BILL AND TED'S VISION OF A NEW WORLD ORDER

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ABSTRACT

A problem or indeed an opportunity is rapidly arising caused by the quantity of media oriented data that is, it seems exponentially increasing and circulating through the computers, storage systems and networks of all companies.

Particularly relevant are those that are media/content aligned. We are becoming all too familiar with the plaintive cry; "Where is that !#*!*#!! media file?" or; "Why does it take us three weeks to locate the pop-promo/campaign that we did for Billy Wizz?".

The paper argues that the effective management of these "assets" and the effective distribution of the information to those that need to have access to it is one of the biggest challenges/opportunities that is around right now. To be able to observe and utilise these assets quickly and effectively means big savings in time and money. It also means further commercial benefit is realisable from assets where none existed before and the users of this information will find the whole process far more enjoyable which should lead to even more inventive use of the information.

To efficiently manage those assets requires a system with an understanding of the myriad of data types (e.g. D1, YUV, tiff, targa, Quicktime™, JPEG, MPEG etc.) and their relationships with each other (e.g. are they derived from or related, do they have copyright or documentation associated etc.) The system also needs to understand the concept of 'real-time' in a video, film or audio context and be able to generate such streams to the designated workstation, output channel or desktop. This paper proposes and discusses the solutions that are available to deal with the above outlined scenarios.

MEDIA ASSET MANAGEMENT - THE CHALLENGE

Let us start by defining terms.

By **media asset** we are referring to items which can range from paper based documents and records to photographic stills and movie material; and from analogue video or audio images to digital images held in various forms on tape or disc. In fact we are talking without restriction about any item of material which can be used in the creative processes relevant to our industry such as digital television; audio and photographic production; CD Rom production; Animation; Web authoring and Desk top publishing. Furthermore, the definition of assets need not be confined to those involved in the creative processes. It can include, for example, legal documents or contact information.

The **management** of these assets refers to the ability to "register" the existence of an asset, to identify it, to manipulate it and to enable it to be searched for. An additional desirable facility that may be provided as part of an asset management system is a workflow component which allows tasks to be defined using references to assets registered in the system and for results to be automatically registered in the central data base. This helps avoid those frustrating searches for the final cut and wondering whether it was the "final cut" file or the "really final cut" file.

In practice, until now, most of the asset related information which is stored and accessed via computerised systems and networks has consisted of database records and textual documents (say 85%). Complex Media Data which means such things as audio, image and video files stored as digital binary data has amounted to only 15%.

Again, existing practice has been to base asset management systems on a LAN based file server providing a central storage location for files, with the files located in directories or folders and grouped within a disk (either physical or logical drive). There are a number of reasons why this situation has started changing.

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Firstly, the file classification system has shortcomings in that inherently it has to be constructed from the perspective of one particular user and may not be ideally suited for another user (for example an accounts person would want to see the files classified quite differently from a programme maker) and in any case the base information available for searching is limited to the filename, meaning that in all probability the only way to verify the content of the file is to actually open it. This leads to excessive amounts of unproductive time being spent simply searching for the correct file.

This problem is exacerbated where the file relates to Complex Media Data and although as stated above this has accounted for only 15% of stored data, this percentage is increasing rapidly. It is reasonably expected that the ratio 85% to 15% will "turn around" by the year 2000 so that by then it will be the Complex Media Data which will account for the 85% and the record or textual files which will account for only 15%.

This rapid change in the nature of the information stored stems from the technological advances which make ever increasing speeds of processors and networks a fact of life and raises in the user the desire to exploit the increase for storing the asset itself rather than simply information relating to the asset, especially as the number of formats which can produce the asset in a form suitable for data storage and retrieval is also growing rapidly.

The third reason for change is that delivery mechanisms are more varied than ever before and developing all the time. Television, Books, CD-ROM's, Web sites, Interactive TV, larger numbers of TV Channels - all of these outlets are growing and their appetite for information and material is growing with them. Consequently the ability to manage the assets which they require access to in an effective way is essential if the opportunities which this information explosion brings are not to be missed.

HOW ASSET MANAGEMENT CAN WORK BETTER.

To improve on the folder based or text based database scenario just described, we should look at the necessary and desirable attributes of a management system.

Like the conventional file server arrangement described above, the system will be a computerised network with users accessing the centrally stored data from individual work stations. Not all the information need be in the same physical store and in fact a large system will consist of several servers and a mixture of tape and disk devices, but this should be transparent to the user at his desktop machine.

