CloudSim

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Introduction

Introduction

OSRF

To support the development, distribution, and adoption of open source software for use in robotics research, education, and product development.

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Senior software engineer

Brian Gerkey

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Steffi Paepcke

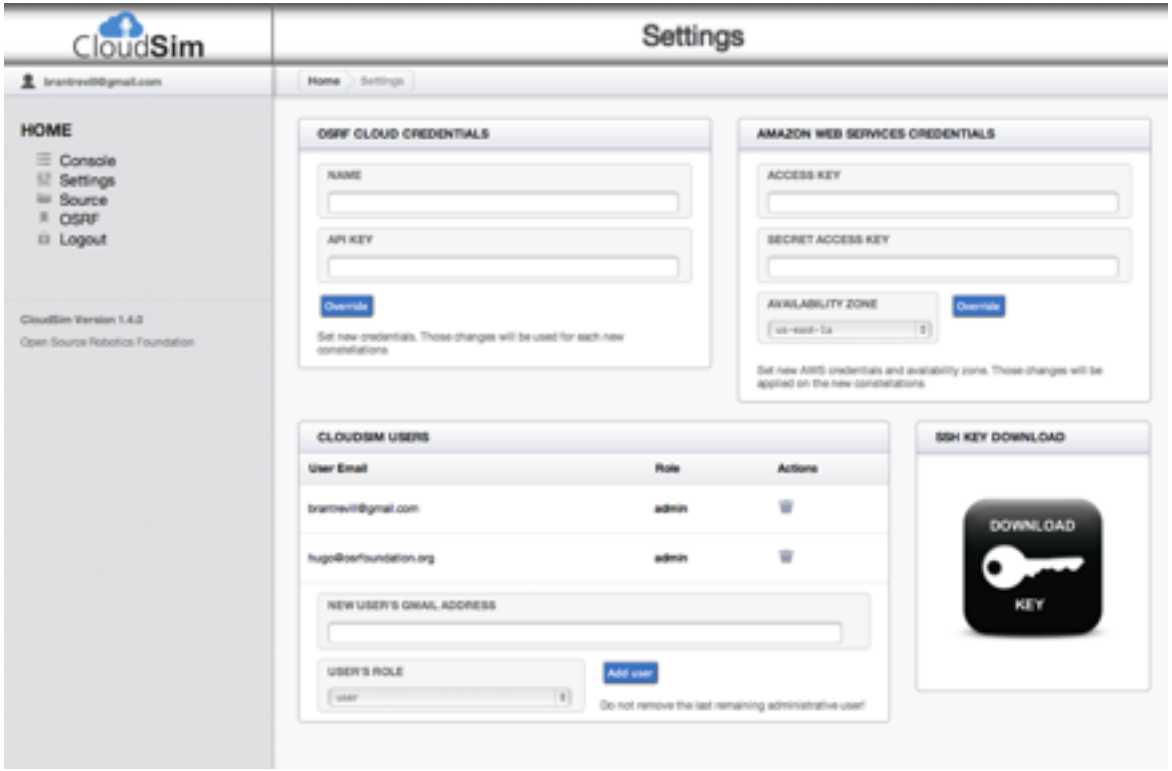
UX

Brant Revill

Web

Introduction

Introduction



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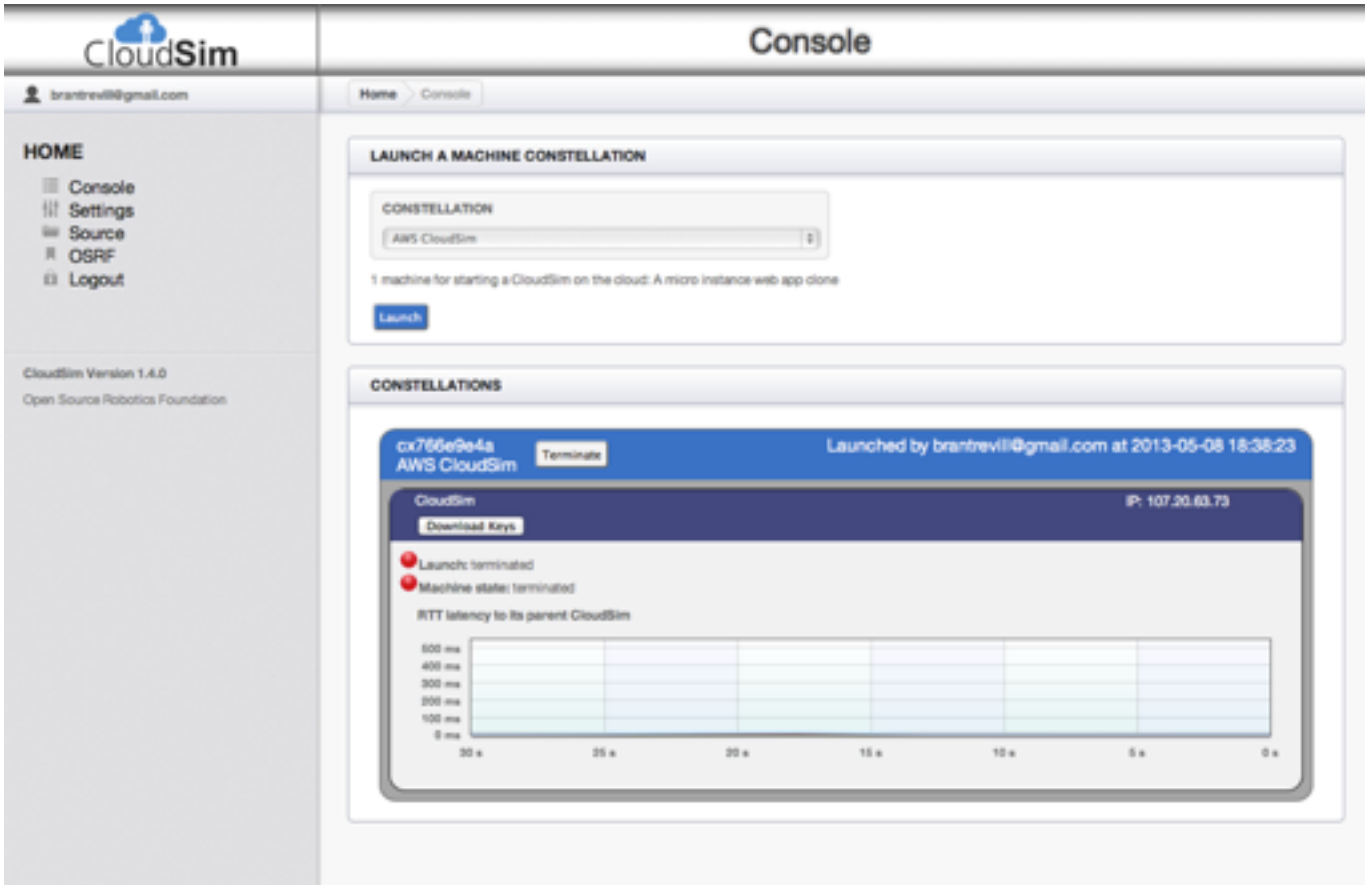

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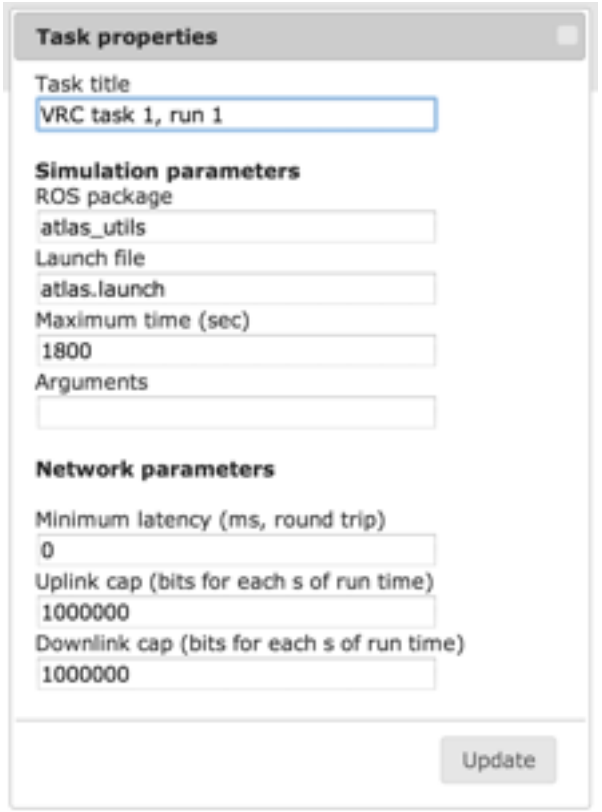

