Usage of AI in Stakeholder Requirement specification: a Comparison between Human- and AI-based workflows

OVERVIEW

- Introduction and Use Case description
- Workflow elicitation Human-based
- Workflow elicitation AI-based
- Detailed description of AI-based process
- Advantages
- Critical points
- Possible Mitigations

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INTRODUCTION

- AI as a tool to support and speed up product development:

    - How can AI be used as a support to the various V-Cycle phases?

    - How can AI be used in the most automated way, with the least human supervision?

   - What is the optimal trade-off between AI use and human intervention?

CASE UNDER STUDY

- Definition of **stakeholder requirements** for a fictive automotive ECU

- With reference to ASPICE 4.0, focus on **SYS.1**

- **Goal**: define a workflow blending human and AI interventions in an efficient way
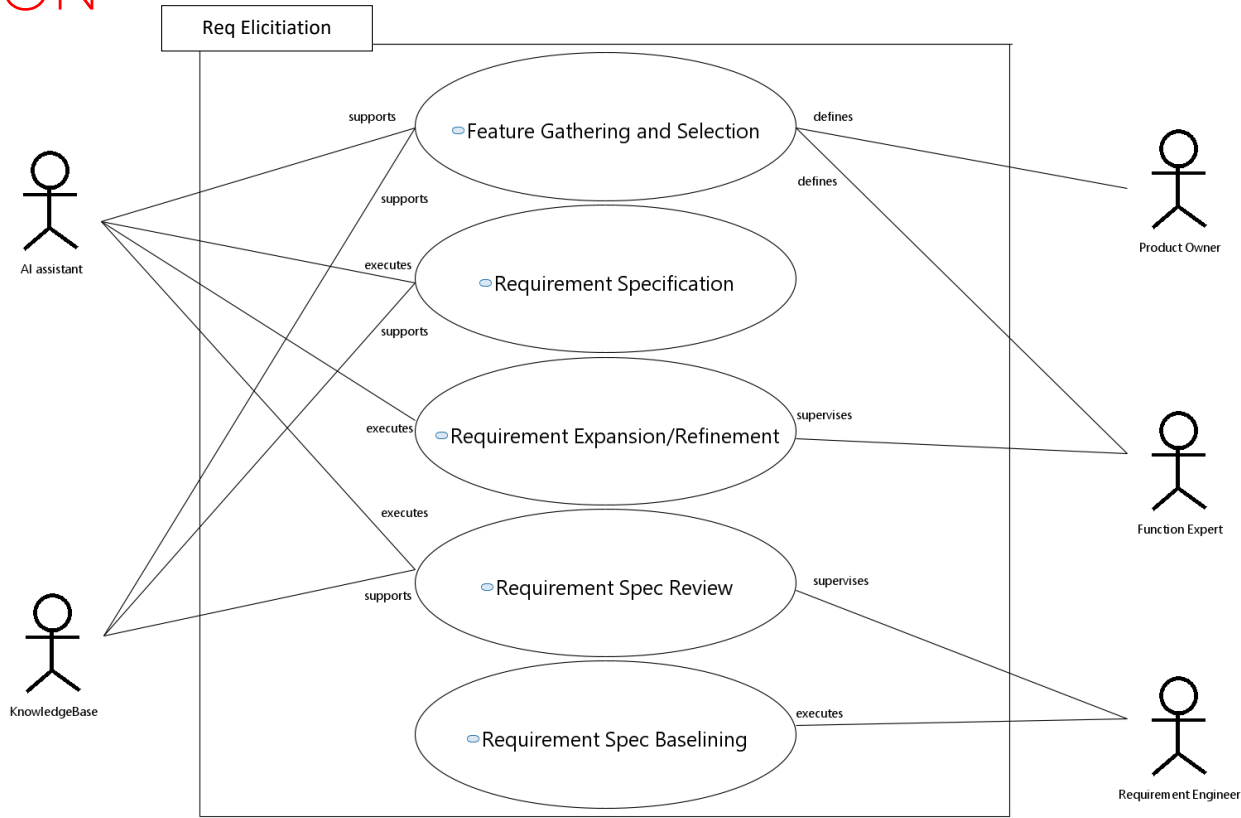
