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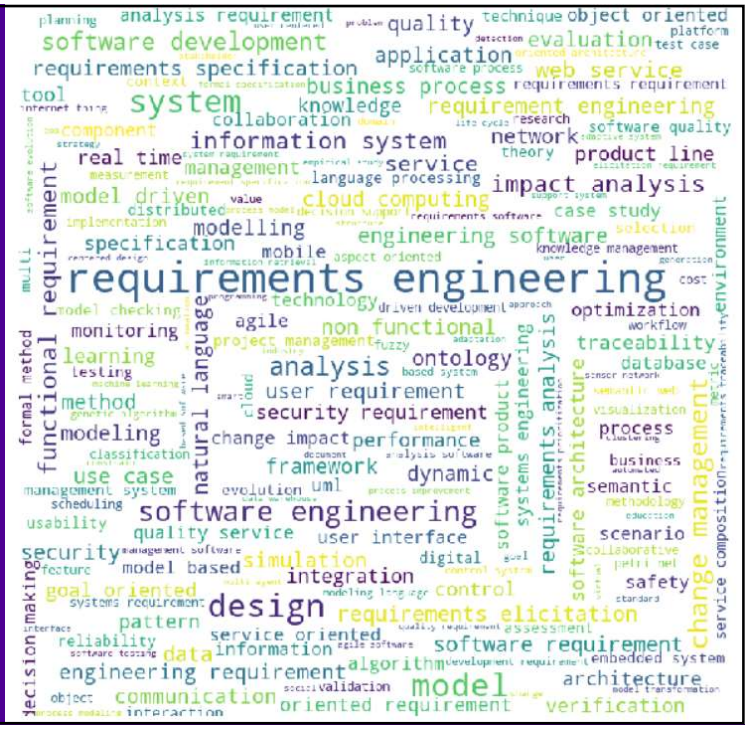
Requirements Engineering

Introduction

Zheying Zhang



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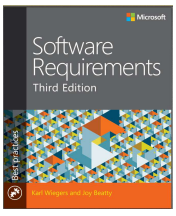
General information

- Instructor: Zheying Zhang
  - zheying.zhang AT tuni.fi
  - Office: Pinni B1034
  - Lectures, assignments, and study materials are handled in Moodle
- Teaching assistant: Maruf Rayhan
  - maruf.rayhan AT tuni.fi
  - Assignments, group work, group work discussion sessions
- Special arrangement and support – contact the instructor

- Textbook
  - Karl E. Wiegers and Joy Beatty, Software Requirements, 3rd ed. Microsoft Press, 2013 -> Ebook available in tuni library



- Supporting materials
  - Documents with links or references for further reading are provided for every lecture
- Moodle learning environment

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Schedule

Lectures	Time	Room
Tuesday 12.9 - 10.10	14 – 16	Sähkötalo SA205 S3 auditorio
Friday 15.9 - 13.10	12-14	Tietotalo TB103 auditorio
Group work Discussion sessions with TA: 5.10, 12.10, 26.10, 2.11, and 9.11 Time & Place: 8 - 10 in Tietotalo TB214		

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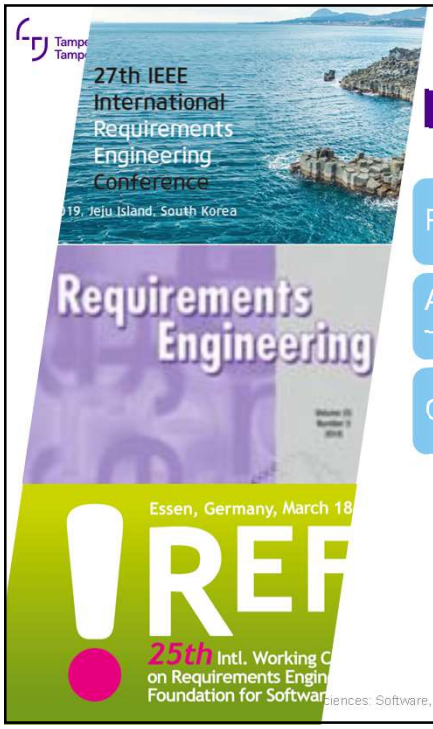

Learning Objectives

Product value, role of RE in product development

Activities, techniques, notations, and tools involved in RE – compare, combine, apply, critically evaluate

