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Requirements Engineering

A very brief overview

Why do Software Projects Fail?

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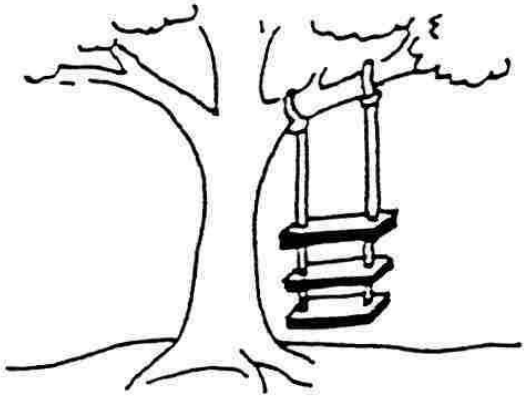
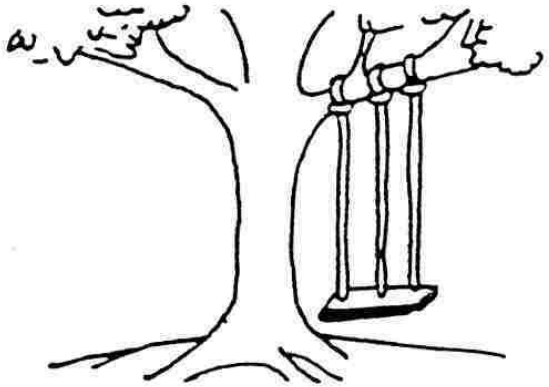
- ” 80% of new products fail, 70% of software projects fail **due to poor requirements”**

  Leveraging Business Architecture to Improve Business Requirements Analysis, 2014

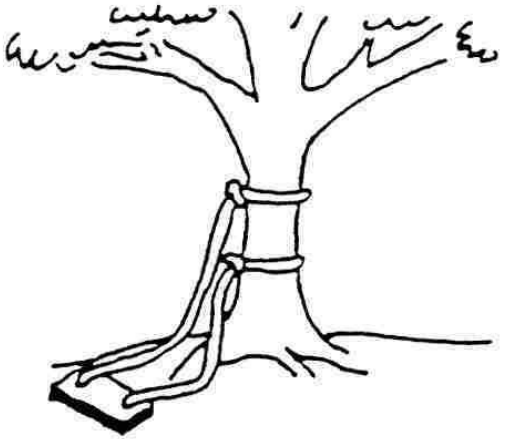
“Problem solving is an art form not fully appreciated by some”



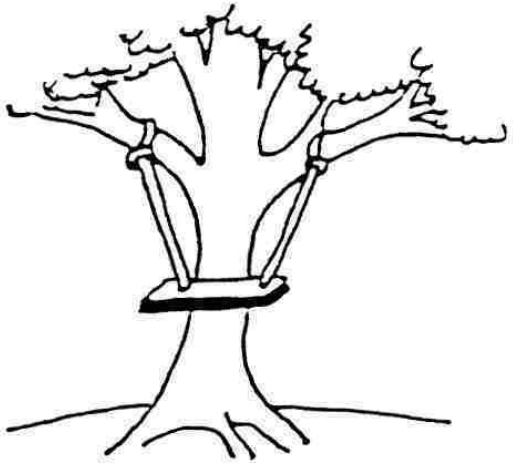
As proposed by the project sponsors



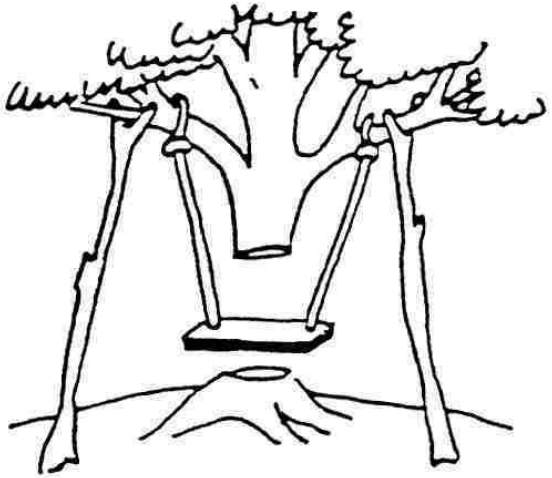
As specified in the project request



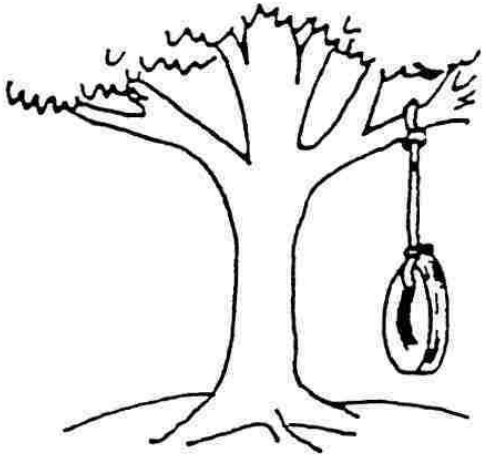
As designed by the senior analyst



As produced by the programmers



As installed at the user's site



What the user wanted

Tree Swing graphic by S Høgh 1993 - from Businessballs.com/treeswing.htm 2013

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Requirement

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- "Requirement - statement which translates or expresses a need and its associated constraints and conditions" – ISO/IEC/IEEE 29148 standard
- Functional
  - what the system should do
- Non-functional
  - How well/good/fast the system should do
  - a quality of the (functionality of the) product
  - It can represent the use case as a whole or one of the specific functional requirements
  - HOW does not mean technical requirement.

Example of requirements

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- Functional Requirements: “The product shall record all the roads that have been treated”
- Nonfunctional Requirements
  - Look and Feel: The product shall be attractive to a teenage audience.
  - Usability: The product shall help the user to avoid making mistakes,
  - Performance: Any interface between a user and the automated system shall have a maximum response time of 2 seconds.
  - Operational and Environmental: The product shall be usable in dim light.
  - Maintainability and Support: A new weather station must be able to be added to the system overnight
  - Security: Only direct managers can see the personnel records of their staff.
  - Cultural and Political: The product shall be able to distinguish between French, Italian, and British road-numbering systems
  - Legal Requirements: The product shall comply with insurance industry standards.