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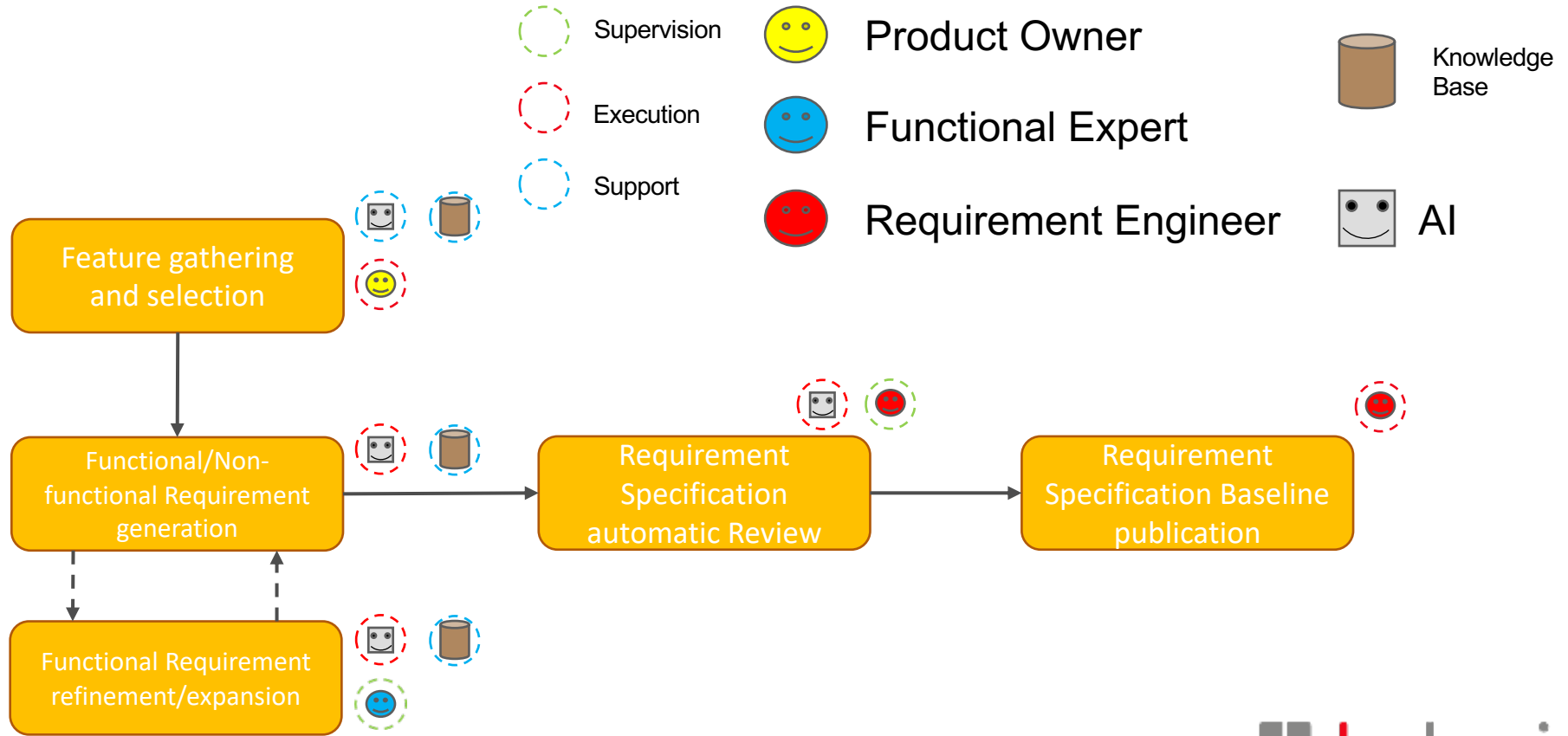# Use case: human-based requirement elicitation
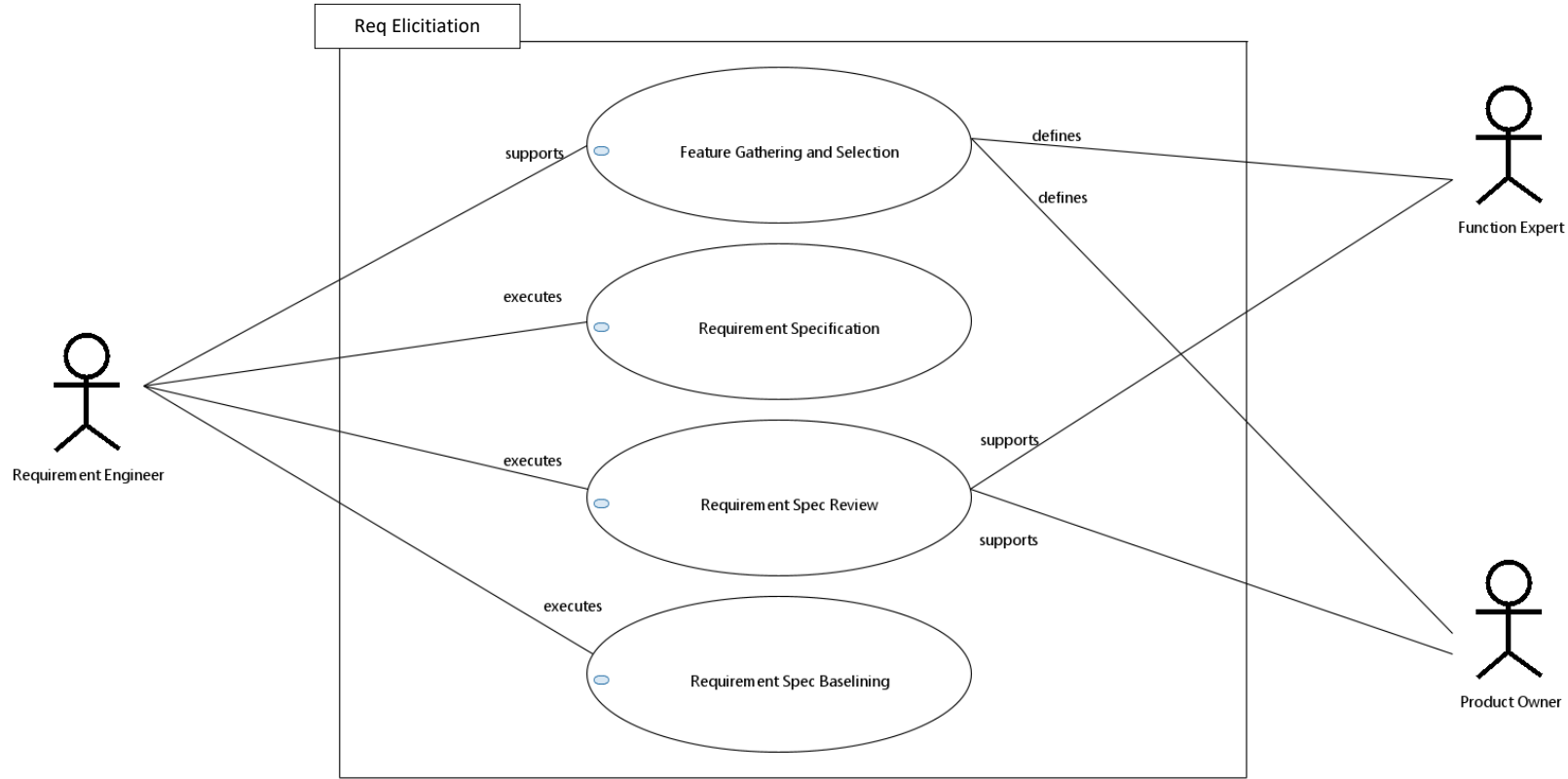
USE CASE: HUMAN-BASED REQUIREMENT ELICITATION WORFLOW
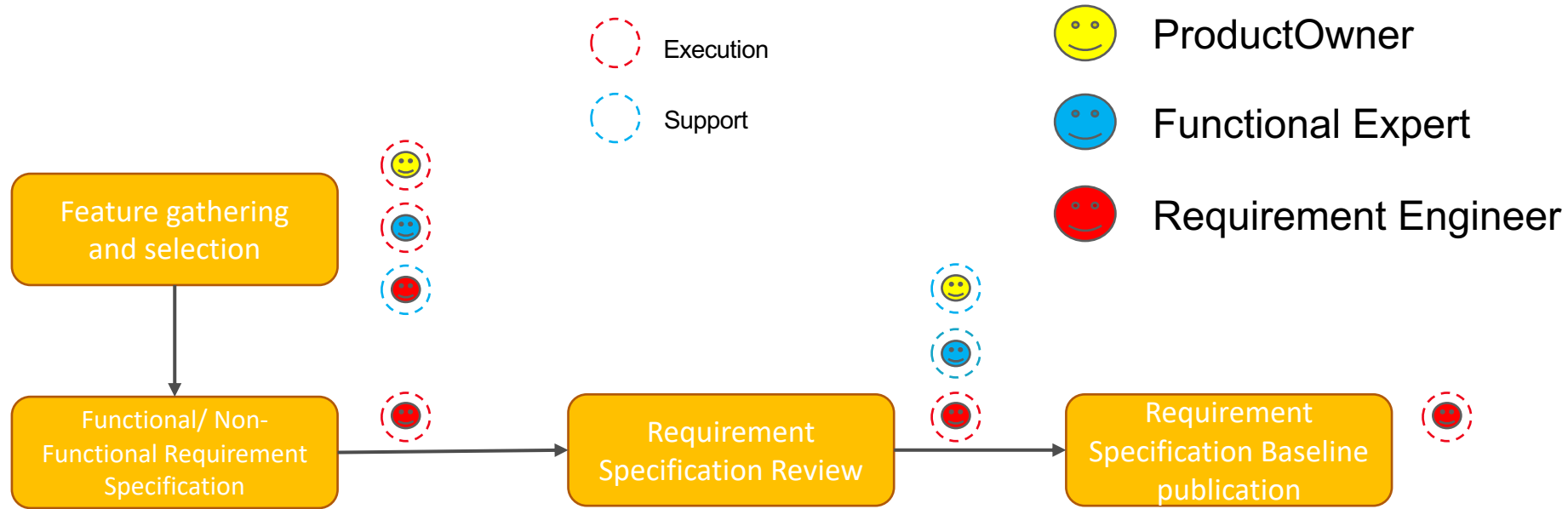
Comparison of Use cases: AI-based requirement elicitation

