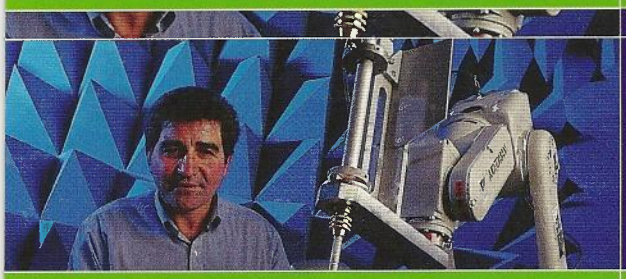
NEW HORIZONS

2000

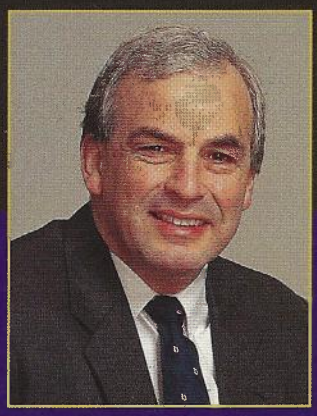
Telstra

Research Laboratories



Contents

Living in a brave new internet world



Hugh Bradlow
Chief Technology Officer

'In Launceston, we are conducting a socio-technical study (called *eLaunceston*) of the factors which motivate and drive people to use the Internet.'

Back as far as the 1970s, when Internet technology was first being developed, no-one could have predicted that it would become the communications success story of the century.

Originally, a technology push by its creators for the defence and academic world, the Internet has enriched the communications experience for everyday users and has changed the communications landscape forever. It's here, it's real and demand for its services and applications has exceeded anyone's wildest dreams.

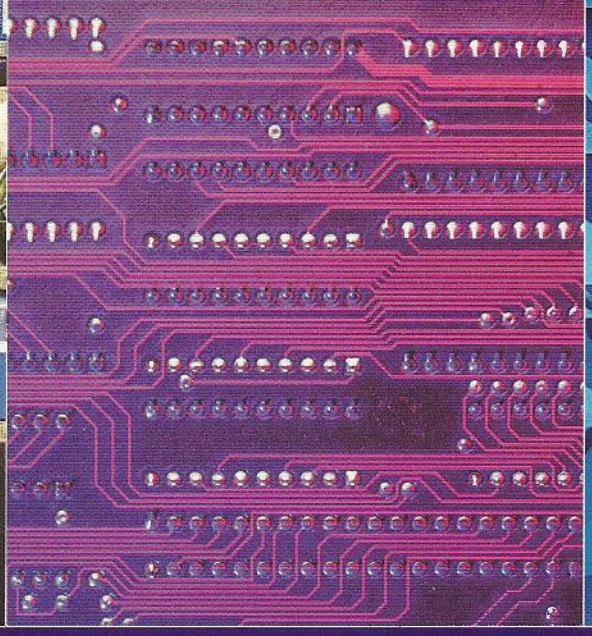
Australia is responding strongly to the new wave economy and, while not a global leader, is a major player with about 36 percent of the population connected to the Internet. This is almost double any other developed country in the Asia Pacific region. Added to this, 42 percent of Australia's population also has a mobile phone and recently Pay TV has started to grow in popularity to where it now accounts for about 17 percent of households.

Against this backdrop, Telstra has been rapidly expanding its business base for the last five years, from that of a 'telco' to a new age information services company. We are making major investments in our telecommunications infrastructure to ensure that Australia is at the forefront of the Internet world.

We have defined a vision for our future networks which we refer to as the Data Mode of Operation (DMO). DMO has been established to consolidate Telstra's multiple data and Internet-based networks into a single, new generation low cost network. Through DMO, we will not only have a network architecture designed to handle increased traffic but, among other applications, DMO will underpin the connection of high speed Internet access as part of Telstra's initiative to broadband Australia.

The DMO program is not only about network infrastructure – it is also delivering a new systems infrastructure so that we can simplify our customers' online experience. It's about ensuring that no matter how complicated the technology, customers will be offered services that are easy-to-use and easy-to-access. This means that whether they contact us via telstra.com on their PC or their WAP mobile phone, our customers will have access to the same services and will be treated as the same person (no multiple logins and passwords), despite coming through different access doors.

New Generation Telephony (NGT), a strand of DMO, promises greater flexibility in telephony services and will be built as an application running on the DMO core network. In short, NGT will revolutionise the customer experience and, among its many great features, will include the ability for a




Australia is responding strongly to the new wave economy...

customer to add or remove a telephone line in their house or business – by merely clicking a mouse button.

While the Internet continues to enrich the lives of people and enhance the efficiency of business, there is another 'mega trend' occurring in communications – mobility. We have seen the mobile phone offer telephony on the move, but as people become more dependent on data applications such as email, they also begin to expect them to be mobile. So wireless data is taking off.

The mobile phone, which today is smaller and lighter than ever before, is set to become the most widely available data capable device in the world, permitting a variety of text, voice and data transactions. Banking and shopping are only some of the activities that will be carried out by mobile phone users. Telstra's mobile data plot is evolving rapidly. We already offer WAP services and have initiated commercial trials of GPRS in Sydney and Melbourne – the first such commercial deployment in the world and we are experimenting with equivalent technology for CDMA, known as 1xRTT.

The software and application-driven future of communications, which will see computers adapting more and more to human needs and personal requirements, holds tremendous opportunities for Telstra and Australia. Pluggable, click-to-dial, easy, integrated and automated are just some of the key features that TRL researchers are focusing on when developing new applications. Now, the challenge for Telstra and for TRL, is to enable the successful transfer of our ideas from our Labs into the market place.

In Launceston, we are conducting a socio-technical study (called *eLaunceston*) of the type of factors which motivate and drive people to use the Internet. By trying to better understand what people want from the Internet (and whether local content that is directly relevant to their daily lives increases their usage patterns), TRL will be better placed to develop the type of products that people are looking for. By using *eLaunceston* trial participants as a test market, Launceston will be used as a way of bridging proof-of-concept to commercialisation and getting the products from the Lab to the market faster.

A multimedia development laboratory is also being established this year in Launceston. A joint initiative of Telstra and the Commonwealth Government, this project will provide high-speed digital access for between 2,500 and 5,000 homes and businesses in Launceston and will become Telstra's trial site for new online applications, especially consumer services. The project not only builds on the Commonwealth's existing commitments to boost Tasmania's IT&T skills base, but ensures that Australia is well placed to seize the opportunities offered by the information age.

According to Metcalfe's Law, the value of a service is exponentially proportional to the number of its users. It's only at the point that someone makes the technology affordable that it becomes relevant and potentially usable by the majority. At TRL, we are working on products that will not only help simplify people's lives in an increasingly time-challenged century, but will be affordable.

I hope you enjoy reading our publication and learning more about Telstra's superior research capabilities. In the information age, where we have greater technical capacity for information, but less and less personal capacity to capture everything that's out there, the challenge for Telstra is to focus on delivering the information you want – when you need it.

HBradlow

Hugh Bradlow
Chief Technology Officer

Highlights

eLaunceston

The *eLaunceston* project has established a regional web portal that provides an ideal environment for a long-term in-depth study of Internet usage when the site is enhanced with local web-based information.

Zinc whiskers

Highly conductive and virtually invisible airborne zinc whiskers can wreak havoc in sensitive electronic circuitry. TRL has designed and developed a compact detector to monitor the presence of zinc whiskers in risk-prone areas

ADAGE

TRL has developed a tool that will allow businesses to automatically implement many software changes, without relying on sophisticated IT skills or coding experience. Using ADAGE, an application designer can draw user interface screens and business process rules onto a graphical user interface and ADAGE will automatically generate an expert system application.

CONDOR

Condor, an expert system developed by TRL, provides call traffic managers with real-time visual representations of call volumes, allowing effective management of mass calling events and protection of other customers from the effects of an overload situation.

