OverSim

A Scalable and Flexible Overlay Framework for Simulation and Real Network Applications

Ingmar Baumgart, Bernhard Heep, Stephan Krause

IEEE P2P'09, Seattle, Washington, USA

Universität Karlsruhe (TH)
Research University • founded 1825

TeleMatics Institute of Telematics

What is OverSim?

- OverSim is an overlay framework
  - → providing common functions for rapid prototyping

- Once a protocol is implemented in OverSim, you can…

…use OverSim as an overlay simulator
  - → simulations with >100,000 nodes
  - → strong GUI support (e.g. for debugging)
  - → gathering of statistical data

…run your protocol in real networks
  - → deployment in PlanetLab

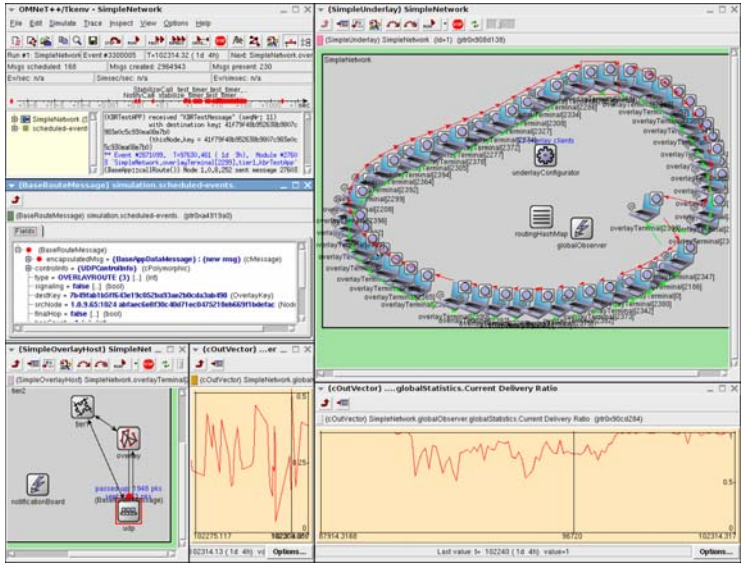
…emulate an overlay network
  - → connection to real network devices
  - → for demonstrational purposes

→ all without any code modification !

In a Nutshell

- OverSim runs on
  - Linux, Windows, Mac OS X, Nokia Internet Tablets
- Written in C++
  - based on OMNeT++
- Well documented
- Open Source (GPL)
- Internationally and actively used

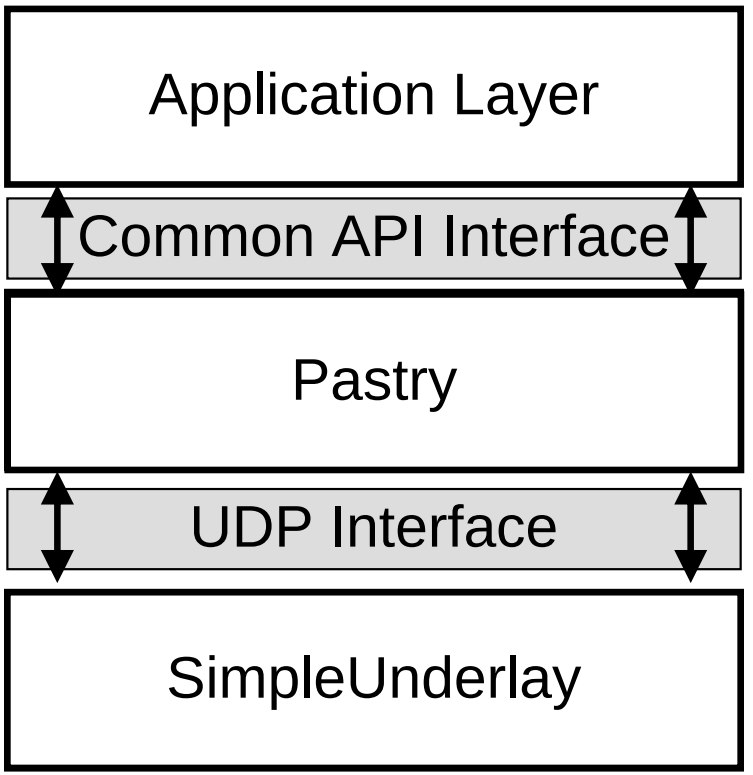
  → up to now, more than 5,000 downloads
- OverSim includes several structured and unstructured overlay protocols, and event distribution protocols:
  - Chord, Kademlia, Pastry, Bamboo, Koorde, Broose, Gia, VAST, QuON, i3, Scribe, SimMUD, NICE



