

HyLive: Hypervideo-Authoring for Live Television

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Abstract. In this paper we discuss the commonalities and differences of hypervideo and interactive television. We show that, even if the interaction and presentation of both are similar, there are strong differences in handling the content and the link structure of those media. The production and editorial process for live interactive television with hyperlinks and added value including production and editorial workflows is examined. The results led to a concept and a prototypical implementation for an editing tool and a web-based client player for interactive live television with hypervideo structures, called HyLive.

Keywords: hypervideo, live television, interactive television, synchronized additional information

1 Introduction

Hypervideo follows the basic idea of hypertext replacing text by video content. While hypertext has a static lead medium, hypervideo has a dynamic one. The conceptual components of hypervideo are video and hypermedia. Currently there are two basic definitions of hypervideo. One emphasises the aspect of augmenting information to digital video as for example Hesse does [HES05]. Hyperlinks in the video are activated by the user, who so gets access to additional information synchronised to the actual scene in form of texts, images or even other videos or sequences in the same video. The other one emphasises the influence of the audience on the storyline [HEI00]. This kind of definition has its origins in the field of storytelling. Activating a hyperlink by the user from this point of view means a change from one scene to another or from one perspective to another or from one aspect to another in regards to the content. Furthermore this means that the user as an audience does not follow the content in a linear but in a non-linear way; the audience takes the step from passive to active viewing. Each step of interaction contributes to an individual story-plot for the user. None of both ways of defining hypervideo is entirely wrong, but both seem to be incomplete. Hypervideo could include both: the usual interaction options like running the video, fast-forward and fast-backward, pause, stopping and the other basis func-

tions deriving from the medium “video” combined with the possibilities of hypermedia and storytelling [HOF06].

Independent from the definition the media content and its structure can be distinguished between hypervideo with a closed structure and hypervideo with an open structure. In the closed structure there is only one video to which all additional information is related. Even a link to another scene means only, that another defined frame in the video is called to be seen. The open structure however also includes links to additional information sources outside of the video itself. This means that there can be links which reference other hypervideos or selected subsequences in them. Changing a perspective in the storyline is easily feasible by leaving one hypervideo and switching to another one.

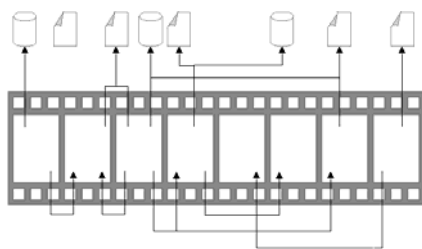


Fig. 1. Closed hypervideo structure: only internal links.

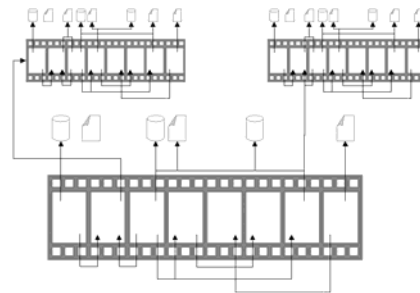


Fig. 2. Open hypervideo structure: internal and external links.

In spite of all potential capabilities and benefits hypervideo still is rarely used. At the moment there is no mass media application for hypervideo to be found [RIC07].

The main problem of interactivity in the television context remains the back channel from the audience to the broadcaster. Most concepts are aiming to broadcast more data than only the video information to the audience. The most common technology for this use case is teletext. The additional information in this system is mostly textual information like national and international news, weather forecasts and TV schedules. The textual information is encoded into the blanking interval of the TV signal. This approach does not allow any synchronisation of the additional information and the actual content of the video. Few teletext pages seem to be in a synchronous relation to the video content. These are mainly pages which show subtitles or live comments. This kind of synchronisation is achieved by human editors who watch the programme and publish the texts just in time [ZDF07].

While the analogue technical systems going to be replaced with digital systems by the broadcasters some new approaches of adding informational and interactive values to the programmes are upcoming. The digital technologies offer the chance to extend synchronised additional information as well as more interactivity to the individual audience. Most popular examples for those applications are EPG (Electronic Programme Guide) and the MHP (Multimedia Home Platform). While EPG offers only information about the programme schedule and a few descriptions of the programme itself, MHP concentrates much more on interactivity.

