

Consolidated Asset Flow Management Is Key to Monetizing Multi-Screen Strategies

*New Business Models Become Viable for
Content Suppliers and Network Operators*

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INTRODUCTION

As content suppliers and network operators adjust business models to the new realities in electronic entertainment, they're discovering they need new, highly automated approaches to managing and distributing assets that go well beyond their traditional modes of operation.

Emerging monetization strategies depend on these entities' ability to streamline operations across multiple content and service categories in order to provide consumers access to entertainment, advanced advertising and new applications over any device, anywhere they are at any time. How operations managers respond to this new set of workflow management challenges will go a long way toward determining whether these new strategies succeed.

On the one hand, the complexities call for an entirely new type of workflow management platform that can serve as a single point of content aggregation, processing and distribution. But in order to avoid costly duplication of existing functionalities, managers must be able to integrate the new platform with myriad legacy components, including content libraries and media asset management systems, back office components, encoding/transcoding modules, advertising management systems, policy servers, metadata repositories and much more.

In other words, operations strategists must not only find a solution that allows them to efficiently execute on multi-screen business models; they must be sure the solution they choose is able to leverage existing operational assets to the maximum extent possible.

SeaChange® International has designed its AssetFlow™ Workflow Management System to provide content suppliers and network operators of every description the end-to-end processing tools they need to meet all their requirements for serving the multi-screen marketplace, no matter how complex those requirements might be. At the same time, AssetFlow, as a highly modular, open system, is well suited to

servicing immediate as well as long-term needs. This means operations managers can implement those functional elements of AssetFlow which they need now for specific content ingestion, processing, packaging and distribution requirements with assurance they can continually add support for new functions as time goes by.

The ensuing discussion will enumerate in detail the specific needs of both the content supplier and network operator segments and explain how AssetFlow operates with other components in the operations framework to meet all requirements that might arise in either type of provider environment.

NEW CONTENT AND SERVICE REQUIREMENTS

The exact requirements of content suppliers and network operators vary when it comes to the list of functionalities that each must enable to support a streamlined, highly efficient approach to delivering all types of content across all outlets. But they share similar goals when it comes to the types of activities and consumer experiences they ultimately want to support.

Content Supplier Requirements

Presently, various players in both segments have different migration steps beyond traditional distribution models that they're taking toward fulfillment of these goals. A big near-term objective of most content suppliers, already in execution to one extent or another, is online distribution of at least some elements of their long-form programming, most often in delayed time windows for on-demand access after broadcast airings.

Sometimes this involves use of third party portals as well as their own. And, in some cases, this online distribution involves broadcast of live programming over the Web through their own or aggregators' sites. Monetization around all these strategies may rely on

dynamic placements of video advertising, per-use access fees, subscriptions or some combination of these models.

At the same time, the proliferation of smartphones connected to 3G – and now even 4G networks – is driving growing consumer demand for high-value mobile content, either through access to bundled long-form live programming or, more prominently, via access to Web-based on-demand content. For example, 23 percent of all U.S. owners of iPhones now routinely watch video on their handsets, according to research compiled by Morgan Stanley. On the 4G network side, average usage over WiMAX connections supplied by Clearwire Corp. is running at 7 gigabytes per month, or about three times the average over 3G networks, much of it driven by video consumption, according to company officials. Indeed, they say, some consumers are hitting a terabyte of monthly consumption.

New requirements affecting the architecture of workflows and content management processes are also coming into play over content suppliers' traditional linear TV and video on demand outlets. Beyond the need to supply programming in SD and HD formats to local broadcast stations, cable TV operators, telcos and satellite service providers, content suppliers are beginning to explore new advertising models in both VOD and linear programming, including demographic and geographic targeting, interactive response and "telescoping" between short- and long-form ads. They're beginning to add other interactive applications to their content as well, including polling, "mini guides" enhancing users' search for content within a given programmer's domain, "T-commerce," and enhanced information options that viewers can activate with the click of a remote.

Adding to all this are new arrangements programmers are working out with network operators in support of "TV Everywhere" distribution of their content to qualified subscribers and with consumer electronics manufacturers in support of special program packages that are exclusively available to buyers of "connected TV" sets. And, now, in the latest development,

programmers are engaging in new arrangements with various outlets in support of providing their content in 3D.

Network Operator Requirements

Network operators, of course, are pursuing opportunities tied to all these developments but with their own migration strategies and perspectives on the workflow processes they require. For example, VOD has rapidly expanded to include a variety of time-shifted programming modes such as "start over," "look back," "catch-up," and network PVR, each with its own viewing rules, advertising models and approaches to capture and distribution.

Similarly, interactive applications and advanced advertising across linear and VOD content and TV Everywhere, embracing connection to PCs and, eventually, mobile phones as well, bring with them new asset management and processing requirements. Where advertising and interactivity are concerned, operators have an urgent need for an integrated workflow system that facilitates management of EBIF (Enhance Television Binary Interchange Format) resources to support implementation of new applications on set-top boxes.

