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# Error resiliency schemes in H.264/AVC standard

Sunil Kumar [a,*], Liyang Xu [a], Mrinal K. Mandal [b], Sethuraman Panchanathan [c]

[a] *Electrical and Computer Engineering Department, Clarkson University, Potsdam, NY 13699, USA*
[b] *Electrical and Computer Engineering Department, University of Alberta, Edmonton, Canada T6G 2V4*
[c] *Computer Science and Engineering Department, Arizona State University, Tempe, AZ 85287, USA*

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**Abstract**

Real-time transmission of video data in network environments, such as wireless and Internet, is a challenging task, as it requires high compression efficiency and network-friendly design. H.264/AVC is the newest international video coding standard, jointly developed by groups from ISO/IEC and ITU-T, which aims at achieving improved compression performance and a network-friendly video representation for different types of applications, such as conversational, storage, and streaming. In this paper, we discuss various error resiliency schemes employed by H.264/AVC. The related topics such as non-normative error concealment and network environment are also described. Some experimental results are discussed to show the performance of error resiliency schemes.


*Keywords:* H.264/AVC; JVT; MPEG-4 Part 10; Video coding standards; Video coding; Video compression; Error resiliency; Error resilient video coding

## 1. Introduction

With the success of MPEG-2 in DVD and HDTV applications, the demand for higher coding efficiency in video-based services has grown significantly. In 2001,

* Corresponding author.
*E-mail addresses:* skumar@clarkson.edu (S. Kumar), xul@clarkson.edu (L. Xu), mandal@ece.ualberta.ca (M.K. Mandal), panch@asu.edu (S. Panchanathan).

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ITU-T Video Coding Experts Group (VCEG) together with the ISO/IEC Moving Picture Experts Group (MPEG) formed the Joint Video Team (JVT) to develop a new video coding standard with better coding efficiency. The committee completed the final draft of ITU H.264 also known as ISO MPEG-4 Part 10 in May 2003. The H.264/AVC (Advanced Video Coding) [1] is thus a new video coding standard of the ITU-T VCEG and ISO/IEC MPEG, which achieves better compression than all other existing video coding standards. The H.264/AVC has been developed based on previous standards such as H.261, MPEG-2 (also known as H.262), H.263, and its enhanced versions H.263+ and H.263++. This new standard is designed to address applications that are likely to use transmission media such as Cable Modem, xDSL, or UMTS that offer much lower data rates than broadcast channels [2].

Apart from better coding efficiency, the standard has also given strong emphasis to error resiliency and the adaptability to various networks [2]. To give consideration to both coding efficiency and network friendliness, H.264/AVC has adopted a two-layer structure design (Fig. 1): a video coding layer (VCL), which is designed to obtain highly compressed video data, and a network abstraction layer (NAL), which formats the VCL data and adds corresponding header information for adaptation to various transportation protocols or storage media [2]. For stream-based protocols such as H.320, H.324M or MPEG-2, the NAL delivers compressed video data with start codes such that these transport layers and the decoder can robustly and easily identify the structure of bit stream. For packet-based protocols such as RTP/IP and TCP/IP, the NAL delivers the compressed video data in packets without these start codes [3].

A coded video sequence in H.264/AVC consists of a sequence of 'coded pictures.' A coded picture can represent an entire *frame* or a single *field* (for interlaced frame). However, we shall use the term '*frame*' to represent both the entire frame as well as a field, in this paper. The main features of H.264/AVC, which distinguish it from the previous video compression standards, are briefly discussed below [2,3]:

- Two context adaptive coding schemes, context-adaptive variable-length coding (CAVLC) and context-adaptive binary arithmetic coding (CABAC), improve coding efficiency by adjusting the code tables according to the surrounding information.

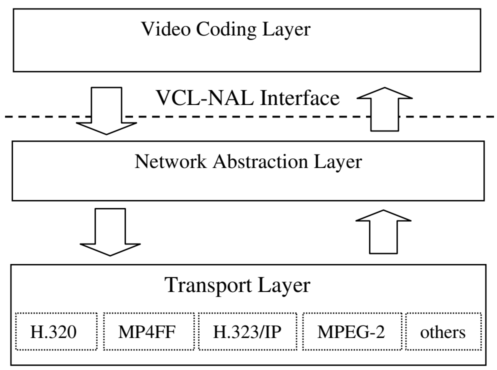


Fig. 1. VCL and NAL layers in H.264/AVC.