Information Society
Technologies

ARTIST2 – Year 1 Review

Grenoble, October 3rd-4th, 2005

Activity   *Joint Programme of Research Activities*

Component Modeling and Composition

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Outline of the Presentation

Industrial Needs and Experience

Year 1 Activities

- Achievements & Ongoing Work

- Interaction and Building Excellence Between Partners

- Management Perspective

18 Month Perspective

- Work planned for the next 18 months

- Achievements expected

Industrial Needs and Experience

- Artist2 Interaction with Industry
    - (almost) all partners carry out projects in collaboration with industry.

- Industrial Needs
    - "Manage complexity" by component-based modeling and design
    - Handling non-functional requirements throughout the design cycle
    - Problems: Cross-cutting non-functional requirements,

        Heterogeneous systems

- Possible Global Impacts of Research Results
    - Techniques for handling timing- and other non-functional properties compositionally,
    - Handling dependence of non-functional properties on platform (computational resources).
    - Tools for design of heterogeneous component-based systems.

Year 1 activities
Aims

- **Brief State of the Art**
  - Current component technologies support syntactical aspects of composition.
  - There are several languages for expressing QoS and non-functional requirements, but we lack a coherent framework for their semantics.

- **Aims**
  1. Techniques for handling non-functional properties in component-based systems:
     - Specification of **rich interfaces** (in particular timing),
     - Handling dependence on platform (resources),
     - Relation between required and guaranteed properties
     - **Composability** (will new component interfere with system?)
     - **Compositionality** (predicting system properties)
  2. Coherent theory for design of **heterogeneous** component-based systems.

Year 1 activities
Achievements & Ongoing Work

Identification of and **consensus** on key issues

- separation of different types of properties (timing, resources, …)
- Flexible relation between required and guaranteed properties
  -> connections with work by OFFIS, ETHZ
- abstraction of simple timing properties from system description

Surveys on

- Compositional techniques for timing properties [Timisoara, Uppsala]
- Classification of non-functional properties on the basis of compositionality properties [ABB, Mälardalen]
- Techniques for expressing and predicting different classes of QoS properties [group effort, in progress]
- Book on Component-Based Software Engineering [Eindhoven, Mälardalen]

Year 1 activities
Achievements & Ongoing Work

1. A framework for composition of heterogeneous systems is being developed into *IF for components.* [Verimag]
   Comparison and Start of collaboration with Metropolis team [Parades, submission of European projects, …]
2. Bridge between INRIA's non-functional contract model and IF semantics [INRIA, VERIMAG]
3. SaveCCM, a simple component model for automotive applications [Mälardalen, Uppsala, CC Systems, ABB]
4. Component model for the MAST framework focusing on schedulability analysis [Cantabria, CEA]
5. Techniques to generate behavior descriptions from observations [Dortmund, Uppsala]
6. Industrial Case studies
   - CC Systems [Mälardalen]
   - Man B&W [Aalborg, OFFIS]

Year 1 activities
Fruitful Research Collaborations: Example

Cluster meeting, Jan. 05:

- T. Henzinger [EPFL] presents his work on Interface Specifications, allowing to derive Required functional properties form Guaranteed, and vice versa.
- L. Thiele [ETHZ] presents his RT-calculus, where computation resources are first-class citizens (separation of concerns)

Spring 05:

- Thiele et al. extend RT-calculus, allowing to derive requirements on workload and computation resources, from guarantees/requirements, and vice versa [EMSOFT 05]

Autumn 05:

- Ongoing collaborations to combine timed-automata based tool support with RT-calculus ´concepts, to develop techniques for flexible analysis of the relation between timing properties, computation resources, and scheduling [ETHZ, Timisoara, Uppsala]

Interaction & External Collaboration

- **Interaction Between Partners**
  - Several new cooperations [ETHZ, Timisoara, Uppsala], [Aalborg, INRIA]
  - Joint projects under evaluation between Artist partners [CEA, EFPL, INRIA, Parades, Verimag, Uppsala, …],

- **Overseas Collaboration:**

  - Monash Univ [H. Schmidt]: Reliability,

  - SEI [K. Wallnau]: PECT (Prediction-enabled composition technology)

  - NTU (Taipei) [Y.-K. Tsay] (Required/Guaranteed properties)

Year 1 activities
Management Perspectives

- What worked well
  - Establishing connections with activities in this and several other clusters (HRT, Verification, Platforms).
  - Discussions and comparisons between different approaches at meetings.

- Difficulties encountered
  - In full generality, problems concerning compositional specification and reasoning about timing properties are hard; they may become easier in specific design contexts.

- Structural changes in the activity
  - Stronger integration with other activities in ARTIST2, in particular with the HRT cluster.

Next 18 Month Perspective
Work Planned for the next 18 months

- **Work on timing properties**
  - Continue work to develop, relate, and combine existing approaches
  - Completion of work on
    - Techniques for joint analysis timing analysis, computation resources, required/guaranteed properties,
      - Workshop for comparing different approaches (Lorentz)
    - Survey of different types of QoS properties,
    - Adopting timed automata techniques (IF) for implementing QML contracts,
    - Case studies,
- **Theory and tools for composing heterogeneous systems**
  - Develop an execution platform for *IF for Components*,
  - Use it as a basis in new collaboration projects,

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