Workshop ABF Challenges, Pisa, 2012

Music Accessibility for Visual Impaired

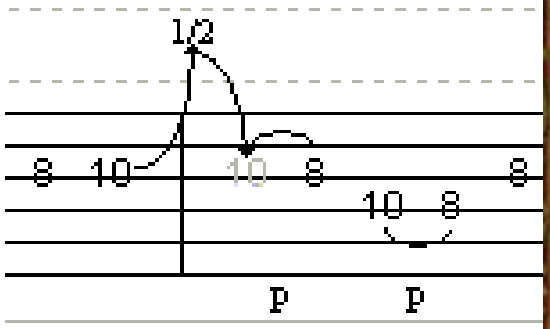
Paolo Nesi, Giuseppe Nicotra

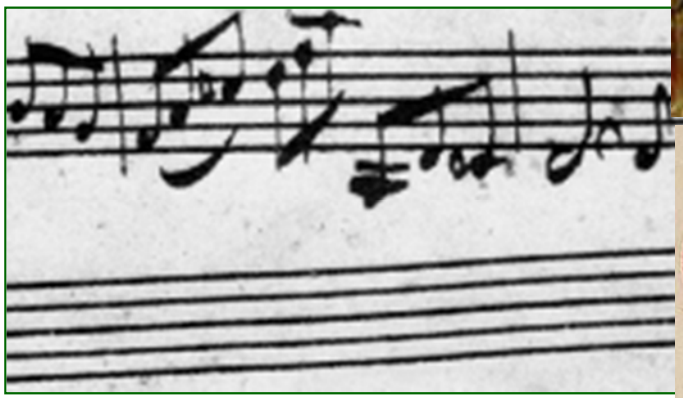
University of Florence
Department of Systems and Informatics
Distributed Systems and Internet Technology Lab, DISIT Lab
Paolo.nesi@unifi.it tel: 0039-335-5668674
http://www.disit.dsi.unifi.it
06-July-2012, Pisa, Italy

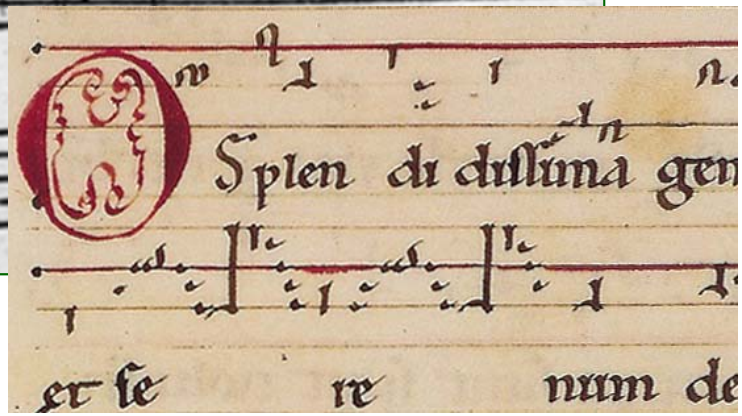
Music Domains

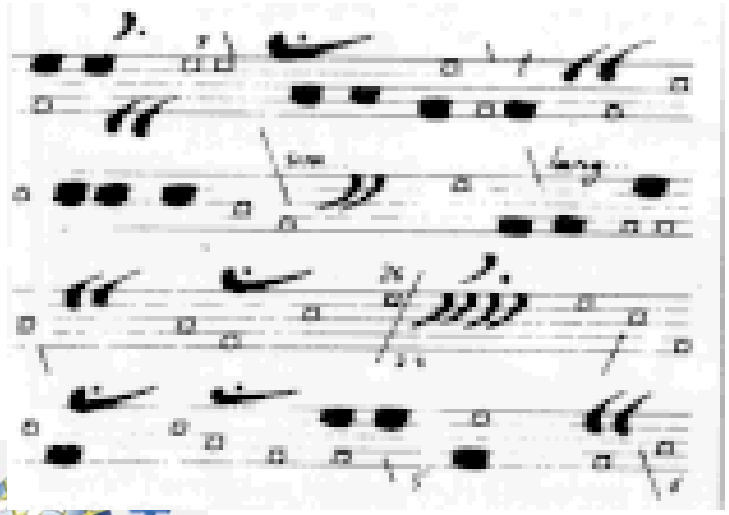
- Music is a **multifaceted** and **multidomain** space
- **Audible Space** is the effective valuable result of a long and heavy work of the artists: composers and performers
  - intepreting a representation / description (the original work) with the aim of transmitting the intentions and emotions of the composer
  - Almost «*visual representation*»
- The **transmission** of **music *as sound*** is quite recent since the recording technology is recent.
- On the other hand the **music representations** on physical «visual» support is quite old.

