Fine Tuning Your SAW System

System Requirements

The Software Audio Workshop is designed to run under Microsoft Windows 3.1 or higher on a 386-40 MHz or higher PC compatible machine.

You must have a minimum of 8 megs of RAM memory and we suggest a minimum of 200 megs of hard disk SoundFile storage space.

It is recommended that you have a separate hard drive of 245 megs or more for audio data storage.

You need a mouse or similar pointing device and we recommend a minimum SVGA video resolution of 800 x 600.

Maximizing Your System's Speed

Of course, using a faster computer, like a 486/50 or 486/66 or higher will theoretically improve overall performance by default, one of the most important factors contributing to maximizing *SAW's* performance is the transfer rate of your disk data. Using fast SCSI II disk drives, or the newer Enhanced IDE drives helps considerably. Also, a Vesa Local Bus hard disk controller can improve hard disk access speeds.

By using the Hard Disk Speed Test program provided with the *SAW* Demo, you can get a good indication of how fast *SAW* can move data from your hard disk into memory. Run the write test and then the read test on the same file. By using some of the techniques provide in this document, you may find that you can drastically improve your disk speed for use within the *SAW* environment.

The HD Speed program will create a 5mb file during the write test. Use this same file for reading each time you change something in the system and check the speed again for a comparison. When you are through, make sure to delete this file in the File Manager.

Windows Efficiency Tips

Hard disk recording and editing requires complex manipulation of DMA (On Most Cards) and hardware & software interrupts. If you have no specific need to run Windows in 386 Enhanced Mode, it is Recommended That You Run Windows In Standard Mode when using the SAW application.

System overhead requirements are much less demanding in Standard Mode and timing accuracy is much more stable. On the whole, Standard Mode seems to improve overall system speed also.

You may force Windows to run in Standard Mode by typing *WIN /S* at the DOS command line when you start Windows.

In many cases, however, Enhanced Mode can offer speed advantages with some high-end controller/harddrive combinations. Compare the difference between Standard / Enhanced modes. Make sure Virtual Memory is set to "None", and if the "32-Bit Disk Access" button is present, try selecting it.

If you decide to run Windows in Enhanced Mode, it is highly recommended that you turn off the Virtual Memory Disk Swapping in the Windows Control Panel, in order to maximize SAW's ability to allocate larger DMA and disk buffers.

SmartDrive Suggestions
The SmartDrive Disk Cache that comes with Windows should be adjusted so that Write Caching is defeated. This greatly enhances the recording speed to disk and helps eliminate possible glitching problems that might otherwise occur.

The following example sets a typical Windows SmartDrive installation to eliminate Write Caching on the C harddrive. It also adjusts the cache size from 1024 kbytes in DOS to 512 kbytes in Windows, giving Windows more memory to use for applications. Note that defeating the cache on a second audio drive will help audio file throughput. The SmartDrive line is modified in the Autoexec.bat file to read as follows:

C:\WINDOWS\SMARTDRV.EXE 1024 512 C D-

If you are using Windows For WorkGroups 3.11 you should check the 32-bit file/disk access areas to make sure that any write caching is defeated here as well. We suggest not checking the 32 Bit File Access box, and also set the cache size under that box to 128.

In many cases, removing SmartDrive or any Disk Cache, will improve disk throughput significantly for *SAW*.

Memory Suggestions
HIMEM.SYS or some other high memory manager should be used along with DOS 5.0 or higher so that DOS may be loaded in high memory.

A typical setup in the Config.sys file might look like this:

DEVICE = C:\DOS\HIMEM.SYS
DOS = HIGH

Using the EMM386.SYS expanded memory manager is not recommended. If you need expanded memory for other DOS programs, try using a memory manager such as QuarterDeck's QEMM386®.

Files & Buffers Suggestions
DOS should be told to allow for at least 50 Files and also to reserve about 20 Buffers.

A typical setup in the Config.sys might look like this:

FILES=50
BUFFERS=20

Disk Compression Utilities
Disk compression schemes which attempt to increase your hard disk size by compressing data on the fly will usually not work with high quality audio files. The audio data is too random for the compression algorithms to operate efficiently on and will usually cause a serious reduction in disk transfer rate times, or stuttering during play/record.

32 Bit Disk Access
If you have a VESA Local Bus Motherboard with a 32 bit VL Local Bus Disk Controller installed, or are using a Western Digital or compatible hard disk, you may experience significant speed increase of disk reads and writes by using Enhanced Mode with Virtual Memory Turned OFF and 32 Bit Disk Access Turned ON. The 32 Bit Disk Access can talk directly to Western Digital and certain other disk controllers with 32 Bit routines that eliminate the need to switch to Real Mode for disk access. This can result in significant speed increases for disk reads and writes.

To turn on 32 Bit Disk Access, start Windows in Enhanced Mode (by typing WIN at the DOS prompt) and open the Windows Control Panel application. Select the 386 Enhanced icon and select the Virtual Memory button. Change the Virtual Memory setting to NONE and check the 32 Bit Disk Access box. If there is no 32 Bit Disk Access box as an option, your system is not compatible with this method of disk handling.

