

Digital Daily Systems at HFF Potsdam

Screening of data-based HD-Content

HD content should ideally be monitored uncompressed in its source format and resolution. This article describes how future screenings of image sequences with up to 2K resolution will be conducted in several Academy for Film and Television Potsdam (HFF) cinemas. The project centres on three remote-controlled server systems supplied by DVC, feeding Kinton and Panasonic projectors.

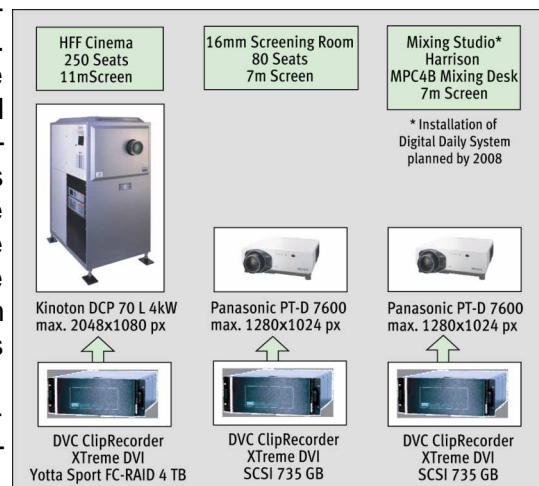
Introduction

Since the end of 2006, in three of the six cinemas of the Academy for Film and Television Potsdam (HFF) „Konrad Wolf“ digital acceptance systems are installed which allow the direct viewing of virtually every type of file based content in high resolution without conversions or other delays.

The heart of each of these three systems is the DVC ClipRecorder XTreme DVI whose playback software QuickClip Server, developed by Drastic Technologies, was specially modified for the use of HFF Potsdam to achieve more flexibility for file formats, position and colour-resolution. The students can load the content to be viewed from the central server to the three systems. This happens via a web interface developed together by HFF, DVC and Drastic. The playback functions of the three systems will be remote controlled with a Crestron media control from the auditorium. While two of the three systems are connected to Panasonic DLP projectors of 1280x1024 resolution, the real highlight of the installation is a DCP 70 D-Cinema projector. The DCP 70 is based on the DLP-Cinema-Technique of Texas Instruments (TI), which is purchased from TI by Barco, one of only three licence holders throughout the world (**picture 1**).

The projector features a native display with a maximum resolution of 2048x1080 pixels and corresponds to the DCI-specifications.

The systems were co-financed with 75% coming from HFBFG funds (university construction support law) and from the European funds for regional development (EFRE) "multimedia in the university".



Picture 1: Complete installation:
Digital Screening in three cinemas



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The point of origin

The syllabus at the HFF consists of eleven different study courses and is very practically oriented. Hence, in the curricula a large number of student projects are fixed. This leads to a high level of in-house production. Some of these productions are still accomplished by traditional means - PAL or negative / lab based.

But for a long time animation films have been produced which are computer generated and file-based at high-resolution. They are output via the Management Graphics Cine III film recorder of the HFF or transferred to other HD formats. Since 2003 a Thomson Spirit Datacine 2K film scanner with Transfer Engine has been installed at HFF. This combination allows users to generate DPX files with high resolution from 16-mm or 35-mm film which are supplied to the post production pipeline via a central Framestore with 15 TB of storage capacity at the moment.

Other high-resolution file formats are generated by the Final Cut, Flame, Cyborg, Combustion, Maya and After Effects workplaces, and also by digital photo cameras for stop motion animation.

Problem

The increasing file-based processing in resolutions higher than SD (PAL) led not only to an increased amount of data, but posed the problem that the file formats used could not be played back at their native resolution in real-time with the existing technology.

The data had to be down-converted in a time consuming process and then transferred to classical VTR formats to scale them to the HFF cinemas projection screen size.

The time this process was taking was unacceptable not only from the point of not being able to review content quickly but because of the amount of storage involved it was in only possible to keep the high-resolution projects for a short time.

Another problem occurred during film acceptances especially with the viewing of digital film artefacts in SD formats. As the presentation of the material was carried out only at lower resolution this impaired the viewer's ability to make critical judgements.

