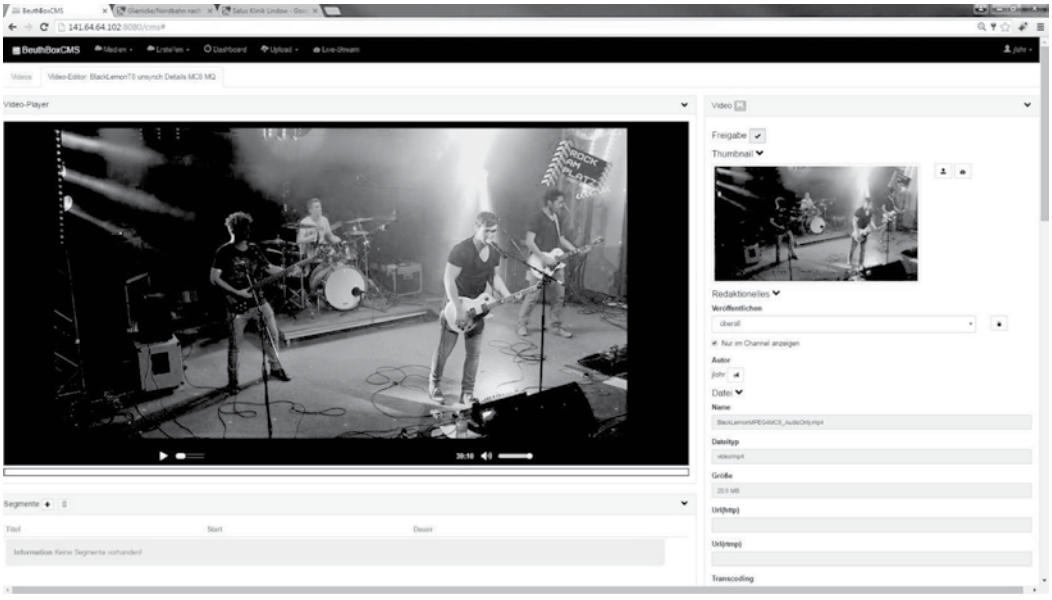
Fig. 1: BeuthBOX – The WebTV / Video Portal of the Beuth University of Applied Sciences Berlin (http://beuthbox.beuth-hochschule.de)

Fig. 2: The Video Content Management System of the WebTV Platform BeuthBOX



The Project “Video-based Knowledge Transfer” (former name 'ViWiTra', current name 'ViSuARe TASK' – Video-supported Augmented Reality Task Assistance) is our second main project based on interactive and hypermedia video technologies. The aim of this project was to provide tools and functionalities for the production as well as for the online and offline presentation of video and hypermedia based step-by-step instructions for construction, assembling and service tasks in industrial field. The important requirement in

the project is the simplicity in the functionality of recording and creating tutorials and documentations, so the employees on they self can use it in a very simple and intuitive manner. One of the main results of the project is a mobile App for fast and easy production of video-based documentation and tutorials, which can be enriched at each step trough: hints with recommended tools, warning information about possible dangerous aspects or documents and comments – a Hypermedia Approach (Fig. 3).

Fig. 3: The Mobile Application 'Video-based Industrial Assistance' for Fast and Easy Creating of Hypervideo Tutorials

2. MPEG-DASH TECHNOLOGY

Current research in the field of video streaming technology is focused on MPEG-DASH. In 2012, this technology was being standardized, so that today a stable condition has been reached and reliable webcasts can be realized. MPEG-DASH stands for dynamic bitrate adaptive streaming and is sent via the hypertext protocol through all networks. By using various audio and video codecs, the streaming server can reach different terminal devices, e.g., personal computers, convertibles, and smart phones (DASH Forum). The use of MPEG-DASH standards for Internet webcasts ensures webcasts without interruption even for volatile broadband capacities. During a webcasting an informative business video via a company portal, for instance, the maximum bandwidth cannot always be provided. The advantage of the MEPG-DASH technology is in the fault tolerance in the network connectivity.

