Cloud Computing Simulation for Smart Grid

Hanlin Chen

the Department of Electrical and Computer Engineering
Ohio State University
chen.8059@buckeyemail.osu.edu

April 10, 2019

1   Introduction

The growth of power data in smart gird motivates use of high performance cloud computing application. In the cloud model, all data processing, software and hardware are delivered to users via internet in forms of service such as platform as a service (Paas), software as a service (Saas) and infrastructure as a service (Iaas). Compared to traditional computing framework, the cloud computing can handle much higher volume of data from smart grid and provide promising power management to users. The performance of cloud model could be addressed by its processing speed and throughput. In addition, various factors such as hardware infrastructures, allocation of virtual environment and smart grid application are directly linked to these performance measurements. In this paper, we proposed a novel cloud based data center architectures to improve data processing in the smart power grid. The runtime simulation is done to investigate the effect of hardware configuration and allocation policy of virtual machines on execution of smart grid application using open source toolkit Cloudsim [1]. The structure of this paper is as follow. Section II reviews overall architectures of proposed cloud based data center for smart grid. Section III studies two common VM scheduling: time shared policy and space shared policy. Section IV includes all simulation results and time analysis. Section V gives the conclusion.

2   Cloud-Based Data Center Architectures

The basic cloud architectures enable supports for maximizing the availability and increasing demand of computing power and data storage[2]. In our experiment, the cloud computing service is provided by one power company. Therefore, only 1 Cloud Service Provider (CSP) or 1 data center is required in our simulation. The data center is accountable for providing seamless infrastructure services for all cloud users in the city. In order to achieved higher utilization of computing, the virtualization of hardware is used and allocating computing hardware on user's request. The advantage of virtualization is that the service provider is

not obligated to allocate all hardware resources in advance and charge users based on usage of storage and bandwidth. In addition, it can also prevent applications from interrupting each other during execution, and provide higher data security. The detail of cloud-based data center architectures are displayed in figure 1.
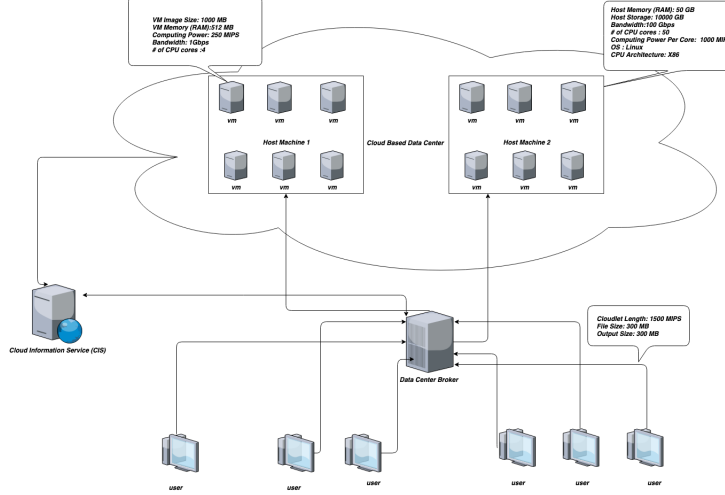

Figure 1: The Smart Grid Cloud Architecture

The data center has two host machines or servers and each host has the configuration: RAM = 50 GB, storage = 10000 GB , bandwidth = 10 Gbps and 50 CPU cores with processing power of 1000 MIPS per cores . We divide the city where has 40000 users into 50 regions and each region is served by 1 VM. Therefore, number of VM is equal to 50. Each VM has the configuration: image size = 1000 MB, RAM= 512 MB and 4 CPU cores with total processing power of 250 MIPS. The total storage and processing power of two host should be larger enough to handle all data generated from these 50 regions. The cloudlet is the job or task that users submit to cloud for processing and has fixed instruction length and data transfer size. For simplicity, in our simulation all user submit cloudlets with same configuration: length = 1500 MIPS , file size = 300 MB and output size = 300 MB.

References

[1] Cloud Computing and Distributed Systems (CLOUDS) Laboratory, "Cloudsim." [Online]. Available: http://www.cloudbus.org/cloudsim/

[2] K. Nagamani, C. G. V. N. Prasad, and K. S. Chatrapati, "A novel framework for optimal component based data center architecture," in *2016 International Conference on Information Communication and Embedded Systems (ICICES)*, Feb 2016, pp. 1–10.