
Blu-ray Disc

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What is ***Blu-ray***???

- The Blu-ray Disc(BD),also known as Blu-ray,is the name of next generation optical disc format.
- The format was developed to enable recording,rewriting and playback of high-definition video and audio(HD) as well as storing large amounts of data.
- It has the capability of holding as much as five times more than the storing capacity of traditional DVD’s.

Why the name *Blu-ray*??

- The name Blu-ray is derived from the underlying technology, which utilizes a blue-violet laser to read and write data instead of the red laser as in the present DVD. The name is a combination of "Blue" (blue-violet laser) and "Ray" (optical ray).
- According to the Blu-ray Disc Association the spelling of "Blu-ray" is not a mistake, the character "e" was intentionally left out so the term could be registered as a trademark.

Who developed *Blu-ray*?

Computer and media manufacturers, with more than 180 member companies from all over the world. The Board of Directors currently consists of:

Apple Computer, Inc.
Dell Inc.
Hewlett Packard Company
Hitachi, Ltd.
LG Electronics Inc.
Matsushita Electric Industrial Co., Ltd.
Mitsubishi Electric Corporation
Pioneer Corporation
Royal Philips Electronics
Samsung Electronics Co., Ltd.
Sharp Corporation
Sony Corporation
Sun Microsystems, Inc.
TDK Corporation
Thomson Multimedia
Twentieth Century Fox
Walt Disney Pictures
Warner Bros. Entertainment

What *Blu-ray* formats are planned?

- As with conventional CDs and DVDs, Blu-ray plans to provide a wide range of formats including ROM/R/RW. The following formats are part of the Blu-ray Disc specification:
  - *BD-ROM* - read-only format for distribution of HD movies, games, software, etc .
  - *BD-R* - recordable format for HD video recording and PC data storage.
  - *BD-RE* - rewritable format for HD video recording and PC data storage.

  There's also plans for a BD/DVD hybrid format, which combines Blu-ray and DVD on the same disc so that it can be played in both Blu-ray players and DVD players.

How much data can you fit on a *Blu-ray disc??*

- A single-layer disc can hold 25GB.
  A dual-layer disc can hold 50GB.
- To ensure that the Blu-ray Disc format is easily extendable (future-proof) it also includes support for multi-layer discs, which should allow the storage capacity to be increased to 100GB-200GB (25GB per layer) in the future simply by adding more layers to the discs.
- Over 9 hours of high-definition (HD) video on a 50GB disc.
  About 23 hours of standard-definition (SD) video on a 50GB disc.

How fast can you read/write data on a *Blu-ray disc*?

- According to the Blu-ray Disc specification, 1x speed is defined as 36Mbps. However, as BD-ROM movies will require a 54Mbps data transfer rate the minimum speed we're expecting to see is 2x (72Mbps).
- Blu-ray also has the potential for much higher speeds, as a result of the larger numerical aperture (NA) adopted by Blu-ray Disc. The large NA value effectively means that Blu-ray will require less recording power and lower disc rotation speed than DVD and HD-DVD to achieve the same data transfer rate. While the media itself limited the recording speed in the past, the only limiting factor for Blu-ray is the capacity of the hardware. If we assume a maximum disc rotation speed of 10,000 RPM, then 12x at the outer diameter should be possible (about 400Mbps). This is why the Blu-ray Disc Association (BDA) already has plans to raise the speed to 8x (288Mbps) or more in the future.

What video codecs will *Blu-ray* support?

- ***MPEG-2*** - enhanced for HD, also used for playback of DVDs and HDTV recordings.
- ***MPEG-4 AVC*** - part of the MPEG-4 standard also known as H.264 (High Profile and Main Profile).
- ***SMPTE VC-1*** - standard based on Microsoft's Windows Media Video (WMV) technology.

