

Hypervideo

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INTRODUCTION

Hypervideo is the adaptation of the hypertext metaphor to video. By annotating and referencing video objects, diverse media, and pieces of information the video stream can be unlocked to the global web of knowledge.

Hypervideo combines the advantages of hypermedia as a dynamic, associative, and extendable network of information that can be shared and searched by many users at the same time, and of video as a natural and intuitive media to convey complex dynamic processes. Therefore, hypervideo will be one of the most important media for learning on the Semantic Web.

This article will first introduce the concepts of hypervideo. Then the history of hypervideo applications will be outlined, and current applications on the market will be presented. Design aspects will be discussed taking the example of one hypervideo application. Then, use cases for hypervideo will be presented. Finally, we will discuss possible future trends before coming to the conclusions.

BASIC CONCEPTS

Hypervideo is an application of the hypermedia concept. However, in contrast to other hypermedia, such as the World Wide Web, hypervideo not only is a hyper structure of linked media pieces, but it has an inherent structure. All information linked to the video is organized along the timeline of the continuous video stream guiding the reader and giving a major direction

of exploration. To understand the specific nature of hypervideo we should first have a look at the underlying concepts: hypertext, multimedia, and hypermedia (a detailed discussion can be found in Myers, 1998).

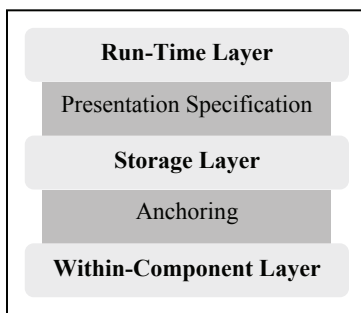
Hypertext has been defined as a combination of natural language text with the computer's capacity for interactive branching, or dynamic display of a non-linear text, which cannot be printed conveniently on a conventional page (Conklin, 1987). The single pieces of information linked together are called the nodes. Anchors are used to mark nodes or sections of nodes and to serve as connection points for the links that actually describe the connection between information entities (Steinmetz, 1995).

Multimedia describes the computer-based integrated generation, manipulation, and interaction of different media, where, according to Steinmetz (1995), continuous (time-dependent) and discrete (time-independent) media have to be combined. Schulmeister (2002) further emphasized the importance of the interactive manipulation of such media as relevant for characterization.

Hypermedia unifies the concepts of hypertext and multimedia by describing a hyper structure of multimedia nodes (e.g., text, image, audio, and video). Common hypertext structures found in the Web combining different pieces of media in a basically text-oriented structure are often referred to as hypermedia (Nielsen, 1990).

The basic model for hypermedia leads back to the early hypermedia systems such as Augment or HyperCard and has been published by Halasz and Schatz (1994) known as the *Dexter hypertext reference model*. Figure 1 shows the Dexter model that separates the

Figure 1. The Dexter hypertext reference model



hypermedia structure into the within-component layer (containing the original data units, that is, files that are unaware of their belonging to a hyper structure), that are referenced by anchors. The storage layer represents the hyper structure with the relations between units of information, which then is presented by the run-time system.

The expression “hypervideo” finally has been coined by Locatis, Charuhas, and Banvard (1990). In a hypervideo the non-linear hypermedia structure is applied to the originally linear video stream, which thus can be broken up. Table 1 summarizes the terminology used to describe the basic components of a hypervideo (Finke, 2005; Finke & Balfanz, 2004).

HYPERVIDEO SOLUTIONS

One of the first interactive video systems was the *Aspen Movie Map* by the MIT (Bender, 1980), where the spectator could control a ride through the city of Aspen by interacting with a touch screen. Hyperlinks were attached to a 3D model of the city topology

providing direct connections between different locations. Another MIT project was *The Elastic Charles* (Brøndmo & Davenport, 1991), where different video clips could be browsed and additional media could be accessed via selecting moving icons (Micons) that had temporal and spatial relevant behavior. In interactive arts the installation *Portrait no. 1* by Luc Courchesne in 1990 allowed the spectator to flirt with a virtual girl by selecting of a choice of more or less charming utterances. Another way of hyperlinking video content was the “video-footnotes” accompanying a video presentation in the Kon-Tiki museum in Oslo, Norway, where additional text and images could be selected (Liestøl, 1994). Another pioneering project was the *HyperCafé* (Sawhney, Balcom, & Smith, 1996) that gives the spectator the impression to sit in a café and to navigate between different conversations that are interwoven and editable in a graphical tool. Text and Micons were overlaid on the video to indicate cross-references also as wireframes to highlight navigation opportunities. *HyperSoap* (Bove, Dakss, Agamanolis, & Chalom, 2000) is an academic application designed for interactive television, primarily for soap operas to link home shopping information to video objects. The system includes an editor that supports automatic object tracing.

In the recent years, as the Internet has become mature the integration of video into the World Wide Web has become the predominant idea. The advancements in video compression and broadcasting also as the availability of sufficient bandwidth have provided the technical foundation for this development. Several systems have been developed since then; some of them are now published and sold as commercial products. Table 2 gives an overview of more recent hypervideo applications that can be distinguished by the type of media links for which they are primarily designed.

Table 1. Hypervideo terminology (Finke, 2005)

- *Hypervideo Node*: Units of information represented as files or media.
 - o *Video Node*: Specific node representing a video that can be used as basis for a hypervideo.
 - o *Information Node*: All nodes that can represent information linked to a video.
- *Hypervideo Anchor*: Defined section of a node that can be referenced by other anchors or serve as source of a link.
- *Hypervideo Link*: Connection between two anchors. Hypervideo documents primarily should use anchors on video nodes as source and anchors on video of information nodes as target.
- *Hypervideo Structure*: Entire structure of nodes, anchors, and links.
- *Hypervideo Document*: Synonym for hypervideo.
- *Video Annotation*: Process of defining anchors in the video and linking information to it.
- *Sensitive Region*: Representation of the video anchor in the run-time layer; has a duration and a space it covers in the video surface; can be divided into several intervals.

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