Gain a grounding in RE related research

- Current research issues and direction in the field
- Awareness of the research reported in
  - IEEE international requirements engineering conferences
  - International working conference on requirements engineering: Foundation for software quality (REFSQ)
  - Requirements Engineering Journal (REJ)
  - IEEE Software
  - Digital libraries

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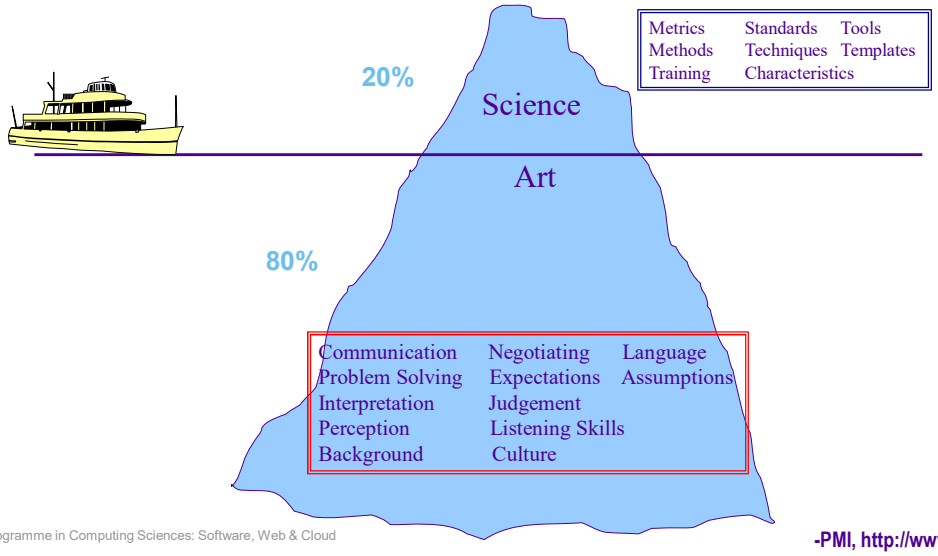
RE is more of an Art than a Science



-PMI, http://www.kcpmichapter.org

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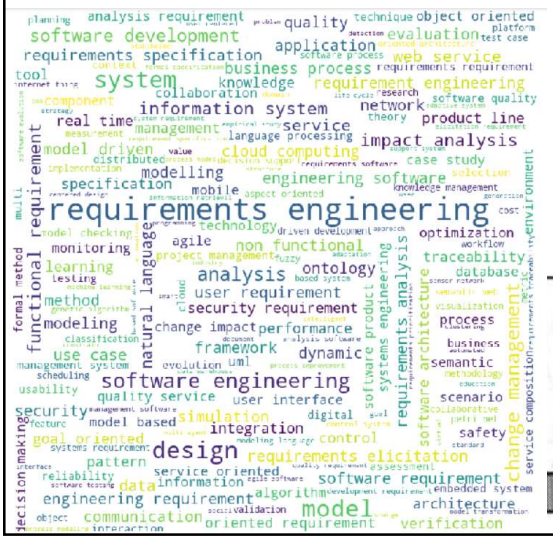
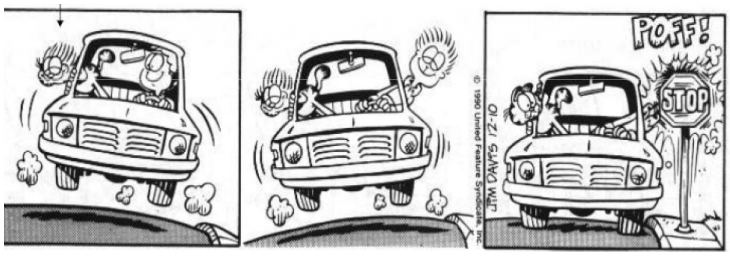
Course outline



- Requirements elicitation
- Requirements analysis and negotiation
- Requirements specification
- Requirements validation
- Requirements management



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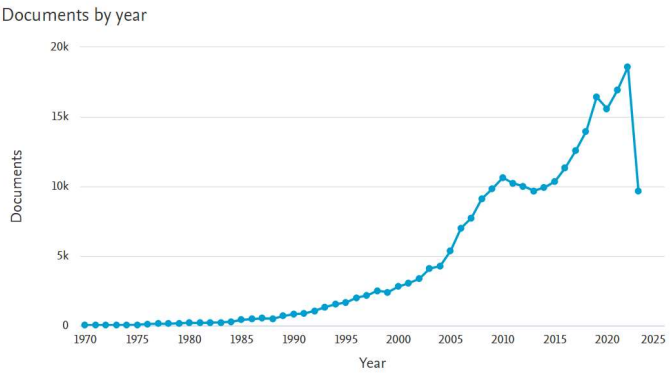
Vibrant research on RE (data collected from Scopus)