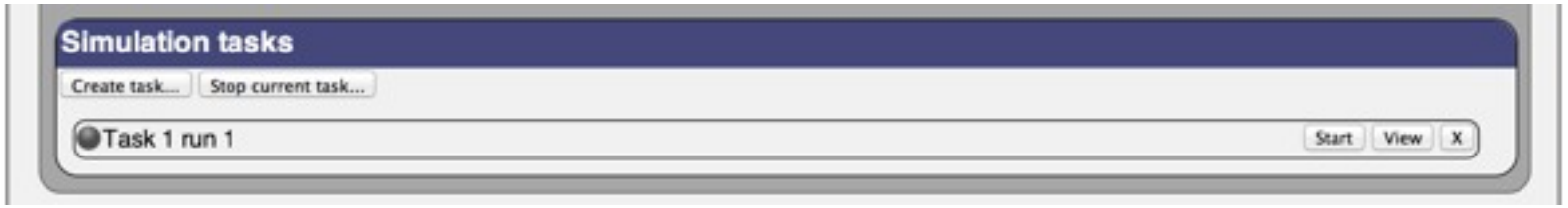

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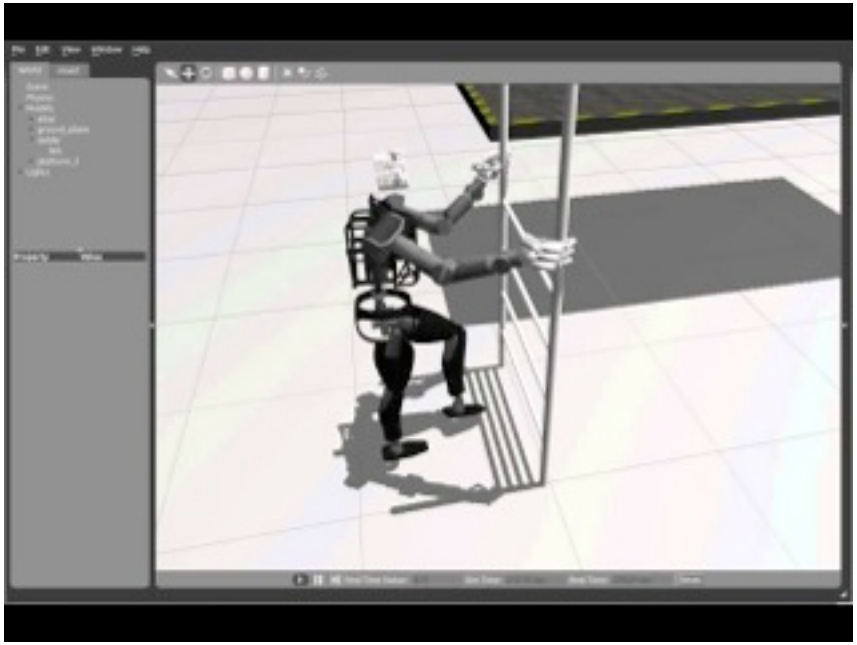


