

***Avid***<sup>®</sup>

DTV/HDTV – An Avid Perspective



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## Executive Summary |

With the recent commencement of DTV broadcasts in North America, digital television, both standard definition television (SDTV) and high definition television (HDTV), is no longer just a vision—it is a reality. DTV offers tremendous new opportunities, but it also creates new challenges. DTV formats expand rather than replace existing distribution fulfillment requirements. While DTV grows in adoption, 95% of the viewing audience is still watching 601, which will continue to generate the majority of revenues for some time to come. Gone are the days of a single-format, single-version master—enter the new multi-format, multi-version world. The challenge is clear: Enable producers to efficiently deliver multi-version content in multiple 601 and DTV formats.

The Avid solution is not a black box, but a collection of building blocks with which to create flexible, scalable and cost-effective HD solutions. The key to these solutions lies not simply in the capability of the boxes, but in the sharing of metadata – the creative decisions themselves. It is this flow of metadata that dictates how projects flow through editing, audio, graphics, effects and animation processes to completion.

With the advent of HDTV, there is a natural tendency to consider a traditional offline-to-online workflow in which the 601 online suite is simply replaced by a HDTV online suite. An analysis of HD post-production workflows demonstrates that producing 601 masters and versions in an efficient and cost-effective manner is not simply an automated downconversion process from HD. Work in a 601 online suite is required. Offline, 601 online and HD online are all important steps in HDTV projects. Just as offline systems are used to optimize the usage of more expensive 601 online suites today, the industry will gravitate towards a workflow that optimizes the usage of expensive HDTV resources.

A significant new format trend holds the key to greatly simplify multi-format delivery: 24 fps progressive (24P). Film will no longer be the only 24P medium, as several new 24P tape formats for HD are launched. 24P formats enjoy several key benefits, the most significant of which is the ability to output multiple formats from a single source.

At NAB 99, Avid launched 24P Universal Editing and Mastering. Symphony™ Universal, a new model of the Avid Symphony family, incorporates this new technology at the SDTV level. Symphony Universal enables content producers to edit 24 frame progressive content in its native format, and, at the push of a button, deliver NTSC, PAL, 4:3, 16:9 and letterbox formats. It will also output list formats such as film cut lists and 24 fps EDLs for HD conforming. The offline-only version of this capability (Universal Offline) will be available as an option for the Media Composer® XL series for Windows NT®.

Also at NAB '99 Avid showcased a technology demonstration of an upcoming HDTV conforming and finishing system, code-named "Avid HD". Currently in development, Avid HD leverages a wide range of Avid technologies and will provide a complete set of editing, audio, graphics and effects tools. A key feature will be the ability to automatically conform and finish projects originated on Media Composer, SOFTIMAGE®|DS or Avid Symphony in a wide range of HDTV resolutions.

The Avid HD solution includes editorial, audio, graphics, effects, animation and finishing products, as well as storage and networking. These products are the building blocks in a scaleable, flexible and economical approach to handling the content creation challenges of today and tomorrow.

## **Making Sense of the Formats |**

DTV refers to digital television, which can be broadly described as all broadcasts sent to the home digitally whether over the air, by cable, by satellite or any other means.

There are a multitude of DTV formats, all of which fall into two families: Standard Definition Television (SDTV) and High Definition Television (HDTV). SDTV refers to the digital equivalents of our standard 601 NTSC and PAL interlaced formats, as well as similar spatial resolutions that are progressively scanned. HDTV refers to high-resolution widescreen DTV formats. The two prevailing HDTV formats in the United States include 1920x1080 at 30 fps interlaced scanning and 1280x720 at 60 fps progressive scanning.

The emerging DTV standards are a complex maze, composed of a myriad of formats. There are four components, or dimensions, to any DTV format: Resolution, scanning method, frame rate and aspect ratio.

Resolution	Resolution simply refers to the number of pixels and lines that make up an image. The number of lines can be 480, 576, 720 or 1080 lines. The number of pixels per line may include 720, 1280 or 1920 pixels.
Scanning Method	Scanning method refers to whether the image is interlaced ("i") or progressive ("p"). An interlaced frame sweeps the image as two fields that are interlaced to form a given frame. A progressive frame is scanned in a single vertical sweep rather than scanning as two interlaced fields.
Frame Rate	Frame rate refers to the number of frames presented per second – 24 fps, 25 fps, 30 fps, 50 fps or 60 fps. It also includes NTSC derivatives such as 23.976, 29.97 and 59.94.
Aspect Ratio	Aspect ratio refers to the horizontal and vertical dimensions of each individual frame, typically 4:3 or 16:9.