In order to increase the ease of finding and using an asset for a range of activities which may range from broadcast play-out to accounts processing, the properties or metadata for the asset needs to be stored in such a way that it can be quickly accessed in a wide variety of search types. For example the accounts user may be interested in all items used in the last month which carry a copyright for Bloggs and Co, whilst the play-out user may want to check that all items for Thursday's schedule are in hand. In some applications, a textual database may be sufficient and in fact that is all that has been possible until recently. However, in many situations, there are real productivity gains if the user can see a representation of the actual images being used, or listen to the audio tracks that decisions are being made about. For example, consider the benefits of a graphic designer being able to preview the images he will need to use for tomorrow's job by dialling in to work and downloading a package of preview images. Another example where images and audio have real benefits would be a project that extends over a period of time. The client can keep track of the project remotely by viewing updates over a dial-up connection or even better over a high speed WAN.

The technology to deliver this quality of information does exist and the individual tools are in daily use, the real power is bringing all the ingredients together as a coherent system which can solve real users problems.

For example consider an asset which exists as a video clip recorded on D1 or Betacam tape. The clip may have been selected for use in an effects shot or perhaps a documentary. When that clip is received into the organisation, perhaps to go into a tape store or to be used immediately it is registered as an asset and a typical set of information which may be recorded is as shown in Figure 1. The visual content is likely to be described in text form, perhaps using keywords or by extracting information from the closed caption information if it is available. The content should also be stored as a visual representation. This could take the form of one or more representative still frames, as shown in Figure 2, or it might be a compressed Quicktime™ or MPEG video - whatever is needed to help the user identify and extract visual information from the clip by viewing the asset from his desktop without the need to draw the actual asset or tape out of store. The ease of browsing from the desktop means that the user is able to either complete his task more

efficiently or improve the quality of his output by being able to consider more options. The precise requirements for the visual representation or proxy of the image will vary from application to application but the old maxim that a picture is worth a thousand words is certainly true. Some examples are given in the case studies at the end of this paper.

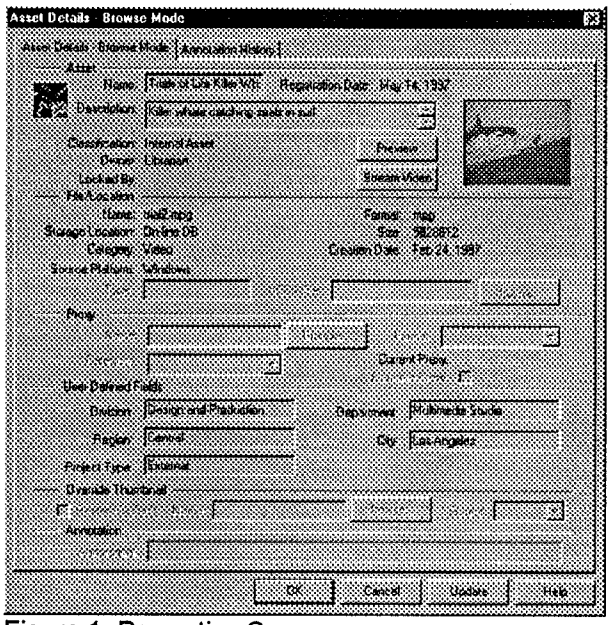

Figure 1: Properties Screen

In addition to a representation of the asset, why not store the actual video asset as data on the system so that the user can view and directly control the use of the asset itself in addition to a compressed representation. Whether or not that is done depends on a number of factors such as the working practises at the facility, the speed of the network, capacity of the storage and ultimately budget! The point is that it can be done and it should be an option that is considered, not very long ago it just could not be done.

The bandwidth required to represent audio information is much less and typically there would be no need to store a lower resolution or compressed version of an audio asset, the full asset could be used directly at the desktop. An exception might be for long audio pieces where a short extract could be stored.

When it comes to finding the required assets, all the information that was entered must be available as search criteria. In addition to standard items such as name and date, searches could also include associations such as copyrights, grouping information, project information etc.. Ideally, the actual video or audio content should be available as a search criteria so the user can say things like "show me images similar to this one", or "show me audio clips with the same drum beat as this one".

This may sound fanciful, but the technology is now in place to carry out these tasks. It has been publicly demonstrated for some time and will be available in a commercial form by the end of 1997.

