NEW HORIZONS

Telstra
Research
Laboratories

New Horizons 1996

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HIGHLIGHTS 1995/96

A TRL intelligent networks team solved potentially costly traffic overload problems associated with Telstra's popular Priority™ One3 platform, and demonstrated the ability of the improved One3 platform to withstand overload.

TRL established an Internet program – mobilising all areas of research, from network performance to service prototyping – to develop a faster, more secure and higher quality service for future Internet customers.

Researchers collaborated with Telstra Multimedia to develop new cable modem systems capable of providing higher speed connections to the Internet, paving the way for more sophisticated, two-way multimedia services to the home. TRL is also investigating the use of Internet caching to increase service speed and reduce costs.

TRL has played a key role in designing – and managing – Telstra's Experimental Broadband Network (EBN), a pre-commercial, wide-area ATM network connecting universities, hospitals and research institutions in different states. The EBN is being used to trial distance learning, video retrieval, remote medical diagnosis and supercomputer networks.

Researchers adapted the TRL-developed ViewFinder™ X.500 electronic directory system for use in the Internet White Pages™ service. Viewfinder™ was also selected by a major international company from a field of global contenders for a series of global directory assistance trials.

Engineers and social scientists evaluated the technical performance and customer perceptions of DECT (digital enhanced cordless technology) as a means of providing cord-free access to the wired network in office and home environments.

Shaping tomorrow's business with today's technology.

The past year has been a watershed for global telecommunications. Record numbers of new users across the world have taken to using the Internet and mobile phones for their day to day communication, business and personal.

As I write this, there are 4.5 million mobile phone customers in Australia, more than half the number of telephone customers on Telstra's fixed network. At current growth rates, by the year 2000, more Australians will be using mobile phones than fixed-phone services.

This overnight revolution in telecommunications is the biggest challenge Telstra has ever faced. Within the space of a few years, our core business has jumped from delivering relatively slow, analogue telephone services to developing and delivering advanced, high-speed information services, based on wireless, optical fibre, digital, multimedia and interactive technologies.

Furthermore, the Australian telecommunications market, like many around the world, will soon be thrown open to all players. In short, it's not just a matter of ever-shifting goal-posts. It's a whole new ball game, and the arena is global.

In a global market, we can only win new customers through offering the best service at the best price, and we plan to achieve this through the focused application of advanced technology. This is why TRL's research and development role is so important to Telstra's business, adding value by helping us improve services and cut costs. TRL is making a difference at every level, from developing an integrated, more efficient network architecture, to identifying and developing new ways of supporting the communications and information needs of Telstra's corporate and business customers.

In the following pages, you'll find many examples of how TRL is applying its technological foresight and analytical skills to Telstra's business. I hope you'll be as excited as we at Telstra are about the future: a future being shaped by today's technology, where the global will be local, where access will be universal, and where services will be individually tailored to meet the different needs of every customer, the future 'market of one'."

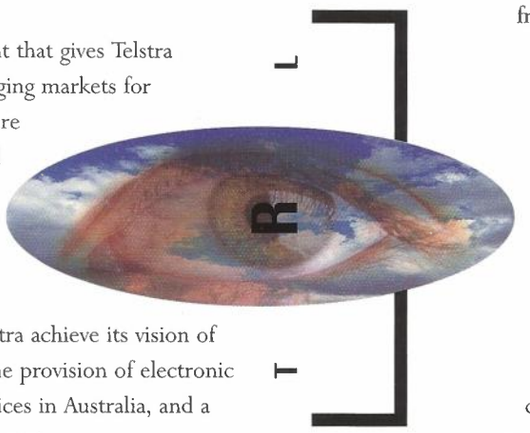
W. Frank Blount
CHIEF EXECUTIVE OFFICER, TELSTRA

Driving Telstra's vision of the future

A LITTLE OVER TEN YEARS AGO, a research team at Telstra Research Laboratories (TRL) began investigating a new packet switching technology that was unfamiliar to the international telecommunications community – except for the few researchers around the world excited by the technology's enormous potential.

Today, asynchronous transfer mode (ATM) is regarded as a key to delivering advanced multimedia services to homes and offices. ATM switches can cost-effectively deliver high quality real-time video streams and high speed data packets over broadband networks, whatever the transmission medium.

It is this kind of technical foresight that gives Telstra an edge in the hugely profitable emerging markets for broadband communications. TRL's core competence in research and advanced technology ensures that Telstra has the long-range vision needed to spot threats and identify opportunities on a global scale.



We are committed to helping Telstra achieve its vision of being the customer's first choice in the provision of electronic communication and information services in Australia, and a significant provider in the Asia-Pacific region.

In fact, we have put in place a program structure that supports this aim. TRL has just emerged from a period of consolidation with a new, leaner research program structure and the expansion of its skill base with the incorporation of the Sydney-based Technical Development Group.

The new programs focus TRL's expertise more sharply on areas critical to Telstra's business – broadband services being amongst the most important. The broadband services delivery program in turn is focused on interactive multimedia, including Internet services.

As the media constantly remind us, the Internet has changed forever the standard for home-based communications, introducing tens of millions of people worldwide to the idea of accessing visual and text based services over a telephone line. But Internet users still face problems with service assurance and quality, communications security and response time. TRL has established an Internet program to identify and resolve the technical issues in systems, facilities, infrastructure and processes that may impede Telstra's delivery of commercial, interactive and real-time services via the Internet.

In other critical areas, TRL is playing a significant role in shaping tomorrow's technology through its participation in international standards organisations. Its prominent role in both the TINA (Telecommunications Information Networking Architecture) Consortium and DAVIC (Digital Audio Visual Council) will ensure that Telstra benefits from standards designed to create a seamless, open digital environment in which telecommunications, computing, information content and broadcasting can readily converge.

Within this issue of *New Horizons*, you'll find many more examples of how TRL is adding value to Telstra's business in areas such as mobile services, communications security, business communications, services navigation, network operation and management and service assurance for customers.

In the race for better, faster and cheaper services and more compact and user-friendly customer devices, no telecommunications company today can afford to risk backing the wrong candidates for the next generation of new technology. TRL's research and development is a key to finding the best technology options for Telstra, and to helping it transform visionary ideas into profitable services.

Graham Shepherd
DIRECTOR, TELSTRA RESEARCH LABORATORIES

The aim of all research and development is to carry us forward from the present to the future – quickly, effectively and profitably.

Welcome to Telstra Research Laboratories

Telstra Research Laboratories (TRL) is the research and development centre of Telstra Corporation Ltd, Australia's largest telecommunications carrier. TRL has the highest concentration of communications, software and electronic engineering experts in the country, with more than 500 at its Melbourne Laboratories and 50 in Sydney.

Between them, TRL's people bring a range of innovation skills to Telstra – in engineering, scientific research, software and artificial intelligence, mathematics, psychology, education, linguistics, anthropology and other social sciences, electronics, computer graphics and customer interface design. This synergy enables TRL to develop effective technologies that will underpin the success of Telstra's future services and products.

Telstra invests $66 million annually in TRL's activities.

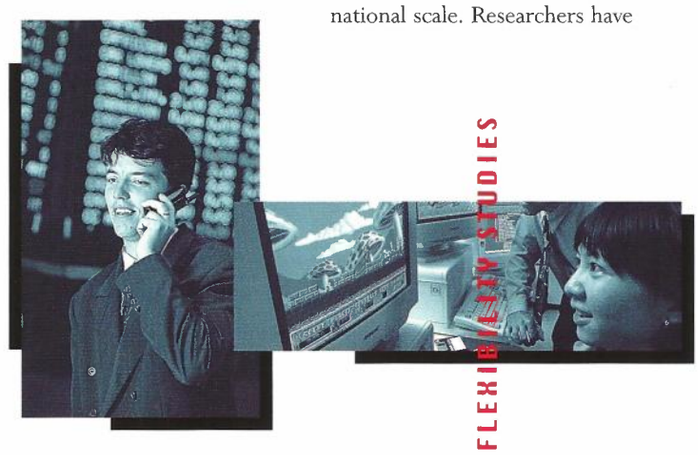
What does TRL do?

TRL has the technical expertise to develop precise models of future network architectures. These models allow business units to make informed choices about their investments. For example, small differences in the cost and effectiveness of customer access technologies – such as ADSL copper, hybrid fibre-coaxial cable, optical fibre or wireless – could result in large discrepancies when replicated on a national scale. Researchers have developed accurate and detailed models of different possible customer access 'futures' for strategic comparison.

With its strengths in human communications and market research, TRL has the analytical skills to investigate new markets for Telstra and identify existing communications opportunities in different industries. TRL's human factors experts also advise business units on the most effective 'look and feel' for new products and services.

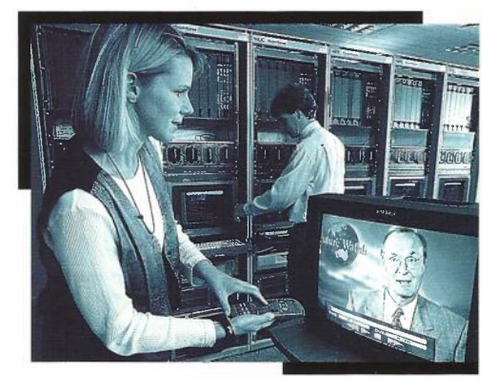
TRL boosts its research effort through collaborations with universities and high-tech companies in Australia and overseas. It represents Telstra in international strategic alliances – with organisations such as Microsoft, IBM

CUSTOMER-FOCUSED RESEARCH PROGRAM



FLEXIBILITY STUDIES

MONITOR GLOBAL DEVELOPMENTS



and Novell – to investigate information and communication technologies that should pave the way for a high-quality global multimedia services network.

Researchers also monitor global developments in telecommunications standards and technology. Standards ensure that the architectures put in place to support future services and products provide a seamless, integrated and open network environment for service and content providers, and for customers. TRL researchers have been participating in key international standards and industry organisations that determine the broad directions of audio-visual, security and electronic directories systems. Importantly, they have the technical background to understand the implications of new standards for Telstra's business.

TRL carries out feasibility studies, and develops computer models and laboratory-based demonstrations to test new standards and technologies, enabling business units to preview emerging technologies. Such demonstrations also enable Telstra to get some way up the learning curve before it introduces a new technology. This translates into a higher return on investment, and better quality of service for customers.

The new customer-focused research program structure in place at TRL enables researchers to work closely with business units in developing and testing new products. Apart from contributing to product and service innovation, TRL supports Telstra in carrying out customer trials, such as the ADSL/MediaStream™ trial in Melbourne.

Becoming digital

When information is broken down into digital bits – a stream of 0s and 1s – it is easier to control, transmit and combine than streams of analogue information.

Telstra is investing $3.3 billion in the Future Mode of Operation (FMO) program to digitalise and modernise the public switched telephone network. Almost two-thirds of the network is now digitalised. Telstra plans for the network to be 100 percent digital by the year 2000 or earlier, giving customers improved access to and control of new services.

TRL played a key role in assessing the digital switching and transmission technologies now being deployed in the FMO program.

Low-cost, repeater-free link to Tasmania

The $30 million optical fibre Bass Strait link that connects Tasmania to the mainland network features a 240 km undersea span that is repeater-free. Telstra has installed an optical amplifier at either end of the link and special low-loss optical fibre, saving millions of dollars in costs and making upgrades easier.

TRL first proposed this radical option at a time when the relevant equipment was not yet commercially available. Through laboratory demonstrations, close collaboration with suppliers and technical know-how, TRL researchers were able to prove the viability of the repeater-free system to Telstra designers and planners.

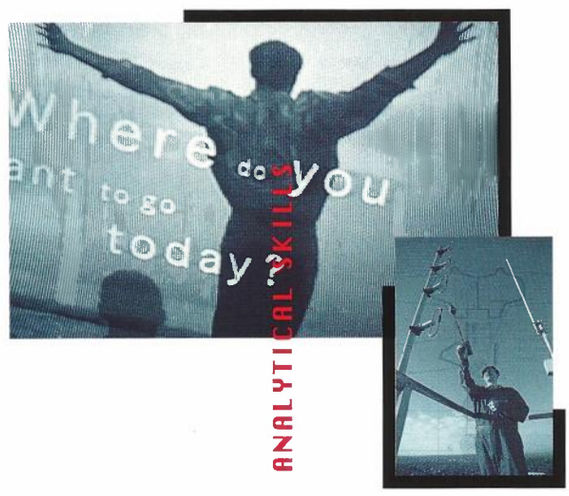
Introducing ATM to Australia

ATM is a packet switching platform capable of speedily and cost-effectively delivering video, voice, text and data over any type of broadband infrastructure – optical fibre, coaxial cable or copper. TRL first began investigating ATM in 1985, later developing several prototype ATM switches to demonstrate the technology's capabilities to Telstra business units at a time when commercial ATM equipment was not yet available.

In 1990, TRL set up a research ATM network between its Melbourne laboratories and a Department of Defence site in Adelaide. Researchers used the experience gained with this network to establish and manage a national ATM-based Experimental Broadband Network (EBN) between Melbourne, Canberra, Sydney and Brisbane. Telstra is using the EBN to test advanced multimedia applications such as remote medical diagnosis, multimedia distance learning, supercomputer networking, information storage and retrieval and application sharing between remote users.

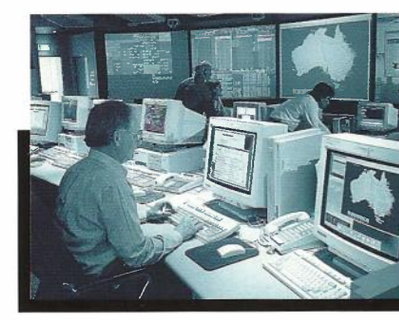
It was TRL's experience in ATM that encouraged Telstra's Capacity Planning Group to consider introducing ATM to the core network. TRL is also supporting the introduction of Telstra's first commercial high speed data service based on ATM.

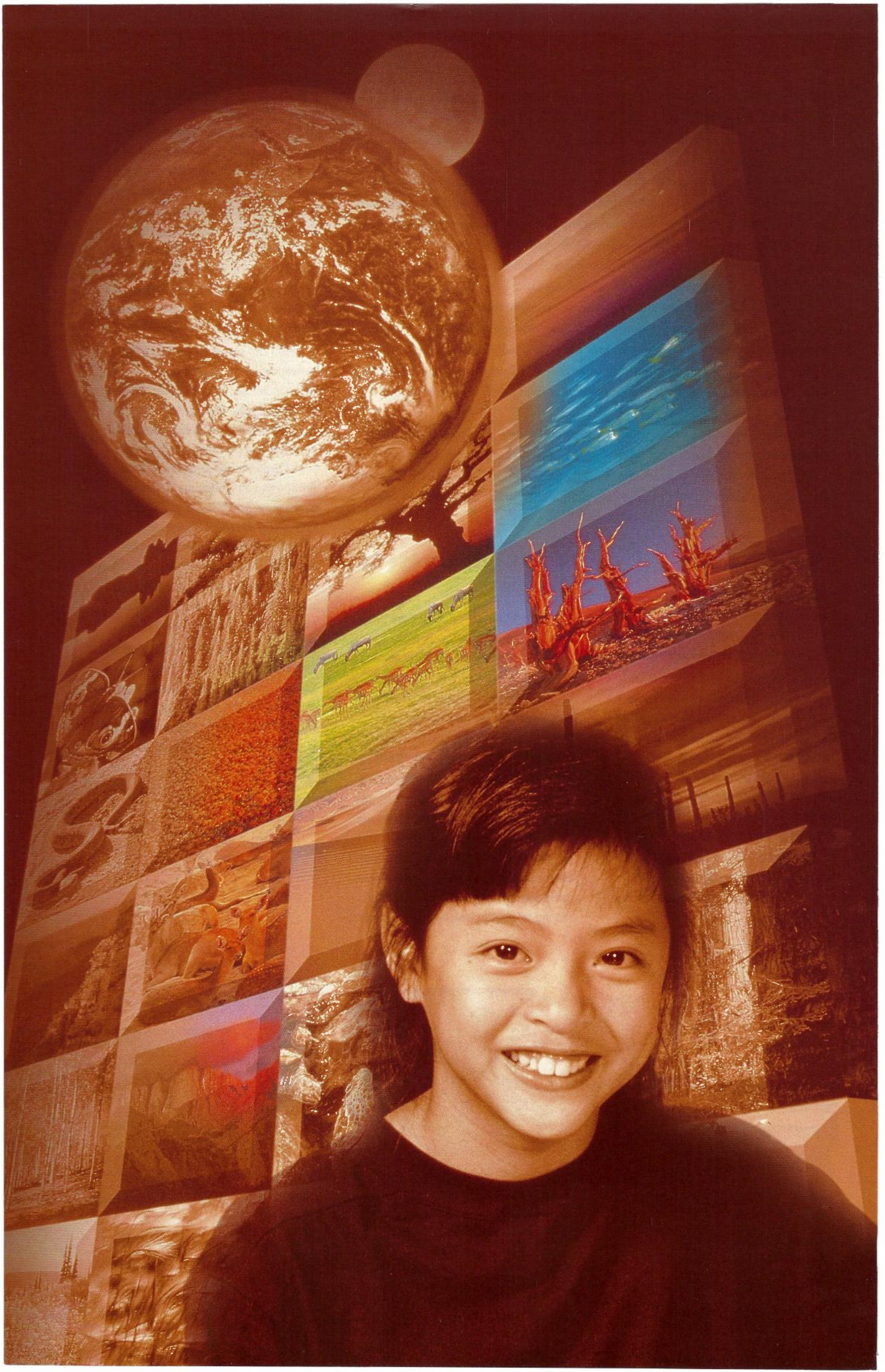
DEVELOPING PRECISE MODELS



ANALYTICAL SKILLS

INVESTIGATE INFORMATION AND COMMUNICATION TECHNOLOGIES





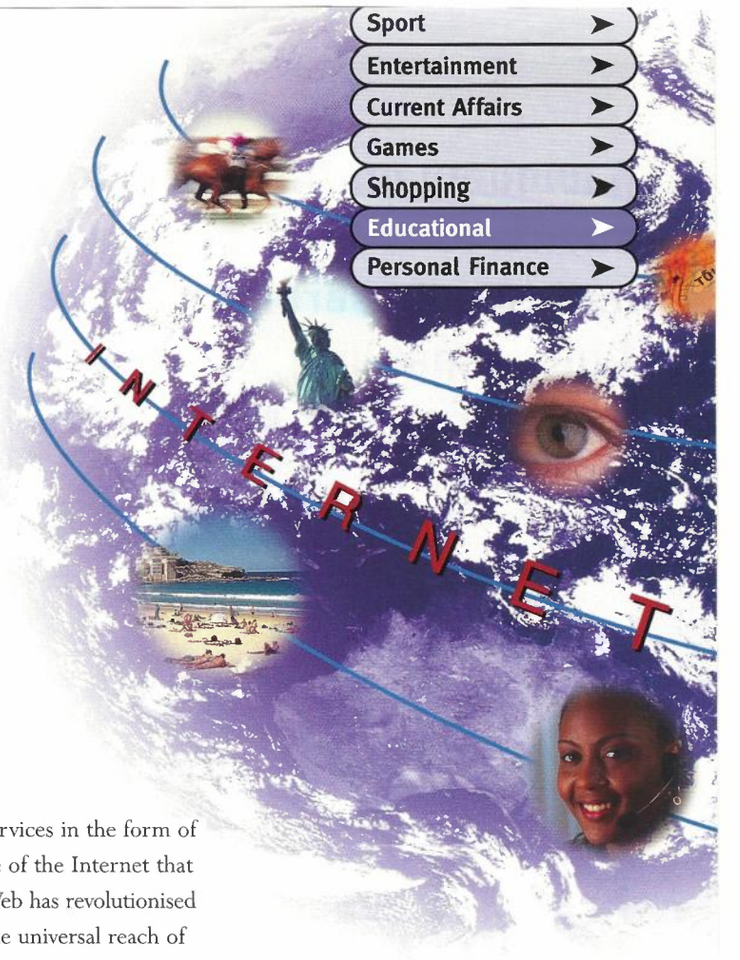
A window on the world in every room – PC, TV, screen – phone or a new generation of terminals? Interactive multimedia services to the home will combine the real-time capability of the telephone with the data and video transfer capabilities of desktop computers and pay TV.