Every format is composed of some combination of these four components. For SDTV and HDTV the combinations are:

DTV Component	SDTV	HDTV
Resolution	720x486 (digital NTSC) 720x576 (digital PAL)	1280x720 (US standard) 1920x1080 (US standard)
Scanning Method	"i" and "p"	"i" and "p"
Frame Rate	30 or 25 fps	24, 25, 30, 50 and 60 fps
Aspect Ratio	4:3 or 16:9	16:9

The Advanced Television Systems Committee (ATSC) is a US-based organization that coordinates the development of DTV standards in the United States. The formats listed above are some of the more popular DTV formats described in Table 3 of the ATSC recommendation (some combinations of frame rates and scanning methods are not in the ATSC spec).

The FCC standard for digital broadcasts does not include explicit requirements with respect to scanning formats, aspect ratios and lines of resolution. However, a broad cross-section of interested parties—including the broadcasting, consumer equipment manufacturing and computer industries—have coalesced around a consensus agreement regarding the preferred DTV formats.

## The New Reality: A Multi-format, Multi-version World |

HDTV is rapidly becoming part of the post-production landscape as the demand for HDTV programming increases. At the time of this writing, there are 48 DTV stations with operating HD broadcast towers in the United States; an additional 70 stations plan to have them by year end. Upwards of 20,000 HDTV sets have been sold worldwide to a combination of industrial buyers and high-end consumers. HDTV is a reality.

But HD should also be seen in context. 30,000 SDTV units have been sold worldwide, and 99% of the world's viewers are still watching analog NTSC and PAL. There are an estimated 250 million NTSC television sets in the US alone, and that won't change overnight. According to the Consumer Electronics Manufacturers Association (CEMA), 13,176 HD-ready TV sets were sold to dealers in the US in 1998, primarily for the professional market. This compares with 27,000,000 conventional television sets sold in the same period.

The adoption of HDTV and SDTV will increase as the cost/benefit ratio improves – which ultimately means more content and less expensive TV sets. HDTV programming in the 1999/2000 season is expected to be less than 5% of the broadcast day but at least one HDTV signal will reach about 25% of the viewing public. HDTV will, however, grow at an increasing rate. SDTV, especially widescreen SDTV, will likely be adopted more quickly. SDTV is less expensive and has more immediate benefits to consumers. These include improved image and audio quality, a wider aspect ratio and digital multicasting—the simultaneous broadcasting of multiple channels using the bandwidth of a single traditional channel.

The growth of DTV is inevitable. HDTV and SDTV enhance the viewer's experience and represent exciting new opportunities for content producers. Furthermore, HDTV masters ensure the archival value of content. We are moving to a digital world—from acquisition to consumption. The debate is about the length of that transition, not whether or not it will occur.

The transition initiates the dawn of a multi-format world. Multi-format distribution ensures the maximum number of viewers, and reaching viewers drives advertising dollars, subscription revenues, and the very business of broadcasting. HDTV and SDTV adoption will continue, but 601 delivery will be critical to reaching the mass market and driving the largest portion of revenue streams for years to come. In this context, HDTV is not a solution unto itself, but an important element in multi-format distribution.



But multi-format distribution is only one part of the coming revolution. The challenge is not simply to create compelling content and distribute it to the widest possible audience. Content must also be made geographically and demographically relevant in as many ways as possible. Gone are the days of creating a single version of a program. Now we create the network version, the syndicated version, the cable version, the domestic and international versions, the airline version, and so on. The same is true in the spot market. :60, :30, :15 and :10 cuts are all created from the original masters as part of the broadcast strategy for a high-end spot. A national or regional commercial is no longer produced as a single generic spot. Now several local versions are the requirement. For example, a commercial for the Midwest is now a Chicago version, a Detroit version and a St. Louis version. The deadline is still the same, but three or four spots now have to be created in the time that it used to take to produce one. Repurposing content for different programming is yet another form of versioning. This trend will intensify as new post-production solutions enable us to create multiple versions with greater ease and efficiency.

In this new multi-format, multi-version world, the television post-production process becomes considerably more complex. Multiple DTV, PAL and NTSC masters in 16:9, 4:3 and letterbox aspect ratios, along with multiple versions for different markets, result in a far more complex fulfillment task. The solution is not simply narrative offline editing systems and HD conforming stations. The solution must provide an economical and efficient means to produce all of the necessary formats and versions.

## **24P + the Emergence of Universal Mastering |**

With all of these new formats expanding the world of content distribution, there is a tremendous amount of new interest in the oldest format in the industry: 24 fps progressive.

Film is, of course, a 24 fps progressive medium. Film has always held a tremendous amount of appeal for three main reasons:

- | Film provides the highest resolution master, future-proofing the content. This is particularly important in the face of an ever-changing set of formats. Producers often acquire their programs in film to protect their assets for years to come, insulated from changing video signal specifications.
- | No matter where you are, film is film. You can play it back anywhere in the world because it always runs at 24 fps.

- | You can derive all other formats from film. A modern day telecine can create HDTV, PAL, NTSC and other formats all from the same source material.

