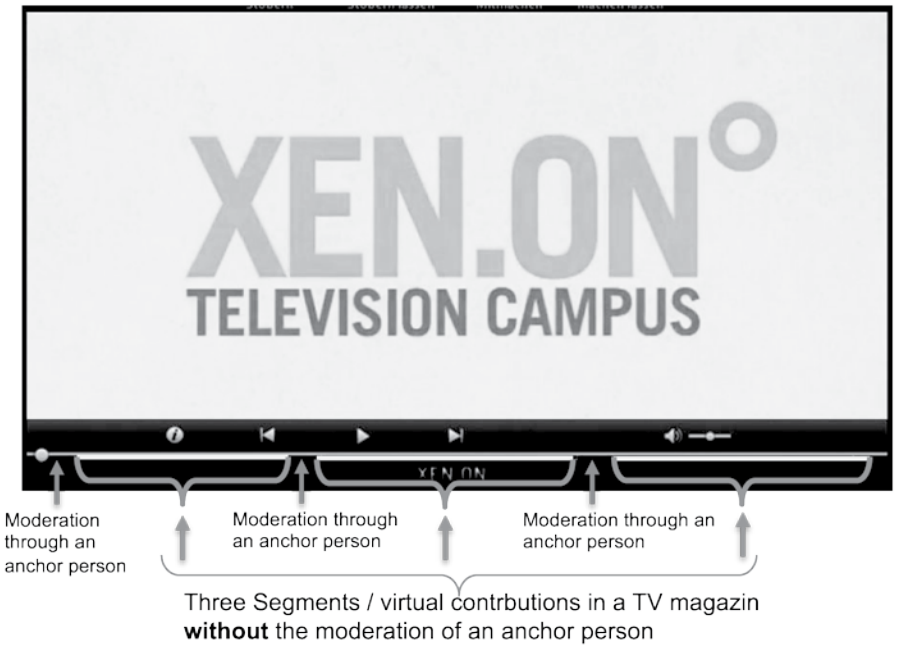


The user can consume the whole TV magazine with moderations or access directly the individual virtual contributions/clips. There is on the WebTV player the possibility to search for individual contributions and they will be presented as usual video sequences, but they are delivered only as 'virtual contributions' and will be start and end of the above mentioned IN and OUT markers of an segment.

There are number of advantages to work with 'virtual contributions/clips'. Beside of saving time and skills for real video editing there are possibilities also to research beyond the limits of the webcasted raw material or in other virtual, adjoining contributions (chapters) without any transition. Fig. 9 shows the metadata of virtual media contributions in the content management system, e.g., picture direction 263 sec, duration of contribution 2,400 sec, beginning of file 70 sec and duration of file 2,700 sec.

Fig. 9: Content Management System with Metadata for The Player

The (semi)-automatization and extension of editing processes of video files and media contributions like the 'virtual cut' , essential graphic or audio enhancement functionality supported by a content management system is a novelty. The editing process is shifted from physically production to display representation and presentation. That means that the editing processes of cutting, graphic or audio enhancement are carried out by the presenting terminal device just before the media contribution is displayed. This way, 'editing' processes are shifted to the display stage, hence a physically non-edited media stream will

be transported through the distribution stage with content management system, content and streaming server as well as network.

The process stage "cut" allows the definition of beginning and end of a contribution. In addition, also the audio volume level or the image brightness can be displayed. The process stage "enhancement" allows the determination of logos, color or sound for the complete contribution.