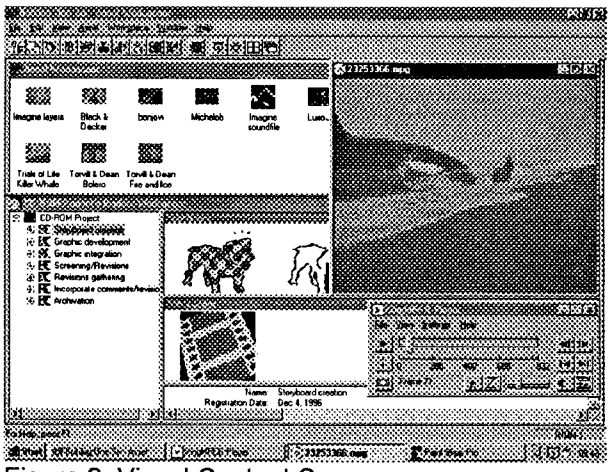
Figure 2: Visual Content Screen

THE BIG DIGITAL PICTURE

Having considered the requirements of asset management from the point of view of analysing what one is trying to achieve, we would now like to illustrate the realisation in practical systems.

Figure 3 shows such a system and shows on the left hand side an equipment configuration which is typical of a conventional television facility. There is a machine room equipped mainly with VTR's, linear and non linear edit suites, a telecine, graphics work stations, play out facilities and a film and tape library. To the right is a network with RAID storage, digital tape storage and gateways to the Internet and a WAN. The network also serves the other user work stations - not just the production personnel but accounts and resources personnel, in fact, anybody concerned with the use, procurement and costing of the assets. The linkage between the two halves is shown.

Much of the material being used in post production and broadcast today already exists in a digital form and in fact a large part of Figure 3 is probably already in place in many installations. The asset management can be thought of as essentially a missing link rather than a whole new way of thinking.

In order to make the information that is stored on the asset management system useful, there must be information exchange between different manufacturers equipment and file systems. In

addition, information needs to be transferred from the conventional world of tapes and films into the digital storage system.

