'Oops, I did it again,' and again, and again...

Digital video recorders enable users to time shift television, but will the market shift into high gear?

Dean Takahashi, illustration by Dan Vasconcellos -- Electronic Business, 6/1/2002

Sections:
The promise of DVRs?
The box war
Try it again Sam
The Moxi vision
Challenge from the PC?
Integration rules
Don’t call them couch potatoes. During the last SuperBowl, users with TiVo digital video recorders (DVRs) weren’t sitting still, or at least their hands weren’t still. On average, they paused or replayed parts of the Super Bowl broadcast 44 times. Instead of watching instant replays of the game, these “football” fans replayed Pepsi’s Britney Spears commercial! The Mountain View, CA-based company collected the anonymous data from 10,000 subscribers across the country, and it promptly trumpeted the results as a sign of the profound impact that DVRs are having on TV viewing.

Ever since Echostar-WebTV, TiVo and Replay TV introduced the first DVRs in 1999, pundits have been predicting that DVRs would be the killer application—a replacement for the tired video cassette recorder (VCR)—that would allow consumers to time shift, or skip commercials, and watch their favorite programs (or commercials) whenever they wanted.

But, unfortunately, the early adopters were few in number. Much like the early DVD players, digital video recorders from TiVo Inc. (Mountain View, CA), Echostar Communications Corp. (Littleton, CO), Microsoft Corp.’s UltimateTV (Mountain View, CA) and SONICblue Inc.’s Replay TV (Santa Clara, CA) took several years to build up to an installed base of just a million units. At $400 or more and sometimes with $10 monthly fees, they were pricey for the limited technology that they delivered.

“There has been a lot of experimentation with business models,” says Michael Paxton, an analyst at market researcher In-Stat/MDR, a Scottsdale, AZ-based division of Reed Business Information, the parent company of ELECTRONIC BUSINESS. “They haven’t gotten over the hurdle of convincing consumers yet. Those who have them love the machines, but they’re too few.”

**The promise of DVRs?**

The question is how and when digital video recorders will become a mainstream mass market for everyday consumers and a financial windfall for electronics companies. Some analysts believe that the DVR is an essential part of the digital living room and one of the drivers of the greatest consumer electronics upgrade cycle in history. Others believe it is just one feature of many in the kitchen sink of functions that will soon be performed by digital set-top boxes. Only by integrating itself into the set-top, some say, will the DVR earn its place in the living room.

The consensus suggests the DVR industry is about to pick up momentum as either a stand-alone box or as part of a set-top box. The catalysts include competition between cable TV and satellite TV for the premium TV subscribers, the fall of prices for DVR systems selling at retail and enhancements that are expected to make DVRs easier to use and more attractive to consumers.

About 80% of the 50 largest cable operators plan to implement DVR technology in the next 12 months, according to the Multimedia Research Group, Sunnyvale, CA. As slow as they have moved in the deployment of interactive TV, the cable companies know that subscriber churn, or the likelihood that consumers might drop their subscriptions for a better deal, is much lower with DVR households. Consumers with DVRs are more likely to order premium channels, says Ken Morse, chief technical officer at Lawrenceville, GA-based Scientific-Atlanta Inc.’s PowerTV unit.

Analysts say that hitting that price threshold will make DVRs accessible to a couple of million consumers, and the more the price falls the more acceptance the boxes will
enjoy. Andrew Wolfe, chief technology officer of SONICblue, says that his company will deploy a $300 box at retail before year-end. Based on such progress, DVR shipments are expected to rise from 1.5 million units in 2001 to 17.5 million units in 2004, with market revenues increasing from $550 million in 2001 to $5.6 billion in 2004, according to In-Stat/MDR (see chart below). Those forecasts are lower than a couple years ago, but they still represent a fast uptake for a new consumer electronics technology.