An interruption-free webcast is ensured by leveling speed fluctuations of data transmissions in telecommunication networks. This interruption-free data transmission is obtained by a continuous, automatized adjustment of the data rate for audio and video. Starting with a transmission of a small bandwidth, it is increased step by step to the highest quality level available. For transmitting the video and audio channels from encoder to server MPEG-PS (Program Stream) is used, which was standardized in 1995 (Reimers, 2005). At the server, the data stream is conveyed in program streams by means of MPEG-DASH. The data stream on the Internet will be not interrupted if the connection between sender and receiver is faulty. Although occasional pixel or image errors may occur, they are rarely or not perceived by the viewer, since the overall context is usually obvious. The reference player of MPEG-DASH, version 1.5.1, is used as basis for the developments at the Beuth University (DASH Forum).

Fig. 4: SMIL File Defines Quality Levels – Five Levels for Video and Four Levels for Audio

```
<?xml version="1.0" encoding="UTF-8"?>
<smil title="Testvideo">
<body>
<switch>
        <video                                                                    height="404"
src="RockAmPlatz2015/B8/BlackLemon_synchT6_MPEG4MC8_1080p_5000k.mp4"
                systemLanguage="en" width="1080">
                <param name="videoBitrate" value="5000000" valuetype="data"></param>
                <param name="audioBitrate" value="128000" valuetype="data"></param>
            </video>
            <video                                                                    height="404"
src="RockAmPlatz2015/B8/BlackLemon_synchT6_MPEG4MC8_720p_3000k.mp4"
                systemLanguage="en" width="1280">
                <param name="videoBitrate" value="3000000" valuetype="data"></param>
                <param name="audioBitrate" value="128000" valuetype="data"></param>
            </video>
            <video                                                                    height="404"
src="RockAmPlatz2015/B8/BlackLemon_synchT6_MPEG4MC8_720p_1500k.mp4"
                systemLanguage="en" width="1280">
                <param name="videoBitrate" value="1500000" valuetype="data"></param>
                        <param name="audioBitrate" value="92000" valuetype="data"></param>
            </video>
            <video                                                                    height="404"
src="RockAmPlatz2015/B8/BlackLemon_synchT6_MPEG4MC8_450p.mp4"
                systemLanguage="en" width="800">
                <param name="videoBitrate" value="750000" valuetype="data"></param>
                <param name="audioBitrate" value="64000" valuetype="data"></param>
            </video>
            <video                                                                     height="90"
src="RockAmPlatz2015/B8/BlackLemon_synchT6_MPEG4MC8_90p.mp4"
                systemLanguage="en" width="160">
                <param name="videoBitrate" value="200000" valuetype="data"></param>
                <param name="audioBitrate" value="32000" valuetype="data"></param>
            </video>
</switch>
</body>
</smil>
```

The player requires encoded files for each contribution, e.g., MP4 format and a multi quality file in SMIL format. Fig. 4 (above) shows a multi quality file with four audio and five video qualities and their features, e.g., height, width, and data rate.

3. MPEG-DASH AND HYPERMEDIA

Hypermedia refers to media contributions that are composed of media elements. The media elements can consist of various videos, audios, images and texts. They can be composed sequentially or in parallel manner and they can link each other with bidirectional links. The well-known advantage of the hypermedia concept is to provide additional/extended content directly at the right place of the main content – the associative linkage technique (Yankelovich, 1986). For instance, at the right time position - time segment (scene) - of a video, which comprises some special topic, there could be provided additionally content. The following figure 5 is showing one possible solution for a lecture hypermedia video providing additional content – right bottom – to download at the current video position.

The editorial work to enrich a video-based lecture with hypermedia content demands still a manually process because of an exactly matched/related content recommended through a lecturer person. With the automatically recognition capabilities of e.g. the content of the presentation slides a video content

management system could automatically recommend appropriate extended content based on the keywords, topics, titles or tags.

