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1995

Rukmin W. (1995). The convergence of broadcasting and new communication technologies and interactive communication technologies. In AMIC Update on communication technology: a user-friendly guide to the new communication technologies, Singapore, November 24-25, 1995. Singapore: Asian Media Information and Communication Centre.

https://hdl.handle.net/10356/86723

The Convergence Of Broadcasting & New Communication Technologies And Interactive Communication Technologies

By

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Introduction

It is estimated that the multimedia related market in Japan will peak US$ 950 bn by the year 2010. This technology will penetrate almost every sphere of human activity. Multimedia will bring forth new businesses and the Japanese experts estimate the creation of 2.4 million employment opportunities in Japan due to these multimedia related businesses.

Before we look at the effects of the digital revolution and convergence, we should see how information is distributed and processed in the present times. It is only then that we would be able to appreciate the influence of the new technology.

As you know, we have in our homes a television (or may be several), a number of radios, a telephone and may be a computer. These are our sources of information. We also go and purchase several newspapers and magazines each day to satisfy our thirst for knowledge and information. We will spend a considerable amount of time selecting the information we need before we are able to study or read it. It is because all kinds of information are bundled into the packages that bring the information to us. These packages may be books, radio or TV programmes, etc.

We are becoming increasingly information dependent and our jobs information based. We are becoming knowledge workers. Therefore we must be able to select the kind of information we need very quickly and the systems that are evolving must provide a means of filtering the wanted information from the unwanted.

Digitalisation

* The analogue situation

We have so far been living in an analogue world, meaning, that all the television, radio and to some extent the telephone signals are conveyed as continuous waveforms. This has been satisfactory up to now, but with increasing demand for more and better quality programmes, exchange of information, interactivity, etc., this analogue system is proving itself incapable of handling such large volumes in the available capacities of the transmission media such as the airways, cables and the satellites. To give a perspective of this limitation, the VHF band III allocated for television can contain only 5 channels and the UHF bands IV and V, only 40. The demands are now in 100s of channels in addition to other data channels such as for computer applications. Obviously, this capacity is not enough. The situation becomes worse when one considers the HDTV or Enhanced TV the capacity required is even larger.

Another disadvantage of analogue systems is that they are subject to effects of man made noise, interference, etc., which tend to distort the signal. These problems manifest in the programme production process as well as in the transmission and reception processes.
Digitalisation provides some answers to these problems.

*** Advantages of digitalisation**

Digitalisation means taking samples of the analogue signals, measuring signal levels of these samples and representing these values in a binary form. This means that the values are given in 1s and 0s. The advantage of such a representation is that it is easier to detect in the midst of all kinds of artifacts and interferences. Therefore a digital signal is considerably more robust. New transmission techniques are also being introduced to enhance the advantages of the digital system.

However, the digitalisation does not, as it stands, provide any solution towards increasing the transmission capacities of the media. The signals are now in large quantities of 1s and 0s, called bits, which occupy portions of the frequency spectrum similar to the analogue versions. New techniques are required to reduce the number of bits so that less spectrum capacity is necessary.

*** Compression**

Digital compression is one of the 'buzz' words of the present times. It may therefore be appropriate to explain briefly what it means in a layperson's language. The process of reducing the number of bits required to transmit a video or audio signal is called Compression. This reduction is achieved using three methods, for video signals.

*** Video compression**

A picture is made up of a collection of tiny picture elements. Some of which change if they are in a moving part of the picture, whilst others remain static over the sequence of pictures. When this sequence of pictures is transmitted, the information of all the picture elements must be sent to be able to reconstruct the sequence accurately at the other end. This usually involves transfer the of a large quantity of data (which the transport medium may not be able to handle in real time).

If it is possible to reduce the quantity of data that must be sent, but still be able to reconstruct the picture sequences without any loss of picture quality, then video signals become transportable in real time. Data reduction (or compression, as it is called) may even make it possible to transmit more than one video signal simultaneously. This, obviously, constitutes an increase in efficiency and cost effectiveness.

As explained earlier, there are some picture elements that do not change during the sequence because they depict the stationary part of the scene. The information on these elements, therefore, need not be sent for each frame. Once sent it can be stored and reused for the subsequent frames. We need to send only the information on the moving parts of the scene. This would then form a method of data reduction or compression. The picture sequence can be reconstructed at the receiving end without any changes or losses.