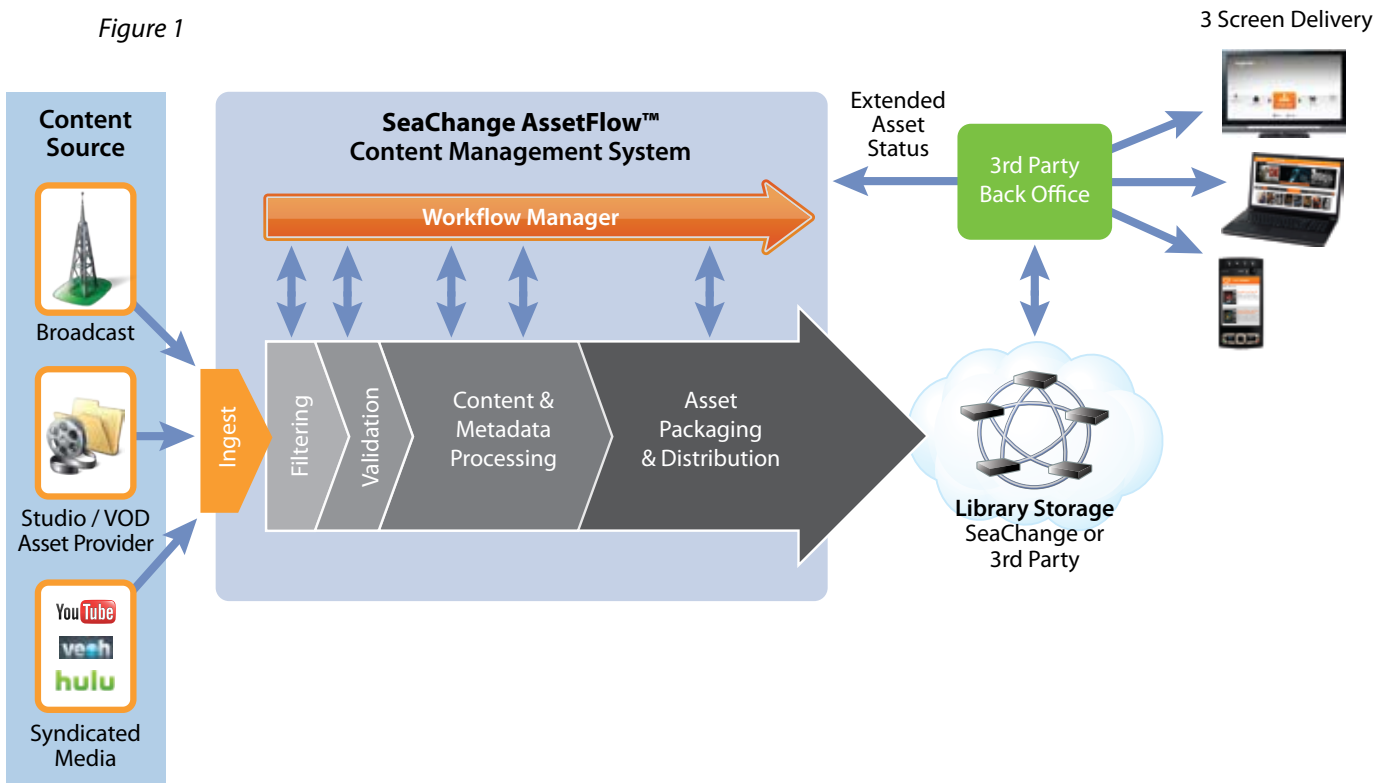
In the case of TV Everywhere, one of the many requirements operators seek in a consolidated workflow management system is the ability to support "stream-through" of IP content from suppliers. Here, the management system's ability to recognize distinctions in metadata and processing requirements for one type of content from other types helps facilitate low-cost joint implementations of premium content availability to PCs on the part of content suppliers and service providers within their respective Web portal domains.

Adding to the new requirements for supporting multi-platform distribution is operators' pursuit of new strategies involving delivery of ever more content to the TV in IPTV mode.

THE NEW PROCESSING ECOSYSTEM

Obviously, when considering how to structure workflows to accommodate all the processes associated with all these different distribution models, content suppliers and network operators must deal with an extremely complex matrix of operational requirements within each target screen environment. Figure 1 illustrates how this is accomplished in the AssetFlow architecture.

