

Gerald's Column

by Gerald Fitton

Last month you were treated to a brief introduction to 'Streaming Audio'. I didn't discuss all the various formats nor the bit rates which they imply; however, I assure you that a 300 kbps broadband modem will handle all the formats I've found including the memory hungry .WAV format. Mind you, some formats have more fidelity than others and some formats (particularly the high fidelity ones) do have larger file sizes. Large files for the same run time imply higher streaming bit rates. When it comes to Video this is important.

Craig and Sam

You will recall from last month that it was Craig, my eldest, 13 year old grandson who proved quite conclusively that what he described as "cool music" could be streamed over the Internet, through my 300 kbps NTL Cable Modem, via a Wireless Router to my HP h4150 iPAQ PDA (Personal Digital Assistant - a hand held computer). Later I found Radio 4; this streams what I told Craig was "Real Entertainment"! We agreed to differ.

My second grandchild, Sam, is 9 year old. He was rather put out by Craig's account of his 'musical' exploits and, as every parent and grandparent knows, it is no use trying to explain that life is unfair and that a 'treat' for one grandchild does not imply that the other three will receive their 'fair share' of whatever is around!

So, what could I do but have Sam round for a day (during his half term holiday) and provide him with a 'treat' which would at least equal, and perhaps surpass, that of Craig.

Making Videos

I have two means of making videos. It was the second one (next month) which provided Sam with his 'best treat'. In this month's article I shall describe our use of my camcorder.

My Camcorder

My camcorder is a Panasonic NV-DS5 which is getting on for ten years old! One of the things I like about it most is the large 3.8 inch colour LCD screen.

At the full optical zoom of 10 x, only one quarter of the imaging chip is in use. The remainder (the surrounding three quarters of the chip) is employed by something which Panasonic call "Digital SIS". The SIS stands for Super Image Stabiliser. When the SIS is enabled then a certain amount of camera shake is taken out by the SIS program. It does this by remembering what it should be looking at and using the peripheral part of the imaging chip which contains something similar to the previous frame. Clever?

If I pan the camera quickly from left to right then the image I see on the LCD screen, and which is recorded on the DV (Digital Video) tape, lags (in time) behind the scene at which the camcorder is pointing directly. Only by disabling the SIS can I get a fast pan in which the image is always exactly in line with the camcorder.

The time lag for an intentional tilt or pan (or zoom) is the price which has to be paid for counteracting camera shake.

I filmed Sam making a couple of dozen 'Pigs in Blankets'.



From the picture (Pigs/jpg) you will realise that instead of expensive oysters (devils) we have cocktail sausages (pigs) wrapped in the streaky bacon. By the way, streaky is best because the fat makes it taste so much better even if it is reputed to be less healthy than the more expensive lean bacon sometimes on special offer at the local supermarket.

From Camcorder to Computer

The picture (Fire/jpg) shows (very clearly? - I hope so) the location of the FireWire DV terminal at the back of the camcorder. It is between the battery housing and the OFF/ON power switch. In order that Sam could take a clean picture of this socket (more 'treats') you'll see that I've used a bit of sellotape to hold the DV socket cover open. Also in this picture you will see the shielded FireWire cable. It is below the DV socket.



It is surprising (to me) what 9 year olds do at school these days. Sam may not be able to type using all his fingers (I am teaching him to touch type) but he does know a lot about the way computers work. With little prompting from me he connected the FireWire to the camcorder and within a minute had 'pulled up' some 'Movie Maker' software.

He clicked on all the correct icons even though they don't make movies at school! How did he work that out? It took me ages! The camcorder automatically rewound and then transferred the digitally encoded data on the camcorder's DV tape to an .AVI file on the computer hard drive. Sam clicked on "Stop Capture" at the end of the two minute sequence and the camcorder stopped. Let me make it clear to you. Neither Sam nor I clicked any buttons on the camcorder. The whole of the camcorder control came from the computer along the FireWire and into the (ten year old?) camcorder.

Sam disconnected the FireWire and then, after discovering with some relief that it was still working, I put the camcorder back in its bag. It had survived and would be available for another 'shoot' on another day.

We had two minutes of video on the computer in the form of a 400 MB .AVI file. The FireWire connection had transferred data at over 3 MB per second. The computer had processed and stored the data on the hard drive at this rate.



This speed, 3 MBps, is the equivalent of about 30 000 kbps. Have a look at the picture [Size1/tif]. It shows that the streaming rate is 30 MBps. My broadband connection runs 100 times more slowly at 300 kbps. How could we ever hope to stream this video?