Under these circumstances important details of the film remained concealed to the viewers and as the next step following the end acceptance is often the film exposure, which is subject to high external expenses, poor decisions at this point lead to unnecessary additional costs.

The aesthetic judgement of newer high-resolution recording procedures was not possible with down converted material. However, with the present trend towards high-resolution productions it is precisely this judgement that is critical within the scope of film education and the investigation of newer artistic representation forms.

Method of resolution

The solution of the problem described was to be reached by the use of systems which satisfied the following criteria:

- Playback of all file formats used at the HFF on a real-time basis with the synchronous binding of initially up to six audio channels
- Display of all formats and colour depths used in the production process
- Integration in a high-speed network for rapid transfer of data and future ability to connect to a SAN.
- Complete remote control of the systems, both during the loading of files and also during all playback functions to allow an easy and secure workflow to a wide range of users without the involvement of further support staff.

After a detailed study of the devices available in the market it quickly became clear that the extensive demands of the HFF could not be fulfilled by "off the shelf" systems.

The biggest challenge came in relation to the automated change-over of the picture and data formats during remote operation.

Advertising for a proof of concept prototype, at first the search was on for an organisation that could carry out complex adaptations of software and hardware and enter together with HFF into a new development. To this end a tailor-made system was developed together with DVC, Herrsching.

After successful testing of the prototype with 735 GB of capacity and a data performance of about 350 MB/Sec two other systems were ordered with additional FibreChannel options and up to 4 TB storage capacity.

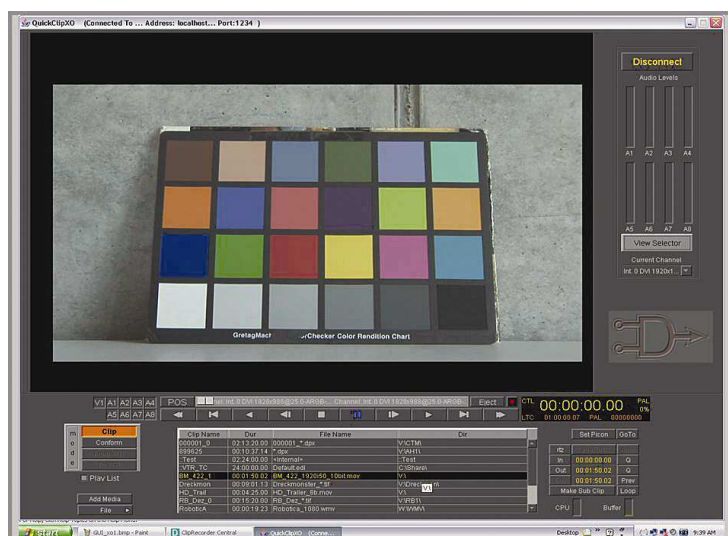
These successful tests meant that the next step could begin - the procurement of a projector. It was to be installed in the big cinema of the HFF, about 250 seats, 11-m-wide projection screen. It would need to display at native resolution the high resolution content passed from the installed ClipRecorder system and at the same time handle a large selection of alternative content. The choice fell to a Kinton projector, the DCP 70 L.

Tabelle I. Unterstützte Datenformate und Auflösungen (Auswahl)
Table I. Supported Fileformats and Resolutions (Selection)

file formats	sources
<ul style="list-style-type: none"> • DPX 10bit lin, log • TIFF 8/10bit (16bit) • Quicktime • WMV-HD • sgi • bmp • Cineon log • MPEG-TS 	<ul style="list-style-type: none"> • Spirit, Flame, Combustion, Digital Film Cameras etc. • Animation, Editing and Digital Photo Cameras • Final Cut Pro (Blackmagic HD Codec, 4:2:2 uncompressed) • Variety of cources & Codecs • Animation Department • Animation Department • Animation Department • e. g. HDV-Kameras
layout	resolutions
<ul style="list-style-type: none"> • Film (Belichter) • D-Cinema • „HDTV“ 	<ul style="list-style-type: none"> • 1828x1332, 1828x1102, 1828x98 @ 24, 25, 30 fps • 2048x1080 und Derivate @ 24, 25, 30 fps • 1920x1080p(i) @ 24, 25, 30 fps, 720p-Formate
audio formates	audio channels
<ul style="list-style-type: none"> • .wav 16/20/24 bit • .bwf 16/20/24 bit • .aiff 16/20/24 bit 	<ul style="list-style-type: none"> • Up to 6 mono channels or 3 stereo channels • Up to 6 channels • Up to 6 channels

