

THE HARDWARE

Hardware is the physical pieces of computer equipment that you use. The central piece of hardware in a music technology setup is a computer. Nowadays this can be either a PC or an Apple Macintosh, and there are numerous different types of each available.

TYPES OF COMPUTER

Either a PC or Mac can be used for making music, and users are divided into two equal camps. Generally the same software is available for both. There are a variety of reasons why some people prefer Macs over PCs and vice versa, but the main reasons are below ;



Macs

- Built from the ground up by one manufacturer, meaning that all components are compatible
- Apple now own Emagic and no longer support PC's. Therefore if Logic is your sequencer of choice you need a Mac in the future
- Look good
- Can't really be upgraded

PCs

- PC's are cheaper if you build your own, as there are many different manufacturers making components, the competition keeps the price down
- Easily upgradeable and can be built fairly easily
- Massive range of software available
- Due to the wide variety of components, there can be compatibility problems which can be a nightmare to resolve

WHAT COMPUTER DO I NEED?

A few years ago the PC wasn't thought of as reliable enough for professional use for music, but there are now many specialist music PC retailers who provide pre-configured packages complete with technical support;

Red Submarine
Carillon
Inta Audio
Digital Systems
Digital Village

Since the arrival of these companies, PCs are more common in professional studios.

Deciding on what sort of computer to buy can be difficult. If you are intending to make music on a computer, then be wary of buying one from a general computer shop. It is far better to buy one from a specialist retailer who can give you appropriate technical support.

The choice between Mac and PC is really down to preference, and that preference now extends to choice of sequencing software. If you want to use Logic, get a Mac. Other than that, there are no rules.

Once you have decided between Mac and PC, then you need to look at what you will be doing with the computer. If you want to record lots of audio, then you need a big hard drive, but can afford a slower processor. If you wish to use the computer to replace the entire studio and want it to make sounds as well as record them, then the processor speed becomes more important.

A general rule is not to buy the top of the range, as in a short time it will have halved in price.

MIDI

MIDI (Musical Instrument Digital Interface) is a universal standard for keyboards, drum machines and synthesizers to communicate.

Sequencing is the recording, editing, storing and playing back of MIDI information. It is different from conventional tape recording as no sound is recorded, only information about what notes are being played.

EDIROL UM-2 USB MIDI Interface



THE CHOICE OF MAC

Apple Mac computers come in 3 forms – laptops (iBook and Powerbook), all in one formats (eMac and iMac) and desktops (Power Mac G4 and Power Mac G5). The cheapest are the eMac which are around £500 and the iBook at around £800. The most expensive, and the ones most used in recording studios are the Power Mac G5's, which start at £1500 (plus monitor).

THE CHOICE OF PC

Choosing a PC can be more complicated. You could buy from a specialist retailer, for instance Phil Rees (www.philrees.co.uk) supply a budget music PC for £500 which is capable of most recording tasks, or at the other end of the scale Inta Audio (<http://inta-audio.co.uk>) supply the Elite workstation for £2000.

THE OTHER CHOICE

The other choice is to build your own or buy a PC from a normal retailer, specifying certain components. You can do this simply by researching what music PC retailers use for their machines, and then buying these components elsewhere. Be aware that the technical support from a normal PC retailer will be poor compared to the music PC retailer.

As a general rule of thumb, the following manufacturers are most commonly used for music PCs:

COMPONENT (Manufacturer)

MOTHERBOARD (Asus)

Ensure it has an Intel chipset

PROCESSOR - CPU (Intel)

The newest processors cost a lot more than ones that are 6 months out of date, so pick one of those

MEMORY (Crucial, Geil)

Ensure you buy the correct memory for your motherboard – the Crucial memory website will tell you what you need for your computer

HARD DRIVE (Seagate)

The Seagate Barracuda is a popular drive for reliability and noise

GRAPHICS CARD (Matrox, ATI)

Some support more than one monitor, which is great for music technology

THE SOUND CARD

Once you have decided on the computer system, you will need a soundcard to go with it. Most computers have built in sound, but it is generally of a low quality and needs to be replaced by a sound card or audio interface.

Some sound cards are installed inside the computer, and are called PCI cards. Others are external and connect either to a PCI card inside the computer, or via a USB or Firewire cable. The ones that connect with USB or Firewire are the most flexible as they can also be used with laptop computers, whereas PCI cards can't.

