A New Generation Digital Content Service for Cultural Heritage Institutions

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Abstract. The evolution of semantic technology and related impact on internet services and solutions, such as social media, mobile technologies, etc., have determined a strong evolution in digital content services. Traditional content based online services are leaving the space to a new generation of solutions. In this paper, the experience of one of those new generation digital content service is presented, namely ECLAP (European Collected Library of Artistic Performance, http://www.eclap.eu). It has been partially founded by the European Commission and includes/aggregates more than 35 international institutions. ECLAP provides services and tools for content management and user networking. They are based on a set of newly researched technologies and features in the area of semantic computing technologies capable of mining and establishing relationships among content elements, concepts and users. On this regard, ECLAP is a place in which these new solutions are made available for interested institutions.

Keywords: best practice network, semantic computing, recommendations, automated content management, content aggregation, social media.

1 Introduction

Traditional library services in which the users can access to content by searching and browsing on-line catalogues obtaining lists of references and sporadically digital items (documents, images, etc.) are part of our history. With the introduction of web2.0/3.0, and thus of data mining and semantic computing, including social media and mobile technologies most of the digital libraries and museum services became rapidly obsolete and were constrained to rapidly change. A tremendous push on renovation has been directly driven from the young users that expect to find in accessing and using cultural heritage and educational services (such as, digital libraries, museum, and educational portals and tools) the same mechanisms and dynamisms they are used to find in games and social networks. In fact, it is quite common to see teenagers sharing discussion groups on school aspects on Facebook with their teachers, and/or to get from professors demonstrators about experiments as links to play videos from YouTube portal. On the facts, at the present, we are in the phase in which the most

famous cultural institutions have already partially adequated their services and offers to exploit the new technologies and opportunities, e.g., getting visibility on the major social networks. For example, on top positions in terms of Facebook likes and/or Twitter followers we have: MoMA, Metropolital Museum, Musée du Louvre, British Library, Guggenheim Museum, Centre Pompidou, British Museum, Getty Museum, Los Angeles, Smithsonian Institution, etc. In most cases, these institutions use social media solutions as promotional channels rather than taking the opportunity of exploiting the semantic computing innovations to provide new services and tools for their customers, for example to increase the user engagement. The last step would imply to dominate a higher level of technology awareness and it is much more complex to be conquered, in terms of both acceptance and investments. Success cases include: museums that have included interactive installations, mobile tools with augmented reality for supporting the visits, interactive content for mobile devices, the exploitation of geolocalized information, etc. Thus addressing different phases in which the user interact with the digital content in virtual and physical scenarios; before, during and after the visits in the museum. A faster and more complex evolution is observed for digital libraries and archives; which are cultural institutions in which the final experience start and finish on internet, rather than physical such as in the museums. Recently, new ways of fruition of cultural heritage digital content on the web have been proposed in which both content and users find their reciprocal relevance, and advances in establishing/creating stable relationships. The attention of professional users is focused on content oriented web sites, and in most of them several forms of content aggregation are offered. Several web portals and social services are growing as portals/engines, for example, collecting content metadata of articles, video, etc., indexing citations; thus, indexing cultural heritage metadata. Those portals and services are facilitators for the content identification, and the real content files/items, the digital essences, are only referred from the metadata; real files are only accessible from the original portal (web site, archive) of the content provider. This happens for many digital libraries, such as Europeana and partially for ACM, PubMed and IEEE and the other portals of publishers.

In most cases, the cultural institutions see their content ingested, promoted, distributed and exploited by final users via online commercial partners (e.g., google, amazon, YouTube), that may take benefits to commercial resell and/or via advertising. Most of these services are extremely general purpose and gradually exploit semantic computing technologies taking into account user profiling and providing suggestions and recommendations, also reselling ads spaces in web pages. In most cases, the benefits obtained by final users in exploiting the social networks services have motivated the users to use largely them, also as early solutions for professional usage: for example for content based service promotion, sharing content with students, distribution and discussion channel, etc.

