Music Notation Applications
Requirements and MPEG Technology

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Activities

• Context
• Rational for Integrating MN into MPEG tech.
• Music Notation Applications
• General Requirements of Music Notation
• Current and new Application Requirements for Music notation and Multimedia
• MPEG Technology and Music Notation
• What we would like to do

Additions:
• Notes on Modeling Music Notation
• List of references, links, applications
• Basic Functionalities of Music Notation
Modeling Music notation and Multimedia integration

We have analyzed the problems in the last years identifying specific requirements in the area of Multimedia Interactive Music

Music integrated with multimedia maintaining the interactive aspects of music notation:
- Transposing, Editing, …..
- Selecting traces, play along, …..
- Formatting, etc.

Music Notation has a relationships with all the AV information and impacts on:
- Synchronization with other media
- hyperlinks, annotation, cataloguing, identification, etc.
- DRM, etc.

In this context, Music Notation can be regarded as divided in the 4 domains:
- Audio, Logical, Visual, Graphic:
**Map of Relationships**

**High level**
- LVMNL

**Low level**
- Graphic/Interaction
  - BIFS
  - SVG
  - Font

**Audio**
- Melody
- SASL
- MIDI
- SAOL (CSound)

**Synchronization**

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**Rational for Integrating MN into MPEG tech.**

- Availability of products that also include these aspects and suffer for the lack of integration with other Audio visual formats

- Increment of the market for the industry

- New market segments, mainly:
  - Long life music education,
  - edutainment, entertainment, etc.
**Music Notation Applications**

- **Multimedia music notation distribution**
  - DRM, protection, with the next features

- **Music Education and courseware construction**
  - PC, i-TV, electronic lecterns, tablet PC, PDA..keyboards

- **Karaoke: singer support, entertainment, etc.**
  - Synchronizations, audio rendering, etc.

- **Multimedia music manipulation in archives, music schools, music information centers, etc,**
  - Searching technology, annotation in all domains

- **Music editing integrated with audiovisual**
  - Music formatting and transcoding from MN to other visual aspects

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**General Requirements of Music Notation**

- **GR1, scalability:** to write simple music notation pieces files without spending time and token to describe all the context. At the same time the model has to support the writing of complex structure of music pieces with multivoices, multistaff, etc., according to the applications identified. This will make it suitable for simple devices and applications such as those supposed for mobile equipment.

- **GR2, interoperability:** this is a typical feature of MPEG applications; interoperability is required among i-TV, Mobile Devices, PDAs, Tablet PCs, electronic musical instruments, special hardware, cars, etc.

- **GR3, extensibility:** to have the possibility to create new symbols with their related rules or code for formatting (conversion to the visual domain and from this in graphical domain) and executing/playing (conversion to the audio domain).
Application Requirements for Music notation and Multimedia

- **R1**, annotation of music notation with audiovisual content: of the students on the lesson, audio visual annotations of the teacher.
- **R2**, decode of music notation with different decoders to obtain different views of the same music representation (main score, parts, Braille, Gregorian, spoken, etc.). This can be done by using additional information or automatic formatting engines. This is very useful to work on different devices (piano keyboards, PDAs, mobiles, i-tv, sheet, screen, etc.), etc. The music notation integrated with audiovisual could be streamed with video, audio, .. on mobiles, etc. (see MPEG4 model)
- **R3**, supporting query by content integrating audiovisual and music notation, usage of music notation model for verifying the match with MPEG7 descriptors of music that presently are very simple, increasing the expressivity of MPEG7 music descriptors.
- **R4**, distribution of music notation with multimedia aspects integrated in, by using a suitable DRM model based on MPEG21
- **R5**, executing music notation synchronously with audio visual content, animation, for educational purpose, for entertainment, etc., see Karaoke, etc.

