Improving the Assessment of Advanced Planning Systems by Including Optimization Experts' Knowledge

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Automatize planning

Optimization in different areas

ADVANCED PLANNING SYSTEMS

Functional Requirements & Quality Attributes

Software & Models.

Developers

Traditional Software Devs

Process Opimization Experts

APS-RA
REFERENCE
ARCHITECTURE

Based on the

Functional Requirements

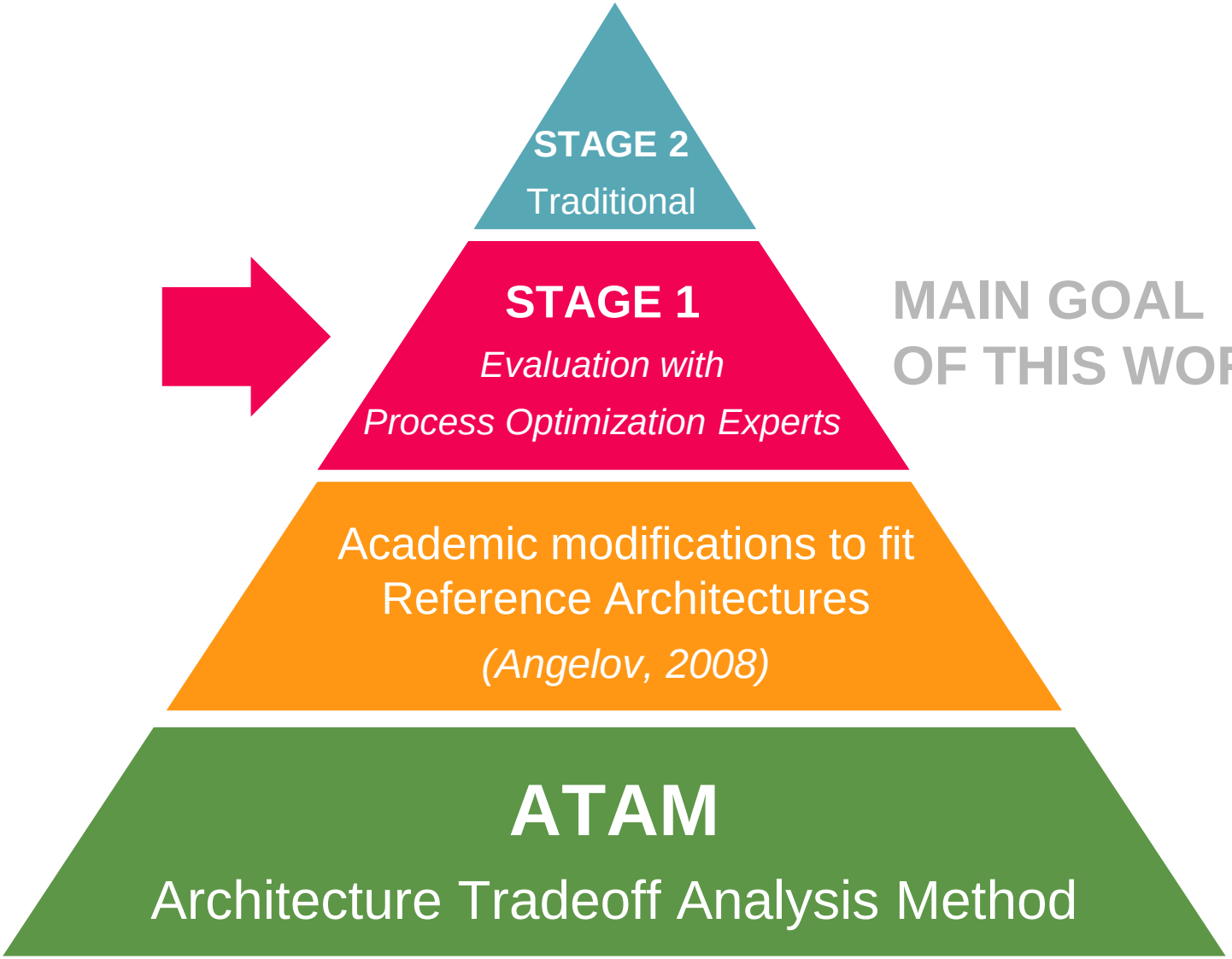
& Quality Attributes

for the software, the models, and the relation solver-APS.

