

High Definition Optical Discs – A Retailer Update

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VSDA first published *High Definition Discs 101- a Non-Technical Primer* in late 2004. While the basics remain the same, much more information is now available to help retailers understand and support the launch of the next generation format(s) of movies on optical discs.

This update will not review the background information in the original document, but will approach the topic from the perspective of what a retailer needs to know to (a) make individual decisions regarding business models and business entry, and (b) communicate about high definition discs with customers.

Why Now?

While high definition disc formats launched into the marketplace in early/mid 2006, some retailers still ask "why now?" Does the consumer need another new format? Indeed, many consumers are still renting (and a few buying) VHS tapes.

Even though adoption by the mass market of high definition discs is probably five years away, there are valid reasons that the introduction of high definition video on a 'packaged goods' format is good for our industry.

1. Growth in consumer purchasing of DVD software is slowing as market penetration of DVD hardware reaches saturation. A new format should stimulate a renewed growth rate.
2. Studios consider standard DVDs to be a "broken format". The CSS copy protection was easily defeated soon after it was launched. With little effort, today, perfect copies of movies on DVD can be made and given to friends or family, or sold. Next generation high definition discs includes a copy protection scheme certain to be much more robust.
3. The number of US households with high definition TVs is growing steadily. According to a late 2005 study, half of U.S. consumers intend to buy a high definition TV for their next television. It is projected that, by 2011, 81% of all U.S. households will have at least one hi-def TV. Of the 16 million high definition TV households in 2005, only 7 million subscribe to high definition content sources (such as those provided by digital cable and satellite), but this is projected to increase to nearly 70% of high-def households by 2010. ***High definition movies could be the "killer app" that encourages consumers to convert from DVD to VOD or PPV if high definition packaged goods are not available to them.***

What is High Definition Optical Disc Media?

Put simply, high definition formats take advantage of technology that allows for more data to be included on an optical disc so movies can be released with the picture quality that matches the maximum capability of a high definition television, with space left over for advanced "bonus features" and interactivity.

A standard DVD holds approximately 9 gigabytes of data on two layers within the disc. This is enough to hold just under four hours of video content (usually a movie with some bonus features).

High definition discs will use a new technology to write and read a disc, which uses a blue laser (as opposed to a red laser beam used by standard DVD) with a shorter wavelength. A single layer disc will hold either 15 or 25 gigabytes of information (depending on format) – and eventually one disc may hold as many as eight layers of data. (At anticipated compression standards, a two hour movie in high definition will require about 15 gigabytes of storage.)

Studios are planning to release product in high definition at the same picture resolution currently used for HDTV transmissions (1080i or 1080p). In addition to picture quality, studios are planning discs with menus that are less "clunky" and flow better, and with significantly more interactivity and bonus features.

What additional features will High Definition discs include?

Recently, much information has been released about the content planned for high definition discs. Some changes involve the way a disc is authored and the way menus are navigated. Others include the way a consumer watches a disc. And, still others involve interactivity.

While the earliest releases of high definition discs don't nearly take full advantage of these capabilities (similar to the earliest DVD days not maximizing the potential of that format), a lot of exciting opportunities are being explored by the authoring and creative communities.

Navigation

Menus on most standard DVDs are "linear". A viewer clicks on one menu option, relocating them to another screen with another menu, and so on. In order to reach a higher-level menu, the viewer must back out of each lower-level menu. And today menus aren't available while you are watching the DVD content.

Menus on high definition discs are expected to be more like using a menu on your Windows PC. Navigation between menu items will be simpler and quicker. A full

screen change won't be necessary between menus. And, menus should be available *during* the content – so you'll be able to access them *while* you are watching a movie to bring up features which may run *alongside* the movie.

Viewing Experience

Consumers will have multiple version choices on one disc. They may be able to select viewing the wide-screen version or pan-and-scan, or perhaps the "R" rated version instead of the "Unrated" version (or maybe even the sanitized airline version) of a movie.

