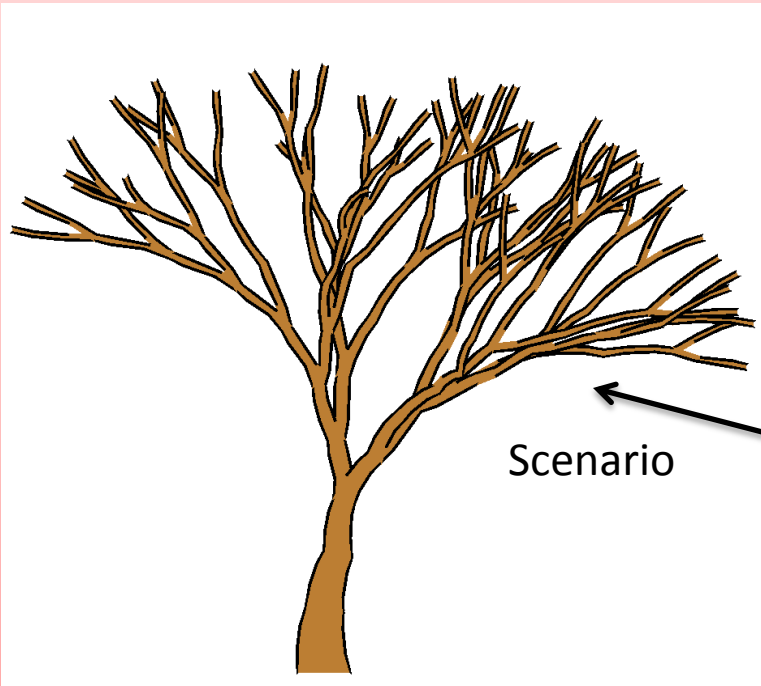
Phase - 2

Brain Storming

Scenarios

Stakeholder Centric

Comparing Scenarios with utility tree reveals disconnects between what the architects and stakeholders believe to be important system qualities.

Three things may happen when a scenario is placed in the utility tree

Business Drivers

Phase - 1

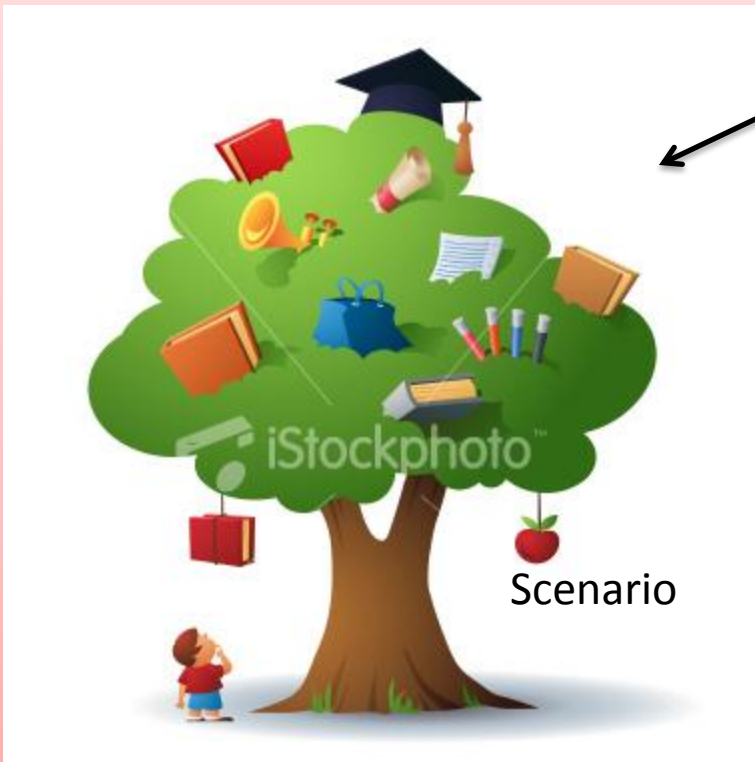Phase - 2

Architect Centric

Scenario

Utility Tree

Stakeholder Centric

Brain Storming

Scenarios

Each High Priority Scenario is inserted to an appropriate leaf node in the utility tree.

Architect

Scenario

Utility Tree

The Scenarios matches well to an existing leaf node.

