MEDIA ASSET MANAGEMENT: THE NEED, THE CHOICES, THE PAY-OFF

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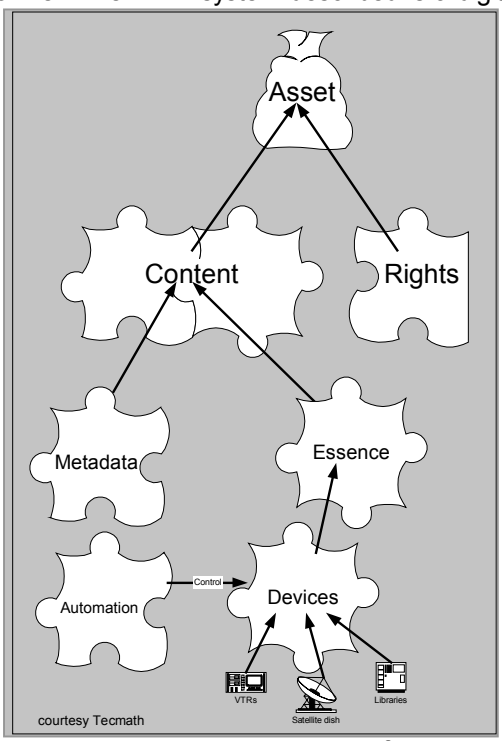
Introduction

NBC, as a media production and distribution company has for some time been concerned about the need to make its various media assets secure as well as easily and economically available to those in its operating groups who have a regular need to access it. In this paper, It is our intention is to lay out most of the operational and technical issues that need to be considered by any media asset owner. The MAM system described is a digital



content management system for use in broadcast production and archiving. The details are the result of a 12-month study of NBC's needs and capabilities.

Terminology

Most media companies currently have systems in place to handle automation, devices, essence, metadata, content, rights and assets. Unfortunately, there is scant coordination between these elements today, which are mixtures of analog and digital systems. The question before us is; how do we create a unified digital asset management system that provides timely access to assets, increases the value of assets and creates efficiencies in the production and distribution of programming, to the degree required for investment in the system?

An ASSET is defined as CONTENT for which one has the RIGHTS to sell or distribute.

CONTENT is defined as ESSENCE and METADATA used to describe that particular ESSENCE.

ESSENCE is the raw video, audio, or image from devices like video recorders, video servers and satellites.

History of the Project

In December 1999, NBC began a company wide effort to study Media Asset Management

(MAM) systems, capabilities and requirements. The MAM Group's mission was to determine if there was a need for better asset management tools within NBC and if so, what functions would they perform and what benefits would they offer.

Baseline Functional Needs

The results revealed pockets of Media Management expertise, a mix of different media asset management systems and a distinct desire for greater Media Asset Management capabilities. Throughout production divisions, users chiefly articulated desires to:

- Improve Workflow Productivity by having media more readily available
- Communicate, Collaborate and Gain Access to Assets across & within businesses
- Exploit New Business Opportunities by marketing latent assets

NBC's Media Asset Management Model

The MAM group developed a stratified architecture for a media asset management system consisting of 3 layers:

- An End User Application Layer – reflecting current operations in a broadcast environment like shooting, editing, integrating with commercials and playing to air.
- A Foundational Layer – reflecting the need for standards in digital formats, networking and storage, so that baseline functional needs could be met.
- A Middleware connection layer – recognizing that equipment and formats must be flexible in the business units to meet particular needs, but must link to a common digital format suite in the media asset management foundation.

- Scaleable, Extensible, Redundant MAM system
- Metadata Structure must be Defined and Standardized
- Visual media management references must be Accessible From the Desktop
- Complex Technology should be Invisible To User
- Flexibility – The system must accommodate existing and future standards and formats
- A Digitization Strategy for New & Existing Assets is required
- Fast Production Cycle Times – nothing should impede current production speed
- Copyright Protection
- Simple Metadata Creation Processes
- Open Architecture
- Security Technology needs to be incorporated

NBC News Archives

In 1996-97, NBC News Archives created a database and search system, OMAR, for the 2.3 million tape/film inventory in the NBC news archive. OMAR (Oracle Media Archive Research) is a networked, text based research tool used by nearly every business unit in NBC.

Out of the hundreds of hits an OMAR search may produce, there is little information that allows an archivist to rapidly winnow out the unsuitable and order the most highly desired clips. Hundreds of tapes might need to be pulled from the library, often dubbed and delivered to the producer who must go through each to find a suitable clip. OMAR provides valuable handles to the contents of the archive, but the archive is so rich, with multiple clips on each tape that a lot of time is spent searching and very little time finding.

In addition to the lack of visual information in search results, News Archive was interested in capturing production data developed by producers, writers, editors and others in the production process. This information would be valuable to archivists in appropriately describing captured clips, so searches produced more relevant results.

