

LearnLib Tutorial

@ ASE 2013

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www.learnlib.de

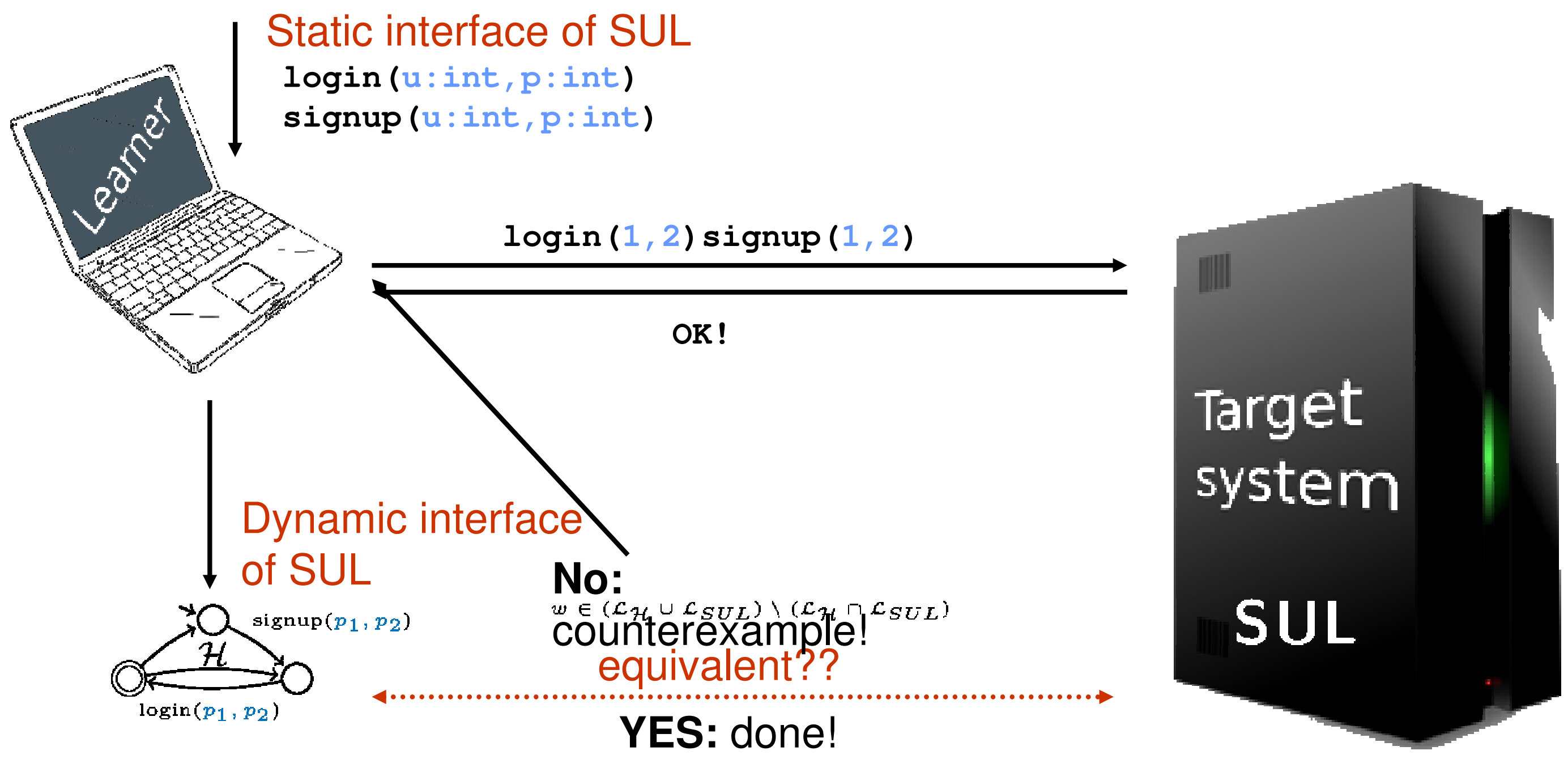
Tutorial Resources

- <http://www.learnlib.de>
- <https://github.com/LearnLib/learnlib>
- <https://github.com/LearnLib/learnlib-ase2013-tutorial>

