

# Protected WEDELMUSIC



The techniques for **PROTECTING MUSIC** of WEDELMUSIC refers to tools that allow the save transmission of WEDEL objects and the insertion of identifiers into music (audio files, printed score sheets, images of music score) in order to demonstrate the owner, the musical area and the distributor.



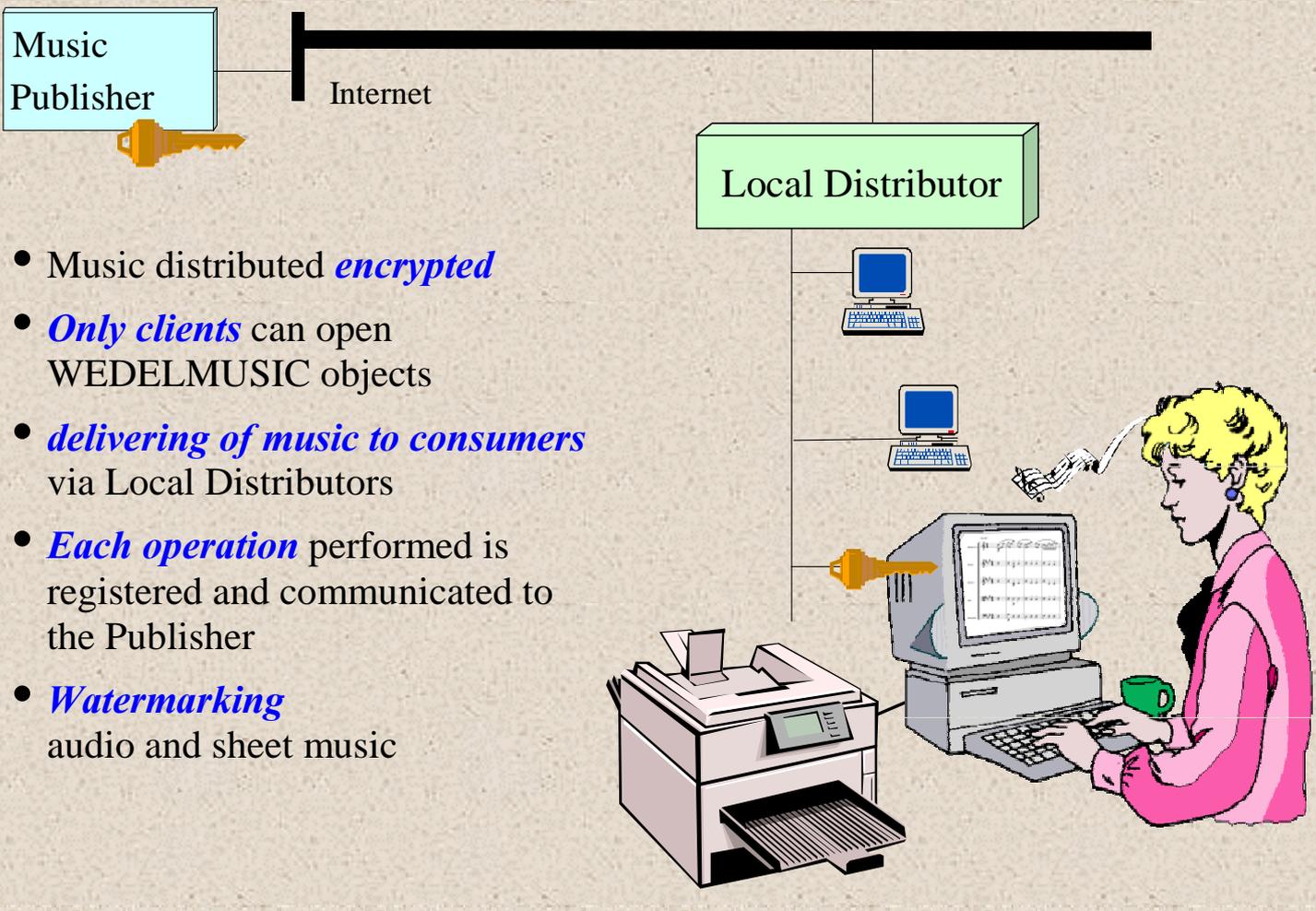
<http://www.wedelmusic.org>

WEDELMUSIC enables publishers and consumers to manage their music interactively protecting their intellectual property rights. E-commerce for music distribution is not viable without adequate protection methods. To fully trust every customer and control his/her applications on a computer is not possible.