At present there is no standardized combination between the different concepts for hypervideo and added value systems. Instead of single different media like video and

teletext a new media approach is conceivable, “interactive live added value systems”. This means interactive teletext, where the actual content of the video stream is synchronized to related additional media, which can easily be reached by the use of links as known as in any internet browser.

2 State of the art

Since specified by the BBC [BBC74] in 1974 teletext, as the most common added value TV system, is almost unmodified. Only minor changes like HiText for a higher resolution have been developed. But even such small development steps were not considered by all broadcast service providers offering teletext.

With the digital technologies some new services appeared. Especially commercial broadcasters providing programmes with specific content were interested in creating new interactive services. As a result, many mainly private stations offer set-top-boxes. Some of them allow viewing several perspectives onto one event. This has been used for sporting events mainly, like soccer or car racing event.



Fig. 3. Internet programme n-TV plus (<http://www.n-tv.de/n-tvplus>)



Fig. 4. Internet media archive WDR WebTV (<http://www.wdr.de/themen/homepages/webtv.jhtml>)

Since the internet is becoming a more often used medium for broadcasting information some television stations are offering their programmes in the internet, too. Most of those internet services are not more than the pure television programme. But some providers are interested in offering more features. The most often used method shows some similarities to the hypertext approach. The actual television programme, as seen on any TV set, is streamed through the internet. This stream is accompanied by links which are grouped into several categories like “current news”, “sports news”, etc. (see Fig. 3). Selecting a link opens a new frame with the additional information, mostly a web page, but the links themselves are not bound to the visible information in the video image. To support a comfortable use such services should be available through the ordinary TV image. Any constraints, like the installation of a special software application, are critical for the acceptance the service. Instead of enriching the regular programme, the videos are archived for programme-on-demand purposes. The audience is then able to watch the programme at any time. In some

applications the archived programme is enriched by links to additional information. The offered links are synchronised to the video content and change over time. The additional information is edited to the programme after its transmission but before archiving.

Figure 4 gives an impression of such productions. The internet application WDR WebTV of the German WDR (Westdeutscher Rundfunk) allows watching archived programmes on demand, navigate the programmes, and include subtitles especially for people with impaired hearing and get additional information to the programme in relation to the actually shown content.

The research and development of hypervideo applications, which do not connect to a live transmitted television programme, can be found in several publications [ZAH03][DOH03]. However, nearly all of these applications are based on archived and post-produced video material. The main focus of our current research lies on the question how hypervideo links can become dynamic, e.g. for animated or moving objects, in a live video stream.

3 Live interactive hypervideo-based TV

In this chapter a strategy for combining the ideas of hypervideo and interactive television will be introduced. The differences of classical television, classical added value systems, online and multimedia editing and hypervideo will be examined and a feasible production process and work flow will be described.

The goal is to find practical strategies, how additional informational and interactive elements can be added to live television. We have done some earlier research and development in this respect in a project called HyPE, a hypervideo environment with an open API [HOF06]. HyPE should as well be a stand-alone hypervideo application, but it should also be possible to adaptively control the hypervideo player and the behaviour of the hypervideo links by an external application as for example a narrative presentational logic. The external application should be able to control the presentation of hypervideo links in a hypermovie in relation to the profile and the behaviour of a user.

Due to some hypervideo productions done with HyPE there appeared questions about the practical use of HyPE in a live television context. The main question is whether hypervideo links could be defined, enabled and included in a running hypervideo just-in-time.

3.1 Differences between Hypervideo and live interactive TV with added value

As already discussed there are two different structures of hypervideo, an open structure and a closed one. However, while being different in the handling of associations between video sequences and additional information, both types deal with videos, which have a well-defined beginning and end. No hypervideo link can refer to a video frame before the beginning or after the end. In the context of live interactive television this is different.

A live television stream does not allow for intercontextual links, which refer to other frames in the video stream. Even if a live programme is well scheduled and planned it is impossible to link to future parts of the programme. Intercontextual links can be possible if earlier parts of the programme were stored and access is given in an appropriate authoring process.

The other possibility for intercontextual links is similar to the open hypervideo structure (Fig. 2) and is independent of storage and archiving. It means that there are hypervideo links which do not refer to the same video stream but to another one, which is independent from the first one.

