
# The Interactive-Music Network

## MUSICNETWORK and MPEG Report

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# 1 Executive Summary and Report Scope

Since the beginning, one of the main aims, if not "the aim" of MUSICNETWORK has been to focus on stimulating the realisation of widely adopted formats for music notation representation. These formats, which must be integrated with multimedia applications and models, will deal with the needs of all the relevant actors (including publishers, music editor producers, copyists, integrators, etc.) involved in the realisation and the distribution of an "interactive" multimedia music piece. Music notation representation is an important issue, and an open standard format allowing exchange and cooperation with other multimedia formats still does not exist. We should not be limited to the applications only related to the printing process. It is clear that music notation needs to be and will be in the future accessed more and more using different kinds of devices, from the PC to Tablet PCs and UMTS terminals, from the classical printed music sheets to the electronic lectern.

Great part of the work described in this document has not been economically supported by the MUSICNETWORK. The MUSICNETQWORK has performed only the coordination of the reported activity. On this regard, the MUSICNETWORK has worked with the support of many working-groups, including Music Notation, Standards, Imaging, Accessibility, Education, Library, etc.
The actual work has been performed with the coordination of a large number of experts coming from several areas of Europe and worldwide. Currently, the MUSICNETWORK has more than 850 participants, from more than 50 different countries.

The first task was the identification of the requirements for the integration of music notation with multimedia applications. This work has been performed with the support of several experts at the MUSICNETWORK open workshops by means of the discussion forums and the mailing lists provided by the MUSICNETWORK portal. This analysis has been performed with considerations of the past experiences of several European Commission projects, including CANTATE, MOODS, WEDELMUSIC, IMUTUS, PLAY, PLAY2, etc., that worked in the area of music notation, and in some cases, on the integration of music notation with some multimedia content and features.

The second step was to study the state of the art technology in the area of music, computer music and electronics, to better understand the music notation/representation formats, their integration, and aspects on all the WGs involved in the MUSICNETWORK, and their usages in multimedia applications. These activities have been described in a number of deliverables and reports of the MUSICNETWORK that have been downloaded by thousands of participants from the MUSICNETWORK web site. It is evident that this work has received very strong attentions and interests and it has been strongly appreciated by all related communities.

This second step has allowed us to understand the state-of-the-art and the real needs of the users and of the companies that produce music and computer music applications for the market, mainly in the areas of education, entertainment, content distribution, archiving and cultural valorisation, electronic consumer equipments (such as i-TV, PDA, cellular phones, and others), etc. At the same time, the experts of the MUSICNETWORK have identified the major problems that are preventing and/or limiting the exploitation of the present technical and technological solutions in those applications.

As mentioned before, one of the main limitations for the full exploitation of music notation/representation integrated with multimedia, is the lack of a common standard for representing the notational information. On the other hand, the presence of a standard is not the unique problem since presently there are some *de facto* standards that cannot be used and are not used for solving the above mentioned problem. These include representations from FINALE, SIBELIUS, etc. In fact, in most cases, these *de facto* standards are capable of supporting more than 95% of the global production of music notation pages. However, they remain unacceptable and incapable to be fully exploited in multimedia music applications. Another interesting case is that of the XML-based music notation formats. In the last 5 years, we have seen about 15 different XML-based models proposed by several groups and companies. Among these only MUSICXML of Recordare has gained interest demonstrating a quite interesting interoperability with several applications, including in some measure, FINALE and SIBELIUS. In this case, the MUSICXML remains a subset of their models, and it is not capable of modeling multimedia music concepts. The same problem is evident from the potential new

effort for starting a standardisation process in IEEE. If the idea is to model only the music notation, the format will remain without a real usage in the area of multimedia music. This is confirmed by other efforts in the past in which we have seen other proposed standards as interchange formats for music notation such as NIFF and SMDL (SMDL was an ISO draft, now cancelled, to produce a standard on music notation).

On the basis of this experience and rationales, the effort of the MUSICNETWORK has been concentrated to a different direction, that can lead in a unique step to create a standard for the representation of music notation which allows complete integration with a multimedia framework. The path to reach this goal has been identified in realizing a standard for music notation/representation within the MPEG framework, with a special attention to MPEG-4. MPEG-4, which is the emerging standard on multimedia distribution, is composed by several parts, some of which are already supported by Microsoft Media, Quick time, Interactive TV, and of many digital TV distribution channels, etc.

The scope of this report is to document the activity performed by the MUSICNETWORK to coordinate this effort of bringing new functionalities regarding the music notation and representation into the multimedia world and thus into the MPEG, as recently identified as a mean to reach the above mentioned objectives. Other details regarding the work performed to this aim can be found in the documents produced and listed at the end of this document.

MPEG is the largest standardisation group that works on multimedia coding. It is a working group of ISO (International Standard Organisation, WG 29) and it is the producer of all the MPEG standards: MPEG-1 (coding for distribution at small bitrates, including the core of the mp3 format), MPEG-2 (audiovisual coding for digital TV and higher bitrates), MPEG-4 (multimedia coding for audiovisual objects, to be used also by satellite distribution, etc). At the forum, there are participants from all the major companies including IBM, MICROSOFT, HP, SAMSUNG, SONY, THOMPSON, PANASONIC, YAMAHA, SANYO, PHILIPS, SHARP, etc. under the umbrella of their respective National Bodies. Overall, MPEG includes more than 400 major companies involved in Consumer Electronics devices and technologies, and all the major research centers in the area. At each meeting, typically about 300 partners are represented. It is to be noted that a standard accepted in MPEG is an ISO standard accepted by National Bodies world-wide. Any activity and document produced by an MPEG meeting is accepted in plenary session and thus it obtains acceptance by the important and large companies, which are present at the meeting, such as those mentioned above and many others. This is why MPEG has been considered by the MUSICNETWORK as the best forum to propose and to create a Music Notation/representation standard with multimedia integration.

The MUSICNETWORK activity aiming at the integration of Music Notation in MPEG started in May 2003 (month 10), with the elaboration of a joint proposal for the MPEG meeting in July 2003, in Trondheim. The MPEG group has agreed on setting up an Ad Hoc Group, which is, in MPEG parlance, a specific group aimed to study a particular topic. In this case, the Music Notation and its possible integration in MPEG. A mailing list (a reflector in MPEG parlance) has been setup, together with a web site to support this activity. The chairs of this AHG have been designated by MPEG to be Paolo Nesi (also chair of the MUSICNETWORK) and G. Zoia of EPFL, Switzerland. The result obtained so far has been really exceptionally good, as commented by MPEG and ISO:

As a general assessment of the work performed by MUSICNETWORK for integrating Music Notation in the MPEG framework, *Leonardo Chiariglione (Digital Media Strategist and chair of MPEG and of DMP and of concertation group on DRM of the EC)* have publicly stated at the MPEG Forum in front of hundreds of experts of the world (in Munich 2004) and reported in an email of appreciation to Nesi and Zoia that

«*The topic of this proposed MPEG work item and the approach followed by the Ad Hoc Group are an excellent demonstration of the synergy that can be created between advanced research topics and standardisation as carried out by MPEG in integrating existing technology with potential industrial impacts. In the case of music notation the added value is in bringing to life application fields where education, culture and entertainment blend.*

*Recently the colocated Symbolic Music Representation Ad Hoc Group and MUSICNETWORK meetings resulted in the production of the Draft Call for Proposal on Symbolic Music Representation. The work is*

*being done at a high level of professionalism and great enthusiasm and can sure become a guide for other future topics.*

*I congratulate on your achievements so far and look forward to seeing your successful reaching of the next milestones."*

The above statement has been also reported and public available in the Assessment document of the MUSICNETWORK, DE6.1.1 which is publicly available on the web site.

The activities performed are all public. All the documents, test cases, web pages, etc., and even emails exchanged, can be accessed via free web access. Please see at the end of this document, for a complete list of references and relevant http links.

# 2 Motivations and Rationales

Currently, the music market is characterized by several products that present some forms of integration between music notation and multimedia. Examples include music education related areas (integrating multimedia), music management in library (integrating with multimedia for navigation and for synchronization), karaoke (synchronization based integration), etc.

The integration of music notation in MPEG can cover the needs of these tools and can provide much more features by adding interoperability, porting them on i-TV and on mobiles, supporting scalability of format complexity, etc., permitting to these tools to integrate the powerful MPEG model for the multimedia modelling and play.

The integration of music notation with MPEG can open the way for a large number of new applications and markets. Examples include multimedia electronic lecterns, music education via i-TV, multimedia content integrated with music notation on piano keyboards, mobiles, PDAs, etc. This action could enlarge the present market for music notation, nowadays limited mainly to music-sheet production; it may open the path to create very interesting new applications, and also renewing existing applications that already use some integration between multimedia and music notation.

An AHG has been created by MPEG on the basis of the request from the members of the MUSICNETWORK to explore further this integration.
The MUSICNETWORK had previously started an activity on collecting detailed requirements for the music notation and its integration on multimedia. These requirements include: format analysis, and activities for defining the requirements and the functionalities of the new standard.

The requirements developed have been taken into account for producing a call for technology to include a Music Notation Model into MPEG. In addition, they are used for determining the criteria for assessing the proposals, to verify that the potential standard meets the specified requirements, and to specify the conformance point for the standard. This will be applicable to all tools that use similar technology, involving:

- Music notation format; and
- Music notation decoder (formatter of music notation, piano roll, Braille production, etc.)

MUSICNETWORK participants as well as external companies, institutions, organisations and research centers are very keen and interested in working with the AHG in MPEG, in an effort to guarantee that their needs will be included into the MPEG standard, so that their tools that will be compliant with the standard. There is also a strong market impact since these tools could be integrated in a wide range of multimedia applications for I-TV, PDA players, Piano Keyboards, etc., and integrators will have the possibility of selecting among several different standard implementations of Music Notation Decoders, all compliant with the same Music Notation format.

The MUSICNETWORK has started an activity on collecting detailed requirements for the music notation and its integration on multimedia. These requirements include: format analysis, and activities for defining the requirements and the functionalities of the new standard.

# 3 Activities and Documents

Details regarding the authors and the way to access to the following documents are reported in Section 10.

Historical aspects of Music Notation and multimedia can be found in:

- DE4.3.1 deliverable of MUSICNETWORK WG on Music Standardization, M18.

