

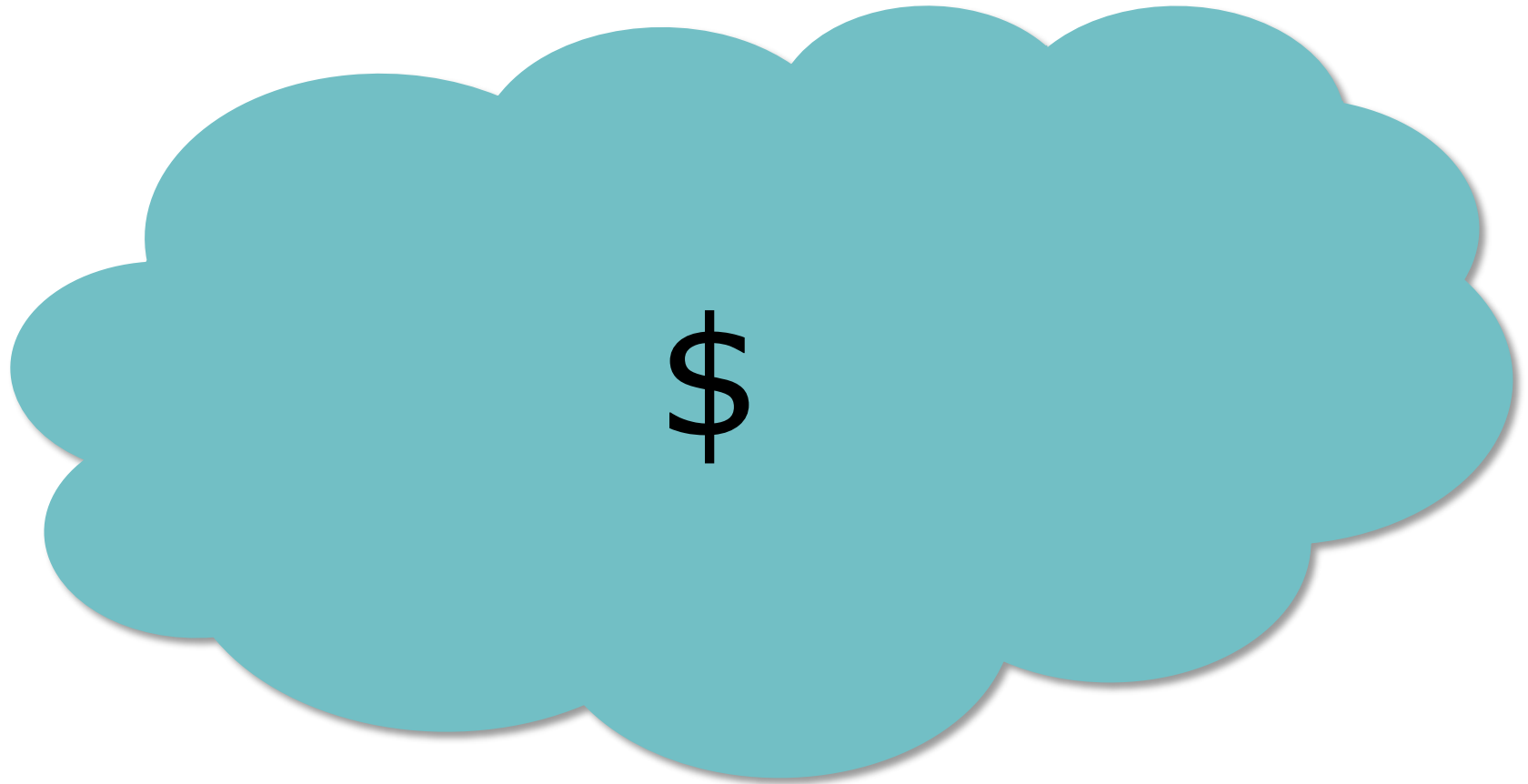
Adaptive Scheduling of Workflows on Clouds with Deadlines

Michael Gerhards^{1,2}, Volker Sander¹,

Adam Belloum², Marian Bubak²

Cracow Grid Workshop (CWG)- 27/10/2014

Wanna save Money using the Cloud?



Properties

- Horizontal scalability
- Vertical scalability
- Typically hourly billing
- On demand provisioning

Questions

- How many resources?
- Type of resources?
- How long?
- When?

DEADLINE

vs.