Flexible Architecture

- Layered architecture
  - Underlying network
  - Overlay layer
  - Application layer
- Consistent interfaces between layers
  - UDP between network and overlay
  - Common API between KBR overlay and application

→ Exchange of one component is transparent to all other components



Underlay Abstraction

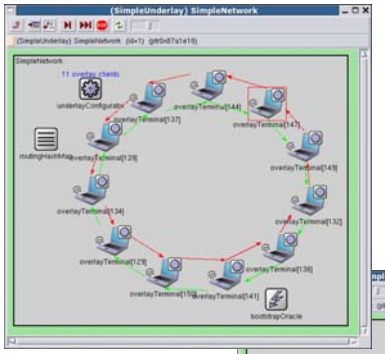
OverSim offers different underlay models

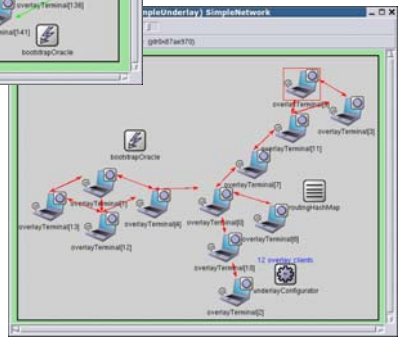
- Simple Underlay
  - Low computational overhead
  - Coordinate-based delays calculated from CAIDA/Skitter measurements
  - Logical access network
- INET Underlay
  - Based on the INET framework
  - Complete IP stack is modeled
  - Backbone simulation
  - Extendable by INET framework models, e.g 802.11

Overlay Protocol Support

Base class for structured overlays to facilitate implementation of new overlay protocols

- Overlay message handling (RPCs, statistics)
- Generic lookup function for KBR protocols
  - → support for different iterative and recursive routing modes
- Peer failure discovery
- Bootstrapping support
- Visualization
  - Topology, messages, node state
- Proximity awareness
  - Vivaldi, GNP





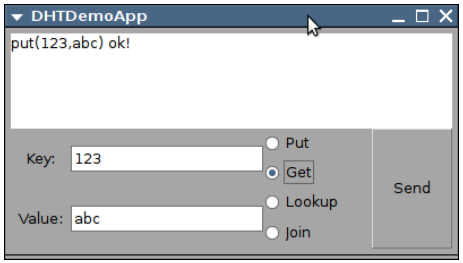
P2P Applications

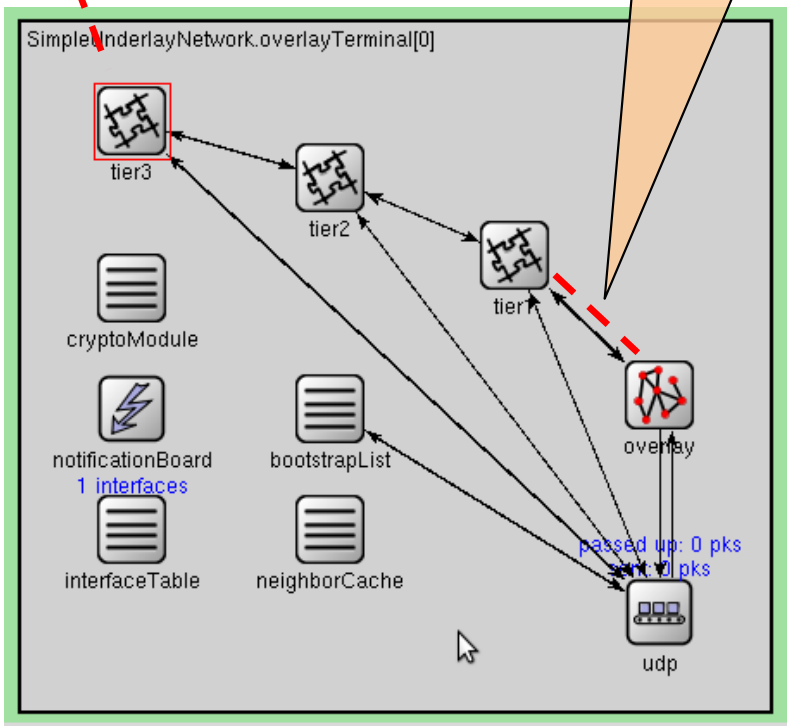
- Support for
  - layered (tiers)
  - component-based

