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Services between video producers and broadcasters.

Do we need a standard?

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***Abstract*— The need to create a standard which unifies data transfer between producing companies and broadcasters of live programs will be discussed in the article, as well as examples of services which may be implemented, and the contribution of all parties involved in the processes for carrying out that standard. In this work, a study is conducted on added services which producers may provide to the broadcasters about content; a system is proposed by which additional communication expenses are not made and a model of information transfer is offered which allows low cost developments to supply new media platforms.**

Keywords-component; audiovisual standard; media production; media distribution; content delivery.

I. INTRODUCTION

The model change which Digital Terrestrial Television (DTT) is causing, IP-based television in all its forms or simply diffusion on Internet is provoking on one hand, that traditional broadcast companies look for new markets with new technologies and on the other hand, other companies have started to broadcast material by these new means with only having rights and not necessarily licenses, as in the case of broadcasting.

On the other hand, the proliferation of chains and transmission channels have consequently put into motion, as a consequence, the abandoning of productions, and concentration on transmission itself while at the same time, a large number of companies specialized in production have emerged which generate cheaper content and which can be commercialized on different supports and technologies.

The spreading of new systems of broadcasting and distribution of multimedia content has had as a consequence a larger need for aggregation of data and metadata to traditionally based contents of video and audio supply. Broadcasters have to add value as data or interactive services to the classic programmes. Broadcasting chains of this type of channels have become overwhelmed by the quantity of resources, infrastructures and development needed for these channels to provide information; channels often lack knowledge about subjects they broadcast because production is performed externally. Knowledge of the material is passing to production companies who in fact fully know the topics of the programs.

When an event will be transmitted, producer companies usually send data or specify the data format with the communication link and parameters to use during the event. Broadcasting companies have to adapt and/or develop their IT and communication infrastructure in order to receive the data associated to the program itself. Data have to be transformed, filtered, processed and adapted for each technology. These processes increase the production cost for the events, and this events usually occurs during a short period of time (normally hours).

In order to avoid this kind of shortcomings, several recommendations and standards have been created to exchange metadata between production and distribution of stored programs. The problem lies in live programs, which in many of them, data is a very important part for understanding the event to be broadcasted. Producers sometimes offer data to channels but most often, channels are not able to face developments which are required, due to above all, uncertainty of the return in their investment. The solution to this problem includes reduction of implementation costs for development of services on these new platforms.

The service types could be: graphics, assistance to commentators, subtitling, file, advertising, education, etc., for different programmes types; sports, live music, political elections, etc.

The general model is based on:

- Data model: based on XML documents.
- Application; receive and processes de XML files.
- Communications: data inside the same video transmission.

The cost reduction for interactive programmes and data delivery will increase the number of live events with associated data, educational content or services for the viewers.

Audiovisual contents which are generated are sent to different clients by two clearly differentiated types of transmission:

- Delivery in real time (live programs). The video material is coded in MPEG2 Transport Stream for its transfer to the destination by unidirectional data link. On the other end of the link it is connected to a decoder to convert the data stream on base band video.
- Delivery in a file or tape. By this means of delivery, the edited file is sent by disk or tape to transmitting stations.

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Production companies have the data; they are experts in each of the subjects they produce. For data and metadata interchange of taped programs, different standards and recommendations exist, the problem arises in data exchange for live programs in which channels have to adapt their applications or create new ones to be able to give service to viewers.

In this work, the need to create a standard of data service on distribution networks of live programs will be presented based on the following principles:

- The producer of the event generates data, because he best knows the content of the broadcasting.
- Data on XML documents for a better adaptation to existing technologies. This data exchange facilitates creation of new applications.
- Data delivery on the same video networks, so that data go tightly connected to the signal itself with the consequent saving in communications.

In part 2, operational aspects related to the work presented are reviewed, in part 3, an analysis of services which can be offered from producers is conducted in order to present solutions to these services. In part 4 the models which differ from the general model presented in the same chapter are discussed in more depth. The last chapter includes conclusions as well as mention of future work to be developed.