End User Applications

In the Media Asset Model, the application layer should augment current production methods with digital tracking and management information. It should allow each business unit to select specific equipment and components that help them meet their objectives and provide additional functions of sharing material, creating new products and streamlining the workflow.

- Business objectives serve to dictate equipment and methods for production. For example, Nightly News shows have very short turnaround times, measured in hours and minutes. News shows receive much of their production material from feeds received by satellite from remote bureaus or locations. Local news production (at least at the 13 NBC stations) works on similar timelines but have news crews bringing tapes back to the station throughout the broadcast day. The media asset management system needs to create efficiencies but respect diversity in program production and efficiencies already in place.

Acquisition

Acquisition of programming has two meanings. It can be the commissioning of programming, such as entertainment shows or topical magazine shows contracted from an outside production company. It is also the highly decentralized activity of capturing video, audio and data in the field.

Commissioning & Pre-production: Storylines, storyboards, locations, crews, scripts are assets. They can be managed by a properly designed system. As a metadata standard is defined, and digital equipment is deployed (PDA's, wireless modems, disk camcorders) the acquisition stage can be integrated into the overall asset management system.

Capturing: The wide variety of crew responsibilities and methods used in this activity preclude short-term changes. We expect to see digital recording in the field, on removable optical disks, possibly by 2003. The adoption of digital acquisition equipment will take place over a 10-year period, from 2003 to 2013. The digital asset management system we design today must easily accommodate the integration of digital acquisition systems. Acquisition equipment vendors need direction to add content management features to their product and the publication of metadata standards to these vendors may help to provide needed direction.

Facilities recording feeds on video servers are acquiring digital essence. The MAM system will add metadata to the essence, during ingest, creating content.

Ingest

Ingest is the digitization of analog materials. Video, audio, paper notes, contracts, time and date information is analog until ingest. Ingesting activity is currently ad-hoc. A media asset management system places a structure on this activity and must be carefully engineered to produce efficiencies. Ingest is the first opportunity to add metadata to essence that is ingest. The MAM system described herein pre-supposes that metadata will be added at this ingest stage. A specific question for each business is whether to ingest high resolution, broadcast quality video and low-resolution proxies, or simply low resolution and metadata. This decision is budgetary, as high resolution files can be expensive to store on hard disks. The chosen architecture needs to accommodate both digital high-resolution files and analog videotape footage, so that unreasonable economic demands are not placed on business units.

Ingest changes the basic workflow of production units. Resources currently dedicated to backtracking to gain information on essence can be deployed up front, at ingest, to support the desired functions of sharing material, creating new products and streamlining the workflow. Ingest can also include the current activity of Producers and associate producers, who screen material and make logs of tape contents.

Ingest is well understood by archivists, who add metadata to essence they catalog. Their critical to quality needs are listed in bullets below.

- Graphical User Interface must emphasize editorial considerations, not on navigating around the computer application.
- The Synopsis, Subjects, Personalities, Places, and Dates fields should be displayed proximate and readily accessible.
- The process of associating the content descriptions [metadata] to the assets should be fluid.
- The entry and validation of descriptors should be friendly, perhaps like a spell-check operation.
- There must be a Standard English spell check.

- Considering the possibility that a server, network, or workstation could crash, users must be able to save content and order data without closing their records, and the system itself must automatically periodically store unsaved data.
- It must be possible to create a new distinct record, which carries the Editorial ID and selected other information from the previous record, forward to the next record.
- It must be possible to generate ID numbers based on specific editorial information. (Our ID numbers, for instance, are not crystallized at random, but rather are synthesized by combining bureau, assignment, and date information with a sequence number.)
- It must be possible for users to pre-set certain search criteria.
- Rights Data Linked to Other Footage Records. Thus, the same set of rights does not have to be re-entered for each instance.
- It should be possible to scan hard documents, e.g., third-party contracts, into the database.
- Users with data-entry privileges must be able to instantly propose new descriptors that are immediately, if tentatively, associated with that record.
- Set Resolution of Thumbnails.
- Ability to Set Thumbnail (snapshot of video essence) frequency at Ingest.

Production

Tape logging, scripting, tape dubbing, ingest into nonlinear edit systems, editing, graphics creation, effects creation, screening are subdivisions of production activities. A MAM system will affect production activities in different ways so we describe them separately.

Tape logging

Currently, operators put a tape in a screening VTR and play it, writing time code numbers and indicating shot changes, noting the contents of a videotape recording. They often capture data on a piece of paper, which is then handed off to an editor and sometimes stored with the tape cassette.

With a MAM system, tape logging becomes part of an ingest function. Operators will be able to concentrate on simply adding higher level information to data captured automatically from the video and audio contents of the tape. During the ingest stage, low-resolution images will be captured and linked to the high-resolution video that spawned them. The logging process will produce a universal ID to the clip which can be referenced back to the high resolution videotape by reel number barcode and timecode on the tape. All videotapes and datatapes used in a MAM system will need a consistent barcode numbering scheme. As producers screen the low-resolution files, they can continue to add information about the essence that will help others to later locate clips they may have an interest in using.

