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Lecture 8 – Technical Issues and Future Trends

Definitions
Because the term Multimedia Technology has such a wide variety of potential meanings and crosses over such a wide number of seemingly disparate industries, it is easy to loose sight of the commonalities which exist. Because of the degree of "convergence" which is occurring between broadcasting and telecommunications sectors it is worth analysing these seemingly diverse categories, if for no other reason than to provide a reference framework within which to work.

Background
One could argue that a multimedia producer working at the most simplistic level, producing interactive CD-ROMs, has little in common with national broadcast television networks, and clearly the technical systems and protocols involved in each extreme are vastly different. But as we move into the era of desktop video, broadband datacasting and the information super highway, the boundaries between cottage industry and trans-global media empires are beginning to blur.

The technology once needed to produce, say, a television documentary was quite substantial. The cost of film stock alone was often prohibitively expensive. And the technical skills needed to light, shoot, edit, sound-mix, write and produce even a basic production usually meant a team of experienced professional film makers were needed, along with a truckload of gear worth many hundreds of thousands of dollars. Today, a talented individual with a basic understanding of camera, editing and sound can fulfil many of these roles on a small broadcast-quality digital camera and a relatively inexpensive desktop computer.

The result is that an individual, with a good eye and a story to tell, can theoretically produce a professional broadcast quality production for a fraction of the cost of using traditional methods. This is probably just as well since the proliferation of competing media alternatives coming on-stream are going to need a continuous supply of content to fill on-air programming commitments. What is more, the need to fund this content acquisition program will be from a diminishing revenue stream as the advertising dollar, or the public purse, is stretched even further across all competing media. Traditional production methods may well be simply too expensive for most productions.

At the upper end of the multimedia pyramid is the motion picture industry, and although it might seem that this multimillion-dollar market is no place for one-man bands and cottage industries, the reverse is often the case. Many of the largest Hollywood blockbusters rely on the skills of hundreds of small subcontractors, working behind the scenes on desktop computers, producing special effects, set designs and computer animations sequences. In addition to this, the motion picture industry is undergoing arguably the most significant technological changes since the introduction of sound in the late 1920's. Digital Film (high definition video) is rapidly replacing 35mm motion picture equipment not only on location but also for distribution and screening. The cost savings and speed of production has helped convince leading industry producers, such as George Lucas, to shoot major motion pictures like Star Wars Episode II, entirely on digital film. It would seem inevitable that 35mm film will be replaced by video in cinema release films just as 16mm film has all but vanished as a production medium for broadcast television.

Hollywood may still be a far cry from most multimedia productions, but if recent history has anything to teach us, it is that this year's cutting edge technology is tomorrow's main stream. So to ignore the technology which is evolving in motion pictures, or broadcast television, is to ignore the technology which will be in common use by tomorrow's mainstream multimedia producers.

On-Line vs Off-Line
Multimedia falls into two distinct categories:

1. On-line delivery means delivery via a network which can include cable, terrestrial broadcasting, satellite transmission and wireless communication.

2. Off-Line is a delivery system not connected to a physical network or broadcasting medium and would include such systems as CD, CD-ROM, DVD, video cassette and even Motion Picture Film.

Although the production techniques used in both on-line and off-line content may be identical in some cases, the media, technology and end-use applications are often vastly different. And because much of the more recently evolved streams of the multimedia industry is so new and revolutionary, the market is still relatively immature. Many people, especially those over thirty, have never used an interactive CD-ROM, played a computer game or even surfed the Internet. But even *their* lives will be changed by the revolution in multimedia which is unfolding, and most of that change will be via on-line services.

Interactive vs Non-Interactive
There is no disputing that the big push in multimedia is in the area of Interactive communication. The Internet, which is inherently interactive, has gone from being an addictive pastime of computer geeks, to a legitimate business, research, and entertainment medium, in a very few years. Interactive TV, on the other hand, has proved to be somewhat less successful in those few markets where it has been trialed. This is in part due to the fact that television audiences are a mature market who for the most part want to be entertained in a passive and therefore non-interactive way. Many DVD movies contain interactive extras, shoe-horned onto the disc, simply because the industry has the technology to do this. There has been very little market research conducted to indicate whether the extra work involved in adding sometimes superfluous interactive material on DVDs has any effect on sales or market potential.

Hopefully, as these technologies mature, we will see the use of these new features evolve to take full advantage of their potential. The use of interactivity when it is appropriate is a very valuable asset. Being forced to use interactivity, simply because the technology exists, may backfire and may well engender the disapproval of a discerning and increasingly sophisticated audience.

