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A. Oliphant *and* B. Scudamore

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A. Oliphant and B. Scudamore

Abstract

The introduction of the personal video recorder is transforming our viewing habits.

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TV gets personal

Andrew Oliphant and **Bryher Scudamore** describe how the introduction of the personal video recorder is transforming our viewing habits

The PC is an amazing product; every year prices fall, while processing capabilities and storage capacity continue to escalate. The personal video recorder (PVR)—a TV recorder that records on a computer hard disc as opposed to tape—has evolved as a direct consequence of the development of the PC as a low-cost, high-performance consumer product. Sharing many features with a PC with tens of gigabytes of hard disc storage, the PVR has the potential to revolutionise the way broadcasters schedule TV programmes and the way viewers watch them.

Making a PVR an attractive product needs more than the convergence of TV and computer technology. In particular, an effective programme guide service, downloaded either with the TV signal or via the phone network, is crucial in establishing the PVR's attractiveness to viewers. The stored guide data simplifies programme selection and recording, and offers new features like automatic recording of all episodes of a series, even if they're not all at the same time each week.

What does a PVR do?

So what makes a PVR more special than the video cassette recorder (VCR) that most people already own? First, there are no tapes to lose, no more frantic searches for a tape to record that 'unmissable' programme. One press of a button will record the programme just starting. Secondly, a hard disc drive can record and replay at the same time, allowing 'trick' modes like pausing and rewinding live TV. If the phone rings, you can pause the PVR while you answer the call—even if you're watching a live football match. If you missed that gag that seemed to make the studio audience laugh so much, you can go back and listen to it again. Perhaps most important from the point of view of lifestyle, you no longer have to choose between watching

a programme live or recording it and watching it later. You can start to watch it a few minutes after it starts, or any time thereafter; the children can watch their favourite programme as soon as they have finished their homework. A PVR beats the tyranny of the TV schedule. If you're watching a time-shifted programme you can 'fast forward' through any boring bits, until you're once more in step with the live broadcast. Not necessarily good news for the scheduler, as those boring bits may include the adverts or trailers that the broadcaster is particularly keen you should watch.

Programming a PVR is much easier than programming a VCR, an operation that is said to defeat most people. The downloaded programme data means that the PVR can present you with an electronic programme guide (EPG). With the remote control you can highlight the programme you want and press record. The PVR should do all the rest, including informing you of any conflicts. The processing power of the PVR allows it to present the programme data to

1 Odd man out—TiVo is the silver box under the TV set





2 PVRs for TiVo (left) and Axcent (below) have many similar features

the user in different ways: by time, by channel, by alphabetical order of title and so on.

The programme guide data can be more than just a list of titles and times. It can also include so-called metadata—data describing the programmes, for instance lists of principal actors, a programme genre such as ‘technology’ or ‘drama’, information about related programmes, or a brief text summary. This metadata can be used by the PVR to manage the recording process. For instance, if a programme the user has selected for recording is declared by the metadata as part of a series or serial, then the PVR can alert the user to this fact and offer to record all episodes.

The PVR can also use metadata to record programmes ‘on spec’, taking account of the kinds of programmes users have recorded in the past, or preferences they have entered as part of the set-up procedure. Normally the programmes chosen by the PVR will have lower priority than programmes chosen by the user—they are recorded using disc space that would otherwise be unused.

What’s available?

Two brands of PVR were launched in the US in 1999—TiVo and Replay TV. TiVo models were manufactured by Philips and Sony, Replay models by Panasonic. Since then, TiVo seems to have become the better established of the two, with production of Replay-branded models now discontinued, although Replay now sells its technology to be branded by other manufacturers. Microsoft has recently launched a PVR



in the US as Ultimate TV, for the DirecTV satellite chain (TiVo also makes a PVR for DirecTV, as well as a standalone non-dedicated model). In Germany, a PVR was launched by Grundig under the name Selexx in autumn 2000, using technology from Axcent. It works with the numerous free-to-air services available on the Astra 1 satellite system. In the UK, TiVo was launched in autumn 2000 under the Thomson Scenium brand, and Sky has announced that it will launch a PVR for its satellite services during 2001. The Sky PVR will be made by Pace, using the X-TV technology developed by NDS.

This is just the beginning. At electronics trade shows more and more manufacturers say they intend to launch boxes with PVR functionality within the next 18 months—some by the end of this year.