The application scenarios on multimedia music can be recovered in:

- DE4.1.1 deliverable of MUSICNETWORK WG on Music Notation, M18.
- DE4.3.1 deliverable of MUSICNETWORK WG on Music Standardization, M18.
- DE4.2.1 deliverable of MUSICNETWORK WG on Music Library, M18.
- M10068, MPEG2003, ISO/IEC JTC1/SC29/WG11, "Music Notation Application Requirements and MPEG Technology",
- M10355, MPEG2003, ISO/IEC JTC1/SC29/WG11, "Music Notation Functionality and Interface to MPEG",
- M10622, MPEG2003, ISO/IEC JTC1/SC29/WG11, "A new Application Scenario for Music Notation in MPEG".
- N6049, MPEG2003, ISO/IEC JTC1/SC29/WG11, "Application Requirements of Multimedia and Music Notation",
- N6149, MPEG2003, ISO/IEC JTC1/SC29/WG11, "Application Scenarios for Music Notation integrated in MPEG",
- M10661: MPEG2004, ISO/IEC JTC1/SC29/WG11, "Proceedings of AHG on Music Notation Requirements / MUSICNETWORK".

The technical requirements of the Music Notation and representation, to be integrated in multimedia music applications are reported in:

- DE4.1.1 deliverable of MUSICNETWORK WG on Music Notation, M18.
- DE4.3.1 deliverable of MUSICNETWORK WG on Music Standardization, M18.
- DE4.6.1 deliverable of MUSICNETWORK WG on Music Accessibility, M18, aspects on music Braille and spoken music, music accessibility related projects,
- DE4.7.1 deliverable of MUSICNETWORK WG on Music Imaging, M18. from images to music notation, OMR, Optical Music recognition, music sheet digitization, OMR evaluation model, music sheet restoration,
- M10355, MPEG2003, ISO/IEC JTC1/SC29/WG11, "Music Notation Functionality and Interface to MPEG",
- M10357, MPEG2003, ISO/IEC JTC1/SC29/WG11, "Music Notation Technical Requirements",.
- M10654, MPEG2004, ISO/IEC JTC1/SC29/WG11, "Music Notation Technical Requirements and Integration in MPEG-4",
- M11025, MPEG2004, ISO/IEC JTC1/SC29/WG11, "Study on Draft CfP on Symbolic Music Representation",

Analysis and overview of Music related standards, multimedia applications, and frameworks that could host music notation and why, comparative studies, including a list of the most relevant standardisation bodies (in music and multimedia areas), their goals and related patents aspects, can be found in:

- DE4.3.1 deliverable of MUSICNETWORK WG on Music Standardization, M18.
- DE4.2.1 deliverable of MUSICNETWORK WG on Music Library, M18: usage of music in libraries considering needs and tools and standards, content description and identification, metadata modeling and management,
- DE4.4.1 deliverable of MUSICNETWORK WG on Music Distribution, M18: tools and formats for music distribution (audio or music notation, or music sheets), tools for music protection and DRM, review of the most relevant projects on music area, copy right aspects, collecting rights, comparing technologies for music distribution, identification of metrics for comparing different technologies, problems of music distribution, business models, MPEG21,
- DE4.5.1 deliverable of MUSICNETWORK WG on Music Protection, M18: the intellectually property rights, copyrights, registration, needs and requirements on music protection, payments systems, digital rights management, licensing models, active and passive protections, watermarking

and fingerprinting, business models, content description and identification, encryption and decryption, standardization activities in the area of protection, DRM technology providers.

The analysis of the state of the art on music notation, comparison among different XML music notation formats and models, metrics for the comparison of music notation models, comparison among those models in managing integration with multimedia, relevant problems of the present notation and models when are used in multimedia application can be recovered in:

- DE4.1.1 deliverable of MUSICNETWORK WG on Music Notation, M18.
- DE4.2.1 deliverable of MUSICNETWORK WG on Music Library, M18.
- DE4.6.1 deliverable of MUSICNETWORK WG on Music Accessibility, M18
- M11019, MPEG2003, ISO/IEC JTC1/SC29/WG11, "Draft Evaluation Criteria for Assessing SMR Proposals",
- M11021, MPEG2004, ISO/IEC JTC1/SC29/WG11, "Examples of Matching SMR aspects and available technologies",
- M11025, MPEG2004, ISO/IEC JTC1/SC29/WG11, "Study on Draft CfP on Symbolic Music Representation",
- M11307, MPEG2004, ISO/IEC JTC1/SC29/WG11,"Proposed SMR Evaluation Model and Procedure",

The requirements regarding multimedia music applications in MPEG can be recovered in:

- DE4.1.1 deliverable of MUSICNETWORK WG on Music Notation, M18.
- DE4.6.1 deliverable of MUSICNETWORK WG on Music Accessibility, M18.
- M9731, MPEG2003, ISO/IEC JTC1/SC29/WG11, "Proposal for Music Notation Modeling and its Integration within MPEG-4 and MPEG-7",
- N6689, MPEG2004, ISO/IEC JTC1/SC29/WG11, "Call for Proposals on Symbolic Music Representation", The requirements reported in this documents are a concise version with respect to those reported and described in the above mentioned MUSICNETWORK deliverable.

The suggestions about how to integrate music notation/representation into MPEG can be recovered in:

- DE4.1.1 deliverable of MUSICNETWORK WG on Music Notation, M18.
- M9731, MPEG2003, ISO/IEC JTC1/SC29/WG11, "Proposal for Music Notation Modeling and its Integration within MPEG-4 and MPEG-7",
- N6457, MPEG2004, ISO/IEC JTC1/SC29/WG11, "Draft Call for Proposals for Symbolic Music Representation",
- M10654, MPEG2004, ISO/IEC JTC1/SC29/WG11, "Music Notation Technical Requirements and Integration in MPEG-4",
- M11022, MPEG2004, ISO/IEC JTC1/SC29/WG11, "Graphic functionality in MPEG-4 and Symbolic Music Representation",
- M11354, MPEG2004, ISO/IEC JTC1/SC29/WG11, "MPEG-4 and SMR: report on available functionality for graphics",
- N6689, MPEG2004, ISO/IEC JTC1/SC29/WG11, "Call for Proposals on Symbolic Music Representation",
- N6690, MPEG2004, ISO/IEC JTC1/SC29/WG11, "DRAFT SMR Evaluation Procedure",
- N6812, MPEG2004, ISO/IEC JTC1/SC29/WG11, "SMR Evaluation Model and Procedure",

# 4 The time report of the activity performed

The purpose of the activity of MUSICNETWORK in MPEG is to integrate Music Notation in MPEG. The activity started in May 2003 (month 10), with the elaboration of a joint proposal for the MPEG meeting in July 2003, in Trondheim. The MPEG group has agreed on setting up an Ad Hoc Group, which is, in MPEG parlance, a specific group aimed to study a particular topic, in that particular case the Music Notation and its possible integration in MPEG. A mailing list (a reflector in MPEG parlance) has been set-up, together with a web site to support the activity. The chairs of this AHG have been designed by the MPEG to be Paolo Nesi (chair also of MUSICNETWORK) and G. Zoia of EPFL, Switzerland.

During the whole process, a number of intermediate documents have been produced: user's scenarios, intermediate reports, and requirements. All these documents are available on the Web site and have been mentioned above.

Finally, several workshops dedicated to a common coordination in elaborating requirements starting from those of general applications for multimedia music and Music Notation have been organised. In the same activity, the requirements of integrating music notation in MPEG-4 have been obtained. These meetings have been organised to co-locate with MPEG and/or MUSICNETWORK open workshops.

# 5 Expressions of Interests

A request for Expressions-of-Interest (EoI) has been produced, in order to show the interests of music community in this topic. A wide range of EoI has been received, from the academic sectors as well as from industries. From the academic world, EoI have been received from institutions including libraries, research centres and universities. From industries, EoI have been received from companies dealing with audio processing (automatic generation of scores from audio), or dealing with optical recognition of music scores, or even dealing with e-learning and education.

18 EOIs have been received

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Other companies interested in this activity and participating to the general discussion (either by participation to the Munich meeting or to the previous MUSICNETWORK meetings related to the AHG activity), which may be interested in a call for proposals include:
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and many many others of some 300 qualified companies, and institutions, which are participating the activities of the MUSCINETWORK.

## 5.1 Global List of People and Companies Involved

The following list only consists of some of the active participants. It includes people who have attended MUSICNETWORK meetings/events which are oriented at the Music notation and related to the activity with SMR in MPEG. In addition, it also includes a list of the companies that are subscribed to the reflector. This list is not public. This document will be made public after removing the list of people involved and their affiliations.

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# 6 Activity Evolution and reporting on meetings

The activities coordinated for the integration of Music Notation/Representation in MPEG can be summarized in chronological order according to the following activities. Sections are organized on the basis of periods or meetings.

## 6.1 May-July 2003

- elaboration of a proposal (an input document) on the integration of Music Notation into the MPEG framework for the 65$^{th}$ MPEG meeting:

- Production and presentation of document **M9731, MPEG2003, ISO/IEC JTC1/SC29/WG11.**
- Participation of P. Nesi and J. Barthelemy at the 65th MPEG meeting (Trondheim, NO) which established the Ad-Hoc group on Music Notation Requirements.
- We presented the document mentioned above
- We obtained to create an AHG (ad hoc group) of MPEG on Music Notation. MPEG identified as chairs of the AHG P. Nesi (chair of MUSICNETWORK) and G. Zoia (EPFL, already worked on MPEG-4).
- The mandate posed by the MPEG Audio chair to the AHG has on Music Notation was the following.

| N5894 | AHG on Music Notation Requirements |
|---|---|
| Mandate: | · Describe Music Notation applications<br>· Develop Requirements for Music Notation modeling based on these applications<br>· Assess how these requirements can be met with existing MPEG technology and highlight possibly missing technology<br>· Solicit industry input to the ongoing activity |

## 6.2 2nd Open Workshop MUSICNETWORK, September 2003

A full description of the activities held at the second open workshop has been included into the DE7.1.1, which is an official deliverable of MUSCINETWORK.

