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MEDIA ASSET MANAGEMENT FOR BROADCASTING CONTENT PROVIDERS IN MALAYSIA

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Abstract

The digitisation of electronic operations has created new challenges for traditional broadcasters. Systematic production workflow, content indexing, archiving and retrieving processes have not been adopted well in this transition to the digitalised environment. Further to this issue, small and medium-sized broadcast organizations are experiencing the brunt of this technology disruption. There remain large amounts of content that require digitisation, to be repurposed for transmission following new quality control standards. This is an exploratory study that proposes a scalable media asset management (MAM) solution especially for small-scale content providers. The study is guided by three objectives. 1. What MAM workflow system is currently used by broadcasters? 2. How can metadata features be used for effective MAM process? 3. How does machine learning facilitate Media Asset Management workflow? This qualitative research used face-to-face in-depth interviews with broadcasters at their respective premises, content providers and vendors; Participant Observation and Content Analysis were conducted at Production Operation Centres and production houses. The study proposes a Proto-type template for use by content providers, which would facilitate ingestion at the beginning of the workflow and reduce rejection at the technical and content quality control rejection before on-air-transmission.

Keywords: Archives, Machine learning, Media asset management (MAM), Metadata, Technology disruption.

1. Introduction

Broadcasters such as RTM, TV3, and ASTRO are all in the process of migrating from their traditional broadcasting practices to advanced digital broadcasting processes. Currently, each part of the multimedia service offered by systems manufacturers and designers is developed with considerations to fulfill the needs of individual operators. In this respect, content management or MAM system for broadcasters is constantly evolving and being upgraded; resulting in significant resources spent in reinventing and rewriting media management systems. MAM located under the umbrella of the DAM is primed for managing media assets for broadcasters. [1, 2] posit that the content processing cycle of media management starts with i. Ingest ii. Metadata Creation, iii. Storage/Content Repository, iv. Access, v. Transform/Repurpose and vi. Distribute. The downside of an ineffective MAM causes loss of opportunity at the reuse of content after archiving.

This study adopts with modifications, the design of the assets management system, shown in Fig. 1 that can be deployed organization-wide for an efficient broadcast workflow, and used by multiple multimedia services large and small such as vendors. The new MAM system will significantly reduce service start-up costs, as each new service will be able to take advantage of existing processes. Content sharing and reuse are greatly simplified with common interfaces, and any improvements made to the content management processes are immediately available to all services.

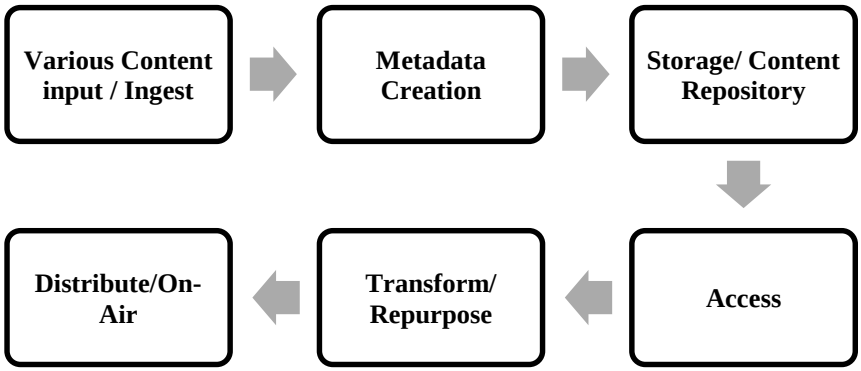

Fig. 1. Standardize MAM workflow [1, 2].

The study proposes prototypes of the key components that make up a MAM system, briefly outlined in the following sections. Particular emphasis has been placed on the strategic role that metadata and quality control plays in the beginning and before the transmission stage of the system. Other designs and implementation issues have been addressed in more detail elsewhere [3].

Significant to broadcasters would be the proposed model that enhances an end-to-end MAM workflow from archiving processes to systematic documentation up to the on-air transmission. The availability of such a model will see zero or minimal rejection at the technical and content quality control stage before transmission. End users need not re-invent content; only repurpose them for multimedia broadcast

1.1. Statement of Problem

The systematic executions of workflow, indexing, archiving and retrieving of content have been affected by poor compliance due to technology disruption. While resourceful broadcasters are coping with this disruption, small and medium-sized content producers and vendors are looking for solutions.

