Test-Framework Architecture

This proposal for a Master thesis topic concerns developing a robust architecture for an automotive software testing framework.

Statement of Problem

In an assignment to develop engine control software for a customer in the automotive industry, a need for a simulation tool was seen. The need stems from a lack of hardware resources, resulting in limited possibility to test and verify system updates in the target environment. A simulation tool addresses the problem by providing a simulated system environment in which the engine control unit is to be deployed—e.g., to provide the unit with realistic input data (e.g., CAN-communication), and to respond realistically to its output. A framework was developed to satisfy this need, and has been used by this customer since.

Even though the tool has only been used at one specific customer as of now, similar needs from other customers (also in other industries) have been noticed.

Today it is possible to execute the same test suites on a virtual representation of the unit running within the simulation framework, and on the actual target hardware—a highly desired feature. In addition, a vital aspect of the framework is its lightweightness and that the simulated environment is easy to modify.

The main use cases for the framework today are:

1. **Verification.** In order to keep up with a high development pace and complex configuration situation, the framework has been integrated in a CI-pipeline and included in commit checks.
2. **Debugging.** Due to the design of the target system, troubleshooting erroneous behaviour has proved difficult. The simulated environment provides the possibility to log internal states and signals, which facilitates troubleshooting.
3. **Error injection.** Related to both the two above use-cases, the framework offers the ability to generate test scenarios that include faulty data to verify correct behaviour.

Although the framework is well-written and currently in use, it has grown (and still grows) organically. There is thus a need to do a from-the-ground-up analysis and refactor/reimplement according to a suitable and robust architecture. An important part of that challenge is to systematically investigate and document key stakeholders and their requirements.

As support, the students will have access to the in-house team that develops the framework.

Purpose and Expected Outcome

The purpose of this topic proposal is to describe a high-level architecture for the test framework, where the long-term goal is to develop it into a product.
It is expected for the students to:

- Perform and document an initial **analysis of the key stakeholders and architectural drivers** for the test framework;
- Distil and describe key **architectural principles and requirements**;
- Develop and describe a **high-level architecture**, including identifying **existing technologies** that can be used;
- **Validate** the architecture with key stakeholders;
- Create **reference implementations** (proof-of-concept) for central parts of the architecture.

**Method**

A Design Thinking methodology may be appropriate to apply as the students will be able to interact with stakeholders to understand and define the challenge at hand, ideate around possible solutions (e.g., architectural patterns or existing technologies), as well as validate through prototypes where suitable.

**Final remarks**

We do appreciate that this is quite a sizable chunk of work, so there is a need for some initial scoping together with the students. While the scope can be adapted based on the students’ preferences, implementation of proof-of-concepts is considered a priority.

**About Ictech AB**

Ictech is a software consultant company based in Göteborg with offices in Linköping and Västerås. Ictech’s mission is to attract and offer highly skilled individuals for assignments both on-premises at customer companies and in-house teams to deliver software solutions. Ictech has about 130 employees, of which 100 are stationed in and around Göteborg. Ictech has a broad customer base, spread across multiple industries including a significant presence in the automotive software domain.

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