CDMA guidelines

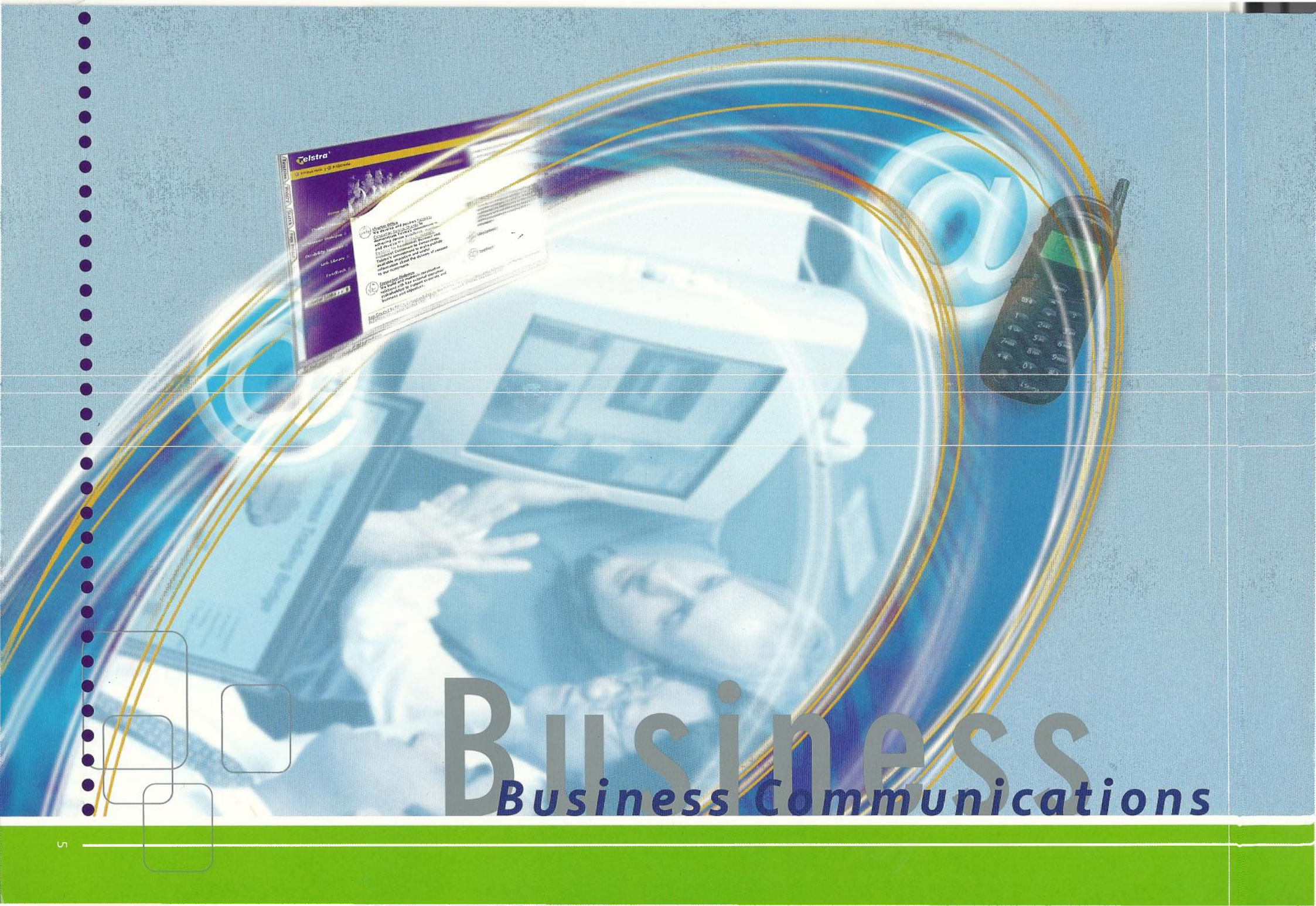
In order to extend the coverage of Telstra's new CDMA network in a cost-effective manner against tight deadlines, a TRL team with specialist skills, assisted in the study of repeater design and performance. The work led to the development of guidelines on the design and installation of CDMA repeaters.

Internet Call Waiting

Internet Call Waiting provides a "virtual" second line, enabling a subscriber with a single telephone line to access the Internet without missing incoming phone calls. The service is being prepared for commercial release in 2000.

Web collaboration

In addition to the traditional phone call, customers and service representatives can simultaneously view the same web page and interact to discuss a problem, fill in a form or arrange a product sale. Remote interaction enables both parties to better understand each other and develop agreed outcomes together.


Business
Business Communications

The business of the future is here.

New communications technologies, with the Internet at their heart, are fundamentally changing how business is conducted – how people buy and sell, how goods and services are distributed, how information and ideas are transferred. These technologies present new opportunities and those businesses that are innovative and not risk-averse will reap the benefits. Other businesses which, for one reason or another, are slow to come to grips with e-commerce and the new economy, may find the going tough. The message to them is a simple one – get involved, now.

TRL's creative use of telecommunications and technology is helping business to capitalise on the vast opportunities offered by the Internet. Our resources and know-how are helping businesses to resolve their communications challenges, leaving them free to focus on their core business goals.

Business success will increasingly be dictated by the new information technologies. They can help business to realise the key drivers of increasing business growth, improving efficiency, reducing costs, and improving customer service. TRL has a range of initiatives aimed at providing businesses with a competitive edge in the new world.

For instance, TRL is helping business get the best value from Internet Protocol (IP) networks by improving the quality of service and user access.

We are helping businesses make the move into online trading, creating an online environment for business-to-business trading that allows the business to participate without radical re-engineering of their current tools and processes.

It can be difficult forecasting markets for new technology. TRL researchers are investigating new modelling techniques designed to evaluate the potential commercial value of new products in the Internet age. The aim is to help business better identify promising opportunities.

TRL has trialed a new technology called *Business TV* which is aimed at improving the efficiency of staff communication. It is an IP-based video-distribution technology designed for corporate Intranets. Staff can watch video programs on their desktop computer screens, such as a message from the boss, staff communications, a training course or a live seminar. It's easy to use, instantaneous and saves on time and employee travel costs.

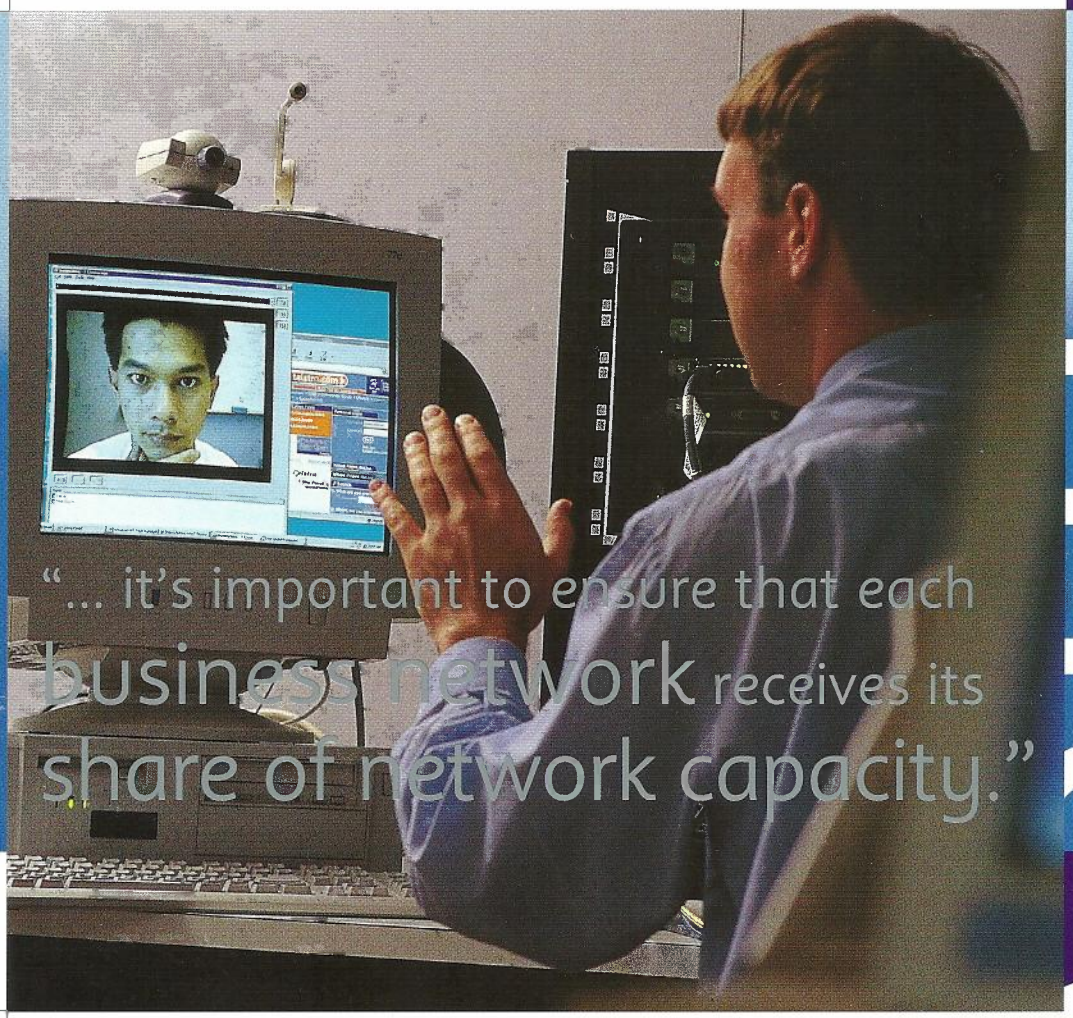
While email has been a boon to business, some experts are predicting that Instant Messaging (IM) will become a compelling alternative, bringing even greater benefits. TRL is looking at providing IM users with integrated communications that will span all telecommunications devices and media.

Notwithstanding the success of email in the office, it can sometimes be difficult finding the right person in a large organisation. Telstra's on-screen internal staff directory service makes the search as easy as clicking a mouse.

TRL has successfully trialed an important new feature, which uses the directory to automatically set up a phone call between the caller and the staff member listed on the screen.

The trend in communications is towards hand-held and personal Internet-ready devices – and Telstra's ultimate goal is to provide an anywhere, anytime, anyhow communications capability for each and every customer. This presents TRL with a number of challenges and we are actively investigating new devices and applications, with an eye always on customer usability and relevance.

