

Film postproduction

A step-by-step state of the post world at today's hottest facilities as they learn to hustle and workflow.

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Digital postproduction for the feature film is taking a step up -- to data.

Resolution-independent information that includes not only images but information about those images -- data which lives as a 2K or 4K master -- is a means to create a single digital version that can be accessed and improved simultaneously by the editor, dust-buster and visual effects artist. Yep, it's time to learn a new workflow -- or two or three -- based on a data-centric pipeline that, in the near future, will likely make videotape obsolete and deliver the promise of digital networking.

Encouraging the ascendancy of the data post pipeline are the Thomson Viper FilmStream, Panavision Genesis, Arriflex D-20 and Dalsa Origin at the acquisition end and the growing need for a d-cinema master at the other end. Following is a look at the entire feature film postproduction pipeline, from previsualization to final master, and an examination of just how close the industry is to going completely tapeless.

The name game

It's no longer "previsualization" -- slowly but surely, the "pre" is dropping off, leaving just "visualization."

The domain of previz always has been about creating dead-on accurate imaginings of complex visual effects shots in the hopes of determining precisely what the shoot will require -- thus avoiding costly, disastrous mistakes. But workflow has changed, Pixel Liberation Front executive producer Sean Cushing says. He and PLF have worked with visual effects facility Sony Pictures Imageworks, and he reports that his company has been in "an interesting workflow arrangement" for Sony's planned 2007 release "Spider-Man 3."

"From the commencement of the previz job, we are using Imageworks' character rig and pipeline tools," he explains. "It takes a degree of openness on their part to open up their toolbox."

But once they do, the impact is dramatic.

"They take our work directly and have absolutely no translation job," Cushing continues. "They can

instantaneously start to work from our previz. It's an incredibly effective concept that makes sure that the previz is utilized throughout the whole process. We can use their pipeline and tools so our work is applicable to them all the way down into post."

Computer-generated shots make previz essential, he notes. "There's no need to change the camera or placement of the characters. You up-res the characters and environment, but the scene is intact. Working with the VFX house's character rig makes it seamless."

Increasingly, previz tackles entire sequences that include shots that won't consist of visual effects but are essential for editorial to be able to cut together the story being filmed. That component of workflow is one PLF has been advocating over the past year; Cushing says the goal is to get the film editor working as quickly as possible.

"I think that moves the whole process up where decisions are made in preproduction that will probably be the same throughout post," he says. "Having the editor on early gives the director confidence that he or she will be satisfied with the outcome."

A twist in the color palette

If there's an Achilles heel in the emerging data-centric workflow, color is it. For decades, color was a known commodity, and filmmakers could communicate information about it with lab timers in printer lights. Now, the new digital workflow has thrown a monkey wrench into the works.

"The next horizon that no one has cracked yet -- although we are close -- is having a continuous color pipeline from the origination of on-set color tools all the way to the (digital intermediate) and mastering the product," says Steven Kaminsky, a freelancer who faced color-management issues as postproduction supervisor on Warner Bros. Pictures' digitally acquired "Superman Returns." "It's not a continuous flow yet, but I think we're close to it."

Since the colors that film captures are not the same that video displays, more than a few film professionals have been faced with the difficult reality that what they see through their lens probably won't be what they see on the monitor in the post house and almost certainly won't be what's projected in the movie theater.

But help is on the way. For more than a year, the American Society of Cinematographers, the professional group most directly impacted by this state of affairs, has been working on creating the Color Decision List, a standardized way to communicate color and ensure consistency. According to Post Logic Studios senior colorist Lou Levinson, who is on the ASC committee tasked with creating the CDL, progress is being made.

"We know it works," Levinson says. "We know we can exchange a set of nine numbers, and they tell you how to do a primary color correction on whatever picture they're associated with."

Yet to be worked out, however, is the not-insignificant task of how to move the numbers around from device to device. "We don't have an agreed-upon transport mechanism," he says.

Meanwhile, Hollywood companies concerned with color, such as Kodak and Technicolor, have been working on solutions. Kodak's Look Manager System allows cinematographers to model the desired look and communicate their intent directly to the post house and lab. Based on Kodak Color

Science, KLMS aims to deliver more color-accurate dailies without film tests that burn up time and money.

