

Blu-ray disc: A one step solution to DVD

Deepa. G

PG Student

IV Semester, MCA, MCC, Bangalore,

deepraj77@yahoo.co.in

Abstract: - My paper is intended to provide an overview of the Blu-ray disc prerecorded application format, blu-ray disc platform is being designated to provide access to high definition digital broadcast recording and high definition playback functions. Earlier to blu-ray disc the user had to contend with two different forms of media for standard definition i.e., VHS for recording and DVD- video for package media playback. But now blu-ray provides a one-stop to fulfill the desires of users who want to use all of the above functions.

I. INTRODUCTION

Blu-ray Disc (BD) is one of the latest optical disc formats specifically created for the storage of data and high-definition video. This format was designed to be the successors to the standard DVD (SDVD) format in response to a need for increased disc capacity. A single layer BD has over 5 times the capacity of a single layer DVD (25GB vs. 4.7GB). A dual layer BD can hold up to 50GB of data which equates to about 9 hours of high definition video or about 23 hours of standard definition video. About The name Blu-ray Disc is a trademark of Sony Corp. and is derived from the blue color of the laser used to read and write BDs. The "e" is intentionally left out of the name due to trademark restrictions. Blu-ray disc (BD) is appropriately named after the blue laser used to write the data. The first blue laser was developed in 1996 by Shuji Nakamura (Nichia Corporation). In 2002, an alliance was formed, called the Blu-ray Disc Association, including the likes of Sony, Samsung, Sharp, Hewlett-Packard, and Royal Philips.



Fig 1: Image of Blu-ray disc

BD-ROM is being designed not only for pre-packaged High Definition (HD) movie content but also as a key component of a consumer HD platform. As shown in Figure 1-1 below, the Blu-ray Disc (BD) platform is being designed to provide access to HD content throughout the home via HD digital broadcast recording and HD playback functions.

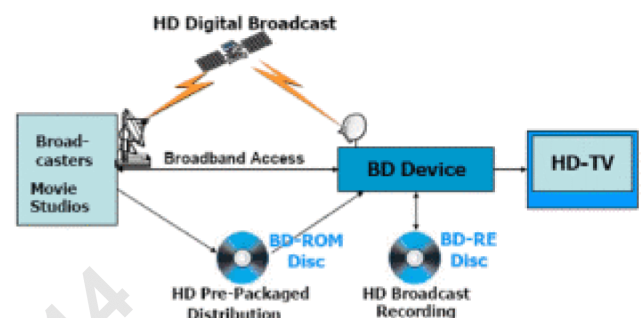


Fig 2: HD Content Distribution as envisioned by the BD Application Standard

When DVD-Video was developed, Standard Definition (SD) image recording devices were already present in the market (VHS). The user therefore had to contend with two different forms of media for SD: VHS for recording and DVD-Video for package media playback. For HD however, we are at the initial rollout stage for HD broadcast receivers, HD recording functions via package media, and HD pre-packaged content distribution. By combining all of these functions into one platform, BD provides a one-stop-shop to fulfill the desires of users who want to use all of these functions. Simply put, the user will be HD compatible by using BD. Features of Blu-Ray Disc are

- Record HDTV without any quality loss
- Instantly skip to any spot on disc
- Record one program while watching other on the disc
- Create play lists.
- Edit or reorder programs recorded on disc
- Automatically search for an empty space on the disc to avoid recording over a program
- Access to web to download subtitles and other extra features

- And many more...

Back ground of Blu-Ray Disc

1st generation: Compact disc (CD): 650/700 MB. It is with us for over 20 years. Wavelength of laser which reads data: 780 nm Color of laser: Red

2nd generation: Digital versatile disc (DVD): 4.7 GB. It offers high quality sound and video than CD. Wavelength of laser which reads data: 650 nm Color of laser: Red

3rd generation: Blu-ray disc (BD): 25/50 GB -Next generation optical disc format.



Fig 3: image representing BD

Developed by blu-ray disc association (which includes Apple, Hitachi, HP, LG, Panasonic, Pioneer, Philips, Samsung, Sharp, and Sony) -Wavelength of laser which reads data: 405 nm -Color of laser: Blue-violet which was developed by SHUJI NAKAMURA at NICHIA CORPORATION

II. BLU-RAY DISC COMES IN FOUR DIFFERENT FORMATS

- *BD-ROM (read only)*: for reading recorded content.
- *BD-R (recordable)*: for PC data storage.
- *BD-RW (rewritable)*: for PC data storage.
- *BD-RE (rewritable)*: for HDTV (high definition television) recording.

Types of Blu-Ray Disc

SINGLE LAYER: Can hold data up to 25/27 GB that means 2 hrs of HD video or about 13 hrs of standard video.

DOUBLE LAYER: Can hold data up to 50 GB that means 4.5 hrs of HD video or more than 20 hrs of standard video.

