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The Application Engineering Research Group at Alpen-Adria-Universität Klagenfurt

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Abstract: We sketch here the general orientation ("Mission") and the recent research projects of our research group which is part of the Institute of Applied Informatics in the Faculty of Technical Sciences.

Keywords: Application Engineering, Model Engineering, Model Centered Architecture, Domain Specific Modeling Languages, User Centered Computing, Digital Ecosystems

1 Mission

The Application Engineering Research Group was founded in 1990 and has been active until now. Although the group head is a professor emeritus since October 2016, the group is still working together based on common interests: all members now have different affiliations but communicate regularly on common research and are publishing together. In addition, there is a number of master and PhD students working at subjects of the group's research fields.

Since its beginnings, the group focuses on human-centered informatics; our research and teaching activities address topical issues in this area. We continuously take part in the international scientific discussion and assessment, and we cooperate with research institutions all over the world. At the same time, by regional activities (e.g. consulting- and development projects with local enterprises) we contribute to empowering our region.

2 Research Topics and Projects

In research and teaching we focus on human centered research in

1. model engineering: user centered (requirements) modeling languages that are intuitively to understand, apply and validate,
2. design and realization of user-oriented application architectures with a strong focus on the integration of user needs into the development process,

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3. customer centered, accessible, effective and sustainable software and services.

We conduct both fundamental research as well as experimental and applied research in close cooperation with industry following the principle: “There is nothing more practical than a good theory”

2.1 Model Centered Architecture

The Model Centered Architecture paradigm sees an information system to be a compound of various models, each of which is formed with the means of a Domain Specific Modeling Language (DSML). Figure 1 shows the template structure of a digital ecosystem component.

From a MOF perspective, MCA focuses on the MOF levels M2 (definitions of the DSMLs to be used for the specification of the system, its interfaces and its contexts), M1 (specification of all system and data components using the DSMLs) and M0 (the instances, i.e. models of concrete objects, functions and processes).

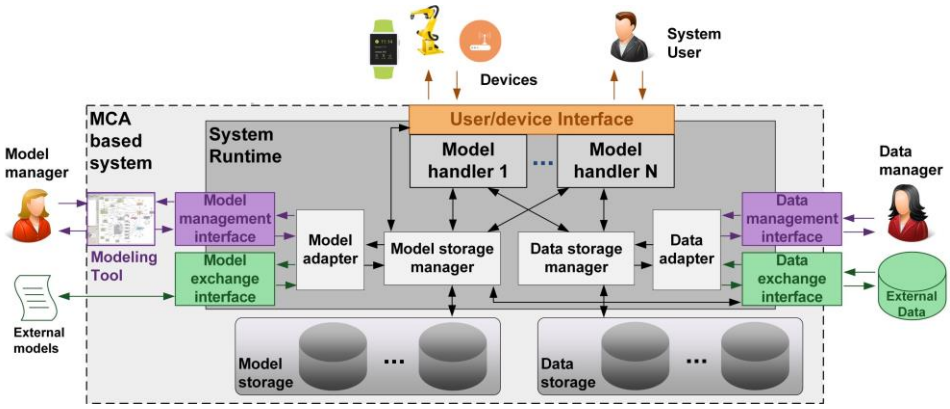

Figure 1: MCA based system template

2.2 HBMS

The vision of Human Behavior Monitoring and Support (HBMS) is to develop an Ambient Assistive Living System, which is able to

1. monitor an individual carrying out activities (e.g. of daily life),
2. to abstract, aggregate and integrate the observed behavior into an individual human cognitive model (HCM) and
3. to assist the individual in cases of need retrieving knowledge from the HCM and reasoning about the most appropriate advice to give.

Thus, HBMS facilitates elderly people with memory weaknesses to live longer autonomously in their familiar environment.

The practical result of this project is the HBMS system prototype (see figure 2), which we implemented following the MCA paradigm. The prototype realizes the aforementioned vision by components that allow

- to obtain the data corresponding to the observed user behavior from external Human Activity Recognition (HAR) systems through a flexible HAR interface controlled by models expressed in the DSML AREM-L;
- to match the obtained observation data against the predefined HCM which is expressed in the DSML HCM-L to determine the current status of the user action in the specific behavioral scenario;
- to form the support propositions based on the result of the match and present them to the user via multimodal support interface (e.g. as audio suggestions or via the tablet UI) which again is defined using a DSML.

In forming support propositions, the system relies on predictive models based on probabilistic ontologies, which allow anticipating next steps in the scenario.