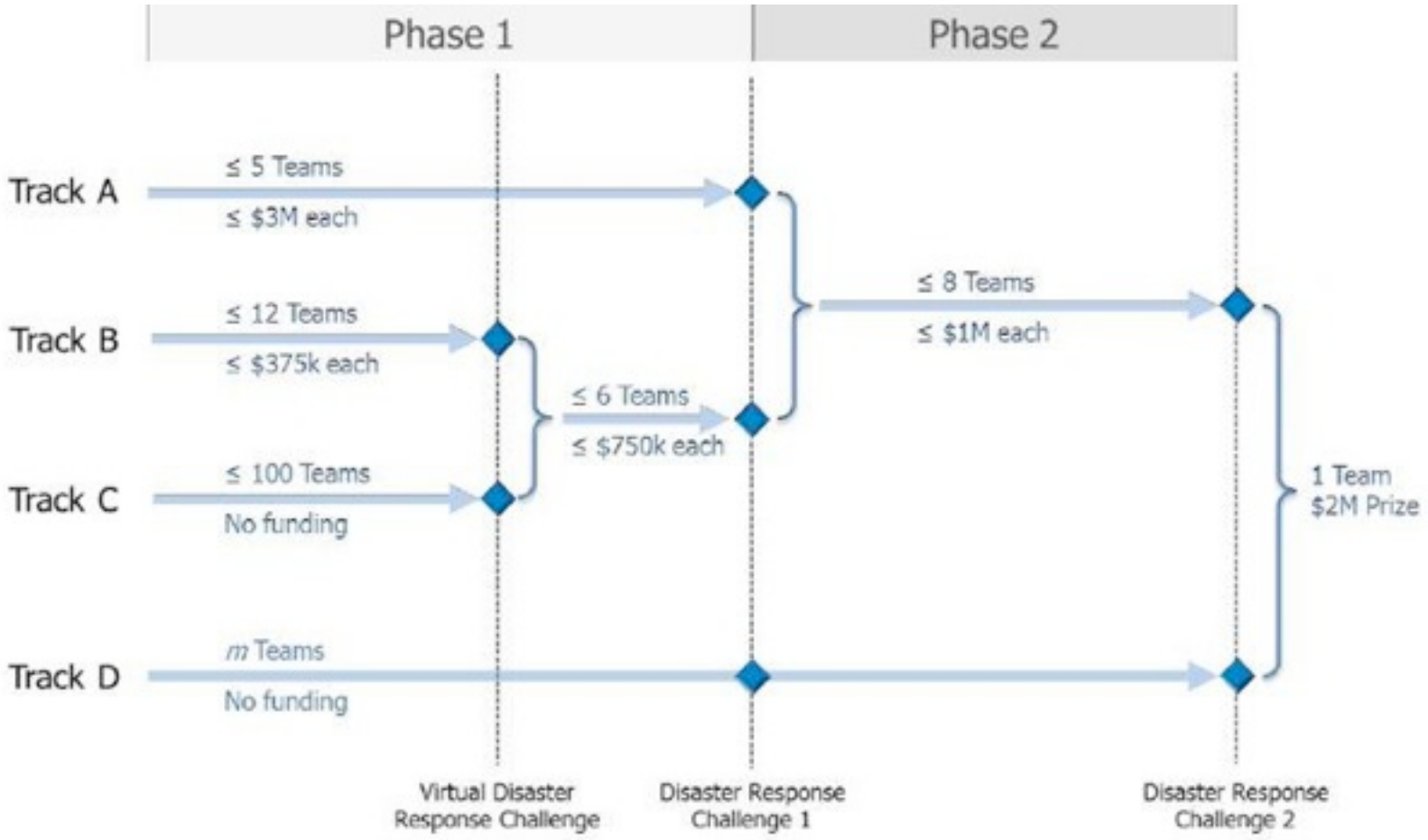
DARPA Robotics Challenge

DARPA Robotics Challenge

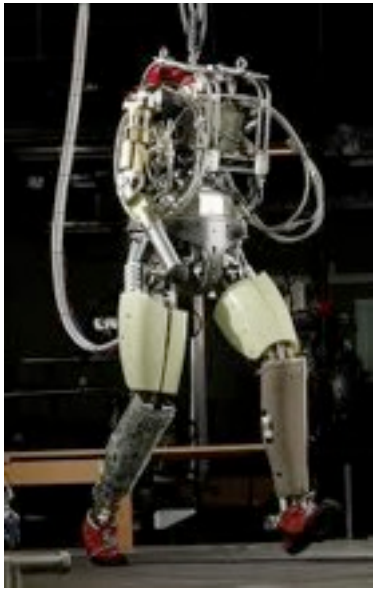
Disaster

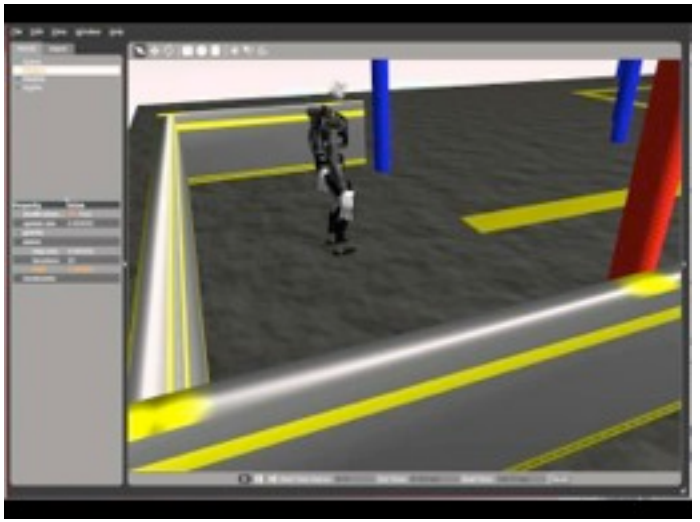
Response

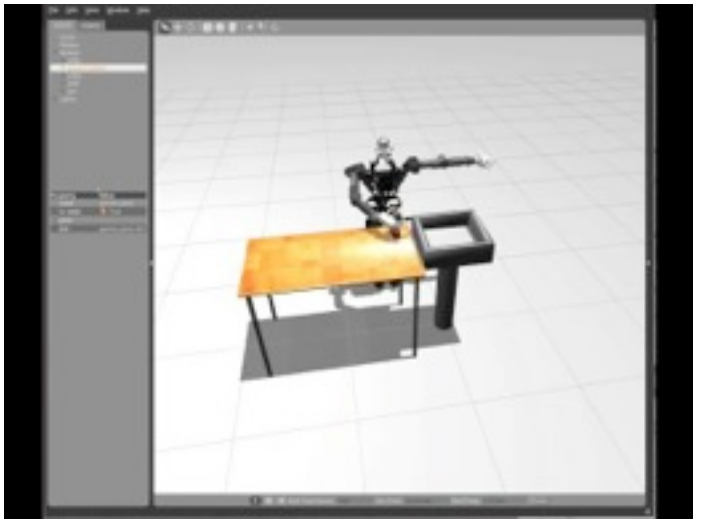
DARPA Robotics Challenge



DARPA Robotics Challenge







