

A Heterogeneous Approach for Wireless Network Simulations

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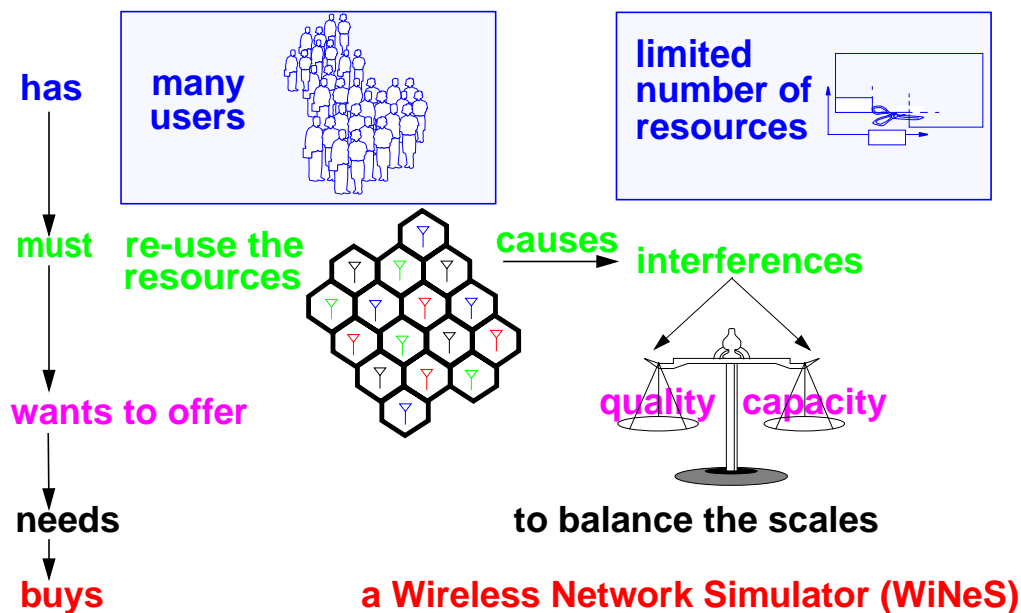
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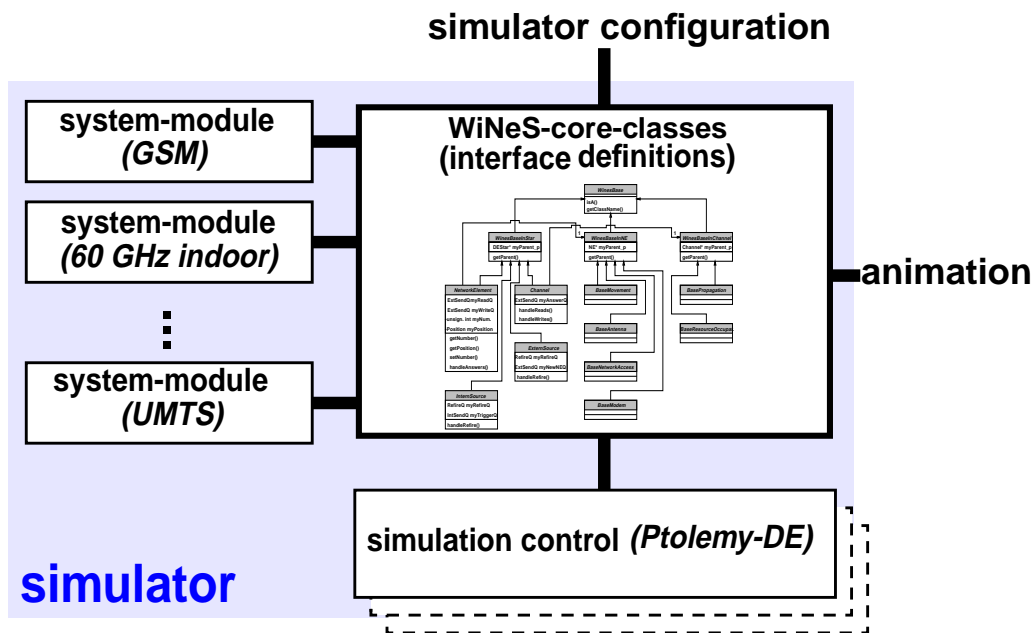
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1. Motivation: System Simulations of Mobile Cellular Networks
2. Wireless Network Simulator: Overview
3. Choosing a Model of Computation: Specifics of Mobile Cellular
4. Application: Simulation of a 60 GHz Indoor System

