

EXPERTISE

- Multi-core architectures for embedded systems
- Operating systems for safety-critical environments (e.g. ARINC 653)
- Formal methods, verification, model checking
- Constraint programming: basic research and applications
- Procedures of operations research and artificial intelligence

SERVICES

- Analyzing the existing hardware and software architecture
- Consulting on the migration of real-time-critical legacy applications on multi-core
- Consulting on and supporting the certification process for safety-critical systems and the requirement analysis for resource management
- Developing tools for the generation of conflict-free schedules
- Formal validation and verification, model checking

INDUSTRIES

Aerospace, Medical technology, Automotive,
Railroad technology

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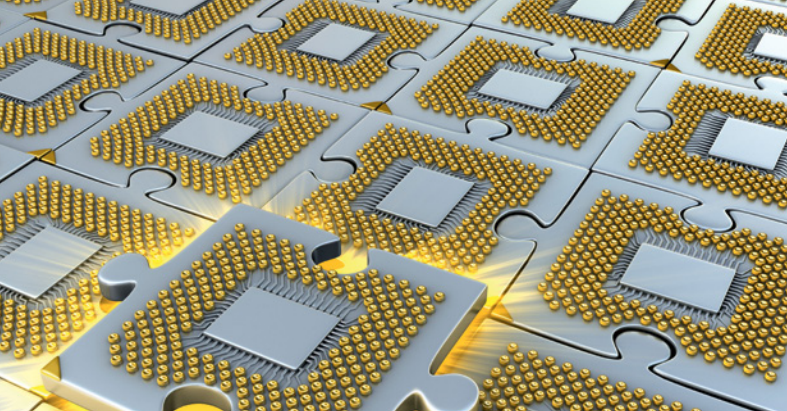
PRECISION PRO

SCHEDULING OF SAFETY-CRITICAL SYSTEMS
ON MULTI-CORE PROCESSORS

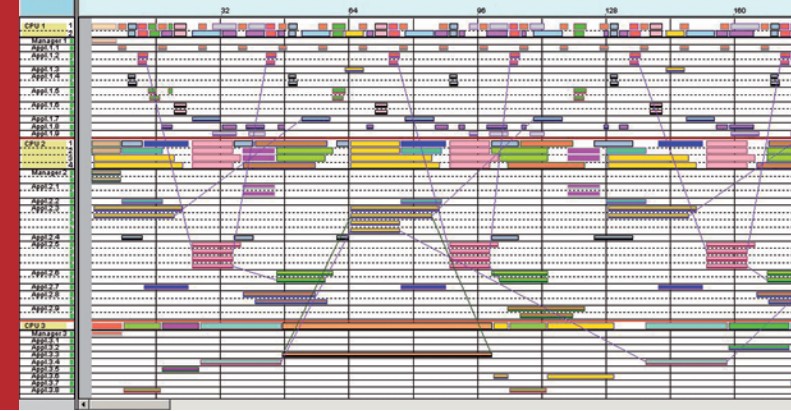


CHALLENGE

In safety-critical fields such as aerospace, medical technology, automotive and rail road industry, the behavior of simple as well as complex embedded systems needs to be predictable. Multi-core processors, with their numerous concurrently running applications and the potential conflicts over shared resources, pose a particularly significant challenge to the development and certification of such systems. A solution for safety-critical embedded systems with real-time requirements is the definition of execution patterns, the so-called static scheduling. With simple computer applications, for instance on a home PC, the user can spontaneously decide which program he is going to use at that moment. In contrast, systems in safety-critical fields execute defined work steps that are continuously repeated. Processing an execution pattern usually takes only a few seconds. While the generation of a schedule for just a few applications on a limited amount of processors can still be done manually, the introduction of multi-core processors with several processing cores and a large number of concurrent applications requires an automated approach. This is all the more relevant when, in addition to the scheduling processing time, other resources such as the bandwidth of communication channels or temporal dependencies between applications need to be taken into account as well.



CONFLICT PREVENTION AND OPTIMIZATION OF THE SYSTEM WORKLOAD WITH PRECISION PRO



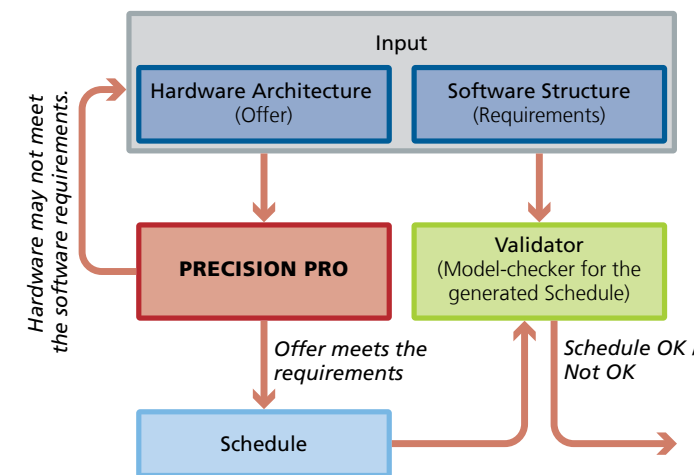
PRECISION PRO generates schedules with flexible configurations and a user-defined level of detail

EXPERTISE

Based on our expert knowledge in system design of complex parallel hardware architectures and our established expertise in the generation of scheduling tools, we guarantee the optimal utilization of your hardware resources in embedded systems. We will initially analyze the existing hardware architecture and the resource requirements. Subsequently, we will configure our scheduling tool PRECISION PRO specifically to your requirement profile. The scheduling tool features a user-friendly design: the graphic interface and the combined automatic and interactive planning component allow the quick generation of schedules whose results may be individually altered by you. Various alternatives in the design of the software or the variable allocation of individual software components on the cores of multi-core processors may, for instance, be tested freely and changes can be implemented quickly. Compliance with the specifications will be guaranteed at all times.

The usage of PRECISION PRO ensures an early conflict prevention and an optimization of the system workload of multi-core processors instead of costly problem solving during the integration stage. The engineering process of complex real-time applications gains flexibility and efficiency through PRECISION PRO because

a target-oriented product-variant generation of the software is already supported at an early design stage. Our consulting does not stop at the planning stage, however. We will also help you with the migration of multi-core architectures, support you with quality control, and assist you in the preparation for international certification processes.



YOUR BENEFIT

PRECISION PRO lets you generate a conflict-free schedule for complex multi-core processor systems with several thousand time slots in less than a minute. We guarantee that the schedule will be conflict-free and can be executed on the existing hardware. By considering additional resources in the scheduling process, such as external memory or the communication channels' bandwidth, it is guaranteed that an exhaustion of resources leading to a non-deterministic system behavior will not occur at any point in time because conflicts can already be avoided in advance. Using special algorithms and heuristics, PRECISION PRO can also generate schedules that allow a processor load of more than 90 percent. The generated schedule can be graphically displayed, with a flexible layout and a user-defined level of detail. Using various figures of the generated schedule, such as the processor and bus loads, you are enabled early on in the development process to assess different hardware architectures without having to depend on an error-prone manual resource estimation of the system.

Short-term changes can also quickly and easily be integrated: the generated schedule can simply be converted into various operating system-specific formats and thus be integrated in a superordinate system development process, as well. You will benefit from saving time through the automated generation of schedules, the optimal hardware workload and the simplified development process when changes in the hardware and software become necessary. The certification process is simplified, as well, because the software generates the schedules conflict-free and logically reproducible. For the certification of highly critical systems we can additionally offer you the tool-supported formal verification of a schedule using a model checker.