DARPA Robotics Challenge
Map-reduce the best robotics teams in the world

Map: simulated arenas vs
- Operator skills
- Cutting edge software

Reduce: best score of
- Time
- Task completion
- Bandwidth utilization

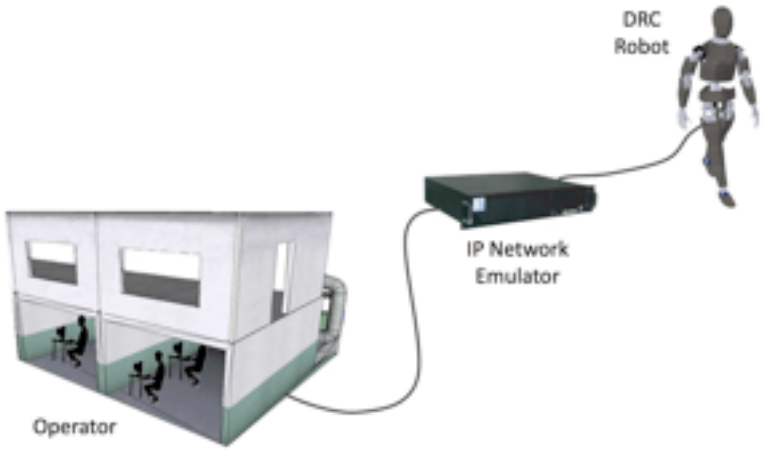
15 tasks, 3 days.