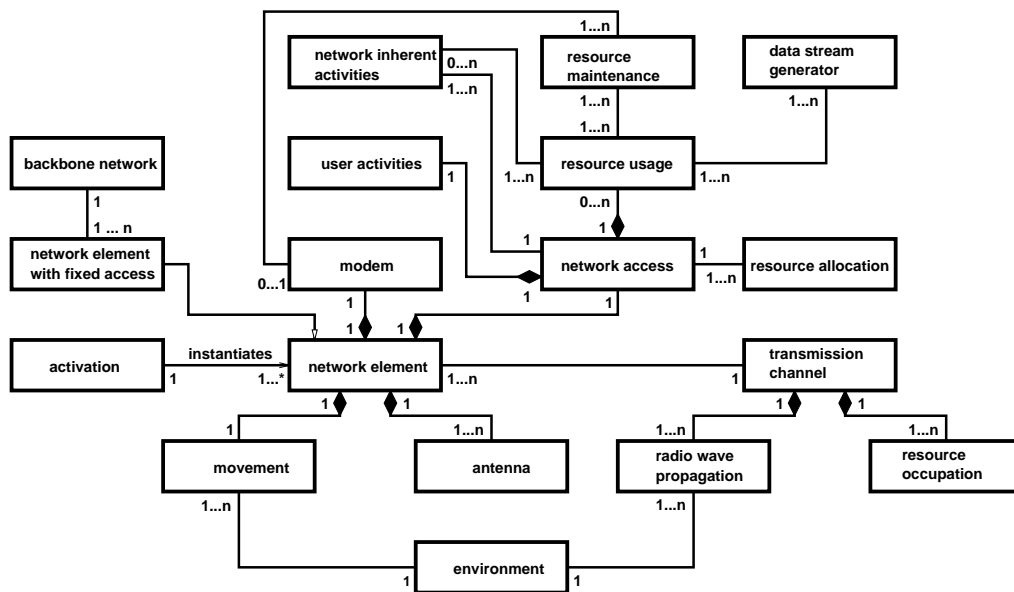
System Simulations for Mobile Cellular Networks

a network operator...



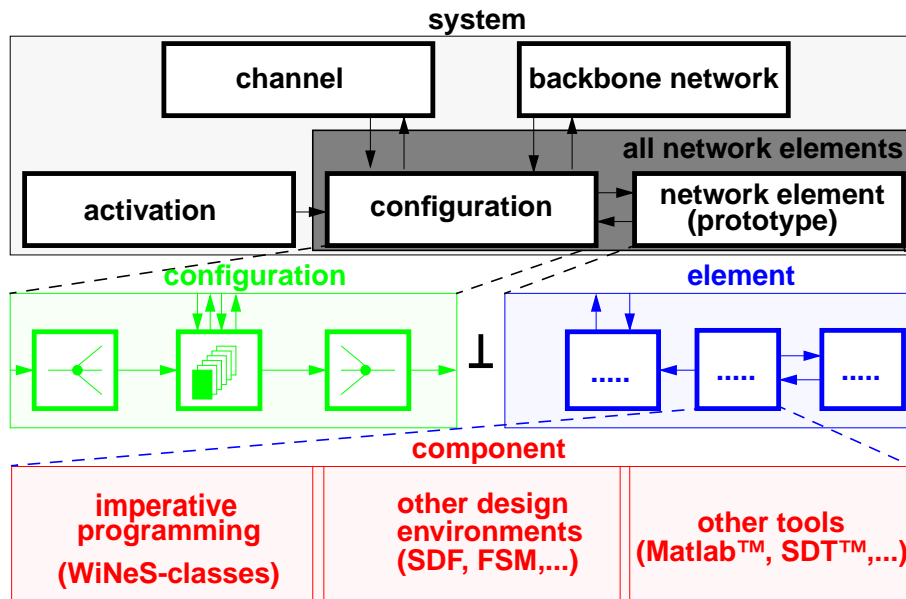


Wireless Network Simulator (2) Object-Oriented Analysis



Model of Computation (1)

