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# MUSIC-4YOU.COM – DIGITAL MUSIC E-COMMERCE CASE-STUDY

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## ABSTRACT

During the past couple of years a new business has arise on the Internet – digital music e-commerce. Web-sites such as Apple iTunes, Real Rhapsody and most recently the renewed version of Napster with Microsoft support have attracted a lot of attention to this new business. This paper introduces and describes an example of a digital music e-commerce web-site – Music-4You.com – developed in the framework of a European project called MOSES. However, Music-4you isn't just another digital music e-commerce site. It introduces some new concepts in the electronic trading of digital music, such as the negotiation of rights licensing conditions, the usage of new media formats and the possibility of music providers add their own music to the web-site and to define their own business models and rights management.

## KEYWORDS

Digital music, MOSES, MPEG-4, e-commerce, licenses, copyright, Digital Rights Management

## 1. INTRODUCTION

The offer of goods and services through online commerce never ceased to grow. New online services, goods and even Business Models are being provided every day. One good example on how the Internet and the IT itself has shifted a well-implanted traditional business is the music industry. Music industry always relied on traditional analog channels to sell their products – discs (vinyl or CDs) and cassettes – to the final consumers. This industry relies traditionally on intermediaries to sell their product to final consumers. Perhaps no other decade in history has contributed so much to the growth of the music industry as the 1990s, the digital decade. The emergence of the compact disc (CD) with a smaller, lighter, and more durable format than vinyl and cassette is one of the most important ones. Also, the sound quality does not diminish over time. CD players are inexpensive and accessible in cars, elsewhere, almost everywhere. Consumers are going digital and online [10]. Consumer trends show that consumers are going more and more digital and online.

Today, the music industry is facing the Internet as a single opportunity to extend their businesses. With the growing Internet bandwidth, the existence of new content distribution architectures and mechanisms, the existence of new compression technologies (like the (in)famous MP3 audio compression), the distribution of digital music through electronic means has become a reality. This is clearly a business opportunity for music industry; however the same technological factors that provide such opportunities are also seen as a threat. Music piracy has become a huge problem for copyright holders and for editors [12, 13].

Online piracy takes two dominant forms: distribution of files from unlicensed internet sites known as web and FTP sites; and peer-to-peer traffic on file-swapping services such as Kazaa, Grokster, Gnutella, WinMX and others. IFPI estimates that the number of infringing music files on traditional web and FTP sites on the internet remained flat at approximately 100 million during 2003, while unauthorised files on peer-to-peer systems dropped by approximately 20% from their peak in April 2003 to approximately 800 million by the year's end. This has resulted in an estimated 900 million infringing music files on the internet as of January 2004 [10, 11].

Piracy is one of the biggest barriers to the e-commerce of digital content (not only music) and therefore some technological solutions are currently being developed to try to solve this problem. Some good examples

of web-sites that are trading online music and using some protection technology are: Apple iTunes, Real Rhapsody and the newest version of Napster (supported by Microsoft technology). However, these three examples share a common problem – lack of interoperability - they all use their own specific content formats, their own protection technologies and are therefore incompatible among them. This is not a problem for the companies but for the final consumers which would like to exchange their content with their existing devices such as computers, pocket PCs and PDAs, mobile phones and specific portable media players. For companies this is in fact an important differentiation competitive factor.

MOSES[1], a founded European IST R&D project has actively contributed to and has produced the first reference software implementation in conjunction with the MPEG group a new standard called IPMP-X. The main objective of this new MPEG standard was to improve the interoperability between the different frameworks that were used to protect content (music was just one of the types of multimedia content that could benefict from this). This would allow to consumers to obtain music either from Apple iTunes, Real Rhapsody, Napster or any other available music services and listening to it on the same device (content and device interoperability). MOSES project also started the development of an open Digital Rights Management (DRM) framework called OpenSDRM that was used to manage and trade the multimedia content and rights of digital content on MOSES. Finally, in order to prove its concept, MOSES endorsed the development of a digital music E-Commerce site called Music-4You and made it available to the global Internet community. On the following sections of this paper, it will be presented shortly the OpenSDRM platform and the Music-4You web-site.


## 2. OPENSDRM PLATFORM

The OpenSDRM platform (Figure 1) is an adaptive framework [3], since it can be configured for use with several different E-Commerce business models and different types of content. OpenSDRM deploys a traditional DRM solution for multimedia content rights protection and can be applied to the publishing and trading of digital multimedia content. Additionally, the security architecture proposed by OpenSDRM started being developed from the OPIMA international specifications [1], MPEG-4 IPMP Extensions [2] and the emerging MPEG-21 IPMP architecture [4].