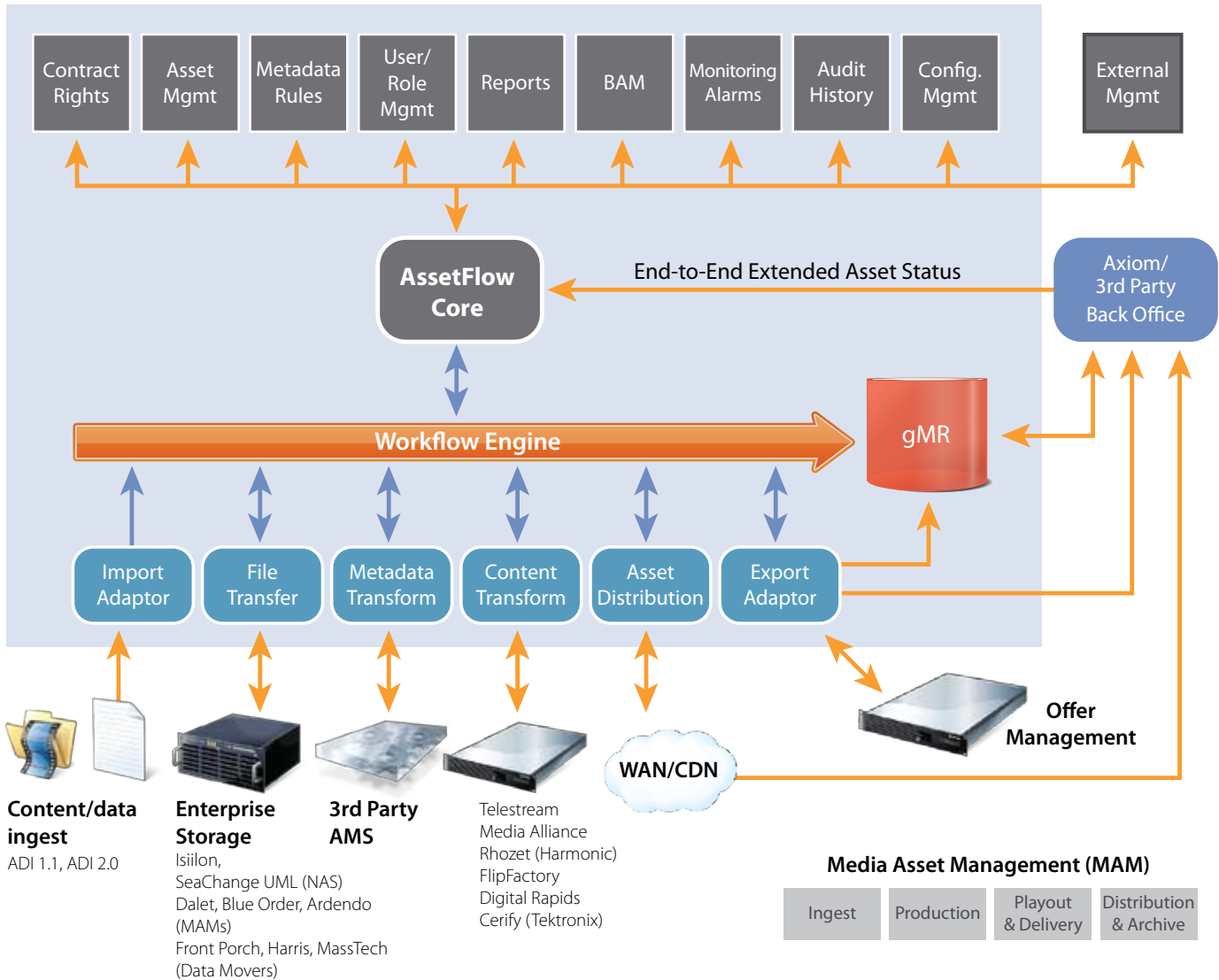
Figure 1



From a high-level perspective, all these requirements engage multiple data and processing points across a content management ecosystem that can be broken into four fundamental segments:

- **Upstream** – the arena where all the processes touching on preparation of content can be found, starting with post-production ingestion into storage and extending to the new convergence-enabling workflow functions such as content and metadata validation and processing; orchestrating how encryption, digital rights, watermarking and fingerprinting are applied; directing encoding/transcoding and adaptive stream formatting; implementing interactive applications, and coordinating advertising-related processes.
- **Back Office** – where offer management, navigation, performance measurement and other functions are activated in response to commands communicated from the workflow management system as it passes processed metadata fields into the back office asset management database;
- **Distribution** – all the traditional network outlets as well as CDNs and mobile paths that content is fed into by the workflow management system;
- **Client** – all the points of content access and presentation across the subscriber universe.

Figure 2 AssetFlow - High Level Architecture



THE SEACHANGE ASSETFLOW ARCHITECTURE

Every function within these segments that's pertinent to enabling a desired end-user experience must be orchestrated and tracked from the core workflow management system. Figure 2 provides a high-level architectural view of how the SeaChange AssetFlow platform fits into this ecosystem.

