Writing a Reproducible Article
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Writing a Reproducible Article

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HPC applications nowadays use both multi-core CPUs and GPUs.
Managing efficiently computation execution and data transfer is extremely complex.
Need for portable performance $\leadsto$ **Runtime** system.
Context

- HPC applications nowadays use both multi-core CPUs and GPUs
- Managing efficiently computation execution and data transfer is extremely complex
- Need for portable performance $\leadsto$ Runtime system

Many configuration parameters:

1. Task granularity
2. Scheduling strategies
3. Application structure

Emerging challenges:

1. Finding optimal combination of parameters for a given machine
2. Evaluate configurations on a wide variety of platforms
3. Quickly identify performance issues (e.g., bottlenecks)

Possible solution: Simulation
Our proposal

StarPU
Dynamic runtime for hybrid architectures. StarPU execution consists in scheduling a graph of tasks with data dependencies on the different computing resources

Simgrid
Versatile simulator for distributed systems

Implementation:
- StarPU applications and runtime are emulated
- All operations related to thread synchronization, actual computations and data transfer are simulated
- Control part of StarPU is modified to dynamically inject computation and communication tasks into the simulator
- StarPU calibration and platform description is used by Simgrid
Results

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<table>
<thead>
<tr>
<th>System</th>
<th>GPUs</th>
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</thead>
<tbody>
<tr>
<td>hannibal</td>
<td>QuadroFX5800</td>
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<td>TeslaC2050</td>
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<td>TeslaM2075</td>
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<tr>
<td>frogkepler</td>
<td>K20</td>
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</tbody>
</table>

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![Graph showing Cholesky and LU performance for various systems and matrix dimensions.](image-url)
Results
Results

- Works fine now, but coming to this point was not easy
- We had to do many iterations of:
  1. Running complex beta code on several not always dedicated machines
  2. Comparing with simulations, debugging, understanding, remodeling and going back to step 1 until not satisfied

- With good results, we decided to make a reproducible article
  1. From outside it looks like any other pdf paper
  2. From inside ...

I will try to convince you that our article is not only reproducible but also readable and understandable!

http://dx.doi.org/10.6084/m9.figshare.928338
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data

experimentation

source code

Requires a daily usage of a labbook (org, git/svn, …)