Additional aspects

- **navigation on music notation and multimedia aspects of MPEG**, as annotations or story path built in the content. The navigation is mainly the activity related to the exploitation of annotation and relationships of music notation with multimedia, thus see **R1 and R5**.
- **showing/playing audio visual content related to Music Notation symbols and context**. This activity is mainly related to the synchronous execution of music notation with audio. See **R5**.
- **authoring music notation integrated with multimedia aspects for creating the content used by the above mentioned requirements, synchronization, annotation, etc..** This requirement is mainly included in the description of **R1 and R5**
- **joining the music notation with the MPEG SAOL**. A good model for audio performance modeling see R5 and the technology section
Structure of the requirements

• Description
• Rational for its introduction
• Basic Functionalities involved, taken from the reference page
• Applications that needs this requirement, take from the reference page
• Description of potential users
• Customer satisfaction and need
• Presence in current applications
• Dependency with other requirements
• Conflicts with other requirements

MPEG Technology and Music Notation

• We reviewed and analysed:
  • Current Solutions
  • MPEG4 aspects
  • MPEG7 aspects
  • Benefits to be obtained integrating MN into MPEG
Current Solutions

- **MIDI**
  - Absolutely Limited in logic
  - Lack of visual and graphic

- **MPEG-4 Structured Audio and BIFS**
  - Mainly audio, strongly limited in logic
  - Lack of visual and graphics for music

- **MPEG-7 Melody DS**
  - Only descriptors, limited in audio and logic
  - Lack of visual and graphics for music

- **XML based Music Notations**
  - Most of them are disappearing
  - One is good for interchange, others for innovative applications…

Benefits to be obtained solving Problems

- creating innovative applications incorporating multimedia integration with musical content
- distribution multimedia music content on media devices, i-TV, PDAs, cellular phones, etc. (interoperability)
- creating content and courseware for music education
- production of music notation and synchronisation with other media
- creating and managing content in music archives
- creating the support for the interoperability among the above mentioned different applications
- creating musical information for consumers with different accessibility needs

- **Creation of new products, exploitation of new markets**
The whole relationships

Client side
- Music Query
- Music Annotation
- MPEG4 Player

Server side
- Melody database
- Music Piece
- Music Notation database
- SASL SAOL
- MPEG4 Player
- Audio Decoder
- Music Notation Coder

The first focused aspect

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What we would like to do

• Standardize the music notation format for MPEG
• Extension of MPEG4
• Create a new Object Type (and format), capable to decode Music Notation input stream and creating the visual aspects.
• Synchronizations and control performed at level of BIFS note to keep related the Music Notation and the audio samples
• This solution has a simpler implementation of player, complexity mainly confined in the decoder

We have this technology,
• we have the format and the decoder,

we would like to show that this technology is
  – really good for MPEG and
  – MPEG is good for Music Notation applications with multimedia

• After that we can take decisions?
Reccomendations

• Review of M10068 document to evaluate requirements in the MPEG context in Brisbane
• Make a precise schedule plan to refine the work within a fixed date.
• Submit the produced document to interested companies, create an output document on and “Applications of Multimedia and Music Notation”

• Define a precise case study application for requirements to exemplify the integration of Music Notation into MPEG technologies
• Investigate in details the case study by next meetings to identify well addressed functionalities and potential critical aspects

• Integrating in a MPEG4 player a decoder of Music Notation
• Focused application Education of Music Notation
• Music Education and courseware construction
  – Play training
  – Exercise
  – Navigation and editing in audiovisual and music notation
  – Etc.

• MPEG and interoperability
  – PC, i-TV, electronic lecterns (tablet PC), keyboards
Who will do the work

• MPEG people:
  – EPFL, DSI, FHIGID, FNB (new), IRCAM
  – AHG: 66 subscribers, 34 from industry
  – The intention to present a liaison from RECORDARE to remain informed about that
  – New additions forthcoming: ARCA, EXITECH, etc.

• MUSICNETWORK
  – MUSICNETWORK: 600 subscribers, 250 from Industry
  – WG Notation: 450 subscribers, 150 from industry
  – Last MUSICNETWORK open workshop: 100 people
  – Last WG Notation meeting, 30 people, 9 industries

• We are pushing them into MPEG, some of them already joined MPEG…