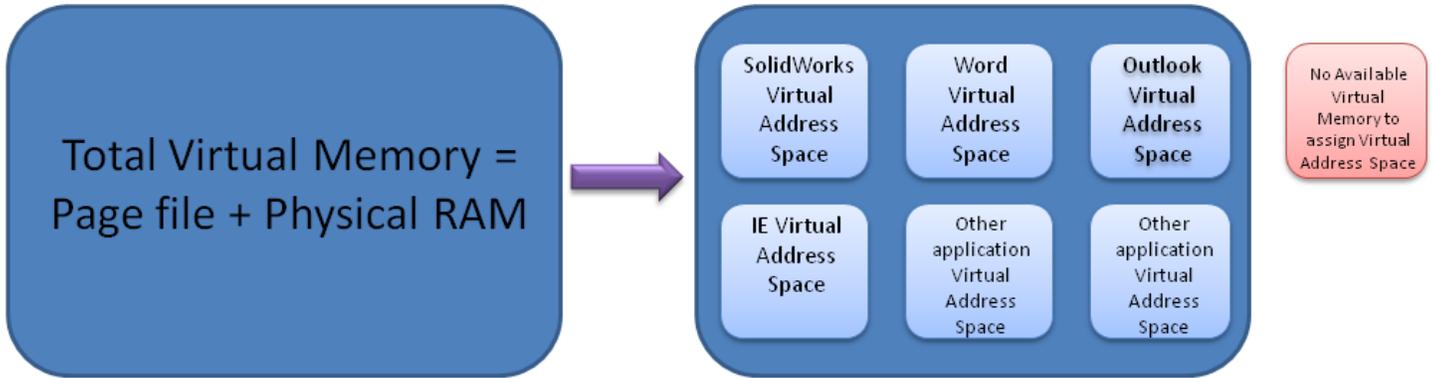# SolidWorks and Memory

The purpose of this document is to provide answers to common questions surrounding how Windows handles memory and its effect on SolidWorks. The complexity of memory management limits the scope of this document; however we will cover the principles and provide some specific examples. Outlined below are the four different memory definitions that you will need to be concerned about.