With KLMS, the cinematographer previsualizes a scene by modeling the effects of gels, filters and postproduction techniques on Kodak film stock and then delivers that look to the post house or lab.

Kodak's Display Manager System, a companion product, calibrates the display devices -- including digital projectors -- for a consistent visual reference. The system measures the color gamut and tone scale of the display device to simulate the print film look and also can be used to match multiple displays to one another.

Technicolor, the company that has put color in motion pictures since the 1920s, created a digital version of printer lights, an age-old system that has enabled cinematographers throughout the decades to communicate exact color information to the lab timer. Technicolor vp imaging research and development Josh Pines and vp imaging Chris Kutcka came up with Digital Printer Lights, which was beta-tested by Daryn Okada, cinematographer on Buena Vista's April release "Stick It." Since then, Technicolor has refined the user interface and adapted it for use with digital cameras such as the Thomson Viper and Panavision Genesis.

Another company with a color management solution is Gamma & Density Co., founded by cinematographer Yuri Neyman. G&D's Cinematographers Color Correction Program, or 3cP, is a multifaceted tool aimed at emulating the film lab's printing lights, type of film stock, processing filters and printing processes, as well as video and special effects. One tool calibrates monitors, so the cinematographers can communicate not just with the lab timer but with the telecine colorist. Using a G&D Telecine Color Control Chart and standard bars, 3cP establishes the correlation between printing lights and video data. The on-set 3cP monitor is calibrated to be identical to the telecine monitor. For digital cameras, 3cP also transforms photographic and video information into data understood by the computer. 3cP was most recently used on Paramount Vantage's "Babel," on which Rodrigo Prieto was the cinematographer.

On location -- and in high definition -- with dailies

For at least some productions, a daily can now come in high definition. "We have choices now," says Kaminsky, who reports that Iridas' SpeedGrade OnSet enables a cinematographer to adjust color and communicate those changes to the colorist. "You can do on-set color and capture that and go no further with dailies if you want to. And, for digital origination, there are tools and technologies to set a look for each set-up and capture that and leave it at that for dailies."

Encore Hollywood has integrated its digital intermediate services with digital dailies, using its MTI Films' Control Dailies system. This way, color decisions made at the dailies stage can be retained and reapplied later in the DI process.

On the set of "The Feast of Love," Lakeshore Entertainment executive vp production Richard Wright used Ascent Media's UP Drive HD nonlinear dailies system. "What it does is take your dailies in full HD resolution and allow you to arrange them and play them in any order," he says. "You can see everything you need to see in 15 minutes. It's HD -- so you're looking at something that has pretty much the same resolution as film -- but it's not linear like film. And it's simple to use. Even a producer can operate it!"

The "E-ticket ride" for digital dailies, Kaminsky says, is Creative Bridge's 36-foot-long mobile digital lab and theater, which is set up for digital grading of dailies, with comfortable seating for eight people. The mobile lab/theater is a treasure chest of cutting-edge tools, including Assimilate Scratch, Gamma & Density's 3cP, KLMS and Display Manager, digital storage/playback from S.two and Codex Digital, calibrated monitors and a 2K digital projector. Launched at NAB 2006, Creative Bridge's Mobile Digital Lab & Theater is currently working on ESPN's miniseries "The Bronx Is Burning," which is shooting with two Thomson Vipers.

"When the tapes are ingested onto our server on the Mobile Digital Lab, Jeff Olm, our colorist, reapplies the specific LUT used for each scene," Creative Bridge co-founder Brian Gaffney says. "Jeff plays the dailies in the theater with surround sound and the grade applied for director Jeremiah S. Chechik, DP Doug Koch and second unit DP David Stump, and any tweaks are made at this point. He also makes

modifications to the LUTs and puts these on a USB memory stick for easy loading on set. Jeff then records the color-corrected clone of the master tape and makes a DVCPRO copy." This workflow is turning around 21-22 hours of dailies five days a week.

But HD dailies are not yet standard. At PostWorks, New York, senior technical adviser Joe Beirne says, "We find that the screening of HD during production and editorial is considered an expendable luxury by many features.

"Too often, we see a filmmaker first encounter their feature at the scale and quality they shot it in at the first preview, or even in the DI," he adds.

