The What, Why, Where and How of the Media Supply Chain

An eBook from
Vidispine – An Arvato Systems Brand

What is the role of APIs for MSC?

The supply chain components we see today are the result from decades of hard work from the industry. The eBook mentions a number of standards that for sure has made it easier to build supply chains with components from different vendors. In the other dimension, a well-organized API makes it possible to orchestrate the components efficiently. Without APIs, MSCs are still possible to achieve, but they tend to be much more inflexible.

Where are the next innovations around MSC coming from?

It is hard to not mention AI here. AI has the potential to, if used wisely, automating steps in the chain. Obviously, the Manipulation and Analysis steps can be made automatic or semi-automatic using ML. But it is important to always look at these steps as part of the chain, so whatever tools that are introduced, they have to match the other steps of the chain, or the promised gains will fail to arrive. Another use of AI which is even more exciting is the use of AI in analysis of the chain itself. The workflows of a full MSC can be complex, but AI can provide insight into any inefficiencies in the chain, something that Henry Ford would have loved!

—Isak Jonsson, Chief Technologist at Vidispine – An Arvato Systems Brand

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Introduction

"Media supply chain" is a phrase we frequently see around industry tradeshows and publications, but what does it actually mean, why do I need one, and how do I implement one? In this series we start from the ground up, looking at the what — what does the term mean and what does it encompass. The where — where cloud, "on prem" and hybrid fits in, and the how — how to actually implement one. Finally, we'll look at the future of the supply chain and its place in the wider video ecosystem.

Applying modern manufacturing principles to media: fundamentals of the media factory and media supply chain

Standardization is critical to efficiency and eliminating errors/waste in media workflows too, whether that's in interfaces, file formats or metadata structure, and we'll look into this further in a later article.

Eliminating waste is at the core of the Toyota Production System, the pre-cursor to the LEAN methodology. The Toyota Production System, or TPS has two central principles, just-in-time and jidoka.

Just-in-time

Just-in-time means making only what is needed, only when it's needed, and only in the amount that it is needed. In the manufacturing process, it means only having the components arrive in your facility as you need them and only in the quantity to produce the quantity of end product you need – to exactly satisfy customer demand.

If we think about this in a media context, we can see how this principle presents the opportunity to eliminate significant waste. For example, consider the number of versions and different file formats required to fulfill the multitude of distribution platforms many workflows now need to support. If we were to create and store all these different versions persistently, the storage requirements would be significant. If, by contrast, we only store the video, audio, caption and metadata in a componentized mezzanine form, and only create the distribution versions as they are needed for delivery, we can dramatically reduce the storage required and thereby eliminate waste.

A (digital) media supply chain can be any production and distribution workflow system where media files and their associated metadata needs to be managed based on the current business model. But we've been producing and distributing video for over a century, and media asset management (MAM) systems have been around for over 20 years, managing media files and associated metadata.

The one thing that's changed then, or at least evolved, is the business model; the type of media, how we consume it and how much we consume has all changed rapidly over the last decade and the business models associated have had to evolve to keep pace. We won't look at those trends in detail here but, in short, it has meant we need to produce more media, more versions of that media and, in many cases, get that media to market quicker.

Henry Ford is famously quoted as saying a customer could have "any color that he wants, as long as it is black!" In reality, the Model T was actually available in quite a wide range of colors, but his point was that the success of the automobile would be in the efficiency of its production and the key to that efficiency was the standardization of parts and processes.
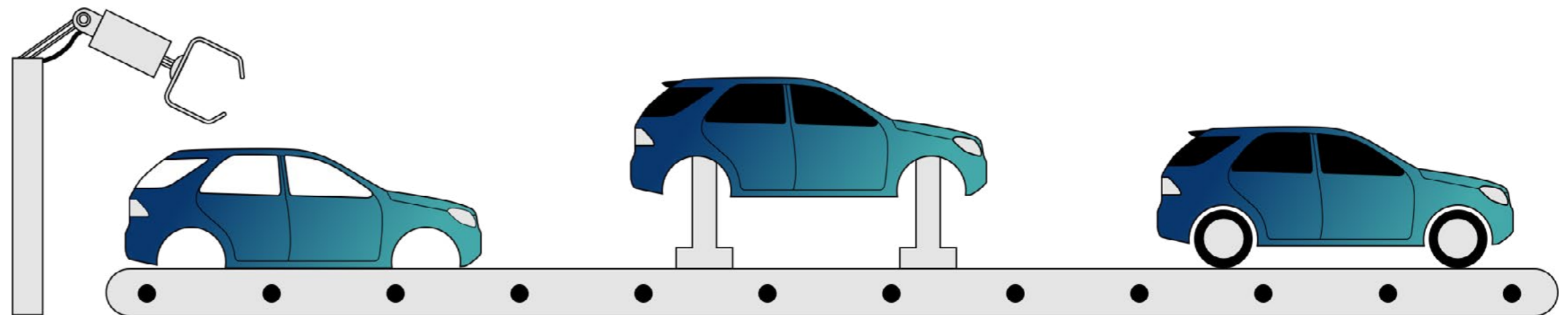
> " Any color that he wants,
> as long as it is black! "
>
> —Henry Ford

