

Towards Application-Specific Architecture Platforms: Embedded Systems Design Automation Technologies

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Extended Abstract:

This talk will address the emerging architectural platform approach to improve time-to-market, and the design automation technologies needed to support it. In particular, the talk will focus on key programmable platform components and the embedded software and architecture modelling tools developed at STMicroelectronics to best exploit them.

Architectural platforms can be defined as a domain- or application-specific base design which is easily configured to the specific needs of a given market. This configuration can be done before fabrication, i.e. at the design level, supported by hardware configuration and synthesis tools. The configuration can also be done after chip fabrication, by programming portions of logic on the chip implemented as embedded FPGA (eFPGA). Alternatively, configuration can be done more simply by downloading new S/W program code for on-board embedded processors, assuming embedded reprogrammable memory is used (for example, embedded Flash or one-time programmable memories).

Design platforms are being used increasingly in the industry, and we illustrate this trend with a case study of a domain-specific platform at STMicroelectronics in the area of set-top boxes, where ST has achieved strong leadership. This platform, like most in the industry today, is configured at design time.

We then present a proposed application-specific architectural platform, or 'ASAP', which aims to combine design time configuration and post-fabrication configuration. This platform is highly configurable via software-programmable parallel processors. We examine the different needs for a range of processor types, from application-specific instruction-set processors (ASIP), through domain-specific processors for DSP and microcontrol, to general-purpose RISC. This leads to an optimized heterogenous multi-processor solution, which combines high flexibility and low time-to-market with the concurrent need of low-cost and low-power for consumer-type markets.

We briefly present the design automation challenges to help design, configure and program the resulting ASAP platform. This is followed by an overview of the ST/Central R&D system and architecture design automation environment, with emphasis on the 'FlexWare' retargettable embedded software development toolset. This processor-retargettable toolset includes high-performance C compilation, source-level debugging, instruction-set simulation, architecture modelling and performance analysis tools. We present the tools individually as well as case studies on the use of this environment for designs in consumer audio (set-top box, DVD, MP3 players) and low-power wireless.

We continue with an overview of the second generation FlexWare environment, which is currently in beta phase. Early benchmark results are presented. Finally, we conclude with a long-term roadmap of the ASAP platform design automation technologies, which include the third generation FlexWare tools as well as new multi-processor oriented technologies.