PostWorks' solution is to adapt the Avid DNxHD codec for compressed HD to create a "digital work print" approach to the screening of HD. "DNxHD preserves the raster size, color-space and high resolution of the original film scan, while allowing for a more flexible workflow in projecting calibrated server-based and tape HD rushes as well as the conforming of full-res HD assemblies as the edit process progresses," says Beirne, who reports that this digital work print workflow is being built into PostWorks' data-based and 4:4:4 RGB tape-based feature editorial and DI projects.

Down the road, dailies will eventually be available in 2K or even 4K. Company 3 president/managing director Stefan Sonnenfeld describes the yet-unrealized goal of scanning once, at high resolution. "Traditional films are still doing film-to-tape transfers in HD just because it's the system in place now," he explains. "You'll have to overhaul everyone's facility to change that, and you can't turn on a dime."

The end of sneaker net

"I'm done with tape," Kaminsky says. "There are times when you have to go to tape, but I never want to order another tape deck again."

Digital networking -- the ability to send dailies, visual effects and other image files across town and around the world -- is nothing new in Hollywood; companies offering limited versions of networking, including pioneer Pacific Bell, have come and gone for a decade. But as the pipeline gets fatter and therefore faster, the promise of digital networking for the entertainment industry is finally being realized.

Digital dailies, visual effects, editorial review and approval and digital intermediate finishing are all dramatically streamlined by the ability to send secure digital files from Point A to Point B. And there is an abundance of network providers from which to choose.

Ascent delivered high-res digital dailies for the second and third installments in Buena Vista's "Pirates of the Caribbean" franchise from Company 3, using its UP web and satellite, for viewing on location. "We can set up a full virtual environment on location with a satellite downlink so that while they're doing telecine, they can receive (those digital files) right on location," Ascent vp feature film services Steven B. Cohen explains. Company 3 also set up a virtual private network with Industrial Light + Magic, the lead visual effects company, to incorporate VFX elements into the DI master.

"We did the dailies, and then we carried that look into the preview process, and that preview process information was carried into the DI process," explains Sonnenfeld, who graded the second and third "Pirates" films. "We finalized the look in the DI process, and then all the deliverables including for ancillary markets -- from the d-cinema master to the home video and marketing materials -- emanate from one source with one person supervising."

Sohonet has been a successful networking service for the media and entertainment communities since 1995. Based in the U.K., Sohonet now reaches from Rome to Auckland, New Zealand, with a flexible bandwidth connection from 2MB per second to multiple GBs. Sohonet even offers a "delivery calculation tool" that enables filmmakers to figure out how long it will take to transfer their material, based on resolution and bandwidth.

According to managing director Dave Scammell, Sohonet is now working closely with Codex Digital, a digital recording/playback device that stores almost two hours of material in 2K and just under an hour of 4K material.

"Imagine you're shooting on a stage at Pinewood Studios, shooting digitally and capturing on the Codex unit," Scammell says. "Instantly, you can have the dailies sent across to a studio in Burbank, your original material to the VFX house. Your editorial people in London or Los Angeles could have instant access to the material, all without scanning."

Some facilities are creating their own services. In Burbank, FotoKem has just unveiled Global Data. Based on either an Internet or Sohonet connection, Global Data incorporates FotoKem's own blend of encryption and software to accelerate and streamline performance over the Internet. "It makes full use of whatever pipe is available," FotoKem senior vp technology Paul Chapman says.

Targeted toward TV and feature animation projects, FotoKem has Global Data centers in Seoul and Tokyo, locations where removable hard drives can be dropped off or picked up. A 50-megabit connection links FotoKem with Vancouver for high-speed transmission of visual effects; FotoKem just put a data center online in Ireland for an animated pilot and will soon set up a data center in Australia for a major motion picture from Fox.

"What's unique about this is that it's cost-effective for the client, and it isn't weeks of setup," FotoKem senior vp digital and data development Rand Gladden says. "One phone call to FotoKem and we take all the confusion, planning and setup away. We make it easy for clients to use the process."

