BIGHybrid: a toolkit for simulating MapReduce in hybrid environments

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Introduction

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Introduction

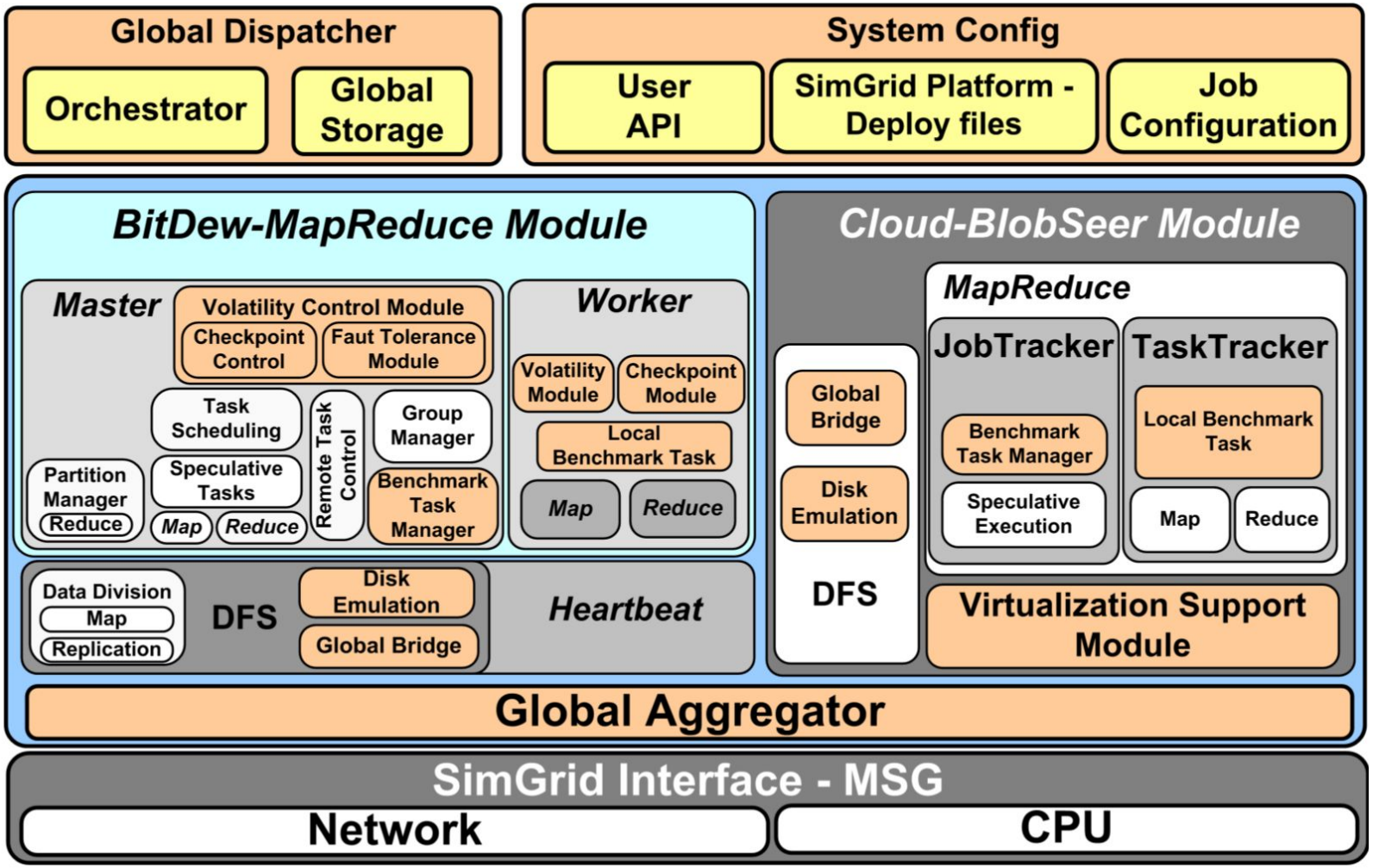
- 3 V's of Big Data:
  - Volume;
  - Variety;
  - Velocity;
- Data geographically distributed:
  - Several databases distributed geographically w/ slow links;
  - Multiple data in different places;
- The scientific community has proposed Cloud as an infrastructure for Big Data. [Xavier et al., 2015], [Amazon, 2016]
  - Problem: high cost with resources usage;

Introduction

- Desktop Grid (DG)
  - Resources are dedicated and volatile.;
  - A large number of users donate idle computing power (Volunteer Computing);
- BIGhybrid:Hybrid Infrastructure (Cloud Computing + Desktop Grid).