WEDELMUSIC presents sophisticated mechanisms for music protection:

- protecting digital objects by using encryption techniques
- allowing the definition of personalized Digital Right Management, renting, retail, etc.
- watermarking audio files
- watermarking images of music score
- watermarking music sheets while printing them

The model adopted is based on the distribution of music from publishers to customers by using the Local Distributors: libraries, conservatories, music schools, music shops, etc. They may distribute the music coming from several publishers. Local Distributors are WEDELMUSIC certified institutions with authorized client computers. Client computers may print protected music sheets. Attendees/clients of Local Distributors may work on a large WEDELMUSIC database located in the Local Distributor for processing music, arranging, transposing, reducing for piano, listening, printing, querying, converting, extracting excerpts, etc., according to the allowed operations.



# General Issues of the Module

## *Transaction Model*

The WEDELMUSIC distribution is based on a transaction model that allows customizing the service of music distribution completely. It may range from on-line to off-line distribution of digital objects. WEDELMUSIC objects may have very complex structure and a large data size (with high-resolution audio, images, videos) as well as very simple and manageable to be transferred on-line. Specific transaction policies may be defined according to the publisher's needs and interests.

## *Digital Right Management*

Each operation that can be performed on the WEDELMUSIC object can be permitted or inhibited; more than 50 different multimedia functionalities can be distinctly managed. A permission table is available for the definition of Digital Right Management policies. A price can be associated with each permitted operation. The permission table depends on the status of the WEDELMUSIC object: demo, rented object, when it has been sold, when the renting period has been expired, etc. Each performed operation is tracked and thus the publisher may know exactly which are the often requested operations and the most frequently requested music pieces. This allows analyzing the needs of the end-users with statistic tools. Operation which are normally inhibited can be on-line requested and received when needed.

## *Watermarking*

Besides the active protection of the transmitted digital objects via encryption, watermarking can be regarded as a passive security mechanism. Especially if the data leaves the trustworthy environment watermarking will be the only protection mechanism left. Watermarking hides information into digital objects such as images, videos, audio files and text pages. These techniques are adopted embed robust codes that can be used for demonstrating the ownership of the digital object in the case of copyright infringement. The hidden code contains the publisher identification code, the music piece identification code, and the Local Distributor of music identification code. The possibility to hide this information and read it after several types of attacks makes the watermark suitable as a protection mechanism. The watermark reader is part of the watermark tools to detect and read the hidden code for demonstrating the ownership.

WEDELMUSIC techniques for watermark present the following capabilities:

- The watermark inserted in the printed sheet is not disturbing the music reading and playing.
- The watermark inserted into an audio file is not disturbing the listening of music.
- The watermark remains readable after acquisition with scanner and reprints as well as after photocopy with distortions, filtering, zooming, rotations, cropping, noise addition, flipping, etc.
- The watermark resists sheet manipulation until the music printed is considered unreadable.
- The watermark removal with image processing techniques is more expensive than buying the same music sheet.

## *Watermarking Images of Scores and Music Sheets while Printing Them*

In digital music distribution, such as in WEDELMUSIC, the music sheets are printed on the client site. Therefore, the copyright owner, in most cases, may only count the printed copies. Typically, music sheets are distributed with a simple fingerprint reporting the music code, the publisher name, etc. Publishers cannot control the usage of printed music sheets in insecure environments. In these conditions, the insertion of a hidden watermark in music sheets is the only possible protection mechanism left.

New techniques for watermarking music (in image format and/or during the phase of printing music sheets) were implemented in order to protect the WEDELMUSIC printed sheets. The methods have been obtained after a deep analysis of the possible solutions to hide data code into music sheets. A user group of experts has performed a validation of the results obtained, stating that the chosen watermark is almost invisible.

## *Watermarking Audio Files*

The watermarking of audio files allows inserting non-detectable code into WAVE and MP3 files. The approach is based on the psycho acoustic model of the human auditory system and therefore guarantees that the watermark is not audible. The watermark reader can be profitably used for demonstrating the copyright infringement.