research directions - digital video formats

In the online version you will find a brief overview of *digital video technology*, written by Andy Tanenbaum, as well as some examples of videos of our university, encoded at various bitrates for different viewers.

What is the situation? For traditional television, there are three standards. The american (US) standard, NTSC, is adopted in North-America, South-America and Japan. The european standard, PAL, whuch seems to be technically superior, is adopted by the rest of the world, except France and the eastern-european countries, which have adopted the other european standard, SECAM. An overview of the technical properties of these standards, with permission taken from Tanenbaum's account, is given below.

\mathbf{system}	spatial resolution	frame rate	\mathbf{mbps}
NTSC	704 x 480	30	243 mbps
PAL/SECAM	$720 \ge 576$	25	$249 \ \mathrm{mbps}$

Obviously real-time distribution of a more than 200 mbps signal is not possible, using the nowadays available internet connections. Even with compression on the fly, the signal would require 25 mbps, or 36 mbps with audio. Storing the signal on disk is hardly an alternative, considering that one hour would require 12 gigabytes.

When looking at the differences between streaming video (that is transmitted real-time) and storing video on disk, we may observe the following tradeoffs:

\mathbf{item}	streaming	downloaded
bandwidth	equal to the display rate	may be arbitrarily small
disk storage	none	the entire file must be stored
startup delay	almost none	equal to the download time
resolution	depends on available band-	depends on available disk
	width	storage

So, what are our options? Apart from the quite successful MPEG encodings, which have found their way in the DVD, there are a number of proprietary formats used for transmitting video over the internet: Quicktime, introduced by Apple, early 1990s, for local viewing; RealVideo, streaming video from RealNetworks; and Windows Media, a proprietary encoding scheme fromMicrosoft. Examples of these formats, encoded for various bitrates are available at Video at VU.

Apparently, there is some need for digital video on the internet, for example as propaganda for attracting students, for looking at news items at a time that suits you, and (now that digital video cameras become affordable) for sharing details of your family life.

Is digital video all there is? Certainly not! In the next section, we will deal with standards that allow for incorporating (streaming) digital video as an element in a compound multimedia presentation, possibly synchronized with other items, including synthetic graphics. Online, you will find some examples of digital video that are used as texture maps in 3D space. These examples are based on the technology presented in section ??, and use the streaming video codec from Real Networks that is integrated as a rich media extension in the blaxxun Contact 3D VRML plugin.

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