What audio codecs will ***Blu-ray*** support

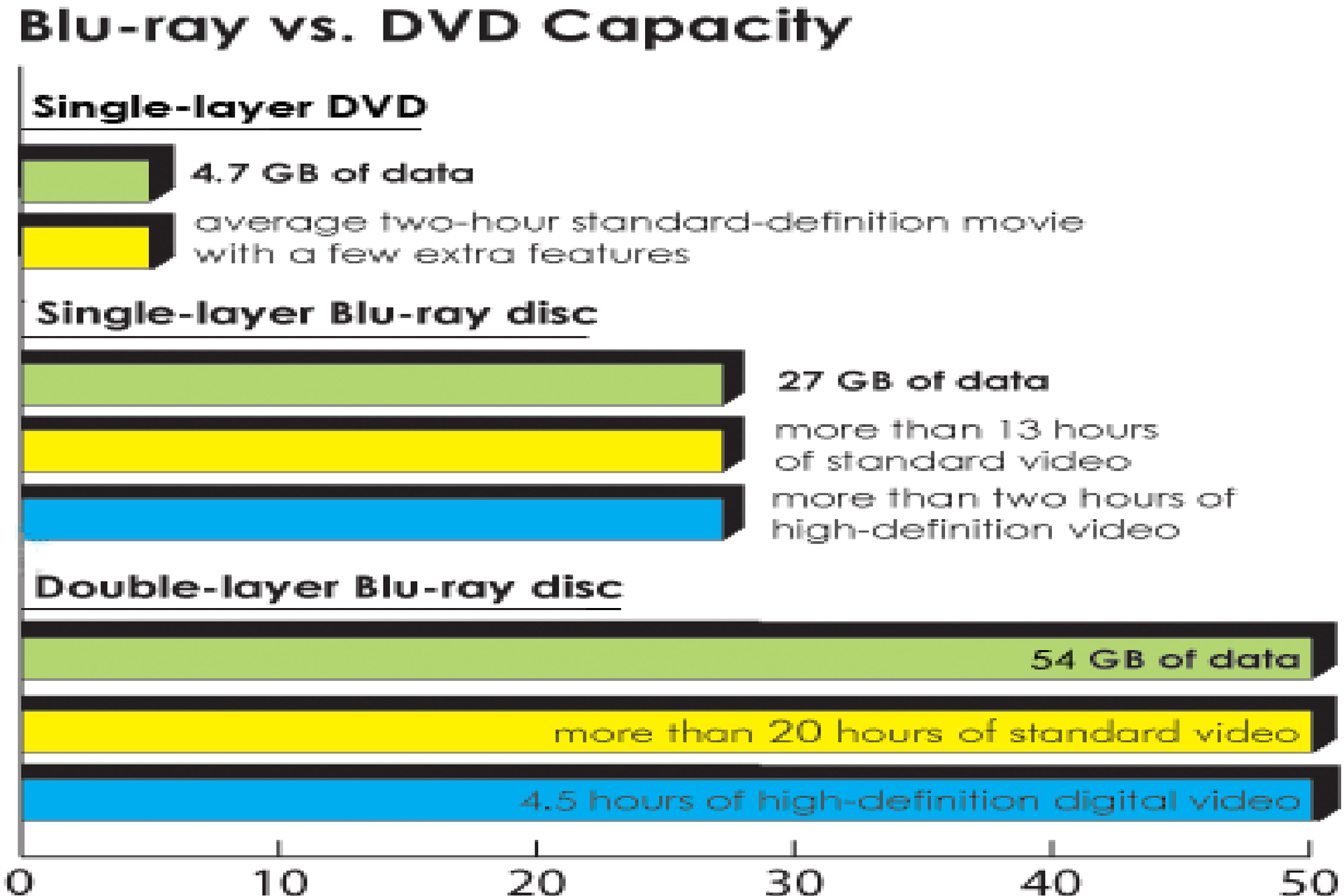
- ***Linear PCM (LPCM***) - up to 8 channels of uncompressed audio. (mandatory)
- ***Dolby Digital (DD)*** - format used for DVDs, 5.1-channel surround sound. (mandatory)
- ***Dolby Digital Plus (DD+)*** - extension of Dolby Digital, 7.1-channel surround sound. (optional)
- ***Dolby TrueHD*** - lossless encoding of up to 8 channels of audio. (optional)
- ***DTS Digital Surround*** - format used for DVDs, 5.1-channel surround sound. (mandatory)
- ***DTS-HD High Resolution Audio*** - extension of DTS, 7.1-channel surround sound. (optional)
- ***DTS-HD Master Audio*** - lossless encoding of up to 8 channels of audio. (optional)

What resolution will the video on a movie BD be?