The OpenSDRM platform is completely distributed and modularized allowing the separation of all the major actors and functionalities that are provided by the system. In terms of business, this platform was built having in mind that different entities could assume a specific function in the content distribution chain and conduct their own business exploiting that specific functionality. One example of this refers to the fact that the multimedia content retailer only trades the content to the final user, while the license production functionality may be assured by a completely different and independent entity.

This DRM solution is composed of several optional elements covering the content distribution value chain, from content production to content usage. It covers several major aspects of the content distribution and trading: content production, preparation and registration, content, interactive content distribution, content negotiation and acquisition, actors and user's strong authentication and conditional visualization/playback [6]. Even though the MOSES project refers explicitly to MPEG-4 file format as the content format choose, this infrastructure was designed with the concern to be adaptable and applicable to all types of content and business models (for download, streaming or even broadcasting). Currently the OpenSDRM platform is independent of the content format that is used and also from the content protection mechanism.

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[1] MOSES stands for MPEG Open security for Embedded Systems,and was an EC project joining companies from all over Europe that is implementing the new MPEG-IPMP Extensions framework and at the same time developing business models and applications for secure content exchange between embedded devices
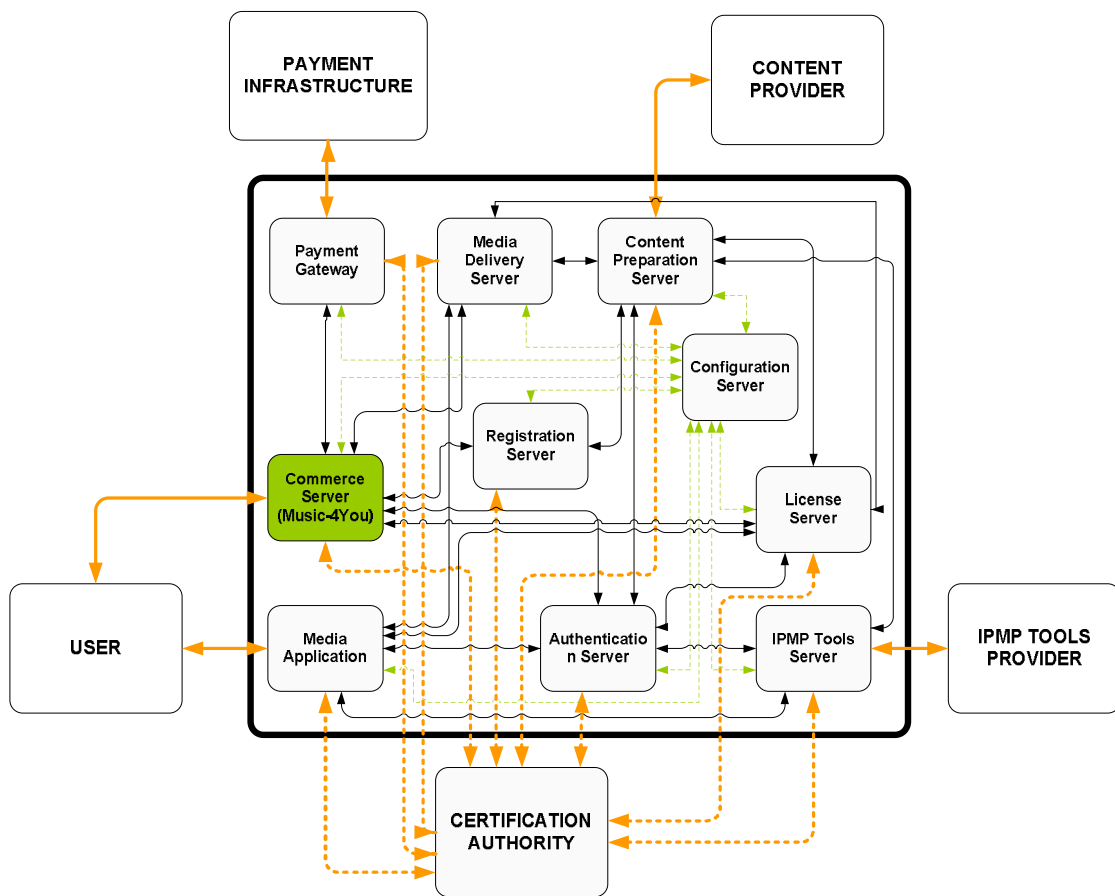
Figure 1 - OpenSDRM reference architecture

## 2.1 External Entities

OpenSDRM is composed of several components and actors that interact externally with the OpenSDRM architecture: User, IPMP Tools Provider, Content Provider, Payment Infrastructure and Certification Authority.

