

# **Multimedia: Trends and Prospects**

Background Briefing Paper  
of the

Telecommunications  
InfoTechnology Forum  
(Please attribute any quotation)

The Mandarin Oriental Hotel  
Hong Kong  
30th September 1996

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## 1. Multimedia

Multimedia is about the handling of information in multiple means (media). Apart from text, information can be represented or “coded” as graphics, image (such as still picture), sound (voice, music) and video (moving picture). Multimedia enables richer and arguably better presentation of information. Current technologies only exploit our visual and hearing senses and in the future information we might be able to “touch” or “smell” information.

Multimedia posts a new set of challenges as compared to the traditional text-based technology. For example, a book is arranged in a “linear” fashion in which the author needs to design the flow and link ideas chapter by chapter. Paths can be devised so that different readers can proceed in different ways. Authoring multimedia information requires fundamentally different skills. Apart from writing skills, we need artistic ways to present information and other means of delivering information.

Multimedia presents new technical challenges to capture, code, edit, store, search, retrieve, transfer, distribute, present and access information. These challenges are tackled (and created) by advances in technologies.

## 2. Applications

Multimedia applications cover a wide range of possibilities:

- Cooperative work environment: Desktop video conferencing, shared workspace, multimedia messaging
- Video-On-Demand (VOD): Movies, time shifting, pay-per-view, karaoke
- Video Games: Software downloads, multiplayer games, betting/gambling
- Interactive Viewing: Replays, camera angles, play-along TV
- Sports: Game shows, polling
- Advertising: Coupons, interactive Infomercials
- Transactions: Home shopping, banking, finance
- Electronic Information Services: Internet / World Wide Web, news, sports, weather, medical advice, travel schedules, local information, restaurant guides
- Telephony: Video phones, plain old telephone service (POTS)
- Publication and authoring: Hypertext/hypermedia textbooks, magazines, documentaries, encyclopedias and atlases
- Education: Interactive learning, interactive distance learning
- Medical Operation: Remote operation, patient medical information/history

A generic way to segment the market is to classify the target users into residential and commercial sectors. The end deliverables can also be divided into standalone products which are distributed using traditional physical channels, or “online” products which need to be accessed through a telecommunications infrastructure.

Standalone products could be in the form of CDROM, CDI, VCD, DVD and so on. Multimedia technology makes it possible to put lots of information on a piece of plastic disc. Individual users can make use of their personal computers, preferably with multimedia capability, to access and use information in a way which can hardly be possible with traditional hardcopy books and text-based applications.

Another means is to connect users to servers or gateways through a telecommunication network. The network could be of narrowband, wideband or broadband in nature. A good example is Internet access through voice grade phone lines. In addition, we should not forget the alternative means of wireless communication, cable television network and the use of satellite.

A more aggressive and visionary approach is to offer residential broadband services. For example, video-on-demand was once thought of as a killer application in the mass market. System operators have been conducting technical and market trials to assess its technical feasibility and market acceptance. The general consensus is that VOD should be one of the first applications but by itself VOD does not justify the investment in the infrastructure.

### 3. Value Chain

The multimedia value chain can be divided into the following components:

Content		Distribution			User Environment	
Content creators	Packagers	Traditional distribution and...	Digital networks	Gateway	On-premises distribution	Devices
Game software	Print media / publishers	Local / inter-exchange	Local telephone companies		Local area networks	Computers Software
Movie / TV studios	Computer information services	Telephone companies	Inter-exchange carriers		Telephone wiring	Consumer electronics
Print media / publishers	Home shopping	Print media	Cable television systems		Electrical wiring	Game players
Recorder music	Ad agencies	Broadcast TV stations	Cellular / wireless carriers			Set-top boxes
Retail / mail order	Cable / broadcast networks	Movie theaters	Satellite carriers			
Retail financial services	Healthcare	Video stores				

**Table 1 Multimedia Value Chain<sup>1</sup>**

Content is ultimately the end product that a user needs and is willing to pay for. A content creator uses the knowledge, creativity and brand awareness to produce valuable content. A content packager selects programming from various content creators to make available an assortment of deliverables that its target users collectively will want to buy. For example, a cable TV operator acquires movies from different producers to ensure that the subscribers will be welcomed.