NEED OF
SPECIFIC
EVALUATION
METHOD

Architecture Evaluation Methodology

Ensures the architecture design enhances the elicited Quality Attributes.



MAIN GOAL
OF THIS WORK

ATAM-M STAGE 1

Works with Process Optimization Experts (POE).

Evaluates Quality Attributes that apply to the model and/or solver-APS relation.

Capitalizes POE's knowledge and focuses on what is important for them.

Identification of Architectural Patterns & Styles

Second generation of Scenarios (Level 2)

Comparison/rework of Utility Tree.

Quality Attribute Questions (Level 1)

Generation of Utility Tree

Introduction and presentation.

Discovery and proposal of Design Decisions, instead of Tactics.

Questions (Level 2) about Design Decisions.

List of risks, sensibilities and tradeoffs.

DESIGN DECISIONS (DDs)

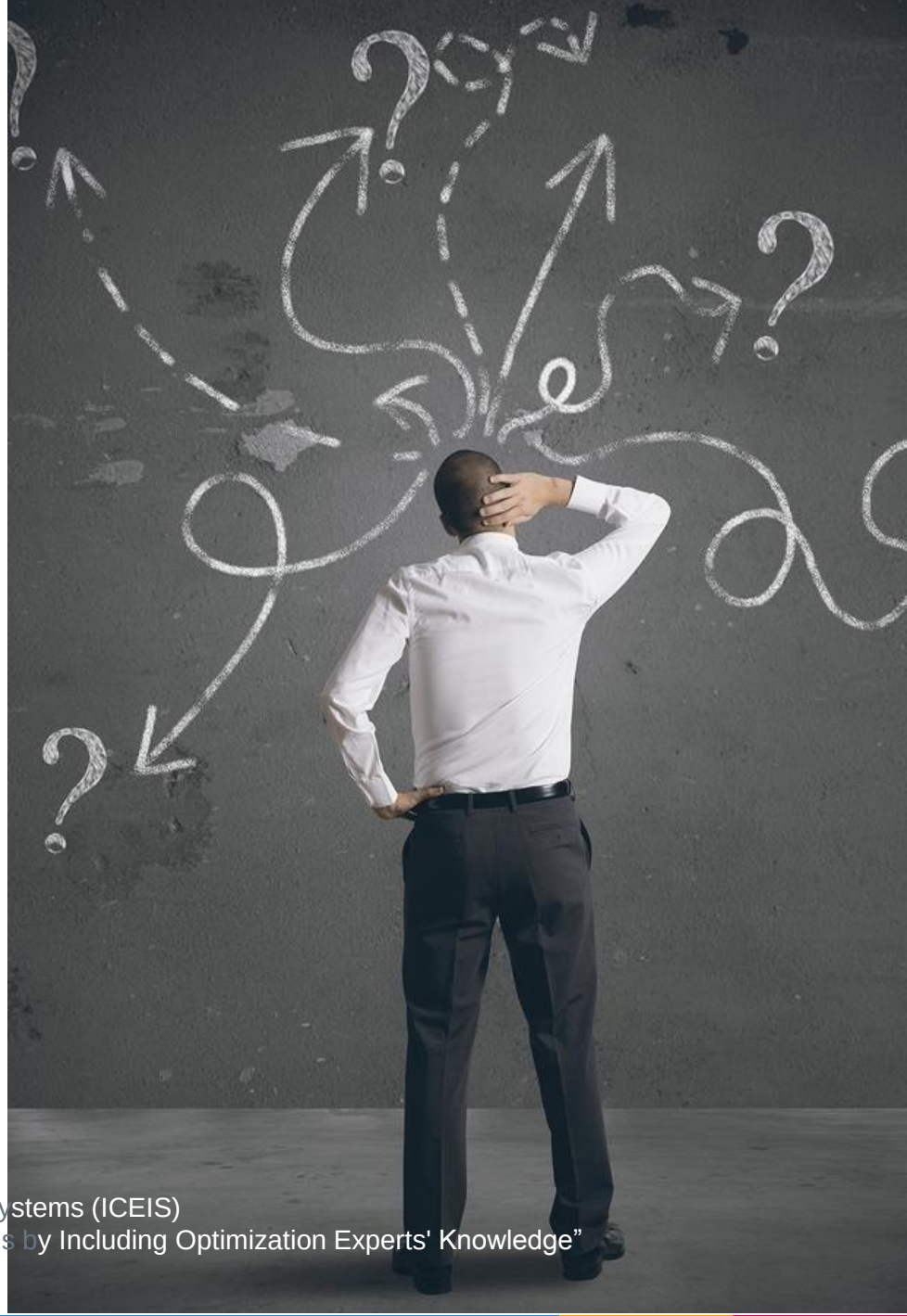
DDs are structural choices made when planning and developing a model, regardless of the solving approach, that improve or hinder its qualities, and/or its relation with the APS.