The WWW links of the event with the program and other details are:

http://www.interactivemusicnetwork.org/events/notation_workshop_2003.html
http://www.interactivemusicnetwork.org/events/Second_OpenWorkshop_2003/programme_openworkshop_2003.html
http://www.interactivemusicnetwork.org/wg_notation/documents.html?l_s=struttura&gruppo=106&order_by=data&asc_desc=asc

During the workshop the attendees of the workshop have

- Identified and discussed the most important aspects of music notation formats with a particular attention to the structural aspects, requirements for music notation formats, XML usage, context, process of standardization, etc.
- Taken the decision to start with the production of a document modeling requirements and then producing a sort of commonly accepted standard in collaboration with standard bodies. The main results are the activities started with MPEG and OASIS

## 6.3 August-October 2003

- discussions on the reflector and preparation of input document on Music Notation Application Requirements for the 66th MPEG meeting.
- The work of this group is reflected in approximately 120 emails that were exchanged among the 65 subscribers of the mn-mpeg email reflector, including 34 subscribers from industry.
- The general discussion on Music Notation Requirements has been very active during the first part of the AHG; it has slowed down slightly in the second part mainly due to the event of the MUSICNETWORK Workshop (September 13-15) where these topics were discussed in an audience of about 40 people, and most probably, the imminent deadline for the second call of the 6th European framework. The discussion has been initially focused on fundamental issues related to Music Notation and MPEG, after that it shifted to basic application scenarios and requirements for the integration of music notation into multimedia frameworks. Detailed results about this discussion have been reported in document **M10068**: "Music Notation application requirements and MPEG technology".
- production and presentation of document **M10068, MPEG2003, ISO/IEC JTC1/SC29/WG11.**
- participation of P. Nesi at the 66th MPEG meeting (Brisbane, AU), to present the document mentioned above, to convince MPEG in accepting music notation to be included in the standard, on the basis of the functionalities needed and their innovation.

- At the meeting, it was decided to continue the work on requirements, passing from application requirements to specific technical requirements. The following mandate was posed by the MPEG Audio chair to the AHG on Music Notation:

| 6030 | AHG on Music Notation Requirements |
|---|---|
| Mandate: | • Describe technical requirements for Music Notation format (i.e. coded representation) and decoder.<br>• Assess how these requirements can be met with existing MPEG technology and identify missing technology<br>• Describe the system architecture that supports integration of the Music Notation decoder with existing MPEG technology.<br>• Verify that proposed requirements and system architecture satisfy the commonly used formats for and usage of Music Notation.<br>• Solicit industry input to the ongoing activity |

- As a first result, we obtained the publication of an official document of ISO MPEG stating that some requirements and functionalities were missing in MPEG. Please refer to document **N6049, MPEG2003, ISO/IEC JTC1/SC29/WG11 which is referred in the bibliography and available via the web site**. The document contains the applications requirements and some details regarding missing functionalities in MPEG what could be satisfied by adding Music Notation in the MPEG environment.

## 6.4 November-December 2003

- discussions on the reflector and preparation of two input documents on Music Notation Application Requirements and integration of Music Notation into the MPEG framework for the 67th MPEG meeting.
- The work of this period is reflected in more than 90 emails that were exchanged among the 94 subscribers of the *mn-mpeg* email reflector with about 53 from the industry. A proposed meeting to be held in Florence has not been confirmed.
- The general discussion on Music Notation Requirements has been active throughout the whole duration of the period; a relative majority of messages has been coming from subscribers active in the music and music publishing domain, the rest from subscribers more active in multimedia and MPEG. The main discussion has been focused on both basic issues related to Music Notation formats and to application scenarios and requirements for the integration of music notation into multimedia frameworks. Detailed results about this discussion are reported in document m10357: "Music Notation Technical Requirements".
- The general discussion on the MPEG technology and the interface to the MPEG-4 System Architecture (mandates 2 and 3) has been active as well throughout the whole duration of the period; messages have been coming from subscribers active in the music and music publishing domain and in similar amount from subscribers more active in multimedia and MPEG. The discussion has been focusing on editing/interaction requirements for music notation, on general issues related to MPEG-4 Architecture and related features, and finally on possible interface (nodes) and bitstream definition in the context of MPEG. A major attention to MPEG-4 has been noticed, whereas further integration with MPEG-7/-21 has been also considered. Detailed results of this topic are reported in document m10355: "Music Notation Functionality and Interface to MPEG".
- In the final part of its work, the group has solicited expressions of interests to the ongoing activity as informal letter to the AHG chairs or as formal input to MPEG. Three informal EoI have been received from the following companies:

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- A more concrete form of support has not been possible, probably due to the short time. Official positions and contributions (with presence of representatives) are expected for the next meeting.
- production and presentation of document **M10355,** MPEG2003, ISO/IEC JTC1/SC29/WG11 **(**Recommendations about Music Notation and its interface to MPEG technology), and of **M10357,**

**MPEG2003,** ISO/IEC JTC1/SC29/WG11 (Recommendations about Music Notation applications, requirements and format).

- participation by G. Zoia at the 67th MPEG meeting (Waikoloa, Hawaii, USA) in which was decided to continue the work to have more information and arriving at preparing a Call for Technology for creating a task into MPEG and thus an integration into the standard of the Music Notation.
- The mandate posed by the MPEG Audio chair to the AHG has on Music Notation was the following.

| | AHG on Music Notation Requirements |
|---|---|
| Mandate: | • Progress and finalize technical requirements for Music Notation format (i.e. coded representation) and decoder.<br>• Describe the system and interaction requirements to support integration of the Music Notation decoder into existing MPEG technology.<br>• Verify that proposed requirements and system architecture satisfy the commonly used formats for and usage of Music Notation.<br>• Progressively submit the requirement document to companies interested in multimedia and music to solicit input and collect expressions of interest<br>• 5. Produce additional descriptions of application scenarios to exemplify functionality of Music Notation integrated with MPEG tools |

- As a result we obtained the publication of an official document of ISO MPEG stating that some requirements and functionalities were missing in MPEG. Please refer to document **N6149, MPEG2003, ISO/IEC JTC1/SC29/WG11 which is referred in the bibliography and also available accessible via the web site**. The document contained the applications requirements and scenarios and some details regarding missing functionalities in MPEG that could be satisfied by adding Music Notation in the MPEG environment.

## 6.5 January-March 2004

- discussions on the reflector and preparation of a input document on Music Notation Application Requirements and integration of Music Notation into the MPEG framework for the 68th MPEG meeting in Munich.
- The work of this period is mainly divided in two different phases; 1) work done through the reflector generated more than 100 emails that were exchanged among the 118 subscribers of the *mn-mpeg* email reflector, with about the half of the subscribers from the industry; 2) the meeting held in Munich during two full days March 13-14, co-located with the 3rd MUSICNETWORK workshop.
- The general discussion on Music Notation Requirements and interface to MPEG has been active throughout the whole duration of the period; messages were almost equally divided between those coming from subscribers active in the music and music publishing domain, and those from subscribers more active in multimedia and MPEG. The discussion threads have been focused on both basic issues related to Music Notation formats and to application scenarios and requirements for the integration of music notation into multimedia frameworks and MPEG. Detailed results about this discussion are reported in input documents m10622, and especially 10654: "Music Notation Technical Requirements and integration in MPEG". Further discussion was focused on integration with MPEG-7/-21. Finally, a thread was dedicated to the organization and logistics of the meeting in Munich.
- A very active discussion took place about new possible application scenarios involving both music notation and MPEG standards. One main scenario that was discusses on the mailing list was about the "Synthetic Opera" scenario, which generated input document M10622. Other application scenarios have been presented as input to the meeting (included in M10661) and reviewed during the AHG meeting; see section 6 for details.
- Organisation of the 3d MUSICNETWORK workshop/Ad-hoc Group meeting co-located with the 68th MPEG meeting, in the AHG meeting the requirements were refined and discussed with the Music Notation and MPEG experts. In the meeting it was decided to change the AHG name to "Symbolic Music Representation" because the term "Music Notation" was felt to be too restrictive.

- participation to the 68th MPEG meeting (Munich, DE) in which a draft call for proposal for Symbolic Music Representation was produced.
- **Presentation of M10654, MPEG2004, ISO/IEC JTC1/SC29/WG11,** "Music Notation Technical Requirements and Integration in MPEG-4",
- integration of results of MUSICNETWORK workshop on Music Libraries and MPEG in documents produced by AHG on music notation.
- M10568, **MPEG2004, ISO/IEC JTC1/SC29/WG11,** "Proposal for Music Instrumentation and WeightedScales Descriptors and Descriptor Scheme", Jerome Barthelemy, Benoit Meudic, Marc Texier, as a result of the workshop on Music Libraries and MPEG mentioned above.
- The mandate posed by the MPEG Audio chair to the AHG has on Music Notation was the following.

| N6460 | AHG on Symbolic Music Representation |
|---|---|
| Mandate: | · Progress and consolidate the draft CfP on Symbolic Music Representation.<br>· Verify that the proposed draft CfP requirements and system architecture satisfy all of the common application scenarios integrating Symbolic Music Representation and other multimedia content.<br>· Submit the draft CfP document to companies and institutes interested in multimedia and music to solicit input and collect information on additional suggested test methodologies and material.<br>· Further investigate MPEG available technology (with Systems and SNHC experts) concerning the control of the playback speed change in an MPEG-4 multimedia scene. |

· As a result we obtained the publication of an official document of ISO MPEG **N6457, MPEG2004, ISO/IEC JTC1/SC29/WG11** presenting to the public at world-wide level a call entitled "Draft Call for Proposals for Symbolic Music Representation".

## 6.6 3rd Open Workshop of MUSICNETWORK co-located with MPEG AHG Meeting

At the 3rd Open workshop of MUSCINETWORK (also AHG Meeting of MPEG SMR) in Munich, March 13th and 14th. The MUSICNETWORK coordinated the workshop and the activity.

The WWW links of the event with the program and other details are:

http://www.interactivemusicnetwork.org/events/Third_OpenWorkshop_2004/MUSICNETWORK-OW-March-2004-Description-v1-4-clean.htm

38 experts participated the event. After the introduction by the AHG chairs, the group was divided into two separate task groups, the first group mainly focused on music notation formats and requirements for the format itself and the integration into MPEG (MPEG-4 mainly); the second group mainly concentrated on issues more related to MPEG-7 and MPEG-21, particularly on metadata and descriptors related to music, and DRM.

The table below represents the schedule of the AHG meeting.