Recently, professional users are unsatisfied by those general purpose social media solutions since they do not provide satisfactory facilities to perform advanced semantic aggregations and associations, learning management, that are, in effect, needed for educational and professional purposes. This new trend has determined the creation of a number of more specific and tuned services that in the case of digital library for arts

can be identified as: Artyčok: http://www.artycok.tv, Digital Theatre: http://www.digitaltheatre.com, Digital Dance Archives: http://www.dance-archives.ac.uk, SP-ARK: http://www.sp-ark.org, etc. The needs of more sophisticated content services is becoming more sophisticated, pretending from the content and user services new social and semantic features with collaborative tools, aggregations tools, linked data, connection with social networks and mobile devices, augmented reality, navigation tools, etc.

In this paper, and overview of ECLAP (European Collected Library of Artistic Performance, http://www.eclap.eu) is presented. ECLAP has been set up as co-funded by the European Union ICT Policy Support Programme as part of the Competitiveness and Innovation Framework Programme, Theme CIP-ICT-PSP.2009.2.2, Grant Agreement N°250481. The main goal of ECLAP is the content aggregation and metadata semantic enrichment for Europeana. Europeana http://www.europeana.org collects cultural heritage metadata coming from several aggregators (as ECLAP), institutions, universities, foundations, museums, schools of art, that represent the European cultural heritage. Europeana foundation and portal do not collect content items files, but only classification information (i.e., metadata), including the original URLs to the content. These URLs refer to the original content owner and/or to the content aggregator. According to this, ECLAP performs cultural enrichment and promotion of European culture, and provides support for relevant improvements in learning and research in the field of performing arts. At the same time, ECLAP is a live lab in which several new technologies and solutions in the area of semantic computing and social media have been developed and put under trial of the final users and institutions. On this regard, ECLAP is open for both content and research results experimentations, and presently comprises more than 35 prestigious international institutions; 18 of them started since ECLAP early set up in the 2010, others joined ECLAP successively as affiliated and networking partners of ECLAP. They are representative of many different cultures and countries of the world such as: University of Florence, Dario Fo & Franca Rame Archive, University of Rome La Sapienza, Liber Liber, Fondazione Fabbrica Europa, Italy; Beeld en Geluid (Sound & Vision), University of Amsterdam, The Netherlands; Escola Superior de Música e das Artes do Espectáculo do Porto, Portugal; Festival International de Films de Femmes de Créteil, France; The Institute of Polish Culture University of Warsaw, Grotowski Institute, Poland; Museu de les Arts Escèniques Institut del Teatre de Barcelona, Universidad de Castilla La Mancha, Spain; La Bellone House of Performing Arts, Belgium; MUZEUM of Ljubljana, Slovenia; Hungarian Theatre Institute, Hungary; Museum of Archaeology & Anthropology, University of Cambridge, University of Glasgow, Coventry University, UK; Spain; Festival Cielos del Infinito, Chili; University of South Africa, South Africa; Department of Information Systems for Arts and Humanities, Russia.

The paper is organized as follows. Section 2 provides an overview of ECLAP. Section 3 presents the ECLAP aggregation tools. Mobiles tools are described in Section 4. In Section 5, the ECLAP services as collaborative and social tools are commented, putting in evidence their added value. Some notes on administrative tools and related

data about ECLAP usage are reported in Section 6. Conclusions are drawn in section 7.

2 ECLAP Overview

ECLAP offers a wide support to cultural institutions on performing arts in moving towards the direct exploitation of new technologies for digital content management for different purposes that range from direct: dissemination, promotion towards Europeana, open data, social media, education and training, to the better understanding of new technologies and solutions. To this end, ECLAP is both a Best Practice Network and provider of Content and User Services (see Figure 1).

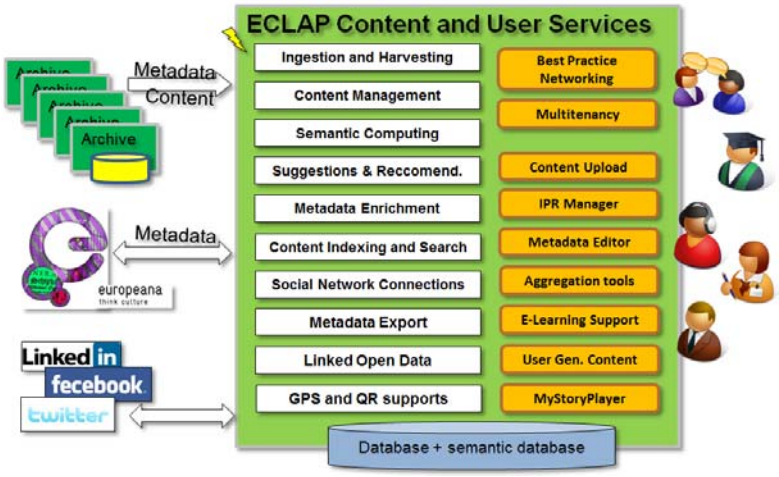

Fig. 1. ECLAP Services: back end and front end.