1. Scenario has been already considered in utility tree exercise. (Duplicate)

Architect

The Scenarios dose not match to any existing leaf node in utility tree, but it can be associated with an existing branch of the utility tree .

Scenario

Utility Tree

1. The Quality attribute addressed by the scenario has been covered by other scenarios in the utility tree.

2. A scenario may be associated with multiple quality attributes. In that case the scenario is placed into the leaves of several branches.

Architect

Scenario

Utility Tree

The Scenario cannot be associated to any branch of the utility tree

1. Scenario expresses a quality requirement that has not been addressed previously in the utility tree exercise.

2. The architect may have failed to consider an important quality requirement.

3. Further Analysis of Architecture on this Scenario is required. (Repeat Phase 1)

Present Results

The collected information from the ATAM needs to be summarized and presented back to the stakeholders.

1. Introduction
2. Evaluating a Software Architecture
3. ATAM overview
4. The ATAM for <system name>
5. Summary of Business Drivers
6. Summary of Architecture Presentation
7. Quality Attribute Utility Tree
8. Scenario Generation, Consolidation, and Prioritisation
9. Analysis of Architectural Approaches
10. Risks, Sensitivities, trade-offs, Nonrisks, and Other Issues
11. Conclusions

Architecture Trade of Analysis Method

1 Present the ATAM. (ATAM Consultant)

2 Present business drivers. (Project Manager)

Presentation Phase

3 Present architecture. (Architect)

4 Identify architectural approaches.

5 Generate quality attribute utility tree.

6 Analyze architectural approaches.

Investigation and Analysis Phase

7 Brainstorm and prioritize scenarios.

8 Analyze architectural approaches (Map Scenarios)

Testing Phase

9 Present results.

Reporting Phase

Architecture Trade off Analysis Method

- The ATAM workshops typically takes three days and the involvement of 10-20 people
  - Evaluators
  - Architects
  - and other system stakeholders

Project Manager

Evaluation Team

Architect

Day 1

8:30	Introductions/ATAM Presentation (1)
10:00	Customer Presents Business Drivers (2)
10:45	Break
11:00	Customer Presents Architecture (3)
12:00	Identify Architecture Approaches (4)
12:30	Lunch
1:45	Quality Attribute Utility Tree Generation (5)
2:45	Analyze Architecture Approaches (6)
3:45	Break
4:00	Analyze Architecture Approaches (6)
5:00	Adjourn for the Day

Phase 1

Break of several week

Day 2

8:30	Introductions/ATAM Presentation (1)
9:15	Customer Presents Business Context/Drivers (2)
10:00	Break
10:15	Customer Presents Architecture (3)
11:15	Identify Architecture Approaches (4)
12:00	Lunch
1:00	Quality Attribute Utility Tree Generation (5)
2:00	Analyze Architecture Approaches (6)
3:30	Break
3:45	Analyze Architecture Approaches (6)
5:00	Adjourn for the Day

Day 3

8:30	Introductions/Recap ATAM
8:45	Analyze Architecture Approaches (6)
9:30	Scenario Brainstorming (7)
10:30	Break
10:45	Scenario Prioritization (7)
11:15	Analyze Architecture Approaches (8)
12:30	Lunch
1:30	Analyze Architecture Approaches (8)
2:45	Prepare Report of Results/Break
3:30	Present Results (9)
4:00	Further Analysis/Assignment of Action Items
5:00	Adjourn

Phase 2

Day 2	
8 : 30	ATAM Presentation (Evaluation lead)
10:00	Business Presentation (Project manager)
10:45	Break
11:00	Architecture Presentation (Architect)
12:00	Identify Architecture Approaches
12:30	Lunch
1:45	Utility Tree Generation
2:45	**Analyze Architecture Approaches**
3:45	Break
4:00	**Analyze Architecture Approaches**
5:00	Adjourn for the Day

Day 3	
8:30	**Analyze Architecture Approaches**
9:30	Scenario Brainstorming
10:30	Break
10:45	Scenario Prioritization
11:15	**Analyze Architecture Approaches**
12:30	Lunch
1:00	**Analyze Architecture Approaches**
2:45	Prepare Result / Break
3:30	**Present Result (Evaluation lead)**
5:00	Adjourn for the Day

The results are improved architecture.