Editing material at 24 fps progressive also has tremendous benefits:

- | PAL and NTSC masters can be created from a single 24P video source, much like the telecine. Without 24P this requires expensive standards converters, where motion artifacts are introduced when converting from NTSC to PAL for international distribution. There are high-end black boxes that will remove motion artifacts resulting from NTSC pulldown, but they are very expensive and can cost upwards of \$300 (US\$) per finished minute of programming. This can add \$15,600 (US\$) to the cost of delivering the PAL version of a one-hour program.
- | There is a one-to-one correlation with the master source. This allows far more precise editing, painting and effects. It also provides frame accuracy for both film cut lists and EDLs.
- | Storage is more efficient in digital nonlinear systems (requiring 20% less disk space than when working in NTSC).
- | Greater performance is realized in the rendering of effects and composites (20% faster than in NTSC).
- | Workflow can be faster. Working in 24P yields a 60% decrease in rotoscoping time compared to NTSC (painting 24 frames versus 60 fields) and a 50% decrease compared to PAL (24 frames versus 50 fields).
- | Producing a master from a sequence edited natively in 24P delivers smooth motion picture playback in NTSC due to the continuous 2:3 insertion upon playout. PAL is smooth due to a 1:1 frame correlation at 25 fps.
- | Frame accuracy is maintained. EDLs no longer need to be adjusted for the + or – frame discrepancy introduced by editing 24 fps material at 30 fps or 25 fps. These discrepancies can make a program containing two or more layers unusable.

Supporting the 24 fps trend this year are new tape formats that are 24 fps progressive—first for HD and soon for 601. Why is tape going 24 fps progressive? Because the post-production community has recognized the clear advantages that film enjoys. The proliferation of 24P formats opens a whole new set of opportunities and enables the safest, most flexible method for teleproduction.

Enter the concept of Universal Mastering. Universal Mastering provides the ability to work on a nonlinear system with 24 fps progressive media and produce all masters and versions from a single source. Imagine enjoying all the performance, workflow, storage and precision benefits of 24 fps progressive. Imagine the press of a button producing NTSC, PAL, 4:3, 16:9, film cutlists and more, all from a single source.

Universal editing and mastering is composed of several tools and technologies that enable the following:

- | The ability to edit and manipulate 24 fps progressive media.
- | The ability to produce multiple masters (NTSC, PAL, SDTV, and HDTV) from that media.
- | Aspect ratio control. Pan and Scan enables editors to extract 4:3 versions from 16:9 material with an intuitive keyframe interface. It allows editors to interactively previsualize and select which portions of the composition are shown.
- | Reconciliation of title and graphic placements for both 4:3 and 16:9.
- | Management of program duration across formats. Editors working on a 24P project can see the exact length that the project will be when output to PAL and NTSC.
- | The production of film cut lists for recutting negative, as well as 24 fps EDLs for communicating with HD tape-based systems.
- | Tracking and conforming film-based projects across multiple transfers of the negative (Film-Tape-Film-Tape).

At NAB 99 Avid launched 24P Universal Editing and Mastering at the SDTV level within a new model of Avid Symphony. The offline-only version of this capability will be an option in the Media Composer XL for Windows NT family.

Universal Mastering will change the face of finishing for film and 24P tape-acquired television programming.

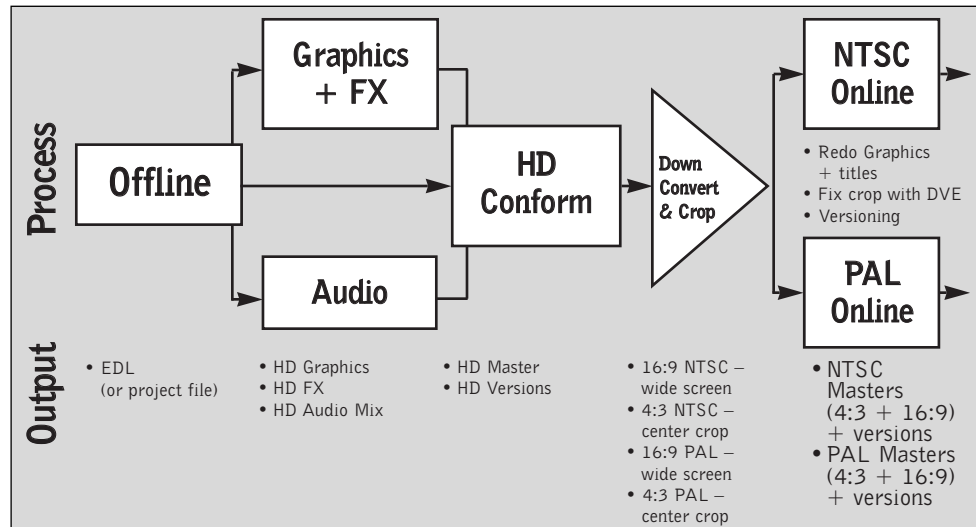
## **HDTV: A Workflow Perspective |**

Traditionally, workflow has moved from an offline suite to an online suite, where the program master was produced. International distribution, content localization and repurposing create the need for multiple masters and multiple versions. HDTV adds yet more.