Another method is to select very small details of the picture, which can be considered unnoticeable to the human eye and discard them. Only the picture elements constituting the significant parts of the picture are transmitted as data. The reconstructed picture sequence at the receiving end though still acceptable is not the same as the one transmitted. This is a lossy compression technique and uses a method called Discrete Cosine Transform to identify the elements to be transmitted.

(OHP - Motion compensation)

The third method deals with moving parts of the picture. Essentially, the technique involves dividing the picture into blocks of 16 x 16 pixels and computing the positions of each of these blocks with respect to the previous picture and transmitting motion vectors (or information on the new positions of the blocks), instead of data on all the picture elements. This method is called motion compensation.

(OHP - GOP)

Digital compression as defined by the MPEG-2 standard (named after the Motion Picture Experts Group) is a combination of these three methods, and the data are transmitted in groups of pictures containing the so-called Intra Pictures (which are independent of any past or future pictures), Predicted Pictures (which are predicted from the most recent I & P pictures) and Bi-directional Pictures (which are interpolated from the most recent or the nearest future I & P pictures). Data reduction rates in excess of 1/50 can be achieved with this technique.

*** Audio Compression**

In the case of audio compression, the technique used is that in the presence of louder audio signals, the softer sounds are inaudible and therefore need not be considered. This method affords a considerable reduction of audio data rate with very little subjective impairment to the final audio quality.

* **Enhanced capacity**

The reduction of data rate realised through these methods are such that the existing transmission media will now be capable of accommodating much more programmes than ever before. For example, the five channels in the VHF band III, will with these new methods be able to provide 3 standard quality programmes in each channel.

Digitalisation and compression are paving the way to transport all kinds of signals in a common media, since all analogue signals are converted to bits and it does not matter whether they are from video, audio, computer data or telephone signals. This is the essence of convergence, and one may call it Multimedia. Convergence also enables digital video and audio signals to be processed as computer data, which means that these signals can be stored on hard disks or optical disks; edited on standard computer platforms; even have images created as animation sequences or as scenery. Following are some examples of convergence as used in programme production.

New Production Tools

Programme Planning Aids

Production of high quality programmes requires extensive planning and considerable amount of time and effort have to be spent for this exercise. Significant savings could be made if some aspects of the planning process are computer assisted. Computer based virtual studio systems are being developed, which are capable of mixing live and synthesised images, in order to simulate programme scenes. The scenery sets are created by the computer and lighting of the set is simulated. The producer is able to see the effects of the scene he has created on a monitor and could change viewing angles using simulated camera movements. Set and scenery changes can be made so that several scenarios can be tried. The technology therefore, provides the producer a relatively quick method of experimenting with scenery sets, lighting, talent movements and camera movements without actually using up studio or talent time. When a satisfactory sequence is thus created, it can be shot under actual conditions with minimum expenditure of time and money. This technology is being developed by the NHK and is aptly called Desk Top Television Production (DTTP).

In some instances, the final film can be a combination of real and synthesised images processed by a computer system. A broadcast magazine recently described a promotional film produced in Hong Kong that won the Mercury Award. The film titled 'Flight Path to the Future' contained images of a present day airline morphing into a futuristic version and live action material mixed with the 3-D representation of a fictitious airport.

(OHP, DTTP)

Graphics & Animation Equipment

Digital Technology has probably made the biggest impact in this area. In animation, it is now possible not only to generate cells electronically (for cell animation), but facilities are also available for the graphic artists to generate 3-D start and end images and to define the trajectory of the image movements. The computer system will then generate all the intermediate frames required for the sequence. Top of the range models like the Silicon Graphics, Indigo family accomplishes this using several graphic engines. There are also lower cost systems. For example the Crystal software requires, only a fast PC with a graphic board and a sufficient hard disk memory. The software is capable of 2-D and 3-D graphics and animation as well as full control of professional vtr machines. In a 1 Gb of memory nearly 700 frames can be stored. With faster processors becoming available, like the Pentium, P-7, etc., the production of animation sequences will be accelerated considerably. The only bottleneck would be the recording media, as each frame must be recorded as it is generated and the tape machine must be cued for each frame. However, using a non-linear editing system, the generated frames can be immediately transferred to the digital store in a non-linear system for instant playback or transfer to tape as a composite sequence. The Animo from Cambridge Animation systems is a complete animation graphics station. The Animo enables animators to create, manipulate and view in motion, sequences of animation. The system stores libraries of lip movements, character movements (i.e., walking, running, etc.), facial expressions, etc., which can be added to any image under preparation. Lip synchronisation is also automated and follows a sound track. Once created, the entire sequence can be downloaded to a recording medium.

