Automation and integration are the keys to successful digital asset management

Received (in revised form): 4th June, 2021

Paul Murphy
Digital Image Expert, UEFA, Switzerland

Paul Murphy is the Digital Image Expert at UEFA, where he is responsible for the digital asset management system for managing photography and graphics. Prior to arriving at UEFA, he managed a picture desk at Sportsfile, the leading sports photo agency in Ireland.

UEFA, Rte de Genève 46, CH-1260 Nyon 2, Switzerland
Tel: +41 22 707 25 33; E-mail: paul.murphy@uefa.ch

Abstract This paper examines how digital asset management at UEFA has grown from a traditional library and archive system to an integral part of the organisation's ecosystem. It describes the various challenges faced and discusses the lessons learned.

KEYWORDS: facial recognition, data model, data mapping, sport

INTRODUCTION

Founded in 1954, the Union of European Football Associations — more commonly known as UEFA — is a large organisation, constituted of 55 member associations across Europe. As the governing body of European football, it organises over 2,000 football matches in a given season. Among other tournaments, it is probably best known for the UEFA Champions League — the biggest competition in European club football, and the UEFA EURO — the competition for national teams that occurs every four years.

UEFA's objectives are, among other things, to address all questions relating to European football; to promote football in a spirit of unity, solidarity, peace, understanding and fair play, without any discrimination on the part of politics, race, religion, gender or any other reason; to safeguard the values of European football; to promote and protect ethical standards and good governance in European football; to maintain relations with all stakeholders involved in European football; and to support and safeguard its member associations for the overall well-being of the European game.

Rather than focus on UEFA's many moving parts, however, this paper focuses on the management of digital media assets at the organisation.

The management of still image assets at UEFA has grown from a centralised archive platform, created to provide a solution to a photography problem, to an integral part of UEFA's digital ecosystem. This has been achieved through the adoption of automated business rules and workflows to drive digital asset management (DAM), along with the use of internal data structures to ensure the system is capable of integrating with other digital entities.

Automated processes were central to the success of the initial DAM system (DAM 1.0), but while automation and data mapping worked well, usability issues relating to the asset search function left room for improvement. The automation processes were subsequently

enhanced by revising the data model to embrace an 'integration-first' approach, and move from text parsing to data mapping. The addition of an artificial intelligence (AI) layer has also helped address the tagging problems associated with data mapping.

There have been many details to fine-tune along the way, but studying suppliers' metadata to create rules for mapping supplier data into a format that UEFA can use has made integration considerably more straightforward. After the initial implementation of a DAM platform, it became clear that DAM was more than just an archive tool — it was a key piece in an evolving digital jigsaw, and had to be able to integrate with any tool at the organisation, while also allowing for external platforms to use UEFA's application programming interface (API). DAM itself became a concept — a complex matrix of principles, practices, permissions and peculiarities — and one that needed a strategic approach.

DAM 1.0 helped provide a solution to inefficient processes and poor data governance principles that were holding back the business by creating a mess of digital assets stored and managed on different islands. DAM 2.0, however, made it possible for DAM to be integrated more easily and quickly with other business processes. It brought with it an 'integration-first' approach, with administrators working hard to ensure these assets connected throughout the organisational structure to meet business goals and objectives with efficient workflows and processes.

This has not only eradicated various inefficiencies but also improved rights management, as integrations can only occur where the rights permit; for example, one stakeholder group can no longer download an asset and share it with another group that does not have the rights. Of course, being an important player in a digital ecosystem requires knowing when (and when not) to integrate — an over-integrated system benefits no one.

In what follows, this paper will examine the evolution of DAM at UEFA and discuss the lessons learned.

BACKGROUND

In 2013, UEFA's communications department took a hard look at the organisation's photography management and realised that there was a big problem. Specifically, there was a sprawling mess of repositories, both internal and external, with no structured policies for metadata or rights management, and 11 active locations to go check when searching for a piece of content.

UEFA created a position to run all photography aspects of the organisation and tasked this person with the centralisation of still images with a DAM 'solution' in the form of a photo library, which became known as the UEFA Digital Library. It soon became apparent, however, that migrating the various repositories to a single repository would not be enough. DAM had to become a living, evolving aspect of a new digital ecosystem, ready to integrate and be integrated with.

The system was installed with minimal resources in place to manage it. This made it possible to build a system with advanced levels of automation, right from the start.

The incredible volume of football administration undertaken at UEFA generates extensive data, so it was clear from the outset that the system would benefit from a rich supply of data. This made it possible to create automated workflows and business processes for DAM 1.0. It also made it possible to create a data model to facilitate those workflows, and build a DAM system that was ready to plug in and integrate with other UEFA tools.

While this offered a strong foundation for DAM, the migration of various repository users onto a new platform was never going to be simple. Much more than simply copying and pasting their accounts, the process required understanding their use cases, their needs and demands, and perhaps

most importantly, understanding the rights they had to these assets.

