

A

Seminar Report

on

“Blue-ray Disc”

Submitted in partial fulfillment of the requirement for the award of degree
of Bachelor of Technology in Computer Science

SUBMITTED TO:

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SUBMITTED BY:

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Preface

I have made this report file on the topic **Blue-ray Disc**, I have tried my best to elucidate all the relevant detail to the topic to be included in the report. While in the beginning I have tried to give a general view about this topic.

My efforts and wholehearted co-corporation of each and everyone has ended on a successful note. I express my sincere gratitude towho assisting me throughout the preparation of this topic. I thank him for providing me the reinforcement, confidence and most importantly the track for the topic whenever I needed it.

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Acknowledgement

I would like to thank respected Mr..... and Mr.for giving me such a wonderful opportunity to expand my knowledge for my own branch and giving me guidelines to present a seminar report. It helped me a lot to realize of what we study for.

Secondly, I would like to thank my parents who patiently helped me as i went through my work and helped to modify and eliminate some of the irrelevant or un-necessary stuffs.

Thirdly, I would like to thank my friends who helped me to make my work more organized and well-stacked till the end.

Next, I would thank Microsoft for developing such a wonderful tool like MS Word. It helped my work a lot to remain error-free.

Last but clearly not the least, I would thank The Almighty for giving me strength to complete my report on time.

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Introduction

Blu-ray, also known as Blu-ray Disc (BD) is the name of a next-generation optical disc format jointly developed by the Blu-ray Disc Association (BDA), a group of leading consumer electronics and PC companies (including Dell, Hitachi, HP, JVC, LG, Mitsubishi, Panasonic, Pioneer, Philips, Samsung, Sharp, Sony, TDK and Thomson). But before coming on the Blu-ray technology let me explain some previously used optical storage mediums.

- CDs
- DVDs

CDs and DVDs are everywhere these days. Whether they are used to hold music, data or computer software, they have become the standard medium for distributing large quantities of information in a reliable package. If you have a computer and CD-R drive, you can create your own CDs, including any information you want.

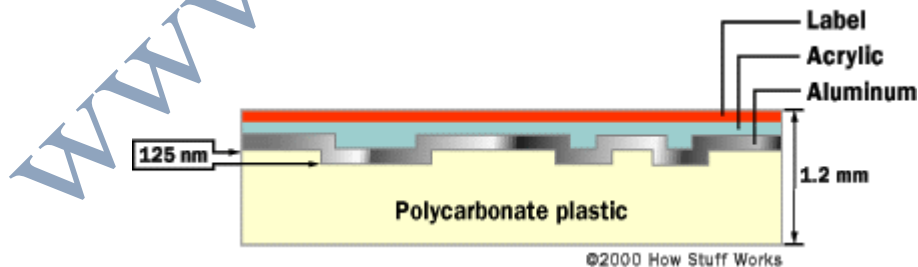


CDs or Compact Discs

A CD can store up to 74 minutes of music, so the total amount of digital data that must be stored on a CD is:

$$44,100 \text{ samples/channel/second} \times 2 \text{ bytes/sample} \times 2 \text{ channels} \times 74 \text{ minutes} \times 60 \text{ seconds/minute} = 783,216,000 \text{ bytes}$$

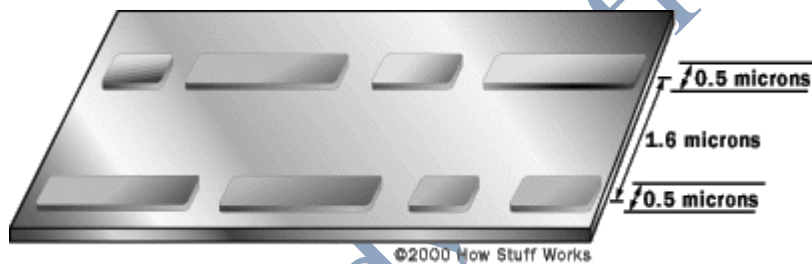
To fit more than 783 megabytes (MB) onto a disc only 4.8 inches (12 cm) in diameter requires that the individual bytes be very small. A CD is a fairly simple piece of plastic, about four one-hundredths (4/100) of an inch (1.2 mm) thick. Most of a CD consists of an **injection-molded piece of clear polycarbonate plastic**. During manufacturing, this plastic is impressed with microscopic bumps arranged as a single, continuous, extremely long spiral track of data. Once the clear piece of polycarbonate is formed, a thin, reflective aluminum layer is sputtered onto the disc, covering the bumps. Then a thin acrylic layer is sprayed over the aluminum to protect it. The label is then printed onto the acrylic. A cross section of a complete CD (not to scale) looks like this:



