

Low energy data and concurrency management of highly dynamic real-time multi-media systems

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The merging of computers, consumer and communication disciplines gives rise to very fast growing markets for personal communication, multi-media and broadband networks, in the information technology (IT) area. Rapid evolution in sub-micron process technology allows ever more complex systems to be mapped on platforms that become integrated on one single platform (system-on-chip). Technology advances are however not followed by an increase in system design productivity.

One of the most critical bottlenecks is the very dynamic concurrent behaviour of many of these new applications. They are fully specified in software oriented languages (like Java, UML, SDL, C++) and still need to be executed in real-time cost/energy-sensitive way on the heterogeneous SoC platforms. The main issue is that fully design-time based solutions as proposed earlier in the compiler and system synthesis communities cannot solve the problem, and run-time solutions as present in nowadays operating systems are too inefficient in terms of cost optimisation (especially energy consumption) and are also not adapted for the real-time constraints (even RTOS kernels).

This dynamic nature is especially emerging because of the quality-of-service (QoS) aspects of these multi-media and networking applications. Prominent examples of this can be found in the recent MPEG4/JPEG2000 standards and especially the new MPEG21 standard. Also the emerging Ambient Intelligence and virtual reality paradigms will stimulate this further. In order to deal with these dynamic issues where tasks and complex data types are created and deleted at run-time based on non-deterministic events, a novel system design paradigm is required. This presentation will focus on the new requirements that result in system-level synthesis. In particular both a "dynamic data management" and a "task concurrency management" problem formulation will be presented, that have to deal with the very dynamic nature of these systems. The concept of Pareto curve based exploration is crucial in these problem formulations and their solutions.