The box war

The stakes are huge in the battle to define the winning combination of features in a mainstream consumer DVR box. Dozens of chipmakers, systems companies and software firms are vying for a piece of the pie. In the U.S., cable giants AOL Time Warner Inc., New York, and Comcast Corp., Philadelphia, will go to war with the combined Echostar-DirecTV company, if the proposed merge of the satellite TV rivals is approved. Motorola Inc.’s General Instrument division is squaring off with Scientific-Atlanta to provide DVR-equipped set-top boxes to cable and satellite players, while challengers like TiVo, SONICblue and Microsoft scramble for a piece of the retail market. Players including Tokyo-based Sony Corp. and Philips Electronics NV, Amsterdam, the Netherlands, have licensed DVR technology from TiVo; while SONICblue has a deal with Motorola.

In the semiconductor world, dozens of chip makers hope that making chips for the media center/digital video recorder will turn them into the Intel of consumer electronics. But they’re all coming from different directions. DVD players have been a boon for chipmakers Cirrus Logic, ESS Technology and ST Microelectronics. Zoran ST, Broadcom and Hitachi dominate the market for chips for set-top boxes. On the software front, there is an equal amount of maneuvering. Moxi Digital Inc., Palo Alto, CA, says Echostar is beginning trials with Moxi’s “media center” software, which incorporates DVR and just about everything else conceivable in a set-top box. Meanwhile in March, Moxi announced plans to merge with Digeo Inc., a Kirkland, WA-based start-up funded by Paul Allen’s Vulcan Ventures.

Moore’s Law is keeping the DVR train moving. The second-generation of DVRs arrived last year. Microsoft launched UltimateTV, but sales of the system were disappointing at about 45,000 units. TiVo rolled out its Series 2 box last fall with AT&T Broadband at a $299 price tag and with new features including a bigger hard disk for recording 40 or 60 hours of video, video on demand, digital photo viewing and music playback.

SONICblue launched the Replay TV 4000, which has a 30-gigabyte hard-disk drive to store several times more video than earlier boxes. It also allows consumers to connect to the Internet via broadband and enables them to pass around movies to friends and family in a Napster-style exchange. SONICblue limited the number of
times a video could be exchanged to 15 times, but the TV networks and movie studios promptly sued anyway, alleging the trading was another way to violate film copyrights. SONICblue contends that consumers have the right to fair use, a legal term with plenty of precedent that says its OK to use copyrighted material for personal use after it has been purchased. The wrangling has parallels to the Napster case, as well as the rights battle that took place as Hollywood squared off against DVD manufacturers five years ago. For all the fighting, SONICblue has only sold about 5,000 boxes, thanks to the hefty $700-plus price.

Why the lukewarm reception for DVRs? It’s still early in the adoption cycle. It took seven years for the DVD player to hit 14 million units sold in a year (2001). Most consumer electronics gadgets sell based on several factors: ease of use, perceived value for customers and affordability. For the first generation of DVRs, analysts say the machines failed on all three fronts. A sizable portion of TiVo’s customers, for instance, never installed their machines, which required a somewhat cumbersome set-up. Customers had to deal with a couple of remote controls if they had cable service. They also didn’t like paying the monthly $10 fee for the TiVo programming service, which didn’t seem to add much value. Andrew Wolfe, chief technology officer at SONICblue, says that the early machines were hampered because they had limited storage and few extra services to offer consumers.

Then there is the cost. In contrast to video game console makers, there was no way to price the hardware low and make up for the losses through software sales. For sure, a $100 DVR box would have drawn many more customers, but there were a lot of reasons that manufacturers couldn’t price the machines so low. The early TiVo machines, manufactured by Sony and Philips, sold for $399 and at one time included a $100 rebate paid by TiVo to customers, who signed up for the $10 monthly service fee.

