Original Article

Capturing workflow in the digital age

Remko Noteboom

is the CTO and co-founder of Southpaw Technology. He possesses more than 15 years of software development experience specifically with digital production pipeline and asset management design. Before founding Southpaw Technology, Remko worked with Nelvana Limited and C.O.R.E Feature Animation developing infrastructure and asset management solutions for large and small CG and VFX productions. Southpaw Technology Inc. produces TACTIC™, an extensible, web-based production asset management system specifically designed to organize and manage assets with workflow across large-scale productions and entire organizations.

ABSTRACT Creating a digital asset management (DAM) solution that can track a digital asset through every stage of that product's life cycle, from initial conception to final product, is a huge untapped market. Most DAM solutions are concerned with the management and 'monetization' of the final digital asset, which, although useful, ignores the entire process that was used to create those assets in the first place. In addition, although many project management tools attempt to manage workflow, none tie directly to the actual assets being created. As the digital world infringes more and more into mainstream business, the complexity of the digital process has become a universally significant problem, covering all markets and all sizes of organizations. This article details why the visual effects (VFX) and computer graphics (CG) markets have been instrumental in bringing new, innovative solutions to mainstream markets, and how the concept of a 'Digital Assembly Line' can bring about solutions that are radically different from today's more traditional DAM approaches.

Journal of Digital Asset Management (2010) 6, 210–215. doi:10.1057/dam.2010.22

Keywords: workflow; production; assembly line; deliverables; computer graphics; visual effects

THE VFX AND CG MARKETS

The VFX and CG markets have proven to be an ideal breeding and nurturing ground for the rapid development of radical new approaches in production DAM and more specifically, DAM combined with workflow. The necessity for solutions like this, coupled with the inability of the market to provide those solutions, has spawned many expensive internal development initiatives that have attempted to keep pace with the rapid advances in CG technologies and the iterative workflow used to create CG assets.

The VFX and CG markets provide a unique perspective on DAM. There are many likely reasons for this. By its very nature, both markets are fast-paced and very receptive to new technology. Both markets push hardware and software to their limits. Over the last two decades, there has been an explosion of

advancements as each new film attempts to outdo previous accomplishments as the recent colossal success of Avatar and the drive toward stereoscopic three dimensions have clearly demonstrated. From a DAM perspective, Avatar's sheer complexity is astounding. Every tree, rock, flower in the forests, every movement, every expression, every detail is thought out, created, retrieved, worked on and stored by some form of a digital asset.

Rapid deadlines and the exponentially increasing pace of underlying technology from both hardware and software vendors have given digital artists the hardware infrastructure and tools to produce an enormous amount of content. Ever more elaborate techniques have been developed over the years to produce the hyper-realistic visual bonanza that we have grown accustomed to on our video screens.

Correspondence:
Remko Noteboom
247 Arlington Ave,
Toronto, Ontario,
M6C 2Z6, Canada

From a digital production point of view, this places extreme demands on technology in every way: CPU power (thousands of CPU farms), data storage (hundreds of Terabytes into the Petabyte range), bandwidth (GB+ networks are standard), demanding users (artists/producers/directors/and so on) and an industry whose sole assets are 100 per cent digital.

Traditional DAM platforms are not even a consideration when it comes to providing workflow solutions in the digital media industries. They simply cannot handle the sheer volume of data. They do not support the incredibly complex workflows in VFX and feature film studios and they are not open enough to integrate with the technologies so often found in these environments. Until recently there has been no commercial solution capable of managing this level of complexity. As a result, production studios have long been forced to develop custom in-house solutions, which tend to be a rapidly developed hodgepodge of short-term solutions with varying degrees of quality.

The reason for this is that production deadlines invariably trump software development schedules. This makes sense because the core business of a digital production studio is content and not software. Software development is done out of necessity, not because there is any inclination. It is true that a few commercial software products have come out of production studios, but all of them required practically complete rewrites in order to produce a viable commercial product that spans an industry rather than a single facility.