Current processes have outlived existing MAM systems, which are not sufficiently flexible to cope with changes in the evolving standards. Besides the deluge of content (85%) from the programming side, content from the news division constitutes about 15% of total airtime (RTM). Typically, sources for airtime content are found in four categories: in-house production, private local productions from vendors, syndicated programs from overseas, looping productions or repeat programs and News and Current Affairs also partly contributed by stringers. Content from such varied sources with wide-ranging formats and quality there is a great need for an efficient MAM.

Broadcaster's content workflow and expected technical and content quality standards must be learned to assess and replicate a suitable model of workflow for vendors to match those qualities for a seamless broadcast experience. The major problem lies with broadcasters who find it difficult to cope with expected technical standards. 1300 registered vendors support the creative industry but only about 800 are active. These vendors contribute a vital 40% to 60% of airtime content throughout the year.

1.2. Research questions

The research process of this study is guided by the following research questions:

i. What MAM workflow system is currently in use by broadcasters?
ii. How can metadata features be used for effective MAM process?
iii. How is machine learning facilitating MAM workflow?

2. Literature Review

McKnight [4] explained that automatic image cataloging is the mecca for digital asset management. To have the capability to upload specific content and classify, store, tag, and essentially take-off itself so that it can be found and tracked at will is what the system aspires to do. Unfortunately, although some would try to claim otherwise. IBM's Visual Recognition, Adobe's Smart Tag, Extensis, are some examples. The DAM technology being the broader version of MAM, is not there yet for efficient execution [5]. As seen in Table 1, MAM is not deployable for sales MAM, on the other hand, is conducive to machine learning for media archival purpose and at the end of the workflow; broadcasters can transform or repurpose the media for on-air transmission or future distribution benefiting from machine learning.

MAM cycle in this context starts from encoding existing and new data arriving at the ingest stage and the archives, to embedding metadata, including date, time, file format (embedded metadata in the asset) that need a reader or photo editing application to extract the information for editing and subsequently for repurposing for multimedia broadcasting [6].

Table 1. Guidelines for the structure of the DAM strategy [2].

Production Initiative (MAM)	Operations Initiative	Sales Initiative
Graphic Project	Telecomm Project	CRM Project
Storage Project	Content Management Project	Inventory Management
Editing Project		

2.1. Metadata

To achieve automatic content management, two aspects of the metadata must be standardized. First, there must be an agreed structural format for the metadata so that processes can be accessed and decoded. While it is not quite there yet in terms of sales initiatives (Table 1). W3C's eXtensible Metadata Language (XML) [7] has become the leading contender. Second, the meaning of the various attribute terms/vocabulary must be agreed upon, so that content processing can be processed intelligently. For example, the vendor and creator attributes are often used equivalently, or the attribute date could mean the creation date, expiry date, date of birth etc. The processing component must be able to interpret the metadata vocabulary correctly given its current context. There has been significant work done by various industry bodies to propose domain-specific metadata vocabularies, e.g., IEEE Learning Objects Metadata for educational material [8].

During the assessment of the prototype content management system, the study would specify its own metadata vocabularies for describing content. From an early stage, we saw metadata as being divided into categories, each associated with a different vocabulary. Each management component generally requires and manipulates only a subset of the available metadata and needs to understand only this small part of the metadata. Therefore, each component specifies a small vocabulary, which must be complied with by the content metadata in order to avail of the service. As the system matures, we expect to publish our metadata vocabularies for each of the content management components so that others may use them, and to adapt our components to take advantage of the most widely accepted of the emerging standards.

We have learned that in order to be effective, metadata must be extremely flexible. There are times when the storage and bandwidth restrictions of a multimedia service require that a piece of media be compressed as small as possible. Therefore, it must be possible to physically separate media from its metadata, temporarily or permanently. Conversely, quality in other parts of the service will suffer if, instead of handling one media file, it is necessary to handle both the media file and an associated file containing its metadata. In order to reduce the size of content items, we would experiment with replacing metadata information with URLs that point to where the information is actually stored.

Numerous media intelligent applications are available for MAM [9], yet there is a lack of viable and scalable solutions for the small producers [3]. According to Ledermann [10], "there is not a single universal, unified system for organizing physical information and media, much less a similarly comprehensive system for digital information".

2.2. Theoretical framework

The Enterprise Video Communications (EVM) model [11] and the Industry Baseline Content Management System (Industry Standard CMS) model [2] offer possible adaptations as a theoretical framework for the study.