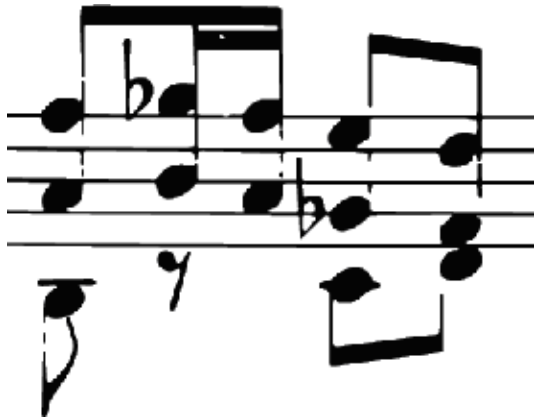
Music Coding





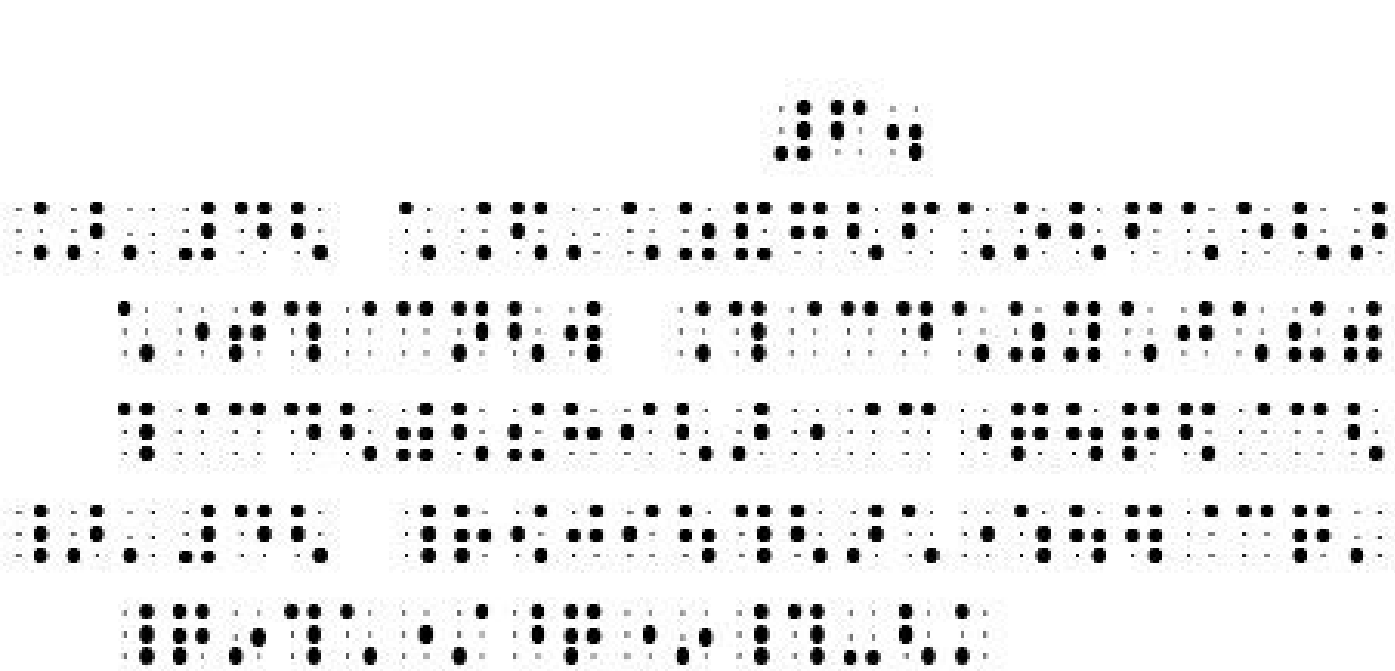


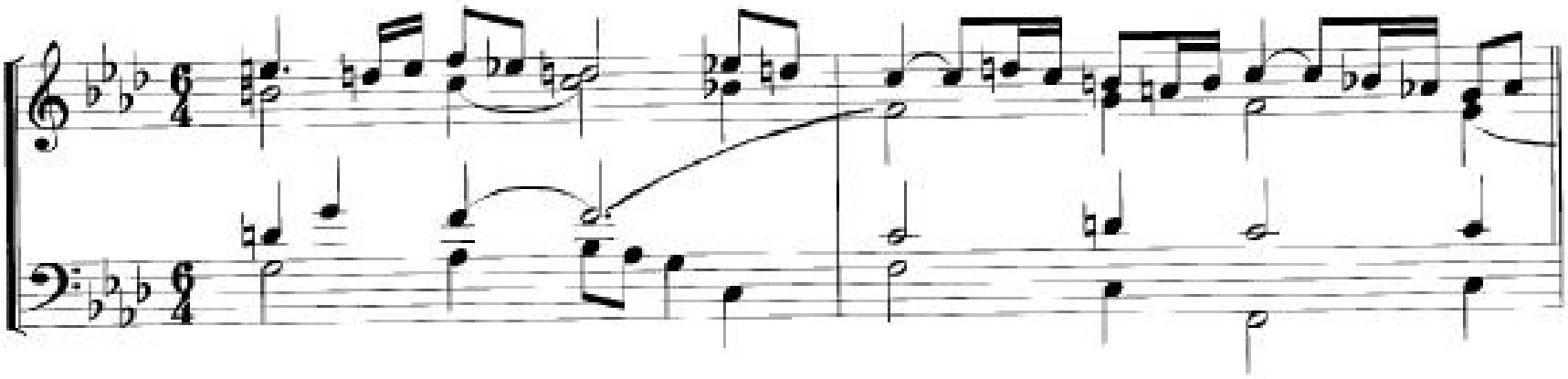




Braille Music Notation

- from the Valentin Haüy work of coding for music reading, **in 1925 Louis Braille** placed the basis for coding/writing music on dots rather than on lines
