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General

1.1 **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), as well as storing large amounts of data. The format offers more than five times the storage capacity of traditional DVDs and can hold up to 25GB on a single-layer disc and 50GB on a dual-layer disc. For more general information about Blu-ray, please see our [What is Blu-ray?](#) section.

1.2 **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" (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.

The correct full name is Blu-ray Disc, not Blu-ray Disk (incorrect spelling)

The correct shortened name is Blu-ray, not Blu-Ray (incorrect capitalization) or Blue-ray (incorrect spelling)

The correct abbreviation is BD, not BR or BRD (wrong abbreviation)

1.3 **Who developed Blu-ray?**

The Blu-ray Disc format was developed by the [Blu-ray Disc Association](#) (BDA), a group of leading consumer electronics, personal 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

1.4 **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.

1.5 **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.

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

Over 9 hours of high-definition (HD) video on a 50GB disc.
About 23 hours of standard-definition (SD) video on a 50GB disc.

1.7 **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.

1.8 **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).
SMPT E VC-1 - standard based on Microsoft's Windows Media Video (WMV) technology.

Please note that this simply means that all Blu-ray players and recorders will have to support playback of these video codecs, it will still be up to the movie studios to decide which video codec(s) they use for their releases.

1.9 **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)

Please note that this simply means that Blu-ray players and recorders will have to support playback of these audio codecs, it will still be up to the movie studios to decide which audio codec(s) they use for their releases.

1.10 **Will Blu-ray discs require a cartridge?**

No, the development of new low cost hard-coating technologies has made the cartridge obsolete. Blu-ray will instead rely on hard-coating for protection, which when applied will make the discs even more resistant to scratches and fingerprints than today's DVDs, while still preserving the same look and feel. Blu-ray also adopts a new error correction system which is more robust and efficient than the one used for DVDs.

1.11 **Will Blu-ray require an Internet connection?**

No, you will not need an Internet connection for basic playback of Blu-ray movies. The Internet connection will only be needed for value-added features such as downloading new extras, watching recent movie trailers, web browsing, etc. It will also be required to authorize managed copies of Blu-ray movies that can be transferred over a home network.

1.12 **Will Blu-ray down-convert analog outputs?**

No, Blu-ray players will not down-convert the analog output signal unless the video contains something called an Image Constraint Token (ICT). This feature is not part of the Blu-ray Disc spec, but of the AACS copy-protection system also adopted by HD-DVD. In the end it will be up to each movie studio to decide if they want to use this "feature" on their releases or not. The good news is that Sony, Disney, Fox, Paramount, MGM and Universal have already stated that they have no intention of using this feature. The other studios, which have yet to announce their plans, will most likely follow suit to avoid getting bad publicity. If any of the studios still decide to use ICT they will have to state this on the cover of their movies, so you should have no problem avoiding these titles.

1.13 **Will Blu-ray support mandatory managed copy?**

Yes, mandatory managed copy (MMC) will be part of the Blu-ray format. This feature will enable consumers to make legal copies of their Blu-ray movies that can be transferred over a home network. Please note that "mandatory" refers to the movies having to offer this capability, while it will be up to each hardware manufacturer to decide if they want to support this feature.

1.14 **When will I be able to buy Blu-ray products?**

If you live in the US or Canada you can already find Blu-ray players from Samsung, Panasonic, Sony, Philips and Pioneer available in stores, as well as a growing selection of

Blu-ray movies. We also expect to see Blu-ray players from LG and Sharp, as well as a second-generation Blu-ray player from Samsung introduced in the near future. The first Blu-ray hardware and software should also be available in many European countries now.

1.15 **What will Blu-ray products cost?**

As with any new technology the first generation of products will likely be quite expensive due to low production volumes. However, this shouldn't be a problem for long as there is a wide range of Blu-ray related products ([players](#), [recorders](#), [drives](#), [writers](#), [media](#), etc) planned, which should help drive up production volumes and lower overall production costs. Once mass production of components for Blu-ray products begins the prices are expected to fall quickly.

According to the Blu-ray Disc Association, the overall cost of manufacturing Blu-ray Disc media will in the end be no more expensive than producing a DVD. The reduced injection molding costs (one molding machine instead of two, no birefringence problems) offset the additional cost of applying the cover layer and low cost hard-coat, while the techniques used for applying the recording layer remain the same. As production volumes increase the production costs should fall and eventually be comparable to DVDs.

1.16 **How much time does it take to write a BD-R and BD-RE disc?**

BD-RE was first introduced to market with 1x (CLV) writing but both BD-RE and BD-R specifications now define 1x and 2x (CLV) operation. Since 1x BD writing transfers 4.29 MB (4,495,625 bytes) of data per second it takes, roughly, 93 minutes to write a full 25 GB disc or 46 minutes at 2x [(25,025,315,816 bytes ÷ 4,495,625 or 8,991,250 bytes per second) ÷ 60 seconds = 92.78 or 46.39 minutes].