At first glance one might think that a HD online suite could simply replace a 601 suite. However, producing 601 masters and versions in an efficient and cost-effective manner is not simply an automated downconversion process from HD. It requires work in a 601 online suite. As a result, offline, 601 online and HD online are all important steps in the creation of HDTV content.

As with any project, the work will flow through editing, audio, graphics, effects and animation on its way to completion. The key to an efficient, flexible, effective workflow lies in the flow of metadata. Traditionally we moved projects through the process using EDLs, a primitive form of metadata that captured only a bare set of information about the content. The invention of the Media Composer composition was the first major advance beyond the traditional EDL. In this new world of visually rich content, the flow of metadata becomes the key enabler.

There are many different approaches to HDTV post-production, and the associated workflows are often as unique as the creative process itself. The following four examples illustrate the tradeoffs you make in designing an appropriate workflow for your business. You should also evaluate which parts of the workflow fit your business, because workflow can span businesses, as it often does today with offline and online.



**1. HD Conform – 601 Downconvert** | This workflow is the closest to the traditional offline/online workflow of the 601 world, and is the first that comes to mind when discussing HD post-production. In this workflow, the project is offlined in a 16:9 aspect ratio. Graphics, effects and animation are created in 16:9 using the appropriate resolution, frame rate and scanning method (i.e. interlaced or progressive). 5.1 audio tracks are mixed. These elements are brought together in the HD suite, where the project is conformed, and the HD master and all HD versions are completed.

Once the HD work is done, the NTSC and PAL masters and versions are created. This begins by downconverting the HD master. If the source material is 25 fps or 30 fps, a single downconversion will be done to either PAL or NTSC, and a standards converter will be used to create the other. Versions in 4:3 are typically created during this stage using a center crop, which simply removes the sides of the widescreen image.

At this stage, we have NTSC (4:3 and 16:9) and PAL (4:3 and 16:9) versions, but the 601 work is not complete. Three major tasks remain:

- | Graphics and titles need to be redone. Downconverting graphics and titles results in significant quality degradation. Size and positioning may need to be adjusted for 4:3 delivery. A variety of versioning requirements, including language translations and "squeeze and tease", must also be completed.
- | All off-screen action (action that moves out of the 4:3 center crop) must be repaired using a DVE.
- | Finally, all 601-only versions (versions that will be delivered only in NTSC and PAL, not in HD) must be finished, including "letterbox 601" versions which require DVE work.

Technically, all of this 601-specific work, with the exception of graphics and titles, can be done in the HD suite and downconverted. However, the 601 suite is a far more cost-effective and flexible environment for these tasks.

The process is dramatically improved with a richer flow of metadata. Linkages between tools enable creative decisions to be carried forward and rework is minimized. For example, if the 601 system can efficiently conform all 601 versions from the offline system, then this stage in the process becomes extremely efficient. For high-end editorial programs, a Symphony system is an ideal choice for finishing Media Composer projects, especially with its ability to Total Conform™ an entire project, including Pan and Scan data. For graphics and effects intensive projects, SOFTIMAGE|DS is an ideal system, once again providing tight linkages to Media Composer for conforming. SOFTIMAGE|DS also provides a versatile toolset capable of handling even the most graphics- and effects-intensive 601 projects.

The entire process is considerably more efficient when working with 24P media, not simply because of storage efficiency and performance, but also in terms of workflow. Using 24P in the HD suite means all HD masters can be derived from a single source, while both NTSC and PAL can be produced and refined in the 601 suite. Using 24P in the 601 suite means the user can work on a single 24P 601 source to produce all 601 deliverables.

