Historically, consumers have been content with having limited choices about the audio experience they receive from broadcasts. However, today’s connected consumers are demanding more choices and more control. They desire an experience that works for them and aligns with their preferences.

A key trend across entertainment is the ability to personalize experiences for consumers. This can start with giving more choice and then grow to integration with social networks, where each user is presented with an experience that is tailored just for them. From the perspective of the broadcaster and operator, personalization can also create additional revenue streams, as advertisements can be targeted to the highest-value consumers for a particular product or market.

While consumers are getting more choice and personalization from entertainment services, generally, this choice has so far been delivered by increasing the number of camera angles or increasing the level of integration with Facebook or Twitter. Audio, on the other hand, has been somewhat left behind in this transition. However, there are many benefits to using audio as a primary method of delivering new experiences. During a sports event, for example, it is the audio that best engages consumers with the atmosphere of the stadium, with the passion and excitement of a commentator, or with the tension surrounding a moment of silence.

Dolby® Personalized Audio solutions create the potential to deliver a wide range of compelling new user experiences. However, the production tools used to enable these new experiences can also deliver operational efficiencies and the potential to deliver more targeted experiences using today’s delivery networks.

The promises of object-based audio

Dolby Personalized Audio solutions are built upon object-based audio. Dolby has led the deployment of object-based audio into cinemas and the home with Dolby Atmos®. Dolby Personalized Audio expands on the possibilities of Dolby Atmos by delivering a flexible set of tools for enabling a wider range of choices for consumers.

As the demand for more audio choices increases, it is no longer feasible to continue creating channel-based mixes for each of these experiences. We have historically accepted inefficiencies in producing multiple audio services, because channel-based production was the only option and the limited number of audio streams meant this was acceptable.
If we consider a service offering 5.1 audio in English and Spanish, delivering those two audio services using channels would require six channels for each service—12 in total. However, if we consider how these services are created, then the music and effects (M&E) are consistent between the two, with only the dialogue changing. So, in the example where the dialogue is center anchored, we could instead break this down into a 5.1 M&E with a separate mono English dialogue and a separate mono Spanish dialogue.

**Efficiency**

The first advantage Dolby Personalized Audio offers is efficiency. By delivering common elements once and only sending the differences separately—in this case, dialogue—we can provide additional experiences using less capacity in terms of contribution, emission, and storage. In this example, we are using only eight channels to carry the audio. Therefore, object-based production means we are 33 percent more efficient.

![Diagram of channel-based vs. object-based audio]

**Figure 1: Example of Object-Based Audio Efficiency**

In many ways, this example isn’t particularly different from the way that some productions take place today. The key part to object-based audio is that metadata flows along with the audio to describe each of these elements, so there is no uncertainty as to what the elements are and how they should be combined.

Dolby tags Presentation metadata as defined by the content creator to ensure that the audio elements will be combined correctly and produces the same audio as the channel-based experiences. Each presentation defines one choice available for the audio; so, in this
example, there would be one set of metadata to define the English presentation and one set to define the Spanish presentation.

**Repurposing and localization of content**

All high-profile content today is created with a view that it will be experienced in a wide range of countries and on a wide range of devices. However, the methods of repurposing the content for different requirements vary widely, and there is no common approach to localization.

With object-based audio, audio elements can be kept separate and are only combined further down the chain, thereby delivering operational efficiencies in the way that content can be repurposed. Typical examples of audio that would be kept as a separate object could include the dialogue (to enable simpler language replacement) or music and soundtracks (to allow for royalty-free music to replace the main music for regions that don't justify the payment for high-profile music).

The example below shows an example of a live sports production where multiple commentary languages are included along with the stereo music as a separate element.