Multimedia to the home

Twenty years from now, when you look out a window, what you see may be five thousand miles and six time zones away. When you watch an hour of television, it may have been delivered to your home in less than a second. Reading about Patagonia can include the sensory experience of going there.
NICHOLAS NEGROPONTE, *BEING DIGITAL*, HODDER & STOUGHTON, 1995

As Nicholas Negroponte points out in *Being Digital*, interactive multimedia services – online data and text 'enriched' by video, graphics and sound – will give us more freedom in the way we communicate and organise our lives. Future broadband networks will offer hundreds of channels of pay TV, video-on-demand, computer games, virtual reality events, CD-quality soundscapes, home shopping and education, and easy access to government information services.

Today, customers are already able to choose – with the click of a mouse – from a growing range of new visual services. They could choose for example to get an inside view of the Sydney to Hobart Yacht Race via the World Wide Web, or browse an electronic catalogue to 'window shop' for a special item.



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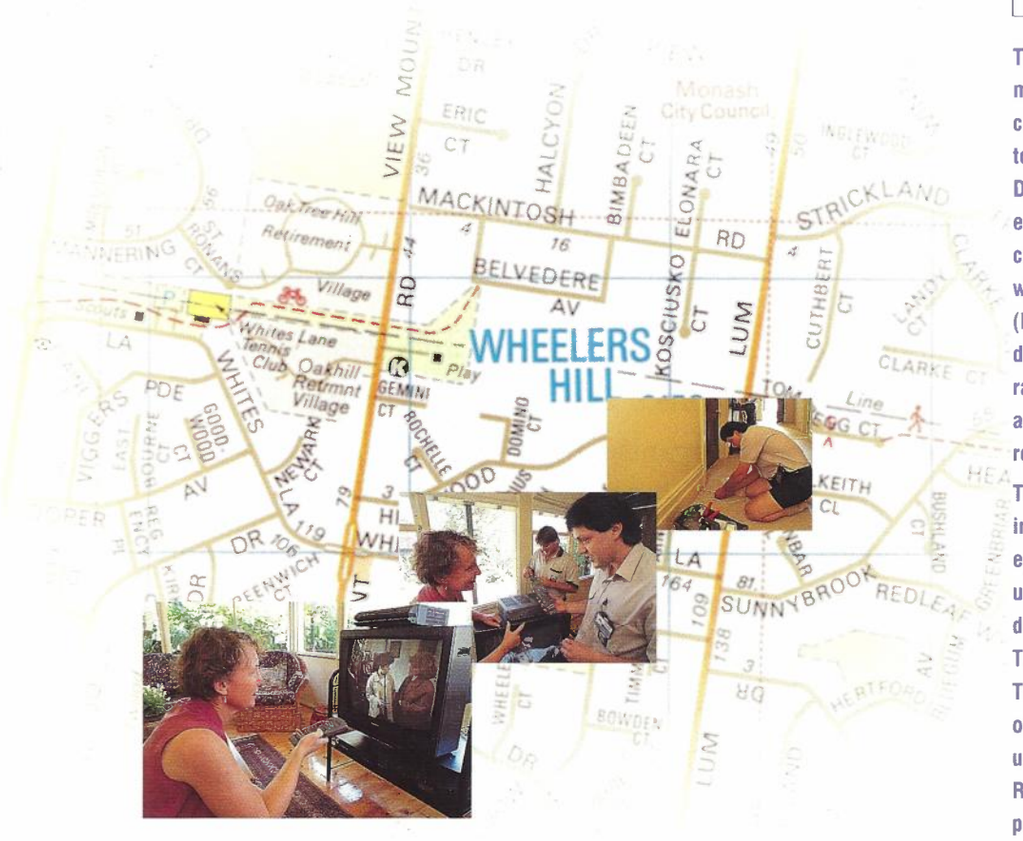
Many Australians have had their first taste of online visual services in the form of pay TV and the World Wide Web, the graphical easy-to-use face of the Internet that has opened access to tens of millions of home users. While the Web has revolutionised the way we communicate – combining computer control with the universal reach of the telephone and the immediacy of pictures and sound – it is yet to prove as easy, reliable and instantaneous as the basic telephone service.

TRL is investigating how Telstra could improve the quality of Internet service. The TRL Internet program incorporates earlier work on electronic directories, security and multimedia-capable ATM switching.

Researchers are looking at factors that will affect the success of online multimedia services delivered over the Internet and over broadband cable networks. What is the critical delay threshold for interactive games? How will the narrowband



Video-over-copper customer trial

TRL has shown that ADSL could reach more than 90 percent of the nine million customers served by Telstra's copper telephone network. ADSL (Asymmetric Digital Subscriber Line) technology enables video signals to be carried over copper telephone wires. Thus – in tandem with Telstra's hybrid fibre-coaxial cable (HFC) network – ADSL and the shorter distance, higher rate VDSL (Very-high rate Digital Subscriber Line) offer an alternative delivery mechanism for the rollout of broadband services to the home.

Through the MediaStream™ trial, which involves 300 homes in Melbourne's eastern suburbs, Telstra is evaluating the use of ADSL in the customer network to deliver pay TV and video-on-demand. The 'headend' of the trial is based at TRL, which also assisted in the design of the trial network architecture and the user interface for program selection. Researchers are also evaluating viewer perceptions of service quality.

Internet handle bandwidth-hungry 3-D imaging and virtual reality? How secure will the Internet be for purchasing and financial transactions?

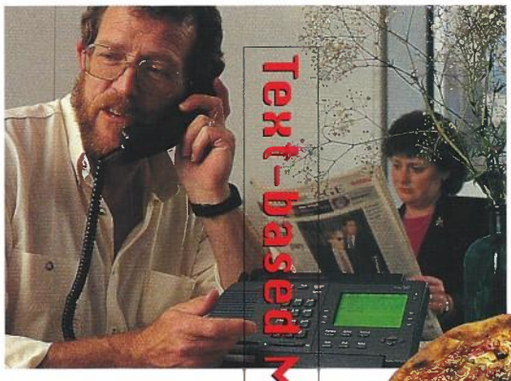
How will we access multimedia services in 2001? Computers are already multimedia-capable, and will soon be virtual reality-capable. By 1999, more than four million homes will have access to the broadband cable network currently being rolled out by Telstra. Will we use a PC-like TV or a TV-like PC? Researchers are investigating the options, including the use of screen phones to access services on the Web.

By 1999, more than four million homes will have access to the world class broadband cable network currently being rolled out by Telstra.

Computer-free Internet access

TRL has developed a screen-telephone demonstration system that will enable customers to access a World Wide Web server without a computer or modem. Text-based menus, delivered to the screen-phone's LCD display, guide users through available service options.

Researchers also assisted Telstra's NTG Products unit to develop a prototype screen phone interface and intelligent network system for home banking. By simply dialling a '13' number, a user could access any banking service within a banking organisation, regardless where in Australia it was located. Other potential applications of the screen-phone include home shopping, and access to services such as MessageBank®.



Video compression expertise

Compressed video has been compared to concentrated orange juice – dehydrate for transport, and reconstitute at the other end. Uncompressed video consumes massive bandwidth. Video compressed by factors of up to 1,000 can be delivered down much narrower 'pipes', a key factor in the success of interactive services.

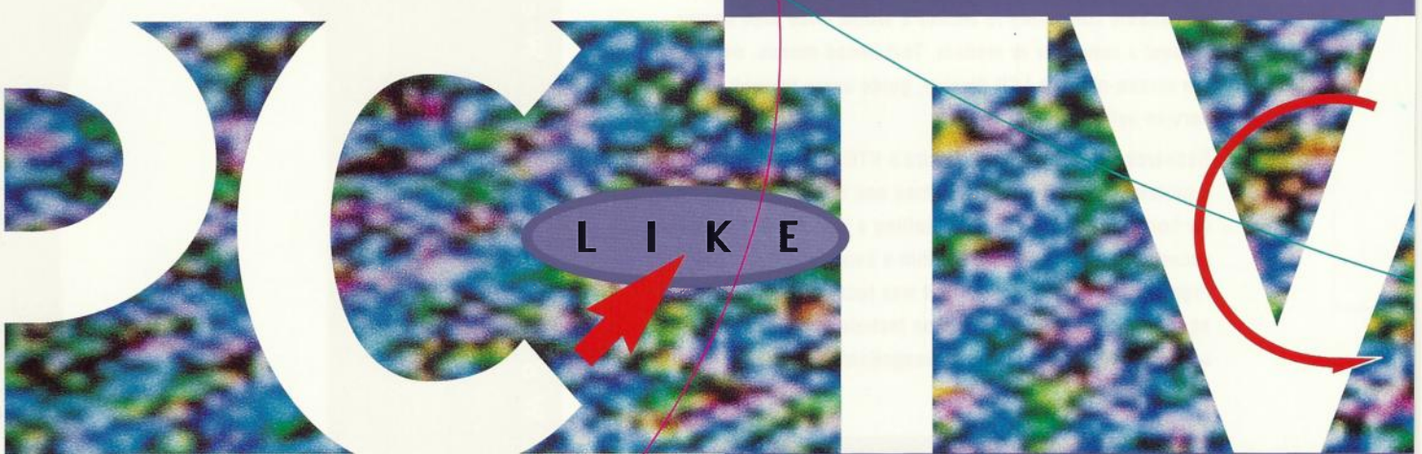
TRL has made significant contributions to the international forum specifying the next generation of video compression standards. Video coding may, in future, be based on object-oriented coding, which allows video images to be broken down into logical units – for example, background is coded separately from foreground. Images thus encoded could be edited as easily as text on a word processor.

Some interactive services require broadband capacity in both directions - from, as well as to, customers. Research is under way to determine how Telstra's network can be geared to carry multimedia from user to user, and from user to provider, for applications such as video calls and interactive games.

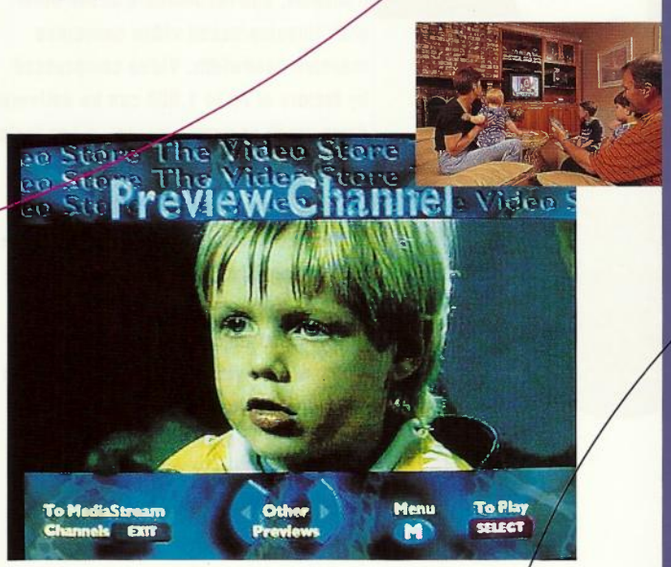
Setting superhighway standards

DAVIC – Digital Audio Visual Council – is an international industry forum assessing the architectures, interfaces and protocols for delivering digital broadband services across an 'open', non-proprietary network environment. DAVIC's 150 member organisations include the world's major telecommunications, computing, software, cable and consumer electronics organisations.

Because of TRL's experience with the MPEG (Motion Pictures Expert Group) video compression standard, Telstra was invited to be one of the 40 founding members of DAVIC. DAVIC-compliant multimedia platforms will provide a consistent level of reliability and connectivity, in the same way that STD® and IDD telephone connections operate reliably within and between different countries. The DAVIC standard will be important in the rollout of Telstra's digital broadband services network to Australian homes and business.



With synergies in human factors research, software engineering and network architecture and management, TRL is helping Telstra transform vision into reality in the era of 'being digital'.



TRL test-bed for advanced multimedia services

TRL engineers, computer scientists and human communication experts have been working with Telstra business units and media artists to develop and test advanced multimedia applications.

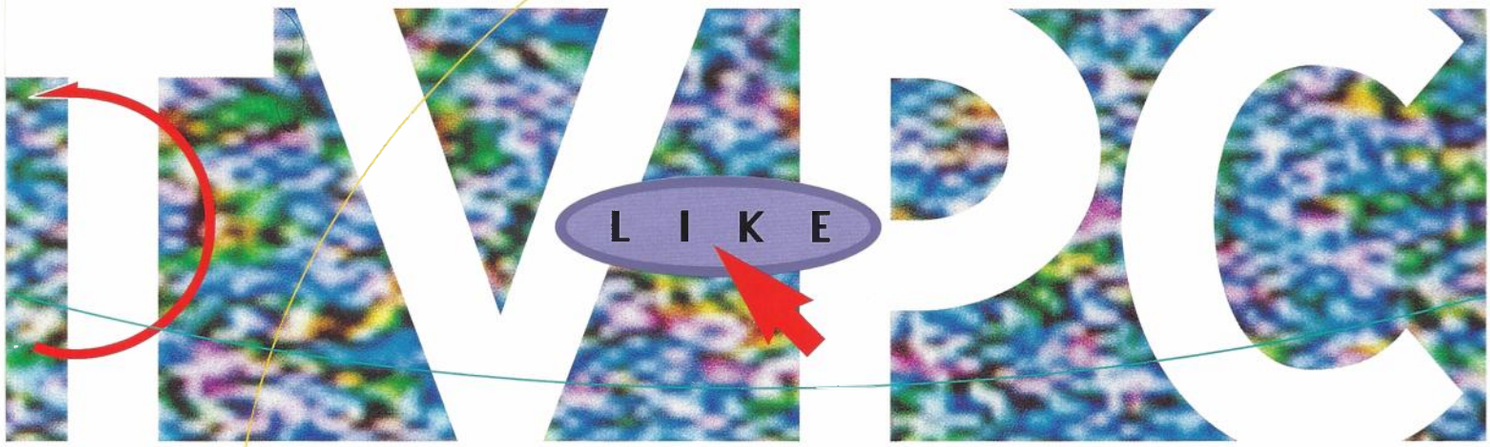
The team is also formulating detailed guidelines for integrating navigation and security functions with new products and services. This will help future service and content providers and network architects design more effective systems.

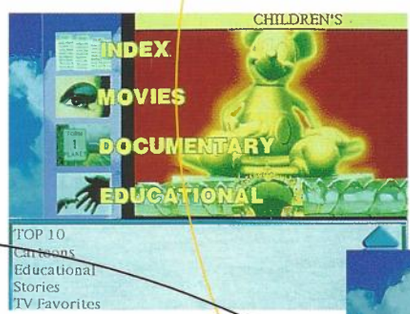
Among the prototype applications developed at TRL is a graphical user interface that assists viewers of video-on-demand services to efficiently locate programs. The interface, designed for Telstra's ADSL/MediaStream™ trial, incorporates imaginative graphics and video clips into an easy-to-use electronic video program guide.

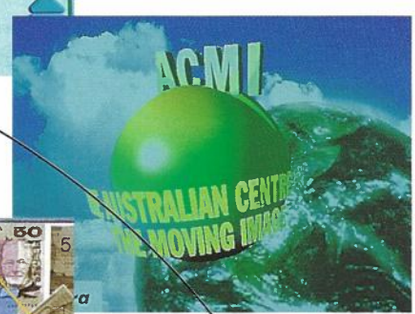
Bang!...Are you dead yet?

Timing is a critical element in interactive computer games, which could one day be delivered to Australian homes via computers linked to Telstra's pay TV network.

TRL has been investigating in the laboratory the delay times required for interactive games, comparing the response times of games delivered over hybrid fibre-coaxial cable, copper wire and local area networks (LANs). Apart from assessing network implications, researchers are assessing user perceptions of quality of service. This may help Telstra business units decide how to provide customers with flexible rates based on required service quality.





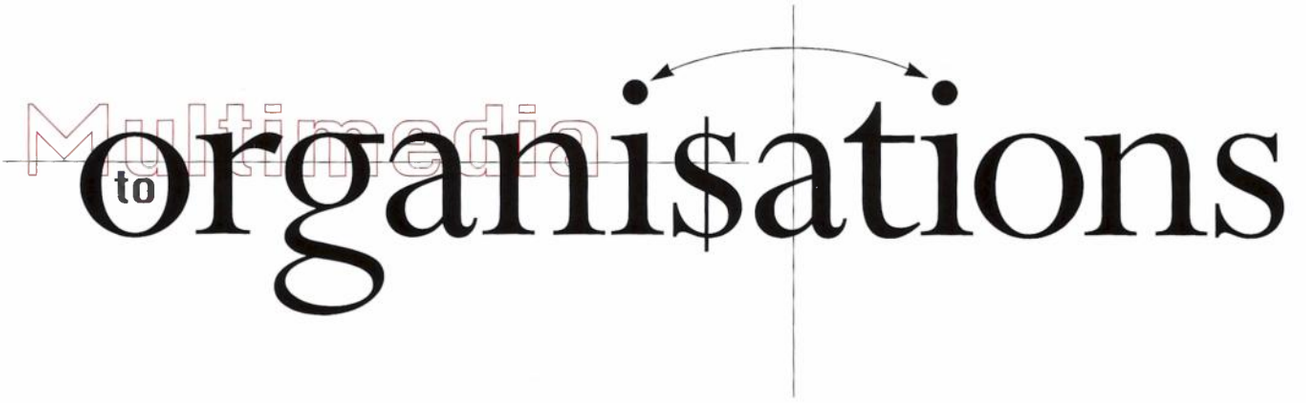


Modem to connect home PCs to cable

Researchers are experimenting with multimedia computers and cable modem systems capable of accessing multimedia services – high-speed Internet access, interactive games, home shopping, personalised news services and so on – over the cable TV network. Because of cable's greater bandwidth, cable modems should offer better performance and higher speeds than existing telephony-based modems.