Requirements engineering activities (IEEE)

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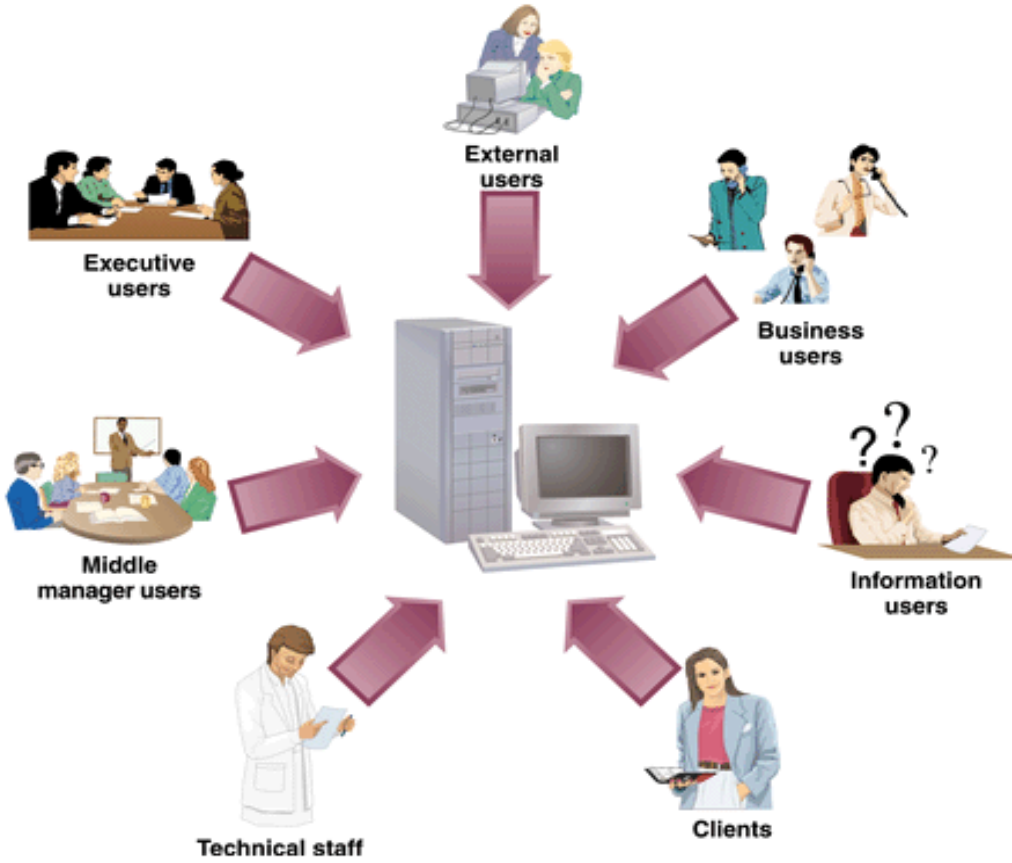
- Requirement Determination / Elicitation /Gathering /Discovery
  - The process of seeking, capturing and consolidating requirements from available requirements sources.
- Requirements Analysis
  - Analysis of elicited requirements in order to understand and document them.
- Requirements specification
  - A systematically represented collection of requirements, typically for a system or component, that satisfies given criteria.
- Systems modeling
  - deriving models of the system, often using a notation such as the Unified Modeling Language (UML)
  - Helps in better understanding and communication the requirements
- Requirements validation
  - checking that the documented requirements and models are consistent and meet stakeholder needs
- Requirements management
  - managing changes to the requirements as the system is developed and put into use

Stakeholders = a source of reqs

- A person that has interest in the system
- Different persons have different interests, thus different requirements
- Interest does not mean "success of the project" (legislation, standards)
- Identifying stakeholders:
  - Owners, Partners, Managers, Staff, Developers, Regulatory bodies, Suppliers, Customers, Competitors
- Analyze stakeholders:
  - What is their motivation? Expectations? Availability? Authority?



Gathering requirements is difficult

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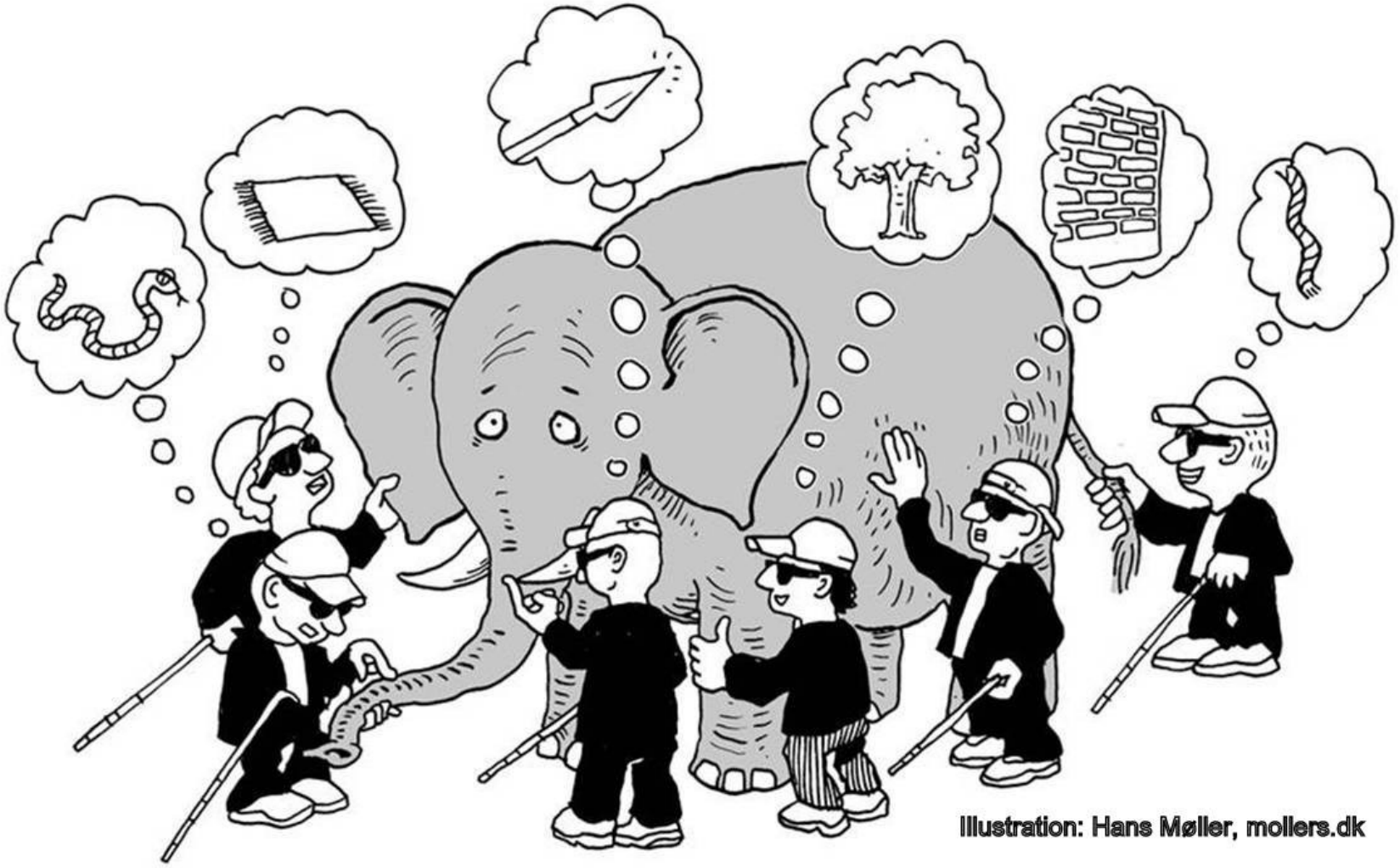