II. DATA CONTRIBUTION

What are metadata? Metadata provide information about data content. Literally, metadata are data further than data, and characterize the content by a group of attributes. These attributes may not only describe content in the form of raw data, meaning, and/or key concepts, content is also characterized in terms of author, quality, production time, format, etc. Also, added information during delivery service (such as receipt information) or information about permits for use of content must be correctly described by metadata. In short, metadata (referring to multimedia/audiovisual content) contain information about all related aspects to the entire chain of content provision.

The fact that audiovisual content has associated metadata offers many advantages. One of the main ones is to be able to make searches for content in a very intense way. Due to the great quantity of information metadata contain, very complex and varied searches may be carried out: by author, description, permits, etc. Another advantage is the ease of content exchange or distribution, since metadata are associated with content, distribution or exchange information is incorporated. Content classification is made easier for storage, for example, perhaps a certain kind of content should be stored in a concrete format so as not to lose quality, while other types of content may be less important. Upon broadcasting, if one does not have rights, this will avoid violation of broadcasting rights.

On several occasions, there has been an effort to standardize the storage process of audiovisual data: for example, code ISAN [1] and code VISAN [2]; technical reports collected by the EBU (European Broadcasting Union) in its projects: TV-Anytime [3], ESCORT [4] or P/META [5]; the BBC data model SMEF [6]; Dublin-Core [7], etc. Many of these proposals have been worked on in parallel and a common representation has still not been reached of this knowledge. On the other hand, each organization has its internal needs of storing certain types of information, needing an effective and efficient data model according to its specific needs.

A. Subtitling

Subtitling is used extensively by television channels to attract public with hearing impairment, viewers who want to learn a language or simply to be able to understand dialog of an event with original sound (opera).

At present, distributors send tapes or discs with series content. This content is usually video material and two audios: original sound and natural. Original sound is that corresponding to dialog in the language of the film while natural is the rest of the sounds different from dialog, this way dubbing companies change the original sound with that of each country. When channels receive material from the distributors, they send a copy of video with low quality to companies specializing in subtitling. These formats integrate the broadcasting system in such a way that audio and video are synchronized with subtitle information.

Two types of subtitles are defined as such:

- Dialog subtitling. This is done so that viewers can see the dialog in the language of the country where the original sound is heard. In the emission, the text forms part of the image and cannot be changed, commands may be sent to change typography.
- Subtitling for the deaf. In contrast to the above, the text does not form part of the image and is shown on the same receptor as the viewer desires. It is closely linked to data transmission in the same video signal.

The arrival of the MPEG compression format has allowed greater possibilities and larger bandwidths to transmit data than analog transmission, this transmission being limited by bandwidth of the vertical deletion lines.

The subtitling regulation [8] specifies how regions, colors, formats etc are to be transmitted in the different transmission forms: DVB-T, DVB-S, DVB-C and DVB-H (terrestrial, satellite, cable and mobile). An exhaustive review of all these can be found in [9].

B. Live Programs

As mentioned above, producers usually make programs for different chains, not only stored programs but also live programs. Clear examples are international sports events, where from a source station images are sent to different chains or broadcasting companies. Chains lower the signal (normally satellite) to place content in the emission system for its packeting and emission continuity. Each of the channels has to adapt the signal arriving to the broadcasting format for which it has acquired the rights to that event.

C. Titling and graphics

In signal production, usually an international signal is generated with titles in English to provide all channels with a

general and uniform heading service. This advantage in production becomes an inconvenience: one is the impossibility of generating differentiated titles because they would collide with those from the original signal when being superimposed on the same image. Filing of the image in the general chain file is another inconvenience since images are already dirty; the value of the image is reduced because the type of production and its possibilities are limited.

To solve the image titling problem, it is usually looked at from different points of view.