Jikoda

The second principle, jidoka, translates as "automation with a human touch". Without automation, it would not be possible to reach the level of productivity required in media workflows to meet business needs. However, media "quality" is hugely subjective and is dependent on human crea-tivity and judgment in the production and distribution process. Therefore, jidoka is critical in the media supply chain too and any media workflow platform must have the interfaces and tools to allow for the "human touch."

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The five pillars of the media supply chains

I.   Infrastructure

Everyone loves a good analogy, so we'll stick with manufacturing. At the center of your operations are your plant or factory and your warehouses. The location, size and layout of your warehouse is going to depend on what you store there and how quickly your plant needs access to it – media and metadata storage is similar.

In some manufacturing, the location of the plant is also very important – keeping it as close as possible to the distribution network or even consumer, to reduce time to market, or keeping it close to the raw material to minimize transportation or acquisition cost.

Historically, media has been similar, with media production processes often co-located with studios and/or distribution headends. However, over the last few years, the amount of proprietary or use-case-specific hardware has dropped almost to zero and the vast majority of media "plant" is now running on commodity CPU in standard IT datacenters. This, together with remote connectivity possibilities, means that we can be far more flexible in locating the infrastructure for the media supply chain, including, of course, private or public cloud as well as hybrid scenarios. Cloud or hybrid infrastructure offers us incredible flexibility to scale our warehouse and plant up and down as the business demands, massively reducing waste. Equally, cloud and hybrid afford us the opportunity to re-tool our plant for different purposes without significant change or startup costs. For example, if we wanted to change the transcoder in a media workflow, with a cloud-based media supply chain, this can be as simple as updating a configuration file.

II.   Transformation

Transformation isn't a term we commonly use, but it works well to describe all the processes we might use to take media and metadata from one form and/or place to another – of which transcoding is, of course, a significant subset. What transformations we include (or exclude) in our workflows has a significant bearing on the overall design and operation of our supply chain, and vice versa.

For example, in the previous article, we looked briefly at standardization and how, by using a standardized componentized mezzanine format, we could more easily apply just-in-time principles on delivery. However, in order to achieve that mezzanine format, it's highly likely that the first step in the workflow after (or during) acquisition will be an initial transformation. In instances where we want to minimize the number of transformations – for reasons of speed or preservation – this additional step may be undesirable. In most scenarios, minimizing the number of types of formats passing through a workflow between acquisition and the final transformation for distribution is going to significantly reduce the variables in the workflow, making the supply chain more maintainable and minimizing errors.

Another consideration in transformations is how they are carried out. When it comes to metadata, most transformations are quick, and the time those transformations take has little bearing on the end-to-end time of the workflow. However, a lot of transcoding and other media processing applications can take a significant portion of time, especially with long-form material, and, therefore, how the process is done and how the output is delivered can have important downstream implications.

One of the ways that Henry Ford dramatically decreased end-to-end production time of his vehicles was through the application of the moving production line. This meant a second task could begin before the first was completed, rather than waiting for each task to complete fully before moving the vehicle between stations or bringing parts and tools for the next task to the vehicle.

