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LEARN, UNDERSTAND & DELIVER!

Systems Engineering Requirement Management & Tooling

27 January 2022

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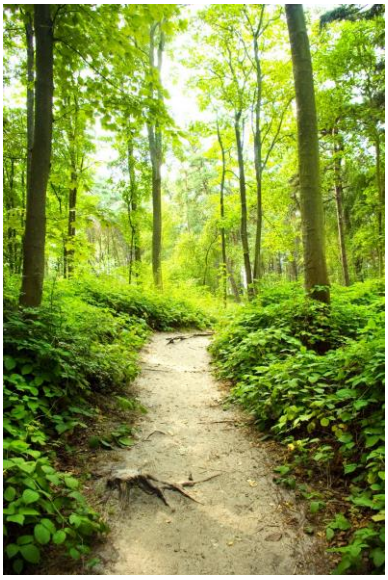
1

Agenda

- Introduction
- Trends
- Requirements Engineering
- Writing Good Requirements
- Some Examples
- Conclusions



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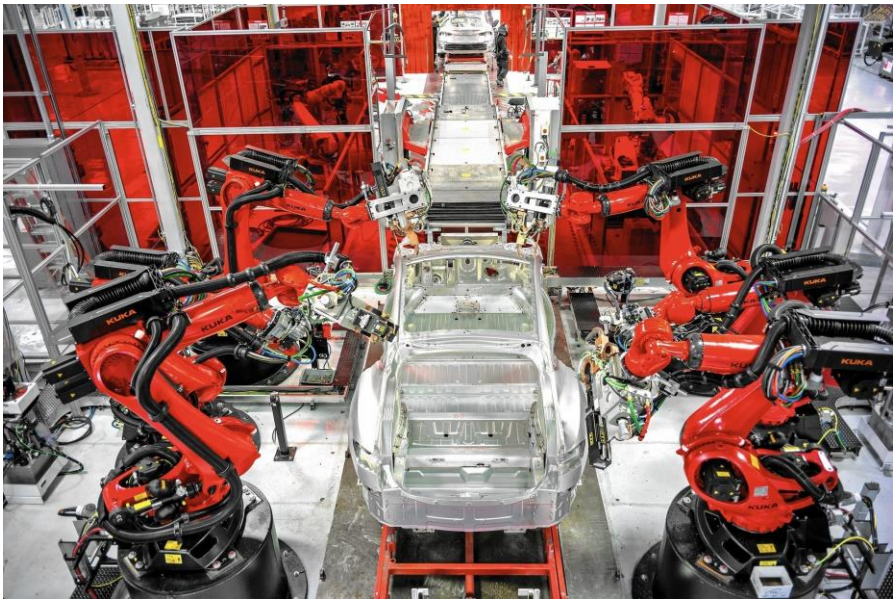
Trends

Waiting in line for the latest iPhone

3

Production line Tesla Model X



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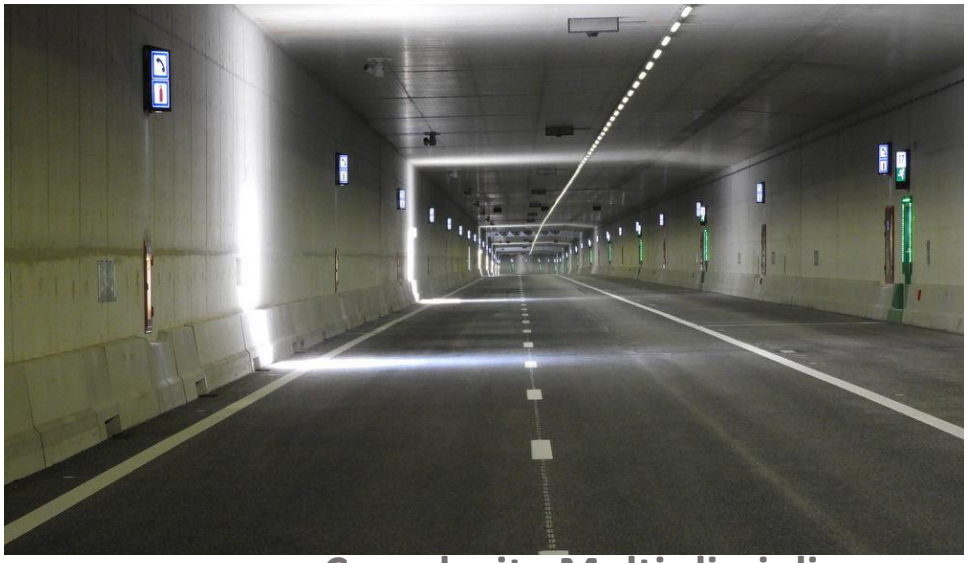