TITLE-ABS-KEY (requirements AND (engineering OR management OR elicitation OR analysis OR specificaiton OR documentation OR validation OR review OR tracing OR quality)) AND (LIMIT-TO (SUBJAREA , "COMP"))

253,785 document results

Select year range to analyze: 1970 to 2023 Analyze

Year	Documents
2023	9669
2022	18585
2021	16925
2020	15571
2019	16424
2018	13965
2017	12575
2016	11350



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Course evaluation

- Individual assignments (max. 25 points, min. 15 points to pass)
- Group work (max. 20 points, min. 10 points to pass)
- Classroom participation 5 points
  - lecture with guest talk/Austria Post (on 22/9) – 2.5 points
  - attended ≥5 lectures in classroom (the lecture on 22/9 is not included) – 2.5 points
- Total amount of points: 25 + 20 + 5 = 50 (min. 25 points to pass the course)
- Grading scale used last year (subject to change for this year):
  1: 25-28; 2: 29-32; 3: 33-43; 4: 44-47; 5: >=48

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Individual assignments (25 points, min. 15 points) - Peer-review assignments

- Assignments are completed in Moodle, 10 assignments
- Two steps to do each assignment (2-2.5 points/assignment)
  - Step 1 (2 points): Sum up your thought and post the answer by replying to the given assignment (After posting the answer, we are able to view the others' answer in the same group)
  - Step 2 (0.5 point): Write feedback to **at least** one answer posted by the other student in the same group ***by replying the post***
    - Each post is reviewed by a maximum of 2 reviewers
- Minimum points: 15 points

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Group work (max. 20 points, min. 10 points)

- Form a group of 3-4 participants with confirmed topic by 2.10
- Discuss the group work plan with TA in group work discussion sessions on 5.10 or 12.10
- Review the group work progress with TA in group work discussion sessions on 26.10, 2.11, or 9.11
- Submit the complete group work report by 15.11
- Review the other two reports (the review checklist will be available in Moodle) and submit the review reports by 20.11
- Every report is evaluated by two other groups, and the points will be adjusted by the TA and teacher.

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Group work: a preliminary list of topics

Each topic can be selected by at most 2 groups (detailed topic descriptions for each assignment are available in Moodle)

Requirements elicitation

1. User requirements extraction
2. Investigating diverse information sources for requirements elicitation

Requirements analysis

3. Literature review on requirements ambiguity detection
4. Requirements ambiguity detection tools

Requirements management

5. Literature review on AI assisted requirements tracing
6. A case study on requirements management in a software development project
7. Requirements management (RM) tools

RE for OSS projects on Github

8. Requirements engineering practice for open-source projects

RE meets ChatGPT

9. Explore to leverage ChatGPT to effectively assist with requirement elicitation
10. Evaluating prompt patterns for user story quality improvement (working with Austria Post, user stories available)
11. LLM to assist a specific requirements engineering task
12. Design and implement a ChatGPT based system to assists requirements elicitation
13. Comparing LLMs with other tools in requirements ambiguity detection

14. A self-defined topic – to be agreed with the teacher and TA

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Date	Content	Individual assignments	Due date
12/9	Introduction		
15/9	Reqs & value	A1: analysis of elements of value	A1: 19/9/23, 20/9/23
19/9	Vision, scope, stakeholders	A2: stakeholder analysis	A2: 24/9/23, 25/9/23
22/9	Type of reqs. (guest talk by Tomas Herda from Austria Post)		
26/9	Elicitation	A3: elicitation techniques	A3: 1/10/23, 2/10/23
29/9	User stories and good reqs	A4: writing good requirements	A4: 3/10/23, 4/10/23
3/10	Requirements prioritization	A5: requirements analysis	A5: 8/10/23, 10/10/23
6/10	Requirements validation	A6: prototyping requirements	A6: 10/10/23, 11/10/23
10/10	RE& RM in software development	A7: fixing communication problems	A7: 15/10/23, 16/10/23
13/10	RM & research	A8: the tracaeability strategies	A8: 17/10/23, 18/10/23
		A9: research on AI4RE A10: TBD	A9: 22/10/23, 23/10/23 A10: 29/10/23, 30/10/23
5.10, 12.10	Group work plan and discussion with TA		
26.10, 2.11, 9.11	Group work progress review with TA		
15.11			Group work report submission
20.11			Group work peer-review