Multi-angle/multi-camera viewing will be functional. They'll have a choice of views when they're watching a football game on disc, and if they're watching a concert disc they may be able to choose a view of the bassist, the singer, the guitarist, the drummer, or the organist, switching seamlessly at their individual command.

Instead of watching either the "commentary" version or the movie itself, the viewer may be able to switch between "commentary on" and "off" while watching the movie (without experiencing even a short pause in the video).

Bonus features will be available *while* the viewer is watching a movie. Trivia or historical information might scroll underneath the picture. Storyboards or trailers might be shown in a "picture-in-picture" frame. A game might show up right on top of the movie.

Interactivity

Interactivity actually has two implications – human interaction with the disc, and disc interactivity over the Internet. (While Internet connectivity is not expected to be mandatory for high definition players to operate, disc features may be enhanced if consumers do connect their players to the Internet or play them on an Internet-connected personal computer.)

While standard DVDs are "play only", high definition discs will allow for information to be added to the discs. A consumer will be able to save their desired language or other playback settings. A consumer will also be able to connect to the Internet and update trailers or other features on the disc. (Perhaps if all bonus features aren't ready by 'street date', they can be later added through an Internet connection.)

Studios have also suggested that more sophisticated video games will be included on high definition discs, to either be played on the high definition player or on a videogame player. Others have suggested that discs could include "admission" to live internet events.

Interaction and connectivity also open up direct consumer business opportunities for the studios. One studio has stated that high definition discs will include a "portal to make transactions". Studios may one day package a feature film disc with an additional movie

or trailer that has not been released for home viewing and could be restricted or locked until the studio enables consumers to view it. Movies could be locked or unlocked on command adhering to traditional PPV limitations, if so designed by the studios.

Will consumers be ready?

Over 23 million high definition televisions had been sold by the end of 2005, growing nearly 130% (more than doubling) from 2004. Consumer research provided by one motion picture studio reveals that half of U.S. consumers intend to buy a HDTV for their next television (and among existing HDTV owners, 66% are planning to buy a HDTV the next time they buy a television). Both Jupiter Research and the Yankee Group project that over half of all U.S. television households will have at least one high definition television by the end of 2007. And, HANA (the High-Definition Audio-Video Network Alliance) estimates that percentage to increase to 63% by 2010.

Despite 17% of all U.S. television households having at least one high definition television, only about 1/3 of those households have ever used these sets to view high definition programming! In fact, less than half of all households with high definition televisions even subscribe to digital cable or satellite services (necessary to obtain high definition programming, unless the consumer uses an antenna to receive over-the-air hi-def signals).

Therefore, there should soon be a substantial base of consumers ready for high definition discs – probably hungry for the high quality viewing experience.

But, will high definition discs be consumed to fill that hunger, or will consumers feed on satellite, cable, VOD, PPV, internet-based downloads, or over-the-air programming?

With both Blu-ray and HD DVD formats launched into the market, consumers may not have sufficient confidence that they'll be investing in a lasting format and may hold off. As one format becomes dominant, consumers should be more willing to engage themselves with high definition discs. Hopefully by that time other delivery vehicles won't have gained popular acceptance.

However, the retail price of entry (hardware pricing) will probably also be a significant factor for all but the early adopters.

Toshiba was the first-to-market with two HD DVD players in the U.S., priced at \$500 and \$800 (with the lower priced player selling at retail under \$400.) However, Toshiba has reached an agreement with Chinese manufacturers and has licensed to them the rights to build HD DVD players to be sold in the United States. While these players will compete with Toshiba's own players, this should flood the U.S. market with low-priced players (perhaps causing a competitive reaction by Blu-ray manufacturers).

The first Blu-ray player was released by Samsung at \$1,000 (and is being sold at retail at prices as low as \$749.) However, prices should drop once PS3 is launched in the United States in the Fall, as PS3 will play movies on Blu-ray discs.

Some analysts expect hardware prices for high definition players to fall below \$50 by 2010.