Compression

You will know (but Sam didn't) that I know the answer to this question. However, being unable to wipe the College dust from off my feet, I had to do a few (order of magnitude) sums with him. He saw the problem clearly. What, I asked him, was the solution? After only a moment's hesitation he told me that the only thing I could do is to convert the file to some other format. Where do they learn these things?

Have I told you about a Managing Director I encountered about a year after I started work in the Vickers Armstrongs' Aircraft design Office? There was a crisis. The MD entered the Design Office and started asking questions. I knew that eventually, because it was an aerodynamics problem, he would come to me. I was terrified. He asked me his first question - which I answered. His second question was "Why?" - which I answered. His third question was "Why?" - which I answered. He paused. He looked me straight in the eye. I was perspiring buckets. His two 'henchmen' and my boss (and my boss's boss) were surrounding my desk. His fourth question was "Why?" - which I answered.

Then, without another word he turned on his heel and walked away leaving one henchman.

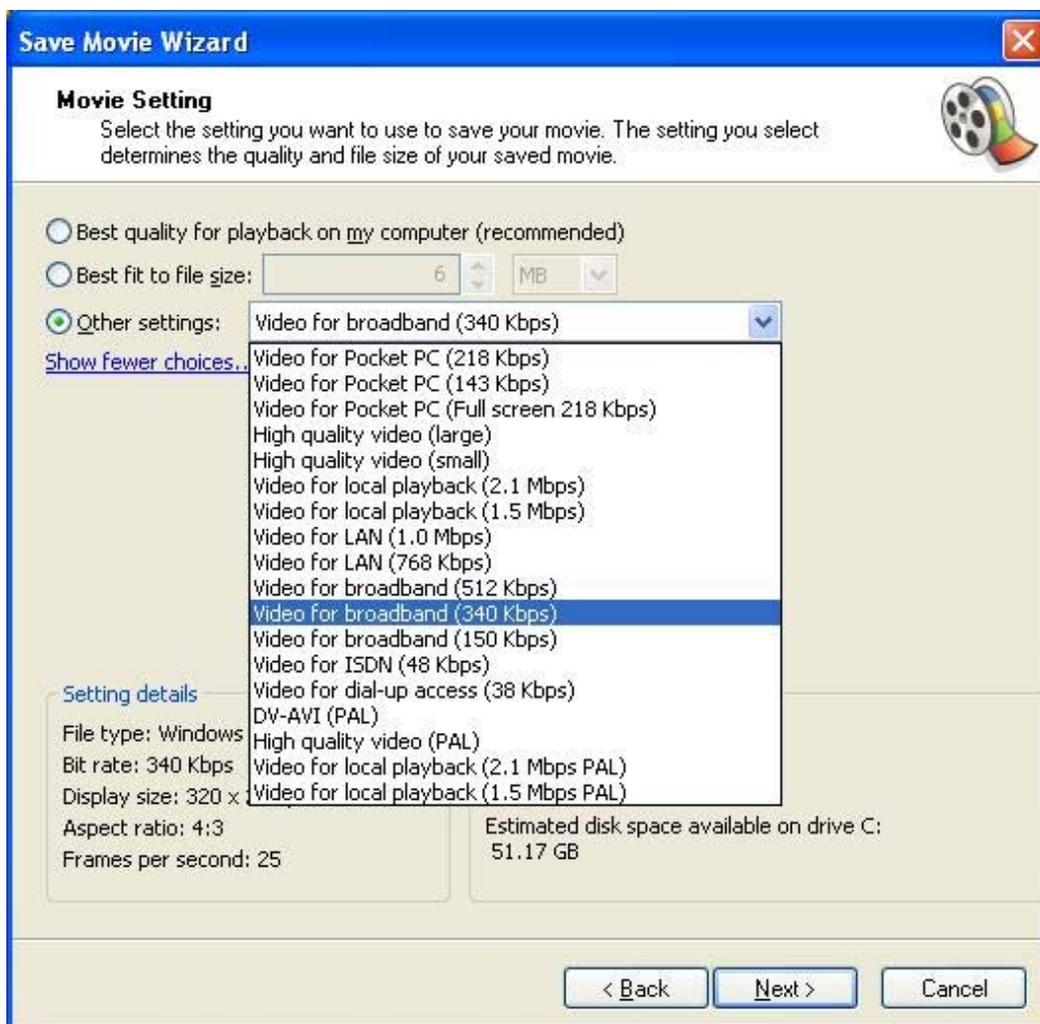
The henchman looked at me and asked my name. He wrote it down. Then I said to the henchman, "Why did he stop there?" The henchman replied "He has you down as a 'Three Whys Man', he never asks 'Why?' a fourth time. He knows that you know what you're talking about and will leave you to it!" And sure enough, in solving this problem I got all the resources I asked for and more. I had only to mention to my boss that I needed an extra 'computer' (a girl to do calculations) and one would 'appear' from nowhere!