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Course cancellation

- Cancellation to be done in SISU by Sept. 18 at the latest

> ”I found myself using knowledge from the requirements engineering course, … my team knew I had something to say to just about every JiRA ticket we started analysing and working on ….” – *from a student’s internship report in 2020*

> ”understanding the RE processes helps me to understand more clearly the requirements, the reasons behind them, and possibly the mistakes of them, and can provide feedback… to improve the requirements…” - *from the course feedback 2020*

> that truly expanded my skill set. While my university studies in project management and requirements gathering and design provided a helpful background, it was the hands-on experience at [redacted] Oy that brought these concepts to life. Throughout the internship, I

from a student’s internship report in 2023

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Describe what specific skills or knowledge you hope to gain or improve upon by the end of this course in a word or a phrase.

Everyone can write max. 3 phrases.

Join at menti.com
use code: 8511 7420

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Describe what specific skills or knowledge you hope to gain or improve upon by the end of this course in a word or a phrase.

103 responses

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Introduction

Why requirements engineering?

1. Have you taken software engineering or related courses before?
2. Have you participated in at least one software system development project before?
3. Have you been involved in requirements analysis processes in projects you participated before?
4. Have you faced challenges related to requirements in past projects?
5. Are you currently working in a role related to requirements analysis and management?

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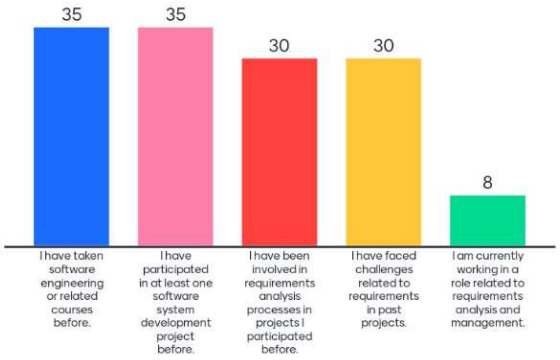
Your experience and knowledge related to requirements in software/product development projects



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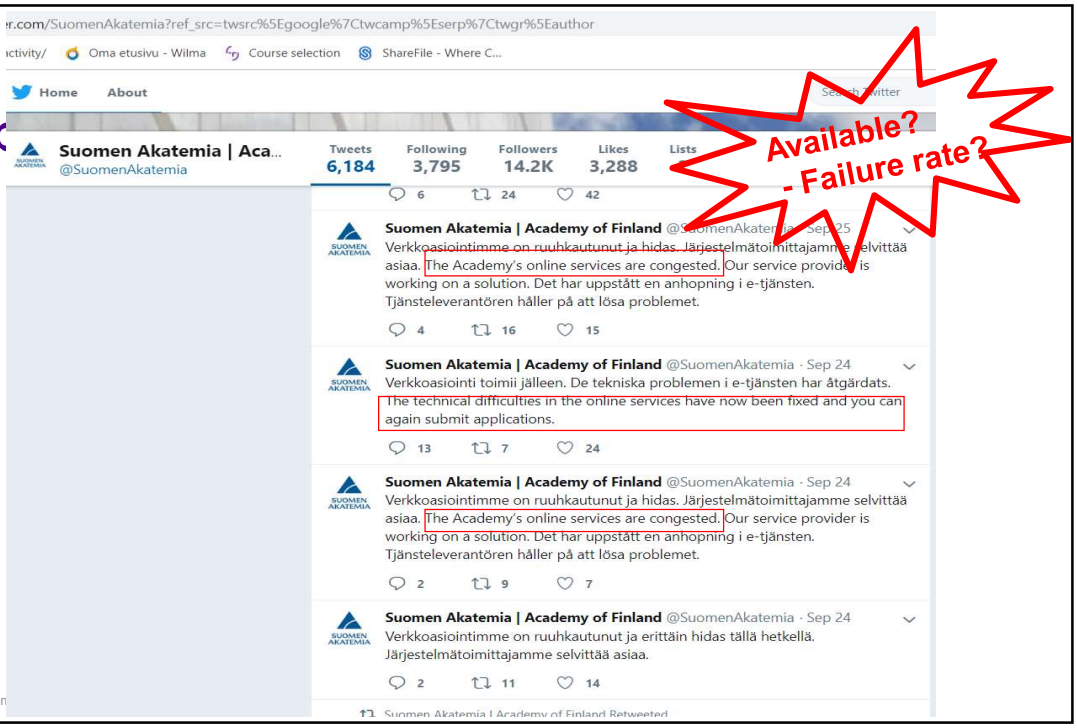
Examp