Both Blu-ray and HD DVD discs have the capability to include an additional layer of programming which could hold a standard definition movie playable in existing DVD players. Whether studios will release discs in this arrangement or not remains an individual decision of each studio. Universal and Warner have already released some of their titles in this "hybrid" format, the first being *Rumor Has It*.

If consumers aren't ready to invest in high definition disc players in the early stages of the product lifecycle, they may be hesitant to buy *any* discs (and may actually increase their rental frequency).

What About Two Formats?

High definition hardware and software have been launched on two incompatible formats, Blu-ray and HD DVD. Each format has significant hardware manufacturer and content provider support.

While there are considerable similarities between the two formats, there are also differences. In the past, the two factions had discussed coming together into a single format, but compromise was not reached. And, both formats have stated publicly that these talks have ceased.

The basic differences between the disc formats are that Blu-ray holds more content, and HD DVD is less costly to manufacture. (However the basic practical differences are that Blu-ray has more studio support, and HD DVD hardware is considerably less expensive.) Another difference is the surface layer density, a compromise the HD DVD camp isn't willing to make (as it would increase the manufacturing cost). The camps also have not been able to agree on whether to include the use of either Java or iHD for programmatic interactivity.

Patent interests weigh heavily, as well. Key patent holders and player makers may not be interested in a common, open standard. There are significant long-term licensing fees at stake, which could be lost by one camp or the other in the case of compromise. But, there is also recognition that if neither format succeeds (due to consumers rejecting a format choice), no patent or license holders will reap rewards.

The chart below lists the differences and similarities between the formats, as well as the supporters behind each.

	HD DVD	Blu-ray
Storage Capacity	Single layer = 15GB Dual layer = 30GB Triple layer = 45GB	Single layer = 25GB Dual layer = 50GB Four layer = 100GB Plans for 8 layer (200GB)
Backward Capability	Dual layer, dual sided discs can be manufactured with a 30GB HD side and 8.5GB standard DVD side, making it playable on a standard DVD player (or, presumably, as a standard DVD on a Blu-ray player). Standard DVDs can be played with the HD player.	Although not yet adopted as a format standard, a three-layer disc can be produced with Blu-ray high definition on two layers and standard definition on one. (This disc is one-sided.) Standard DVDs can be played with a second optical pickup.
Durability	The disc is the same as a standard DVD. The data layer is buried in the middle of the disc, halfway through a chunk of plastic 1.2 microns thick.	The data layer is behind .01 microns of plastic and a protective coating. This disc is slightly thicker (and some say less flexible) than existing discs. A coating has been developed to protect the disc from fingerprints, stains, and scratches.
Game Consoles	Microsoft has announced an add-on component for its Xbox to allow HD DVD play.	Sony has announced that Blu-ray discs will be playable on the PS3 when released in 2006.
Copy Protection	AACS	AACS plus BD+ and ROM mark
Managed Copy	Mandatory	Mandatory
Manufacturing	Can be manufactured on the same production lines as current DVDs, representing a huge initial cost savings. There will be minimal per disc cost increases over standard DVD.	Plants need to be re-tooled for replication. It is speculated, though, that replicators could sell off 40-50% of their current DVD production assets to produce Blu-ray. Sony DADC anticipates that, while Blu-ray will be more expensive to start, the cost of making a Blu-ray disc will eventually equal that of a standard DVD.

US Launch	Spring 2006	Summer 2006
Studio Support	Universal, Warner, Paramount, New Line	Sony, BVHE, Warner, New Line, Fox, Lionsgate
Hardware Manufacturers	Toshiba, NEC	Sony, Hitachi, LG, Matsushita, Pioneer, Philips, Samsung, Sharp, Thompson
Interactivity Environment	iHD	Java
PC Manufacturers	Microsoft, Intel, HP	Dell

What advances in copy protection will high definition discs include?

High definition discs (Blu-ray and HD DVD) will include AACS (Advanced Access Content Control) to protect its digital data. This system is similar in function to the CSS system used on standard DVDs, however the encryption is distributed differently and is more robust.

