Ultra Scalable Simulation with SimGrid

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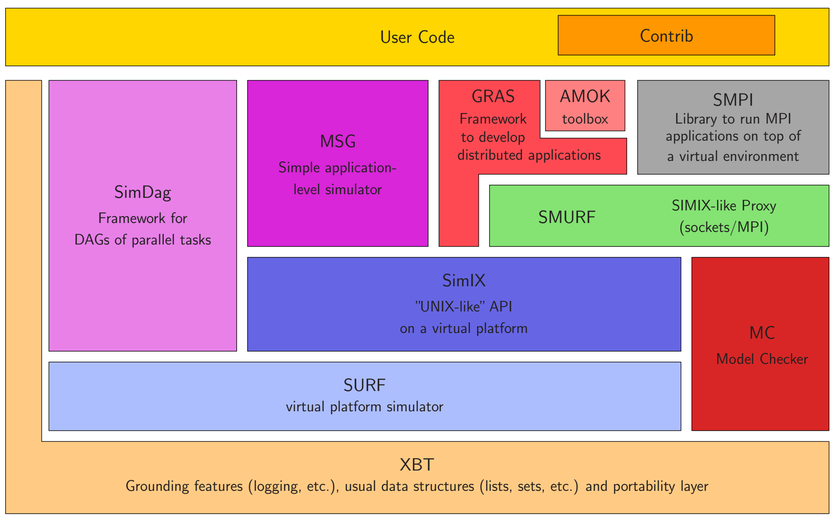
AGENCE NATIONALE DE LA RECHERCHE ANR

Objectives and strengths

Objectives

- SimGrid comes from the HPC community
  - Open to the community of large scale distributed systems
- Many ad-hoc simulators on the field
  - Provide an open source toolbox
  - With validated models
  - With user support
- A simulation kernel is not enough
  - Ease the definition of experimental conditions
  - Provide analysis and visualization features
  - Manage a complete simulation campaign



Strengths

- SimGrid has 10 years of expertise
- Fast and accurate simulation kernel
- Modular structure
  - Domain specific APIs
- A solid user community
  - 130 members on the user mailing list
  - Grounded 40+ papers
- Complementarity within the consortium
  - Core-team members and power users
  - Targeted community members

WP1: Models

Simplicity leads to scalability

- P2P requires simple models
- Constant time or Last Mile

Towards new resource models

- Storage
- Multi/Many-core
- High Performance Networks

Validation

- Crucial to the trustworthiness of the simulations
- Definition of a formal and theoretical framework

WP5 : Parallelizing the simulations

Distribution

- Break the memory barrier
- Distribute the simulated processes
- Keep a centralized orchestration

Parallelization

- Suppress the mutual exclusion execution of independent processes
- Leverage multi-core architectures

Simulation forks

- Accelerate simulation campaign
- Study some what-if scenarios without running the whole simulation again

WP3: Simulation analysis

Which metrics of interest?

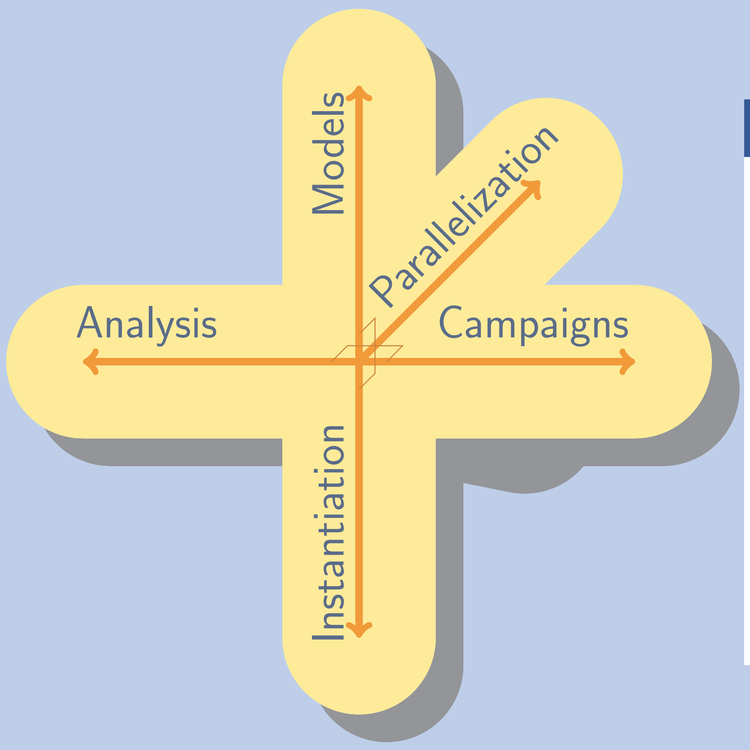
- Logging and trace processing
- User-driven process

Visualization

- Help the quick detection of hot spots
- Parameterized multi-view interface (2D/3D)

Effect inference

- Find recurring patterns



WP4: Campaign management

Planning and execution

- Couple SimGrid with an application launcher
- Setup, scheduling and control

Result storage

- Define an appropriate format
- Develop adapted access tools

Adaptive experimentation

- Add a feedback loop to conduct the campaign

WP6: Applicability

Cluster Dimensioning

- Help computing centers to prepare infrastructure upgrades
- Design a simulated benchmark suite
- Explore what-if scenarios (more cores, faster network, ...)

Peer-to-peer storage

- Assess the benefits of opening SimGrid to a new research community
- Validate the new resource models on a real distributed application

WP2: Model instantiation

Monitoring tools

- Feed the simulation kernel with realistic inputs
- Enrich existing and new models

Application-level topology mapping

- Discover the network topology experienced by an application

Workload characterization

- Replay real applications in a simulation context

Expected outcomes

Faster

- Increase the simulation speed
- Towards a embedded usage

Larger

- Push the scalability limits
- Reach the millions of machines

Stronger

- Validate the models
- Strengthen the tool itself

Wider

- New models
- New users

Leader

- Become the reference toolkit of the domain

Partners

- LORIA – Nancy Université
- INRIA Bordeaux Sud Ouest
- LIP – INRIA Grenoble Rhône Alpes
- Centre de Calcul de l'IN2P3 – CNRS
- INRIA Saclay Île de France
- LIG – CNRS
- CRESTIC – Université de Reims Champagne Ardenne
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SIMGRID

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