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This article, by **Bob Greeney** Director Engineering, Planning Branch, is based on the material contained in the Interim Report of the Digital Video Services Task Group established within Standards Australia.

Digital video services for Australians

Bob Greeney

The introduction of pay TV will bring with it a range of new digital entertainment and information services.

These services will be provided through free-to-air broadcasting channels, via satellite systems, microwave distribution systems or by cable.

A key issue for the consumer is how these various services might be interfaced so that they can each be accessed through a common terminal device.

Commonly called digital video systems, many of the new services can be displayed on a video display unit such as a television set or computer. As digital video systems and other digital services develop, it has become increasingly important that digital systems be introduced as open systems; that is, where there is a high degree of commonality in the delivery mechanisms, encryption systems and display units. This factor is likely to become critical to the success of new digital services. Without common standards, users will need to have a separate designated set-top unit for each service.

For the purpose of this paper, the term 'user' means anyone, whether a domestic or residential user, or a business user, who wants to have access to digital services.

What are digital video services?

Typically, digital video services will be pay TV delivered by satellite, microwave, copper and fibre optic cable and terrestrial transmissions. This will also be terrestrial free-to-air digital television in the near future. There is the need to provide interfaces for video tape recordings, video disks, compact audio disks, digital audio cassettes and compact disk ROM. To these services can be added multi-media personal computers, the Internet, telephony and facsimile services which are likely to be required at the same terminal.

The Digital Video Services Task Group - Standards Australia/New Zealand

Recognising these demands and the need for suitable standards, the Digital Video Services Task Group (DVSTG) was established by the Joint Electrotechnology Board of Standards Australia and Standards New Zealand. The Task Group aims to provide an overview of how, where and in which standards committees the many related topics in digital video and related

The Task Group has a membership of around forty and representatives from manufacturing industry, Government departments, commercial broadcasters, regulatory agencies (including the ABA), pay TV service providers, telecommunications companies, user groups, consultants and research organisations.

The main task of the DVSTG is to consult with interested bodies and individuals and identify the unique characteristics that apply to Australia and New Zealand. The DVSTG is also to prepare a report and development plan that:

- details the standards needed for expedient delivery of digital services to consumers;
- provides a review of existing relevant standards; and
- identifies problems and suggests solutions and opportunities in providing comprehensive, integrated, digital services delivery to the consumer, via one (or a small number of) flexible, multifunction interfaces.

The Group's Interim Report was published in June 1995 for comment.

It has long been recognised that world wide standards are essential for the international exchange of information, interoperability between equipment and services, and cost reductions in all associated equipment. There is also a need to

recognise similar benefits for access by all Australians to all of the digital services that are likely to be available in Australia.

The establishment of proprietary technical systems different from world wide standards could effectively lock users into particular services because of their inability to access services from another provider using a different technical system. Therefore, use of proprietary systems of coding and access means that later service providers must persuade their potential customers to install a second, third or fourth set-top unit to receive and pay for their new services with different coding schemes. In the worst case, proprietary systems might even block access to free-to-air services.

As well, because the proprietary systems were developed and are manufactured overseas, there is less opportunity for Australian industry participation in the provision of digital video services.

Similarly, with the introduction of digital services by cable and particularly fibre optic cable with its almost unlimited capacity there are claims for more cable networks to be installed to meet the 'standards' of the service provider. These claims ignore the enormous cost of bringing even one cable service to all possible outlets. Added to this is the visual impact on the environment, the cost and inconvenience to the user and the likely impediment to the viability and success of the later service providers.

Because of the technical problems and expense involved in bringing together, at the user's terminal, a variety of services using different methods of transmission, the DVSTG is concerned that digital services should be introduced as open systems.

As well as these external services, there must be interfaces for VHS videotape, videodisc, compact disc, audio cassette and CD-ROM.

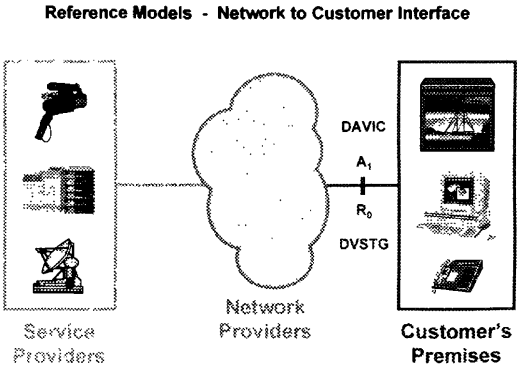

Figure 1 End-end delivery of digital services

Reference models

The Group established a number of reference models for the guidance of sub-groups, including a model for the end-to-end delivery of digital services, a model for user interface options, and another covering the future requirements for interactive multimedia services. The basic model is the end-to-end delivery of digital services.