The user range was very broad. Internal and external staff may have different needs and rights depending on their department, and these in turn differ from the needs and requirements of users from the 55 member associations, competition sponsors, local organising committees for competitions and events, volunteer groups and social responsibility campaigns. External agencies included marketing, publication and design businesses, all with very specific contracts stipulating how they interacted with the organisation and what assets they needed to access. Commercial partners, such as competition sponsors and rights-holding broadcasters, represented another huge pool of users whose needs, requirements and rights needed to be understood.

More than just the clean-up and migration of repositories to a single source, DAM 1.0 also provided the opportunity to clean up access management for digital assets. The new DAM system needed not only to manage existing assets, but also assets relating to forthcoming events as they occurred, as well as get content from asset creators to stakeholders in a timely, automated manner.

DAM 1.0 IMPLEMENTATION

In total, the various repositories contained 1.5 million assets to migrate to DAM 1.0. Metadata policies were non-existent, asset rights were not in place and duplications ran wild. Dealing with this was the first challenge.

The first step was to split the data into three areas: source, content type and rights. Of these, source was easiest to ascertain, as this was determined by the content area in which the asset was stored. Content type, meanwhile, was initially classified from a high level into approximately 30 categories, such as commercial content, knowledge management content, content from member associations, content shot for internal purposes only and so forth.

These content types were further split into three areas: competition, organisation and internal. The rights were identified as those from editorial agencies, commissioned/commercial content and corporate assets.

The taxonomy implemented was simple. It was based on the structure of UEFA competitions, the teams, the players and the organisational structure. This aligned with other platforms within the organisation and how the navigation was structured on UEFA.com. By creating a taxonomy based on existing systems, this ensured that the assets would be more 'integration-ready'.

It was not enough simply to mine the data and develop a structure to classify the migration content. To ensure the DAM system would be a useful tool in UEFA's tech stack, a level of automation to manage new content as it arrived was required. This automation became a core principle and driving force of the system for still images and graphics at UEFA.

Before the automation could be implemented, the migration content had to be further analysed and the first metadata policies created. When extracting the International Press Telecommunications Council (IPTC) from a sample set from each source, the following were identified:

- what each supplier provided UEFA in terms of photography and graphics (title and description fields);
- who they were (source, by-line);
- why they were producing the content (title and description); and
- the rights UEFA had on the assets (description, by-line and copyright).

Diving deeper into the metadata, it became clear that UEFA's most active suppliers had their own metadata policies. Each major agency had an established caption style, while freelancers had some differing styles — some unique and some closely matching the major agencies. As most of UEFA's photographic content is agency-based, it was decided to automate these workflows, leaving only the freelancer content to be managed manually.

Based on what was identified from the agency photography, it was possible to establish the necessary business rules to automate the mapping of agency data to UEFA's data and taxonomy.

For these rules to be robust, it was vital to understand fully how each agency treated the various aspects of the organisation and its properties. For example, although the UEFA Champions League was always called as such, some agencies described the European Qualifiers for the UEFA EURO or FIFA World Cups as simply EURO or World Cup qualifiers, dropping not only the official name but also the event organiser's name from the metadata.

The various agencies' names for the different UEFA competitions were compiled into a list. From this data set business rules were put in place to parse the title field of the IPTC metadata for this information and then apply the appropriate tag and ID from the internal data system. The same exercise was conducted for team names and player names, parsing the description field.

These business rules not only made it possible to perform the initial migration but then to get thousands of live matchday images ingested and tagged in the DAM system using the embedded metadata. The DAM system read and mapped all the metadata to UEFA data and IDs, added as tags and classifications.

Business rules were also used to automate the migration of information regarding asset rights. This was based on the source FTP account used for the uploads. Then, with a cleaver rule to check what competition was tagged, the asset right, where applicable, became a competition-specific asset right. All agency content could now pass from photographer to end user without the need for a DAM administrator to do anything.

With this, UEFA had a powerful tool on its hands. Metadata-driven tagging workflows meant that the thousands of images coming in would be instantly available to relevant stakeholders.

Figure 1 illustrates where the digital asset team would bring its match photography