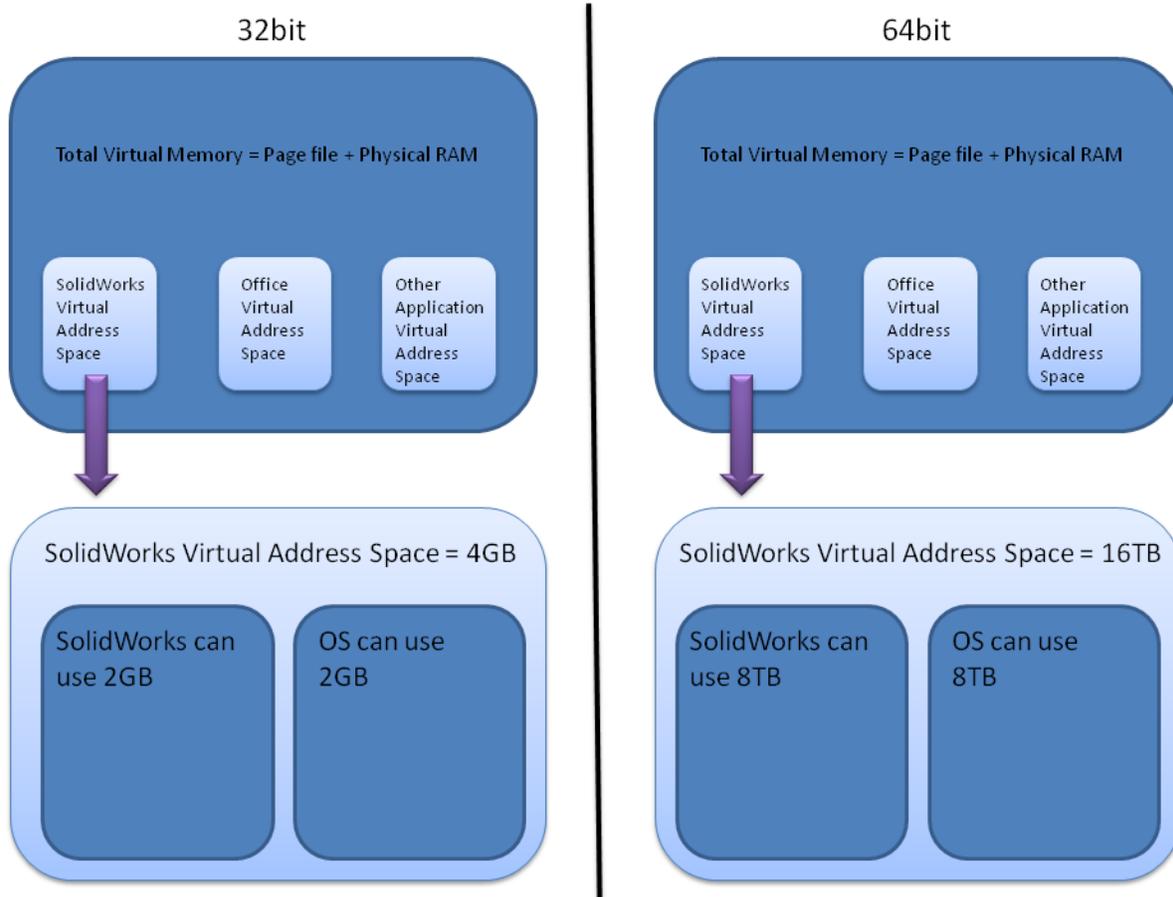|	
Physical RAM	These are the RAM modules physically installed in your computer.
Page File	This is a file on your hard drive named pagefile.sys. When the memory in use by all the existing processes exceeds the amount of RAM available, the operating system will move pages (4 KB pieces) of one or more virtual address spaces to this file, thus freeing that RAM frame for other uses. There can be one such file in each hard drive partition.
Virtual Memory	Virtual memory is the total virtual address space that can be used by all of your software and your operating system. The total virtual memory on a computer is determined by page file + physical RAM. As more applications are opened, they use up more of the total virtual memory that is available. If there is no virtual memory available, all applications become unstable. This can mean crashing, slow performance, or unintended behavior of the applications. Virtual Memory is represented by the dark blue box in the picture below.
Virtual Address Space	Only a set amount of the virtual memory can be used per process. This amount of virtual memory is defined by the assigned virtual address space. All threads of a process can access its virtual address space. However, threads cannot access memory that belongs to another process, which protects a process from being corrupted by another process. Each light blue box below represents the virtual address space assigned to each process, which is using up portions of the total virtual memory. The pink box represents a process that cannot be assigned any virtual address space because all of the total virtual memory is currently assigned to other processes.

Total Virtual Memory = Page file + Physical RAM

SolidWorks Virtual Address Space | Word Virtual Address Space | Outlook Virtual Address Space | IE Virtual Address Space | Other application Virtual Address Space | Other application Virtual Address Space | No Available Virtual Memory to assign Virtual Address Space

How much total virtual memory can I have?

SolidWorks is a process, which means it cannot use all of the total virtual memory. It is limited to the assigned virtual address space. The amount that can be addressed per process depends on the operating system and how much virtual memory is available. The maximum amount of virtual address space will not always be the same per process and can change depending on your application load and how much virtual memory is available.

