

MPEG-4 Character Animation

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MPEG-4 is an ISO/IEC standard developed by MPEG (Moving Picture Experts Group)¹. MPEG-4 provides standard and unified ways to:

- Represent units of audiovisual contents, called “media objects”.
- Describe the composition of these objects to create compound media objects that form audio visual scenes;
- Multiplex and synchronize the data associated with media objects, to transport them over network channels, providing appropriate QoS; and
- Interact with the audiovisual scene on the receiver’s end.

The geometric representation and animation of synthetic characters (Virtual Humans and cartoon-like characters) is well specified in MPEG-4. The following is a brief overview of the MPEG-4 specification for character animation.

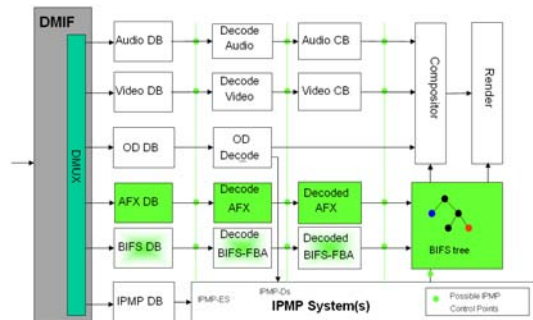


Figure 1 : MPEG4 streams overview

MPEG-4 streams for Virtual Characters animation

MPEG-4 defines the FBA (Facial and Body Animation) object to describe the geometry of the virtual character and animate it^{2, 3}.

The FBA specification defines two sets of parameters: The first one specifies the geometry of the FBA model: FDPs (Face Definition Parameters) and BDPs (Body Definition Parameters). These parameters allow the decoder to create an FBA model with the specified shape and texture. The second set defines the animation of the face and body: FAPs (Face Animation Parameters) and BAPs (Body Animation Parameters) Fig.1 shows a schematic view of the FBA object.

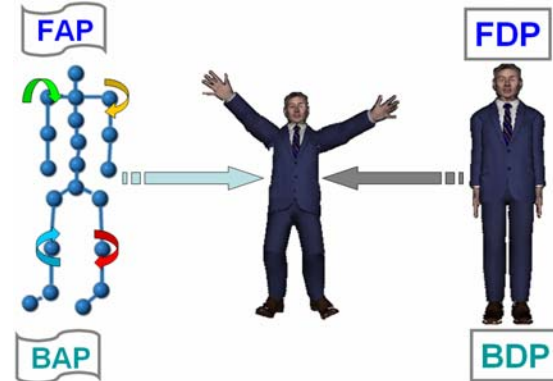


Figure 2: MPEG4 BIFS-FBA object

MPEG-4 Body Definition Parameters

The MPEG-4 BDPs used to define the body of the virtual human, are directly related to the VRML/Web3D H-Anim 1.1 specification⁴. According to the H-Anim standard, the human body consists of a number of segments (such as the forearm, hand and foot) which are connected to each other by joints (such as the elbow, wrist and ankle). A H-Anim stream contains a set of Joint nodes that are arranged to form a hierarchy. Each Joint node can contain other joint nodes, and may also contain a segment node associated with that joint. Each segment is a normal VRML transform node describing the 3d shape of the body part. Segments can contain sites which can be used for attaching clothing and jewelry, and

can also work as end-effectors for inverse kinematics applications. They can be used to define eye points and viewpoint locations as well. A Segment node may contain a number of displacer nodes, specifying which vertices within the segment correspond to a particular feature or configuration of vertices. The H-Anim specification defines a single Humanoid node which stores human-readable data about the humanoid, such as author and copyright information. That node also stores references to all the joint, segment and site nodes, and serves as a "wrapper" for the humanoid. In addition, it provides a top-level Transform for positioning the humanoid in its environment.

MPEG-4 Body Animation Parameters

The MPEG-4 BAP (Body Animation Parameters) are used for the synthesis of body movements. In order for the tool to animate the virtual human, it obtains access to the H-Anim joints and alters the orientation angles (yaw, roll, pitch) to match those defined in a BAP stream. A BAP stream can contain up to 296 parameters describing the topology of the body skeleton.

Anatomical deformations

Since the BDP model is made out of separated segments, defined by a mesh of polygons, when the rotation angles of the joints are modified by the applied BAPs, the children segments are rotated from its original position. The result is a discontinuous surface over the rotated joint. The set of vertices that form the polygon mesh of the segment; need to be modified to keep an anatomically realistic, continuous surface over the modified joint.

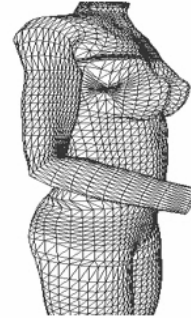


Figure 3 : MPEG4 body deformation

MPEG-4 defines the use of preset deformation tables, which contain the coordinates of the segment vertices to be deformed in the key postures of each joint. The deformations of the segments on intermediate postures (not contained in the preset tables) are calculated using linear interpolation.

MPEG-4 Animation Framework eXtension, AFX

The AFX – pronounced ‘effects’ provides an integrated toolbox for building attractive and powerful synthetic MPEG-4 environments. The framework defines a collection of interoperable tool categories that collaborate to produce a reusable architecture for interactive animated contents⁵. The current standard is going to evolve to the AFX framework, able to take into account generic articulated Virtual Characters (e.g. without H-Anim skeleton)⁶.

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Implementation examples of MPEG-4 compliant body and facial animation as well as additional resources on this subject can be found in the references section.

References:

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