"Telstra's ultimate goal is to provide an **anywhere, anytime, anyhow** communications capability for each and every customer."



More value from business IP networks

It's becoming increasingly recognised that quality of service (QoS) will be an important issue for business multimedia.

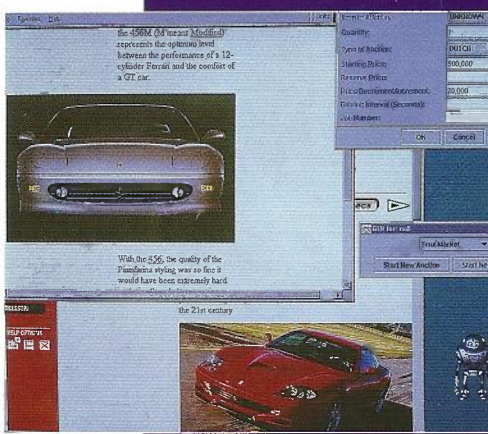
Many office desktop computers are now equipped with microphones and video cameras for applications such as IP telephony and videoconferencing. Most of today's corporate networks can be accommodated on IP Virtual Private Networks (VPNs).

Theoretically, this technology allows each business to have a secure private network and to share network capacity, thereby reducing business costs. But in practice, it's important to ensure that each business network receives its share of network capacity, and that its performance is not adversely affected by traffic on other networks sharing the same pipes.

Current IP networks do not offer QoS for different types of traffic. However, the protocol and network design is rapidly evolving to support this type of capability. TRL is leading the way in the deployment and engineering of these new techniques.

TRL's integrated solution to QoS and shared-capacity issues is based on IP differential services technology and ATM traffic management technology within Telstra's new DMO (Data Mode of Operation) network infrastructure.

Until now, IP-network access has mainly been via ISDN or modem connection to the telephone network. However, cable, ADSL-copper, terrestrial wireless and satellite offer the bandwidth required for teleworking, videoconferencing and telephony applications and may soon become more widely used. Further, the global availability of ISPs (Internet Service Providers) means that business travellers can use encrypted tunnel technology to securely communicate with head office. TRL is developing architectures to make access as consistent as possible for users and administrators of private IP-networks and IP-VPNs.



Opening the door to **easier e-trading**

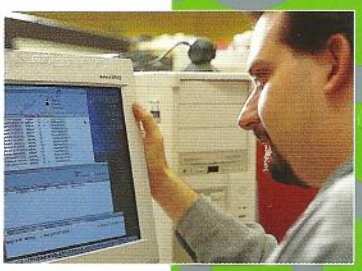
The Internet's impact on business-to-business (B2B) relationships has been profound, with many companies struggling to keep pace with Internet technologies and protocols that are required to operate effectively in an online environment.

While the Internet has dramatically changed the way we buy and sell and has probably most noticeably impacted business-to-consumer trading relationships, its impact on B2B relationships and the necessary re-engineering of business processes has also been considerable.

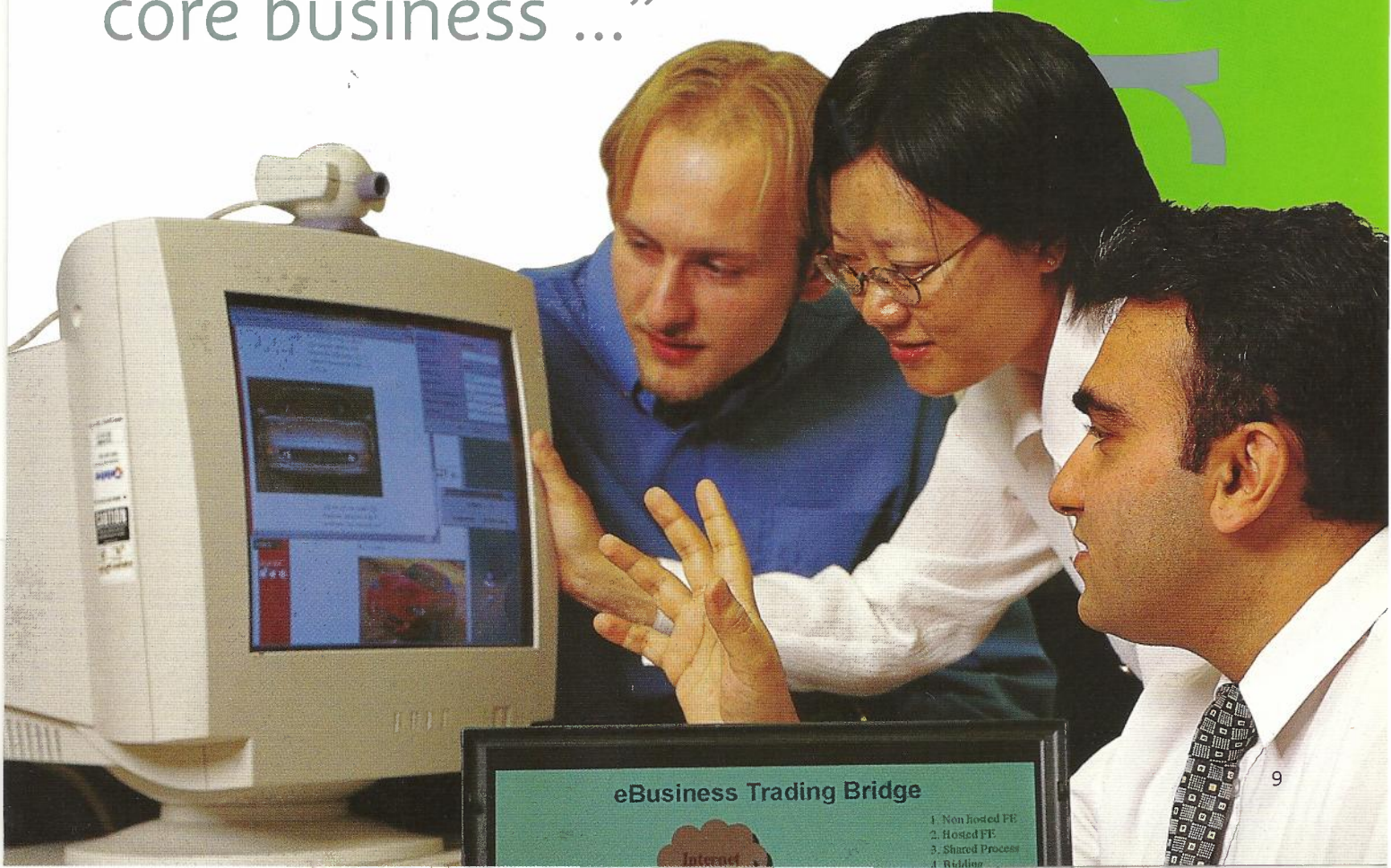
TRL has been working on a project that will help more businesses make the move into trading online. The project's aim is to reduce the investment required by businesses to perform trading protocol conversions, business process mapping and message format conversions.

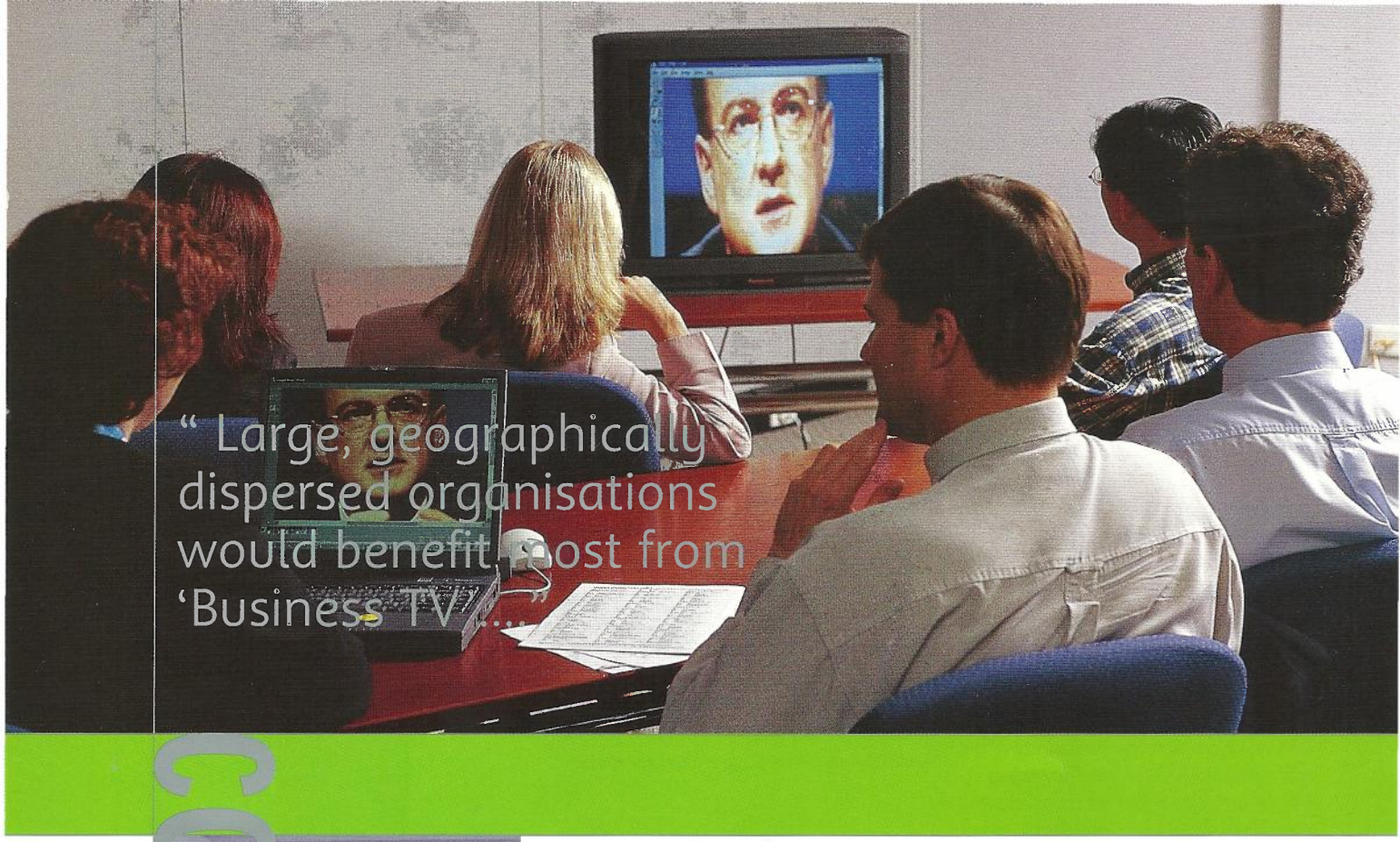
The outcome will be an interoperable, online environment for B2B trading, which will make businesses independent of trading protocols, Internet technologies and business processes, as well as change business relationships. This leaves the company to focus on its core business, without being needlessly sidetracked by new technologies.

