

Lecture

Performance Modeling of Computer Systems

Gunter Bolch, Informatik 4

PMC

Reproduktion jeder Art oder Verwendung dieser Unterlage, außer zu Lehrzwecken an der Universität Erlangen-Nürnberg, bedarf der Zustimmung des Autors.

A Overview

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◆ Motivation 5

- Performance Measures 6
- Performance Evaluation 7
- Model Types (Queueing Networks, Petri Nets and Markov Models) 9
- Model Evaluation Methods (Simulation, Analytical Methods) 16
- Examples (Terminal System, Multiprocessor System) 20

◆ Modeling Process 29

◆ Queueing Systems 51

- Description (Kendall's Notation) 51
- Distributions (Exponential Distribution, Phase Type Distribution) 56
- Performance Measures (Little's Law) 75
- FIFO Systems 81
- Priority Systems 115
- Heterogeneous Queueing Systems, Batch Systems 139

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- ◆ **Queueing Networks** 163
 - Description Performance Measures 165
 - Markov Analysis 186
 - Product-Form Queueing Networks 217
 - Jackson-, Gordon/Newell- and BCMP-Theorem 229
 - Convolution, Mean Value Analysis (MVA) and FES-Method 259
 - Approximation Methods: Bard-Schweitzer-Method, SCAT, Summation Method and Bound Analysis 290
 - Non-Product-Form Queueing Networks 315
 - Robustness, Decomposition, Priority Networks
 - Optimization 344
- ◆ **Applications** 359
 - Multiprocessor-, Client Server-, Terminal-, Kommunikation -, Operating- and Production Systems
- ◆ **Performance Evaluation Tools**
 - Queueing Network Tool **PEPSY** Performance Evaluation and Prediction **SY**stem
 - Markov Analyzer **MOSEL** **MO**deling **S**pecification and **E**valuation **L**anguage

■ References:

- ◆ Bolch, G:
Leistungsbewertung von Rechensystemen
 mittels analytischer Warteschlangenmodelle,
 Teubner, 1989, 311 pages
- ◆ Bolch, G., Greiner, S., de Meer, H. Trivedi, K.:
Queueing Networks and Markov Chains,
 Modeling and Performance Evaluation with Computer Science Applications,
 John Wiley & Sons, 1998, 726 pages
- ◆ Begain, K., Bolch, G., Herold, H.:
Practical Performance Modeling - Application of the MOSEL Language
 Kluwer Academic Publishers, 2001, 409 pages
- ◆ Menasce, D., Almeida, V., Dowdy, L.:
Capacity Planning and Performance Modeling,
 Prentice Hall, 1994, 412 pages
- ◆ Gelenbe, E. and Pujolle, G.:
Introduction to Queueing Networks
 John Wiley & Sons, 1998, 244 pages