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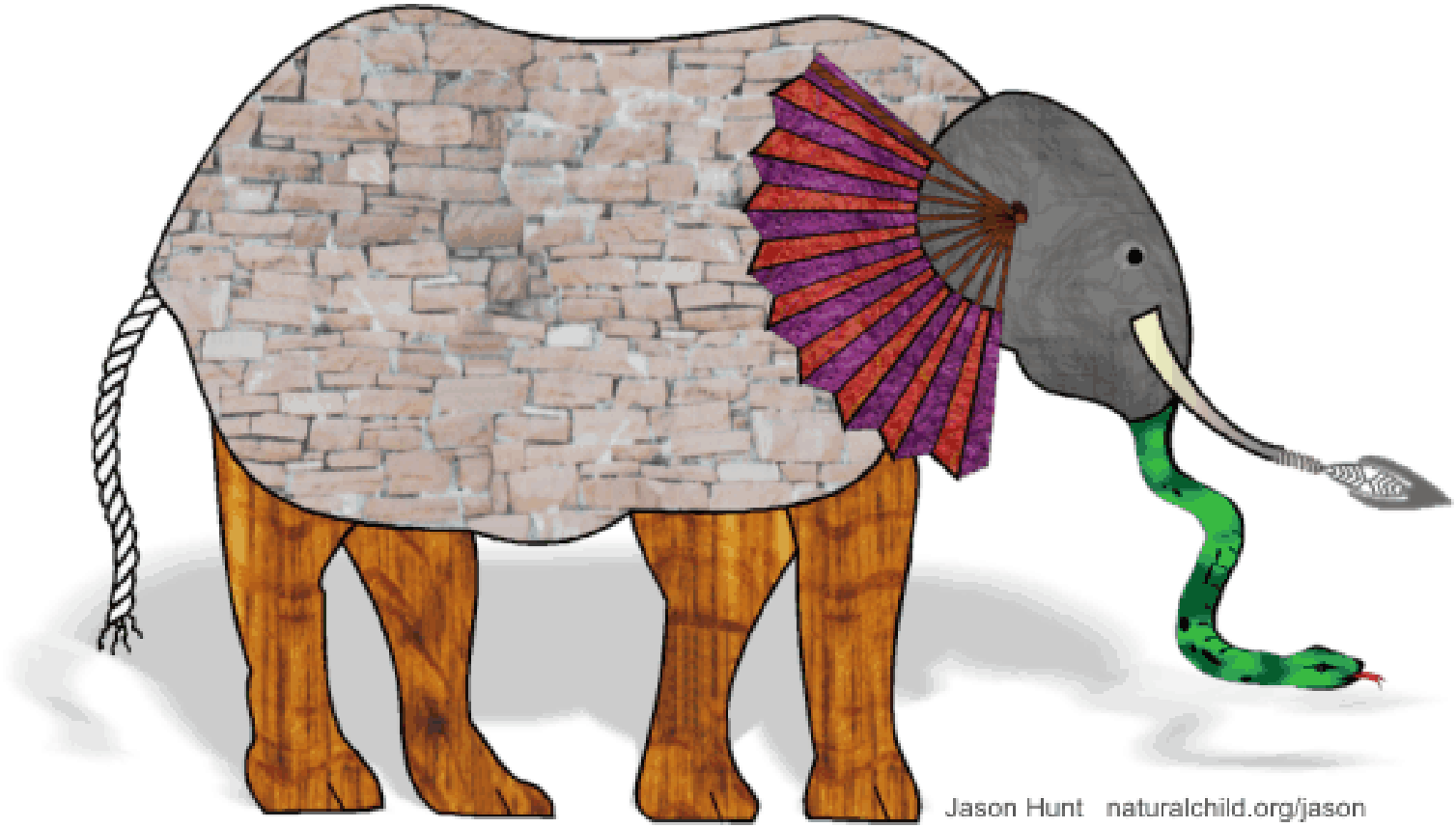

Stakeholder issues

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- Do not understand what they want (before they see the final product)
- All their requirements are most important
- They change requirements after cost and schedule fixed
- Communication with them is slow
- Are not technical experts
- Do not know about latest technology
- Do not understand development process

Techniques for requirements elicitation

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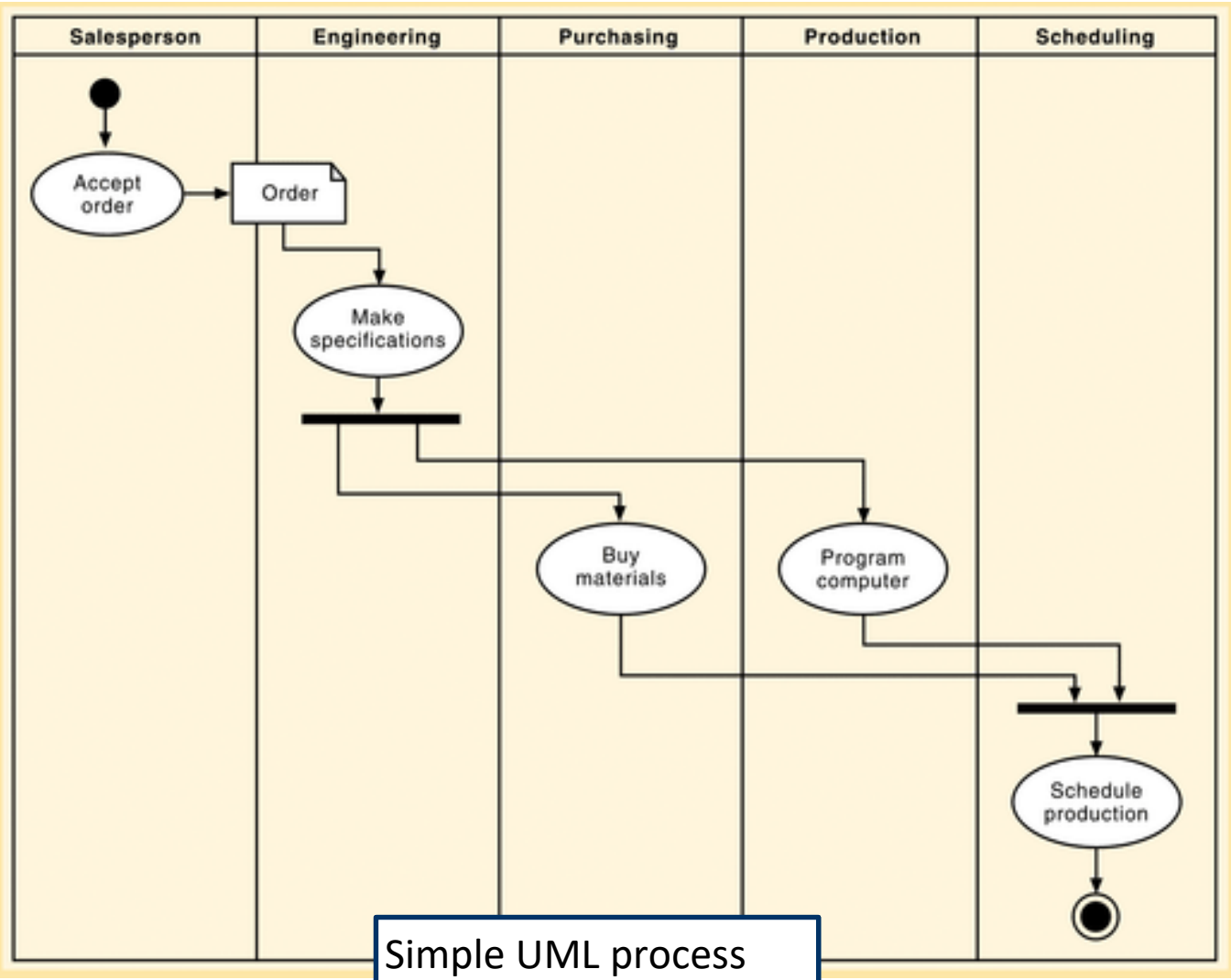
- Questionnaires
- Interviews
- Document Analysis
- Observations
- Prototyping