- Braille's music notation (and not only music) allows a visually impaired teacher to **teach at sighted and visually impaired students**

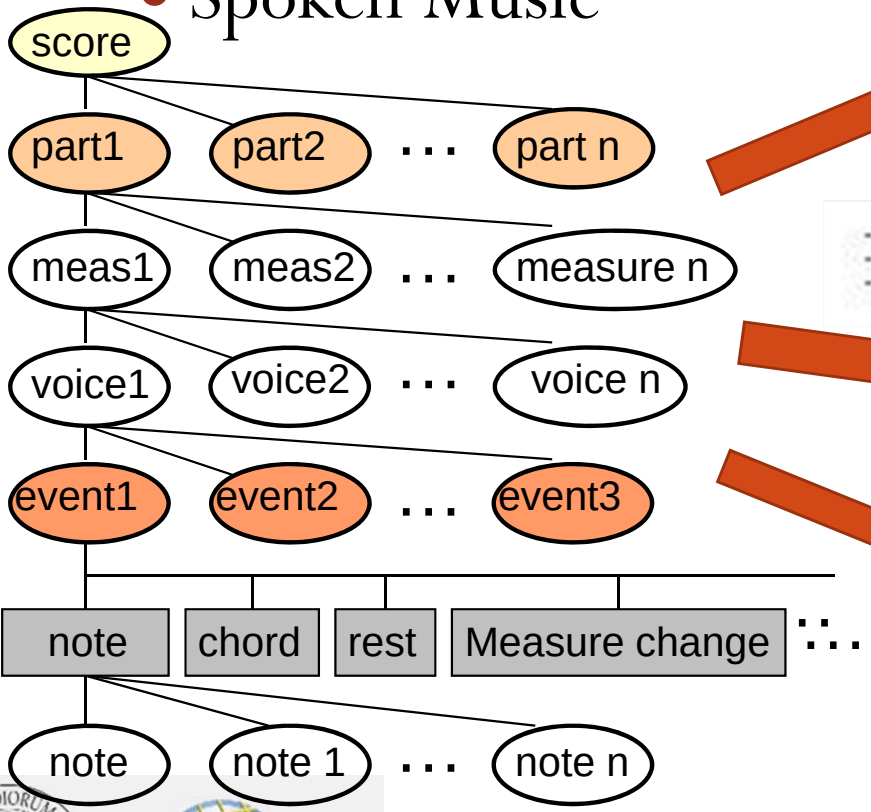




The same music in print and in Braille

ICT as Enabling Technology

- **Symbolic Music coding** can be rendered in:
  - Classical notation
  - Braille notation
  - Spoken Music