As **Best Practice Network,** ECLAP consists of a number of working groups that analyse the state of the art and identify the best practices for the creation of guidelines to cope with technical and strategic problems of the sector. To this end, three main ECLAP Working Groups (with corresponding blogs and forums) have been set up to cover the areas of: digital libraries and models for performing arts content [1],, intellectual property management and tools [2], and digital content based tools for teaching and learning of performing arts in the new era [3]. Other Working Groups can be activated on ECLAP to cope with other topics. The ECLAP networking activity is grounded on the ECLAP community of experts that work on the working groups and meet each other at ECLAP workshops and conferences, such as ECLAP 2012 in Florence, Italy [4], ECLAP 2013 in Porto, at Europeana meetings, and in other conferences of the sector. For facilitating the networking and discussions, ECLAP is also a repository of technical documents, demonstrators, best practices and standards that can be used to better understand the sector problems and find corresponding guidelines, state of the art solutions as well as future activities and project proposals.

On the **cultural content side**, ECLAP is bringing together hundreds of thousands of the most relevant performing arts content items (often previously inaccessible on Internet), including collections on theatre, dance, music, cinema and film. These consist of performances, master classes, lessons, educational material, festival, costumes, sketches, scenography, lyrics and posters. Managed file formats include video, audio, documents, images, animations, playlists, collections, annotations, 3D, interactive content, Braille music, e-books and cross media interactive content, serious games and tools [5].

Fig. 2. ECLAP Portal.

The ECLAP **Content and User Service** exploit the use of advanced social media and semantic computing technologies and solutions for the content enrichment, aggregation and distribution of rich multilingual performing art content towards multichannel: PC and mobiles (see Figure 2). Presently, ECLAP distributes more than 110000 distinct objects, up to 13 major metadata languages, towards a community of about 2000 registered users, world-wide distributed, while the largest communities of users and connections come from Italy, UK, USA, France, The Netherlands, Portugal and Slovenia. This means that ECLAP users can search from a unique service both technical documents and performing arts content. This approach may be an advantage since in many cases the distinction from technical documents and performing arts content is not strict. For example, these aspects are mixed and blurred in backstage technical documents, interviews, educational content, comments, and web pages. This also means that, for this purpose, the indexed content on ECLAP is heterogeneous and cross media, ranging from video, audio, documents, images, to blogs, web pages, collections, play lists, annotations and tools [6]. In fact, at each query the ECLAP query service provides an answer in terms of faceted results including different content types and formats. The indexing and search facilities of

ECLAP provide support for fuzzy correction of typos and for advanced queries, with and/or operators, substrings, perfect matching, etc. [6]. ECLAP offers a wide range of innovative solutions and tools to support cultural institutions in managing, providing access to and disseminating their online digital content collections to users in 21 languages. The ECLAP major content services are reviewed in the following.

Managing content. ECLAP provides services and tools for automated content ingestion, adaptation, metadata ingestion and editing, semantic information extraction, indexing and distribution by exploiting the most innovative and consolidated technologies [7]. The content ingestion may start taking metadata and content files from any kind of archive and/or database or by providing them via FTP and/or web based utilities. Once the metadata area ingested, an intelligent content processing back office is capable of collecting and automatically repurposing content for distribution via pc and mobiles, coping with more than 500 digital file formats. According to ECLAP workflow, the obtained metadata are sent to Europeana only after that the metadata have been enriched and linked to a reachable digital resource and when the IPR details have been finalized, with needed quality level. The IPR management and the assignment of access restrictions is a way to enable the increment of possible available content on the internet. Permissions as IPR models can be enforced on content by each ECLAP institution (content owner), by using the IPR Wizard tool [5].