- BD resolution will follow the standard HD resolution standards currently used for HDTV transmissions. This means, at least for the present, the maximum resolution will be 1080i/p, or ***1920x1080*** in either interlaced or progressive format (not many displays can support 1080p, and even less can resolve or display the full 1080 lines). There is also 720p resolution (***1280x720,*** progressive), which is the current native resolution of many home theatre displays, and also SD resolution support, similar to today's DVDs.

Will *Blu-ray* replace DVDs???

- Yes, that's the expectation. The Blu-ray format has received broad support from the major movie studios as a successor to today's DVD format. In fact, seven of the eight major movie studios (Disney, Fox, Warner, Paramount, Sony, Lionsgate and MGM) are supporting the Blu-ray format. Many studios have also announced that they will begin releasing new feature films on Blu-ray Disc day-and-date with DVD, as well as a continuous slate of catalog titles every month.


Blu-ray vs. DVD Capacity
Single-layer DVD
4.7 GB of data
average two-hour standard-definition movie with a few extra features
Single-layer Blu-ray disc
27 GB of data
more than 13 hours of standard video
more than two hours of high-definition video
Double-layer Blu-ray disc
54 GB of data
more than 20 hours of standard video
4.5 hours of high-definition digital video
0
10
20
30
40
50

What is the difference between *Blu-ray* and DVD?

Parameter	Blu-ray	DVD
Storage capacity	25GB (single-layer) 50GB (dual-layer)	4.7GB (single-layer) 8.5GB (dual-layer)
Laser wavelength	405nm (blue laser)	650nm (red laser)
Numerical aperture (NA)	0.85	0.60
Disc diameter	120mm	120mm
Disc thickness	1.2mm	1.2mm
Protection layer	0.1mm	0.6mm
Hard coating	Yes	No
Data transfer rate (data)	36.0Mbps (1x)	11.08Mbps (1x)
Data transfer rate (video/audio)	54.0Mbps (1.5x)	10.08Mbps (<1x)
Interactivity	BD-J	DVD-Video

Will *Blu-ray* be backwards compatible with DVD?

- Yes, several leading consumer electronics companies (including Sony, Panasonic, Philips, Samsung, Pioneer, Sharp and LG) have already demonstrated products that can read/write CDs, DVDs and Blu-ray discs using a BD/DVD/CD compatible optical head, so you don't have to worry about your existing DVD collection becoming obsolete. In fact, most of the Blu-ray players coming out will support upscaling of DVDs to 1080p/1080i, so your existing DVD collection will look even better than before. While it's up to each manufacturer to decide if they want to make their products backwards compatible with DVD, the format is far too popular to not be supported. The Blu-ray Disc Association (BDA) expects every Blu-ray Disc device to be backward compatible with DVDs.

What about *Blu-ray* for PCs?

- There are plans for BD-ROM (read-only), BD-R (recordable) and BD-RE (rewritable) drives for PCs, and with the support of the worlds two largest PC manufacturers, HP and Dell, it's very likely that the technology will be adopted as the next-generation optical disc format for PC data storage and replace technologies such as DVD±R, DVD±RW, and DVD-RAM.

Is *Blu-ray* the same thing as HD-DVD?

- No, HD-DVD (previously known as AOD) is the name of a competing next-generation optical disc format developed by Toshiba and NEC.
- The format is quite different from Blu-ray, but also relies heavily on blue-laser technology to achieve a higher storage capacity.
- The format is being developed within the DVD Forum as a possible successor to the current DVD technology

Blu-ray vs HD-DVD?