**Meeting Schedule**

| | 13th March 2004 | | | 14th March 2004 | |
|---|---|---|---|---|---|
| | Room1<br>Music Notation and decoding in MPEG | Room 2<br>Music Metadata, Protection and Distribution in MPEG-7 and MPEG-21 | | Room1<br>Music Notation and decoding in MPEG | Room 2<br>Music Metadata and MPEG-7 |
| 9:00 | Open, General overview, scope of the meeting, P. Nesi, G. Zoia | | | Shorted overview and summary of the previous day | |
| 10:00 | Section: Music Notation Application Scenarios | MPEG-21 and Music: Status quo and possible improvements (Protection, DRM and Distribution) | | Section: Music Notation formats | MPEG-7 and Music: Applications, Examples and Scenarios, actual state in the domain |
| 11:30 | | MPEG-21 and Music: Applications, Examples and Scenarios | | Requirements of Music notation and decoder | MPEG-7 and Music: Applications, Examples and Scenarios for new applications |

| Lunch | | | | | |
|---|---|---|---|---|---|
| 14:00 | Requirements of Music notation and decoder | MPEG-21 and Music: Requirements for Protection and Distribution (Producers, Distributors, Music Libraries, etc.) | | Music notation and Integration with MPEG | Contributing to MPEG requirements MPEG7, music description |
| 16:00 | Music notation and Integration with MPEG | MPEG-7 and music: music libraries specific practices | | Review and completion of the MPEG draft Call for Technology/Proposal on Music Notation and Decoding | |

*1. Task Group on music notation format and integration with MPEG-4*
Input documents reviewed by the task group:

- **M10622, MPEG2004, ISO/IEC JTC1/SC29/WG11: A New Application Scenario for Music Notation in MPEG.** This document presented the "synthetic opera" application scenario, introducing new requirements in terms of interaction with other media, including visual SNHC, and in terms of content protection (MPEG-4 IPMP/IPMPX).
- **M10661, MPEG2004, ISO/IEC JTC1/SC29/WG11: Proceedings of AHG on Music Notation Requirements / MUSICNETWORK**. This document includes all together, most of the contributions by the different experts; it includes further examples of music notation related applications and examples of music notation XML formats and tools.
- **M10654, MPEG2004, ISO/IEC JTC1/SC29/WG11: Music Notation Technical Requirements and Integration in MPEG-4**. This document contains a first draft of requirements for music notation and its integration in MPEG. A refined version containing the results of the discussion during this AHG has been uploaded to the MPEG site at the end of the AHG meeting (6pm on Sunday).

The greatest part of the discussion took place about technical requirements. Different classes of requirements have been identified, proposed and discussed, starting from general requirements and integration with MPEG down to more specific symbolic music representation requirements. Requirements have been divided in core and non-core, exact and effective wording has been investigated as far as possible, exhaustively. See in Annex 2 the detailed list of contributions discussed in this session.

A fundamental discussion also took place about the exact name to be given to the technology the group was dealing with. Music notation is viewed as too restricted in scope as terminology. A more suitable title, "symbolic music representation" was proposed and accepted. The AHG proposes therefore to change the identification of both the task and AHG in this way.

*2. Task Group on Music Metadata, Protection and Distribution in MPEG-7 and MPEG-21*
A first session was dedicated to the MPEG-7 presentations and discussions followed by an MPEG-7 analysis. The main points are summarized as followed:

**Strengths**
- New possibilities of music representation/description
- Share and build up knowledge about how to develop metadata in an interoperable way
- Interoperability beyond (partners of) a specific project
- Relation to automatic extraction of information/metadata
- Agreements on cataloguing/classification issues (e.g. by profiling -> instrumentation)
- Framework for using and improving standards for applications instead of starting from scratch
‘ Paves the way to standardize benchmarking for intelligent applications involving multimedia metadata and search/retrieval (better possibilities to compare results)

**Weaknesses**
- Missing symbolic representation, or at least missing bi-/multi-directional connection between symbolic representation and realization (no cross-reference to scores, thus no possibility to connect MPEG-7 metadata to the score)
- Score-based similarity search etc. still more reliable than audio-based similarity search
- Over-/underspecified descriptors (e.g. „author“ leaves out most roles of persons involved in the creation of a multi-faceted music object, such as arranger, conductor etc.)
- What’s bridging the gap between low-level and high-level descriptors in order to obtain a useable kind of information about music?
- Automated metadata generation will not be able to replace manual cataloguing and classification for quite a while
- Complexity/size of the standard makes validation hard (10000 lines of XML code needed for the validation of 10 lines); need for XML scheme subsets
- IP status of MPEG-7: unclear licensing conditions for the use of MPEG-7 in applications

**Opportunities**
- New services for end users/library patrons, e.g. browsing through an opera or a music video
- Additional features based on automated classification rather than on manual classification
- Multimedia as a way (e.g. for libraries) to bring heterogeneous formats and kinds of information together (e-learning, publications, ...)
- Accessing fragmentary content: splitting a single item into different chunks e.g. for music analysis
- Description as a proxy of the „original“ data (legally easier P2P distribution of metadata instead of the „original“ data?)
- MPEG-7 is bound to play a major role in the Semantic Web; use cases should be developed

**Threats**
- Missing interest from information management technology providers and users to move towards MPEG
- Difficulties in finding the initial user base
- IP problems with (automatically generated) metadata as derivative works

**Possible future Proposals and Contributions to MPEG-7**
Use Cases -> Requirements (-> Descriptors etc.)
- Professional performers/promoters/... looking for repertoire (duration, instrumentation, ...)
- Non-professional performers looking for repertoire (according to difficulty, tessitura, ...)
- Musicological use (analysis, ...)
- Composition (incl. orchestration)
- Music librarians (Minimum catalogue records; automatically cataloguing of MPEG files; typical patron’s inquiries/usage etc.)

**Profiles**
- Is the SMP (Simple Metadata Profile) within MPEG-7 sufficient for music librarians?
- Is the „Bibliographic Profile“ (minimum information sets) proposed to MPEG-7 sufficient for music librarians? (Profile under consideration, N6039)

- Further profiles already part of the standard:
- MPEG-7 User description profile
- MPEG-7 Core description profile (broadcasting, e-learning, courseware, ...)
- Further profiles under consideration:
- MPEG-7 Audiovisual logging profile
- MPEG-7 Simple profile (generic)
- Further profiles to be assessed/proposed?
- Music profile (incl. instrumentation, performing, listening, ...)?

**Integration of classification schemes**
- instrumentation, genre, performance/education (difficulty etc.)

**Integration of cataloguing schemes/formats**
- MODS (Metadata Object Description Schema) - http://www.loc.gov/standards/mods/
- MARC (Machine-Readable Cataloging) - http://www.loc.gov/marc/
- IMS LOM (Instructional Management System - Learning Object Metadata) (metadata container for e-learning objects)

**Interoperability with library catalogues, e-learning repositories etc.**
- ZING as a means to search MPEG-7 data?
- What mapping is needed to use ZING for MPEG-7?

**Guidelines**
- How to use/utilize MPEG-7 as a vendor of library systems?
- How to use/utilize MPEG-7 as a library/librarian?

The sessions of the workshop dealing with MPEG-21 consisted of two parts. MUSICNETWORK participants identified possible contributions to MPEG-21 consisting in use cases and requirements. Two uses cases were discussed in detail.

Within MPEG-21 use cases are collected in N4991. The aim of this collection is a better understanding of the functionality, a high level description, and a basis for core experiments. The current available document N4991 was created in 2002. We are aware that this document will be revised during the 68th MPEG meeting. Yet, this available document was the basis for a short analysis, which showed that music distribution within MPEG-21 is either related to labels, albums, and tracks or is mainly addressing rendering rights. Furthermore, the use cases in N4991 do not consider the full content creation and distribution work flow. In addition to the fact that no use cases for music scores and related content are available this is a general lack as the full potential of MPEG-21 is really visible when considering the full workflow within these processes. Besides commercial users of MPEG-21 there are also non-commercial organizations, which can strongly benefit from MPEG-21: libraries and archives. This is obvious as their focus is on content and meta-data and their distribution and accessibility.

The potential contribution of the MUSICNETWORK to MPEG-21 is knowledge and experience of organizations and people involved in the distribution and accessibility of music and related content.

The following document was reviewed by the Task group:

- **M10568, MPEG2004, ISO/IEC JTC1/SC29/WG11, "Proposal for Music Instrumentation and WeightedScales Descriptors and Descriptor Scheme",** Jerome Barthelemy, Benoit Meudic, Marc Texier.

As a result the ISO MPEG document **N6454, MPEG2004, ISO/IEC JTC1/SC29/WG11,** "Workplan for Core Experiment on Music Instrumentation and WeightedScaleType" was approved by the MPEG group.

### 6.6.1 Presences at the meeting, Munich, Germany, March, 2004

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The list has been omitted in this public version for privacy reasons……
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## 6.7 April-July 2004

- discussions on the reflector and preparation of three input documents into the MPEG framework for the 69th MPEG meeting in Redmond USA. These documents have been presented by P. Nesi.
    1. **M11019, MPEG2004, ISO/IEC JTC1/SC29/WG11,** "Draft Evaluation Criteria for Assessing SMR Proposals",
    2. **M11021, MPEG2004, ISO/IEC JTC1/SC29/WG11,** "Examples of Matching SMR aspects and available technologies",
    3. **M11022, MPEG2004, ISO/IEC JTC1/SC29/WG11,** "Graphic functionality in MPEG-4 and Symbolic Music Representation",
    4. **M11025, MPEG2004, ISO/IEC JTC1/SC29/WG11,** "Study on Draft CfP on Symbolic Music Representation",

The work of this AHG mandate can be summarized by the following points;

- Dissemination activities, performed to increase visibility of the Draft Call on SMR and the related work in progress and expectations;
- Resubmission of the Draft call proposal to the most important companies of the related sectors: music editors, music formats, computer music education, etc.; This activity has been done by using the relationships and huge databases of the MUSICNETWORK, IRCAM, FNB, University of Leeds, etc.;
- work done through the email reflector with more than 180 emails exchanged and 120 subscribers, with about the half of the subscribers from the industry;
- work done at the meeting held in Redmond, the Sunday before the MPEG meeting.

