

Performance Evaluation of UML Software Systems

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Overview of the presentation

- Motivation: Performance evaluation at the Software Architecture level
- Modeling Performances with UML
- Mobility Modeling with UML
- Future Works

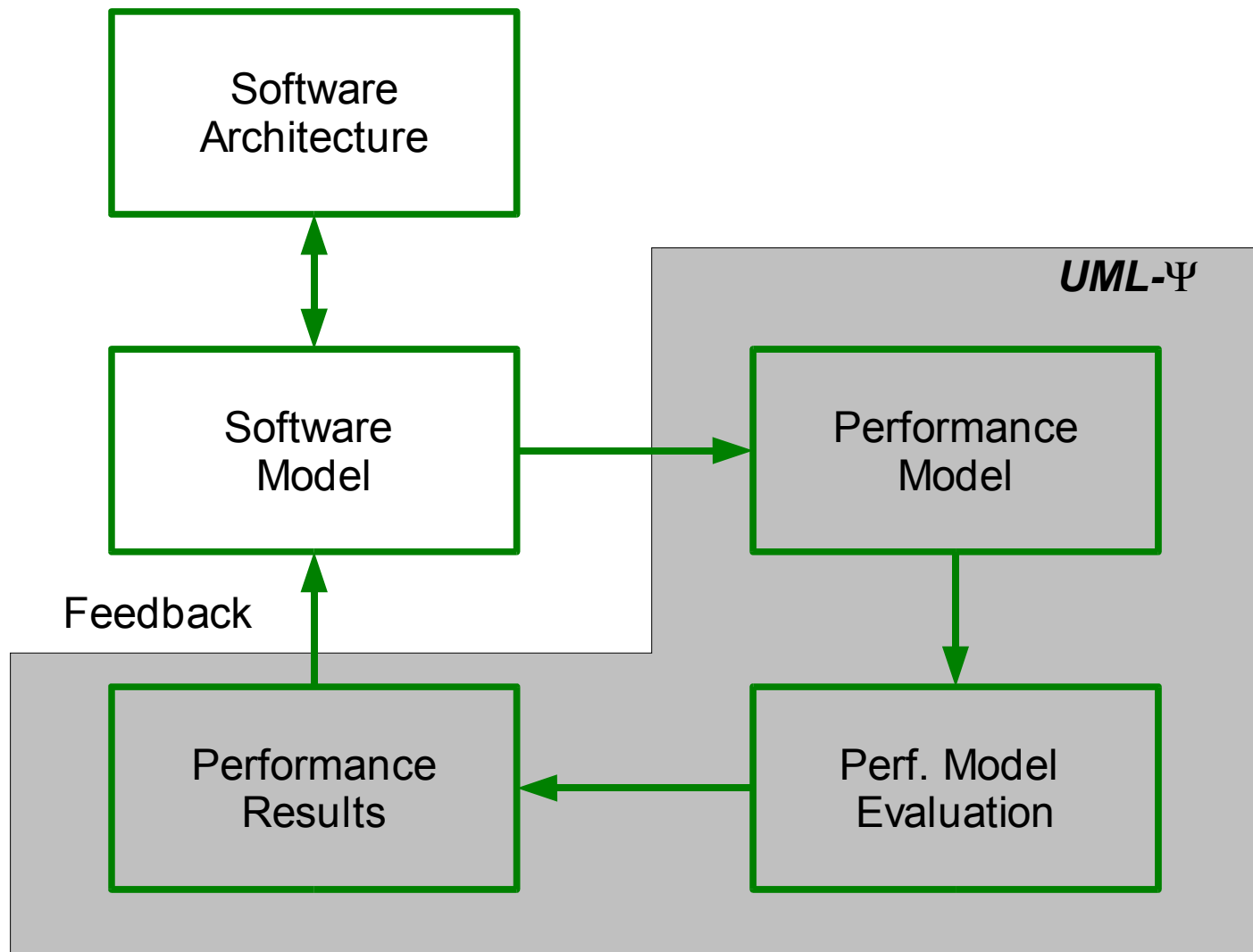


Performance Evaluation at the Architectural Level

- Early identification of performance problems in Software Architectures is very useful
 - Costs of changing the design increases as the software development process proceeds
- Performances of SA can be evaluated with
 - **Measurement-based approach**
(requires a running system)
 - **Model-based approach**
(can be done at early stages of the software development process)



