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Performance Analysis of Multiple Virtualized Servers

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ABSTRACT

Server virtualization is considered as one of the most significant changes in IT operations in the past decade, making it possible to manage groups of servers with a greater degree of reliability at a lower cost. It is driven by the goal of reducing the total number of physical servers in an organization by consolidating multiple applications on shared servers. In this paper we construct several x86_64 servers based on VMware vSphere, and then analyze their performances using open source analyzing tools Pylot and Curl-loader. The results show that despite the enormous potential benefits of virtualization techniques, the efficiency decreased by increasing the number of virtual machines. So, a trade-off is needed between number of virtual machines and expected efficiency of servers.

Keywords: Server virtualization, VMware vSphere, web server, FTP server.

1. INTRODUCTION

Virtualization is a technique for hiding the physical characteristics of computing resources from the way in which other systems, applications, or end users interact with those resources. There are three categories of virtualization: network virtualization, storage virtualization and server virtualization [1].

Server virtualization has become a popular topic in recent years, and it is often mentioned in technical magazines, network device providers' white papers, textbooks and research papers. Server virtualization is the masking of server resources (including the number and identity of individual physical servers, processors, and operating systems) from server users. The intention is to spare the user from having to understand and manage complicated details of server resources while increasing resource sharing and utilization and maintaining the capacity to expand later. It gives a number of advantages including efficient resource management, saving space, strengthening security, saving costs and decreasing in greenhouse gas emissions [2].The popularity of server virtualization technology is increasing, and the market is expanding as companies release new products.

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Therefore, many organizations are implementing virtualization strategies for take advantage of its benefits.

Nevertheless, unfortunately, very little study has been done on the performance analysis of server virtualization technique despite its ability to substitute a large amount of physical servers, which is attributed to its efficient resource management. IT managers may ask about the amount of overhead forced by using virtualization. IT managers may ask two other questions about server virtualization:

a. What is the difference between performance of Web/FTP servers running on regular server and virtualized servers?
b. Is virtual machine slower than the underlying physical machine?

To answer these questions and issues, we examine some cases of server virtualization in a real environment. In this paper, we construct several virtual servers into the x86_64 based physical server built on VMware vSphere, then analyze their performances using open source analyzing tools Pylot and Curl-loader. We analyze the performance of the single physical server and multiple servers based on VMware ESXi. The results of our evaluation can be used as the basis of constructing multiple servers based on the server virtualization technique.

The rest of this paper is as follows: section 2 describes the employed tools in evaluation of Web and FTP servers, section 3 illustrate the evaluation environment while section 4 shows the results of the evaluation and section 5 includes conclusion.

2. PERFORMANCE ANALYSIS TOOLS

There are many commercial and open source tools for analyzing the performance of servers. In this paper, we use two open source tools Pylot and Curl-loader. The first is used in evaluation of web servers and the latter is used for measuring FTP servers. A brief description of the tools is given in this section.

Pylot Is a free open source tool for testing performance and scalability of web services. It runs HTTP load tests, which are useful for capacity planning, benchmarking, analysis, and system tuning. Pylot generates concurrent load (HTTP Requests), verifies server responses, and produces reports with metrics [3].

Curl-loader (also known as "omes-nik" and "davilka") is an open-source tool written in C-language, simulating application load and application behavior of thousands and tens of thousands HTTP/HTTPS and FTP/FTPS clients, each with its own source IP-address[4].

3. TESTING ENVIRONMENT

In order to achieve more realistic results, we have performed experiment on a LAN with several distinct systems. Figure 1 shows the network architecture used in this paper. We provided a typical ftp-server and an http-server, and measured the performance in both situations with and without virtualization. The virtualization is done by using the premier virtualization product VMware ESXi. We first explored web server running on a native physical system. Then the second test is performed for web servers running within VMware vSphere [5], and we continued up to six virtual machines. It worth mentioning that in order to generate results that are more realistic, we dedicated one client for sending request to each virtual machine.

