

# High Definition Discs 101 – A Non-Technical Primer

(First Printed August 2004, Last Revised September 2006)



## CONTENTS

1. What is a DVD?
2. How is a High Definition Disc different?
3. Why High Definition Discs Now?
4. Two Formats Released
5. What's To Come?

### *What is a DVD?*

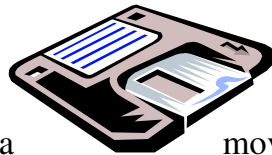
When most people in the home entertainment business think of a DVD, they think of movies. In fact, the most popular use of the DVD format is to release movies to the consumer.

However, a DVD isn't a movie. It's merely a "portable storage medium". It's no different from a floppy disc you used to use in your computer, a "music" or data CD, or the memory card that you use in your camera or mp3 player – except that it holds more data or information.



The biggest difference between a DVD and all of the other storage formats is its capacity. Capacity is important because a 2 hour movie, using current compression methods (explained later in this primer), requires nearly 5 gigabytes (GB) of storage. Before DVD, none of the other forms of portable storage medium would hold a full movie.

The old floppy discs of yesterday held 1.44 megabytes of data. One thousand megabytes equals approximately one gigabyte. So, it would have taken 3,500 floppy discs to hold a movie which could be played back in the quality of a DVD. It was possible, but not practical.



of yesterday held 1.44 megabytes of data. One thousand megabytes equals approximately one gigabyte. So, it would have taken 3,500 floppy discs to hold a movie which could be played back in the quality of a DVD. It was possible, but not practical.

A CD, like the one used either for storage for your computer files or the ones you buy commercially with music (both are technically the same), holds 650-700 MB of data. This storage level is fine for a music album, which in WAV format (which is the audio format that plays in your car or home CD player) holds over an hour of music. But, about 7 CDs would be needed to hold a 2 hour movie compressed in the same quality as a DVD. It's possible, but still not practical.

*(There are compression techniques that allow a full-length movie to be stored on a CD. This is how VCDs are produced – which are popular on the underground market in Asia and available around the world. However, the quality of playback of a VCD is comparable to that of VHS.)*

DVDs (Digital Versatile Discs), in their basic state, hold 4.7GB of data each. One DVD equals about the same amount of storage capacity as 6½ CDs, and has capacity for just under two hours of video – enough for most movies.

In order to release movies which were two hours or more, and so that “extras” could be included, some movies were released on a set of two DVDs and, midway through a movie, the discs had to be switched. This problem was solved when disc capacity was doubled and even quadrupled by creating discs with a “flip side” and discs with second layers.

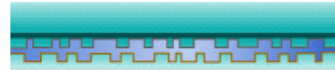
*(Back in late 1999, the first of few double-sided, double layer disc movies (called DVD-18 because it held about 18GB of data) was released – Steven King’s “The Stand”. Pressing a DVD-18 was much more complicated, and only a few replicators were prepared to go into production. Production costs were very expensive, and there were a lot of defective discs. So, this concept was abandoned as a standard for increasing capacity.)*

A double-sided, single layer disc or a single-sided, double layer disc (the most common format released commercially today) holds 8.5GB – enough for a movie over three hours long with plenty of extras (which are usually produced at a much less space-intensive compression rate).

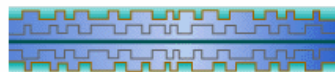
**Single-sided, single layer (4.7GB)**



**Single-sided, double layer (8.5GB)**



**Double-sided, double layer (17GB)**



### ***How is High Definition Disc Different?***

High definition discs takes the next giant step toward increased capacity. How?

In each computer or DVD player is an optical reader (which you call the “CD-drive” in your computer). The optical reader emits a laser which is used to read the information on the disc. The standard reader is known as the “red laser”, and it reads CDs and today’s DVDs.

High-definition discs require more capacity on the same size disc. The laser needs to read a tighter line of information on the disc. (Think of the LPs or phonograph records “of old”. Basically 78 RPM records and 33 1/3 RPM records were the same size. But, the grooves were thinner on the 33 1/3 records, allowing for more information to be written on the disc.)

High-definition disc optical readers use a “blue laser” which emits a shorter wavelength than “red laser” and can focus on that tighter line. The capacity on a single layer high-definition disc is either 15GB or 25GB (depending on format). Some movies have already been released on dual layer or dual side discs, and there’s talk about multiple layer discs in the near future. In fact, Sony has announced that by the end of 2008 they’ll be able to launch an *eight* layer disc with capacity of 400GB!