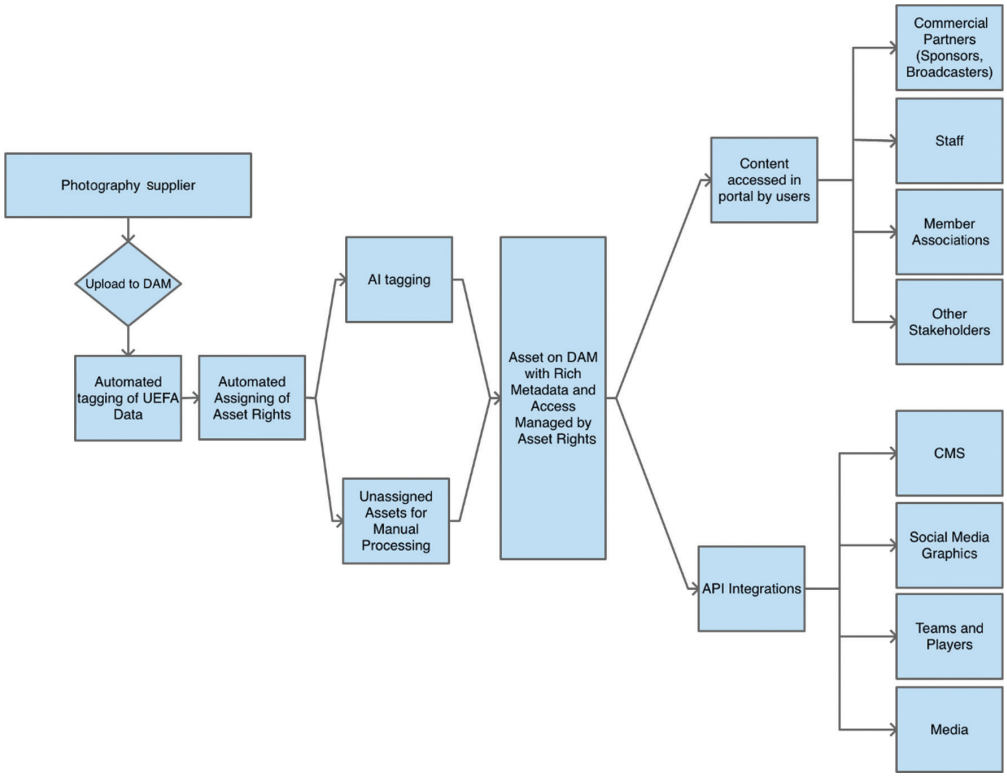

Figure 1: Match photography workflow

workflow to the next level with a move from DAM 1.0 to DAM 2.0.

UPGRADE AND EVOLUTION

DAM 1.0 was implemented a season before UEFA EURO 2016, a major national team tournament that took place in the summer of 2016. This meant there was a full season to road-test the workflows and processes on major club competitions like the UEFA Champions League.

The upcoming EURO tournament was going to be a huge stress test. During the request for proposal process, it had been a critical requirement for the DAM system vendors to provide a system that could handle the massive volumes of data that would be ingested daily. It was also going to be a huge test of the automated tagging and workflows, as they had to work without creating performance issues.

DAM 1.0 was by no means perfect. There were extensive business rules in place to automate the tagging and management of thousands of images on a daily basis. At the same time, however, there were many usability issues. Although users had a tool to search for and retrieve digital assets, this searching proved difficult at times. While the content in the DAM system was coming from professional sources in photography and graphics production, and metadata followed industry standards, the end users were from various backgrounds and languages and the metadata policies did not immediately translate to users.

Most obviously, not every user needed something specific to a match or event. By way of example, if someone were to call up in urgent need of a picture of a 'bored football fan at a match', there was nothing in the taxonomy to support this — or for that matter, any other theme-based searches. At the same time, there was far too much content for the average user to wade through in order to find what they needed. This was a major inefficiency of DAM 1.0, and had to be fixed by applying an AI integration.

Another example of major inefficiency concerned the management of member association logos. Historically, when UEFA's member associations revised their logo as part of a rebranding process, the process of updating that logo on UEFA's digital platforms was cumbersome and inefficient. Many people at member associations had different contacts at UEFA, with the result that the update would come in drips and drabs. While a private administrative tool might have the latest logo on launch day, a public-facing platform like UEFA.com might not have been updated until several weeks later.

This might seem a simple use case, but using the wrong logo for a member association or a team is not a good practice. Consider, for example, a club competition match, such as a UEFA Champions League match. The two clubs participating in the match will have their logos appear across numerous platforms, including UEFA's native and social platforms, match pages, editorial graphics, football administrative tools, match reporting tools and physical signage material within the stadium itself. These logos simply cannot be wrong.

To streamline this process, the digital asset team met with colleagues to discuss the problem. Now, the team are among the first in UEFA to get member associations' new logos and can update the assets on the UEFA Digital Library and create the necessary derivatives to upload manually to the legacy administrative tool, which has thus far proven impossible to integrate. This means there is now a decent level of management in place for these assets and the risk of logo misuse has been minimised, even if it is not optimal.

While this particular example demonstrates the importance of making asset management more efficient and defining clean and distinct policies and workflows across the organisation, it also provides a business case for making an organisation's DAM system more than just a centralised repository for still images and graphics. Indeed, it should be integrated, to the extent

possible, with all organisational platforms. The system should be where an asset is created and then via integration 'delivered' to all other aspects of the organisation, with derivatives created on the fly.

DAM 1.0 was effectively created to be a library — a solution to the problems emanating from the mess of photography storage. The roadmap for this, however, was too simplistic. As part of a digital ecosystem, DAM had to be much more.

After UEFA EURO 2016, the DAM system had more than 2.5 million assets. Search was difficult and inefficient asset workflows were being identified.