The online trading environment will enable a company to both rapidly establish and dismantle its changing network of trading partners, with minimal system development effort. Businesses will also be able to subscribe to different trading models – such as online auctions – without having to change their existing systems or business processes.

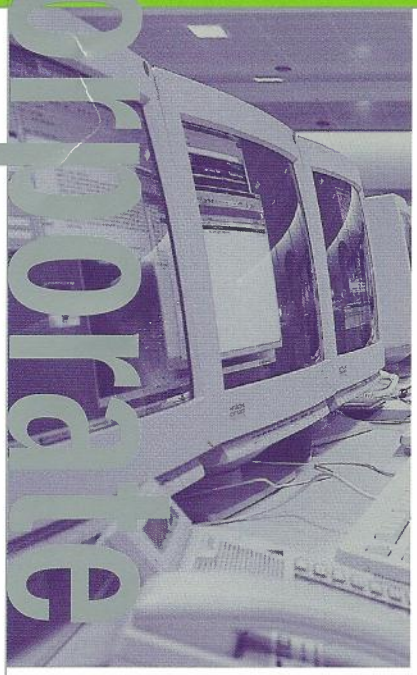


"This means that a company could continue to **focus** on its core business ..."





corporate intranet



Business TV puts everyone in the picture

The technical feasibility, usability and commercial potential of *Business TV* was put to the test by TRL this year when a trial was carried out at a Sydney Telstra site and coordinated from TRL in Clayton, Melbourne.

Business TV is an IP-based video-distribution technology designed for corporate Intranets. Accessible through a web browser, *Business TV* enables live and pre-recorded video programs to be delivered directly to a company's desktop computers via its Intranet.

Business TV offers many benefits. It is cost-effective and easily deployed, saving on employee travel costs and requiring a relatively modest investment in communications infrastructure.

At the successful conclusion of the trial, information was gathered from participants about quality of the audio and video and also the usability of the service itself. These results are being used to refine the technology.

On a practical level, *Business TV* is easy to use. A central server streams programs over the Intranet at predetermined times. Each user can choose the desired program by clicking on a program guide on their desktop PC.

The service may be used to broadcast programs such as:

- CEO messages
- shareholder meetings
- staff communication briefings
- updates on processes and procedures
- training courses and live seminars (including slide packs)
- industry news

Large, geographically dispersed organisations would benefit most from *Business TV* by using it to communicate more effectively with staff. For example, sales staff in state or regional offices could simultaneously view a presentation detailing a new pricing structure or product offering.

Unlike existing Internet browsing and video-on-demand services, IP-multicast technology involves unidirectional information flow, which requires less network bandwidth. Multicast video is similar to broadcast TV in that each program only ever occupies one stream. However, multicast programs do not need to be sent to every point of the network, only to users requesting a program. This is useful in corporate Intranets, which tend to be congested.

IM Growth fastest in Communications History

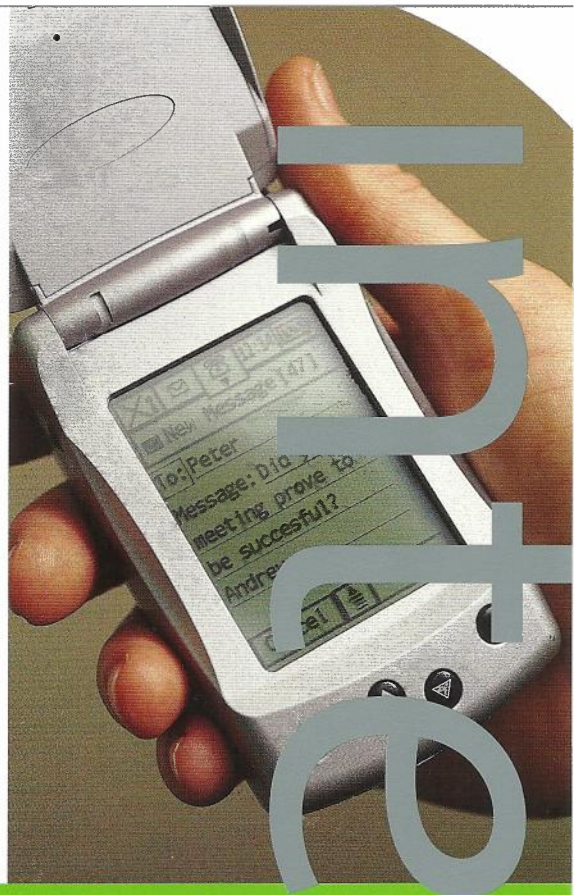
Instant Messaging (IM) is a rapidly growing area of Internet communications involving the spontaneous delivery of short messages between 'buddies' or friends.

According to the *Wall Street Journal*, IM has grown faster than any communications medium in history, attracting about 80 million users by mid-1999. Market research firm, *Ferris Research*, predicts that in five years time, two-thirds of corporate email users will be using Instant Messaging as an alternative to email. Further, a recent *Computerworld* survey found that 17 percent of US corporations had already used Instant Messaging for interactive chats.

Currently, IM is a computer-based technology that sits between synchronous communications (conferencing and real-time voice or text chat) and asynchronous systems (email and fax). Apart from instant text message capability, recent IM systems integrate other services such as email, voice-on-IP, video conferencing and mobile phone Short Messaging Services (SMS).

IM systems rely on the use of 'presence' information to indicate the availability of a buddy or colleague. For instance, the buddy may be shown as being 'online', 'offline', 'video-capable' or may have selected to display a message such as 'don't disturb' or 'out of office'.

TRL is extending the vision of IM and 'continuous presence' systems to provide users with integrated communications that will span all telecommunications devices and media. Researchers are developing services that make use of user-presence information drawn from a range of network and computing resources and individual profile information (personal preferences), to provide intelligent synchronous, asynchronous and semi-synchronous messaging and real-time communications.



"...predicts ... two-thirds of corporate email users will be using Instant Messaging as an alternative to email."

Corporate Directory Dial trial

TRL has successfully tested an enhancement to Telstra's Corporate Directory product, View500, which makes finding the right person in a large organisation as easy as clicking a mouse.

Developed by TRL as an internal directory service, View500 is now a commercial product used by a range of large corporate and Government departments, providing fast computer-based access to internal telephone directory lists.

The trial of Corporate Directory Dial tested a new feature for the View500 system that enables users to initiate a telephone call by clicking on the number displayed on the View500 screen. View500 uses a browser style screen interface, and the software enhancement makes the numbers listed on the screen 'active' links to an automatic dialling process.

When activated, Corporate Directory Dial software sets up a telephone link between the caller and the recipient on the screen. Once the desired number has been double-clicked, the Corporate Directory Dial rings the calling party's telephone. When the caller picks up the handset, the program dials the number of the desired recipient.

The three-month trial concluded at the end of 1999 and involved more than 1700 Telstra employees, who found the new system fast, accurate and easy to use.

Digital media library for online sound and video searches

TRL has been working with internal business units and industry partners to prototype a digital 'media library' for archiving and indexing multimedia. The facility would enable multimedia producers around the country to browse, view and retrieve copies of high-quality video and audio sequences or programs over the Internet.

Telstra is targeting a service, based on this prototype, at customers of its new Digital Video Network (DVN). The DVN is a high-speed connection used by Australia's broadcast TV networks to exchange video program material.