Storage
The main storage media used for base level multimedia production is magnetic, usually in the form of hard drives, but with optical discs for backup. Distribution tends to be via CD or DVD. Higher up the multimedia ladder, film is still used for some production, although more and more of the intermediate post production steps are being handled by magnetic media in the form of digital data. However magnetic media has three distinct disadvantages:

1. It is not capable of extremely dense data capacity.

2. It is not capable of extremely fast duplication or transfer.

3. It is prone to damage and desensitising from a variety of causes.

For these reasons the market is constantly on the prowl for the ideal storage medium. In the short to medium term this appears to be satisfied by optical technology. CDs, DVDs and other high-capacity optical media solve all three criteria, at least for backup and distribution purposes. For short term storage, magnetic media still has the edge over optical systems, at least for the time being. Fast access time still tips the scales in favour of magnetic media for hard drives and non-permanent removable media.

Whatever the future holds in terms of storage technology, if technology increases at the current rate of development, it has been estimated that the average consumer may have the multimedia storage capacity equivalent to 14,000 hours of viewing time by 2010.

Bandwidth
Hand-in-hand with storage capacity is the bandwidth capability of multimedia systems. Bandwidth refers to the data carrying capacity of a media network, computer system or transmission frequency. The predicted explosion in available bandwidth over the coming years is what has led industry analysts to predict the evolution of the Internet into the Information Super Highway. Although technology now exists to webcast video and even HDTV over the Internet using TV-on Internet protocols, the technology is very much in its infancy. The uses of dense fibre-optic distribution networks offer the best potential for seemingly unlimited bandwidth for on-line datacasting and communications. Competing technologies include satellite transmission and wireless application Protocols (WAP) but none of these systems appear to have the sheer capacity and bandwidth which optical systems promise.

Convergence
Convergence is a buzzword which has permeated the broadcast and multimedia industries over recent years. Its most widely used context refers to the trend towards a merging of broadcasting and telecommunications industries. More specifically it relates to the use of broadband technologies, and the use of the Internet as a viable broadcast medium, to challenge conventional broadcast markets.

At present, most of the world which is fortunate to be connected to the Internet, does so from very slow dial-up connections, which places severe limitations on the type and content of web based material which can be effectively utilised. This “Digital Divide” means technology-rich countries, such as the United States, enjoy the benefits of ultra-fast data transfer for nominal cost whilst poorer countries can provide only modest communication systems at costs which are prohibitively expensive for most of their populations. Even comparatively affluent countries like Australia are slipping behind many North American, European and some Asian countries in the field of high speed data connection, due in part to the sparse population and the huge distances involved. Satellite coverage, for example, makes a lot of sense for a small country where a small “footprint” means that relatively small dish antennae are required. In a large country like Australia the satellite footprint needs to be so huge that the size of dishes required to receive the dissipated signal, makes it prohibitively expensive for most potential customers. The same is true of cable distribution. Australia has a population approximately one third of either the UK or Japan spread over a continent the size of the continental United States. This makes the economics of installing high-speed cable to every home and business much more expensive, per customer, than in more densely populated countries.

Never the less, high speed data communication systems will be installed wherever the demand exists despite short term delays which may be caused by financial constraints and government inaction. The very future of commerce and communication depends on it. Like it or not we are now living in the Information age, and information in the twenty-first century means high-speed communication – full stop.

Baseband vs Broadband
The term broadband refers to the transmission of multiple signals simultaneously over a given network or transmission. It is typically used by broadcast media such as satellite broadcasters, Digital Subscriber Lines (DSL), and cable television networks. Baseband on the other hand can transmit only one signal at a time. Typical baseband services include LANs (Local Area Networks). Broadband transmissions typically transmit at much higher speed than baseband systems in order to achieve the higher data transfer rate required.

Transfer Rate
The speed at which a transmission medium carries data is called the transfer rate and is usually measured in bits per second (bps) although current technology often requires transfer rates of millions of bits per second (Mbps) or even billions of bits per second (Gbps). The ability of various media to carry specific transfer rates is an inherent quality of the medium. For example the transfer rate potential of a twisted pair telephone line is only a fraction of that which could be achieved on a coaxial cable and even that is far less than the ability of a fibre-optic network to convey data.

The types of cable networks include:

<u>Twisted-pair cable</u>
Normal telephone lines are usually made up of twisted pair copper wires. Sometimes called POTS (Acronym for Plain Old Telephone System) the telephone network used for telephony worldwide (PSTN – Public

Switched Telephone Network) relies heavily on twisted pair cable for much of its voice and data traffic. Twisted pair is capable of transmitting higher volume data protocols such as ISDN (Integrated Services Digital Networks) at data rates of up to 128Kbps or even ADSL (Asymmetric Digital Subscriber Line) which can accommodate rates of up to 8.45Mbps.

