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Colliding Technologies

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The next generation of **DVD** media — high definition or **HD** — has begun to ship. The players should appear on the market soon. High definition video requires a lot of storage space — much more than current-generation **DVDs** can provide. That's the main factor driving the change. Before you buy into high definition video, though, there are a few things you should know.

First, there are two competing standards: **HD-DVD** and **Blu-ray**. **HD-DVD** was developed by **Toshiba** and **NEC** and counts **Universal Studios**, **Intel**, and **Microsoft** among its supporters. **Blu-ray** was invented by **Sony** and has the endorsement of **Disney**, **Fox**, **Apple**, and **Dell**. Both technologies use media that looks identical to today's **CDs** and **DVDs**. They both use a 405-nanometer blue-violet laser instead of a red laser used in current **CD** and **DVD** drives. The blue-violet laser's shorter wavelength means that it can be tuned more finely to increase storage capacity.

However, that's where the similarities end. The two technologies are fundamentally different and incompatible with each other. Those who remember the **Betamax** vs. **VHS** wars of the 1970s will know what to anticipate in this new media war. Movie studios and hardware manufacturers will exert a strong influence; but it will all come down to consumer preference.

HD-DVD

HD-DVD has more similarities to today's technologies than **Blu-ray**. It uses a 12cm. diameter disc with a 1.2mm.-thick substrate sandwiched between two 0.6mm.-thick layers of transparent polycarbonate, just like a **DVD**. A reflective coating on one side of the substrate of a single-sided disc lets the reading mechanism interpret the pattern of microscopic "pits" and "lands" burned into a shallow spiral groove extending from the hub to the outside edge of the disc — just as it does for any other optical disc. Because **HD-DVDs** use narrower width grooves (commonly referred to as track pitch) and smaller pits and lands, they can store three times more data than current **DVDs**.

HD-DVD's track pitch (groove) is about half that of a **DVD** (0.40 microns compared to 0.74 microns). The **HD-DVD's** pits are also close to half the size of a **DVD** (204 nanometers compared to 400 nanometers). These factors allow an **HD-DVD** to store 15GB of data on a single layer disc, compared to a **DVD's** 4.7GB-per-layer capacity. Adding another layer to the same substrate will double **HD-DVD's** capacity to 30GB. Manufacturers can also place two more layers on the other side of the disc for a storage capacity of 60GB.

The second factor in the technology is a higher-precision laser required to read the smaller grooves and pits and lands. Both **HD-DVD** and **Blu-ray** technology use a 405-nanometer wavelength blue-violet laser instead of

the 780-nanometer red laser in **CD** drives and the 650-nanometer red laser in **DVD** drives. This permits an even tighter focus than existing technologies.

Both **HD-DVD** and **Blu-ray** will support two substantially more sophisticated video compression/decompression algorithms (codecs). They will support the **DVD** standard's **MPEG-2** codec as well as **MPEG-4 AVC** (also known as **H.264**) and **SMPTE VC1**. This latter standard is based on **Microsoft's Windows Media Video** technology. As neither **HD-DVD** nor **Blu-ray** discs have the capacity to store an uncompressed, full-length movie in high definition, these codecs are essential for delivering high-definition video on disc. The more efficient **HD-DVD** codecs can reduce file size by two thirds, permitting a 15GB disc to hold 180 minutes of high-definition video.

HD-DVD Media

There are three different types of **HD-DVD** discs being released:

1. **HD DVD-ROM** (read-only media) for prerecorded content, such as movies, music, software, and games
2. **HD DVD-R** (one-time recordable discs) for video recording and data storage/backup
3. **HD DVD-RW** (rewriteable discs).

These discs will initially come only in a single-layer format, with double-layer rewriteable discs appearing later. Combination and twin-format media will probably be offered to ease the transition from **DVD** to **HD-DVD**. Combination or hybrid discs are single-sided dual-layered discs with **HD-DVD** content on one layer and **DVD** content on the other. Twin-format discs will carry **HD-DVD** content on one side of the disc and traditional **DVD** on the other.

Toshiba announced a double-sided, dual-layer hybrid **ROM** disc which consists of a dual-layer **HD DVD-ROM** side and a dual-layer **DVD-ROM** side. This hybrid disc can store 30GB of high-definition content on the **HD DVD-ROM** side and 8.5GB of standard-definition content on the **DVD-ROM** dual layer side.

Consumers will be able to play their movies in standard definition on their existing equipment and in high-definition when they upgrade their TVs and disc players. This will avoid having to buy the same content twice and may be a factor for movie studios not to adopt this technology.

Because **HD-DVD** discs are physically almost identical to current **DVD** discs, the same production lines can be used to produce both discs, saving the expense of building new factories. The hardware is also cheaper to make because of its similarity to **DVD**. Consequently, **HD-DVD** discs and players will probably be cheaper than their **Blu-ray** counterparts.