In practice, recording time depends upon many factors including the writing speed supported by the recorder and disc, the amount of data to be written, if defect management or read-back verification is employed and the transfer rate of the data source.

Blu-ray vs DVD

2.1 **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) have released titles in 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. For more information about Blu-ray movies, check out our [Blu-ray movies](#) section which offers information about new and upcoming Blu-ray releases, as well as what movies are currently available in the Blu-ray format.

However, the two formats (Blu-ray and DVD) will most likely co-exist for quite some time until HDTVs become more widespread.

2.2 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.

2.3 Why should I upgrade from DVD to Blu-ray?

The simple answer is HDTV. If you've ever seen high-definition (HD) video on an HDTV, then you know just how incredibly sharp the picture is and how vivid the colors are. In fact, HD offers five times the amount of detail compared to standard-definition (SD). The problem with today's DVDs is that they only support SD and don't have the necessary storage capacity to satisfy the needs of HD. That's where Blu-ray comes in, it offers up to 50GB of storage capacity and enables playback, recording and rewriting of HD in all of the HD resolutions including 1080p. The format also supports high-definition audio formats and lossless audio.

In addition to the greater video and audio quality, the extra storage capacity also means there will be plenty of room for additional content and special features. This combined with the new BD-J interactivity layer adopted by Blu-ray will bring the menus, graphics and special features to a whole new level. For example, you will be able to bring up the menu system as an overlay without stopping the movie, and you could have the director of the movie on the screen explaining the shooting of a scene while the scene is playing in the background. The advanced interactivity combined with the networking features of Blu-ray will also allow content producers to support new innovative features such as downloading extras, updating content via the web, and watching live broadcasts of special events.

Thanks to the greatly enhanced HD video and audio quality as well as the advanced interactivity and networking features, Blu-ray represents a huge leap forward in the DVD viewing experience and will offer consumers an unprecedented HD experience.

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

Parameters	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
Track pitch	0.32µm	0.74µm
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)	720×480/720×576 (480i/576i)
Video bit rate (max)	40.0Mbps	9.8Mbps
Video codecs	MPEG-2 MPEG-4 AVC SMPTE VC-1	MPEG-2 - -
Audio codecs	Linear PCM Dolby Digital Dolby Digital Plus Dolby TrueHD DTS Digital Surround DTS-HD	Linear PCM Dolby Digital DTS Digital Surround - - -
Interactivity	BD-J	DVD-Video

2.5 Will Blu-ray replace VCRs?

Yes, as VCRs don't support recording of HDTV programming consumers will soon need to replace them. Blu-ray recorders combined with hard drives offer a very flexible alternative for those that want to record HDTV. While HD-DVRs already allow consumers to record HDTV, the amount of HDTV programming that can be recorded and archived is limited by the size of the hard drive. Blu-ray recorders will offer a solution to this problem as they allow consumers to record the video to Blu-ray discs and then free up the hard drive. This should make them popular among people that want to archive a lot of their HDTV recordings. The Blu-ray recorders will also offer a lot of compelling new features not possible with a traditional VCR:

- Random access - instantly jump to any place on the disc
- Searching - quickly browse and preview recorded programs in real-time
- Create playlists - change the order of recorded programs and edit recorded video
- Simultaneous recording and playback of video (enables Time slip/Chasing playback)
- Automatically find an empty space to avoid recording over programs
- Improved picture - ability to record high-definition television (HDTV)
- Improved sound - ability to record surround sound (Dolby Digital, DTS, etc)

2.6 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.

Blu-ray vs HD-DVD

3.1 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.

3.2 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.

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.

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 released 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 fewer 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.

3.3 What is the difference between Blu-ray and HD-DVD?

Parameters	Blu-ray	HD-DVD
Storage capacity	25GB (single-layer) 50GB (dual-layer)	15GB (single-layer) 30GB (dual-layer)
Laser wavelength	405nm (blue laser)	405nm (blue laser)
Numerical aperture (NA)	0.85	0.65
Disc diameter	120mm	120mm
Disc thickness	1.2mm	1.2mm
Protection layer	0.1mm	0.6mm
Hard coating	Yes	No
Track pitch	0.32µm	0.40µm
Data transfer rate (data)	36.0Mbps (1x)	36.55Mbps (1x)

Data transfer rate (video/audio)	54.0Mbps (1.5x)	36.55Mbps (1x)
Video resolution (max)	1920×1080 (1080p)	1920×1080
Video bit rate (max)	40.0Mbps	(1080p) 28.0Mbps
Video codecs	MPEG-2 MPEG-4 AVC SMPTE VC-1	MPEG-2 MPEG-4 AVC SMPTE VC-1
Audio codecs	Linear PCM Dolby Digital Dolby Digital Plus Dolby TrueHD DTS Digital Surround DTS-HD	Linear PCM Dolby Digital Dolby Digital Plus Dolby TrueHD DTS Digital Surround DTS-HD
Interactivity	BD-J	HDi

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