**User** represents a person who wishes to consume a piece of content. This content may or may not be protected however the way to access and display such content may require the use of protected devices, software and licenses. The user will make requests to Open SDRM in order to: identify him, download licenses and play multimedia using a web browser, EPG, Media Player. In a final analysis the User interaction with OpenSDRM will always result in one of two things: either the user can play/render the content and enjoy it or he can't; being then informed of the reason for this prevention.

**IPMP Tools Provider** is any organization that produces tools for encryption, scrambling, watermarking and others that can be applied to content protection. These tools will be made available to OpenSDRM for use in content rights protection. These tools will need to comply with some guidelines. These guidelines and a subscription translates into a business relation that must exist between a given Content Provider and the IPMP Tools Provider, since mostly, a given producer and/or distributor of content may want to choose which type of protection the content will have and respectively which tools can be applied to the content and from which supplier.

**Content Provider** is any multimedia content supplier that feeds OpenSDRM with content and optional metadata. The content can be complex multimedia content that is ready for distribution, or simple content, for example JPEG images, that can be edited and combined with other content. In the MOSES project MPEG-4 content was used.

**Payment Infrastructure** facilitates OpenSDRM e-commerce features by providing services for handling electronic payments. The interface between OpenSDRM and the Payment Infrastructure is generic and independent of the payment method, allowing therefore a multiplicity of payment systems.

**Certification Authority** is responsible for receiving requests for and issuing credentials to, entities. These credentials will be used by entities to authenticate themselves to each other, allowing the establishment of secure and authenticated communication channels between them. All the components in the OpenSDRM architecture communicate using the channel security provided by the SSL/TLS protocol. This Certification Authority may be internal to OpenSDRM, and therefore entirely managed by some entity, or it may be an external commercial Entity.

## 2.2 Internal Functionalities

The OpenSDRM platform performs a complex set of functions. This section describes such functions and the corresponding interfaces. These functions include: Media rendering, Media delivery, Commerce, Authentication, License production and distribution, IPMP Tools registration and distribution, Content registration, Content preparation and protection and the Payment.

**Content Preparation server** (CPS) this server component is responsible for the content preparation. It receives raw content from a specified source or sources and encodes it on a specified format, adds metadata and protects it. Currently, and under the MOSES project, content will be encoded in MPEG-4 format, according to some pre-established templates. These templates will allow the creation of MPEG-4 files containing music files in MP3 or AAC format together with some JPEG images about the album and artist.

**Payment Gateway** (PGW) is a server component responsible for verifying and validating the payment methods provided by the User for a Commerce Server;

**Commerce server** (COS) is a server component responsible for trading the content with the users. Normally, content is chosen via web browser, some very generic metadata might be consulted, information about the price is also available, and especially the content usage conditions might be established. This component is in fact the Music-4You portal.

**Media Delivery server** (MDS) is a server component responsible for exchanging pieces of content with the client. This Media Delivery server will implement a specific protocol (download (FTP, HTTP, or other), streaming (RTSP, other), broadcast) to exchange protected content with the client application.

**Registration server** (RGS) is a server component whose role is to assign unique identifiers to content and to register metadata information for that specific content. This architecture will be as close as possible to standards and therefore for this unique ID, it follows the MPEG-21 directives about Digital Item Identification (DII), using a reduced version of the MPEG-21 DII Digital Object Identifiers (DOI) [7].

**Authentication server** (AUS) is responsible for authenticating all the entities, internal and external to the DRM system. It validates the access rights of all the entities and components in the system working as a SSO point, registering and managing components and users on the system. It uses cryptographic XML credentials to authenticate both components and users in order to authenticate the transactions exchanged between them (XML Encryption and XML Signatures).

**License server** (LIS) is a server component responsible for house-keeping the rules associating a user, the content and his/her corresponding access rights. This component will accept connections from authenticated client Media Players for downloading of licenses, which will be applied to the protected content through an appropriate IPMP tool. The licenses are XML formatted using Open Digital Rights Language (ODRL/OMA profile) [8], and, in the future, they will migrate to the Rights Expression Language (REL) [9], currently being developed by MPEG-21.