LearnLib

- Library for Active Automata Learning Algorithms
- **Framework for Application in Practice**
- 10+ years of experience and development
(from c++ to Java, from closed source to open source)
- Open Source
- LGPLv3

Brief Recap

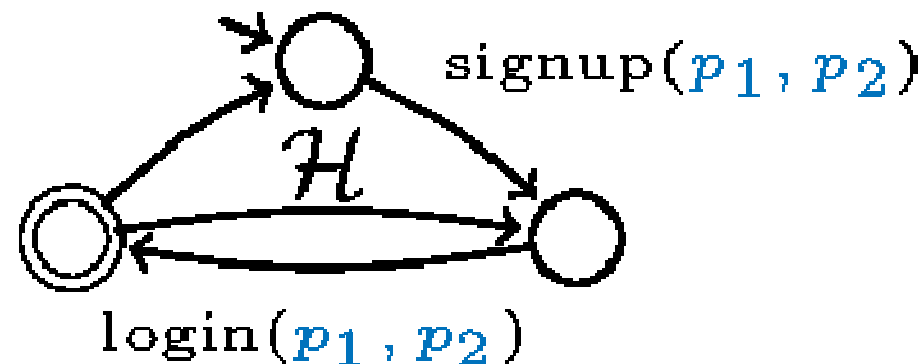


Equivalence Tests

Finding Counterexamples vs. Conformance Testing

Model-based Testing

- Randomized DFS
(Random Walk)
- Random Test Cases
(Random Words)



- Exhaustive BFS
(Depth k)
- Conformance
(W-Method)