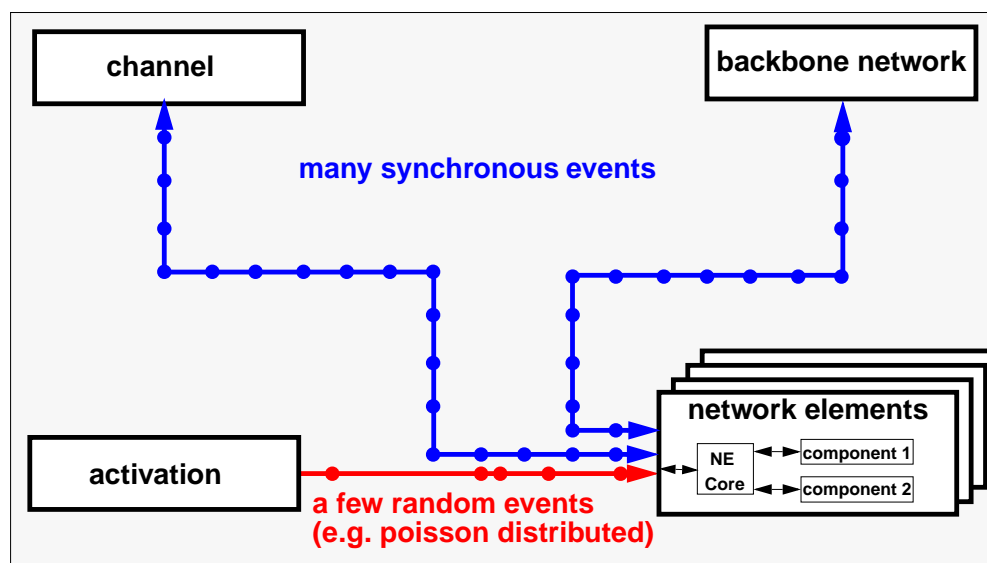
Multiple Layer Model



Model of Computation can be different in each layer

Model of Computation (2)

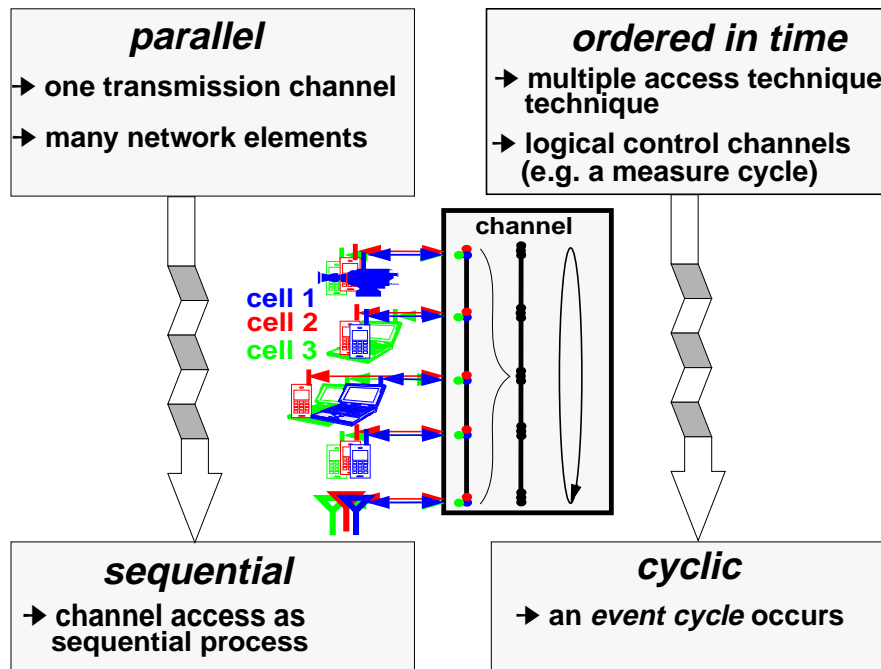
Events on System Layer



event-tags need not to be totally ordered through all layers

Model of Computation (3)