**IPMP tools server** (ITS) is the server component responsible for registering new IPMP tools and for receiving authenticated client Media Player requests for the downloading of a specific IPMP tool. It is also responsible for making IPMP tools available to the Content Preparation Server to allow the protection of content.

**Media Application** (MPL) This component represents the software that will be used to render the content. This is a generic component with the particularity of being able to display/playback the appropriate content for which the necessary audio/video codec is available (if this codec is not available it may be downloaded from a remote secure server). This player may work with one or several IPMP tools in order to

control how the content is accessed by a particular user. This component works on the client side of the general architecture; however it plays an important role in the DRM functions.

## 3. THE MUSIC-4YOU WEB-SITE

The Music-4You web-site (www.music-4you.com) is a digital music B2C e-commerce site that was developed to prove the technological concepts behind MOSES (mainly the MPEG-4 player IPMP-X implementation and the OpenSDRM platform integration). The content format adopted for this music web-site was MPEG-4 (IPMP-X had been developed primarily to target this format), and a specific MPEG-4 player, integrating the IPMP-X, was developed and distributed freely to users, during the project lifetime. MPEG-4 also presented the advantage of adding additional media information to the music tracks, such as images and the music lyrics. Currently, the MP3 format is also supported and a specific player was developed to be able to render the MP3 protected files.

Music-4You (Figure 2) was developed with the purpose to be a music portal, targeted for two types of final users: consumers that wanted to listen to music and to music bands (music providers). The portal aggregates the work of several bands, allowing them to disseminate their work over the Internet with few effort and investment, with the possibility to protect their content according to a set of parameters previously specified. On the other hand, consumers could access to a large set of free music and to non-free music previews and downloads. Resuming, in the Music-4You portal coexistence of paid and free content is a reality.



Figure 2 - Music-4You main web-page

Another important Music-4You characteristic is that its business model is built on the concept that protected content had no value – in this sense, the protected content refers to content that is ciphered and

cannot be played on normal players without the appropriate clearence. This seems contradictory, however what it means is that the users may download the content they want from the web-site, share it their friends, even on P2P networks, and publish them on web-sites and so on, because content is protected (ciphered) and therefore content by itself has no "real" value. What confers value to the content are the associated licenses (which contain associated rules and the corresponding decryption keys) personalized for a given user and expressed using a Rights Expression Language (REL). This license is to be used and interpreted by the MPEG-4 player, and the appropriate IPMP tool that enforces the rules on the content and uses the appropriate deciphering key to render it. The licenses used by Music-4You are count and time expiry-based, however many other conditions could be added to the licenses, which can be expressed using Open Digital Rights Language and in the future in MPEG-21 REL as REL.

MOSES targeted not only the PC as the final device, but also embedded devices, such as PDAs and Mobile Phones. The same architecture, with the proper adaptations, tackled all these devices to provide the same functionality – the possibility to listen to music and at the same time uphold the rights of the copyright owners. A specific version of the Music-4You portal was developed and tailored for small screen rendering devices, such as PocketPCs.

## 3.1 Users functionalities

Music-4You portal allows the users to access to the portal multimedia content – in this case music tracks. All the users are allowed to view all the information about the bands on the web-site and to download all the free content from the portal. To access the protected music tracks the users need to register on the Music-4You portal. The registration process on Music-4You requires the installation of a specific software called Wallet. The Wallet is a client side-software that holds the user private information and that is used also for downloading the licenses for a specific content.

### 3.1.1 Users registration

Music-4You users that whish to access to protected content will need to download and install on their computers a special software called Wallet (Figure 3). This Wallet will hold all the private information of the user, the licenses the user possesses to access some content and also is responsible for downloading protection tools.