It was at this point that UEFA really began to embrace the concept of DAM. Work began on creating a proper strategy for DAM, with automation and integration as core principles. It was also at this time that the first calls were held with AI vendors to discuss facial recognition.

Although the digital asset team joked that their work would only be done once they no longer had to answer requests for help finding assets, they recognised that they had to understand exactly *why* users were still having problems locating what they needed. What was missing from the data? What processes were not working correctly? A piece of the puzzle was still missing.

The team looked once more at the available data, and investigated the AI market to see what was available to help solve the problems users were facing. Resolving these issues represented an essential step towards making DAM the engine driving the flow of content at UEFA. The library structure of DAM 1.0 was out of date and an upgrade to a new more flexible platform would provide opportunities to get content to stakeholders in new and better ways.

DAM 1.0 TO DAM 2.0

UEFA learned many lessons from DAM 1.0, not least what worked and did not work with the automated business rules. It was also clear that users could not always find what they needed easily, and that to streamline inefficient business processes, DAM had to be embedded throughout the organisation. Indeed, within a modern digital ecosystem, no one should be using the DAM system to download an asset in order to upload it manually to another organisational tool. For this reason, the digital asset team kept a careful eye out as other tools in the organisation were evolving or updated, looking for opportunities to integrate DAM.

In 2020, UEFA's DAM vendor released a completely new product that finally made it possible to move from the existing on-prem solution to the cloud. 2020 was also due to be a very big year for UEFA, with the UEFA EURO final tournament taking place in an unprecedented 11 host cities across Europe. This represented an incredible undertaking for the organisation, and one that required the digital asset team to have an innovative high-end DAM system integrated with other platforms in order to ensure premium content workflows.

When the tournament was postponed by 12 months due to the coronavirus pandemic, this provided space to make the transition from on-prem to cloud and to upgrade to new software, with a longer time constraint. The strategic approach was simple: improve the overall user experience by creating a new data model that would also simplify integration capabilities. The delay of the tournament and pause in European football made it possible to focus attention on getting the data model right.

INTEGRATIONS

The second major strategic objective was to move from a Simple Object Access Protocol (SOAP) to Representational State Transfer (REST) API. Many of the early attempts to integrate fell at the SOAP hurdle as developers no longer wanted to work with it — everything was working on REST API. The updated platform, together with the new

data model, would give developers a solution that would be very easy to integrate. Not only did the digital asset team look at where DAM could be integrated to deliver assets more efficiently to other platforms (eg, there were many cases where assets were shared via links to internal staff, who downloaded them and then uploaded them into another platform for another user population), it also looked at tools that could be integrated to enhance the user experience and data on the platform itself.

The DAM 1.0 taxonomy and data model had been built around what was being used by other platforms, and this can largely be seen when navigating UEFA.com. Although the site itself has undergone many changes since the launch of DAM 1.0, the tool was built with a mind to integrate with the content management system (CMS) when that tool was itself due to upgrade. This update in CMS supplier coincided with the system upgrade and was the first integration to be done. As the assets had the structural data required by the website in terms of match, teams and player IDs, this was set up quickly once DAM 2.0 was ready. The old CMS was managing all content natively, so the parallel upgrades made it possible to integrate the DAM system into the CMS from the outset.

The DAM system has also been integrated with the UEFA media channel. This is a platform where members of the media can access content from UEFA along with media information concerning the tournaments, events and matches UEFA organises. For UEFA EURO 2020, the digital asset team has worked towards integrating assets from the DAM system by using an asset right called 'media channel', which can be called via the API based on the tags 'competition', 'season', 'match', to make assets available to users of the media channel. In terms of asset retrieval, this provides a better user experience than having multiple platforms for different purposes. This integration also removes the need for media teams to download from the DAM system and upload manually to their own platforms.

With everything now managed by the digital asset team with automated business rules, UEFA always knows which events and which suppliers are providing the assets that will be distributed via the media channel, so each event can be part of a workflow that automatically adds the asset rights so the asset can be retrieved via the API. This allows for much quicker speed to market for these assets.

The digital asset team has also investigated creative tools to integrate with the platform, such as a tool that editorial teams can use to remove the backgrounds from photoshoot images easily, rather than multiple social media editors and website/app editors duplicating one another's work by cutting out identical images from the same content.

During UEFA EURO tournaments, a massive amount of photographic content is shot during so-called 'squad access days'. This entails sending photographers to the team base-camps before the tournament kicks off in order to create assets of every player in a variety of poses. With the photoshoot for one squad typically resulting in 1,000 assets, this translates to 24,000 assets for one tournament. This provides ample stock images for all stakeholder needs throughout the tournament, with the assets getting used and repurposed for many years after.