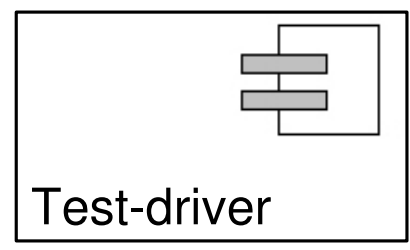
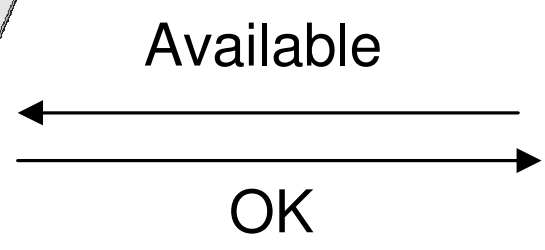
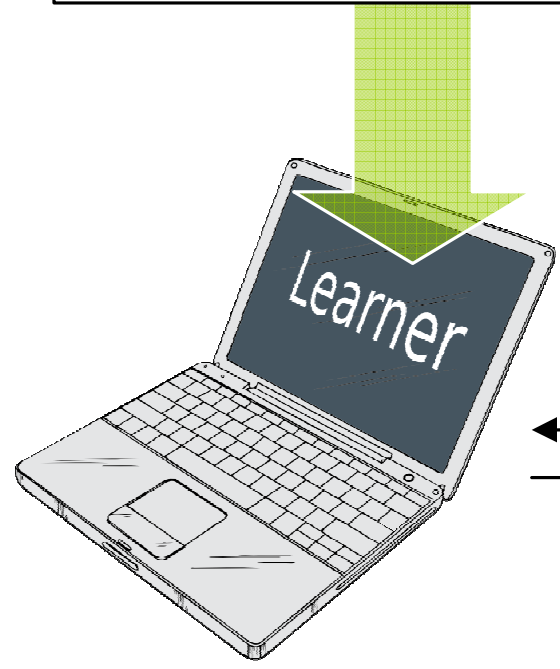
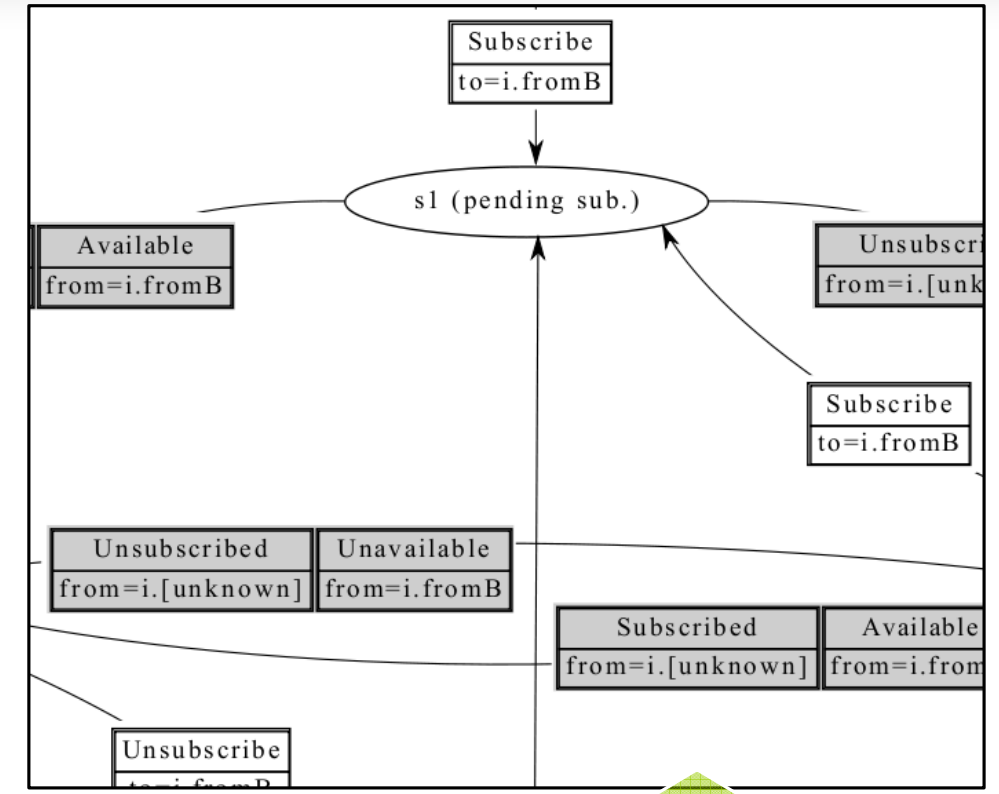
Practical Challenges

```

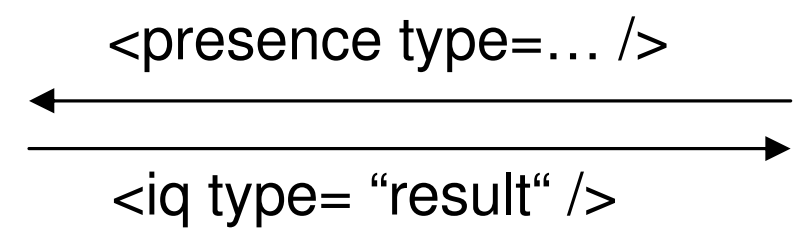
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interfacing real systems:

- alphabet generation
- abstraction
- data



equivalence queries



membership queries

reset

LearnLib: structure & components

Algorithms (LearnLib)

- Learning algorithms
- Counterexample analysis
- Equivalence Tests