Channel Access

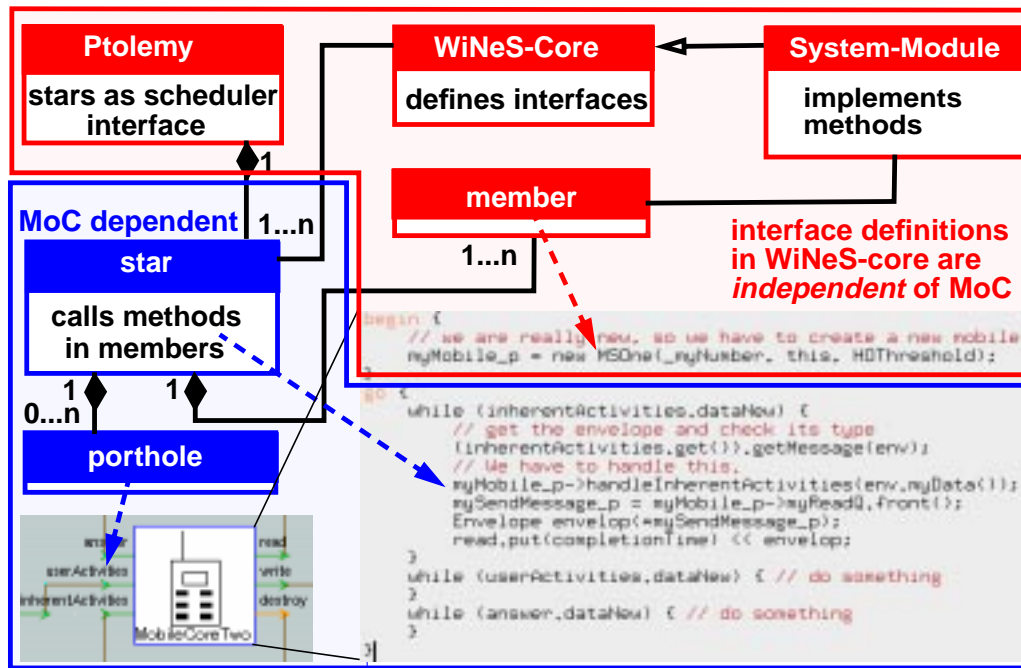


Model of Computation (4)

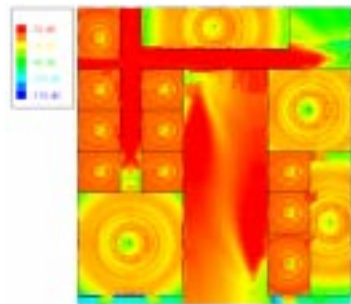
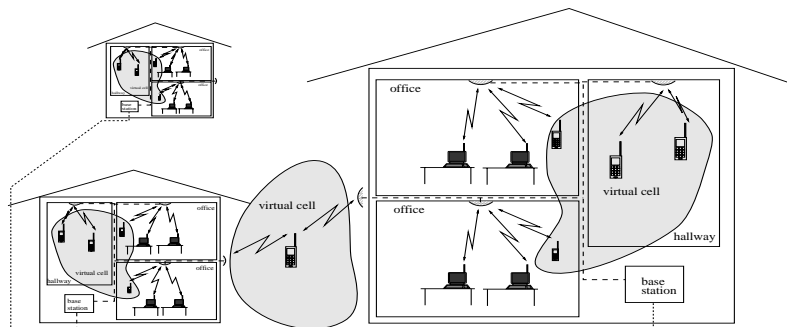
Alternatives

synchronous timed system		communicating sequential processes	
<p>discrete event MoC</p> <p>😊</p> <ul style="list-style-type: none"> → mutable system configuration possible <p>😞</p> <ul style="list-style-type: none"> → overspecifies model if applied in all layers → run-time scheduling (overhead ≈10%) → sequential DE has performance limits → parallelization hard to implement <p>fits for random events</p> <p>works fine</p>	<p>synchronous language</p> <p>😊</p> <ul style="list-style-type: none"> → fast compile time scheduling <p>😞</p> <ul style="list-style-type: none"> → number and order of events must not change → mutable system configuration → random activation <p>fits for channel access</p> <p>not tried yet</p>	<p>CSP/π-/Fusion-calculus</p> <p>😊</p> <ul style="list-style-type: none"> → automatic scheduling based on rendezvous → mutable system configuration and concurrency inherent in the model <p>😞</p> <ul style="list-style-type: none"> → non-determinism <p>use event cycle to get determinism?</p> <p>not tried yet</p>	