"There has been a lot of experimentation with [DVR] business models. They haven’t gotten over the hurdle of convincing consumers yet."
—Michael Paxton, analyst, In-Stat/MDR

The boxes included sophisticated electronics. The biggest item was the hard-disk drive, which stored the shows in digital form. But each box needed a tuner to receive the programming in analog form, a front-end subsystem that demodulated or deciphered the signal, a back-end subsystem that included the MPEG-2 video decoder that decompressed the video stream, and more chips to encode the signal and send it to the TV display. The machine also sported other chips, including a PowerPC-based microprocessor and 10 megabytes of memory. Full told, in one system there were 48 chips, including 39 digital chips and 9 analog, on a system board that had 824 components. The Sony box cost an estimated $397 to manufacture, according to Portelligent, an Austin, TX-based market research firm that tears machines apart. The hard-disk drive itself cost an estimated $95, though that price fell fairly quickly to $50. The chips in the machine cost an estimated $107, the most expensive of which was a $15 MPEG-2 encoder created by Sony. Thanks to falling component prices, the cost now is more like $280.

Try it again Sam

In the second-generation boxes, the manufacturers applied their skills of cost reduction, combining many of the chips into a smaller number. TiVo’s Series 2 switched to microprocessor from MIPS Technologies Inc., Mountain View, CA, and it included three major chips, including a Broadcom encoder, a highly integrated Broadcom decoder, as well as a TiVo custom chip with the program guide and other functions. The machine can record two streams of video at once. The lower chip count cut costs, but the hard-disk drive—storing 40 to 60 hours of video—costs about the same.

About 40% of the cost of the current DVR box is silicon. As a result it can be subject to cost reduction, says SONICblue’s Wolfe. The third-generation boxes that SONICblue plans to introduce this year could take advantage of several kinds of chips, including media processors from start-ups including Equator Technologies...
Inc., Campbell, CA, or TriMedia Technologies Inc., Milpitas, CA. Avi Katz, CEO of Equator, says that media processors, which are programmable chips that process a wide variety of media signals such as sound or video, now have the sufficient processing power to handle simultaneous tasks, for instance receiving multiple video streams and displaying video to more than one TV. With a media processor or a highly integrated custom chip from companies such as Broadcom, the goal of reducing a DVR machine to a single chip is within sight.

But there are limits to how much integration can be done. Most of the parts like the front-end include analog components that are difficult to integrate into digital chips. In addition, the processing requirements keep going up. For instance, for consumers who want to watch one channel while they're recording another, a manufacturer has to add another tuner to the box. To navigate through complex program menus and perform multiple tasks, the box needs a faster CPU. Hence, SONICblue's Wolfe believes the boxes need microprocessors that run at 700 megahertz or more. By year-end, the hard drives are expected to hit 60 gigabytes of storage.

The Moxi vision

Steve Perlman, founder of Moxi Digital, took the industry by surprise in January at a press conference at the Consumer Electronics Show in Las Vegas. The founder of Moxi Digital said his company had designed the software and hardware reference platform for Moxi’s Media Center, which combined a kitchen sink of features including DVR, music and DVD playback, wireless networking and satellite or cable TV reception. What's more, Perlman said that each satellite box would cost only $350, and each cable TV box, which included an extra analog-digital converter and cable modem, would cost $450. The Moxi box was loaded with extras like a 733-megahertz microprocessor from VIA Technologies Inc., Taipei, Taiwan, 96 megabytes of memory to buffer the streams of video coming into the box, and an estimated 80-gigabyte hard disk. Perlman said that an extension box that cost only $50 could be added so that consumers could connect other TV sets in the household to the Media Center. The more TVs connected, the cheaper it would be to hook up a Moxi system compared to paying $250 or so for each satellite box to connect every TV in a house.

But rivals and analysts said that Perlman’s Las Vegas vision was just a mirage. A month later, word surfaced that Moxi was having trouble raising a new round of venture capital and was looking for a buyer. Perlman denied rumors that the company was in trouble, but he agreed to step down as CEO and become the vice chairman of the company. Then Moxi agreed to merge with Digeo. Other competitors said that Moxi was reaching too far into the future for its component prices. Ucentric Systems, a rival start-up in Maynard, MA, estimated that its own box for cable TV would cost an estimated $550 to $650 to deploy.