Observe, document, analyse processes



Simple UML process

- Ways to act
  - Business Process Analysis
    - How things are done now
  - Business Process Improvement
    - How steps could be done better (faster, cheaper, in parallel, etc)
  - Business Process Automation
    - Which steps can be automated

Prototyping

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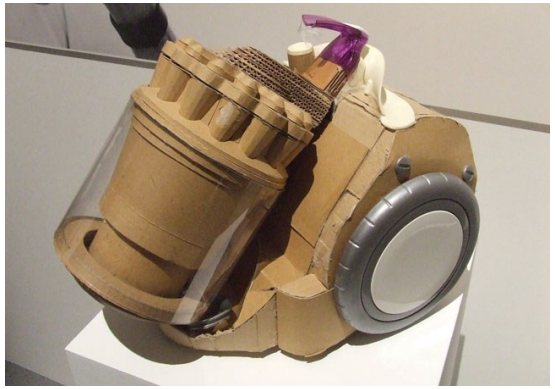
- *"A type of development in which emphasis is placed on developing prototypes early in the development process to permit* ***early feedback and analysis*** *in support of the development process."* (IEEE)
- A prototype is an initial/partial version of a system which is available early in the development phase
  - Some functionality may be left out, A prototype does not include all possible requirements
  - Non-functional requirements (performance) are less stringent
  - No complete documentation
- Can be done at early stages to clarify or discover new requirements
- Use to bridge the terminology gap between stakeholders
- Essential for developing the 'look and feel' of a user interface

Prototyping



- In other design fields a prototype is a small-scale model:
  - a miniature car, a miniature building or town
- In software design it can be (among other things):
  - a series of screen sketches, a storyboard, etc,
  - a Powerpoint slide show
  - a video simulating the use of a system
  - A piece of software with limited functionality written in the target language or in another language
- Some tools: Powerpoint, Balsamiq, Figma etc.

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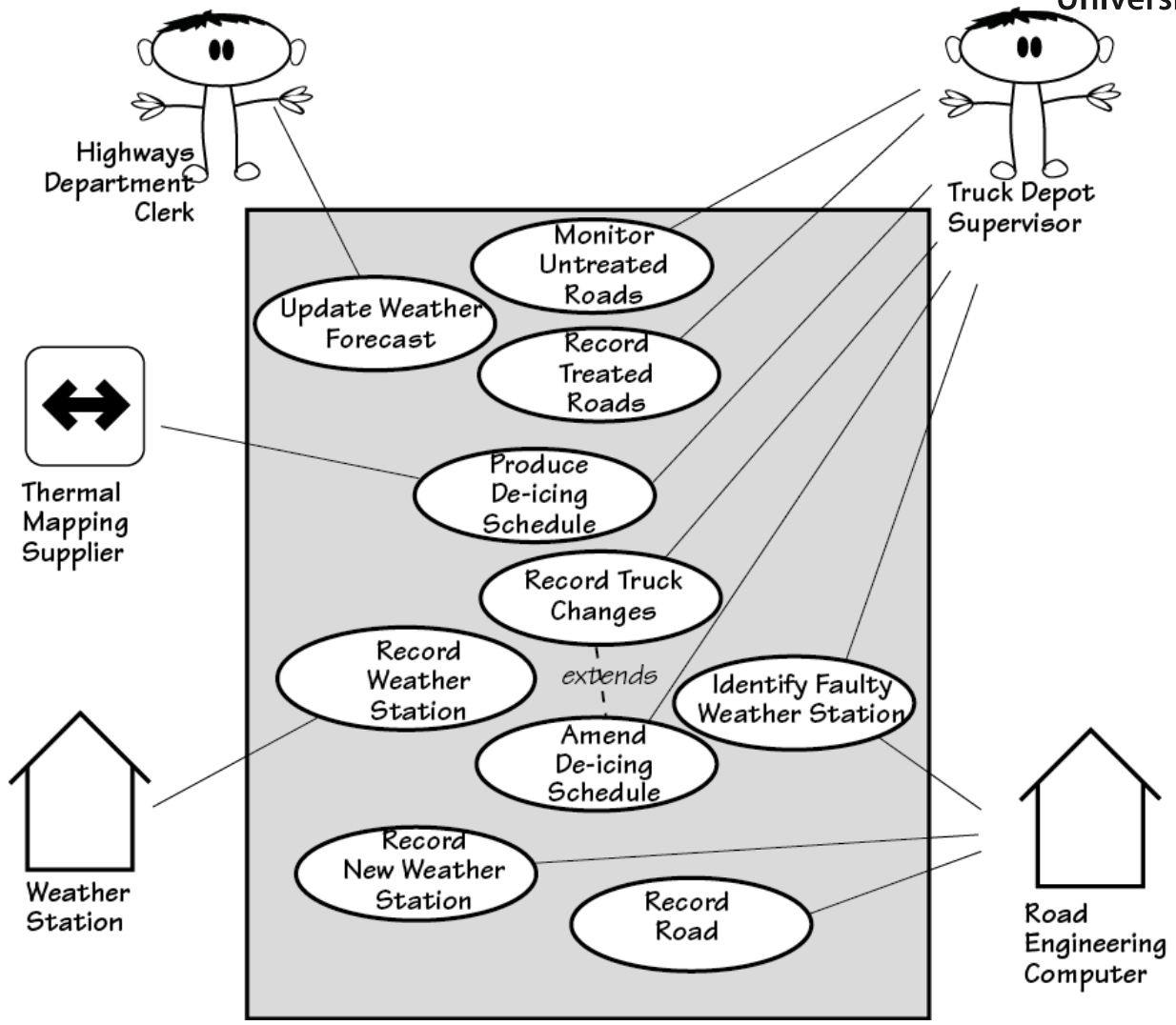
Requirements modeling

- An alternative (graphical) way do describe requirements
- *"All models are wrong, but some are useful"* (George Box)
- NOTE: we are representing the concepts of the system (domain models) **not** providing design models