Complexity Multi-disciplinary Systems Engineering

5

Unlimited Possibilities

6

ISO 26262

ISO 15288

ISO 9000/1

MBSE

MDR

SysML/UML

Agile/Scrum

IEC 61508

Functional Safety

V-Model/Waterfall

7

Requirements Engineering

The Process

Writing Good Requirements

Experiences

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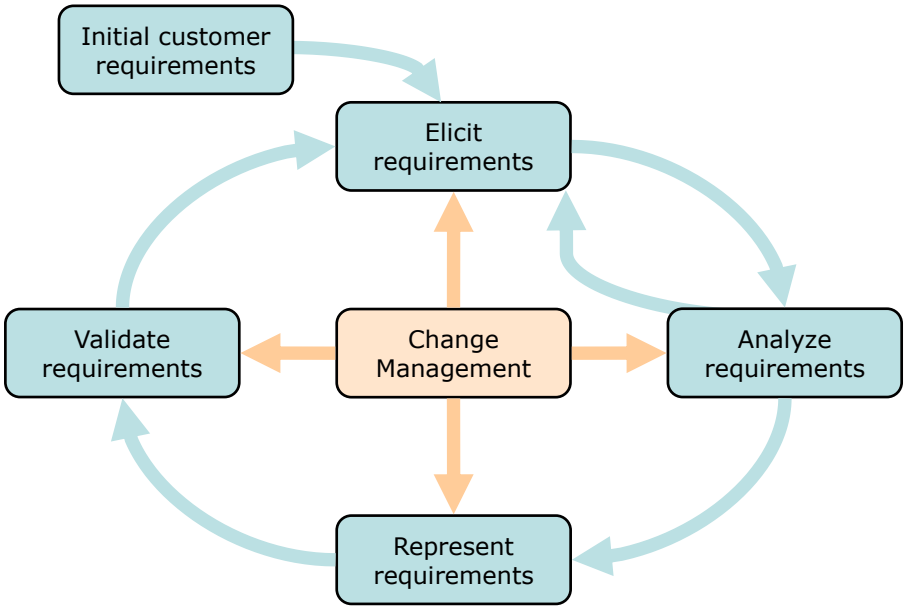
8

The Requirements Engineering Process



9

Why is it so hard, while it looks so easy?

- 100% People
- Often not tangeble or concrete
- Lack of communication and common way of working
- Solutions stifle innovation
- Anything is possible! But is that really necessary?

10

Writing Good Requirements

11

An example:

The system shall perform at the maximum rating at all times except that in emergencies it shall be capable of providing up to 125% rating unless the emergency condition continues for more than 15 minutes in which case the rating shall be reduced to 105% but in the event that only 95% can be achieved then the system shall activate a reduced rating exception and shall maintain the rating within 10% of the stated values for a minimum of 30 minutes.

12

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13

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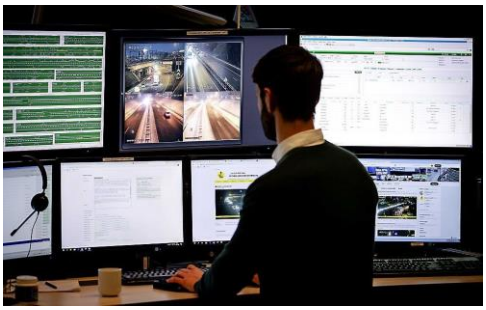
14

Expressing requirements



The
OPERATOR
shall be able to
initiate the safety procedure
in less than five seconds.

In every requirement, look for
- an ***actor***,
- an **action**, and
- a **success measure**.