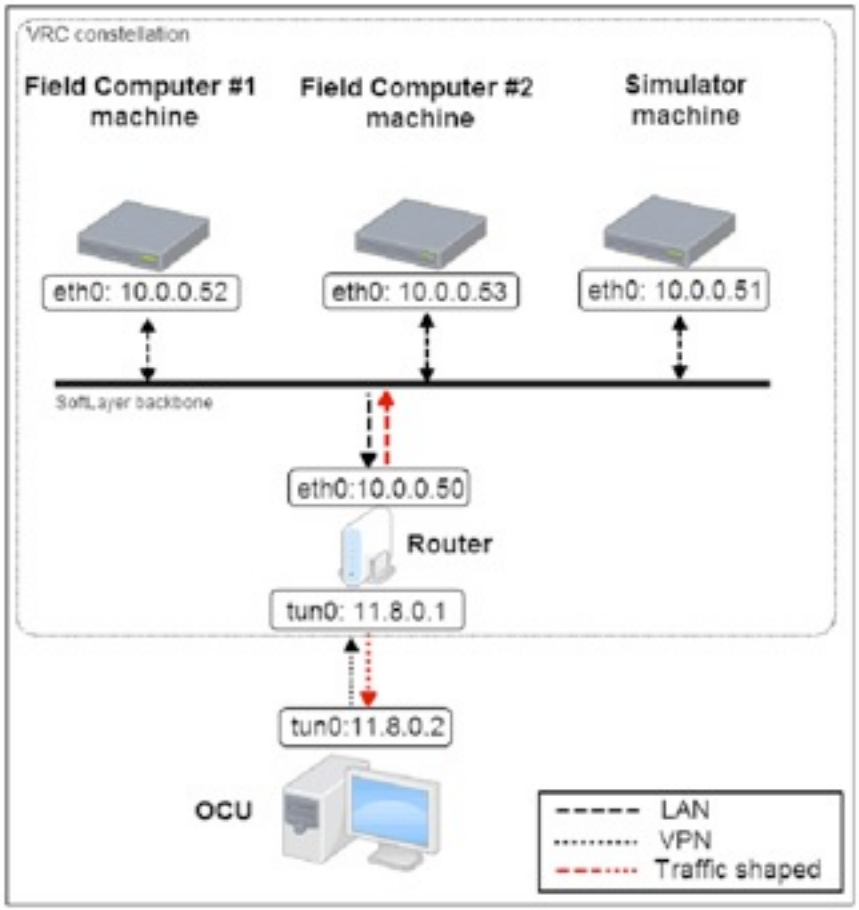
theroboticschallenge.org

CloudSim: design and overview

Configuration

- Network routes
- Software, simulation configurations
- Security





Private instant network

Evolution

CloudSim evolution

September 2012 (2012-09)

Brian's prototype:
- Amazon gpu machine
- OpenID authentication
- Python thread that bring up a machine, setup ROS, X and Gazebo

December 2012

Version 1.0
- New front end
- push notifications (polling)
- REST API
- Redis backend

CloudSim evolution

February 2013

Constellations
- chaining VPNs does not scale
- virtual lans (AWS VPC)
- Constellation plugin (single thread):
    - launch, terminate
    - start task, stop task

