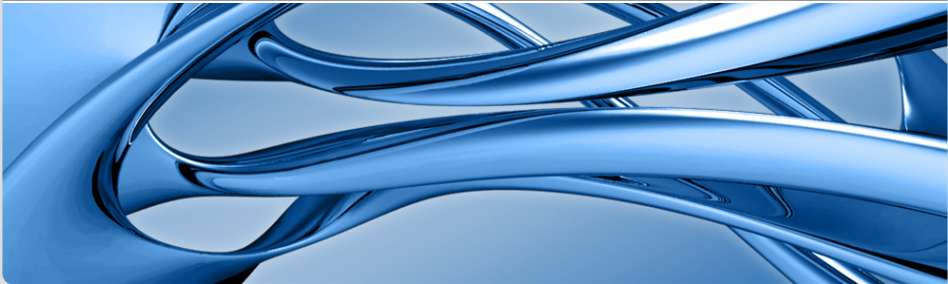


Modeling and Simulation of Load Balancing Strategies for Computing in High Energy Physics

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KARLSRUHE INSTITUTE OF TECHNOLOGY (KIT)



Motivation

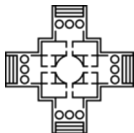
■ 1

■ 2

■ 3

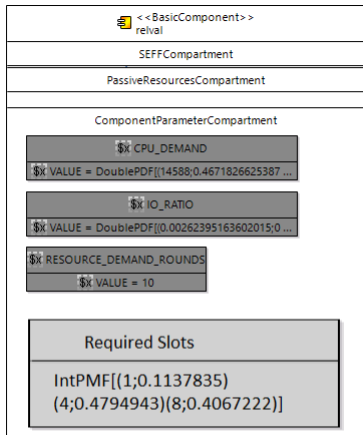
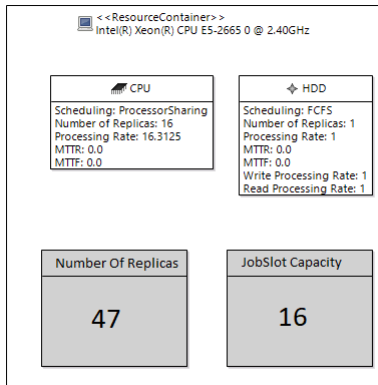
■ 4

- Model driven software architecture simulator
- Developed at KIT, FZI and University of Paderborn
- Enables performance predictions
(Reussner et al., 2016)
- Extended for simulation of Cloud Computing/HPC
 - Architectural Templates
(Lehrig & Becker, 2016)
 - SimuLizar
(Becker et al., 2013)
- Successfully used for optimizing cloud infrastructure
(Ostberg et al., 2014)



Palladio Logo
(<http://palladio-simulator.com>)

- Model each kind of computing job with its resource requirements
 - CPU & I/O
 - Required job slots
 - Number of events
- Model each type of computing node
 - Number and processing speed of cores
 - Processing speed of I/O
 - Number of job slots
 - Number of instances of node
- Model load balancing strategy
 - First fit search based on available job slots
 - Easily modifiable to evaluate new strategies
- Model high load on system
 - Closed workload
 - Enough jobs to guarantee that systems never idles
 - Each job type has configurable share of load



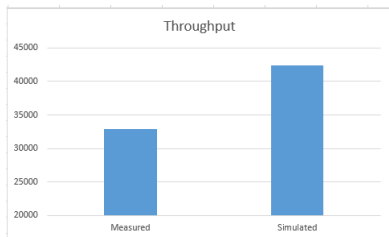
Data sources:

- Historical job monitoring data
 - JobMonitoring, WMArchive job reports
 - From CERN Hadoop analytix cluster using CMSSpark framework (Kuznetsov)
- Site VO resource share and node benchmarks

Obtaining model parameters:

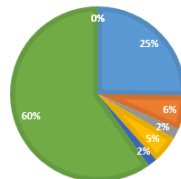
- Match jobs and node performance information
- Group computing jobs by type and requirements
- Extract resource demand distributions and load composition

Results



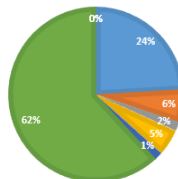
SIMULATED SHARE OF JOB TYPES

■ analysis ■ hctest ■ hcxrootd ■ production ■ relval ■ reprocessing ■ test ■ unknown



MEASURED SHARE OF JOB TYPES

■ analysis ■ hctest ■ hcxrootd ■ production ■ relval ■ reprocessing ■ test ■ unknown



Results



Outlook

■ 1

■ 2

■ 3

■ 4