New Musical Knowledge
Thanks to the Creation of An International Standard

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Introduction

After decades during which Information Technology was viewed as a computing discipline for number crunching controlled by punched cards, today, thanks to multimedia, it has assumed the role of *cement* among disciplines that emphasize knowledge of *esthetic quality*, such as *figurative art, music, literature*, as shown by the *storing of manuscripts* by Google, the inclusion of *Leonardo's Notebooks* in the Vista operating system by Microsoft, and possibly *European project Quaero*.

However, none of these projects address the problem of the *dynamic generation of new knowledge.* This brief article attempts to summarize the main points of the new IEEE open Standard P1599, for the *realization of a universally accepted way of encoding sound and music* and their *symbolic representation,* to create *new knowledge* and *new ways to enjoy music.*

Topics from the Call for Papers:

Area 1, New Forms of Knowlegde, Characteristics of Knowledge as a free, open-ended, cumulative good

Area 3, Intangible investments in apprentichip, education and research.

1. The importance of digitized music

The world market for music represents, for products distributed on physical supports, a volume of about 33.6 billion US$ yearly, not including about 4.6 billion US$ of pirated copies, mostly on CDs, with DVD's growing at about 8%.

Immaterial supports, such as files, sold through Internet and mobile telephony are supplanting physical ones, reaching 1.1 billion US$ yearly. The European market represents 12 billion US$, of which 115.8 million in Switzerland. However, in spite of the acute need for a standard to encode and distribute music, people are tied to closed, unreadable and binary representations such as WAV, MP3, etc.

Standard IEEE P1599, a technology defined by the authors of the this article[1], uses all modern techniques for the diffusion and enjoyment of music and removes the barriers of encoding to make it closer to humans – in a tradition of symbolic notation that goes back at least 40 centuries – hence machine-readable and non-proprietary.

[1] The project, supported by the IEEE CS Standards Activity Board, has been endorsed by the Intelligent Manufacturing Systems global research fund and accepted for financial support by the Commission for Technological Innovation of the Swiss Federal Government, however it has not yet attracted the attention of European bodies

2. Past Proposals For Symbolic Music Standards

The idea to encode music symbolically for digital computers is not new[2] and recognizes that ***music is not just sound***. It is, instead, a *complete experience,* the *adventure of entering a new world, understanding a narration* and *seeing images*. Music has always incorporated the newest technology of a given epoch, and the marriage with computer science is old, as the *early algorithms for composing by Mozart and Haydn* show.

Proposals for symbolic standards for computer applications have been for several decades, as shown by the Plaine-And-Easie Code[3] and DARMS[4]. Attempts have been made to use the new technology brought about by SGML with its subset SMDL[5], but it failed to attract much attention because of lack of applications.

Presently, there are some de-facto standards using XML, relevant to this standard. *MusicXML* is a proprietary standard by company Recordare[6], is used in existing applications (including popular *Finale*), and has been in existence for over five years. The *Music Encoding Initiative*, or *MEI* [7], is a project by the Digital Library of the University of Virginia.

3. How New Standard P1599 Works

Symbolic Music means that musical aspects are represented in a *symbolic form*, with readable symbols for musical events. Thus they can be read, extracted, and processed in any way, by the general public as well as by musicologists, as with scores. PAR1599 uses XML, the new language for Web programming, and has thus the advantage of being both human and machine readable, and it enjoys therefore characteristics such as *extensibility, standardization*, and *foreseen longevity.*

PAR 1599 considers *structures for music* consisting of *different layers*, each of which represents an aspect of the piece.

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[2] We shall not comment of musical representations from the past, e.g. Babylonians, ancient Egypt, the inscriptions at Delphi, the cultures of ancient Asia, Western notation of the last four centuries, all human readable.

[3] B.S. Brook, "The Plaine and Easie Code", in Musicology and the Computer, ed. Barry S. Brook. New York: City University of New York Press, 1970 pp53-56.

[4] DARMS, Digital Alternate Realization of Musical Symbols: R.F. Erickson, "The Darms Project: A Status Report", Computers and the Humanities 9(6):291-298 (June 1975).

[5] S.R Newcomb, "Standard Music Description Language complies with hypermedia standard", IEEE COMPUTER, July 1991, pp. 76-79. Special issue dedicated to *Computer Generated Music* edited by **Denis L. Baggi** (one of the authors of this writing).

