Agile and Lean in Safety-critical Software Development

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About Myself

- +12 year industrial experience of software development projects
- Industrial PhD Student
  - employed by Etteplan
  - Finnish company
- Advisors from Mälardalen University, Västerås
  - Sasikumar Punnekkat
  - Stig Larsson
The world is full of challenges
Challenge #1: Being an “Industrial PhD”

<table>
<thead>
<tr>
<th>Company</th>
<th>Academia</th>
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<tbody>
<tr>
<td>Earn money</td>
<td>Scientific contribution</td>
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<tr>
<td>Find improvements</td>
<td>Papers, papers and papers</td>
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“Research-related work”

Not research-related work

Study rate

Course-work
Conferences
Etc.
Our customers’ challenges

Our customers’ customers want

More intelligent / automated solutions

Safe products

More complex software

Must fulfill international standards

Increased development time and cost
Why not look at Agile and Lean?
Agile and Lean promises

- Shorter time to market
- Managing change better
- Higher productivity
- Less documentation
- Team satisfaction
Overall research question

- How can **agile and lean thinking** improve the efficiency of developing **software for safety-critical systems**?
  - Which benefits?
  - Which barriers?
    - How can we overcome them?

- **Constraints:**
  - Under current regulations
  - In context X (domain)
Research approach

A. What is the problem?
   - The standards?
   - The current way of working?

B. What is the potential solution?
   - What is Lean Sw. dev?

C. What happens when we combine them?
   - Adapted safety development life-cycle models?
   - Empirical evidence
A. The problem: Current standards?

EN 50128 for Railway
Extreme Programming (XP) vs EN 50128

- Both **supporting** and **conflicting** features
- XP does not address all
  - planning,
  - hazard/risk analysis,
  - documentation,
  - verification and validation activities
B. The solution? Lean?

- Larger improvement framework
- Starts from existing process
  - Thinking, then Doing
  - Quality focus all the time
  - Visualize and optimize flow
  - Eliminate waste to increase productivity

- But how to define it for, and apply it to, software development?
  - Systematic Literature Review
Seminal Lean Sources Identified

- Lean production in general
- Lean software development
2nd paper: A comprehensive framework for Lean software development

Lean Software Development

Key concepts

Value, Waste, etc.

Goals

Recommended activities

Examples of practices
A. The problem: Current way of working

- Paper C: Which waste can observed by looking at assessment data?
- Analysis of reports from audits
C. Upcoming research

- Empirical investigations
- Application of selected agile and lean principles and practices
- In the safety-critical software domain
- Solve real-world problems
- Contribute to “general knowledge”
Participatory Action Research –
Applying Lean A3 problem solving as research?

1. Diagnosis
   - Finding problems
   - Identifying root causes
   - Collecting data (go to gemba)
   - Value stream mapping

2. Planning
   - Looking for state-of-the-art
   - Agile / Lean solutions?
   - Involving affected people
   - Creating baseline

3. Taking action
   - Pilot projects
   - Participating

4. Evaluation
   - Comparing with baseline
   - Interviews
   - Retrospectives
   - Paper writing
Research Challenge Summary

- Getting time for research
- Combining complex software with safety
- Developing safe software efficiently
- Applying agile and lean in regulated environments
- Defining Lean software development
- Performing research at work
Thanks for listening!

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Smart way to smart products