Besides intercontextual links there are intermedia links, which refer to related additional information which are not included in the video, for example related web-pages or the like. The difference of such links in live interactive television to hypervideo is the definition of the links. Intercontextual links as well as intermedia links can be shown in the transmitted frame. So the problem is how to prepare, store and present those intermedia links.

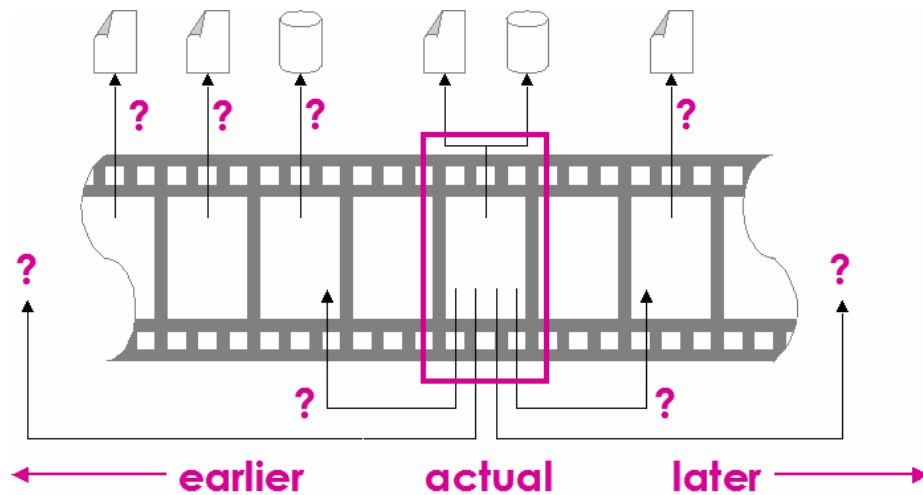


Fig. 5. Structural Question for live hypervideo links

3.2 The users and their tasks

The structural differences between hypervideo and live interactive television cause differences for their users as well. In general there are two classes of users, the audience at one side and the editors on the broadcasting service side. The goal of the audience is mainly to be entertained or edutained. For live interactive television with an information layer added this means to follow the programme and access the additional information from time to time.

A user class we focus especially are the experts in the editorial department of the broadcast service. They enrich the video sequences with interactive elements related somehow to their visible content. Interactive elements in this context are both, ele-

ments for interactions like voting and hypervideo links which refer to additional information about the content. This general goal is to be divided in several subtasks:

- plan and schedule the programme,
- assemble additional information and arrange references,
- schedule, sequence and arrange the interactive elements,
- design the appearance of the interactive elements and
- test the arrangement and its functions.

So far the production of live interactive television with associated information does not differ from hypervideo. The differences will be visible with the start of the live transmission:

- watch the live stream and apply the predefined interactive elements,
- activate and publish the links,
- deactivate the links in dependence of the streamed content and
- interpret the audiences' feedback.

These tasks can not be performed by a single person. Several groups are involved in this process as there are the TV editorial department, which takes care about the television part of the programme and the online editorial department which takes care about the interactive elements. Three particular persons are involved in this editorial department:

- the online editor for the online investigation and the preparation of the additional information,
- the screen designer for the design of the interactive elements and their appearance and
- the live editor who has to publish and deactivate the interactive elements just-in-time and has to react to unexpected changes in the programme schedule.

This task structure is the result of discussions with persons in charge for multimedia and online services at the german NDR (Norddeutscher Rundfunk) as well as of some other research on how online journalists work.

3.3 The editorial workflow

From the subtasks for live interactive television described above follows an information flow and a workflow where both editorial departments are highly interconnected with each other.

The editorial workflow starts with the TV editor, who is in charge to prepare a live event. This event shall not only be a television programme but also include options for interactive add-ons. The TV editor schedules and plans the programme. All plans and the additional information go in parallel to the screen designer and the online editor. The screen designer uses certain tools for designing the interactive elements. The online editor does an investigation on related information which can be integrated into the interactive programme and produces specially needed media and/or web-pages. The information from the TV editor, the online editor and from the screen designer is merged by live editor. With the detailed information about the programme

schedule he or she is able to prepare and position the interactive elements. When the transmission of the live programme starts the live editor follows the programme and places, publishes and deactivates links and other interactive elements (Fig. 6).

