

LoGen – Generation and Simulation of Digital Logic on the Gate-Level via Internet

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Outline

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- LoGen
 - What is LoGen?
 - Technical Background
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 - Digital Circuits in LoGen
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- Simulation of Circuits
- LoGen's current Use and Availability

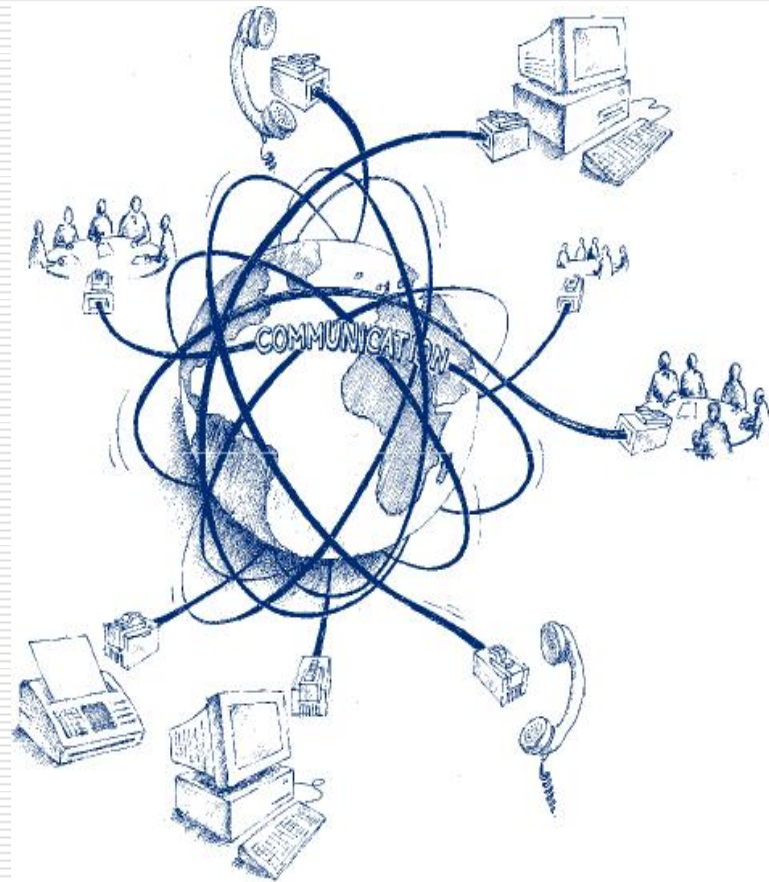
Introduction

□ Blended Learning

- Singh et al.:
“...provide the right content to the right person at the right time...”

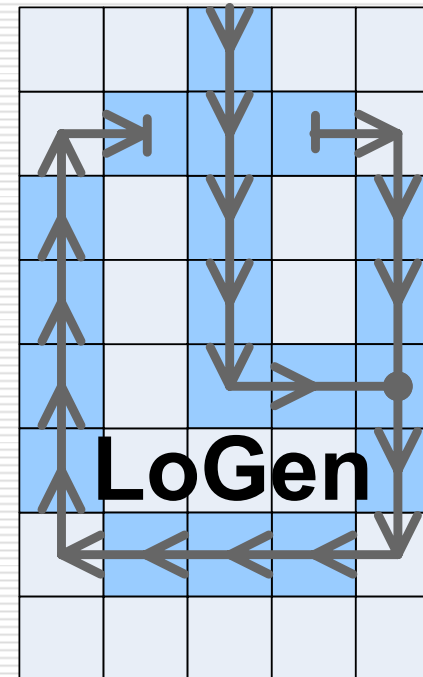
■ E-Learning

- Intelligent Tutor Systems (ITS)



What is LoGen?

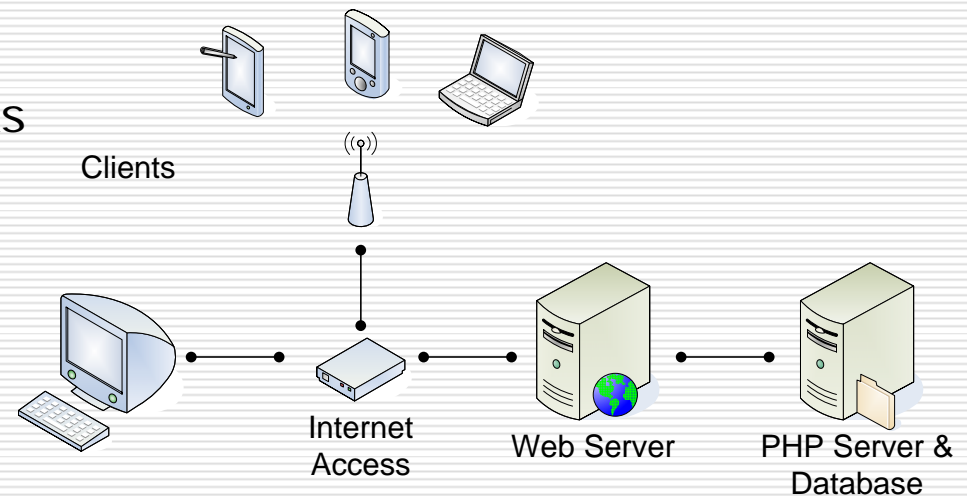
- ❑ Tutoring system
- ❑ Generation & simulation of digital circuits
 - Browser-based
 - Straightforward & simple
 - ready to use, no installation
- ❑ No CAD or design tool!
- ❑ Target groups
 - High school graduates
 - Freshmen/beginners
 - Undergraduates