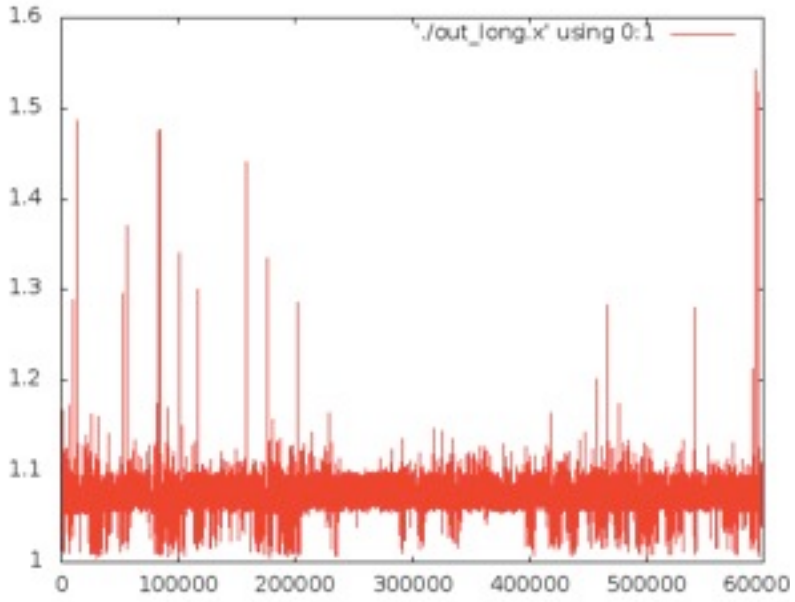
Development slows down
- 20 min

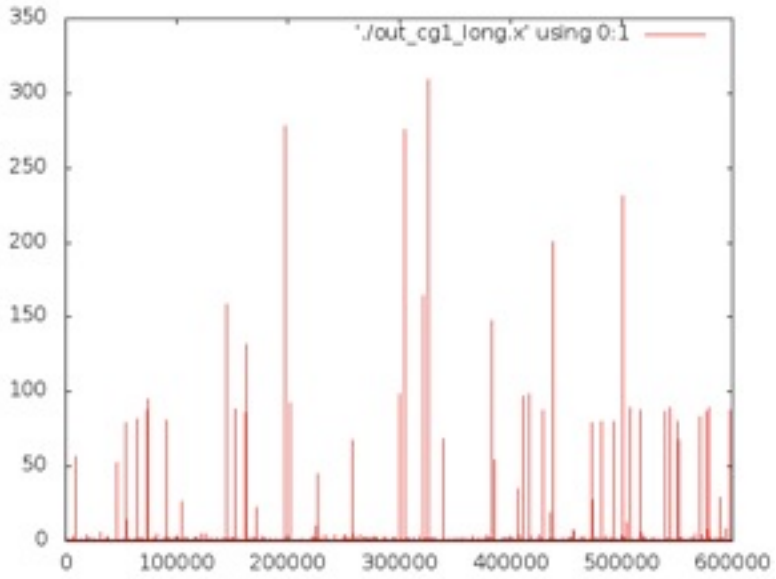
CloudSim evolution

February 2013

CloudSim evolution

Issues:
- not getting full 10 gbs bandwidth
- some strange behavior
- capacity
- jitter





CloudSim evolution

SoftLayer

Pros
- up to date performance
  - NVIDIA K10 processor
  - 2x Intel Xeon-SandyBridge E5-2690-OctoCore [2.9GHz] CPU
- no hypervisor
- single tenancy