All that being said, the chaos that is production has provided a fertile breeding ground for new ideas and techniques for solving the challenge of tracking the huge number and size of digital assets through every stage of the process as each asset gets manipulated, fixed, updated and approved. This turbulent environment makes production DAM solutions not just a question of return on investment (ROI), but an essential component of day-to-day operations.

As the enterprise world moves relatively slowly toward increasing digital processes, they have started to face the same production issues that have long plagued the VFX and CG industries. Having little experience with digital

production, the enterprise world is at a loss as to how to capture and manage the workflow in their digital efforts. Added to the complexity is communication, outsource packaging, dependency tracking, file naming conventions, notes, statuses, reports and more. IT administrators are starting to notice that all of their tools are insufficient to deal with the ever-increasing amount of content lying around untracked and out of context on their massive hard drives.

Part of the challenge is understanding how to incorporate the human factor. The success of production has always been, and continues to be, intricately tied to people. The underlying problem is that today's tools for creating digital content have far exceeded the ability to manage those tools. Even in industries where digital content is not the final product, organizations are finding that they are still capable of producing enormous amounts of content. Today's somewhat archaic method of using coordinators with clipboards, tracking data in countless spreadsheets, and dictating naming conventions through large, often illegible, printed documents, just does not scale to the pace at which digital artists are able to produce their assets.

The only way to solve this is to combine DAM with the workflow common to the content creation process in a solution best described as 'production DAM'.

WORKFLOW

It is generally understood that there is a production problem that requires a DAM plus workflow solution, but many DAM vendors lack a concrete understanding of how it actually would be implemented successfully in a production environment. As mentioned earlier, the vast majority of DAM solutions are concerned with either the archiving of finished digital assets or the delivery of finished digital assets to an end user. Very few are concerned with the actual creation process of the digital assets themselves. Capturing the digital creation process is where workflow and DAM come together.

Workflow can be defined as:

The flow or progress of work done by a company, industry, department, or person.¹

Workflow dictates what an individual or process must actually do. Managing workflow means to

clearly define all the roles of the people and automated processes involved. It must dictate how work is packaged up and delivered down to the next process. Once every stage of the workflow has been defined, it is up to the asset management system to track every stage. The DAM system must have an understanding of what the processes are, what needs to be delivered to whom and in what format. This allows the designers of the workflow to strictly define and control the process while freeing the artists and other beneficiaries of the system to focus on what they are good at: asset creation.

THE DIGITAL ASSEMBLY LINE

In the early 1900s, Henry Ford developed techniques that would revolutionize the manufacturing world. His contributions to mass production are still very relevant in today's digital world:

The economies of mass production come from several sources. The primary cause is a reduction of nonproductive effort of all types. In craft production the craftsman must bustle about a shop, getting parts and assembling them. He must locate and use many tools many times for varying tasks. In mass production, each worker repeats one or a few related tasks that use the same tool to perform identical or near-identical operations on a stream of products. The exact tool and parts are always at hand, having been moved down the assembly line consecutively. The worker spends little or no time retrieving and/or preparing materials and tools, and so the time taken to manufacture a product using mass production is shorter than when using traditional methods.

The probability of human error and variation is also reduced, as tasks are predominantly carried out by machinery. A reduction in labor costs, as well as an increased rate of production, enables a company to produce a larger quantity of one product at a lower cost than using traditional, non-linear methods.²

It is striking that most digital processes have not migrated to using techniques of mass production well known in the manufacturing world. Digital content is still largely produced using the same methods of the craftsman of old.

Complexity is one of the main reasons vendors have failed to tame the digital assembly line. In today's economy, the production line has to be much more flexible in order to produce customized content. Unlike the physical world, mass production of identical digital assets is trivial. However, in a digital pipeline, employees must produce a large number of similar but ultimately different assets. This variance is often one that requires a human to judge, criticize, comment on, and possibly, alter. This is where a digital process differs from a physical one.

The scalability of a digital asset creation workflow or 'assembly line' lies in its ability to help employees effectively and efficiently create assets in a similar fashion but that also has the ability to adjust to the individual characteristics of each individual asset. This requires careful design with an intricate understanding of the process.

