CISTER
Research Center in
Real-Time & Embedded
Computing Systems

Poster

Parallel Software Framework for Time-Critical many-core Systems

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Parallel Software Framework for Time-Critical many-core Systems

CISTER Research Center

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Abstract

Critical real-time embedded systems demand for more andmore computational performance to process big amounts ofdata from multiple data sources with guaranteed processingresponse times.

P-SOCRATES

Parallel Software Framework for Time-Critical many-core Systems

MOTIVATION

Critical real-time embedded systems demand for more and more computational performance to process big amounts of data from multiple data sources with guaranteed processing response times.

Requires

- Time-criticality
- Energy-efficiency
- Dependability
- Computing power with high performance

OPPORTUNITY

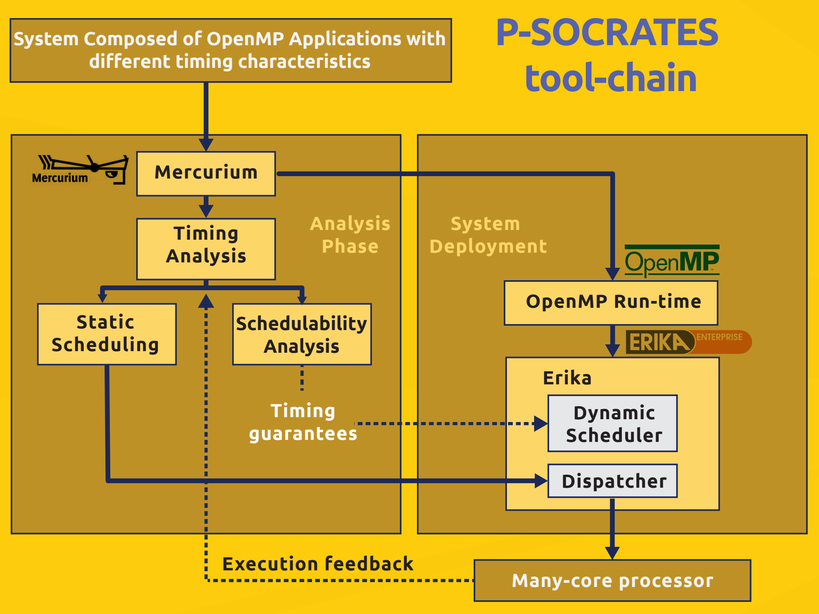
The rapid evolution of hardware parallel architectures, becoming mainstream in all computing domains, can cope with the performance requirements of critical real-time embedded systems.

These new parallel architectures are driving a truly convergence of high-performance computing and critical real-time embedded systems.

CHALLENGE

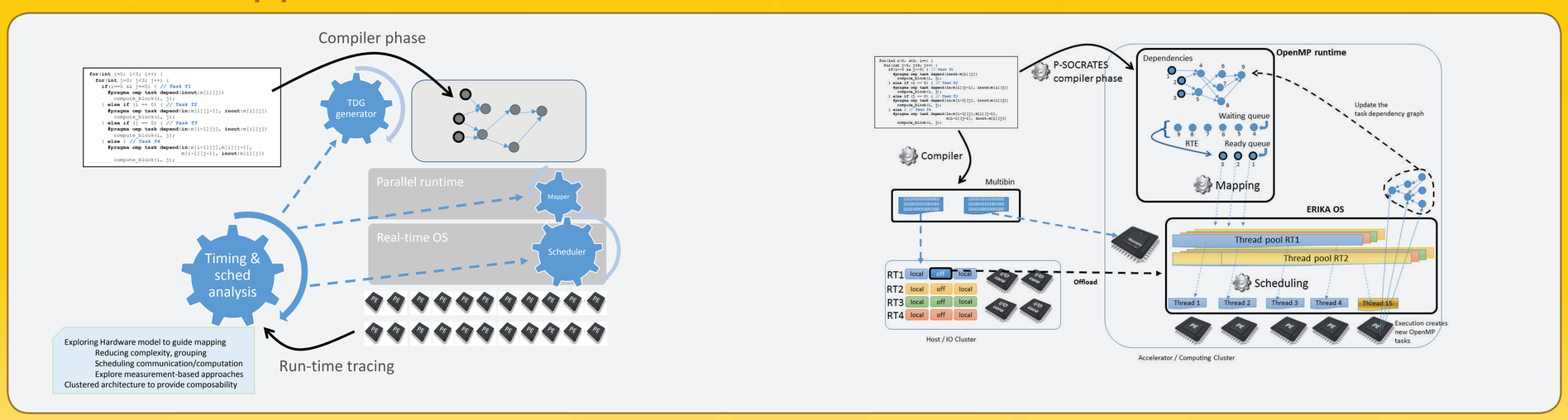
The complexity of parallel programming has already been identified as a major in general purpose computing, and it is now exacerbated in critical real-time embedded domain due to timing guarantees requirements.

P-SOCRATES SOLUTION



- Mercurium (source-to-source compiler)
  - » Analyses OpenMP applications and extracts parallel software components and data-flow and control-flow information
- Timing Analysis Tool
  - » Execution time upper bounds of each parallel component including impact of hardware interferences
- Scheduling algorithm
  - » Assigns parallel components of OpenMP applications to OS threads, respecting the timing properties of each application
  - » Assignment can be static, for systems requiring strong timing guarantees, or dynamic, for systems with more relaxed timing guarantees
- Schedulability analysis tool
  - » Efficiently determines the schedulability of a complex system composed of multiple OpenMP Applications
- Lightweight OpenMP run-time library
  - » Efficiently implements OpenMP4.5 functionality to fully exploit parallel opportunities while maintaining the timing guarantees derived by the timing and schedulability analysis
- Erika Operating System
  - » Implements light and efficient OS mechanisms supporting the time predictable parallel execution
  - » Assigns OS threads to cores respecting the timing guarantees derived by the timing and schedulability analysis
- Many-core architectures supported
  - » Kalray MPPA
  - » Texas Instrument Keystone II

Technical Approach



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