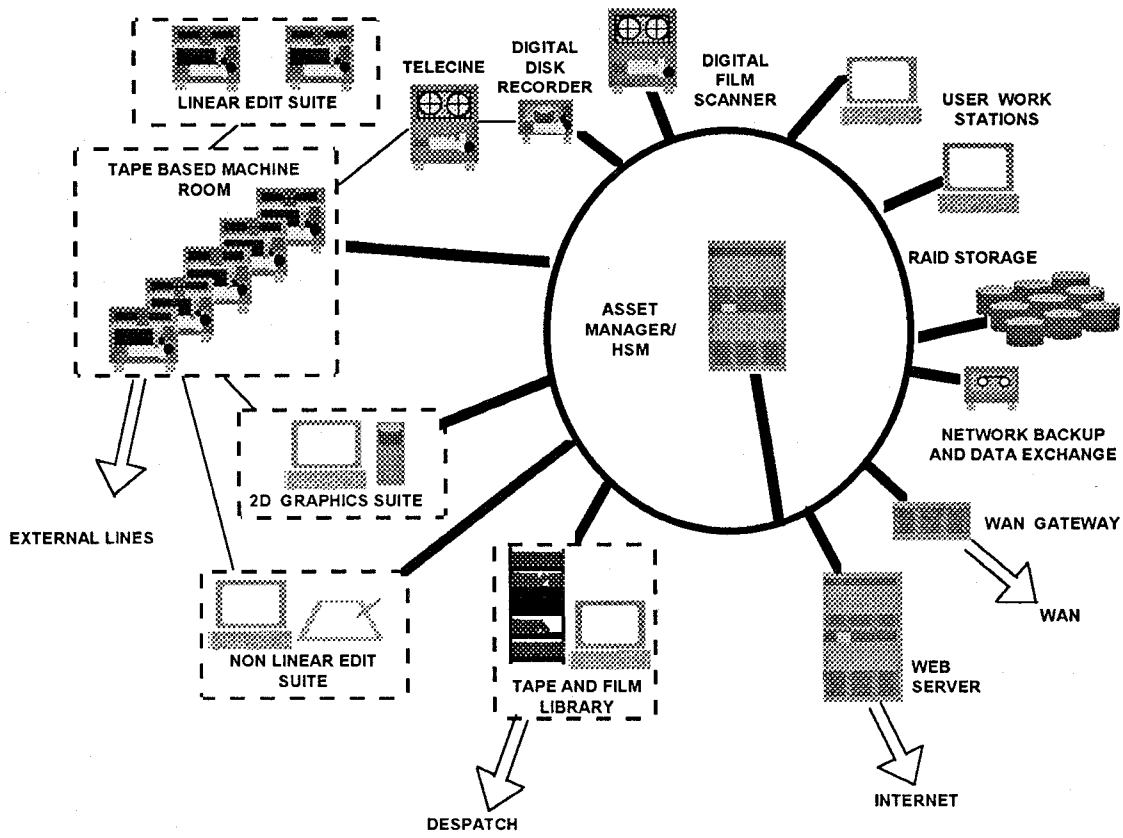

Figure 3: The Big Digital Picture

As more and more digital systems use standards such as Quicktime™ and TCP/IP network protocol, the problems associated with accessing the information stored within them are getting easier to solve. Non-digital assets present more of a challenge and to be useful, the asset management system must deal with these assets in an elegant way. For example, video and audio digitisation can be automated using shot logs or broadcast schedules and tape movements can be tracked using bar codes. In order to make the system as a whole work, this element of tracking and using information that already exists is vital and is a large part of any system design.

Because the asset management system works on a client server architecture, the metadata for assets can be updated from any workstation and it typically does not matter what sort of workstation is used to preview visual or audio information. A typical model would be that the main information such as picture content, title and timecodes would enter the system automatically, possibly with close caption information. This would later be updated with extra information as the asset is used as part of a programme or scheduled for playout.

In recent years, enormous strides have been made in the availability of high speed networks and high capacity, high speed disk and digital tape storage. This technology is crucial to the practicality of the asset management solution being proposed and is worthy of further discussion.

The network in Figure 3 will typically consist of a mixture of ethernet and high speed networks such as ATM, fibre channel and HiPPI. Ethernet with a maximum bandwidth of 10 Mb/s or 100 Mb/s is inexpensive and typically comes as standard with many computers. Ethernet is ideal for delivery of metadata and preview quality video and audio to desktop Macs and PC's whereas a higher speed network is needed to transfer uncompressed or broadcast quality compressed pictures in real time.

Ideally, the high speed network should be set up as a switched architecture to ensure that multiple streams of data can be transferred between sets of machines without interfering with each other. The maximum bandwidth available on these connections will vary depending on the network but will be in the range 155 Mb/s to 1000 Mb/s. As a datum, uncompressed D1 digital video has a native bit rate of 270 Mb/s and broadcast quality MPEG-2 requires a bit rate of 6-15 Mb/s.

Once the assets and the metadata are available digitally, the network can be extended beyond the in-house system or intranet and can be opened up to include a high speed Wide Area Network (WAN) such as SohoNet or BT's MediaNet or just as easily to the worldwide web to allow controlled access from anywhere in the world. Video streaming is now possible using standard telecom links opening up all sorts of possible scenarios for client review and project management.

The subject of security is important when considering an in-house system and an asset management system must allow permissions to be assigned at a number of levels to allow reading, writing and assigning capabilities, it should also allow permissions to be set on a project by project, or a user by user basis. If these issues are important on an in-house system, then they are really important once access is opened up to the web.

Storage is shown as a RAID (Redundant Array of Independent Disks). Disk technology has made enormous advances in recent years with no sign of stopping. Individual Disks of over 20GBytes are available and transfer speeds of around 10 MBytes/s per disk are not uncommon. By creating a RAID, one can arrange a number of disks so that in total they offer greater capacity and operate at a greater bandwidth than a single disk The array also protects against loss of data in the event of a single disk failure and typically provides additional protection such as redundant power supplies and even redundant controller cards with some systems.

A single RAID of say 72 GBytes capacity will hold around 35 minutes of uncompressed D1 images for graphics work or over 25 hours of MPEG-2 material at broadcast quality. The data bandwidth available from a single RAID will largely depend on the host interface and is typically in the region of 35 MBytes/s for SCSI and 70 MBytes/s for fibre channel. Multiple RAIDS can be striped together to behave as a single file system or can be treated as individual file systems managed by the asset management system.