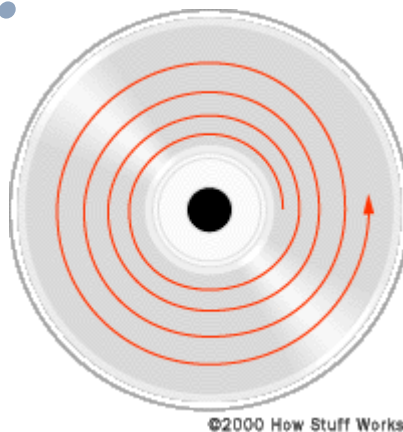
Cross-section of a CD

A CD has a single spiral track of data, circling from the inside of the disc to the outside. The fact that the spiral track starts at the center means that the CD can be smaller than 4.8 inches (12 cm) if desired, and in fact there are now plastic baseball

cards and business cards that you can put in a CD player. CD business cards hold about 2 MB of data before the size and shape of the card cuts off the spiral. The data track is approximately 0.5 microns wide, with 1.6 microns separating one track from the next. (A micron is a millionth of a meter.) And the bumps are even more miniscule. The elongated bumps that make up the track are each 0.5 microns wide, a minimum of 0.83 microns long and 125 nanometers high. (A nanometer is a billionth of a meter.) Looking through the polycarbonate layer at the bumps, they look something like this:



Bumps On CD



Spiral Track on CD

You will often read about "pits" on a CD instead of bumps. They appear as pits on the aluminum side, but on the side the laser reads from, they are bumps.

The incredibly small dimensions of the bumps make the spiral track on a CD extremely long. If you could lift the data track off a CD and stretch it out into a straight line, it would be 0.5 microns wide and almost 3.5 miles (5 km) long!

DVDs or Digital Versatile Discs

Nearly every movie produced today is available on DVD, and many older movies are being moved to the DVD format. Often, a movie comes out on DVD before it comes out on video tape, because the manufacturing and distribution costs for DVDs are so much lower! By bringing outstanding picture and sound to our favorite films, the DVD format is doing for movies exactly what CDs did for music.

A DVD is very similar to a CD, but it has a much **larger data capacity**. A standard DVD holds about seven times more data than a CD does. This huge capacity means that a DVD has enough room to store a full-length, MPEG-2-encoded movie, as well as a lot of other information typical contents of a DVD movie:

- Up to 133 minutes of high-resolution video, 720 dots of horizontal resolution.
- Soundtrack presented in up to eight languages using 5.1 channel Dolby digital surround sound
- Subtitles in up to 32 languages
- DVD can also be used to store almost eight hours of CD-quality music per side.

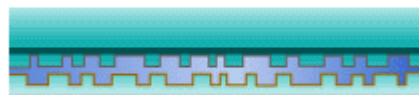
DVDs are of the same diameter and thickness as CDs, and they are made using some of the same materials and manufacturing methods. Like a CD, the data on a DVD is

encoded in the form of small pits and bumps in the track of the disc. A DVD is composed of several layers of plastic, totaling about 1.2 millimeters thick. Each layer is created by injection molding polycarbonate plastic. This process forms a disc that has microscopic bumps arranged as a single, continuous and extremely long spiral track of data. Once the clear pieces of polycarbonate are formed, a thin reflective layer is sputtered onto the disc, covering the bumps. Aluminum is used behind the inner layers, but a semi-reflective gold layer is used for the outer layers, allowing the laser to focus through the outer and onto the inner layers. After all of the layers are made, each one is coated with lacquer, squeezed together and cured under infrared light. For single-sided discs, the label is silk-screened onto the nonreadable side. Double-sided discs are printed only on the nonreadable area near the hole in the middle. Cross sections of the various types of completed DVDs (not to scale) look like this:

Single-sided, single layer (4.7GB)



Single-sided, double layer (8.5GB)