TEATRO ALLA SCALA

MOODS

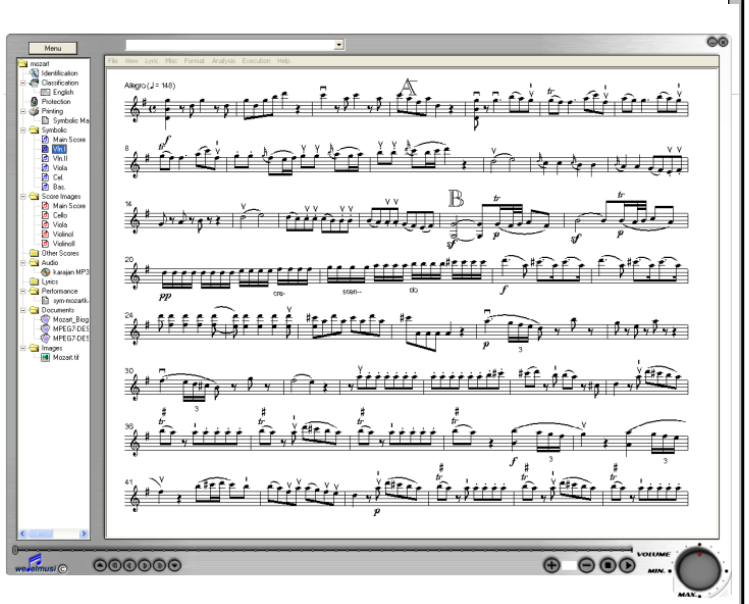
The Coding Problem

Interactive MusicNetwork Multimedia

- **European Commission** extablished the MUSICNETWORK NOE chaired by University of Florence, Italy (2000)
- **Study and development** of international standard for music coding supporting different rendering and multimedia on the basis of several activities as:
  - WEDELMUSIC ICT project
  - MUSIC XML coding
  - BRAILLE XML coding
  - Finale coding
  - Sibelius coding
  - …

Symbolic Music Representation

- **MPEG SMR as MPEG-4 part 23**
- **WEDELMUSIC** format from EC project of European Commission