UEFA's editorial and marketing teams use graphic creation platforms to generate fantastic content with these assets. Historically, this would have required downloading all these assets, renaming them, cutting them out and then uploading into another platform. Now, however, the DAM system has been plugged into the graphics tool and certain poses captured at the squad access days can be delivered directly. This means the assets are created and uploaded to the DAM system and delivered direct to the tool exactly as required. The ease of these integrations is also down to the data model, which took a huge leap forward with DAM 2.0.

A further integration is a content tool geared towards a mobile and social-first approach. Thanks to its integration with DAM 2.0, this tool can deliver live content direct to the mobile devices of teams' social media staff and players that they can post on their social channels. The app also gives teams and players access to content captured by UEFA photographers via galleries tagged by team name.

Being able to support teams and players in this way is only possible thanks to the incredible advances in technology between DAM 1.0 and DAM 2.0 (see below).

A NEW DATA MODEL

To facilitate migration, the DAM system was cleaned up in advance. As part of this process, almost 1 million assets deemed no longer relevant to the organisation were removed. Efforts were made to improve metadata from historic content, and the digital asset team worked in parallel with an AI supplier to integrate a facial recognition product.

Whereas DAM 1.0's data model and automation were in essence simple but very effective, when combined with UEFA's enormous wealth of data on everything from matches, to line-ups, players, venues, match officials, dates, times, and more, the possibilities for data modelling in DAM 2.0 are seemingly endless. Indeed, during early discussions with the system vendor, both parties became very excited. Ideas were floated about the application of PIM-style metadata to player images in order to build huge data profiles for each player in the system. Editorial teams would be able to search for players within set data ranges, such as date of birth, height or the league or country in which they played — or had played. People would be able to search for the player of the match within the context of a given match, or find all player-of-the-match winners for a specific competition within a certain date range. Had a user wanted to search for the top scorer in a given competition and season, this too was feasible.

If someone wanted to log into the UEFA Digital Library or connect via API and retrieve pictures for all active players in the current season of women's football, with a height of 150–155 cm and a birthday in April, then with DAM 2.0, this was technically possible.

Likewise, if a user wanted to follow an individual's career path, then this too was potentially viable. For example, if one wanted a picture of Arsène Wenger — the former footballer, coach and now football executive at FIFA — his ID would not only be attached to images of him in his various roles, but also all the clubs and organisations he was attached to within that career. It would also be possible to relate the data: Arsène Wenger was the coach of Arsenal FC; Arsenal FC is in London; London is in England; the UEFA member association for England is the English FA. So, with only the tag of the team Arsenal FC, one could associate the city, country and related UEFA member association. This model would allow make it possible to have data within the data.

This was all very exciting stuff, and with every discussion about what the new product could offer, more layers of data were added to the discussions, and everyone always left the meetings visibly energised about how 'cool' this upgrade would be and how users would be blown away by the incredible things the data would allow them to do.

But then reality hit home.

Was all this really necessary? Was there any reason other than 'because we can'? The discussion was brought back to the system's users and the reason the upgrade was needed: to have a system that put a premium on integration in order to improve the user experience. This huge data model would not necessarily serve these purposes. Indeed, it could have made the tool harder to integrate and at the same time confuse users.

The data model concept was stripped back to basics and rebuilt according to what

was relevant and genuinely important — the automatic mapping of data to assets using rules based on the ingested metadata to make the assets appear in integrations and get the right content in front of the right people.

Having players' heights, appearances or scoring records on the asset management system would not serve any purpose or add any value to the user experience. In practice, if a website editor doing a piece on the top ten goal-scorers of a given season wants to find assets to go with their story, they almost certainly know who the top ten names are already, and would not be using a DAM system to find out this information. Indeed, the various editors consulted about this confessed that even if the DAM system did provide such information, they would still verify it with the data team. And besides, who would want an automated image gallery to show players of a certain age, height, average speed, passing completion rate, etc?

There was also a question of which aspects of the data would and would not be indexed for search. Consider, for example, Cristiano Ronaldo — a player whose career spans Sporting Club de Portugal, Manchester United FC, Real Madrid CF and Juventus, as well as the Portugal men's national team. Using Ronaldo's player ID, the DAM system would allow users to review Ronaldo's entire career by showing when he played for each of these teams.

In turn, each of these teams has associated data, for example, Real Madrid CF is associated with Madrid, Spain, while the Portugal men's national team is associated with the Portuguese football federation.

So, to get a picture of Ronaldo at Sporting Club de Portugal, all that is required is to select the player filter for Ronaldo followed by the team filter for Sporting Club de Portugal, or to search for 'Ronaldo and Sporting Club de Portugal', and this will return images from his time at that club only.

By contrast, had UEFA implemented the massive data model where a player's entire career was indexed, and also indexed the teams field to enable the filtering of searches by club name, a search for 'Ronaldo and Sporting Club de Portugal' would have returned *all* assets relating to Ronaldo, not just those related to his time at Sporting. What is more, if these images were sorted by descending order of capture date, the top images would be those of him at his current club, Juventus, followed by many thousands of images of him at Real Madrid CF, then Manchester United FC and only then Sporting Club de Portugal.