Specify Scenarios from User Stories

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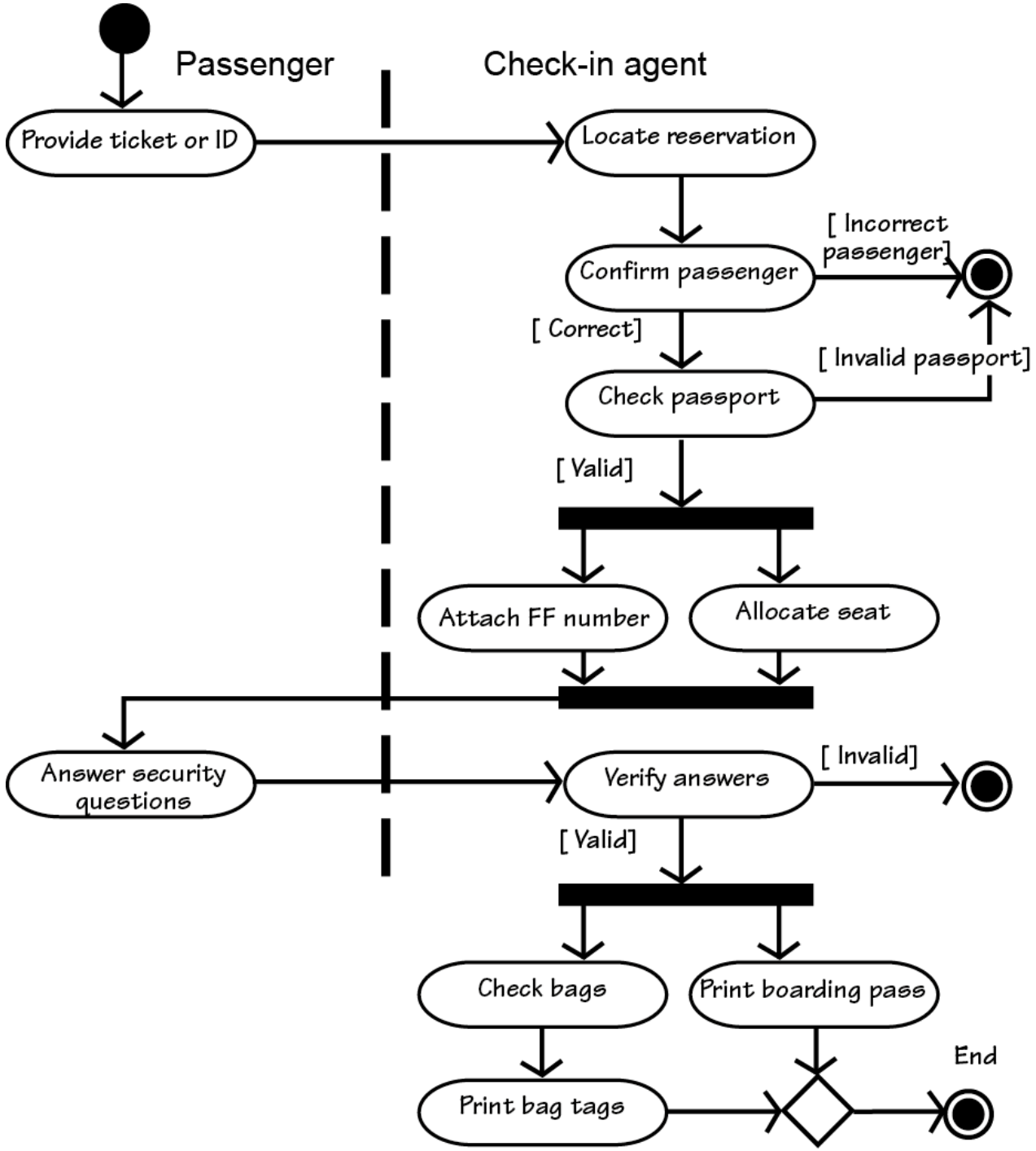
- A scenario is a story describing a business use case
- Typically as a number of steps (3-13)
- In a language and detail level acceptable to stakeholders
- Example: Customer:"I make sure I have **the right passenger and the right flight.** It would be pretty embarrassing to give away someone else's seat or to send a passenger to the wrong destination. Anyway, somehow I locate the passenger's flight record in the computer. If he has not already given it to me, **I ask for the passenger's passport.** I **check that the picture looks like the passenger and that the passport is still valid.**"
- ….

1. **Get the passenger's ticket or record locator.**
2. **Is this the right passenger, flight, and destination?**
3. **Check the passport is valid and belongs to the passenger.**
4. Record the frequent-flyer number.
5. Find a seat.
6. Ask security questions.
7. Check the baggage onto the flight.
8. Print and hand over the boarding pass and bag tags.
9. "Have a nice flight."