Case studies

- Test-driver tools
- Data mappers
- Abstraction

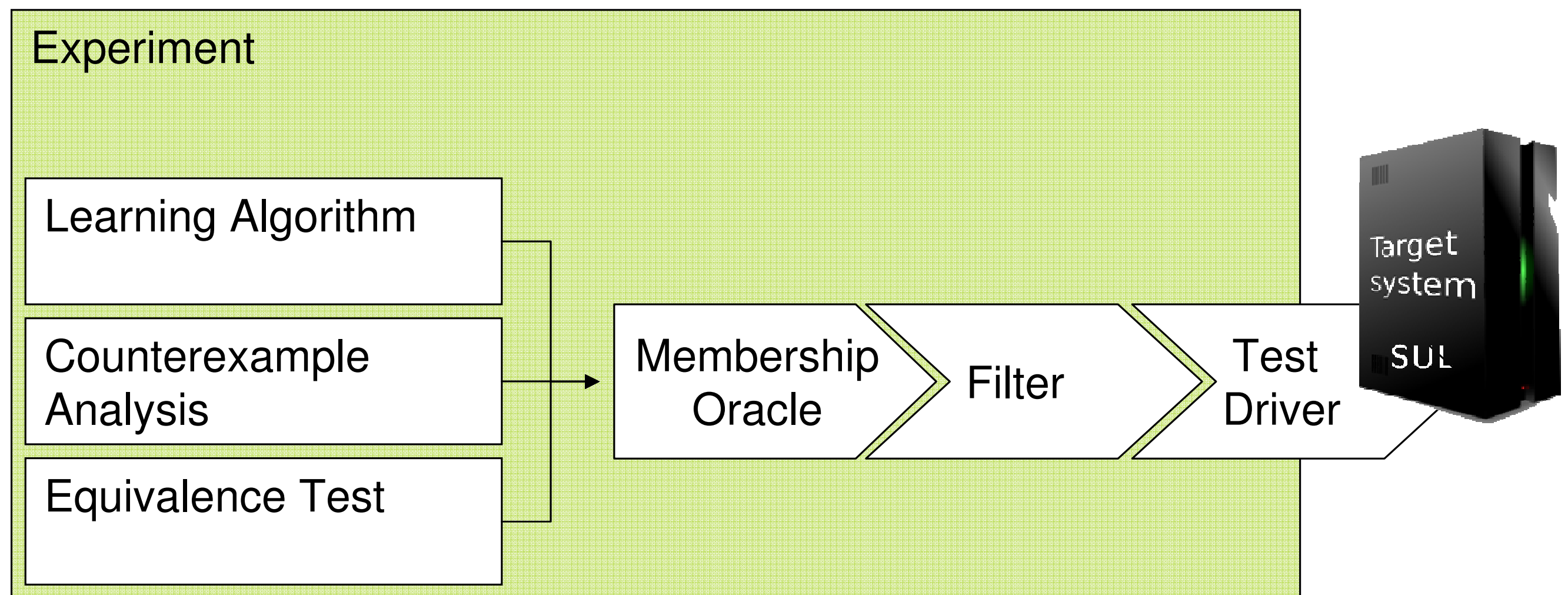
AutomataLib

- (Small) automata library
- Statistics
- Logging
- Import/export (dot, ppt, xml etc.)
- Simulation environments

LearnLib Studio

- Visual composition of learning experiments

Experimental Setup



LearnLib Components (I)

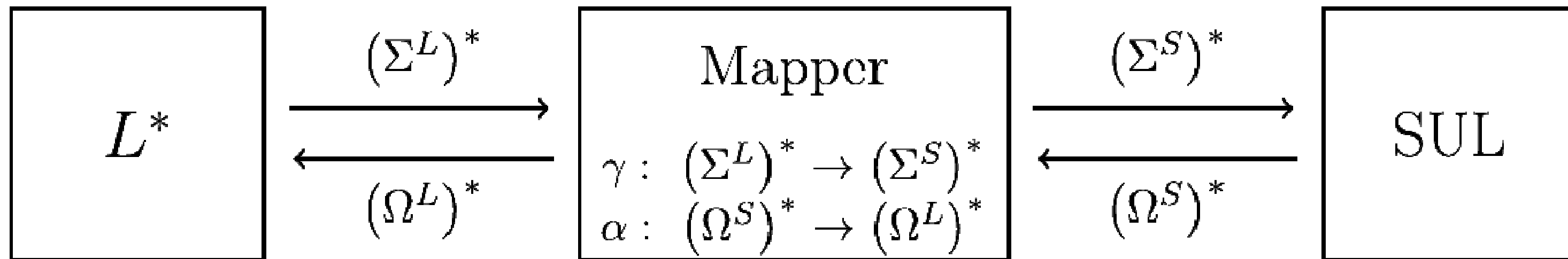
- **Learning algorithms**
 - Angluin's L^*
 - Rivest and Schapire's "Reduced Observation Table"
 - Non-uniform observation table
 - DHC