Distribution can be through traditional distribution channels or new digital networks. A cartoon can be shown in a theater or can be made accessible through an online access. In the context of equal access, a gateway operator connects subscribers to various service providers. Examples include online service providers (America Online, CompuServe, Prodigy, Microsoft Network etc.), Internet service providers and Level 1/Level 2 gateways in the video dial-tone (VDT) context.

An information appliance accesses the multimedia content, applications and services on a standalone basis or through a communication network. Such a device could be a highly flexible, powerful and thus costly personal computer or a cheaper set-top box.

#### **4. Communication**

While multimedia brings along interesting and valuable applications to us, its influence is further strengthened by connecting people together. In a standalone fashion, a user can receive information or interact with a multimedia application. In a networked mode, multimedia enables people to communicate more effectively and efficiently. For example, electronic mail facilitates the exchange of information in an almost seamless manner. Its multimedia extension introduces the possibility of voice message, graphics, video and multimedia data. Apart from store-and-forward applications, interactive services promise the future availability of home entertainment, electronic shopping, banking services and advanced conferencing services. All these require an advanced information infrastructure, at national, regional and global levels.

The network infrastructure can generally be divided into a core network and an access network. Given the high bandwidth requirements of multimedia communication, a fixed network will be more appropriate than a wireless one. The core network is likely to be a broadband switched network with the capability to carry voice, data and multimedia traffic. Asynchronous Transfer Mode (ATM) is a candidate to establish the core network given its potentially huge capacity and functional characteristics (such as quality of service).

The access network refers to the “last mile” to the users. Recently the focus has been put on fiber-to-the-building (FTTB), hybrid fiber coax (HFC) and asynchronous digital subscriber line (ADSL), though in the near term, ISDN may be a candidate if the price is low enough to attract broad interests. Unless a new firm wants to build a new infrastructure, existing telephone and cable television operators have the advantage of owning a network. Their existing businesses also establish core competence necessary for running a large scale multimedia business.

A telephone operator runs two-way voice and data communication services. The telephone business reaches a large number of subscribers and if properly run, there is a strong brand recognition. The support organization also has the experience to support many subscribers. Other important advantages are the availability of a core fiber network (assuming the operator is well established) and an access network. As a result, the existing infrastructure (physical and organizational) can be upgraded to support new business initiatives and at the same time an integrated assortment of services can be offered to the subscribers (both residential and commercial). FTTB and ADSL are the natural candidates for telephone operators.

For a cable television operator, the cable plant offers huge pipes to home (a “500-channel” world). A core fiber network, if it exists, together with a cable access network makes multimedia applications possible, which could include digital video broadcast, entertainment and information services. Cable modem has been a hot topic of discussion recently and one of the applications is access to the Internet. In terms of a business environment, cable operators are stronger on the content side as they have close links to content providers and packagers and at the same time they usually produce their own programming.

The convergence of technology has blurred the boundary of information technology, telecommunications and media industries. De-regulation of markets increases competition in existing industries. Firms are planning to expand their business operations to opt for additional revenue streams. Aggressive diversification is probably a good defensive strategy. As a result, we find telephone companies moving towards the entertainment, information and transactional businesses, while cable operators are talking about the integration of voice, data and video services using their cable networks. Although it is premature to conclude who the winner (if any) will be or what the business model should look like, the provisioning of interactive services in these industries will be major drivers for investment and technological progression.

## 5. Experience

To achieve the future goal of wide penetration of broadband and interactive services, the communication technologies should drive the price low and at the same time there should be a big enough mass of subscribers to fund the huge investment. The other side of the formula is the demand of the potential subscribers. A good indicator for future

**Table 2 Typical Willingness-to-Pay Numbers<sup>2</sup>**

<b>Service</b>	<b>Payment Method</b>	<b>Range</b>
Broadcast television	Per month	\$4-\$7
Distance learning	Per hour session or class	\$1-\$2
Distance learning - high-end seminar	Per seminar (4-8 hours)	\$50-\$200
Interactive TV session	Per 2-hour session	\$1-\$2
Movie on demand	Per movie	\$3 (older movie) to \$9 (newer movie)
Special events	Per event	\$15-\$35
Telecommuting services	Per day	\$3-\$10
Teleshopping	Per shopping event	\$1 or 1 percent of bill, whichever is smaller
Video games	Per 2-hour session	\$2
Videoconferencing	Per hour	\$10 local, \$50 long distance
Videomail	Per 2-minute video message	\$2-\$6

reference is information based on current usage pattern. Table 2 shows typical willingness-to-pay numbers for America. Of course, we need to be careful about the use of these figures since they will vary from one community to another, but yet these numbers if available will be helpful in completing the business model.

