Abstract - Changing trends in technologies, notably cheaper and faster memory hierarchies, have made it worthwhile to revisit many hardware-oriented design decisions made in previous decades. Hardware-oriented designs, in which one uses special-purpose hardware to perform some dedicated function, are a response to a high cost of executing instructions out of memory; when caches are expensive, slower or in scarce supply, it is perfectly reasonable to use hardware that do not compete with user applications for cache space and do not rely on the performance of the caches. In contrast, when the caches are large enough to withstand competition between the application and operating system, the cost of executing operating system functions out of the memory subsystem decreases significantly and software-oriented designs become manageable.

Keywords - Cache, cloud, Operating System (OS), Ram, Virtual Memory.

I. INTRODUCTION

Memory management is the act of managing the memory of the computer. The essential requirement of memory management is to provide ways to effectively allocate portions of memory to programs at their request, and free it for reprocess when no longer required. This is critical to any advanced computer where more than a single process might be underway at any time, like in the distributed system.

Several methods have been devised that increase the effectiveness of memory management in computer. Virtual memory systems separate the memory addresses used by a process from actual physical addresses, allowing separation of processes and increasing the RAM available by using paging or swapping to secondary storage. The quality of the virtual memory manager can have an extensive effect on overall operation of the system.

In hardware, memory management involves components that physically store data, such as RAM (random access memory) chips, flash-based SSDs (solid-state drives) and memory caches. In the operating system, memory management involves the allocation and constant reallocation of specific memory blocks to individual programs as user demands change.

Memory management is a complex field of computer science and there are many techniques being developed to make it more systematic.

The Central Processing Unit:

CPU of a computer is a micro processing chip that does most of the data processing. It performs the basic arithmetical, logical, and input/output operations of a computer system. The CPU is the brains of the computer - every instruction, no matter how simple or complex, has to go through the CPU. So let's say you press the letter 'y' on your keyboard and it appears on the screen - the CPU of your computer is what makes this possible.

Cache: is a storage space (buffer) it is a high speed memory device which stores high speed data from the processor before sending it to RAM since RAM works at a slower rate than the rate at which processor sends the data.

RAM or Random Access Memory:

RAM is an integrated circuit memory chip that allows information to be stored or accessed and the data is used by the operating system and other programs while the computer is in use. RAM is volatile, meaning that it exists only while the computer is powered on and changes along with the system's immediate requirements.
RAM is accessed with a high speed by the computer's systems and software and stores data and applications along with programs. The graphic user interface, or GUI, is also stored in RAM. Once the computer is turned off, RAM is cleared and only starts up again when the system is rebooted.

Virtual Memory:
This is an imaginary location for storing data, it is supported by the operating system and not in disk operating system (DOS), it allows the execution of processes that are not completely in the memory. Virtual memory is also a substitute for set of addresses. The purpose of virtual memory is to enlarge the address space, that is, the set of addresses a program can utilize. For example, virtual memory might contain twice as many addresses as main memory. A program using all the virtual memory therefore would not be able to fit in main memory all at once, the program could execute it by copying it into the main memory those portion of the program, that are need for execution.

Disk Storage:
It is a drive, a randomly addressable and rewritable storage device. Conceptually disks are simple.

II. TYPES OF MEMORY MANAGEMENT
- Hardware memory management
- Operating system memory management
- Application memory management

These are described in more detail below. In most computer systems, all three are present to some extent, forming layers between the user’s program and the actual memory hardware. The Memory Management Reference is mostly concerned with application memory management.

A. Hardware memory management
Memory management at the hardware level is concerned with the electronic devices that actually store data. This includes caches memory and RAM.

B. Operating system memory management
In the operating system, memory must be allocated to user programs, and utilize by other programs when it is no longer required. The operating system has also the features of virtual memory, it can pretend that the computer has more memory than it actually does, and also that each program has the machine’s memory to itself.

C. Application memory management
Application memory management involves supplying the memory needed for a program’s objects and data structures from the limited resources available, and reprocessing that memory for reuse when it is no longer required. Because application programs cannot in general estimate in advance how much memory they are going to require, they need additional code to handle their changing memory requirements.

Application memory management combines two related tasks they are:

1.) Allocation
When the program requests a block of memory, the memory manager must allocate that block out of the larger blocks it has received from the operating system. The part of the memory manager that does this is known as the allocator.

2.) Recycling
This occurs when memory blocks have been allocated, but the data they contain is no longer required by the program, then the blocks can be recycled for reprocess. There are two approaches to recycling memory: either the programmer must decide when memory can be reused this is known as manual memory management, or the memory manager must be able to work it out this is known as automatic memory management.