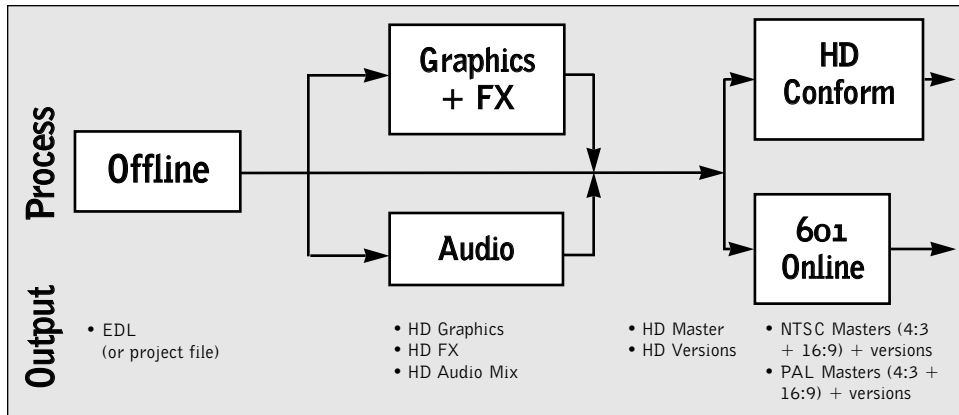
Once again, a richer set of metadata improves the process. For example, when using Media Composer with the new Universal Offline Editing option, the project can be edited in 24P with 16:9 and 4:3 versions created using the Pan and Scan function. Graphics, effects and animation can be created in 24P using products like Avid SOFTIMAGE®|Marquee™, Avid SOFTIMAGE|Media Illusion™, and Avid SOFTIMAGE|3D™. All audio can be edited and mixed for 5.1 at 24 fps in Digidesign® Pro Tools®.

For the HD online, a linear HD suite conforms the offline using a 24 fps EDL. Eventually “Avid HD”, an upcoming nonlinear HD conform and finishing system, will conform projects from SOFTIMAGE|DS, Media Composer and Symphony. Avid HD will be able to exchange a far richer set of metadata than a simple EDL. All HD masters are derived from that single metadata source.

For the 601 online, the project could be Total Conformed in 24P using the Symphony Universal mastering system. All 4:3 and 16:9 versions are autoconformed, replicating all effects and audio work as well as Pan and Scan information. After CG and DVE fixes are completed, all 601 deliverables are produced from that same source: NTSC and PAL, 4:3 and 16:9, and even film cut lists for archival purposes.

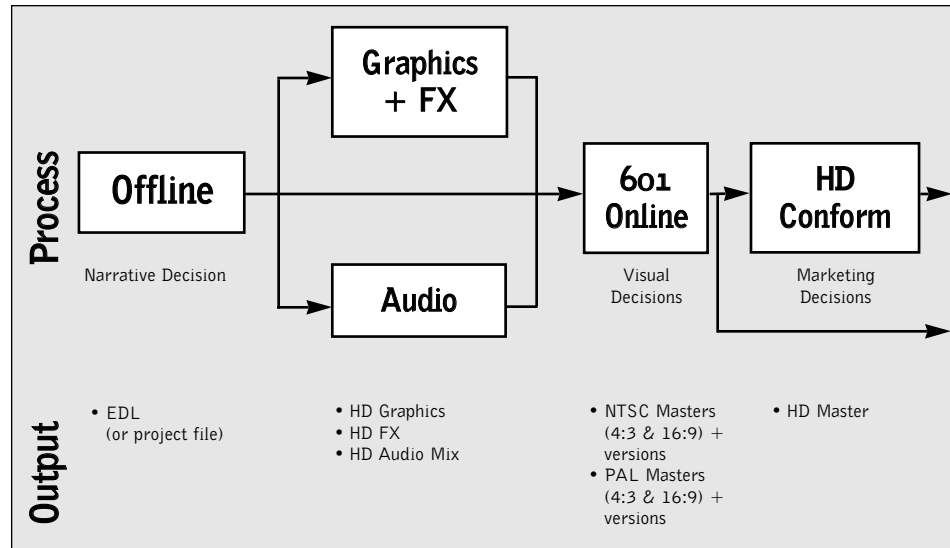
Fundamentally, the task of producing 601 is not simply a matter of pushing a button in the HD suite. Recreating titles and graphics, fixing Pan and Scan problems, and creating versions of content that will be delivered in NTSC and PAL – these all require 601 work. It is highly inefficient and expensive to be creating multiple 601 versions and fixing center crop problems in an HD suite.

Perhaps the greatest disadvantage of this downconverting strategy is that all 601 deliverables begin after the HD master is complete, jeopardizing the primary revenue stream.



**2. Parallel 601 – HD Conform** | In the *Parallel 601 – HD Conform* workflow, the 601 online and the HD online happen in parallel. It is clear in the previous *HD Conform – 601 Downconvert* workflow that there are tremendous benefits to using a nonlinear 601 finishing system to produce the NTSC and PAL online content. This is not simply because of the toolset and the flexibility, but because of the rich stream of metadata that flows from the offline system. The benefits are accentuated with a Symphony Universal Mastering system, as all 601 deliverables can be created from a single source.

A nonlinear finishing system with an efficient conforming process also enables a parallel workflow in which both the HD conform and the 601 conform can be completed simultaneously. The parallel strategy enables post-production facilities to produce all the 601 masters and versions far more quickly, accurately, and inexpensively. Furthermore, one no longer has to wait until the HD online is complete before 601 deliverables can begin.