**Table 3 Some Interactive-TV Trials Planned to Start 1996<sup>3</sup>**

Location	Company	When begun	No. of customers	Current services	Network type	Server makers	Set-top unit makers
Tampa Bay, Fla.	GTE	Spring, 1996	N.A.	N.A.	Hybrid (fiber-node-coax-home)	N.A.	General Instrument
Europe: 1.Milan 2.Munich 3.Mons, Belgium 4.Cambridge, UK 5.Reykjavik, Iceland 6.Basel, Switzerland 7.Aveiro, Portugal	Amuse (Advanced Multimedia Services for Residential Users): European Commission; consortium of major European telecom companies; major European universities and research centers	4/96 (Munich) 7/96 (Milan) and rolled out to other sites	10-20 homes per site, rising to 100 per site	Video on demand Audio on demand Home banking Home shopping Travel services Networked games	1.ADSL/OPAL 2.Cable 3.Cable 4.Fiber to curb 5.Fiber to box 6.Cable 7.Access to Milan via Pan-European ATM network	ICL (Cambridge); Siemens Nixdorf (all others except Aveiro - not available)	OnLine Media (all others except Aveiro - not available)
Tokyo, Japan (suburb)	Nippon Telegraph & Telephone and Microsoft	2nd Quarter, '96 thru 1st Quarter, '97	N.A.	Video on demand Home shopping News on demand Karaoke on demand	Fiber to curb	NEC	NEC
Thousand Oaks, Calif.	GTE	Summer, 1996 (commercial)	N.A.	Home shopping Home banking Digital music Games	Hybrid (fiber-node-coax-home)	N.A.	General Instrument
Sydney, Australia	Interactive TV Australia	10/96	N.A.	Printed information and coupons Play along game shows	Signals embedded in standard TV programming, phone return	N.A.	Interactive Systems

Notes: (a) Dates refer to start of trial, unless commercial service is indicated. (b) Data on European Commission Trial from Interactive Video News, Feb. 5, 1996.

In order to verify the feasibility of technical options and the viability of the new business, there are many trials being conducted over the world. Table 3 and Table 4 illustrate some ongoing and new trials on interactive television. The infrastructure for interactive television when established will not only be used for obvious applications like video-on-demand but in fact, the capacity of the telecommunication network will also make many other multimedia applications possible. There are plenty of questions? What services should a service provider offer? What technologies should be chosen? When should a firm invest and start a new business to gain early entry versus potential obsolesce of technologies? Are standards available and will the market accept them, or do we go ahead with proprietary solution?

**Table 4 Some Ongoing Interactive-TV Trials**

Location	Company	When begun	No. of customers	Current services	Network type	Server makers	Set-top unit makers
Orlando, Fla.	Time Warner	12/94	4000	Video on demand Home shopping Games	Hybrid (optical fiber-node-coaxial cable-home)	Silicon Graphics Inc. (SGI)	Scientific Atlanta with SGI subsystem
Germany: 1.Berlin 2.Stuttgart 3.Hamburg 4.Cologne Bonn 5.Nuremberg	Deutsche Telekom	1/95 (to end in '98)	2950	Video on demand News on demand Home shopping	Fiber to home or to curb, then coax to home; return route in some cities is phone or ADSL	1.SEL-Alcatel 2.HP 3.Philips 4.DEC 5.n-CUBE, Sequent (hardware); Oracle (software)	1.SEL-Alcatel 2.SEL-Alcatel 3.Philips 4.Nokia 5.Apple
Colchester and Ipswich, England	British Telecom	6/95 (pilot began in mid-'94)	2500	Video on demand Home shopping Home banking Community information Music Games	Fiber to home or curb for 10% of homes; ADSL over twisted pair for 90%	n-CUBE, Sequent Computer Systems, Oracle Systems	Apple Computer
Fairfax County, Va.	Bell Atlantic (Dover, N.J.)	5/95 (commercial service)	1000	Video on demand	ADSL	n-CUBE	Stellar One
Redmond, Wash.	TeleCommunciations Inc. (TCI) and Microsoft	3/95	100	Video on demand	Hybrid (fiber-node-coax-home)	Compaq Computer	Compaq Computer
Cambridge, England	OnLine Media, ICL, SJ Research, and Cambridge Cable & Advanced Telecommunciations Modules	3/95	100	Video on demand Home banking Music News	Fiber to curb, then coax to home	ICL	OnLine Media
Omaha	US West	8/95, to end in 8/96	80	Video on demand TV listings	Hybrid (fiber-node-coax-home)	Digital Equipment Corp. (DEC)	Scientific Atlanta using 3DO graphics chip
San Jose, Calif.	Pacific Telesis	12/95	1	Video on demand TV listings	Hybrid (fiber-node-coax-home)	Hewlett Packard (HP)	Scientific Atlanta
<b>Without full video on demand</b>							
Canada and UK	Videoway	1980 (commercial service)	213000-Quebec 24000-Alberta 99000-UK	Information services Polling Change camera angles Games	Coax	N.A.	Videoway
Boston	GTE and Continental Gablevision	1993	1883	Home shopping News Play-along game shows Games	Coax with phone return	Macintosh and Unix computers	GTE
Carlsbad, Calif.	GTE Main Street and Daniels Cablevision	1994	625	Home shopping News Play-along game shows Study at home Games	Coax with phone return	Macintosh and Unix computers	GTE
Toms River, N.J.	Bell Atlantic	1/96	500	Interactive text (e.g., request recipe) Impulse purchase of	Fiber to curb, then twisted pair to home	N.A. (video providers reserve space)	Philips and DiviCom