The standardized media assets management workflow system to be proposed would include an indexing system that would reduce intensive staff handling material for storage, efficient documentation for commerce and repurposing of archive materials, and finally, the model would be tested as a prototype in a real-time production company. Before the playout, technical and production quality control features to be articulated. This proposed model shall validate the main characteristics of a practical MAM system.

This would be a generic MAM model (Fig. 2) articulating the possible functionalities to be included into the three main process of a) ingest b) manage c) distribute.

Ingest	Manage	Distribute
Indexing and Creation of metadata	Embed Applications	Digital Signage
Live event Webcasting	Video On-Demand	Content Delivery and Syndication
Incoming Content Acquisition	TECHNOLOGY	QC
Content Production	Archive and Storages	On wards processing for broadcast

Fig. 2. Adaptation from CMS and EVC for a scaled framework of MAM workflow.

The proposed MAM system would address content and resources management, a two-tier model is proposed. The top tier would be a general or generic three-step flow of ingest, manage and deliver or deploy. Just below these generic steps would be a more detailed set of functionalities that should provide an interface to enable integration of incoming sources of content, construction of metadata, technology for various applications and the final products for distribution. The functionalities of such a model ought to be scalable for the small and medium-sized multimedia content providers.

3. Method

The study by Denzin and Lincoln [12] adopts an exploratory paradigm using qualitative research methods that included face-to-face in-depth interviews at the informants' respective premises in the Klang Valley and Kuching, with mainstream broadcasters, and content providers; Participant Observation and Content Analysis of Production Operation Centres, archives, vendors' production processes and

television programs were conducted. Participant observation by De Walt and De Walt [13] are of a) the workflow of programs input at the archives, b) newsroom archives and processes, c) MAM processes at the production operations centre (POC) quality control unit, d) On-Air play out centre in TV stations.

Production processes and content analysis of selected programs were conducted following 8-step guidelines [14] at several vendors' production houses. Metadata is information associated with a piece of data. The data is often media, such as a text file about a video program, but could also be a person's profile information, network status information, or quality of service information. The metadata usually takes the form of a set of attribute-value pairs. Typically, the value is thought of as text, but we are also using an image or audio content as metadata values. For example, a still image is used as a value for the metadata attribute publicity poster associated with a piece of video content. We use the word 'content' to refer to the composite object made up of data plus metadata, or the data by itself if no metadata exists for that data.

4. Results and Syntax

Technological disruption is the biggest challenge experienced by broadcasters today. Both machine and process keep being upgraded to newer versions from time to time. Traditional broadcasters may have lesser issues with this but not all their systems have Service Level Agreements (SLA). If the system is subscribed to SLA, every time the system comes out with a new batch, with new features, they will upgrade automatically for free. If the system does not have SLA, it means that it will remain at the old version. When a new machine comes in, the older version will not integrate. Broadcasters with limited resources will face issues with continuous changes to broadcast technology and systems. Findings of the study are presented in three parts.

4.1. The MAM workflow system in use by broadcasters.

Media Asset Management in the current broadcast environment manages content from ingestion to on-air-air transmission. Specifically, ingesting completely edited programs at the beginning of the workflow and performing quality checks before transmission.

MAM does not apply directly to the archiving processes (in terms of managing the assets in the archives. However, archive materials are expected to be fully digitized for them to be compatible for MAM process machine to read and recognize content efficiently. The MAM process recognizes two kinds of digitised content in storage, deep archive and online storage. Deep archive is storage for future transmission (within 6 months) while online storage is meant for current transmission (within a week). The system is able to search for any indexed material in the deep archive and restore it to the online storage.

There are several issues here. One the content is not properly indexed by the archives using a standard field for machine recognition. The vocabulary used is 'speaking in different languages'. Next, the playback machines used at the archive are outdated, and cannot be restored to work efficiently and the content itself is available in multiple formats. This issue must be resolved first.

4.1.1. Storage

"Production materials, the raw footages, edited footages meant for post-production are purposefully cataloged using simple metadata for ingestion," says the engineer-in-charge at the production operation centre. He says, "Technicians are a well-trained specialist because they work in their specific area. Technicians performing ingestion will only focus on ingestion and that in-charge of storage will know all about storage processes".

He continues, "Some of the materials in the archive are in poor quality. For examples, Opah (1983), the drama was shot in 16mm film. We have digitized the footages, but we still need to mend it from black and white, scratches etc. Some P. Ramlee films, the reels are torn. This is one of the challenges in restoring the quality of the archive materials".