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Other models can be used

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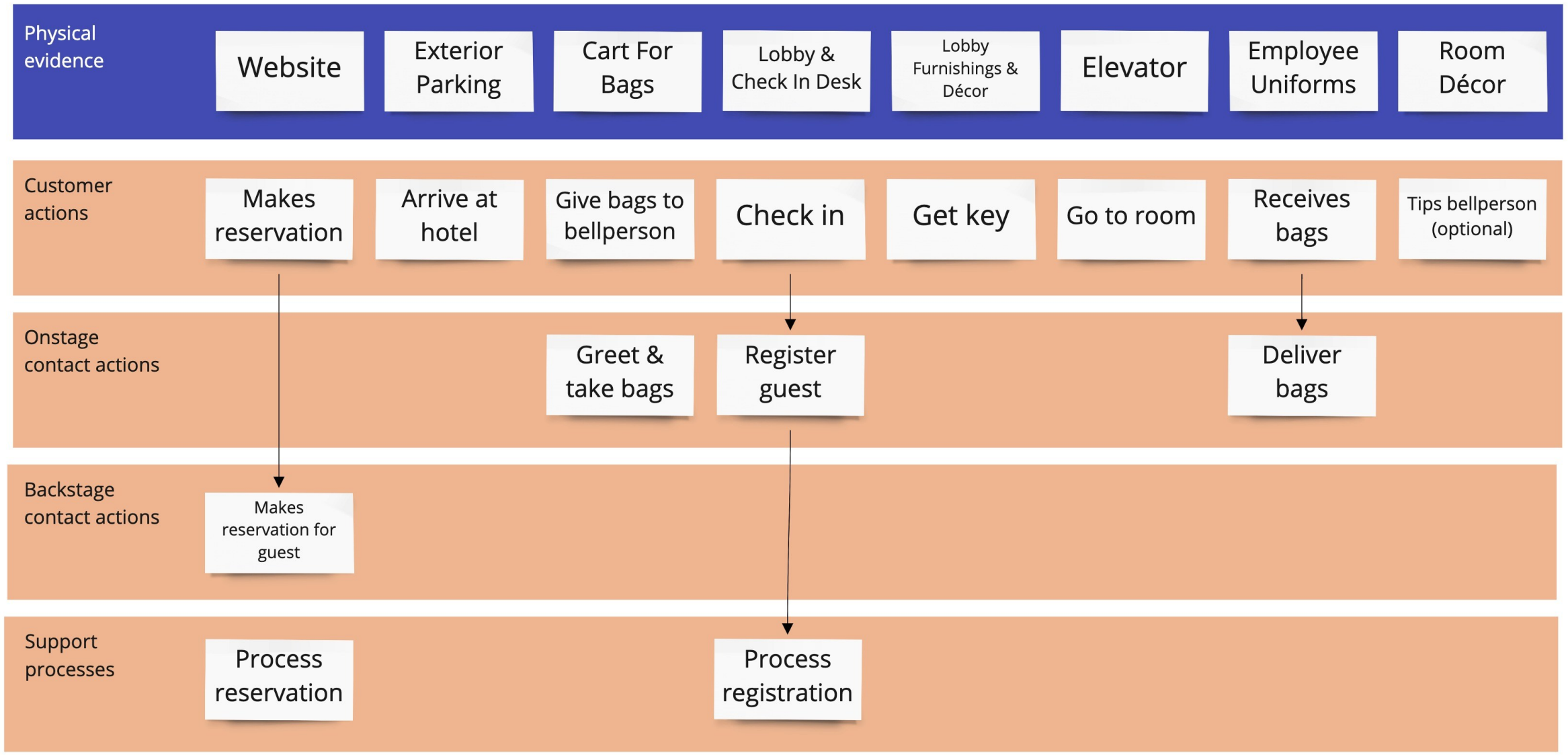
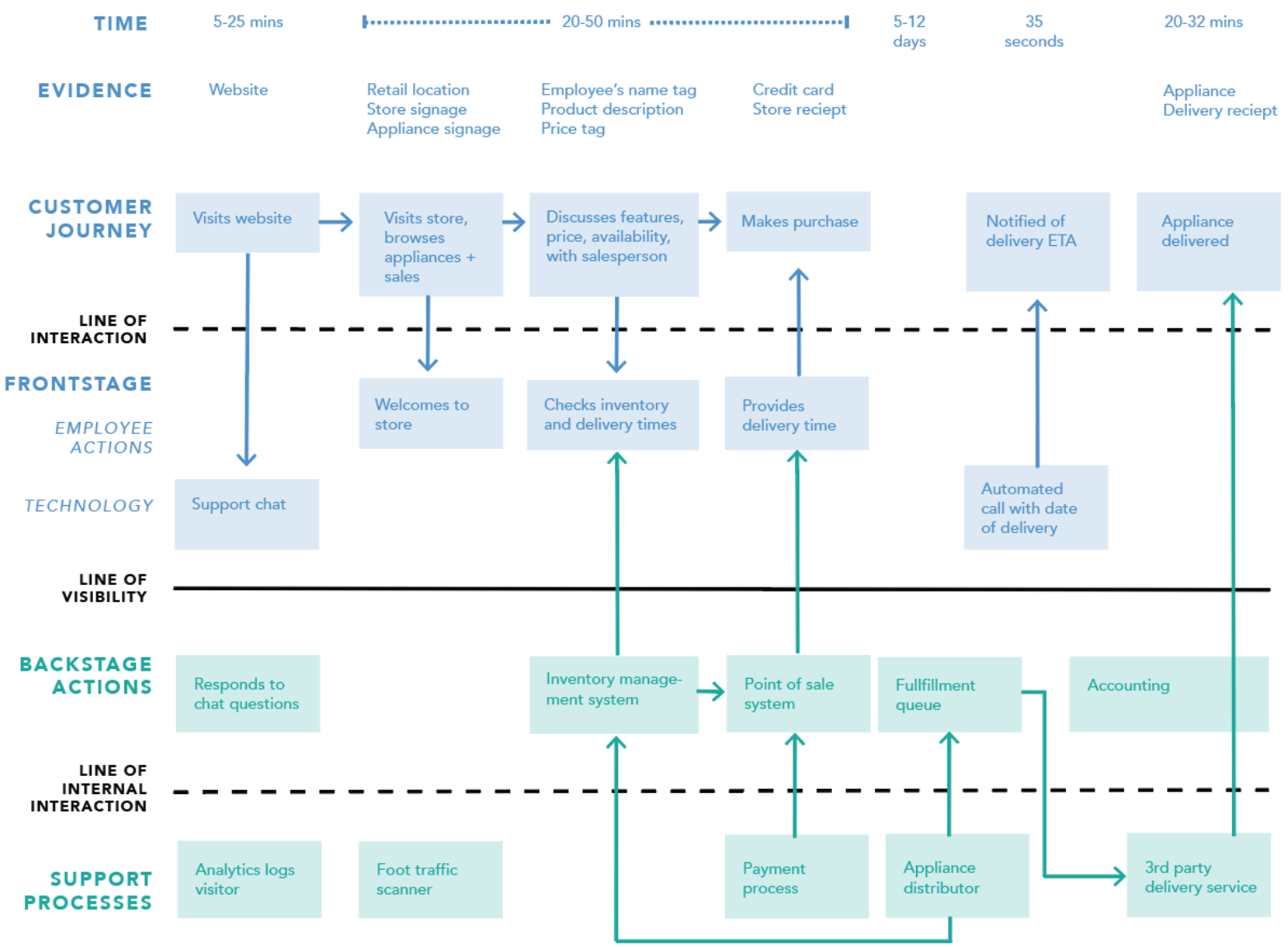
- Data flow diagrams
- Sequence diagrams
- Timing diagrams
- Class and object diagrams
- Etc.
- https://miro.com/guides/service-blueprints/


Physical evidence
Website
Exterior Parking
Cart For Bags
Lobby & Check In Desk
Lobby Furnishings & Décor
Elevator
Employee Uniforms
Room Décor
Customer actions
Makes reservation
Arrive at hotel
Give bags to bellperson
Check in
Get key
Go to room
Receives bags
Tips bellperson (optional)
Onstage contact actions
Greet & take bags
Register guest
Deliver bags
Backstage contact actions
Makes reservation for guest
Support processes
Process reservation
Process registration