News Room Computer System Scripting

It is common for writers to use an I-news system (AKA - Avstar or Basys) to write a story using interview transcriptions and research information. They guesstimate timings and expect the editor to find enough video filler to support the story.

With a MAM system, writers will be able to search for and recall ingested low-resolution video in a window on their word processor. They can look at the video they are writing to, decide on appropriate wording and read time, and roughly piece together interview parts that convey the meaning of their story. MAM is expected to allow the production of more relevant text, and improve the speed of production by reducing the amount of re-writing and re-editing in the current process.

The newsroom computer system also contains valuable metadata that can help archivists.

- Producer Data Entry. A mechanism by which production staff can enter their screening notes directly into the Archives database (for later acceptance or rejection by Archives staff) would be beneficial.

Tape dubbing

Currently, multiple copies of studio feed tapes are simultaneously recorded. Camera field tapes are one of a kind and if multiple producers want to work on related stories, dubs of field tapes must be generated. Also, if archive tapes are one of a kind, they may be

duplicated before leaving the archive. In summary, a lot of time is spent making dubs and moving tapes to satisfy production needs. This not only slows down production while dubs are made, but adds transportation dependencies. Using a MAM system, the ingest stage could create low-resolution files which could be accessed within a few seconds of recording. Several users could then access the material without duplication. The material is screened over a digital computer network, minimizing the need for transportation logistics. If many users (30 or so) must screen material simultaneously, very low resolution duplicates of the file can be automatically generated and put on an alternate server and IP network. The need to dub is nearly eliminated by using a properly designed MAM system.

Ingest to nonlinear edit devices

Differences in Nonlinear edit (NLE) systems impacts the efficiency of overall digital systems. For the most part the systems are used as black boxes, which require videotape, input and output. At the same time, the NLEs create digital media, provide ample amounts of metadata useful to archivists and can control videotape recorders for their ingest. A MAM system will need to "glue" these legacy systems into its architecture. Ways in which this gluing can be accomplished include:

- Ingesting high-resolution file formats that are compatible with the NLE systems, so that the ingested files can be instantly transferred to the NLE storage.
- Ingesting low-resolution formats that are compatible with the NLE systems, so that the browse files can be transferred to the NLE storage at faster than realtime.
- Capturing metadata that can be transferred to the NLE for use by editors and the NLE system for batch input
- Creating edit decision lists with producer's notes in desktop browse editors that can be ingested and used by the NLE system
- Capturing low-resolution video with high-resolution audio for direct ingest by the NLE so that edited audio tracks do not have to be re-digitized and remixed.
- Using the MAM Robotic Library to load video tapes required by the NLE's batch input function
- Wiring the Video, audio and timecode from a MAM Robotic Library's Videotape machines to the ingest system of the NLE
- Allowing the MAM database to query the NLE's database to gather information about
    - clips that will be archived
    - clips that will be used on air
    - clips that have restricted rights
- Putting data tape drives on NLE storage systems that are compatible with MAM's Robotic Library system

Gluing legacy NLE black box silos into a standard architecture presents one of the most difficult technical challenges to the MAM design. The MAM multigenerational plan should include these requirements to insure the smooth integration of high resolution, highly functional nonlinear tools into its architecture.

Editing

Audio layering and mixing, graphics creation, video effects creation, frame accurate timing, video level and color correction, and technical quality control are core aspects of the editor's craft. It is unrealistic to expect producers to take responsibility for these techniques. Pre-editing functions like shot selection, shot timing, shot ordering and archive retrieve are primary targets for the efficiencies of a digital MAM system. A MAM compatible edit system should therefore be as tightly coupled with ingest, logging and scripting functions as possible, to eliminate duplication of efforts.

Creating graphics

Complex layered graphics are often created for show opens, teases, transitions and promos. The collaboration of the edit teams with the graphics team results in the need for file exchange between the devices. As another example of the inefficiencies of legacy digital systems, there is currently little or no capability for edit systems to ingest a high end graphics file directly. While some efforts are underway

to build compatibility, the MAM system should probably look, short term, to legacy digital video routing systems and intercoms to link graphics with edit systems.

Interoperability of graphics systems files from vendors like Quantel, Chyron, MacIntosh, and PC software vendors should be easier to accomplish.

Creating effects

Often accomplished in NLEs or video switchers, effects are generally transitional, but also create "new clips". Clips that specifically relate to rights management, such as those that have had a face obscured or a voice disguised need to be tracked by the MAM system. It will be necessary for operators to properly note new clips and make the system aware of these derived clips to properly track rights and usage in the enterprise.

Screening and approvals

Screening is usually done for review and approval on a TV monitor in standard resolution from a videotape dub of an edited piece. The number of approvers who must screen and pass a piece for distribution varies widely throughout production units. Local news may require no screening approval beyond the producer-editor's. A magazine type news show investigative piece may require screening up to the CEO level, involving 30 or more people over 2 or more screen processes. Advertising and promotions screenings are similarly complex, with bi-coastal production and often, the approval of outside producers and agents required for distribution. Security issues complicate this rigorous process, and pre-approved, pre-air pieces must be carefully handled.