An application memory manager must usually work to several constraints, such as:

1) CPU Overhead:
This is the measure of the extra time taken by the memory manager while the program is running.

2) Pause Times:
These is the time it takes for the memory manager to get done with an operation and return control to the program.

This affects the program’s ability to respond immediately to interactive events, and also to any asynchronous event such as a network connection.

3) Memory Overhead:
This shows the size of space wasted for administration, rounding, this is known as internal fragmentation, and also the poor layout, known as external fragmentation.

The basic problem in managing memory is knowing when to keep the data it contains, and when to throw it away so that the memory can be used for reprocess. This sounds easy, but it is, a hard problem in an ideal world, most programmers wouldn’t have to worry about memory management issues. There are many ways in which poor memory management can affect the reliability and speed of programs.

III. TYPICAL PROBLEMS OF MEMORY MANAGEMENT
A. External fragmentation
This occurs when the total memory space is available to satisfy a request, but it is not together in sequence; storage is
fragmented into a large number of small hole. The wasted space not allocated to any partition is called external fragmentation, which may be due to a poor allocator.

B. frees and dangling pointer

This occurs when program free memory, but trying accessing it later and crashes. This condition is term as premature free, and the surviving reference to the memory is called dangling pointer.

C. Memory leak

This occurs when programs continually allocate memory without ever giving it up and eventually run out of memory. This condition is known as a memory leak.

D. Interface complexity

This occur when object are passed between block, the interface design must consider the management of the memory. When the interface is complicated it will be difficult incase of debugging tools because the code will not be able to be shared.

E. Inflexible design

Memory managers can also contribute to a serious performance problem, if they design was for another purpose and it is been used in a different way. These problem occurs due to the fact that memory management solution tends to make the way in which the program is going to use memory. Such as reference pattern.

The following examples demonstrate the use of the memory management functions:

- Address windowing extension (AWE)
- Allocating Memory from a non-uniform memory access(NUMA)
- Creating guard pages
- Determining the amount of heap
- Getting process heap
- Reserving and committing memory
- Using file mapping

IV. PROPOSAL

Virtual memory is a common part of most operating systems on desktop computers. It helps in storing information thereby improving the memory manager of the system. It has become so common because it provides advantages for users at a very low cost. When we say users referring to a high scale user environment and your desktop at home.

Most computers today have something like 64 or 128 megabytes of RAM (random-access memory) available for use by the CPU (central processing unit). Often, that amount of RAM is not enough to run all of the programs that most users expect to run at once. For example, if you load the Windows operating system, an e-mail program, a Web browser and word processor into RAM at the same time, 64 megabytes is not enough to hold it all. If there were no such thing as virtual memory, your computer would have to say, “Sorry, memory full. Please close an application to load a new one.” With virtual memory, the computer can look for areas of RAM that have not been used recently and copy them onto the hard disk. This frees up space in RAM to load the new application. Because it does this automatically, you don't even know it is happening, and it makes your computer feel like is has unlimited RAM space even though it has only 32 megabytes installed. Because hard-disk space is so much cheaper than RAM chips, virtual memory also provides a nice economic benefit.

However the only disadvantage of Virtual Memory is that, if your system has to rely too heavily on virtual memory, you will notice a significant performance drop. The key is to have enough RAM to handle all the operation you tend to work on simultaneously. Then, the only time you "feel" the slowness of virtual memory is in the slight pause that occurs when you change tasks. When you have enough RAM for your needs, virtual memory works beautifully. The operating system has to constantly take part in the exchange of information back and forth between RAM and the hard disk. This is called thrashing, and it can make your computer extremely slow.

V. CONCLUSION

Memory management is virtual to all computer system, this improves the productivity, and productivity means the total throughput of a computer system. Throughput is limited by how many job can be fixed into the available memory, and how fast the job can executes. Such as primary magnetic storage example a high capacity floppy disks and optical storage and when connected to the network, cloud will also serve as a good storage, thereby minimising the amount of space that could have been used by the computer memory. Virtual memory is a component of most operating systems, such as Windows and Linux. Virtual memory has a very important role in the operating system. It allows us to run more applications on the system than we have enough physical memory to support. Virtual memory is simulated memory that is written to a file on the hard drive. That file is often called page file or swap file. It's used by operating systems to simulate physical RAM by using hard disk space.

Storage is a repository that enables users to store and retrieve this digital data, therefore there is need for storage devices, so as to hold the data / information even when the computer is turn off, so that the information can be used when needed.
REFERENCES


[4.] Memorymanagement.org, a small old site dedicated to memory management.