Some facilities can network from within. Post Logic Studios, for example, has a 4GB-per-second fibre channel network within the facility (CEO Larry Birstock notes that 10GB solutions will be unveiled soon). Technicolor has networked its facilities in Burbank, Hollywood and its soon-to-open DI facility on Sony's Culver City lot. Hollywood-based the Post Group is establishing a fiber link to its sister company iO Film, which is setting up shop next door, as well as its sound facility Novastar and its Momentum visual effects company.

"Each facility has its own server, and we can share data through those servers," the Post Group CEO Stephen Buchsbaum says. "The fiber lets us share tape machines, and you can layback to a tape machine or server at any of the facilities from any of the facilities. It allows us to share hardware, which is the expensive part of our business."

Getting creative in the edit suite

The line between offline with highly compressed images and online material (which puts source material together) has been blurring on some productions, and some post houses are taking advantage of Avid's DNxHD codec to edit in HD early in the creative process. The DNxHD codec offers reduced bandwidth HD (at various levels of compression) so that editors and filmmakers can benefit from HD's better imagery without paying the penalty of huge amounts of storage. Avid DS Nitris and Media Composer systems can share DNxHD media in an offline-to-online HD workflow.

Ascent has unveiled a digital preview service based on a resolution-independent platform. Ascent artists use the film's first cut to produce a conformed color-corrected standard definition or HD video, with a temp audio track laid back. Ascent also offers a variety of projection options, which it delivers and sets up.

And at FotoKem, Avid's DNxHD media is the basis of a workflow for dailies and editorial. In addition to being able to view images better than in lower-resolution formats, the DNxHD format allows the hard drive to be removed from the editorial suite and taken to the theater, where it is played back for previews.

"It removes that stage of having to go into the online conform for previews," Gladden explains. "It allows you to go straight from the cutting room into previews. The final finishing will still take place at a higher res, 2K or 4K, but you're able to see the picture better and identify any issues with photography or lighting as you go through the editorial process. Overall, it makes the process cleaner and higher quality all the way out to the preview."

By being able to deliver previews with a removable hard drive, the production saves days of work preparing the edit for screening. All that time, Gladden points out, can be used in editorial to improve the film. For Lionsgate's slated 2007 release "Pride," the production finished editing on a Friday, and the preview was done the following Wednesday.

"Traditionally, they would have had to wait two weeks," Gladden says, adding that FotoKem has created a proprietary system for electronic synching within the editorial bay.

Let's get visual

The visual effects industry has long been at the center of bleeding edge digital technology, using removable hard drives to deliver work and making early use of digital networking and proprietary FTP sites to transfer images and sequences. Only now is the rest of the pipeline beginning to catch up.

"Much of what we do is time-dependent," explains Look Effects president Mark Driscoll, who reports that his facility did 250 shots for MGM's upcoming "Rocky Balboa" without ever touching tape. "We don't just need to get something quickly to editorial but often to half a dozen players."

Now, with the landscape around VFX going digital, everyone is working much faster. "The workflow for an all-digital medium is more fluid," Driscoll says. "Editorial can make changes and send us things faster, without rescanning. It's economy of scale. You don't have to be as stingy with what you're starting off with. If you're going to DI the movie, you end up with the ability to keep more footage online. We hardly ever write to tape at all."

Keeping assets in line

As the bean-counting element of digital workflow, asset management is not very glamorous; keeping track of every digital asset and all of the different versions of the film as it wends through the post process can feel like busywork. But all post facilities have ways of managing each asset that comes in the door -- without them, there'd be chaos.

The more storage, the more capacity there is for assets; the more assets there are, the greater the need to manage them. For DI facilities with huge amounts of storage, that translates to a 24/7 information-technology staff. Visual effects facilities also have created asset management solutions, but, notes post supervisor Kaminsky, "it doesn't really handle the heavy lifting" when it comes to the entire post workflow pipeline.

Over at Matchframe, chief operating officer Barry Nulman reports the creation of Matchframe On Demand, a tapeless workflow service aimed at feature films, primetime and reality television and documentaries that includes a logging database, file encoding and, naturally, an asset managing system.

Ascent Media has a management system that can handle that heavy lifting: Atlas is currently home to 8,000 Sony titles.

"Asset management is integral not only to managing the post process but enhancing the value of the product in the rest of the release cycle," Ascent creative services president Bob Solomon says. "We're continuing to develop a platform to look at source elements from capture, in data or film, for repurposing later on -- whether it's changes to the production process, enhancing the collaborative

process or in versioning."