ECLAP supports the institutions in all their activities: metadata selection and mapping, content ingestion, to the definition and management of permissions and licenses on contents, and finally managing their users on ECLAP services.

An ECLAP IPR Model can be associated with each single content or collection. The IPR model has been derived from the work performed on MPEG-21 [8]. This means that access rules are imposed to restrict and regulate the content access taking into account: content format (video, audio, document, etc.), actions/rights (play, download, stream, embed, etc.), device (PC, mobile, mobile application), users' type (private, public, educational, etc.), location (nationality, university, ..), resolution (HD, high quality, medium, low, etc.). This model for content distribution with IPR management, is associated with a strong legal model as Terms of Use and privacy policy (see them on the portal). This allowed ECLAP to have in two years of content ingestion and distribution only one IPR resolution to be managed, that have been solved in a couple of emails, despite to the high number of newly published and accessed content items, and content providers involved, coming from different nationalities.

The ECLAP content management performs a wide range of metadata enrichment activities (based on AXCP media grid [7]). The typical **metadata enrichments** performed by ECLAP can be the addition of technical descriptors of source files, the addition of more languages, the geo localization passing from location named into metadata and descriptors to formal GPS position, the production of QR codes for museum inspection and linkage (see it as augmented reality first step), the content aggregation, the addition of comments and tags, the association of taxonomical classification, the establishing of connections with dbPedia open data, the addition of a formal IPR license descriptor, the association of univocal date and time, the association of an UUID (permitting the management of any kind of identifiers that may be

available for the single content element such as: ISBN, ISAN, ISMN, private coding IDs, etc.), the production of LOD model, the content aggregations, etc. [9]. As a result, the content is described in terms of metadata based on the so called ECLAP semantic model which is much richer than the ECLAP ingestion model [10].

Therefore, the activity of **content publishing** to **Europeana** and as **Open Data** is very simple for the institutions since the content can be automatically ingested in several different manners, processed and automatically adapted for format, metadata and IPR, to arrive to be published as full content information on ECLAP service portal, while a subset of the metadata are provided to Europeana according to the EDM, Europeana Data Model [11]. The enriched metadata are also made available in different formats (as LOD, OAI-PMH, DC, etc.) for the former institutions (content providers) and for massive diffusion and promotion. Thus, the content published on ECLAP is widely indexed on all major engines and can be accessed from any kind of device, from PC, TV and mobiles. The ECLAP service also allows to update and review the extended metadata, for example to make corrections, add more details and/or additional languages, create links with other sources, etc., and automatically provides the updates towards Europeana, LOD, ECLAP, mobile, etc.

The ECLAP content model on WEB also allows the embedding (Copy HTML) of ECLAP content in third parties portals. The institutions may exploit ECLAP as streaming service for the audio-visual content by integrating in their lighter servers the provided HTML code of the ECLAP players. Moreover, ECLAP also provides infrastructural connection for direct promotion of content towards a large number of social networks, including: Facebook, LinkedIn, Diggs, Twitter, etc. The above described mechanisms can be exploited for promoting content on Internet and among other institutions.

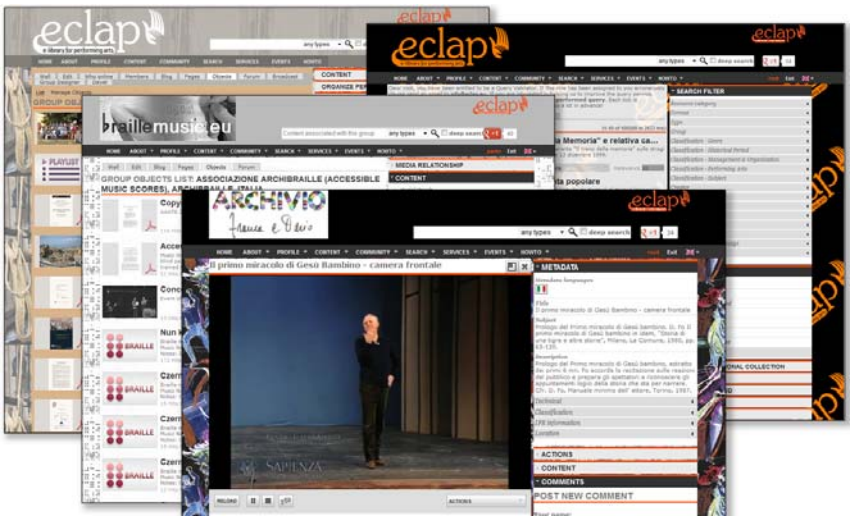

Fig. 3. ECLAP: institutions' groups and channels,
e.g., BrailleMusic and CTFR of Franca and Dario Fo.

