Energy-aware VM Allocation and Scheduling on An Opportunistic Cloud Environment

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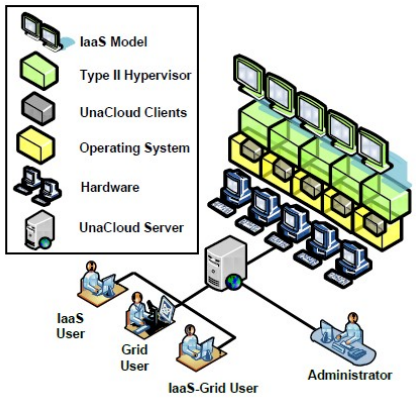
Abstract

UnaCloud is an opportunistic based cloud infrastructure (IaaS) that allows to access on-demand computing capabilities using commodity desktops. Although UnaCloud tried to maximize the use of idle resources to deploy virtual machines on them, it does not use energy-efficient resource allocation algorithms. In this paper, we design and implement different energy-aware techniques to operate in an energy- efficient way and at the same time guarantee the performance to the users. Performance tests with different algorithms and scenarios using real trace workloads from UnaCloud, show how different policies can change the energy consumption patterns and reduce the energy consumption in opportunistic cloud infrastructures. The results show that some algorithms can reduce the energy-consumption power up to 30% over the percentage earned by opportunistic environment.

UnaCloud

What is UnaCloud?

UnaCloud is an **opportunistic Infraestructure as a Service implementation** oriented to academic and research institutions, where the IaaS model is supported through the opportunistic use of idle computing resources available in the institution campus, providing researchers with significant and low cost computing capabilities.



UnaCloud Physical Architecture

Energy-aware allocation techniques for opportunistic cloud infrastructures

A. Algorithm 1. Custom Round Robin Allocation

B. Algorithm 2. Sorting VMs and PMs to Minimize the Use of PMs

Algorithm 3. Sorting VMs and PMs to Minimize the Use of PMs and Executing VMs with Similar Execution Time on the Same PM

Algorithm to Calculate the Energy Consumption Rate of a Meta-task by a Set of Virtual Machines

Results

We carried out the simulation and run the algorithms on the different scenarios.
We used the algorithm 1 as a basis of comparison.
We report average results. We only report results for scenarios assuming 10% and 50% of PMs with a user.
On average Algorithm 2 and Algorithm 3 save up to 36% of PMs more than Algorithm 1 when only 10% of the PMs are busy by users. The average gain on ECR by Algorithm 2 is up to 19% and up to 20% by Algorithm 3
When the number of PMs with users increases up to 50%, Algorithm 2 and Algorithm 3 require 26% less PMs than Algorithm 1. Algorithm 2 and Algorithm 3 save up to 29% and 30% more than Algorithm 1, respectively.

Future Work

- We will implement the new proposed algorithms on the UnaCloud infrastructure.
- We plan to investigate more allocation strategies and scheduling algothms that consider VMs shared resources constraints that can lead to performance degradation on the quality of service.
- We will implement them on top of **benchmarking** tools that reflect an HPC usage, *i.e.* HPCC, IOZone and Bonnie++

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