# Peak2Cloud: Scientific Computing on the Cloud

JOSEPH ANTHONY C. HERMOCILLA, University of the Philippines Los Banos

Peak2Cloud (P2C) is an Openstack-based private cloud for scientific and high performance computing. First, we present how P2C was configured and tested. Then we describe vcluster, a tool for rapidly deploying message-passing clusters on P2C. Lastly, we analyze some benchmark results on the performance of P2C deployed virtual clusters.

Categories and Subject Descriptors: C.2.4 [**Computer-Communication Networks**]: Distributed Systems

General Terms: Network operating systems

Additional Key Words and Phrases: cloud computing, high-performance computing

**ACM Reference Format:**
Joseph Anthony C. Hermocilla, 2010.Peak2Cloud: Scientific Computing on the Cloud. *ACM Trans. Comput. Syst.* 2014, 1, Article 2 (June 2014), 2 pages.
DOI: http://dx.doi.org/10.1145/0000000.0000000

## 1. INTRODUCTION

Cloud computing has become a buzzword in today's modern computing, though there is no agreed upon meaning of the term. In 2011, NIST [Mell and Grance 2011] published a definition that is widely quoted and used. The popularity of cloud computing mainly comes from its ability to provision additional resources on demand with minimum intervention from the provider. It leverages advances in virtualization and web services technologies. For example, a website with a sudden increase in workload can start another server machine (virtual) almost instantaneously to accommodate the additional load.

Cloud computing offers service models which include Software-as-a-Service(SaaS), Platform-as-a-Service(PaaS), and Infrastructure-as-a-Service(IaaS). IaaS allows the consumer to provision computing resources(hardware, network, storage) to run arbitrary software including operating systems [Mell and Grance 2011].

## 2. RELATED WORK

Studies have been published to evaluate the applicability of the cloud for scientific computing.[Ekanayake and Fox 2010] [Evangelinos and Hill 2008] [Expsito et al. 2013][Ludescher et al. 2013] [Mauch et al. 2013][Jackson et al. 2010][Zhai et al. 2011] [Walker ].Most of these utilized the public cloud, specifically Amazon EC2 as their testbed.

---

This work is supported by the Philippine Department of Science and Technology (DOST) Accelerated Science and Technology Human Resource Development Program (ASTHRDP).
Author's addresse: J. A. C. Hermocilla, Institute of Computer Science, University of the Philippines Los Banos

DOI: http://dx.doi.org/10.1145/0000000.0000000

## 3. METHODOLOGY

### 3.1. Openstack

Openstack an open source software framework for deploying clouds. [Sefraoui 2012] It is based on Nebula used by NASA. It provides a public interface that is compatible with Amazon EC2. There are several components of Openstack which are developed separately. Keystone is used to manage authorization and authentication. Glance manages the virtual machine images. The Nova component is used for managing compute nodes.

### 3.2. Hardware

P2C uses commercial-off-the-shelf(COTS) hardware. The cloud controller and compute nodes is a four-core Intel(R) Core(TM) i3-2000 3.10GHz CPU with 4GB RAM and 100GB disk space.

### 3.3. Network Topology

### 3.4. vcluster

### 3.5. Benchmarks

## 4. RESULTS AND DISCUSSION

## 5. CONCLUSIONS

## ACKNOWLEDGMENTS

The author would like to thank the Lord.

## REFERENCES

Jaliya Ekanayake and Geoffrey Fox. 2010. High performance parallel computing with clouds and cloud technologies. In *Cloud Computing*. Springer, 2038. http://link.springer.com/chapter/10.1007/978-3-642-12636-9_2

Constantinos Evangelinos and C. Hill. 2008. Cloud computing for parallel scientific hpc applications: Feasibility of running coupled atmosphere-ocean climate models on amazons ec2. *ratio* 2, 2.40 (2008), 234. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.296.3779&rep=rep1&type=pdf

Roberto R. Expsito, Guillermo L. Taboada, Sabela Ramos, Juan Tourio, and Ramn Doallo. 2013. Performance analysis of HPC applications in the cloud. *Future Generation Computer Systems* 29, 1 (Jan. 2013), 218–229. DOI:http://dx.doi.org/10.1016/j.future.2012.06.009

Keith R. Jackson, Lavanya Ramakrishnan, Krishna Muriki, Shane Canon, Shreyas Cholia, John Shalf, Harvey J. Wasserman, and Nicholas J. Wright. 2010. Performance Analysis of High Performance Computing Applications on the Amazon Web Services Cloud. IEEE, 159–168. DOI:http://dx.doi.org/10.1109/CloudCom.2010.69

Thomas Ludescher, Thomas Feilhauer, and Peter Brezany. 2013. Cloud-Based Code Execution Framework for scientific problem solving environments. *Journal of Cloud Computing: Advances, Systems and Applications* 2, 1 (2013), 11. http://www.journalofcloudcomputing.com/content/2/1/11

Viktor Mauch, Marcel Kunze, and Marius Hillenbrand. 2013. High performance cloud computing. *Including Special sections: High Performance Computing in the Cloud & Resource Discovery Mechanisms for P2P Systems* 29, 6 (Aug. 2013), 1408–1416. DOI:http://dx.doi.org/10.1016/j.future.2012.03.011

Peter Mell and Timothy Grance. 2011. The NIST definition of cloud computing (draft). *NIST special publication* 800, 145 (2011), 7. http://pre-developer.att.com/home/learn/enablingtechnologies/The_NIST_Definition_of_Cloud_Computing.pdf

Omar Sefraoui. 2012. OpenStack: Toward an Open-source Solution for Cloud Computing. *International Journal of Computer Applications* 55, 3 (Oct. 2012), 38–42.

Edward Walker. Benchmarking Amazon EC2 for high-performance scientific computing. (????). https://www.usenix.org/legacy/publications/login/2008-10/openpdfs/walker.pdf

Yan Zhai, Mingliang Liu, Jidong Zhai, Xiaosong Ma, and Wenguang Chen. 2011. Cloud versus in-house cluster: evaluating Amazon cluster compute instances for running MPI applications. In *State of the Practice Reports*. ACM, 11. http://dl.acm.org/citation.cfm?id=2063363

Received May 2014; revised June 2014; accepted June 2014