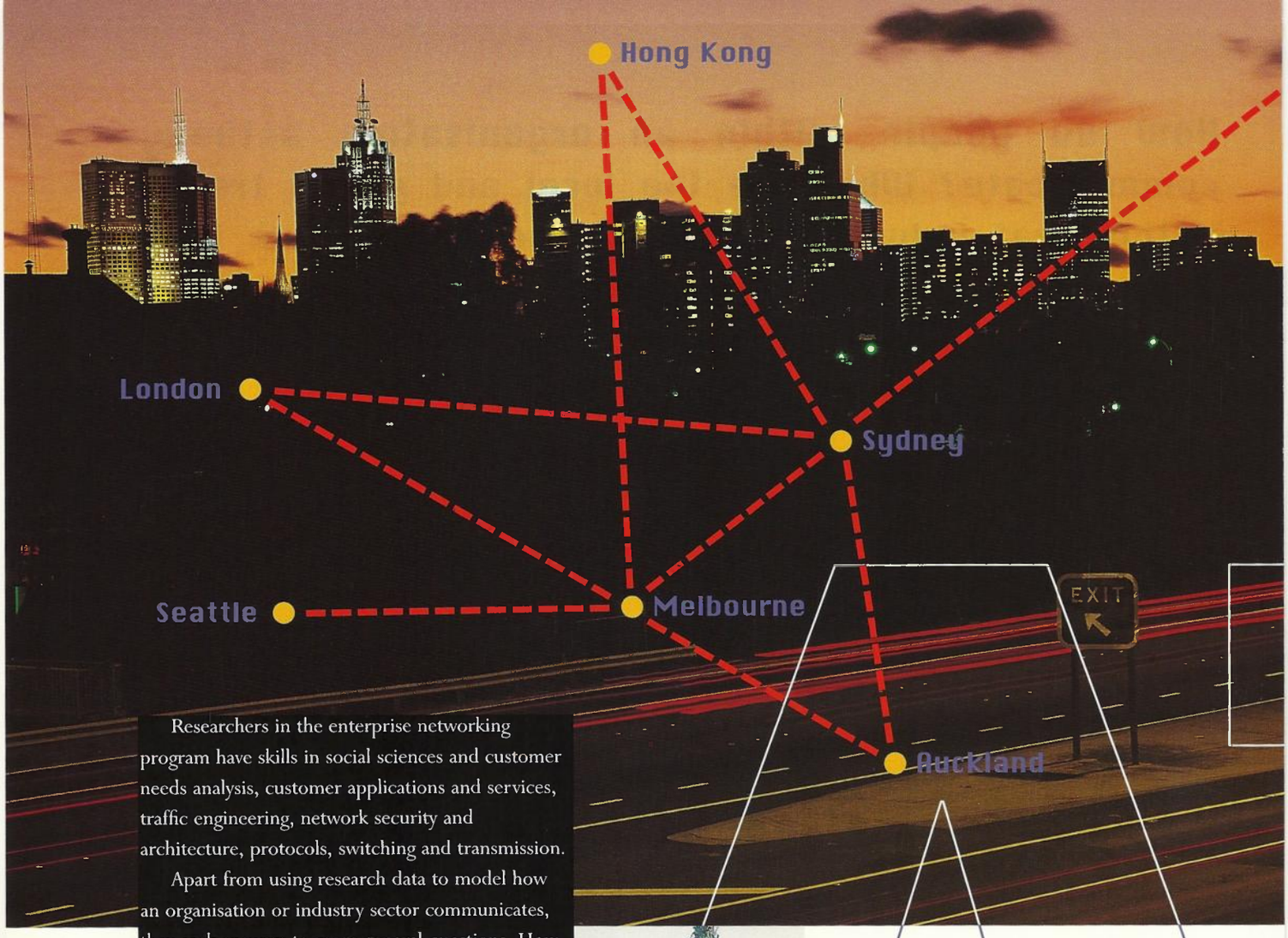
TRL is working with suppliers and Telstra business units to assess the cable modem network's service delivery performance in accessing Web and electronic directory services, including video information, which may facilitate home shopping via personal computers.

How do people within an organisation actually communicate? What are the local and global trends within that industry? How will we do business in a digital world? In helping organisations gear up for the future, TRL looks at the bigger picture.



Mobile phones, voicemail, e-mail and videoconferencing have dramatically changed the way people inside organisations work and communicate. Now, multimedia technologies such as helpdesks, electronic directories and remotely 'shared' desktop applications are extending the reach of organisational communications further, to the desktops of suppliers and customers in distant cities and countries.

TRL carries out studies of how information moves through individual organisations or across entire industry sectors. These information flow studies point to communication strengths and gaps. They also point to non-technological solutions to communications problems – a change in management structure, staff training or changes to work practices – as well as opportunities for Telstra. TRL's information flow studies are being used by Telstra business units to scope future markets and products.



Researchers in the enterprise networking program have skills in social sciences and customer needs analysis, customer applications and services, traffic engineering, network security and architecture, protocols, switching and transmission.

Apart from using research data to model how an organisation or industry sector communicates, they seek answers to more general questions. How can financial transactions be made more secure? What trends are occurring overseas?

What about the Internet? How can it help Australian businesses? What shape will it take in the future? For business organisations, the World Wide Web offers multimedia access to suppliers and markets globally. But the Web still has problems – security, navigation, bandwidth and service assurance for customers are the most urgent.

Construction project planned in virtual workspace

TRL assisted in a CAD (computer aided design) desktop multimedia project that allowed design and construction professionals working on the Greensborough Shopping Plaza in Melbourne's north-eastern suburbs to 'telecommute' between Sydney and Melbourne.

The focal point of the CAD system was a shared, split-screen multimedia 'desktop', which allowed architects and construction personnel in different cities to discuss and edit a CAD drawing. The desktop gave them access to videoconferencing, CAD software, still images, graphics, text and electronic whiteboards. TRL worked with CSIRO, Telstra's Industry Marketing group and the commercial developer, Lend Lease Group on the project.

Telstra and CSIRO are setting up a bureau service in Jakarta, for use by Australian firms involved in design and construction projects in Indonesia.

TRL is assessing how an organisation can cost-effectively introduce ATM to the desktop while protecting

Through its Internet program, TRL is evaluating and bringing together the technologies and services that should greatly increase business use of the Net. These include investigations of the role that ATM could play in providing the core network infrastructure, multimedia service creation and delivery, software architecture protocols for convergence, electronic directories, customer billing, service assurance and network security.

For the education sector, interactive multimedia services and the Internet create the prospect of virtual classrooms and home-based learning. Issues such as privacy, security, quality and appropriateness of content, however, will be key factors in the acceptance of new education services. Telstra, through TRL's technical expertise, is in a position to assist.

ATM – faster multimedia to the desktop?

ATM is a flexible packet switching technology that enables integrated packets of video, data and voice to be carried speedily over a single switching platform. TRL researchers are collaborating with Telstra's Information Technology Group (ITG) to trial ATM enterprise networks for desktop multimedia.

TRL is monitoring the response times and performance of shared applications, including electronic whiteboards and interactive document and image editing. It is also assessing how an organisation can cost-effectively introduce ATM to the desktop while protecting its existing investment in technology.

A global broadband network, equipped with powerful security and navigation tools, wireless access and integrated network management – this is the shape of a future multimedia network, where business meetings, learning, health consultations and routine transactions will be conducted through powerful combinations of images, data, text and sound.

Internet

its existing investment in technology.

In helping organisations gear up for the future, TRL looks at the big picture

VIDEOCONFERENCING

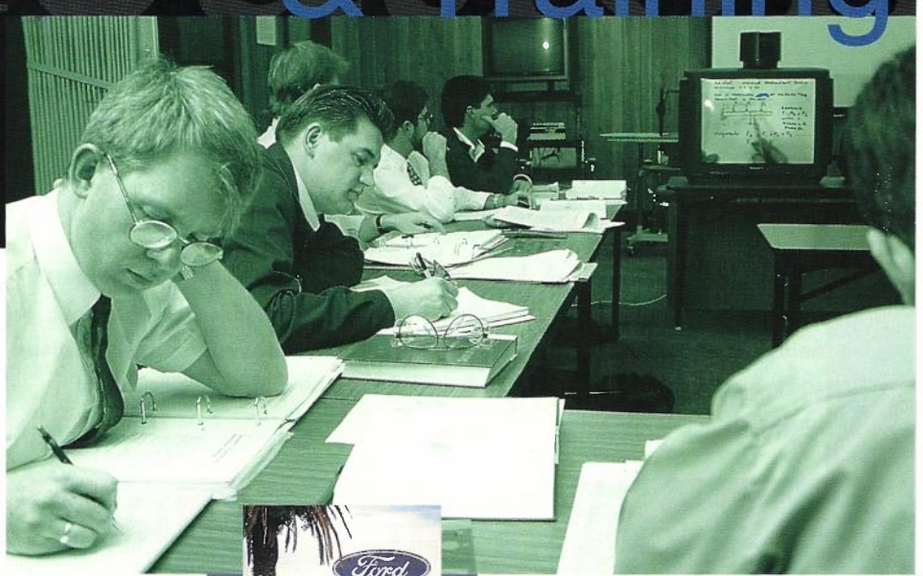
Education & Training

Workplace university

Human communication specialists from TRL are working with Deakin University's School of Engineering and Technology and the Ford Motor Company on a Department of Employment, Education and Training trial to evaluate the use of desktop videoconferencing in workplace education. Preliminary sessions were conducted in 1995 to test the concept and equipment. This was followed by a full semester study commenced in early 1996.

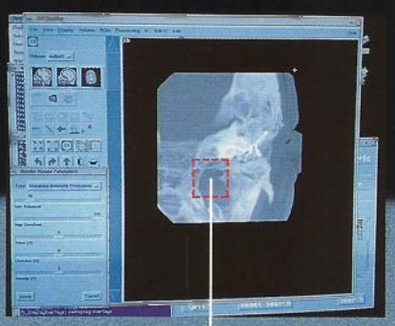
Degree and diploma students at the Ford vehicle factory in Geelong – including toolmakers, fitters and turners, designers and supervisors – are attending weekly classes in Ford's training centre. Lecturers deliver multimedia presentations from a studio at Deakin, using a Telstra ISDN link to carry graphics, data and video, plus a speaker phone as the voice channel.

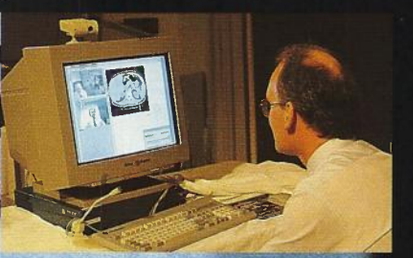
TRL researchers identified a number of issues during the preliminary trial that are being addressed in further studies. Most important were training and support for lecturers, lighting, distribution of students in the classroom, size of the monitor and quality of sound at both ends of the link. While lecturers seem to need a clear view of students for identification, the need by students for a clear image of the lecturer may not be as critical.



Remote medical imaging and diagnosis

The Australian Computing and Communications Institute is using Telstra's Experimental Broadband Network (EBN) to trial a new telemedicine imaging application. Medical practitioners in three Melbourne hospitals can now access their patient records through a common database of stored images from computer tomography (CT) and medical resonance imaging (MRI) carried out at the different hospitals. TRL has played a key role in operating and managing the ATM-based EBN network. Three Queensland hospitals will also take part in trials to assess the use of the EBN for remote medical diagnosis.

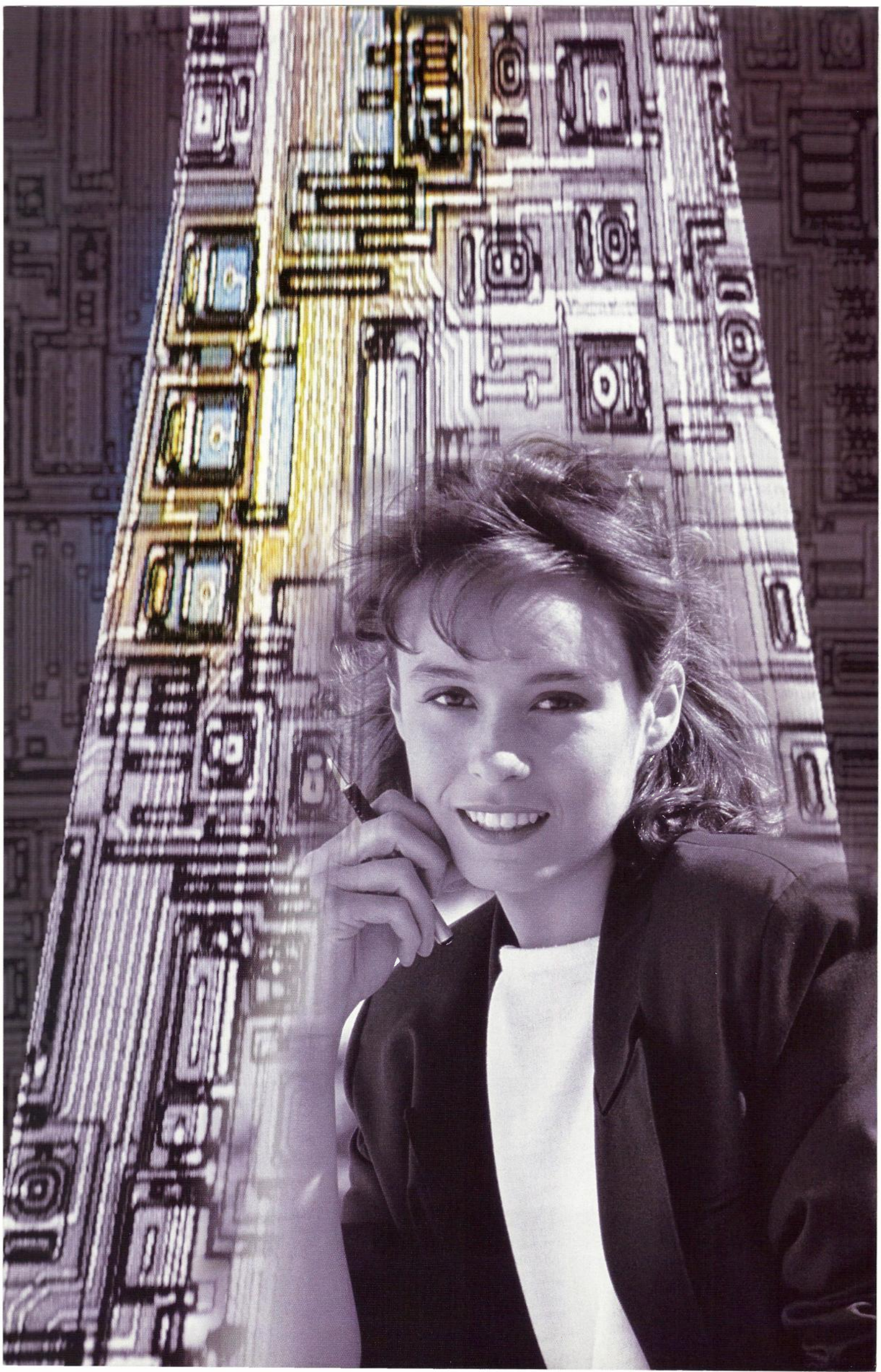




MRI

medical resonance imaging

TELEMEDICINE



Electronic images are bandwidth hungry. Interactive multimedia services involving video, for example, put huge demands on network capacity, particularly at the network core. Telstra's research on ATM, SDH and optical fibre will ensure that its network has the capacity and flexibility to deliver high-speed services reliably and cost-effectively.

The multi-service network

Part of TRL's role is to evaluate the transmission, switching and network management technologies that will underpin Telstra's full service network, which will be capable of speedily delivering advanced services to businesses and homes across Australia.

For Telstra's core network–which connects capital cities and large exchanges within cities–TRL is continuing its research on ATM (asynchronous transfer mode), a flexible packet switching technology that can simultaneously carry data, video, voice and other forms of digital traffic, whatever the underlying transport system. ATM is regarded as a key to the delivery of fast and cost-effective video services.

Coaxial Cable

IMAGING

The core network will need to cope with greatly increased capacity demands as the broadband network expands. Telstra was an early global pioneer of photonics and optical fibre technology, which has dramatically increased network transmission capacity compared with conventional telephone networks. TRL uses its experience in optical fibre and advanced photonic devices to advise Telstra on cost and service implications of new photonic architectures and technologies.

INTERNET

MULTI

At the consumer end of the network, the technological choices are different. Telstra plans to provide broadband cable access to four million homes by 1999. What are the most cost-effective and reliable technologies? Even quite small differences in operational costs between competing technologies can become significant when multiplied millions of times over, so cost models need to be as detailed and precise as possible.

Experts in optics

TRL offers strategic advice to Telstra in all areas of optical fibre technology. For example, it recently recommended that Telstra change its SDH intercapital network equipment to a new wavelength standard, from 1300 to 1550 nanometres (nm). Consequently, regenerators – which prevent signal loss – can now be spaced over longer distances. This reduces the cost and complexity of the intercapital network. Optical fibre regenerator intervals and fibre capacity will be further increased by the introduction of new photonic devices.