The UK version of TiVo, the only PVR available to British viewers at present, is compatible with both analogue and digital terrestrial TV (DTT) services, with digital satellite (D-SAT) services, and with analogue cable services (digital cable will be fully supported later this year). It contains an analogue PAL tuner and has SCART sockets for connection to DTT or D-SAT set-top boxes and a VCR (to download for permanent storage) and a UHF input for connection to an aerial or to analogue cable set-top boxes, which generally don’t have SCART outputs. The other

set-top boxes are controlled by TiVo using an infra-red emitter positioned close to the infra-red remote control receiver on the front panel of the box—TiVo can thus mimic the remote control to change channels as necessary for recording. With this configuration it is possible to record a programme from analogue terrestrial while watching one from the set-top box (or vice versa). The Sky PVR will have two D-SAT tuners so that it will be possible to watch one satellite programme while recording another.

All TiVo's inputs and outputs are in analogue form, even for the digital services; this means that TiVo does not need to be concerned with issues of conditional access and scrambling. For storage it has to convert the analogue signals to digital form and then to compress them, using MPEG-2 coding similar to that used for digital broadcasts, adding cost and raising potential issues of picture quality. The Sky PVR, in contrast, will store the original broadcast digital signal in scrambled form on its hard disc, giving the potential for better picture quality and the possibility for the conditional access operator to control the replay of stored programmes.

Because TiVo contains its own MPEG coder, it allows the user to control the inevitable compromise between video quality and storage capacity. The UK TiVo has about 40 Gbyte of hard disc capacity. This represents about 40 hours storage at 'basic' quality or about 12 hours at 'best' quality (there are also two quality levels in between, 'medium' and 'high').

Data to support the TiVo PVR is downloaded daily via the telephone network, usually during the night. This call is free to the user—or rather the cost of it is included in the £10 a month charged for the TiVo service, without which the PVR will not make recordings. Depending on the availability of data, TiVo will have programme details for up to 14 days in advance. Changes in schedules since publication of listings magazines can in principle be included, but obviously last-minute changes will not be available. TiVo's data is entirely time-driven, rather than event-driven (detecting the programme junctions) so if a programme runs late, it may miss recording the end; a software modification later this year will add an optional 'buffer' at the start and end of recordings. The German Axcent PVR uses a different mechanism for data download: a 64 kbit/s channel on one of the Astra1 transponders to which the PVR tunes by default to top up its programme data

whenever it is not recording from another transponder. The Sky PVR will use the data already broadcast on the system to support the Sky electronic programme guide; this data can be updated very quickly (typically within about 15 minutes) and is event driven rather than time driven so that it will keep recording a late running programme.

Is this the end of scheduled television?

The impact of the PVR

Some analysts have predicted that the PVR will mean the end of the current model of TV broadcasting. Many users of PVRs choose most of their television from what's available on the disc, irrespective of what's on live TV. For them, there's no longer any concept of a schedule, of prime time—or of a watershed for family viewing. Nor is there any concept of a channel, just a list of programmes that have been recorded. This could be a threat to public service broadcasters like the BBC, because their licence fee depends on viewers recognising that they are watching BBC programmes and hence getting value in return for the fee. Combine this with the capability to skip through the adverts, and all free-to-air broadcasters' business models are undermined. Scheduling tricks like 'hammocking'—where the audience for a worthy programme can be supported by scheduling it between two popular programmes—can no longer be applied. Is this the end of scheduled television?

For the moment, the vision seems to be on hold. Sales of PVRs have not met early expectations: only a few hundred thousand so far, world wide. This may be because the devices

3 The TiVo electronic programme guide (EPG) can be overlaid onto a standard TV picture





4 TiVo's channel highlights feature offers broadcasters a method for promoting programmes to PVR owners

are still quite expensive, or it could be because of poor marketing—most people still don't understand what this piece of technology could do for them. However, a pointer towards public appreciation is that most people who have a PVR now don't know what they would do without it—97% of TiVo owners would recommend it to a friend. So once prices come down, we can expect to see PVR penetration increase rapidly and a critical mass will be reached. Some foresee PVRs in 30 per cent of homes by 2006, although this looks rather optimistic at the moment.

Possible developments

Today's PVRs have enough functionality to be useful gadgets—even life changing, according to their owners. However, they're still new and we can expect to see rapid developments in their capabilities. In turn, these developments will trigger changes in the way television programmes are made, scheduled, watched and paid for.

Simply downloading new software to existing PVRs, as has already happened in the US, can enable new services. In the near future, we can expect 'trailer selection' services to appear. You see a trailer for a programme you would like to record, you press a button and the PVR records the programme when it's broadcast—thanks to metadata that links the trailer and the programme. There will be more advanced search facilities, allowing you, for example, to record all films featuring Alec Guinness, or all football matches featuring Manchester United. Members of the family could be offered their own personalised suggestions for recording—and 'adult' content could be protected by a parental lock.

