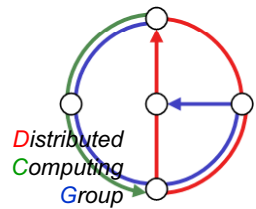


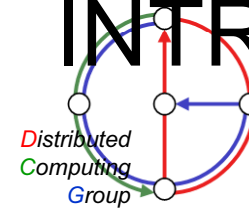
DISCRETE EVENT SYSTEMS



Roger Wattenhofer
Fall 2009


Chapter 0

INTRODUCTION



Discrete Event Systems
Fall 2009

Organization Matters

- Lecture
 - Thu, 1-3pm, ETF E1
 - Roger Wattenhofer
- Exercises
 - Thu, 3-5pm, ETF E1
 - Raphael Eidenbenz, Jasmin Smula
- 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
- Course material still **not stable**
 - Slides/material on web site before lecture...
- **Differences** to last year's course
 - A few new things... a few things dropped...
- **ITET** vs. other types of students...

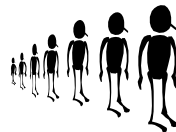
Motivation: Physics

- 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 ...?“

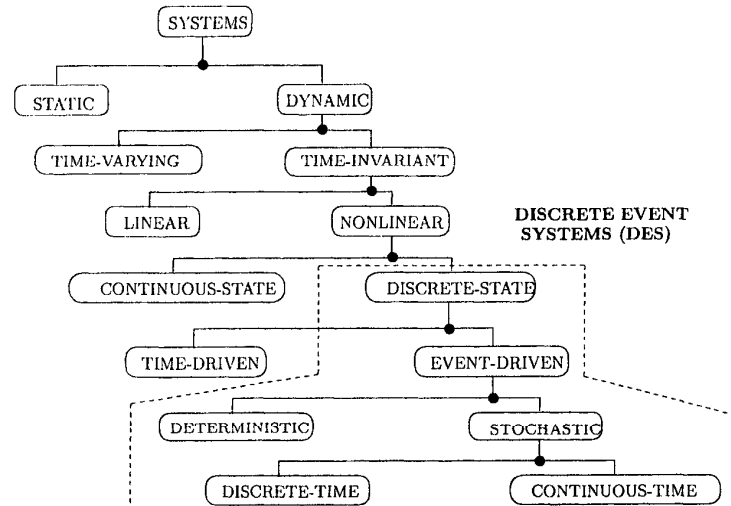


Motivation: Discrete Event Systems

- 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



Motivation: System Classification



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 research papers...