Figure 3 – The digital Wallet running at the end-user device

The Music-4You registration process (Figure 4) is performed directly on the Wallet on appropriate form (1). On this form the user supplies its user information, such as its username and password, email address and also provides a valid payment method. All this information is stored centrally on the OpenSDRM platform (on the Authentication Server) and a new account is created. After this process is completed with success the user can go the portal main page and login on the appropriate fields.
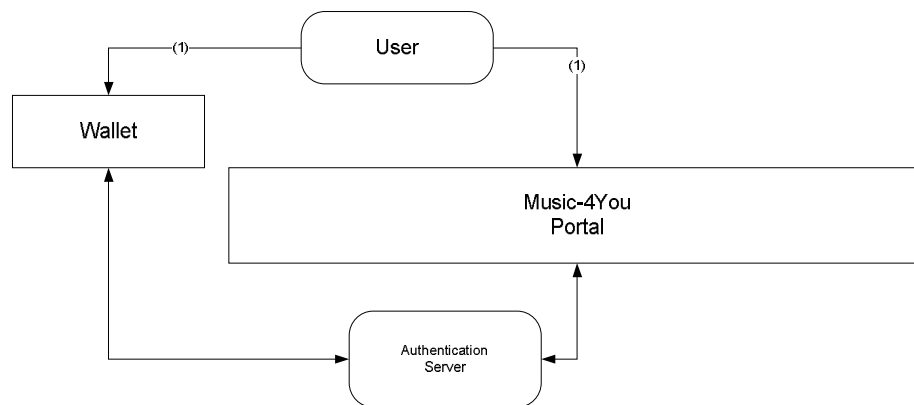
Figure 4 – User registration on the Music-4You portal

The Music-4You portal communicates with the OpenSDRM Authentication Server to validate the user account. This registration process is performed only once – this functionality provides a single sign-on mechanism for various content services.

### 3.1.2 License negotiation

The authenticated users are allowed to download protected content from the portal. The user starts by selecting which is the music track that he whishes to download and a new web-page is presented to him where it will be possible to establish under which conditions the user will get access to the music. It is on this stage that the license conditions are established (in terms of the duration of the license and the number of play counts). The license is bounded to the user and to the specific music track. In the case of more portable devices there was also the possibility to lock a specific music track to just one device or a set of devices owned by the user (Figure 5).
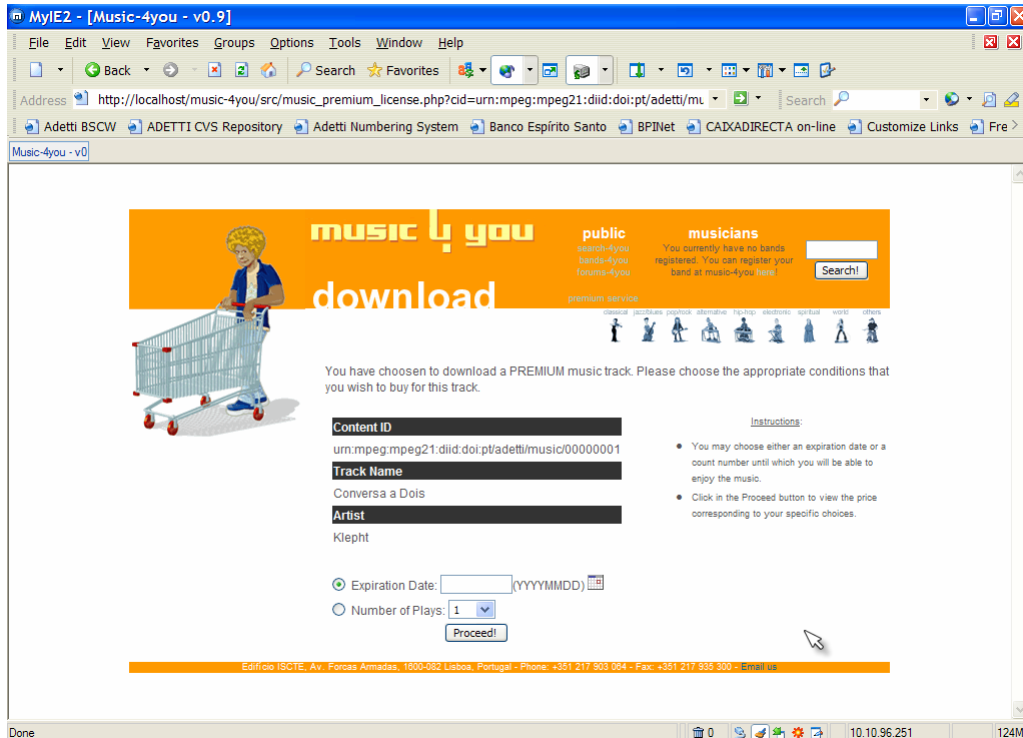


Figure 5 – License conditions negotiation at the Music-4You site

The music track final price is variable, varying in accordance to the licensing conditions established. For instance, a user that acquired a license with no expiry date or no play count limit will pay a much higher price than a user that has bought a license that expires in 30 days.