Archiving and indexing of multimedia content is still an adhoc, labour-intensive and costly process for most producers. However, the media library prototype features intelligent indexing software that streamlines the process. For example, it provides a view of key frames in the video sequence for logging purposes, and also allows entry of descriptive text information for later searches.

The library, a shared but secure facility, will handle all content storage – including long-term tape archive – via reliable digital servers. A user would simply log into the data store to view "browse"-quality video sequences over a secure internet connection. Once the desired sequence was found, a high-quality copy could be delivered directly to a production facility over the DVN.

While the media library may start as an archive for individual producers, Telstra anticipates that it will become an important resource nationally, for producers to exchange material and keep track of copyright and royalty payments in a secure environment. If all producers used a shared archive, it would reduce the cost of locating existing footage and streamline the exchange of multimedia material.

TRL has assisted integrating the prototype facility's hardware and software components. Telstra plans to demonstrate the completed prototype to the media production industry, for feedback and further refinement.

'...the media library phototype features intelligent indexing software that streamlines the adhoc, labour-intensive and costly archiving process.'

Information *Anywhere, Anytime, Anyhow*

Telstra customers will soon be able to send and receive all types of messages at any time and from anywhere in the world.

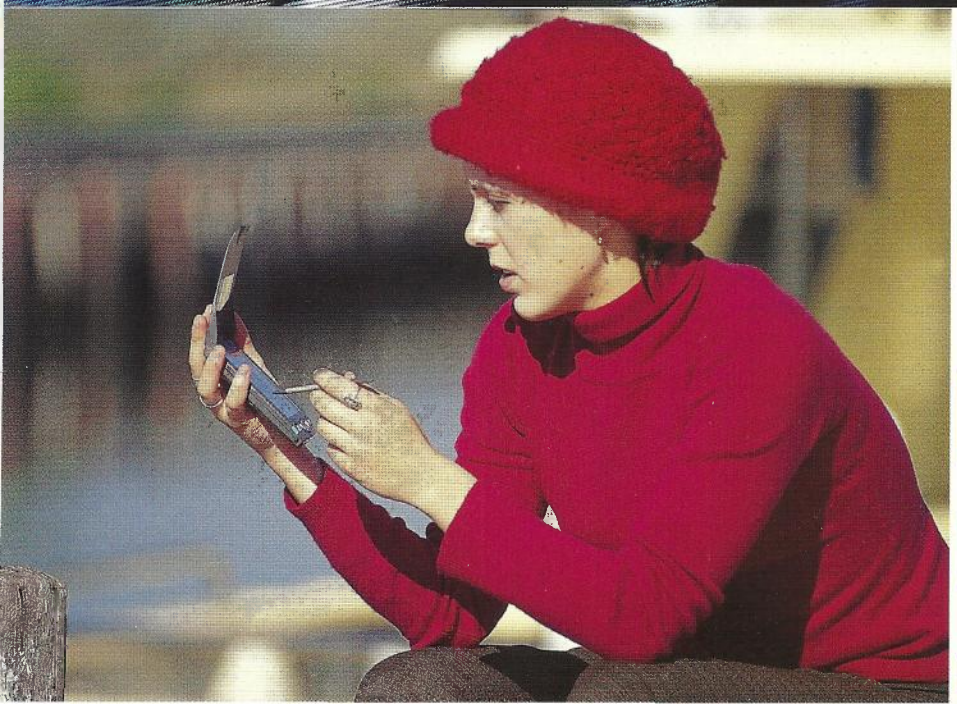
The trend in the Internet space today is towards a proliferation of hand-held and personal Internet-ready devices and TRL is presently exploring devices such as hand-held Personal Digital Assistants (PDAs) and wearable computers.

Applications which are being adapted for these hand-held tools include Unified Messaging and a Personal Information Manager (PIM). Unified Messaging allows customers to access all messages (email, voice-mail, fax, SMS) through a single virtual mailbox. Access to the virtual mailbox is currently possible through email, web browsers, telephones and mobile phones. PIMs offer customers easy access to their personal information, such as calendar, address book and to-do list.

As with any new technology, human factors are a key consideration and TRL is also exploring customer usability issues arising from the integration of these devices and applications.

In the near future, customers will be able to access their messaging, PIM, and information services from anywhere in the world, using whichever device is available to them.

'With any technology, human factors are a key consideration.'



ADAGE:
making IT easier

ADAGE (Application Development and Automatic Generation Environment), a tool developed to allow businesses to easily develop new applications or modify existing ones without the need for manual software changes, is being considered for web browser-based applications.

Introducing ADAGE into an IT environment has clear benefits. Typically the implementation of a business application involves embedding business rules or processes within the system software, and IT specialists are needed to update the software when business requirements change.

Using ADAGE, an application designer can draw the required user interface screens, as well as the business process rules on a graphical user interface, eliminating the need for sophisticated IT skill or coding experience.

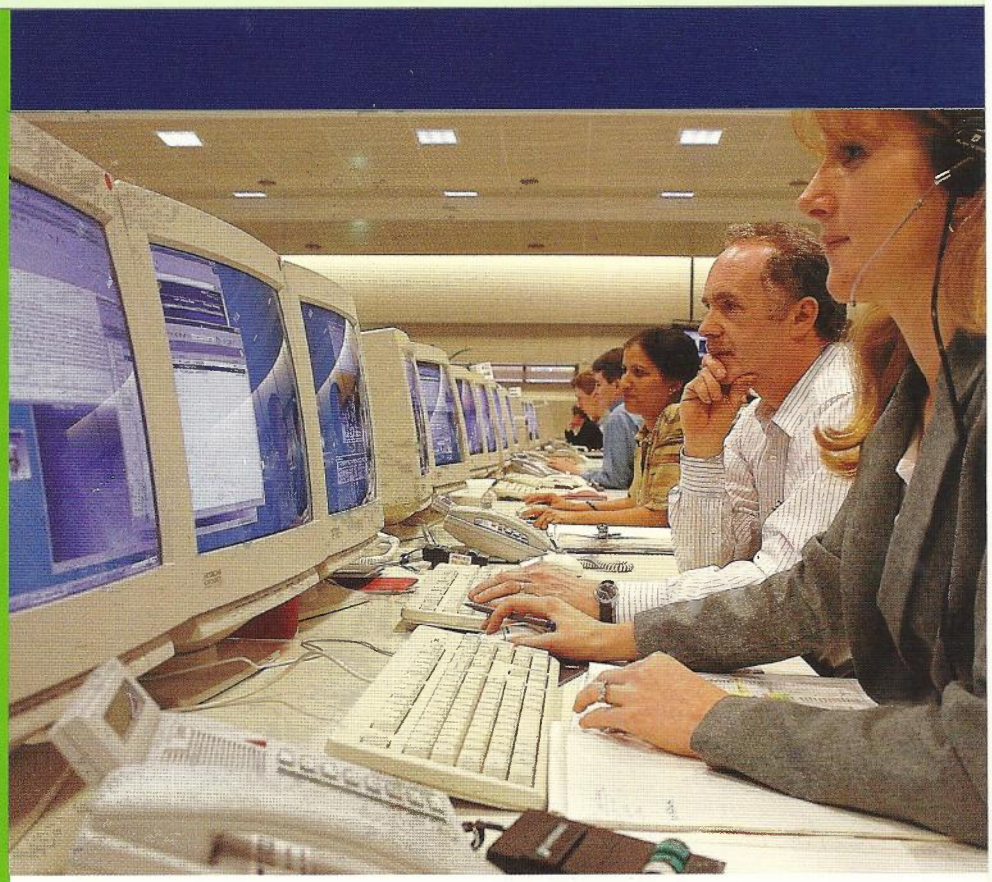
Based on the information provided by the designer, ADAGE then automatically generates an expert system application.

The designer can test the application and then hand it to IT specialists to add components to interact with other systems and databases if required.

A unique advantage of ADAGE is that at any time during the life cycle of the software, the business analyst can modify the applications user interfaces and business rules without requesting an IT update. ADAGE automatically regenerates the application system, saving valuable time and resources.

ADAGE is suitable for any application where a set of business rules can be clearly defined.

The concept and architecture of ADAGE has evolved through many years of R&D into expert system technology. The underlying expert system was initially developed for Telstra's Mobile Helpdesk, which has been in use successfully for several years.



Business opportunity or flop-portunity?

Anyone who still thinks that technology forecasting in a global market is easy, needs to refer back to the now legendary comments made by Thomas Watson (founder IBM) when he said that demand for computers in the world market would be satisfied by five machines.

With literally millions of PCs in today's global marketplace, prudent business leaders are carefully trying to wade through the many seductive technology ventures on offer to find those that are credible and profit-making. At Telstra, the same challenges are being faced as the age of the Internet continually generates an extensive range of commercial opportunities.

TRL is developing conceptual frameworks, tools and techniques to evaluate the new business models presented by emerging Internet technologies. With backgrounds in technology projects, TRL is ideally positioned to objectively assess the potential value of new products.

Traditional investment evaluation techniques, such as Discounted Cash Flow analysis, do not capture the strategic value of some Internet products. Objective assessment is further complicated by the bewildering variation in the demand forecasts for Internet-related products and services.