In essence, the platform's primary role is to manage the asset lifecycle by creating and managing multiple variants of each content and metadata element in support of timely delivery to all screens wherever they might be. This requires support for workflow control and prioritization across multiple, parallel processing points within the ecosystem.

Scalability and Performance Assurance

Content suppliers and network operators alike want a workflow platform that is sufficiently scalable to support ever larger volumes of content flowing into the multi-screen ecosystem. And no matter how large a volume or how complex the processing requirements might be, they want ironclad protection against failure with full redundancy and with functionality that generates audit histories on all content manipulation to facilitate identification of any source in the processing chain that is malfunctioning.

AssetFlow is a highly scalable and fully redundant platform supporting redundant sources for each content source configured in the system,

thereby guaranteeing that virtually no asset or workflow operation will ever be lost to equipment failure. This carrier-grade performance capability depends on detailed reporting and overall system management efficiencies, including multiple user roles and profiles, profile templates for simplified automation and monitoring, logging, auditing and advanced notification.

Dashboard Management

Managers within both segments also require an advanced, user-friendly dashboard that comprehensively addresses the functions that are appropriate to the user's specific needs. This means the dashboard must be easily customizable to specific functional requirements.

External management of the platform through the AssetFlow Dashboard sets the parameters on multiple functions, including contract rights, asset management, metadata rules, user management, content configuration management and much more. This means operations managers have a single interface control over all the third party components that go into supporting these functions, such as DRMs, transcoders and ad servers for all categories of content, including linear broadcast, VOD, online, mobile and advertising.

Greatly adding to managers' flexibility and speed-to-market with multi-screen consolidation is the extensive lineup of components that SeaChange has integrated into AssetFlow, including leading Media Asset Managers, Network Asset Storage components, encoders/transcoders, and data movers. And, because AssetFlow employs industry-standard open interfaces, operators managers can be confident of their ability to plug in additional third party components as conditions require.

The workflow engine executes on these parameters through interaction with a wide range of external components such as ADI

ingestion modules, storage centers and Media Asset Managers (MAMs) to access content for processing. AssetFlow then prepares the content for export over distribution systems by utilizing internal work engine processors in conjunction with external components such as encoder/transcoders, metadata transformers, encryption systems, etc. At the same time, the workflow engine engages with applications further downstream in the back office management system to trigger the offer management, navigation and other processes that are appropriate to managing the user's experience of any given piece of content on any given device.

CONTENT SUPPLIERS' WORKFLOW REQUIREMENTS

Content suppliers, from broadcast giants and studios to niche programmers, have in common the need to maximize monetization of content by pitching it to as many outlets as possible. Where new content processing requirements are concerned, much of the immediate focus among content suppliers is on the need to stitch assets such as trailers and promotions into content. This means the workflow system's import adaptor module must be able to import any metadata format, including MXF, SMPTE 335M dictionary structure, SMPTE 380M Descriptive Metadata Scheme 1 (DMS-1), etc. And it must be able to abstract all input formats ingested into the system and translate them to the formats required to support various distribution outlets such as Xbox, Yahoo!, iTunes and mobile.

Moreover, content suppliers must be able to tailor these stitched-in assets to the geographic requirements of the target destination. With a few commands executed from the workflow dashboard, content managers should be able to update the metadata transformer and apply all the appropriate variants to suit the localization requirements.

Other requirements are rapidly arising as well. As previously mentioned, these include support for new advertising models in VOD and linear programming, interactive applications, TV Everywhere and delivery of content in 3D formats.

Beyond the MAM

It's important to recognize that to meet the new distribution mandates of the three-screen marketplace, content suppliers need to go beyond the functionalities provided by even the most advanced MAM systems. MAM-based digital archives are designed to efficiently manage all the tasks associated with ingesting and managing content files prior to preparations for specific access platforms. They perform logging and archiving of TV, radio and Web content, support proxy generation, browsing and interfaces to NLE/production system and playout. Similarly, MAMs designed to support consolidation of newsroom, sports and entertainment production processes handle ingestion, browsing, NLE and playout from the production center.

In contrast, content suppliers need AssetFlow as a multi-screen workflow management system that performs functions not handled by MAMs. In order to efficiently accomplish the complex steps required to prepare content for delivery over online, mobile, gaming and other over-the-top platforms as well as traditional outlets in compliance with a wide range of device form factors, the new workflow must automate the metadata changes, recording and validation of rights policies, transcoding, splicing, assignment of streaming modalities and other steps vital to three-screen delivery which otherwise would require separate, manullay-intensive systems devoted to the requirements of each outlet.

At the same time, it's essential that the new multi-outlet workflow management system is designed to integrate seamlessly with MAMs and other production processing systems. And it must integrate with many other elements as well, including Network Asset Storage systems, transcoding systems, rights and contract management modules, encryption systems and



much more. In other words, content suppliers want a platform that is modular and flexible enough to protect their infrastructure investments by bringing all relevant elements together to serve the new distribution requirements.