Playback of data formats

The chosen devices, ClipRecorder XTremeDVI's are film-, HD- and VESA players, which can play-back uncompressed and compressed file formats. Compared with the ClipRecorder XTreme2k, in the DVI version a high-end Nvidia graphic card is used for DVI / Dual-Link-DVI and VGA output and the Dual-Link-DVI-output is connected directly with the Kinton DCP 70 L2K projector (or in the other halls with the Panasonic PT-D 7600) (picture 2).



Picture 2. QuickClip XO user interface and preview during local mode

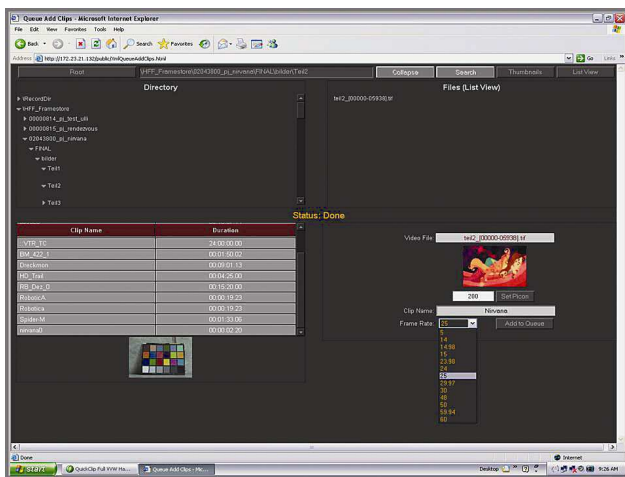
As well as all the standard 2K-, HD- and VESA rasters, the QuickClipXO software used on the Cliprecorder XtremeDVI allows customised rasters of up to 2048 x 1556 resolution at 48 fps frame rate. A choice of the "film formats" of the HFF which are played back with the ClipRecorder XTreme DVI are shown in table I. Beside the uncompressed formats, current compressed formats can be also played such as WMVHD.

The real time playback of the film sequences comes from Disk-Arrays with up to 4 TB capacity. An additional Dual-4Gbit/Sec FibreChannel interface allows playback from an external RAID or SAN system.

The variety of file formats available in the HFF led to the implementation of the "match output to clip" function. Via XML-Metadata the raster, the frame rate and the file format are recognised as soon as the user selects a new clip. The new parameters are automatically taken over from the ClipRecorder and are used to set the raster and colour space of the output, without user intervention.

Functions of remote control

Loading function

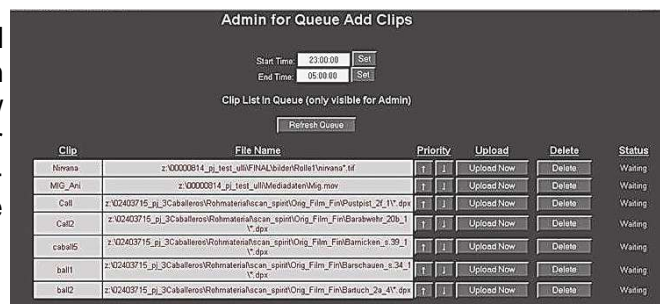


Picture 3. Web-GUI: Interface for students File browser, frame rate and clip naming

Within the scope of another special development a Web-GUI was developed, according to the requirements of the HFF, for loading the systems with data in the background accessible from any workplace. The Web-GUI runs with all current browsers on Linux, OSX, IRIX and Microsoft PCs on the personal computers of the students.

With the Web-GUI the students can transfer data from their project folder on the central Framestore directly to the ClipRecorder systems. Besides Preview-Icons (Picons), the clip name and the frame rate can be fixed and transferred via XML-Metadata to the ClipRecorder XTreme DVI for evaluation during playback.

Then the clips selected on the Web-GUI are copied either automatically at a given time (scheduled copying at times with low data amount transferred, e.g. at night) or from the system administrator on the local storage of the ClipRecorder XTreme DVI (pictures 3 and 4).