Technical Background

- Typical Client-Server architecture
 - Dynamical HTML pages on client
 - Interaction via hyperlinks
 - CGI/PHP scripts via web server to a PHP server

- Central database for
 - Accounts
 - Personalized design files

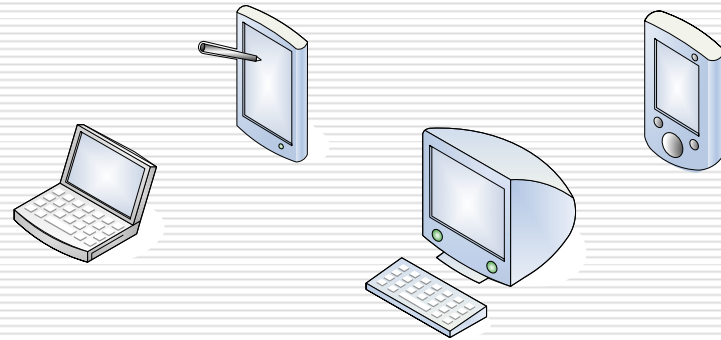


Requirements

- Web-compatible computing device
 - Laptop, Workstation
 - PDA, Smartphone
 - Thin clients are sufficient (→ plain HTML)

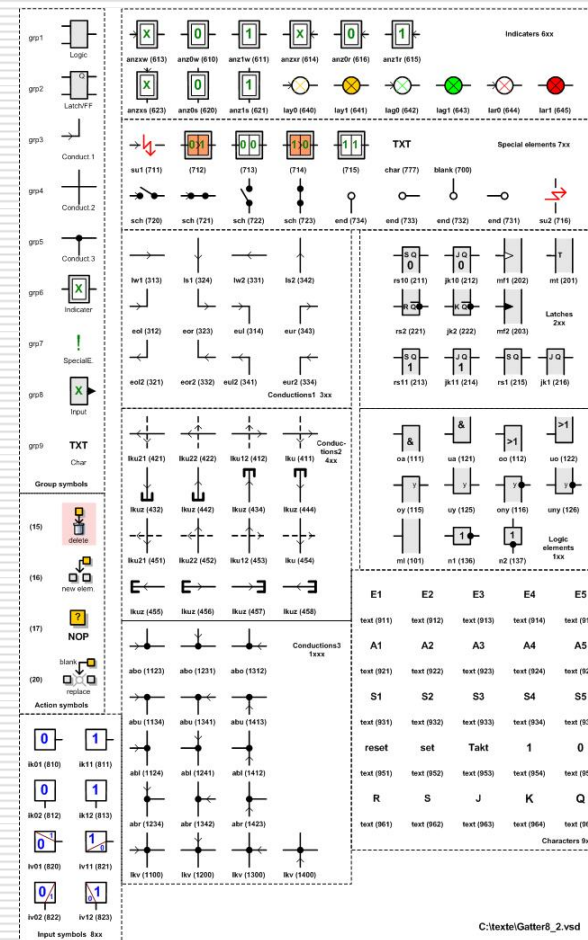
- Internet access
 - Cable/xDSL
 - Dial-In feasible but not suggested

- Standard web browser
 - No plugins required (Java, Flash etc...)