Even with today's specifications, it is unlikely to be practical to store all the digital assets of a typical facility on disk at all times and an archive or near-line strategy is required to provide complete flexibility. The most elegant way of handling this is to combine high capacity RAIDS with a high speed digital tape robotic system which is able to load tapes from a silo under computer control. In this way, the user need not worry about which assets are on disk and which are on tape as the asset management system can manage the retrieval from near-line tape storage to on-line disk storage. The only difference is the access speed - a few sips of coffee for near-line assets as opposed to a heart beat for on-line assets!

CASE STUDIES

Having set the scene with the BIG picture, it is worth discussing some examples of implementations of parts of this picture that have been recently installed.

The two installations I would like to discuss are at the BBC and Smoke and Mirrors, a leading Soho Digital Post Production Facility.

At the BBC, Boxer has installed a media asset management solution to help in the production of a series of seven fifty minute programmes about " The Human Body covering conception through to death." The series is designed as a "landmark" production and the material that is gathered to make the programmes will be used for web-sites, CD-ROMs, interactive exhibitions etc. This requirement for efficient re-purposing is one of the main reasons for this production being selected as a pilot to pioneer the use of media asset management.

The system installed consists of a server, with disk and tape storage and a media acquisition station which allows video and audio from Betacam and VHS sources to be recorded as MPEG-1 movies and high quality still frames. To automate the digitisation process, existing shot logs can be processed to allow multiple clips to be automatically registered into the database on the server. Alternatively, the video tape can be cued manually which is the normal mode of operation for archive material which is typically viewed from VHS.

The system is running Bulldog asset management software and uses the Informix Illustra visual (Object Orientated Relational Database Management System, OORDBMS) database. The system is accessed by the production team using

their existing desktop PC workstations and the existing 10-Base-T network.

Working with the team has been very educational and seeing the grin that still comes to the individual faces when they play full colour movies on their PC desktop screens is very rewarding. The team have also discovered a number of "undocumented" features such as the ability to play more than one movie on the screen at any one time - great for comparing two clips to select the best one to use. At the time of writing, the system had been installed for about three months and already contained around 500 video clips with associated metadata. Watch this space.

At Smoke and Mirrors, the facility consists almost entirely of Silicon Graphics computers with large disk stores running high end editing and effects software. The production team all use Macintosh computers for quotations and job control and the whole facility is networked using a combination of 10 Base-T, 100 Base-T and HiPPI - an ideal application for asset management software. At the time of writing Smoke and Mirrors are working with Boxer to integrate Bulldog asset management software and Informix Universal Server database software into the facility to provide the production team a much greater level of interaction with the artists and editors; to allow the artists and editors to preview forthcoming work without a very expensive supercomputer and to allow clients to review work both within the facility and over a high speed WAN from their offices.

In order to extract the maximum benefits with the minimum operational pain, Smoke and Mirrors are developing an automated video digitisation system which will produce low resolution movies for desktop viewing for all material that is used within the facility without the need for operator intervention. Making the system work as transparently as possible is certainly one of the keys of good design for Media Asset Management and is one of the reasons the implementation at Smoke and Mirrors will be such a good model for other installations.

CONCLUSION

In this paper we have discussed the principles of Media Asset Management. We have shown that rapid changes in modern technology have made it essential, possible and very advantageous to introduce vastly improved techniques for registering, storing and identifying assets which cover a myriad of data types. We have shown that these same changes in technology, in particular the uses of high speed data networks and high capacity storage in the production arena, mean that asset management can and should be an integral part of a cohesive production, post-production and administrative environment.

Mirroring these developments has been a rapid growth in the number and type of content delivery mechanisms i.e., Web, Internet, CD-ROM, Interactive TV etc... This in turn increases the potential for use and re-use of each asset; and increases the potential revenue value of each asset (provided that the asset can be delivered precisely when the client wants it). The successful implementation of asset management technology in this context will save money, resources and can be very profitable!

In conclusion what better than to quote the words of a leading industry firm of consultants on this subject.

In the weekly industry newspaper 'Broadcast' (week of 12th June) is featured a significant piece headlined **"Digital Asset Management vital, media firms warned":** *"Good Management of Digital Assets is vital to the future of the media companies", says the latest Entertainment, Media & Communications (EMC) Technology Forecast – Produced by Price Waterhouse. The report goes on to emphasise that "Over the next three years, choosing and implementing a digital content management strategy may be the single most important decision to be made by film studios and television networks."*