



# Runtime Verification and Monitoring of WoT Systems

## Description of Master Thesis Topic

Ege Korkan, June 19, 2020

Title: "Runtime Verification and Monitoring of WoT Systems"  
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Period: 24 weeks  
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### Context

The topic revolves around the concept of Web of Things (WoT). The Web of Things is being standardized by the World Wide Web Consortium by means of Thing Descriptions (TDs) <sup>1</sup>.

One of the research questions is how to do mashups of WoT devices, i.e. systems of WoT devices, in a structured way that is also describable to the outside, i.e. to the Mashup Consumers. Our recent System Description approach allows this to be achieved where the mashup can be represented in a TD-like format but also as a UML Sequence Diagram to show the messages being sent between the different parties. However, until now how the Mashup Code is or should be run is not studied. This leaves the question on the safety of running it on a system of networked-physical devices.

In this thesis, the student is tasked on proposing a method to deploy such code to a Mashup Controller which also allows to monitor the system after its deployment. The monitoring should then also allow to find the errors during the runtime. It can be thought as a permanently enabled debugger interface or the way ladder diagrams are animated in industrial automation software. Since the System Description allows to also describe the Mashup as a Thing to other Consumers, we also want to map the running application to the states of the application that can be understood in an easier way by other Consumers. We also want it to be integrated into WADE that has been developed in our chair such that it becomes the one place to develop WoT applications.

### Tasks

The work is separated into different tasks. Some optional tasks are marked with an asterisk (\*).

1. WoT Tutorial
2. Understanding WADE
  - a) Understanding Vue.js
  - b) Understanding Electron
3. Understanding UML Sequence Diagrams (the specification and also PlantUML tool)
4. Understanding the System Description (SD)
  - a) Understanding the vocabulary
  - b) Understanding the conversion between sequence diagrams
  - c) Understanding the code generation method
  - d) Linking generated code back to sequence diagrams
5. Programming different Mashups and representing them with SDs
6. Monitoring
  - a) Investigating the servient runtime of node-wot to allow external monitoring
  - b) Investigating the Chrome developer tools, mostly the Network Monitoring side.
  - c) Investigating visualization of the Sequence Diagrams in real time.
  - d) Checking for errors in runtime based on SD or TD of Things.
7. Proposing a way to map system states from a System Description

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<sup>1</sup><https://www.w3.org/TR/wot-thing-description/>

- a) Basic states that are valid for any system such as stopped, running, paused, error etc.
  - b) Application specific states
  - c) Mapping the error messages found in the previous task to system states.
8. Proposal of the entire workflow for deploying and monitoring

## **Preliminary Schedule**

### **Deliverables**

- Master Thesis in ESI Template or 6-8 page scientific paper
- 20 minutes final presentation