So, now you will understand why my response to Sam's remark ("Change the file format") was simply "Why?". Sam's reply was "It makes it smaller?" With a variation on the long deceased MD's technique I asked, "Why do we want to make it smaller?" To which he replied "If there's less of it and it has to run for the same time, then the streaming rate will be smaller!" Possibly age has made me more verbose than in my younger days; so I asked Sam "How much smaller?" His one word answer "Lots!". At last I had him! It was the quantitative nature of my question which had him beaten!

Together we calculated that if a 400 MB file streams at 30 000 kbps and my Broadband Modem from NTL runs at 300 kbps then we had to convert the file to a format for which the two minute video was not 400 MB but a 'mere' 4 MB in size. We needed a compression ratio of about 100. What sort of format would do that without degrading the quality of the picture so that it became unusable?

Video for Broadband

Have a look at my next picture (340kb/tif). Have a look at the TIFF version rather than the one here because it is much clearer. You'll see I have highlighted the selection that, between us, Sam and I made. This particular format is called "Video for Broadband (340kbps)"



The bottom left of this picture is obscured partly by the options menu so I have provided another picture (Size2/tif) which shows only this section of the screen after selecting the 340kbps option. You will see that the display size has been reduced to 320 x 240 pixels.



Although 340 kbps is slightly larger than the 300 kbps nominal speed of my Broadband Modem, I thought that, in view of the impending upgrade to 500 kbps, it was worth a try.

Sam did all the hard computer work (under my watchful eye) clicking icons here there and everywhere as if he was a veteran. We finished up with a .WMV file containing what we hoped was a compressed version of the "Making Pigs in Blankets" video clip.

DeskTop Testing

The moment of truth had arrived. Had the file been compressed? What did the compressed version look like? Would Sam be recognisable at 320 x 240 pixels instead of the 720 x 576 pixels of the original 400 MB .AVI file?

The size of the .WMV file was 4.5 MB so it had compressed. But what would it look like when we played it? Sam double clicked on the file; it loaded into the player; after a very slight hesitation (we need not have worried) there was Sam making 'Pigs in Blankets'.

It had worked!

How much had the quality deteriorated? Surprisingly little. Some of the crispness of the images had gone; pictures without 'fine detail' looked good. In those parts of the movie sequence with much fine detail it was possible to see the difference. When I looked hard I could see that the definition was not as good - but Sam said it was "good enough". Fortunately most of the video was of 'Bold' scenes (close ups) rather than 'Fine Detail'.

iPAQ Testing

I put my iPAQ (an hp h4150) into its cradle; Sam executed 'Synchronise with Pocket PC' and the transfer of the video to the iPAQ ran without a hitch. The display on this iPAQ is 320 x 240 pixels; the video was already formatted for this size of screen so no further conversion was necessary. The two minute video clip ran beautifully on the iPAQ screen complete with vocal commentary by Sam and I.

Upload to Website

I regained control of my desktop computer. It was a struggle to get Sam to give up the operating chair even for a short break but, using all my skills, honed over many years of handling difficult students, I succeeded without having to offer any bribes.

I accessed my experimental (NTL) website and, using ftp://, I uploaded the 4.5 MB video clip and then inserted a link to it from my home page. The upload took about five minutes. It seems to me that uploading is slower than downloading. At least I hoped so. I hoped that the file would download in something close to the two minutes that the file would run.

Downloading to the DeskTop

Now it was Sam's turn again.

He accessed my NTL website using http:// this time and clicked on the link. The video player opened on the screen. Did the video play?

No!

I wish that I could have taken a picture of Sam's face when nothing happened. I guess I was just as disappointed because he looked at me partly with horror and partly with sympathy. "Why isn't it playing?" he asked me (note the "Why?", was he learning?)

I looked at the screen and I saw a bar rapidly progressing from left to right. Under the bar it said "Buffering 48%" - and then 66% - and then 98% - and then ...

Yes! The video started up and there was Sam and the 'Pigs in Blankets' in what I can only describe as 'glorious technicolor and stereophonic sound!'