**3. 601 Conform – HD Conform |** In this workflow, all 601 work is completed and then reconformed in HD.

Post-production for 601 delivery uses a traditional process, moving from a relatively inexpensive offline system to a more expensive online suite. The goal is to deal with all of the time-consuming narrative decisions in offline, and to reserve the expensive online suite for conforming, finishing and mastering.

As we've seen with the previous workflows, HD post-production does not eliminate the need for the 601 suite. By completing the 601 masters and versions before the HD work, these critical deliverables are not only available in the shortest possible time, but important visual decisions have been made. This results in the HD online session being far more efficient.

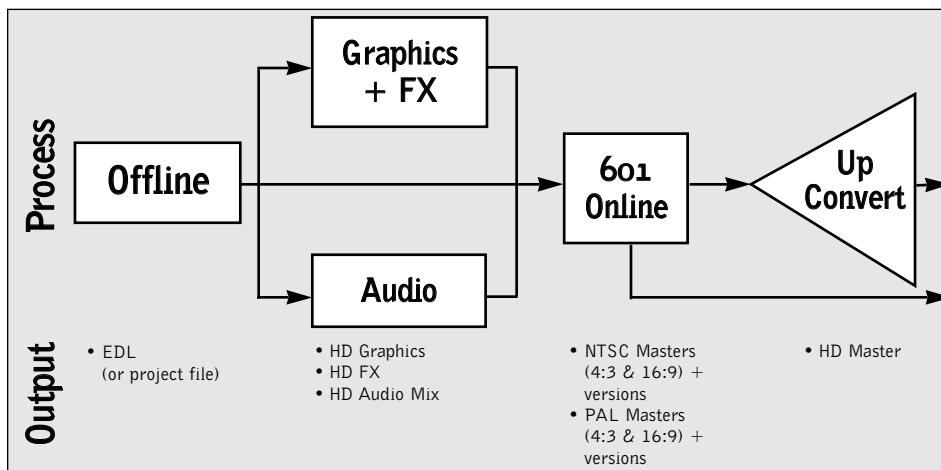
Visual decisions refer to effects, keys, motion tracks, transitions, pace and flow. They are far more dependent on image quality than is the narrative stage. Visual decisions are difficult to properly previsualize on offline systems. By making visual decisions in 601 online and compositing suites with uncompressed video and high quality tools, the time spent on these tasks in the HD suite is dramatically reduced. Clearly many of these elements, in particular effects and keys, will have to be refined when viewed in uncompressed HD, but far less experimentation will be required.



Working in this manner has several advantages:

- | **Cost:** It is less expensive to make visual decisions in a 601 online session than in an HDTV online session. In this era of greater visual sophistication, visual decision-making is becoming the second most time-consuming stage in the workflow. The industry will gravitate towards workflows that make the most efficient use of expensive HDTV resources in the same manner as offline systems have been leveraged to maximize the efficient use of 601 online suites.
- | **Performance + Flexibility:** Nonlinear 601 suites offer far greater flexibility than linear HD suites and far greater performance than HD nonlinear suites, particularly in the areas of real-time and rendering performance. HD images are roughly six times the size of uncompressed 601 images. Nonlinear 601 systems therefore offer more real-time effects and faster rendering speeds than comparable nonlinear HD systems.
- | **Fast 601 delivery:** All 601 deliverables can be completed in the shortest timeframe. This is critical since the largest revenue streams are still derived from 601 programming.

This *601 Conform – HD Conform* workflow is an even more compelling choice when richer metadata is factored in. With 24P Universal Mastering, Symphony Universal will produce all 601 deliverables from a single source, produce the film cutlist for archiving, and produce a 24 fps EDL for connection to a linear HD suite. If all visual decisions made in the 601 suite automatically translate to the HD suite, the process is even more efficient. When Avid HD is released, it will provide tight linkages to SOFTIMAGE|DS, Media Composer and Symphony, automatically conforming projects created on these systems. Avid HD will also provide a complete set of editing, audio, graphics and effects tools to further refine and finish HD projects.



**4. 601 Conform – HD Upconvert** | In the *601 Conform – HD Upconvert* workflow, 601 masters and versions are completed in a typical 601 workflow in 16:9 and the final output is simply upconverted to HD.

The quality is dramatically improved if the source material is shot on HD or film and then downconverted to 601. Film and HD source material go well beyond the typical sharpness found on 601 source material. Because of the extended spatial over-sampling, the images in the downconverted 601 material are naturally sharp and visually superior to 601 images produced through image enhancement hardware, which introduces crispening artifacts. Downconverted 601 images yield the most reliable visual results for programs that must be upconverted back to HDTV.

Using 24P Universal Mastering dramatically improves this workflow process by enabling all deliverables to be derived from a single source.

For many budget-sensitive projects, HD upconversion from 601 has merit. A great deal of third-party development work has been done in this important area of image downconversion and upconversion.