Parameters	Blu-ray	HD-DVD
Storage capacity	25GB (single-layer) 50GB (dual-layer)	15GB (single-layer) 30GB (dual-layer)
Numerical aperture (NA)	0.85	0.65
Disc diameter	120mm	120mm
Protection layer	0.1mm	0.6mm
Hard coating	Yes	No
Data transfer rate (data)	36.0Mbps (1x)	11.08Mbps (1x)
Data transfer rate (video/audio)	54.0Mbps (1.5x)	10.08Mbps (<1x)
Video resolution (max)	1920×1080 (1080p)	1920×1080 (1080p)
Video bit rate (max)	40.0Mbps	28.0Mbps
Video codecs	MPEG-2 MPEG-4 AVC	MPEG-2 MPEG-4 AVC
Audio codecs	Linear PCM Dolby Digital Plus DTS Digital Surround DTS-HD	Linear PCM Dolby Digital Plus DTS Digital Surround DTS-HD
Interactivity	BD-J	HDi

What benefits does *Blu-ray* offer compared to HD-DVD?

- Although both Blu-ray and HD-DVD are similar in many aspects, there are some important differences between them :

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- The first is capacity. Because Blu-ray utilizes a lens with a greater numerical aperture (NA) than HD-DVD, the laser spot can be focused with greater precision to fit more data on the same size disc. This allows Blu-ray to hold 25GB per layer (50GB on a dual-layer disc), whereas HD-DVD can only hold 15GB per layer (30GB on a dual-layer disc). Blu-ray has also adopted a higher data transfer rate for video and audio (54Mbps vs 36.55Mbps). The greater capacity and data transfer rates for Blu-ray will allow the movie studios to release their movies with higher quality video and audio than the HD-DVD format.

What benefits does *Blu-ray* offer compared to HD-DVD?

- The second is content. The Blu-ray format has received broad support from the major movie studios as a successor to today's DVD format. Seven of the eight major movie studios (Warner, Paramount, Fox, Disney, Sony, MGM and Lionsgate) have already announced titles for Blu-ray, whereas HD-DVD only has support from three major movie studios (Warner, Paramount and Universal). This is an important difference because some of the studios might only support one of the formats, so you won't be able to get your favorite movies in the other format. Choosing the format with the most content support minimizes this risk.

- The third is hardware support. The Blu-ray format has broad support from the world's leading consumer electronics, personal computer and media manufacturers, including Sony, Panasonic, Philips, Samsung, Pioneer, Sharp, JVC, Hitachi, Mitsubishi, TDK, Thomson, LG, Apple, HP and Dell. The Blu-ray format will also be supported in the next-generation PlayStation 3 (PS3) video game console. This means that you will have a lot of choice when it comes to players and hardware. The HD-DVD format has far less supporters, so the amount of players and hardware will be very limited. Currently, Toshiba is the only company offering a stand-alone HD-DVD player.

Building a *Blu-ray Disc.*

- Discs store digitally encoded video and audio information in **pits** -- spiral grooves that run from the center of the disc to its edges.
- A laser reads the other side of these pits -- the bumps -- to play the movie or program that is stored on the DVD.
- The more data that is contained on a disc, the smaller and more closely packed the pits must be.
- The smaller the pits (and therefore the bumps), the more precise the reading laser must be.