Again your choice depends on what you are going to be doing with the computer. Below are some examples:

TYPE OF WORK	OTHER EQUIPMENT	TYPE OF SOUND CARD	EXAMPLES
Recording bands	None	Needs to have many inputs for microphones, but not many outputs as mixing will be inside computer	MOTU 896HD (firewire) £1000 – 8 high quality mic inputs and 8 outputs
Recording bands	Mixing desk & effects	Needs to have many inputs and outputs at line level, as computer is just replacing tape recorder	M-Audio Delta 1010LT (PCI Card) £200 – 10 inputs and 10 outputs (line level)
Producing dance music	None	Need one or two good quality inputs and outputs to record vocals or single instruments	M-Audio Audiophile 2496 (PCI Card) £80 – 2 inputs and 2 outputs
Producing dance music	Mixing desk & effects	Need one or two inputs and many outputs for mixing outside computer	M-Audio Firewire 410 (firewire) £250 – 4 inputs and 10 outputs

TOP (black) : MOTU 896HD



M-Audio Audiophile 2496



OTHER HARDWARE

You may also need a **MIDI interface** so that you can connect MIDI equipment such as keyboards and synthesizers to your computer. Some sound cards have MIDI interfaces built in.

If your sound card doesn't have MIDI, then you can buy a MIDI interface that connects to a USB port on your computer for around £40, such as the Edirol UM2-C.

If you don't already have a keyboard, you will need a **MIDI controller keyboard** so that you can play the sounds the computer software is generating. This is basically a keyboard with no sounds built in that just sends out MIDI information. These start at around £70 for one with full size keys.

You will also need some kind of **monitoring system**, as all studios do. You can either get an amp and speakers or active monitors, which are speakers with amplifiers built in. These start at £150. Don't be tempted or persuaded to buy computer speakers – they are not of a good enough quality for recording music. If you are on a low budget, then either use your hifi or buy some good quality headphones.

HARDWARE CONTROLLERS

If you are intending to mix with your computer, then you may miss the hands on feel of a mixing desk with faders. You can buy hardware controllers that provide 8 or more faders to control the virtual mixer on your computer. This can provide the best of both worlds, as it gives the hands on feel that is missing from computer music.

Emagic logic control



DSP CARDS

Finally, there are now PCI cards that can be installed in your computer to provide extra processing power. These DSP (Digital Signal Processing) cards run their own effects and software synthesizers and some provide support for other manufacturers. There are currently two main cards, the TC Electronic Powercore, and the Universal Audio UAD-1.

UAD-1 DSP CARD & POWERED PLUG-INS



HOW DOES IT CONNECT TOGETHER?

Once you have assembled the equipment, connecting it together is the last hurdle. The diagrams overleaf give indications of typical computer music studios.

