

# Blu-ray Technology

## Technologies Compared

**Optical Blu-ray Disc (BD) technology** offers random access to any file in the digital archive. It is a low cost, standardized open solution. Additionally, optical media has industry standard formats; ISO 9660 and UDF (Universal Disk Format) which are supported on every major operating system today including Windows, Linux, UNIX and MAC OSX natively without any additional client software.

Optical media is also less vulnerable than magnetic media as it is less susceptible to environmental conditions. It provides a true WORM (Write Once Read Many) recording medium which is essential considering today's requirements for multi-year data retention periods and growing regulatory compliancy requirements for unalterable, non-erasable storage capabilities. Optical technology meets these requirements as part of its standard features.

	BD	Tape	RAID
<b>Low energy</b>	✓	✓	✗
<b>Random Access</b>	✓	✗	✓
<b>Durability Media</b>	✓	✗	✗
<b>Removable Media</b>	✓	✓	✗
<b>Open Standard</b>	✓	✗	✓
<b>Cost-Effective</b>	✓	✓	✓

**Tape** has been used traditionally for back-up and is now also being promoted as archiving technology. Tape however does not provide random access capabilities. It is also more vulnerable for damage and wear making it usually not the optimum choice. As tape formats are proprietary and subject to change, compatibility is a key issue. Tape standards change approximately every 5 years, reducing the long term efficiency of tape as archival technology.

**RAID** systems (hard disks) require frequent maintenance. Moreover, power consumption and the lack of removability of the media make RAID technology less suited as a single archiving technology. However, as part of a hybrid storage solution (RAID & Tape or RAID & BD), it offers essential benefits to the archiving process, such as random and fast access to the archived data through low-cost, standardized technology.\*

\* See for more info: [DAX Archive Solutions Brochure](#)

## Key Benefits

### Longevity

- 50+ years media lifetime guarantees long-term data retention.
- Promising technology roadmap: 100-200GB/disc.

### Compliance

- BD-R is write-once, offering highly reliable and tamper-proof archives.

### Standard

- Standardized technology (UDF) offers long-term data read.
- Widespread acceptance by users.
- Multi-platform support.

### Green

- Less CO2 emission requiring minimal power and air-conditioning consumption.

### Low TCO

- Use of standard technology simplifies implementation and administration.
- Proven compatibility (CD, DVD, BD, +) reduces the need for costly and inefficient data migrations.
- Economically priced media.



**Blu-ray Disc (BD)** is the next-generation optical disc format. The benefit of using a blue-violet laser (405nm) is that it has a shorter wavelength than a red laser (650nm), which makes it possible to focus the laser spot with even greater precision.

This allows data to be packed more tightly and stored in less space, so it's possible to fit more data on the disc even though it's the same size as CD/DVD. This together with the change of numerical aperture to 0.85 is what enables Blu-ray Discs to hold 25GB/50GB.

Blu-ray Disc types come in two versions: single layer and double layer. A double layer disc may hold up to twice the amount of data or video compared to a single layer disc, and uses two independent layers placed on one side of the disc to store its information. A single-layer disc holds up to 25 gigabytes, while a double-layer disc holds up to 50 gigabytes of data, without the need to flip the disc.

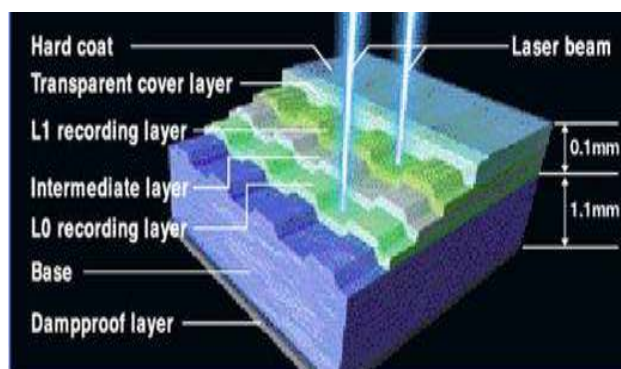
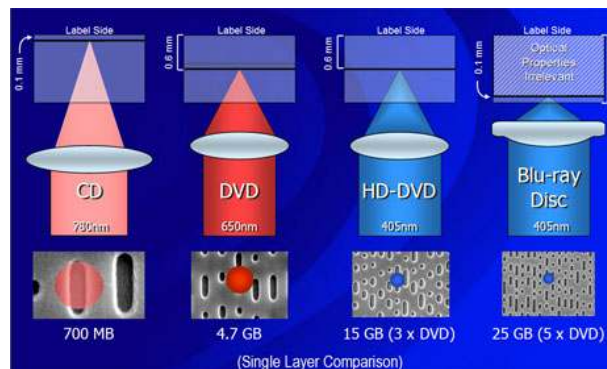
Blu-ray Disc format is easily **extendable** (future-proof) as it includes support for multi-layer discs. This allows the storage capacity to be increased to 100-200GB in the future simply by adding more layers to the discs.

First generation drives are 2x (72Mbps), as BD-ROM movies require a minimum data transfer rate of 54 Mbps. 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.

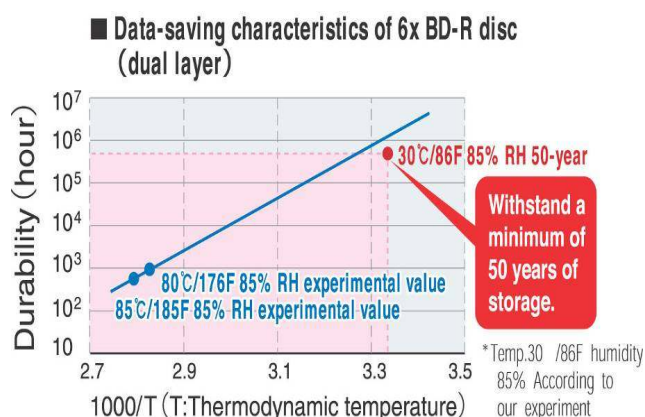
While the media itself limited the recording speed in the past, the only limiting factor for Blu-ray is the capacity of the hardware. If we assume a maximum disc rotation speed of 10,000 RPM, then 12x at the outer diameter should be possible (about 400Mbps). Constant innovations in terms of drive speed and capacity confirm the promise of this evolving technology on a continuous basis.

The development of new low-cost hard-coating technologies has made the use of cartridges 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.



MEDIA	BD-R	BD-RE
type	write-once	rewritable
capacity	25GB / 50GB	25GB / 50GB
layers	single / double	single / double
recording speed	6x	



Tests show that BD-R media are extremely suitable for long-term archival storage purposes. In a typical office environment (normal room conditions), the projected archival lifespan is at least 50 years.

Source: Panasonic