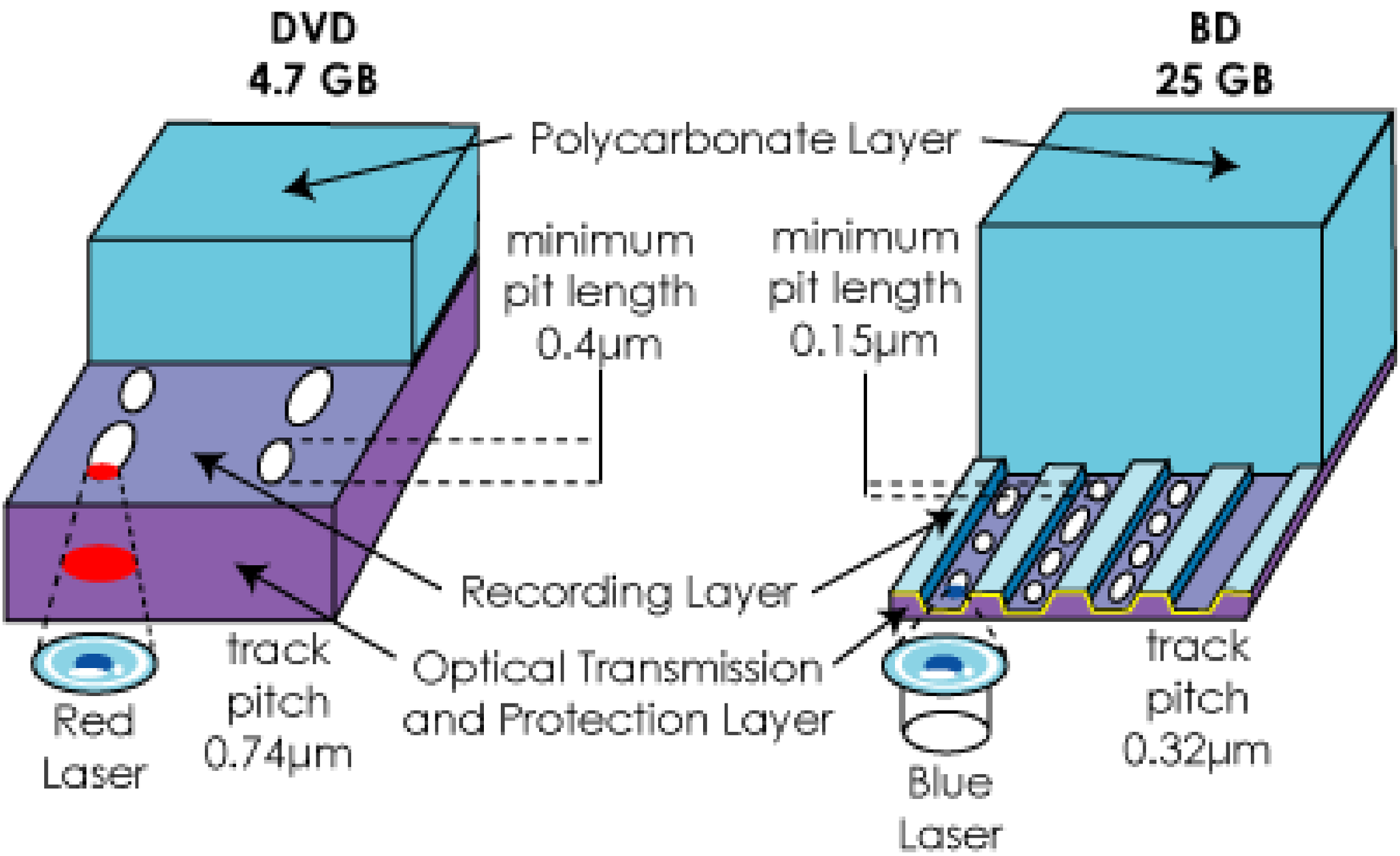
Building a *Blu-ray Disc*……

- Unlike current DVDs, which use a **red laser** to read and write data, Blu-ray uses a **blue laser** (which is where the format gets its name).
- A blue laser has a **shorter wavelength** (**405 nanometers**) than a red laser (650 nanometers).
- The smaller beam focuses more precisely, enabling it to read information recorded in pits that are only **0.15 microns** (µm) (1 micron = 10-6 meters) long -- this is more than twice as small as the pits on a DVD.
- Blu-ray has reduced the **track pitch** from 0.74 microns to **0.32 microns**. The smaller pits, smaller beam and shorter track pitch together enable a single-layer Blu-ray disc to hold more than 25 GB of information -- about five times the amount of information that can be stored on a DVD.

Building a *Blu-ray Disc*…..contd.

- Each Blu-ray disc is about the same thickness (1.2 millimeters) as a DVD. But the two types of discs store data differently. In a DVD, the data is sandwiched between two polycarbonate layers, each 0.6-mm thick. Having a polycarbonate layer on top of the data can cause a problem called **birefringence** in which the substrate layer refracts the laser light into two separate beams. If the beam is split too widely, the disc cannot be read. Also, if the DVD surface is not exactly flat, and is therefore not exactly perpendicular to the beam, it can lead to a problem known as **disc tilt**, in which the laser beam is distorted. All of these issues lead to a very involved manufacturing process.