It is important to note that it is not the DAM system's place to dictate the workflow, but instead, to be flexible enough to support, secure and speedup any workflow. It must be intelligent enough to package and deliver an asset from one step of the process to another, but versatile enough to allow people to work the way they want in creating the asset, regardless of the type of content.

DELIVERABLES AND WORKFLOW

In order to track the process by which someone creates an asset, it must be broken down into a pipeline, which consists of a flow chart of individual processes connected together. Good design suggests that from a pipeline point of view, these processes are black boxes in which each black box receives its 'receivables', does its work and delivers its 'deliverables'.

Taking a step back, one can see that this precisely describes the assembly processes invented and developed by Henry Ford, but instead of cars, it is being applied to a digital process. Specialization of labor merely translates to the workflow within the process. Efficiency is gained by designing a set of processes that best utilizes the talents and specializations of the people and resources available without hindering them under the weight of an overbearing system.

To translate this to digital workflow, the same methodology of designing a digital assembly line can be performed. Effective work process relies on defining exact deliverables from one process to another. Processes become inefficient when each receivable must be 'translated' or worse 'cleaned up' at each stage. This puts extra pressure on the next process in turn because that process must then deliver a flawed deliverable in order to make a predefined quota. In time, the whole process breaks down, resulting in a poor quality end product delivered.

It is therefore critical for a process down the pipeline to have the authority to reject a delivered package that is not packaged in a way defined by the design of the overall pipeline. This 'reject' pushes back the deliverable and forces the previous processes to re-package it. In other words, each deliverable should be packaged properly in order to make the next set of processes as efficient as possible. It becomes even more efficient when the DAM itself is able to package the deliverable, removing this duty from the content creators.

Production DAM can offer this type of digital assembly line. It tracks the progress of every process and securely stores every deliverable in an organized fashion. When a process 'delivers' to processes downstream, it checks them into the asset management system. When a process 'receives' a deliverable from a previous process, it goes to the asset management system for the deliverable. In other words, the production DAM system is intricately intertwined with the workflow of the entire pipeline.

This checkin/checkout procedure for storing deliverables in a production DAM system provides a gatekeeper to ensure that the deliverable is packaged up in the correct way. It provides an opportunity to inspect the deliverable to ensure that it:

- is packaged up in the correct way
- does not contain common errors
- is versioned so that a proper history is recorded
- is stored in the correct location

The DAM system becomes the backbone for the digital assembly line, making sure every

aspect of the process is tracked properly. Everything depends on the infrastructure of the DAM system. Ultimately, for this reason, production DAM becomes not a question of ROI, but an essential and critical component of the entire process.

THE SEARCH ENGINE

Fundamental to any DAM system is the ability to search for assets. Google has been incredibly effective for searching for information on the Internet. The web search engines have provided a framework under which most DAM software operates. These search engines rely on ever more sophisticated search algorithms in order to provide a probabilistic best chance of returning a usable result.

Unfortunately, this fundamentally does not work in the creation workflow process of a digital asset. The search engine is useful for research, but when constructing an asset, it is critical that the search engine returns the exact match and no other. For example, when building an engine, one does not want to have a probability of getting the right parts. They must be the exact parts specified.

No Google-style, tag-based indexing algorithm will ever be sophisticated enough to construct an engine, a building or any complex digital asset. In order to achieve this, a different organizational structure for assets must be used, one in which everything has its place and is organized around a strict set of rules based upon the design of the workflow. This requires the assets to be organized not according to tags and indexing, but according to its 'place'.

Traditional DAM systems require a huge effort of tagging each individual asset. This is a very painstaking and involved process because each asset must be categorized after completion of the asset. With workflow, the resulting tags or metadata associated with an asset are a natural byproduct of the creation process. In an efficient, workflow-driven DAM system, relatively very little time is spent on creating tags. When the asset is completed, it may be necessary to go through some extra tagging process in order to deliver content to an end user, but this is still a natural extension to the creation process and typically does not require the enormous extra effort required when starting with completely finished assets.