Model

BIGHybrid Architecture



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Cloud: BlobSeer + MapReduce

- Cloud Computing environment.
- MR is based on Hadoop.
- The HDFS is replaced by BlobSeer.
- BlobSeer is a DFS with:
  - Independent storages;
  - Enables incremental data update;
  - Strong load balance;
- Homogeneous environment.

DG: MapReduce-BitDew

- BitDew: middleware that exploits the best communication protocol to using in Desktop Grid environment.
- MR implementation is *Barrier Free* (as soon as there is data, it will be processed);
- Hosts are volatile and stable nodes;
  - Volatile nodes → local storage and stable remote storage (e.g. Dropbox, Google drive);
- Heterogeneous environment.

Prototype

MRSG: Cloud Computing

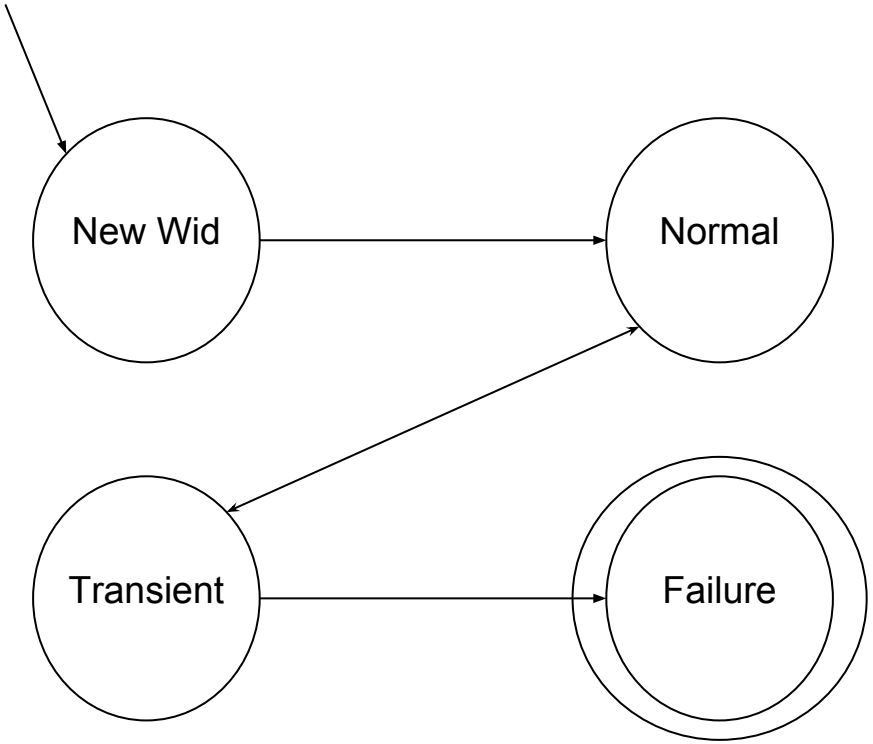
Features

- **M**ap**R**educe over **S**im**G**rid [Kolberg, 2013]
- Based on Hadoop MapReduce
  - HDFS
  - Schedule
  - Master and Worker Nodes
- Homogeneous Environments

MRA++: Desktop Grid

Features

- **M**ap**R**educe with **A**dapted **A**lgorithms to Heterogeneous Environments [ANJOS, 2015]
- Extended to Volunteer Computing
  - Fault Tolerance Mechanism
  - Volatile Module



Volatile Module: machine states

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Validation

Validating the simulator

Validation and updates

- Validations
  - Establish a workload to the experiments with basis on Yanpei Work [1].
  - To validate the used strategies for the BIGhybrid simulator, with these workloads.

Challenges:

- Establish a calibration for the task costs (in flops) and CPU power to an approximation of the job time simulation.

