Project Introduction
Description:
The goal of PANORAMA is to research model-based methods and tools to master development of heterogeneous embedded hardware/software systems in collaboration with diverse and heterogeneous parties by providing best practice, novel analysis approaches, and guidance for development. To that end, the main line of action is geared to extending the scope and interoperability of current system level analysis approaches, particularly by enhancing existing abstract performance meta-models. The enhanced meta-model and the related tool framework will be a common and open platform to support collaborative development.
Relation to openADx
OpenADx

...with a wide-ranging tool landscape

GOALS

- Industry-wide accepted definition of the AD toolchain
- Tool interface standardization
- Ensure efficient implementation and interoperability
- Foundation for reference architecture

Make a complex tool landscape more accessible for enterprise users
Cooperation and potential

- Measurement data
- Verifiable AI
- Urban Traffic Simulation
- Simulation
- Public funded projects
  - e.g. Simulation
- Exchange-platform for timing / performance simulation
- Automotive platform
- Design efficiency
- FMI Standard
- OpenADx
INCHRON tool suite and Vector Timing Analysis tool suite and open source tools can be connected via AMALTHEA data model

APP4MC can be used as open source tool framework
It’s about … Timing

Max Latencies: 3.3 ms, 2.3ms
Core Utilizations, ...

Task 2ms  Control B  Actuate A  Actuate B
Task 1ms  Sense X
ISR  Sense Y  Control A

HW/SW System

Core 0
Mem
Core 1
Development timeline

- **Acquisition**
  - Estimation/ HW Selection
  - A-Sample
  - B-Sample
  - SW V1
  - SW V2
  - SW V3
  - Software V3_ext

- **Design Process**
  - Feature hacking & no tracking of performance
  - Taskforce estimation
  - Timing

- **Final Integration**
  - Delayed SOP
  - No basis for decisions on change requests

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What is AMALTHEA

Hardware
Constraints
Period $T_1 = 2\, \text{ms}$
Deadline $D_1 = 1.5\, \text{ms}$
Period $T_2 = 5\, \text{ms}$
Deadline $D_2 = 5\, \text{ms}$

Costs
$T_1$ takes 10µs on Core0, 20µs on Core3

Decisions
Run $T_1$ on Core0
Run $T_2$ on Core1
Offset of $T_2 = 1\, \text{ms}$

Software

AMALTHEA System Model

Performance simulation

System Performance Analysis

Optimization

Config Generation

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Performance simulation

Refinement cycle and model content

**Abstract system model**
- Software
- Hardware
- Design decisions: Mappings, Activations

**Performance simulation**
- HW/SW System
- Core 0
- Core 1

**Assessment**
- Timing
- Utilization
- Bottlenecks

Discuss, change, refine, optimize

**Content:**
- Execution time, data access for SW task, data sizes,
- #cores, #memories, access delay, interconnection
- Mapping of data to memories & task to cores, task activations

**Event-based simulation**
- Evaluation of dynamic effects, abstract (no real data)

**Common modelling platform**
- AMALTHEA

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Basic workflow

Based on Eclipse:

- **APP4MC** -
  
  [https://www.eclipse.org/app4mc/](https://www.eclipse.org/app4mc/)
  
  - EMF
  - Xtend
  - Ease
  - E(fx)clipse
  - Sirius
  - Gef
  - Sphinx
  - ...

- **CAPRA** -
  
  [https://eclipse.org/capra](https://eclipse.org/capra)
  
  - Sirius
  - EMF
  - Xtend
  - ...

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AMALTHEA / APP4MC within Panorama Project
Centralized E/E Architecture

Source: Bosch

Vehicle Centralized E/E Architecture
- Domain independent vehicle centralized approach with central vehicle brain(s) and neural network (zones): Logical centralization and physical distribution

(Cross) Domain Centralized E/E Architecture
- To handle complexity of increasing cross domain functions

Distributed E/E Architecture
- Mainly encapsulated E/E architecture structure

Centralization shifts integration effort from network to the ECU
**Research focus**

**Heterogeneous Functional Domains**
Integration of heterogeneous function domains

**Heterogeneous Hardware**
Use of heterogeneous specialized hardware

**Heterogeneous Teams**
Involvement of heterogeneous, collaborating parties
For design and development
Heterogeneous Functional Domains

End-To-End Analysis of Distributed Functions in Vehicle Networks

Source: INCHRON GmbH
Heterogeneous Teams

Challenges
- Tool landscape
- Intellectual Property
- Processes
- Know How
- Responsibility
- …

➤ How to interact
Heterogeneous Teams

Classic approach

**Development**
- Source code
- Monolithic executable

**Production**
- .exe

**Field**
- .exe

Modular approach

**Development**
- Source Code
- Modular & reusable executables: services

**Production**
- .exe

**Field**
- .exe

Update
Demo
APP4MC & cloud services

Provisioning of APP4MC IDE

Cloud based services
Focus: Cloud based services

Eclipse APP4MC - Panorama cloud services
Focus: Cloud based services

Eclipse APP4MC - Panorama cloud services
(Example workflow)
Benefits

**Status quo**

- **FPS**: Reducing

**Goal**

- **GPU**: Increase
- **Core**: Increase
- **DDR**: Increase

**Improve insight** in dynamic system behavior

- Systems in development
- Systems in field

**Assess** design choices & requirements

- Systems in acquisition
- Systems in planning or development

**Identify** opportunities

- Prioritization of critical event-chains
- Derive OS configurations (e.g., thread priorities)
Thank you!

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https://itea3.org/project/panorama.html
https://www.eclipse.org/app4mc/

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