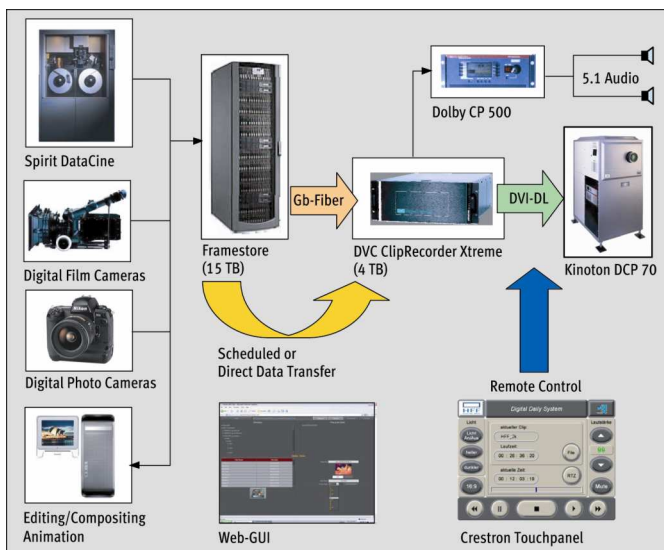
Picture 4. Web-GUI: administration surface – clip queue and transfer scheduler

Playback of the clips

As the ClipRecorder XTreme DVI also has a RS422 control with Sony, Louth- and Odetics protocols, it can be controlled by any playout-automation or Show Control system, and be fully integrated into a film production pipeline.

In the cinemas at the HFF Crestron media controls are used throughout. Using touch panels the lights can be dimmed in the auditorium, the layout of the projection screen changed and all the playback functions of the connected CD, DVD, VHS, DV-, DigiBeta- and DVCPro players initialised.

Also the change-over of the audio channel allocation and the volume of the Dolby Cinema Processors CP500 can be remotely controlled from here. It seemed obvious to implement the playback functions of the ClipRecorder systems into this system to create familiarity for the users.



Picture 5. Mode of action of the complete system

The following functions of the ClipRecorders are remote controlled:

- Play, Stop, Freeze, FFWD, RWD, RTZ;
- Time-Code Superimpose On/Off;
- In/Out-Loop;
- Display of the clip name, the current position and the length of the clip;
- Shuttle-Slider for fast queuing to selected points.



Picture 6. Crestron Touchpanel (picture source: www.crestron.com) and user interface of the HFF Panels (Programming: Mike Kinas, HFF)

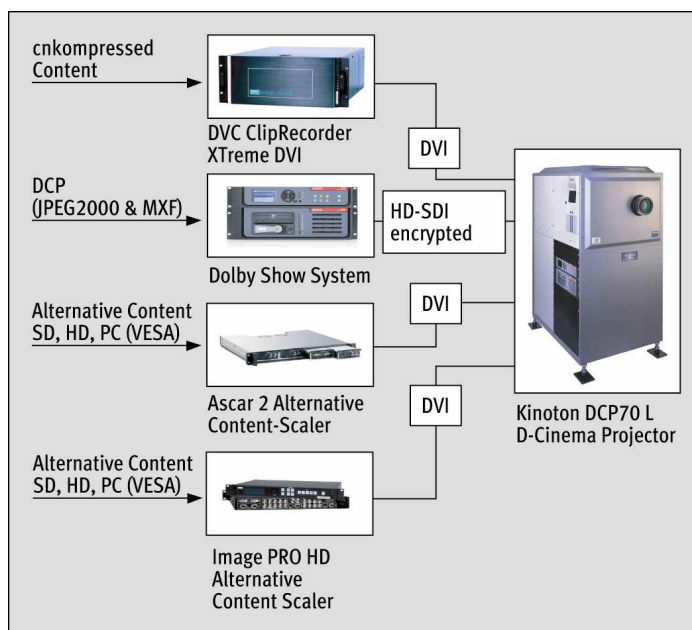
In addition, the clip names transferred via XML which the user has identified within the store are shown on the Crestron touch panels. Also the Kinoton projector DCP 70 being used in the big film hall and the connected input scaler were completely integrated into the control system.