All high definition players will have sets of "keys" that can unlock the included data. Studios will be able to revoke keys, or prevent certain keys from being used to unlock the data (such as keys that have been publicly posted after being hacked – as happened with CSS). Once a key is revoked, future discs won't carry this key and players using the key won't be able to play back *new* discs.

Blu-ray has also added additional copy protection with "ROM Mark" and BD+. "ROM Mark" requires the disc player to recognize the "fingerprint" of the equipment used to stamp the disc which is embedded on the disc (a physical feature which can't be copied). And, BD+ allows discs to carry title-specific security logic, carrying code that can be run on a Blu-ray player to allow or disallow playback.

In addition, it has been reported that high definition disc players will include a sensor that detects an inaudible watermark embedded in the theatrical soundtrack of movies. If the player recognizes a watermark, it will assume that the disc must be an illegal camcordered copy of the movie, and the player won't allow playback. (This watermark is made by slightly varying the waveform of the speech and music in a regular pattern to convey a digital code. The variations are too subtle to be recognized by humans, but easily recognized by the player's decoder.)

It is widely believed by content holders that copy protection will be effective only if the content is sent from an HDMI output on the disc player (a connection that allows transmission of both digital and audio signals), not through component outputs (that most consumers use today to connect their DVD players to their high definition television) or DVI outputs (a more advanced output used to connect computers and some digital cable or satellite boxes to a high definition TV). If this constraint is included on high definition playback, many consumers with high definition televisions in their homes today not

including an HDMI input will *not* be able to view high definition discs in full high definition quality.

At the time of this document's most recent revision, only Warner plans to deploy this constraint (called the *Image Constraint Token*) on its releases, although even Warner hasn't used it on its earliest releases.

What is Mandatory Managed Copy?

One additional feature of high definition discs is "mandatory managed copy". Managed Copy allows for consumers to copy disc content to a hard drive, transfer a movie (legally) to a portable player, or stream content on a home network. This feature is mandatory for all studios. That is, all content provided on high definition discs must give users the option to make at least one copy.

How will high definition formats roll out through retail to the consumer?

Timing

HD DVD, both software and hardware, launched in the Spring of 2006. Toshiba's two players and Warner's initial group of titles were only available through key retailers selling both the hardware and the software (as well as through Netflix for rent). Universal followed soon with its initial slates of titles. As of this revision (September 22, 2006) there are about 55 titles from Warner, Universal and Paramount released in HD DVD, with another 35 titles announced to release by year-end.

Blu-ray launched, both hardware and software, a few months later in the Summer of 2006. Samsung's player and Sony's title slate were more widely distributed through retailers and "rentailers". About 45 titles are now available, including titles released by Sony, Paramount and Lions Gate, and about 50 more are announced for release before the end of 2006 (including releases from BVHE.)

So far, Warner Home Video and Paramount are releasing titles on both formats.

Projections for sales during the initial phases of the launch have been small, with only about \$50 million in hardware sales projected and under \$20 million in software sales projected. In contrast, during what's being called the "Total Market Immersion" phase, from October through December 2006, hardware sales are projected between \$1.5 and \$1.9 *billion*, and software sales between \$225 and \$500 million.

Including set top players, game consoles, and computers with high definition drives, it is anticipated that there will be between 4.5 million and 7.5 million devices in consumers' homes that are capable of playing high definition media, and within 4 years of introduction, there may be over 100 million such devices in the consumer marketplace.

Merchandising

Most participants in the industry bemoan how quickly standard-def DVD pricing raced to the bottom, devaluing the content. High definition discs are expected (based on comments from individual industry participants) to maintain a slight premium retail price differential over standard definition DVDs with "hybrid" discs even a few dollars higher.

Packaging is unique from standard DVDs. Clamshell containers are the same width as a standard DVD, slightly thinner (although thicker than a standard CD package) and slightly shorter than standard DVDs. Blu-ray disc clamshells have a blue perimeter and HD DVD clamshells have a deep red perimeter on the face of the packages, each having the format log engraved on the top perimeter area.