Once the commercial value of new products is assessed from a consistent set of assumptions, care must also be taken to appreciate their profitability under alternative market scenarios and growth assumptions. Ideally, the techniques under development will allow a product's value to be quantified, enabling comparison with alternative product and technology options.

Telstra is a major player in information services but in an era where speed-to-market is the catchcry, the company needs to recognise new opportunities quickly to remain at the top.


Telstra
Home Communications

Home Communications

For the past 25 years humans have been busy adapting to computers. Now computers are adapting to us. Welcome to the new communications era, software-driven and powered by people-focused technologies in which computers are being adapted to people's actual requirements and needs. This is increasingly evident in the home, where the newest family members — the Internet and the PC — have grown to become reliable, responsible and indispensable contributors to the family.

Through its infrastructure, access and connectivity, Telstra is bringing the new information age into the lounge room, the kitchen and the home office. This is happening as the online world is defining itself in the context of the richness and depth of new content, applications and services that are now available to household – and other – users.

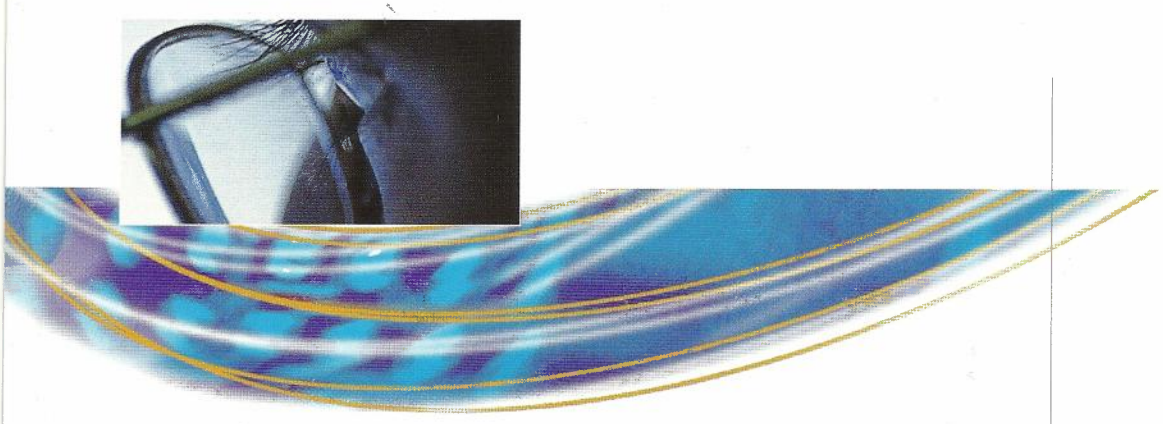
PCs, phones (both fixed and mobile) and televisions are increasingly doing the jobs of each other – converging. We can pay the bills and shop, play interactive games, run a business, telecommute, or just gossip – all from home via the Internet. More and more, ordinary household devices like the refrigerator and microwave will have embedded computers that will allow us to control functions and interact remotely – functions and activities like home lighting, heating, cooling, security, preparing the shopping list or even putting on the roast.

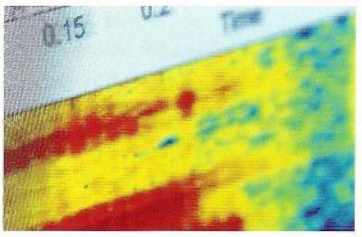
Whether it's a traditional or new age business, the customer relationship is critical. Two years work by TRL has created online storefronts where the customer at home can interact electronically with the customer service representative via the phone and on-screen – using both voice and visual cues. This may well be the future of call centres.

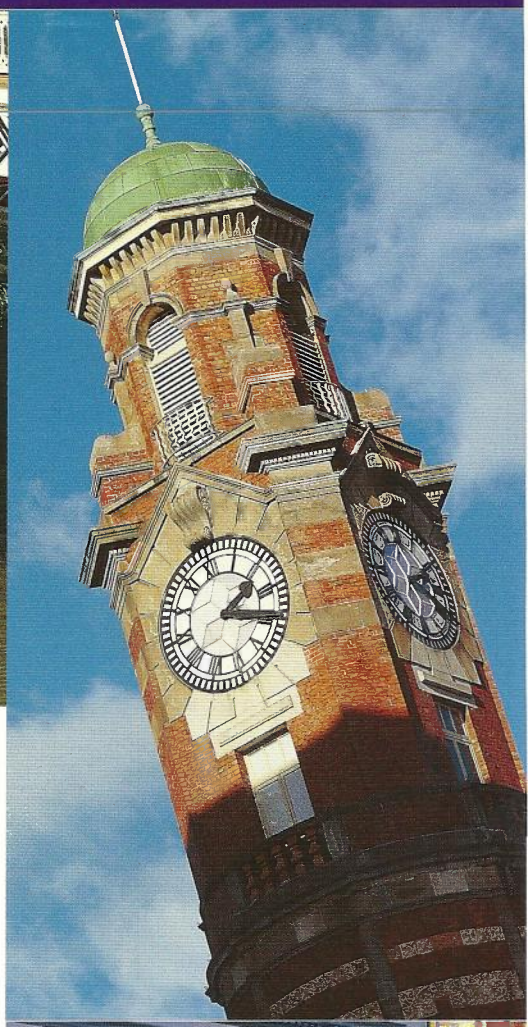
People having a conversation with computers over the phone? Yes, it's now possible. TRL researchers have developed numerous speech recognition services which make virtual 'personal assistants' of computers by scheduling the user's appointments, reading email over the phone and finding information.

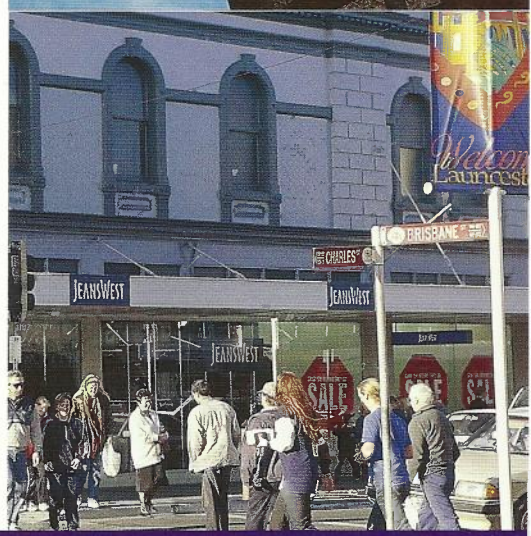
The humble fridge is one of the most enduring – and unchanged – electrical appliances, until now. Equipped with a touch display on the door and a barcode scanner, TRL's Internet Fridge can receive and display email messages, and turn lights, heating, air conditioning on and off at the touch of the display panel. It can even create your grocery shopping list.

"Whether it's a traditional or new age business, the customer relationship is critical."









eLaunceston brings Internet closer to home

Would local content make the Internet more compelling for existing users and entice new users to come online? The answers will become clearer through Telstra's *eLaunceston* project being managed by TRL.

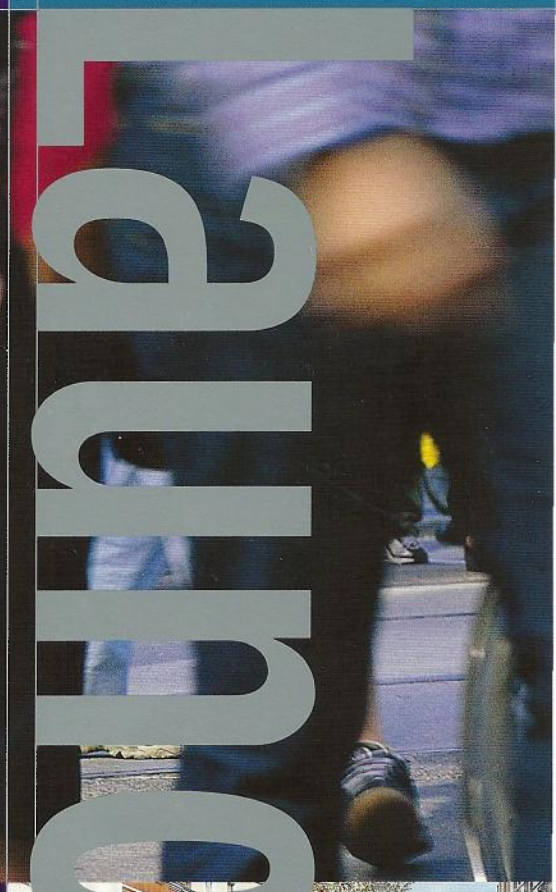
The *eLaunceston* project, a long-term, in-depth study of Internet usage by more than 200 Launceston households and 25 local small businesses, involves customer access through the *eLaunceston* regional web portal. TRL developed the portal (www.elaunceston.com), which was launched in October 1999, in collaboration with the people of Launceston. (Portals are web pages that aggregate information, links and services for user convenience.)