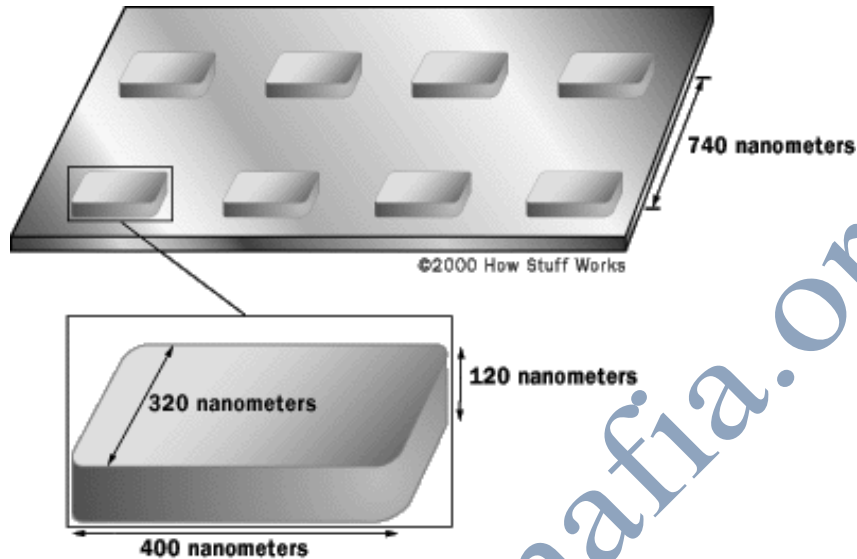
Double-sided, double layer (17GB)



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Each writable layer of a DVD has a spiral track of data. On single-layer DVDs, the track always circles from the inside of the disc to the outside. That the spiral track starts at the center means that a single-layer DVD can be smaller than 12 centimeters

if desired. Data track is -- just 740 nanometers separate one track from the next. And the elongated bumps that make up the track are each 320 nanometers wide, a minimum of 400 nanometers long and 120 nanometers high.



Data Storage: DVD vs. CD

DVDs can store more data than CDs for a few reasons:

- Higher-density data storage
- Less overhead, more area
- Multi-layer storage

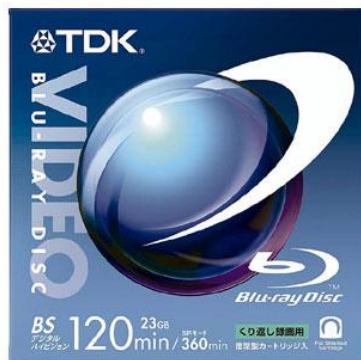
Specification	CD	DVD
Track Pitch	1600 nanometers	740 nanometers
Minimum Pit Length (single-layer DVD)	830 nanometers	400 nanometers
Minimum Pit Length (double-layer DVD)	830 nanometers	440 nanometers

Blu-ray Discs

In 1997, a new technology emerged that brought digital sound and video into homes all over the world. It was called DVD (see page 4 to 6), and it revolutionized the movie industry. The industry is set for yet another revolution with the introduction of **Blu-ray Discs (BD)**. With their high storage capacity, Blu-ray discs can hold and playback large quantities of **high-definition video and audio**, as well as photos, data and other digital content. The Blu-ray name is a combination of "blue," for the color of the laser that is used, and "ray," for optical ray. The "e" in "blue" was purposefully left off, according to the manufacturers, because an everyday word cannot be **trademarked**.

Unlike DVDs and CDs, which started with read-only formats and only later added recordable and re-writable formats, Blu-ray is initially designed in several different formats:

- **BD-ROM** (read-only) - for pre-recorded content
- **BD-R** (recordable) - for PC data storage
- **BD-RW** (rewritable) - for PC data storage
- **BD-RE** (rewritable) - for HDTV recording



What is a Blu-ray Disc?

A current, single-sided, standard DVD can hold **4.7 GB** (gigabytes) of information. That's about the size of an average two-hour, standard-definition movie with a few extra features. But a **high-definition movie**, which has a much clearer image takes up about **five times more bandwidth** and therefore requires a disc with about five times more storage. As TV sets and movie studios make the move to high definition, consumers are going to need playback systems with a lot **more storage capacity**. Blu-ray is the next-generation digital video disc. It can record, store and play back high-definition video and digital audio, as well as computer data. The advantage to Blu-ray is the sheer amount of information it can hold:



- A **single-layer Blu-ray disc**, which is roughly the same size as a DVD, can hold up to **27 GB of data** -- that's **more than two hours of high-definition video** or about **13 hours of standard video**.
- A **double-layer Blu-ray disc** can store up to **54 GB**, enough to hold about **4.5 hours of high-definition video** or **more than 20 hours of standard video**.