MIDI

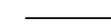
arrow shows OUT to IN



USB



FIREWIRE



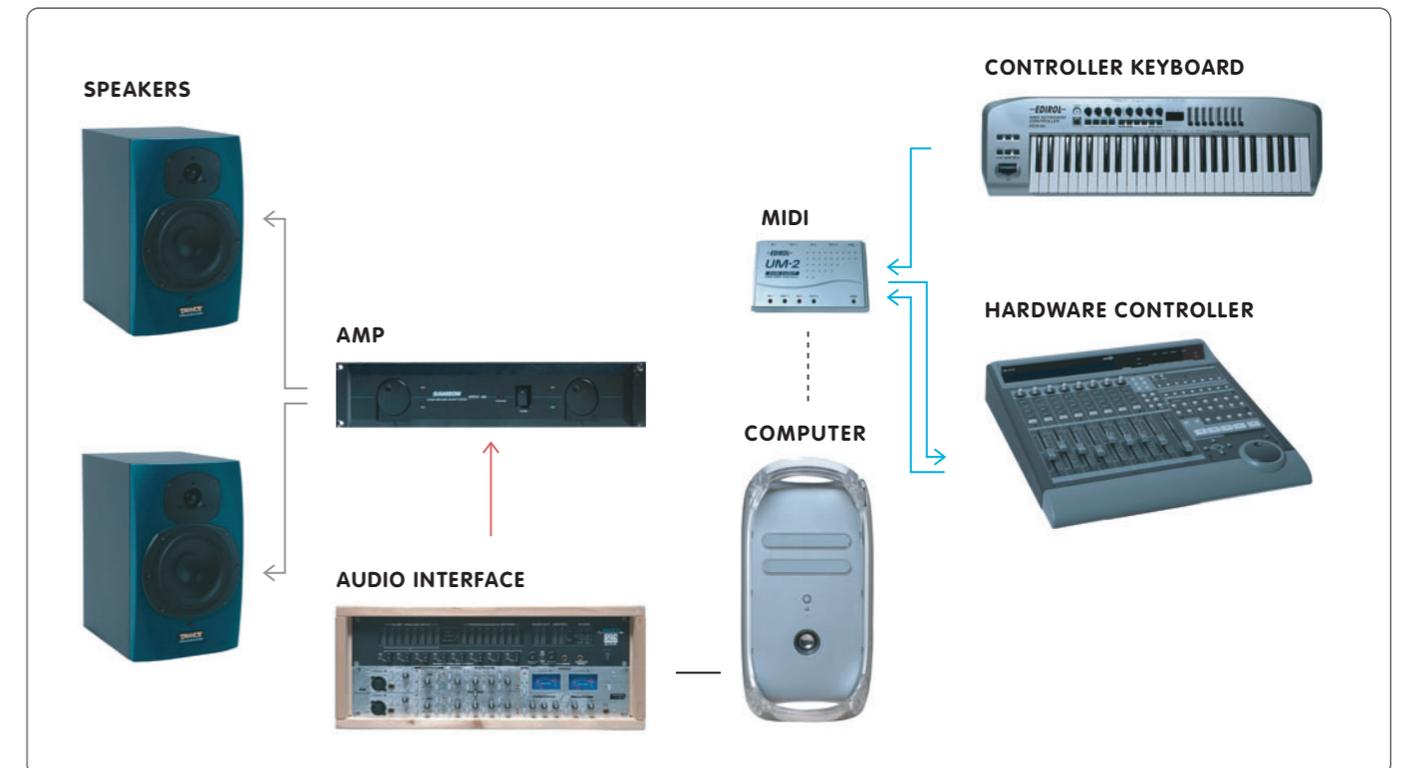
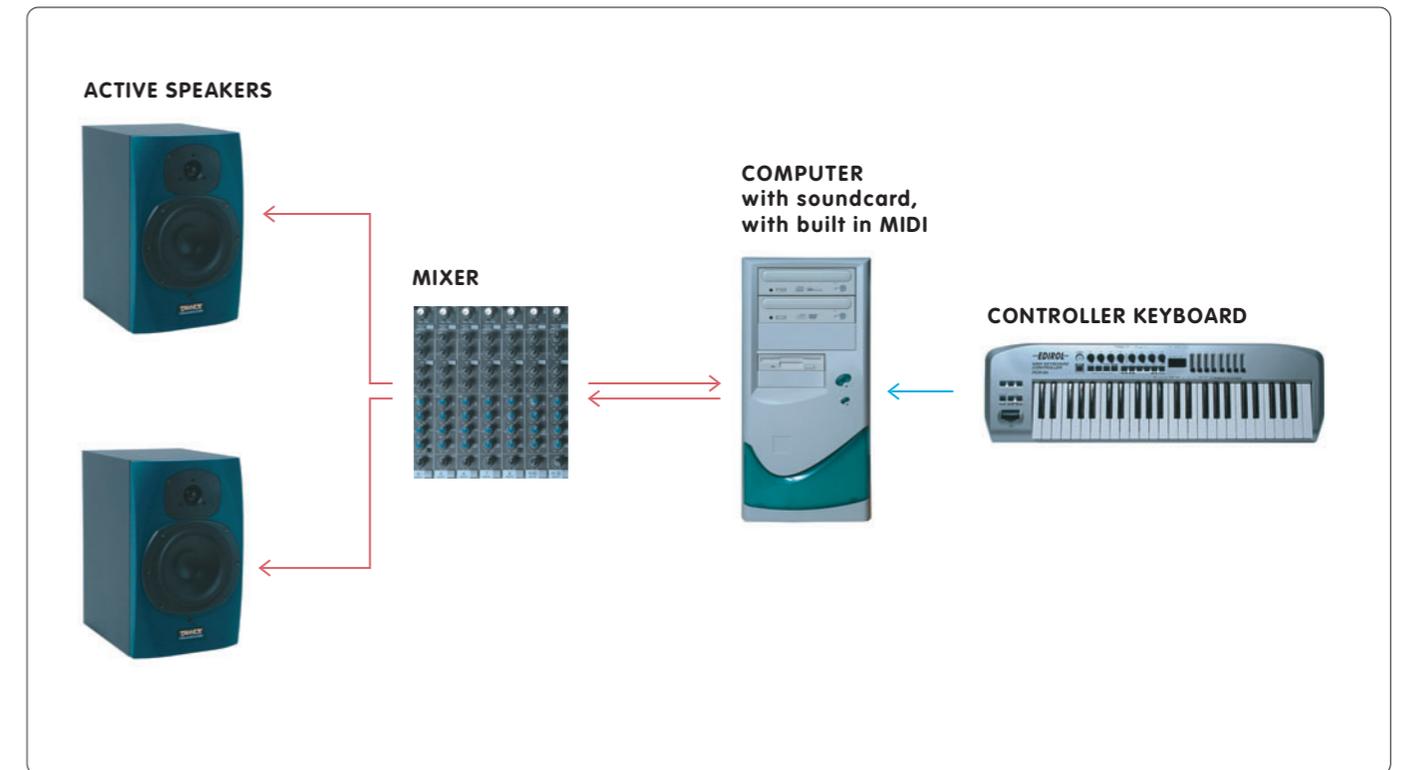
AUDIO