This was not the user experience that anyone wanted; it also would cause tremendous problems for integration capabilities. (By way of an aside, it is *technically* possible to index players' current clubs only, but this requires too much management, and the risk of incorrect data is unacceptably high.)

Another issue that became apparent was the handling of clubs and national teams. In the case of clubs, for example, a single club will usually have multiple teams. For example, FC Barcelona has a men's team (UEFA Champions League), a women's team (UEFA Women's Champions League), an U19 men's team (UEFA Youth League) and a futsal team (UEFA Futsal Champions League). Using DAM 1.0, if the parsing process found only 'Barcelona' in the text, it would be assigned the ID for the men's team rather than the ID for the club.

There was a similar problem with national teams. For example, Switzerland has teams in Men's, Women's, Men's U17, Women's U17, Men's U19, Women's U19, Futsal Men's, Futsal Women's and Futsal Men's U19 competitions.

It perhaps goes without saying, but for integrations to work, they must have accurate, detailed data relating to each specific team. For example, with UEFA's CMS, it is important to know if it is a Men's Champions League or Women's Champions league team that has been tagged. To address this, the new data model was designed

to differentiate better between clubs and teams and between national teams and the competitions in which they compete.

To improve the user experience, this kind of data is not only detailed in the metadata and tags but also presented on the front end in a manner that makes it simple to use.

DAM 2.0 also improved the automated mapping of data. By researching the capabilities of the data model, it was possible to establish what data were needed in the model and what data were superfluous. The research also identified what data would have a positive impact on the sorting and classification of assets, in a manner that would allow the assets to be easily called via the API, and conversely what data, if added to asset metadata, could have a negative impact on search capabilities.

From an implementation point of view, DAM 2.0 moved away from parsing metadata text via automated workflows to directly mapping the unique event codes used by suppliers. UEFA's suppliers use the IPTC field 'transmission reference', sometimes called 'job identifier', to provide a code that serves as the unique identifier for an event, and they plan these codes in advance. Suppliers are now asked to provide regular lists of upcoming events and the IPTC field is mapped to an event item in the new data model which attaches all related data to that event.

For example, take the UEFA Champions League 2020/21 Group Stage match between FC Bayern Münich and RB Salzburg. The event list for this match contains the following data:

- *Date:* 25-Nov-2020;
- *Event Type:* Match;
- *Match ID:* FC Bayern Münich v RB Salzburg;
- *Competition ID:* UEFA Champions League;
- *Season ID:* 2020-2021;
- *Home team ID:* FC Bayern Münich (Men);
- *Away Team ID:* RB Salzburg (Men);
- *Stadium:* Fußball Arena München.

These items have certain associated data; for example, the home team, FC Bayern Münich (Men), is associated with the club FC Bayern München AG, which is in turn associated with the country Germany. The stadium Fußball Arena München is associated with the sponsor's name of the stadium, Allianz Arena; it is also associated with the city München and the country Germany. Should assets arrive in the system with only the transmission reference field completed and no other information, it is still possible to apply detailed match data. This makes the asset searchable and usable instantly upon ingestion, and is further improved when the facial recognition layer is added in. This provides great opportunities for having high speed-to-market rates.

At time of writing, the data model for the 2020–2021 season contained some 1,227 match-related event items with data like the example above. This will surpass 3,000 events by the end of the June and will include the UEFA EURO 2020 match events.

Our person (player, coach, executive) list has over 275,000 entries. All these data points have related data. There is also a list for the various competitions, seasons, stadiums and countries, among other things.

At major events when thousands of assets were being ingested on a daily basis, it was possible to open a new asset when it appeared on the DAM 1.0 system, but the tags would not always have been added. The mapping performance was affected by the huge uploads and it sometimes took up to 30 seconds for the full mapping to take place. With DAM 2.0, however, it really is at the moment of ingestion that this occurs. This is very important as it means that anything connected to UEFA's API gets the full metadata and mapped UEFA data with the asset and there is no risk that an API will call an image before the tagging has taken place.

The search problems users had suffered with DAM 1.0 informed the necessary enhancements with the DAM 2.0 upgrade. By integrating with the new system with

other platforms, the evolution was intuitive for users, and thanks to providing a simpler filter structure in the user interface, change management was not a major concern. The platform itself was instantly more user-friendly and quickly received feedback reflecting this. Indeed, the change in usability was so great that many users thought the UEFA had found a new DAM vendor. The integrations have also benefited many users who no longer need direct access to the DAM platform as the assets are being called into their own platforms. Table 1 provides an overview of what the move from DAM 1.0 to DAM 2.0 changed for the organisation in terms of improving the tech stack, the user interface and user experience, and changing the mindset from a library asset management system to an integration-first system designed to fit into the digital ecosystem.