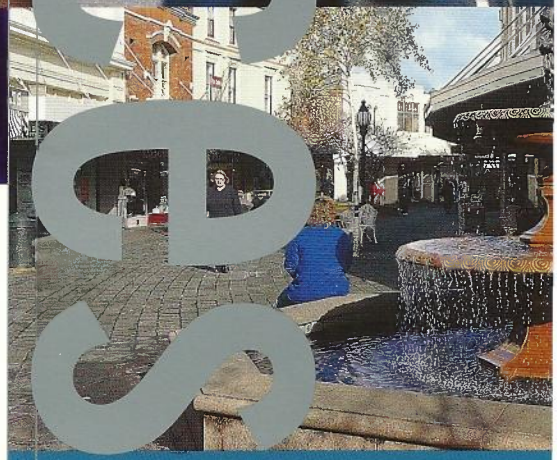
Because of its specific focus on the Launceston community's information requirements, the *eLaunceston* portal provides an ideal environment for Telstra to explore the influence of local web-based information and services on Internet use. The portal, which includes email, chat, discussion boards and local homepages, can also deliver information about Launceston to prospective visitors and to other users around the world.

The project is bringing together TRL's expertise in the following key areas:

- socio-technical issues of Internet use and web technology
- user-centred interface design
- personalised information transactions
- frameworks for electronic business

"...the *eLaunceston* portal provides an **ideal** environment for Telstra to explore the influence of **local web-based** information."





Launceston

Telstra set for commercialisation through B-eLab

Telstra's new multimedia laboratory in Launceston, officially opened in August 2000, will play an important role in the commercialisation of Telstra's future online products by providing a trial site whereby new multimedia applications can be tested prior to wider commercial release.

Broadband eLab, or B-eLab, will be a 'living lab' and will support the introduction of experimental services, especially consumer services, from initial proof-of-concept to the point at which a market trial can be established. It will be staffed by about 25 researchers who will give the Launceston community access to new online applications through limited market trials and early deployment of new products. Some of these initial products will be for application in the area of multimedia call centres.

B-eLab is part of a larger joint initiative between Telstra and the Commonwealth Government, called the Launceston Broadband Project. There are three project components:

- A new multimedia development laboratory (B-eLab)
- High speed digital access for between 2,500 and 5,000 homes and businesses in Launceston
- Funding and support for hi-tech businesses in the region as part of the Federal Government's $5 million development fund

The project will utilise the roll-out of high speed digital access, using ADSL technology. ADSL, which provides up to 30-40 times faster access than from a typical dial-up modem, will create the residential online environment of the future. A group of local consumers with ADSL access will be given the opportunity to trial newer, high speed, online services.

The Launceston Broadband Project will play a major role in ensuring that Tasmania (and Australia) is in the best possible position to seize the opportunities offered by the information age.

"Customers and CSRs can now simultaneously view and remotely interact on the same web page."

Can I help you?

For many businesses today, the first point of customer contact is not 'over the counter' – more often, it is a Customer Service Representative (CSR) working from a telephony call centre. A customer calls with a query and the CSR assists them verbally over the phone.

But what if service could be taken a step further with customers using both voice and visual cues to interact with CSRs?

TRL has done just that by refining its vision of a multimedia call centre, making use of the web to create interactive 'online storefronts'. In other words by creating an IP call centre, customers and CSRs can now simultaneously view and remotely interact on the same web page – allowing the CSR to guide a customer through a website during a sale or service enquiry without interrupting their telephone conversation. If necessary, the CSR could also partially fill in a form which would then be 'pushed' onto the customer's screen, with the reverse also possible.

In 1999, TRL completed and demonstrated a web online collaboration package for use within a multimedia call centre. The system offers such features as:

- CSR-initiated web page navigation
- collaborative web form completion
- targeted information presented to the customer
- a call-waiting style integrated Internet/voice channel

The aim of the TRL work is to ensure that the next-generation IP call centres are fully integrated with Telstra's business systems.

Internet Call Waiting exceeds expectations

Following the successful completion of customer trials, an Internet Call Waiting product is being prepared for commercial release.

The Internet Call Waiting (ICW) product was initially developed by TRL as a 'virtual' second line, which allowed people using a single telephone line to access the Internet to simultaneously receive telephone calls. Incoming calls are diverted at the Telstra exchange and converted from circuit to packet format, allowing the call to be received by the customer using the active Internet link.

The three-month trial involved 12,000 Telstra Big Pond® customers, who found the Internet Call Waiting product a convenient and valuable service with very acceptable voice quality.

The key to its success is the start-up software program developed by TRL, which maximises the benefits of Telstra's digital network capabilities and sets up the customer's computer to receive incoming calls for the duration of the online session.

The customer establishes a connection to the Internet using the Internet Call Waiting program, which makes changes to the customer's telephone call diversion settings. At start-up, the program also activates appropriate Internet telephone software on the customer's computer, such as Microsoft NetMeeting™, which can transmit and receive voice conversations via the computer's microphone and speakers.

Once activated, Internet Call Waiting tells Telstra's network exchange to divert calls to that customer's number to the ICW host platform. The ICW host platform then converts the incoming call to an Internet protocol format, and sends the call to the customer via the active Internet link. The call is then managed by the customer's Internet telephone software, allowing the customer to take the call while staying on the Internet.

At the end of the customer's Internet session, the Internet Call Waiting program then returns all telephone diversions back to their original settings.

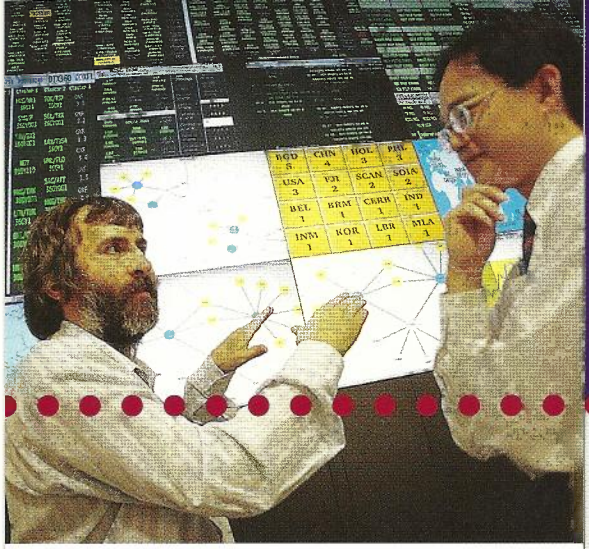
Computers that can learn to speak and listen

TRL researchers have developed numerous speech recognition services that enable users to talk with computers over the telephone. These services include 'personal assistants' that can schedule a user's appointments and read email over the telephone, and call centre technologies that enable a user to ask questions about Telstra products.

The major limitation in bringing new applications like these to the public is the time and cost required for development. To work in everyday situations, these applications must be developed to the point where they can predict what people are going to say, as well as understand the meaning of those sentences. The problem is compounded by the fact that English is an irregular language.

To overcome this problem, researchers are developing software that 'learns' from examples. The software is given examples of sentences that people are likely to say to an application, along with the meaning of the sentence expressed in a simplified way. The learning software then automatically writes large portions of the live service, fine-tuning and generalising it by predicting similar sentences to those it has encountered.

Researchers are also developing speech search engines that will help people to find documents, such as news articles, over the telephone by stating a topic of interest. The search engine would identify the topic and key information in documents, and use them to build the speech interface. TRL is designing the search engine to be tolerant of speech recognition errors caused by noisy environments, and to improve its performance by learning from past user interactions. Already, TRL has succeeded in devising techniques that can develop applications in minutes or hours, rather than days or months.



Voice-on-IP

VoIP – the next step in telephony

Telstra has conducted a number of Voice-on-IP (VoIP) trials, both nationally and internationally, to evaluate the quality of IP-based voice services which are the next step in the evolution of telephony.

The next generation of telephony services will exploit a common IP infrastructure which supports voice, data and video. Voice will be carried by IP packets on this infrastructure. To ensure that customers experience a telephony service that is consistent with, or surpasses that currently supported by the Public Switch Telephone Network (PSTN), much remains to be developed in VoIP technology – including quality assurance, monitoring equipment and analysis tools for network management and reporting.

By its 'packetised' nature, VoIP introduces its own peculiar set of impairments to voice quality, over and above those experienced in the PSTN. Most notable, are those caused by packet loss and packet 'jitter' or delay variation in the delivery of the voice packets. End-to-end delays are also a problem in today's generation of VoIP equipment. The total impact of these impairments on the customer is difficult to quantify and there are no commonly agreed 'quality metrics'.

The trials, which involved TRL, have provided an in-depth statistical analysis of the performance of VoIP services and networks. Telstra now has the tools for measuring end-to-end voice quality, monitoring the dispersion of VoIP call trafffic and faults and analyzing customer call holding time behaviour in the presence of IP packet loss.

These tools have been deployed in the Asia Pacific Internet Community (APIC) VoIP Trial, Telstra Internet Telephony Trial (with Telstra UK), Global Clearing House Trial and Internet Call Waiting Trial.

"researchers decided to update the archetypal whitegood for the new millennium"

Internet fridge for the new millennium

Despite the pace of change that is sweeping across the electrical appliance industry, the humble refrigerator has largely remained untouched – that is, until Telstra researchers decided to update the archetypal whitegood for the new millennium.

Proving that the Internet has the potential to impact on even the most everyday items – such as those sitting in your kitchen – a team at TRL has devised the Internet Fridge.