Vague Design Decisions are risks.

Measurable DDs are sensibility points.

Software DDs can be identified, but model-related DDs need to be proposed.

DDs contribute to variation points in the Reference Architecture.



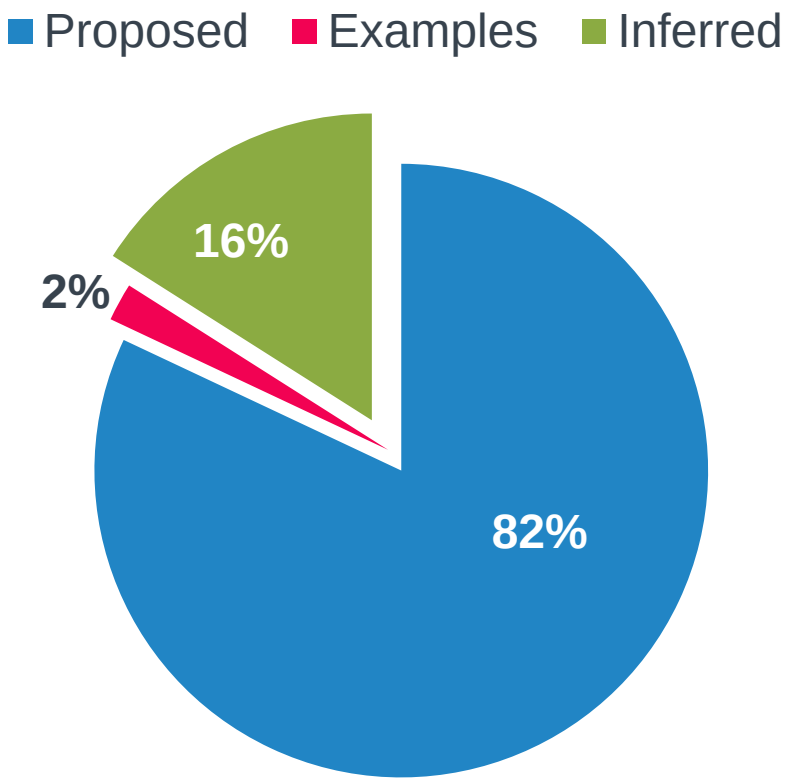
ATAM-M STAGE 1
RESULTS

Participants: recruited researchers, professional experts active on planning problems.

Academic and Industrial experience.

Obtained Results: outputs of the ATAM-M Stage 1, and recommendations regarding the APS-RA.