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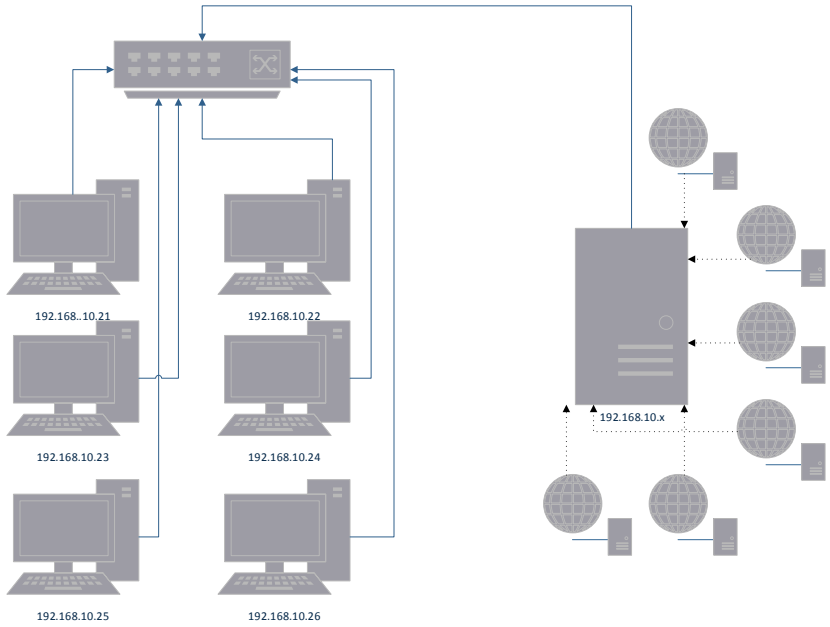

FIGURE 1. The architecture of testing environment

Pylot and Curl-loader tools are installed on all clients to evaluate performance of web servers. Whereas, response time and delay are in many – if not in most – cases the basis for performance analysis and as well when they get higher than expected response time and delay, we may start some sort of optimizations. Response time and delay play a critical role in performance monitoring and analysis. In virtualized and cloud environments they are the most accurate performance metric you can get.

3.1 SERVER SOFTWARE AND HARDWARE SPECIFICATION

Windows server 64bits 2012 is installed in a physical server. For providing web and ftp servers, we used IIS 8.0 (Internet Information Server) integrated in Microsoft Windows. The process of the performance test is done for a single web server and then the virtualized servers. The virtualized servers are constructed based on VMware vSphere ESXi and each server tested respectively. TABLE 1 shows the server specifications.

TABLE 1.
Physical server specification

CPU	Intel Xeon CPU 2.40GHz E5620 4bit Processor
Main Board	Intel S5520HC
RAM	8GB(4GB DDR3 PC-10600 ECC/REG * 2)
HDD	Western Digital 750GB Serial-ATA 7200RPM 64M (Model: WD-WCAW30704893)
NIC	Intel 82575EB Gigabit Ethernet
Operating System	Windows server 64bits 2012
Web/FTP servers	IIS 8.0

3.2 CLIENTS SOFTWARE AND HARDWARE SPECIFICATION

For testing of each virtual machine, we dedicated a separate client to construct real test environment. TABLE 2 shows the configuration of our clients.

TABLE 2.
Clients specification

CPU	
Main Board	
RAM	
HDD	
NIC	
Operating System	Linux Ubuntu 10.04

4. RESULT

4.1 FTP SERVER PERFORMANCE ANALYSIS

As already stated, this tool evaluate the average application server delay of FTP servers. In the configuration file of the tool, number of agents and requests per second set to 1 and 50 respectively. A 10 kilobytes text file is placed in FTP server for downloading by the clients. There are 7 cases to test (single server without virtualization, single server with virtualization, 2 virtual machines to 6 virtual machines). we repeat the experiment 100 times in a way where the requests are simultaneously sent from the client to the server for this purpose that only information relevant the tool affect traffic of network. Figure 2 depicts the results given by Curl-loader for single server to six virtual machines.

