Newsletter

April 2020

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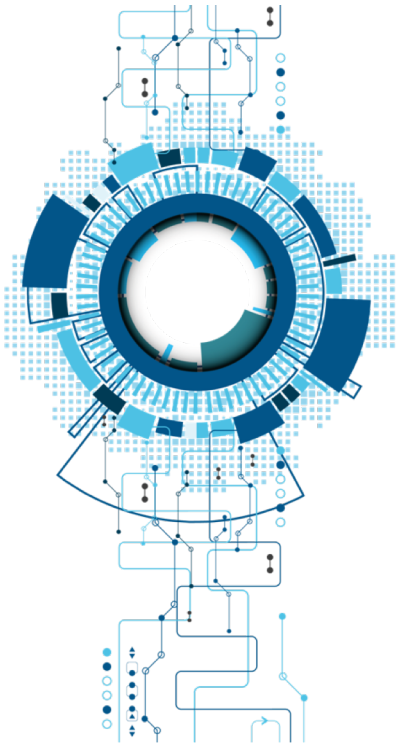
COEMS

Continuous Observation of Embedded Multicore Systems



Welcome to the last issue of our COEMS Newsletter.
Within the COEMS project the five players, University of Lübeck, Accemic Technologies, Thales Austria and Thales Romania, Høgskulen på Vestlandet and Airbus joined their forces to develop a novel continuous observation solution for embedded multicore systems.
We would like to inform you about our achievements, current developments and COEMS-related events in the near future.

The project is coming to an end – we are excited about the final review meeting with the EU on May 28th 2020! Due to the COVID-19 pandemic, the meeting will be in the form of a video-conference. We will prepare demos of the COEMS hardware and tools that we will also release on the web-site afterwards. Likewise, we are consolidating the presentation of our software-tools on our web-page – several of them like the data race checker and instrumentation tools can be applied without the hardware!

Please follow us on Twitter or visit us occasionally for future news: https://www.coems.eu

COEMS Exploitation

As the work on the different COEMS work packages is coming to an end, the tangibles developed in the project have been bundled as a single product, called CEDAR-Tool. The value of the technology behind CEDAR-Tool is created by two major components: the (a) online control flow reconstruction via processor trace and (b) the rule-based online event processing.

Online Control Flow reconstruction via Processor Trace

The techniques prototyped in the COEMS project for the ARM platform can easily be exploited on other hardware platforms, such as Intel, as well. Figure 1 below shows the basic setup. Our technique is using the tracing capability already implemented in most processors on the market today. It shows the system-under-test to the left and its connection to the monitoring hardware on the right side.

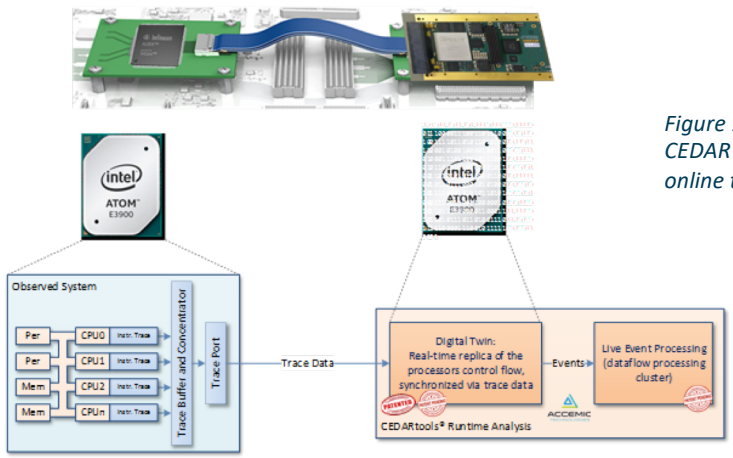


Figure 1:
CEDAR tools architecture: online trace data processing

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 732016.