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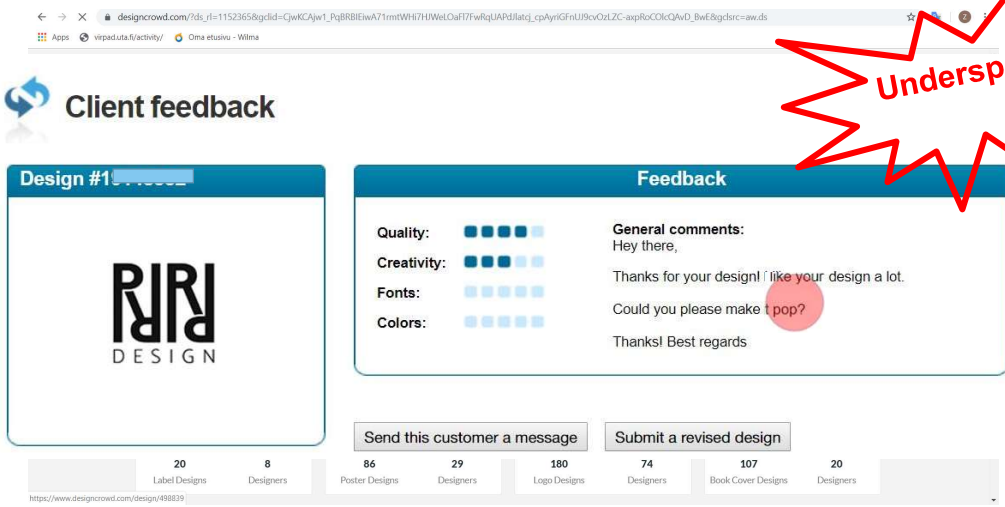
Example 2: A client feedback to a logo design



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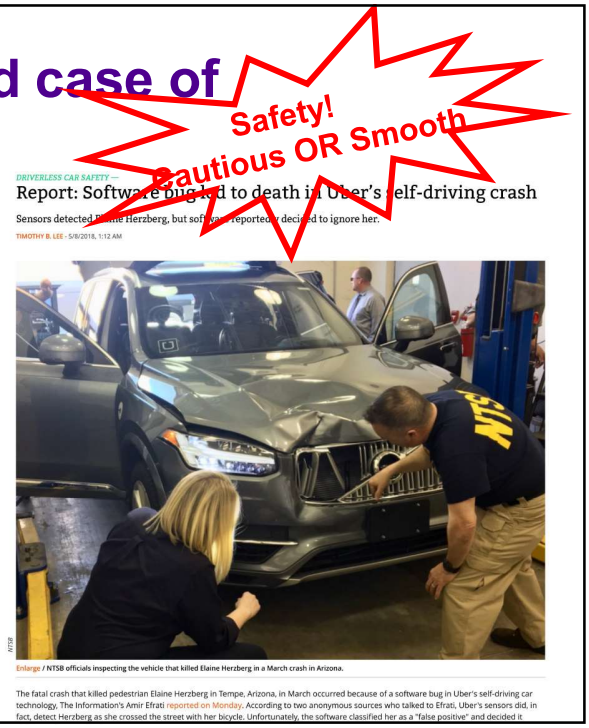
Example 3: first recorded case of self-driving crash

"Software designers face a basic tradeoff here. If the software is programmed to be too cautious, the ride will be slow and jerky, as the car constantly slows down for object that poses no threat to the car or aren' there at all. Turning the software in the opposite direction will produce a smooth ride most of the time – but the risk that the software will occasionally ignore a real object…."