On a 32bit operating system, the maximum amount of virtual address space a single application can use is 4GB. The 4GB is split in half; 2GB for its interaction with the OS and 2GB for the application itself. On a 64bit system, the maximum amount of virtual address space a single application can use is 16TB which is also split in half; 8TB for its interaction with the OS and 8TB for the application itself. See below:

32bit

Total Virtual Memory = Page file + Physical RAM

SolidWorks Virtual Address Space | Office Virtual Address Space | Other Application Virtual Address Space

SolidWorks Virtual Address Space = 4GB

SolidWorks can use 2GB | OS can use 2GB

64bit

Total Virtual Memory = Page file + Physical RAM

SolidWorks Virtual Address Space | Office Virtual Address Space | Other Application Virtual Address Space

SolidWorks Virtual Address Space = 16TB

SolidWorks can use 8TB | OS can use 8TB

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	32bit Any OS	X64 XP	X64 Vista	X64 Windows 7
Maximum Total Virtual Memory	16TB[1]	16EB[2]	16EB[2]	16EB[2]
Virtual address space per 32bit process	4GB/2=2GB	4GB[3]	4GB[3]	4GB[3]
Virtual address space per 64bit process	n/a	16TB/2=8TB	16TB/2=8TB	16TB/2=8TB
Maximum RAM	4GB	128GB	128GB	192GB
Maximum Page File	16TB[1]	16TB[1]	16TB[1]	16TB[1]

1. Terabytes
2. Exabytes
3. 4GB is only attainable if the 32bit process is written to take advantage of extended memory. Otherwise, the maximum is 2GB.

Note: Keep in mind that your maximum total virtual memory is currently limited by the hardware and operating system.

Should I have more page file or more RAM?

It is recommended that RAM should make up as much virtual memory as possible. Increasing page file is not recommended because it is significantly slower than RAM and uses a substantial amount of hard drive space. RAM is much faster and will improve performance dramatically compared to increasing page file.

If your total virtual memory is made up of more page file than RAM, windows will use more page file instead of RAM which can lead to a severe decrease in performance. This is why we recommend setting your page file appropriately based on your application load.

When a Windows operating system is installed, a page file is created that is one and a half times the amount of RAM that is installed in the computer provided there is sufficient free space on the system hard disk. In most circumstances, this value should be sufficient. However, if you have enough RAM, a page file may not even be required.

To help determine how much page file you should have, please review this Microsoft Knowledge Base article.

SolidWorks is running out of memory, what do I do?

There can be many causes for "out of memory" errors. So the recommended course of action would be to first identify why you are running out of memory, then make the appropriate actions based on your discovery. Please consult the Hawk Ridge technical support staff for further details. In general, we follow these guidelines:

- Check that you have enough total virtual memory
- Check how much memory is being used by SolidWorks
- Install more RAM if possible
- Enable the /3GB switch
- Upgrade to a 64bit operating system

The task manager does not accurately report virtual memory usage for applications. Hawk Ridge Systems recommends using the windows performance monitor instead. This can be setup to accurately monitor the exact virtual memory usage of SolidWorks and other applications. See our performance monitor guide for setup details.