Similarly, in media, we can concatenate tasks by using media formats in the production stages of the supply chain that allow for growing file workflows. This means we can start editing a file or a media analysis process (such as QC or AI processes like speech to text) while a file is still being transcoded. For long-form content this can have a significant impact on the overall time it takes the media to pass through the supply chain and reduce time to market. For short clips and media, such as advertisements, there may be limited benefit to growing file workflows. It should also be noted that implementing these workflows does have an impact on network and storage specifications.
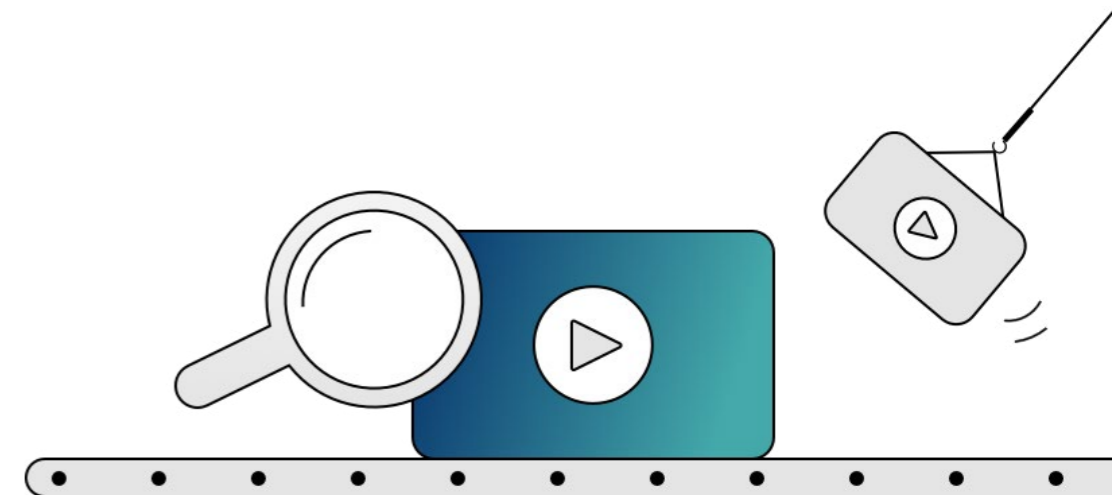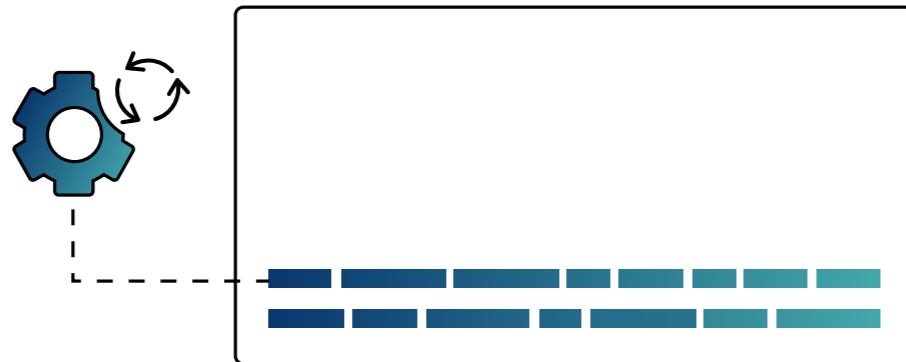
III. Manipulation

Manipulation covers anything we might do to change or add to the media or metadata – most obviously media editing, but we can also include things such as adding captions, graphical overlays and different languages, as well as creating different versions (through segmentation) and other creative processes that might be applied to media. What manipulation we need to do to what type of media will be a significant factor in decisions around infrastructure; a workflow that requires significant manipulation of high-bit rate, high-resolution media may be better suited to a hybrid infrastructure.

IV. Analysis

In many ways, media and metadata analysis isn't dissimilar to media and metadata transformation, but instead of equivalent media or metadata on the output, we get new, enriched or augmented metadata. However, similarly to transformation, what analysis we do and at what stage in the work-flow will depend mostly on the end destination of the media. For example, we may run media through an automated QC tool to check for technical compliance with a delivery format, or even a cognitive service that checks for content compliance if the media is destined to be distributed prior to a watershed or into a region that restricts certain imagery.

We may also perform analysis both on the metadata and media to aid or instruct manipulation, for example using a simple scene detection to find potential ad insertion points, speech-to-text analysis to complement a captioning workflow, or facial/object recognition analysis to add metadata, enabling editors to more quickly find clips to use in an edit.