1) Signal Production: Whoever produces the signal usually sends two different satellite signals: clean signal and titled signal in international language, each of the chains is free to choose one signal or the other. This alternative has the disadvantage of a cost increase from the renting of another channel for signal distribution. The problem is made worse by the placing of content in high definition because format changes from 4/3 to 16/9, to distribute the titled signal; the signal producer has different alternatives:

- 2 Signals: HD with heading for 16/9 and SD with heading in 4/3.
- 1 Signal in 16/9 with heading in 4/3.

2) Event Broadcasting: In each country, owners of diffusion rights of an event, packet the video signal for transmission with their programmes. The form of packeting differs from the importance which is given to an event so that specific content can be created in each country. This way a range of possibilities exists from coverage with their own cameras in the stadium which are mixed with the general production, to the simple rebound of the contribution signal to diffusion without adding anything intermediary. Each of these possibilities has its advantages and disadvantages with its increases in associated costs and in general headings are usually poorer than international broadcasting.

3) Titling Production: Graphics are made in stations by templates; these templates have a fixed content and another variable. Fixed information refers to common elements which are in the same type of title, which are usually one or sequences of TGA's with the key information necessary so that the mixer can incrust the title into the video. The variable part can be an image (static or dynamic) or a text with the classical characteristics of text as far as font, size, etc.

The work process for titling of an event goes from enumeration all the templates types to be used, the creation of common elements of the titles, and the creation of spaces where the variable data of the models will be placed, characteristics and types of content (e.g. text, images, etc.).

Before the event begins, titles are prepared according to templates and stored on pages or sites to be called from the control terminal where the signal is generated. During the event broadcasting, data is updated and new titles are generated in a dynamic way on pages for emission.

D. New ways of broadcasting

For analog broadcasting, this adaptation is trivial and has been in use for a long period of time, the problem occurs when it is necessary to adapt content to each of the different technologies. If adaptation is only image and sound, it is still simple, but the characteristics which each of the systems provides are not taken advantage of. In the case of digital television, information will need to be provided to feed programs in MHP (Multimedia Home Platform), in the case of the web, the program will need additional data to exploit the advantages which it allows, and similarly for cable, mobiles or future technologies.

To fill these gaps, chains create departments to feed content to these new broadcasting formats and/or adapt their computer systems to select data they need from the production sources themselves. Production sources do not always provide this data and if they do, they are in varying formats, using different communication channels for each event. Channels have to adapt their equipment and communications in each program or event which need this type of data in such a way that they must continuously develop interfaces for content adaptation. These adaptation jobs are carried out by each of the channels, investing in jobs with limited or no return.

III. DATA CONTRIBUTION

The creation of data and additional content to the program signal require a close coordination between producers and broadcasters, modification of channel systems, adaptation of the media and application vigilance during emission. These jobs increase production cost and are not normally undertaken in live retransmissions. Necessary conditions for these services to be offered to viewers pass from:

- Decrease cost of content production
- Decrease cost of system development
- Establish communications systems
- Ensure dissemination of this content during the event.

For this type of work, creation of a team composed of producers, chains, communication companies, viewer associations, etc. would be needed to define the needs of each. In this work, we do not intend to present a whole standard, our aim is to show the need and provide examples, configurations and benefits of the creation and use of this type of standard.

A. Environment

In order to achieve the above mentioned objectives, the purpose of this work is based on three models: data, application and communications.

1) Data: Coordination between production and broadcasting can be avoided if data to be transferred among different agents is standardized; in such a way that each knows the format in which data will arrive at any time. This standardization could be done under any technology; the one suggested in this work is the use of XML documents for this transfer, so that creation of a metamodel would be

necessary to include all possible services which can be offered among all parties. The choice of XML documents would be of great assistance when using the application.