Activity of dissemination has been carried out by means of the following actions:

- distribution of announcements via email on several mailing lists: MUSICNETWORK mailing list and newsletter, IRCAM mailing list and newsletter, FNB mailing list, European Commission mailing lists and newsletter, MUSICTEX mailing lists, etc.;
- distribution of a press release statement on several journals of the sector. It has been published by: International Journal of Computer Music, European Commission newsletter on paper, European Commission News on Europa, etc.;
- Submission of the draft CfP document to companies and institutes interested in multimedia and music to soliciting from them contributions/suggestions.

As a result of this activity a high number of companies have confirmed their interest and contributed to the work described in the next points.

The mandate 6667 posed by the MPEG Audio chair to the AHG has on Music Notation was the following.

| | |
|---|---|
| **Mandate:** | To:<br>· Submit the CfP document to companies and institutes interested in multimedia and music to solicit responses and collect information on additional suggested test material.<br>· Progress and consolidate the Draft SMR Evaluation Procedure with collection of weights and discussion about their importance.<br>· Continue the investigation on MPEG available technology (with Systems and SNHC experts) concerning the implementation of audio and graphical aspects of SMR to produce a consolidated report. |

· As a result we obtained the publication of an official document of ISO MPEG **N6689, MPEG2004, ISO/IEC JTC1/SC29/WG11** presenting to the public at world wide level the definitive version of the

"**Call for Proposals on Symbolic Music Representation**". In addition it has also been published by ISO another ISO official document **N6690, MPEG2004, ISO/IEC JTC1/SC29/WG11,** containing the draft evaluation model for SMR proposals.

In addition a document on the draft evaluation model for assessing and selecting SMR has been produced.

### 6.7.1 Technical work

Messages on the mailing list reflector were divided between those coming from subscribers active in the music domain, and those from subscribers more active in multimedia and MPEG, The former covered more than the 80% of the total number of messages. The discussion threads have been focused on

1) revising the requirements reported in the Draft Call on Symbolic Music representation that was issued at the meeting of March 2004 in Munich. This activity has been performed throughout the whole duration of the period. This activity has been mainly related to mandate 1 and has produced a revised version of the Draft call as M11025.
2) Verification that the proposed requirements of the draft call satisfies the scenarios of the common application scenarios integrating Symbolic Music Representation and other multimedia content. This verification has lead to the revision of some of the requirements and thus to the improvement of the draft call. This activity has been mainly related to mandate 2, as discussed in this progress report.
3) Producing a draft version of the assessment model and examples of technologies that matches the requirements mentioned in the call and in the singles aspects or possible solutions related to the requirements. The production of the assessment model with the related examples is the evidence that the present requirements in the study of the draft call (M11025) satisfies scenarios of the common applications that integrate Symbolic Music Representation and multimedia content. This activity has been mainly related to mandates 1 and 2 and has produced two documents one for the "assessment model" (M11019), and one for the examples of the matching (M11021).
4) Working on the aspects related to the SMR integration in the MPEG-4 visual environment, mainly considering BIFS aspects and the new Graphics API under consideration in MPEG; this work has been done in collaboration with Systems and SNHC experts, starting from the control of the playback speed change in an MPEG-4 multimedia scene and considering also many other aspects about visual rendering. This activity has been mainly related to mandate 4, and it has produced a reporting document, M11022.
5) In addition to the above mentioned documents other two documents have been posted on the MPEG site as input documents that are strictly related to the AHG on SMR:
    a. M11083: containing comments on the last version of the Draft Call for Technology on SMR, from Michael Good, Recordare, US;
    b. M11002: Containing some comments on document M11083 provided by James Ingram.

    Please note that, several other comments and answers have been produced on the AHG on SMR reflector via email as a result of the posting of document M11083 by M. Good.

### 6.7.2 Discussion of document m11083

The contribution was presented first by the author. Comments and Recommendations were then discussed in details one by one.
The request to have a precise relation between requirements and application scenarios does not seem easy to satisfy, because such kind of detail in reports has never been requested before. Input documents and Group/AHG reports are available to follow the process to the generation of outputs.
An agreement has been reached on some controversial requirements, especially #16 (all requirement numbers are referred to M11025) on pitch and #7, which has been removed as some part of this point has been moved to #6. Other points were decided as belonging more to the precise definition of the assessment process more than to requirements themselves, especially when dealing with common western music details and fundamentals, and the role of examples in the definition section.
A common understanding was not reached on requirement #2 and #17 dealing with representations other than CWM. Discussion carried on by experts at the AHG in Munich and on the reflector seems to be in contrast to some other positions, on both functionality and evidence. It was decided to leave these requirements in the current form.

Other comments to the above discussed document appeared on the reflector prior to the meeting and some additional comments were also provided by James Ingram in document M11002, reviewed before the above reported discussion.

### 6.7.3 Recommendations for activities and mandates

- at this meeting, a final call for proposal on symbolic music representation, with deadline in January 2004 (to take place in Hong Kong, China), was produced;
- Finalise the assessment model related examples in M11019 and M11021, to completely define a simple and self-assessment model for requirements. Demanding the finalisation of the weights and the tests of the model to the MUSICNETWORK meeting in Barcelona (September 2004), to submit and finalise it at the October Meeting of MPEG, Palma de Mallorca, Spain;
- Further investigate MPEG available technology (with SNHC group) concerning the control of the visual and audio rendering, and to review document m11022 during the meeting (October 2004);

Work to be done in September and October within the end of the next MPEG meeting are:
- finalisation of the weights and the tests of the assessment model at the MUSICNETWORK meeting in Barcelona in September 2004, with the aim of submitting it at the October Meeting of MPEG, and to organise an AHG meeting on Sunday (17 Oct 2004) of the October meeting of MPEG;
- Submit the call for technologies to companies interested in applications integrating multimedia and music and performing another round of dissemination.

### 6.7.4 Presences at the meeting, Redmond, USA, July, 2004

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The list has been omitted in this public version for privacy reasons……
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## 6.8 4TH Open Workshop of the MUSICNETWORK and MPEG AHG meeting

The MUSICNETWORK has planned the 4th Open workshop, September 2004, in Barcelona. In that meeting the discussion of the following contributions in addition to the above mentioned contribution of "Assessment model for SMR" and "Examples on matching technology" related to MPEG have been already planned:

- e-guitare, instrumental e-learning project, O. SEBASTIEN , N. CONRUYT, IREMIA, Université de la Réunion, France.
- The TIME Machine: a Futuristic Approach to Interactive Multimedia Web-based Instruction in Music, Dave Sebald, Strands: Music Education, Interactive Multimedia, Music Technology,
- Secure Music Content Standard - Content Protection with CodeMeter, Marcellus Buchheit, Rüdiger Kügler, VP Research and Development.
- P2P Multimedia Annotation and browsing based on Semantic Web and MPEG-7: An overview of the DBin Project, Giovanni Tummarello, Christian Morbidoni, Francesco Piazza, Paolo Puliti, Francesco Saletti1, Joakim Petersson,
- Multimedia Application With Interactive Digital Animation For Music Performances, Nuno Correia, Instituto Superior de Tecnologias Avançadas (ISTEC), PORTUGAL.
- Musical Interaction at a Distance: Distributed Immersive Performance by E. Chew, R. Zimmermann, A. A. Sawchuk, C. Kyriakakis, C. Papadopoulos, A.R.J. François, G. Kim, A. Rizzo and A. Volk,
- Combining audio and symbolic representations in OpenMusic visual programming language: a multimedia model of Iannis Xenakis', Nomos Alpha, Moreno Andreatta, Carlos Agon, Music Representation Team, IRCAM.
- Challenges and Potentials in Freehand Music Editing Using Pen and Digital Ink, Somnuk Phon-Amnuaisuk,
- Symbolic Music Representation in the MUSITECH Project, Tillman Weyde, Research Department of Music and Media Technology, University of Osnabrück, Germany,
- XML model for Symbolic Music Representation, P. Bellini, F. Naldini, P. Nesi, DSI, Italy

- Symbolic Music Representation and Braille Music models, Giuseppe Nicotra, ARCA, Italy
- Comments on SMR by Eleanor Selfridge Field, Stanford, USA.
- CapXML - Design Goals, by Dr. Hartmut Ring (Capella, Germany)
- MPEG applications and accessible music, by Neil McKenzie/David Crombie (FNB, The Netherlands).
- Introducing Music Space, by Dr. Jacques Steyn (Monash University, South Africa).
- An Abstract Page Description for SMR, A Feasibility Study, by James Ingram (Germany)

Most of the above documents are already available in their draft form on the WWW site of the 4th Open Workshop of the MUSICNETWORK, see www.interactivemusicnetwork.org.

The WWW links of the event with the program and other details are:

http://www.interactivemusicnetwork.org/events/Fourth_OpenWorkshop_2004/MUSICNETWORK-4th-Open-Workshop-plan-v1-2.html

At the meeting of the MUSICNETWORK, time and space have been reserved to finalise the assessment model in terms of missing weights and tests cases to evaluate the proposed technologies to the call that we hope will be issued at this meeting.

The assessment model has been improved and the test cases produced. The MUSICNETWORK has coordinated the effort of producing the documents and the test cases.

### 6.8.1 Presences at the Music Notation sections of the MUSICNETWORK meeting, Barcelona, Spain, September, 2004

24 experts participated at the AHG on SMR:
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The list has been omitted in this public version for privacy reasons……
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## 6.9 5th Open Workshop, MUSICNETWORK meeting at Palma del Mallorca, Spain, October 2004

Fifteen experts participated to the meeting. After the introduction group activity has been divided in three separate “sessions”. The first part of the morning has been dedicated to two further input presentations.

Hartmut Ring and Hartmut Lemmel from Capella, Germany, made first two presentations on how and in which terms the CapXML format can meet or not, in its actual status, the major CfP requirements and implement some of the Test Cases under discussion.
After this, Giuseppe Nicotra from Arca, Italy, presented some issues and typical test cases for the representation of music through Braille; a short discussion followed after which it was decided to reintroduce one test case for Braille. Giuseppe Nicotra and Neil McKenzie have been charged to propose this test case during the week, or even at the end of the meeting.

The second part of the morning has been dedicated to the finalization of the table of weights for the evaluation process. The process has been carried on without remarkable problems; consensus was reached item by item either in unanimous way or by acceptance of voting results at majority. A few aspects being alternative to other ones and with the same weight were firstly considered for removal and after some discussion assigned to a low weight. Thus the identified aspects in the evaluation model have been maintained in the model, and weights have been finalized. Then the evaluation model has been finalized.