5. MPEG-DASH AND MULTIVIEW

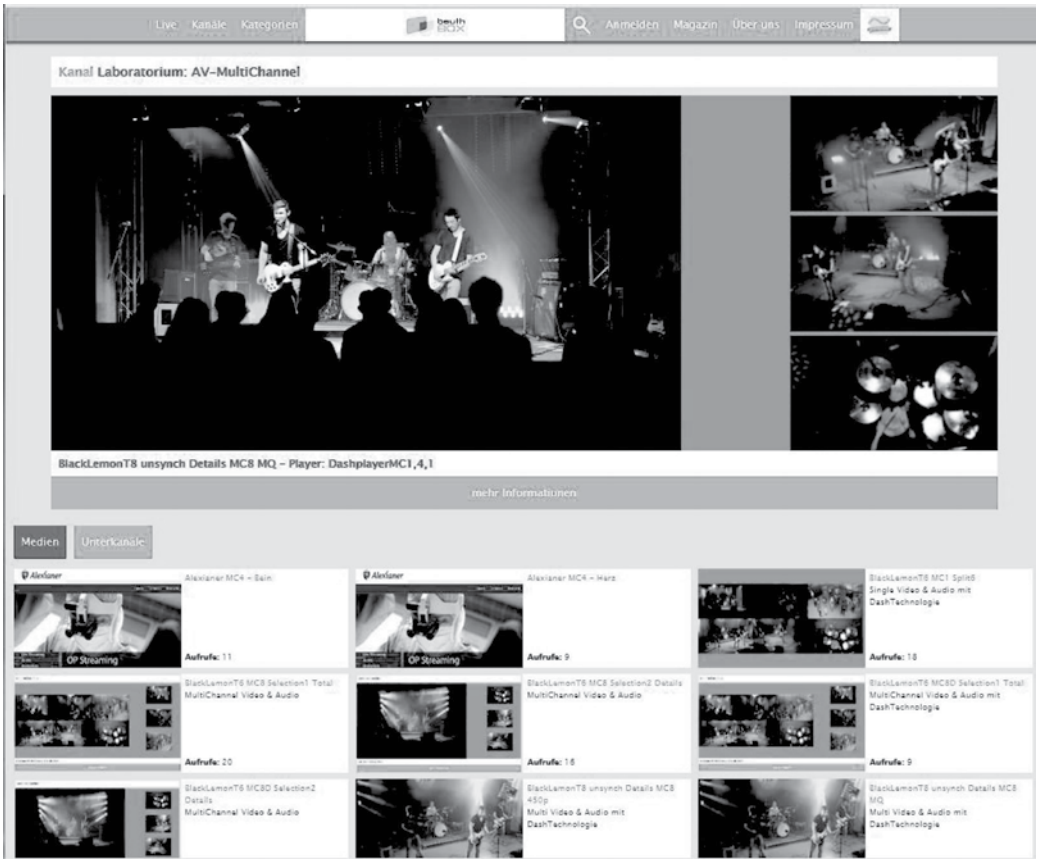
A MultiView application offers the possibility to display parallel more than one video sequences at the same time in the same video player. In our example there will be presented one picture in a large main view window as well as three other pictures in smaller preview windows. By clicking on the smaller pictures the user is able to shift them to the main view window and thus to enlarge them accordingly. The user is enabled to interactively decide on his individual shift of view. The audio track can be interactively selected as well. The BeuthBOX platform integrates a preliminary development of a multichannel system for the webcast of multichannel media contributions in public networks and business intranet. For the transmission of the video and audio channels from encoder to server the standardized MPEG transport stream protocol (TS) is used. Here, the basis of the server and the client's player is the DASH technology. Fig. 7 shows the MultiView player "Dashplayer MC1" that was used for the media contribution "Rock am Platz 2015" (field of application: entertainment) in the BeuthBOX portal. By means of this player four video channels and one stereo audio channel can be displayed. The viewer is enabled to individually choose the size of the individual videos. The audio track is determined by the editor. If the player is operated in full screen mode, the main view is shown as full screen and the other videos are presented as overlapping picture-in-picture on the top right hand side corner (Fig. 10).

5. 1. Transport Streams (TS)

The transmission stream basing on a MPEG-TS protocol comes from an encoder (if it is a live webcast) or from data storage (if it is an on-demand webcast). At the server it is converted into a program stream (PS) in MPEG DASH format. The transport stream technology MPEG-TS makes is possible to use the multichannel material for recording, data management, data transmission until it arrives at the streaming server. Within such transport stream any audio and video channels can be transported. At the streaming server "Wozwa" a transcoding takes place by repacking each transport stream into a program stream in MPEG4 format. For the multichannel application that was developed at the Beuth University of Applied Sciences only four PS connections are extracted out of the eight channel TS media contribution and transmitted into the network. By means of this technology a range of tracks can be selected and hence the media contributions can be customized to individual interests. Firstly, the editor selects the channels which are to be used as media offer and as fallback. The viewer himself has no access to the transport stream. He is, however, able to individually choose the channels he wants to watch or listen to from the program streams that arrive at the terminal device via the network.