2) Application: To avoid system modification for each event, the application would have the capacity to receive the metamodel which is created for data exchange and also proposes the following characteristics:

- Data filtering, for cases in which channels do not want to receive the shower of data some kinds of events may generate.
- Processing and management of alarms, to determine which of the received data is more interesting and to use alarms which alert different types of events.
- Distribution to different broadcasting media, so that received and processed data can be shown on web, DVB-h, mobiles, etc.

3) Communications: The communications channel between the different parties should be conducted with the same medium, so that communications adaptation will not be necessary for any type of event.

The medium proposed in this work is the use of the same video channel where image and sound is received for transfer of these data. This proposal is based above all on synchronization of data with image and audio, being the same physical medium, data will pass through on the same way, so that synchronization will occur naturally. If it were sent otherwise, synchronization would be necessary by insertion of common time codes. This solution would require the slowing of material which arrives before, if data arrive before, the slowing is simple, the problem occurs when video arrives before because this causes serious inconveniences for emission. The MPEG2 TS, is used not only to carry compressed images in MPEG2 but also for other types of formats such as MPEG4 or JPEG2000[15], this is being studied by the European Broadcaster Union (EBU) for its use in professional distribution links.

B. Services

To be able to affront the data model which can serve producers as well as distribution chains, analysis of the type of services which can or usually are offered by producers is necessary.

1) Assistance to commentators: In certain events, commentators have screens with data at their desks which assist them during retransmission. These screens are usually video monitors in which data the organizers deem appropriate appear in a cyclical way. Also, they are usually terminals connected to a data network with a program which shows these data. Commentators must physically be in the stadium to be able to receive these data.

2) Graphics and titling: The program signal usually comes with heading in international language. To allow chains to be able to insert their own heading, a clean feed is distributed, so that TV channels can insert their own titles with graphics and language they are interested in (if they have the rights to do so).

3) Subtitling: For taped programs, as was seen in the above chapter, there is much redundant information, areas and processes when doing subtitling work. The model proposed for this application is classification, as in audio, of original and natural subtitles.

4) File: One of the discussions which are usually repetitive over time in TV channels revolves around the philosophy of the file to be implemented in each company. One of the aspects of these discussions is the filing of material with or without graphics, titled images are usually considered to be ¨dirty¨ but they contain information about test data, clean images are perfect for filing because of their ease of reuse, when the image is titled it is more complicated to remake another heading because there may be problems with composition among titles.

5) Advertising: This is the main return on the investment made in purchase of retransmission rights of events. Many of these events have strict regulations on spaces in which publicity can be broadcasted; this publicity may range from lengthy spaces to small headings inserted in the image. TV channels must decide in real time the moment they can insert their advertisement publicity as the event develops. To provide this service, delivery of a signal would be necessary to indicate the possibility of showing advertisements, their length and type of advertisement that can be included.

6) Education: In our society, e-learning is being used more and more by people who want to acquire different types of knowledge. Events of a minority nature have regulations which many times are unknown to viewers who are not used to these shows. A visualization of the rules as far as how a game is played can enrich content and provide comprehension.

This delivery of rules can be made in a structured way, to be shown on a web page during internet emission or on screen when each of the rules is applied, when the user chooses.

C. Programs:

In this section, the convenience or not of each of the above services will be analyzed. It will be necessary to see the type of programs which are usually shown live and associate them to the different services.

1) Sports: These are of the programs in which data are very important for the commentators as well as for graphic generation.

2) Live Music: Retransmission of music concerts is becoming more frequent, classical as well as modern. In the specific case of opera, most people do not understand the meaning of the songs or the plot. Subtitling song lyrics can assist a great deal in understanding opera.

3) Elections: They are of the most important events in politics. Data are generated by each organism. In Spain there are at least 23 elections every four years: European, national, Senate, 17 regional and local elections.

Chains have video links with each electoral seat where results are read; chains can receive standardized information in the same video signal.

IV. MODEL

As has been put forward in previous chapters, the data delivery model between production companies and dissemination chains is made on the same video signal and is extensible to diffusion between users by DVB in its modes of satellite, terrestrial, mobiles or cable.