Multi-Outlet Support

The new workflow management system must support guaranteed and secured distribution over third party solutions such as Aspera, Signiant, Akamai and Limelight using multiple formats to reach outlets such as YouTube, Apple iTunes, Xbox, Comcast Media Center, MSO VOD catchers and mobile networks. Simple-to-manage distribution through a distribution log should support the addition of new distribution outlets on the fly.

In this new environment the workflow platform must accommodate use of online adaptive streaming systems like Adobe Dynamic Flash, Microsoft IIS Smooth and Apple HTTP together with the implementation of the disparate encryption and fingerprinting systems these systems work with. The platform must be able to ingest live broadcast streams and extract metadata for use in alternative packaging of that content.

Rights Management

Rights management is another vital component of content suppliers' requirements. The workflow platform must keep an inventory of all the rights associated with all the assets and make sure those policies are accurately embodied in the DRMs that are assigned to a particular content element going out to a particular outlet. And the workflow system must serve as the processing center for collection and transfer of the usage data that back office systems use to confirm policy enforcement and payments of royalties.

3D TV

Adding another dimension to all the processing requirements is the emergence of 3D TV. The complexities to be addressed by the workflow management system are immense.

Content suppliers need to be able to accommodate distribution of 3D content in whatever format is appropriate to a chosen distribution outlet. Because there is no standard for 3D TV, this means any given supplier might be creating 3D content files suited to different requirements of DBS distributors, cable MSOs, IPTV providers, over-the-top outlets and Blu-ray.

And content suppliers are exploring use of new technology that supports real-time conversion of 2D programming to "pseudo 3D" in whichever format is appropriate to a given distribution outlet. The new workflow platform must be able to coordinate management of 3D to ensure all these different requirements are satisfied along with all the other processing requirements that are intrinsic to multi-screen distribution of 2D content.

Attention to Nuances

There are many smaller nuances that content suppliers should look for as well. For example, to support aggregation of content from smaller suppliers, the primary supplier must be able to extend the workflow's metadata editor to support those smaller suppliers' creation of metadata appropriate to the new distribution dynamics. In regions such as Europe where a content supplier's output might be funneled to different countries the platform must be able to demultiplex and multiplex audio, video and subtitles on separate tracks specific to each language.

NETWORK OPERATORS' WORKFLOW REQUIREMENTS

Many functions required by content suppliers are also required by network operators. But operators' position in the content distribution chain necessarily creates variations on the use of those functions as well as other requirements which must be addressed by the multi-screen workflow management system. Service providers' efforts to build sustainable business models depend on their ability to deliver multi-screen services with advanced navigation across all streams. And they want to do this in the context of consolidating multiple headends into single core processing centers.

Time- and Place-Shifting

Many operators are already moving aggressively toward next-generation services with new approaches to time-shifted program offerings, delivery of premium content to PCs and eventually mobile handsets, implementation of advanced advertising in VOD, time-shifted and linear programming and the launch of interactive applications, including advanced navigation systems. Each of these efforts require introduction of new operations procedures, workflows and processing platforms.

While it may be feasible to manage trials of these services through independent workflow systems, moving to a commercial scale will require consolidation into a single workflow processing system that's fully integrated with all the headend and back office modules that support these services. For example, to support time-shifted services that make primetime content available for a set period beyond the scheduled broadcast, operators must be able to capture live feeds into a network recording system that operates separately from the VOD catcher-based infrastructure.

Operators need a workflow management system that can manage this new time-shift service as well as the traditional VOD system in a unified way

end to end, leveraging whatever processes they have in common, such as trick-play support and dynamic advertising placement, while supporting processes that are unique to each. And the workflow system has to be able to execute on operational nuances as they change over time in accordance with licensing agreements and other policies. For example, avails carrying ad content from the original linear program running in a short "start-over" window might come open for dynamic placement of new ads when the content file shifts into the longer window of a "look-back" mode.

The same need for management consolidation and flexibility applies to the addition of TV Everywhere processes into the workflow. Content elements that must be processed for time-shift applications, in formats and with policies suited to delivery over the TV service network, must also be processed to operate in IP over broadband links with support for all the policy, authentication, encryption, transcoding, streaming, advertising and other components unique to each category.

These new service models require implementation of new, massively scalable Network Asset Storage systems where ingested content and metadata can be processed by the workflow management system in preparation for distribution over multiple paths to multiple devices. This requires tight integration between the two platforms with the flexibility to accommodate new uses of stored content as new service models emerge.

As operators position headends to serve multiple sites, they need to be able to add localization variants to all these content categories with respect to advertising, text overlays, interactive applications and pricing options. The workflow management system must be able to apply whatever local variants pertain to any given content file so that it's delivered to each site exactly as prescribed.