"Moxi jumped ahead four steps," says Paxton of In-Stat/MDR. "[But] it may be four or five years before their technology really becomes mainstream."

Challenge from the PC?

With DVR costs so high, many wonder whether the personal computer itself is better positioned as the media center of the living room. After all, most computers have all the necessary ingredients, including networking technology, hard-disk drives and graphics processors. For $100, consumers can add a TV tuner card and software from a company like Houston’s SnapStream Media to turn the machine into a digital video recorder.

"The PC can become the hub of entertainment in the living room," says Rakesh Agrawal, CEO of SnapStream Media. "The challenge for us is to make it mind-numbingly simple."

"The PC can become the hub of entertainment in the living room. The challenge for us is to make it mind-numbingly simple."
—Rakesh Agrawal, CEO, SnapStream Media
That's a tall order. Microsoft has major initiatives to simplify the PC under way in its eHome division, but Perlman says that PCs inherently are hard to use because they're general-purpose devices. In addition, he believes that the cable TV companies and satellite providers will never embrace the PC because it lacks encryption technology that can protect the digitized movies and music from piracy.

Integration rules

The integrated DVR/digital set-top combination box seems to be the logical answer to lower costs and a simple interface. TiVo will continue to make stand-alone boxes and license its technology to the box makers and service providers, mostly because it wants to have some control over its fate and close contact with consumers. But it's not clear what the box should include. Overall, it's easier with just one remote control to record TV shows and surf through a satellite or cable TV program guide. Games consume so many resources that they are hard to include in a DVR box. Music isn't hard to add since the hard-disk drive already is there to record it, but digital photo display screams out for new peripherals like printers to print photos from a TV set. DVD playback is an expensive function to add to a box, and it isn't necessary if many homes already have some kind of DVD player, says Peter Glaskowsky, an analyst at In-Stat/MDR.

Meanwhile, life is hard for those who wait for the plodding pace of cable TV and satellite TV to accelerate. Waiting for the era of next-generation consumer appliances has been painful to start-ups who expected a quick road to profits. The DVR companies have wandered in the wilderness for several years. Replay TV sold out to SONICblue, but most of the early pioneers are keeping the faith.

"I believe we can profitably sell a DVR box for $199 in 2003," says Ted Malone, director of product marketing at TiVo. "Nobody can afford to subsidize boxes anymore." If that happens, then many more "football" fans will be able to afford the technology that will allow them to see Britney over and over and over again.

Dean Takahashi is a senior writer at Red Herring magazine. He can be reached via e-mail at dean.takahashi@redherring.com.

MATERIALS BREAKDOWN

bill of materials estimates for Equator’s Dolphin circuit board for a digital video recorder/video-on-demand set-top box

<table>
<thead>
<tr>
<th>Material</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>32 megabytes DRAM</td>
<td>$8</td>
</tr>
<tr>
<td>2 meabytes flash memory</td>
<td>$1</td>
</tr>
<tr>
<td>Equator BSP-15 processor</td>
<td>$45</td>
</tr>
<tr>
<td>hard-disk drive</td>
<td>$80</td>
</tr>
<tr>
<td>peripherals</td>
<td>$7</td>
</tr>
<tr>
<td>multi-standard decoder</td>
<td>$2.50</td>
</tr>
<tr>
<td>super input/output chip</td>
<td>$10</td>
</tr>
<tr>
<td>other components</td>
<td>$18</td>
</tr>
<tr>
<td>circuit board</td>
<td>$15</td>
</tr>
<tr>
<td>assembly costs</td>
<td>$10</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$196.50</strong></td>
</tr>
</tbody>
</table>

10-15% reduction expected with higher volumes. Cost-reduced version, down to a cost of $101, coming later this year.

SOURCE: EQUATOR, INDUSTRY ESTIMATES