The digital video services task group's reference model

The Group has produced a reference model which conforms closely with the open systems prescription.

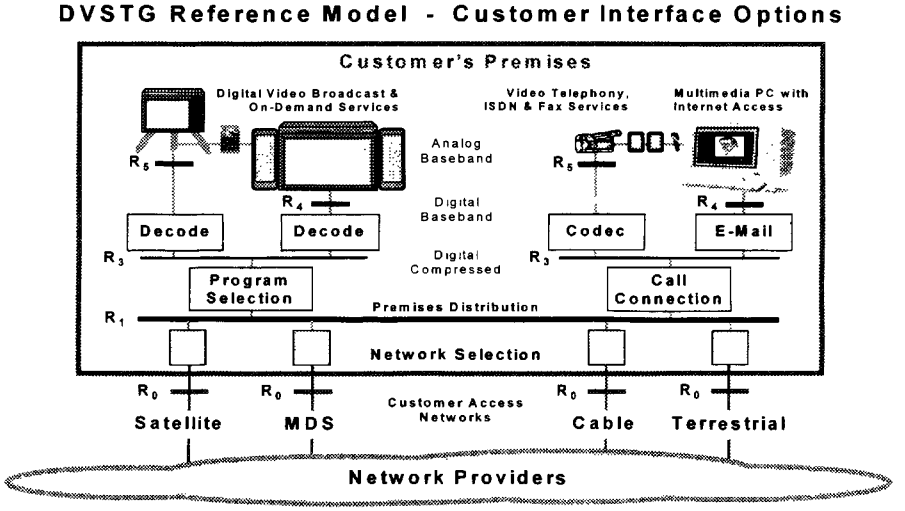

Figure 2 DVSTG Reference model - customer interface options

The reference model is intended to provide guidance to the sub-committees of the DVSTG so that they can propose suitable interface standards and services, all having common framework and terminology.

The reference model is not limited to being a

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simple television receiver, but includes the possibilities for PC-based reception and future video phone options. Similarly, the need for digital video storage and replay capacity was also factored into the proposed reference model.

The flexibility to integrate or segregate the functional blocks, to meet a wide range of application and user requirements, will enable greater product choice for users and innovative product and content opportunities for Australian and New Zealand industry. This flexibility to mix and match different functions is provided via six standard 'interfaces' or 'reference points', labelled R_0 - R_5, which interconnect the associated 'functional blocks'. Standardisation of these interfaces will allow service providers, product suppliers and users to simply 'plug-and-play' to get the desired configuration.

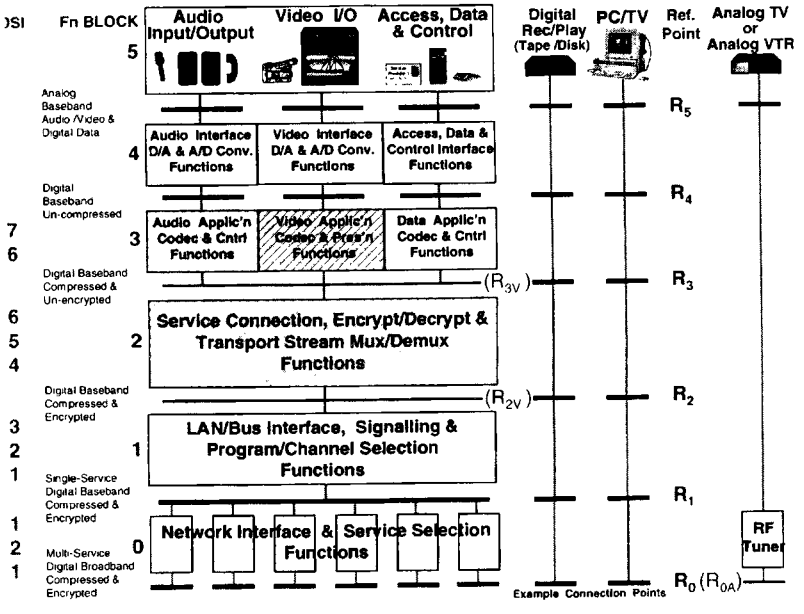

Figure 3

Generic reference model

The DVSTG generic reference model is explained in much greater depth, and with further examples, in Attachment 5 of the DVSTG's Interim Exposure Report of the Digital Video Services Task Group.

The objective is to enable access to and sharing of common functions between various products distributed around the residential or business premises. For example, as shown in Figure 2, the R_1 interface allows two television sets and a PC to share access to common network selection and interface functions.