A. General model

1) File transmission: For delivery of XML documents, the transmission model which is used must be taken into account:

- Contribution. For delivery of information from a production centre to a receiving centre, it is a one on one communication. It is the typical case of delivery of generated data in a stadium to the IBC (International Broadcaster Centre). Because it is a one-few type of delivery, transmission will be by means of NORM (Nack Oriented Reliable Multicast) [10], since it has a good response for few receiving stations.
- Distribution. For information delivery from one centre to many receivers. It is the type of one to many transmissions. A clear example might be delivery of the final Wimbledon tennis match in which there are large quantities of receiving stations that need information. For this case, the use of FLUTE (File Delivery Under Unidirectional Transport) [11] is proposed, with a return by Internet, so that chains which do not receive information can ask for retransmission of a certain type of data as we can see in Fig. 1.
- Broadcasting. In order to send files from a broadcasting chain to viewers, in this case the number of receivers increases considerably and poor radio electrical installations may influence poor reception of the files, so that redelivery petitions which are demanded on return lines may collapse transmission. The best adapted protocol is FLUTE without a return line.

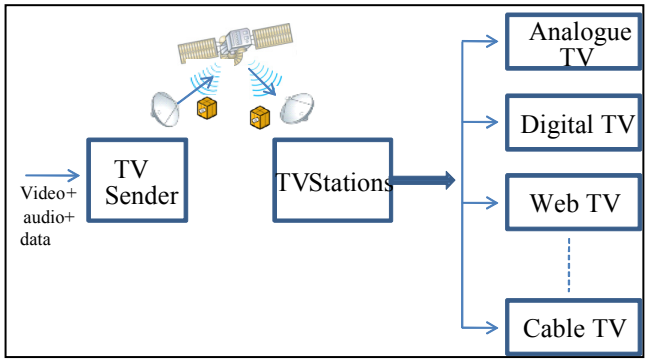

Figure 1. Live signal distribution.

2) Distribution and content filtering: In production as well as reception, depending on the type of event, filtering or distribution of content may be necessary. Application of XML technologies simplifies these tasks since using XSLT documents they can be done in a simple way. XSLT is a language which transforms XML documents into other documents whether they are XML or other formats, see Fig. 2.

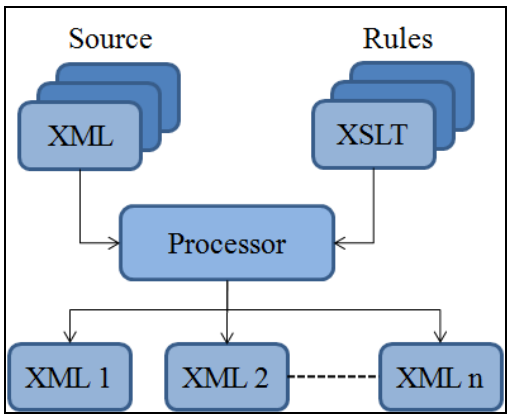

Figure 2. Generic Process for XML by XSLT

Depending on the type of service, this conversion can be made at the source or at the destination. For the specific case of the Olympic Games and data distribution in each channel in the IBC, this transformation is made at the signal distribution to each channel. For the case of a channel that wishes to send content to different distribution media, this filter can be made at each channel, sending data to each broadcasting channel.

XSLT has the necessary functions to be able to manage complex transformation requirements and provide great flexibility to the system since exit data, as well as their configuration can be modified in a simple way only by changing the XSLT document, with the need to recompile the program since the document is read in execution time.

B. Titling

A variation from the general model is proposed for signal titling.

1) The problem: In sporting event transmissions of international significance, broadcasting in each country is carried out by the owner of the rights for that particular country. The output signal (program signal) in the original production center normally contains the graphic elements presented in the language considered the most international: English.

