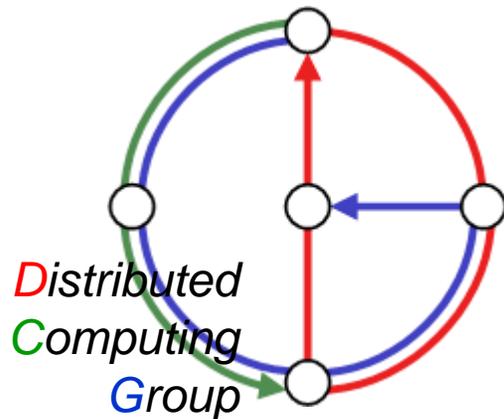


DISCRETE EVENT SYSTEMS



Roger Wattenhofer
Winter 2004 / 2005

Organization Matters



- Lecture
 - Thu, 1-3, ETA F5
 - Roger Wattenhofer
- Exercises
 - Thus, 3-5, ETA F5
 - Thomas Moscibroda, Stefan Schmid
- Course Material
 - Check www.dcg.ethz.ch → courses



Course Overview

- Part 1: Theory of Coke Vending Machines
 - Automata and Languages
 - **Discrete Event Systems (DES) Models**
- Part 2: Theory of Standing in a Line
 - Stochastic Processes
 - Markov Chains, Queuing Theory
 - **Average-Case Analysis of DES**
- Part 3: Theory of Renting Skis
 - Online Algorithms
 - **Worst-Case Analysis of DES**
- Plus a few smaller parts



Some Comments

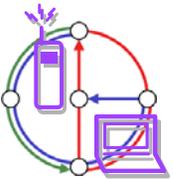


- **English vs. German** language
- First-timer for me: **On-the-fly** preparation of course material (sorry!)
 - Slides/material on web site before lecture...
- **Differences** to last year's course
 - A bit less petri nets, a bit less systems
 - Maybe a bit more theoretical... (sorry again!?)
 - Still I adopted some slides from Lothar Thiele and Thomas Erlebach
- **EE vs. CS** students...



Motivation: Physics

- Science is often based on natural phenomena
- Laws of physics: mechanics, gravitation, electrodynamics
- Continuous variables for mass, velocity, power, etc.
- Can be solved by differential equations



Motivation: Discrete Events

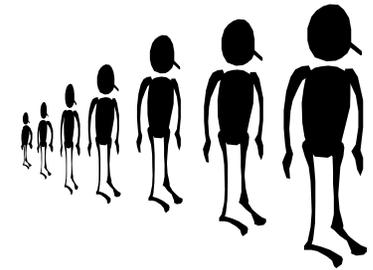
- Some complex systems are not [primarily/only] continuous

- Computer systems
- Communication networks
- Business processes (“workflow”)
- Transportation systems
- Software



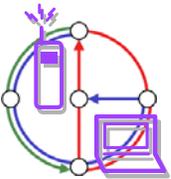
- Instead systems are determined by discrete events

- Telephone calls
- Customers arrivals



- Many variables we are interested in are discrete

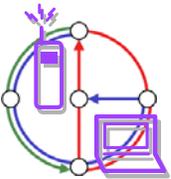
- How many ...?



Motivation: Discrete Event Systems



- System models
 - Find the right level of detail to model a real system
 - “Make everything as simple as possible, but not simpler”
- Correctness verification
 - Formal specification
 - Testing
 - Simulation
- Analysis and Optimization



Literature



- Christos G. Cassandras, Stephane Lafortune. Introduction to Discrete Event Systems. Kluwer Academic Publishers, 1999.
- **Part 1**
 - Michael Sipser. Introduction to the Theory of Computation. PWS Publishing, 1997. (Chapters 1 and 2)
- **Part 2**
 - Dimitri Bertsekas, Robert Gallager. Data Networks. Prentice Hall, Upper Saddle River, NJ, 1992. (Chapter 3)
 - Thomas Schickinger, Angelika Steger: Diskrete Strukturen, Band 2. Springer, 2001. (Chapters 1, 2, and 4)
- **Part 3**
 - Allan Borodin, Ran El-Yaniv. Online Computation and Competitive Analysis. Cambridge University Press, 1998. (Selected Chapters)
- Plus lots of research papers...