  architectures
- Interfaces
  - CommonAPI
  - ALM API
  - XML-RPC interface

  → connection of external applications
- Trace Manager

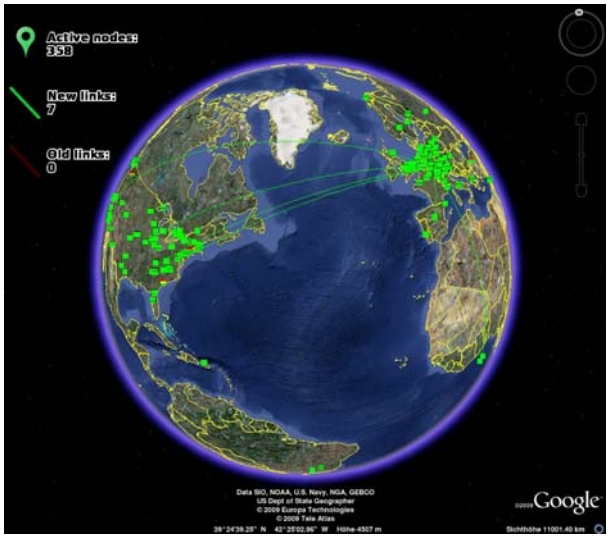
  → scripted user behavior





Real world interconnection

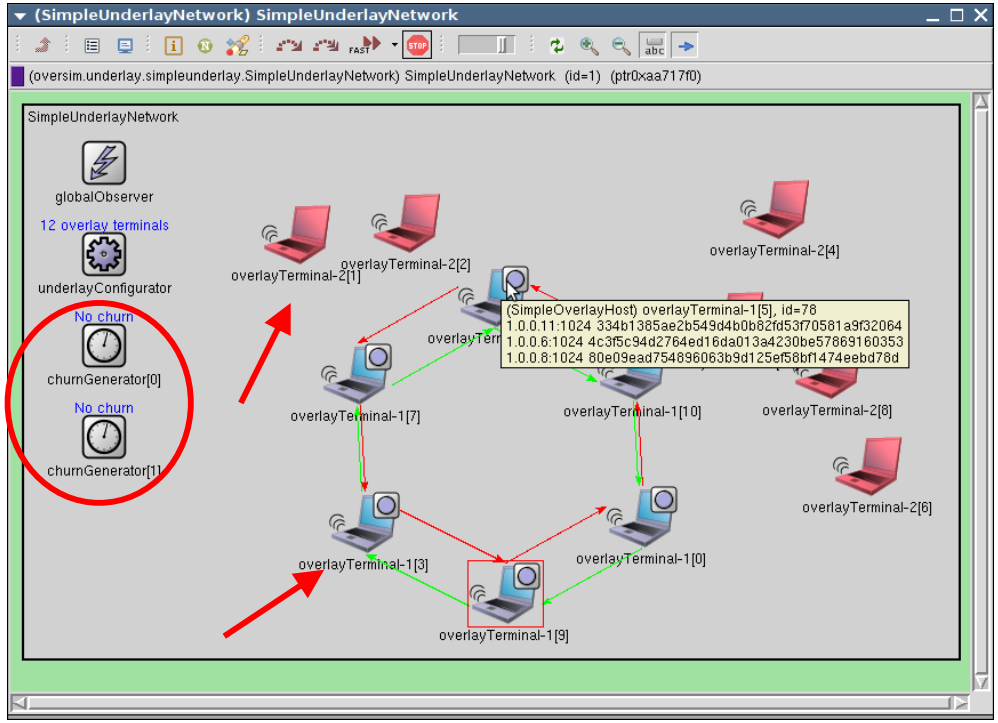
- For real world interconnection:
  - One single host is emulated
  - Exchange packets with the real network
  - → External applications can be connected to the emulated host
  - → Deployment in PlanetLab



- For demonstrational purposes:
  - Emulation of overlay networks with large numbers of nodes
  - → External devices can communicate with emulated overlay

Modeling of Churn

- Several Churn models provided, based on different lifetime distributions:
  - Weibull
  - Exponential
  - Pareto

