Newsletter
December 2018

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COEMS
Continuous Observation of Embedded Multicore Systems

Welcome to the 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. Topics in this issue include TeSSLa features for software-based monitoring of CTF-streams and updates on various meetings and events, particularly we would like to point to our workshop at the HiPEAC Conference in January.

TeSSLa for Software-Based Monitoring of CTF-Streams

Many new features have been added to TeSSLa, the specification and analysis language developed by COEMS, over recent months. While development focused more on hardware-based monitoring for the first year of the project, in the second year software-based monitoring moved into our focus as well. Software- based monitoring is considered in COEMS both as an alternative approach for scientific comparison and evaluation and to tackle challenges that cannot be resolved by hardware-based monitoring alone.

The two issues that had to be resolved for software-based monitoring were to identify a suitable trace format, that can be processed efficiently and is open to many applications, and to identify useful data structures to add to the software-based implementation. Due to fierce memory restrictions the hardware-implementation cannot handle unbounded data-structures, but for the software implementations they can add valuable expressivity to the language.

As a trace format we selected the common tracing format (CTF), an open and free format that is also used for tracing the Linux kernel and has already some tool and industry support, including our industry partners (also see our article from the RV-CuBES workshop last year: https://easychair.org/publications/paper/QljX).

We also added immutable maps and sets as data structures. These data structures turned out to be particularly useful to deal with systems involving dynamic ids, e.g. object-oriented or multi-threaded systems.

The example below shows how these features have been integrated into TeSSLa. Arbitrary event-streams from CTF traces can now be declared as input streams, e.g. new_thread is an event stream containing events whenever a thread is created. Conversion macros like CTF_getInt can be used to read property values of CTF events.

```
# setup

in new_thread: Events[CTF]

def id := CTF_getInt(new_thread, "id")
def group := CTF_getString(new_thread, "group")

def id2group := collectMap(id, group)

in initialized: Events[CTF]

def initializedGroups := collectSet(Map_get(id2group,
  CTF_getInt(initialized, "event_context.thread_id")))

# actual property

def threadCreationAfterInit :=
  if time(initializedGroups) == time(new_thread)
  && Set_contains(initializedGroups, group)
  then id

out threadCreationAfterInit
```

The macro collectMap can then be used to aggregate information about threads and thread groups into maps.

Based on such structures we can then easily specify properties as „a thread must not be created after the corresponding group has been initialized“. We can even output the threads violating that property together with the timestamp of the violation.

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COEMS Workshop @ HiPEAC Conference in Valencia, 21.01.2019

We warmly invite you to participate in the COEMS project workshop. The workshop is presenting the current state of project findings and developments. Several talks from members of the project consortium as well as external presentations will form the basis for fruitful discussions. Attendees from communities like embedded systems design, runtime verification, parallel systems and any other related topic are highly welcome.

Early-bird registration until 25.12.2018 under
https://www.hipeac.net/2019/valencia

Agenda

14:00 *Welcome* (Sascha Uhrig, Airbus)
14:05 *COEMS Project Overview*
(Martin Leucker, University of Lübeck)
14:25 Specifying analysis queries in COEMS
(Martin Leucker, University of Lübeck)
14:50 Data Race Detection with COEMS Tools
(Svetlana Jaksic, Høgskulen på Vestlandet)
15:15 Hardware-Based Nonintrusive Continuous Observation – Bits and Bytes in behind
(Alexander Weiss, Accemic, Germany)
16:00 *Coffee Break*
16:30 Advances in SW based tracing in the railway domain (Peter Tummeltshammer, Thales Austria)
16:55 Stream Runtime Verification Revisited
(Cesar Sanchez, IMDEA Software Institute, Spain)
17:20 Real-time Monitoring for Correctness and Robustness
(Stefan Jakšić, Austrian Institute of Technology)
17:45 *Conclusion, end of workshop*

Papers & Talks

Martin Leucker presented our project at the Industrial Day/EU-Project Workshops at ISoLA 2018 - the 8th International Symposium On Leveraging Applications of Formal Methods, Verification and Validation joint with ARVI COST Action on November 9 in Limassol, Cyprus.

http://www.isola-conference.org/isola2018

Daniel Thoma gave a tutorial on Hardware-based Runtime Verification with Embedded Tracing Units and Stream Processing at the RV 2018 - the 18th International Conference on Runtime Verification which is part of the 8th International Symposium on Leveraging Applications of Formal Methods, Verification and Validation on November 10 in Limassol, Cyprus.

https://rv2018.isp.uni-luebeck.de/tutorials

Martin Leucker gave a tutorial on Runtime Verification: Some Basics and Some Latest Developments at the ICTAC 2018, the 15th International Colloquium on Theoretical Aspects of Computing on October 15 in Stellenbosch, South Africa

https://www.ictac.org.za/tutorials.html

Volker Stolz presented
Static analysis for dynamic data race detection with TeSSLa
by Svetlana Jakšić, Malte Schmitz, Volker Stolz and Daniel Thoma
at NWPT 2018 - the 30th Nordic Workshop on Programming Theory on November 25 in Oslo, Norway.

https://nwpt2018.ifi.uio.no

Daniel Thoma presented
Lukas Convent, Sebastian Hungerecker, Martin Leucker, Torben Scheffel, Malte Schmitz and Daniel Thoma:
TeSSLa: Temporal Stream-based Specification Language
at the XXI Brazilian Symposium on Formal Methods in on November 26 in Salvador, Brazil

http://www.sbmf2018.ufba.br

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Upcoming

In the course of the 14th HiPEAC conference which will take place in Valencia, Spain from January 21 to 23, 2019, COEMS will be presented in a workshop on January 21. – see Agenda, page 2

https://www.hipeac.net/2019/valencia

Alex Weiss will give a talk on Requirements-based Testing and Structural Coverage on the 12th of March at the Aero Testing Expo 2019 conference and exhibition, part of Aerospace Technology Week, taking place from March, 2019 in Munich, Germany.

https://www.aerospacetechweek.com/event/aero-testing-expo

A tutorial on Stream-based Runtime Verification by Martin Leuker, César Sánchez, Torben Scheffel, Malte Schmitz, Volker Stolz, Daniel Thoma and Alexander Weiss will be given at FM 2019 - the 3rd World Congress on Formal Methods which will be held in from October 7 to 11, 2019 in Porto, Portugal.

http://formalmethods2019.inesctec.pt

General Assembly

From October 23 to 25 we held the General Assembly in the Airbus Defence and Space GmbH in Ottobrunn, near Munich, Germany. The assembly brings all partners to the table to discuss the progress on future steps in the COEMS project. All partners gave technical updates on their work packages and we had parallel sessions in which involved partners discussed ongoing project tasks.

The COEMS - team wishes

Merry Christmas

and

a Happy New Year

to all the friends of the project !!

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

www.coems.eu

Consortium:

Universität zu Lübeck Institute for Software Engineering and Programming Languages · Accemic Technologies · Thales · Høgskulen på Vestlandet · Airbus

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