Fakultät für Informatik und Mathematik - Universität Passau

Kolloquiums-Einladung

von Prof. Dr. Hermann de Meer

zum Vortrag von
Prof. em. Dr.-Ing. Dr. h.c. mult. Paul J. Kühn
Emeritus
Institute of Communication Networks and
Computer Engineering
University of Stuttgart

am Dienstag, 13.4.2020
von 10 – 12 Uhr

im Raum 242, IM für bis zu 7 Personen
Teilnahme vor Ort nur nach Anmeldung: sekhdm@uni-passau.de

oder dem Zoom-Meeting beitreten:

Die Zugangsdaten zur Online-Veranstaltung via Zoom
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5099_Professor_Kühn

Performance Modeling of Parallel Processing (Fork-Join Problems) by analytic Task-Graph Reductions

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Siehe Abstract

Performance Modeling of Parallel Processing (Fork-Join Problems) by analytic Task-Graph Reductions

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Abstract: Fork-Join Problems (FJ) appear in parallel executed computations where the process execution depends on the condition that either all parallel processible tasks have been executed or that the first task of them has finished, respectively. Similar problems may occur in communication networks with disjunctive parallel transmission paths to reduce transmisson times for uploading a bunch of disjunctive files or for uploading one large file to reduce times, respectively (by maximum or minimum conditions). Parallel processing is typically supported in massively parallel computers by methods as MapReduce and Hadoop for "Big Data" or parallel search applications and has been massively applied by approximate "Stochastic Network Calculus". Our approach aims at a mathematically exact approach through modeling the problem by directed acyclic task graphs (DAG) for tasks with independent random execution times with arbitrarily distributions. The task graphs are stepwise reduced mathematically exact resulting in one equivalent task with acts as a "virtual service time", a "sojourn time", or a "virtual interarrival time" of a queuing model, respectively. Problems of these types lead typically to queuing models of the arbitrary type GI/G/n with generally distributed interarrival (GI) and service (G) times and n servers, for which exact results exist only for specific classes either analytically or by computational approximations, supported also by tables for applications. In this contribution we first introduce the basic methods for a generalized stepwise task graph reduction through which the problems are reduced to two fundamental Fork-Join Models with Blocking and Non-Blocking Servers. Their computational analyses result in explicit results for the most important performance parameters through their distributions and first and second moments. The general Task Graph reduction method results in 4 basic models whose results are expressed by explicit performance expressions. The method is validated by computer simulations. The method of task graph reduction is applied to a demonstration model of 9 tasks and its results are validated by computer simulations. Two fundamental Fork-Join Models with blocking and non-blocking operation are analyzed for Markovian input and different service time characteristics; their results are presented for different service time types by first and second order statistics as well as by distribution functions of response times.