THE LIBRARY ANALOGY

From a storage perspective, every step of the process for an asset has its predefined location. This is precisely how a library works. The digital world can learn a lot from the Dewey Decimal System, which is used in 200 000 libraries in at least 135 countries³ and has been in use for over a century.

According to Wikipedia: 'This system organizes books on library shelves in a specific and repeatable order that makes it easy to find any book and return it to its proper place'.⁴

When returning a book to a library, you cannot put that book anywhere you choose. Nobody will be able to find it. In a library, there is only one place for a book. The Dewey Decimal System is rather complicated and the average person does not know exactly where a particular book should go. But that is what the librarian is for. A DAM system is merely the digital equivalent of the librarian for digital content.

COMBINING THE LIBRARY WITH THE DIGITAL ASSEMBLY LINE

The reliable ability to retrieve the exact asset for a given purpose in any part of the process serves as the foundation upon which a workflow can be built. The design of the digital assembly line encompasses the definition of deliverables from one process to the next. With each stage defined, the human element is introduced in the form of communication management. These processes can then start creating digital assets and hand off the packaged deliverable to the production DAM system for retrieval by the next stage of the process.

The combination effectively delivers a well-defined, highly scalable production DAM system that can capture the full creation process of digital assets.

ROI OR MISSION CRITICAL SOLUTION?

The adoption of a DAM system in any organization is difficult. This is because, traditionally, DAM systems must resort to ROI arguments to state a business case given the huge upfront costs. Teams of people have to be hired to add the assets to the system. Tagging nomenclature and taxonomy has to be defined and extensive data entry is required to organize all the assets. It takes a long time of dedicated setup before the system truly becomes effective.

These initial costs can be staggering and present a huge potential barrier to adoption.

A DAM system that incorporates workflow does not have these staggering initial costs. This is because the assets themselves do not yet exist. The data entry and tagging process is a natural outcome of the creation process.

As has already been discussed, the digital creation process is so complex, a DAM system with workflow is not just a question of ROI, but is recognized as absolutely mission critical to getting productions done on time. In the decision-making process, ROI becomes subservient to how necessary the system is to the production.

THE FUTURE OF GLOBAL DIGITAL ECONOMY

In today's global economy, it becomes increasingly important to have a global presence. This is even more true for the digital process of asset creation as more and more digital 'production' facilities are opened in countries where talent is plentiful and costs are low.

There are technical challenges and other limitations to outsourcing digital asset creation, however. Those limitations are ultimately limited by two factors: (1) bandwidth and (2) the ability to effectively manage the process. Although bandwidth is definitely still an issue, it is quickly becoming secondary to the effective management of the entire process.

The next phase of production DAM lies in its ability to effectively manage multiple pipelines in numerous simultaneous facilities around the world. The seamless distribution of work to the far reaches of the planet will allow companies to produce content at the most efficient possible location and to seamlessly manage the entire process as if it were local.

CONCLUSION

It is unlikely that the pace of digital content creation or the digitization of business processes will be slow. More likely, the pace will accelerate and continue to infiltrate mainstream organizations. As that pace accelerates, so too will the need for tools that can efficiently manage the content creation process. Digital production is complex and is getting more complex. Software tools will continue to develop ways to make people create higher quality content faster.

Companies are just beginning to realize that they cannot ignore the inefficiencies of the digital process. The creation of these assets cost money. The inefficiencies related to this process cost money. Meanwhile, these processes and these assets are becoming essential to the success of the company.

Production DAM systems must be there to ensure the scalability of the digital process. It must understand the process, the workflow, the people involved and the communication between all the systems. This is the complete and true management of a digital asset.

ACKNOWLEDGEMENTS

The author thanks Eric Schumacher and Gary Mundell for providing suggestions and additional editing.

REFERENCES

- 1 The Free Dictionary, <http://www.thefreedictionary.com/workflow>.
- 2 Wikipedia, http://en.wikipedia.org/wiki/Mass_production.
- 3 OCLC, <http://www.oclc.org/dewey/about/default.htm>.
- 4 Wikipedia, http://en.wikipedia.org/wiki/Dewey_Decimal_Classification.