Integrated Observation and Modeling Techniques to Support Adaptation and Evolution of Software Systems

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Run-time Reconfiguration
CoCoME – Evaluation Scenario
What is iObserve about?

- Model-driven instrumentation of dynamic Cloud applications
- Run-time modeling for automated adaptation and manual evolution support
- Model-based analysis of performance and privacy
Status and Contributions

- Technology-independent and model-driven monitoring [KP2013]

- Integrated run-time modeling [MRT2014] covering …
  - executed system and its architecture models
  - design-time and run-time artifacts

- Aspect-oriented/view-based meta-model evolution [VAO2014]

- Data geo-location analysis for Cloud services [ICSOC2014]
Community Support

- Developed Cloud-based variant of CoCoME as a basis of the common workflow
- Instrumentation Record Language is official part of the Kieker project
  - www.kieker.org
- Organized workshop “Evolution and Maintenance of Long Living Systems” (EMLS)
- Dagstuhl Talks
  - Robert Heinrich – Integrating Observation and Modeling to Support Adaptation and Evolution of Software-intensive Systems
  - Eric Schmieders – Runtime Model based Privacy Checks of Cloud Services
Privacy Checks of Large-Scale Architectural Models
Privacy Regulations

- Geo-Location matters (w.r.t. privacy)
- Regulations constrain data geo-locations (e.g., EU-DPD, HIPA, VPPA)
- Cloud changes data/software geo-location
- Use of cloud services threats regulation fulfilment

[Privacy International, 2007]
Long-term Goals

- **1st funding period** ▶ Monitoring (M) and Analysis (A)

- **2nd funding period** ▶ Planning (P) and Execution (E)
  - How does knowledge gathered in 1st period affect Planning and Execution?
  - Which adaptations are enabled by the new knowledge?
  - How do the new adaptations affect the Planning again?
Publications


TODO: ICSOC


Back-up Slides
Design-Time: Realizing Monitoring

Model Level

- Application Model
- Pointcut Specification
- Advice Specification
- RAC Trace Model

Implementation Level

- Application
- Pointcut Realization
- Probe Realization
- Record Types

Files:
- Application:
  - *.pm
  - *.java
  - *.c
- Pointcut Realization:
  - web.xml
  - aop.xml
  - ejb.xml
- Probe Realization:
  - *.pm
  - *.java
  - *.c
- Record Types:
  - *.pm
  - *.java
  - *.c

IRL
<<conforms to>>
Run-Time: Processing Monitoring Data

Megamodel of the Preprocessing

- Filtering transformations select specific monitoring events
- Semantically rich events can be reconstructed (e.g., Deployment from Heartbeat)
- Reconstruction of entry calls from flow events
- Aggregation of entry call events to call sequences
Run-Time Architecture Correspondence Model

**Trace Meta-Model**

- Monitoring Data
  - Application Element
    - PCM Element
  - Constraint
    - Relation
      - Transformation

**Aggregated & Refined Events**

- Deployment Events
- Entry Call Sequence Model

**Application Run-time Model**

- PCM Allocation Model
- PCM Usage Model

**Transitions**

- $T_{Allocation}$
- $T_{EntryEventSequence}$

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