Non-linear Editing

The non-linear editing system introduces a new concept in video editing. It provides a film style of editing favoured by many editors and it is a considerably speedier process. With all sequences stored on hard disk, gone are the days when the editor needs to rewind and playback sequences. It now requires only to identify the start and the end frames, (addresses of which are stored as pointers), and the system will play the sequence instantly. Editing, therefore, is a mere task of identifying the start and end frames of the sequences and defining the order in which the sequences are to be played. As the computer will always use the original stored material, there is no generation loss. If modification to any portion of the edited sequence is required, it could be done quite simply by changing that particular part, unlike the traditional tape based editing, where all sequences downstream of the change have to be repeated. The economies that can be achieved due to time saving are significant.

(OHP, Non-linear Edit system)

The storage of video material depends on the extent of compression used. If only off-line editing is envisaged, then a higher compression ratio is selected allowing a longer duration to be stored. Editing facilities include video and audio dissolves and fades.

These digital production tools are being increasingly used as they offer cost savings by way of increased efficiency.

Transmission Systems

Digital technology has also effected the transmission side of broadcasting. Following is a description of how the new technology has revelutionised this area.

Currently broadcasting services reach the user via the following transmission technologies.

* **Terrestrial Broadcasting**
* **Cable Networks**
* **Satellite Broadcasting**
* **MMDS Systems**

*** Terrestrial Broadcasting**

The terrestrial broadcasting has been the traditional method. With digital and compression techniques it is becoming possible (as was shown earlier) to transmit more services. These services could include not only television or radio programmes but also various information services such as software, programme guides or any other information.

Digital terrestrial television broadcasting and terrestrial digital audio broadcasting systems are being developed currently and these technologies will be dealt with later.

There is a certain amount of research being carried out on various interactive systems for on air broadcasting. One theory is to use the receiving antenna to transmit the return signals to a local node where all the local return signals are multiplexed before being transmitted to the broadcaster. All receivers then should have address codes for identification so that individual requests may be accommodated.

Cable systems

The introduction of interactive programming will first be via cable systems. In fact, currently there are several trials being conducted in the US and in Europe. These cable systems are physically connected to the homes and therefore are relatively easily adapted for interactive programming. In the US several major film studios are negotiating alliances with cable and telephone companies for the introduction of cable based distribution systems for television, radio,

information, teleshopping and a host of other programmes. Microsoft, the company that introduced Windows for PCs, is actively pursuing this technology and wants to be the market leader in the production of the operating systems for such programmning. The company has recruited hundreds of software experts to develop systems for interactive programming. Bill Gates, the CEO of Microsoft, believes that the PC industry will be a key player in the development of the Global Information Infrastructure. It is commonly known as GII. He predicts that within five years, the functions of the telephone, cheque book, VCR, answering machine, telephone directory, fax machine, and the encyclopedia could all converge into a single device.

Al Gore, Vice President of USA, has coined another term for this concept, he calls it the Information Superhighway. I think, it is a very apt term. Imagine a communication system like a highway, in which all kinds of information, radio & TV programmes and computer data are traveling. Some of these may be tapped by users who are connected to it. They may even transmit some data themselves and this data too will travel on the same highway towards another user who has requested it. So on this highway there will be "bits" (because that is how data will be transmitted) traveling in both directions with various packets (of bits) carrying different types of information and having different destination addressees. The intention is for this highway to be a global highway enabling anybody anywhere in the globe to have access to it for specific individual needs. Bill Gates believes that all the services that were mentioned earlier would be available on this highway. His strategy now is to be able to control the user interface to the highway.

Broadcasters will be able to be some of the programme and information sources for this superhighway.