On ECLAP, each content provider may have its own distribution channel/group (including a forum and a blog in addition to the space for their content collections, and the groups can be open, moderated or private) with the possibility of customizing the group user interface according to their logo and colours (see Figure 3). This **multitenant modality** permits at the institutions to see ECLAP as a non-intrusive service, to reinforce their brand and at the same time to exploit and experiment a number of innovative ECLAP tools, to accelerate the promotion exploiting ECLAP social media, LOD and Europeana channels, and ready to access new users for their content. Moreover, the ECLAP solutions is also very interesting for their users, that may get in contact with other colleagues, and may get a wider set of content in response to their search and queries, and may establish connections among different content belonging to different collections and to Europeana.

3 Content Aggregation Tools

Once of the most interesting features of ECLAP consists in the possibility of creating content aggregations. Content aggregations can be: playlists, collections, e-learning courses, annotations, and audiovisual synchronizations [10], [12]. The ECLAP service allows the users to directly create their own content aggregations and share them with other users. On the other hand, the automated production of content aggregations is possible, for example by providing content that reach the ECLAP ingestion service suitably tagged as belonging to the same collection, e.g., using a collection ID.

In ECLAP, the **Collections** are simple aggregations of ECLAP content that may be personally defined for private use by each user and may be published and shared to the others. During the collection publishing, the user has to assign classification and identification metadata. This allows to consider Collection as regular content and to export them as linked open data, as well as to provide them as aggregated content towards Europeana EDM, and thus are part of the ECLAP semantic model.

The ECLAP **Playlists** are used to create specific collections of audiovisual content, e.g., a set of audio tracks, videos and images, to be played in a given order. The playlist execution consists in the sequential play of the single content objects. In ECLAP, the playlist supports the inclusion of images and audiovisual segments of the media. The same media can be included in several playlists and/or any time segment can be used in any playlist. The execution time ordering for each playlist object is user defined. In ECLAP, the user may put in the play list a small segment of video and audio, without the modification of their corresponding files. The access to the video segment is performed in real time by the video player as execution time only. This permits to create e-learning units without the need to slicing audiovisual. The semantic of ECLAP playlist allows to play the audiovisual content according to the identified sequence only once or in a continue loop, from last to the first forever. From the operative point of view, a user can take from the portal any audiovisual segment to compose its own playlist. The operation is performed on a specific audiovisual flash player in which one can select the start/end of the audiovisual segment. In the case of images, a duration time of their permanence on screen can be also set.

Once a play list is complete, the user may decide to publish and share it on ECLAP. In this case, metadata and taxonomical information are requested. The published playlist can be aggregated in Collections and into Courses as basic elements. Please note that the association of metadata keeps unchanged the metadata associated with the objects composing the playlists.

On ECLAP, e-learning C**ourses** are defined as a set of content objects (audio, video, collection, playlists, web pages, blog, events, etc.) organized in lesson units and glued by descriptive guiding text of the course. A lesson unit may include also links, external resources, questionnaires, soundages, etc. The courses have specific mechanisms to control their access from the students according to the e-learning/distance learning certifications models and legislations. These mechanisms allow controlling the effective access and fruition of the single lesson unit. To this end, a specific back office is provided (for teachers, students, coordinators, tutors, administrators, etc.) to manage the course subscription, monitoring student progresses, etc., as in regular learning management systems, LMS.