When the user accepts the price, the Music-4You portal contacts the OpenSDRM Authentication Server requesting the user payment authorization for the content the user has acquired on the portal. This payment authorization is then passed to the OpenSDRM Payment Gateway that validates it and captures the user payment. After the payment is processed with success the license is produced and stored on the OpenSDRM License Server. The user can afterwards download the protected music track from the OpenSDRM Media Distribution server. There is also the possibility for the music track to be streamed directly from the server to the final user.

### 3.1.3 License download

In order to play a protected file the user needs a couple of elements: a compliant MPEG-4 IPMP-X enabled player (can be obtained on the Music-4You portal), the Wallet installed and running on the PC, the appropriate IPMP tools needed to gain access to the content and the license. Some of these elements, such as the player, the Wallet and the default IPMP tools, can be downloaded from the Music-4You portal and installed on the user's PC. If the protected content needs a different set of IPMP tools they are automatically downloaded and installed (2) on the player when the user starts listening to the music (Figure 6).
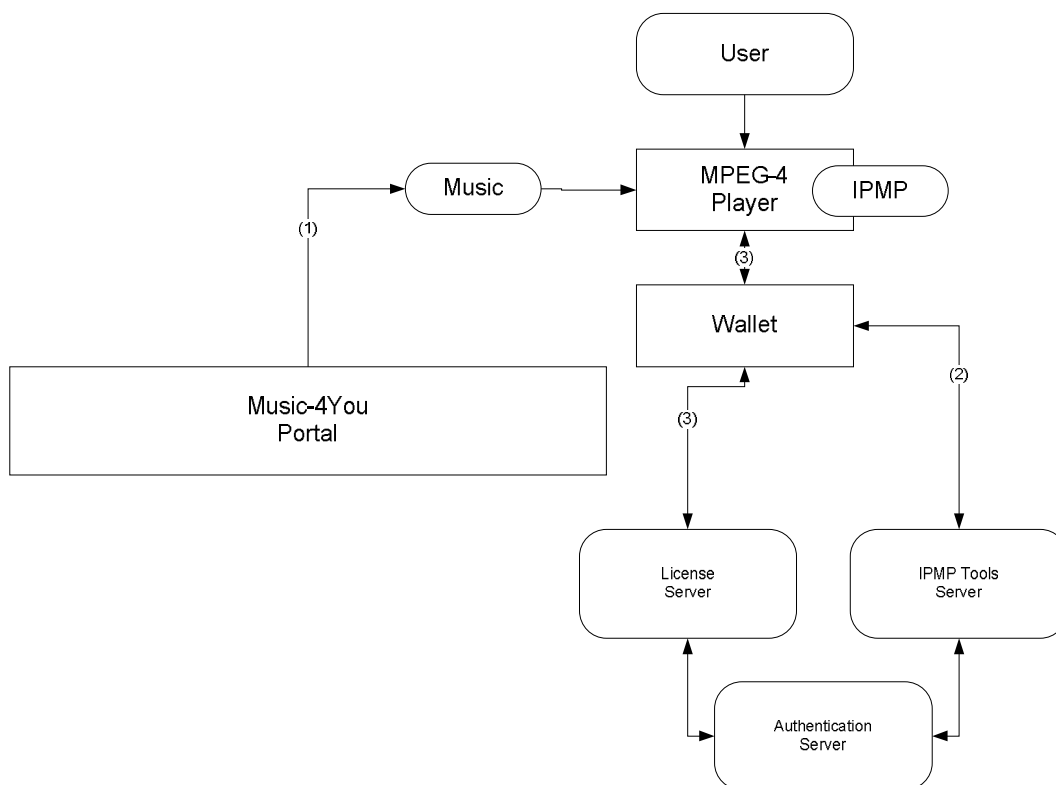


Figure 6 – License download

When the user downloads a protected music track from the Music-4You to its PC (1) and tries to open it with the player, the player checks that the music is protected, retrieves its unique identifier and connects to the Wallet requesting the appropriate license (2).

The Wallet can proceed in two different ways: either the Wallet has already a license stored for that music, it returns that license to the player and the music is rendered. If not, the Wallet contacts the OpenSDRM License Server and asks for the license that corresponds to the user and the music track. If this license exists, it is downloaded by the Wallet and passed to the player that renders the content. If an appropriate license cannot be found, or if the license has already expired, the content is not rendered and the player warns the user about this fact.

