Digital video recorder

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A **digital video recorder** (**DVR**), sometimes referred to by the merchandising term **personal video recorder** (**PVR**), is a consumer electronics device or application software that records video in a digital format to a disk drive, USB flash drive, SD memory card, SSD or other local or networked mass storage device. The term includes set-top boxes (STB) with direct to disk recording facility, portable media players (PMP) with recording, TV gateways with network and local recordings, recorders (PMR) as camcorders that record onto Secure Digital memory cards and software for personal computers which enables video capture and playback to and from a hard disk drive.[1] A television set with built-in digital video-recording facilities was introduced by LG in 2007,[2] followed by other manufacturers.

Foxtel iQ, a combined digital video recorder and satellite receiver.

V+, a combined digital video recorder and cable TV receiver.

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History

Hard-disk based digital video recorders

Consumer digital video recorders ReplayTV and TiVo were launched at the 1999 Consumer Electronics Show in Las Vegas, USA.[3] Microsoft also demonstrated a unit with DVR capability, but this did not become available until the end of 1999 for full DVR features in Dish Network's DISHplayer receivers. TiVo shipped their first units on March 31, 1999. ReplayTV won the "Best of Show" award in the video category[4] with Netscape co-founder Marc Andreessen as an early investor and board member,[5] but TiVo was more successful commercially. While early legal action by media companies forced ReplayTV to remove many features such as automatic commercial skip and the sharing of recordings over the Internet,[6] newer devices

Back view of a TiVo Series2 5xx-generation unit.

have steadily regained these functions while adding complementary abilities, such as recording onto DVDs and programming and remote control facilities using PDAs, networked PCs, and Web browsers.

Hard-disk based digital video recorders make the "time shifting" feature (traditionally done by a VCR) much more convenient, and also allow for "trick modes" such as pausing live TV, instant replay of interesting scenes, chasing playback where a recording can be viewed before it has been completed, and skipping of advertising. Most DVRs use the MPEG format for compressing the digitized video signals.[7] Video recording capabilities have become an essential part of the modern set-top box, as TV viewers have wanted to take control of their viewing experiences. As consumers have been able to converge increasing amounts of video content on their set-tops, delivered by traditional 'broadcast' cable, satellite and terrestrial as well as IP networks, the ability to capture programming and view it whenever they want has become a must-have function for many consumers.

Digital video recorders tied to a video service

At the 1999 CES, Dish Network demonstrated the hardware that would later have DVR capability with the assistance of Microsoft software.[8] which also included WebTV Networks internet TV.[8] By the end of 1999 the Dishplayer had full DVR capabilities and within a year, over 200,000 units were sold.[9][10]

In the UK, digital video recorders are often referred to as "plus boxes" (such as BSKYB's Sky+ and Virgin Media's V+ which integrates an HD capability, and the subscription free Freesat+ and Freeview+). Freeview+ have been around in the UK since the late 2000s. British Sky Broadcasting markets a popular combined receiver and DVR as Sky+. TiVo launched a UK model in 2000, and is no longer supported, except for third party services, and the continuation of TiVo through Virgin Media in 2010. South African based Africa Satellite TV beamer Multichoice recently launched their DVR which is available on their DStv platform. In addition to ReplayTV and TiVo, there are a number of other suppliers of digital terrestrial (DTT) DVRs, including Thomson, Topfield, Fusion, Pace Micro Technology, Humax, VBox Communications, AC Ryan Playon and Advanced Digital Broadcast (ADB).

Many satellite, cable and IPTV companies are incorporating digital video recording functions into their set-top box, such as with DirecTiVo, DISHPlayer/DishDVR, Scientific Atlanta Explorer 8xxx from Time Warner, Total Home DVR from AT&T U-verse, Motorola DCT6412 from Comcast and others, Moxi Media Center by Digeo (available through Charter, Adelphia, Sunflower, Bend Broadband, and soon Comcast and other cable companies), or Sky+. Astro introduced their DVR system, called Astro MAX, which was the first PVR in Malaysia but was phased out two years after its introduction.

In the case of digital television, there is no *encoding* necessary in the DVR since the signal is already a digitally encoded MPEG stream. The digital video recorder simply stores the digital stream directly to disk. Having the broadcaster involved with, and sometimes subsidizing, the design of the DVR can lead to features such as the ability to use interactive TV on recorded shows, pre-loading of programs, or directly recording encrypted digital streams. It can, however, also force the manufacturer to implement non-skippable advertisements and automatically expiring recordings.

In the United States, the FCC has ruled that starting on July 1, 2007, consumers will be able to purchase a set-top box from a third-party company, rather than being forced to purchase or rent the set-top box from their cable company.[11] This ruling only applies to "navigation devices," otherwise known as a cable television set-top box, and not to the security functions that control the user's access to the content of the cable operator.[12] The overall net effect on digital video recorders and related technology is unlikely to be substantial as standalone DVRs are currently readily available on the open market.

