
Reference: QSE-AML-DB

Topic: Prototype of a Generator for Parametercreation of Unittests

Course-Type: Seminar, Project, Bac-/Masterthesis

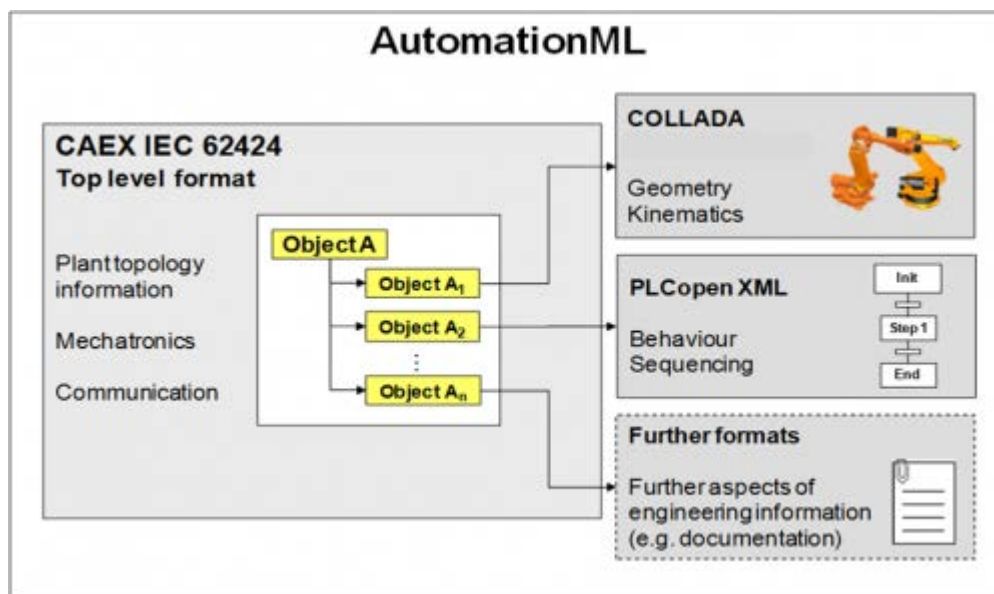
Start: As soon as possible

End: To be defined

Contact: Kristof Meixner (kristof.meixner@tuwien.ac.at)
Felix Rinker (felix.rinker@tuwien.ac.at)
Dietmar Winkler (dietmar.winkler@tuwien.ac.at)
Stefan Biffli (stefan.biffli@tuwien.ac.at)

Background:

Large-scale planning projects in Production Systems Engineering are set in a multidisciplinary environment where engineers of different domains work together in a combined effort to perform their work. AutomationML (AML) [1] is an open standardized modeling and exchange format, based on XML, which aims at integrating models from the various domains of such projects with the help a topology graph (see picture).



AutomationML structure (picture from [3])

BaseX [2] is an XML data base that is well-suited to hold AML and query the industrial models, contained in the database, using XQuery. However, checking the consistency of the AML models requires additional effort, as the resolution of connections, which exist among the AML elements, cannot easily be performed using XQuery. A high level of data and model consistency is needed as it is not only critical for the planning phase but even more for safety during the runtime of the production system.

The internal models of graph databases, like Neo4J [4], or hybrid databases, like ArangoDB [5], are built to represent connections among concepts and to evaluate and reveal relations between instances.

In the context of a process improvement project, this topic aims at the development of a concept and an implementation of a prototype that compares the capabilities and performance of selected databases for different cases (e.g., value consistency checks, dead link checks ...).

The complexity of this topic requires an iterative and incremental approach, which, depending on the course type and effort, offers several sub-topics to be investigated and worked on.

Tasks:

- Analysis of data models and test data
- Identification and evaluation of different database technologies in the context of AML
- Identification and evaluation of different means and methods to validate AML
- Conceptualization of a model for AML in graph/hybrid databases
- Development of a prototype for a specific problem (e.g., consistency checker)
- Evaluation of the prototype

Expertise:

For this topic a set of skills is recommended (at least two are mandatory).

- Good programming skills
- Data modeling
- Interest to try and experiment with different database technologies
- Interest to dive into models of Production Systems Engineering
- Empirical evaluation, e.g. case study, pre/post comparison
- AutomationML (is an advantage)

[1] Drath, R. (Ed.). (2009). Datenaustausch in der Anlagenplanung mit AutomationML: Integration von CAEX, PLCopen XML und COLLADA. Springer-Verlag.

[2] Kircher, L. (2010). BaseX: Extending a native XML database with XQuery Update.

[3] <https://www.automationml.org/o.red.c/story.html>

[4] <https://neo4j.com/>

[5] <https://www.arangodb.com/>