Context-Aware Cloud Topology Optimization for OpenStack

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Abstract. CACTOS offers Cloud developers, operators, and consultants a context-aware optimisation for private Clouds. It leads to better and more reliable user experience, by optimising the mapping of virtual to physical resources, considering application requirements and heterogeneity. The optimisation and simulation requires monitoring, and an integration for controlling and intercepting client requests.

Keywords: Cloud Data Centres, Optimization, Workload Placement.

1 Why CACTOS?

CACTOS\(^1\) overall goal is to optimise a Cloud data centre from infrastructure to application level for better performance, better utilisation and a higher energy efficiency [1]. CACTOS therefore extensively monitors on infrastructure level, analyses application profiles and enhances the functionality of off the shelf Cloud middleware OpenStack (cf. Figure 1) with improved scheduling and workload reallocation algorithms.

For Cloud developers CACTOS aims at better experience, and more reliability due to a requirement aware resource scheduling. Since CACTOS is context-aware, the hardware affinity of applications is considered as well as a heterogeneous infrastructure. Cloud data centre operators benefit from an increased overall utilisation and hence cost and energy efficiency. Operators can choose between load balancing or consolidating virtual resources on physical hardware. CACTOS continuously optimises the placement of applications in a heterogeneous resource pool. CACTOS enables consultants with the capability to detect

\(^1\) http://www.cactosfp7.eu
bottlenecks on hard- and software level. Either manually or automatically via CACTOS reorganising application and hardware infrastructure can be simulated and then enacted for overall improvements.

2 CACTOS Runtime Toolkit in OpenStack

To enable CACTOS in an OpenStack cloud, the monitoring and analysis needs to be connected with the data centre. Bidirectional interactions from the Cloud middleware to CACTOS and back need to be established. Finally, CACTOS can optimise and simulate the OpenStack data centre (cf. Figure 2).

Data centre analysis starts with monitoring on each host of the data centre. The Chukwabased tool gets detailed information from physical and virtual level. The data is processed and stored in HBase. The huge amount of data is used to create application profiles.

Invocations to the OpenStack REST API are intercepted by a CACTOS-aware HTTP proxy. The proxy delegates calls for creating and deleting VMs synchronously to CACTOS. For periodical optimisations, CACTOS accesses OpenStack to migrate VMs and via an IPMI Proxy controls the power state of hosts. CACTOS hence controls the workload placement for existing and new VMs.

CACTOS gets the virtual and physical infrastructure with load information from the HBase. Depending on configuration and utilisation values, CACTOS optimises for e.g. load balancing or consolidation. Additionally, an event-driven simulation uses HBase to predict the data centre workload behaviour.

3 Project Status & Results

The recent CACTOS results are publicly available and linked on the website. The tools will be available on GitHub\textsuperscript{2} with the project ending in 2016.

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References


\textsuperscript{2} https://github.com/cactos