In Europe Free-To-Air[13] and Pay TV[14] TV gateways with multiple tuners have whole house recording capabilities allowing recording of TV programs to Network Attached Storage or attached USB storage, recorded programs are then shared across the home network to tablet, smartphone, PC, Mac, Smart TV.

Introduction of dual tuners

In 2003 many Satellite and Cable providers introduced dual-tuner digital video recorders. In the UK, BSkyB introduced their first PVR Sky+ with dual tuner support in 2001.[15] These machines have two independent tuners within the same receiver. The main use for this feature is the capability to record a live program while watching another live program simultaneously or to record two programs at the same time, possibly while watching a previously recorded one. Kogan.com introduced a dual-tuner PVR in the Australian market allowing free-to-air television to be recorded on a removable hard drive. Some dual-tuner DVRs also have the ability to output to two separate television sets at the same time. The PVR manufactured by UEC (Durban, South Africa) and used by Multichoice and Scientific Atlanta 8300DVB PVR have the ability to view two programs while recording a third using a triple tuner.

Where several digital subchannels are transmitted on a single RF channel, some PVRs can record two channels and view a third, so long as all three subchannels are on two channels (or one).[16]

In the United States, DVRs were used by 32 percent of all TV households in 2009, and 38 percent by 2010, with viewership among 18- to 40-year-olds 40 percent higher in homes that have them.[17]

Integrated TV-set digital video recorders

Digital video recorders are often integrated in the LCD and LED TV-sets. These systems let the user simplify the wiring and installation, because they do not use ports (SCART or HDMI), and they only need to use only one device and power and the same remote control instead of two.

There are examples of security systems integrated into such DVRs, and thus they are capable of recording more input streams in parallel. Some of them include wireless ports such as (Bluetooth and Wi-Fi), so they can play and record files to or from cellular phones and other devices. Such devices can also be used as disguised observation systems, displaying pictures or videos as typical store display.

VESA compatible digital video recorders

VESA-compatible DVR are designed small and light enough to mount to the back of an LCD monitor that has clear access to VESA mounting holes (100×100mm). This allows users to use their own personal monitor to save on cost and space.

PC-based digital video recorders

Software and hardware is available which can turn personal computers running Microsoft Windows, Linux, and Mac OS X into DVRs, and is a popular option for home-theater PC (HTPC) enthusiasts.

Over-the-air digital video recorders

Standalone over-the-air (OTA) digital video recorders are hardware-based set-top-boxes that use an HDTV antenna to record over-the-air broadcast television signals.

Integrated LCD DVR

Side view: Even with all the DVR components inside, the LCD monitor is still slim.

Media type	LCD DVR

VESA Compatible DVR

The underside of a VESA compatible DVR

Media type	DVR

Several companies have launched over-the-air DVR products for the consumer market over the past few years.[18]

Developed by	Lorex Technology

NAS DVR

An increasing number of pay-TV operators are offering their subscribers the ability to create their own digital recording platform capable of storing video, audio, photos, etc. These customizable hardware and software platforms enable subscribers to attach their own network-attached storage (NAS) hard drives or solid-state/flash memory to set-tops which do not have their own internal storage. This minimizes an operator's investment, while offering subscribers the flexibility to create a digital recording solution that meets their specific requirements.

Linux

There are many free DVR applications available for Linux, each released as free and open source software:

- MythTV
- VDR
- LinuxMCE
- Kodi, formerly XBMC[19]

Linux based TV gateway Whole House DVR - These Network Tuner, TV server connect to Satellite, Cable and Terrestrial TV by using multiple DVB tuners and convert the transport stream into IP packets for live viewing over IP networks and for recordings of live broadcast TV.

- VBox Home TV Gateway
- Tivo

Mac OS

Elgato makes a series of digital video recording devices called EyeTV. The software supplied with each device is also called EyeTV, and is available separately for use on compatible third-party tuners from manufacturers such as Pinnacle, TerraTec, and Hauppauge.

SageTV provided DVR software for the Mac but no longer sells it.[20] Previously sold devices support the Hauppauge HVR-950, myTV.PVR and HDHomeRun hardware with its DVR software. SageTV software also included the ability to watch YouTube and other online video with a remote control.

MythTV (see above) also runs under Mac OS X, but most recording devices are currently only supported under Linux. Precompiled binaries are available for the MythTV front-end, allowing a Mac to watch video from (and control) a MythTV server running under Linux.

Apple provides applications in the FireWire software developer kit which allow any Mac with a FireWire port to record the MPEG2 transport stream from a FireWire equipped cable box (for example: Motorola DCT62xx, including HD streams). Applications can also change channels on the cable box via the firewire interface. Only broadcast channels can be recorded as the rest of the channels are encrypted. *FireRecord (formerly iRecord)* is a free scheduled-recording program derived from this SDK.

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