USING AI TO ENHANCE DATA MAPPING

While implementing DAM 2.0, UEFA worked with an AI partner to develop a facial recognition integration. When parsing the description field of the embedded metadata as part of the ingestion business rules on DAM 1.0, it was often a struggle to get the player IDs to tag successfully. Much of the failure related to accents and the spelling of names. It was found that the umlaut used in German was being written by the supplier with a double vowel, so the name in the image caption did not match the name of the player in the ID system. The same issue was happening for players whose known name did not match what was on the back of their jersey and what the photographers and photo agencies, and in many cases football fans, called the player. This meant that the player ID tagging aspect of DAM 1.0 automation was the weakest point of the data mapping.

That problem was identified early and led to the initial research and calls with AI vendors in 2016. This issue effectively boiled down to the fact that until it has been taught what it needs to know, AI is not good for much. Thankfully, UEFA has player headshots for all competitions and so had a repository of player headshots to use as reference images to train the AI model. These images are always manually tagged with the player ID upon ingestion. As this manual process for handling player headshots was already in place, training an AI model as part of that upload process came as no extra work.

With the start of each season or major tournament, these player images are uploaded and tagged, and a workflow is triggered to send the data to the AI database. When live images come in from the matches and events, they are tagged with the person ID upon ingestion at the same time as all other match-related items are tagged.

UEFA is exploring more enhancements using AI, such as brand and logo recognition, as well as football-specific elements, like

Table 1: Overview of the DAM system upgrade

DAM 1.0	DAM 2.0
Created to be an archive/library	Created to be part of the digital ecosystem jigsaw
All users to use platform directly	API users encouraged
Structured data	New rich data model with greater structure
Difficult to search	Easy to search and navigate
Not user-friendly	User-friendly user interface
SOAP API	REST API
Automated business rules	Enhanced automation and artificial intelligence

match officials, yellow and red cards, and identifying actions such tackles, headers and the like. UEFA is also studying the feasibility of what models can be trained to detect, as well as what is useful to improve the user experience in terms of search. Again, while something may be technically possible, it is important to consider whether or not it is actually useful.

UEFA is also using out-of-the-box thematic tagging to help users who are searching for things like bored or happy fan, etc.

The integration with the AI tool was not difficult. UEFA took a pragmatic approach and was braced for the work it would require to make it a success. For example, if one takes those 24,000 assets of the players taking part in UEFA EURO 2020, this translates to an average of 33 photos for each player. Most shots are from the waist up, while some are facial close-ups. Each photo is captioned with the player's name and then tagged within the system. To ensure that all player-related photography received during the tournament would be automatically recognised by the AI integration, the digital asset team indexed around 15 images of each player to train the model further. Given that many of these players would already have appeared in UEFA club competitions that season, there would already be indexed images in the AI tool. Nevertheless, the opportunity to enhance the database with more recent photographs and perform some additional machine-learning is vital for successful facial recognition.

Unfortunately, as with all DAM processes, once AI is set up, the story does not end there. After indexing all the player headshots for the club competitions, like the UEFA Champions League and UEFA Europa League, the facial recognition was initially very successful, and star players in European football were even getting recognised wearing face masks. After a few months, however, the initial excitement started to wane.

With some potentially obvious faces not being tagged automatically, there was clearly some tweaking to do. Some issues related to the number of faces being detected, others to threshold levels that proved to be too low for some images. It also became apparent that it was not enough simply to index the headshots of each player. Training an AI tool is like training an athlete — it is an ongoing process, not a one-off event.

Training the AI required looking at more images of single players and 'topping up' the index for that player. Thankfully, the integration with the AI tool was very easy to use, so the DAM system administrators could tag and index faces quickly in order to train the machine.

Much like many of the automated business processes implemented, the AI tool needs to be managed — it is not a case of turning it on and everything will work. As the model is trained continually, one can be confident that the integrations with other platforms that rely on the player data are running successfully. Now, the DAM system administrators no longer have to spend their time fielding e-mails and phone calls about search queries, but rather oversee all the automated and AI processes to make sure the hard work is being done by the data, and that all users of the DAM system, regardless of whether they are using the user interface or API, are getting the most efficient, straightforward service possible to meet their needs and requirements.

Figure 2 provides an overview of how assets from the supplier are mapped with UEFA's data, have AI tagging and get distributed to the various integrations.

CONCLUSION

In an ideal world, this DAM system would be fully integrated across UEFA's digital ecosystem. However, when one has a variety of old and new tools and systems, both off-the-shelf and custom-developed, feasibility and costs can be prohibitive. With this in