Of particular interest is the ability to realise up to a fourfold Splitscreen representation with the installed Barco Acsar II scaler in the projector allowing for "work in progress " material to be compared or video sources to be shown in parallel with Powerpoint presentations. The very extensive programming of the Crestron touch panels and CPUs was realised by Dipl.-Ing. Mike Kinas (department of education technology HFF) (pictures 5 and 6).

Digital projection

The highlight of the installation, the Kinoton DCP 70 L D-Cinema projector is based on the 2K DLP Cinema technology developed by Texas of instrument (TI) which Kinoton obtains in the form of core components from Barco. Also the TI features CineBlack, CineCanvas, CineLink II and CinePalette are supported.

The DCP 70 L uses the same xenon-high-pressure lamps as used in classical film projectors. The L-version is suitable for lamps with up to 7000 W of power. Nevertheless, for the HFF installation a lamp with 4000 W was enough.



The DCP 70 L D-Cinema projector is already equipped with progressive DCinema inputs for HD-SDI (single link and dual link) and DVI (single link and dual link). To be able to project the content of any digital or analogue source, its capabilities were extended further with the help of Input Scalers. Now additional sources such as S-video, Composite, HD-SDI/SDI (interlaced), RGBHV, YUV and DVI can be attached. The input signals are scaled up on the projector to its native 2K resolution. The Barco Acsar II of the Barco/Folsom-Scaler ImagePro HD is used here, whose special strength is the high-quality up-conversion of SD material.

Picture 7. Digital Cinema-Projector and possible signal sources

In addition, a frame rate conversion and de-Interlacing is applied when required (**picture 7**). The DCP delivers a

native aspect ratio of 1.9:1, within which the wide screen picture typical for cinema of 1.85:1 can be shown without pixel loss.

Also other specific aspect ratios such as 16:9, 4:3 or 5:4 can be projected without loss within the whole projection screen height. For the Cinemascope format (2,39:1) which is very often used in the cinema, the projector was equipped with an additional anamorphic lens which is automatically swung in front of the standard lens when required. Thus pixel loss is also prevented here. With the enhanced configuration software it is now possible to load different LUTs and colour profiles in the projector and interactively adjust the "look" of the projected material. In detail the following functions are available to the students in the HFF with this software:

- Creation of Anti-Log-LUTs;
- Creation of own colour profile conversion matrixes;
- Import and editing of Gamma Lookup tables;
- Use of a P7 colour correction;
- Loading of external generated 3D-LUTs to simulate different film stocks.

In addition, the so-called projector configuration files (pcf) which describe the physical state of the input signal can be specified within this software. Typical parameters are the size and the position of the active picture contents as well as the pixel aspect ratio and content specific LUTs.

The projector supports two different processing modes. In the "Cinema Processing Mode " for D-Cinema Content an enlarged colour management functionality is supported including all scaling and D-Cinema functionalities (e.g. CineCanvas, CineLink II and CinePalette). In contrast the "standard Processing Mode" supports no scaling, with limited adjustment of the colour processing of the projector.

Further functions and enhancements

Another enhancement was purchased within the scope of the installation of the DCinema projector: A Dolby Showstore/Showplayer combination provides for the decoding and playing of future DCI D-Cinema-Content (JPEG2000 in the MXF container).

For 2007, enhancements for the software of the DVC server are planned which should lead to even more flexibility in file handling and picture formats.

The Digitally Daily systems are part of a bigger procurement program which is driven by the Digital Media Institute DMI of the HFF under the direction of Prof. Ulrich Weinberg and the vice-president of the HFF, Prof. Martin Steyer, in collaboration with the department of education technology (department manager qualified engineer Jürgen Prestel) since the beginning of 2005 in several steps.

Thus in 2006 already a prototype for a multimedia workplace for animators, mobile digital recording technology and a lab for virtual set design have been implemented. For 2007 through 2009 other components are planned, in particular the creation of an integrated data-based HD workflow in the HFF.

Also the development of the central video and audio server of the HFF is planned. Beside an increase in capacity, the bandwidth should be also raised significantly to be able to play 2K film data directly from the server without the need to copy it locally to the DVC systems.