General Suggestions
If you're using a Video Accelerator card, try selecting a "Plain-Jane" mode like 800x600x16 and compare the results. Video Drivers with large amounts of colors (Greater than 256) can significantly slow down the system.

Verify that your system is set to the fastest speed. If you have a "Turbo" switch, don't assume the presence of a Turbo light means you're in Turbo mode. Other settings like CMOS Memory Wait States, Bus Timing settings, etc. may have an effect on your system's speed. Use a program like Norton's SI to get a speed rating on your CPU and make sure you are at the faster setting.

If you're using a VLB disk controller, verify that its supplied drivers are properly installed, and, using HDSPEED, compare results with the driver removed.

If you're not using a Microsoft, or Logitech Mouse, try selecting the standard Microsoft Mouse driver, or a Microsoft Mouse and compare results. Some mouse drivers have been shown to significantly slow down machine performance.

Extra Technical TuneUp Tips (Excerpts From Text Contributed By Chris Smith)
Many questions have been asked about loading drivers and programs high. First of all the purpose of loading drivers etc. high (into the UMB) really only helps DOS programs, windows programs use extended memory (>1MB) and loading high

diminishes usable extended memory. Also it should be noted that UMB access can be slower than conventional memory access therefore unless there is some compelling reason (use of DOS programs that require much conventional memory) to loadhigh one should not do so.

Here is a quote from the W4WG resource kit:
"Although EMM386 can provide more free conventional memory by loading programs and device drivers into UMBs, this only helps when running MS-DOS based applications. Windows for WorkGroups 3.11 uses extended (XMS) memory to run the Windows operating system and Windows based applications. Accessing device driver and application code from UMBs is slower than accessing the same code directly from conventional memory. To maximize the performance when accessing MS-DOS based device drivers, it is recommended that EMM386 (or similar third-party memory managers) not be used. In addition to possible performance penalties, EMM386.EXE will use approximately 150K of XMS (extended) memory to provide a mappable memory range for the UMA in which to load device drivers."

As a note, the WIN=XXX-XXX statements in your EMM386 line do not help windows programs. They reserve space for DOS programs running under windows.

Most programs benefit from a disk cache, but a hard disk cache, which normally increases the apparent speed of the disk, gets in the way when a constant stream of data larger than the cache size is being written or read since the cache fills and must be flushed before continuing (sort of like a marathon runner hitting the wall). Therefore the drive that you are recording to should be set up with no cache (either SmartDrive or 32bit file access {W4WG 3.11}).

32 bit file access is a disk cache supplied with W4WG 3.11. It uses a virtual fat table and supersedes SmartDrive (SmartDrive will not cache the drives that 32bfa does). It is very fast but it is not recommended for use in your saw setup.

Also note that when using most SCSI controllers and accessing extended memory (using EMM386 or running Windows) you usually must (to avoid serious crashes) run EITHER the SmartDrive double_buffer *OR* the SCSI controllers ASPI driver (I haven't yet seen a case where both are needed). In every benchmark I have run, the ASPI driver yielded better performance (than double buffering) plus it supplies support for the SCSI CD-ROM and tape drivers. Also the the SCSI ASPI driver should be the first driver loaded in your config.sys (yes, before HIMEM.SYS which should be second).

In most cases SETVER should not be needed. It's purpose is to '*lie*' to the programs in its table about the version of DOS that the program is running on. It's most unlikely that you have a need for it in the Windows environment. Unfortunately the Windows/DOS setup will automatically install SETVER and in the case of a SCSI drive, double buffering (which could actually be helpful if you forgot to load your ASPI driver).

Also note that SHARE is not needed with WorkGroups 3.11 as it provides a virtual driver (vshare) to handle this function.

If you are using Windows For WorkGroups and are not running on a network, and you have a *SAW* setup (no cache, including 32bfa & no swapfile) you wont need to load IFSHLP.SYS.

Typically the HIMEM.SYS, EMM386.EXE and possibly SMARTDRIVE.EXE files that ship with 3.11 are newer versions than those DOS 6.2 provide. The best way, in order to save space and prevent duplicate files, is to move the newer versions (make sure they are first) from the windows directory to your DOS directory overwriting the old ones, then make sure your config and autoexec point to the correct directory.

Other ways to conserve memory-
Make sure your LASTDRIVE statement refers to the last drive letter needed (if not on a network or using a ramdisk, your last physical drive).

Try a smaller environment size (the /E parameter in the SHELL= line). If running windows only programs you may be able to use the smallest(160). To find out how many bytes are actually being used in your environment type "SET > filename.TXT" then check the size of the file you just created.

Unless your are running programs that use the older File Control Blocks versus file handles use FCBS=1,0.

When using a disk cache set BUFFERS=8,0 (this should also improve performance).

Also set STACKS=0,0 unless this causes stack overflow problems with your software.

Unless you need a mouse driver for DOS programs don't bother, Windows has it's own.