QUALITY ATTRIBUTE QUESTIONS



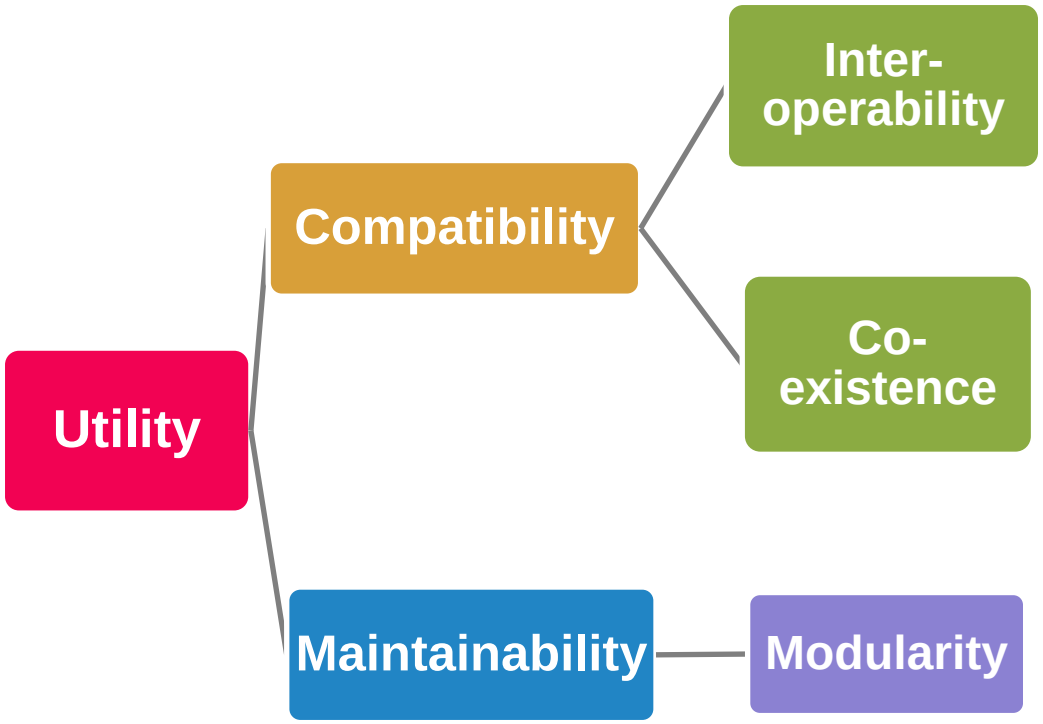
- How much does the solving approach affect the solutions quality? (Decision)
- Which decisions can be taken by the user and which are automatized? (Stimuli)
- Should performance measures vary for each solving approach or each model? (Response)
- How is determined the maximum time a model can use to execute, with a normal use of hardware resources? (Response).

UTILITY TREE **SCENARIOS**

Allows identifying situations in which QA are reflected on the architecture.

Produces 32 nodes, and 7 are classified with high priority and high difficulty.

Results focus on maintainability and model exception management.



The system reads input data for an execution, and negative values are found. The scenario execution is stopped and the user notified.

A model solver is changed, but it is transparent for the user. The existent models do not need changes.

Due to changes on the organization the current models become obsolete. Changing and adapting them do not require more than X weeks.

DESIGN DECISIONS & QUESTIONS

33 Design Decisions identified and proposed.

52 relations between DDs and scenarios of the Utility Tree.