V. Acquisition

Media and metadata acquisition is often the first step in a media supply chain, but it is listed as the last of the five pillars here because in all cases it will be some combination of transformation, manipulation and analysis. The process of acquiring media and metadata, or ingesting into our workflow, is fundamentally about taking that media and metadata from an untrusted to a trusted state. By "trusted" we mean a state in which we know that we have all the required metadata, in the required form, to initiate workflows and that the media will pass through those workflows and down the supply chain without error. Depending on the workflows, we may have different levels of trust, and, depending on the source and how and when we receive the media and metadata, we may also consider separate infrastructure to facilitate our acquisition process. For example, if we frequently but irregularly receive media from other facilities with differing production standards, we could consider creating a cloud-based quarantine where we can receive, analyze (QC), manipulate (add metadata) and transform (transcode to a mezzanine format) incoming media and metadata on an on-demand basis.

04 Specifying the Media Supply Chain
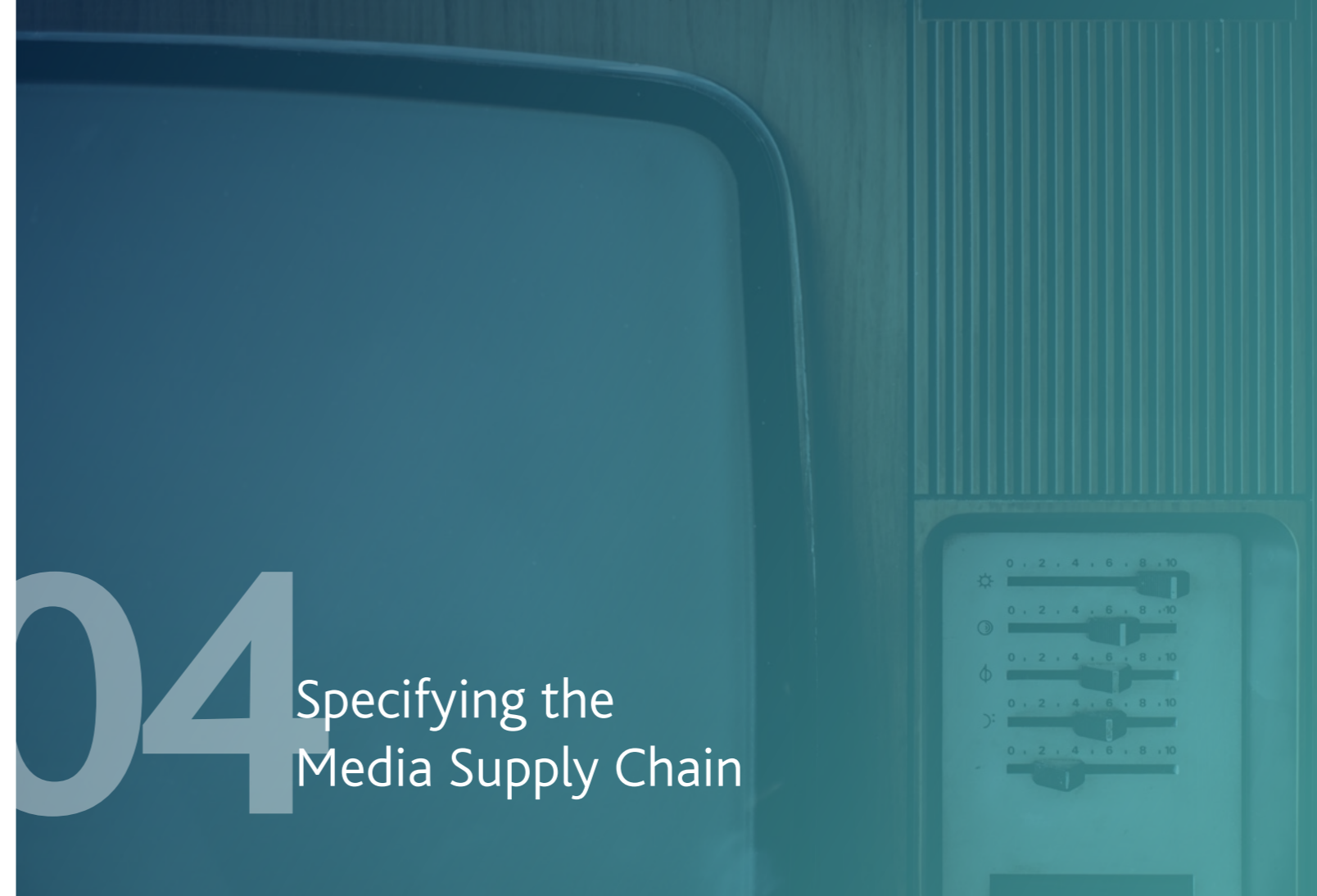
What we are trying to achieve

When we look to specify an implementation or replacement of a system or component that we're already familiar with, as humans, we tend to build lists of detailed items that we see as require-ments, rather than think about what we're trying to achieve overall with that system or component. Last year, my dad was looking to replace his car and spent hours looking at the dimensions of possible replacements, how many liters (or liters/cubic inches) of luggage capacity their boot (trunk) had, and whether the rear seats had a 50/50 or 30/70 split fold. In the end, whether the boot (trunk) capacity was 356 or 342 liters had little importance at all, as his main requirement was that he could still transport my mother, his spinet and a slightly manic chocolate Labrador. In the same way, when looking at specifying the media supply chain it's important to keep focus on what we're trying to achieve overall and what the business goal is.

One area where this frequently fails, is in the pillar "transformation". The work of organizations such as AMWA and the DPP with application specifications has certainly simplified matters, but it's still not uncommon to see requirements that feature a long list of "input" formats as separated media wrappers, video codecs, audio formats, and codecs and sidecar/metadata and the same for "output" with little or no information on wrappers, video, audio and sidecars might be combined or indeed how that combination will be received or consumed. In the best-case scenario this can result in complicated onboarding and complex acceptance tests but in the worst case it will result in a system being deployed that technically meets the specification, but doesn't actually do what you need it to do.

Add the right value

Especially with the incredible insights that can be provided by the latest AI-based tools, analysis tools are increasingly being used to add value in the media supply chain. However, when considering analysis tools, it important to consider not just the potential added value the insights product can bring, but how the tools can be implemented in your environment to actually add that value. For example, before file-based delivery of media assets was commonplace, the ingest of most assets was physically actioned and monitored by an ingest operator who had a duel function of also performing