Model-Based Approach

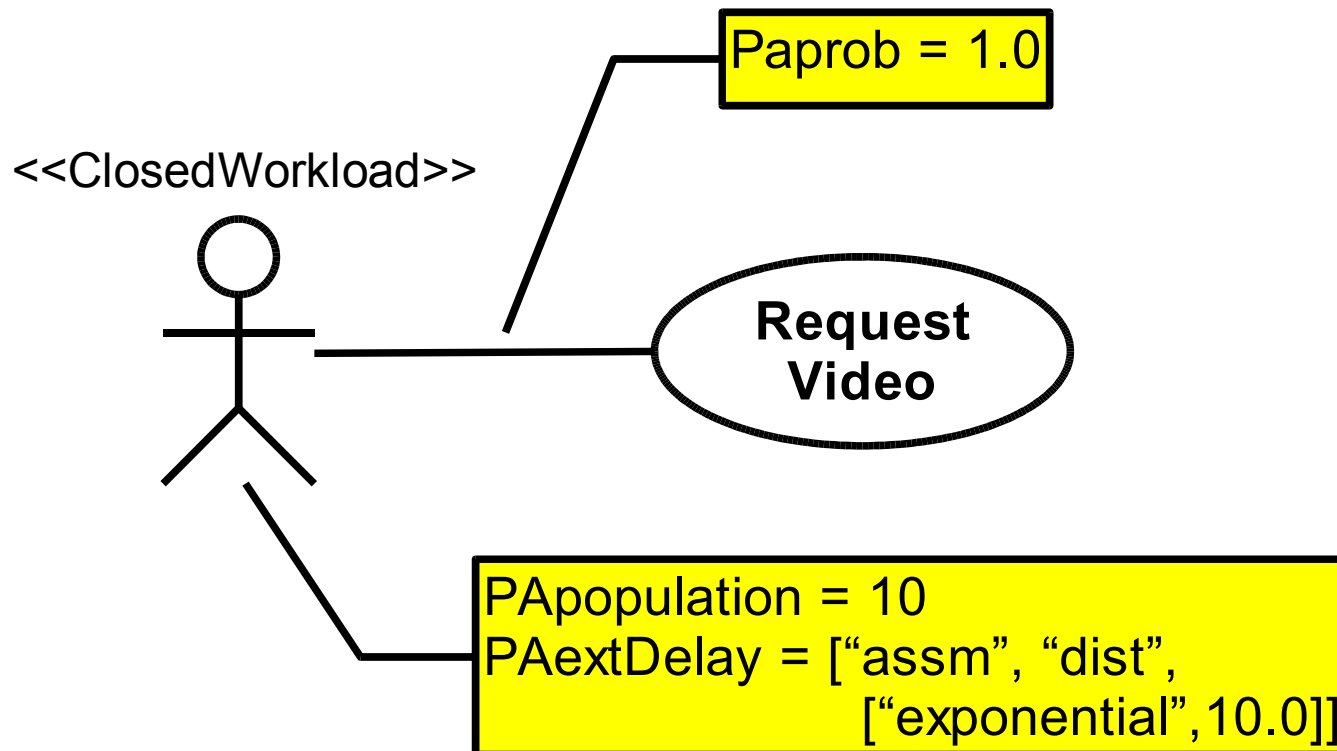


Modeling Performances with UML

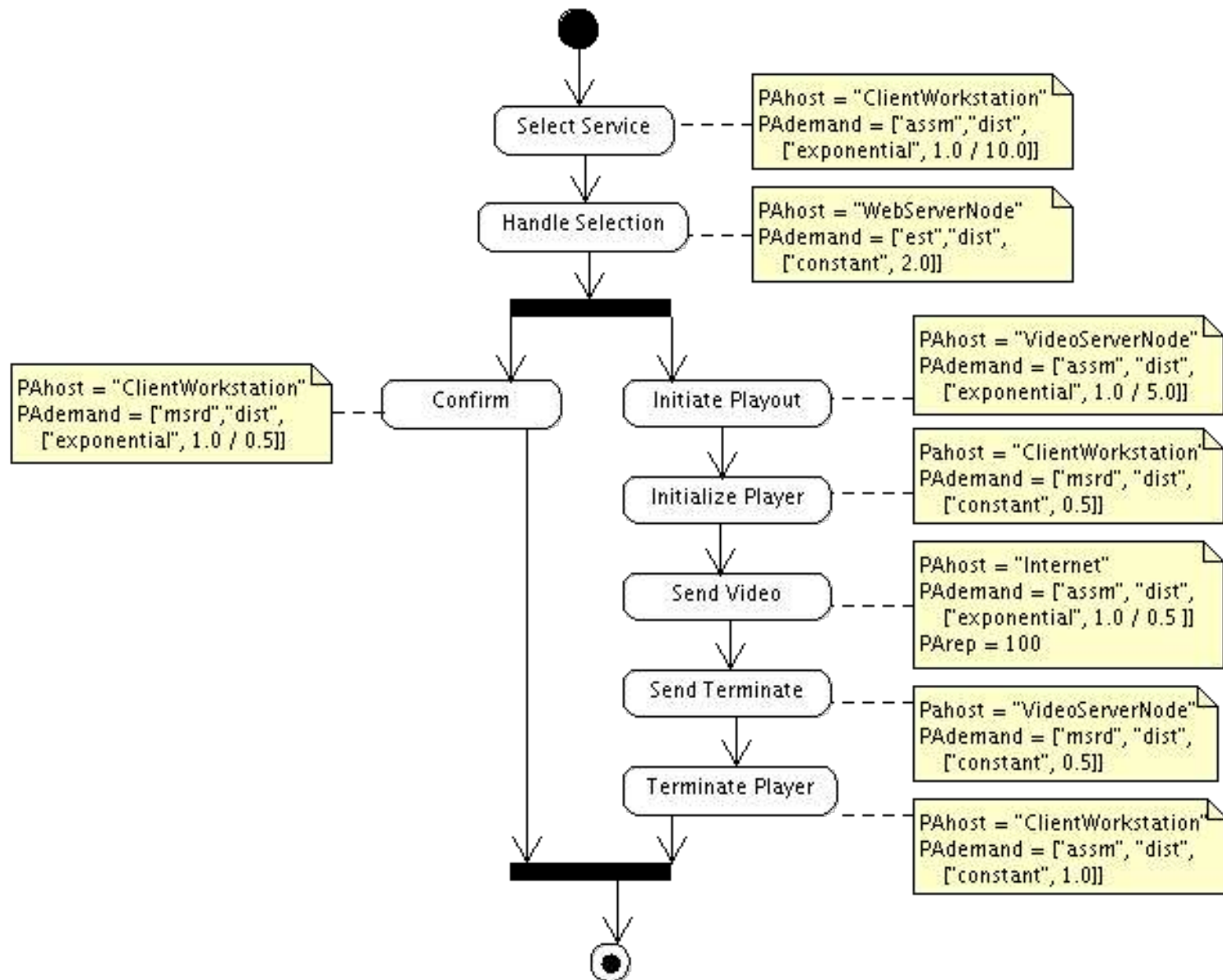
- Combine Use Case, Activity and Deployment diagrams
 - Use Case diagrams → Workloads
 - Activity diagrams → Processing Steps
 - Deployment diagrams → Resources
- Process-oriented simulation model, implemented with a custom C++ simulation library
- Computed results:
 - Utilization/Throughput of resources
 - Mean execution time of actions