arrow shows OUT to IN



SPEAKERS

arrow shows OUT to IN



SOFTWARE

RECORDING SOFTWARE

Once you have your hardware in place, the next step is to decide what software you want and need. There is a wide variety of software available, with an equally wide price range.

Types of software;

- Sequencer
- Audio Editor
- Software Instrument
- Software Sampler
- Plug-in Effects

The most important bit of software for music technology is the Sequencer.

SEQUENCERS

There are many sequencers on the market. Some are better for working with audio, some better for MIDI, some better for video etc. The most common are listed overleaf.

Steinberg Cubase SX



Emagic Logic



Product	Platform	Notes
Emagic Logic	Mac (no future support for PC)	Good for audio and MIDI
Steinberg Cubase SX	Mac & PC (most users are PC)	Good for audio and MIDI
Steinberg Nuendo	Mac & PC	Good for video and audio
Digidesign Pro Tools	Mac & PC (most users are Mac)	Good for audio and surround sound
Cakewalk Sonar	PC	Needs own hardware
MOTU Digital Performer	Mac	Good for video and audio
Propellerheads Reason	Mac & PC	Good for creating music designed as an all in one studio

Most of the sequencers listed come with some software instruments and plug-in effects, so you have all you need to get started. Look at some of the websites listed in the Want to know more? section for more information.

On a professional level, most recording studios run Pro Tools. This sequencer is mainly designed for dealing with audio, and has become a standard replacement for tape recorders.

At a semi-professional (and professional) level, the two main sequencers are Logic and Cubase.

Sequencers all have similar features and operate in a similar way.

Transport controls

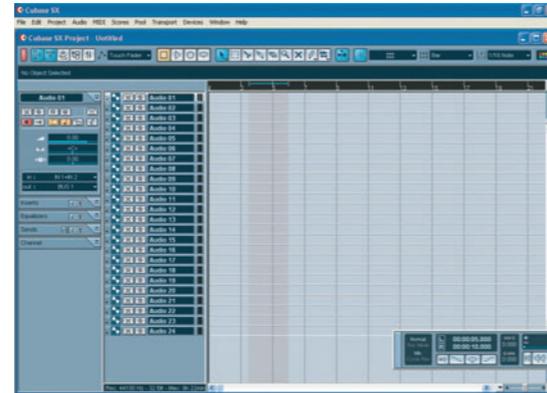
which emulate the Play, Record, Rewind, Stop etc on a tape machine.