4.1.2. Ingestion

Ingestion of content into online storage starts 4 days before the transmission. The MAM system language and workflow at archive are different. MAM operates under the shin of the broader DAM. For examples, MAM is responsible for transmission, where files are stored in a format called 'OP1' and 'OPATEM'. Both formats are different. In MAM, we store appended Audio and Video; one file comes with audio, video and the header. In the DAM, it comes with video and four audios or eight audios separately. When content from the archive is required for transmission it is retrieved from DAM (archive). This file will be large and has to be compressed first.

4.1.3. Segmentation

The engineer at the Production Operation Centre (POC) says, "In the MAM process segmentation within a programme occurs a few times. For examples, a one-hour programme will be chopped into four blocks, virtually not physically, for the insertion of commercials, promos, and PSAs. Once on air, the system will insert them. This is what a MAM system or machine learns what to do and should do".

The Digital Interactive section at the pre-transmission stage will enforce compulsory Quality control (QC) at the end of the MAM process. When QC is completed, the content is sent back to the beginning of the process to be ingested into the MAM system. Every item is indexed to MAM specifications. Two copies will be created, one of the content will be ingested into the MAM process and the other a physical copy or master copy will be printed into SDCAM and sent to the deep archive.

4.1.4. Post transmission

After the playout, the programme (content) will be deleted from storage within 2 days. If the content is planned to be aired again in 6 months' time, it will not delete it. The librarian will transfer the content to a deep archive. The deep archive is located at POC, attached with the MAM but the central archive will keep a master.

4.2. Metadata features for effective MAM process

For an effective MAM workflow, a file-based format is recommended for multimedia content providers to follow. They need to learn basic metadata field requirements.

4.2.1. House format

Broadcasters have their own house format for the entire DAM/MAM processes. It is stated in their policy. Hence, all archive materials are converted batch by batch into house formats that are recognisable by DAM and MAM systems. Content in formats that are obsolete such as films, '2-inch' and beta tapes are converted first. Machines to playback these materials are obsolete now.

Therefore, vendors must from here on sending their content in recommended file base formats. Vendors are given two formats, codec options which are XDCAM 422 and with Apple Processor 422.

4.2.2. Metadata field

Required MAM metadata fields are generally but not limited to media ID, title, episode, duration, segmentation and location, as exemplified in Table 2.

The librarian in one broadcast station gave two examples of lost and found cases without proper metadata fields. "One archive photo of Tun Samy Vellu (now retired former minister) reading news in RTM. We are facing a problem on how to catalogue. We have compulsory (metadata field) such as location, date, what program to fill up and we do not have that information about the photo. When Tun Samy Vellu passes away, we need to use this photo. We do not know who the photographer was and so we cannot retrieve any information about the photo".

However, "The last time we sent archive materials to be digitized in London, we had one footage of Tunku Abdul Rahman (1st Prime Minister) getting off the plane in Malacca. It was the first touchdown followed by the announcement of independence, returning from London. We did not have the date, location, any details of that particular footage but because that moment was recorded in history, we could easily retrieve the details for metadata by just searching".

Table 2. Standard house formats recognisable by MAM system.

Standard field data entry at Ingest Station
• Media ID
• Title of content
• Producer
• Date of production
• Location
• Episode/s
• Segmentations
• Duration

Table 2 shows the basic data field required for ingestion and intelligent system recognition. These data must initially come from the producer or creator of the content. When there is insufficient data, it creates problems for machine automation

to function efficiently. The librarian then endeavors to research and enter as much data about the content manually.

4.3. Machine learning facilitating MAM process

This study concerns itself with how machine learning can facilitate effective MAM processes in the context of Multimedia Content Providers.

4.3.1. Archives

McKnight [4] commented that MAM system must first be taught to automatically recognize what is feed to it. While MAM is conducive to machine learning [5] for media archival purpose, at the front end of the MAM process, librarians have much work to be done most of the time manually.

The Chief Librarian at the Central Archives says, "… the system in use has the capacity to recognize the metadata field of the house format. Here, files are stored in 'OP1' and 'OPATEM' formats. News content is stored separately in DALET and OCTOPUS. The system will automatically track and upload the required content, classify, store, tag, and provide essential information. For example, if you do not tag the photo of 'Tunku Abdul Rahman, the 1st Prime Minister', the system will just tag the closest generic name such as 'a Malay Man'. When fields are empty, the metadata entry now has to be researched and entered manually".