DVD Vs. Blu-Ray Construction



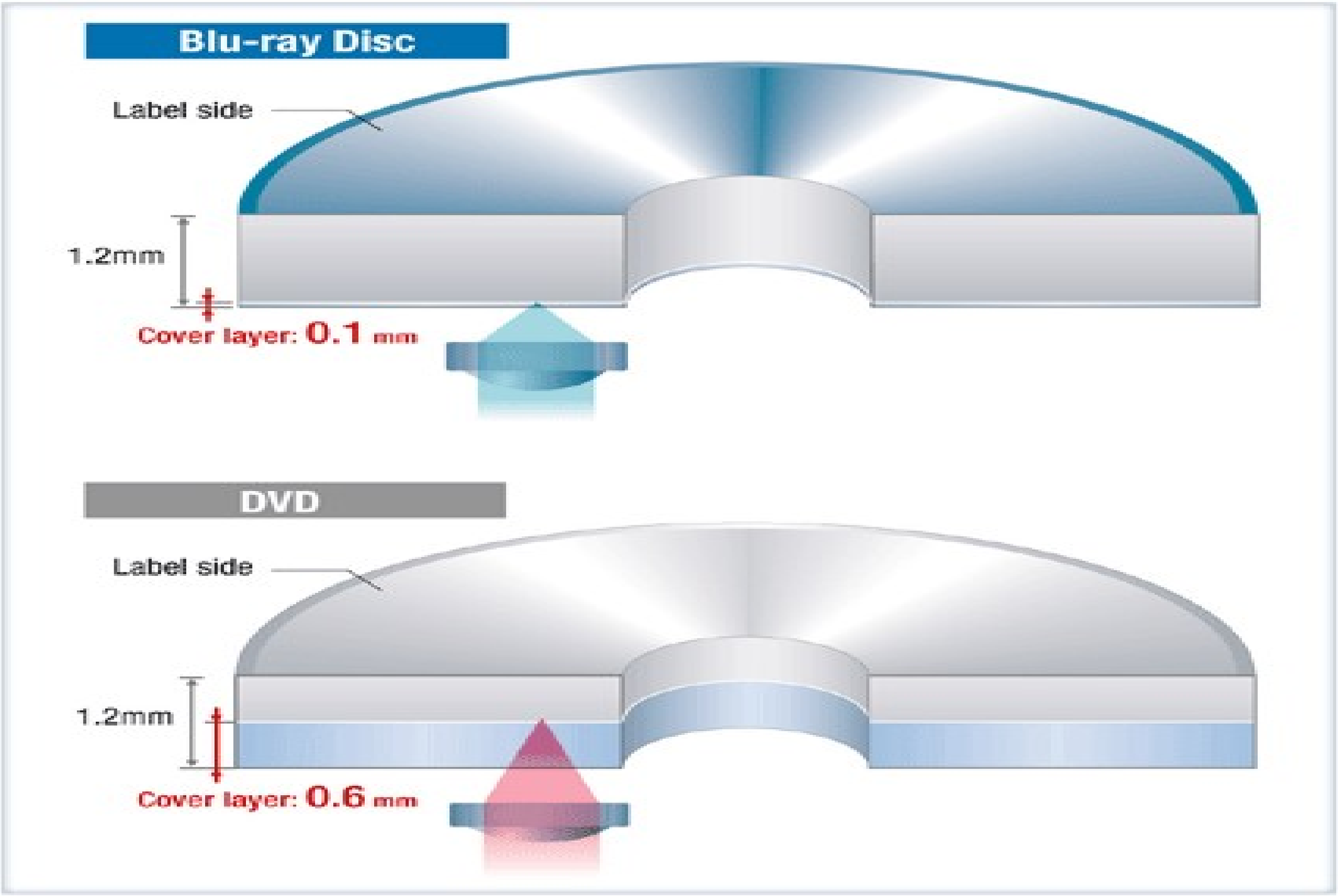
- ***By reducing track pitch and pit length,Blu-ray Disc provides five times more recording capacity than DVD***

How Blu-ray Reads Data??

- The Blu-ray disc overcomes DVD-reading issues by placing the data **on top of a 1.1-mm-thick polycarbonate layer**. Having the data on top prevents birefringence and therefore prevents readability problems. And, with the recording layer sitting **closer to the objective lens** of the reading mechanism, the problem of disc tilt is virtually eliminated. Because the data is closer to the surface, a hard coating is placed on the outside of the disc to protect it from scratches and fingerprints.