The information flow influences the production workflow. TV editorial department and online department work together in the same production. Figure 7 depicts the production process, divided in preproduction and production phases.

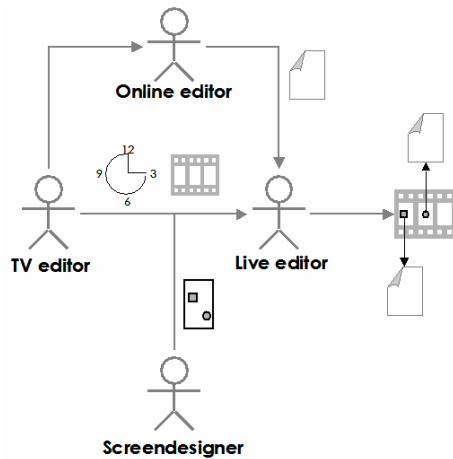


Fig. 6. Information flow in the production of live interactive television.

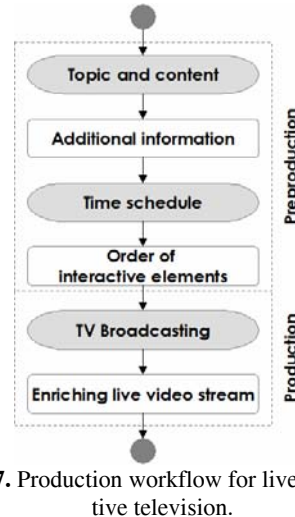


Fig. 7. Production workflow for live interactive television.

4 The HyLive-Application

The analysis together with production professionals lead to the development of the HyLive-application for live interactive television.

The system architecture of the HyLive system follows a modular approach as to be seen in Figure 8. The part of the system which is used by the live editors consists of a computer with a TV board and an optional TV display. This computer encodes the television signal and transmits the encoded signal to the Media Server. Encoder and Media Server both are standard applications. The live editor follows the television programme and selects with the help of the Editorial Tool the hypervideo links which are to be published. The hypervideo links are pre-produced in form of a RSS-Feed. Each single hypervideo link is defined by one item in the RSS-Feed. This allows to generate a new feed with prepared entries as well as to use an existing RSS feed. Every item in the feed can be used as a hypervideo link. The advantage is a very flexible use of prepared and existing information elements. The Editorial Tool is connected to the same Media Server as the TV Encoder. The Media Server combines and synchronises the television signal with the editorial information. The additional interactive information is encoded into the television stream. This signal is finally broadcasted from the Media Server to the Internet.

The audience receives the live interactive television programme via the Internet on their computer in a Client Player. Because this player is implemented as a Flash player it is not necessary to install any new application on the computer to receive and interact with the programme.

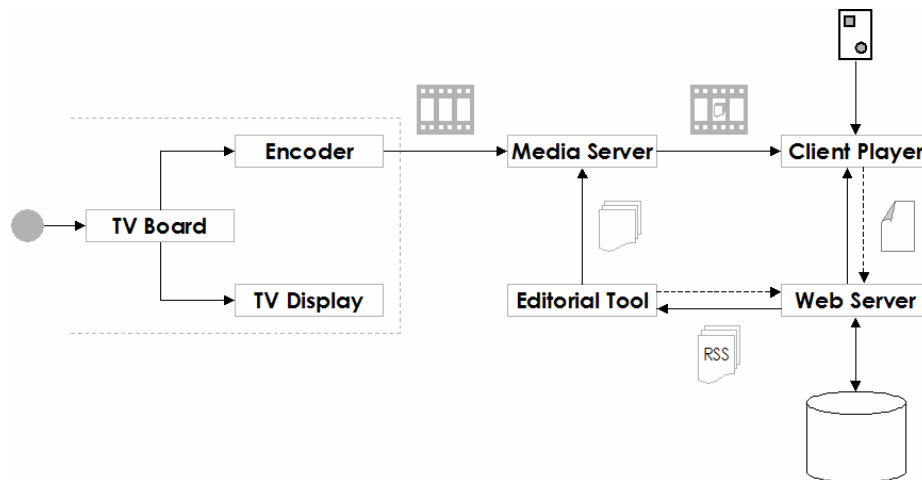


Fig. 8. System architecture of HyLive

The Editorial Tool can be run within a standard web browser. The user interface is designed as a simple and transparent system that can be used efficiently (see Fig. 9). At the top a toolbar with buttons for the basic functions and three columns for the editorial workflow are the parts of the user interface. In the left column the connected RSS feeds are listed. These are the resources from which the live editor can pick the feed items for the live programme.