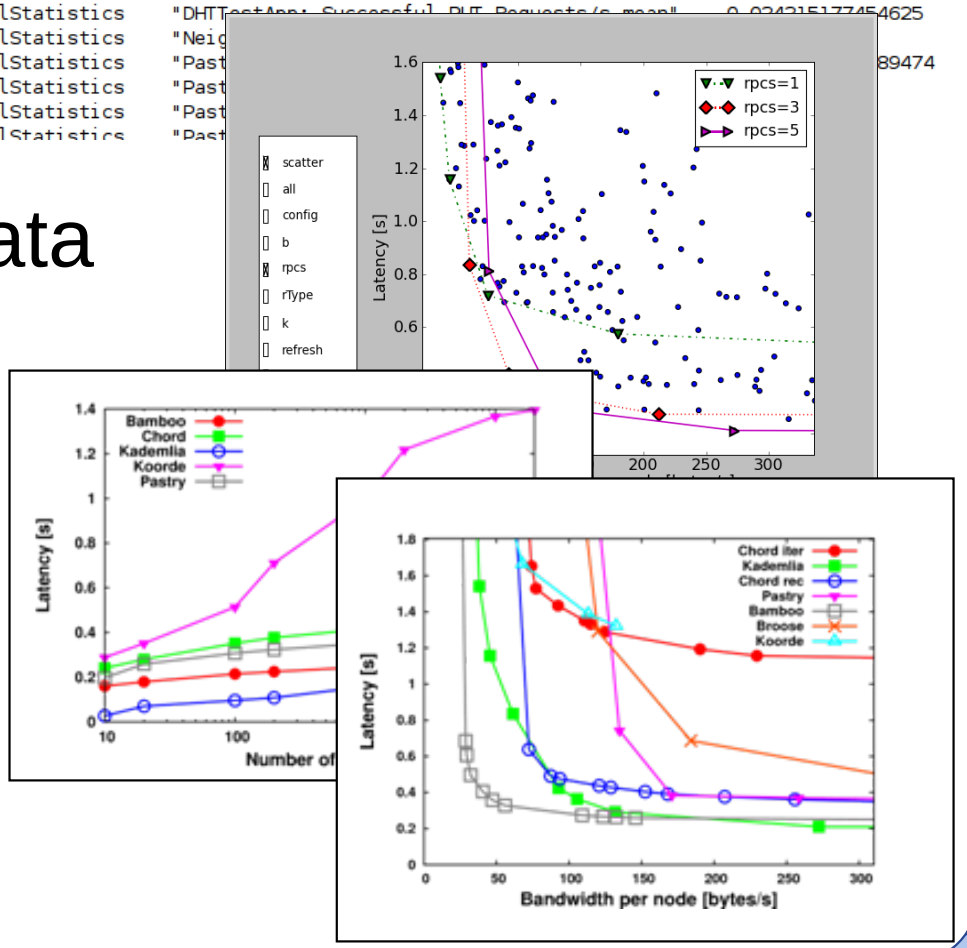


- Simulations with several churn generators possible
  - → different node configurations (parameters, applications)
  - → overlay partitions, landmarks, i3-server

Statistics

```
balStatistics   "DHTTestApp: Failed PUT Requests/s.mean"          0
balStatistics   "DHTTestApp: GET Success Ratio.mean"     0.98969072164948
balStatistics   "DHTTestApp: GET delay (s).mean"         0.66294881581159
balStatistics   "DHTTestApp: PUT delay (s).mean"         0.65709845571269
balStatistics   "DHTTestApp: Sent GET Messages/s.mean"   0.012381014096145
balStatistics   "DHTTestApp: Sent PUT Messages/s.mean"   0.02430289675287
balStatistics   "DHTTestApp: Sent Total Messages/s.mean"          0.036683910849016
balStatistics   "DHTTestApp: Successful GET Requests/s.mean"     0.012293294797899
balStatistics   "DHTTestApp: Successful PUT Requests/s.mean"     0.024315177454625
balStatistics   "Neig
balStatistics   "Past                                                    89474
balStatistics   "Past
balStatistics   "Past
balStatistics   "Past
```

- Central module for gathering statistics
- Post-processing scripts for statistical data
  - → facilitate generation of publication quality plots: scatterplots, vectorplots, lineplots
  - → gnuplot compatible output



Summary

OverSim is a modular and flexible overlay framework

- Various underlay models
  - different speed and accuracy
  - real network use
- Many implemented overlay protocols
  - → can be used as a reference platform for overlay protocols
- Simulation, emulation, real network application
- Easily extendable, well documented
  - → OverSim facilitates rapid prototyping

→ open for contributions, visit:
http://www.oversim.org/

Thank you !

http://www.oversim.org/

Universität Karlsruhe (TH)
Research University • founded 1825

Institute of Telematics