[6] http://www.recordare.com/xml.html

[7] [5] P. Roland, "The Music Encoding Initiative (MEI) DTD and the Online Chopin Variorum Edition", http://www.lib.virginia.edu/digital/resndev/mei/mei_ocve.pdf

Figure 1 below shows the relationship among the constituents of *Symbolic Music Information*, or *SMI*, and between the group with *general*, *structural*, and *logic* layers and that for *layers for notation* (for a score), *audio* and *layers for performance* (MIDI). This means that, for the representation of music, the *standard chosen for audio* is irrelevant, since the *same logical symbol* file is used.

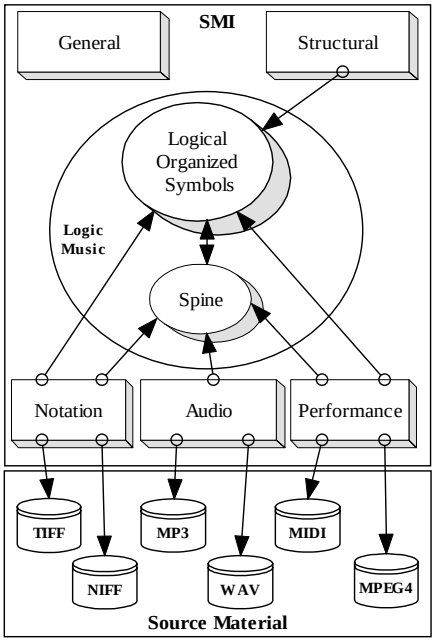

Figure 1. Relationship between Symbolic Music Information (SMI) layers, and between SMI and Source Material.

4. Some Examples Of Applications That Can Be Built With This Technology

These examples, taken from an article[8], illustrate the power of the standard and of the symbolic representation of music.

1. **An opera.** A DVD of an opera allows the user to: *see the play* on the screen, *hear the music*, *see the score*; *read the libretto*; choose *excerpts of alternative renditions*
2. **A piece by a jazz Big Band.** The *harmonic grid* is displayed and the *name of the soloist* pops up at the beginning of each solo
3. **A fugue.** The *theme* is highlighted as it gets passed among the different voices
4. **Music with a "program" or story.** E.g., Vivaldi's *Four Seasons* come with poems that refer to segments of the music.
5. **A piece of Indian classical music.** The *scale* of the raga is shown and the melodic development is highlighted
6. **A piece of several drums**, as in *African Drumming*, to show how the hits do not fall together
7. **Preservation of the music heritage from the past.** To store documents in any media[9]

[8] Baggi, D., *An IEEE Standard For Symbolic Music*, IEEE COMPUTER, November 2005, pp.100-102.

8. **Musicological study.** Ease of queries – for example, all pieces utilizing the lowest note of a grand piano.

These are only examples. New applications can be created, particularly for *different cultures and kinds of music*, such as those studied by *ethnomusicology*, an open field.

5. Existing Prototypes

Jelly Roll Morton's "King Porter Stomp" is an application built at the *Laboratory for Musical Informatics* at the University of Milan, Italy. The screenshot of **Figure 2** contains different windows, of which those with the caption *real time* operate in synchronism while the music is being played.

The user starts with *piece selection*, *King Porter Stomp 1924* or *King Porter Stomp 1939*, two scores of the piece by American composer and pianist *Jelly Roll Morton*, or *Ferdinand Joseph La Motte*, 1889-1941.