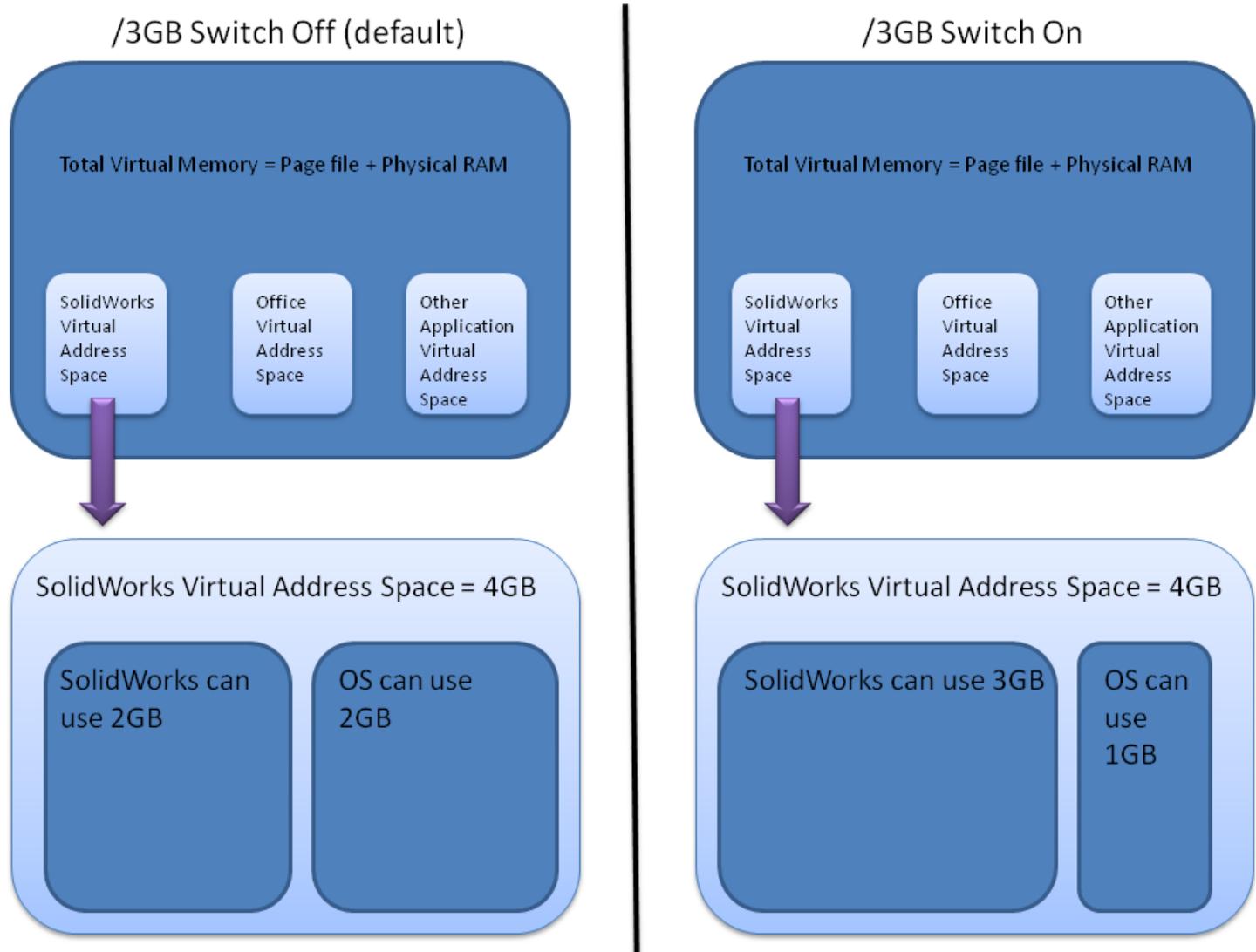5707 Redwood Road, Suite 18, Oakland, CA 94619
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If I cannot upgrade to a 64bit Operating System, is there anything I can do?

The first thing you can do is install a total of 4GB of system RAM. You can also try to simplify the file by reducing features, creating simplified configurations, lowering the rendering resolution, or reducing the complexity of the simulation study. Please consult the Hawk Ridge Systems technical support staff for specific recommendations as each case may be different.

Another option would be enabling the /3GB switch. The /3GB switch can be used for temporary usage for opening large files or one time renderings. It changes how the 4GB of virtual address space is split between the process and the operating system. Instead of splitting the 4GB in half, it gives 3GB to SolidWorks and 1GB to the operating system. See the pictures below. See our /3GB switch document for precautions and setup details.

/3GB Switch Off (default)

Total Virtual Memory = Page file + Physical RAM

SolidWorks Virtual Address Space

Office Virtual Address Space

Other Application Virtual Address Space

SolidWorks Virtual Address Space = 4GB

SolidWorks can use 2GB

OS can use 2GB

/3GB Switch On

Total Virtual Memory = Page file + Physical RAM

SolidWorks Virtual Address Space

Office Virtual Address Space

Other Application Virtual Address Space

SolidWorks Virtual Address Space = 4GB

SolidWorks can use 3GB

OS can use 1GB

Where can I get more information?
http://support.microsoft.com/kb/308417
http://support.microsoft.com/kb/555223
http://support.microsoft.com/kb/307886
Mark Russinovich's technical blog

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