III. CHARACTERISTICS OF BLU-RAY DISC

Life Span: In the case of ordinary discs, the disc life is less. In the rewritable versions, as re-writing is done repeatedly to one area of the disc most probably, the inner perimeter limiting the disc life. BDFS (Blu-ray Disc File Structure) is

designed so as to avoid this problem, by using a system that uses free disc spaces with equal frequency.

Content Protection: Strongest content and copy protection schemes ever developed. Incorporation of Robust copy mechanism

Cost: Long term Profitability model for content. Providers' cheapest production cost

Capacity: The Blu-ray disc enables the recording, rewriting and playback of HD video up to 27 GB of data on a single sided single layer. It is enough to put 2.5 hours of HDTV recording on it. It also can record over 13 hours of standard TV broadcasting

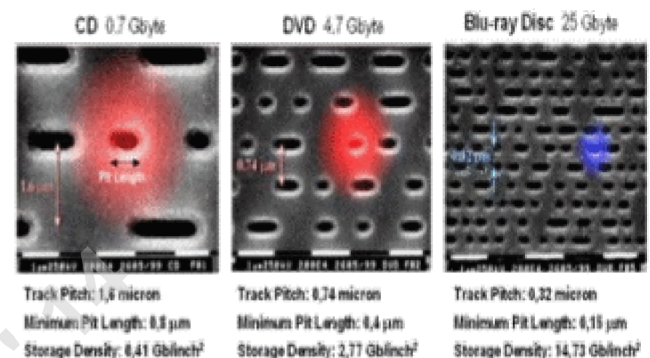


Fig 4: Capacity of CD, DVD and BD

Robustness of Disc: Stronger resistance to scratches and fingerprints the protective layer is hard enough to prevent accidental abrasions and allows fingerprints to be removed by wiping the disc with a tissue.

Compatible: The BD drives are designed to be backward Compatible, i.e. CDs and DVDs work equally well with the BD drives.

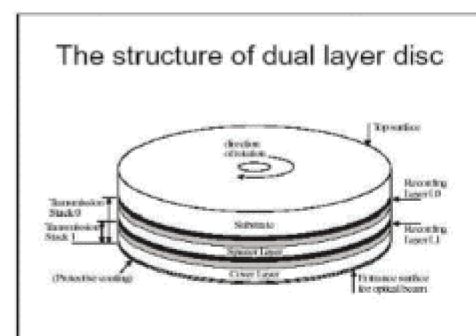


Fig 5: Structure of dual layer disc

IV. PRINCIPAL BLU-RAY DISC

Capacity	23.3 25 27GB (single layer)
Wave length of the laser	405nm
Numerical Aperture of the objective lens	0.85
Data transfer rate	36Mbps
Thickness of the disc	1.2mm
Diameter of the center hole	15mm
Recording method	Phase change
Data track	Groove recording
Visual data	MPEG-2 video

V. COMPARISON OF CD, DVD, BLU-RAY DISC

PARAMETER	CD	DVD	BD
Disk diameter	120 mm	120 mm	120 mm
Disk thickness	1.2 mm	1.2 mm	1.2 mm
Laser wavelength	780 nm	650 nm	405 nm
Numerical aperture	0.45	0.60	0.85
Minimum pit length	0.83 μ m	0.4 μ m	0.138 μ m
Data rate Mb/sec	1.2 Mb/sec	11 Mb/sec	36
Number of sides or two	one	----	one
Number of data layers or two	One	----	One
Data capacity	~680 MB	4.7 GB (1L) 8.5 GB (2L)	27 GB

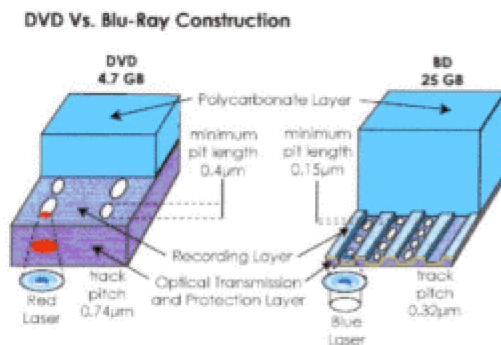
VI. ADVANTAGES OF BLU-RAY DISC

Record High-Definition Television (HDTV) without any quality loss

- Record one program while watching another on the disc
- Edit programs recorded on the disc and create play list.
- Instantly skip to any spot on the disc.
- Automatically search for an empty space on the disc to avoid recording over a program
- Access the web to down load subtitles and other extra features
- Various hard coating technologies make Blu ray disc most durable and family -friendly"
- Hard-coating technology provides resistance to Finger prints, Marks, Scratches, Dust.
- Much more ROBUST than today's polycarbonate-based CD/DVD's (and HD DVD's)