Currently, some broadcasters are experimenting on the use of "highways" to reach their listeners or to provide additional services. They are using the Intenet network. For example, the Canadian Broadcasting Corporation has some of its radio programmes now accessible through the Internet. This arrangement provides listeners around the world a rich variety of general interest programming available on demand. The listeners are not time bound, and can access the programme they like at their own convenience. Similarly, the VOA also has its programme details, audio reports in several languages and a daily digest of the most important interviews etc. available via the Internet.

The superhighway will have the capability to provide video, audio, and data services to users. It will be connected to various databases around the world, to programme sources, banks and shops. etc, virtually connecting everybody to everybody else.

British Telecom (BT) is investing £15 bn on a fibre-optic network, and is conducting trials with Oracle the software giant testing consumer interest on interactive services. The test involving 2500 homes, the UK, are provided with more than 100 hours of digital programmes to be chosen from a menu of options. The control box costs around £250. BT is also testing a new

transmission technique that enables the use of the plain copper twisted pair telephone cables to transmit video programmes to the home.

Satellite Systems

Satellites are making every corner of the world accessible and numerous broadcast services are being offered. Currently research is being conducted on satellite based digital television broadcasting and digital audio broadcasting. Compression techniques will allow 8 standard television programmes to be transmitted within a standard satellite transponder. Likewise, many digital audio channels can be broadcast via satellites.

The above mentioned Superhighway is also expected to be accessible via satellites.

In the Asia-Pacific region, it is estimated that by the year 2000, 79 commercial satellites capable of television delivery will have been launched.

(OHP, Satellites in Asia)

Microwave Multipoint Distribution Systems (MMDS)

MMDS services are relatively easy and inexpensive to establish. They are by their nature narrowcasting services ideal for serving niche market demands. They are essentially PAY TV services and therefore are encrypted. The consumer needs a microwave antenna, a down converter and a decoder to translate the encrypted microwave signal to a TV signal that could be displayed on a conventional TV set. Thailand has introduced such a system and Australia may start soon.

Convergence in Transmission

*** Multiprogramming**

We talked of the increase of TV and radio programmes that would be made available to the user, thanks to video compression and sophisticated modulation techniques. The increase will be in the order of hundreds of new channels and each of these channels will need programmes to fill these channels. This situation will spawn a host of television and radio production services. There would be specialised channels transmitting only a specific type of programmes, for example, there would be round the clock news channels, or sports or educational programmes. This situation exists even now, but the future promises a lot more. There would also be interactive programmes. Viewer will look for all kinds of knowledge programmes, such as documentaries, video clips of personalities etc. Broadcasters with their expertise in the use of pictures and the spoken word will be able capitalise on the increased demand for programmes.

*** DTTB**

The development of Digital Terrestrial Television Broadcasting is progressing both in Europe and USA. It promises to bring numerous additional services which are of better technical quality. On a standard UHF television channel, either 4 standard quality programmes or 1 HDTV programme can be transmitted. The technology will allow a broadcaster to readily change from one configuration to the another, which means that the broadcaster can transmit a HDTV programme at one time and several standard quality programmes during another. It is also possible to achieve what is known as graceful degradation. This means that a HDTV programme will be received by a fixed home HDTV receiver in a strong reception area, in HDTV quality, but a receiver situated far away from the transmitter and receiving a low signal or a mobile TV receiver will receive the same programme at a lower but still at very acceptable standard quality level. The transmission will carry different quality levels in layers and the TV receiver will accept the highest possible level depending on the strength of the received signal. The reception will fail abruptly at some point where the signal strength drops below a specific value. This effect is particular to digital systems.

Digital Terrestrial Television broadcasting when launched, will enable broadcasters to introduce a raft of channels containing programmes like sports, crime, movies. At the moment both Europe and the US are considering their options. The situations in these regions are different in terms of available channels to introduce parallel digital television service. In Europe it is easier to start with satellite and cable based digital television than the terrestrial option, due to a highly congested VHF/UHF band. In contrast, the US is relatively less congested and will commence digital terrestrial television broadcasting in 1996. The US has rejected the intermediate option of introducing of Enhanced Television broadcasting and is committed to a direct transition to digital broadcasting. They expect to run parallel analogue and digital services for about 15 years before the NTSC service is finally discontinued. The audio coding system selected (Dolby AC3) by the US is also different to that chosen by the Europeans (Musicam).