In fact, Atlas is aimed at studios, not individual filmmakers, but it hits the nail on the head with its "macro" view that asset management goes beyond the creation of a film and is useful throughout that film's life in ancillary markets.

Targeted more at the individual film production workflow is Avid's most recently unveiled Interplay, which offers asset management as well as administration and media tools.

"Asset management is another area where I'm hopeful that people will do more development," Kaminsky says. "You can put together a nice process, but you have to hand-carve and custom-fit things together in your workflow."

Intermediate, but also de rigueur

Once a production has reached DI, it's nearly home. Hollywood has quickly embraced the digital intermediate -- a process whereby the cinematographer color-times the film electronically instead of photochemically. And much like VFX, the DI is at heart a digital process: HD for indie films, 2K for a typical feature film and evolving towards a 4K pipeline.

At Ascent, vp digital intermediate services Rainer Knebel was brought in to analyze the DI workflow and train people and choose equipment for maximum results. That resulted in a switch from local storage to central storage, or storage area network, aka SAN, which allows multiple artists access to the same files simultaneously. And Ascent also purchased five da Vinci Resolve systems to give the company the ability to color-grade in 4K.

As the most purely digital portions of the workflow, visual effects and the DI process have already shaken hands. Knebel reports that, for the second and third "Pirates" installments, which were scanned at Pacific Title & Art Studio, they had a digital hand-off between Company 3 and Industrial Light + Magic to ensure consistency with color correction.

"ILM would compare the 16-bit files from Pac Title with our 10-bit color corrected file and then applied the color decisions we made to the 16-bit files," Knebel says. "When we get the 10-bit VFX images back from ILM, we can be pretty sure that the color is there."

Technicolor soon will open a much-anticipated DI facility on the Sony lot. The facility, which has three DI suites, set up with Lustre and da Vinci platforms, is connected to Technicolor's Burbank and Hollywood facilities by a 10-GB pipe that is fat enough to send finished films. It also offers access to the 14 Arri laser film recorders housed in the Burbank facility.

Post Logic also is establishing a 4K DI workflow, having recently tested an entire 4K post workflow with a spec spot that cinematographer Curtis Clark shot with a Dalsa Origin camera. But even if a film can be scanned and color-graded at 4K, the 4K DI pipeline still faces obstacles, according to Post Logic's Birstock. "You can run into huge bottlenecks to take advantage of some of the benefits that data-centric workflow offers because storage isn't cheap," he says.

Now hear this

Like visual effects, audio also has been a part of the workflow that adapted early and has been waiting for everything else to catch up. Since audio files are so much "lighter" than imagery-reliant ones, setting up an all-digital workflow from mixing stage to layback to HD master (and then on to foreign-language mixes and DVD streams) has been a no-brainer at facilities like Universal Digital Sound.

Even so, pipes at audio post facilities are getting fatter. "By making the pipe wider, it'll give us less pushing and pulling of media around, with a more direct way to 'point' to media, which will increase

workflow and decrease the amount of time spent moving files," UDS chief engineer Jeff Taylor says.

On the Sony lot, senior vp engineering Mark Koffman notes that Sony Post Production Sound has been all-digital for five years. What's newer is the ability to ingest film/tape to digital files and move pictures around on removable hard drives. Both Universal and Sony have added Fairlight Pyxis, a file-based HD video playback device.

And, across the board, everyone is adding version 7.2 of Digidesign's Pro Tools, a digital audio workstation. "It works seamlessly with our existing Harrison consoles and Soundmaster Ion systems, all of them linked together via networking," says Richard LeGrand, director of operations at Universal's BluWave Audio. "The Digi product came online and plugged right in."

That's a wrap

Whether videotape goes away next week, next year or never, everyone in the postproduction pipeline recognizes the importance of workflow. As the many tasks within the postprod workflow evolve toward a tapeless, data-centric model, the result is a nonlinear pipeline that can forge new ways of communicating and working.

"I don't think there will be a standardized workflow," Post Logic's Levinson says. "There will be many, depending on the project and the players. And that will keep it interesting for everyone for a long time to come."

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