## 3.2 Content providers functionalities

As it was previously referred, Music-4You provided the possibility for content providers, in this case music bands, to publish their own work on the portal without having to invest on their on web-site. They could just go the web-site, register themselves as a music band and start uploading their content.

When a band is registered on the Music-4You portal, it is automatically created a band's homepage with information relevant to that particular band. The main functionalities provided by Music-4You for content providers are: content uploading and management and Band information registration and management.

### 3.2.1 Content uploading and management

Music band's can register on the web-site and upload music to the web-site (Figure 7, 8). The band administrator can choose either to make the music available for free for the portal users or he may choose to protect it. When the content is uploaded (1) it is automatically categorized (2, 3) and placed on a proper portal section (4).
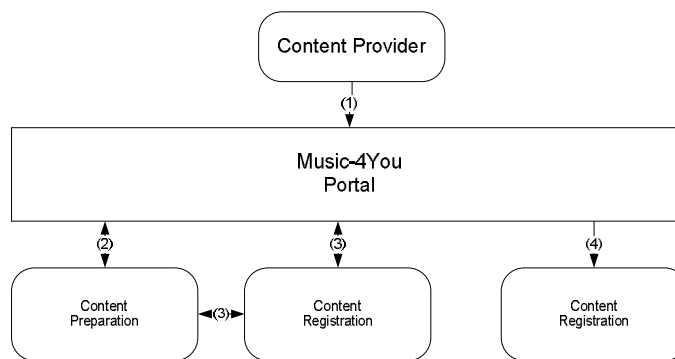


Figure 7 - Content uploading and registration

The format accepted by the Music-4You portal is MP3, and is the MP3 file has already some IDv3 tags; they are automatically loaded to the portal. The Music-4You portal also allows the band's administrator to manage the band's content on the portal, editing the music title and further details.
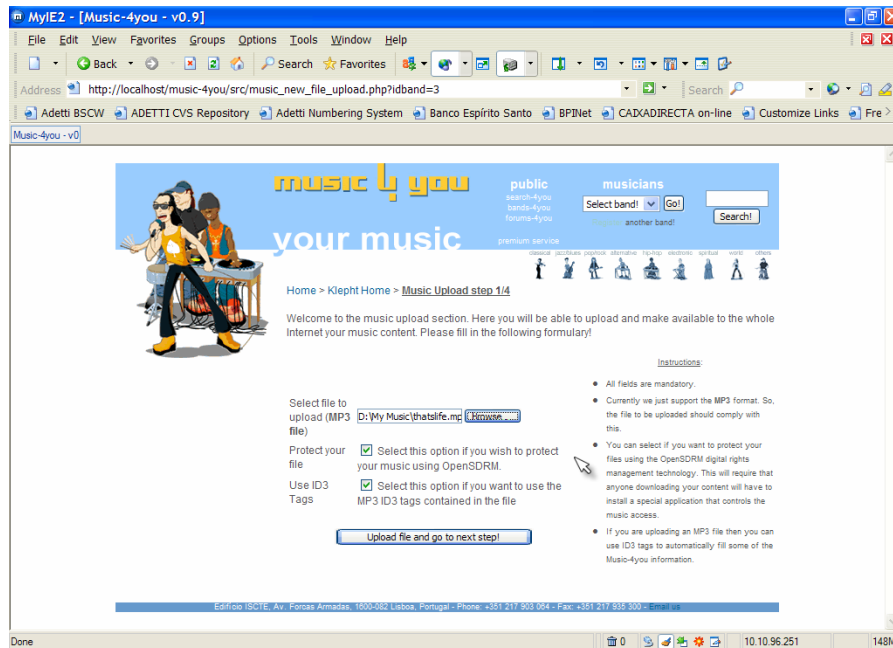