Arrange Page

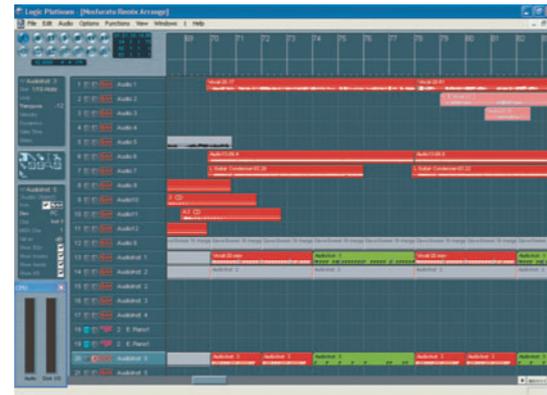
which is where the arrangement for the song is created. This is split into lanes, tracks or channels, which resemble tracks on a multitrack tape recorder. The difference with most sequencers compared with tape recorders is that the amount of tracks you can use is only limited by the power of the computer running the software.

Arrange page samples

Steinberg Cubase SX



Emagic Logic



Steinberg Nuendo

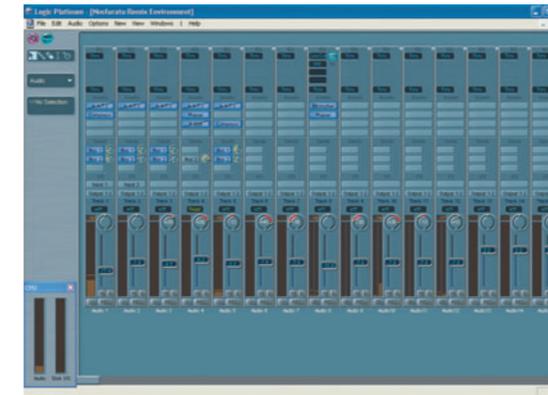


Mixing page samples

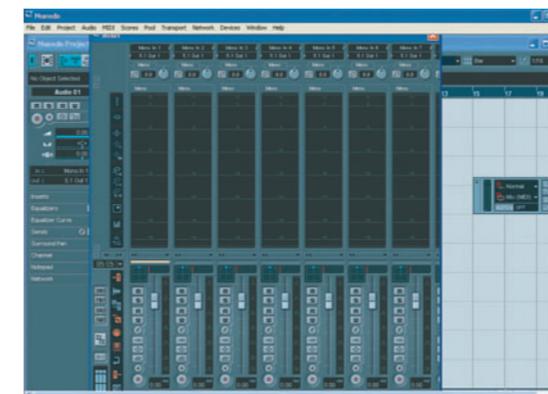
Steinberg Cubase SX



Emagic Logic



Steinberg Nuendo



Mixer

each track has a corresponding channel in the mixer page, which resembles a hardware mixer.

Editing

most sequencers have a few MIDI editing pages and an audio editing page, in order to fine tune recordings and zoom in on them.

The general principle of recording with a sequencer is to open a new blank song, set up a channel on the arrange page for either a MIDI or audio input, tell the computer where to store the recording, set the Tempo (speed of song) and hit record.