Location	Company	When begun	No. of customers	Current services	Network type	Server makers	Set-top unit makers
				premium services		on network)	

Notes: (a) Start dates refer to start of trial, unless commercial service is indicated. (b) Number of customers currently hooked up. Some of the experiments run in conjunction with far larger tests of traditional programming over the new network.

In Hong Kong, the availability of clone computers and cheap peripheral supplies together with the awareness of computer technology have increased the demand and penetration of personal computers. Multimedia PC is more or less a standard when acquiring new systems for home use the takeup rate will probably be lower for general office use. The demand for CDROM products has also increased due to the widespread use of CDROM drives. Another trend is the growing volume of VCD titles in the market, which are available in almost any computer-related retail stores and in many records shops. This trend is repeated in the area of turning old content into digital products. These range from music CD, VCD to the scanning of old documents, paintings and archives. The business potential is huge for turning existing content into digital media which may then be processed as multimedia information.

In terms of interactive applications, we could hardly pass a day without talking or reading about the Internet.. The decreasing costs of computers and communication, partly due to fierce competition, and increasing awareness of the Internet have induced more popular use of the Internet, both for business and personal use. World Wide Web and its browsers plus flexible extensions are good showcase for building multimedia applications using the global network. Though today the access is limited by the capacity (in fact, the relatively high costs) of the access network, it is expected that these constraints will be removed over time, such as by the use of advanced modulation technology, the gradual upgrade of the information infrastructure and the brave new world of open competition.

### Other Issues

The future use of multimedia technologies and applications will be positive but we still need to tackle a number of issues:

- Information in a digital form can be easily copied with quality identical to its original form. Does this risk and promote pirate use of multimedia information?
- How do we manage the intellectual properties of multimedia content? Who owns a series of bits representing part of a music title? Does a person own his/her digitized appearance? Who owns a scanned image of an archive?
- Do we have the right skills to meet the future challenge of multimedia content creation? Can we turn to a traditional programmer to develop multimedia applications? Do we just leave this to the invisible hand of market?
- Will culture and local language be barrier or opportunity to content creators and technology providers? Will it create more and smaller markets or will the demand be skewed towards a common set of killer applications or products? Does localization form a burden or competitive edge?
- In the networked world, do we need a global clearing system to promote the sales of multimedia content? How do we architect a positive feedback loop to ask more people to contribute their work and at the same time award them their fair share of economic return? Should this be a global matter, a regional matter, or just a national issue?

- Does the information infrastructure meet our increasing demand on bandwidth, again at global and national levels? Does a nation gain competitive advantage by having cheaper and bigger pipes to home, and to the outside world?

## **Endnotes**

<sup>1</sup> Adapted from Hagel and Eisenmann 1994 p.40

<sup>2</sup> From D. Minoli *Video diatone technology*, McGraw-Hill 1996, p.5. The context is U.S. and the amount is in USD.

<sup>3</sup> Table 3 and Table 4 are extracted from T.S. Perry, "The trials and travails of interactive TV" appearing in *IEEE Spectrum*, April 1996.