Adaptive Optimizing Virtual Machine for Memory Management

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Abstract- The evaluation of the performance of Memory management is the main problem in any architecture because it reduces the efficacy of the system. Due to memory over commitment and hyperness in virtualized environment, it degrades the performance of the system. For evaluating the dynamic behavior of virtual memory that is a part of hyper memory that can be used to enhance the performance of the virtual memory, we have proposed an adaptive optimization technique in the virtual memory. The hyper memory has its virtual memory that can be used to process a large amount of data with at a very high speed. On run time data processing, the virtual memory can be attached with local memory. The proposed technique in the virtual memory can reduce the number of additional memories to evaluate the dynamic behavior of the system more concisely and more efficiently.

Index Terms- Optimization, Virtual Memory, Hyper Memory, Virtual Addresses, Linear Addresses.

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1. Introduction:

Memory management is used to accommodate different types of programs in primary memory and it is also used to translate the logical addresses generated by the CPU into physical addresses of images loaded into the primary memory (Jeremy, 2013). The address translation is performed by hardware located between the CPU and memory.

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Memory management is complex system as it has used many techniques make memory more efficient. Memory management is

managing the computer memory in the system. The purpose of memory management is to provide dynamically allocation of memory to programs that needs to be run (Mauro, 2010).

Memory management is divided into three categories that is hardware memory management, operating system memory management, application memory management. In hardware memory management, we are concerned with electronic devices that store data and also involve in the hardware memory management such as RAM and many hard drives. It also allocates memory to the user programs and to the programs that are reused by other programs.

Operating system creates the Virtual Address and Physical Address. Both of these are activities of virtual memory systems. Application memory management takes the files from memory with the different addresses which is supposed to run with the help of OS.

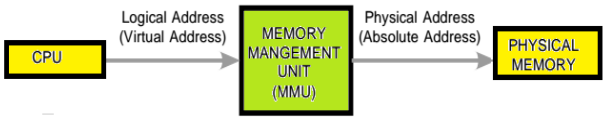

Fig.1: Image process from CPU to Physical Memory

Virtual memory is a process of memory management that is maintained by the real memory in the form of virtual address and physical address. Memory takes the physical addresses which are used by programs. Virtual address are also saved in virtual memory. Virtual Address which is logical or linear, allows a linear address (virtual address) of a program to be located in any portion of physical memory. In the virtual addressing, virtual memory generates the paging that is also mapped on memory (Setzer, 2009).

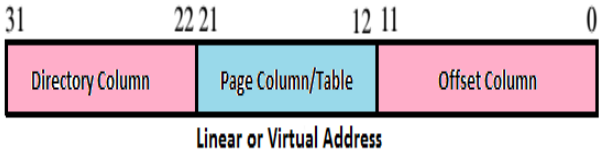

Fig.2: Virtual Memory Architecture

Virtual memory architecture is a control program in inter-VM. It runs on the physical hardware, and creates some logical addresses in virtual machine. Inter-VM provides full virtualization of the physical memory and other privileged operations. It performs the system's resource shared, including memory management, virtual storage management, and other traditional operating system involved. Inter-VM connected with the other system (CPU), every VM user provided with a separate virtual machine having its own address in the virtualization environment, and which is capable of running any software that could be run and itself create the VA and PA at the virtual layer (Zhao, 2009).

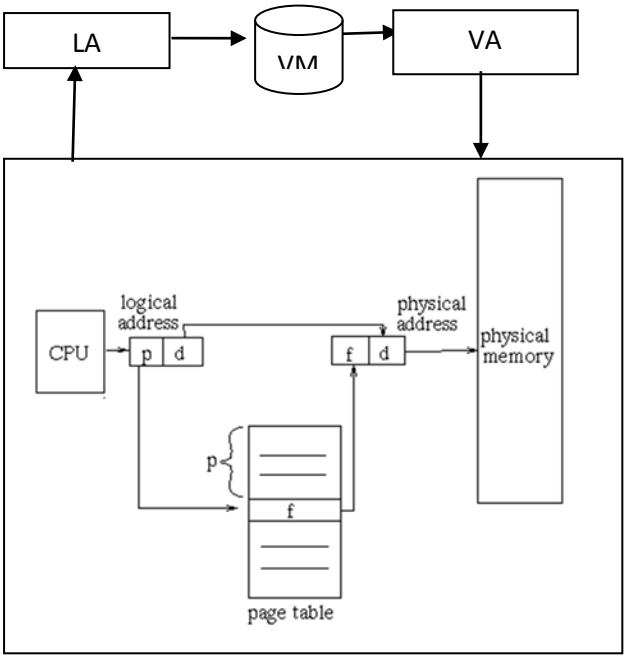

Fig.3: Inter-VM architecture

2. Hyper Memory

Hyper memory is introduced by (ATI Technologies Inc.). ATI's method of using motherboard's main system RAM as a part of the video card buffer memory on their line of video cards and mother boards chipsets. Hyper memory manager is an intelligent memory it produced significant cost reduction and is commonly used in 3D games. It allow the program to use the system RAM in such manner not to crash or work improperly, normally we see that hyper memory manager in video gaming (3D). Hyper memory 3D API and memory manager connects direct with the system so it can be helpful in dynamic allocation of the virtual memory in order to deal with the memory over commitment.

