12.13.3 Virtual Memory Facts

Virtual memory is simulated memory that is implemented as a page file on a hard drive. Virtual memory is used by operating systems to simulate physical RAM using hard disk space. The process of moving data from RAM to disk (and back) is known as *swapping* or *paging*. The Virtual Memory Manager (VMM) is in charge of swapping data between physical memory and the hard disk. The VMM follows these steps to manage applications:

1. The VMM assigns virtual addressing to an application. This is known as *logical segmentation*.
2. The application is then loaded into physical RAM (absolute address space). The process doesn't recognize its location in physical RAM; it only recognizes its virtual space.
3. As the user launches other applications, the VMM will allocate space to those applications in true physical RAM.
4. When there is no more space in physical RAM, the VMM will take the application that hasn't been used for the longest period of time and place it in the *page file* on the hard drive. This is known as *paging out*. Likewise, when an application is moved from the page file back into physical RAM, it is known as *paging in*.
5. If the system needs access to an application that has been paged out from physical RAM, this causes a problem known as a *page fault*. When this happens, the VMM will page out the program in the physical RAM that hasn't been used for the longest period of time to the page file on the hard drive, and will page in the application currently being accessed back to the physical RAM.

Some things to remember when working with virtual memory are:

- Accessing data stored in RAM is faster than accessing data on disk (or in virtual memory).
- Symptoms of low physical memory include slow system performance when running applications, or slow response when switching between applications.
- Disk thrashing occurs when the amount of physical memory is so low that data must constantly be moved from physical RAM, to disk, and then back again.
    - Symptoms of disk thrashing include high disk access statistics and the hard drive light being lit constantly when no data is being written to or read from the hard disk.
    - To prevent disk thrashing, either run fewer applications or add more physical RAM.
- Manage virtual memory performance go to Control Panel>System and Security>Advanced system settings>Advanced tab> Performance/ Settings>Advanced tab >Virtual memory.
- By default, the Windows operating system manages virtual memory settings. The automatic settings are usually adequate. However, the maximum size of the virtual memory paging file and the disk where the paging file is stored can be manually configured.
- The most common recommended minimum page file size is about 1.5 times the amount of physical RAM. However, there are exceptions to this rule:
    - Systems that have a very small amount of physical RAM installed may require a page file that is 2 times the size of the installed RAM.
    - Systems with very large amounts of physical RAM installed typically don't require a large page file.
- To increase performance, move the page file to a different physical disk than that used by the operating system. You can also divide the paging file between two drives to increase performance.
- If the paging file is on the system drive, Windows creates a memory dump file if the system crashes. Support personnel might be able to use this file to help identify what caused the system crash. To save a memory dump, the paging file must reside on the system partition.

    It is better to install more physical RAM if your system is using a lot of Virtual Memory.