VII. WORKING OF 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. Unlike current DVD's, 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 nano meters). The smaller beam focuses more precisely, enabling it to read information recorded in pits that are not only 0.15 microns long this is more than twice as small as the pits on a DVD. Plus, Blue-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 25GB of Information about five times the amount of information that can be stores on a DVD. 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



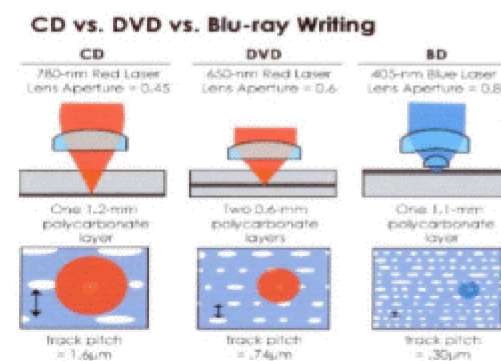
Source: Blu-ray Disc Association

Fig 6: Construction of DVD and Blu-ray

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.

VIII. BUILDING OF 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. 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.



Source: Blu-ray Disc Association

Fig 7: Writing CD, DVD and BD

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.

IX. COMPARISON IN BUILDING BD AND DVD

BD

Data is placed on top of a 1.1 mm thick polycarbonate layer

Doesn't suffer from *BIREFRINGENCE*

Doesn't suffer from *DISC TILT*

Hard coating is placed outside to protect from scratches or fingerprints

DVD

Data is sandwiched b/w two polycarbonate layers, each 0.6 mm thick

Suffer from *BIREFRINGENCE*

Suffer from *DISC TILT*

No such hard coating is placed

X. BLU-RAY VS OTHER NEW DISC FORMATS

- The other big player is HD_DVD, also called AOD (Advanced Optical Disc).
- Single Layer - HD-DVD 20GB - BLU-RAY 27GB
- Double Layer - HD-DVD 30GB - BLU-RAY 54GB
- Other Discs like China has introduced the Enhanced Video Disc (EVD), Taiwan has created the Forwarded Versatile Disc(FVD).
- There are also professional versions of the Blu laser technology. Sony has developed XDCAM and Pro-Data (Professional Disc for Data).

XI. BLU-RAY DISC APPLICATIONS

- *High definition television recording*

The Blu ray Disc format offers consumers the ability to record their High Definition television broadcasts in their original quality for the first time, preserving the pure picture and audio level as offered by the broadcaster.

Next level in home entertainment, offering an unsurpassed user experience Since Blu-ray Disc format incorporates the strongest copy protection algorithms of any format or proposal to date, the format allows for recording of digital broadcasts while meeting the content protection demands of the broadcast industry.

- *High Definition Video Distribution*

Blu-ray Disc format can store High Definition video in the highest possible quality, without need to compromise on picture quality. Depending on the encoding method, there is room for more than seven hours of the highest HD quality video. There is even room for additional content such as special features and other bonus material to accompany the High Definition movie. The Blu-ray Disc movie format greatly expands on traditional DVD capabilities, by incorporating many new interactive features allowing content providers to offer an even more incredible experience to consumers.

- *High Definition Camcorder Archiving:*

With its unprecedented storage capacity, allows for the HD video recorded with an HD camcorder to be converted and recorded Storage capabilities, without the risk of tape wear



Figure 8: Blu-Ray disc reader



Fig 9: Mass data storage

The growing number of broadband connections allowing consumers to download vast amounts of data

Current BD Products

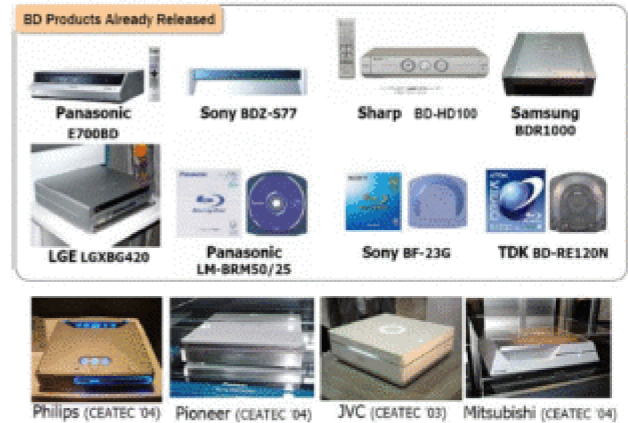


Fig 10: Current BD Products

XII. CONCLUSION

Blu-ray disc has been a consistent road map to emerging disc technologies. Blue-ray 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. 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.

REFERENCES:

- [1] Complete Guide to Digital Audio By—Chris Middleton.
- [2] The Digital Bits Insider Guide to DVD By—Bill Hunt
- [3] DVD Demystified By – Jim Taylor
- [4] <http://www.blu-raydisc.com/en.html>
- [5] <http://www.blu-raydisc.info/>