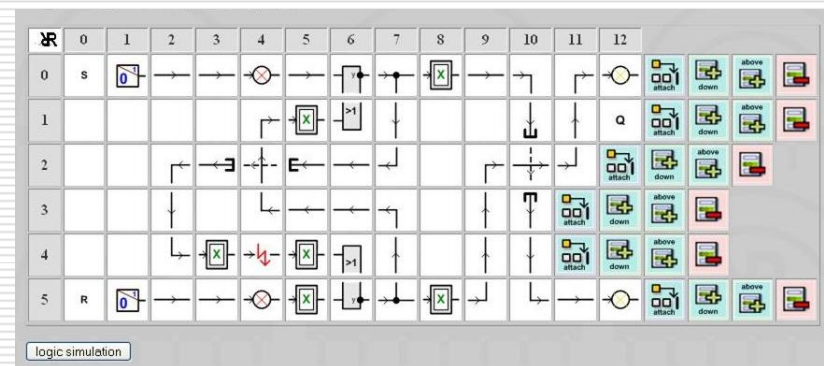
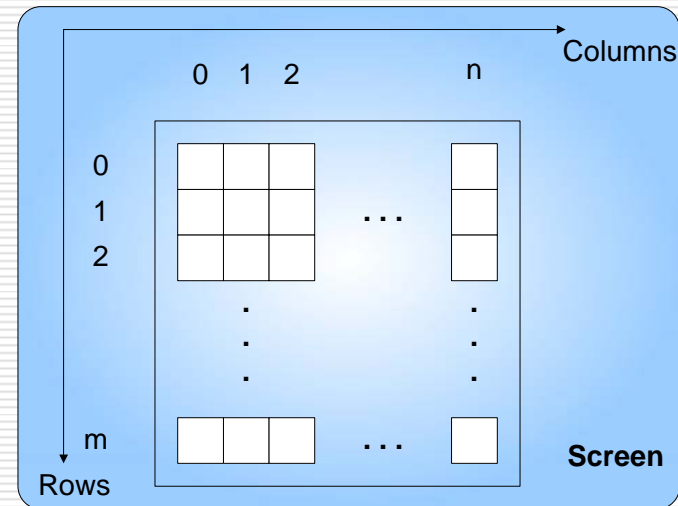
Digital Circuits in LoGen

- Digital logic on the gate level
 - Inverter, (n)and, (n)or
 - Latches, flip-flops
 - Wires (crossings, connections)
 - Bidirectional diodes
 - Displays, light bulbs
 - Stimuli generators
- Pure analysis of combinational logic
- Timing & parasitics *not* taken into account



Generation of Circuits

- Definition of the structural layer
- 2-dimensional chessboard structure
 - Each tile is one gate or part of a complex gate
 - Special tiles for assembling
- Size limited by screen (and motivation)



Generation of Circuits

a group select

replace through

Logic Latch/FF Conduct.1 Conduct.2 Conduct.3 Indicator SpecialE Input Char delete new elem. NOP blank replace

attach down above

logic simulation

0 1 2 n

circuit.dat

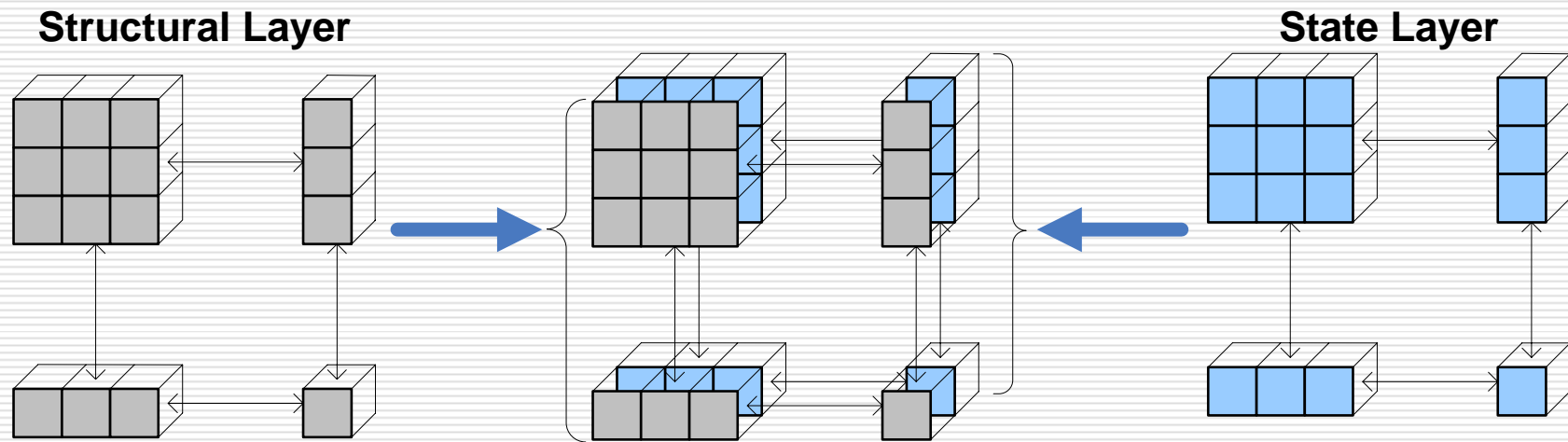
R	0	1	2	3	4	5	6	7	8	9	10	11	12
0	s	0	→	→	⊗	→	y	→	X	→	→	→	→
1					→	X	>1	↓		→	→	q	→
2			↖	↖	↖	↖	↖	↖		→	→	→	→
3			↖	↖	↖	↖	↖	↖		→	→	→	→
4			↖	↖	↖	↖	↖	↖		→	→	→	→
5	R	0	→	→	⊗	→	y	→	X	→	→	→	→