A properly designed MAM system will allow secure screenings of digital video files. While it does not have to be included in a baseline MAM system, specific digital networking software is available to deal with approver's notes and comments, embedded in the digital file itself. With such a system, revisions can be more accurately accomplished. The MAM network and security will be robust enough to allow screeners to see and hear the piece they need to pass or fail. Each business unit will be required to assess their need for a more robust screening system and integrate that system into the MAM system, if it is required. In any case, MAM needs to track the approvals, whether done in an analog screening room or on the digital workstation of an approver. The MAM metadata structure will allow users to query the approval status of a project, for accurate assessments of a piece's status.

Archive/Retrieve

The MAM system should be designed with both on-line and off-line digital storage to reduce the cost of storing large essence files and backing up smaller metadata files. Archive and retrieve refers to the process of putting digital files onto low cost removable media and getting files off the media and on a hard disk again.

There are many types of files in a MAM system, including low-resolution browse, metadata, database, graphics, scanned documents, high-resolution video and audio files, and very low resolution video files. Different file types may require different types of removable media in a robotic media handler. It is important that the system be able to handle high-speed media like tape drives, and quick seek media like optical disks. The system should be compatible with videotape drives as well as datatape drives. As the archive system is the main repository of digital data, rights management must be embedded in the retrieval process:

- Rights information must be readily visible, and the very fact of an associated restriction should be prominently displayed along with the record.
- Non-Archives staff should be able to place orders directly through the application, which then must be approved by archivists. The Approval screen will present the Archives all essential information upon which to make a decision, e.g., duration, rights, original format, etc.
- Any Restrictions should appear during the ordering process, as a warning. [A report might also be generated which alerts Rights & Clearances of any requests for Restricted materials.]

- Ease of use for untrained users:
  - Untrained User's Search should be Straight-Forward The screen used by untrained users (which could be the same one used by trained users) must be inviting and must be able to parse and execute a simple query using keywords and dates. The more flexibility we can give untrained users with*out* adding confusion to the screen, the better.
  - All Text Fields Query. There must be a query that searches across multiple select fields as if the contents of those fields were all in a single field.
  - Weighted Results. It would be helpful if the novice researcher did not have to think about Boolean operators but could simply enter terms and the search engine would then present results under ranked classes, e.g., records which contain the search term as a phrase, records which contain all the terms but not in a phrase, and records which contain some of the terms. A simple numerical ranking system (such as is used on Internet search engines) would not be adequate.
- Flexibility of Search Interface for Trained Users.
  - Users should be able to apply Boolean logic to virtually any field, including fields on related tables. An advanced user should have virtually total flexibility in how they structure their query.
  - Sorting. It must be possible to sort the hit list (regardless of scoring) by event date.
  - This Day in History. It should be possible to search the date field for month and day leaving the year a wildcard.
  - Searching by Paragraph. The ability to query by the intersection of search terms *within the same sentence or paragraph* rather than merely within the same record is an added plus.
- Computer-Enhanced Searches– e.g., those allowing natural language queries or dependent upon thesauri hierarchies – must return results which reflect the quest (a query for *secret agents and moles*, for instance, should not return stories about federal wildlife officers and little animals) and should not miss appropriate records.
- Useful Presentation of Hits. All pertinent information should appear on the same screen, including:
  - Physical Material Characteristics and Locations. All physical material associated to an editorial record should be readily seen. If material exists on film, we should easily see if a film transfer already exists. Also, all film attributes should be apparent (type of film, length, b&w or color, silent or SOF). If there is no physical material associated to the editorial record, we should see that immediately. And the provenance of each dub or transfer should be immediately obvious through this screen.
  - Checkboxes which allow user to choose inventory without navigating.
  - Availability and, if on loan, then to whom, etc.
  - Search Terms should be highlighted in the display.
  - There should be a "Find on this Page" and "Find Next" search feature.
  - There should be several different views of the hit list one of which shows just a few fields of each record, one of which shows the full record, one which shows thumbnails, etc.; ideally, the user could select the fields which would appear in the view, and displays the search term in context – i.e., shows the ten words before and ten words after the search term.
  - Printing:
    - Full Record or Hit List. It should be possible to print either the full record (all fields) or just a hit list or a user-determined set of fields.
  - Highlighting. The search terms should be highlighted in the printout.
  - E-Mail. It should be possible to E-Mail or Download the results.
- Grouping the Selections. It should be possible to sequence and review selected materials, and possibly to sort into distinct bins for different projects.
- Ease of Marking Selections and Placing Order:
  - Marking Ins and Outs. It should be possible to select Ins and Outs from

streamed video and audio, and to calculate the total running time.

