PERFORMANCE MEASUREMENT OF VIRTUAL MACHINES

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Abstract— Virtualization is a technology that allows multiple virtual machines to be installed on the same computer system on top of the host operating system it runs on. For the host operating system, the virtual machine is like a process which requests access to resources. Due to this, performance of the virtual machine is heavily influenced by the host operating system. In this paper we study how Windows 7 and Linux 12.04 affect virtual machine performance. Performance measurement results show that the virtual machine has better performance when Windows 7 is used as host operating system.

Index Terms—Host Operating System, Performance Measurement, Virtual Machine Performance, Virtualization.

I. INTRODUCTION

Virtual machines have helped developers, testers and even end users solve the issue of incompatible software, which is rising in significance every minute due to rapid advancements in hardware and corresponding software to take advantage of these improvements. A developer ideally should ensure that all his code is backward compatible to all previously released versions of the same software. This is not practically possible as the development of more powerful hardware and more efficient operating systems need to be fully utilized to provide better performance. As a result, there are a series of minimum requirements mentioned with each software release. Similarly, a tester needs to ensure that the software being tested works without glitches with all the configurations it claims to work seamlessly on. On the same lines, an end user may need to work with software that is not compatible with the current hardware and software specifications of his system. For the above mentioned reasons, it is imperative that all these people be able to work with their software on a number of different operating system and hardware installations without actually uninstalling and reinstalling software on their systems.

Virtual machines are based upon a technology called Virtualization. This technology allows us to install different operating systems with controlled hardware resources (virtual machines) within the operating system installed on our machine (host machine). The virtual machines do not directly use or interact with the hardware resources of the host machine. Instead, Virtualization ensures that these resources are managed by the host machine's operating system for the virtual machines.
Hence, if a virtual machine runs on identical hardware, but on different host operating systems, virtual machine performance is not identical for all host operating systems [1].

II. LITERATURE SURVEY

Many attempts have been made to study the performance of virtual machines and the numerous factors that have an impact on the same. In [1], the authors focused on the influence

of the host operating system on virtual machine performance. Measurement of the performance of the same virtual operating system (Windows Vista) has been carried out using benchmark applications in controlled conditions using three different host operating systems (Windows XP, Windows Vista and Windows 7). The performance evaluation shows that virtual operating system has the best performance when Windows 7 is used as the host operating system. In [2], the authors focused on the performance measurement of different virtualization technologies for Windows programs running on Linux operating system, namely system virtual machine, kernel virtualization in kernel space and kernel virtualization in user space. VMware Workstation, Longene and Wine have been used as the representatives for the respective technologies and benchmark applications for the performance measurement. Their experimental results show that Wine (representing kernel virtualization in the user space) has the best performance. In [3], the author focuses on comparing the network performance of Windows and Linux for applications using the TCP and UDP protocols. From his research, he concludes that Ubuntu is the better performer as far as the networking performance is concerned.

The purpose of this paper is to compare performance of the virtual machine when it is installed on two representatives (Windows 7 and Ubuntu 12.04) of Windows and Linux, using VMware Workstation. The virtual machine is made to perform video encoding, which overloads the memory and CPU. Under controlled conditions, the time taken for conversion gives a fair performance evaluation of the virtual machines.

III. SETUP USED

The host operating system is unaware that another operating system is running virtually on top of it. For the host operating system, the virtual machine is just another process which requests resources from it. As video encoding overloads the memory and the CPU, the host operating system having better resource allocation will ensure better performance of the virtual machine.

A. Host Operating System
Windows 7 (64 bit) and Ubuntu 12.04 LTS (64 bit) were used as host operating systems.

B. Virtual Operating System
Windows XP (32 bit) was used as virtual operating system.

C. Hardware Components
Configuration of host machine: 4 GB RAM, Intel Core i5-3317U CPU @ 1.70 GHz, 500 GB Hard Disk and 1 GB AMD Graphic Card.

IV. METHODOLOGY

For each of the two operating systems, a series of steps were carried out.

First, install the host operating system on to the host machine. Then, install the latest available device drivers and all the available operating system updates. Now, install VMware Workstation, also ensuring that no other application which may be part of the same package is installed. Setup a virtual machine with 2 GB of RAM and 100 GB of virtual hard disk, which is approximately half the RAM capacity of the host machine and one fifth of its hard disk capacity respectively. Install the operating system which will act as the virtual operating system in this newly created virtual machine setup. For this operating system as well, install the latest available device drivers and all the available operating system updates. Now, install the software for video encoding/conversion (Total Video Converter), also ensuring that no other application that may be part of the installation package is installed inadvertently. Use this software to perform conversion of a sample file of size 848MB in the mp4 format to the AVI format. Perform this conversion 3 times and record the time taken for each conversion. A brief representation of the same is shown in Fig. 1.

Apart from VMware Workstation, no application was installed on the host operating system. Similarly, on the virtual operating system, Total Video Converter was the only

application installed. This was done so as to eliminate the allocation of resources by both the host and virtual operating systems to any other application.

To further remove any discrepancies, average out the three readings recorded for each operating system and compare them.
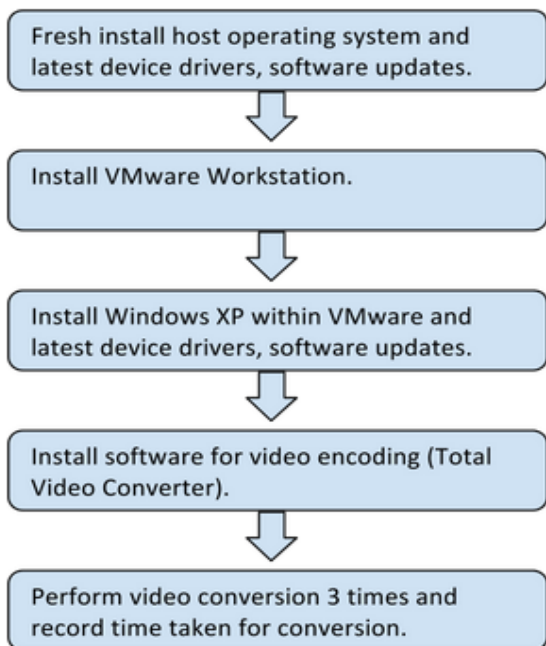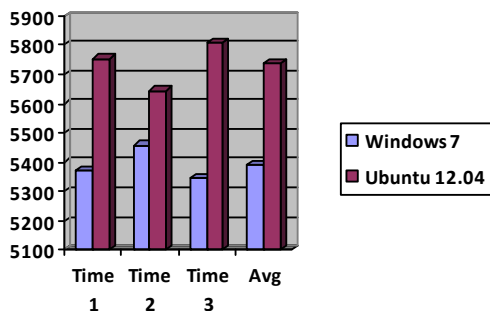

Fig. 1. Methodology

V. RESULTS

Fig. 2. Performance Measurement Results

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VI. CONCLUSION

Fig. 2 shows a bar chart representing the comparison of the time taken for the conversion individually as well as an average comparison.

Every reading observed for Windows 7 is lower

than the reading observed for Ubuntu 12.04, and the average of the three readings is lower in case of Windows 7 by approximately 6.38%. As the virtual machine is made to perform video encoding, a highly resource intensive task, the time taken is a good indicator of the performance. Lesser the time taken for this task to be performed better is the performance of the virtual machine. As the performance of the virtual machine is directly proportional to the management of resources by the host operating system, it can hence be concluded that virtual machine performance is better when Windows 7 is used as the host operating system as compared to when Ubuntu 12.04 is used as the host operating system.

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