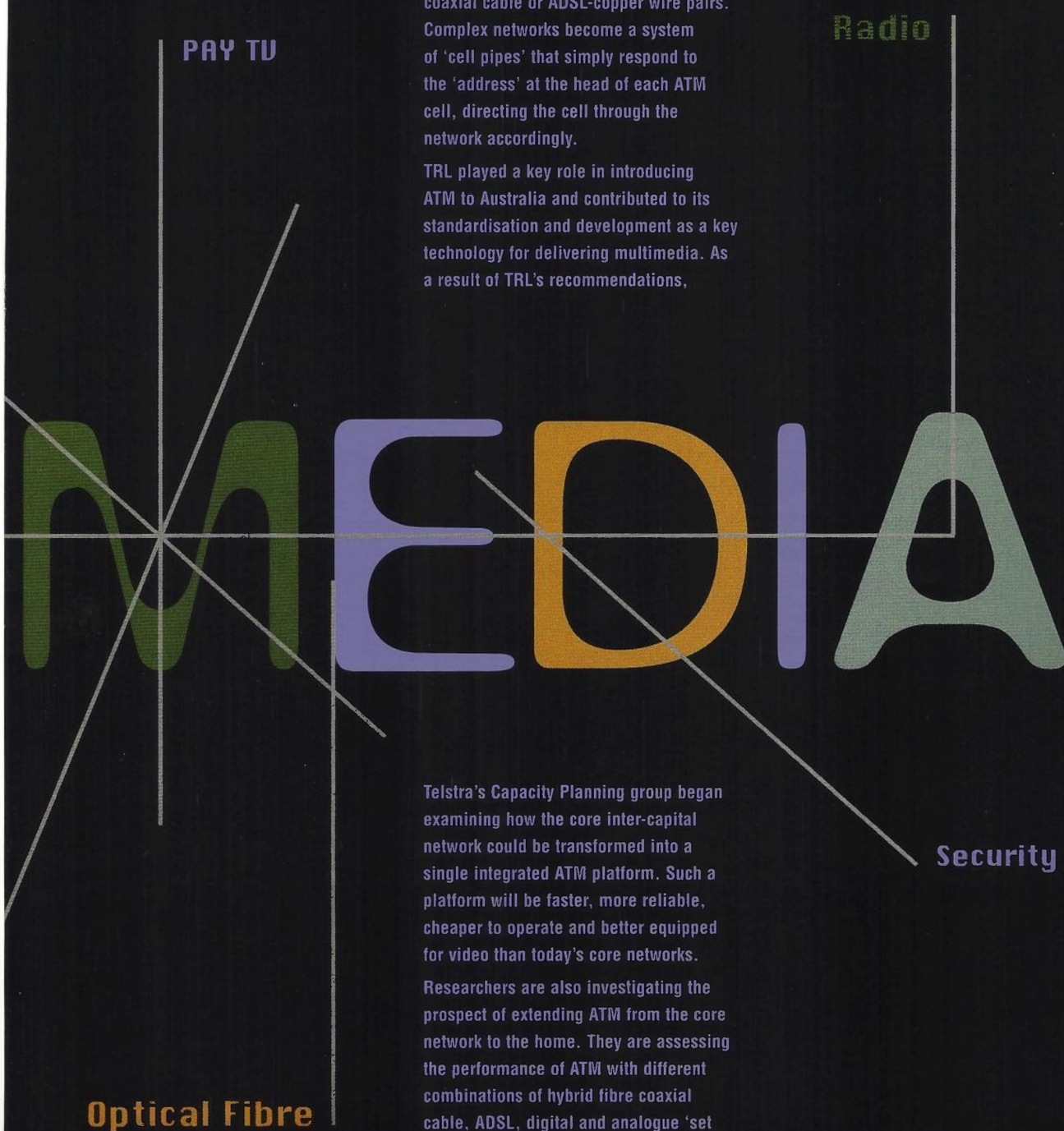
ADSL Copper

Protocols

A switch for all services

ATM greatly simplifies the business of delivering multimedia. A constant stream of standard-length ATM cells – carrying packets of e-mail, voice, data, CD quality music and video – can travel over core-network optical fibre, access-network coaxial cable or ADSL-copper wire pairs. Complex networks become a system of 'cell pipes' that simply respond to the 'address' at the head of each ATM cell, directing the cell through the network accordingly.

TRL played a key role in introducing ATM to Australia and contributed to its standardisation and development as a key technology for delivering multimedia. As a result of TRL's recommendations,



Telstra's Capacity Planning group began examining how the core inter-capital network could be transformed into a single integrated ATM platform. Such a platform will be faster, more reliable, cheaper to operate and better equipped for video than today's core networks.

Researchers are also investigating the prospect of extending ATM from the core network to the home. They are assessing the performance of ATM with different combinations of hybrid fibre coaxial cable, ADSL, digital and analogue 'set top boxes' and video compression standards.

TRL breaks world record for light over fibre

The chirped fibre Bragg grating device counteracts light dispersion over long distances and enables transmission at high speeds. In 1995, TRL collaborated with the Sydney-based Optical Fibre Technology Centre to build a chirped fibre Bragg grating device to send signals at 10 Gigabits per second (Gbit/s) along 270 km of fibre, beating the 160 km world record set by a UK-based research group. Ten Gbit/s is the speed at which the next generation of wavelength-division-multiplexed (WDM) optical networks will run. Current networks transmit signals at 2.5 Gbit/s.

Researchers are now evaluating new optical devices that may become commonplace in future 'transparent' optical fibre networks. All-optical networks are cheaper to run and simpler than electronic networks, yet offer a much higher capacity. A single optical fibre the size of a human hair could, experts say, carry a million multimedia channels simultaneously.

Apart from providing advice to Telstra business units on technical aspects of new customer access systems, TRL has been developing detailed business models to compare the costs of different broadband access architectures. Through contrasting different models, it attempts to answer questions like: Will telephony be delivered separately from interactive video services in the near future? What are the reliability and quality of service implications?

Quality of service begins with the physical infrastructure, and TRL has continued to help safeguard the integrity of Telstra's network by advising on selection of network materials and components, and on work practice and occupational health and safety issues.

As part of its Internet program to improve Internet service delivery and business opportunities, TRL has been evaluating video transmission via Internet Protocol (IP) supported on ATM. Researchers plan to set up a demonstration Internet video-on-demand service over the ATM-based Experimental Broadband Network (EBN).

Telstra plans to provide broadband cable access to four million homes by 1999.

Commercial high-speed services on trial

TRL operates and manages Telstra's Experimental Broadband Network (EBN), a long-distance ATM network used by high-tech Australian research centres to develop sophisticated visual and high-speed services. At the same time, Telstra is gaining experience in operating a commercial ATM network. The EBN backbone comprises four ATM switches located in Melbourne, Canberra, Sydney and Brisbane.

Among the applications being trialled on the EBN are telemedicine and education services, supercomputer networking for super-fast data processing, and advanced desk-top videoconferencing.

Experimental Broadband Network

Frame relay for high speed data services and LAN interconnect

TRL researchers helped select a new frame cell switch that will take Telstra's switched data networks a step closer to ATM access capability.

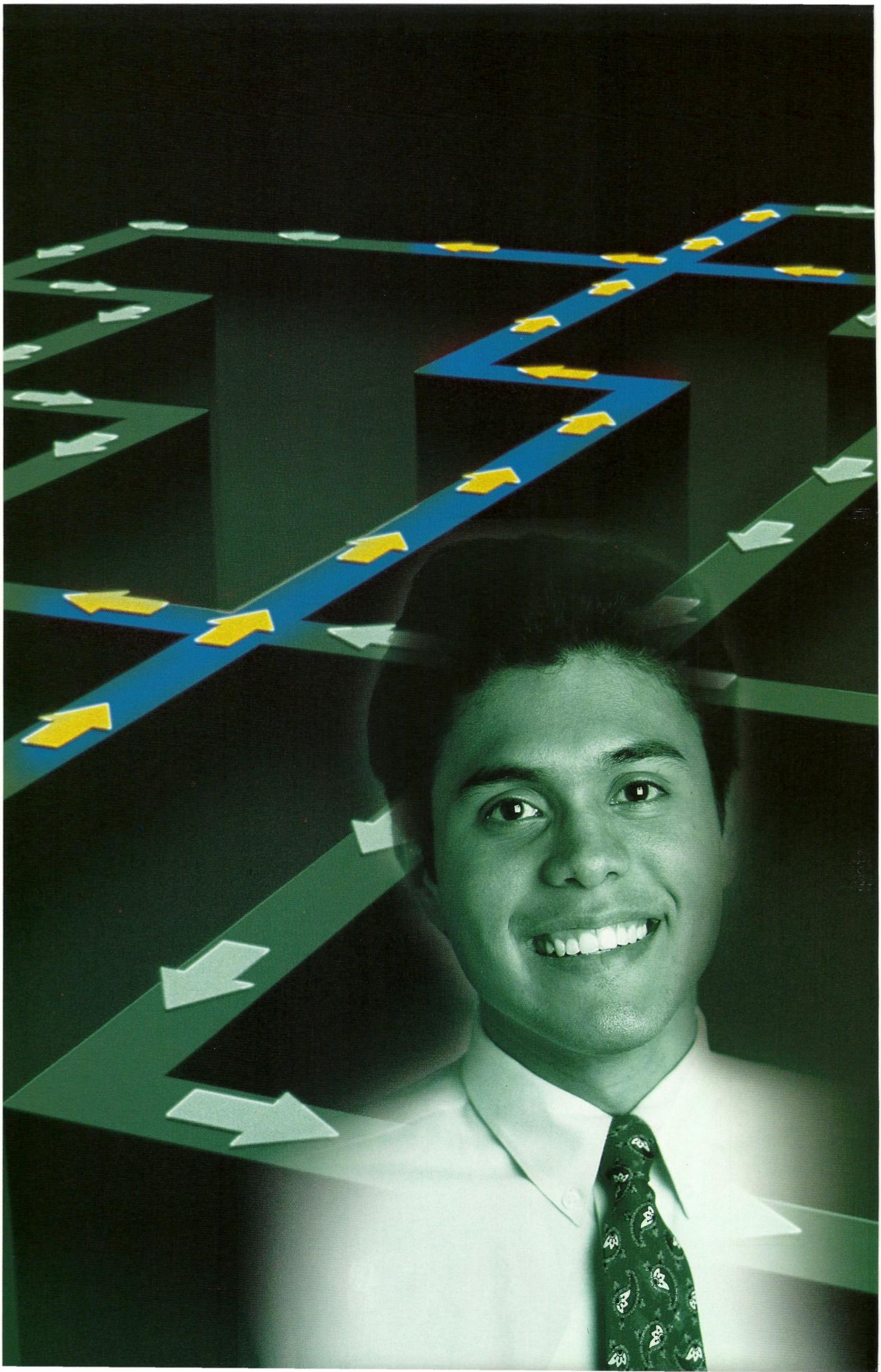
Telstra's Platform Technologies unit has used the switch to upgrade its Austpac® platform to a single flexible platform capable of offering frame relay and ATM data services and using a common support and management system. Frame relay provides a high speed data service to interconnect LANs (local area networks).

While the 2 Mbit/s (Megabit per second) access speed offered by the frame relay service is fine for current applications, new applications will require higher speeds that may be provided by an ATM interface. TRL researchers have been testing the frame relay platform's ATM capabilities and defining the requirements for an ATM-based high-speed switched data service.

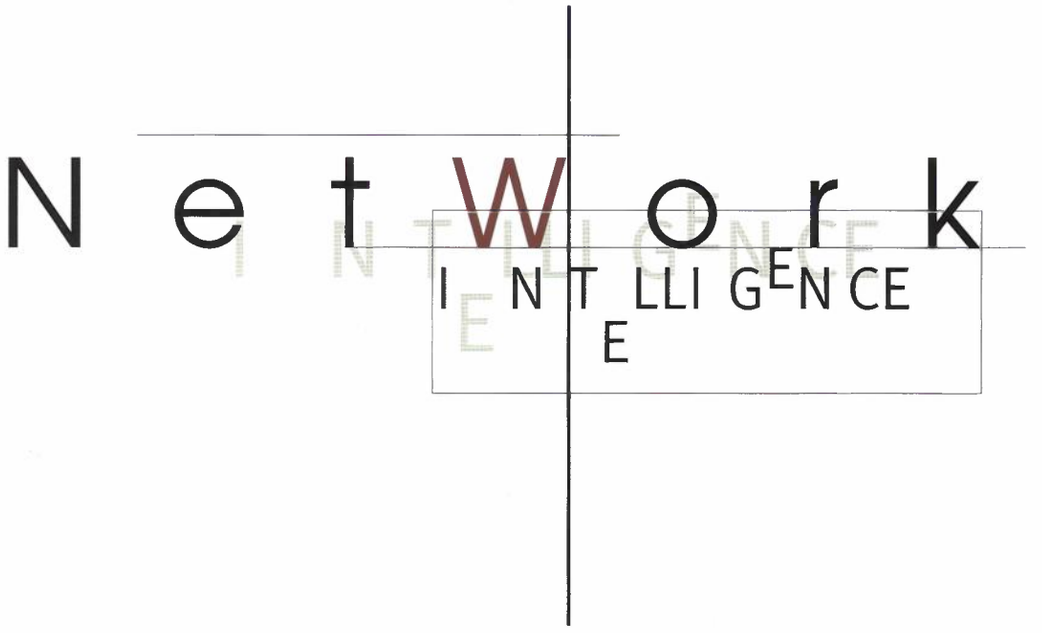
Sealing the CAN

Some interruptions to services in the customer access network (CAN) have been caused by water finding its way into cable joints that house small components called connectors. TRL researchers have evaluated and specified the materials and processes required to make such joints watertight, thus improving the quality of service offered to customers.

A key material is the encapsulating gel that fills the space between connectors and the inside of the joint. TRL's research revealed that gels available from overseas sources were not entirely suited for Australian conditions. Technical specialists at TRL and manufacturers have collaborated to develop a gel system that meets the needs of Telstra and its customers.



Software is the invisible key transforming telephone networks into highly intelligent, self-managing systems that automate, customise and simplify service creation and delivery. Intelligent networks enable Telstra to introduce new customer services quickly and easily, and to maintain the levels of service quality and reliability demanded by today's customers.



STD®, IDD, exchanges, transmission lines, mobile networks, broadband services networks, data networks...Telstra's international telecommunications network is a complex array of interlinked systems. Physical connections – optical fibre, copper pair wire and coaxial cable – deliver signals. Switches package and direct them. Protocols ensure that different parts of the network can 'talk' to each other.

But transmission and switching are only part of the story. Today's customers demand high levels of service – they don't want to lose a high-speed data transmission because a network is overloaded. They expect security, easy navigation and a degree of network 'intelligence'. Network providers too would like routine functions to be automated so that they can concentrate on improving network products and performance.

Software is the key to making networks more intelligent. At the transmission level, intelligent switches are able to monitor and control traffic flow, redirecting traffic if necessary to take advantage of idle network capacity. At a higher level, network management software supports functions like fault detection and correction, service delivery and customer billing. At its most advanced, software will bring new levels of service convenience and personalisation for customers.

Telstra's existing HomeLink™ and Priority™ One3 services are based on intelligent network (IN) architecture. Intelligent networks give customers more control over their calls, enabling them, for example, to redirect calls to another number or messaging system.

Intelligent networks transfer service control from hundreds of network switches to a few computer nodes (service control points) distributed through the national network. New services are simply introduced by software changes at service control points, bypassing the need for switch-by-switch upgrading. This reduces costs for Telstra and its customers, and decreases time to market for new services.

It's moments before the big race...

...and telecommunications networks across Australia are bursting with traffic from callers anxious to place a last-minute bet with betting agencies.

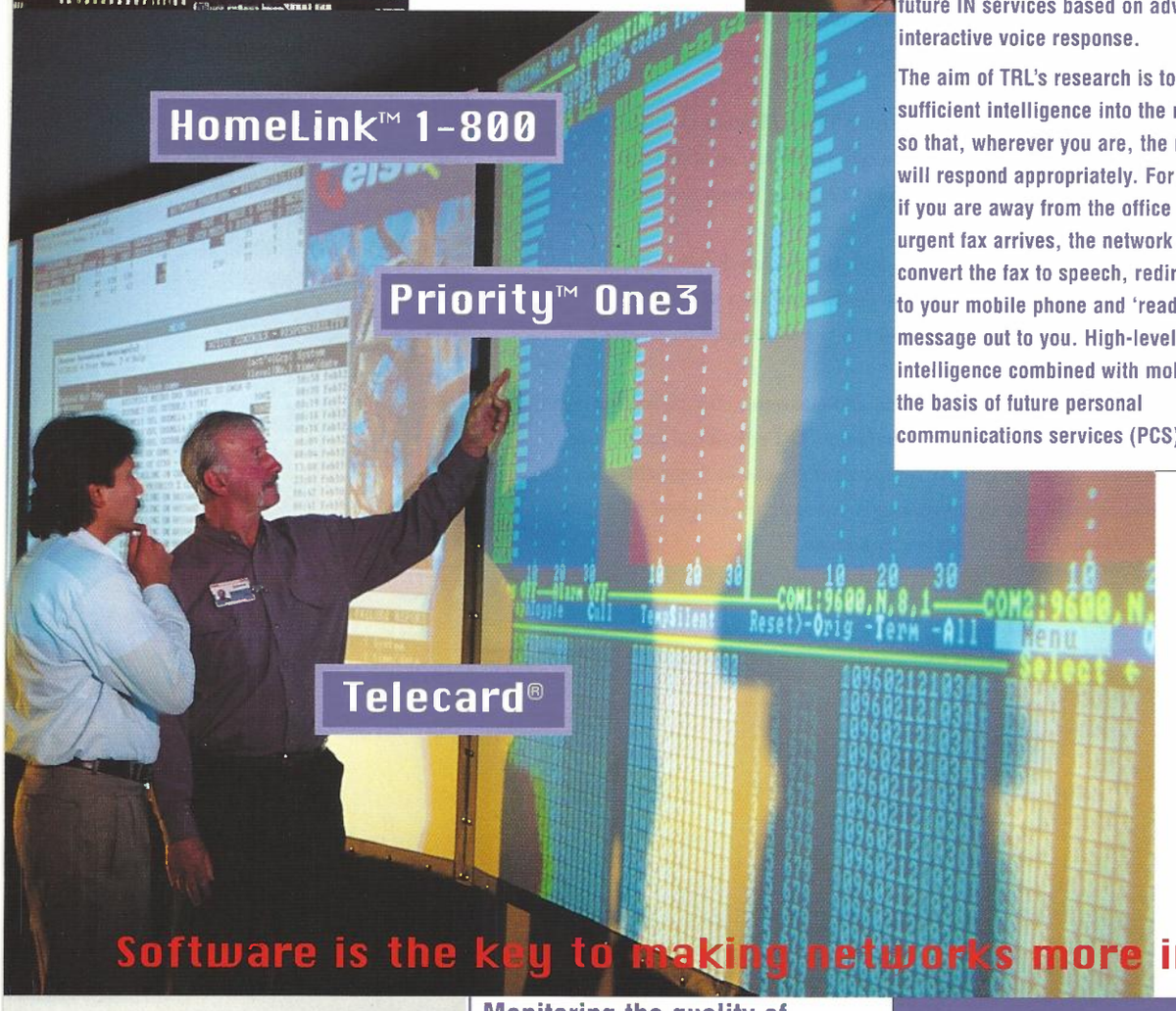
As more and more business customers– including fast food chains and airlines and government organisations – take advantage of Priority™ One3 services, Telstra must ensure that its Priority™ One3 intelligent network platform can handle sudden bursts of intense traffic, such as last-minute bets before an event like the Melbourne Cup.