For the most part, during the early launch phase, software has been merchandised in-store along with hardware.

Marketing Support

Both HD DVD and Blu-ray have formed promotional groups to support aggressive marketing for these formats. In addition, HANA has been formed to market the overall high definition viewing experience.

A \$150 million dollar advertising campaign has been planned for HD DVD. The campaign is being handled by Goodby Silverstein & Partners, the same agency that created the "Got Milk?" campaign. This initiative will encompass all media: print, internet, television and other outlets. All advertising will boast the tagline "The Look and Sound of Perfect." A new Web site was also launched which touts the HD DVD's video and audio capabilities and includes trailers of HD DVD movies.

Sony's been driving Blu-ray marketing during the initial phase, with a company-wide marketing initiative designed to foster awareness of the Blu-ray format with consumers. They kicked off their blitz with a demo event held on the studio lot in Culver City, CA, geared to media and retailers. Their marketing strategy includes "piggybacking" on the marketing of its standard DVD titles, including those ads on television and radio, saying "available on DVD and on Blu-ray". Sony's retail chain, Sony Style, is also running Blu-ray product demos in its top stores.

All major consumer electronic retailers have been regularly advertising high definition players, often along with high definition discs.

Consumer Reaction

Early adopters have been generally pleased with product quality. However, there were initial concerns that the Toshiba players took a long time to start up and took a long time to load and play an HD DVD. Other features on the Toshiba player were equally "clunky". (Toshiba has since created firmware to correct these problems which consumers could either download and apply or could obtain in DVD format.)

Some concerns have been noted regarding Blu-ray's visual quality, however Samsung is also releasing a firmware fix.

Overall, the price vs value relationship has been cited as most important among the first group of consumers and reviewers of the formats.

What else, and what's next?

Additional Formats

In addition to HD DVD and Blu-ray high definition disc formats in the United States, two other formats (EVD and FVD) have launched in China. EVD is actually just a DVD disc with a different set of video/audio specifications using a stronger compression algorithm than MPEG-2, therefore allowing high definition movies to be stored onto a DVD.

FVD is different from the DVD specifications, with capacities slightly larger than for DVDs. A single layer FVD can contain 5.4 GB of data, and a dual layer contains 9.8 GB. The anticipated second generation FVD will support single, dual, and triple layers with sizes of 6 GB, 11 GB and 15 GB.

Both EVD and FVD will produce 1080i pictures, but neither will produce 1080p.

In North America, the recently announced VMD platform uses a technology to create multiple layers and much greater storage within the thickness of a standard optical disc. It uses the existing red laser platform, which DVD uses. This could make VMD attractive to content vendors, disc replicators and consumer electronics manufacturers, as little retooling is required for mass production. Benefits to the consumer may be VMD's true HD viewing quality, affordability, proven technology and compatibility with their existing DVD collections.

But, most interesting is that a patent has been applied for a process which would create a single disc containing a movie with both a Blu-ray version and an HD DVD version, as well as a standard definition version (therefore playable in any high definition or standard DVD player). At this point in time, this is only a vaporware announcement – however, if it becomes reality it could well solve the format incompatibility problem, and hasten consumer transition to high definition discs.

And, while the high definition disc concept hasn't yet gained wide consumer adoption, the next generation format is already in development. Although not today targeting the

home video market but rather intended for data storage, holographic DVDs will hold 300 gigabytes of data. That's enough to hold 26 hours of broadcast quality high definition video.

Holographic discs are anticipated to be 13 cm in diameter, slightly wider and thicker than a standard DVD. They use light from a single laser split into two beams – the signal beam and the reference beam. A hologram is formed where these two beams intersect within the recording medium. A chemical reaction occurs in the medium when the bright elements in the signal beam intersects the reference beam, causing a hologram.

While some look to holographic discs to become the next generation of packaged goods, others anticipate that standard or high definition discs will be the lasting format for those wanting physical media.

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