ARRANGE PAGE

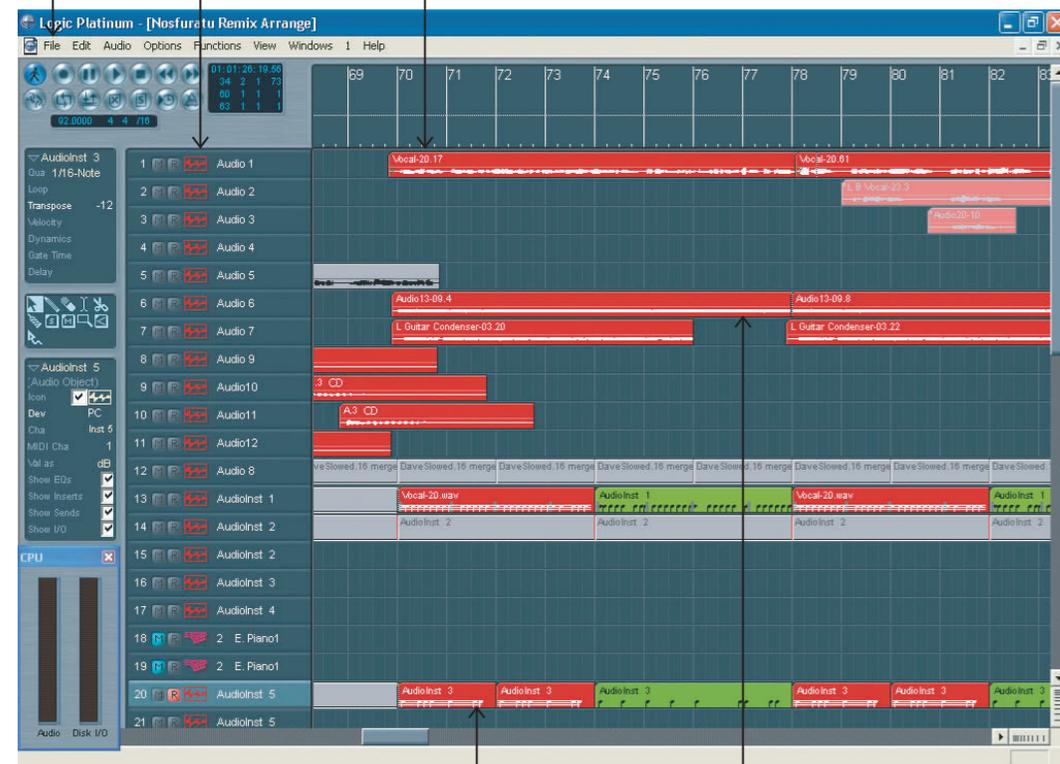
The arrange page is a time based display, with the start of the song on the left and the end on the right. Each thing you record is called a Region and is represented by a coloured box on the arrange page. This can be moved around, cut, reversed etc as you wish. The arrange page normally has a grid which relates to the tempo and time signature of the song, so you can easily move things around in time.

The lines on the regions on the screenshot are displaying Automation, which is where you program the sequencer to remember your mix, so the lines could be indicating where the channel level changes, for example.

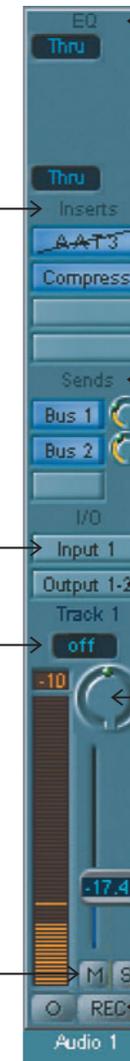


Emagic Logic

MENU **TRACKS** **RULER** showing bars and beats, with time left to right



MIDI REGION **AUDIO REGION**



EQ
Clicking here will open an EQ menu

Insert Effects
Clicking here will open a menu of effects you can load as an insert effect on this channel (internal and plug-ins)

Send Effects
Clicking here will allow you to send some of the channel to a send effect

Audio Input
Clicking here chooses which audio input is assigned to the channel

Automation
This is where the sequencer remembers fader movements etc, so the mix can be repeated

Audio Output
Clicking here chooses which audio output the channel is assigned to

Pan
These controls all function the same as a hardware mixer

Fader

Mute & Solo

Record
This control "arms" the channel so it is ready to record from the assigned audio input

New channels can be added for more tracks, software instruments can be assigned to tracks so that sound is generated by the software, tracks can be routed to external MIDI devices, video can be imported to write music along to, the list goes on.

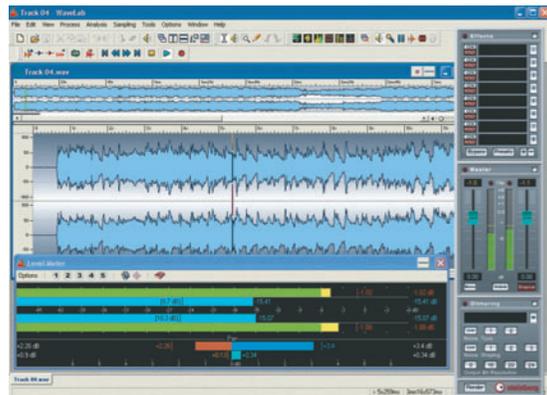
It is not practical to cover the ins and outs of operating each sequencer within this workbook, so please refer to instruction manuals and the Want to know more? information at the end of this chapter.