- **Handling Counterexamples**
 - Maler and Pnueli
 - Shahabaz and Groz
 - Rivest and Schapire
- **Equivalence queries**
 - Chow's "W-Method"
 - Random walks
 - Hopcroft and Karp's almost linear time explicit equivalence test
 - Evolving hypothesis

All algorithms work for DFA + Mealy machines

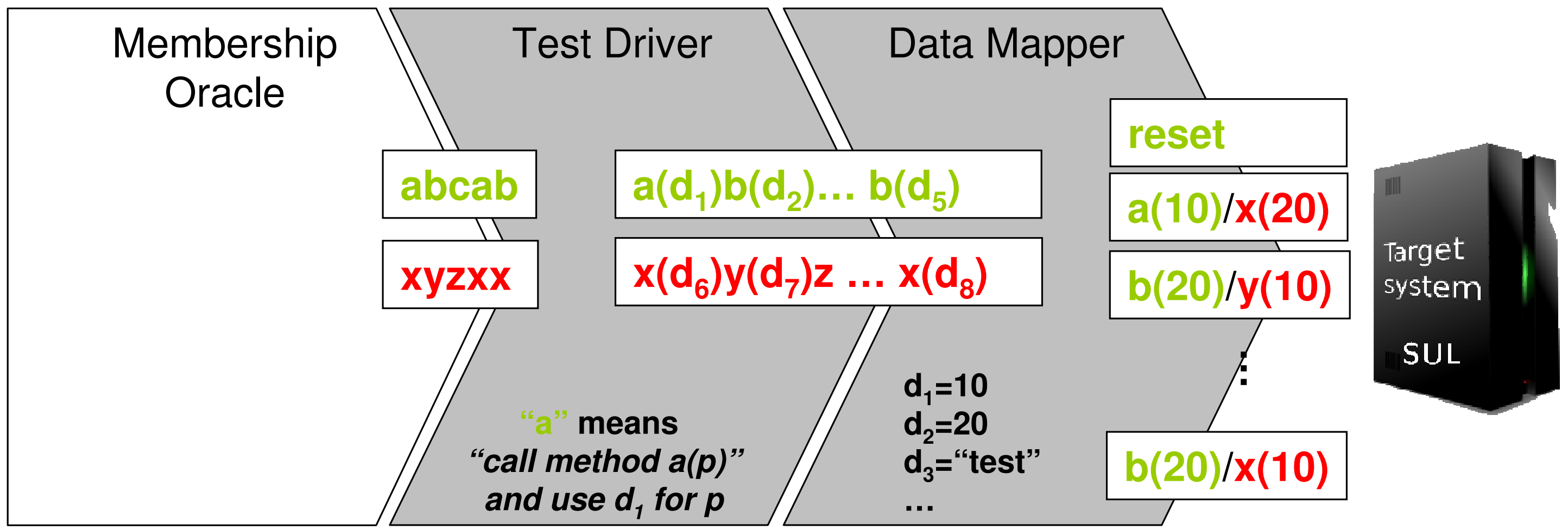
LearnLib Components (II)

- **Filters**
 - Cache
 - Prefix Closure
 - System State Reuse
 - POR
 - Symmetry
- **Test Drivers**
 - Reflection
 - Web Services
 - Web Applications
 - Processes (StdIn / StdOut)