Advertising

When it comes to all the new advertising strategies now in play among service providers, the consolidated workflow management system is absolutely vital to efficient execution. The workflow management system, in addition to supporting multiple transcoding modalities, interaction with the NAS and other functions common to other applications, must also manage all the functions associated with the various advertising models.

It must read and act on spot schedule files from multiple ad management sources for each linear and VOD advertising campaign as those files apply to each break on each channel within each zone served by a given headend. It must know to look for and apply metadata changes for VOD advertising while recognizing metadata is not used with linear ad schedulers.

The workflow management system must support demultiplexing and transcoding processes on individual audio and video tracks, along with audio normalization processes to prevent volume fluctuations between ads and programming. It must be integrated with content editing suites to support mark-ins and out-cuts.

In the case of networks that employ EBIF (Enhanced Television Binary Interchange Format) to enable set-top support for advertising applications, the workflow platform must demultiplex and act on PIDs (Packet Identifiers) to ensure applications are matched to content in accord with site and other variants. In situations that use multiple ad streams that are designed to use the set-top as the placement mechanism in accord with specific profiles, the workflow system must be able to manage the “squeezing” process that trims a fraction of a second off the spot to ensure a smooth transition from programming to ad content.

Advertising also puts a high priority on the ability of the workflow platform to confirm absolute adherence to ad policies. It must have

an embedded quality-assurance capability that validates that the ad is formatted and placed as required by the ad management system. It must provide support for load balancing, error detection and fault monitoring across all transcoders, splicers and other key elements. Support for SNMP (Simple Network Management Protocol) monitoring capabilities in the MPEG TV and broadband domains is essential.

THE SEACHANGE ASSETFLOW TEMPLATE AND PROCESSES

SeaChange brings a vast wealth of experience to bear in the design, systems integration and implementation of its AssetFlow Workflow Management System. Along with a VOD customer base exceeding 42 million households worldwide, the company holds a 70 percent share of the global linear ad placement technology market, supports workflow management across 6,000 broadcast channels and provides workflow management and other solutions in the mobile space for over 100 video content providers and seven managed mobile network operators across 1,500 unique handset models.

The company has built a far-reaching ecosystem of partners that provides a full slate of pre-integrated options for operations managers to use in conjunction with AssetFlow, including:

- Network Asset Storage: Isilon; SeaChange UML, etc.
- Transcoders/Encoders: Rhozet and Carbon Coder (Harmonic); Flip Factory (Telestream); Digital Rapids; Media Alliance; Cinegy; Anystream; Envivio; EGT; Cisco; Scopus; Tandberg; Leitch, etc.
- Automated Quality Assurance: Cerify (Tektronix)
- Media Asset Management: Dalet; Blue Order; Ardendo, etc.
- Data Movers: Front Porch Digital; Harris; MassTech, etc.

Setting Up Workflow Processes

The AssetFlow system was built on jBPM-based technology to enable consolidated management of the full range of processing requirements tied to evolving distribution needs of content suppliers and network operators across all outlets and all screens. It provides operations managers a highly flexible approach to set their workflow templates to precisely match their requirements.

For example, in one illustration of this flexible approach, an implementation template might be organized around six steps which a manager deems essential to end-to-end lifecycle management of all the assets and functions that go into enabling a perceived set of business opportunities associated with multimedia convergence. In this sample set-up, the six steps, all of which are managed through the AssetFlow Dashboard, include:

• Initiate

- Identifies and sets up interfaces with all the sources of assets, including live broadcast feeds, MAMs and other post-production centers, VOD catcher systems, the Internet, physical media such as DVDs and VHS tapes, and, in the case of dynamic advertising applications, ad servers;
- Identifies the “drop box” points of ingestion where each asset that needs to be processed is fed into the Network Access Storage system. Along with supplying its own NAS, SeaChange has provided support in AccessFlow for tight integration with all the major NAS suppliers;
- Automatically initiates workflow processes on assets when they appear in the drop box.

• Filter

- Determines which assets found in a selected drop box will go through the processes associated with a particular set of workflow criteria.

• Validate

- Provides optionally activated mechanisms to determine if an asset meets certain business rules and what to do with the asset if it doesn't. Validation can be applied separately to metadata and content associated with that metadata or just to the metadata alone or to neither. Validation allows the user to avoid costly processing of an asset that has been corrupted or contains inaccurate data. In the case of metadata, the validation happens once prior to processing of content so as to prevent errors in the processing. On the content side, because validation is essential to quality assurance, it can be applied both before and after processing. Prior to processing, the user may want to make sure the content file is clean so as to avoid a waste of processing resources on corrupted content. Post processing validation determines whether any defects were introduced during processing.