Use case: AI-based requirement elicitation worflow

Legend:
- (green dashed) Supervision
- (red dashed) Execution
- (blue dashed) Support

- 🙂 Product Owner
- 🙂 Functional Expert
- 🙂 Requirement Engineer
- 🤖 AI
- 🛢 Knowledge Base

Feature gathering and selection

Functional/Non-functional Requirement generation

Functional Requirement refinement/expansion

Requirement Specification automatic Review

Requirement Specification Baseline publication

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DESCRIPTION OF AI BASED PROCESS: FEATURE GATHERING AND SELECTION

- Feature gathering and selection is carried over by the **PO**, with support of an AI with RAG (Retrieval Augmented Generation), based on the company functional and product knowledge base

- In case of new functions or products, the knowledge is generated in form of a «**brainstorming**» between a PO and an AI as discussion partners

- This is at least, in the first steps, an **iterative process** (a dialogue between the human and the artificial partners)

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Description of AI based process: requirement generation

- The **AI** plays the role of a **requirement engineer** and generates functional and non-functional requirements, based on the selected features.

- This process is typically iterative. The human operator gives directives to the AI to drive it in specific directions or narrow the perimeter to control functional coherence and quality/quantity of the requirements.

- The **operator** also plays the role of a **supervisor**, validating the results.

- Requirement format can be defined in a detailed and specific way

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DESCRIPTION OF AI BASED PROCESS: REQUIREMENT SPECIFICATION REVIEW

- The generated requirements are **reviewed by the AI** against **semantic** criteria such as redundancy, correctness, coherence, ambiguity and more **formal** aspects such as atomicity, tracing, testability etc.

- The human partner takes the **overviewer** role, checking that the results are correct and complete.

- Up to a certain level, it is also possible to have the **AI reformulate** unsatisfatory requirements.

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- The reviewed requirements can be finally baselined and released

- This step is done by a human operator.

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COMPARISON OF THE AI-BASED VS. THE HUMAN-BASED WORKFLOW

- The AI takes the role of the Requirement Engineer in the AI-based workflow, as far as concerns the most formal aspects (formulation, review).

- This allows a **more direct involvement** of the PO and Functional Experts in the requirement elicitation process.

- The most tedious and demanding activities (formulation of correct and formal requirement, formal review, completeness, coherence, ambiguity reviews) are passed over to the AI.

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Comparison of the AI-based vs. the human-based workflow

- The human partner takes over a **supervisory** role on those activities and is left much more time to concentrate on **creative innovation, feasibility analysis, product refinement**

- Access to the **company knowledge** is wider, as any document stored in a machine-readable format can be used by the AI. This allows a much broader use of **complex** and **distributed** knowledge.

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COMPARISON OF THE AI-BASED VS. THE HUMAN-BASED WORKFLOW

- As a side effect, the damage of knowledge loss due to employees leaving of the company is significantly mitigated.

- The knowledge base can be extended also to standards, guidances, laws etc.

- The AI-based workflow is heavily automatable, as the approach works both with a direct interaction of a user with an AI (e.g. Chatbot) or by use of a programmed process accessing local or remote AIs through standard APIs.

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CRITICAL POINTS AND POSSIBLE MITIGATIONS

- Output quality is heavily dependent on the prompt formulation:

  - ❌ Skill in prompting techniques needed (**prompt engineering**)
  - ❌ Steep initial learning curve to reach the desired result quality, it gets easier as experience in prompting is accumulated
  - ✓ With the evolution of the AI models, the importance of prompting techniques is decreasing, as models are inherently more focussed and targeted on common use cases

- Output formatting:

  - ❌
    - Prompting techniques specifically designed to control output format must be used, in order to directly use outputs
  - ✓
    - Newer models can manage structured data as a built-in feature (e.g. csv, JSON, tables)

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CRITICAL POINTS

- Text generation models are stochastic constructs:

  ❌ Generating n-times with the same prompt generate n similar but not equal outputs.

  ❌ This has to be taken in account in case of **more formal activities**.

  ❌ Hyperparameterisation can trade off **creativity** vs. **deterministic** behavior, but only up to a certain point.

  ✅ Human supervision and validation is still needed as models «hallucinate» still nowadays, although decreasingly.

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CRITICAL POINTS

- Confidentiality issues:

  ❌ Each time a remote AI model is used, any information passed through the prompt or any file attached is potentially leaked to an **unclearly defined third party**, whose privacy policies are sometimes elusive and hard to prove.
  There is no real guarantee, that that material won't be used as **training material** for the AI.

  ✓
  - It is advisable either to use **local**, **isolated** models (which require a powerful and expensive equipment to run with acceptable performance) or to **share only public**
  ✓ **data**.

  - It is possible to use an AI model itself to classify the confidentiality level of the material, based on a configurable policy. This must be done locally, obviously.

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THANK YOU FOR YOUR ATTENTION

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ANY QUESTIONS?

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