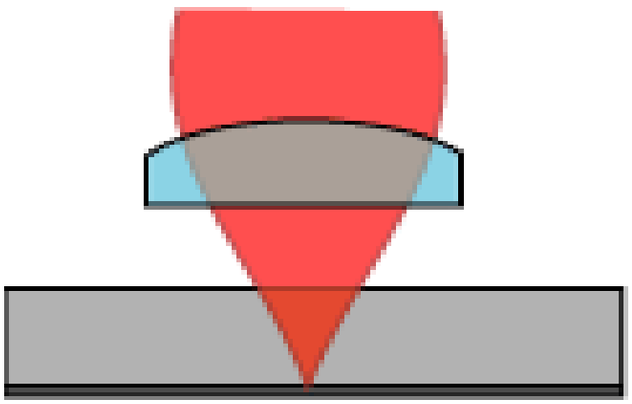
Hard coating technology

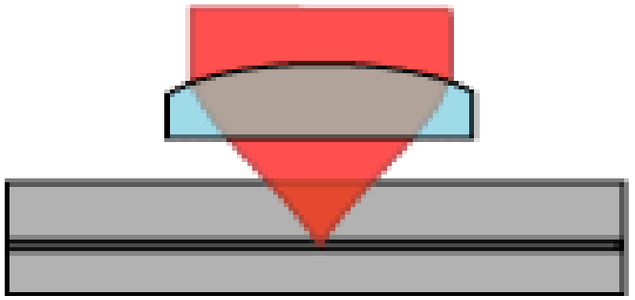
- Because the Blu-ray Disc standard places the data recording layer close to the surface of the disc, early discs were susceptible to contamination and scratches and had to be enclosed in plastic caddies for protection.
- The recent introduction of a clear polymer coating has given Blu-ray Discs substantial scratch resistance. The coating is developed by TDK and is called "Durabis". It allows BDs to be cleaned safely with only a tissue. Verbatim recordable and rewritable Blu-ray Disc discs use their own proprietary hard-coat technology called “ScratchGuard”.

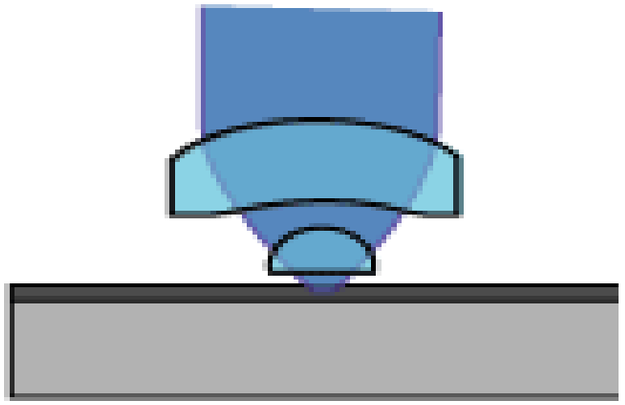

Blu-ray Disc
Label side
1.2mm
Cover layer: 0.1 mm
DVD
Label side
1.2mm
Cover layer: 0.6 mm

CD vs. DVD vs. Blu-ray Writing

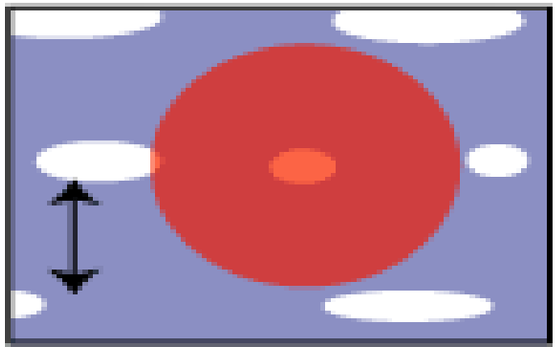
CD	DVD	BD
780-nm Red Laser Lens Aperture = 0.45	650-nm Red Laser Lens Aperture = 0.6	405-nm Blue Laser Lens Aperture = 0.8