The chosen items are dragged into the middle column where the editor can arrange a first order of the links and group items in sets, which shall be published at the same time. The right column is for the publishing functions. If any corrections in the positions of the hypervideo links have to be done, this takes place in a coordinate field. With one click on one of the central buttons the editor is able to publish a selected hypervideo links or a whole set of them. The published hypervideo link or set is highlighted in the middle column. Using the “Next”-Button allows to deactivate the currently published hypervideo links and to publish the next ones from the ordered list.

The player client on the side of the TV audience will be usually integrated into a web-page of the broadcast service but it can also be run as a stand-alone application if Flash has been installed in their web browser. The player receives the combined signal of the live interactive television programme from the Media Server of the broadcast service and displays it. The appearance of the interactive elements is independent from the player client. The design of the interactive elements is transmitted through signal. So it is possible to change the design of the hypervideo links and interactive elements at run time of the programme by the editor. This includes also the position of each element within the video frame.

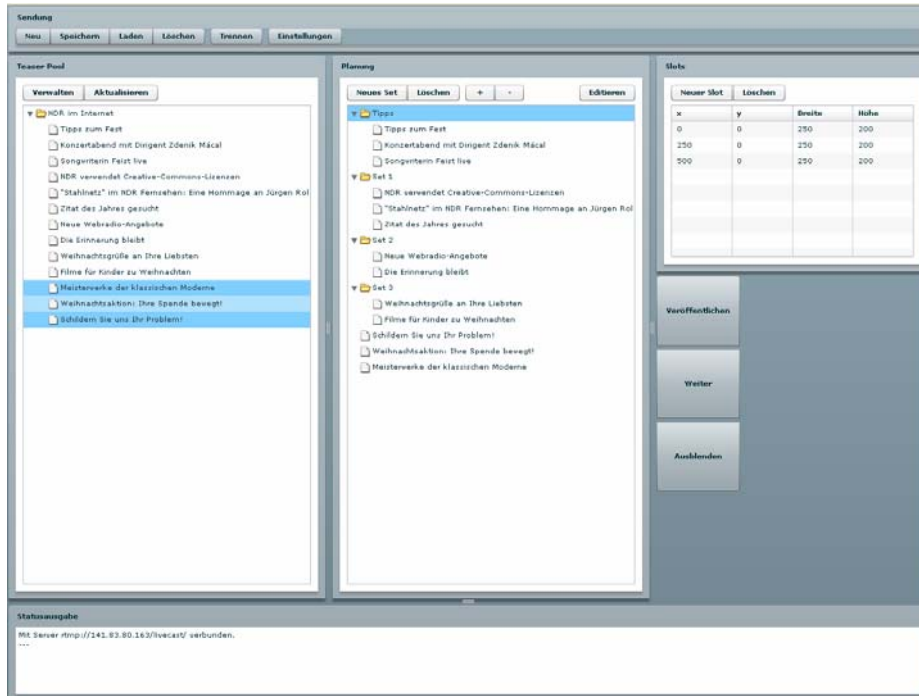


Fig. 9. The HyLive-Editorial-Tool



Fig. 10. HyLive player client with different designs of integrated hypervideo links.

5 Further Work

The basic functions of the HyLive system are working well. The design and development of the Editorial Tool has already been finished. For the player client some

more functions will be integrated in the next release. Besides the active support of subtitles, which is not implemented yet, most important interactive functions like voting etc. will be realised.

No evaluation has been done so far with real audience. The reason is that the HyLive system so far was only used internally. The first broad and public use is planned in a Eurovision Programme in cooperation with the German NDR. The results will be evaluated.

Acknowledgements

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