Chapter 4
System Benchmarking on Public Clouds: Comparing Instance Types of Virtual Machine Clusters

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ABSTRACT

There are several public cloud providers that provide service across different cloud models such as IaaS, PaaS, and SaaS. End users require an objective means to assess the performance of the services being offered by the various cloud providers. Benchmarks have typically been used to evaluate the performance of various systems and can play a vital role in assessing performance of the different public cloud platforms in a vendor neutral manner. Amazon’s EC2 Service is one of the leading public cloud service providers and offers many different levels of service. The research in this chapter focuses on system level benchmarks and looks into evaluating the memory, CPU, and I/O performance of two different tiers of hardware offered through Amazon’s EC2. Using three distinct types of system benchmarks, the performance of the micro spot instance and the M1 small instance are measured and compared. In order to examine the performance and scalability of the hardware, the virtual machines are set up in a cluster formation ranging from two to eight nodes. The results show that the scalability of the cloud is achieved by increasing resources when applicable. This chapter also looks at the economic model and other cloud services offered by Amazon’s EC2, Microsoft’s Azure, and Google’s App Engine.

1. INTRODUCTION

The cloud is an emerging platform that is taking shape as more vendors offer services and researchers delve deeper into how to use it and how to measure it. Currently, reliance is placed upon the specifications that each cloud vendor publishes to judge price and performance comparisons. With more widely

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accepted benchmarking, these specifications may become easier to compare in a more direct manner. Performance is one of the key factors for any enterprise when determining the true benefits of cloud computing. Cloud providers promise many services with corresponding service quality attributes to end users.

End users however require a vendor neutral means to assure that a certain level of performance will be achieved before they commit to hosting their applications and services in the cloud provided by a specific cloud provider. This is where benchmarks play a vital role. Benchmarking would allow enterprises to perform transparent and insightful comparisons to see how various types of applications run on different clouds with various kinds of instance configurations.

When examining the performance of cloud computing, it is worthwhile to note the many different varieties of performance testing that can be done. The evaluation of a cloud environment can vary widely depending on the hardware, hypervisor, guest operating systems, and applications used in the configuration (Ahuja & Sridharan, 2012). Policies set in place by the cloud provider can also have an effect in relation to how much of a priority over the system resources a virtual machine has. Each vendor that offers a cloud service will inarguably use a different setup and configuration that may lead to changes in performance.

The contents of this paper detail the benchmarking of the Amazon Elastic Compute Cloud using the STREAM benchmark for memory bandwidth, IOR benchmark for disk input and output, and NPB-EB benchmark for communication speed. Section two examines some example cloud platforms. Section three identifies previous work in cloud benchmarking, section 4 provides a sampling of system level benchmarks, and section five focuses on the benchmarking performed and its results. Section six draws conclusions.

2. PLATFORM

Current cloud computing offerings come from a number of service providers ranging from small local companies running 3rd party cloud OS software to offer up their hardware resources to other local businesses to some of the worlds largest companies running massive services running their own proprietary software to serve clients across the entire globe. The smaller providers are typically more focused on local business clients as their hardware infrastructure isn’t large enough to scale for the needs of large national or international companies. For this reason we will focus on a subset of services offered by the three largest providers; Amazon Web Services (AWS) Elastic Compute Cloud (EC2) which was used in testing for this paper, as well as Microsoft Windows Azure (Azure) VM Roles, and Google Cloud Platform (GCP) App Engine (AE).

The Elastic Compute Cloud (EC2) by Amazon is an Infrastructure as a Service (IaaS) public cloud. EC2 is available, for an hourly fee, to the public. As an IaaS product, EC2 offers users a virtual machine and options of OS to be installed on it. This is to contrast against the Platform as a Service (PaaS) product, where an OS with middleware is rented to the user, or Software as a Service (SaaS), which provides an end-product or application for use. This makes EC2 flexible for use during peak hours or as a full time enhancement or replacement of the existing server infrastructure of a business.

The VM Roles from Windows Azure are very similar to the EC2 instances and are also IaaS services but are a less mature product and as such offer far fewer sizing options. AppEngine (AE) from Google in contrast is a PaaS and offers no options of operating system and even restricts the programming languages to Java (and others that compile to java byte code), Python, and currently experimentally, the Google Go language.