Storing a two hour movie (at the same level of compression and definition as a high-definition TV broadcast) will take about 20GB of space. So, plenty of space will be left over on the disc for extras and interactivity. Some movies will have multiple endings, and some even multiple story lines. The viewer will have the ability to surround the movie picture with “tickertape comments” or other information that adds to the enjoyment or appreciation of the movie. With many gigabytes of storage left over, opportunities are endless.

### ***Why High Definition Discs Now?***

There are a number of reasons that high definition discs were released to the consumer market early 2006. First, the consumer electronics companies aren’t making a lot of profit from standard definition DVD players (which are being retailed as low as \$15). They need something new to sell.

Second, high definition discs will offer better copy protection from digital piracy. Encryption will be more advance and dynamic. Pirated copies may be traced back to the manufacturer. And, uploading or downloading a 20GB movie over today’s internet bandwidths will make P2P sharing extremely difficult.

Third, high definition televisions are being purchased in more and more homes in the US. The FCC has mandated that all televisions sold starting in March of 2007 have tuners capable of receiving high definition content, and has also mandated that all television stations stop broadcasting analog signals by February 2009. So, the number of high definition TV households will continue to grow, and is anticipated to reach 21 million by the end of 2006 and 180 million (81%) by 2011.

Once consumers view a high definition signal on television, most will really see the difference – it’s even much better than viewing a standard DVD on a high-definition TV. Consumers with high definition TVs search for content which they can watch in high definition. If the only way that they are able to view a movie in high definition is to watch in on Pay-Per-View or Video-On-Demand, they’ll probably try it. This could become the “killer application” that draws consumers to these delivery options - if the alternative of high definition discs for sale and rental isn’t available.

## *Two Formats Released*

Two formats of high definition discs have been developed: HD-DVD and Blu-Ray. Sony has developed the Blu-ray technology, which is endorsed by Hitachi, LG, Matsushita, Mitsubishi, Pioneer, Phillips, Samsung, Sharp and Thompson. Toshiba and NEC have developed HD-DVD. These two formats are not compatible – that is, a Blu-Ray disc won't play in an HD-DVD player and vice versa.



Why two formats? It's all about licensing fees. Neither patent holder wants to give up the huge revenue stream they'll receive in licensing if their technology succeeds. (Sony, along with Phillips, controlled the underlying patent for the CD format, but not for the DVD format which is primarily based on technology developed by Toshiba and Time Warner. Sony presumably doesn't want to lose the future revenue stream from high definition discs.)

This chart compares the two formats *as of this writing*. The attributes of each format are changing quickly, though.

	HD DVD	Blu-ray
Storage Capacity	1-layer – 15GB; 2-layer = 30GB; 3-layer = 45GB	1-layer = 25GB; 2-layer = 50GB; 4-layer = 100GB;  Plans for 8 layer disc (200GB)
Backward Compatibility	Dual layer, dual sided discs can be manufactured with a 30GB HD-ROM side and 8.5GB dual layer standard DVD side, making it playable on standard DVD player (or as a standard DVD on a Blue-Ray player)  Standard DVD can be played in HD DVD 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. The disc is one-sided.  Standard DVD can be played in a Blu Ray player with a second optical pickup.
Studio Support	Warner, Paramount, New Line, Universal	Sony (Columbia/TriStar), Buena Vista, Fox, Paramount, Warner, New Line, Lions Gate
Hardware Manufacturers	Toshiba, NEC	Sony, Hitachi, LG, Matsushita, Pioneer, Phillips, Samsung, Sharp, Thompson
Durability/Protection	The disc is the same as a standard DVD. The data layer is buried in the middle of a 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 than existing discs. A disc coating will be used for protection

Manufacturing	Can be manufactured on the same line as current DVDs, representing a huge start up cost savings. There will be minimal per disc cost increases.	Plants need to be re-tooled for replication. It is speculated that replicators could sell off 40-50% of their current DVD production assets to make Blue-ray. Sony DADC anticipates that, while Blue-ray will be more expensive to start, the cost of making a Blue-ray DVD will eventually equal that of a standard DVD.
Copy Protection	AACS (which includes 128-bit AES encryption and device key retirement) plus mandatory HDCP encrypted output and a volume identifier layer,	AACS plus BD+, which is a mandatory protection mechanism that monitors for substitution hacks (such as virtual device drivers that steal content) and enables field-renewable encryption.
US Launch	Spring 2006	Summer 2006

As you see in the above chart, home video suppliers are lining up behind formats. Although no studio has committed to release movies on one format “exclusively”, most have expressed that it’s not likely that they will release on both (at least from the get-go).