The problem created by this "dirty" signal in the different broadcasters is double: On one hand, title adaptation produces the superposition of different graphics on a same image. On the other hand, those titles will remain in the channel's historical files.

If we send the data into the MPEG2 stream we solve both problems.

2) Production side: There will be two types of installations: Master and Slave installations. As Master figure shows in Fig.3, the mixer consists of 1 to n inputs (10...In) and a GPI's (On) output (General Purpose Interface).

The system consists of a spy software in charge of watching over the operations performed in the titling station. The type of data generated will consist of: The model of title together with its text, the pages being prepared for their broadcast and the page located at the titler output.

On the other hand it will be necessary to detect every time the titler for broadcast is "punctured" by means of the GPI's detector. Each time this signal is set to 1, the triggering detector sends an impulse to indicate the mixer has been set to air. The various data are multiplexed over the output transport stream, together with the video without titling and the international audio, for its distribution to the different televisions. The transport stream is uplinked to the satellite for its distribution as in Fig. 1 to the different broadcasters.

Within the broadcasters' facilities, the signal must be multiplexed to obtain the different signals and data. By means of the titler's remote control, they are being executed the same generation and title-display commands as in the origin. The GPI signal regenerates again to command the mixer to puncture the titler, every time that, in its origin, a title is punctured in the mixer.

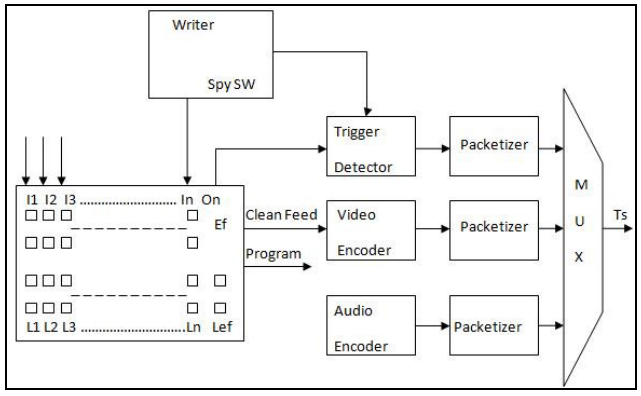

Figure 3. Video mixer

3) Data distribution and conversion: The files to be transferred will have a structure XML for a better adaptation of the different results to current technologies. In this way it will be obtained a data stream over the video stream.

In the target station the system must process the contents coming with the image, for the sending of commands to the titling stations. Two types of translation will have to be carried out:

- Message adaptation to the language, being able to include adapted publicity.
- Command adaptation to the titling machine, since the target broadcaster may have a machine with a different protocol from that produced by the signal.

It will also be necessary a distribution of the texts which, predictably, are going to be used so that translations of every item can be carried out in each television.

Before each event broadcast, it will be necessary a distribution of the texts which predictably are going to be used, so that translations of every item can be carried out in each television, generating XSLT's for the language and for the commands of the target machine.

Fig. 4 shows as XML incoming generates a continuous stream of data through the XML files. In order to provide the system with a higher modularity, this is divided into two processes: The translation to the country language and the translation corresponding to the commands of the titling machine. For each incoming message from the event production, there is an XSLT associated containing the translation of the messages. Once the conversion to the language has been carried out, it takes place the conversion to the specific commands for the type of machine needed. Additionally, there will an XSLT for each type of command to be executed.