And there are even plans in the works to develop a disc with twice that amount of storage.

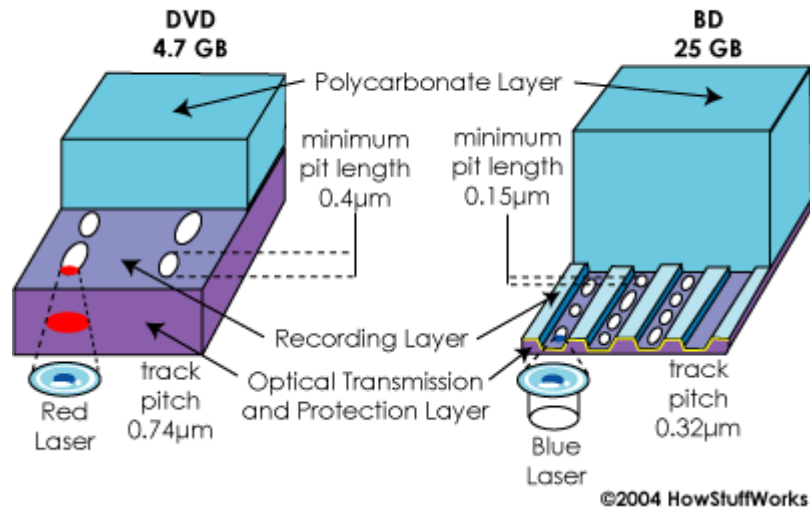
Blu-ray discs not only have more storage capacity than traditional DVDs, but they also offer a new level of **interactivity**. Users will be able to **connect to the Internet** and instantly download subtitles and other interactive movie features.

How Does Blu-ray Work?

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. 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. Plus, 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.

DVD Vs. Blu-Ray Construction



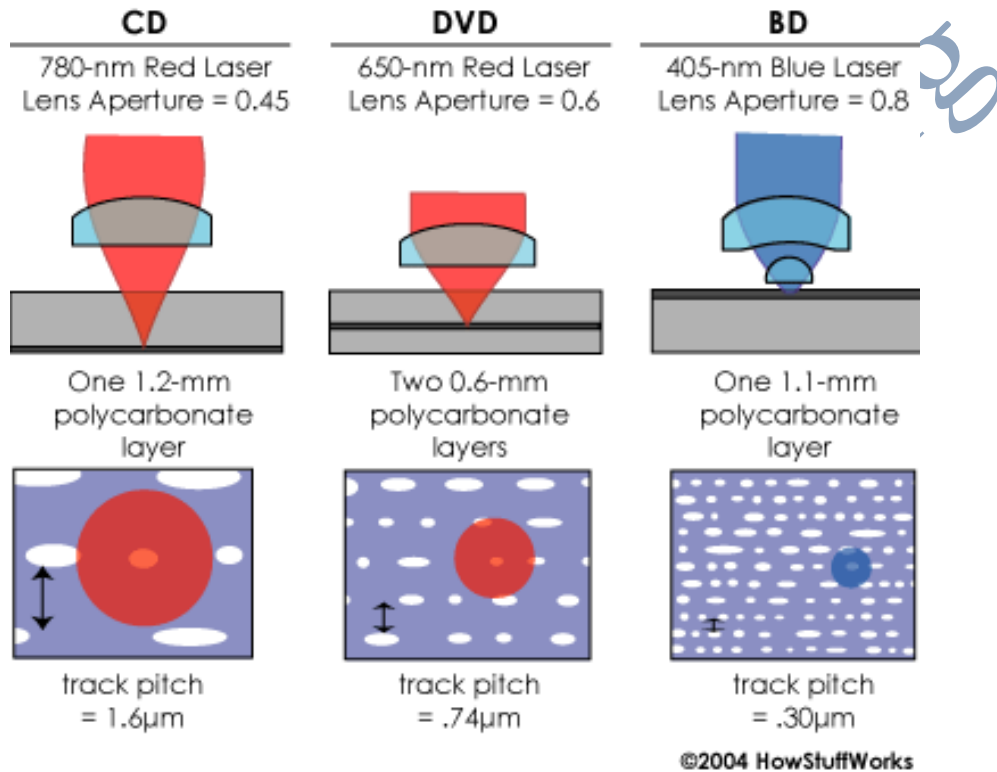
Each Blu-ray disc is about the same thickness (**1.2 millimeters**) as a DVD. But the two types of discs store data differently. In a DVD, the data is sandwiched between two polycarbonate layers, each 0.6-mm thick. Having a polycarbonate layer on top of the data can cause a problem called **birefringence**, 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.

