High Performance Computing: Towards Better Performance Predictions and Experiments

Tom Cornebize

2 June 2021, PhD defense

Context

[...] scientific computing, supercomputers, Moore's law [...]

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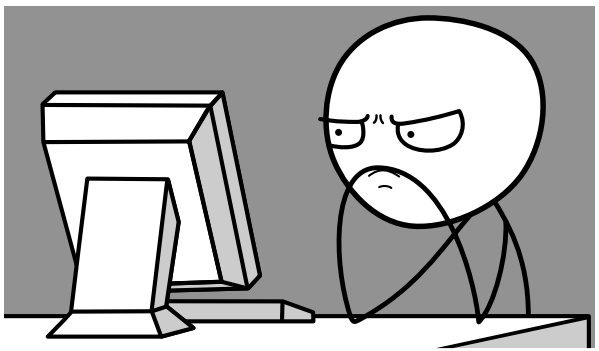
Typical Performance Evaluation Questions (Given my application and a supercomputer)



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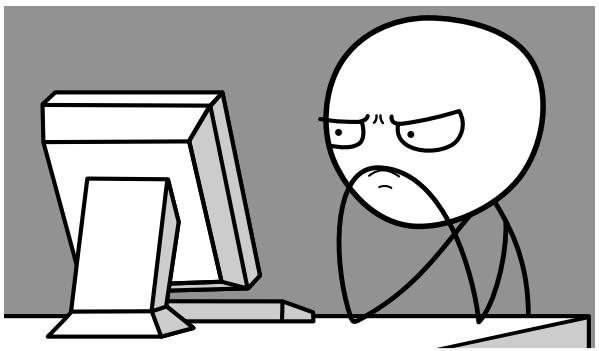

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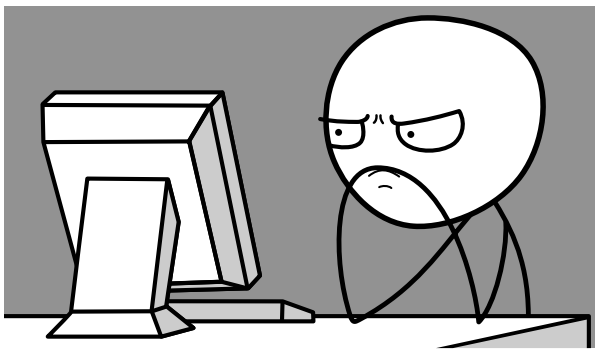

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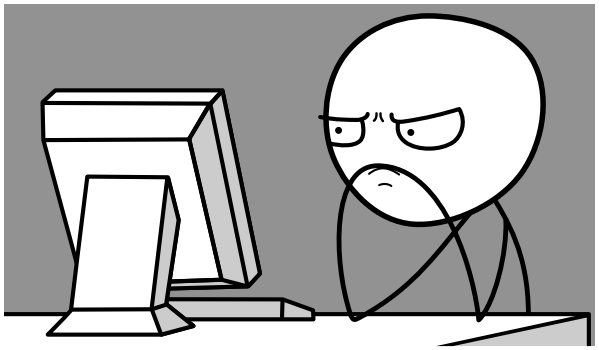

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Holy Grail: Predictive Simulation on a “Laptop”

Capture the **whole application** and **platform complexity**

Sim(Em)ulation: The SMPI Approach

Full reimplementation of MPI on top of SIMGRID

- C/C++/F77/F90 codes run unmodified out of the box
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Emulation: how?

- Computations run for real on a laptop
- Communications are faked, good fluid network models
- Performance model for the target platform

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Thesis contribution

- Case study: High Performance Linpack (HPL)
- Skip the expensive computations (mostly `dgemm`) and replace them by a performance model
- Extensive (in)validation, comparing simulations with reality