The software simulator of a parallel computing system with message passing

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Introduction

• Information systems need to efficiently use massive distributed and parallel systems

• There is lack of tools aimed to development of parallel algorithms

• Requires ability to simulate and debug created algorithms
Purposes

• Create tool aimed to simulate parallel algorithms

• Provide a mechanism to implement C/C++ code

• Allow execution of different computational tasks on independent processing elements

• Allow configuration of target platform

• Collect execution dump
Existing alternatives

• Some number of **hardware** simulators like: NcSim, NoXim, NocSim and etc.
  – There are aimed to simulation of hardware.
  – Simulation of high-level algorithms becomes slower and more complicated.

• There are no **software** simulators.
  + Hardware part is simulated only for adequate evaluation of algorithms
Program

• Directed graph represents parallel program

• Nodes are active program elements

• Links are data dependencies
Platform

- Set of processor elements connected to each other
- Can be configured in special file
  - Network bandwidth
  - Count of PE’s
  - Type of PE’s
Computational tasks

- Terminals
  + Data transformation code execution

- Shared Data Objects
  + Shared data in distributed systems

- Dynamic control
  + Conditional unrolling
  + Parallel iterative cycles
  + Parallel conditional cycles
Implemented dynamics

Supports:

• Dynamic operators generation and removal

• Dynamic branch unrolling
Possible usage

• Create parallel algorithms
• Implement real functionality using existing C/C++ code
• Debug real algorithms on configurable platform
• Collect and analyze different dumps as a result of simulation
How it works

Comm. algorithm

Algorithm correction

Simulation

Output

- *.vcd schemes
- Debug info
- Process execution info
- PE workload
Summary

Hardware part:
• PE types
• Task queue
• Data buffers

Software part:
• Dynamic operators
• Shared data
• Code implementation
• Statistics on results of work
Thank you