

Virtual Space

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Abstract

The Parallel (and Distributed) Discrete Event Simulation (PADS) community – over it's more than 20 years of existence – has achieved remarkable results in getting the execution of simulations of discrete event systems faster, involving multiple, logically and/or physically dispersed, communicating computational resources. A solid, mature and empirically approved body of foundational concepts, models, systems, methods and algorithms are at hand and well documented in more than 50.000 pages of research papers. PADS simulation engines, model and software libraries, and operating systems have proven feasibility and applicability of these results in solving real world problems. Despite the (healthy) self-criticism of it's proponents ("Will the field survive?"), PADS was – and is – a success!

With this talk we aim at a prospect for the challenges posed by the emerging new models of computational and communication, the evolving new paradigms of interaction and coordination, the new styles of system design, and even the availability of new technologies, for which – in my opinion – no other community qualifies better than the PADS community.

Overview of the talk

From it's very roots – the pioneering *conservative* (Chandy-Misra-Bryant) and *optimistic* (Sowizral-Jefferson) thought models, PADS has attained it's most prominent achievements in the acceleration of the simulation of the dynamics of complex discrete event systems using a parallel (which governs the evolution of a system over simulated time in an iterative, synchronous way) or distributed (which decomposes the event structure underlying a system into logical space/time regions and executes those asynchronously) approach. Both the optimistic and conservative thought models have undergone extensive reshaping, enhancements, combinations, integrations and generalizations, and so have the conceptual models for virtual (or logical) time – without being conclusive up until today. Event ordering, synchronization protocols, causality preservation, speedup, time keeping and time management have had the highest research appeal in the PADS community.

In this presentation I will argue that a plethora of new challenges are waiting to be approached, possibly based on new thought (or machine) models: After Alan Turing's paper "On computable Numbers with an Application to the Entscheidungsproblem" theoretical computer science adopted the Turing machine model, and a computer science of

"algorithms" emerged since the 1950s, viewing computation as the transformation of input (data) to output (data) by executing algorithms. Consequently, today's computational models (like the Von Neumann machine model) explain system components in terms of "what they compute". This, however, appears less expressive than so called "interaction models" – expressing how components interact, and how these interactions are coordinated. This observation, and claim for a model able to express "interaction" is by no means new, and many approaches to extend computation beyond "algorithmics" (beyond Turing machines) have been attempted. One such concept is Robin Milner's "Elements of Interaction" originating from the CCS "concurrency" thought model, another one is Peter Wegner's "Interaction Machines" originating from an "interaction" thought model.

The observation of technological progress supports these thoughts: Most recent advances in microprocessor-, wireless communication- and sensor-/actuator technologies envision a whole new era of computing, popularly referred to as "pervasive" or "ubiquitous" computing. Autonomous, ad-hoc networked, wirelessly communicating and spontaneously interacting computing devices appearing in great number, and embedded into environments, appliances and objects of everyday use will deliver services adapted to the person, the time, the place – or most generally: the context – of their use. The nature and appearance of computing devices will change to be hidden in the fabric of everyday life, invisible networked, and augmenting environments to form a pervasive computing landscape, in which the physical world becomes merged with a "digital world". In such a world, "interaction" seems to be more powerful than "algorithms".

As for the PADS thought models, which are dominated by concepts for "virtualizing" time, the "virtualization" of space could be a promising juxtaposition.

About the Speaker

Alois Ferscha received his PhD degree from the University of Vienna, Austria, and joined the University of Linz in 2000 as a professor for computer science. He has been involved in parallel and distributed simulation for about 15 years, contributing to self-adaptive synchronization, performance evaluation and performance prediction of parallel and distributed discrete event synchronization protocols. He was general chair of PADS'97, and PC chair of PADS'98. Currently he is focused on pervasive and ubiquitous computing, new models of computation and coordination, spontaneous interaction and distributed interactive simulation.