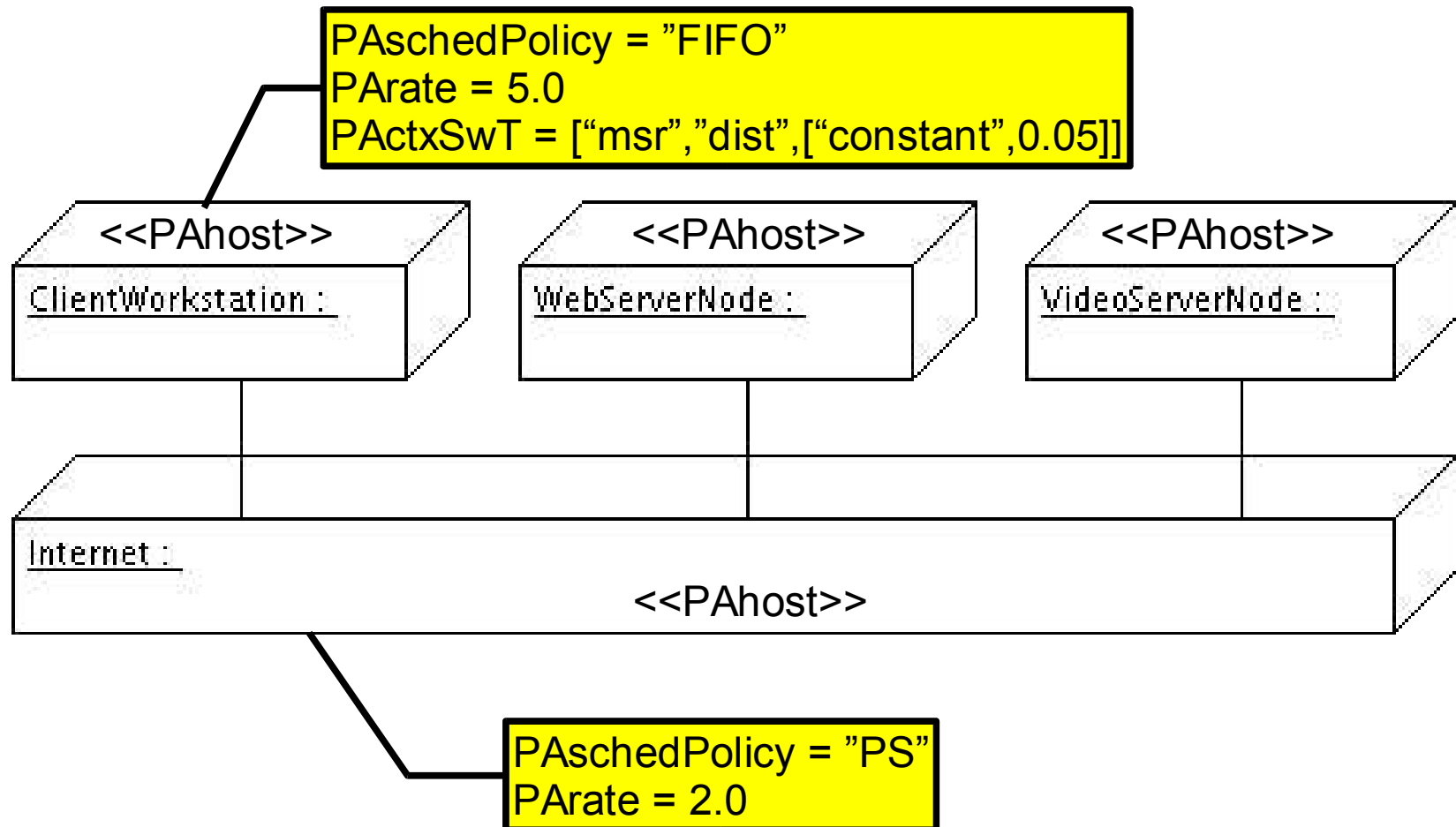
Annotations: Use Case Diagram



Annotations: Activity Diagram



Annotations: Deployment Diagram



UML Mobility Modeling

- Problem of *notation*. Different proposals for high-level UML mobility modeling:
 - V. Grassi and R. Mirandola,
“UML Modeling and Performance Analysis of Mobile Software Architectures”
 - Baumeister et al.,
“Extending Activity Diagrams to Model Mobile Systems”
 - P. Kosiuczenko,
“Sequence Diagrams for Mobility”
 - Others...