TRL carried out load testing of a recent Priority™ One3 network introduced by Telstra in early 1996. The load testing confirmed the effectiveness of overload controls recommended and prototyped by TRL. These controls protect the service database platform against sudden 'turbo-charged' traffic bursts.

Intelligent networks of the future

TRL researchers are developing advanced prototypes of the next generation of intelligent networks that will follow on from the HomeLink™ 1-800, Telecard® and Priority™ One3 platforms. These will allow Telstra to use standardised solutions to deliver services, reducing product costs while improving service consistency. TRL is also developing capabilities to support future IN services based on advanced interactive voice response.

The aim of TRL's research is to build sufficient intelligence into the network so that, wherever you are, the network will respond appropriately. For example, if you are away from the office when an urgent fax arrives, the network could convert the fax to speech, redirect it to your mobile phone and 'read' the message out to you. High-level network intelligence combined with mobility is the basis of future personal communications services (PCS).



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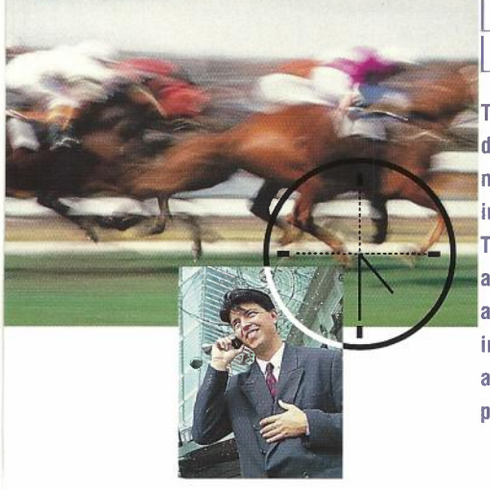
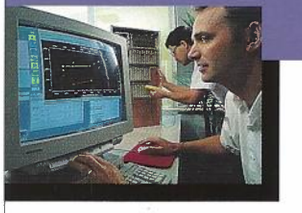


Monitoring the quality of international calls

TRL's Sydney laboratories has developed a distributed network analyser (DNA) to measure the transmission characteristics of international traffic. This new system alerts Telstra operations staff to customer problems as soon as they occur. Telstra will initially apply the DNA to the monitoring of echo in international traffic. The DNA raises an alarm if the echo rate rises above a predefined threshold.



TRL researchers are working closely with Telstra's Information Technology Group (ITG) to create a new generation of software tools and products that will streamline network performance and create new service environments for customers.

In the future, many of these will be built using TINA (Telecommunications Information Networking Architecture), an emerging industry standard for software architecture being adopted by the world's leading telecommunications and computing companies.

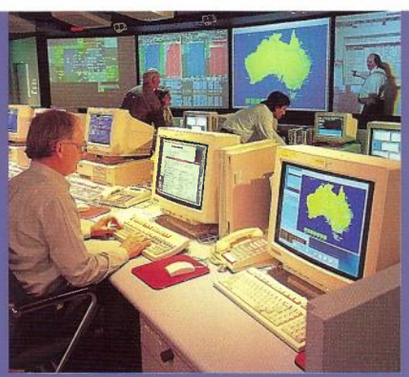
TINA promises to transform the network and its associated management and support computing platforms into a single distributed data processing environment. TRL is regarded as an R&D leader in the development of TINA tools and practical applications.

Apart from improving service quality, speed and customer choice, software can enhance network management and service assurance. TRL's Artificial Intelligence (AI) research team – one of the largest AI applications groups in Australia – has been developing leading edge intelligent management systems designed to reduce network operating costs and enhance service assurance.

A test-bed for new products

Researchers here have built a model intelligent network platform based on standards developed by the International Telecommunications Union (ITU). The model platform is being used to prototype and evaluate new products and services. Designers can retain or discard factors integral to the 'look and feel' of new products without the need to put the product on a commercial network.

One such product is a Priority™ One3 home banking service for use with screen phones. A single Priority™ One3 number calls up a series of screen menus that direct and connect a customer to the appropriate bank department, which may be in another State. TRL is also developing techniques for combining the power of the Internet with intelligent networks to deliver user-friendly products that integrate data and voice.



NETWORK MANAGEMENT CENTRE

Self alerting, self-correcting networks

TRL developed an intelligent management system for cellular mobile networks that links customer reports of faults to network management systems, improving fault diagnosis and reducing network response time. The system is linked to Telstra's Mobiles Helpdesk, enabling staff to keep customers informed about remedial action.

In another project, artificial intelligence researchers have applied neural network technology to the redirection of telecommunications traffic in the event of failure, such as accidental line damage. The new system can allocate alternative paths within 60 milliseconds (0.06 of a second), instead of the several minutes usually required. Rapid response time is critical to service quality in future high-speed, broadband networks, where megabits of information could be lost in the space of a second.

TINA leads to OASIS

TINA is a standardised architecture comprising software building blocks known as 'objects'. TINA provides guidelines for assembling objects into applications or services. It also specifies an underlying software platform on which these objects can execute.

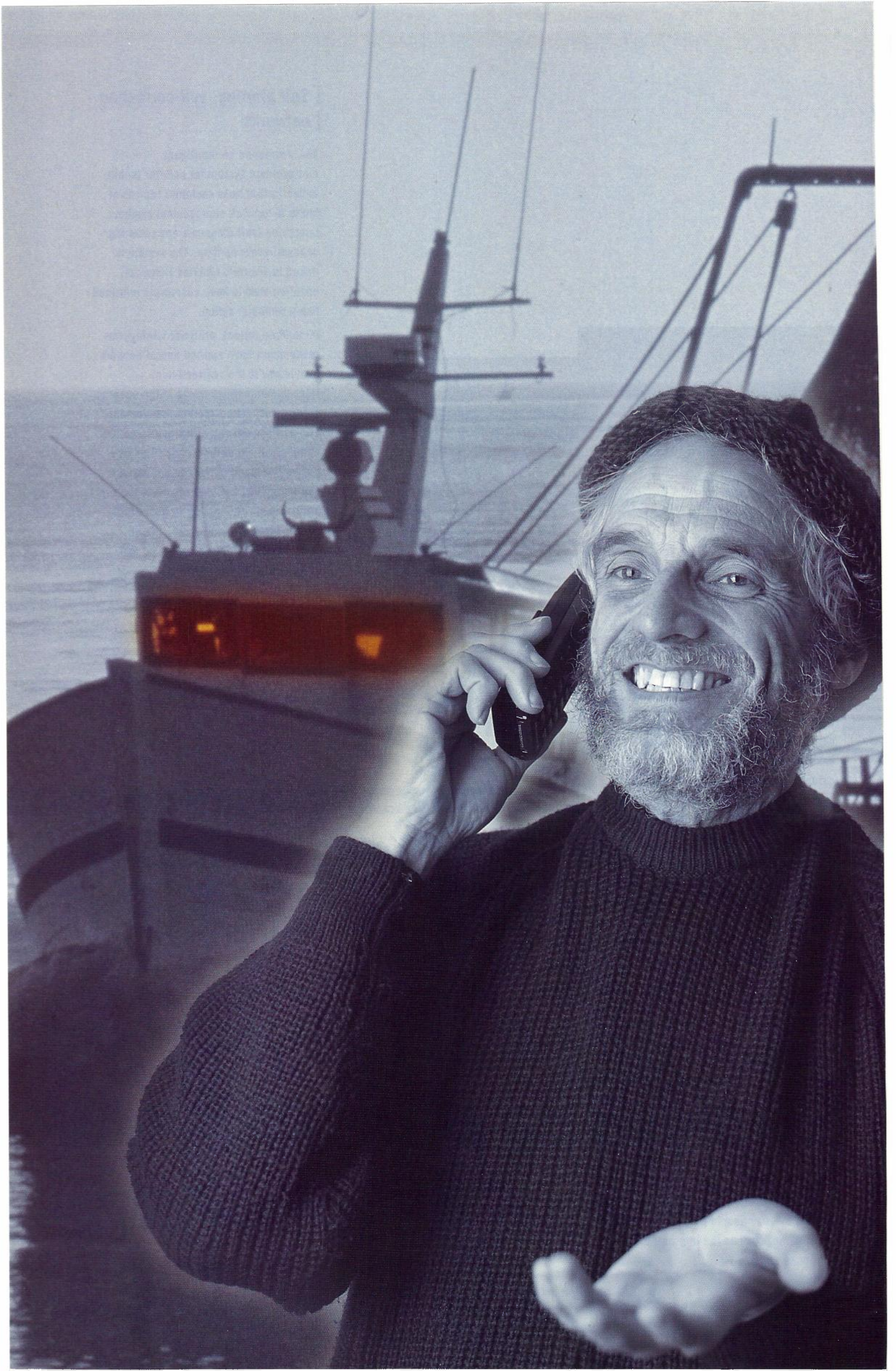
Recent developments at TRL include PlatyTools, a software toolset which helps programmers build TINA applications. PlatyTools is being used in a joint TRL/ITG project called OASIS (Operations and Support Information Systems). The OASIS system will provide accurate information on how network faults affect customer services.

Apart from streamlining network management , TINA will give more control to customers. It opens up possibilities such as trying out services before subscribing, activating new services via a home PC, creating customised services, or auditing service use by household member. Experts believe that TINA could be a unifying force in the way people perceive services to the home, such as the Internet, the telephone and pay TV.

Telecommunications Information Networking Architecture

TRL is regarded as an R&D leader in the development of TINA tools and practical applications.

OASIS

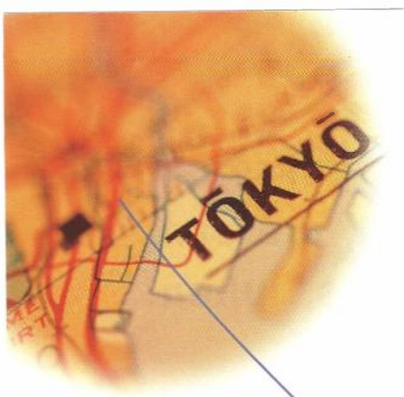


The office of the future will be portable, personal and fully featured. Unplugged and untethered, we can travel anywhere, yet be ready for business when needed.

Mobility

Millions of Australians have taken to the 'information skyway' since Telstra first introduced cellular mobile networks to the country in 1987. We have the fourth highest penetration of mobile phones per head of population in the OECD, behind Norway, Sweden and Finland – which all introduced mobiles five years earlier than Australia.

Many telecommunications services once solely provided over wire can now also be delivered without them. Mobile voice services such as call forwarding and voice mail are being complemented by data network services for personal digital assistants (PDAs) and mobile computing. Mobile phones and PDAs are becoming truly pocket-sized. Soon they will offer powerful advanced call-handling capability provided by the network, rather than the terminal itself. They may also be activated by spoken commands, creating further scope for compact, convenient design.



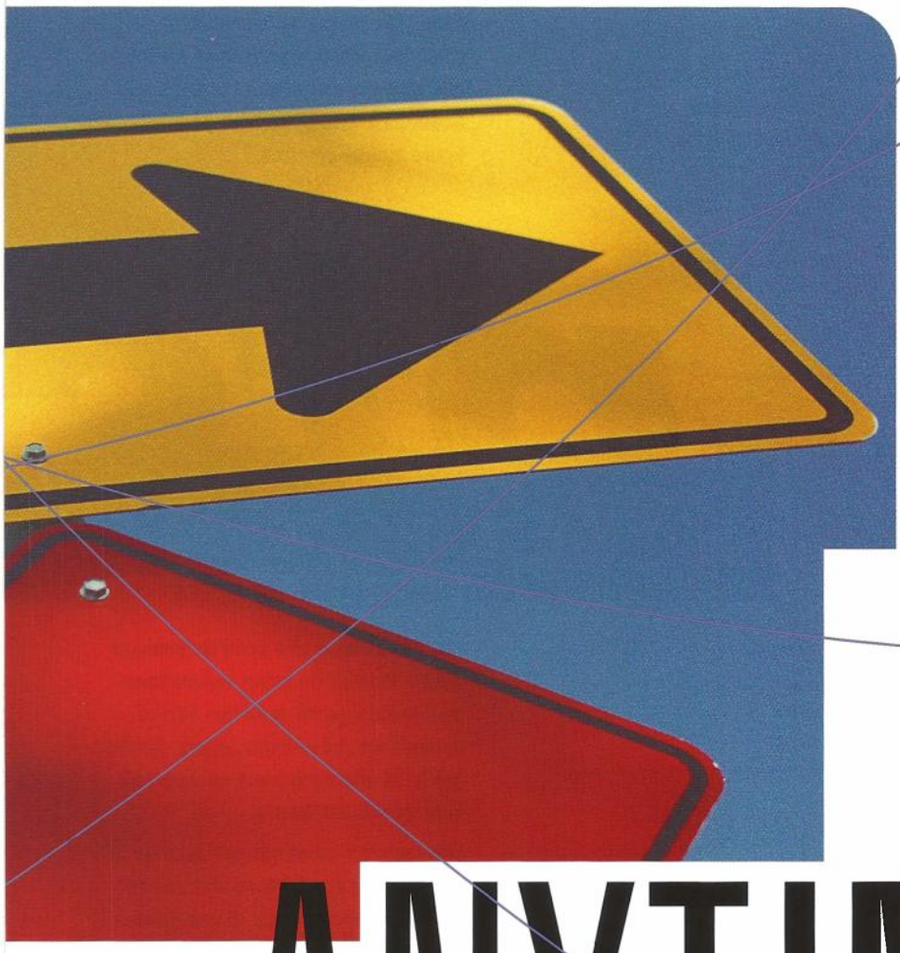
COMMUN

Satellite networks will widen existing cellular coverage to take in the entire planet. Consumers will be able to take advantage of satellite-based Global Positioning System (GPS) services in everyday life. Mobile networks and car navigation equipment guided by GPS satellites will show you alternative routes to work in heavy traffic. Personal GPS navigators may be among a new generation of mobile products such as pager pens and watches, cordless infrared printers, and pocket communicators for children.

Telstra's experience in wireless communications – which include cellular mobile, cordless and satellite technologies – will not only benefit Australians. In countries such as India and Indonesia, where fixed telephone networks are inadequate for population size and spread, wireless is demolishing old geographical, cost and infrastructure barriers. Telstra's experience in delivering wireless

ANYWHERE

ICATION



technologies and mobile services over large areas is helping network providers in the Asia-Pacific region put millions of new users in touch with the wider world.

TRL's research on mobility incorporates:

- personal communications services (including intelligent networks and automated voice access systems)
- electronic directories and 'intelligent agents'
- network monitoring and service assurance
- radiofrequency (RF) and related health issues
- cordless technologies and cordless/cellular mobile integration
- security
- evaluation of new technologies and standards from a customer perspective.
- intelligent networks for mobility management.

ANYTIME

Say "G'day"

As mobile terminals get smaller, functionality and ease of use become limited by keypad size. Speech recognition technology may be the solution. It could offer Telstra customers the convenience of voice-activated dialling and call redirection and control through spoken commands.

Speech recognition technology differs from automated voice response systems where customers press a key in response to a series of pre-recorded messages. With speech recognition, computers are 'trained' on representative samples of words – or parts of words – and phrases spoken by different people. This 'experience' helps the system recognise the same utterance delivered with different inflections by different speakers.

TRL owns a large database of Australian-accented speech samples, which will be essential to training overseas systems for use here. Human factors researchers here also have experience in scripting and evaluating voice interactive services.

The vision of personal communication services

Intelligent agents are just one aspect of PCS, a visionary approach to communications that will ensure future services – voice, fax, data, paging – are personalised, mobile, flexible, integrated and easily controlled at the user end, irrespective of underlying technology.

TRL is evaluating critical PCS technologies and standards in areas such as interactive voice response, human factors, voice recognition technology, intelligent network technology, network interworking and network evolution. In 1995, TRL standards and mobile communications experts were invited to talk at major conferences in India and South-East Asia on number portability and future mobile services.

Agents

Intelligent

Safety in the airwaves

TRL has developed a software package called 'RadHaz' to assist maintenance staff in locating RF radiation hazard patterns around antenna towers. RadHaz has been attracting much commercial interest outside Telstra.

TRL routinely measures and surveys RF fields in and around base station and customer environments. It coordinates Telstra's national program to implement safe work practices for staff working around RF-emitting equipment. It has developed a site management procedures package that condenses important information about base station RF radiation, access, security and power. And it offers regular seminars and training packages through Telstra Learning on basic RF safety and awareness.

digital

Butlers

Evolving better mobile networks

Telstra has a packet data service based on a special radio network, which is separate from its cellular telephone networks. It also offers a circuit-switched data service supported on its digital cellular network.

TRL has investigated the option of putting the packet data service onto Telstra's digital cellular network. This would provide better radio coverage, eliminate the need for a special purpose radio network for packet data, and should reduce costs. Telstra would still offer customers packet and circuit switched data services, both supported on the one GSM network.

Researchers have also been assessing emerging technical standards from Europe and the USA – such as UMTS (Universal Mobile Telephone Service) – for the next generation of digital mobile cellular networks.

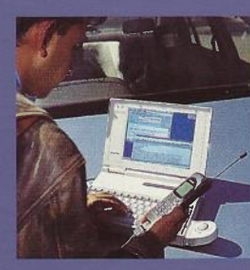
Artificial intelligence researchers have developed network performance monitoring software for faster and more effective fault detection. Apart from improving network management the software is capable of processing network monitoring data for market analysis.

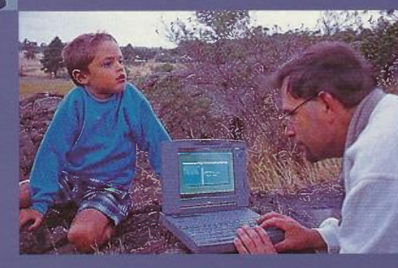
Cordless networks for home and office

DECT (Digital Enhanced Cordless Telecommunications), a digital standard for cordless communications, is self-organising for easier radio network planning, and offers seamless handover and bandwidth-on-demand capability for voice, data and fax.

DECT has linkages with GSM (Global System for Mobile communication) digital cellular mobile technology, making DECT a strong candidate for a dual-mode handset that automatically switches between cordless and cellular modes, depending on a user's position relative to base stations. DECT may also play a role in future PCS services to the home, in which appliances and communications terminals will be linked via wireless networks.

TRL has evaluated DECT as a technology for local mobility within office environments and between buildings in close proximity. Researchers from the Socio-Technical Research Group have analysed data on users' calling patterns, perceptions of service and sound quality, and their responses to being within reach at all times.





Your own agent

In telecommunications, 'intelligent agents' – sometimes referred to as digital butlers – are small software packages capable of roaming the world's networks, and interacting with each other to negotiate deals, authorise agreement or retrieve information on behalf of a user.

Agents may one day monitor and direct your incoming and outgoing calls and messages, reschedule your diary following changes in flight or meeting times, and even rearrange flights. They may monitor the stock market for you, and buy or sell shares. They may book tickets for a show, or search out favourite news topics from databases around the world. After retrieving information, they may even edit it in transit. Over time, an agent would learn about your habits and preferences, and require less programming.

For mobile users, intelligent agents will give small, mobile terminals powerful capabilities. TRL is one of a few international R&D groups evaluating leading edge intelligent agent software for use in mobile applications, among them automated diary management.

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Callers
Services
Print
Redial

In the world of high technology, it is easy to overlook the fact that telecommunications exists to serve the needs of people. The function of telecommunications is to enable people to exchange and access information – at any time, from any place and in any form.

With new network and service opportunities like speech recognition becoming available, Telstra is looking more closely at how the customer will interact with the new services, and how these services can be tailored to individual customers.

TRL's Human Communications program provides Telstra business units and external organisations with insights into the critical interface between people and technology. The program cuts across all areas of research and product development – broadband services, mobility, customer access including automated voice access, artificial intelligence, market modelling, enterprise networks, human factors design and service assurance.

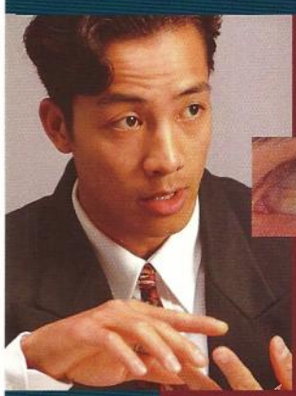
The combined skills of researchers in the Human Communications program span business administration, sociology, anthropology, education, psychology, socio-linguistics and political science.

Projects are carried out in diverse industry and community sectors – defence, domestic/consumer telecommunications, construction, health and education. Depending on the client's requirements, researchers conduct information flow studies, evaluate field trials of new communications technologies, or advise on the introduction of new technology.

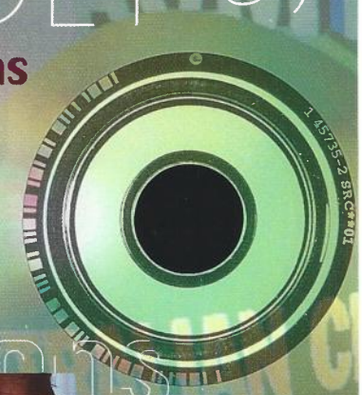
Information flow studies provide client organisations with insights into the social dynamics underlying their communication processes. Researchers define the information and communication needs of targeted groups, identifying information 'blockages' and gaps.

Electronic classrooms

TRL is supporting the growth of distance education in Australia in a number of areas. It is working with a multi-campus university to determine how telecommunications can help educators manage at a distance. It is assessing the value of the Internet in broadening the cultural opportunities for children in rural schools. It has evaluated computer managed learning programs delivered to staff by Telstra Learning. And it has carried out a study of information flows in Victorian primary and secondary schools to identify existing and future needs and service opportunities.



solutions



Health connections

Australia's health industry employs about eight percent of the workforce. It has undergone an enormous shake-up over the past few years, with communications emerging as one of the expanding areas of opportunity.

TRL has carried out customer and market analysis of opportunities as diverse as remote diagnostics for country hospitals, networks to link general practitioners with hospitals, information flow studies within cancer treatment centres, and a complete 'inside out' view of communications within a large metropolitan region health service.

The outcome is a comprehensive blueprint for future telecommunications development in Australia's health sector. This will be used as a strategic marketing tool by the Industry Marketing group of Telstra's Business and Government unit, and by Telstra Multimedia Pty Limited.

A better 'look and feel' for Telstra products

A joint TRL/NTG Products usability team is revising Telstra's Product Development Process, identifying how human factors issues and a consistent 'look and feel' product approach can be incorporated at each step. The aim is to cut product development and redesign costs, while making new products more attractive to customers.

Keeping customers satisfied

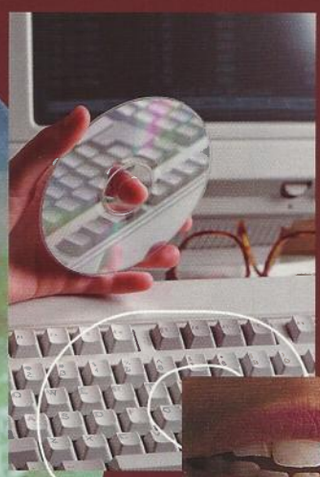
Researchers have been helping Telstra identify where quality of service meets – or may fall short of – customer perceptions. TRL's research has given business units insights into ways of increasing call success rate, repeat dialling patterns of customers, the effect of transmission quality on customer perceptions, and ISDN quality of service.

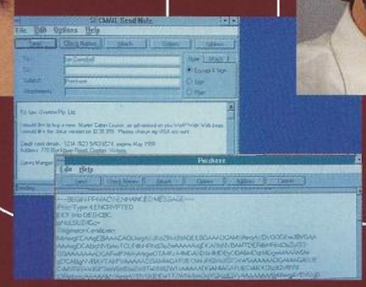
Price is an important component of value for the customer. TRL coordinated a large national customer survey, the results of which Telstra can use to model price options for STD and IDD calls.

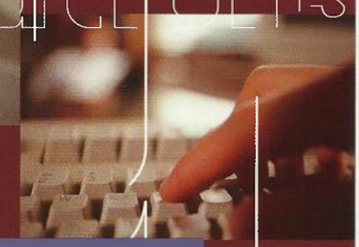
Networks central to 'distributing' education

Some experts say that in this era of globalisation, the network is becoming central, and the computer peripheral. Globalisation and information distribution is a trend happening in almost every large organisation, schools and universities included.

Telstra is poised to play a significant role in helping educators deliver services to schools and universities in Australia and the Asia-Pacific region. With four million homes available for connection to Telstra's broadband network by 1999, opportunities will open up for educators to deliver engaging visual, interactive education programs to the home. Telstra's presence in many Asian countries, coupled with Australia's good reputation in tertiary education, places Australia in a strong position to exploit many opportunities in delivering further education to countries in the region.







Quick response to student inquiries

TRL helped Telstra design an interactive voice response system for the Victorian Tertiary Admissions Committee (VTAC). The system is used by thousands of students to find out whether they have been accepted into VTAC-related tertiary courses.

This is one of several studies of the usability of automated voice access systems for routine information and support services in public and private sector organisations. Researchers have analysed databases used in customer support systems to help clients provide faster service to customers. Results will be used to refine design guidelines for future automated voice access systems. TRL researchers are advising Telstra to 'hasten slowly' so that customers will not be put off by unpredictable script routines.

Apart from providing recommendations to clients for improving communication in the workplace – through a mix of technical, organisational and social changes – such studies can be used by Telstra business units as a strategic planning tool for scoping future markets and products.

Examples of current Human Communications projects include:

- use of telecommunications to support managers in 'virtual' organisations
- improved use of e-mail within organisations
- new cordless phone technologies and desktop multimedia
- use of the Internet in schools and tertiary institutions
- desktop multimedia for training and distance education
- opportunities for telecommunications in the health sector, including telemedicine
- advice on service delivery (home banking, video-on-demand, etc.) for Telstra multimedia trials.

On the home front

TRL researchers have been evaluating user response to a cordless technology known as DECT (Digital Enhanced Cordless Telecommunication system). At the moment, they are assessing its suitability for personal communications services (PCS) in an office environment.

Such a technology could be extended to PCS in the home. Future services may be delivered within the home via a wireless LAN (local area network) that connects domestic appliances and communication terminals such as PCs and wireless phones.

TRL researchers have been scoping a wider study of general household needs and trends to identify opportunities for future communications services.


Netscape - [Query Form]
Edit View Go Bookmarks Options Directory Window Help
Category
ain Street
Arts & Entertainment
Music
Selections
erformace
oncerts
ecords
Os
heet Music
nstruments
emorabilia
an Clubs
ound Equipment
oftware
Browse
Customise

In the paperless era of interactive multimedia technology, how will you book a holiday, and how will you find a plumber? Today's electronic directories are a step towards intuitive and responsive navigators that will not only locate a name or service, but complete transactions on your behalf.

Within the space of a few years, telephone directories have evolved from paper, to an operator-assisted service, to CD-ROM and, more recently, to the Internet. This evolutionary pathway has made life easier for users, who may soon be using electronic directories as a gateway to online catalogues and home shopping.

International standards are designed to ensure that information systems the world over are compatible and consistent. TRL has played an important role in the development of the X.500 global electronic directory standard, and has developed an electronic directory system called ViewFinder™, one of the first in the world to fully conform to X.500. The standard makes it possible to enhance simple databases with the sophisticated search, security, picture and sound capabilities required for comprehensive multimedia services.

As well as developing standards-compliant systems, TRL has been using artificial intelligence to enhance the usability and potential of Telstra's electronic directory services. It has developed a prototype natural language interface that will help customers find information over the Internet, or over interactive broadband services networks. The 'plain English' interface allows users to describe what they want in their own words – the system will intelligently guide them by matching the words to related terms in the directory. More user-friendly directories dissolve barriers to customer access.

Navigating future broadband services will become easier with the introduction of full service personalisation. Such systems would keep track of a customer's service preferences over time. Eventually, the customer would not need to search through thousands of video titles or news topics to find a desired program. The television set or PC would have a short-list ready, based on past choices.

Intelligent agents may carry out such functions for us in future. According to software experts, these autonomous bits of software will be capable of navigating the world's networks and databases, interacting with each other on their owner's behalf.

Because they will be able to move between different networks – fixed and mobile – intelligent agents will provide services providers with an open platform for the development of advanced applications.

This versatility may prove of real value for Internet users. The Internet comprises many wide area networks loosely connected into a global inter-network having no single network manager or integrated systems support. As the Internet continues to grow in size and complexity, users will find it harder to navigate. Information agents and more intelligent forms of today's 'web robots' may be the solution, enabling businesses in particular to overcome the problem of locating products and services.

Internet through the ViewFinder™

ViewFinder™ is a standards-compliant electronic directory system developed at TRL. It is now used by a number of large Australian corporations – including Telstra – as an enterprise directory capable of holding at least 200,000 entries.

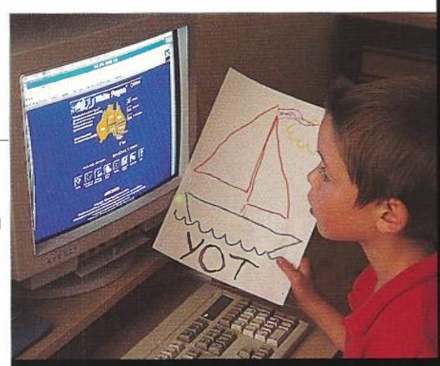
Earlier this year, TRL demonstrated the capability of ViewFinder™ as a public White Pages™ directory. Telstra already offers an Internet White Pages™ directory with online access to all 55 white pages directories in Australia, the first national telephone directory in the world to be put on the Internet. Trials are now under way to investigate moving the existing commercial service to ViewFinder™. A ViewFinder™-based Internet directory will offer users greater multimedia and hyperlink capabilities, as well as greater levels of security for future directory-based transactions.

TRL's human communications experts have been helping Telstra provide a consistent user interface for White Pages™ on a range of electronic media – the Internet, public kiosk touch-screens, screen-phones and CD-ROM.

Intelligent service directory for a full service network

The plain English interface developed by TRL may form part of a prototype comprehensive service directory that could give customers ready access to the many interactive broadband services planned for Telstra's full service network.

Service directories based on the prototype would be distributed throughout the Telstra network and incorporate intelligent agent technology. The service directories may also be connected to service personalisation systems–for profiling individual customer service requirements and use patterns–being developed at TRL.



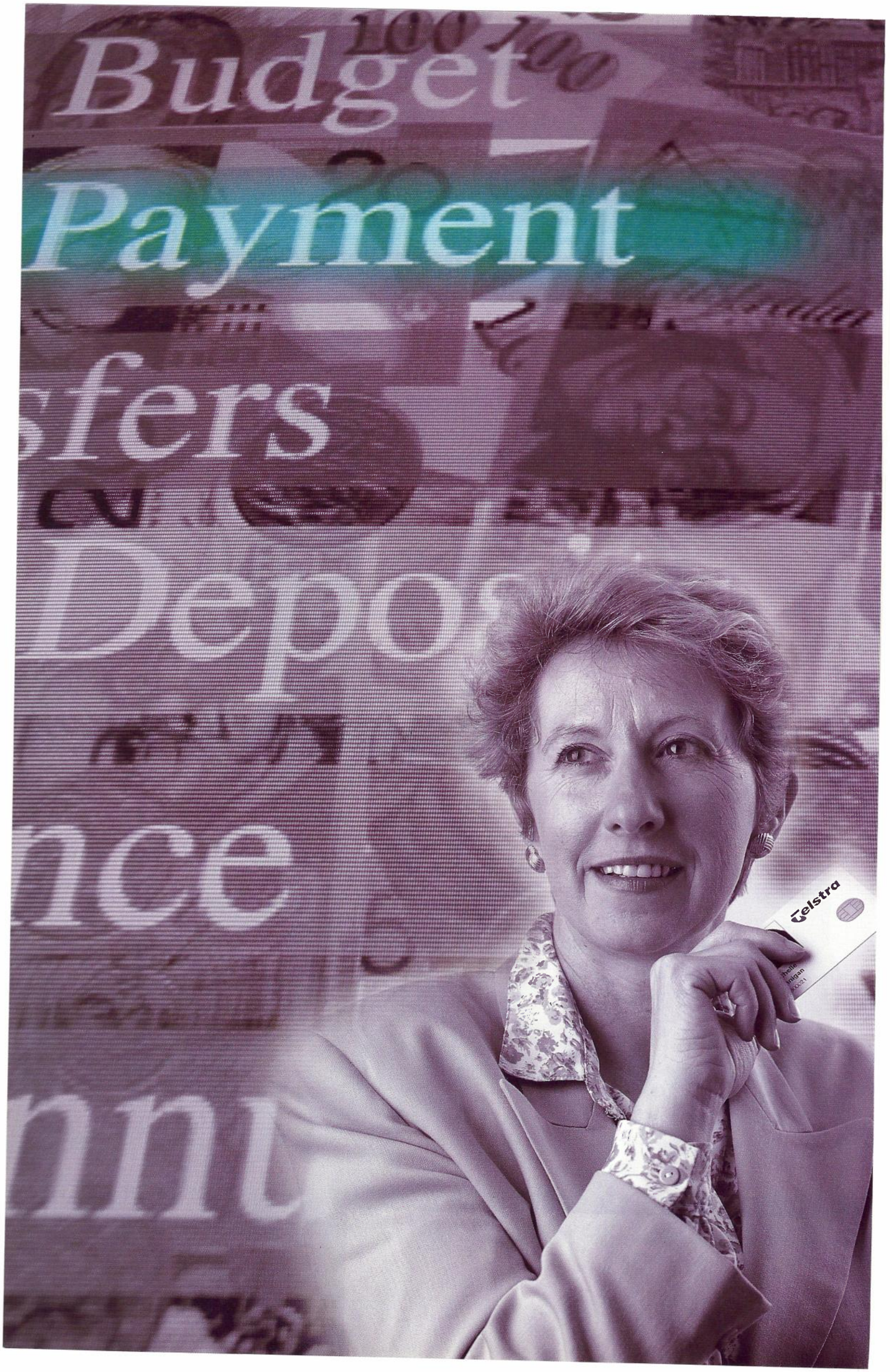
'Plain English' directory interface

TRL's artificial intelligence research team has used neural network techniques to develop a plain English interface that could be used for Telstra's electronic directories. Users can be as vague or liberal in their use of search words as they choose. The system will match idiosyncratic search terms to online categories, guiding users to their desired destination.

Agents to enhance mobiles?

Information retrieval and message filtering are among the many 'talents' of intelligent agents, small computer programs designed to represent their human clients in the digital world. Other 'talents' of agents include: monitoring (stock prices, flight schedules, etc.); 'orchestrating' (rearranging an itinerary, finding a competitive price, assembling a personalised newspaper); and 'trading' (buying and selling transactions, operating an online home-office service).

Intelligent agents are one of the technologies being investigated for future personal communication services (PCS). They are able to act on behalf of the user in mobile network environments, which are restricted by small user interfaces and intermittent network connections. Agents keep computing when the customer is offline. TRL has been investigating the use of intelligent agents in mobile networks.


Budget
Payment
Telstra

Are you confident about sending credit card details over the telephone network? For electronic trading to become widely accepted, customers need to be confident that the systems they use are fully secure. Telstra is building privacy and security systems that should make public networks safer to use for all players - customers, content and service providers and network providers.