Coaxial cable
Often used for Local Area Networks (LANs), coaxial cable is capable of high-bandwidth and is much more expensive than twisted pair wiring. It is therefore used for high-bandwidth broadband systems and fast baseband systems such as Ethernet and even cable TV distribution.

Fibre-optic cable
Fibre optics enable very fast data networking with transfer speeds of up to 100Mbps but because of their complexity and high cost are usually limited to high-end communication backbones.

The types of wireless networks include:

Broadcast radio
The term broadcast radio refers to “radio frequency transmission” and is thus somewhat confusing in that it includes terrestrial television broadcasting. It includes both analog and digital transmission.

Cellular radio
The obvious example being mobile phone “cellular” networks. It includes both analog and digital transmission although analog cell phone networks are being steadily replaced around the world due to the increased carrying capacity of digital transmission.

Microwave
Microwave transmission is usually limited to line-of-sight and satellite telecommunication networks. Because microwave transmissions can be harmful to human health they tend to be limited to extremely low power or fixed positions on the tops of buildings or communications towers.

Satellite
Satellites are used for both telecommunications and narrowcast transmission direct to subscriber. It has some limitations in that geostationary satellites need to be positioned a very long way out in space (approximately 22,000 miles) in what is called a geosynchronous orbit. This is one where the orbit of the satellite matches the rotational speed of the earth so that its position in space in relation to the earth remains constant. Naturally the power of the transmitted signals are very feint indeed and are therefore subject to interference due to weather conditions and solar activity.

Infrared
This is a communication medium with a very short effective range. Because it is effectively a line-of-sight transmission, it is really only suitable for communications between computers and Personal Digital Assistants (PDAs) across a room.

Video-on-Demand (VOD)
As its name implies Video-on-Demand or VOD is a system where a subscriber can choose what video (or multimedia) material is to be viewed or accessed and when. There are a number of competing models in this category. One has programs (typically recent release movies) screened at regular intervals allowing the viewer to commence watching at a convenient time. This has limited appeal to many viewers who like the flexibility of renting a video or DVD and replaying it at will.

Another more recent development allows a subscriber to remotely commence replay or download to a personal digital recorder for replay as required. However bandwidth limitations, copyright and security issues plague the potential for widespread adoption of this technology in the short term.

Asynchronous vs Synchronous Transmission Modes
Asynchronous Transmission is a method of data transmission where the data stream is not synchronised by reference to a clock or timing signal. Instead data is sent in small packets of bits, sent one after the other in a

continuous stream, but with a start and a stop bit to mark the beginning and end of each data unit. Modem connections over telephone lines are a good example of asynchronous data transmission. Synchronous transmission, on the other hand, locks the transmission of data to a clock or timing device so that communication is synchronised.

Transmission direction
There are three basic types of data communication, which are based on the direction of travel of data along a given network or media system:

1. Simplex transmission: Is a system in which data travels in one direction. Conventional analog radio and television are examples of simplex transmission.

2. Half-duplex transmission: Is a system in which data can travel in either direction but in only one direction at a time. Two-way radio transmission is a good example of such a system.

3. Full-duplex transmission: Is a system in which data can travel in both directions simultaneously. A telephone line or a Local Area Network (LAN) are both examples of Full-duplex transmission.

Future Trends
Predicting the future of any technology is fraught with danger. Predicting the future of multimedia technology is even more risky. The changes, which have occurred over the last decade alone, give a clue to the potential changes as new systems are released, mature and in some cases vanish without trace. The rate of change is the key. At no point in history has the rate of change in technology been more pronounced than at present. And all indications are that the rate of change is increasing at an alarming rate. On the positive side this means we are in for an exciting ride. The down side is that the premature obsolescence of existing technology becomes a daily event. Expensive installations become legacy technology, and from a financial perspective, high capital investment in yesterday's technology becomes a millstone around the neck of multimedia production companies.

A classic case in point is the large number of Hollywood special effects companies and Post-Production houses which have gone bankrupt in recent years. It appears that the main common denominator in all of these failures, has been the high cost of equipment and software purchased in recent years based on estimated returns on capital investment. As the technology rapidly advanced the installed systems became obsolete almost overnight, and the cost of equivalent next generation technology dropped dramatically. This meant highly skilled staff could resign from debt-burdened bureaus and form start-up companies with greatly reduced overheads, cutting edge equipment and no legacy infrastructure to slow down the work-flow. The existing companies then faced a double edged sword: They had to compete with lean and mean competition staffed with the best people, (who often they had trained,) who could now undercut them on price and in many cases offer superior services to their former customers.