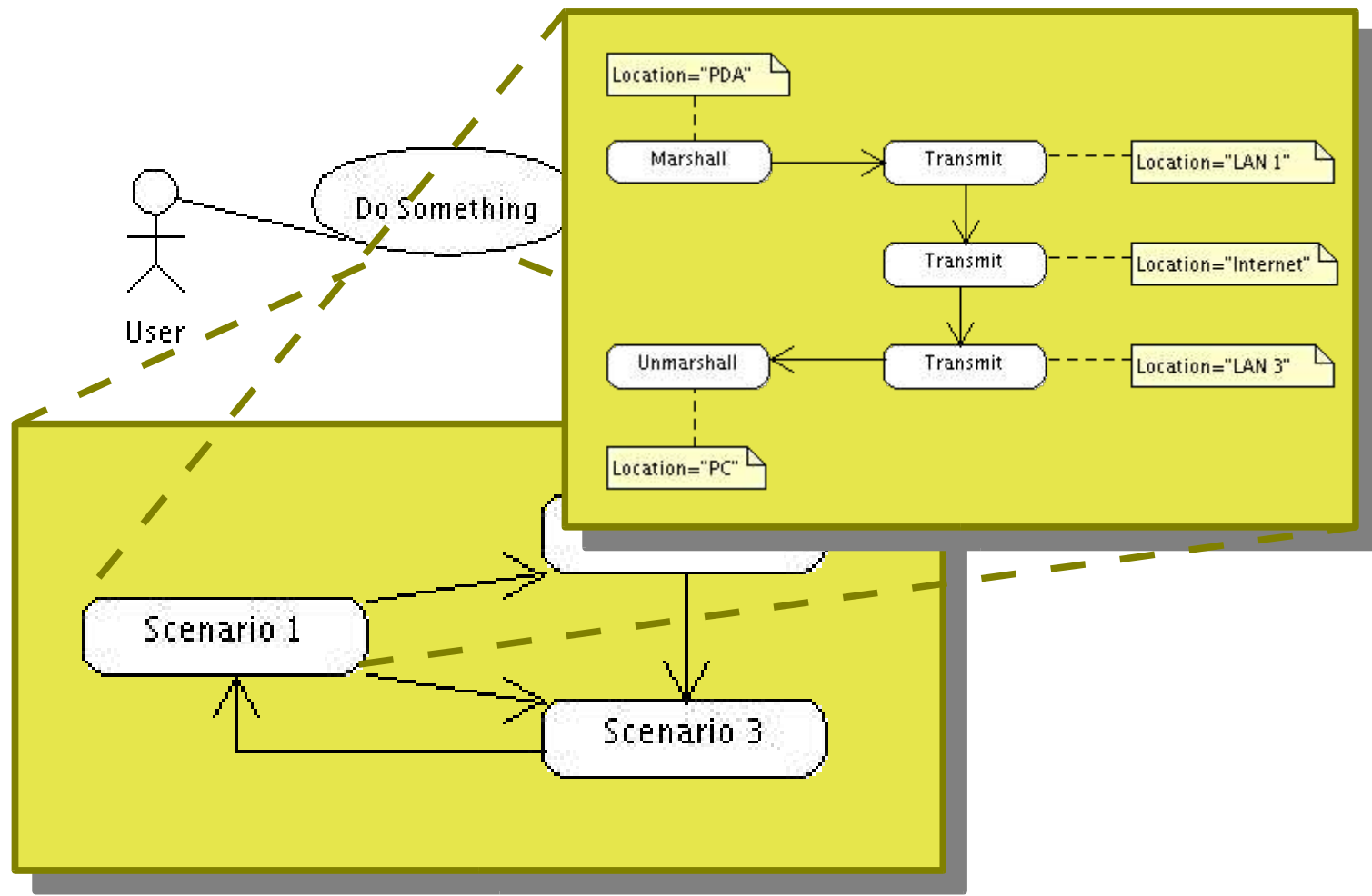


Our proposal

- Unified UML notation for mobility AND performance modeling
 - **Deployment Diagrams**
 - Represent the configuration of physical resources available in the system.
 - **Activity Diagrams**
 - Represent the computations performed on the system
 - Describe how the physical configuration of the system changes as the result of mobility (both physical and logical)
 - **Use Case Diagrams**
 - Represent workloads



The approach / 1



The approach / 2

- Each workload (user class) is modeled as an **Actor**.
- Each behavior executed by actors is represented by a **Use Case**.
- Use Cases are expanded into **top-level Activity Diagrams**. Each action represents a possible system configuration.
- Top-level Activity Diagrams are detailed with the actions performed while the system is in that configuration.
- **Deployment Diagrams** represent resources.



Conclusions

- We proposed a unified approach to mobility and performance modeling of software systems
- The approach is based on standard UML notation
 - We defined a UML profile based on (a subsef of) OMG's “UML Profile for Schedulability, Performance and Time Specification”
- We have built a performance evaluation tool UML- Ψ to show the approach in practice.
 - The performance model is a process-oriented simulation model.



Current Status & Future Research

- What we have:
 - A UML-based approach for performance evaluation of software architectures at the SA level.
 - A prototype tool to implement the approach
 - An extension of the approach to mobile systems
- What we are working on
 - Extend the approach with more features
 - Integrate our approach into a general framework
 - Extend the approach to reliability



More Informations

- Our papers on UML performance modeling are available online at:
<http://www.dsi.unive.it/~marzolla>