A more sophisticated aggregation tools has been derived from MyStoryPlayer tool [12]. With MyStoryPlayer users may define **annotations and/or relationships** among audiovisual content segments (image, video, audio) (see Figure 4). For example, defining sequences of video, synchronized execution of video segments, annotation of an audiovisual segment by using another segment, etc. The associated comments and tags to the relationships can be used to search, filter and describe the annotations. This approach allows creating multiple media executions and comments that can be used for training and explaining didactical situations. By using the MyStoryPlayer, an ECLAP user can perform annotations on any audio, video or image located on the portal by using a simple on-line tool. Then the annotations performed may be played/executed by the MyStoryPlayer tool, where a full interactive player allows navigating on the several relationships established among the audiovisual content elements on ECLAP. The activity performed on the audiovisual executions, including the clicks and jumps from one video segment to another, etc., can be recorded as personal experiences (paths) and shared with the other users, for example for educational purposes. The semantic model in terms of RDF triples allows searching for annotations and it is sent to the MyStoryPlayer according to contextualized SPARQL queries [13]. The semantic relationships are also published in terms of LOD and on Europeana EDM, and thus are part of the ECLAP semantic model. As for the other features like play lists and collections, no alteration is performed on the original file, thus no specific IPR authorization is needed to use them in MyStoryPlayer.

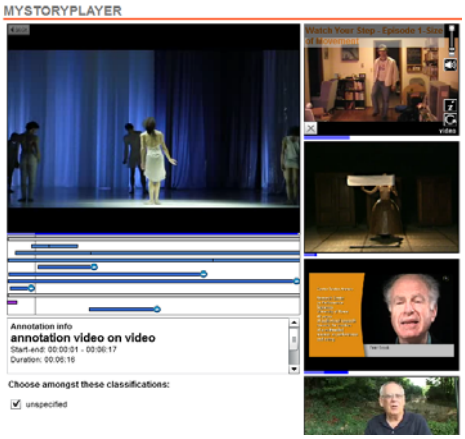

Fig. 4. MyStoryPlayer.

4 Mobile Tools

The content access from mobile devices is presently a facility that is given for granted by many institutions. Most of the present smartphones and tablets are capable to access at complex web pages to play video and open large documents. On the other hand, in order to use these devices for educational and professional usages several other features have to be available. To this end, in ECLAP the Content Organizer mobile application has been developed. The Content Organizer allows at the final users to get access content from multiple cultural heritage portals according to the IPR models, saving the registration and authentication credentials. It is available for iOS, Android and Windows Phone and it allows users to download and organize content in the mobile device. The content download may start from ECLAP portal as well as from QR code. Once the content is downloaded to the mobile, the user can manage on the mobile device, performing search, browse, tags, and get GPS and general information, etc. The Content Organizer may organize and play ePub formats, video, audio, cross media content, images, documents, pdf, collections, etc. The content can be browsed for groups, portals, taxonomy and personal tags. The latter are also used for creating a personal organization. The content is indexed and can be accessed via GPS locations, permit the upload of content from their mobile, etc.

5 ECLAP added value collaborative and social tools

One of the challenges of ECLAP has been the setup of a service and environment in which professional activities would be facilitated by the mediation of computer supported collaborative tools. In fact, in most cases content aggregation portals are simple ingestion tools in which the metadata are ingested and then passed to Europeana. In the case of ECLAP, the best practice network and the service portal have the potentials to continue at providing the services for a longer time. In terms of services for the final users, ECLAP is providing a set of added value tools and services that motivate the institutions and final users to continue stay the usage of ECLAP.

Networking and connections with colleagues. ECLAP service allows the user to get registered on groups and channels, on which blogs and discussion forums are available. Moreover, the comments and votes can be associated with each content and web page. This allows creating a collaborative environment in which different kinds of discussions may be hosted. These mechanisms are also supported by the possibility of importing contacts from social networks and by the possibility of sending direct recommendations and messages, and establishing stable connection with other colleagues. **User recommendations** and suggestions. In different contexts, the ECLAP users receive suggestions about content and/or colleagues of their interest. This service is based on estimating similarity of those elements with their static and dynamic profile [14], thus contextualized suggestions on the basis of general interests and recent behaviour on ECLAP. This feature is strongly appreciated by ECLAP users, since the suggested contents are among the most frequently clicked. Suggestions are also provided by means of regular newsletters via mailing. **Content management**,