The buffer was needed because the streaming rate was faster than the download rate.

Sam had asked me "Why?" (why the delay before the video started) I had to explain that the buffer filled up at 300 kbps but playing the video empties it at 340 kbps. We needed enough in the buffer before the video started to prevent it becoming empty before we got to the end of the two minute clip. It could be nearly empty but it mustn't run dry.

What a clever bit of software to work out just how much of the 4 MB file to download. It would still download the rest of the file whilst playing; it would just run dry at the end.

Now, without wishing to encroach on Colin Singleton's excellent Puzzle Corner, I would like you to work out (as did Sam and I) how long it was before the film started playing. Here are the figures I would like you to use for this sum. The clip runs for 120 seconds. The download rate is exactly 300 kbps. The clip runs at 340 kbps. The answer is considerably less than two minutes but long enough for us to get concerned.

Answers may be sent to to: gerald.archive@ntlworld.com. You will receive a reply even if you are wrong!

Downloading to the iPAQ

This next test would be the crucial one. Could we stream video to the iPAQ?

You will recall from last month that Craig took the iPAQ down the street 100 yards (?) and could still get what he described as "cool music" from some radio station which, in my opinion, should be closed down in favour of Radio 4. Sam wanted to see his video (I took it so why should he call it his?) on the iPAQ at a place remote from the computer room.

It was my turn to show my expertise.

I opened up the web software on the iPAQ and brought up the home page (using http://) which had the link to what had become Sam's Video. Sam and I walked down the street (guess who was holding the iPAQ) and, still in view of the house but about 50 yards away and not the 100 yards claimed by Craig, Sam tapped on the link. The video player came up on screen and we saw ... that the buffer was filling. It seemed to take ages and then ... there it was! 'Pigs in Blankets' with Sam speaking to the camera.

The two minutes were over all too soon and Sam opted to try again from further away. We walked another 20 yards (it wasn't raining) but still in sight of the house.

Sam clicked on the link again. This time the video started up almost immediately. "Why?"

I'll have to leave you with that question.

Summary

I suppose that the most important thing to report is that "Sam had his 'treat'!"

However, it may be that Archive readers are more interested in the technical aspects of our experiments so I'd better summarise them too.

The two minute DV (Digital Video) file on the camcorder tape was downloaded to the computer as an .AVI (Audio Video Interleaved) 400 MB file having a display size of 720 x 567 pixels. This was compressed to about 4.5 MB partly by reducing the display size to 320 x 240 pixels and partly by using a lossy compression technique. The file format chosen (from many - we did other experiments I'll tell you about another day) streamed at a constant rate of 340 kbps for the full two minutes. This format is one of the many .WMV (Windows Media Video) formats we could have chosen for our experiment.

We tested the system out using both a desktop and iPAQ PDA (Personal Digital Assistant) by uploading the 4.5 MB file to my experimental (NTL) website and then streaming the download. Because the streaming rate (at 340 kbps) exceeded the download rate (300 kbps) some, but not all, of the download was first stored in a temporary FIFO (First In First Out) buffer. After something less than 2 minutes (you work it out and write to me!) the video started playing whilst still downloading the remainder of the 4.5 MB file.

The Broadband Modem was connected to a Wireless Router and the Wireless Router streamed the video to first the DeskTop machine and later (separately) to the iPAQ PDA.

The PDA screen is 320 x 240 so that, even if the resolution of the video were to be improved, there would be no improvement in the picture displayed on the iPAQ PDA.

Next Month

I have a second means of making video clips. It is one which I was sure Sam could handle so I was more than happy to let him 'have a go' with it and produce his own 2 minute clip.

What is my second means of creating video?

Did it work?

You will have to wait and see!

Also I shall report on our attempts to stream video at bit rates higher than 340 kbps.

Communication

Thanks for all your emails, letters and discs. These days I am finding an increasing number of my correspondents are sending me CDs they have burned rather than floppies. They use a CD because the files they are sending me are much larger than can be fitted onto a floppy. I guess it is a sign of the times?

I am no longer on dial up. You can send me these larger files as email attachments.

One side effect from my new (broadband) toy is that I have a second email address. In future I would like you to email me at <gerald.archive@ntlworld.com> and not at the (now obsolescent) 'abacusline.demon' address.

Although this latter email address will gradually fade away I shall retain the Abacusline website at <http://abacusline.demon.co.uk> for a while as my 'public' website. Eventually I may let you know how to access all the high resolution (large file) pictures and, more importantly, the (even larger file) video clips which are on my new experimental website.