Academy for Film and Television „Konrad Wolf“ Potsdam

Resident in the media city Potsdam-Babelsberg, the artistic media academy HFF „Konrad Wolf“ is the largest and oldest film academy in Germany. New media technologies are also an integral part of the eleven study programmes - which cover all important areas of film and television - as well as the orientation of the cultural roots of these media.

Academy for Film and Television (HFF)

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Since 1990 **DVC Digitalvideo Computing GmbH** has been developing, producing and selling integrated system solutions for the Digital Video, Presentation and HDTV market. At the same time DVC is the European and/or German master distributor for several well-known manufacturers in the HDTV/Digitalvideo, desktop video, broadcasting and streaming media market.

DVC's own products including the ClipRecorder, ClipDisk, ScreenDisk and the Megacine have their focus in markets like film scanning, video post-editing, Digital Dailys, presentation and research & development. Together with Kinton as a strategic partner, DVC offers server systems and solutions for the growing future markets of DigitalCinema and HD presentation.

As a distributor DVC represents well-known manufacturers such as AJA, DataDirect, DNF, Drastic Technologies, MikroM, Optibase, SeaChange and VideoClarity. An international distribution network has been established with the help of representations in Austria, Denmark, France, Great Britain, India, Italy, Spain, The Netherlands and Vietnam.

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Drastic Technologies Ltd, founded in 1991, is a major industry provider of products for digital media capture, control, conversion and delivery. These products are sold as software only applications or as part of a complete DDR solution built and certified by Drastic. Drastic's strength lies in its core technologies for the manipulation of digital media. RS-422 Serial control, VTR Emulation and media file conversion are areas where Drastic excels. The use of open industry standards such as standard file formats, SAN/ NAS/ NTFS file systems and carefully designed modular technology allows an easy integration and upgrade path for production and broadcast facilities.

Drastic products include 1) stand alone software and digital disk recorders for clip control, VTR emulation, external device control and digital media playback management; 2) software for media file conversions; and 3) SDKs for media control, interface and translation.

Current Products

VVW The VVW Series of digital disk recorders represents the culmination of years of expertise and research in digital video capture, control, conversion and delivery. The VVW Series is available in uncompressed SD/HD in 8/10 bits YCbCr or RGB, supporting NTSC, PAL and HDTV standards, in single or multiple channel configurations, and includes VTR Emulation and Serial Control support and MediaReactor file conversion software.

QuickClip QuickClip software provides a subset of the VVW functionality for the user of specific digital video hardware. QuickClip software is available for (uncompressed) AJA SD/ HD, Bluefish444 SD/ HD, Optibase VideoPump SD/HD, and (compressed SD) CineView Pro/XL hardware.

MediaReactor MediaReactor file conversion software allows the user to convert between dozens of digital media file types including streaming video files, high quality still image/ graphic and audio file types. Features include batch processing, an aggressive preview app, and support for industry-crucial file types. The modular software architecture allows new formats to be added seamlessly. Software plug-ins provide support for Uncompressed, Avid, Matrox, Animation and MJPEG file types. Options allow the user to choose the product level they need and add formats as their needs grow.

DrasticPreview DrasticPreview is a skinnable VGA screen media player which allows the user to view a wide variety of file types on their VGA screen. It also displays a wealth of metadata and real-time information about the media file including time code, file type/codec, filename, Reel ID, Composer etc. The user is able to browse for saved digital media clips for individual viewing, compose PlayLists for sequenced clip playback, and run or save to disk for later review.

Drastic SDKs Drastic Software Developer Kits offer a range of tools for the developer of custom video and audio capture, control and playback applications. Specific SDK packages include:

- o MediaCmd SDK - contains tools for controlling an external VTR.
- o Serial Emulation SDK - contains tools for being controlled by an external device, such as a BUF or DNF controller.
- o MediaReactor Translation SDK - contains tools for digital media file conversion – a wide range of file formats are available.
- o DrasticPreview SDK - contains tools for viewing digital media files on the user's VGA screen.
- o MediaRead SDK - contains tools for converting a wide range of digital media files to uncompressed format – many “read” formats available.

Locations and Resellers

Drastic's head office is located in Toronto, Ontario, Canada. Drastic Technologies Ltd has resellers and distributors operating in the USA, Canada, Europe (DVC), Australia, and Asia.