52 Questions related to Design Decisions

DESIGN DECISIONS

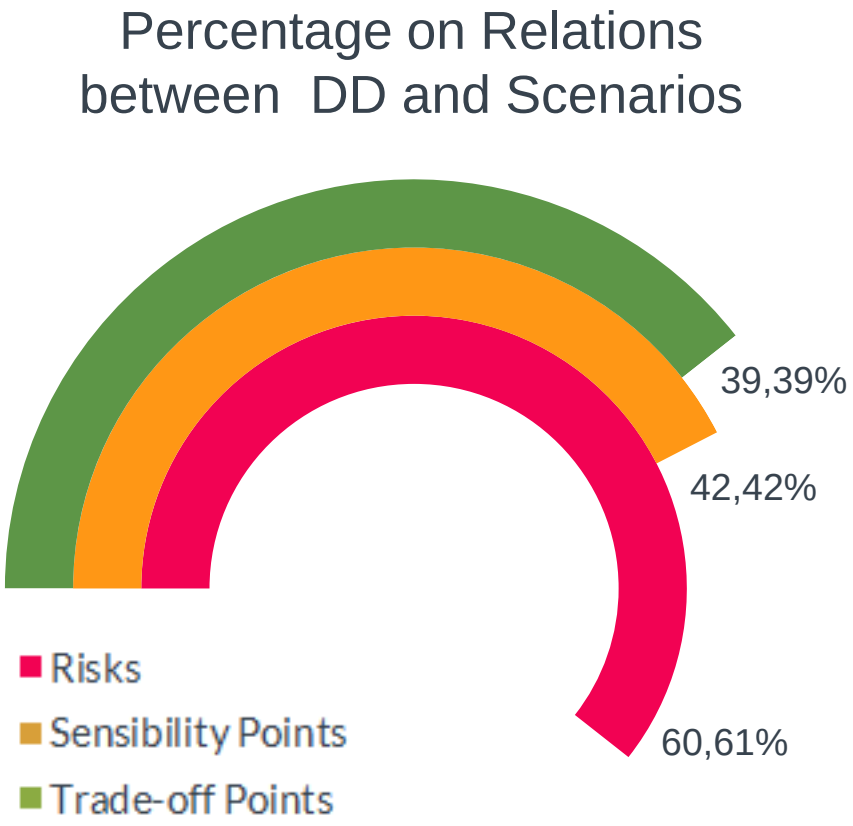
- Link models and solutions obtained from each execution.
- Consistency check with historical data from previous runs.
- Process monitor during scenarios solving.
- Available hardware/software resources for model solving.
- Limiting solver execution parameters.
- Create documentation for each model.

DD QUESTIONS

- Do language semantics limit changes available to a model? (Decision, risk).
- Is the model modifiability affected by the lack of documentation? (Response, risk).
- How much working time is acceptable for a senior user to learn to manage the solutions traceability? (Response, sensibility point).
- How do error tolerance changes affect the solutions quality? (Stimuli, trade-off).

RISKS, SENSIBILITIES & TRADEOFFS

Derived by inspecting each DD on each scenario from the Utility Tree.



EXAMPLE

- Design Decision: Limit time to execute a particular model.
- Risk: on some scenarios, it represents the risk of having unfeasible solutions because the allotted time is not enough for solving.
- Sensibility: on some scenarios, metrics can be derived to further the study of required time to solve an problem.

APS-RA ASSESSMENT

APS-RA enforces the selected QA, the variations are pre-planned in order to maximize the interoperability.

APS-RA works as a framework due to the wide range of considerations, not limiting the solving approach to Operation Research, considering production strategies, and more.

NEW FUNCTIONAL REQUIREMENTS

- Managing Restrictions, gives the models the ability to be executed with different sets of restrictions.
- Solution Traceability: added as parts of existing requirements, aims to store some intermediate solutions under specific conditions.

CONCLUSIONS

Participants are **consistent** on assigning relevance, revealing their interest to study those attributes.

Successful application of the novel proposal of **Design Decisions**, their applicability to optimization models, and their similarity to architectural tactics.

Effective **inclusion of participants** with expertise areas not related to Software Engineering.

Fruitful evaluation of APS-RA through the ATAM-M Stage 1 method, allowing to study aspects that are **key for the APS domain**, but cannot be evaluated with a traditional methodology.

Thank you!

Questions?

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