(https://arstechnica.com/tech-policy/2018/05/report-software-bug-led-to-death-in-ubers-self-driving-crash/)



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Example 4: Galaxy Note 7 Exploding Battery Mess (2016)

- The Samsung recall about 2.5 million Galaxy Note 7 phones after complaints of overheating and exploding batteries
- Causes
  - Battery size - missing requirements of specific spatial allowances needed for the battery
  - Welding defect cause the battery to catch fire – insufficient requirements for the QA protocols for 3rd-party components

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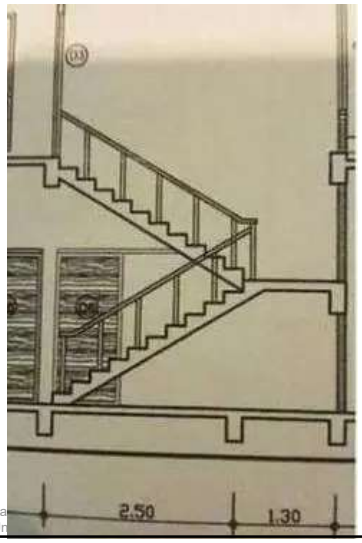
The state of practice of IT projects – Chaos reports



MODERN RESOLUTION FOR ALL PROJECTS

	2011	2012	2013	2014	2015
SUCCESSFUL	29%	27%	31%	28%	29%
CHALLENGED	49%	56%	50%	55%	52%
FAILED	22%	17%	19%	17%	19%

The Modern Resolution (OnTime, OnBudget, with a satisfactory result) of all software projects from FY2011-2015 within the new CHAOS database. Please note that for the rest of this report CHAOS Resolution will refer to the Modern Resolution definition not the Traditional Resolution definition.

Hastie and Wojewoda, Standish Group 2015 Chaos Report - Q&A with Jennifer Lynch, https://www.infoq.com/articles/standish-chaos-2015

CHAOS Report 2018: successful: 36%, challenged: 45%, failed: 19%.

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Pain in requirements engineering (Fernández et al. 2016)

Which contemporary problems exist in RE?

- Incomplete and/or hidden requirements
- Communication flaws between project team and the customer
- Moving targets
- Underspecified requirements
- Time box/Not enough time in general: bad estimation, unrealistic release dates and scope changes

Fernández, D.M. et al. Naming the pain in requirements engineering, Empir Software Eng (2017) 22: 2298. https://doi.org/10.1007/s10664-016-9451-7

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Requirements errors are likely to be the most common class of error

Requirement errors typically comprise over 40% of all errors in a software project (Leffingwell and Widrig, 2003)

- U.S. air force projects: "36% of all defects were due to faulty requirements translation. Only 9% of these errors were resolved in the requirements phase" (Sheldon 92)

Error propagation in software development lifecycle

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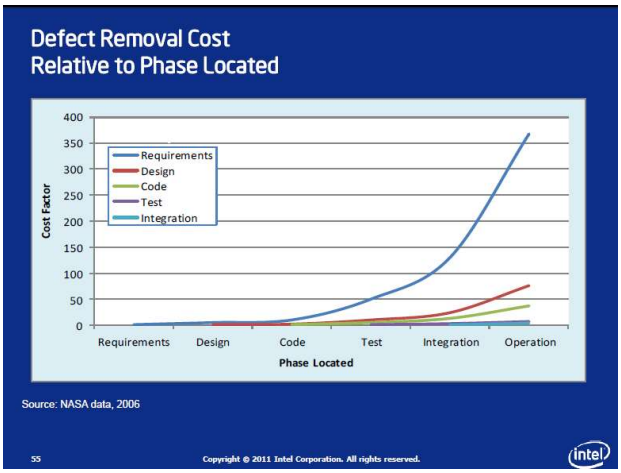
Requirements errors are likely to be the most expensive errors to fix



- Requirement errors typically cost over 10 times more to repair than other errors

E. Simmons (2011), 21st Century Requirements Engineering: A Pragmatic Guide to Best Practices, excerpt from PNSQC 2011 Proceedings

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What are requirements?

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Readings

1. H. F. Hofmann & F. Lehner: Requirements engineering as a success factor in software projects. IEEE Software, July/August, 2001, 58-66.

3. Watch a short comedy sketch: The Expert
https://www.youtube.com/watch?v=BKorP55Aqvg&t=5s

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Group Formation

- Form a group of 3-4 participants with a common interest in a group work topic
- The last date to confirm the group and the group work topic: Oct. 2nd, 2023