- Display resolution of thumbnails can be set Lower than Ingest Resolution. [4]
- Inventory Management
  - Tracking Asset Movement. (It must be possible to precisely track tape and film locations – to check tapes out to borrowers and check them in when they're returned, to note when tapes are on a shipment and when the shipment has been received, and to check whole shipments out to a single person.)
  - Displaying Inventory Information. (It must be possible to display all individual tape information on a single screen, including current location, current loan information and history of loan and shipment information.)
  - Overdue Notification. (It must be possible to send e-mail notifications out periodically to borrowers that their loans have aged excessively.)
  - Deaccessioning. (It must be possible for authorized parties to remove footage from the collection but to maintain a record in the database of that action.)
  - Transferring Checkouts. (It should be possible to expeditiously transfer checkouts between borrowers.)
- General Administration
  - Maintain Accounts and Categories:
    - The application administrator should be able to establish user accounts, including setting numerous security/role levels, without the intervention of a data base administrator.)
    - The application administrator should be able to set up Bureaus, Domains, Assignments, etc., in the system, without the intervention of a DBA.
    - Create Reports both ad hoc and regular). Application Administrators should be able to query any table(s) and present results.
  - Maintain Thesaurus, including the ability to merge heretofore distinct descriptors into one, to approve or remove descriptors, to modify them.
  - Create Shell Records. Application administrators should be able to create series of shell records (setting a range of Editorial ID numbers).
  - Make individual corrections. Users with sufficient privilege should be able to query the database, produce a result set, and modify individual records from those results without first navigating to a separate input screen.
  - Make bulk corrections. Application Administrators should be able to make mass corrections across records.
  - Maintain Rights and Clearances Data. Rights and Clearances staff should be able to maintain and update Rights and Clearances tables.
  - Security Levels. Application Administrators should have maximum flexibility in setting various user privileges.
  - Usage Statistics. Archives administrators should be able to know who's logged in when, for how long, amount of streamed data, etc.
  - Messaging. System administrators should be able to alert active users on-screen when, e.g., the system is to be taken suddenly out of service.
  - Remote Access. System administrators should be able to mirror a user's session in order to remotely assist users having difficulty using the system.

Integration

Integration is the joining of pre-produced elements into a "seamless" stream of content and commercials. Integration also refers to the customization of output products, for specific distribution channels. For example, MSNBC's show "Time and Again" is finished in different ways for distribution through MSNBC, NBC Network, and Airline viewing. Different "bugs", distributor ID's, opens, closes or credits may be required for each distribution channel. Integration backs into the production process in the creation of pre-produced elements and will only become more complex and time consuming as digital channels proliferate. Content owners and program producers as well as business leaders indicated their desire to create new products, and this stage is a primary location for enabling new products, and avoiding prohibitive additional costs.

A MAM system can aid integration by:

- Automatically timing show segments for commercial integration
- Routing show segment files to servers for further customization
- Generating customization templates that automation systems can use to create customized products
- Extracting vital show information for distribution to Electronic Program Guides
- Extracting graphical elements and audio used in the production chain to generate lower resolution files for internet and wireless distribution

Commercials

Commercials are probably the most important aspect of the integration phase, and indeed, the business itself. In the typical station environment, the Traffic Department handles commercials. Commercial time slots are sold with provisions and guarantees for audience size, as rated by Neilson and others. As media asset management systems provide new functions to interactive consumer systems, commercial sales and delivery systems much match new functions, to boost income streams from improved interfaces to our customers.

Control of the viewer's screen becomes all important, which can only be accomplished via a 1 to 1 relationship with the consumer, or, providing information to the distributor in real-time, that allows a distributor to insert commercial messages at appropriate times. Feedback from customer sites or tight control of the distribution timing is critical to the control of the screen.

Distribution

Distribution is staging product for delivery to the customers. As the distribution of media becomes more complex, with analog on-air, digital on-air, cable, internet, broadband, wireless, data etc., having handles on digital products, such as those provided by a MAM system are becoming more important. Automation systems will be forced to incorporate more complex associations, including advertising links, banner integration and digital headers in digital products. Return information, like viewer preferences and viewing times will be used to optimize distribution strategies. A MAM system will help programmers and sales staff to analyze programming for best possible results.

Foundation Layer

Clearly there must be standards established for an enterprise wide archival system to be successful. The difficulty is choosing standards that are useful to all users of the enterprise, and are also robust and extensible.

Format of Digital Suites

Archive and Distribution format MPEG-2

MPEG-2 SP / ML provides adequate quality in standard definition for distribution and archive. It is an open decoding standard, which means that future generations will be able to read encoded files without regard to decoding IP. It is very efficient, high quality, component based and can be encoded in realtime. It is efficient because of temporal compression, which unfortunately means it cannot be edited in its native form. It can be edited if it is decoded and re-encoded, which degrades the signal quality and risks audio impairments.
MPEG-2 has a well defined "transport stream" which allows satellite distribution of interleaved video, audio and data signals. The MPEG-2 transport stream can be ingested and used in limited integration applications by some video servers.