The final session in the afternoon was dedicated to the finalization of the set of Test Cases for the different Requirements and aspects. Like for the morning session, consensus was reached item by item and the relevant set of Test Cases to be retained as final has been selected.

The WWW links of the event with the program and other details are:
http://www.interactivemusicnetwork.org/events/modelassessment/MODELAssessment-for-SMR-v1-0.html

### 6.9.1 Presences at the meeting, Palma de Mallorca, Spain, October, 2004

18 experts participated at the meeting:
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## 6.10 August-October 2004, included

The work of this period can be divided in different phases; 1) work done through the reflector generated approximately 120 emails that were exchanged among the subscribers of the *mn-mpeg* email reflector (with about the half of the subscribers from the industry); the informal call for weight tables to be used in evaluation received 21 answers.

The general discussion on SMR Evaluation Criteria, Weights and Test Cases has been active throughout the whole duration of the meeting. The discussion threads have been focused on basic issues related to draft Evaluation Criteria document and at the same time to more practical issues concerning the preparation, selection and upload of actual Test Cases for the different aspects under evaluation. Progress results about this discussion and related work made at the two meetings are contained in input documents m11307: "Proposed SMR Evaluation Model and Procedure". The zip file for this document also contains the detailed excel file with weights as proposed by experts; in fact after the Redmond meeting an informal call was made inside the group to collect opinions of experts about relative weights for the several Requirements of the CfP and related aspects.

- **M11307, MPEG2003, ISO/IEC JTC1/SC29/WG11.** Paolo Nesi, Giorgio Zoia, James Ingram, Pierfrancesco Bellini, Jerome Barthelemy, M. Campanai, Kia Ng, Gioseppe Nicotra, David Crombie, "Proposed SMR Evaluation Model and Procedure", AHG on Symbolic Music Representation / MUSICNETWORK, Palma de Mallorca, Spain, October 2004,
- **M11354, MPEG2003, ISO/IEC JTC1/SC29/WG11.** Giorgio Zoia, Pierfrancesco Bellini, Paolo Nesi, Jerome Barthelemy, "MPEG-4 and SMR: report on available functionality for graphics", AHG on Symbolic Music Representation / MUSICNETWORK, Palma de Mallorca, Spain, October 2004,
- **M11313, MPEG2004, ISO/IEC JTC1/SC29/WG11.** Jerome Barthelemy, Gregoire Carpentier, "Proposal for a Core Experiment of WeightedScalesDS", Palma de Mallorca, Spain, October 2004.

The mandate N6821 posed by the MPEG Audio chair to the AHG has on Music Notation was the following.

| | |
|---|---|
| **Mandate:** | • Submit the CfP document to companies and institutes interested in multimedia and music to solicit responses.<br>• Submit the SMR Evaluation Model and Procedure document to companies and institutes interested in responding to the CfP<br>• Support proponents in the CfP response process. |

· As a results we obtained the publication of an official document of ISO MPEG **N6812, MPEG2004, ISO/IEC JTC1/SC29/WG11** presenting to the public at world-wide level the evaluation model and procedure for the "Call for Proposals for Symbolic Music Representation" named . "**SMR Evaluation Model and Procedure** ", accessible at: http://www.interactivemusicnetwork.org/mpeg-ahg/

## 6.11 Some global figures about the activities of the MPEG Ad-hoc group, from 08/2003 to 10/2004

- 625 mails exchanged by about 80 persons very active;
- 127 experts persons registered to the AHG reflector

- about 50% of companies
- 18 Expressions Of Interest (EOIs) have been received
- hundreds of people joinine the AHG MPEG meetings

# 7 Official public Plan of MPEG ISO regarding the Symbolic Music Representation

| Activity | MPEG meeting | Dates |
|---|---|---|
| CfP on SMR issued | 69th MPEG meeting, Seattle, WA, USA | 19-23 July 2004 |
| Draft SMR Evaluation Procedure issued | 69th MPEG meeting, Seattle, WA, USA | 19-23 July 2004 |
| Draft Selection of Test Cases, analysis of collected weights | AHG meeting in Barcelona | September 2004 |
| Final selection of Test Cases, SMR Evaluation Procedure issued (with final weights). | 70th MPEG meeting, Palma de Mallorca, ES, | 18-22 October 2004 |
| Responses to CfP on SMR due | 71st MPEG meeting, Hong Kong, CN, | 17 -21 January 2005 |
| Draft Verification Analysis of CfP Responses | AHG on SMR Meeting | February 2005 |
| Final Verification Analysis of CfP Responses; selection of technology for RM0 | 72nd MPEG meeting, Busan, KR. | 18 – 22 April, 2005 |
| RM0 documentation | 73rd MPEG meeting, Poznan, PL | 25-29 July 2005 |

# 8 Documents produced

## 8.1 Main web pages

- web page of the MUSICNETWORK: http://www.interactivemusicnetwork.org
- web page of the MUSICNETWORK working group on Music Notation: http://www.interactivemusicnetwork.org/wg_notation/index.html
- web page on the glossary on music notation: http://www.interactivemusicnetwork.org/glossary/index.htm
- web page of the MPEG AHG on Symbolic Music Representation hosted by the MUSICNETWORK http://www.interactivemusicnetwork.org/mpeg-ahg/

## 8.2 OFFICIAL MUSICNETWORK DOCUMENTS, deliverables

- **DE4.1.1,** MUSICNETWORK Deliverable, Working Group on Music Notation, "Music Notation Coding", accessible at: http://www.interactivemusicnetwork.org/wg_notation/upload/musicnetwork-de4-1-1-mn-music-notation-coding-v1-4.pdf
- **DE4.2.1,** MUSICNETWORK Deliverable, Working Group on Music Library, "Music Representation for Music Libraries", accessible at: http://www.interactivemusicnetwork.org/wg_libraries/upload/musicnetwork-de4-2-1-lib-music-representation-for-music-library-v1-1.pdf
- **DE4.3.1**, MUSICNETWORK Deliverable, Working Group on Music Standards, "Multimedia standards for music coding", accessible at: http://www.interactivemusicnetwork.org/wg_standards/upload/musicnetwork-de4-3-1-multimedia-standards-for-music-v1-5.pdf
- **DE4.4.1**, MUSICNETWORK Deliverable, Working Group on Music Distribution, "Distribution of coded Music", accessible at: http://www.interactivemusicnetwork.org/wg_distribution/upload/musicnetwork-de4-4-1-wg_distribution-v1-5.pdf

- **DE4.5.1,** MUSICNETWORK Deliverable, Working Group on Music Protection, "Protection of coded Music", accessible at: http://www.interactivemusicnetwork.org/wg_protection/upload/musicnetwork-de4-5-1-protection-of-coded-music-v1-4.pdf
- **DE4.6.1,** MUSICNETWORK Deliverable, Working Group on Music Accessibility, "Music Coding for Print Impaired People", accessible at: http://www.interactivemusicnetwork.org/wg_accessibility/upload/musicnetwork-de4-6-1.pdf
- **DE4.7.1,** MUSICNETWORK Deliverable, Working Group on Music Imaging, "Coding Images of Music Sheets", accessible at: http://www.interactivemusicnetwork.org/wg_imaging/upload/musicnetwork-de4-7-1-coding-images-of-music-v2-8-20040208.pdf
- **DE5.1.1,** MUSICNETWORK Deliverable, All working groups, "Models Integration", accessible at http://www.interactivemusicnetwork.org/overview/MUSICNETWORK-DE5-1-1-Models-Integration-V1-0.pdf
- **DE6.1.1,** MUSICNETWORK Deliverable, All working groups, "External Assessment and Evaluation Report" : accessible at: http://www.interactivemusicnetwork.org/overview/MUSICNETWORK-DE6-1-1-External-Assessment-and-Evaluation-V1-9.pdf

## 8.3 OFFICIAL INPUT MPEG ISO DOCUMENTS provoked by the MUSICNETWORK

**All the information and documents that have been used to create the following documents are accessible as single or multiple pages on the MPEG AHG main web page:**

**http://www.interactivemusicnetwork.org/mpeg-ahg/index.html**

**They cannot be made available in their forma model of ISO since are not public for ISO, while they have been published as content in the AHG and in the MUSICNETWORK.**

- **M9731, MPEG2003, ISO/IEC JTC1/SC29/WG11**, Paolo Nesi, DSI, University of Firenze, Italy, Giorgio Zoia, EPFL, Switzerland, Jerome Barthelemy, IRCAM, France, Pierfrancesco Bellini, DSI, University of Firenze, Italy, David Fuschi, ILABS, GIUNTI, Italy, David Crombie, FNB, The Netherlands, Francesco Spadoni, RIGEL, Italy, Kia Ng, University of Leeds, UK, Martin Schmucker, FHGIGD, Germany; "**Proposal for Music Notation Modeling and its Integration within MPEG-4 and MPEG-7**", MUSICNETWORK IST Network and related working groups (DSI, IRCAM, EPFL), Throndenheime, Norway, July 2003.
- **M10068, MPEG2003, ISO/IEC JTC1/SC29/WG11,** Paolo Nesi (DSI, University of Firenze), Giorgio Zoia (EPFL), Pierfrancesco Bellini (DSI, University of Firenze), Jerome Barthelemy (IRCAM). "**Music Notation Application Requirements and MPEG Technology**", AHG on Music Notation Requirements / MUSICNETWORK, Brisbane, Australia, October 2003.
- **M10355, MPEG2003, ISO/IEC JTC1/SC29/WG11,** Paolo Nesi (DSI, University of Firenze), Pierfrancesco Bellini (DSI, University of Firenze), Giorgio Zoia (EPFL), Jerome Barthelemy (IRCAM), "**Music Notation Functionality and Interface to MPEG**", AHG on Music Notation Requirements / MUSICNETWORK, Waikoloa, USA, December 2003.
- **M10357, MPEG2003, ISO/IEC JTC1/SC29/WG11,** Paolo Nesi (DSI, University of Firenze), Pierfrancesco Bellini (DSI, University of Firenze), Giorgio Zoia (EPFL), Jerome Barthelemy (IRCAM), "**Music Notation Technical Requirements**", AHG on Music Notation Requirements / MUSICNETWORK, Waikoloa, USA, December 2003.
- **M10568, MPEG2004, ISO/IEC JTC1/SC29/WG11,** Jerome Barthelemy, Benoit Meudic, Marc Texier, "Proposal for Music Instrumentation and WeightedScales Descriptors and Descriptor Scheme", as a result of the workshop on Music Libraries.
- **M10622, MPEG2004, ISO/IEC JTC1/SC29/WG11,** Giorgio Zoia (EPFL), James Ingram, "**A new Application Scenario for Music Notation in MPEG**". This document presented the "synthetic opera" application scenario, introducing new requirements in terms of interaction with other media, including visual SNHC, and in terms of content protection (MPEG-4 IPMP/IPMPX). AHG on Music Notation Requirements / MUSICNETWORK, Munich, Germany, March 2004.