MPEG SMR as MPEG-4

Distribution

- School Server
- Archive
- Distributor
- Producer
- …

For music education at home, at school

For entertainment in theaters, archives, at home, at school

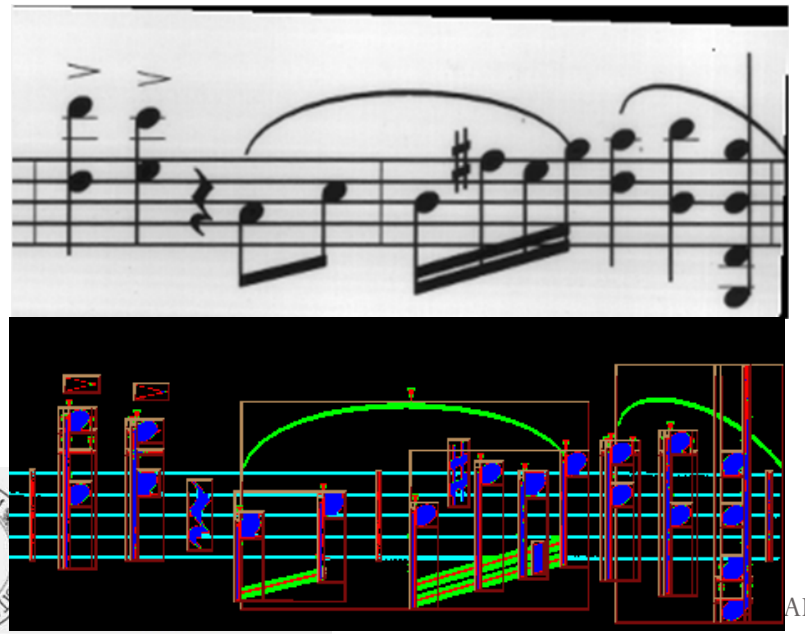
ISO/IEC JTC1/SC29 WG11
MPEG
MOVING PICTURE EXPERTS GROUP

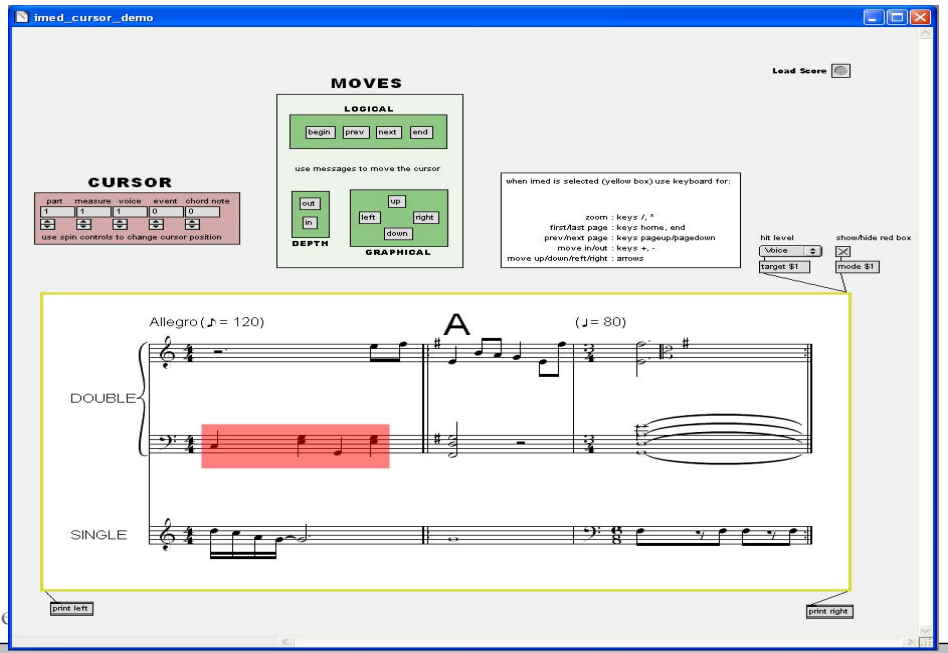
Fruition Devices

Applications

Optical Music Recognition, OMR

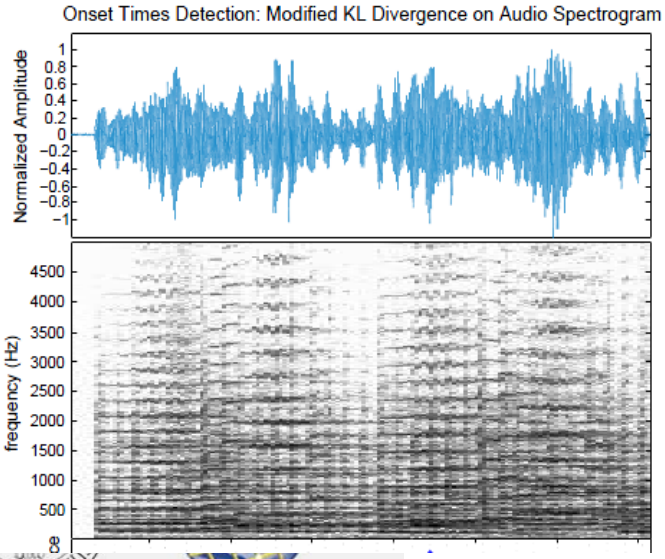
- **I-Maestro project of the European Commission**: http://www.i-maestro.org
  - **OMR: generating Symbolic Music coding from** music scores in different *paper based "visual" notations* to symbolic music representation coding!
    - *Technologies developed:* Image and Video processing, augmented violin
  - **Collaborative work for music teaching and learning**, heterogeneous pupils
    - *Technologies developed:* distributed systems, music coding, competitive work

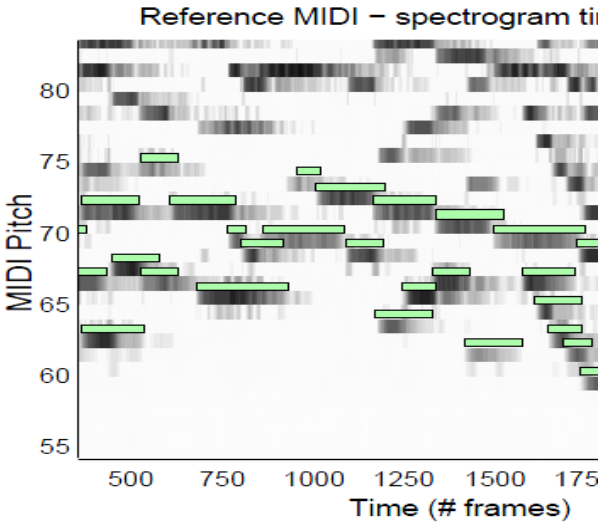


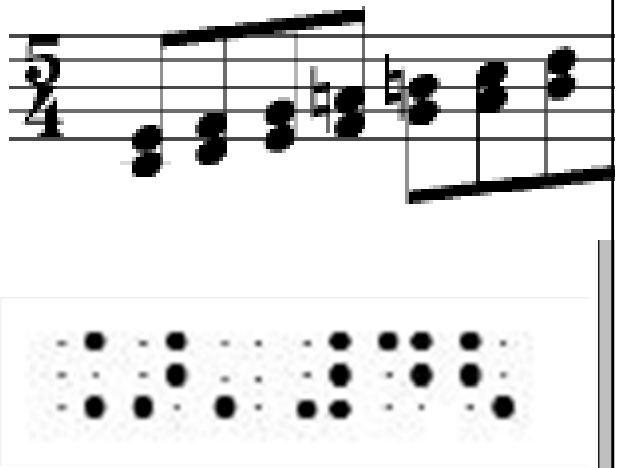


Transcoding Problem Challenge

- **Passing from** sounds (monophonic and polyphonic) to a symbolic music representation coding via Signal Processing
  - ***Technologies developed***: Polyphonic Transcoding, instrument independent….
  - ***Developed algorithms*: winner for piano** and in the firsts three for generic at the MIREX international research competition among algorithms for transcoding of polyphonic music