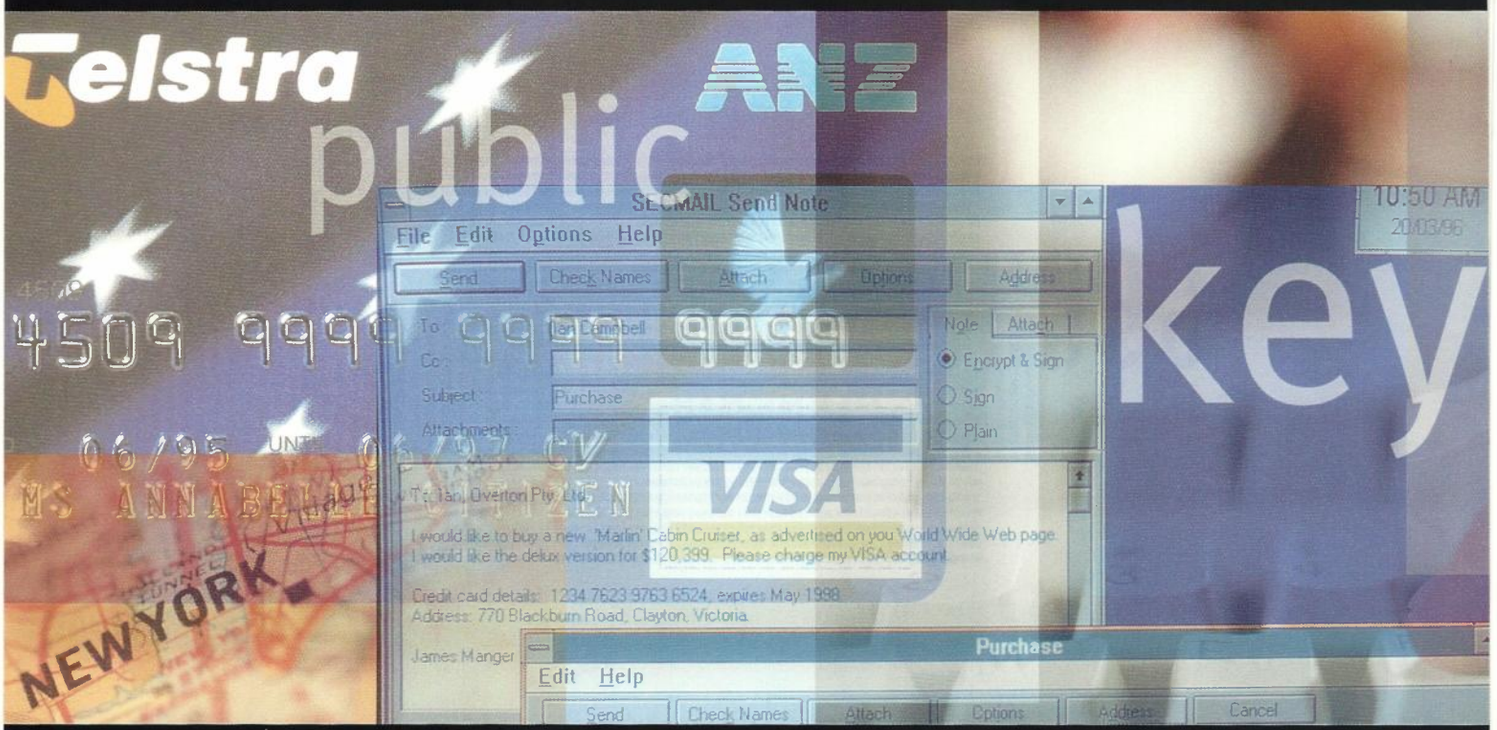
Lack of security has stopped many users and businesses from using the Internet to buy and sell goods and services. Despite the presence of protective 'firewalls', the Internet is still a security risk, lacking central control and uniform operating standards, and open to users the world over.

What should a fully secure network offer? Customers must be confident that their credit card and personal information is protected, that a message will be received by the appropriate person, that unauthorised users can't 'eavesdrop', and that messages are not altered in transit. Businesses, especially, require message verification - that the nominated sender, for example, did indeed authorise and forward an order for goods or services.

The problem is not just one of protecting e-mail and other electronic information in transit. It's also about protecting sensitive customer information stored in computer servers distributed throughout the network. Internet service providers, for example, need to keep credit card details in a system that is not online to the Internet.

Telstra's response to the security issue is to design a standardised security architecture that protects data end-to-end as it moves from the sender, through the network, to the receiver or distant server, whatever the intervening transmission and switching technology.

TRL researchers have been using their knowledge of security, distributed computing
and open systems to design a digital signature facility – a key element of a privacy and security platform for Telstra's corporate network. The digital signature facility supports software applications that encode and authenticate e-mail messages, protect them from being changed, and allow a receiver to verify a sender's identity. Telstra has been using the facility to protect customer e-mail over the Internet, and to enhance its electronic directory services.



The facility is based on a widely used security technology known as public key cryptography. Cryptography is the science of encoding and decoding information using 'keys'. In public key systems, each user is assigned two keys - a public key and a private, confidential key. A sender uses the receiver's public key to encode and forward a message, which the receiver decodes using their unique private key. The sender uses their own private key to sign the message. The receiver verifies the 'signature' using the sender's certified public key. The message is thus proven to be authentic and intact.

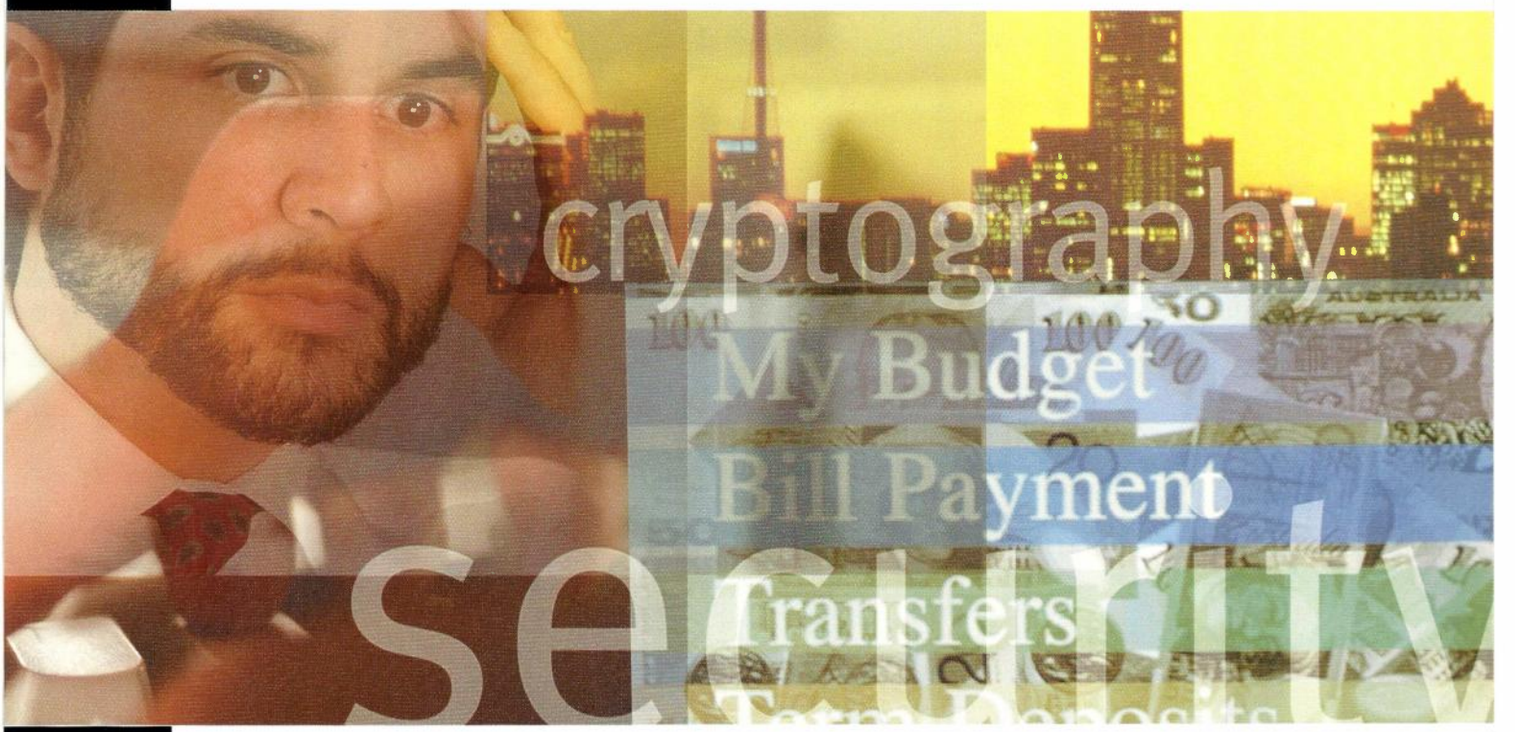
People will only use online credit for pay TV and interactive multimedia services if they perceive them as low-risk. TRL's expertise in public key cryptography, smart cards, international standards and distributed computing environments is helping Telstra create a secure electronic marketplace for services like electronic directories, video on demand, home shopping, interactive games, home banking and business data services.

Standards to protect all players

Customers will not be the only ones to worry about security in an electronic marketplace. Content providers will have to find ways of protecting intellectual property, service providers will need to ensure they get paid for access to their services, and network providers will need to ensure they get paid for network use.

DAVIC – Digital Audio Visual Council – represents the interests of the world's major telecommunications and computing organisations, service providers and content providers. Its aim is to gain industry-wide agreement on standards for the critical building blocks of multimedia networks, including set top boxes, the units that will sit on our TV sets and control access to online services.

By participating in DAVIC, TRL experts ensure that such standards enhance, rather than hamper, commercial trends. For example, any decisions taken about the design of set-top boxes may need to take into account the need for built-in smart-card readers.



Secure e-mail

Public key cryptography can only be effective in protecting e-mail and other electronic communications if the public key component of the two-key system is both correct and readily available. This is the function of a third-party certification authority – to issue a 'certificate' for every user in the system verifying that his or her public key is current, correct and authentic.

TRL has been assisting Telstra business units to integrate digital signature systems with e-mail. These security systems provide encryption as well as authentication to ensure messages remain confidential and can be related back to individual users.

In another project, TRL has been helping Telstra's National Directory Services build a certification authority for – and provide secure access to – its electronic directories on the Internet. It is the first time in Australia that a commercial certification authority has been integrated into an X.500-based directory system.


Help
Exit
Macro Stop
Macro Run
Applications Menu
File Menu
Image Menu
Region/Curve Menu
Text Menu
Utility Menu
User Menu
PDXE Commands
file /img1/P254/R0.
file /img1/P254/R0.
Macro 'DUPLAB' done.
> infobox
> pickmac
>
Top/Bot
Set A
Init
Twist
Size
0 Deg
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15 Deg
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Parameter
R
L

We have come to trust the telephone service as a lifeline in an emergency. Supplying power to a broadband infrastructure based on optical fibre and coaxial cable, however, presents a new challenge.

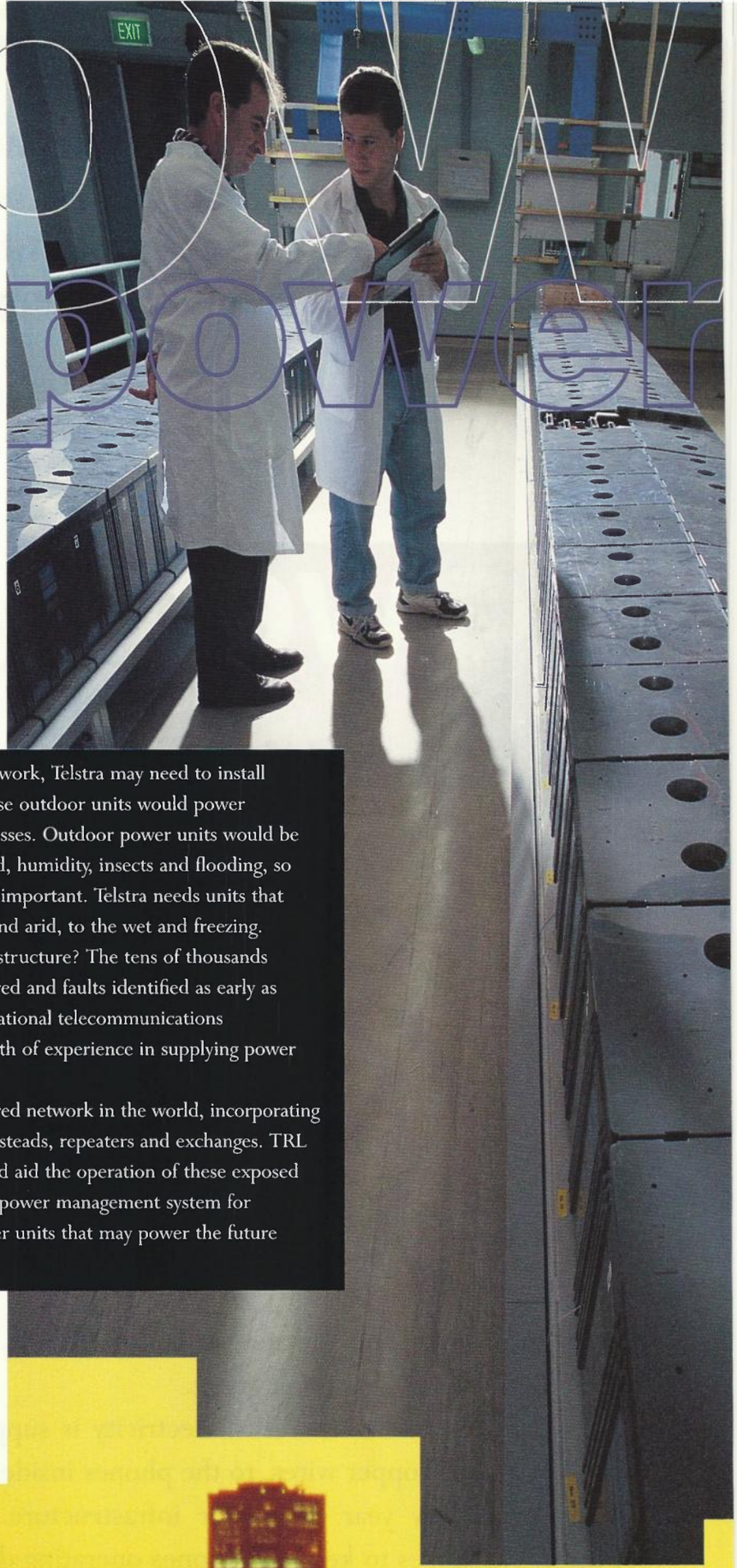
Power *to the* NETWORK

As any mobile phone owner will understand, power is essential to keep telecommunications equipment going.

In traditional telephone networks, electricity is supplied from telephone exchanges, down twisted pair copper wires, to the phones inside our homes. Telstra spends about $200 million every year on power infrastructure. It maintains lead-acid battery supplies at exchanges to keep telephones operating during power blackouts. Thus the telephone has come to be regarded as a 'lifeline' connection to the outside world.

Unlike today's twisted pair copper networks, broadband networks based on optical fibre and coaxial cable cannot transport power from exchanges. While Telstra could use mains power for broadband networks, it still faces the problem of providing backup power during blackouts. But is backup essential? For pay TV customers, the temporary loss of connection may be more a matter of inconvenience than urgency.

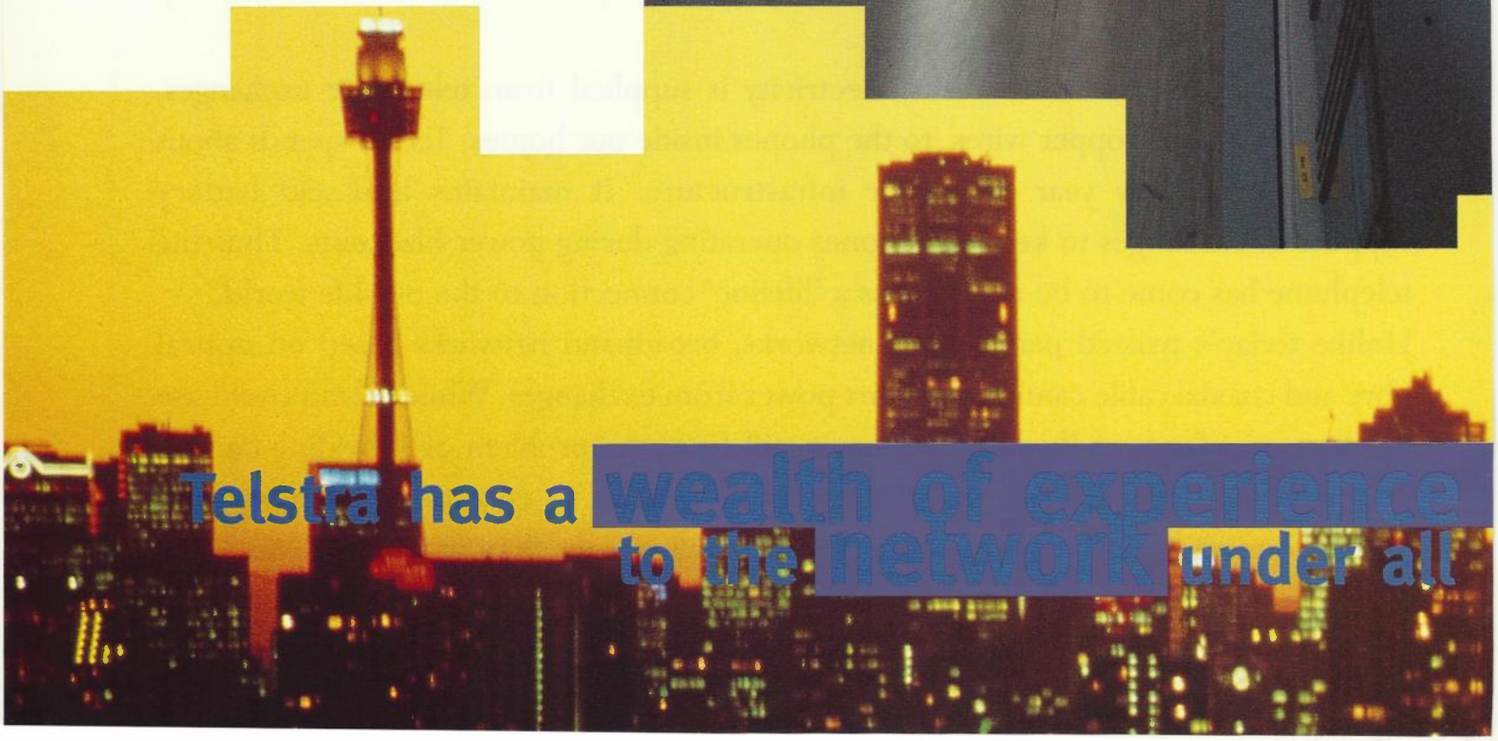
power



To provide backup power to its full service network, Telstra may need to install kerbside power units throughout the country. These outdoor units would power broadband links to surrounding houses and businesses. Outdoor power units would be subject to environmental stresses such as heat, cold, humidity, insects and flooding, so robustness, protection and maintenance would be important. Telstra needs units that will work in all Australian climates, from the hot and arid, to the wet and freezing.

How would Telstra manage such a power infrastructure? The tens of thousands of outdoor units would need to be closely monitored and faults identified as early as possible. Having been responsible for Australia's national telecommunications infrastructure for many decades, Telstra has a wealth of experience in supplying power to the network under all conditions.

For example, Telstra has the largest solar powered network in the world, incorporating many solar powered sites located at outback homesteads, repeaters and exchanges. TRL has developed an automated system to monitor and aid the operation of these exposed sites. This system may translate into an intelligent power management system for monitoring the tens of thousands of outdoor power units that may power the future full service network.



Telstra has a wealth of experience to the network under all

Surge protection studies

TRL maintains a high-voltage laboratory in which Telstra can test equipment for lightning susceptibility. Among the equipment items tested are Telstra's Touchfone® telephones, and the units through which customers access the broadband pay TV network.

TRL is assessing the risk of lightning damage to equipment and investigating ways of minimising the risk. This includes developing protection specifications for set-top units and the more powerful and advanced network interface units that may one day supersede them. TRL's research on Touchfone® telephones alone resulted in an equipment redesign that will save Telstra tens of millions of dollars annually.

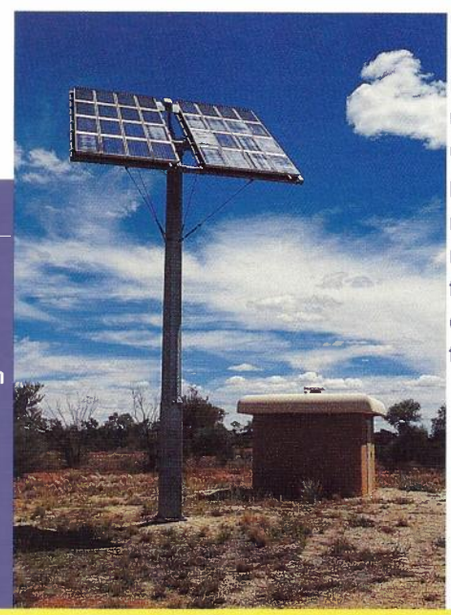
Researchers also measure the effects of lightning throughout Telstra's network to determine protection requirements for exchanges and customer equipment.

From the outback to the kerbside

How would Telstra monitor and manage the tens of thousands of kerbside power units required to support a telephone service over the pay TV network? The answers may come from TRL's experience in assisting Telstra to manage its solar powered network for outback telecommunications.

One of the problems with batteries is that there is no commercially available battery 'fuel gauge'. TRL researchers, however, have developed an advanced software system for monitoring and assessing battery condition over time, which should help Telstra reduce the operating costs of its solar powered network. The system analyses changes in battery impedance, a key measurement not available on existing monitoring devices.

In a broadband cable network, the power monitoring system could be linked to network management systems monitored from central management control centres, ensuring rapid response to power unit faults.

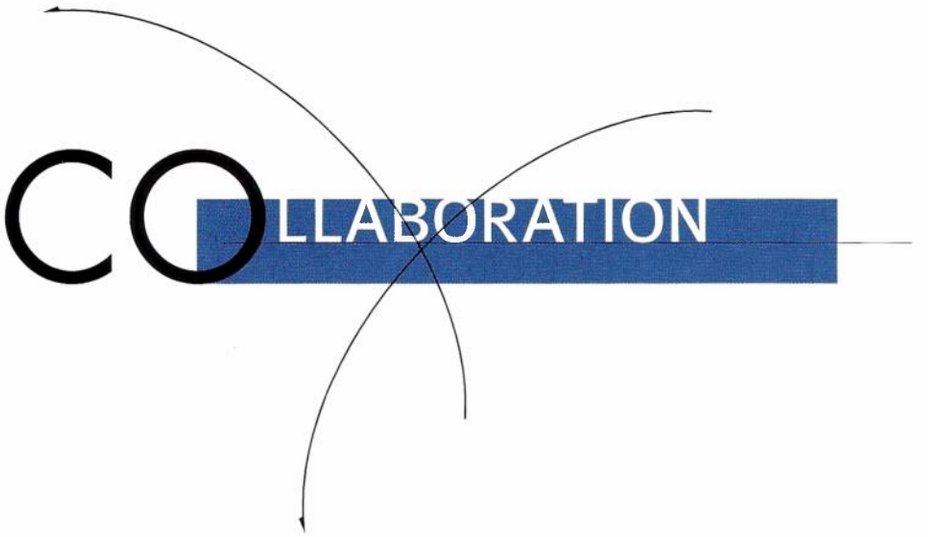


Batteries and beyond

The telecommunications industry is the second largest consumer of lead acid batteries after the automotive industry. Telstra maintains battery systems in each of its 5,000 exchanges as backup power to keep telephone connections operating during blackouts. TRL is helping Telstra explore new ways of generating and distributing power to future broadband networks.

in supplying power conditions

TRL supports Telstra's business units and strategic alliances at all levels – from participating in global trials with multi-national companies, to gaining an understanding of how customers wish to communicate and developing prototype products and services.



Researchers help society invent the future. The researchers at TRL are no exception – part of their job is to monitor global telecommunications developments and alert Telstra to opportunities for improving operations and service to customers. Their participation in international and industry standards bodies such as the ITU (International Telecommunications Union), TINA-C (Telecommunications and Information Technology Architecture Consortium) and DAVIC (Digital Audio Visual Council) means that researchers here can help shape the direction of new technologies and be among the first in the world to transform these 'paper' standards into working prototypes.

The quest for leading edge technology is ultimately determined by the market. What new services are people likely to demand? What are the systems and network implications?

Research at the Laboratories is organised into programs that correspond to the needs of Telstra's business units. This enables researchers to collaborate closely with corporate, network and retail staff on projects critical to Telstra's business success – broadband networks, customer access, interactive voice services, human factors, market modelling, electronic directories, security, mobile systems, service assurance and network management. TRL has provided considerable support to Telstra Multimedia Pty Ltd in its rollout and planning of new broadband services.

Researchers also collaborate with commercial organisations outside Telstra. They have worked with Microsoft to evaluate the Microsoft broadband network operating system (BNOS) for carrying interactive multimedia services over large networks. They are working with other overseas and local companies to develop leading edge desktop multimedia, intelligent agent, networking and security technologies.

The Laboratories' Socio-Technical Research Group has been using its expertise in the social sciences to profile and explore telecommunications opportunities in market sectors such as education and health. These researchers coordinate and participate in trials involving universities, schools, hospitals and a range of commercial and public sector organisations.

Through TRL's research collaborations with other research centres like the Australian Photonics Cooperative Research Centre, Telstra is able to tap into specific technical expertise in areas such as photonics and distributed systems.

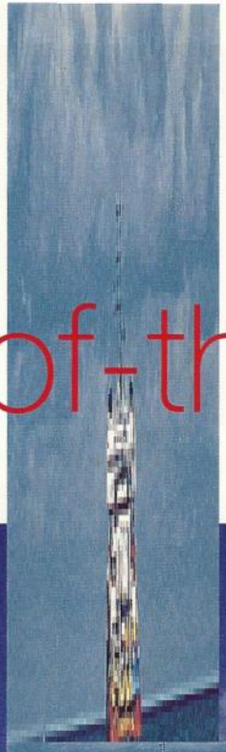
Mobilising the best in Australian R&D

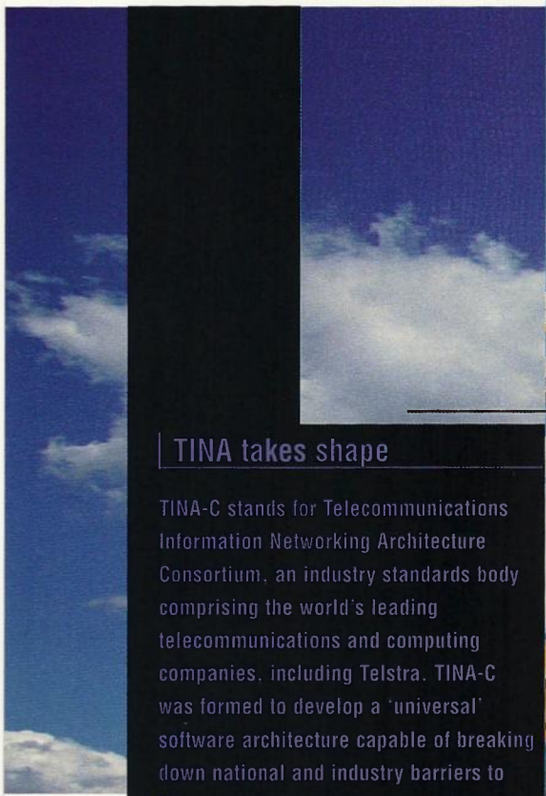
TRL's research and development collaborations include a number of Australian Cooperative Research Centres (CRCs) – the Australian Photonics CRC, the Distributed System Technology CRC and the Research Data Network CRC.

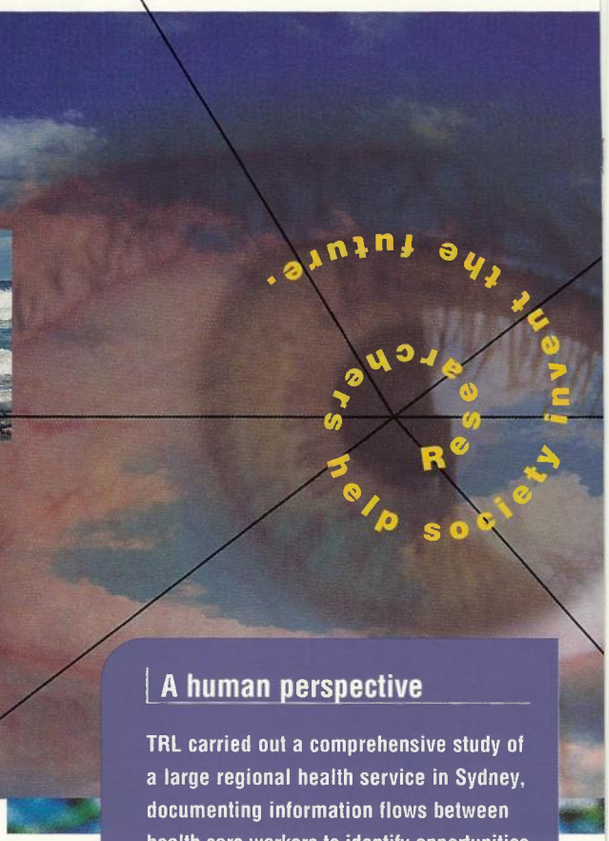
Laboratories staff also manage many projects within Telstra's Centres of Expertise program, through which Telstra augments its in-house R&D. The program funds work at the Teletraffic Research Centre (University of Adelaide), the Centre of Expertise in Distributed Information Systems (University of Queensland), the Switched Networks Research and Telecommunications Software Research Centres (University of Wollongong), and the Mobile Communications Research Centre (University of South Australia).

...researchers to collaborate closely with corporate, network and retail staff on projects critical to Telstra's business success.

State-of-the-art optic







Research helps society invent the future.

TINA takes shape

TINA-C stands for Telecommunications Information Networking Architecture Consortium, an industry standards body comprising the world's leading telecommunications and computing companies, including Telstra. TINA-C was formed to develop a 'universal' software architecture capable of breaking down national and industry barriers to the convergence of telecommunications, information technology and content.

Telstra, through TRL, has been an active member of TINA-C, pioneering the development of tools and practical network applications that are influencing the direction of TINA specifications. The latest application is OASIS – operations and support information systems – a smart network monitoring system that tracks faults from a service, rather than network, perspective.

A human perspective

TRL carried out a comprehensive study of a large regional health service in Sydney, documenting information flows between health care workers to identify opportunities for improved communications.

The study is one of a series that TRL has carried out in association with the health sector. Researchers have evaluated a trial computer network in Brisbane that gives general practitioners access to hospital information. They have also worked with a major Melbourne medical centre to document information flow between cancer patients, medical specialists, support staff and carers.

Educational institutions, manufacturing companies, Telstra Multimedia Pty Ltd and Telstra business units are among the many customers seeking TRL's user perspective on technology.

fibre technology

Microsoft interactive TV trial under way

Researchers are working with Telstra's Information Technology Group (ITG) to evaluate a Microsoft interactive TV system. The end-to-end architecture is designed to deliver interactive multimedia services such as video-on-demand and home shopping. It comprises Microsoft operating system software at both the customer and service delivery end of the system; standard personal computers; ATM switching technology; and experimental, purpose-built set-top units. The evaluation team developed a simple application to test the system's performance, and are investigating new applications and ways of scaling up the system for larger trials.

GLOSSARY

ADSL (Asymmetric Digital Subscriber Line)
A technology that enables the copper telephone network to carry data streams of up to 6 Mbit/s (e.g. video signals).

ATM (Asynchronous Transfer Mode)
A high-bandwidth, low-delay, packet-like switching protocol that allows voice, text and data to be transmitted simultaneously over optical fibre, coaxial cable or copper networks.

Bit
The smallest unit of digital information used by information processing, storage and transmission systems. Bit is short for binary digit. The binary system uses only '0' and '1' to represent all possible quantities.

Broadband
A general term used to describe transmission at bandwidths higher than 2 Mbit/s (e.g. high-speed data and video services).

Convergence
The integration of computing, communications and content.

DAVIC (Digital Audio Visual Council)
An international body – comprising the world's major telecommunications, computing, software, cable and consumer electronics organisations – which assesses the architectures, interfaces and protocols required for digital broadband service delivery over an open network environment.

DECT (Digital Enhanced Cordless Telecommunications)
A European cordless communication standard that may be used in future PCS networks.

Desktop multimedia
The integration of various applications onto a single personal computer, often including videoconferencing, audio, motion video, shared applications and data.

Digital
A method of storing, processing and transmitting information through the use of distinct electronic or optical pulses that represent the binary digits (bits) '0' and '1'. Digital technologies employ a sequence of discrete pulses to represent information, as opposed to the continuously variable signals of analogue technologies.

EBN (Experimental Broadband Network)
A non-commercial Telstra network managed by TRL that utilises ATM technology to support a range of new multimedia and data services such as information retrieval, remote medical diagnosis and super computing networking.

Frame relay
A simplified packet transport protocol used to connect local area networks (LANs) over large distances.

FSN (Full Service Network)
A Telstra term for the broadband access network that will carry multimedia services such as pay TV, and narrowband services such as telephony, over the same cable and systems infrastructure.

Hybrid Fibre Coaxial cable (HFC)
A shared broadband access architecture that incorporates the optical fibre between major exchanges, and the coaxial cables in suburban streets that connect to customers. Currently being used for Foxtel Pay TV.

Intelligent agent
An advanced software system that filters information arriving at a computer from outside sources, or is used to traverse the information services available across a network in search of user-specified information.

Intelligent network (IN)
A telecommunications network architecture that employs computers to customise telecom services for unique user needs, or to create and implement new types of telecommunications services in response to market demand.

Internet (the Net)
A global inter-network of computers, networked using Internet Protocol (IP), and linked via telecommunications networks. The Internet enables applications such as e-mail, the WWW, file transfer and other services to run across different networks and operating systems.

Internet Protocol (IP)
Part of the TCP/IP family of protocols describing software that tracks Internet addresses, directs outgoing messages, and recognises incoming messages. Used in gateways to connect networks at a high level.

ISDN (Integrated Services Digital Network)
A digital network that provides an internationally agreed standard for voice, data and signalling, and brings higher bandwidth – and hence multimedia capability – to the desktops of individual users.

ITU (International Telecommunications Union)
An international standards body established by the United Nations which aims to establish standardised communication procedures and practices worldwide.

LAN (Local Area Network)
A short-range (typically within an office or building) high-bandwidth communications network that links computers, printers and other peripheral devices under central control.

Mbit/s or Gbit/s (Megabits or Gigabits per second)
Units for measuring the rate of digital information transfer – a megabit per second is a rate of a million bits per second; a gigabit, a billion bits.

MPEG (Motion Pictures Experts Group)
A standards body that has proposed an image compression standard for full motion video. MPEG takes advantage of the fact that full motion video consists of many successive frames with large areas that do not change, such as blue sky background.

Multimedia
The combination of multiple forms of media in the communication of information between users and machines. Communication formats usually include voice communications (speech recognition, speaker verification and text-to-speech), audio processing (music synthesis, CD-ROM), data communications and video.

Narrowband
Communication technology with a data transmission capacity of under 1 Mbit/s. Includes online interactive services (e.g. Internet), voice, facsimile services, slow-scan video images and low-rate data transmission.

Navigators
Software systems that provide an advanced user interface and allow users to search through and select from information stored on a server.

Packet switching
On a packet-switched network, data is packaged and routed in 'blocks' or packets, each having a header with the network address of the sender, and the destination address.

PCS (Personal Communication Services)
A term used to describe an intelligent, digital, two-way wireless telecommunications system that may make 'one-number, anytime, anywhere' communications possible. The concept includes cordless telephones, cellular mobile phones, paging systems and intelligent networks.

PDA (Personal Digital Assistant)
A mobile terminal that combines any or all of data, voice and fax functions with PC functionality.

Photonics
Technology based on the use of light pulses to carry data, images and sound over hair-thin optical fibres made of pure glass or other transparent materials. Photonics offer extremely high transmission speeds.

Public key cryptography
A communications security system under which each user is issued with a confidential private key and a public key, providing more extensive privacy protection than single key systems.

SDH (Synchronous Digital Hierarchy)
An international transmission standard that organises communications traffic in broadband, optical-fibre, digital networks into a hierarchy to achieve more efficient use of network capacity.

Standard
In telecommunications, a standard is a body of rules defining the interfaces among telecommunications devices and networks. Currently established standards cover voice, data, facsimile and video communications.

TINA (Telecommunications Information Networking Architecture)
A software architecture designed to allow for the global convergence of telecommunications, computing, broadcasting and advanced network management.

Video compression
A method of transmitting analogue television signals over a narrow digital channel by processing the signal digitally. Video signals can be digitally compressed by up to a factor of 100 for transmission at rates of between 1.5 and 6 Mbit/s.

Video-on-demand
A service through which customers could access large databases of movies and other video programs through a multimedia interface, and control program viewing in the same way as a VCR – using pause and rewind for example.

World Wide Web (WWW or the Web)
A series of interlinked computer sites which display text, graphics, images and sound. Users browse the sites via a graphical user interface. Web sites are like multimedia magazines, with additional interactive features and links to other sites.

X.25
An ITU protocol for packet switched networks that facilitates the systematic, secure and error-free exchange of information between computers, terminals and the network.

X.500
An ITU standard that governs the user directory structure in e-mail and electronic systems. In theory, any e-mail user directory structured according to the X.500 rules can be consulted by any other standard-compliant e-mail system.

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