Modelling and Simulation of Load Balancing Strategies for Particle Physically Experiments at CERN

State of the Art of

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Contents

1 Motivation

- show Motivation of research
- show current practice how done currently
- outlook: desired state

1.1 Worldwide LHC Computing Grid

- explain what wlcg is
- which experiment? CMS
- some specifications: jobs, cpus, ...
- highly heterogeneous, lot of constraints, like bad connection of some datacenters
- [1] [3] [12]

1.2 State of Practice

- load balancing manually
- operators look at monitoring data and send new jobs to compute node (datacenter) which they think is best
- heavily influenced by experience
- not optimal, shown by motoring data
- does not account nature of jobs (io vs compute), leading to not good utilization of the nodes
- desired: full utilization of nodes by submitting the right amount of io and compute job, so that hdd and cpu are utilized
- example too much io jobs: cpu are idling, wasting time

1.3 Outlook

- simulate effect of different load balancing strategies and decide on these results what the best scheduling is
- for that first a model of the wlcg is needed
- allows on the one hand to optimize scheduling
- on the other hand evaluate what happens if grid is changed, like dynamically adding Amazon nodes when price is low

2 State of the Art

- selection of research which related
- show where they lack and own is needed

2.1 Resource management for Infrastructure as a Service (IaaS) in cloud computing: A survey

- [18]
- overview about problems in IaaS

2.2 Cloud Simulators

2.2.1 Rapid Testing of IaaS Resource Management Algorithms via Cloud Middleware Simulation

- How to test load balancing alorithm. Able to test algorithm directly without reimplementing them for specific simulator.
- CACTOS Runtime Toolkit integrates monitoring and resource management via a variety of algorithms.
- The CACTOS Prediction Toolkit: Cloud simulator with the ability to evaluate resource management algorithms without modification
- cloud simulators: CloudSim, GreenCloud
- missing: several date centers, which are connected, local data etc.

2.2.2 A survey of mathematical models, simulation approaches and testbeds used for research in cloud computing

- [20]
- lot of simulations

2.2.3 CloudSim

- [5]
- mostly used
- lot of simulators are based on it

2.2.4 CDOSim

- [8]
- based on cloudsim
- represent more user than provider perspective

2.2.5 Emusim

- [6]
- Profiling based Approach to extract Workload Models
- simulates behaviour of application

2.2.6 Cloud Simulator for Autoscaling

- [22]
- based on queueing models
- allows to evaluate autoscaling algorithms

2.2.7 Locality Sim: Cloud Simulator with Data Locality

- [11]
- based on cloudsim
- considers data-locality

2.2.8 NetworkCloudSim

- [9]
- extends CloudSim
- models network

2.2.9 GreenCloud

- [14]
- energy-aware of severs, switches and links
- energy efficiency
- packet level

2.2.10 MDCSim

- [16]
- multi-tier data centers
- detailed implementation of each tier

2.2.11 Palladio

- architectural templates [15]
- black box resource demand [10]

2.2.12 CACTOS

- [21]
- CACTOS Runtime Toolkit: monitoring and resource management
- install cactos on servers to monitor and manage them
- CACTOS Prediction Toolkit: evaluation of alternative data center deployment scenarios, and resource management algorithms
- uses PCM and SimuLizar

2.3 Grid Simulators

2.3.1 GridSim

- [4]
- foundation for cloudsim
- best developed

2.3.2 OptorSim

- [2]
- used to evaluate data replication strategies

2.3.3 SimGrid

- [7]
- framework for simulation of distributed applications in Grid platforms

2.3.4 DGSim

- [13]
- trace based
- automatizes the simulation process
- generating realistic grid systems and workloads

2.3.5 ChicagoSim

- [19]
- Data Grids
- respects data locality

2.3.6 Differences Grid and Cloud

- [17]
- cloud virtualized resources
- our case rather grid

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