



An Introduction to
Dolby Vision™



Dolby introduced Dolby Vision™ in January 2014 as the natural next step after 4K—bringing high-dynamic-range (HDR) and wide-color-gamut technology to homes around the world. Reaction from content creators, audiences, manufacturers, and broadcasters has been enthusiastic—a wide range of televisions from LG, VIZIO, and other manufacturers is now available to consumers worldwide, and streaming video providers like Netflix, Amazon Video, and VUDU are providing the latest Hollywood and original content.

Delivering this new experience comes with many challenges:

- How do you ensure that the viewer sees the visuals just as the director intended?
- How do you ensure that people can enjoy this new experience on a wide range of devices, from high-end televisions to PCs and mobile devices?
- How do you deliver this new experience efficiently?
- How do you enable this experience for movies, traditional broadcast, and games?

Dolby has invested a decade and millions of dollars in developing science and technology that powers the end-to-end ecosystem that addresses these challenges.



DELIVERING CREATIVE INTENT

Hollywood and television directors, live-broadcast producers, and game producers all want to be sure that viewers see what they intended. Dolby is working with the movie, broadcast, and game industries to ensure that the original creative intent of the content makers is preserved right through to consumer televisions and other devices.

A key challenge in maintaining creative intent is that different models of display devices have different capabilities—for example, different peak brightness, contrast ranges, or color capabilities. Because each device is different, Dolby Vision display solutions include technology that takes the full-range, uncompromised signal and maps the signal to the capabilities of that display through a process called display management.

Working with the content makers and the broader industry, Dolby has helped define a set of standards for HDR delivery. These standards include a more efficient way to represent HDR (PQ, standardized as SMPTE ST 2084), information about the display the content was mastered on (SMPTE ST 2086), and dynamic information about the content (SMPTE ST 2094). When this information is available, the Dolby® display manager is able to further optimize the quality of the content on the consumer's display.

In applications where content is produced offline, such as movie and episodic content for video on demand, Blu-ray™, and cinema, this metadata is created during the color-grading process and forms part of the distribution master.

For live production, where it may be impractical to generate or carry metadata through complex broadcast plants, metadata is generated algorithmically at the point of transmission encoding.

DOLBY VISION – UNCOMPROMISED HDR FOR TODAY AND THE FUTURE

To deliver an uncompromised experience, a system must consider the entire ecosystem—“glass to glass,” from the camera to the display—and should consider both existing and future technologies.

Cinema and broadcast cameras today can capture high-dynamic-range and wide-color-gamut content, even if their current target is Standard Dynamic Range (SDR). Content creators must ensure that the signal they capture and archive is of the highest quality—once compromised, the original signal is impossible to recover. In offline environments, content creators archive in OpenEXR, which is a 16-bit floating-point format. In live environments, the format archived must be as high in quality as possible. PQ (SMPTE ST 2084) is one format that allows efficient representation of original signals.



For color grading of movies and episodic content, Dolby has created systems that automatically generate content metadata and allow directors to see how their content will look on consumer devices. They can then add “trims” to allow them to adjust how the automated algorithms work.

For live content, Dolby is working with camera manufacturers and broadcasters to create equipment that will allow producers to create high-quality PQ signals that can be transmitted, and (optionally) to include content metadata just before the signal is transmitted.

Another challenge for content providers is serving early Ultra HD™ (UHD) televisions that are capable only of SDR reproduction. Multiple ways of achieving backward compatibility are currently proposed, but only one (Dolby Vision dual layer) is in market today. One of the challenges is wide color gamut. The new Rec. 2020 color space allows many more colors to be displayed, but if a Rec. 2020 signal is displayed on a legacy (Rec. 709) UHD television, colors can be distorted. The Dolby Vision dual-layer backward-compatible solution includes an uncompromised SDR Rec. 709 signal.

REACHING THE MASS MARKET

UHD televisions are now in the reach of the mass market—prices for these televisions now range as low as US\$499. Producing a high-quality HDR experience on these TVs (and on other devices like tablets) requires advanced technology that understands the content and can adapt the edge-lit backlight to deliver the best experience possible. The dynamic content metadata in Dolby Vision technology makes highly accurate HDR possible even in mass-market devices.

DELIVERING THE EXPERIENCE FOR STREAMING, UHD BLU-RAY, AND GAMES

Dolby today works with the leading streaming providers to deliver Dolby Vision content to their customers. Netflix, Amazon Video, and VUDU, and more providers soon to announce, deliver their HDR content in Dolby Vision by preference.

The Ultra HD Blu-ray™ specification includes Dolby Vision as an optional enhancement, and Dolby is working with industry partners throughout this ecosystem to enable Ultra HD Blu-ray with Dolby Vision.

Games are a natural for HDR—most triple-A games, that is, those with high development budgets, now use physical-based rendering, where what the gamer is shown is rendered as if it were real life, and Dolby Vision makes that content more



realistic. Dolby is working with leading game studios to bring games to market using Dolby Vision. Epic Games (Unreal Engine) and Amazon Lumberyard both showed examples of Dolby Vision at GDC 2016 (Game Developers Conference) in San Francisco.

DELIVERING THE EXPERIENCE FOR BROADCAST

Dolby has been an active participant in ATSC and DVB standards processes for HDR and UHD broadcast, with the goal of ensuring that the highest-quality HDR and SDR video can be broadcast to homes across the world.

Grass Valley and Dolby have collaborated on showing how cameras can deliver PQ video for broadcast. At NABShow 2016, Dolby showed real-time content mapping hardware that helps production teams deliver both uncompromised SDR and uncompromised HDR.

Dolby engineers have been collaborating with leading sports and live-events broadcasters to develop reliable operating practices for shooting in PQ.

Dolby has been an active participant in international standards for video, contributing to the new ITU-R BT.2100 standard for HDR TV, as well as actively standardizing core technologies such as PQ and metadata in SMPTE (SMPTE ST 2084, ST 2086, and ST 2094-10). Dolby also participates in MPEG and 3GPP video standardization efforts, and is standardizing its technology for reshaping and composing HDR signals in ETSI.

WHAT'S NEXT?

Most Hollywood studios today deliver their content in PQ with Dolby Vision metadata, and Dolby is working with broadcast, episodic, and game studios to deliver new content. Our partners in the television industry are delivering innovative Dolby Vision TVs across a wide price range worldwide. Dolby looks forward to working with partners in other industries to deliver exciting new HDR and wide-color-gamut experiences to new display devices.

Dolby Vision was created to effectively address the challenges to delivering HDR and wide-color-gamut experiences through a robust future-ready solution. Dolby Vision is leading the drive toward next-generation imaging technology to enable spectacular visual experiences for audiences across the globe.