

Acknowledgement: Materials are provided by U-Test consortium

Project facts:

Total cost: EUR 3 713 233,75

EU contribution: EUR 3 713 233,75

Coordinator: Oslo Medtech, Norway

Topic(s):<u>ICT-01-2014 - Smart Cyber-Physical Systems</u>

Funding scheme: RIA - Research and Innovation action

Overall project objective: Improving CPS dependability via systematic and automated testing of Uncertainty in CPS HORIZ N 2020

The consortium

[simula.research laboratory] - by thinking constantly about it















Cyber-physical systems (CPS) in U-Test

Diverse types of CPS elements: sensors, actuators, controllers, gateways, cloud storage, etc.

Infrastructural resources are from IoT, Network functions and Clouds

Multi-level interactions in virtualized environments







Our CPS view



HORIZ N 2020



CPS Infrastructures



Our problem: Uncertainty

- The presence of uncertainty is pervasive in CPS
 - Strongly influence function, composition, business, and trustworthiness of CPS
- Emerging types of uncertainties due to the change of CPS
 - Conventional aspects, e.g., infrastructural physical resources and typical system/application operations
 - Emerging novel aspects: data uncertainties (data/data-centric CPS), actuations and elasticity of CPS resources, and data governance
- How to discover them and then deal with them?
 - Uncertainty analytics through testing
 - Also adaptation of CPS resources considering uncertainties

U-Taxonomy



 Infrastructure and Application Levels: focus on common and specific uncertainties within infrastructures and applications





Uncertainty Model







Example





Model-based and Search-based Testing





- Use information models for basic elements in IoT, network functions, and clouds
- Deploy a new CPS using virtualized components or configure existing CPS
- Deploy test utilities and perform tests on the fly

Summary: U-Test Results and methods



- Understanding Uncertainty (U-Taxonomy)
- Modeling Framework
 - Extensible and Configurable
- Testing Framework
 - Extensible and Configurable
- Tools implementing Taxonomy and Frameworks
- Standards (Crosscutting)

Model-Based Testing:

- Abstraction
- Managing Complexity
- Automation
- Systematic

Search-Based Testing

- Optimization
- Smart Mechanisms
- Discovering unknown uncertainties
- Genetic Algorithms.....

Thank you for your attention!

www.u-test.eu