SERVICE BLUEPRINT *Example*



Functional Requirements

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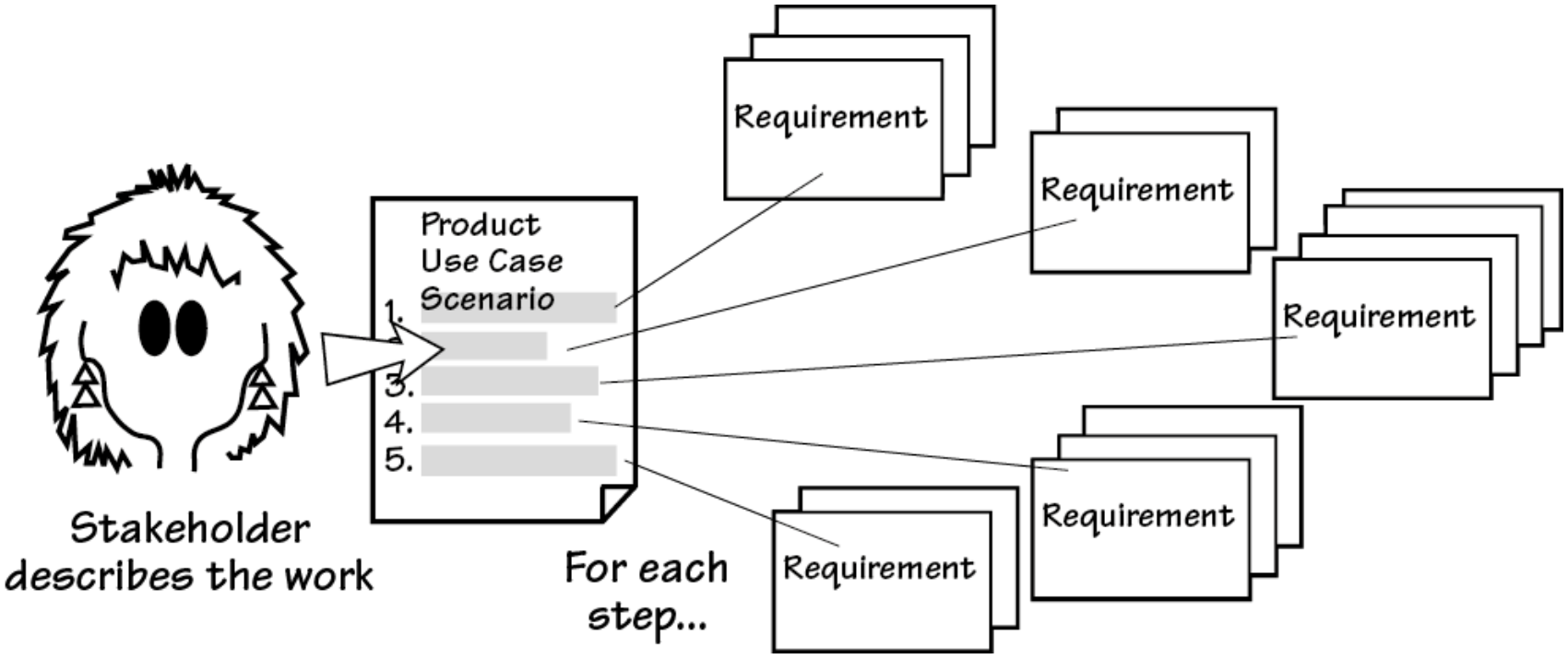

Example

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- For each step, ask, ***"What does the product have to do to complete this step?"***

- For example, the first step in the scenario is
  - ***Engineer provides a scheduling date and district identifier.***

- The first functional requirement to come from this step is fairly obvious:
  - ***The product shall accept a scheduling date.***

- Another requirement from the first step is
  - ***The product shall accept a valid district identifier.***

Requirements, Not Solutions

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- There is a difference between a requirement and its solution.
- It is important to your requirements discovery that you do not write solutions instead of requirements.
- Example:
  - "The product shall display pictures of goods for the customer to click on."
  - !!! The requirements analyst has assumed a screen, a picture, and ordering by clicking.

- Here's the correct way to write this requirement:
  - "The product shall enable the customer to select the goods he wishes to order."

Acceptance/Fit criterion

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- Description: ***The product shall record the weather station readings.***

- Fit criterion: ***There exists an accessible record of weather station readings that shall match the readings sent by the weather station***

- This can be use later on for (acceptance) testing

NON-FUNCTIONAL REQUIREMENTS

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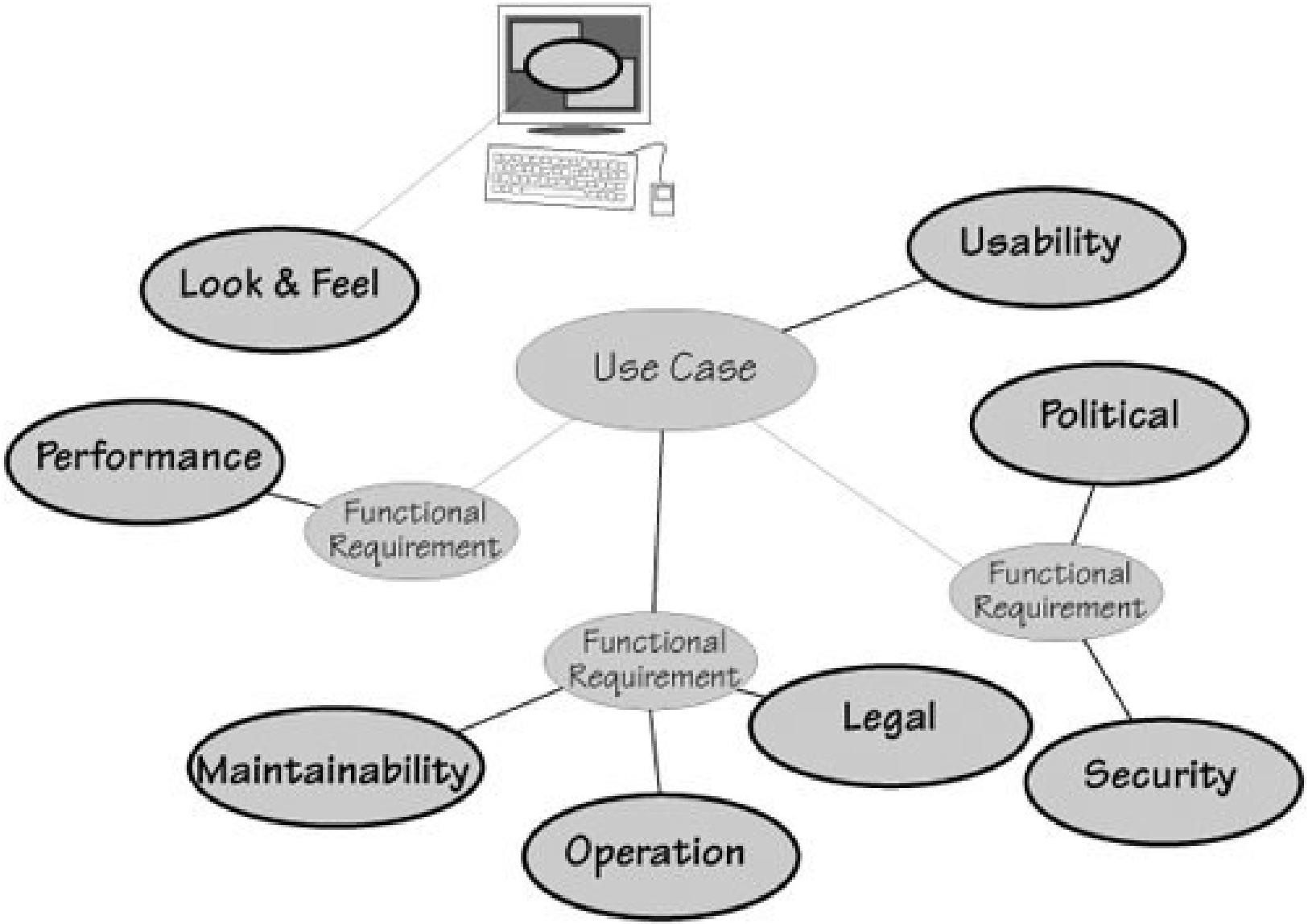

Non-functional Requirement Fit Criteria: Usability Requirements Example

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Description: The product shall be easily learnable and intuitive.

