

Uncertainty

SEsCPS Breakout Session

Aspects of Uncertainty

- Concrete Definition of Uncertainty is complicated
 - Hard to define
 - What is under the umbrella of uncertainty
 - Different kinds of uncertainty
 - Requirements
 - Environment / Context
 - Modeling Uncertainty
 - Uncertainty in Code
 - Behavior Uncertainty
 - Uncertainty in Human Users
 - Prediction of User Behavior
 - Prediction if the user will behave according to requests
 - Uncertainty about the adaptation of the system
 - SoS behavior
 - Infrastructure uncertainty
 - Hardware vs software uncertainty
 - Differentiation between known and unknown uncertainty

Human in the Loop?

- For the foreseeable future, human in the loop will be necessary
- Reasons
 - To ensure proper operation
 - In particular for unknown uncertainty we could not foresee another way
 - To modify the system's behavior

Reducing Uncertainty via Monitoring

- Uncertainty in the environment leads to violations of implicit assumptions
- Monitoring:
 - Both the environment and the system
 - To validate if the assumptions are still valid
 - To help to reveal and reduce uncertainty
 - To modify behavior / code
- Potential strategy: collect data that might be irrelevant, but collect as much as possible.
 - It is not just about the value itself, but about the combination of multiple values.

Change the way software is developed?

- Lack of methods to systematically use the collected data
 - Some work in the area of requirements monitoring
 - Data-driven design
 - Problem: Uncertainty of the data
- System must be more evolutionary
 - flexibility by design (but not perfectionistic from the start)

Prioritization of Uncertainty

- It is hard to prioritize
- Is categorization of criticality for the system possible
 - Risk analysis techniques already exist
 - But also uncertainty about risks
- Impact to reliability