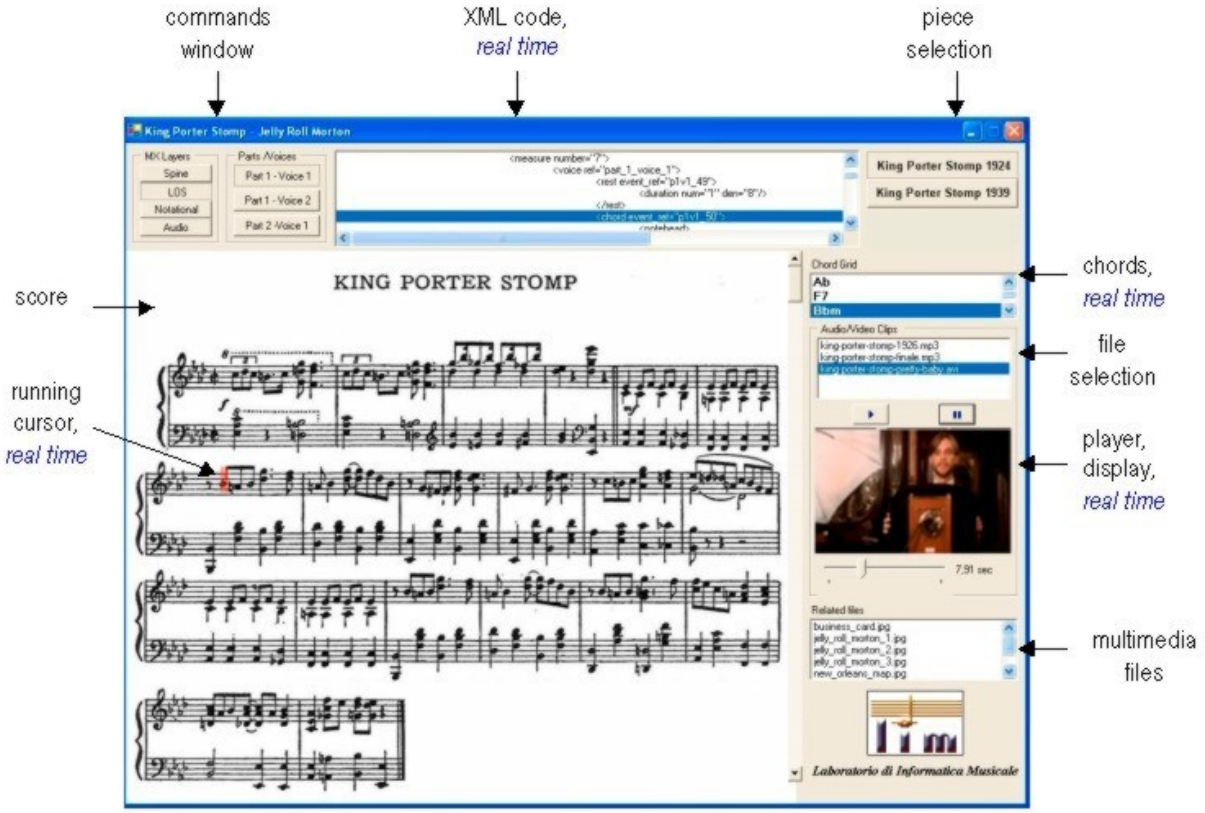

Figure 2. Screenshot of a browser for *King Porter Stomp* by Jelly Roll Morton

[9] G. Haus, "Rescuing La Scala's Audio Archives", *IEEE COMPUTER*, 31(3), pp.88-89, IEEE CS Press

In the *file selection* window, the user can choose among alternate multimedia files and renditions: a recording from 1926, a MIDI rendition of the 1924 score, and an excerpt from Louis Malle's movie *Pretty Baby* of 1977 in which a character patterned after Morton is heard composing the piece in the background. Here the movie is shown in the window *player*, *display*.

Several synchronized activities execute in real time: music and sound, the *running cursor* on the *score* windows, which can be moved at will, and the *XML code* window showing the encoded events such as Logical Organized Symbols of Figure 1. The *command window* selects which XML code is displayed: *spine, LOS, notational* and *audio*, and which of the three *voice* the running cursor will follow. The *chords* window displays the harmony, while the window for the *multimedia files* allows selection of pictures, portraits of Morton, of his band, and curiosities.

Other existing applications are: a jam seesion, ***Crazy Rhythm,*** recorded in Paris in 1937, with among other Coleman Hawkins and Benny Carter, no score, with harmonic grid, showing which of the four saxophonists takes the solo; and an excerpt from Puccini's ***Tosca,*** which follows the original score by Puccini himself[10], with the choice of various tenors and of a video.

6. Conclusions

This project represents a unique chance for European companies, academic institutions and research laboratories, because:

- The standard is open and free for use by anybody, as per IEEE regulations and bylaws
- Originally based on American technology because of lack of know-how in Europe, it is being developed in Europe by European academic institutions and companies
- It will radically change of enjoying music since, besides passive listening, it makes the musical experience available to anybody, at any level.

[10] Courtesy of publishing company **Ricordi**