The story doesn't end there. With the incessant march of technology advancement, third generation start-up companies equipped with even faster desktop computing power, are now challenging the marketplace especially at the lower end of the multimedia industry. Clearly there must be a limit to this phenomenon but predicting where it will end is a difficult task.

Strategies for coping with rapid technological change are many and varied and achieve differing degrees of success. The first rule is not to over capitalise. Cutting edge equipment comes at a premium price. Often second order systems will achieve comparable results at a fraction of the cost. Leasing equipment makes financial sense as long as the buy-out residual is less than the market price at that point in time. However this is rarely the case with computer and multimedia equipment. Renting or leasing arrangements with minimal residual may be a smarter alternative. This requires the equipment to be written down in a shorter period of time, which imposes critical cash-flow constraints on the incumbent companies.

Many companies now choose to hire staff on contract who can provide their own computer equipment. This has the twofold benefit of lowering capital cost (which must be amortised over several years) and providing flexibility with staffing in times of fluctuating workloads. When times get hard, unproductive staff and their

technology become redundant. This naturally comes at a price in both human resources “goodwill” and the fact that younger “rising stars” may not have the financial capital to commit to such arrangements. Freelance operators now make up a growing sector of the multimedia workforce and this has the added benefit of reducing the workplace overheads of small companies, as more and more contractors opt to work from home or on the move.

Whatever technological changes take place, and no matter what exciting new opportunities present themselves, one thing is certain; viable business models must be developed to make the new industries economically sound. There has been a headlong rush to embrace new technologies in the wider multimedia field and some spectacular failures have resulted. The sale of new 3G (third generation mobile phone network) frequency spectrums, to enable telecommunications companies to capitalise on new technologies, is a case in point. Some major players have paid enormous sums of money to secure bandwidth only to discover that consumers were not prepared to pay the asking price for technology they either didn’t understand or felt they didn’t need. The fallout from these high profile “tech-wrecks” have sent shudders throughout the entire telecommunications and broadcasting industries and players are tending to down-grade potential revenue streams from a whole range of new media business models.

However currently existing industries with long established economic credentials can not afford to be complacent. The broadcast and telecommunications landscape is changing irrevocably and at a rapid pace. The cash-cow industries such as Free-to-Air (FTA) commercial television are facing a bleak future with the high cost of conversion to digital (for both Standard Definition and High Definition TV (SD & HDTV), as well as dwindling income from advertising revenue due to the growth of alternative media. Time-shift viewing by FTA viewers and even electronics which allow television commercial breaks to be skipped when recording, will be further enhanced with the next generation of Personal Digital Recorders (PDRs) or Personal Video Recorders (PVRs). Some industry analysts estimate that as much as 88% of advertising material goes unwatched in some markets where such technology allows advertisements to be skipped.

Of similar concern is the potential for widespread piracy of copyright material such as recorded music and motion pictures. US regulators have successfully closed down the Napster peer-to-peer MP3 search and download system, only to have it replaced by dozens of competing Napster look-a-likes. Since the closure of Napster, the amount of net traffic in the form of peer-to-peer file transfer, has increased threefold, (according to some analysts,) which is of immense concern to the music industry, which is effectively facing extinction if unrestrained piracy is allowed to continue. The movie industry is just as concerned at the prospect of high-speed data transmission combined with high-capacity digital storage. The reason is the risk of royalty revenues dwindling as customers turn their backs on traditional distribution channels in favour of peer-to-peer piracy of current release movies, (sometimes before they are even released at the cinemas).

There are no simple solutions to these problems, but a combination of sophisticated encryption technology, Internet surveillance and strictly enforced copyright legislation on an international level, will be required if the problems of content piracy is not allowed to cripple the entertainment industry.

Conclusion

Multimedia technology is still very much in its infancy. But it is undergoing immense expansion on all fronts. In some respects it is unfair to lump so many disparate technologies under such a single umbrella. The concept of Convergence is somewhat misleading and many would argue that far from the industry seeing a convergence of multimedia technologies we are in fact witnessing a spectacular divergence of differing media options. For example where we once had only terrestrial broadcast analog television, we now have terrestrial and satellite broadcast, narrowcast and webcast, analog and digital, Standard Definition and High Definition television. Not to mention distribution via videocassette, DVD, VCD, and VOD. To describe this explosion of viewing options as anything but divergence seems a conflict of terminology.

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