This situation presents that the consumer buying a Blu-ray player will only be able to play high definition discs manufactured by the studios that are releasing in the Blu-ray format (Sony, Fox, Warner New Line, Lions Gate, Paramount and Disney), while the consumer buying an HD DVD player will only be able to buy or rent high definition discs manufactured by the studios releasing in that format (Universal, Warner, New Line and Paramount).

Technology has recently been developed which will allow both HD DVD and Blu-ray discs to contain both a high definition layer and a layer (or two) of standard definition. Warner and Universal have already begun releasing this “hybrid” disc. Consumer buying these discs will be able to:

- Play the movie in high definition on the appropriate DVD player,
- Play the movie in standard definition on their current DVD player, and
- Probably play the movie in standard definition on the alternative format high definition player (that is, for example, a disc containing a HD DVD movie and a standard movie could be played in standard definition on a Blu-Ray player.).

Multiple formats have never been good for a product launch.

The launch of the VCR was a giant revolutionary step in human behavior. Never before had people been able to time shift television, nor were they ever before able to rent or buy a movie and watch it any time they wanted on their television set.

But many believe that consumer confusion between buying a Beta or a VHS machine (two competing, incompatible VCR formats) slowed down the voracity to jump on the VCR bandwagon. The consumer didn't know which player to buy, and was afraid that studios might stop supporting one format or the other, and didn't want to invest in the format that would become extinct. (During the VCR launch, studios regularly released movies in *both* formats – a tactic which may not be enjoyed in the high definition launch.)

Compare the launch of VCRs to the launch of DVDs. DVD technology was evolutionary, not revolutionary. It allowed consumers to watch a somewhat better picture with somewhat better sound on a format which was smaller, cheaper and probably more durable. However, although it was far from the revolutionary step taken when the VCR was introduced, DVDs were accepted and purchased at an unprecedented rate by the consumer. Some speculate that this happened because there was no confusion and no cause for consumer pause.

The audio industry has recently gone through a similar format war with the launch of SACD and DVD-Audio. Similar to the impending high definition DVD format war, these formats are incompatible and require unique players. While sound quality is improved significantly with either over standard CD quality, and CDs are mastered to play in 5.1 sound (which is what home theater amplifiers use for movies – splitting sound across 5 speakers plus a subwoofer), neither of these formats have sold well and many retailers and consumers are writing them off.

On the other hand, younger consumers are used to electronic game titles being released on various, incompatible formats. And this industry continues to grow.

And, consumers may not consciously see the analogy, but Pay-TV networks (HBO, Showtime, etc) frequently offer *different* movies. If you want to see the latest Harry Potter movie, for example, you need to subscribe to HBO. And, Showtime has its own exclusives. Perhaps consumers have accepted this confusion because (a) they have already had the opportunity to buy or rent whatever movie they want at the video store, and (b) because they only have to pay a monthly subscription fee (with no up-front investment) and can cancel or switch at any time.

However, it is evident to most that a format war will not optimize the potential of the launch of a high definition format, and that an early-on compromise or surrender by one camp or the release of a dual-format player will hasten consumer acceptance.

## *What's To Come?*

Both formats have released in very limited supply and distribution during their initial launch phase. Studios and consumer electronic manufacturers are projecting that distribution will expand and sales will grow during Q4 2006. Some retailers, during this early phase are supporting both hardware and software, some have chosen not to, and a small number have chosen to sell software and not hardware. Netflix initiated rental of all high definition titles from the first release date.

Each retailer needs to develop its own strategy and make an independent decision regarding its support for high definition discs. EMA will continue to provide information to help make those decisions.

EMA will keep its members informed with updated developments regarding high definition discs. This information will be available by email as well as on the web. Click [here](#) to review this area of our website.

## **Entertainment Merchants Association**

16530 Ventura Blvd., Suite 400  
Encino, CA 91436  
818.385.1500  
[www.entmerch.org](http://www.entmerch.org)

© Entertainment Merchants Association