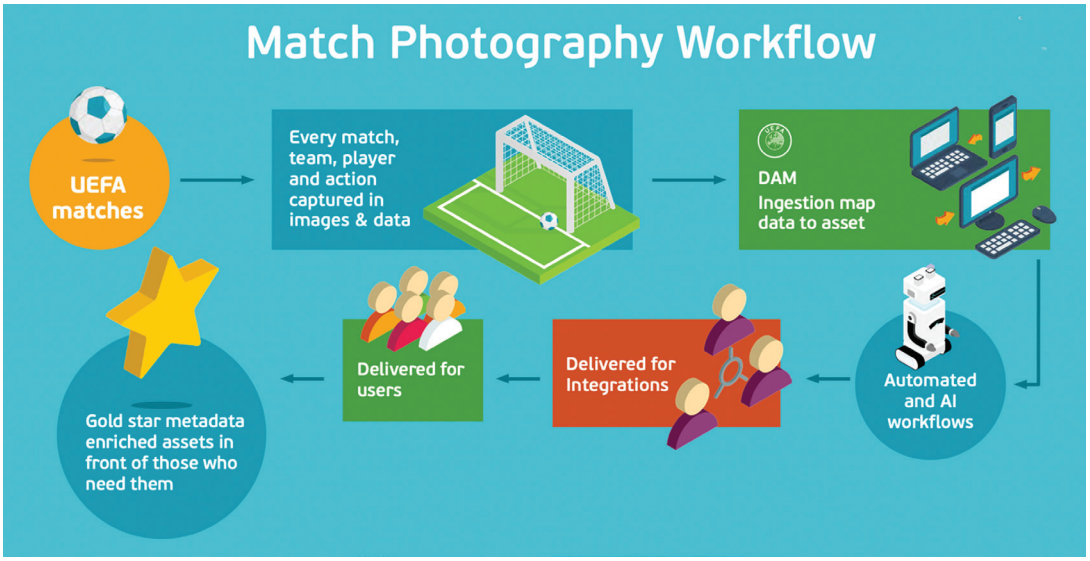

Figure 2: Full asset workflow

mind, the DAM system is mapping the data used across the organisation in order to be integration-ready at all times. Thus, as tools evolve and improve, and when integrations become feasible, the DAM system will be easily 'plugged in'. At the same time, it is important to remember that it is not always necessary or good practice to integrate. An integration-first policy has a DAM system with assets that are ready and easy to 'plug in', but whether this *should* be done must always depend on the use case.

On top of integrating with tools, like the CMS, and content distribution tools for specific target groups via mobile apps, UEFA is working on ways to utilise creative tools that would allow the DAM system to be part of the creative workflows — tools that would make it possible to have assets worked on by various stakeholders, with every step of the creative process being managed within the DAM system. UEFA is also exploring the integration of editing tools, for image cut-outs, brand overlays and on-the-fly derivatives for certain use cases. Other integrations being developed are to ingest assets directly into the DAM system from photo agency subscriptions, without the need to download from their website and upload to the DAM system. These assets would go through the automated rules and behave similar to live match content, etc, becoming immediately accessible to relevant stakeholders within the DAM system or through the API.

The use of metadata is crucial to success with assets. Until one's data model is defined, there is no point in thinking about anything else. Never set the model and policies in stone. Be ready and equipped to enhance and evolve the system as the business objectives change over time. When business processes change, one's DAM system should be able to move along with it, and when the business hits a roadblock it is time to consider upgrading. Always be aware of what is on the market in terms of DAM and in terms of integrations. Focus on organisational needs, revisit them periodically and always keep DAM at the forefront of the stack.

This DAM solution was created to centralise the management of still image assets and fix a problem. With the resources available for the management of the DAM system, automated processes were essential for it to be an effective tool. The established metadata policies led to the creation of business rules that gave the DAM system

metadata-driven automation, utilising UEFA data to make the system integration-ready.

After EURO 2016 it was clear that UEFA's DAM solution needed to evolve, and that it needed to do this on an ongoing basis. Search had shown problems for users, inefficient processes were identified, and research was conducted into AI enhancements to improve the user experience.

For UEFA, DAM 2.0 represents more than just a software upgrade. The new data model has been built on the lessons learned from DAM 1.0. The capacity to integrate was a key priority of the move to DAM 2.0. It was essential to have a system that would utilise the data at its disposal to allow assets to be called by other platforms, internal or external, through simple API calls. While the ability to be able to utilise data in incredible ways is undoubtedly exciting, more than anything else, it must be easy to search for and retrieve assets. Whether on the DAM platform or via API, getting the right content in front of the right people is essential to success.

This DAM system will continue to grow, and even when it evolves into DAM 3.0, automated workflows and the integration-first approach will be the driving factors behind any future enhancements and strategic decisions. Never miss an opportunity to grow, evolve or update DAM — it must always follow the business objectives and should move with the organisation. Sometimes that means creating a new data model or the integration of new technology like AI; sometimes it simply means switching vendor.

DAM is not easy — it requires structure and organisation. Using a rich data model makes it possible to do so many things with automated business rules, and if it follows the same structural principles of other elements of one's organisation's ecosystem then integrations will be less challenging to achieve. Even with limited resources to hand, a well thought-out and implemented DAM solution can do remarkable things to eradicate inefficiencies. What is more, by actively evolving workflows and processes, listening to users and always understanding their needs, goals and objectives for digital assets, it can continue to do so.