publication and promotion, publication and update on Europeana, publication of LOD, distribution towards mobiles, content and video streaming for third party portals via embedding, IPR management to control content access, multitenant solution for content provider branding of the group, connection with social networks for content promotion (contact importing, social icon and recommendation towards social networks such as: YouTube, Facebook, LinkedIn, Twitter), etc. The automated content ingestion and processing facilities based on AXCP belong to the content management [7]. They are provided for both massive professional and user generated content. **Content aggregation tools**, which can be used for personal purpose and for educational access and content distribution, such as: playlist, collection, MyStoryPlayer, courses, Social Graph. This feature is associated with the several facilities for content enrichment (addition of semantic information, links, comments, annotations, contextualization, tags, votes and the addition of other languages for metadata). **Search facilities** with its indexing, advanced features and faceted results on all the extended metadata (more than 500 metadata fields for each content) is a very interesting and requested feature [15]. Taking into account that ECLAP provides a much better search quality with respect to the similar services accessible for cultural heritage content provided by the former institutions. This is due to the fact that: most of them do not take into account full text multilingual and semantic search. Moreover, only a small part of the ECLAP semantic model metadata are accessible on Europeana. **Social Graph tool** (see Figure 2) that allows seeing, explore, play and browse the relationships among users and content. The Social Graph is directly accessed from the home page of each registered user. The users have the possibility of learning more about the relationships established among content and those among users, thus stimulating them in creating more connections among content and users. A large number of new relationships are going to be added on this semantic tool.

6 Administration and Monitoring Tools

In ECLAP, a relevant effort has been dedicated to provide at the single institutions and group a set of tools for managing and monitoring the development of their content and activity for their groups/channel members, and social network analysis. The content management allows performing single and massive editing and changes on content associated with the group. For example, to change the taxonomical association to all content elements of a collection, the change of the IPR model for a large set of selected content, etc.

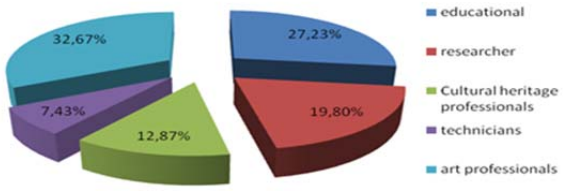

Fig. 4. Distribution of ECLAP users profiles.

Regarding the group's users, each group manager can pose specific queries. For example, to understand which are the most active users, the most accessed content, the most active periods, the commonly accepted content types and topics, the most interested devices, the collective intelligence profile of the registered users, etc. In Figure 4, the distribution of the active 1800 ECLAP users is reported, where: educational are teachers and students; cultural heritage professionals are editors and archivists; and art professionals are performers, directors, composers, etc. The ECLAP users remain on the portal for about 5 minutes for each session, and during their permanence spend a large part of their time playing video, reading documents and web pages, 6% of them perform queries, and recently the 10% of them navigate into the social graph. In terms of areas of work, they dedicate their time at the content workflow for the 55%, at content access 20%, networking the 11%, query and search 4%.
In terms of content, the ECLAP users present an equal interest on content and informative web pages. Among the content accessed and downloaded, the most requested are PDF documents with 60%, while online video streaming and documents view provoke similar interest of about 18%, images are seen in the 55% of the cases. These data have also to be weighted with respect of the offered population of the 112000 content elements that present: 65% images, 4.5% of audiovideo, 1% of web pages, 29% of documents.

7 Conclusions

The strong technological evolution in the field of digital media, digital library, social networking and cloud computing have determined a strong push in the renovation of cultural heritage solutions for archival institutions and museums.
ECLAP is presently used by more than 35 institutions mainly from Europe. It may be regarded as a new generation of digital content service tools for cultural heritage institutions that allow them to exploit specific and advanced benefits from semantic and social media technologies: networking and social networking, automated user recommendations, automated content management, advanced and collaborative content aggregation tools, IPR management, advanced indexing and search facilities, social graph and LOD, and mobile applications. These advanced features are also supported by precise and massive administrative and monitoring tools, which include facilities for social network analysis, and statistical data analytics.
ECLAP can be regarded as a vertical service for performing arts institutions, while it could be easily replicated for several other cultural heritage single institutions and/or aggregations of them. Moreover, some of the ECLAP tools (IPR Wizard, MyStory-Player, Social Graph, automated back office based on AXCP [7], MINT metadata mapper, etc.) can be also adopted in other services.

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