The transmission stream into the Internet is a crucial point for multichannel contributions, since there exists an increased data rate and a very fast processing of the network packages is of importance. Out of sequential network packages the media display is converted into a parallel version at a certain point of time (e.g., frame). For this, the first arriving packages are delayed until the last packages for an event, e.g., frame for video 4, have arrived. The lower the resolution is, the shorter is also the transmission time of every package and thus the waiting time until the parallel version is complete.

Fig. 10: Top: DASH Player MC1, Bottom Left: Fallback Video, Full Screen Mode



Hypermedia contributions can consist of elementary media, such as text, audio video, pictures, and links. From the medial point of view, a virtual media contribution can consist of different transport streams that packetize within a period of time the information of different real media contributions for a certain point of time. In broadcasting, technical transport streams are known that are used for elementary audio and video as well as for subtitles. In the Internet, HTML elements are used to comprise dynamic information. Future developments consider the issue how manage all media elements as transport streams and to bring them via the network from server to terminal device. The variety of terminal devices, the different ways of access as well as the diversity of possible displays, e.g. from smallest to highest resolutions, call for a flexible media processing direct at the terminal device. For live transmissions as well as for on-demand processes transport streams can be used.

5. 2. Transport Streams in The Editorial System

The editorial system of the BeuthBOX platform provides the possibility to choose by means of the transport streams used the audios and videos displayed. First, the total number of transport streams is indicated, e.g. eight for all elementary streams. Then, the individual views are defined by entering their position in the transport stream. Thereby, a new arrangement is possible, since the order of recording does not need to be the same as the order of display. Finally, it is indicated which stream is to be used in fallback. Transport streams with latencies Latencies are time lags of concurrent, parallel events. Latencies can be positive or negative, which means that from the temporal point of view an event can be delayed or rushing ahead. The designation "delay" means a positive latency, if for instance audio is later displayed than video. In the recorded multichannel transport stream latencies occurs. Due to the parallel recording of video and audio streams, a first delay occurs that causes a disordered display. The delay is dependent on the channels processed and their frame size. If a video card records eight parallel videos, all frames are processed one after another. In our example of eight video recording tracks this means, that each channel has an offset of eight frames. If during the recording a converter for SDI or a mixer for audio/video is integrated in the signal paths in front of the recording card, further delays accrue. The latency then adds up to 70 frames. For video, the latency is at 25 images /sec for a frame of 40 ms, for audio it is at 48 kHz for a sample at 0,01 ms. In this example, high latencies result: 70*40 ms= 2,8 s.

For live operations, further dependencies for latencies would have to be considered, since in this case the calculation needs to included the factor of the stream, e.g. factor eight for frame size, for data rate, for data volume.

Since a video image is considerably more complex than audio, there is a lower processing speed with regards to compression, storage and transmission. Therefore, the audio signal is available earlier. In the described case of storage in the transport stream, the audio signal is delayed, clocked and then matched to the frames.

5. 3. Transport Streams with Fallback with and without Network Connection

If a webcast of a multichannel process in an existing network with low network capacities is not possible a fallback as single view process is provided. For this, a track is selected from the transport stream. For the fallback, a standard program or a MultiView split screen could be used. For a multichannel application without existing network a fallback with an offline demonstrator can be used. The offline demonstrator which is realized as HTML 5 App is a download application that receives the data from a storage, for instance from a blue ray or a hard disk (Fig. 11).