COST

Trade-off between deadline and cost constraints

Idea: Adaptive Scheduling

Initial Resource Allocation Plan



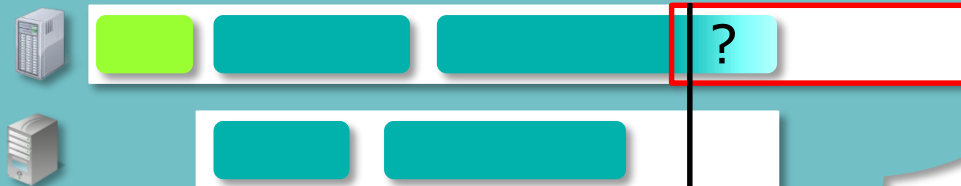
Estimate

- Cost
- Makespan
- Required resources

schedule



Runtime Deviation



Decision point

Adapt plan

reassign
from
to



Solution: Visit us at our Poster

CGW Workshop 14, Krakow, Poland, October 27-29, 2014

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Michael Gerhards^{1,2}, Volker Sander¹, Adam Bellour², Marian Bubak²

¹ FH Aachen - University of Applied Sciences, Heinrich Heussstr. 1, 52428 Juelich, Germany
<http://www.fh-aachen.de/formulare/frage@fh-aachen.de>
² University of Amsterdam, Science Park 107, 1098 XJ Amsterdam, The Netherlands
<http://www.uva.nl/http://www.comit.nl/vgerhards>
 m.gerhards@fh-aachen.de, v.sander@fh-aachen.de, a.s.bellour@uva.nl, bubak@ap.fhnw.pl



Michael



Adam



Volker



Marian

Problem Statement

Cloud computing offers new scheduling opportunities. Any cloud-aware scheduling algorithm has to decide on the number of actually used resources and for each resource about its instance size, and, to address the occurred monetary cost adequately, start time and end time. Basically, it has to perform a trade-off between deadline and cost constraints in an elastic environment. Neither static nor dynamic scheduling strategies alone address all characteristics of a cloud ecosystem. While dynamic scheduling can react on unexpected behaviors and runtime variations, an initial setup of resources is required. The proposed adaptive scheduling strategy combines the advantages of both mechanisms to form a novel approach for deadline constraint dynamic scheduling of scientific workflows on cloud infrastructures.

Solution

Application Model

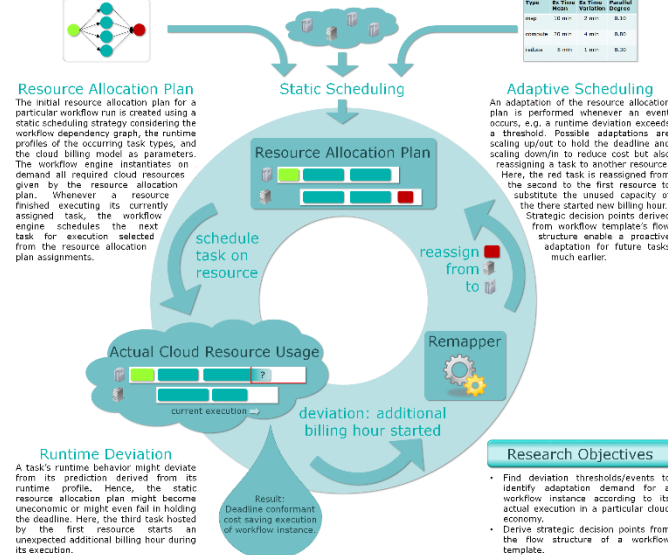
The targeted application models are large scale computational workflows having thousands of tasks and following well-structured data dependencies such as the templates of the Pegasus workflows, Eigenomics, CyberShake, Inspiral, Montage, and SIFT. The maximal makespan is limited by a deadline.

Cloud Ecosystem

Cloud infrastructures provide horizontal and vertical scalable on-demand resources following typically an hourly billed pay-as-you-go cost model. Any cloud-aware scheduling algorithm has to decide on the number of actually used resources and for each resource about its instance size and occupation time to address the occurred monetary cost.

Runtime Profiles

All thousands of tasks of a workflow template only follow few task types. A runtime profile for each task type is created based on gathered monitoring/provenance data of previous runs. The runtime profile of a task type also depends on its multithreading capabilities that are applicable on a particular cloud resource.



- #### Research Objectives
- Find deviation thresholds/events to identify adaptation demand for a workflow instance according to its actual execution in a particular cloud economy.
 - Derive strategic decision points from the flow structure of a workflow template.

Michael GERHARDS, M.Sc.

FH Aachen – University of Applied Sciences
Campus Jülich

Germany
Heinrich-Mußmannstraße 1
52428 Jülich
T +49. 241. 6009 53791

M.Gerhards@fh-aachen.de, V.Sander@fh-aachen.de,
A.S.Z.Belloum@uva.nl, Bubak@agh.edu.pl

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