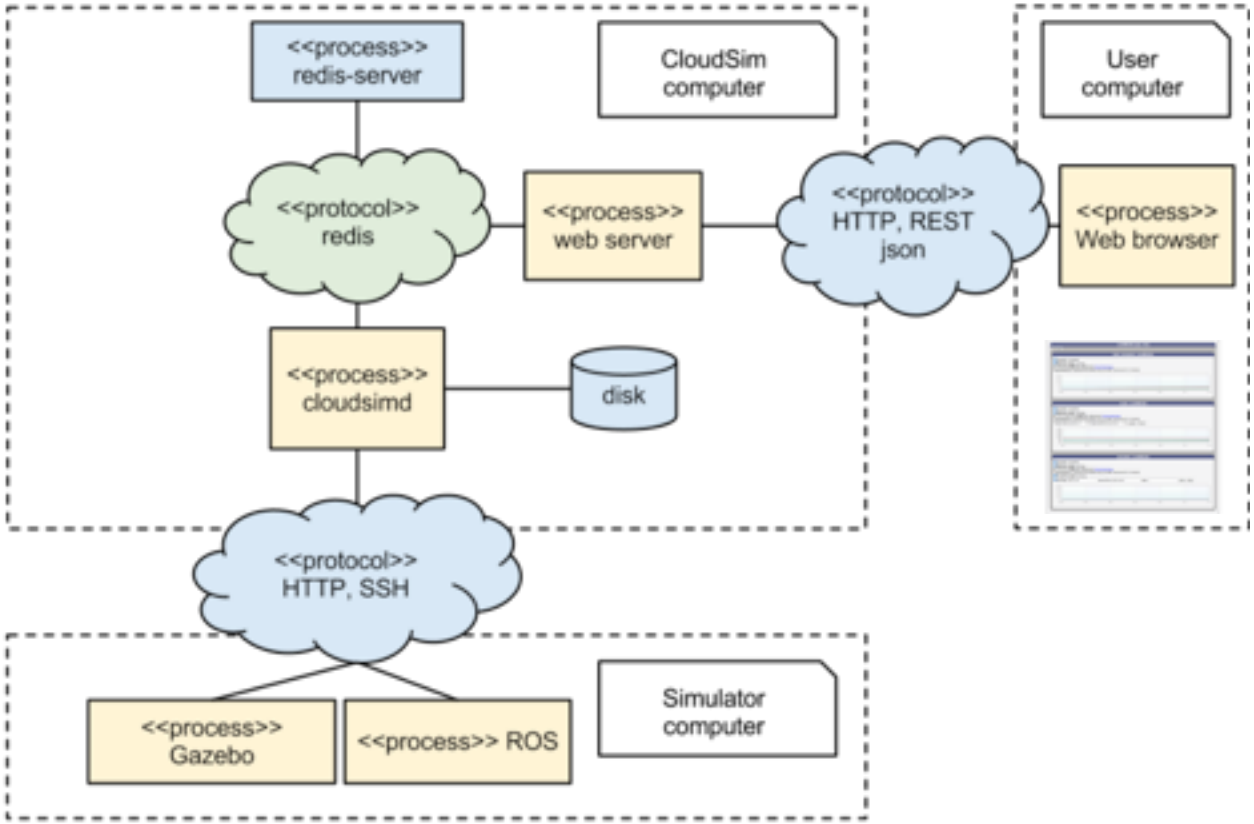
Cons
- monthly instead of hourly
- inflexible network topology and FW
- 1h provisioning [with bugs]

Status

Status

CloudSim architecture

- Thin web client
- Web server to process requests
- Daemon to launch cloud machines
- Simulation machines



CloudSim, Simulator and Web Client machines

Limitations

Limitations

Latency

- Some extra ms. are required to reach the machines on the cloud
- The latency is not fixed and depends on the geographic location of user/provider

Cost

- Pay on demand
  - Amazon $2.10/h
  - SoftLayer $1200.00/month
- Are we ready to pay for CPU cycles?

Small range of GPU-based providers

- A wider selection of providers would reduce costs
- Mitigated by demand for game streaming

Benefits

CloudSim benefits

ROS in a box

- curated selection of:
  - hardware
  - software (Groovy Precise Gazebo)
  - networking and routing
  - robotics (controllers, sensors)
  - simulation worlds

Concurrent by design

- 1 or 100 machines, same time
- Open and extensible

Low barrier to entry

- Thin client
- Platform for sharing

Future possibilities

Future possibilities

Research and industrial
- Store of simulation experiments
- [Automatic] [parallel] Testing
- Design optimization

Education
- Competition in the classroom
- Share simulations, data, benchmarks

Other future lines
- Launch other open source robotics software
- Connect to data sets

Expansion
- Deploy to real robots

Dream big

Conclusion

Conclusion

Motivated by specific requirements of the DARPA Robotics Challenge
Contribute to the success of Gazebo
Enables new workflows in robotics simulations
Makes ROS and Gazebo more accessible
Open Source, BSD license

CloudSim could be to be to ROS/Gazebo what Android is to Linux

http://gazebosim.org/wiki/CloudSim