• Normalize and Localize

- These two closely related steps comprise the mechanisms that determine which processing tasks are performed on any given metadata or content asset by the AssetFlow platform. Rules associated with various business models as they apply to specific categories of content for distribution to different end points over different network paths dictate the changes in metadata that must be made by the metadata editor to suit the requirements of each content element. Those changes in turn dictate the changes in processing that will be applied to the content for each distribution scenario. This dynamic process can assign many variants, such as usage policies, types of encryption, streaming formats, encoding, advertising and ITV applications, etc., to each content segment. In addition, the localization step allows variants on each content file to be modified to fit specific destination points.

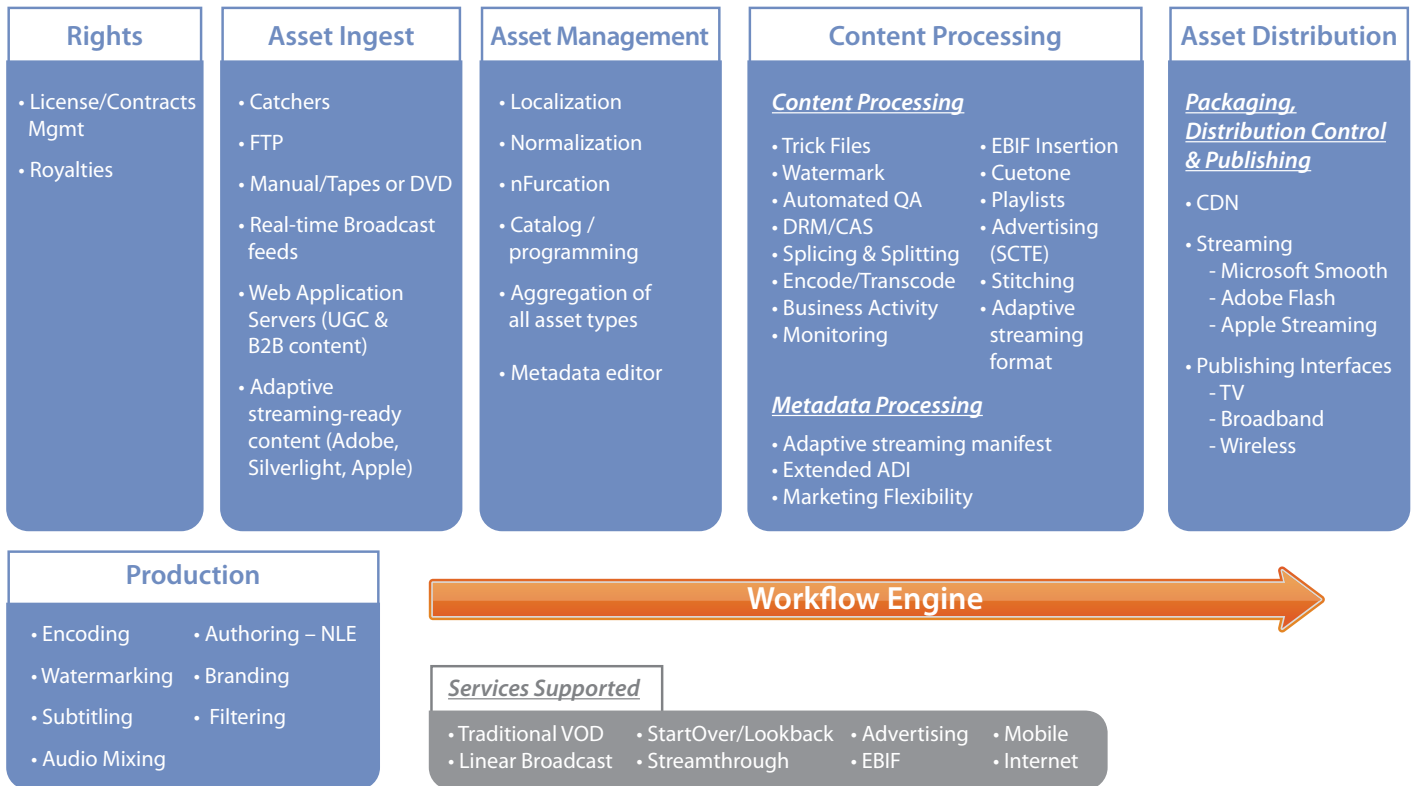
• Distribute

- Sets the destinations for all content elements and identifies the distribution paths.

AssetFlow Functions

All the functions of the AssetFlow platform that are put into play via the set-up steps enumerated on the previous page are outlined in Figure 3.

Figure 3



Most of these functions have been touched on at different points in the preceding discussion. Together they comprise the full slate of requirements for an advanced workflow management system that can accommodate virtually any multi-screen business model devised by either a content supplier or network operator.

To further illuminate just how comprehensive the AssetFlow solution is toward fulfillment of these requirements, it's worth delving deeper into some of the dimensions associated with content processing in the workflow. One key feature pertains to allowing users to readily choose from multiple options precisely which processes apply to a given type of content, thereby leveraging a relatively small number of function categories to support a very broad array of usage profiles.