NEC was the first to announce an **HD-DVD** disc drive for the PC; but has not yet announced a ship date for its **HD-DVD Multireader HR-1100A**. **Toshiba's HD-A1** went on sale in March for \$499. The company also announced that its next **Qosimo Notebook PC** will be the first to feature an **HD-DVD** drive. It will play **HD-DVD** discs and read and write **CDs** and **DVDs**. **Microsoft** is expected to introduce an external **HD-DVD** drive that will turn the **Xbox 360** into a high-definition **DVD** player. **Sony's PlayStation 3**, on the other hand, will come with a **Blu-ray** drive capable of playing high-definition movies and games.

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Fewer movie studios have joined the **HD-DVD** camp than the **Blu-ray** one; but **HD-DVD** manufacturers promise to have movies available soon after the appearance of **Toshiba's** players.

Blu-ray

Blu-ray technology diverges more drastically from current optical-disc technologies because **Blu-ray's** engineers decided to start fresh rather than build on an existing technology with its limitations. They began by dealing with the optical disc's problem of birefringence, a condition which causes the

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When the beams diverge too far, the disc becomes unreadable.

The engineers moved the substrate on top of the polycarbonate closer to the laser. They also protected it with a thin (98 microns) transparent outer layer to virtually eliminate birefringence. However, the protective layer is so thin that the substrate becomes extremely vulnerable to scratches, dust, and fingerprints. Enclosing the **Blu-ray** disc in a protective cartridge was deemed too clumsy for the worldwide market; so **Blu-ray** disc manufacturers may coat the outer layer with an even thinner layer of **TDK's** super-tough **Durabis 2** coating. (**TDK** began shipping discs treated in this manner in December, 2005.)

Most of the other differences with **Blu-ray** technology relate to increased precision. A **BD-ROM** will have a much tighter track pitch than that of an **HD-DVD** — 0.32 microns, compared to 0.40 microns. This will require a laser with a larger lens aperture to gather more of the reflected light to resolve greater detail. Both **HD-DVD** and **Blu-ray** use a 405-nanometer wavelength blue-violet laser; but **Blu-ray** drives will be equipped with a 0.85 numerical aperture lens, compared to the 0.65 numerical aperture lenses on **HD-DVD** drives or 0.60 for **DVD** lenses.

The Technology at a Glance:

	DVD	HD-DVD	Blu-ray
track pitch	0.74 microns	0.40 microns	0.32 microns
pit size	405 nanometers	204 nanometers	150 nanometers
laser wavelength	650 nanometer, red	405 nanometer, blue-violet	405 nanometer, blue-violet
lens aperture	0.6	0.65	0.85
storage, single layer	4.75 GB	15 GB	25 GB
storage, double layer	8.5 GB	30 GB	50 GB
codec	MPEG2	MPEG-4 AVC; SMPTE VC1	MPEG-4 AVC; SMPTE VC1

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Blu-ray Media

Just as with **HD-DVD**, **Blu-ray** discs will come in three formats:

1. **BD-ROM** (prerecorded **Blu-ray** discs),
2. **BD-R** (recordable media), and
3. **BD-RW** (rewriteable media).

Blu-ray's tighter track pitch, more finely-tuned laser, and lens with a larger aperture mean that a **Blu-ray** disc will be able to store nearly twice as much data as an **HD-DVD** disc. A single-layer **Blu-ray** disc will be able to store 25GB of data. Dual-layer discs will hold double that capacity.

Sony expects to begin shipping its **BDP-S1 Blu-ray Disc** player and the **VAIO RC** desktop computer in July. The player will be priced around

\$1,000 or \$2,300 with the **VAIO PC**. The company planned to begin shipping 25GB **BD-R** (write once) and **BD-RE** (rewritable) discs in April for about \$20 and \$25 respectively. The 50GB **BD-R** and **BD-RE** dual-layer discs will come in subsequent months for about \$48 and \$60 respectively. The **BD** player is designed to deliver 1920x1080p (progressive scan) output. It will also have an analog component output for 1080i (interleaved scan) so people who own **HD-capable** televisions without **HDMI** can enjoy **Blu-ray** discs.

The **BWU-100A**, an internal **Blu-ray Disc** drive for computer use, will support recording of 25GB and 50GB **BD-R** (write once) or **BD-RE** (rewritable) discs at 2X maximum speed. It will only take about thirty minutes to burn a full 25GB disc. The drive will also support recording of standard single layer 4.7GB **DVD+R/RW**, Double/Dual Layer 8.5GB **DVD+R**, **DVD-RAM** and **CD-R/RW** media. **Panasonic** plans to start selling a **Blu-ray** high-definition disc player in September for under \$1,500 and expects to sell five million players in the first year. **Samsung** and **Pioneer** also expect to have players available soon.

Sony Pictures' Home Entertainment division recently announced it will be shipping eight movies on **BD-ROM** discs beginning on May 23 with an additional eight titles being released in June. Industry analysts expect close to 100 titles to be available from all of the **Blu-ray Disc** supporting studios by the end of the year. They will span from recent hits to classic favorites.