## **Linear or Nonlinear HD |**

When evaluating HD finishing systems, a number of factors must be kept in mind:

- | Support for 24 fps, 25 fps and 30 fps is critical. There will also be increasing interest in working at 50 fps and 60 fps.
- | Support for ATSC-recommended HDTV formats is essential. Support for 601 is extremely useful. Resolution independence safeguards against future formats.
- | Metadata connection with offline and 601 online systems is highly desirable. EDLs are the bare minimum. Tighter linkages are critical for an efficient workflow.

For short-form projects, nonlinear HD solutions will have tremendous advantages over linear equipment. While linear equipment is fast in a rigid, serialized environment, it is slow and inflexible when dealing with visually sophisticated content. Metadata interchange between nonlinear solutions tends to be far richer than with linear systems. Finally, nonlinear solutions will be more cost-effective, more flexible and will provide richer toolsets than linear systems.

For long-form projects, linear HD solutions will remain viable in the near term. Nonlinear HD has roughly six times the storage and bandwidth requirements of uncompressed 601. Long-form work, therefore, places far more burden on nonlinear systems than short form work. Bear in mind, however, that processing power will increase and storage costs will decrease at a rapid rate. It will not be long before nonlinear HD is a powerful solution for long form work.

## **Avid HDTV Solutions |**

### **Editorial Solutions |**

**Avid Media Composer |** The Avid Media Composer product family is the worldwide standard for offline and mainstream online editing. It is also the most widely used editing system for HDTV programming. The Academy Award-winning Avid Film Composer® has been used to cut more feature films than any other nonlinear system. Film is the most demanding of HD projects. Media Composer systems are not only capable of handling 16:9 images, but can also produce both 25 fps and 30 fps EDLs.

With the introduction of the Universal Offline option, the new Media Composer XL series for Windows NT becomes even more valuable in the HDTV post-production process. It handles 24P images and is the first offline editing product with full Pan and Scan functionality. In an environment that demands multi-format and multi-version distribution, it is also uniquely qualified to deliver 25 fps and 30 fps digital cuts as well as to manage timecode between the various formats. Most importantly, Media Composer is the only editing product with Total Conform; everything created in the offline session is perfectly re-created in Avid Symphony Universal.

**Avid Symphony |** In a world where multi-format delivery has become a necessity, Avid Symphony Universal is unique. Universal Mastering accepts material from any 24 fps source, whether it is film or tape. An integrated 24P digitizing tool automatically recreates the original 24P material upon digitizing from a standard NTSC or PAL deck. Having a one-to-one correlation with the master source means that you can create more precise Intraframe™, painting, color and rotoscoping effects. Furthermore, it efficiently delivers all the 601 formats, including NTSC and PAL in 16:9, 4:3 and letterbox, as well as frame-accurate film cutlists and EDLs.

These features are particularly important in the HDTV world. A 601 finishing system is an important part of any workflow involving the production of HDTV and 601 shows. Avid Symphony Universal, with 24P native compatibility, fits into any such workflow. It can either receive 24 fps projects directly from an HDTV system, or it can Total Conform a 24P project from Avid Media Composer, producing a frame-accurate EDL for a linear or nonlinear HDTV online suite.

Avid Symphony Universal is a true multi-standard delivery system for the worldwide distribution of television programming. For a series, the cost for one season of NTSC to PAL conversion returns the Symphony investment. The ability to work in a true 16:9 format, coupled with Pan and Scan functionality and 24 fps online capability now gives a producer the ability to deliver multiple masters from a single sequence.

### **Graphics, Effects + Animation Solutions |**

**Avid SOFTIMAGE|DS |** is a comprehensive, integrated set of post-production tools offering companies a highly versatile creative environment for graphics- and effects-intensive projects—a complete digital studio. With seamlessly integrated picture and audio editing, compositing, image treatment, effects and character generation, SOFTIMAGE|DS is well equipped for creating and completing projects such as TV commercials, station promos and bumpers, music videos and effects-intensive TV programs.

Material acquired or created in anamorphic 16:9 aspect ratios can be edited, manipulated, finished and mastered in SOFTIMAGE|DS today. An upcoming release is scheduled to include the ability to work with graphic images of any resolution, including HD and above, for delivery in 601 formats. In addition, Avid HD will be able to Total Conform projects created in SOFTIMAGE|DS.

**Avid SOFTIMAGE|Marquee |** is a resolution independent, 3D title animation software package. It combines the flexibility of 3D animation with the functionality and speed of standard processing. Marquee is completely HDTV-ready; it is independent of resolution, frame rate, aspect ratio and scanning method.

Resolution	Marquee is resolution-independent: Any width by height pixel resolution can be entered by the user, and rendered out at that resolution. At any point in time the user can switch resolutions and all the objects end up in the correct places; there is no "conversion" step between resolutions.
Aspect Ratio	Marquee is aspect ratio-independent: Any aspect ratio can be entered and switched at any time. This provides control over how objects are mapped to the pixel resolution. When safe title guides are enabled, reference 4:3 guides are provided.