4.3.2. Content QC

At the Quality Control before ingestion, there is content QC and technical QC. The producers at the source must manage content QC. This QC is guided by (1) Guidelines found in the Film Censorship Act 2002 [15] and (2) Broadcasters' Content Code 2004 [16]. Broadcast stations will remind producers of their QC obligations at the stage of pitching. Next, the same content will undergo a second review after final edit in issues such as racism, politics and any other sensitive contents that are not appropriate for airing. Content QC will also comment on the quality of picturization. The MAM system cannot do this subjective evaluation. Experienced producers do it.

4.3.3. Technical QC

However, at the technical QC, the machine takes over the evaluation of content. This is done by feeding to the machine the expected range of technical compliance parameters that content being evaluated should match.

The issue here is the volume of content coming in for 24/7 broadcasts. The old system of deck-to-deck QC was simply humanly not possible. Machines have now taken over this portion of the workflow. After QC evaluation, producers are updated for corrective action. Producers and vendors sometimes make corrections up to four times. This is an outcome of using non-compliant equipment at the shooting and editing stages. They need to convert to the same apple, Adobe Premier or AVID formats used by the station.

When the QC rejects a piece of content, the vendor has to correct, re-edit and reprint the content to its recommended format. It is a very expensive and tedious process. However, vendors are happy to comply when they migrated to file base

format. It did simplify matters. However, it took an initial resource investment which small vendors and broadcasters found insurmountable.

There are three basic criteria given in Table 3 for checks to be carried out at the technical QC. The check for white must come from the colour bar only. The camera in use must generate the colour bar and programme continues on the same card. If the measurement of the white luminance of the colour bar is higher than 700 mV, there will be a whitewash in the content. This picture quality is unacceptable.

Table 3. Standard criteria for technical quality control recognizable by MAM.

Criteria for technical quality control and evaluation
• Luminance @ 700mV or 0.7V on the white area, to check the white colour from the colour bar only. • Chrominance on colour. 2 standard of chrominance, which are 75% and 100%. ABU standard we use 75%. only US and Japan use 100% chrominance level" • sound level from colour bar @ tone by dB full scale -18dB

Secondly, the check on chrominance is in colour. The camera must reproduce the true colour. For example, someone wearing a yellow shirt but at the transmission, the shirt colour is seen as yellow-green. This caused by poor calibration of chrominance at source is not done properly. The TV station can be sued. There are two standards of chrominance, which are 75% and 100%. Most Asian countries use ABU standard of 75%.

The third criterion is the sound level. When recording sound, there is an audio tone and colour bar. The tone must be generated at source using dB full scale -18dB. If this is not calibrated and monitored correctly at recording, then audio level at transmission will be bad.

5. Conclusion

This exploratory study proposes a scalable media asset management (MAM) solution, especially for small-scale multimedia content providers. The study arrives at two conclusions. That established broadcasters are sufficiently endowed with resources to manage technological changes to their MAM processes. Next, small broadcasters and vendors are struggling with limited resource to make the required changes to survive in the industry.

Although the machine learning process has taken the burden off the humans interphase, the accuracy of some sections of metadata entry and programme content quality control still depends on human interventions. There have been grievances raised among the technical community about machines taking over their job functions, but the volume of content turnover is unmanageable that it is inevitable for machines to take over eventually.

Machine learning does facilitate the MAM workflow. Its automatic recognition of content as per the indexed information works at will. What is not currently possible by the machine is only caused by human error. The technical QC is only

enhancing the quality of broadcast of the station. It is for the producers and vendors to comply with such regimens to manage the MAM system efficiently.

As the demand for new multimedia services grow exponentially and the number of multimedia clients engaging in broadcasting content increases, a reliable content management system must be available to all broadcasters irrespective of whether they are established or small. They need a system that can track and locate any content in the MAM system.

The study concludes that MAM/DAM processes from archiving to systematically documenting content up to on-air transmission are an important component of broadcasting that quality and efficiency should be a priority. The availability of such a MAM model will ensure seamless broadcasting. The availability of set standards for quality control would achieve ZERO or minimal rejection at the technical and content quality control stage before transmission. This would largely improve the performance of especially small broadcasters.

6. Future Research

This study is limited by its scope. Interviews and content analysis on vendors need to be extensive. Their contributions to the development of prototype metadata field entry and QC parameters have yet to be tested in the field. Implications of the current practices to the broadcasting community and in particular to the field of media asset management are yet to be crystallised.

There is much work to be done in terms of establishing a model for systematically analysing and exploiting content workflow, especially scalable for smaller broadcasters. Research for a MAM model using utilizes machine-learning technology has much to be gained by the smaller broadcasters and vendors.

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