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Cloud resource management to improve energy efficiency based on local nodes optimizations

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Abstract

The energy consumption of Cloud Computing systems is one of the current concerns of systems architects. In order to reduce the energy consumption, they have provided techniques which go through the design of locations for data centres, together with techniques for the proper management of resources, taking into account the energy consumption of the system. This paper presents a resource allocation technique that maximizes the system efficiency. This technique is based on taking decisions at two levels: physical machine level and overall system level. Each of the levels ensure its own proper performance. To test that the technique complies with the initial hypothesis, simulations through the CloudSim tool have been developed. Also, we compared the results with a resource allocation technique based on a full knowledge of the system. As a result, we obtained a better solution time with the proposed technique that the other technique. Moreover, we obtained a lesser use of intra cluster network and a more energetically efficient cloud system.

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Keywords: Cloud computing; Resource allocation; Virtualization; Energy efficiency

1. Introduction

The definition of Cloud Computing, which has grown in acceptance, was created by NIST[1]: Cloud Computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications and service) that can be rapidly provisioned and released

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technique based on decision-making at local level. This means that it operated at two levels, locally and at the level of the overall system.

The simulation results obtained with CloudSim show that the proposed technique has reduced the number of messages transmitted through the network. With about half of messages, it has achieved a result similar to the most favourable case, the maximum consolidation of the VM. The utilization of resources of CPU and main memory of the proposed technique is greater than utilization-based technique. Regarding to the energy consumption of the system, we can say that the proposed technique enables lower energy consumption. So, it can be said that with a considerable reduction in the network utilization, it has been able to get the system reaches its most efficient point to a reduction in energy consumption.

Table 1. Overall system comparison.

	Initial state	Minimal approach	Maximum approach	Proposed approach
Power consumption (W)	102.3	103.4	102.6	101.6
Number of physical machines	10	10	8	9
Number or reallocations	-	41	138	77
Distance to highest efficiency point	-	42.2	12.7	27.7
Memory utilization (%)	59.9	60.3	48.2	55.3
CPU utilization (%)	47.4	49.4	43.5	50.3

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