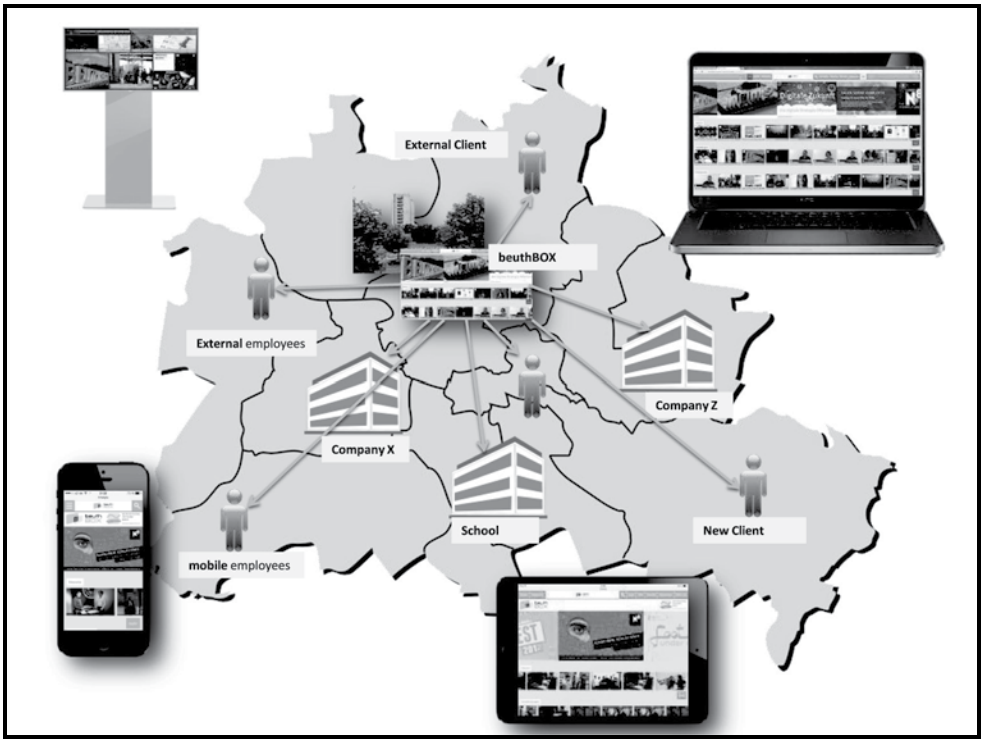
Fig. 11: Delay Editor and Offline Demonstrator for the MultiView Recordings

6. APPLICATION SCENARIOS

The above described video-based technology offers a wide range of possible applications: e-learning and information, knowledge acquisition and knowledge transfer as well as entertainment. Companies, external employees at mobile working places, or clients using mobile devices can get access to the video-based content (Fig. 12).

The MPEG DASH technology makes it possible to reach any terminal device by any access network.

Fig. 12: The BeuthBOX Portal Offers Media Contributions for Companies, External Employees at Mobile Working Places or for Clients with Mobile Terminal Devices



Due to the companies increasing internationalization, multilingualism is getting more importance. For communication and media transfer the possibility to select different audio channels and thus different language versions is therefore of the same relevance as the selection of an appropriate perspective of a media contribution.

6.1. E-learning and Information

One of the most prominent fields of application is e-learning and information. Hence there is growing e-learning and information contributions in the university field and also at the Beuth University of Technology Berlin. The media contributions are lecture recordings with an approximate duration of of 90 minutes, preparations for exercises and laboratory with the duration of some minutes, interviews with lecturers and researchers about their current projects or special didactical methods with a duration between five and ten minutes. One of the main goals of the BeuthBOX platform is to provide an intuitive multimedia/hypermedia system environment. Video is the main information 'channel', but could be enriched at any position with additionally pictures, documents, links to the Internet and links/recommendations to other video contributions. The media contributions should be able to optimize with regard to didactics and learning structures.

A mix of elementary media is offered in order to address different learning types. For e-learning purposes are virtual contributions preferable to MultiView videos, which consist of texts and images.

In the winter term 2014/15 two lectures "multimedia processes audio" and "multimedia processes video" by Prof. Lohr were recorded with multichannel processes in the course of a pilot project (Fig. 13 – top). Due to first technical limitations the display of multichannel contributions could only be realized as single view in a fallback process and as separate application of 10 minutes content. Currently multichannel applications have become available that offer two views (MC2): 1. lecturer with blackboard as well as 2. computer surface for slides and computer tools (actors). For the audio tracks the lecturer and the computer sound were recorded. For the recording in real time the fallback solution was produced as third video stream by means of a picture-in-picture process (Fig. 13 –bottom LHS). The aspect ratio of presentation and camera still poses a problem, because a standardization to the format 16:9 has not yet been possible.

The DASH player becomes active by switching to the main view: At first, the image of the main view is blurredly displayed in low resolution. After some time, the buffer is filled enough, high quality packages arrive and the image becomes now clearer and the sound brighter (Fig. 13 – bottom RHS).

Fig. 13: E-Learning/MOOC Scenario – Top: Interactive Player with Two Parallel Video Streams (Left The Lecturer, Right The Presentation), Bottom Right: Fallback, Bottom Left: DASH-Quality Stage 0 (90 pixels horizontally)