The concept of defining functions as modular building blocks with standard reference points between them, follows the principles of 'layered models', as defined for the computer industry.

The Open Systems Interconnection (OSI) 7-layer reference model is an example which readily maps to the DVSTG reference model. The benefits of layering include: choice of protocol options and associated grades of service; migration to improved technology implementations and better interface standards as they evolve (with little or no impact on other layer functions and interfaces); sharing of lower layer functions by multiple higher layers (multiplexing); and the provision for interoperability between different supplier's products.

The DVSTG generic reference model

To achieve the objective of having a flexible (non-hardware oriented) model, and to provide for easy migration from the existing analog services to the future digital interactive multimedia services, the sub-committee has adopted a 'layered' approach for the Generic Reference Model. This is illustrated in Figure 3 and outlined in detail in Section A5.5 of the DVSTG Interim Report.

The reference model is intended to define associated interface standards which permit open access to a wide variety of services, delivery options, standards and technology changes, as well as catering for practical hardware and software implementations. It is intended to avoid the prospect of users having to buy multiple interface units, protocol converters and multiple set-top units for each television set to allow access to all available services.

Using the generic reference model (Figure 3) and the related physical model, equipment suppliers can provide products which may include as many or as few 'functional blocks' as they wish and as many or as few standard physical interfaces as they wish.

Wiring of user premises

The wiring of user premises is another issue that is affected in a major way by transmission standards.

Installing home wiring designed to support a particular delivery system or service provider may limit the consumer's ability to later swap from one delivery system or service provider to another, or to have access to a second or third service. This is due to the spectrum utilisation and technical characteristics of the wiring implementation being optimised for the first-chosen delivery system. For example, home wiring designed to support services delivered by MDS may be unsuitable to support services delivered by cable or satellite.

Also, multiple points of entry for different and technically incompatible services may lead to the need for multiple cables throughout domestic premises, as well as multiple set-top units. This

would have particularly serious consequences in buildings like apartment blocks and hotels.

Choice of open standards for digital video services will substantially reduce these problems, but if incompatible systems are allowed to develop there will be substantial negative effects for users and service providers.

These wiring standards issues are presently being addressed by Standards Australia committee RC/5.

What's happening overseas?

The DVSTG has taken account of developments in other parts of the world. As well as considering the recommendations of the Broadband Services Expert Group (BSEG) for the development of standards for broadband services, the DVSTG considered international precedents where governments have mandated open access standards for broadcasting services (e.g. the European Union and Canada). The Group also considered developments in the Digital Video Broadcasting (DVB) and the Digital Audio-Visual Council (DAVIC) projects. These are European groups working towards world standards for digital broadcasting networks.

DAVIC is mainly driven by the telecommunications industry members in Europe and the DVB is driven mainly by European television industry members. Both groups have overlapping interests and many industry members are common to both.

The DVB Project The Digital Video Broadcasting Project (DVB) brings together more than one hundred and eighty organisations from across Europe and elsewhere in a challenging venture which is vital for the future of television. DVB is driven mainly by European television broadcasting industries, but includes companies with origins in the USA and Japan.

The objective of the project is to bring about consensus on the systems that will be used for digital television broadcasting in the years ahead.

The goal of the DVB Project is to develop a family of systems for many or all delivery mechanisms, and to use as much common technology as possible. Even where transmission environments are quite different, most essential elements should be the same. Commonality will benefit both the equipment supplier and the consumer.

The timetable for the development of the systems is necessarily short. It is a reality of today's world that technical evolution and product development cycles are becoming ever shorter. To be useful and to succeed in the real world, the DVB Project had to move quickly and efficiently.

A digital satellite broadcasting system has now been developed which can be used with any European satellite transponder, current or planned. A matching cable system has been developed at the same time. The development of the digital terrestrial system is also well under way and the relationship between broadcast and telecommunication network delivery systems is under study. The DVB systems can broadcast a flexible range of picture qualities, together with adaptable multi-channel digital sound, and the service configuration can be tailored to specific service-provider's needs, whether they be free-to-air or pay services.

In short, the DVB systems can respond to current and foreseen market demands in Europe.

Digital broadcasting is not compatible with analog. In order to maintain their current audience during the introduction of digital terrestrial services, European broadcasters may also include the PAL program as a digital service within their new digital channel. This new channel could be a magazine of services. However this is only feasible if open standards, such as the DVB plan, are in place.

Therefore a transition path is required. The set top decoder is one of the interim steps in the transition phase until a full digital receiver is marketed and put into the home. When open standards are adopted, European householders who purchase new digital television receivers will benefit from the improved quality and enhanced options (wide screen, CD sound etc.). Digital set top decoders will not be necessary.