COEMS Exploitation

Rule-based Online Event Processing

Monitoring and verification of a CPS is based on a given specification of the system's correct behavior. In case a misbehavior is detected, further complex processing steps are triggered. The innovation of the CEDARtools IP lies in the capability to transfer a subset of the specification into a set of rules that can be concurrently applied to the processor state stream in real time on the digital twin. The three elements allow this capability are
i) the Observation Specification Language (OSL) TeSSLa that can be used to capture the rules mentioned above;
ii) a data flow processing unit that applies the rules to the stream of processor states; and
iii) a compiler/mapper that converts TeSSLa into instructions for the data flow processing elements.

Exploitation at Høgskulen på Vestlandet (HVL)

As a research and higher education institution, HVL will mostly build on top of COEMS achievements, or improve the performance of individual components. HVL plans to exploit contributions developed in-house, such as the data race checker, as well as contributions by other partners.
Specifically, HVL will improve the DR-Checker based on TeSSLa scientifically, to result in further scientific publications. In addition, HVL will continue contributing to the maintenance of the Open Data platform that hosts some COEMS results in the form of recorded traces, specifications and other artefacts. The highly visible presence of COEMS materials on the platform will ensure that users and visitors to the repository will be aware of the COEMS project and its results.

HVL will further disseminate current COEMS results and set the foundation for subsequent collaboration in the form of research projects, e.g., a recently granted project from the Norwegian Research Council to collaborate with CentraleSupélec at Rennes, France, and a COEMS-themed winter-school.

Exploitation at University of Lübeck (UZL)

The University of Lübeck is also a research- and higher-education institution, and has developed several of the core COEMS technologies and tools, namely, the specification language TeSSLa, its software-based implementation, its compiler for the COEMS hardware, and the program annotation tools. UZL plans to exploit these results in the future in a multitude of activities, including further research on e.g., new application domains for the specification language TeSSLa, performance improvements of its compiler and interpreter, further incorporating COEMS technologies into some of UZL's lectures, master theses and student projects.

The tools and documentation developed within COEMS by UZL will mostly be made available on the COEMS website. UZL plans to keep tools and documentation available in the future and to continue development.
While the hardware-based tools will be primarily supported by other COEMS partners, UZL plans to also make its software-based tools, e.g., the TeSSLa compiler and interpreter as well as the instrumentation tools, available to commercial users.

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COEMS Exploitation

Exploitation at Accemic

Accemic has developed in COEMS innovative hardware technologies that facilitate testing and debugging, increase product reliability and help satisfy customer requirements.
Accemic will make the hardware available to end-users and system integrators. While the first group will receive the CEDAR-Tools product in the form factor of standalone lab bench equipment, integrators will receive board-level products for integration in their test equipment.
Hardware purchases will be accompanied by maintanence and subscription services. In addition, Accemic will also offer dedicated consulting and training to allow users to extract the biggest possible benefits out of their investment into CEDAR-Tools.
Further options are sublicensing and bundling e.g. to OEM integrators, as well as licensing IP to processor manufacturers.

Exploitation at Thales (TAT/TSR)

Thales' main exploitation area is the use of technologies and methods developed in COEMS in their TAS Platform, which is a distributed fault tolerant computing platform for safety critical railway applications. The TAS Platform is the foundation for more than 70% of all railway business in Thales Group worldwide, a 4-billion-euro business.
In the next years, TAS Platform project intends to further maturate the COEMS technologies.
The developed tracing/debugging solution will become part of the TAS Platform version to be released in 2021, improving usability and reducing development costs. The TAS Platform is currently used by Thales customers only but there is the aim to open the Platform as external product for other companies.
Thales is following the "open hardware architecture" initiative which enables new tracing and debugging methods. The TAS Platform development team will be involved in the research activities and evaluate novel tracing technologies. The tracing insights gained through COEMS will be a valuable input.

