MPEG-4 : A Solution for Interactive Digital Television

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Presentation overview

MPEG-4 Systems
- A standard for interactive rich media

Application to Broadcast
- A standard for interactive digital television
- Examples of interactive MPEG-4 services

Conclusion
- MPEG-4 is the solution for interactive multimedia broadcast
MPEG-4 Systems:
A standard for interactive rich media
MPEG-4 Systems Principles

Key concept:

Audio-visual scenes made of audio-visual objects composed together according to a scene description:
- allows interaction with elements within the audio-visual scene
- coding scheme can differ for individual objects
- allows easy re-use of audio-visual content

Audio-visual objects:
- audio (single or multi-channel) or video (arbitrary shape or rectangular)
- natural (natural audio or video) or synthetic (text & graphics, animated faces, synthetic music)
- 2D (Web like pages) or 3D (spatialized sound, 3D virtual world)
- streamed (video movie) or downloaded (audio jingle)
MPEG-4 Systems Principles

Scene Description:

- **Spatial/temporal relationships** between objects
  - 2D, 3D, mixed 2D and 3D scene description
- **Behavior and interactivity** of the audio-visual objects and scenes
  - Scripting and optional Java APIs
- Protocols to modify and animate the scene in time.
MPEG-4 Systems Principles
Scene Composition

- **Object Descriptors as signaling framework**

- **BIFS** for scene composition & simple interactivity
  - VRML concepts: set of nodes to represent the primitive scene objects to be composed, the scene graph constructs, the behavior and interactivity through routes and **scripts** (Ecma script)
  - + Integration of streams
  - + 2D capabilities
  - + Integration of 2D and 3D
  - + Advanced Audio Features (ex: environmental spatialization)
  - + Timing model
  - + BIFS-Command and BIFS-Anim protocols to modify and animate the scene in time
  - + Upstream protocol

- **XML based version of BIFS**
  - **XMT** (eXtensible MPEG-4 Textual format)
BIFS-Command

Scene Graph

Root Transform

BikeSwitch

Bike

Body Transform

Right Leg
Left Leg
Body
Left Arm
Head
Right Arm

Switch

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BIFS-Command ES
BIFS-Anim

Scene Graph

- Root Transform
  - BikeSwitch
    - Bike
  - Body Transform
    - Right Leg
    - Left Leg
    - Body
    - Left Arm
    - Head
    - Right Arm

BIFS-Anim ES

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BI FS Binary Representation

**BI FS-Command**
- Compression factor of 10 to 25 compared to textual description
  - Context dependency
  - Hierarchical, linear quantization of scene data
  - Differential multiple fields coding and mesh coding integration

**BI FS-Anim**
- Compression factor of 15 to 30 compared to textual description
  - Linear quantization and predictive coding (including rotation and normals)
  - Adaptive arithmetic encoding
Programming languages

Programmatic Control of the “Presentation Engine” of MPEG-4 Systems through

- Scripting: ECMAscript
- Java: MPEG-J

MPEG-J

- Optional feature
- Java APIs enabling access to the scene, network, decoders
- Local or streamed applications (MPEGlets)
- Optionally allows compression and archiving of Java classes
MPEG-J Architecture

MPEG-J Run Time Environment

Java Virtual Machine

Java MPEG-let

Terminal

Network Buffers Decoders Buffers Compositor

Presentation Engine

Execution Engine

Java Packages
IPMP (Intellectual Property Management and Protection) is prerequisite for publishing serious, valuable content in digital form.

IPMP support integrated deeply into MPEG-4 systems.
- Hooks are already included.
- On-going developments on IPMP extension will support broader interoperability.
Profiles and Levels

Profiles define subsets useful for a large class of applications/services

Profile types

- Audio (natural and synthetic): types of objects
- Visual (natural and synthetic): types of objects
- Scene description (e.g. behaviour)
- Object Descriptor (mainly timing models)
- MPEG-J
- Graphics

Levels limit the number of objects and complexity
Application to Broadcast:
A standard for interactive digital television
MPEG-4 network tools

- MPEG-4 is fully compatible with MPEG-2
  - Includes tools adapted to MPEG-2 networks
  - MPEG-4 and MPEG-2 media can coexist
  - MPEG-4 can easily be integrated in DVB & ATSC

- MPEG-4 provides a natural evolution path towards IP networks
  - Includes tools adapted to IP networks
  - ISMA selected MPEG-4 tools and uses IETF-defined transport

- MPEG-4 provides tools for error-prone networks (wireless)
MPEG-4 terminal playback

MPEG-4 is fully compatible with MPEG-2
- Can take advantage of MPEG-2 hardware legacy (MPEG-2 streams as MPEG-4 media)

MPEG-4 provides a natural evolution path towards multi-network access
- Terminal playback can combine media accessed via several access networks in a single user experience

MPEG-4 provides terminal-based composition
- Deterministic representation allowing to control the look and feel and the playback behavior
- Natural framework for media push based services
- Allows media personalization
MPEG-4 adaptability

- MPEG-4 allows a seamless migration / coexistence of streaming & broadcast services
  - Online and broadcast services can be designed consistently, taking advantage of their complementarities

- MPEG-4 quality can be scaled to the transport channel
  - Broadcast (e.g. satellite) channels can afford high (MPEG2-like) quality
  - Broadband (e.g. ADSL) channels get down-sized (streaming) quality
  - Non-guaranteed bandwidth channels can use scalable streams

- MPEG-4 profiles allow for a gradual increase in media complexity as playback devices scale-up
MPEG-4 interoperability

- MPEG-4 defines an interoperable binary format for interactive multimedia content
- MPEG-4 defines the minimal level of interoperability
  - OS and terminal independent
  - Authoring tool independent
    - interoperability at the authoring level (XMT)
- MPEG-4 interoperability groups (MPEG-4, M4IF, ISMA) are currently very active
MPEG-4 service examples
MPEG-4 service examples

- Media on-demand
- Corporate TV channel
- Live music promo
Conclusion

MPEG-4 is THE solution for interactive multimedia broadcast

- Rich:
  - fully featured interactive media

- Broadcast oriented:
  - meets broadcast quality and network requirements

- Multi-vendor:
  - open standard, interoperability on the way

- Network opportunistic:
  - can take advantage of any combination of transport networks

- Economically viable:
  - scales with network / terminal capacity, at a cost equivalent to competing technologies
A little about Envivio

- MPEG-4 Broadcast software
  - Authoring, Server, Client
- Partnerships

SI GMA Designs

Avid

INTERTRUST

THOMCAST

Network Appliance

nCUBE

wavexpress

sgi