

# Human In the Loop

ICSE2015

SEsCPS Workshop

# Definition of „Human“

## Abstract Roles in CPS

- Engineers, supporters
  - Software, mechanical, electrical, operators
  - Design/build CPS capable of reflecting end user requirements
- End users
  - CPS tries to satisfy requirements / achieve given goals in a dynamic way
- System-external humans
  - Eg, pedestrians in context of autonomous driving

# Definition of Loop

- Definitions of Loop
  - Runtime-Loop
  - Lifetime Loop of CPS in design and runtime phase
- Engineers create the Runtime-loop
  - Improve CPS in lifetime loops (iterative development)
- End users control the runtime-loop
  - Control based on explicit communication between CPS and human
    - Eg human needs to resolve conflicting requirements
  - Based on implicit communication
    - assumptions made by CPS by eg analysing historical data

# Questions

- How should CPS make who aware of changes?
  - Change type - engineers/supporters, endusers
  - How should notification model look like?
    - so that user is efficiently supported in decision making (eg resolving conflicts regarding requirements)
    - and can provide high-quality feedback to CPS
- What type of changes may enduser introduce to CPS?
  - Can the CPS „calculate“/define the costs of adaptation to new requirements?
  - How does the need for human input limit the capabilities of CPS?
  - How are CPS capable of refining/optimizing „bad“ user input for most effective/efficient outcome?

# Questions

- Which responsibilities/actions do humans (always) need to have/execute?
  - When does the CPS have to conduct the human?
    - How does the system make the user aware of the impacts of the user's decision?