For example, VOD-related content and advertising

processes are very different from those that need to be applied to linear content and advertising in linear content. But this doesn't mean that accommodating VOD applications in different viewing environments needs to be more difficult.

Managers assigning processing functions to VOD content will typically want to generate trick files, transcoding for different formats, automated quality assurance, encryption and possibly watermarking. Turning linear content into time-shifted VOD-like content entails application of the same processes but only after the workflow system has executed on additional commands associated with capturing live feeds and passing them into the recording system. All of this, plus the previously mentioned re-categorizing of time-shifted content from a short-term to a longer-term state of availability under different licensing terms, can be easily enabled in the workflow set-up through the system dashboard.

Another nuance in treatment of different categories of content comes with situations where “stream-through” handling of content is mandated. Here the processing requirements may only apply to changes in the metadata that have nothing to do with orchestrating any changes in the content itself with regard to formatting, transcoding or other parameters.

In this case, the workflow system must know not to look for metadata components describing the transport format, encoding used or anything else that’s specific to the content or its mode of delivery from an outside source. Instead, the system must know to look for information in the metadata that describes where the content source originates so that the workflow system knows to pass through content from that point of origination without flagging it as an aberration because it has no content parameter-specific metadata. Again, the user can accommodate these requirements through simple point-and-click commands on the dashboard.

Similarly, users can add mobile video into the workflow mix without having to add a large set of dedicated functions. In mobile applications, most of the required functions are the same as what one would use with VOD. The primary difference is the need to activate commands tied to transcoding for different modes of adaptive streaming in accord with the resolution and other formatting requirements of specific handset models.

Digital rights management and associated security measures provide another example where different usage requirements can be enabled by tapping into the same workflow management system. Content suppliers have a need to be very thorough in their use of DRM, watermarking and fingerprinting, ensuring that all usage policies are articulated within each rights enforcement system and that the systems are appropriately matched

to suit the device platform targeted by each content configuration. And they have to manage a layer of rights policies that have to do with determining whether and how any given service provider can use specific content elements and what advertising placement options are permitted. All of these requirements can be met through commands exercised on the AssetFlow Dashboard.

The rights management requirements of service providers typically are quite different from those of content suppliers. Since the basic policy metrics have been set at the content end, service providers need only maintain an inventory that keeps track of all the policies associated with all assets. Plus they need a mechanism to confirm policies are adhered to and to measure usage in instances where they have a hand in royalty payments.

But the service providers’ requirements in this arena become much more complicated with implementation of TV Everywhere services, where user authentication, authorization and usage policies must be implemented within the network domain. Much remains to be determined in the ongoing trial stages of TV Everywhere implementations, but the AssetFlow platform is already equipped with contract and royalties management modules that can execute on whatever models are embraced by the industry.

Business activity monitoring is another area of vital functionality that the AssetFlow platform supports through simple settings on the dashboard. The system at any given instant can provide asset journal readouts on system throughput, identification of bottlenecks and component errors and how any particular asset is passing through the system, including analysis on all variances and how much time is consumed in processing. And, as previously discussed, the system supports optional applications of quality assurance on both metadata and content assets.

CONCLUSION

Tectonic shifts in consumer behavior, together with technology advances in distribution networks, end user devices and content itself with respect to types of applications and advertising that can now be applied, represent a cogent force for change in content and service provider business models. Providers must necessarily feel their way along in this transition, engaging in trials tied to every promising new approach to monetization of content and services.

But no matter which strategies prove viable, all are agreed that the migration path leads to models tied to distribution of content and applications to all connected devices in response to users' requests wherever they happen to be. Fortunately, content suppliers and network operators don't have to wait until all the details are worked out before they implement the workflow management architectures that will achieve the processing efficiencies that are essential to maximizing returns on these new business models.

By implementing the SeaChange AssetFlow Workflow Management System early on in this transition, content suppliers and network operators can expedite their explorations by making it easy to mount new trials as well as variations on approaches taken within a given trial. In instances where they're already in the commercialization phase of new business models, there's an even greater imperative to put the AssetFlow efficiencies into operation.

Most important, content suppliers and network operators can be confident that whatever strategies prove out over time, they will be able to use the AssetFlow platform to maximize efficient execution of those strategies. And because it is a system with open interfaces that can be easily integrated into external modules and systems, managers not only protect existing infrastructure investments, they also afford themselves the latitude to add new external components in response to ongoing advances in vendor products.

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ABOUT SEACHANGE

SeaChange International is a leading provider of software applications, services and integrated solutions that deliver a high-quality television experience across TVs, PCs and mobile devices. By partnering with leading cable and telco companies, SeaChange enables in-home and mobile entertainment, as well as advanced advertising solutions, allowing broadband operators to differentiate their offerings and create strong customer loyalty.

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