Frame Rate Marquee is frame rate-independent: Any frame rate can be used, including drop-frame, for calculating timecode. Changing frame rate simply alters the number of frames generated during rendering.

Scanning Method Marquee is independent of scanning method: Both interlaced and progressive scanning of frames may be enabled, and may be switched at any time.

**Avid SOFTIMAGE|Media Illusion™ |** software is a powerful resolution-independent, digital nonlinear compositing solution for creating subtle and amazing special effects. Customers worldwide use Media Illusion for feature film, HDTV and SDTV television and non-broadcast production. It seamlessly merges paint, compositing, image manipulation and special effects into one artistic and intuitive domain. Media Illusion easily integrates with Avid editing systems and complements your editing system's capabilities with the tools needed to complete even the most challenging effects work quickly and economically.

Media Illusion is entirely resolution-independent and timebase-independent. It includes CompositionLink, making a fast and automatic process of the creation of HDTV versions of offlined effects sequences from Media Composer and Symphony.

**Avid SOFTIMAGE|3D |** is the industry-leading software solution for 3D character animation and effects. It is the most complete end-to-end 3D modeling, animation and rendering package for the film, commercial and game development markets. As a result of its resolution independence, SOFTIMAGE|3D is the optimal solution for 3D content creation in the HD production environment.

#### **Audio Solutions |**

**Avid Digidesign Pro Tools |** Pro Tools is the industry-standard workstation for audio editing and mixing applications, including all segments of film and video post-production, as well as music production. Pro Tools is a hardware/software product available in a variety of configurations for computers running Macintosh® and Windows® operating systems.

Pro Tools is currently HDTV-ready, offering:

- | Support for 24 fps and 30 fps time code
- | Fully-automated mix environment capable of 5.1 mixing
- | Optional 5.1 channel panner plug-in, co-developed with Dolby Labs for integrated, automated multi-channel surround panning
- | Compatible with hardware- or software-based Dolby Digital encoders (the audio standard for ATSC)

## **HD Finishing Solutions |**

**Avid HD |** "Avid HD" is the code name for a HD conform and finishing system currently under development. It leverages the capabilities of a wide range of Avid technologies and will provide a complete set of editing, audio, graphics and effects tools. Work originated on a Media Composer, SOFTIMAGE|DS or Symphony can be automatically conformed and finished in Avid HD to produce the highest quality HD masters.

## **Infrastructure Solutions |**

**Avid Unity™ MediaNet |** is a revolutionary new solution for nonlinear tools, enabling shared, protected storage and facility management. It functions with all Avid products and grows with your needs. Avid Unity MediaNet utilizes fibre channel storage and TCP/IP-compliant network software to enable real-time media sharing and high-speed media transfer. It features a network-based access scheme that is highly secure but nearly transparent to the user, while allowing access rights to "float" with a user throughout the network. Simply put, it is the foundation of the Avid Nonlinear Production Environment.

Avid Unity MediaNet is HD-ready today. In its highest performance configuration, the network is capable of delivering sustained bandwidth of over 350 MB/sec – enough for two streams of uncompressed 1080i video plus a key. This same configuration is capable of supporting up to nine editing systems using up to 2:1 compressed 601 video (and/or any mix of lower resolutions). It is being tested and integrated at some level with every Avid product.

Avid Unity MediaNet provides the same value in a HD environment as it does for 601; it will connect your nonlinear tools, enable them to interoperate, and allow you to take control of your workflow.

## Conclusion |

HDTV is at the center of the most exciting changes in the post-production industry today.

New technologies are enabling us to create content that is more compelling and more relevant to the widest possible audience. Post-production solutions must not only empower artists in the creation process, they must also facilitate the distribution of their output. The challenge of delivering multi-format, multi-version content is one that stretches the concepts of flexibility, efficiency and cost-effectiveness.

Traditional workflows and the relationship of time, performance and cost to decisions in the production process are at odds with the realities of DTV. The demands HDTV will put on producers will require multiple 601, HDTV, and SDTV masters, and these can't simply be produced as automated downconversions from HDTV masters.

The Avid solution for HD is evolutionary in that it builds on equipment you already own and enables faster, better and less expensive methods of post-production by enabling your tools to share metadata – the creative decisions themselves. Our HD solution is revolutionary in that it provides unique capabilities that will enable the post-production community to address a whole new set of opportunities; 24P Universal Mastering is a key component of this revolution.

Avid is dedicated to advancing the efficiency and productivity demanded in this new HDTV universe. Avid HDTV solutions mark a turning point in the television industry. This is one of those moments when technology catches up to an ambitious vision... a vision of a completely integrated Nonlinear Production Environment – a scaleable, comprehensive approach to providing the building blocks you need to work effectively, now and in the future.

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