Connection between Ptolemy and System-Modules



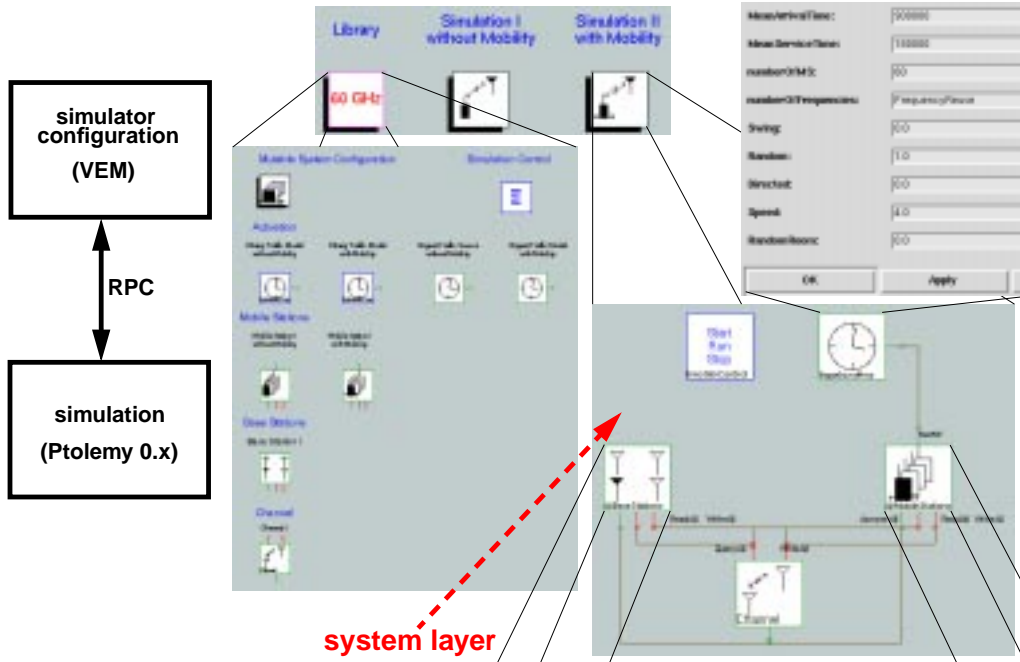
Application: 60 GHz System Module



- ✓ each room == one cell
- ✓ system simulations in Generic Office Environment
- ✓ radiowave prediction by incorporated on-line Radiowave Propagation Simulator (RPS)
- ✓ different activation and mobility models

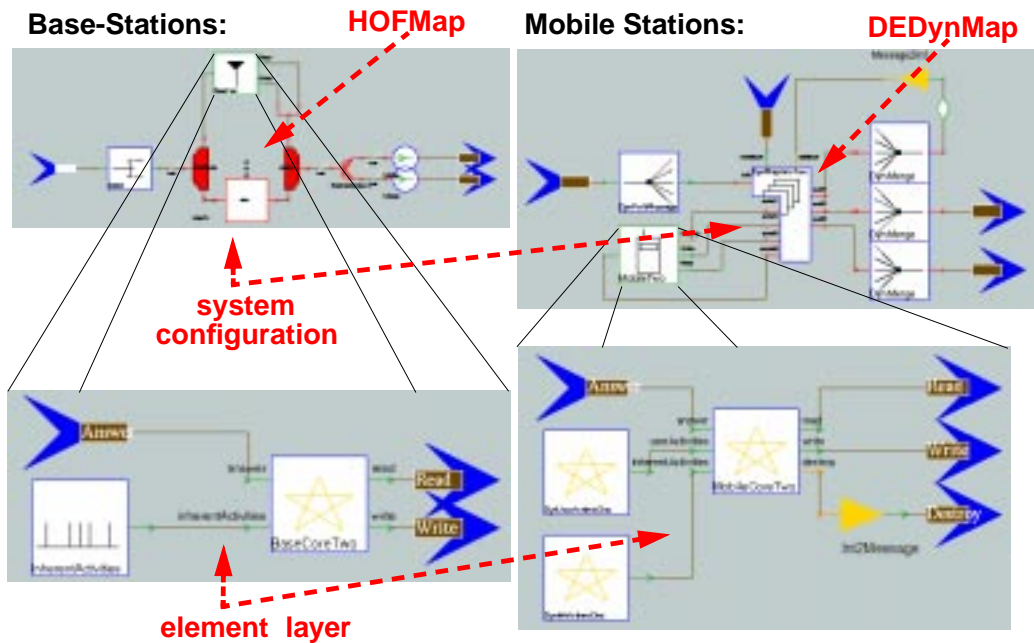
60 GHz System Module (1)

