Valutazione delle prestazioni di Architetture Software con specifica UML tramite modelli di simulazione

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Where performances can be evaluated?

- Requirements Definition
- System and Software design
- Implementation and unit testing
- Integration and system testing
- Operation and maintenance

Model-based Performance Evaluation

Measurement-based Performance Evaluation
General Software Performance Modeling

Software Model

Performance Model

Results and Feedback

Model Evaluation
The approach

- Software Model
- UML Model
- Performance Results
- Simulation Program
- Simulation Model
- Modeling Algorithm
- Feedback

UML-Ψ

Model Impl.
UML

- UML is a graphical modeling notation
- Widely used to describe Object-Oriented software systems
- Informally specified
- Provides several types of diagrams
  - Use Case
  - Deployment
  - Activity
  - State
  - Class / Package
  - Collaboration
  - Sequence
Performance Model in UML
Model Generation

**UML Model**
- Use Case Diagrams
- Activity Diagrams
- Deployment Diagrams
- Tagged Values

**Performance Model**
- Workloads
- Processing Steps
- Resources
- Model Parameters
- Simulation Results
What we have done

• We described how performance analysis can be done at the SA design level
• A UML profile has been defined for adding quantitative annotations to UML models
• We define a process-oriented simulation model of a SA
• A prototype tool (UML-Ψ) has been developed
  ♦ Parses annotated UML diagrams saved in XMI format
  ♦ Generates simulation model
  ♦ Executes simulation and reports feedback
Current Research

- UML 2.0 becoming an adopted specification right now
  - More formally specified
  - Could help in validating the simulation model
  - Simulation model validation answers the question “are we building the right model?”
  - Simulation model verification answers the question “are we building the model right?”
- Integrated UML-based performance and mobility modeling
  - Preliminary work presented at ESMc'03
Mobility and Performance Modeling with UML
Integrated UML performance and mobility modeling

• Description of all the mobility scenarios / behaviors could be too verbose
  ♦ More compact notation
  ♦ “Template” mechanism

• There does not exist a standard “UML profile for mobility”, BUT...
  ♦ There is a very interesting proposal from uniroma2 which definitely should be considered
More UML profiles

• We focused on performance modeling only
• Consider other properties as well
  ♦ A good candidate may be UML reliability modeling
  ♦ Work by Vittorio Cortellessa
• To be done
  ♦ Define a UML profile for expressing informations related to reliability and fault tolerance
  ♦ Derive a (simulation?) reliability model, as we already do for the performance model
    • Tricky: simulation of rare events, must be handled with suitable techniques
Simulation tool integration

- Integrate different tools into a unified framework
  - Performs different kind of analysis (performance, reliability, dependability...)
  - Derives multiple models
    - Queuing-network based
    - Simulation
    - ...

Relevant publications


♦ S. Balsamo and M. Marzolla, Performance Modeling of Software Architectures based on UML and simulation (in preparation)

♦ All available on [http://www.dsi.unive.it/~marzolla/publications.html](http://www.dsi.unive.it/~marzolla/publications.html)