AUDIO EDITOR

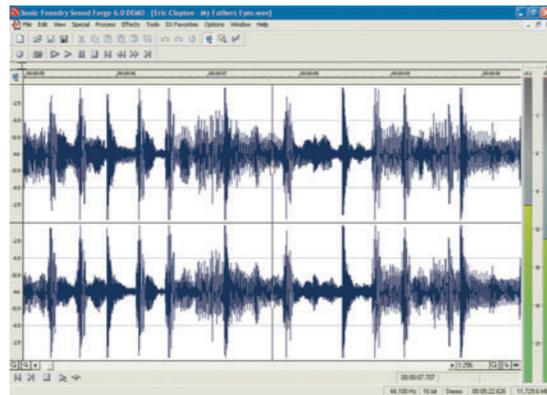
Another variety of recording software is the Audio Editor. Audio Editors primarily exist for editing audio files, but can also be used for recording and playback. Below are some of the more popular choices.

Product	Platform	Notes
Steinberg Wavelab	PC	Good in built surround facilities and CD/DVD burning
Sony Sound Forge	PC	
Adobe Audition (was Cool Edit)	PC	Able to record and playback multi channel audio burning
Bias Peak	Mac	
TC Works Spark	Mac	

Steinberg Wavelab



Sony Sound Forge



The typical features of audio editing software are;

- Editing** - cut, paste, reverse, level change etc
- Effects** - built in effects and ability to use plug-in effects
- Mastering**
- Analysis**
- CD/DVD burning**
- Recording**
- MP3 Encoding**

SOFTWARE INSTRUMENTS AND SAMPLERS

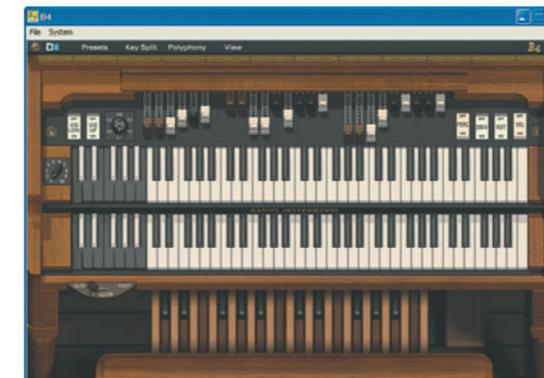
You can now buy software that emulates, or 'pretends to be' a synthesiser or sampler. Software instruments come in a few standards. The most common standard being VST (Virtual Studio Technology) instrument and plug-in, which was invented by Steinberg. Most applications support the VST standard, except Pro Tools (although there are "wrappers" available that can enable them to work).

The newest and second most common standard is the Audio Unit (AU) standard, which was developed by Apple for their Mac computers. Therefore if you are a PC user, your instruments will be VST instruments.

Most sequencers come with some software instruments that can be used straight away. Cubase SX comes with the "Universal Sound Module" that contains all sorts of sounds, as you would expect from a keyboard.

Most software instruments have similar controls, and the ones that emulate real instruments, such as the Native Instruments B4, have controls that replicate the emulated instrument.

Native Instruments B4



Software instruments are played with a MIDI controller keyboard, and most can either run on their own, or within a sequencer. Some can be quite intensive in their use of the computer power, so you may only be able to run a couple at a time.

Software samplers are based on the same principle as software instruments, to replace the hardware. The beauty of software samplers compared with their hardware equivalents is that the screen on a computer is a lot larger and more capable than the screen on a sampler. This makes editing of the sample (which is an audio recording) easier as you can see the waveform.



As with the software instruments, some sequencers come with their own software samplers, such as Logic's EXS24 sampler. They too come in a variety of formats.

PROPELLERHEADS REASON

Reason is a different kind of software package that integrates a basic sequencer with software instruments, samplers and effects in a virtual rack.

It comes complete with samples and instruments and is ready to create music. It visually emulates a studio, so you have to move virtual patch leads to connect instruments to the mixer etc.

Reason has become very popular as a compositional tool, especially for electronic music, as it is very quick to produce results.

PLUG-IN EFFECTS

Plug-in effects follow the same principles as software instruments, in that they are software emulations of hardware devices.

The most common plug-in standards are VST on both PC and Mac, DirectX on the PC and Audio Unit on the Mac.