- **M10661: MPEG2004, ISO/IEC JTC1/SC29/WG11,** Paolo Nesi (DSI, University of Firenze), Pierfrancesco Bellini (DSI, University of Firenze), Giorgio Zoia (EPFL), Jerome Barthelemy (IRCAM) "**Proceedings of AHG on Music Notation Requirements / MUSICNETWORK**". This document includes all together most of the contributions by different experts; it includes further examples of music notation related applications and examples of music notation xml formats and tools. Munich, Germany, March 2004.
- **M10654, MPEG2004, ISO/IEC JTC1/SC29/WG11,** Paolo Nesi (DSI, University of Firenze), Pierfrancesco Bellini (DSI, University of Firenze), Giorgio Zoia (EPFL), Jerome Barthelemy (IRCAM), **"Music Notation Technical Requirements and Integration in MPEG-4**", AHG on Music Notation Requirements / MUSICNETWORK, Munich, Germany, March 2004.
- **M11002, MPEG2004, ISO/IEC JTC1/SC29/WG11,** James Ingram, **"Position Paper about the SMR Draft Call for Proposals",** Containing some comments on document M11083 provided by James Ingram. AHG on Symbolic Music Representation / MUSICNETWORK, Redmond, Washington state, USA, July 2004,
- **M11019, MPEG2004, ISO/IEC JTC1/SC29/WG11**, Paolo Nesi (DSI, University of Firenze), Pierfrancesco Bellini (DSI, University of Firenze), Jerome Barthelemy (IRCAM), James Ingram, David Crombie, "**Draft Evaluation Criteria for Assessing SMR Proposals**", AHG on Symbolic Music Representation / MUSICNETWORK, Redmond, Washington state, USA, July 2004,
- **M11021, MPEG2004, ISO/IEC JTC1/SC29/WG11,** Paolo Nesi (DSI, University of Firenze), Pierfrancesco Bellini (DSI, University of Firenze), Jerome Barthelemy (IRCAM), James Ingram, David Crombie, Neil McKenzie, "**Examples of Matching SMR aspects and available technologies**", AHG on Symbolic Music Representation / MUSICNETWORK, Redmond, Washington state, USA, July 2004,
- **M11022, MPEG2004, ISO/IEC JTC1/SC29/WG11,** G. Zoia, Jerome Barthelemy, Pierfrancesco Bellini, Paolo Nesi and Mikael Bourges Sevenier (Mindego inc.), "**Graphic functionality in MPEG-4 and Symbolic Music Representation",** AHG on Symbolic Music Representation / MUSICNETWORK, Redmond, Washington state, USA, July 2004,
- **M11025, MPEG2004, ISO/IEC JTC1/SC29/WG11,** Paolo Nesi, Giorgio Zoia, James Ingram, Pierfrancesco Bellini, "**Study on Draft CfP on Symbolic Music Representation**", AHG on Symbolic Music Representation / MUSICNETWORK, Redmond, Washington state, USA, July 2004,
- **M11083, MPEG2004, ISO/IEC JTC1/SC29/WG11, Michael Good, "Response to Draft Call for Proposals N6457",** containing comments on the last version of the Draft Call for Technology on SMR, from Michael Good, Recordare, US; AHG on Symbolic Music Representation / MUSICNETWORK, Redmond, Washington state, USA, July 2004,
- **M11307, MPEG2004, ISO/IEC JTC1/SC29/WG11,** Paolo Nesi, Giorgio Zoia, James Ingram, Pierfrancesco Bellini, Jerome Barthelemy, M. Campanai, Kia Ng, Gioseppe Nicotra, David Crombie, "**Proposed SMR Evaluation Model and Procedure**", AHG on Symbolic Music Representation / MUSICNETWORK, Palma de Mallorca, Spain, October 2004, accessible at: http://www.interactivemusicnetwork.org/mpeg-ahg/Proposed-SMR-Evaluation-Procedure-v1-0.doc
- **M11313, MPEG2004, ISO/IEC JTC1/SC29/WG11.** Jerome Barthelemy, Gregoire Carpentier, "Proposal for a Core Experiment of WeightedScalesDS", Palma de Mallorca, Spain, October 2004.
- **M11354, MPEG2004, ISO/IEC JTC1/SC29/WG11,** Giorgio Zoia, Pierfrancesco Bellini, Paolo Nesi, Jerome Barthelemy, "**MPEG-4 and SMR: report on available functionality for graphics**", AHG on Symbolic Music Representation / MUSICNETWORK, Palma de Mallorca, Spain, October 2004,

## 8.4 OFFICIAL PUBLIC and OUTPUT MPEG ISO DOCUMENTS provoked by the MUSICNETWORK

**All the content that has been used to create the following documents are accessible as single or multiple pages attacked to the MPEG AHG main web page:**

**http://www.interactivemusicnetwork.org/mpeg-ahg/index.html**

- **N6049, MPEG2003, ISO/IEC JTC1/SC29/WG11,** Paolo Nesi (DSI, University of Firenze), Giorgio Zoia (EPFL), Pierfrancesco Bellini (DSI, University of Firenze), Jerome Barthelemy (IRCAM), "**Application Requirements of Multimedia and Music Notation**", AHG on Music Notation Requirements / MUSICNETWORK, Brisbane, Australia, October 2003. (ISO public Document ISO/IEC JTC 1/SC 29/WG 11 N6049)
- **N6149**, **MPEG2003, ISO/IEC JTC1/SC29/WG11,** Giorgio Zoia (EPFL), Paolo Nesi, Pierfrancesco Bellini (DSI, University of Firenze), Jerome Barthelemy (IRCAM), "**Application Scenarios for Music Notation integrated in MPEG**", AHG on Music Notation Requirements / MUSICNETWORK, December 2003, Waikoloa, Hawaii, USA, (ISO public Document as ISO/IEC JTC 1/SC 29/WG 11 N6149).
- **N6454, MPEG2004, ISO/IEC JTC1/SC29/WG11,** "**Workplan for Core Experiment on Music Instrumentation and Weighted Scale Type**", March 2004, Munich, Germany.
- **N6457, MPEG2004, ISO/IEC JTC1/SC29/WG11**, "**Draft Call for Proposals for Symbolic Music Representation",** AHG on Music Notation Requirements / MUSICNETWORK, March 2004, Munich, Germany, (ISO public Document as ISO/IEC JTC 1/SC 29/WG 11 N6457)
- **N6689, MPEG2004, ISO/IEC JTC1/SC29/WG11**, "**Call for Proposals on Symbolic Music Representation**", Audio Subgroup, Public document, Redmond, USA, July 2004. (ISO public Document ISO/IEC JTC 1/SC 29/WG 11 N6689) accessible at: http://www.interactivemusicnetwork.org/mpeg-ahg/w6689.zip
- **N6690, MPEG2004, ISO/IEC JTC1/SC29/WG11,** "**DRAFT SMR Evaluation Procedure**", Audio Subgroup, Public document, Redmond, USA, July 2004. (ISO public Document ISO/IEC JTC 1/SC 29/WG 11 N6690) accessible at: http://www.interactivemusicnetwork.org/mpeg-ahg/w6690%20%28DRAFT%20SMR%20Evaluation%20Procedure%29.doc
- **N6812, MPEG2004, ISO/IEC JTC1/SC29/WG11**, "**SMR Evaluation Model and Procedure**", accessible at: http://www.interactivemusicnetwork.org/mpeg-ahg/

## 8.5 Direct access to document that contains the above content and much more

1. Application Scenarious
   - ApplicationRequirements-MusicNotation-1-0.html
   - ApplicationRequirements-MusicNotation-1-0.doc
   - Application Scenariuos: ApplicationScenarius.html
   - The corresponding slides presented at the Audio-System group: ApplicationRequirements-slides.pdf
   - The corresponding slides presented at the Audio-Requirements group: ApplicationrRequirementsSummary.pdf
   - What can be done with music notation: Functionalities and their Relationships of Music Notation, definitions
   - Present and innovative Applications of Music Notation
2. Describe technical requirements for Music Notation format (i.e. coded representation) and decoder.
   - Appendix on Music Notation Symbols
   - Glossary of music notation http://www.interactivemusicnetwork.org/glossary/
3. Assess how these requirements can be met with existing MPEG technology and identify missing technology
4. Possible Integration into MPEG
   - Describe the system architecture that supports integration of the Music Notation decoder with existing MPEG technology.
   - Graphic functionality in MPEG-4 and Symbolic Music Representation (graphic-mpeg4-smr.doc) The example is can be visualized Haydn - Menuet (This SVG document shows some of the needed graphic functionality with b-splines, lines and text).
5. Verify that proposed requirements and system architecture satisfy the commonly used formats for and usage of Music Notation.