[1] Chen, Yanpei, Alspaugh, Sara, Katz, Randy ***Interactive Analytical Processing in Big Data Systems: A Cross-Industry Study of MapReduce Workloads***
Proceeding of the 38th International Conference on Very Large Data Bases (VLDB) Proc. VLDB Endow. 5(12), VLDB Endowment, 1802-1813, Aug 2012

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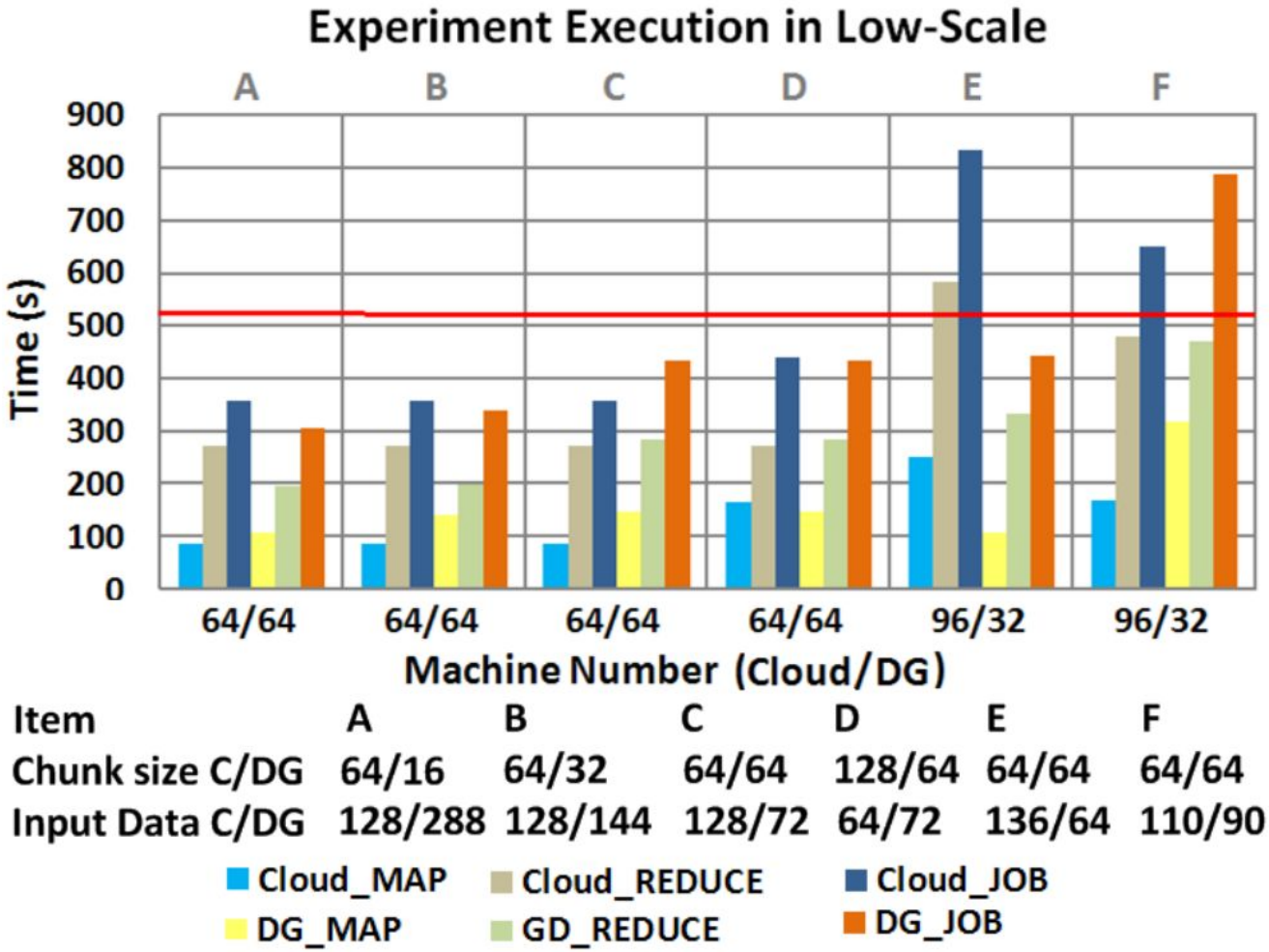
Strategies

- Volunteer hosts.
  - Execution time vs volatile nodes;
- Cloud Resources.
  - Cloud vs DG resources;
- I/O Interference.
  - Search for a relation between performance and interference in hybrid infrastructure;
- Channel communication.
  - Bandwidth impacts between nodes to define a chunk size;
- Data load balance.
  - Data distribution between Cloud and DG;

Results: small hybrid-infrastructure



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Future Works

Future Works

- Apply disk contention.
- Enable simulation of other distributed applications than MapReduce.
- Define the Global Dispatcher and Global Aggregator.

Thank You!

Questions?

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