Production format - DV

DV based compression, like DVCPRO, DVCAM, and consumer DV are editable in their native forms, don't degrade when edited, don't degrade substantially when decoded and re-encoded. They are at least three times "heavier" than MPEG-2 at 8 Mbps, so, to archive in DV format is not as efficient as

archiving in MPEG-2 long GOP. (We don't edit in the archive).

Browse Format – MPEG-1

The browse/edit format included in the above proposal is MPEG-1 at about 1.5 Megabits per second. This is an open format used in Video CD and other desktop applications. If encoded properly, the quality is equal to S-VHS, which can be put "on-air" in a pinch. The 1.5 Megabits per second limits the switched 100-baseTX network capability to about 30 clients, using a single server simultaneously. Additional servers and networks are required to reliably expand MPEG-1 browse editing to more than 30 clients.

Alternative Browse Formats

MPEG-4

MPEG-4 will be a scalable standard, starting at about .3 Megabits per second and allowing data rates up to 4 Megabits per second. This will allow the single browse server, which currently supports 30 MPEG-1 users, to support 120 MPEG-4 users. The MPEG-4 signal can carry digital "objects" which could be graphics or metadata, so users could display a data overlay with running picture. MAM system upgrades to MPEG-4 may involve IP licenses for MPEG-4 encoding that increase upgrade costs, MPEG-4 formats have been engineered for lower bitrate channels, such as those involving the internet and low cost media like DVD. MPEG-4 could form a standard for internal production and external distribution, if jog audio and frame accurate timecode are properly integrated into MPEG-4 formats.

Wavelet

Some companies are also developing a scalable Wavelet compression browse format. The system is marketed as IPV for Internet Pro Video and is aimed at wide area production. Wide area production is not currently used in production circles because of bandwidth limitations and costs of Wide Area Networks. IPV is not a standard, open format, but holds great promise if face to face production meetings are not a requirement and production time is not measured in minutes. Using an IPV system would allow editors anywhere in the world to quickly edit footage that is arriving on a server anywhere else in the world. Wavelet compression is attractive because of its scalability, but the lack of International Standards supporting the format currently limits its usefulness in broadcast applications.

Screening format - RealVideo

The basic client is free, the encoder and server are cheap. MPEG-1 browse files can be used to encode RealVideo in faster than realtime. In large MAM systems, which need to support hundreds or thousands of users, Realvideo is suitable. The Realvideo format is proprietary and could be treated as an interim format, to be replaced by MPEG-4 or IPV when players and encoders are cost effective.

Audio Standards

Uncompressed 48 kHz AES/EBU locked to video

AC-3 audio in transport streams – for distribution, integration and archive only.

MP-3 for voice overs, and networking of voice overs.

44.1 sampled AES/EBU audio from CD-ROMS

RealAudio for super low bitrate browsing using a modem.

Metadata Standard

In the case of NBC, OMAR is the current metadata standard. Our MAM systems will incorporate a Metadata standard that embraces and extends the current OMAR system, so that NBC business units can archive more data and a structure that will support sophisticated searches for material in the archive.

Production Metadata

Intelligence Video Index, Content Description Metadata (Dynamic Metadata Dictionary Structure and Contents)

When the draft SMPTE standards for "Dynamic Metadata Dictionary Structure" and "Dynamic Metadata Dictionary Contents" have been approved by SMPTE and have been evaluated by the various companies that have a vested interest in this issue as meeting those companies requirements, they will become the likely STANDARD for all motion imagery metadata systems.

SMEF Data Model v 1.5 or later
Metadata system is developed by the BBC and is meant to be the STANDARD for motion imagery systems metadata.

Production Database and Local OMAR database

The structure and topology of MAM databases are key aspects to the performance and security. Production databases include data information from automation systems, newsroom computers, nonlinear editing systems and ingest cataloging systems. In a production database, ample information may simply refer to the specific phase a production essence clip may be in. That information is usually irrelevant to an archive database. We therefore see the need for a filter between the production database and the archive database. Librarians or archivists would “shape” the data during its migration from a Production database to Archive database, to make the archive search functions quicker and more accurate. The Production data can also be filtered by Middleware; software components that understand different structures in databases. Middleware is addressed later in this document.

Proposed Requirements for a MAM database might include the following:

- Database can be expanded easily, depending on storage architecture limitation.
- Data Records have limitations, however may be hyperlinked to other records with special processing.
- Database will either reside on one system with failover capability to one or more other systems, or will be accessed in parallel from two systems simultaneously
- System outage time will be required for upgrades hardware and software additions and new version rollouts
- An on line backup methodology will be set in place to provide complete data backup.
- A "read only" replication system may be employed for redundancy and performance enhancement
- Depending on Network architecture, low resolution accessible from producer workstation
- Depending on network architecture, Target browse datarate- Less than 1 Mbps data rate with audio
- Preferred application: Web browser
- Time to ingest tape to digital will be minimized with conversion system
- Work flow will allow for "look ahead digital conversion"
- Small snippet of taped material will allow one to partially view without complete digital conversion
- Database will be accessible to the user except for specific maintenance outage periods

Middleware

The middleware is actually the link to and from central archive and business unit. The middleware layer is the filter of data and formats going to archive and the transcoding from archive.

