MPEG-7 Binary Format for XML Data

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For the MPEG-7 standard a binary format for the encoding of XML data has been developed that meets a set of requirements that was derived from a wide range of targeted applications. The resulting key features of the binary format are: high data compression (up to 98% for the document structure), provision of streaming, dynamic update of the document structure, random order of transmission of XML elements as well as fast random access of data entities in the compressed stream.

To provide these functionalities, a novel, schema-aware approach was taken that exploits the knowledge of standardized MPEG-7 schema (which defines the syntax of the transmitted XML document) on the encoder and decoder side: the XML schema definition, which is instantiated by the XML description, is used to assign codes to the individual children of an XML element. These codes are signalled in the binary format to select nodes in the XML description tree. The only prerequisite for the usage of the binary format is the knowledge of the schema at the encoder and decoder. Therefore the technique can be applied not only for MPEG-7, but for all XML documents that have been validated according to a known schema (this need not be the MPEG-7 schema).

The bit stream of the binary format is organized as a sequence of Access Units. Each Access Unit can be decoded independently, and contains information about a fragment of the description (fragment payload) and where to place the fragment in the current tree (context path). This design with two specialized tools is essential for the advanced functionalities listed above.

The ‘fragment payload’ coding compiles finite state automatons from the complex type definitions of the XML schema. En- or decoding is done by the propagation of a token through these automatons. If a state has several possible successors, the next state is selected at the decoder by reading the bit stream. The encoder selects the next state by looking at the XML description (writing the corresponding code in the stream). The content, which consists of primitive data types, is encoded with dedicated encoders. Also specialized data type codecs can be plugged in that are not defined in MPEG-7.

The ‘context path’ tool generates code tables from the complex type definitions. Each possible child (e.g. element or attribute) is assigned a code, the length of which is determined by the overall number of children of the respective complex type. The concatenation of these codes results in a path through the description tree addressing one specific node and identifying its data type.

Compared to the standard text compressor ZIP, or the XML-optimized tool XMill, the MPEG-7 binary format achieves a 2-5 times better compression of the document structure and provides additional functionalities. These increase the flexibility and make it also useful in broadcast applications and scenarios with limited bandwidth.

Details about the binary format can be found in: