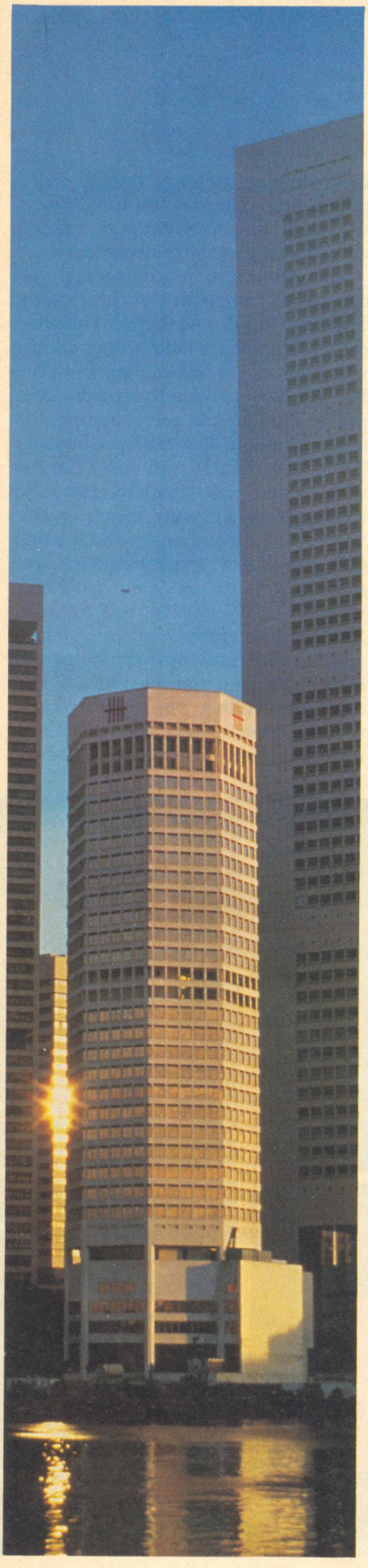


The interactive island

Singapore's Teleview system

Integrating teletext and videotext has given Singapore the ultimate in information-distribution systems

by **Trevor Richards** and **Peter Yuen (M)**,
Marconi Command & Control Systems Ltd.

If you look at a map, you will see that Singapore is about the size and shape of the Isle of Wight; but there the similarity ends. Singapore has a population of 2·6 million and it is still growing. With no natural resources, it must manufacture to prosper; hence an expanding workforce is needed to fuel its growth in the 21st century. People must commute, work, shop and communicate in a crowded environment. To do so, they have embraced information technology and put it to good use. Singapore's industries are largely based on computer technology, and its people use these products to make the island function efficiently.

Changi Airport has always been one of the most efficient airports in the world and has just doubled in size. The new terminal is using computers in the control of services and passengers, with the stated aim that incoming passengers will spend no more than 20 minutes from arrival before they step into a taxi.

Singapore has a huge container port, now handling a greater tonnage of cargo than Hong Kong. It is probably the busiest port in the world. It uses computers to reduce the loading and unloading of ships to a few hours. Computer networking allows companies and organisations around Singapore to complete the customs documentation within a few minutes, without the need to leave their own shipping departments.

The newly built rapid mass transport system is constantly being analysed to see the traffic loading on all sections of the network. This information is derived from the ticketing machines and the entry/exit barriers. They know everything about passenger movement and can respond to traffic fluctuations with more trains, if required.

Teleview

In the mid-1980s, Singapore began trials of a new form of public-information service. Known as Teleview, the new service is a particularly graphic example of Singapore's commitment to information technology. Developed for, and in conjunction with, Singapore Telecom by Frimley-based GEC-Marconi, Teleview is an advanced interactive information-distribution system, aimed at bringing the information age into the homes and offices of all Singaporeans (Fig.1). For users

Teleview brings high-quality images directly to the home

of Teleview, going to the bank, estate agent or shops can be a thing of the past as transactions can be conducted from the comfort of their own homes. Less time performing mundane tasks, the theory goes, leaves more time for leisure pursuits. Teleview is now a reality in Singapore, having been launched publicly at the end of 1990. The system covers the whole island of Singapore and has an initial capacity to handle up to 10 000 users. In the next 4 years the numbers of users is likely to grow to over 100 000, reaching 500 000 in about 10 years.

The technology for Teleview evolved out of the teletext and videotext systems launched in the late 70s. Teletext works by transmitting text and other graphic images through the airwaves (off-air) by adding digital signals to the standard television signal. The 625 lines in a picture are made up of two interlaced fields, with each field being scanned from top to bottom and containing 312·5 evenly spaced lines. The teletext data are transmitted in the period during which the television recovers from the bottom of the picture back to the top ready for the next field — the vertical blanking interval (VBI). The pages are held on a central database and continuously transmitted, one by one, on a cyclical basis. A user's decoder receives all of the transmitted pages but displays only the page requested. Having requested a page, the response time can be quite long and depends on the size of the database. Teletext systems do not allow the user to respond to the information provided.

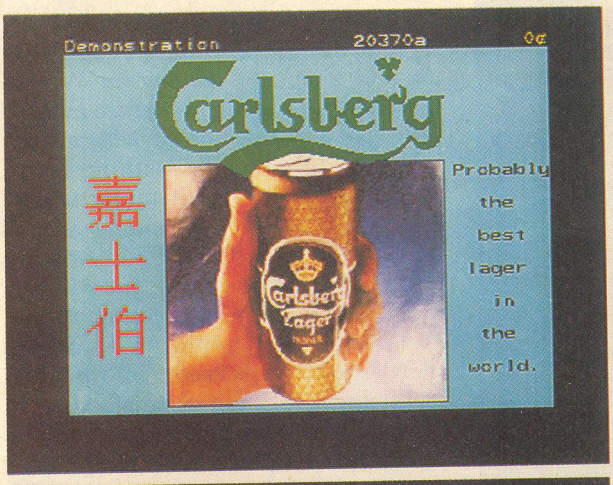
Videotext systems do not transmit pages until a user requests it. The system operates totally over the telephone lines, which limits the speed at which information can be sent. The system can, however, permit the user to respond to the information provided.

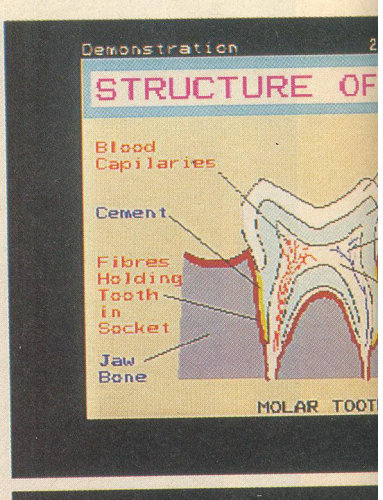
Teleview has combined the interactive capability of videotext with the high data-transmission-rate capability of broadcast. The combination of telephone line and dedicated TV channel allows the system to respond to requests for data, which can contain complex graphic and full-frame photographic images, in a fraction of the time that conventional teletext and videotext systems achieve.

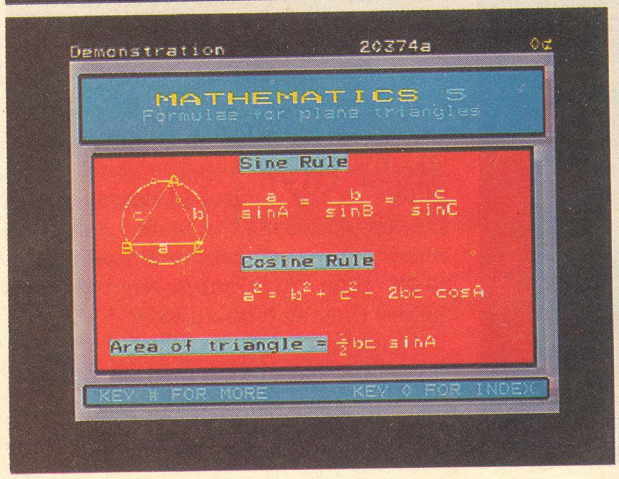
Teleview also encompasses the capabilities of both World System Teletext (WST) and CEPT videotext presentation layer data syntax to provide a full range of facilities. Both the BBC and independent television companies in the UK were among the first services to use WST technology. WST and CEPT provide Teleview with a defined standard for data transmission, allowing future expansion and integration with existing services already implementing these standards.

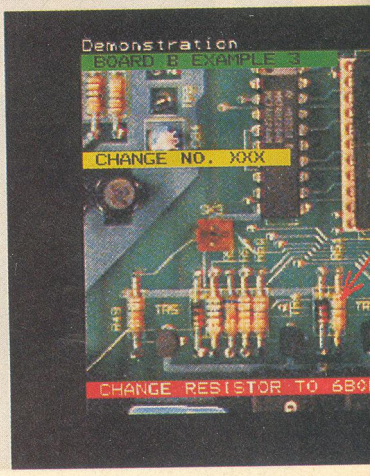
System overview

Teleview provides a range of facilities to a large number of end users, including teletext, picture videotext, personal computer, directory inquiries (English and Chinese),

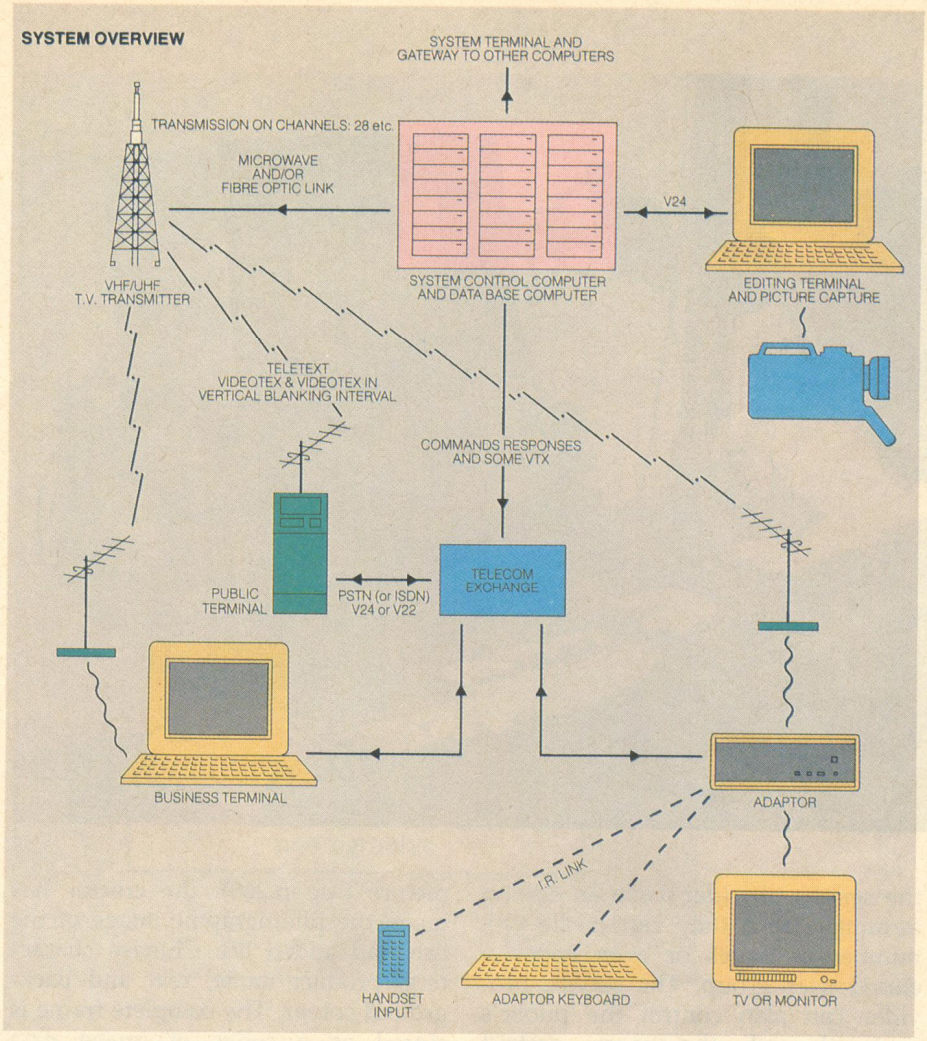






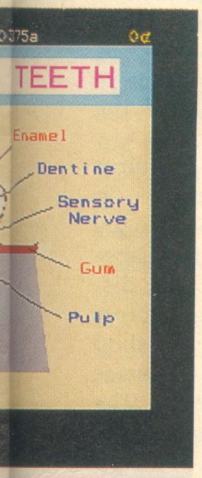


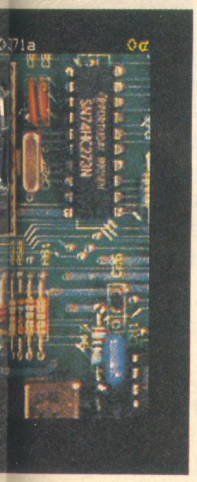
Teleview system overview



messaging, teleshopping and telesoftware. The system is extremely flexible and can be linked, via gateways, to other databases to provide rapidly changing information such as news headlines, airline flight information or currency and stock-market pricing.

Depending on the type of access terminal used, the user has available three basic modes of operation: teletext, videotext and PC. The teletext mode is used to assess the quality of the broadcast reception at the start of each session. When bad reception makes data reception impossible, the central system reverts to the 1200 baud telephone line for transmission. The teletext mode is also used to provide message-waiting and time-synchronising facilities. The dedicated terminals can also receive the normal teletext transmissions from the Singapore Broadcasting Company.





Sample Teleview pages — advertising, and educational from basic to advanced

Most of the Teleview facilities available to the user are accessed in videotext mode. The PC mode uses a form of Basic to provide local programming capability, as well as the ability to receive and execute programs transmitted by the central system (telesoftware).

At the heart of the Teleview system is the central control and database computer. It is here that the vast wealth of information, supplied by service providers, is stored ready for immediate access. User interaction with the central system is achieved by the Teleview user dialling up the central database and logging on from any terminal. The requested data are then sent using the selected transmission path.

Teleview achieves its high data-transmission rate by using a dedicated Band IV UHF TV transmitter using the full field for transmission instead of the VBI. This approach gives an instantaneous data rate of approximately 5·5 Mbit/s. Additionally, Teleview employs time-division multiplexing, allowing many users to be served simultaneously, each receiving blocks of data at approximately 100 kbit/s. To request and display a full-frame photograph (150 kbytes uncompressed) would take about 12 s; however, times of 2-4 s are achieved for typical display of 50 kbytes. With image compression, the frame data are reduced, resulting in even faster transmission times.

Editing terminal design

'"What is the use of a book", thought Alice, "without pictures or conversation?".' Pictures are regarded as at least of equal value to words. Pictures are user friendly. Service providers, such as shopkeepers and car salespeople, use teleview as a window through which they communicate with their customers. The ability to mix photographs with text provides a powerful medium with which to inform and rapidly update the consumer. Apart from advertising, Teleview could be used to link manufacturing companies to assist, for example, in identifying and referencing a particular component on a complicated circuit board for replacement.

Each Teleview page is created by

Teleview editing terminal at work

the service provider using an editing terminal. Here they can create any number of pages or even create a closed user group. The service provider can also control the public's route through the pages, restrict access to some information or even charge for particular services.

To provide a user-friendly environment, the frames are created directly on-screen with an interface that uses a mouse and pop-up menus. The frame can be thought of as a series of stacked planes in a fixed order, each containing specific image types (text, photo, geometric etc.). The frame is made up from the image planes and the five CEPT levels, which define the display standard. The TV image is masked by the full screen background, which is set to black.

To see the data on lower planes, e.g. the photo image, the planes in front are made transparent in the area of the image. During the creation of a frame, the editor allows the user to view all or some of the planes simultaneously, while working in one of them. It allows the user to switch between the planes, to add to or edit its contents.

One method of creating a frame is by using the image produced by a high-definition colour camera and adding text and graphics to enhance it. In the example of the 'Carlsberg' picture (see p.260), the creator has taken the photographic image of the can and added the Chinese characters, product name, text and background colour. The complete frame is stored as a series of image data planes, simplifying future editing or merging with other like image data. Another approach is to use the live photographic image as a template for copying or tracing.

When the user is satisfied, the frame is tagged with a keyword and page number before being stored in the central database. The various data types that go to make up a particular frame are referenced and stored separately, thereby allowing a photograph or geometric plane to be used in many different frames. Where a frame contains a photographic image, this portion is compressed by a selectable algorithm to allow less data to be held in the database, making room for more pages and improving the response time of the central system for these types of frames. Several pages can also be defined as linked pages, giving the user easy access to related information. The frames are stored in the central system in a hierarchical structure, making for easy selection by the user.

When a subscriber requests a particular page, the central database locates all the data types that make up the frame and formats them ready for transmission. The frame is now structured and divided into multiple parts including chunk header, text data, field buffers, field specifications, DRCS data and photographic data. Each frame is divided into multiple blocks of either 1024 bytes or 4096 bytes depending on data type.

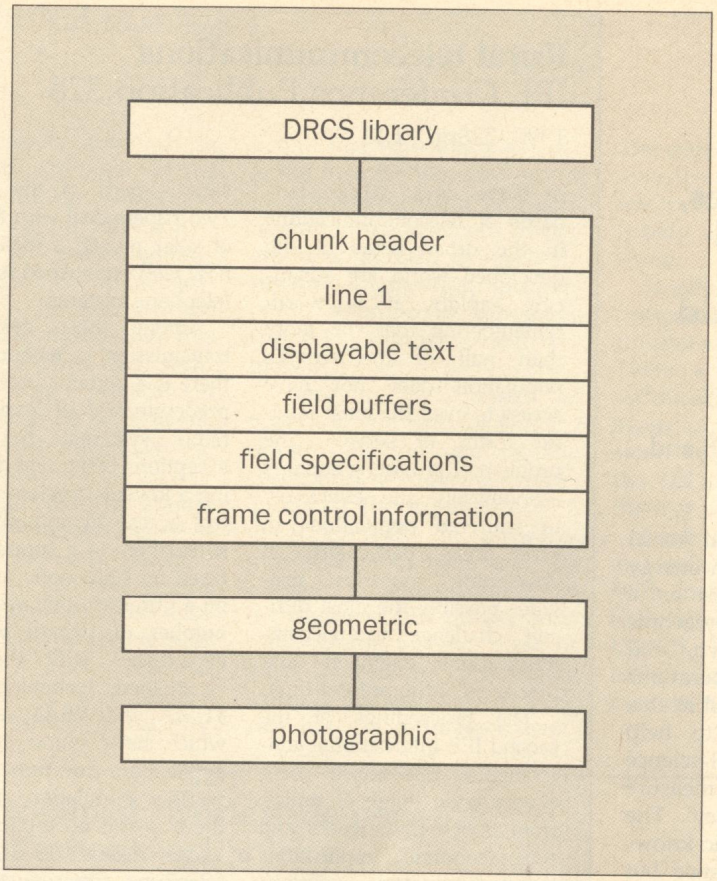
The dynamic redefinable character set (DRCS) library contains a number of character sets in a bit-map format, the characters of which can be modified or deleted and new characters created using an editing terminal. This allows service providers to create their own logos or to use different script styles.

The chunk header is the basic frame identification, including the information header, chunk number, identification number, indicators and text length. The chunk number provides the frame types, for example, text type, picture type and DRCS type frame. The indicators are used to signal whether the frame is a response frame and whether it uses the DRCS. The text length is the amount of displayable text.

Where the frame type requires data to be entered by the user in response to prompts, as in a dialogue frame, the field buffers and field specifications must reside after the displayable text. The user then enters data into the field buffers — shop orders, income-tax forms, Chinese telephone directory inquiries. The field specifications are the control information for the field buffers, which include the co-ordination of each field, the field length and field identification. Other data areas in the frame include frame-control information, geometric and photographic data. The total number of blocks in a frame depends on the size of photographic area and the number of graphical data. A typical photographic frame size is 30-70 kbytes.

User terminals

User terminals are the public's 'looking glass'. They are the access points that unlock the vast wealth of information held within Teleview. A



Structure of transmitted data

range of terminals are available covering business, private and public uses, ranging from software and circuit cards to convert your own PC (giving restricted capability) to dedicated equipment providing the full range of facilities. The operating mode of the terminal and all requests for information by the user are made using either a special alphanumeric infra-red keypad, or a standard IBM-compatible keyboard. For the untrained user, an onscreen help facility is available at any time. The information requested by the user is displayed on the terminal screen, which, in the case of the dedicated terminal, can be the user's own domestic television. Each screen of data is termed a frame. The large colour palette (262144 colours/shades) allows full-colour photographs to be displayed to full effect.

The displayable screen is structured into 23 lines and 40 characters (80-column format is also available). Lines 24 and 25 are reserved for menu commands and warning messages. The received frame may contain several types of data and, on detecting a predefined data sequence, the user terminal will act accordingly, e.g. decompressing photographic data or storing telesoftware. To reduce waiting time, each block of data received by the terminal is acknowledged and then displayed while the next block is being received. Thus, when a frame contains several data types, the user sees the picture being built up, with the photographic image being the last to be displayed.

Teleview is not restricted just to the home or office, but may be used through public terminals in places such as airports, shopping malls and tourist-information offices. The applications for such a system are endless — from home shopping and banking, house buying and holiday bookings, to directory inquiries, stock-exchange information and messaging. Any person with a Teleview terminal also has access to telesoftware packages for home and business use, such as accounting, word-processing and games.

Being both an information and a communications system, Teleview has enormous potential in extending school lessons into the home. Many schools and colleges in Singapore are actively experimenting with Teleview to supplement the formal education process; students would be able to recap on the day's school lessons, or do homework with the results being electronically mailed to the tutor. The picture and graphic capability is particularly useful for the teacher. Preparing lessons that involve diagrams and photographs as well as text and extracts from books is dramatically simplified.

The size and cost of a system like Teleview makes it impractical for many applications. However, the architecture and hardware can be tailored to suit the applications, such as shopping centres, amusement parks or tourist information offices. The central system computer could easily be a PC or file server where large databases are not required and the number of subscribers is limited. In the UK, VHF/UHF frequencies are not readily available and legislation makes setting up a dedicated broadcasting service extremely difficult, if not impossible. Of course, the off-air broadcast could be replaced by cable networks or high-speed digital links. Singapore has launched one of the first commercial integrated services digital network (ISDN) services enabling voice, images and data to be carried on telephone lines at data rates of 64 kbit/s. Although not as fast as broadcast transmission, high-speed digital links provide an easy alternative giving respectable performance. Satellite communications have the advantage of providing a wide coverage capable of reaching remote locations. Fibre is also now beginning to take the place of copper in telephone networks, giving the capability to carry all forms of information. Although fibre networks are already with us, it may be some time before the fibre finally reaches into many homes.

Finally, as the cost of networks for use in the domestic market falls, consumer equipment such as the PCs, video, fax and telephone will be capable of interaction. As people gain the ability to conduct mundane but essential tasks efficiently, they will have more time to participate in and enjoy leisure pursuits.