attach down above

logic simulation

Simulation of Circuits

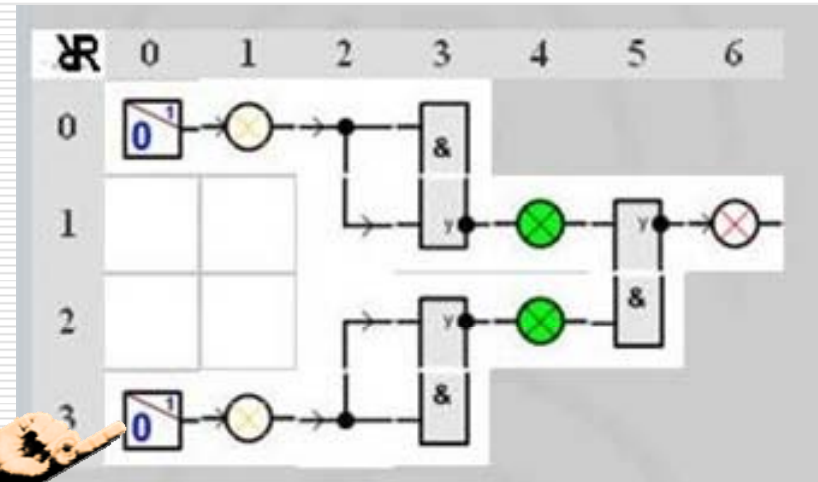
- Additional state layer
 - Current value, own function
 - No. of predecessors & successors
- Evaluation of the structural layer + state layer
- Mechanism from automata theory



Simulation of Circuits

□ Example circuit

- simple 2-input OR-gate
- 3 NANDs
- 2 stimuli generators to drive the inputs

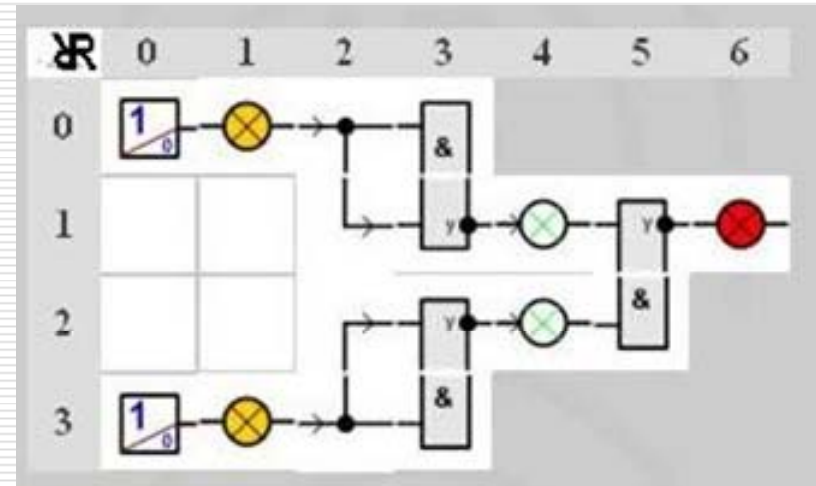


□ Activate the first stimuli generator to change the input values

A	B	Out
0	0	0
0	1	1
1	0	1
1	1	1

Simulation of Circuits

- The input value changed again
- The evaluation result is indicated using a red bulb



A	B	Out
0	0	0
0	1	1
1	0	1
1	1	1

LoGen's current Use

- Recruiting new students
 - Introductory courses for high school graduates
- For students
 - Auxiliary learning method next to technically oriented lectures
 - During exercises
 - For laboratory test
 - As project to work on
- The ideal case ;-)
 - Self-evaluation of own work and ideas

Availability

- Free access via the MD's web server
- German and English translation
- Guest account for simulation
 - Login-Name: **xxx**
 - Password: **yyy**
 - Email for a personalized account



- URL

<http://www.elektrotechnik.uni-rostock.de/logen>

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Thank you for your attention.
Feel free to ask!



LoGen

Backup Slides

Separation from other Tools

□ Comparison with Hades

(<http://tams-www.informatik.uni-hamburg.de/applets/hades>)

	Target Group	Realization/ Bandwidth	Interface	Adaptation Phase	Abstraction Level	Functional Spectrum
Hades	Graduates & Advanced Users	Java / High, online	Multiple Windows, sophisticated	Training & Practice required	Gate level, System level, HW/SW Codesign	Circuit Generation, Time-Sim, Execution of Java Applets
LoGen	Freshmen, Beginners	HTML / Moderate, online	Hyperlinks	Appr. 5 Minutes	Gate Level Digital Logic	Circuit Generation, pure Functional Evaluation