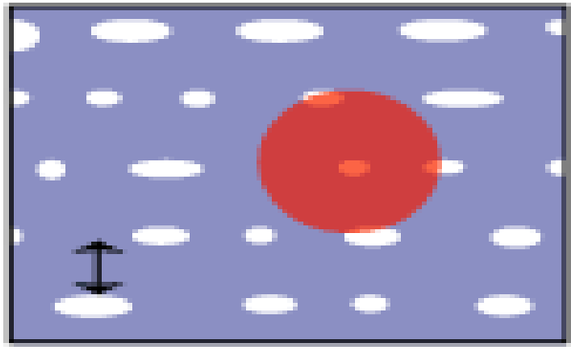


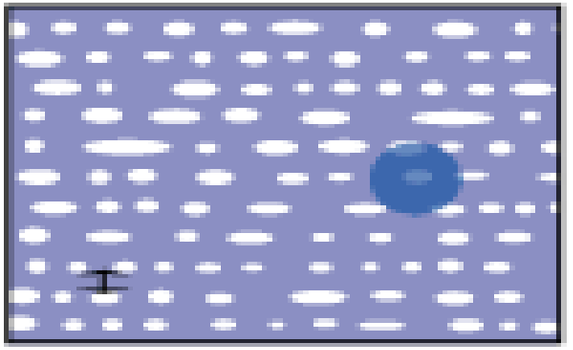




One 1.2-mm polycarbonate layer	Two 0.6-mm polycarbonate layers	One 1.1-mm polycarbonate layer







track pitch = 1.6µm	track pitch = .74µm	track pitch = .30µm

Designing the disc

- The design of the Blu-ray discs saves on manufacturing costs. Traditional DVDs are built by injection molding the two 0.6-mm discs between which the recording layer is sandwiched. The process must be done very carefully to prevent birefringence.
- The two discs are molded.
- The recording layer is added to one of the discs.
- The two discs are glued together.
- Blu-ray discs only do the injection-molding process on a single 1.1-mm disc, which reduces cost. That savings balances out the cost of adding the protective layer, so the end price is **no more than the price of a regular DVD**.

Uses of *Blu-ray Disc*

- Blu-ray discs not only have more storage capacity than traditional DVDs, but they also offer a new level of **interactivity**. Users will be able to **connect to the Internet** and instantly download subtitles and other interactive movie features. With Blu-ray, you can :
- **record high-definition television (HDTV) without any quality loss**
- **instantly skip to any spot on the disc**
- **record one program while watching another** on the disc
- **create playlists**
- **edit or reorder programs** recorded on the disc
- **automatically search for an empty space on the disc** to avoid recording over a program
- **access the Web to download subtitles and other extra features**

Blu-ray Competitors

- In the meantime, JVC has developed a **Blu-ray/DVD combo disc** with an approximate 33.5-GB capacity, allowing for the release of video in both formats on a single disc. But Blu-ray is not alone in the marketplace. A few other formats are competing for a share of the DVD market.
- The other big player is HD-DVD, also called **AOD** (Advanced Optical Disc), which was developed by electronics giants Toshiba and NEC. HD-DVD was actually in the works before regular DVD, but it didn't begin real development until 2003.
- Blu-ray and HD-DVD are the two major competitors in the market, but there are other contenders, as well. Warner Bros. Pictures has developed its own system, called **HD-DVD-9**. This system uses a **higher compression rate** to put more information (about two hours of high-definition video) on a standard DVD. Taiwan has created the **Forward Versatile Disc** (FVD), an upgraded version of today's DVDs that allows for more data storage capacity (5.4 GB on a single-sided disc and 9.8 GB on a double-sided disc). And China has introduced the **Enhanced Video Disc** (EVD), another high-definition video disc.

The future of *Blu-ray Disc..*

- There are also **professional versions** of the blue laser technology. Sony has developed **XDCAM** and **ProData** (Professional Disc for Data). The former is designed for use by broadcasters and AV studios. The latter is primarily for commercial data storage (for example, backing up servers).
- It seems that the future holds a whole lot more than 25 to 54 GB on a single disc. According to T3:Pioneer goes beyond Blu-Ray, **Pioneer** is developing an optical disc that will blow away the hard disc in most of our PCs in terms storage capacity, holding **500 GB** of data. How so? Pioneer's lasers are **ultraviolet**, which have an even shorter wavelength than the blue.

THANK YOU