Fit criterion: New users shall be able to add, change and delete roads within 30 minutes of their first attempt at using the product.

Non-functional Requirement Fit Criteria: Usability Requirements Example

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Description: The product shall be understandable.

Fit criterion: Nine out of ten road engineers shall be able to successfully complete [list of selected tasks] after one day's training.

Requirements specification

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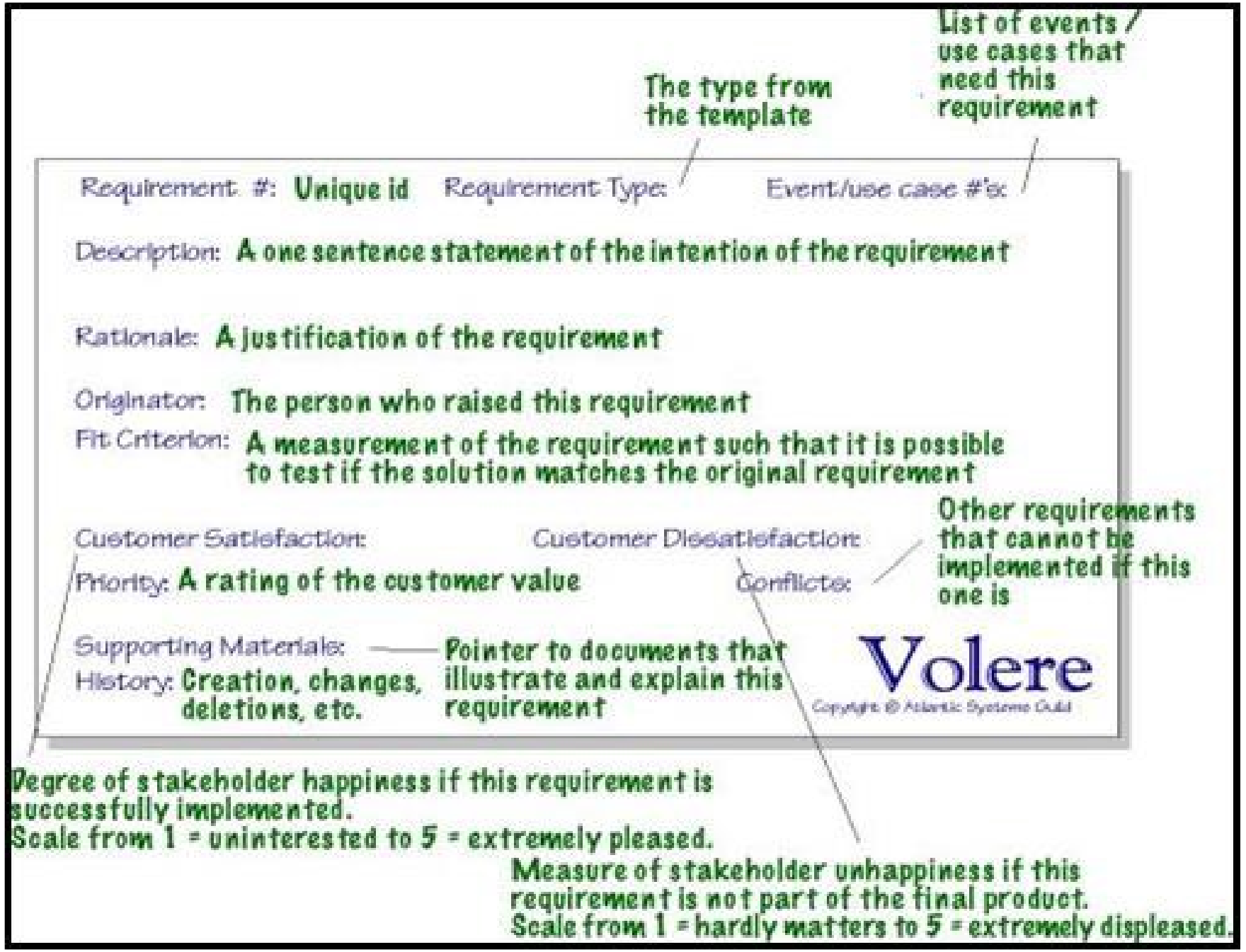
- Detailing the characteristics of a requirement
  - To which use case /scenario belongs
  - Description
  - Dependencies on other requirements
  - Priority
  - Acceptance criteria
  - Which stackholder(s) provided the requirements
  - Which actor(s) use the requirement
  - Who specified the requirement
  - When last updated/added/deleted
  - Etc

Lots of different templates available!!!



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Priority

- From different perspectives
  - How important for different stakeholders
  - How difficult to implement (cost, time, etc)
  - How important is the stakeholder

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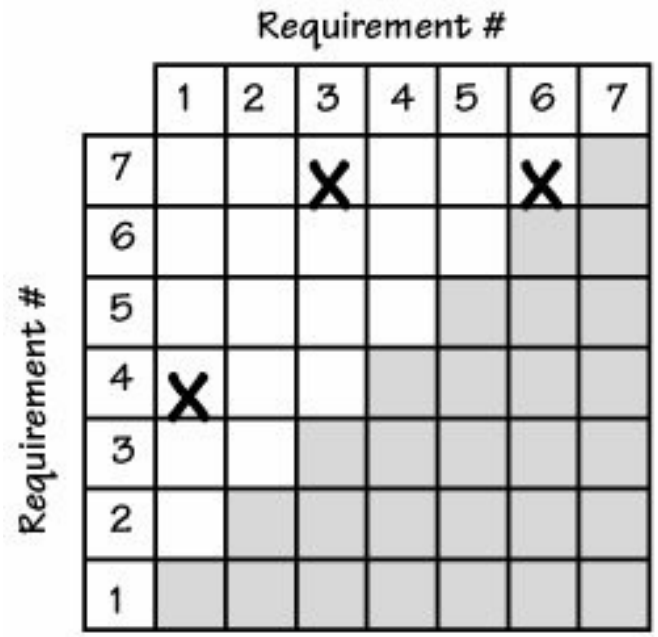
Conflicting requirements

- Identify and keep track
- Try to understand and discuss with stakeholders
- A conflict matrix may help with the bigger picture



Result of your analysis work

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- System proposal (Technical Document)
  - Requirements
  - Optionally models
- After that
  - Project management - evaluate and assign resources
  - Design
    - Choose different architectures to satisfy NFRs
    - Design GUI
  - Implement
    - Evaluate different technologies

Most important:

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- The requirements are there to guide you in the design and production of your system
  - Also to tell you when the work is done
- Do not collect everything, just what you need in order to make the system work for its intended purpose
  - Most requirement templates include a lot of things your project may not need.