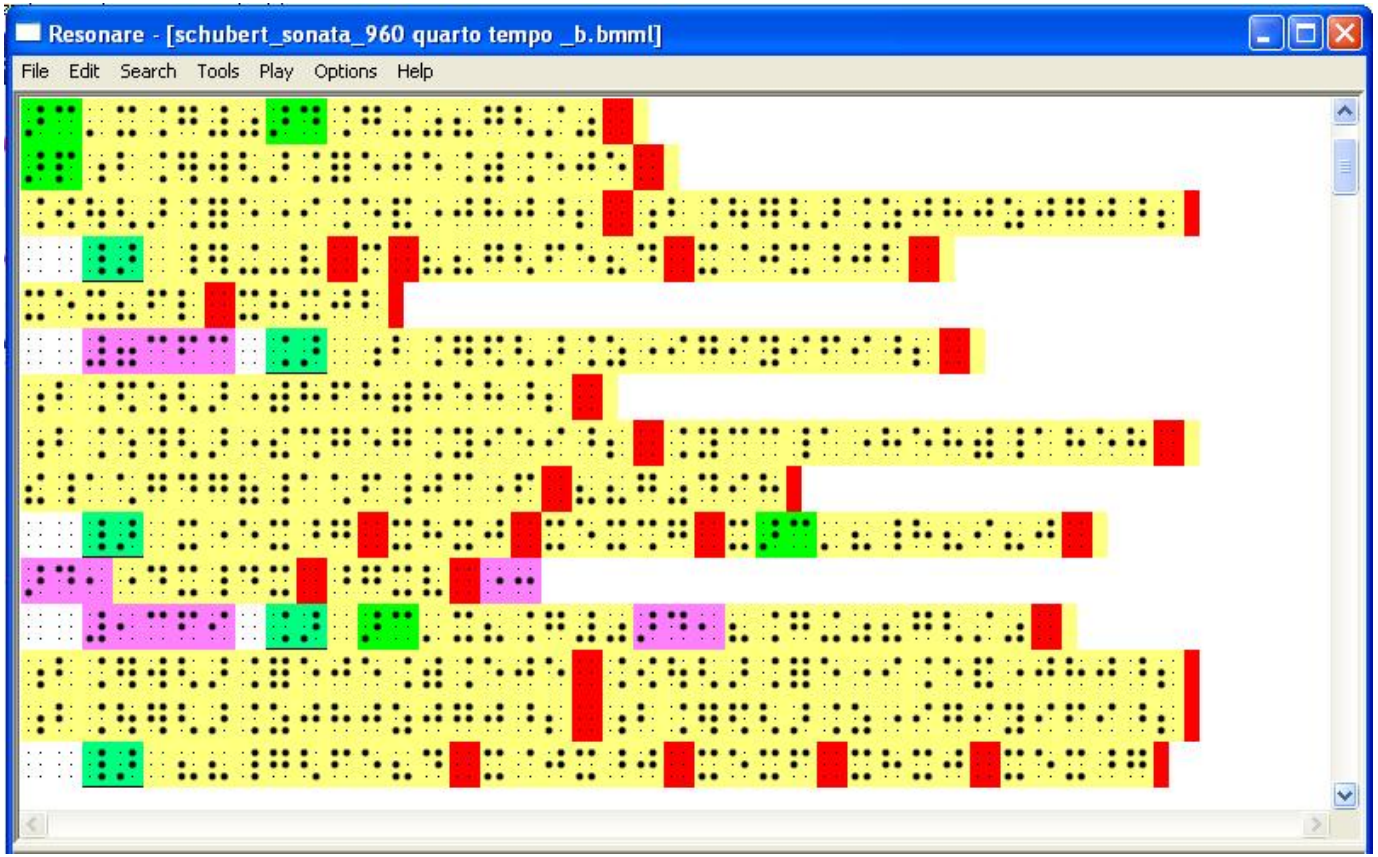






BMML (Braille Music Markup Language)