Fig. 5: Concept Screen From The Current Work atThe Beuth University for Lecture Recording (Source: Master Thesis - Fortunata Lehmann)

4. MEDIA CONTRIBUTIONS

Up to now, raw material of defined features was needed in order to upload media contributions to a content management system. Visual, auditory or textual features comprised a defined technical format, a defined sequence or a defined sound or display. If the raw material is of high medial quality, only few processing steps, as for instance a technical formatting, are necessary. Advanced content management systems require for the content upload (integration of media contributions) only an adaptation of the technical format to the corresponding distributions channels in automatized processes.

Fig. 6: Status of The Automatized Transcoding Process for Video Files in the BeuthBOX VCMS

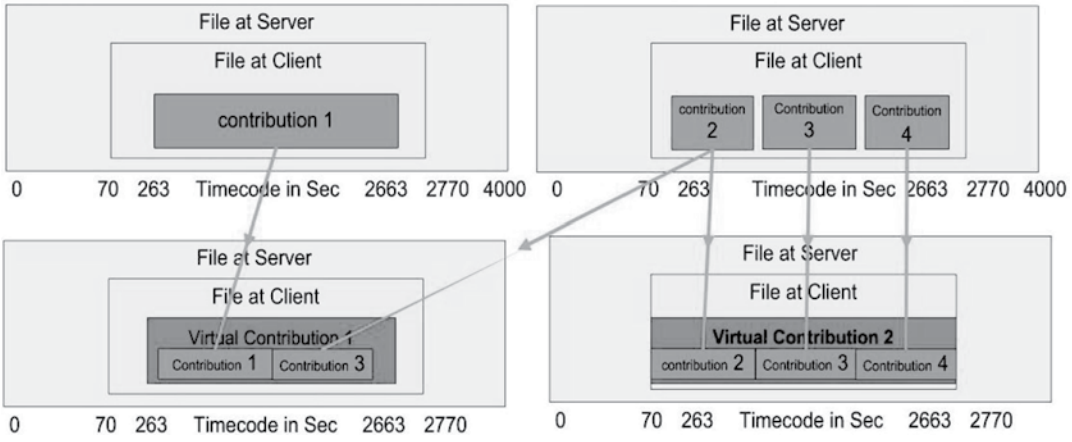
4.1. Virtual Contributions (Clips)

The Usually way to public video-based media contributions is to edit the 'raw' video files and to assemble those files together into one final video sequence. If we imagine the video files from the lecture recordings or for step-wise work documentations and tutorials are 'easy' video sequences without the need for a sophisticated editing like for a cinema, TV documentary or else creative media product. Instead of the quite demanding skills and time for the physical video-editing there are new technically possibilities to create so-called 'virtual contributions (clips)' without the physically process of 'cutting' video files.

A virtual media contribution is based on the raw material directly from the production stage. Contributions consist of two time events: time code of the beginning and time code of the end of the contribution. Like mentioned above this is the usually way to provide video contributions for distribution and

we speak here about the absolute time limits of a contribution with the physically beginning and the end of the file. The 'virtual contribution' occurs, if the beginning and the end of the contribution, in turn, are relative to the physically beginning and end of a video file. If the editor, however, makes a difference between file and the virtual contribution, the viewer has the possibility to search online in the material. Thus an introduction and further information beyond the time limits of the virtual contribution can be followed. In this case, the beginning and the end of raw material and contribution are different (see Fig. 7).

Fig. 7: Process Stage „cut" Defines The Time Code of The Beginning and The End of a Contribution



Furthermore, there are concepts of segmentations/segments and markers. Markers denote an event at a certain point in time (time code). They are a bookmark that can be clicked on, but which does not interrupt the presentation (see Fig. 5).

A special case of the use of markers is the definition of several chapters of a media contribution by a sequence of markers. In this case, a media contribution can consist of the first marker for the beginning and its successor for the end. In this case, segmentations are used and thus sections are defined. At the Beuth University we have conducted a cooperation project with the Electronic Media School and provided them the possibility to work with virtual contributions/clips inside of a TV magazine broadcast 'XENON' (see Fig. 8)

Fig. 8: Screenshot from the WebTV-Player XENON (http://141.64.64.105/xenon_player)