Building a Blu-ray

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.

CD vs. DVD vs. Blu-ray Writing



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.

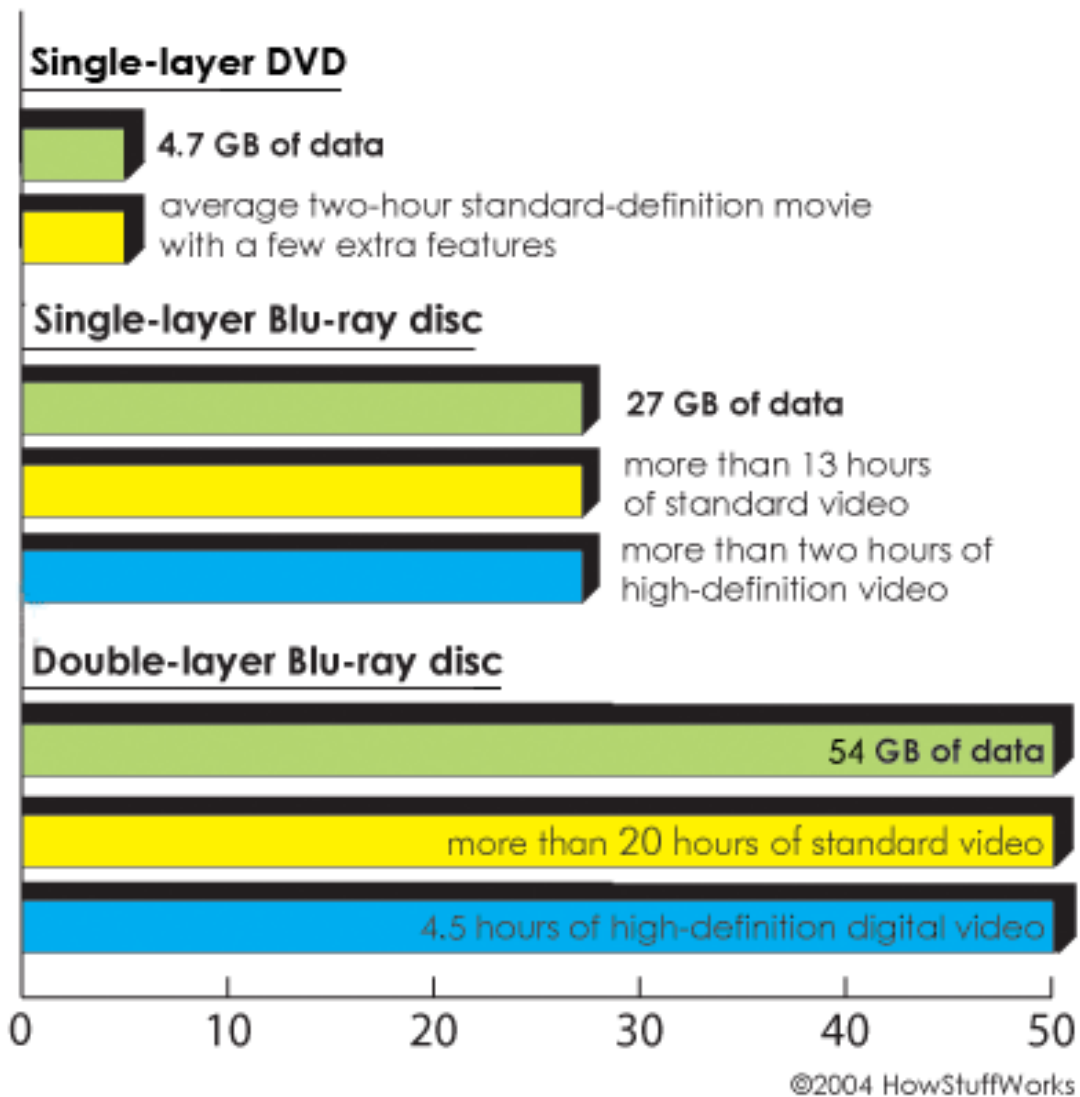
1. The two discs are molded.
2. The recording layer is added to one of the discs.
3. The two discs are glued together.