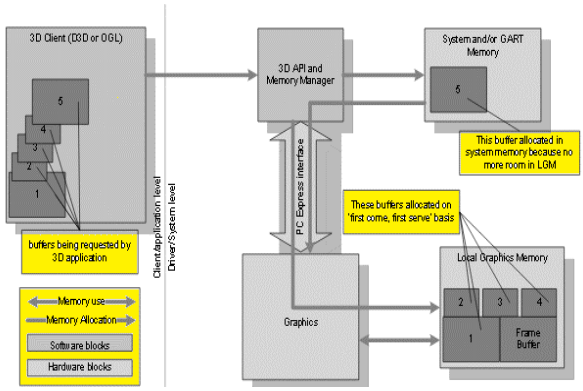

Fig.4: Hyper Memory connectivity with System

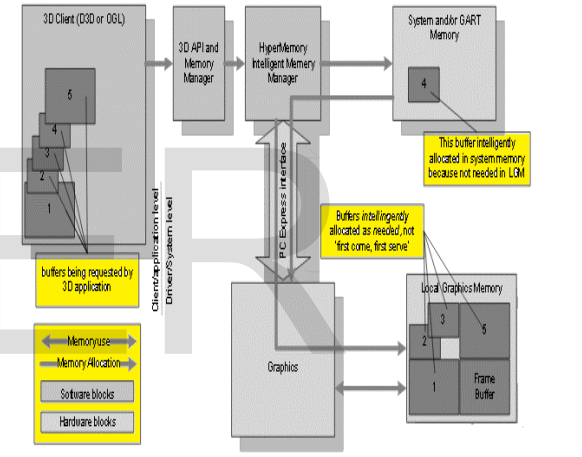

Fig.5: Hyper memory connectivity with 3D System

3. Literature Review:

Waldspurger in (Waldspurger, 2010) described that the ballooning software ESX Server uses to manage the memory resource in virtualization by a balloon module. Whenever the server reclaim memory the balloon starts inflate by allocating pinned physical pages within the virtual machine using appropriate native interfaces.

Zhao in (Zhao, 2009) worked on dynamic memory growth and automatic memory resizing by implementing MEB on Xen. Xen is a ballooning technique which is not much helpful in absorbing the huge amount of memory pressure. Zhao worked on new technique that was able to absorb more than the memory pressure that the ballooning mechanism.

Mauro in (Mauro, 2010) suggested that there should be cloud architecture for dynamic load management in which he developed an algorithm that selects the sender hosts, sender guests and receiver hosts, it was an efficient algorithm for memory management but there was a question now that how to select guest machines to be migrated, and the most convenient destinations. These classical problems are even more severe in a cloud context characterized by a very large number of hosts.

4. Proposed Methodology

Hyper- memory will has two key components one is the Virtual Memory and the other one is the Memory Controller. Virtual memory is a new pathway towards intelligence in the use of the memory. The virtual machine thus acts as hardware for virtual memory and this virtual machine has more memory rather than an application and here virtual machine acts as hardware which is attached to run dynamically.

When a virtual machine will run on the system, it will link with the system by hyper memory which will act as intelligent manager and will show the system that this virtual machine is not an application. It is the part of the system hardware and it will use the memory dynamically while running.

This allows the virtual machine to access the memory of the system dynamically and it would be much helpful to deal with the memory over commitment in virtualization environment. As hyper memory is basically the intelligent manager for 3D games so it will helps the virtual machine to use local graphics while running on the system.

When the system considers the virtual machine as a hardware of it than while running the system will not bound or fix the memory for it and allows it to run and use the memory without any limitation hence, the system will be allocating the memory dynamically the virtual machine.