*** ISDB**

The Integrated Systems Data Broadcasting system developed by NHK is designed to be a generic digital multiplexing system where audio, video and data signals can be broadcast within the bandwidth of the transmission medium independent of the mix of the these signals. This system may become a world standard.

This digital transmission system uses the same MPEG coding standard but with a few variations that enable the above mentioned mix. The receiver will be able to select any of these individual programmes responding to user selection.

(OHP, ISDB1 and ISDB2)

This system can be used for terrestrial broadcasting as well as for cable systems and satellite broadcasting.

*** Enhanced TV**

In Europe and in Japan, two systems of improved analogue television are being introduced as an intermediate stage to digital broadcasting. These systems are compatible with the current television broadcasting systems in a similar way colour television was compatible with B & W TV. The European enhanced TV system is known as the PALplus and that in Japan is called the EDTVII or Hi-vision. These new systems incorporate the 16:9 aspect ratio, higher resolution and ghost canceling. The disadvantage is for the consumer having a conventional TV set which will display programmes transmitted as enhanced TV in a "letterbox' format. This means that there will be black bands on the top and bottom of the screen like in a cinemascope film.

*** DARC/ RBDS**

Data Radio Channel is a high speed data multiplex system that is developed by the NHK, which uses the FM broadcast channel. It provides a facility to transmit traffic information, information about the programme being broadcast, newspaper for the visually impaired, and differential global positioning systems (dGPS). The dGPS system provides navigational data to vehicles, by using reference stations placed along traffic routes. Similar systems are in use both in Europe and the US, being called RDS and RBDS respectively.

Another product that is been tested in the US is known as Coupon Radio. Coupon Radio gives FM stations the ability to broadcast " information messages" directly to the listeners. For instance, discount coupons can be broadcast by the station, retrieved by the listeners, and taken immediately to the retail store issuing the coupon. Coupon radio data is sent via an FM station's RBDS subcarrier using RBDS radiotext feature.
Informessages in the form of discount coupons or special product information are stored on a computer at the station. At any time, they can be easily revised or deleted. Once stored, the informessages are linked to specific commercials using linking codes embedded within the commercial. When the commercial is aired the linking code triggers the computer to send the informessage to the station's RBDS encoder.

In the receiver, the informessage is stripped from the RBDS data stream and stored in memory. The data is transferred to a " smart card" by pressing a button on the receiver.The smart card is a credit card size device that contains a memory chip. In a typical application, a listener, after learning of an interesting discount about a product during a commercial, simply push a button to store the transmitted marketing data. He will take this card to the local retailer who scans the card in a device similar to the credit card verification unit. A hard copy of the coupon is printed. The card in addition to validating the special announced, will also provide demographic information that may be required for statistical analysis.

(OHP, DARC 1 - 3)

* **DAB**

Digital audio broadcasting is another development following digitalisation and the compression technology. In Europe, the Eureka 147 system has been developed, which provides high quality sound with very rugged reception for all types of receiving conditions. This technology has been developed with the motorist in mind and is designed to give him/her fade free reception, within the coverage area. A single channel of DAB can contain 6 stereo programmes, However it can be adapted to varying service needs. All the features of the current RDS, RBDS and DARC, and more can be incorporated in the DAB channels. DAB in Europe is expected to begin in 1995.

In the US, the DAB system that is developed uses the same FM and AM frequencies and is designed to be piggy backed on existing transmissions, or to use the adjacent channel which is normally not used in the conventional broadcasting systems. Some tests have already been conducted in the US and promising results have been observed, for both FM and AM systems. DAB in the US is expected to be launched in 1997.

Several international short-wave broadcasters (e.g. VOA, Deutchewelle, BBC) are studying the prospect of using Satellite Digital Audio Broadcasting for their services. The VOA has for example conducted tests using the NASA satellite. The signal was received on highways, in residential and in downtown areas. The results showed that CD quality audio can be received at all vehicle speeds, if there is direct line of sight to the satellite with no obstructions due to dense foliage or buildings. Countries in the high altitudes (far North of the equator) suffer due to the lower elevation angles to the satellite, the signals being susceptible to obstruction by buildings and other obstacles. A solution being considered is another system of satellites, which are ideally suited for such countries. The proposal requires 6 satellites in what are called highly elliptical orbits (HEO),

(OHP, HEO)

The satellites having a visibility of about 8 - 12 hours per day of the coverage area, (Europe, Canada, North America, Japan). The signals will be switched from one satellite to another as each satellite moves away from visibility. This study under the European Satellite Agency's Archimedes project is continuing.