Some plug-ins are designed to emulate hardware effects units, and this is more common with the ones that run on DSP cards such as the UAD-1. Some plug-ins are designed to make recordings better, the Antares Auto Tune being a very popular effect that can put a singer in tune. Other plug-ins are simply there to mess the sound up as much as possible, and everything in between.

As with the software instruments, free and shareware plug-ins can be found on the internet, again look at the weblinks in the Want to know more? section.

Software effect plug-ins have controls that resemble the controls you would get on a hardware effect, so a reverb plug-in would have controls for room size, reverb time, diffusion etc. Generally software plug-ins come with presets that are a good starting point to use.

Effect plug-ins can be used either on individual channels, on groups of channels (busses) or on the whole mix (master bus).

Emagic compressor



Emagic platinumverb reverb



TC WORKS Native Reverb



Waves TrueVerb reverb



Waves Q10 Paragraphic Equalizer



Emagic evp88 Electric Piano Virtual Instrument



T-Racks mastering plug-in



WORKING WITH TECHNOLOGY

Working with technology can invoke a range of feelings, from joy through to despair. However, it is possible to minimise the despair by being sensible and following some basic tips. Most importantly, if at all goes wrong, keep calm and be logical.

FILE MANAGEMENT

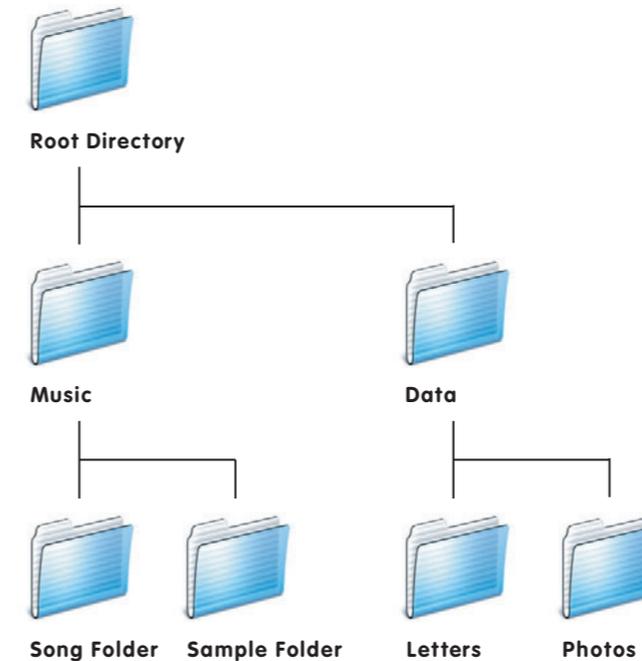
If you use tapes to record onto, whether for the multitrack or master or both, organisation and labelling are highly important. It can be very frustrating to lose the master tape of a project with a deadline looming, or to tape over a multitrack tape because it wasn't labelled – you must have done this with videos, and studios are no different.

If you are using a computer to create music, then file management becomes even more important. There are a few basic facts about computer design that are worth noting.

If you are building or buying a computer for music, then it is a good idea to get two hard drives – one for data and one for programs and operating system files. This is for two reasons; firstly it is easier to backup as all data files are on one drive, secondly it is faster for the computer to have the program files separate to the audio and data files, rather than on the same drive.

When organising files on a computer it is better and faster to have a tree structure to your files than to have loads of files and folders in the root directory.

This also makes it easier to backup files, as they are all within one folder.



BACKUP

Once you have mastered the art of file management, this will make backup easier. There are several choices when it comes to backing up, but whichever you choose, ensure you do choose one! It is a hard lesson to learn when a hard drive decides to stop working and you have all your work on it. Backup, and regularly.

CD-ROM

CD-ROM's are probably the cheapest form of backup. The problem with using a computer to record audio is that very quickly one song can take up a CD-ROM's worth of data or more.

DVD

DVDR discs hold 4GB (4000 MB) of information, so you can fit 10 × 5 minute × 16 track songs on a DVD. DVD discs are more expensive, and not all computers have a DVD burner.

Hard drive

A more preferred and easier form of backup is to use an external hard drive, connected via USB or Firewire. External hard drives cost £70 for an 80GB drive, enough for 200 × 5 minute × 16 track songs. See the weblinks in the Want to know more? for information on backup software.