Module 5: Critical Thinking

Evaluate and experiment with virtual memory settings on a computer

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Stallings defines virtual memory as “a storage allocation scheme in which secondary memory can be addressed as though it were part of main memory" (Stallings, 2019, pg. 343). With my computer having 16 GB of RAM, I wondered how turning off virtual memory, and doubling virtual memory space would affect the performance of my computer. This paper discusses observations made when adjusting virtual memory settings when running different resource-intensive programs.

Computer Specifications

The computer that I used runs on the Windows 10 (64-bit) operating system, with an AMD Ryzen 7 3700X 8-Core Processor (64-bit) running at 3.60 GHz and an AMD Radeon RX 5700 XT GPU. The computer also contains 16 GB of RAM. My virtual memory settings were set to automatically manage paging file size for all drives and when I had no active applications running, the paging file size was set to 3332 MB. Microsoft says that “a PC should have a minimum page file size of RAM, plus an extra 257 MB” and for the maximum, “the page file size should be 3 times that of the system RAM” (Zafar, 2022, para. 10-11). Soysal explains that when the “paging file size is smaller than RAM size, new allocations of managed memory are granted, which leads to more garbage collection and higher CPU usage” (Soysal, 2021, para. 4 ).

The two applications that I focused on when making observations of the CPUs performance when adjusting the virtual memory setting is Microsoft Flight Simulator and the Google Chrome web browser. The system requirements of Flight Simulator include 8 GB of RAM at the minimum, but 16 GB is recommended (Steam, n.d.). It also has a minimum requirement to have an AMD Ryzen 3 1200X, which has 4 CPU cores (AMD, n.d.). For the Google Chrome Browser, each web browser tab “is itself an instance of the application with all the general processes” and “each Google Chrome tab takes up RAM space” (Mills, 2022, para. 4).

With my computer running on the Windows 10 Home Operating System, and an AMD Ryzen 7 3700X 8-Core Processor running at 3.60 GHz with 16 GB of RAM. Both the operating system and processer are 64-bit. The computer is also running with 16 GB of RAM. Before experimenting with the virtual memory settings on my computer, virtual memory paging file size was set to 2457 MB.

No Virtual Memory

With virtual memory turned off, I noticed that the load times for Microsoft Flight Simulator was slower than usual. I was able to navigate through the main menu and select the plane and location I was going to fly with no issue. When I had the level load, I did not see a decrease in image quality, but once I started to look around the cockpit and start flying, Flight Simulator crashed unexpectedly. I will note that when I had the game running, my RAM utilization was at 8.4 GB, which is about 50% of what was available. Considering that the minimum requirements for Flight Simulator is a processor with 4 cores, and the fact that virtual memory allows “core processes to share memory between libraries, which consists of written code that provides the foundation for a program's operations”, I can understand why Flight Simulator would crash (Rand, 2021, para. 7).

Knowing that Google Chrome takes up RAM with each tab being opened, I began to repeatedly open a lot of new tabs, while watching the memory utilization on task manager. When the RAM utilization went up to 10 GB of RAM (out of the 15.9 GB available), I noticed that the background image of my desktop went black, and when the RAM utilization went to 12 GB, my three monitors began to flicker, and I got the Blue Screen of Death (BSOD). I was opening tabs in Chrome at a rapid rate, so it is possible that my CPU ran out of main memory, and task manager was unable to keep up with the statistics at that point, ending up crashing the computer.

Large Page File

As recommended, I set the minimum page file size to the size of my computers RAM, which is 16 GB. For the maximum page file size, I thought that going the recommended triple size of RAM of 48 GB was overkill, so I went with double, for a maximum page file size of 32 GB. Setting the page file size to 32 GB, my storage space decreased by 32 GB, however, it is a drop in the bucket when you have a 1 TB SSD. When I played Microsoft Flight Simulator, the game ran smoothly, and I was able to fly without the program unexpectedly crashing. When I was watching the size of the paging file with performance monitor, I noticed that the page file usage was at 0.018% but had a peak of .025%, which was about 0.4 GB of virtual memory space at the max.

When opening a lot of Google Chrome tabs, I was able to continuously open tabs without any unexpected behavior. I opened enough tabs to take up 10.6113 GB of RAM, and I noticed that the paging file usage was increasing, going up to 0.82% of the Paging file. When I opened some of the chrome windows to close them, it did take more time than normal to pull up the screen and close than what I am used to seeing, but the computer did not crash. This is because some of the tabs that were not active were being placed in virtual memory, allowing for more room for more processes to be active in main memory.

Conclusion

Virtual memory played an important role in keeping the applications and my computer operating smoothly, without any unexpected crashing. When main memory was being stressed, my computer was able to place some of the inactive processes into virtual memory when I was opening numerous Google Chrome pages. Virtual memory also played an important role when I was running an application that has a minimum requirement of a processor with four cores. The page file can be used for multi-processing, as it allows memory to be shared across core processes. When I set the page file size to 32 GB, the amount of the page file was minimal relative to the size of the page file, however, I did notice a spike of page file usage when running resource intensive programs such as Microsoft Flight Simulator and Google Chrome. Virtual memory helps to maintain the stability of applications and the computer itself, preventing unexpected crashing, and also allows shared memory between libraries.

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