In this region, Indonesia has expressed interest in launching a digital audio service via satellite. Its time scale for the introduction is still unknown, but the plans are to even manufacture the receivers within the country.

DAB via satellite will provide numerous programmes and data services, such as traffic, GPS information etc. Currently, in Germany, a satellite based digital sound broadcasting system is being tested. This uses audio compression techniques to be able to transmit close to a 100 stereo channels in CD quality in one transponder. The system named as the SARA project, provides broadcasters in several locations facility to uplink directly to satellite for reception by

rebroadcasters or individual listeners using digital audio receivers. The receiver is capable of selecting any progamme channel. The extension of such a service is for national and regional or local programmes to be transmitted via satellite direct to homes. The local broadcaster needs to pay for only the bandwidth he uses, likewise the other national or regional broadcasters.

(OHP, Allsat)

New Opportunities for Broadcasters

*** Revenue sources**

Broadcasters will have numerous opportunities to diversify their income sources, in fact, they will have to actively look for such diversification in order to stay alive. Using the broadcast channel for ancillary data transmission for niche markets, pay per view services, programmes/archival material on remote terminal access, pay TV, interactive programmes, Video on Demand, are some of these possibilities. For some of these areas the broadcasters may need to collaborate with other service providers such as cable operators, Internet etc.

*** Programmes/Information for niche markets**

Microwave Distributions Systems are being introduced in several countries to serve niche audiences, like specific language groups and other interest groups. They are all Pay TV Channels and are inexpensively established.

*** Telemusic**

This is a development to transmit television musical programmes with embedded control data which would control an electronic organ at home which has a MIDI interface.

*** Programme/information access via remote terminals**

* Internet

As mentioned earlier, some broadcasters have already commenced making audio programmes available on the Internet for listeners around the world. To access these programmes one must subscribe to the Internet Service. This is a low end version of the Superhighway.

*** Programmes on line**

In the fully digitised world of broadcasting, there will not be any video tapes, video recorders and video cassettes. All the video and audio material will be on some digital storage like the hard disk we know, but with very large capacities. All programme production activities will be by accessing these material from the digital storage. It will be very easy to make available selected portions of these material to the outside world via remote treminal like the home computer for a fee.

*** Programmes in CD ROMs**

Television New Zealand has produced a CD ROM containing a version of an Encyclopedia with moving images and sound. It is retailing at around US$ 100.00 This is an avenue for broadcasters to exploit as programmes are made, an enormous quantity of footage is discarded in the editing process. Some of these footage would be of interest to special interest groups, and can be made available to them in the form of CD ROMS. There is even the CD-i format where some interactivity is introduced.

(OHP, TNVZ)

*** Interactive Progamming**

Various studies have shown that user preferences are for larger choices of programmes and participation in programmes, meaning interactivity, and not increased quality for the same additional cost. Following are some interactive systems that are being tested.

*** Video-on-Demand (VoD)**

Several organisations have been experimenting on different levels of Video on Demand services. The different services are;

Pay per View (PPV)

In this service encrypted programmes are transmitted at fixed times and viewers who purchase programmes have to watch them at the scheduled times. Some systems allow the programme to be recorded for later viewing but the programmes can also be encoded to prevent such recording.

Enhanced PPV or Near VoD

In this service, the same encrypted programme is transmitted at staggered intervals, and viewers can choose the most convenient time to view. Some services allow viewers to take a break and join another transmission of the same programme at a later time.
Bell Atlantic commenced tests on an ADSL (Asynchronous Digital Subscriber Line) system which provides a facility to transmit video signals on ordinary copper telephone lines. At the home terminal there is a decoder which translates the incoming coded signal to a video signal that is displayed on the TV receiver. The decoder also presents an on-screen menu which allows the viewer to point and click his choice of programme.