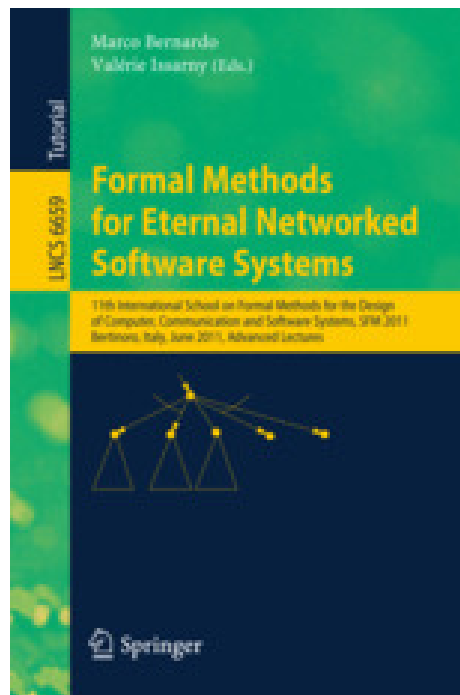
Mappers



Test Drivers



Literature / documentation

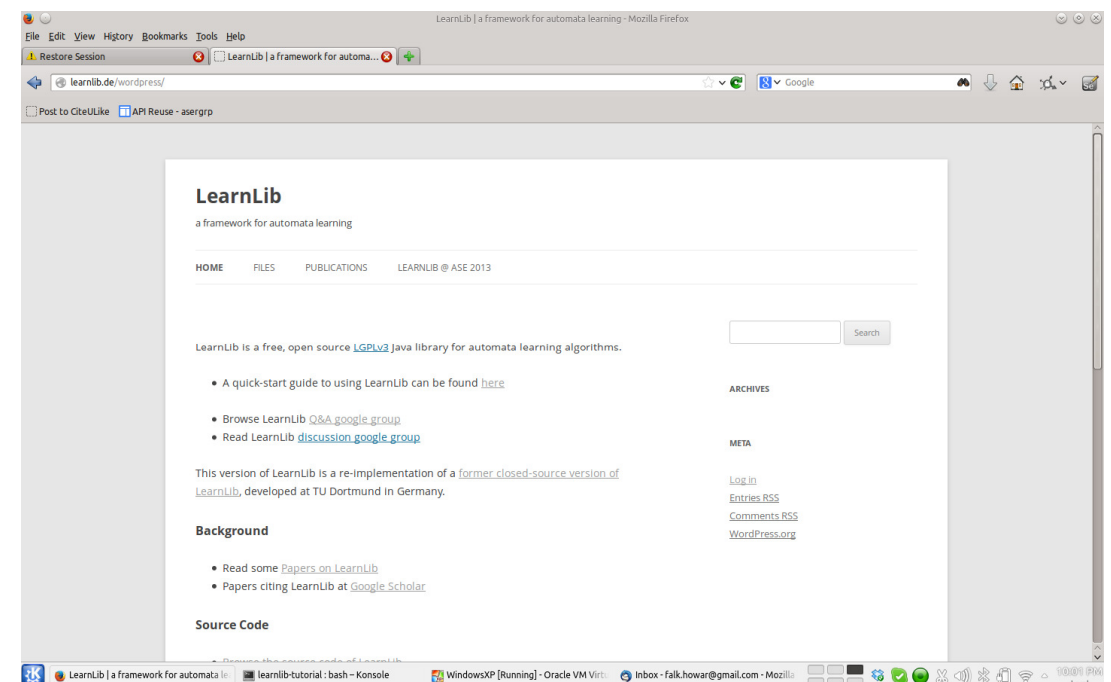


Bernhard Steffen, Falk Howar, Maik Merten: *Introduction to Active Automata Learning from a Practical Perspective*. **SFM 2011**.

Maik Merten, Bernhard Steffen, Falk Howar, Tiziana Margaria: *Next Generation LearnLib*. **TACAS 2011**.

<http://www.learnlib.de>

- Tool
- Documentation
- Tutorials
- Pointers to literature



Tutorial Resources

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