



## Ensure Video Quality in Your Mobile Delivery

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**Though mobile devices are becoming more sophisticated, with more processing power and better usability, providing video across multiple platforms remains a challenge.**

Provided by 3G, HSDPA, and Long-Term Evolution (LTE), the boost in bandwidth availability is fueling the rise in mobile video access from handsets and netbooks. Larger screens, advances in compression technologies, flat-rate data-access charges, and more efficient and improved quality media adaptation technologies also are driving mobile video access growth.

Variations across mobile screens, netbooks, and handsets dictate the adaptation of entertainment content as terminals typically vary in screen size, network access bandwidth, and media/codec processing and protocol capabilities. The conversion from one format to another is accomplished in real time or in an offline mode depending on the use case.



Marwan Jabri brings nearly 20 years of research and development expertise in multimedia communications systems and intelligent signal processing. He has significant expertise in media communications protocols, and he was closely involved with the ITU in the development of the ITU H.324/H.324M standards. He was also founder of the Systems Engineering and Design Automation Laboratory (SEDAL) at University of Sydney and was awarded the Outstanding Young Investigator Medal by the Australian Telecommunication and Electronics Research Board.

For example, a content asset may be available in an MPEG2 transport stream (MPEG2TS) file format and require delivery to a netbook user connected over a 3.5G mobile network with an Adobe Flash player. The video format in the original stream may be in MPEG2 video and Dolby AC3 audio.

Delivering this content for best viewing on the consumer's netbook with the Adobe Flash player would necessitate the following conversions:

- MPEG2TS to Flash video format (FLV)
- MPEG2 video to H.264 AVC
- AC3 audio to AAC
- Bandwidth from a high bit rate of 1 to 6 Mbits/s to few hundred kbits/s
- Screen size from HD (1080i/p, 720i/p) or SD/ED (480i/p) to VGA, HVGA, or QVGA
- And possibly the frame rate from 30 f/s to around 20 f/s

If the netbook consumer uses the Microsoft Windows media player, the container format would have to be Microsoft's Windows Media with Microsoft's Windows Media audio/video codecs.

### Essential Media Adaptation

Depending on the use case, the media adaptation will need to be performed on demand in real time or in an offline (batch) mode. The most basic operation of media adaptation is video scaling, encoding or transcoding, frame-rate, and bit-rate adaptation.

If video codecs are defined by standards, how can one encoder be superior to another? Standards define valid bitstream structures and decoders, but not encoders or encoding strategies. So as long as compressed video bitstreams comply with the specification, the standard has served its purpose.

As an example, most modern video standards use a motion prediction tool. Motion prediction is usually about determining whether a portion of a video frame (e.g., a 16- by 16-pixel macroblock) is present in a previously encoded frame. If it is, then the amount of bits needed to encode that portion can be significantly reduced by reusing the portion.

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To do this, the encoders first need to determine the best matching block in an area surrounding the macroblock in the previous frame (motion estimation). On the basis of the match, the encoders next will determine whether the macroblock is unchanged (encoder can skip) or if some differences exist and can be encoded. (The encoding of the differences will yield fewer bits than the encoding of the macroblock itself.)

Each of these two steps can be implemented in various ways. Some are more efficient, like compute cycles and memory utilization. Others provide much greater quality. The second step can be invoked in a variety of ways, according to an encoding strategy and the context of the application—constant versus variable bit rate, offline-mode versus real-time transcoding, etc. Hence, when it comes to video, adherence to a standard is not a measure of quality.

Real-time or on-demand transcoding is challenging because the transcoder has to convert the media stream from one codec to another while maintaining appropriately short input to output latency. The transcoder does not have the benefit or luxury of multiple passes over the incoming bitstream to transcode while maintaining bandwidth efficiency using information from a time later in a clip. The real-time transcoder has to employ coding strategies that predict the changing

bandwidth needs of video frames and encode them accordingly. Failure to do so leads to highly variable video quality and inefficient bandwidth utilization.

Bandwidth variations are common in networks in general, though they are more severe in mobile and wireless networks. In today's 2G to 3.5G networks, quality of service is rarely in place or enabled, and best-effort approaches are used. Available bandwidth to a 3/3.5G user typically varies from 64 to 300 kbits/s. Fluctuations in available bandwidth result in severe degradation in the customer experience.

Dynamic bit-rate adaptation (DBRA) is a general term used to describe the ability of a delivery system to adjust its transmitted bandwidth to match network fluctuations. DBRA approaches are different for real-time streaming protocol (RTSP) and hypertext transfer protocol (HTTP) progressive download (PD).

In RTSP, infrastructure providers and handset vendors are increasingly adopting a standardized approach. For the RTSP DBRA scheme to be of value, handset support and the support of RTSP streaming and relay servers are essential.

For HTTP PD, there is no standardized way today to implement DBRA. Different terminals and media-player technologies implement different strategies. Some, like Apple's iPhone (OS 3.0), require a multiplicity of bit rates to be listed in the content asset, and the decision of which one to select is left to the iPhone media player. Other streaming and media-player technologies use different approaches.

### [Moving Forward with the Essentials](#)

As mobile video delivery technologies have emerged, designers are facing new challenges in delivering video to any screen/terminal. Smart encoding, real-time transcoding, and dynamic bit-rate adaptation strategies are available today and are essential ingredients for scalable software-based deployments delivering a high-quality customer experience at a reasonable cost.

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