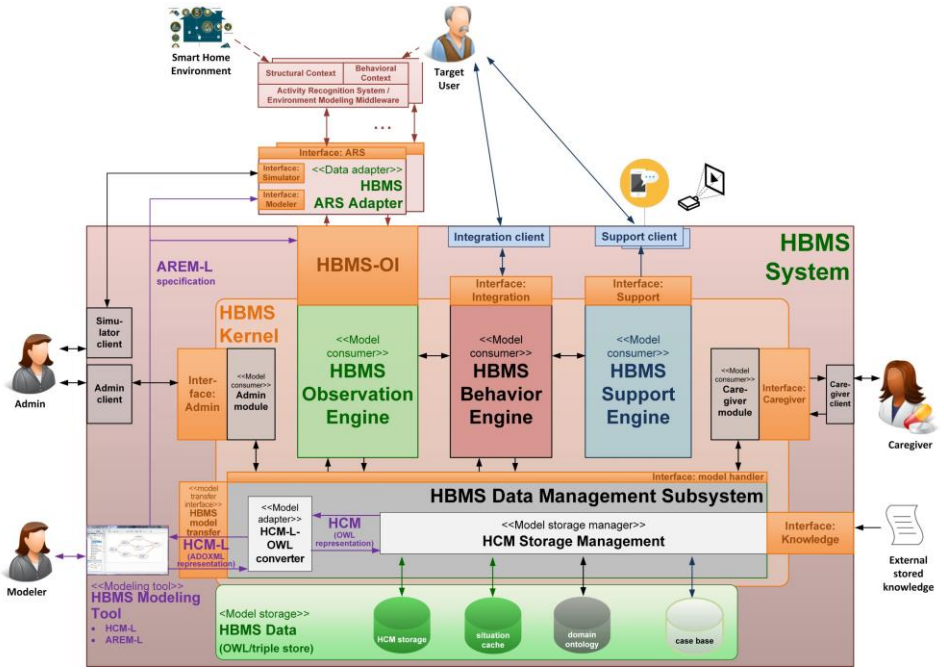

Figure 2: Architecture of the HBMS prototype system

We plan to continue the research in the area of cognitive modeling of human behavior, concentrating mainly on collecting the observations from IoT devices and covering Industry 4.0 scenarios (e.g. in production environment with potentially dangerous steps).

2.3 QuASE

The Quality Aware Software Engineering project focuses on organizing and supporting an efficient quality-related communication between all parties in the development process (such as software developers and business stakeholders). The different backgrounds and contexts of stakeholders are considered by an ontology-backed harmonization (mutual mapping) of views and concepts learned from various data and knowledge bases (e.g. those empowering ticketing systems).

The practical result of this project is the QuASE system (see figure 3), which again was implemented following the MCA paradigm. The system allows

1. to specify terminological glossaries based on common ontological core;
2. to connect these glossaries to understandability contexts (e.g. user categories, project categories, or specific projects and users);
3. to define understandability content units as containers of information which can be misunderstood and has to be harmonized. Such units can be arbitrary documents or fragments of problem descriptions managed by ticketing systems such as JIRA.
4. To harmonize the information shaped by content units by translating the terminology therein between understandability contexts.

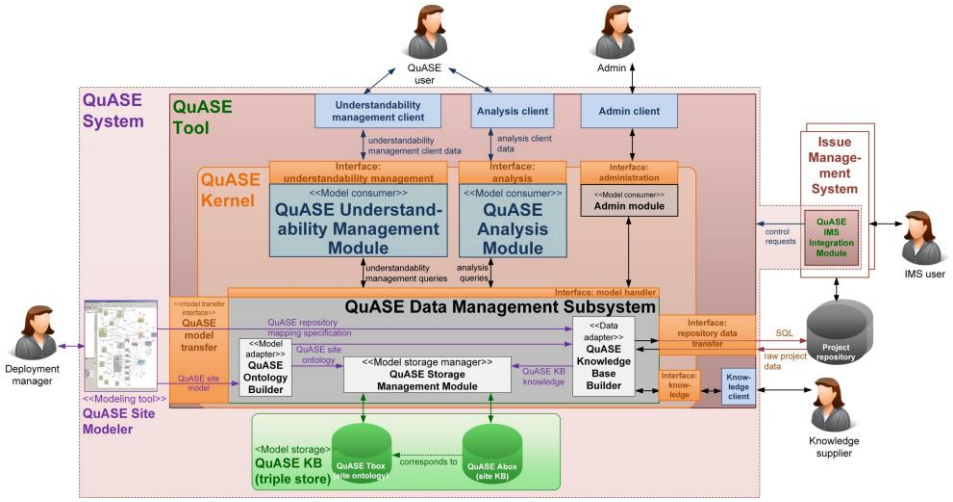

Figure 3: Architecture of the QuASE system

3 Relevance for the EMISA Special Interest Group

The head of the AE Group, Heinrich C. Mayr, founded the EMISA special interest group together with Bernd Meyer in 1979. Since then he has been a member of the steering committee. The members of the AE Group have organised several EMISA events. We are also involved in related international activities, such as the International Conference on Conceptual Modeling, which took place in Klagenfurt in 2005. Since then, Heinrich C. Mayr has been a member of the ER Steering Committee. During the term of office 2016-2018 he was its chairman.

In the field of teaching, we deal with topics that are very similar to those of the EMISA. The focus is on modeling with its formal foundations and its applications in business practice, the development of modeling methods, model-based application architectures and application engineering.

4 Recent Related Publications

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