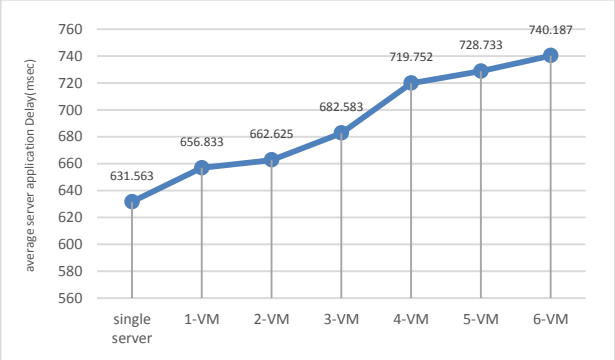

FIGURE 2. FTP evaluation results by Curl-loader

Here we take the advantage of Confidence Interval (CI) to show whether there is significant differences between performances of test cases. In general, when a number such as the median or the mean of a series of performance results is drawn in a diagram, it is important to quantify their accuracy. Confidence intervals quantify the uncertainty about a summarized data that is due to the randomness of the measurements. Figure 3 shows a comparison between the two systems when only

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one virtual machine is running and when 6 virtual machines are running. The figure is drawn for 90% of confidence. As the results shows, there are significant differences between two shown cases with 90% of confidence.

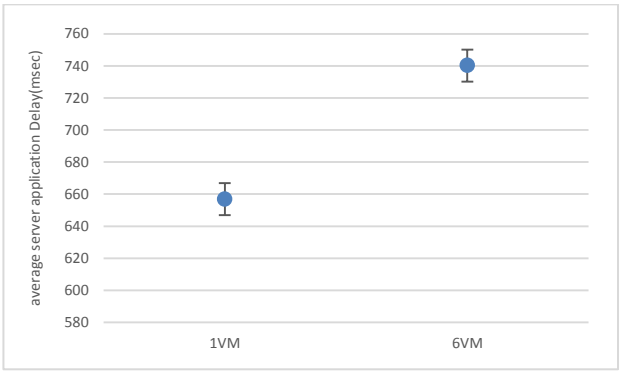

FIGURE 3. single VM versus six VMs using Confidence Interval

4.2 WEB SERVER PERFORMANCE ANALYSIS

Pylot is used for measuring and analyzing the response time of web servers. The number of agents set to 1. Afterwards, we repeated the experiment 100 times for each case and each continued until a steady state. Figure 3 shows the results extracted from Pylot for single server to six virtual machines.

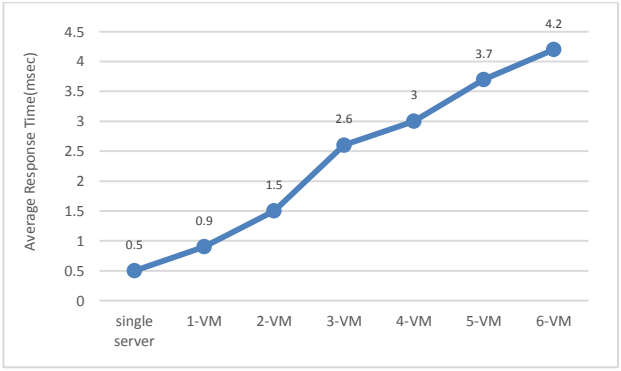

FIGURE 4. Test result according to Pylot

5. CONCLUSION

For an efficient multiple server operation the multi-server construction using server virtualization technique can be an alternative to the single web server construction in a physical system. There are various factors that impress to decision of organization and people for on going to virtualization. In addition Response time and delay are important particularly for those who pursuant height performance. Test result shows that by increasing the number of virtual machines the performance

of the multi-server configuration deteriorates. As well in order to more assurance, we have used the concept of Confidence Interval.

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