Data Messaging and Database Connectivity

Generally, handling the data in a local MAM System means observing standard IT rules for networking and redundancy. The MAM system should allow each business unit to use metadata that is unique or proprietary, and filter out meaningless data before migrating the media and data to archive.

Data messaging between systems can be handled with protocol tools like CORBA (Common Object Request Broker Architecture) XML (Extended Markup Language), COM, ContentShare and several others. A MAM system should strive for a unified approach to data messaging and connectivity.

Archive Business Logic

Business rules dictate the value and security of a clip and each operating group in the content game have their own business rules. For example, if Dateline shoots an investigative piece, they restrict display of their footage, until they agree it is OK to distribute. The same goes for Nightly News, Access Hollywood and many other production groups.

So, how do we reasonably migrate data and video to the archive, without violating business rules of each operating group?

Basically, three types of data in the internet-broadcast/archive system are anticipated: High Resolution Essence, Low Resolution Essence, and Metadata. The data will be stored on several media, including Videotape, Datatape, Optical Disk, Staging Hard Disks, On-line Server Hard Disks.

The goal of a MAM system should be to provide the correct access to these data, cost effectively.

It is helpful to query the business rules of each production group:

1. How much material gets ingested or recorded in the facility, daily?
2. Weekdays or Weekends or 7/24 ?
3. How long do you need to keep material on-line, in the facility?
4. How many dubs do you make of incoming material?
5. Do you erase any media that you know will not be re-used?
6. Do you have rights to the essence used on air?
7. What happens to your media when you run out of shelf space?
8. How long do your produced stories take to completion?
9. Do you need to "Hotel" your editing seats, have several users in the same seat during a day or week?
10. When could your production groups make information about your essence available to insiders and outsiders?
11. When could you release essence rights to insiders and outsiders?

Answers to these questions determine workflow and timing to and from the archive.

Data Backup

While it may be anticipated that metadata will always remain on-line. Eventually, the metadata will need to be backed up to some permanent storage and taken to another location, for catastrophic disaster protection. When will we make backups and where will the data be stored?

Replication of essence will also be required, based on popularity and needs. Media will need to be checked out and checked in, if, for example, the Robotic Library's shelves are full and media must move to shelves inside or outside the facility.

Automation System

An automation system can provide cost benefits, especially when tied to a Digital Asset Management System. But, the talent involved in high quality production may be a resource necessary for a good product. Thus, automation cannot be employed throughout the enterprise, but discreetly, where it will enhance the speed of production and not detract from production values recognized by the viewer. Newer digital systems in the home may provide "packaging" services that preclude the need for traditional "TV Show" packaging. When such a system provides a platform for consumption that is acceptable to several millions of "view-sers" the resources of a media asset management system may be a requirement to satisfy the capabilities of the consumer system. Such systems could allow show "Clipping", viewing only parts of traditional shows that are attractive to the viewer, or interactive shows, that branch in realtime.

Automation during the distribution phase has provided clear cost benefits, through the reduction of staff required to handle distribution. New markets may be necessary to justify the cost benefits of a Media Asset Management system, if production is the activity focus of the system.

System Build

The media asset management system is a complex system with functional dependencies. Phases should be proposed, which build, test and measure cost benefits. Phased projects allow users to adopt new functions gradually, with a more complete understanding of the new processes. Finding the correct functions to justify the costs may require several distinct analyses of build out scenarios.

Basic Questions:

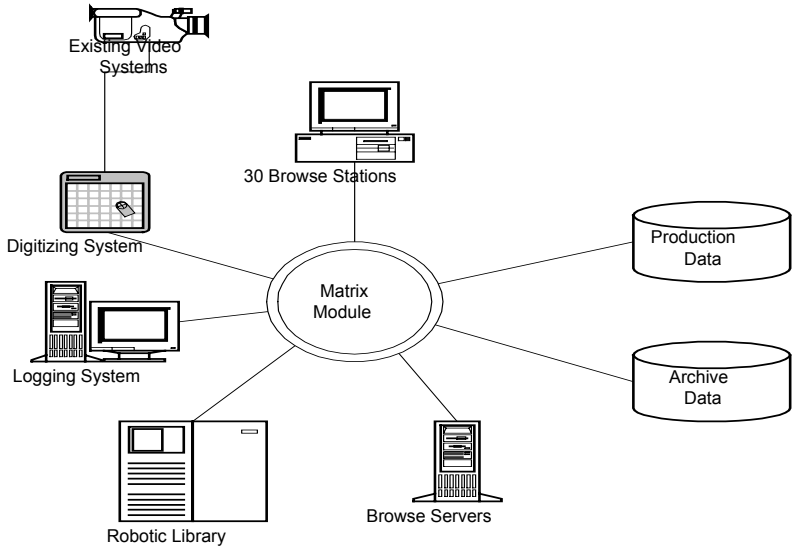
Business unit cost-justification
Business Capital Budgets: Should each business unit justify its needs for a media asset management system, and build one if it can be justified to management?