Figure 8 - Content uploading and registration at the Music-4You portal

### 3.2.2 Band information registration and management

This includes the registration and management of information related to the band news, information about the band's agenda (public appearances, records releases, etc.), the band's contact (the contact point of the band that can be used to hire the band for concerts), links relevant to the band, band's discography, band member's information and band's pictures (Figure 9). All this information is available on the portal for the general public, and can be only managed by the band's administrator registered on the portal.
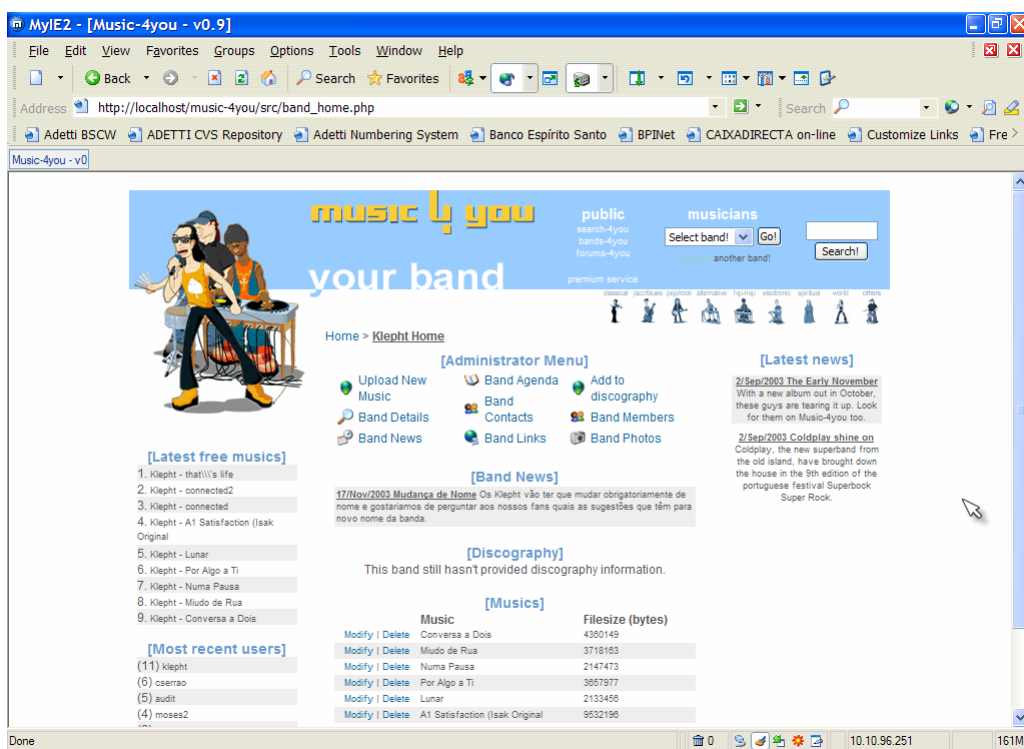


Figure 9 – Music-4You Band Management

## 4.   CONCLUSION

In terms of Electronic Commerce, the Music-4You portal represents an important leap when compared with other existing similar music portals, in which the basic business model is the traditional "buy once, listen forever". Music-4You had the concern to offer to the final users the possibility configure the licenses granularity and vary the final price according to the conditions established by both. Therefore Music-4You offers E-Commerce business model flexibility and extensibility to multimedia content providers.

On the other hand Music-4You offers the possibility to non-commercial bands, with low resources and low effort, to promote their work on a large scale basis and at the same time to protect their content from copyright infringements. Music-4You however doesn't force that all the content on the site has to be protected – if the content provider wishes, content can be made available without any protection technology.

The Music-4You portal was launched on the beginning of 2004, at the MOSES project end, and was fairly promoted on the media. Music-4You major functionalities were presented on some public exhibitions. This was quite useful to create the necessary portal awareness and attract users and bands to test it. Although on a first stage the number of users and bands has grown rapidly, after the project ended the portal as stabilized and maintained its number of users.

In terms of the content interoperability goal, this was not entirely achieved due to the fact that a new player had to be developed to support the MPEG-4 format and the integration with IPMP-X. This was not entirely a drawback since MPEG-4 is a full-featured multimedia format that can contain on the same file

images, audio and other types of multimedia objects. This permitted Music-4You to add value to the music tracks – it is not just the music itself, but also band images and even the music lyrics. This was a good incentive for users to download and use this new player.

Another aspect of the system presented is the need to install an additional software component called Wallet, to access to protected content. This might work as drawback since users are often resistant to such installations. However, this component is vital on the system to hold user private information, such as payment instruments and licenses that are stored on a protected component.

Despite some of the problems that were referred on this paper, Music-4You represented a turning point in the Electronic Commerce of digital music. The possibility to aggregate on the same portal both content providers and users, plus the possibility to use a protected format that supports interoperability between players that can help to boost the business.

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