Copyright Protection

Sony is banking on its **PlayStation 3** game console to boost the installed base for the **Blu-ray** format. However, the company delayed **PlayStation 3's** release until early November because it is still trying to finalize the copyright protection technology and other standards for the **Blu-ray DVD** disc. Both **Blu-ray** and **HD-DVD** will use a new copy-protection scheme called **Advanced Access Content System (AACS)**. A consortium of companies that includes **Intel**, **Microsoft**, **Sony**, **Toshiba**, **Warner Brothers**, and **Disney** developed **AACS** specifically for high definition optical discs. **AACS** encrypts the content which can only be unlocked with dynamic "keys" with which all **BD** and **HD-DVD** players will be equipped. Unlike **DVD's** voluntary implementation, **Blu-ray Disc's** copy protection mechanism is mandatory and will be governed by strict licensing procedures.

The **AACS** consortium also moved, in January 2006, to require hardware manufacturers to down-convert (to 960x540 resolution) any **HD** content sent to a display device over an analog connection. This will further impede copying of high-definition content. The consortium believes that as soon as the video signal is converted to analog their encryption is useless. However, the consortium's action will make any **HDTVs** without **HDMI** ports virtually useless.

HDTV

It's not enough to buy into either the **HD-DVD** or **Blu-ray** format to get the full high definition experience. You'll also need a high definition television (**HDTV**). It is important to note that all **HDTVs** are digital but not all digital televisions are high definition. This is important because manufacturers are gradually moving from analog to digital sets, as the federal government requires all television stations to convert to digital broadcasts by April 7, 2009.

HDTV monitors or "HD-ready" sets can display **HDTV** through an external tuner such as a cable or satellite set-top box. Integrated **HDTVs**, which have the tuner built in, will be more expensive. An **HDTV** should support a minimum of 780 progressively scanned lines (780p) or 1080 interleaved lines (1080i). Full resolution **HD** video will require a display of 1920x1080p. The higher resolution renders a better picture.

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Panasonic plans to release a **Blu-ray** player at the same time as its new 103-inch flat screen TV. **Panasonic** expects the set to cost several times more than its 65-inch Plasma TV priced at \$10,000.

Converting to **HD** video is currently an expensive proposition. Unless you're an early adopter who has to be the first one in your neighborhood to have the latest technology, you may want to wait until the consumer market settles on a format.

HD video players also face stiff competition from other kinds of consumer recording and display devices. These include

hard-drive recorders such as **Tivo**, video delivered on demand over broadband and cellular networks to PCs and TVs, portable chip-based storage cards, and, eventually, **Internet Protocol Television (IPTV)**.

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Technology Left Behind — An Ode to the Typewriter

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A few weeks ago, flipping through a copy of *Martha Stewart Weddings*, I came across an article listing creative ideas for wedding guestbooks. One of the brainstorms touted as an alternative to the traditional guestbook was the use of an older, manual typewriter, upon which guests could type their well-wishes to the bride and groom. The typed pages could later be assembled into an album of sorts. (To see the typewriter guestbook in action, visit: <http://www.marthastewart.com/page.jhtml?type=content&id=channel2650087&site=weddings>) A few days after stumbling across the typewriter guestbook, I turned on the television and was greeted by an Acura car commercial. The scene opens up in a café with people in business suits sipping coffee and working on their laptops. In the background, you hear the tap-tap-tap of keys, oddly punctuated by the ding of the return of a typewriter. The camera shifts to focus on a young man with a large, bulky typewriter, circa 1982, and the announcer's voice says, "Isn't it time to upgrade?"

In the examples above the typewriter is depicted as a novelty or an obsolete piece of technology that has been superseded by computers. However, for many years the typewriter served businesses and organizations, libraries included, as a reliable, relatively inexpensive tool for neatly and quickly printing text. This column discusses the early history and evolution of the typewriter, touching briefly on the use of type-

writers in libraries and the place for typewriters in today's information technology world.

In the Beginning

While there are arguments to be made that other people developed typing machines first, it is commonly accepted that the first modern typewriter was invented in 1867 by **Christopher Latham Sholes**. **Sholes**, a newspaper editor by trade, and his partners, **James Densmore** and **Carlos Glidden**, were granted a patent for the TypeWriter on June 23, 1868.¹ In this first model, the ribbon had to be hand-linked, and it wrote in capital letters only. Several more years of development and another patent later, **Densmore** arranged for **E. Remington and Sons**, the gun manufacturer, to produce the **Sholes-Glidden TypeWriter**, which was released on the market in 1874.²

The machine did not immediately catch on. Many people were interested and gathered to see the typewriter demonstrated, but few actually purchased one. One notable exception is **Mark Twain**, who bought a **Remington no. 1** in 1874, after seeing a sales clerk type a remarkable 57 words a minute. **Twain** later learned that the typist was able to achieve such an impressive rate only by typing the same phrase over and over.³

For the next several years, the typewriter was largely considered a novelty item. They car-

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