- Appendix on Music Notation Comparison, to be downloaded from MUSICNETWORK or to be requested to the AHG chairs since it is covered by copyright and cannot be made public. It will be posted on MPEG:

6. Press releases
   - from March 2004: w6303_Press Release.pdf
7. Some Presentation in slides
   0. Slides presented at the MPEG meeting in Trondheim supporting the above document and position.
   1. SMR with SLIDES: SMR-March-2004-v1-0.pdf

### 8.6 Links of MUSICNETWORK related events

- First MUSICNETWORK Workshop: http://www.interactivemusicnetwork.org/workshop/workshopprog.html
- Second MUSICNETWORK Workshop: http://www.interactivemusicnetwork.org/events/Second_OpenWorkshop_2003/second_openworkshop_2003.html
- Third MUSICNETWORK Workshop: http://www.interactivemusicnetwork.org/events/Third_OpenWorkshop_2004/MUSICNETWORK-OW-March-2004-Description-v1-4-clean.htm
- Forth MUSICNETWORK Workshop: http://www.interactivemusicnetwork.org/events/Fourth_OpenWorkshop_2004/MUSICNETWORK-4th-Open-Workshop-plan-v1-2.html
- Fifth MUSICNETWORK Workshop: http://www.interactivemusicnetwork.org/events/modelassessment/MODELAssessment-for-SMR-v1-0.html
- Special section at IAML IASA Conference in 2004: http://www.interactivemusicnetwork.org/events/iaml_iasa_2004/resonance.html
- Workshop on Editorial Technologies for Music and Multimedia October 2003 Paris. http://www.interactivemusicnetwork.org/events/resonance.html

## 9 Other References


- Bellini, P., Nesi, P. (2001). WEDELMUSIC FORMAT: An XML Music Notation Format for Emerging Applications. Proceedings of the 1st International Conference of Web Delivering of Music. 23-24 November, Florence, Italy, pages.79-86, IEEE press.
- Bellini, P., Nesi, P., Spinu, M. B. (2002). Cooperative Visual Manipulation of Music Notation. ACM Transactions on Computer-Human Interaction, September, 9(3):194-237, http://www.dsi.unifi.it/~moods/
- Byrd, D. A., (1984). Music Notation by Computer. Department of Computer Science, Indiana University, USA, UMI, Dissertation Service, http://www.umi.com.
- CANTATE project, (1994). Deliverable 3.3: Report on SMDL evaluation, WP3.
- Dannenberg, R. B. (1993). A Brief Survey of Music Representation Issues, Techniques, and Systems. Computer Music Journal, 17(3):20-30.
- NIFF Consortium, (1995). NIFF 6a: Notation Interchange File Format.
- Selfridge-Field, E. (Ed.). (1997). Beyond MIDI - The Handbook of Musical Codes. London, UK: The MIT Press.
- Sloan, D. (1997). HyTime and Standard Music Description Language: A Document-Description Approach. E. Selfridge-Field (Ed.), Beyond MIDI - The Handbook of Musical Codes. (pages 469-490). London, UK: The MIT Press.
- SMDL ISO/IEC. (1995). Standard Music Description Language. ISO/IEC DIS 10743.
- Smith, L. (1997). SCORE. Beyond MIDI - The Handbook of Musical Codes, (E. Selfridge-Field, ed.), The MIT Press, London, pages 252-282.
- Taube, R. (1998). CCRMA, Common Music.' CCRMA, Stanford University, California, USA.

- Taupin, D., Mitchell, R., Egler, A. (1997). Using TEX to Write Polyphonic or Instrumental Music ver T.77,'hprib.lps.u-psud.fr.
- Wood, D. (1989). Hemidemisemiquavers...and other such things. A concise guide to music notation, The Heritag Music Press, Dayton, Ohio, USA.


Manny many other references are reported in the above mentioned documents produced by the MUSICNETWORK.

# 10 Additional http Links

**Some links to related tools/products and company (in alphabetic order):**

- Berlioz http://www.berlioz.tm.fr , music editor
- Finale, CODA, MakeMusic, music editor and educational tools
- Graphire Music press, http://www.graphire.com
- Igor, NOTEHEADS, http://www.noteheads.com Music editor, music sheets, ...
- MIDIllustrator: MidiIllustrator Music Notation Software: Print, Practice and Play Midi Sheet Music, http://www.MidiIllustrator.com MidiIllustrator is music notation software: Notate, print, practice & play free Midi sheet music. Bring your favorite songs to life. Convert 1000s of Midi & Karaoke files freely available on the World Wide Web into dynamic, interactive scores. User friendly learning tools boost your musical abilities. Learn new music step by step, sight reading notes from the staff OR without reading a note using lead sheets with chord notation, guitar frets & the on-screen piano.
- Mozart http://www.mozart.co.uk , music editor, ...
- MusEdit http://www.musedit.com
- MUSICALIS, music editor and educational tools
- MusicXML, interchange format
- Nightingale http://www.ngale.com/
- NoteAbility http://debussy.music.ubc.ca/~opus1/index.html
- SIBELIUS, music editor and educational tools
- Vivaldi, Opus, Amadeus http://www.vivaldistudio.com , Music editor, OMR, educational tools, music sheets
- WEDELMUSIC: Web Delivering of Music Scores, EXITECH, music editor, multimedia integration and distribution
- Capella, music editor and educational tools, http://www.whc.de/
- MIDISCAN: optical music recognition tool
- SmartScore:
- SharpEye: optical music recognition tool
- SCORE: http://ace.acadiau.ca/score/LINKS3.HTM, music editor

**Some Links to Music Learning tools**

- eMedia Bass (http://www.emedia.org/)
- ClicknPlayMusic (http://www.cnpmusic.com)
- eMedia Guitar (http://www.emedia.org/)
- Evolution (http://www.evolution.co.uk)
- Flute in play (http://www.musicalis.com/)
- Guitar Magic (http://www.sdgsoft.com/)
- http://guitar.about.com/library/blguitarlessonarchive.htm?PM=ss11_guitar
- http://seattlepi.nwsource.com/pop/less11.shtml
- http://www.geocities.com/Broadway/4131/teachyourself/guitar.html
- http://www.guitar-online.com/
- http://www.musiclearning.com/
- http://www.people.fas.harvard.edu/~desmith/guitar/acoustic/songs.htm
- PlayPro (http://www.intelliware.com.au/software/playpro.htm)
- Voyetra (http://www.voyetra.com/site/)
- ACE, MUSIC ACE series of tools
- Play-along-Recorder, http://www.play-after-me.com

- Play the recorder, http://www.frontdsk.com/lptr/
- Palatine initiative: software for used in universities http://www.lancs.ac.uk/users/music/research/sware.html
- MacGamut, music theory: http://www.macgamut.com/
- Practica Musica:http://www.ars-nova.com/practica.html
- Note Ability: http://debussy.music.ubc.ca/~opus1/NoteAbility/NAwelcome.html
- emusicTheory: http://www.emusictheory.com/
- Musica Analytica: I know absolutely nothing about this: http://www.ertechsoft.com/pages/ma.html
- Music Interval: http://www.musicinterval.com/
- Pitch-class set analysis http://www.palatine.org.uk/directory/index.php/Music/TheoryAndAnalysis/pitch/
- Ear Training tools http://www.mhhe.com/helpdesk/benward.html, Ear Training tools http://www.rising.com.au/auralia/
- MIDIllustrator: MidiIllustrator Music Notation Software: Print, Practice and Play Midi Sheet Music

**Some referred Projects and tools:**

- **CANTATE: music notation, library, SMDL,** projects.fnb.nl
- CCARH and MuseData: http://musedata.stanford.edu/databases/index.html
- CUIDADO: Processing of Music and Mpeg7: http://www.ircam.fr/produits/technologies/multimedia/cuidado-e.html
- Guido http://www.informatik.tu-darmstadt.de/AFS/GUIDO/
- HARMONICA, network http://projects.fnb.nl/harmonica
- IMUTUS: Interactive music tuition system
- MOODS: Music Object Oriented Distributed System
- MUSICWEB educational, teaching, object oriented, CORBA. Computer aided music education http://sun1.rrzn.uni-hannover.de/musicweb
- MUSICAL (eContent): Multimedia Streaming of Interactive Content Across Mobile Networks, http://musical.intranet.gr
- NIFF, http://www.musitek.com/niff.html
- OPENDRAMA: music tools for opera show, http://www.opendrama.com
- SMDL, a closed ISO Standard
- Variations 2 at the Indiana University - Bloomington http://www.dml.indiana.edu/.
- Xemo project http://www.xemo.org
- MUSITECH project: http://musitech.fmt.uos.de at the University of Osnabrueck, department of Music and Media Technology http://www.fmt.uos.de
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**Links to list of Music Notation resources**

- Document list of Working Group on Music Notation of MUSICNETWORK. The addition of new document can be done by all MUSICNETWORK participants. The page also contains a list of examples of music notation, just to show which are the most relevant requirements for the modeling of music notation, at structural level. This is very interesting for modelling the logical part of music notation. The addition/upload of new documents can be done by all MUSICNETWORK participants. The registration is free and can be performed via the main www site of the network.
- Music Notation Codes: http://www.music-notation.info/en/compmus/notationformats.html, http://www.music-notation.info/en/compmus/musicnotation.html , http://www.music-notation.info/,
- Notation Scoreing Zone, http://www.synthzone.com/notation.htm
- MusicMoz, http://musicmoz.org/Computers/Software/Notation/
- AudioMIDI, http://www.audiomidi.com/software/notation.cfm
- DMOZ: http://dmoz.org/Computers/Multimedia/Music_and_Audio/Software/Notation/
- Music Notation and Engraving, http://www2.coloradocollege.edu/dept/MU/Musicpress/Default.htm
- Musical Information in Musicology and Desktop Publishing, Music Notation example of the most frequend hardness, http://www.ccarh.org/publications/reprints/ieee/ by Eleanor Selfridge-Field and Edmund Correia, Jr.
- MML http://www.musicmarkup.info/ MML (Music Markup Language)
- An article on music notation XML for interchange format http://emusician.com/ar/emusic_xml_music/index.htm

- An article from IRCAM on Music Notation aspects and Synchronisation (mention of the AHG activities) mn-req-alignment.pdf
- music notation glossary, from David Pawson, RNIB: http://www.dpawson.co.uk/smrf/
- virginia tech glossary of Music notation http://www.music.vt.edu/musicdictionary/
- Glosasry of music notation http://www.interactivemusicnetwork.org/glossary/, thanks to Giuseppe Nicotra

**References to Organisations:**

- MUSICNETWORK: The Interactive Music Network
- MIDI.ORG: http://www.midi.org
- Music Educator: http://www.musiceducator.org/modules.php?name=Downloads&d_op=MostPopular
- Technology Institute for Music Educators, http://www.ti-me.org/
- EICTA: European Industry Association, Information Systems Communication Technologies Consumer Electronics, http://www.eicta.org
- EL.pub, Interactive electronic publishing R&D news and resources home page, http://www.elpub.org
- EMF, European Multimedia Forum, http://www.e-multimedia.org
- MEA: Mobile Entertainment Analyst, http://www.wirelessgamingreview.com/mea/
- MEF: Mobile Entertainment Forum, http://www.mobileentertainmentforum.org/