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**. Blu-ray has a **higher data transfer rate -- 36 Mbps** (megabits per second) -- than today's DVDs, which transfer at 10 Mbps. A Blu-ray disc can record 25 GB of material in just over an hour and a half.

Blu-ray Advantages

- 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 discs are better armed than current DVDs. They come equipped with a **secure encryption system** -- a unique ID that protects against video piracy and copyright infringement.

Blu-ray vs. DVD Capacity



Blu-ray vs. other New Disc Formats

Will Blu-ray replace previous DVDs? Its manufacturers hope so. 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.

Blu-ray Availability

Blu-ray recorders are already available in Japan, where more consumers have access to HDTV than in the United States. Outside of Japan, once more TV sets come equipped with a high-definition tuner and more films and television shows are produced in high-definition (which is expected to happen by late 2005 or 2006), Blu-ray movies and TV shows on disc should become widely available. But the format is already available for home recording, professional recording and data storage.



Sony Blu-ray disc player/recorder

Another important factor is **cost**. Just as with most new technologies, Blu-ray equipment will be pricey at first. In 2003, Sony released its first Blu-ray recorder in Japan with a price tag of around \$3,000. The price is expected to drop as the format gains popularity. Blu-ray discs may also be initially more expensive than today's DVDs, but once demand grows and they can be mass-produced, manufacturers say the price will drop to within 10 percent of the price of current DVDs. Even when the new video standard begins to replace current technologies, consumers won't have to throw away their DVDs, but they will need to invest in a new player. The industry is

planning to market **backward-compatible** drives with both blue and red lasers, which will be able to play traditional DVDs and CDs as well as Blu-ray discs.

Blu-ray FAQ

What is Blu-ray?

Blu-ray, also known as Blu-ray Disc (BD) is the name of a next-generation optical disc format. The format was developed to enable recording, rewriting and playback of high-definition video (HD). The format is also likely to become a standard for PC data storage and high-definition movies in the future.

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. The name is a combination of "Blue" and optical ray "Ray". According to the Blu-ray Disc Association, the spelling of "Blu-ray" is not a mistake. The character "e" is intentionally left out because a daily-used term can't be registered as a trademark.

Who developed Blu-ray?

The Blu-ray Disc format was developed by the Blu-ray Disc Association (BDA), a group of leading consumer electronics and PC companies with more than 100 members from all over the world. The Board of Directors currently consists of:

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

TDK Corporation

Thomson Multimedia

Twentieth Century Fox

Walt Disney Pictures

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 software, games and movie distribution.

BD-R - recordable format for HDTV recording and PC data storage.

BD-RE - rewritable format for HDTV recording and PC data storage.

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

A single-layer disc can fit 23.3GB, 25GB or 27GB.

A dual-layer disc can fit 46.6GB, 50GB or 54GB.

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.

How much video can you record on a Blu-ray Disc?

Over 2 hours of high-definition television (HDTV) on a 25GB disc.

About 13 hours of standard-definition television (SDTV) on a 25GB disc.

How fast can you record a Blu-ray Disc?

According to the Blu-ray Disc v1.0 specification, 1x speed will require a 36.5Mbps data transfer rate, which means it will take about 1 hour and 33 minutes to record 25GB. The Blu-ray Disc Association are currently working on the v2.0 specification, which will support 2x speed to cut the time it takes to copy content from one disc to another in half. In the future, the data transfer rate is expected to be raised to 8x or more.

When will Blu-ray Disc recorder become commonly available ?

You'll probably have to wait until 2006-2007 for Blu-ray recorders to become commonly available. The driving force behind the development of Blu-ray Disc recorders is the need to record HDTV programming and currently the only country where HDTV is well established is Japan. There's still only a few different Blu-ray Disc recorders available to consumers in Japan, but as you can see Blu-ray Recorders section, most well-known consumer electronics companies have their own prototype Blu-ray Disc recorder in development, so we expect to see more Blu-ray recorders on the Japanese market during 2005. According to Sony of America's senior vice president Mike Fidler, products

based on the Blu-ray Disc format are not likely to be available in the United States until late 2005 or early 2006.

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.

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