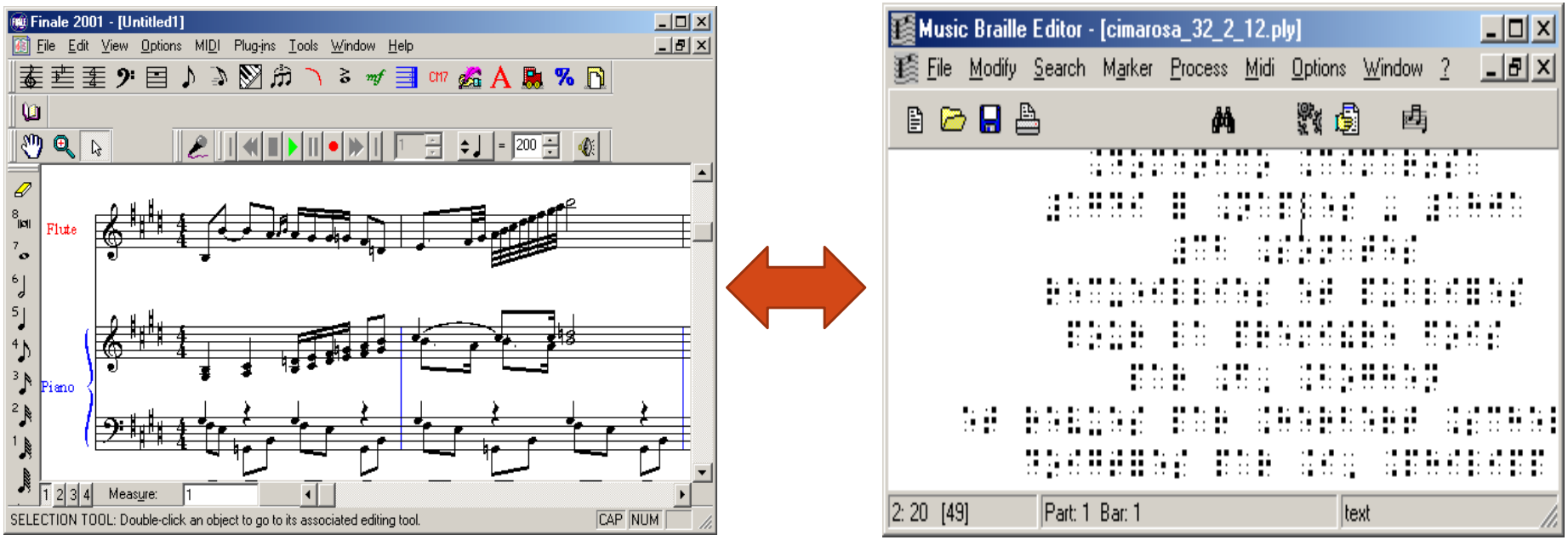
- Aligned with MPEG SMR model
- **Contrapunctus EC project** to develop tools and to draw benefit from this new format
- **Resonare Tool** help to:
  - navigate on notation, rendered on Braille devices
  - memorize and understand
  - personalize / bookmark
  - play…



Braille Music Markup Language and tools

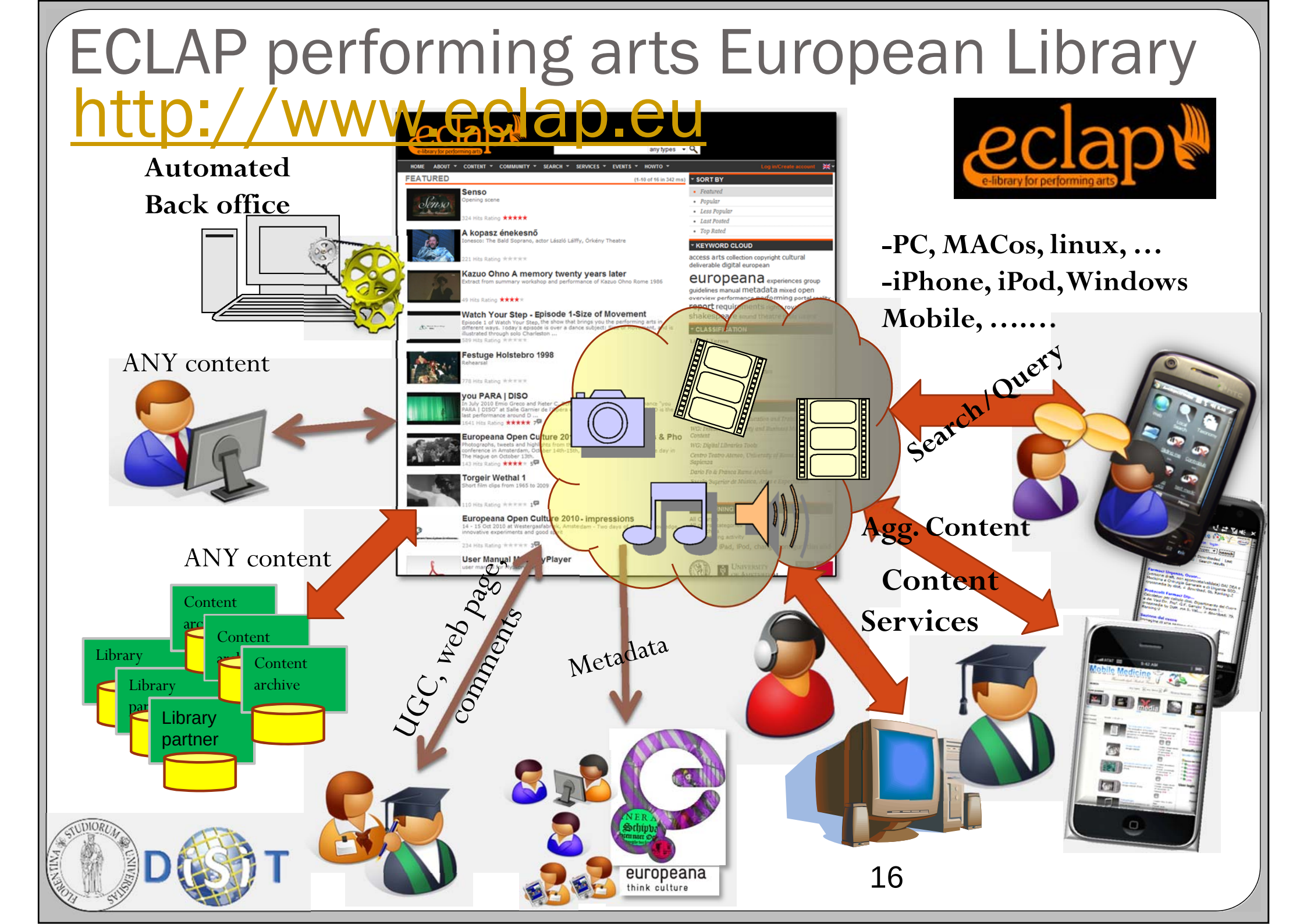
The **Contrapunctus** multidisciplinary team produced:

- conversion modules (back and forward), aimed at facilitating access to existing music in digital formats



ECLAP performing arts European Library

http://www.eclap.eu



ECLAP is a best practice collaborative network on performing arts:

- distributing over 90 thousand content objects
- 35 prestigious European institutions,
- Traditional music, Braille Music, video, audio, etc.
- Access via PC and mobile devices.

Conclusions & Future Work

- **Research activity** on MUSICNETWORK, WEDELMUSIC, IMUTUS, CONTRAPUNTUS, MIREX R&D projects opened the doors to social inclusion, thus reducing not only technological barriers, but also cultural ones.
  - **Enabling technologies** such music coding and signal processing, etc., allowed to create specific Braille coding models and new tools, thus:
    - reducing the gap for accessing to music,
    - Increasing the access to music for visually impaired
    - increasing the amount of accessible music
    - Increasing the number of possible tools for producing correctly coded music
  - **New generation of solutions and tools** has been provoked by MPEG SMR work
- **Additional work is needed** on:
  - Collaborative tools for music training and composition, annotations
  - Making MPEG SMR & BMML more accessible on multiple devices
- .....

References

- F. Argenti, P. Nesi, G. Pantaleo, "Automatic Transcription of Polyphonic Music Based on The Constant-Q Bispectral Analysis", IEEE Transactions on Audio, Speech and Language Processing, IEEE Computer Society press, Vol.19, n.6, pp.1610-1630, Aug. 2011.
- P. Bellini, I. Bruno, P. Nesi, ``Assessing Optical Music Recognition Tools", Computer Music Journal, MIT Press, Boston, USA, Vol.31, N.1, pp.68-94, Spring 2007
- P. Bellini, P. Nesi, G. Zoia, ``Symbolic Music Representation in MPEG", IEEE Multimedia, IEEE Computer Society press, ISSN 1070-986X, Vol.12, N.4, pp.42-29, October-December 2005
- P. Bellini, I. Bruno, P. Nesi, ``Automatic formatting of music sheets through MILLA rule-based language and engine", Journal of New Music Research, Routledge, Vol.34, N.3, ISSN 0929-8215, pp.237-257, September 2005
- P. Bellini, P. Nesi, ``Automatic Justification and Line Breaking of Music Sheets", International Journal of Human Computer Studies (IJHCS), Harcourt press, ISSN 1071-5819, Vol.61, Issue 1, pp.104-137, July 2004.
- P. Bellini, F. Fioravanti, P. Nesi, ``Managing Music in Orchestras", *IEEE Computer,* IEEE Press, pp.26-34, Settembre 1999.
- .....
- ....

Projects and Links

- MOODS: http://www.dsi.unifi.it/~moods/
- WEDELMUSIC: http://www.wedelmusic.org/
- IMAESTRO: http://www.i-maestro.org/
- MUSICNETWORK MPEG SMR: http://www.interactivemusicnetwork.org/mpeg-ahg/
- CONTRAPUCTUS: http://www.punctus.org/
- BMML ArchiBraille: http://braillemusic.eu/
- ECLAP: http://www.eclap.eu
- Other projects: IMUTUS, VARIAZIONI

Music Accessibility for Visual Impaired

Paolo Nesi
University of Florence
Department of Systems and Informatics
Distributed Systems and Internet Technology Lab, DISIT Lab
Tel: 0039-3355668674
Paolo.nesi@unifi.it
http://www.disit.dsi.unifi.it