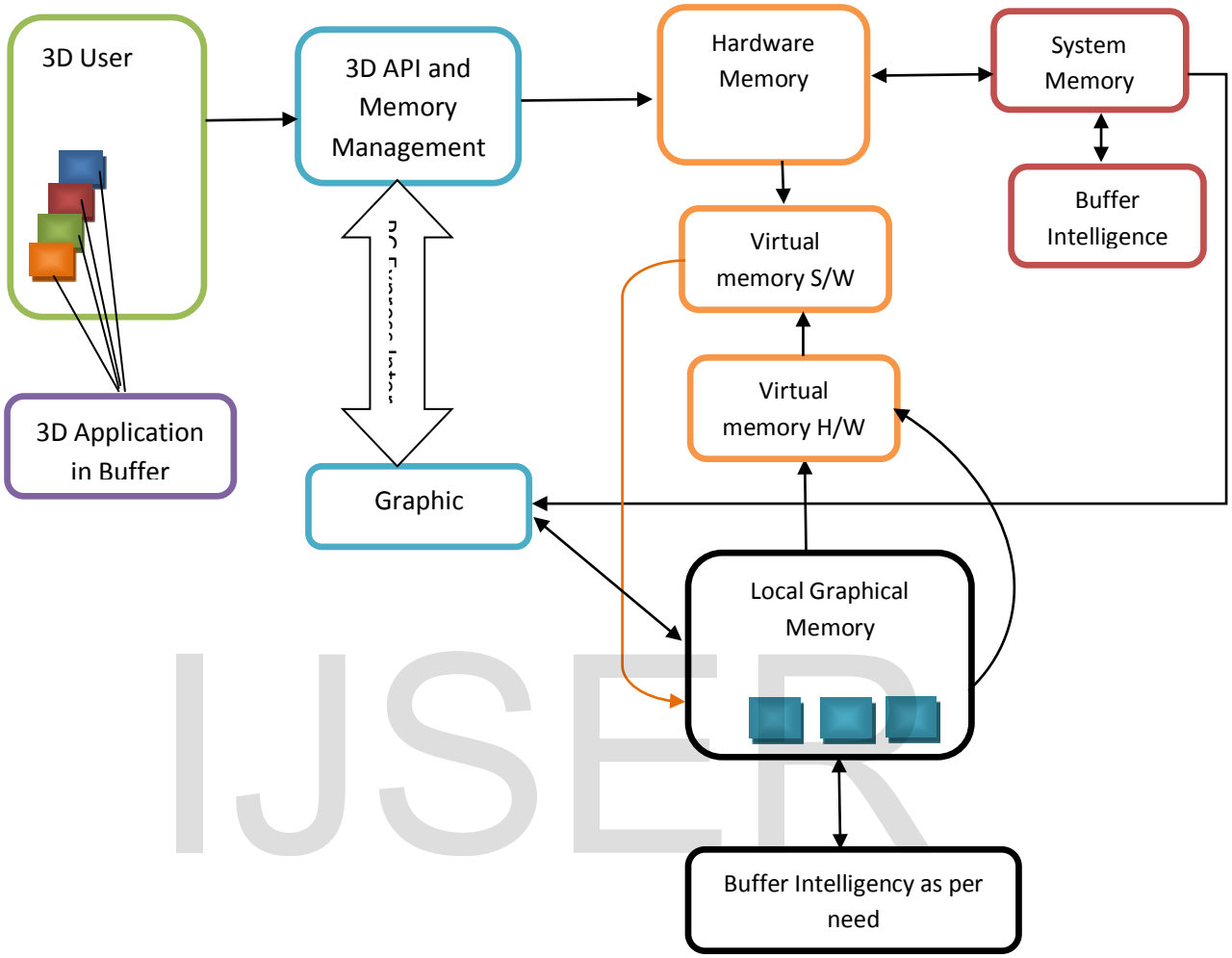

Fig. 6: Hyper Memory connected with Virtual Machine Hardware and Software

5. Conclusion

We have presented the mechanism used to manage memory resources to overcome the memory over committed problem. Our contribution includes novel technique and algorithm for allocating memory across virtual machines to deal with memory over commitment problem. It is quite clear that these two elements pre-emptive virtual memory and hyper memory will make best use to invest in using the virtual machine dynamically and comparatively expensive memory of local graphics as well. This forces the designers to use entirely featured VPUs (Visual Processing Unit) which should not cost them memories too high. This will surly a good investment for the customers as well.

References:

1. Jeremy Singer, L. V. (2013). *A Comparative Look at Adaptive Memory Management in Virtual Machines.*

2. Mauro Andreolini, S. C. (2010). *Dynamic load management of virtual machines in a cloud architectures. In Cloud Computing (pp. 201-214).* Springer Berlin Heidelberg.

3. Setzer, A. S. (2009). *Network-aware migration control and scheduling of differentiated virtual machine workloads. Garching, Germany.*

4. Subramanian S, N. K. (2012). *An adaptive algorithm for dynamic priority based virtual machine scheduling in cloud.*

5.7 Waldspurger, C. A. (2010). Memory Resource Management in VMware Server. *palo Alto, CA 94304 USA.*

6. Weng, C. (2011). *Dynamic Adaptive Scheduling for Virtual Machines.*

7. Zhao, W. (2009). *Dynamic memory balancing for virtual machines. VEE '09 Proceedings of the 2009 ACM SIGPLAN/SIGOPS international conference on Virtual execution environments.* New York,NY, USA: Association for Computing Machinery.

8. Berger, T. Y. (2004). *Automatic Heap Sizing: Taking Real Memory Into Account.*