Layout

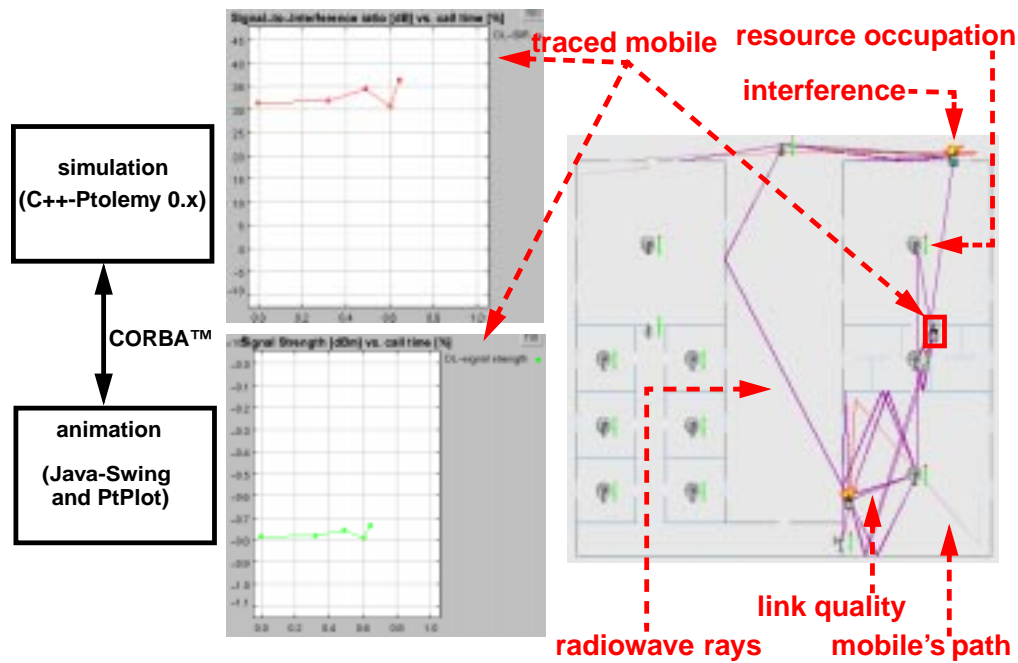


60 GHz System Module (2)

System Configuration



60 GHz System Module (3) On-line Animation and Trace



Summary and Future Work

- heterogeneous approach in three senses:
 - different mobile cellular systems are modeled in different system modules
 - use of a Multiple Layer Model allows for a different MoC in each model layer
 - Event-Cycle for channel access allows for different MoC on system layer and simplifies parallelization
- ready to use:
 - two system modules (GSM and 60 GHz indoor)
 - simulation control: Ptolemy 0.7.1 - Discrete-Event Domain
 - on-line animation written in Java™ and connected via CORBA™
 - simulator configuration via Ptolemy0.x-GUI
- plans:
 - simulation control which allows for concurrency (first choice: base on PtolemyII - CSP / PI)
 - more generic GUI for animation/configuration (use of DIVA system visualization?)
 - new system modules: 3G-UMTS, 4G-research project (IBMS)