at least a cursory, if not full QC, on the media. When we moved to file-based delivery, the ingest operation became automated massively accelerating workflows and removing the need for an ingest operator – QC could easily be performed by automated software analysis tools too – automated QC. This worked brilliantly while there were no errors, but when there were, many facilities found themselves with no one who could read the error report and know how to resolve the issue. As a result, at the time many of the automated QC tools were simply turned off or taken out of the workflow. That specific issue has largely been resolved over time by improved standards and changed working methods, but there are still lessons to be learned. With access to many of these systems on demand, through individual SaaS offerings or through a PaaS (Platform as a Service) such as Vidispine's Vidinet, the opportunity to test out a solution before implementing is far more accessible than in the past.

Is 'Cloud' even a question?

Only a year ago, one of the biggest decisions for anyone looking to implement, replace or upgrade part or all of their media supply chain solution was where to put it – on premise, in a private cloud, in the "public" cloud or some hybrid or two or all three of those. Today, for the majority of media organizations, it is almost taken for granted that at least some of the infrastructure and services will be cloud-based, and what or how much is on premise depends largely on legacy storage or systems that needs to remain operational. Hybrid infrastructure no longer requires convoluted and complex solutions – simple agents collocated with assets or systems keep everything securely connected. For some components, there is still a cost advantage to "on premise" but with the pace of change in the industry and consumer demand, the flexibility offered by a PaaS solution is often a better match to business requirements. Where your assets are stored may be an exception to this for a number of reasons, but good media supply chain solutions should have broad support for different storage systems and vendors as well as operationally agnostic.

05 Build it, buy it or somewhere in between

Learn your scales

If we think about business software solutions in general, historically there have been two main approaches. For many organizations, the only viable option was to purchase a turnkey system. Likely with some customization to their needs, and for any change in requirements in the lifetime of the system to be handled together with the vendor through change requests, system upgrades, or additional customization. The alternative option, open to organizations with appropriate resources, was to build their own completely custom solution, and maintain that themselves – though there are many instances where the latter example has grown into the first.

Today, those two options still exist, but as media technology has converged with standard IT, standardization has made possible a whole scale of options that have emerged in between.

Don't start from scratch

BYOS (build your own system) or BIY (build it yourself) no longer has to mean starting from scratch or complete custom development. Solutions such as VidiCore provide the object repository and metadata structures that enable you to focus on developing the application layer, rather than the underlying framework. Accompanying toolkits can massively accelerate development while templated solutions, called "Themes" in the Vidinet platform, enable developers to realize a minimum viable product for common use cases, such as a media library, within only a couple of hours.