The transition from the existing analog broadcasting environment in Europe into a fully digital environment may take up to 10 or 15 years because:

- existing householders have invested in PAL colour televisions and VCRs, therefore existing broadcasters would lose their economic base in the event of a sudden transition to pure digital;
- when a digital signal is decoded to PAL television by the digital set top decoder, video and audio quality can be no better than its usual PAL quality;
- market penetration during this interim phase should follow the normal pattern of acceptance over three to five years;
- only a few additional or new services could be commercially attractive, and these would most likely be pay TV services;
- digital programming and multiplexing, prior to transmission, is dependent on management software. These packages are not yet fully developed; and
- fully interactive service systems and software

management packages are yet to be compiled and developed for the new sophisticated services.

The general technical solution, valid for the source coding for all electronic media involving video, whether for broadcasting, publishing or storage, has the following basic philosophy:

- systems are designed as containers to carry flexible combinations of MPEG-2 video and audio, or other data;
- systems will use the common MPEG-2 transport stream multiplex; and
- systems will use a common Service Information system, giving details of the program being broadcast, recorded, etc.
- for transmission via satellite, cable or terrestrial means:
- systems will use a common forward error-correction (FEC) system.
- they will also use a common scrambling system; and
- modulation and channel coding systems, and any necessary additional error-correction systems, are chosen to meet the different media transport circumstances.

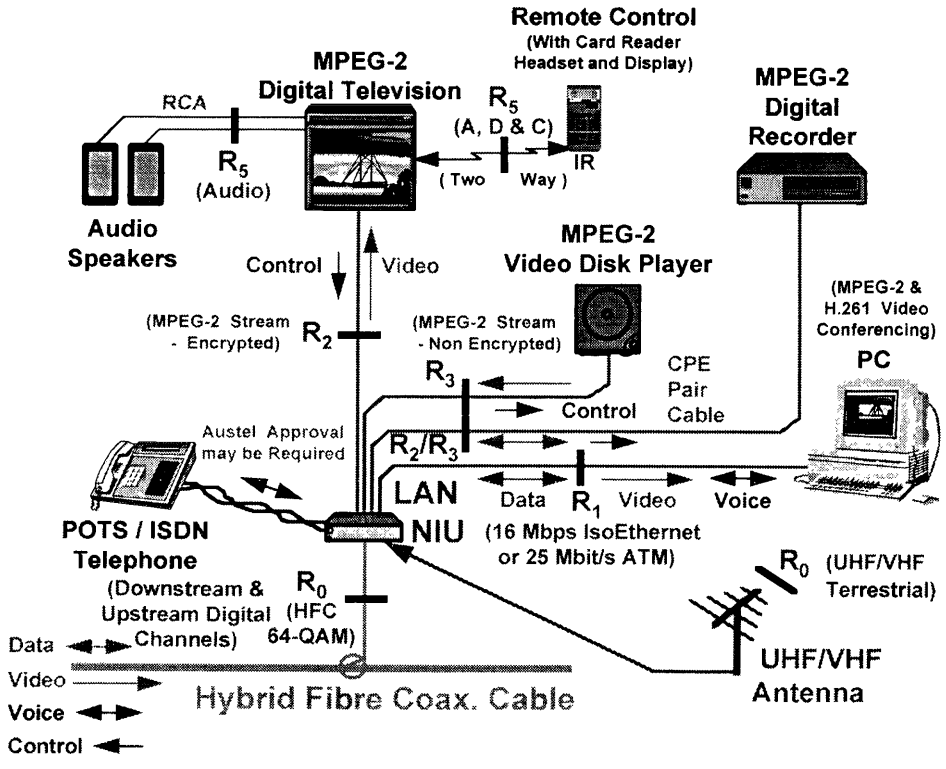

Figure 4

Hybrid fibre optic coax cable to an approved network interface unit (NIU) with in-built, star-wired local area network (LAN capabilities). Connected to the NIU are a digital telephone or videophone, personal computer, MPEG-2 video disk player, MPEG-2 digital recorder and MPEG-2 digital television with audio speakers and a Infrared-remote with 1-way programming.

The Digital Audio-Visual Council (DAVIC)

The DAVIC is a non-profit association registered in Geneva, Switzerland. Its purpose is to ensure the success of emerging digital audio-visual applications and services. In the first instance these will be broadcast and interactive types. It aims to do this by assisting in the development of internationally agreed specifications of open interfaces and protocols that maximise interoperability across countries and applications/services.