Management Needs for facilities
Do the efficiencies proven by a media asset management system provide compelling reasons for management to require that selected business units incorporate a media asset management system in their facilities.

the digital infrastructure developed for a browsing system, when high speed network and digital storage cost-performance improves to the levels required.

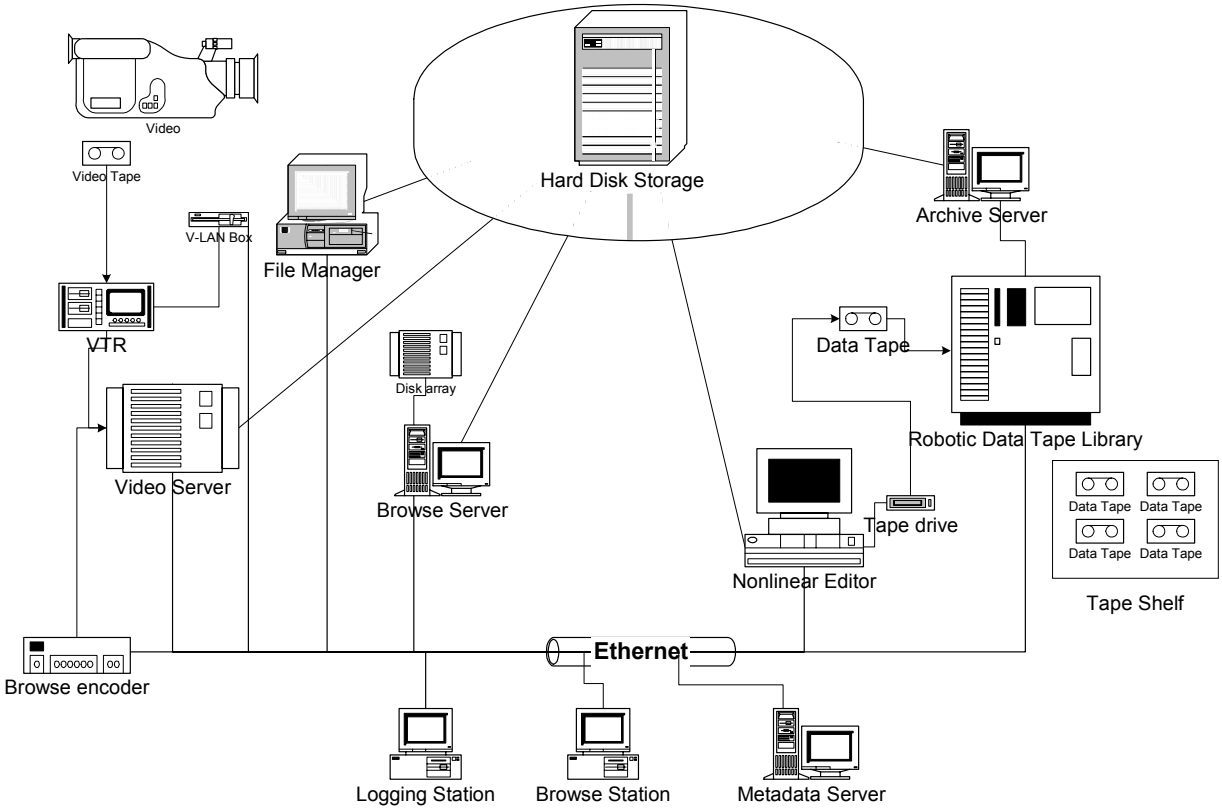
System Components and Vendors

The following diagram illustrates a mid-term MAM solution that includes Ingesting, Producing and archiving high-resolution, browse/edit resolution and metadata. The basic MAM module does not include the Nonlinear editor, Storage Area Network and File Manager, or Video Server which are included in the mid-term solution.



A goal of the basic MAM module is to augment existing analog video and audio systems with advanced digital management techniques, which would support **sharing material, creating new products and streamlining the workflow**.
The MAM module would interface with text based search tools, a powerful database and robust hardware currently operating in News Archives. The MAM system would introduce infrastructure to handle digital essence, and improve the functions of searching.

The higher resolution analog video and audio systems in TV production can be replaced with



Conclusion

Each of us needs to understand the changes that technology will bring to our business and consider the need for a unified approach to Media Asset Management. The next logical step is to test the technology and vendors, develop firm cost benefits modeled from the test production system and proceed with a pilot build if business conditions warrant. Internet and interactive divisions should provide further impetus for the effort.