Applications of STPA in Software Testing

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Case: Debt collection in the public sector in Denmark

- Debt collection to all of the public sector is centralized in a government agency.
- It has many automated and case-worker initiated automated processes.
- Legality is obviously important but is not trivial.
- **Legality** is an emergent property similar to safety in socio-technical systems.
- Another emergent property of such a system is **efficiency**, i.e. how efficiently can it collect debt.
The importance of verbal abstraction

Jens Rasmussen (1982) analyzed verbal protocols developing a model of possible decision sequences of human operators in industrial process plants.

This identified a number of statements of "states of knowledge" which can be arranged in a rational sequence.

These states of knowledge can be found too when testing pure software systems:

- A bug or defect found in testing represents an alert to someone
- The analysis of observations can trigger tasks or further analysis: Is there a requirement breach
- Further analysis will dive into the possible effects and outcomes of the defect.
- A state of ambiguity is often reached in which we need to decide how to act on a bug.

Abstractly Defining Testing

Fact – Cause – Observation

• “A test can prove the presence of a bug, not its absence” (P. W. Dijkstra, 1969).
• Explorative testing is still a very important testing method.

Goal – Result

• Software testing has been used to systematically test and validate systems against requirements at least since the early 1970’s.
• Various test engineering and analysis methods are employed to do this.

Purpose – Effect

• As digitization transforms businesses measuring the effects on business becomes important.
• Tradesmen of the Roman empire used to melt gold in the testa, a clay pot, to prove its value.

Meaning – Value

• “Quality is value to some person” (G. Weinberg)
• Performance, safety, and security testing is becoming increasingly important
The problem of ‘testability’

- Testability is an emergent property of a system describing how well it can be tested.
- Test environment infrastructures usually mimic production environments.
- Dynamics in development and system complexity often result in severe testability problems when we approach the higher levels of abstraction.
‘Engineering’ a control structure
A "lateral” approach to control structure workshop facilitation

Random entry idea

Moving and challenging the idea: “Could it be otherwise?”

“Why?” questioning to identify logical boundaries: “Why is it like this?”

Ed de Bono, e.g. Lateral Thinking for Management
Lessons Learnt Applying STPA to Software Testing

• With increased complexity of systems and and emergent properties testing needs to work on more abstract levels than before.

• STPA can help dealing with the complexity. Testability of complex systems can be improved with STPA

• Control structures can be difficult to analyze. A lateral approach to facilitation has been found to work well.

• The dynamics of agile, iterative, and continuous delivery add complexity - but are here to stay.

• STPAs top-down approach can be made robust to change and iterative development.