15

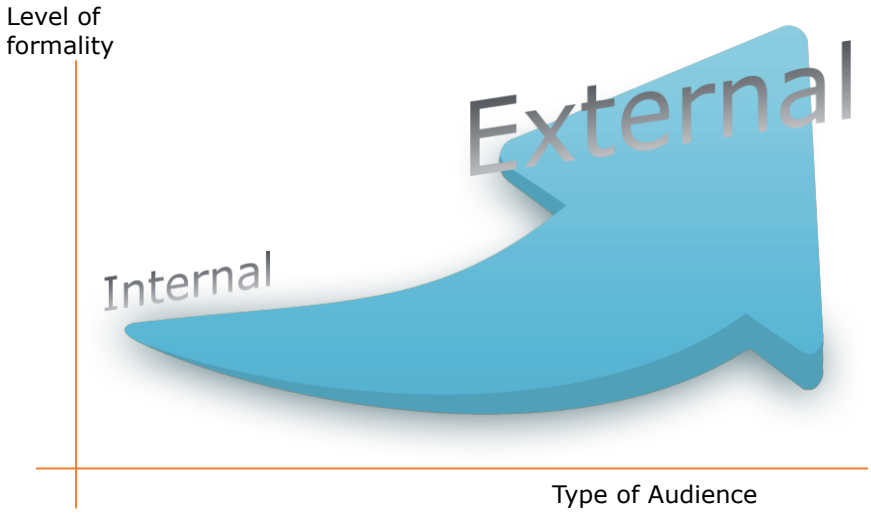
Examples Patterns

EARS: Easy Approach to Requirements Syntax

Pattern	Example
Ubiquitous	The operator shall be able to initiate the procedure to close a traffic lane within 10 seconds.
Event-driven	When the procedure to close a traffic lane is initiated, the traffic control system shall start to guide traffic to the open lane.
State-driven	While a traffic lane is closed, the system shall monitor if traffic is following the initiated guidelines.
Unwanted behavior	If traffic is still using the closed lane, then the system shall initiate the safety procedures.
Optional	Where the operator selects the standard procedure A, the system shall indicate to the motorists that the lane will be closed.

16

You write for others!



17

Shall, Should, Must, er….

The operator **shall** be able to select a recipe to give the paint the color chosen by the customer.

The system **must** be able to process 1,000,000 currency transactions per minute.

The energy-saving lamp **should** be able to generate a brightness of minimal 470 lumens

- IEEE Recommends SHALL, as it is strong language and neutral (not part of MoSCoW).
- Choose one and use it consistently

18

Strong Language

IEEE recommends using strong language such as shall for each requirement.

Do not use phrases like:

- Except in unusual circumstances ……
- May usually be thought of as …..
- In general ……..
- Might be …….

19

Use a template, in a tool

SEP-1810 - The meantime between failure for the barrier is minimal 15 years

Type: System Requirement
Author: System Administrator
Project: SEProject
Basis Name / ID:

Owner: T. Dijkema
Assignee(s):
*Status: Concept

Subtype: Non-Functional
Specialization: Reliability

Description

The meantime between failure for the barrier is minimal 15 years

Further Detailed Information

Detailed Information:

Design Justification and Acceptance Criteria

Design Decision: Use titanium in stead of stainless steel
Test Type: Sat
Other Test Type:
Verification Method: Inspection
Other Verification Meth.: Regular inspections required with 4 years interval
Verification Description: Normal use, - no corrosion- no hairline cracks- no metal fatigue

20

Example

Catalytic Converter

Most vehicles are required to be equipped with a catalytic converter. Some older vehicles and heavy duty trucks may be exempt. If your vehicle requires one (or two or three, depending on the model vehicle) it must be present, installed and functioning properly.

1.0 All petrol engine vehicles built after 1990 shall run on unleaded fuel.

1.1 If the owner can provide documented proof that it is not possible to convert the engine to run on unleaded fuel, the DMV can issue a waiver.

1.2 ….

21

Example

The customer shall be able to pay with bank transfer, credit card or Paypal.

Use a leveled approach

1.0 The customer shall be able to choose his preferred way of payment.

- 1.1 The customer shall be able to pay through bank transfer.
- 1.2 The customer shall be able to pay with a credit card.
- 1.3 The customer shall be able to pay through Paypal.

22

Example

When the transmission shifts through the gears, distinctive steps from one gear to the other should be noticeable to the driver.

Event driven

When the transmission shifts from one gear to the other, the driver shall be able to notice the distinctive shift changes.

23

Remember:

- DO NOT wander – stay within scope
- DO NOT design the system
- DO NOT build in let-out clauses
  - *Except, unless*
- AVOID vague words:
  - *Usually, generally, often, normally, typically, etc.*
- AVOID vague terms:
  - *User friendly, versatile, flexible, etc.*
- AVOID wishful thinking:
  - *100% reliable, please all users, run on all platforms*
  - *Safe, never fail*
  - *Handle all unexpected failures*

24

Requirements Tools

Classic RE Tools

- DOORS
- Caliber/RM
- Yakindu

Blended Tools

- Cradle
- Enterprise Architect

Application Life Cycle

- Polarion ALM
- Microfocus ALM
- Relatics
- DevSuite
- TopTeam

Agile

- Jira/Greenhopper
- VersionOne
- MiroBas †
- Jama

Useful Add-ons

- QVScribe
- ReqLab

25

Conclusions

- Requirements Engineering is a skill and needs to be developed
- You write for others
- Agree on a common way of working
- We can help!

26

What can we do for you?

- Training and Consultancy:
  - Requirements Engineering
    - Requirements Engineering Foundations
    - Risk of Words
    - Interviewing Techniques & Guidelines
  - UML & Design Patterns
  - MBSE with SysML
  - Scrum
- Application LifeCycle Solution:
  - Polarion ALM

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27

Questions

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28