As prices of hard disc storage drop, we can

expect to see storage capacity increase to the point where a PVR could be used for long-term storage as well as for time-shifting. However, many people feel that they want to 'own' a recording in a permanent, removable form; for them a PVR with a recordable DVD drive would be the ideal, combining the ease of use of a PVR with the durability and exchangeability of a DVD.

But the possibility of exchanging near-perfect digital recordings raises the spectre of something approaching 'Napster for video'. We have already seen how the audio industry has tried to prevent the exchange of material on CDs, and video content is more valuable than audio. Whatever technology comes up with, rights management will be essential.

If scheduling loses its power to attract viewers, its place will be taken by the invisible metadata that supports PVR functions. The battle to get programmes seen will be won by the provider that can describe them most fully and attractively in its metadata. And just as you can choose between different listings magazines at present, in future you will be able to choose between different metadata suppliers. Some PVRs will be connected to the world wide web so the user can download metadata from web sites.

With a PVR, it's possible for the viewer to skip all advertisements, but the content still has to be paid for, implying the need to positively encourage viewers to watch commercials. One possibility would be to use the ubiquitous metadata to target advertisements at specific interest groups. For example, single men would get a preponderance of advertisements for computers and cars, while families with children would be targeted with toys and baby food. And how does the PVR know about your new baby? Simple: you've started recording Teletubbies. The programmes you choose to watch tell the PVR about your domestic circumstances and lifestyle, so it can choose adverts for you as well as programmes.

The PVR's combination of storage, processing power and supporting metadata offers the potential for new kinds of programmes where the viewer navigates around the stored programme rather like navigating around a website. For instance, you could choose the order in which you viewed the items in a news bulletin or magazine programme. There are obvious applications for such 'segmented' programmes in educational broadcasting, but we might also see interactive non-linear dramas where there is more than one route through the plot, or programmes where a number of

BBC myChannel for Dan Jensen

Friday, March 2, 2001 3:26 PM

3:30 PM		Wipeout
3:50 PM		Casualty
4:40 PM		Kilroy
5:25 PM		Get Me the Manager
5:55 PM		Crimewatch Daily

Something from the Heart: After a major hotel explosion, Charlie finds himself treating a high profile patient with controversial views on the NHS.



Drama

BBC, duration 50 mins

21-Feb-01

5:10 PM

Delete

Reschedule

Add

Exit

packages could be put together in different ways, perhaps to tailor the material for different audiences.

The TV-Anytime Forum

All these new applications will require standards: standards for metadata to choose programmes, standards for finding the programmes in a multichannel, web-connected world, and standards for management of the rights that must be paid for in order to support the services. These standards are being generated by a new worldwide body, the TV-Anytime Forum—an association of organisations that seeks to develop specifications to enable audio-visual and other services based on mass-market, high-volume digital storage. The Forum comprises over 150 member organisations from Europe, the USA and Asia. Membership is open to all who sign the memorandum of understanding and attend meetings.

The Forum was inaugurated at a meeting in Newport Beach, California in September 1999 and is now working to develop open specifications designed to allow consumer electronics manufacturers, content creators, telecommunications companies, broadcasters and service providers to exploit high volume digital storage in consumer platforms. Meetings are held at approximately two month intervals. In December 1999, a call for contributions (CFC) was issued to draw requirements and

technologies and increase participation in the creation of standards. The Forum published its first specifications in July 2000 and hopes to have agreed versions of all of them by the end of this year.

DIY TV

If PVRs become as popular as some experts predict, then everyone can become their own television boss. Never again need viewers be trapped by the taste of channel controllers and schedulers. With an easy trawl through an attractive EPG once a week, viewers could create their own customised channel—and if they can't be bothered to do that, then the PVR will do it for them, using the supporting metadata to pick programmes to suit their tastes. They can always be certain there is something worth watching, waiting for them on their PVR. Never again the cry 'there's nothing on tonight'.

Links

http://www.tivo.com/home_flash.asp
<http://www.replaytv.com/home.htm>
<http://www.axcent.de/en/products/default.asp>
<http://www.grundig.com/produkte/highlights.htm>

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Andrew Oliphant MIEE is Head of the Transmission Systems Group at BBC Research & Development Department (andrew.oliphant@rd.bbc.co.uk); **Bryher Scudamore** leads the BBC's Personal Television team (bryher.scudamore@bbc.co.uk).

5 Future PVRs may offer viewers their own personal channel made up of a mixture of live and recorded programmes from all available channels