![Figure 2: Example of Live Sports Production with Separate Audio Elements](image)

At various points down the chain, the music can be replaced by alternative music for different distribution paths, while the main music is available for the primary delivery.
Better tailored experiences for different platforms

Examining the audio capabilities of different devices and delivery pipes, we can see that there is a range of differences in the ability of these platforms to deliver the ideal sound experience. Today, broadcast audio continues to be mixed in studios and outside broadcast trucks on high-quality speakers in a controlled environment. However, consumers are increasingly listening to broadcast content on a wide range of devices.

With playback on mobile devices, we have a different set of capabilities compared with the stereo speakers in a TV set or a home theater system. If the audio engineer was listening to the mix on a mobile phone, it is likely that the mix would be different from the one he or she would create today in order to ensure that dialogue clarity is maintained. The same audio elements need to be included, but the balance would be different.

With personalized audio production, we can create metadata to control how the audio elements are mixed for different devices. While the most flexible approach is to implement Dolby Personalized Audio on the devices themselves, it is also possible to get some of the benefits by rendering a specific mix of the audio for different delivery paths. As an example, take a mix delivered for the main broadcast path—the audio engineer may decide that a certain combination of dialogue and M&E is appropriate when replayed in 5.1. However, when the same audio is delivered to a mobile encoder, more dialogue and less M&E might be appropriate. With personalized audio production, metadata can be created that is then used to create different combinations of the audio prior to the emission encoders.

Realizing the benefits today

Dolby has deployed a number of object-based workflows in different environments. Dolby Atmos was launched for the cinema in 2012 and uses Dolby’s object-based audio expertise to deliver amazing immersive experiences for moviegoers. Dolby Atmos experiences are now available in the home via home theaters and mobile devices equipped with Dolby Atmos.

While delivering personalized audio to the home requires a change in the STB, mobile app, or other replay device, it is possible to achieve the production efficiencies and flexibility today. For live workflows, Dolby has developed a new set of tools that make use of Dolby object-based audio solutions and deliver live events with immersive and personalized experiences. These same tools can provide more flexible productions and the channel-based audio required for today’s transmission paths.
Dolby has developed Dolby ED2, which enables object-audio metadata to be carried along with the audio. The Dolby ED2 stream can then be converted into a number of different audio outputs—as defined by the original creator of the content—and carried through the metadata. Dolby ED2 builds on the known compatibility of Dolby E. The core coding is the same—delivering high-quality mezzanine compression, but now it includes additional metadata required for combining the audio elements as originally intended. Dolby ED2 is one solution for delivering these new experiences through the broadcast infrastructure. Dolby is working with standards bodies and other organizations to ensure that this new metadata can be supported through a wide range of technologies and devices.

Figure 3: Dolby Professional Reference Decoder DP590

The Dolby Professional Reference Decoder DP590 is the tool that enables audio engineers to define and monitor the various combinations of the audio elements that they wish to create. Each defined combination is referred to as a Presentation, and downstream decoders can be set to decode and create each presentation—for example, “5.1 English”—whenever this is required. The metadata used within the presentation is fully defined in the Dolby DP590 and is therefore under the control of the audio engineer. Presentations can be appropriately named for the production. They may refer to languages, targeted delivery paths, or enhanced experiences as desired by the producers.

Dolby has also developed the DP591 and DP592, which can encode, decode, and monitor Dolby ED2. These tools enable workflows that use audio elements and produce the various outputs required at various points in the chain—for example, monitoring the audio elements individually, decoding so as to add additional audio elements, or creating the 5.1 audio from the audio elements for the final transmission.

The Dolby DP591 and DP592 have been designed to be flexible platforms that can support a range of applications. For example, the DP591 supports the encoding of Dolby Personalized Audio experiences for delivery to consumers when the decoding of Dolby Personalized Audio is available in the consumer devices.

Dolby knows that there is continuing pressure to deliver new experiences for consumers and that this usually creates an additional burden to the production. However, with object-based
audio solutions, Dolby has focused on ensuring that its tools and techniques also deliver production advantages. By doing so, tomorrow’s audio experiences will be delivered more flexibly than today’s and with greater efficiency, thereby paving the way to create a wider range of personalized and more immersive experiences.

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