True VoD

This involves very powerful computer servers to be able to store and playback several programmes to many viewers at times of the viewers choice and also provide viewers the facilities of stopping, spooling etc. as they would with a home VCR. The computer software company Oracle has developed a media server which is designed to enable viewers to create what are effectively personally-customised channels. It brings together

video, audio and text from information providers and delivers it via cable and telecommunications operators to consumers and business users. It is called a "data warehouse" by the developer. It is capable of processing thousands of transactions a second and manage the multiple data sources that are required. The company is working with Bell Atlantic to develop an interactive VoD and home shopping progamme and with ABC to develop a multimedia news-on-demand in the US. The system runs on a new generation of computers called " massively parallel computers" where thousands of micro-processors are operating in parallel. Each micro-processor has its own communications pathway to the outside world, serving one customer. Banks of such systems will provide individual attention to each customer and respond to his demands.

Enhanced VoD

In this system, the server will inject the requested programme at very high speeds into a special VCR or memory in the viewer's receiving system. The viewer is then at liberty to view in his own time. The recorded material can be viewed probably twice before it gets erased, unless the viewer pays to keep the programme.

Teleshopping

One-stop shopping is already in the homes of some countries. One form of this facility is available over the Internet network and is called the CommerceNet. The system will have security systems with code words etc. to ensure that no one can fraudulently use the system. The service providers hope that within 5 years, 3000 organisations will use the system to advertise and market their products. This is ideal for small businesses as it costs very little to reach the whole globe. This is looked at as the first step towards the Global Information Infrastructure and is capable of linking up other similar systems.
Customers can order their products through the system and if it is software it will be delivered immediately and billing and payment will be conducted electronically. Teleshopping will impact rather adversely on traditional methods of selling where shopfronts with expensive displays are necessary to attract customers.
Another development provides the user to design his own shopping mall on the screen, which he could traverse passing various "shopfronts". Clicking any of the "shopfronts" will open a catalogue of the products available from that shop. He then could call up more information of the product he is interested in.

*** Electronic Newspaper**

I touched on today's situation where we purchase several newspapers and magazines everyday to find the information and world news we are interested in. To do this we have to go through all this paperwork we purchase each day. Electronic newspaper takes away this hassle and allows you to filter all the unnecessary information and reach the information that you need very quickly. All you need to do is the designate the type of news you want and it will be on your computer screen in probably less than a second. If a hard copy is required, all one has to do is to print it using the printer connected to

the computer.

*** Home Office**

In the future one may not need leave home to work. With information highways, it is natural to connect one's home to the highway. With a fax machine, videophone and a computer one can be linked to one's office. Any work that one could do in office can now be done at home. In Australia, this is being tried. In this experiment, the office worker has to allocate part of his home (possibly a room) as his work area and has to keep a record of his attendance. He is given all the necessary equipment such as a computer with a modem, fax and a telephone. Can you imagine peak hours without traffic jams! Of course, there would not be any peak hours as everybody is at home.

*** Business Television**

A concept called Business Television is gaining popularity in the US. Some large businesses use satellites to reach their staff scattered all over the world to inform them of business activities, product launches and also to run training courses for their staff. The system is interactive so that ideas can be exchanged between the speakers and the audiences. The Ford Motor company, for example, is developing the largest interactive satellite based training network. This network will reach its 6000 dealer outlets with 8 channels of training, news, corporate information programming. There will be real time voice and data interactivity. Desktop television is an extension of this concept where business news and training programmes are delivered to computers so that staff need not leave their work places to view these programmes.

(Slide - Reasons)

*** Radio on Demand**

A new development has recently been announced where Microsoft has presented a concept of Radio-on Demand. Radio listeners are given the option of retrieving information from radio broadcasts in non-real time. This idea will lead to new radio services. The Microsoft plan is to introduce a user interface to computers that instructs the computer the type of information the user needs from the radio broadcasts. This information can be traffic information, weather, etc., and the computer will monitor the broadcasts and will store the requested information to be retrieved by the user at his/her own time. The information will be updated so that the latest is always available to the user.

The Future

The future for the broadcasters will certainly be different to what it is now. There are different ways to be in the business and these ways are dynamic as technologies change and improve at a rapid rate. Whatever the changes may be, they should be good news for the user as more and more services will become available at lower costs as competition intensify.

(OHP Future TV set)

The broadcasters will try to prevent their market share from being eroded due to movie channels and teleshopping facilities, etc.. But they will have to accept that the superhighway is what the consumer will want to use in the future, because he/she will notbe bound by programme schedules.

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