DAVIC has a membership of more than one hundred and fifty organisations from 20 countries in all regions of the world. The members represent virtually all commercial interests in the emerging digital audio-visual applications and services industry, especially telecommunications interests.

The current activities in DAVIC are focussed on a first set of applications encompassing video distribution, video on demand, teleshopping and other basic interactive services. DAVIC's workplan is to produce a set of technical specifications of building blocks that users can implement for the purpose of deploying complete end-to-end systems or providing applications and services. These specifications are called DAVIC 1.0.

The specification development process started in October 1994. The final approval of specifications is planned for December 1995. The DAVIC Board of Directors is well aware that a wider range of applications can be supported by the progress of digital technologies. A Strategic Planning Advisory Committee has been established to produce a draft workplan for the next generations of DAVIC specifications. Future issues of DAVIC specifications will support more functionalities, thus allowing the implementation of new applications and services, while retaining backwards compatibility as far as technically and economically feasible.

Preliminary recommendations of the DVSTG

During discussions within the DVSTG on developing a digital broadband standards regime, it was agreed that four umbrella criteria ideally need to be satisfied.

1. Users will require 'open access'. This means that any user should be able to receive any service offered by a service provider in a practical and economic manner. In the same way, any service provider should be able to supply their services to every user in a reasonable and practical manner.

2. Users will require the principle of commonality to be fully applied for the development of future user equipment. This means that functions, equipment, wiring and decoding ideally should be

common for the delivery of services irrespective of the technology utilised, and should not unnecessarily block access to existing equipment or duplicate user equipment already installed.

3. As the transition from analog to digital technology progresses, any new digital user equipment must be provided with a practical and adequate means for the continued reception of existing analog services.

4. Domestic industry and local content providers should have the opportunity to design, develop and provide equipment and services on fair and reasonable terms for the service providers.

It has often been said that standards should not be formulated too early or left until it is too late. The concept of interfaces, as proposed in the reference model developed by the DVSTG, alleviates this concern. For example, if an improved video compression algorithm is developed, and this is almost certain within the next decade, then user equipment would require only a new video decryption board or unit. It is assumed that space and switch facilities will then allow both the old and new to provide services as required.

The use of proprietary systems and techniques is likely to serve to exclude provision of possible services to various classes of users.

Some of the recommendations from the DVSTG included:

- standards need to be international, open, and produced by consensus in a timely and transparent manner;
- Australia and New Zealand should consider imposing similar common standards for transmission and a common encryption algorithm as are embodied in the European decision in this area;
- to ensure that the domestic industry has the opportunity to benefit from Australia's and New Zealand's unique position in digital broadband services, the governments should require fair and reasonable access by domestic manufactures to the conditional systems of the service providers;
- because of the likely costs and disruption to consumers resulting from duplication of wiring systems, a standard supporting a common wiring system within the customers' premises for all digital broadband services is urgently required;
- new services should not block out existing services. They should also not confine the customer to a single broadband access location nor to a single viewing choice;
- any new standard in the digital broadband area should include a single presentation protocol, a common remote control, and a single individual customer identification number for each customer irrespective of the service provider;
- standards should ensure that the supply of broadband services should be independent of underlying transport mechanisms, thus allowing a mix of technologies to be used from CD-ROM to high speed multimedia delivery networks;
- The large number of regulations confronting product and service developers need to be rationalised and consolidated;
- all stakeholders, including industry, regulatory and standards bodies, consumers, technology users and the research community, should have the opportunity to participate in standards setting;
- technical standards should be based on an agreed Digital Video Services Reference Model;
- in essence, the reference points and the corresponding physical interfaces (and possibly also some functional blocks) in the reference model will be the objects of standardisation;
- a standard for the RF interface should be specified, which de facto would be the published Australian Frequency Plan;
- a standard for a baseband analog video interface is required;
- a standard tor a baseband digital video interface is also required; and
- a standard bitstream should be defined for the digital interfaces in the DVSTG Generic Reference Model.

A possible outcome for the user

An example of the possible outcomes from the generic model, which places no limitations on where an equipment supplier may wish to provide a physical interface, is shown in Figure 4. It indicates a range of analog and digital interface options for each piece of equipment, and a range of equipment modularity or integration.

Of course, this model is a long way from the present, but it represents where the DVSTG would like to lead the development of standards for digital video services and the integration with a full range of other digital services delivered to the home.

This example is well suited to a fully digital, fully interconnected home (or small business) having a structured twisted pair cabling scheme (for which there are existing Australian Standards).

Footnote: *The author wishes to acknowledge the work of the members of the DVSTG in preparing the Interim Report of the Digital Video Services task Group, and the material contained in that report, much of which has been reproduced in this article, particularly the diagrams.*