At the other end of the spectrum, even turnkey enterprise systems offer far more user configurability and customization than in the past. For example, where changing or setting up a new metadata schema, rules and workflows may once have required the services of the system vendor. Many systems now offer standardized interfaces that allow system administrators to tailor the system to their needs and adapt them over time. This significantly reduces the total cost of ownership of systems, but also means that systems are far more likely to continue to provide strong return on investment even as your business evolves.

Should significant custom developments or integrations be required with these enterprise systems, the majority now offer one or more API (application programming interface) and, depending on the system, will offer a multitude of options for extending and integrating the system whether that development is done by you, the vendor, or a third party.

Bridging the two ends of the spectrum, there can be a number of options combining toolkits and templates and "off-the-shelf" applications that would otherwise be part of a turnkey offering.

Standardization

About 15 years ago, when the majority of video was still viewed offline, there was much discussion about the convergence of broadcast and IT. At the time, the focus of this topic was really about the move from proprietary to commodity hardware components within the content chain. Ten years later, convergence with IT was again a topic, but this time it applied more broadly to the production and distribution of video and the focus was not on hardware, but on standards and processes.

Standardization has occurred in all parts of the media supply chain.

In 2004, as media organizations were just beginning to move to file-based video workflows, the file wrapper MXF, the Material eXchange Format, was introduced in an attempt to facilitate the seamless interchange of media files between systems. It took several years to achieve the breadth of interoperability that MXF promised but over the last decade MXF has certainly become the standard—or at least a dominant file format in media production. Over the last couple of years, MXF have been augmented by IMF, the Interoperable Master Format.

IMF still uses MXF as the file format for media components (audio, video etc), but other connections between these components and other structure and descriptive metadata are written in XML. The theory is that while only a handful of people can look at the 0s and 1s that make up an MXF file and understand them, the majority of people can open up an XML file in a basic text tool and understand its meaning.

Standards enable automation

When it comes to describing and monitoring the workflow steps that make up your media supply chain, you'd think there would be something better than a long chain of proprietary symbols… and there is. BPMN, the Business Process Model and Notation, provides a graphical notation for specifying business processes that can also be described using XML. BPMN is widely used across many industries to describe everything from human resource processes to making pizza. The graphical notation can also be used to monitor workflows with an intuitive diagrammatic representation of the workflows. While there is a little nuance in applying it to media workflows, BPMN, and other standards like it, enable the media industry to apply automation to the media supply chain in a clear and transparent way.

While MXF and BPMN are both published by standards bodies, other standardization comes from de facto standards. For example, while most storage vendors offer proprietary APIs, which are commonly the way to get the most functionality and flexibility from that system, many will also offer other interfaces, such as Amazon S3 (Amazon Simple Storage Service). This becomes the lowest common denominator for interfacing the storage with other components and means that new applications and services can be quickly onboarded.
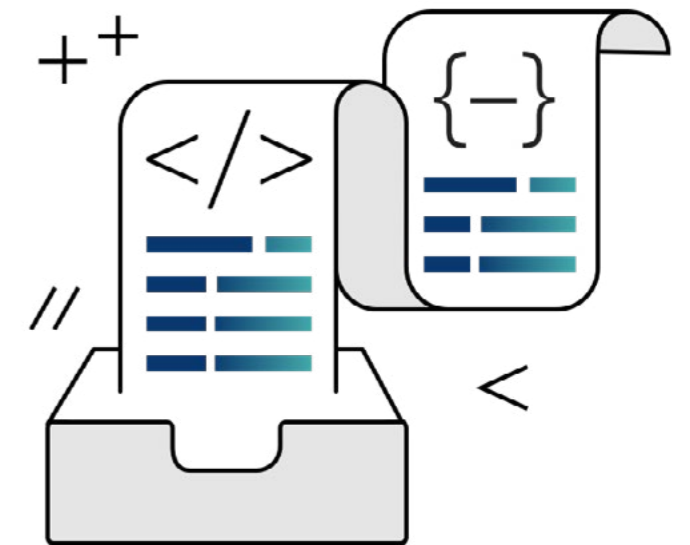
The role of APIs and toolkits

APIs are not new to media production, but it is a strong indicator of their importance today that many products and platforms have done away with traditional product definitions in favor of simply publishing API documentation. The next step in this direction is the availability of toolkits that enable the rapid implementation of an API in new applications. An example of this would be the VidiCore Development Toolkit, VDT, that provide developers with starter templates that bring together UI and back end components, significantly shortening development time.