COEMS @ Embedded World

This year's "embedded world 2020" in Nuremberg was marked by the approaching corona crisis. Despite a drastic decline in visitor numbers, Accemic Technologies was able to present the results of the COEMS project to an interested audience of experts at the embedded4You joint booth. The COEMS demonstrator, which shows the non-intrusive observation of a control system for balancing a ball on a moving plate, attracted great interest among the visitors.
In addition, two presentations about the results of COEMS were given to a large audience at the embedded world congress: Thomas Preusser, Alexander Weiss: "Conclusive On-the-fly Validation of High-Level Functional Tests" and Albert Schulz, Franz Münz (Airbus): "Debugging Complex Failures of Real-Time Multi-Core Systems".

https://www.embedded4you.com/

https://www.embedded-world.de/en

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“Floortalk” @ Thales Austria

As part of Thales Austria’s internal presentation series called “Floortalk”, a presentation of the research project COEMS was held on 16th January 2020.

Next to people from the higher management about 35 interested employees attended the presentation. The title of the presentation was “Observation and Tracing of TAS Platform Applications - COEMS” with focus to usability of COEMS technology in scope of future TAS Control Platform activities. After a short overview of the COEMS project Alexander Weiss (guest speaker from Accemic Technologies) talked about state of the art “Hardware Tracing” and “Improved Structural Tests” driven by COEMS technology. The presentation was followed by an overview of debugging/tracing technologies within TAS Control Platform which are currently applied to customer projects. The output of COEMS is seen as a future complementary technology to existing technologies and methods to analyze complex railway application systems. The presentation was closed by a short demonstration of COEMS tools to be applied to a simplified railway application setup. Additionally live coverage as well as the graphical representation of the railway application was shown.
Questions and a discussion of the presented topics closed the successful event.

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Papers & Talks

Malte Schmitz presented: *„Runtime Verification for Timed Event Streams with Partial Information“* by Martin Leucker, César Sánchez, Torben Scheffel, Malte Schmitz and Daniel Thoma at RV 2019 - the International Conference on Runtime Verification in Porto, Portugal.

https://www.react.uni-saarland.de/rv2019/

In the course of the FM 2019 - the 3rd World Congress on Formal Methods which took place in Porto, Portugal, COEMS has been presented in a tutorial on stream-based runtime verification by Martin Leucker, César Sánchez (from IMDEA institutes, Madrid), Malte Schmitz, Volker Stolz and Daniel Thoma.

http://formalmethods2019.inesctec.pt

In the course of the Dagstuhl-Seminar 19432 „Analysis of Autonomous Mobile Collectives in Complex Physical Environments“ which took place in October in Dagstuhl / Wadern, Germany, TeSSLa has been proved in a challenge.

https://www.dagstuhl.de/de/programm/kalender/semhp/?semnr=19432

Thomas Preusser and Albert Schulz presented the COEMS solution in a talk in the course of Echtzeit 2019 which took place in Boppard, Germany in November.

https://www.real-time.de/echtzeit.html

COEMS has been presented in a workshop in the course of iFM - the 15th International Conference on Integrated Formal Methods which took place in Bergen, Norway in December.

http://ifm2019.hvl.no

Alex Weiss presented the COEMS solution in a talk in the course of ESE Kongress - the Embedded Software Engeneering Congress in December in Sindelfingen, Germany.

https://ese-kongress.de/frontend/index.php

At the Embedded World 2020 the COEMS solution has been presented by Accemic at the Embedded4you booth as well as at the Embedded Conference which took place in March in Nürnberg, Germany.

https://www.embedded-world.de/en

https://www.embedded4you.com/

The COEMS team would like to thank the brilliant members of the external expert group and all friends for their support!

We hope everyone has the chance to come safe through this very special time!

Take care!

For more information about the project please visit the COEMS website:

www.coems.eu

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Consortium:

UNIVERSITÄT ZU LÜBECK
INSTITUTE FOR SOFTWARE ENGINEERING AND PROGRAMMING LANGUAGES

ACCEMIC TECHNOLOGIES

THALES

Høgskulen på Vestlandet

AIRBUS

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