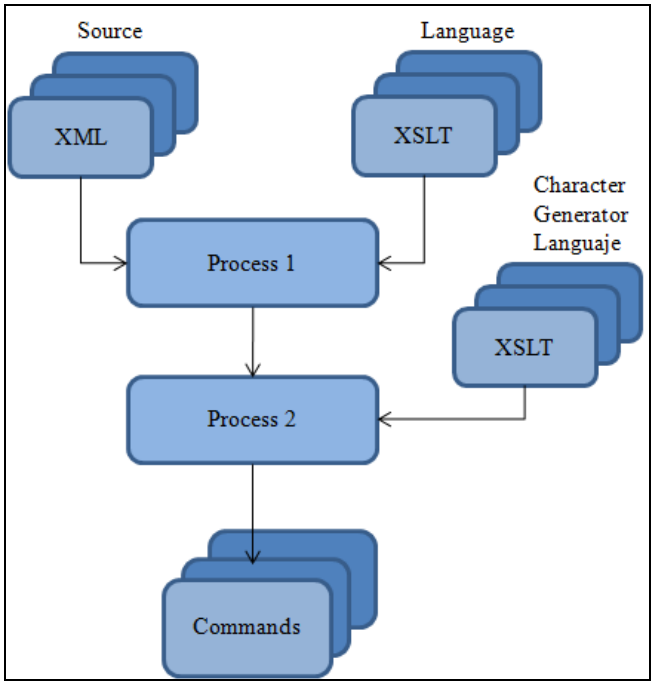

Figure 4. Machine command generation with XML files.

This approach can be seeing with more details in [12].

C. Subtitling

Two types of tasks are presented: preproduction and emission. In preproduction, a distribution of files is carried out with identification of each heading while in emission only the identifier absorbed in the video signal is sent. These processed can be done too for closed captioning info.

1) Preproduction: Files are distributed to chains, that carry out translation of each of the subtitles in the languages desired, information as far as entry time for each subtitle is only one reference, never a real data, since it is a live program, this data can vary. The DFXP file [13] contains all necessary information, with the exception that fields begin and end are purely orientative being a live program, if time of duration exposition is more real. An example of the distribution file is:

```
<p xml:id="subtitle98" begin="32m0.76s" duration="1.45s">
    Hello Figaro,
 </p>
```

The translated file will be:

```
<p xml:id="subtitle98" begin="30m0.76s" duration="1.45s">
    Hola Figaro,
/p>
```

2) Emission: During emission the text identifier is sent which is to be shown in the PES packet of data in the MPEG2 TS. Each packet can be sent many times by FLUTE protocol to avoid transmission errors. Delay in audio or video is usually quite troublesome in such a way that de-synchronization between audio-video is produced, this margin is usually 200mS, in the case of headings, this delay is not as strict and almost a second can be waited without the viewer noticing, so that the identifier can be sent many times using this protocol.

When an identifier reaches the television channel, a simple search is conducted of the identifier in the translated file, selecting information to incorporate it as a subtitle in the broadcasting.

On a parallel, a DFXP file is generated with the synchronized information of audio, video and data and its later filing for possible future broadcasting.

An example of XML which is sent in broadcasting will be:

```
<p xml:id="subtitle98"
 </p>
```

"Subtitle98 is displayed showing the text "Hi Figaro" or "Hola Fígaro" for two seconds on screen or for closed caption. This approach can be seeing with more details in [14].

D. Rest of services

To assist commentators, each of the channels can prepare its own XSLT to receive information they consider to be most appropriate.

Before saving file material, the filter can be made in the same buildings of the TV channels, selecting data they want to store and which each company believes useful for later broadcasting or viewing.

Filtering of entry data flow can be made the same way for its distribution to other media so they feed each of the installed platforms without need to create specific content for each of them, in the same way education can be carried out with possible levels of aid.

V. CONCLUSION AND FUTURE WORK

In this work an effort has been made to lower development costs of broadcasting companies in audiovisual content, based on delivery of data and metadata associated with live programs by video lines which are necessary for program broadcasting. This lowering of cost not only benefits broadcasting companies but also users who can benefit from the advantages they will have by being able to access data and assistance that the producer of the program has. On the other hand, the advantages have been shown of the possibility that the video itself carries incorporated data, advantages in synchronization, filing, program reuse etc.

There is a long road to development, there are still more services needed, documentary automatic systems from the metadata which are carried by video, alerting systems, automatic production systems which select video lines from data which are sent along them and to be redefined by user and artistic, etc.

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