06 The video ecosystem – the context of the media supply chain

In the introduction to this ebook, we started with the definition of the media supply chain. A (digital) media supply chain can be described as:

> " Any production and distribution workflow system where media files and their associated metadata needs to be managed based on the current business model. "

While siloed systems can be uncomplicated, they are, well – siloed. From the John Donne poem "No man is an island," for media asset management systems came "No MAM is an island" and while the play on words might no longer work, the sentiment remains exactly the same for the media supply chain.

Whether you're building out your media supply chain yourself, or working with a vendor or other partner to deliver a turnkey system, in order to maximize the productivity and/or efficiency of the system, it will need to be connected to other technologies or business processes.

We can refer to the applications, services and platforms that comprise and extend our media supply chain and the other systems it interfaces with as the ecosystem. More broadly, we can describe the video ecosystem as the processes and technology involved in the business of generating revenue from video or using video to enable other business.

If, for example, we can connect our media supply chain to our rights and scheduling system, from the rights we can anticipate incoming content, and potentially populate metadata — and from the schedule we can automate processes to ensure content is available on our playout server or at our headend when it needs to be. Conversely, metadata we generate and store in the media supply chain might be used to drive EPG (Electronic Program Guides) or recommendation engines at the scheduling and delivery points – that in turn may increase ratings or "downloads" and not only increase efficiency but also ROI.

Similarly, if we connect the media supply chain to our advertising inventory management and/or sales systems, we can integrate the planning of ad insertion into the media supply chain processes and/or use descriptive metadata in the media supply chain to automate the insertion of context-relevant commercials – the latter here also has the potential to drive additional revenue.

There are many other examples at other points in the content chain, for example in studio, location or even live production, around newsrooms, or other business process tools. However, one challenge commonly faced, both within the core elements of the media supply chain and in its connection to the rest of the content ecosystem, is that these connections and integrations require significant scoping and start-up costs. The result of this is that, while there is demonstrable ROI in these systems and connections, with the start-up effort that ROI can take quite some time to be realized. In an area of technology that is moving at such a fast pace as media is, that can present some perceived risk.

Cloud-based platforms are already helping to reduce those start-up costs and diminish that risk. With minimal initial investment, systems can be spun up and, especially in integrating other systems, sandbox and staging systems can be managed cost effectively.

With an eye to the future, there will be far greater emphasis on "fast start" and preintegrated technologies that enable users to go from a blank sheet of paper to productive systems in a matter of hours or even minutes. This dramatically changes the risk profile of adopting new technologies and, in turn, should provide a base for faster and/or more innovation in this space.

However, people do business with people, so at the center of the ecosystem will always be the community. In a world where we will have the ability to build a system with little or no communication between customer and vendor, critical for the content ecosystem will be to have a hub for that community, empowering users and enabling knowledge exchange.

Case study: Designing and integrating a cloud-based MAM system in only three weeks with Vidispine

Your (Digital) Media Supply Chain with Vidispine

The amount of content created every day puts a heavy demand on the underlying platforms, while the need to quickly turn your raw content into compelling stories is greater than ever. The Arvato Systems brand Vidispine stands for our comprehensive products and services for the media industry.

Borne from decades of experience in broadcast industry and with a state-of-the-art approach to technology, workflows and business of the media supply chain, our solution represents the ultimate flexibility, financial transparency and control. Whether by using our turnkey applications and services, other media services through the cloud-based marketplace and/or our open APIs and toolkits, our solution empowers users to rapidly and easily adapt to changing business demands.

In addition the Vidispine Content ecosystem forms a community for where customers and partners can integrate with all the Vidispine platforms, applications, and services. As a customer or a partner in the Content ecosystem, you will gain access to essential services and applications for orchestrating your media workflows.

Let us help you get started with your next gen Media Supply Chain.

Contact us for more information or a demo at hello@vidispine.com

Further reading:

⟶ **VidiCore API**　　　　⟶ **Media Service Platform VidiNet**

⟶ **Media Asset Management**　　　　⟶ **Vidispine Blog**

> It is time to look at digital media in the bigger picture. Not only as 0's and 1's, but how they fit in the entire organization. Only then the true value of the bits can be achieved.
>
> By applying supply chain logistics and best practices in computer science, media is served to the right user at the right time. At the right cost. Breaking down the chain into components, looking at interfaces on each one, will tell you a lot about what possibilities you have.