The most visual parts of the Internet Fridge include its large touch-sensitive display on the outside of the door, the barcode scanner at waist-height and the cable trailing out the back for connection to the Internet. But as well as looking impressive, the fridge's applications provide a significant enhancement to the most basic of kitchen routines.

For instance, instead of leaving messages to other household members by sticking them on the fridge with a magnet, messages can be emailed directly to the Internet Fridge's display from any email account or WAP phone. Similarly, children's artwork can be emailed straight to the fridge door and the latest take-away menus and advertising offers can appear on the fridge and then disappear when out-of-date.

A shopping list can also be created by swiping the bar codes of empty products in front of the fridge before throwing them out. This list can then be read on a WAP phone when out shopping, or if you are time-poor, the supermarket can simply deliver the products to your home.

But perhaps the most powerful aspect of the Internet Fridge is its integration with other household appliances. Any of the lights in your home can be turned on or off from an icon on the display panel, while the air-conditioning, spa and alarm system can all be controlled without leaving the kitchen.

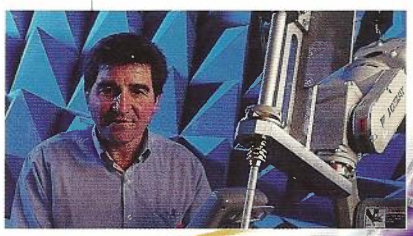
It's hard to know when something like this concept fridge will be in everyone's homes, but it does show the potential of the Internet in making our increasingly busy lives a little less hectic.

Mobile

Mobile Communications

Mobile communications

Australia has one of the highest penetration rates of mobile phones in the world. It is now around 42 percent and increasing at almost one percent per month. In all probability, this rate will accelerate, and could even reach near 100 percent penetration as machine-to-machine and people-to-machine communications grow in importance.



"In a few years, there will be more wireless appliances connected to the Internet than there are PCs in the world."

Mobile telephony has changed the face of communications. The next step – integrating the ubiquitous access of mobiles with the Internet to enable the transmission of virtually unlimited amounts of data – will be even more compelling.

We are moving to a world without wires and mobility will play a central role in the future of the data paradigm.

In Australia, it is projected that mobiles will soon overtake fixed line phones to become the most widely available data capable device. In a few years, there will be more wireless appliances connected to the Internet than there are PCs in the world.

Wireless communications and broadband are the next wave of technological innovation. Combined, these two elements of the communications revolution will mean that Australians will be able to go online, anywhere, anytime – using lightweight, wireless devices, which permit a variety of text, voice and data transactions.

In Australia, Telstra leads the mobiles space. It has the largest number of customers, the highest quality networks in terms of in-building and geographic coverage and two national digital mobile networks – GSM and CDMA – with 94-95 percent population coverage.

Telstra's mobiles pre-eminence is not only in terms of market share, but also in terms of quality of customer base, technical innovation, value-added features and sophisticated customer service. In all these areas, TRL plays a key role.

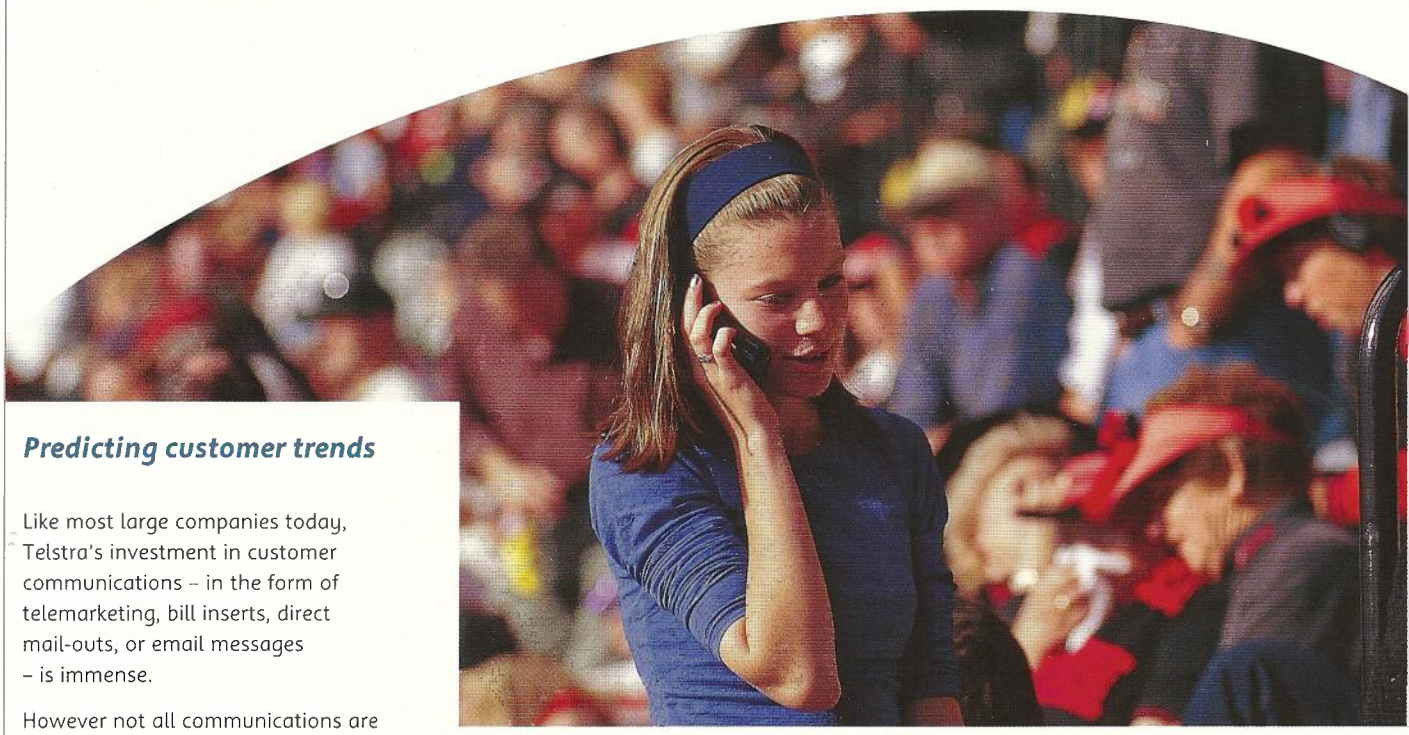
Telstra is using artificial intelligence to help run the mobiles network. It has developed and trained more accurate modelling tools which seek to anticipate changing customers needs in relation to their mobile service. The modelling tools identify trends in past customer data, impose these on current data, and subsequently, help predict future customer trends.

Service quality is a key driver in the highly competitive mobiles market. TRL researchers have been involved in work that protects customers from signal interference in those channels used for mobile telephony.

TRL has written a program that can assess the intensity of radio signals around cellular mobile base station sites.

The radio signals from a mobile phone may be amplified by certain hearing aids. TRL has worked with manufacturers and hearing-impaired people to produce an Australian standard and develop special accessories to ensure mobile phones can be used with hearing aids.

customer trends



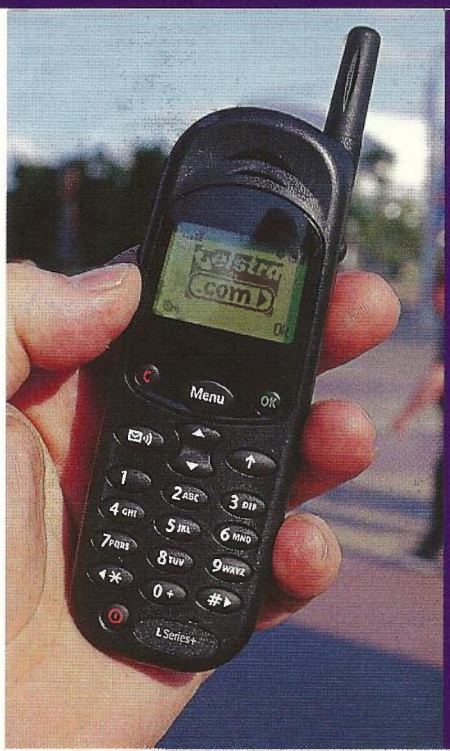
Predicting customer trends

Like most large companies today, Telstra's investment in customer communications – in the form of telemarketing, bill inserts, direct mail-outs, or email messages – is immense.

However not all communications are necessarily relevant to each customer. So how do we ensure that customers only receive information they want?

TRL researchers have developed more accurate predictive modelling tools that identify trends in past customer data and then impose these on current data to forecast future customer trends. Although, like weather forecasting, there are no guarantees, predictive modelling does allow Telstra to zoom in on 'populations of interest', which can significantly increase the efficiency and profitability of its customer communications.

These predictive tools are being used to help Telstra's mobiles business retain customers. The tools enable Telstra OnAir Marketing to identify users likely to either disconnect from MobileNet® or to upgrade their service in the near future. Telstra can then selectively approach these customers through telemarketing, direct mail-out, or SMS messages sent directly to a customer's mobile phone.



"...predictive modelling does allow Telstra to zoom in on populations of interest."

Smart tools sharpen mobile network

TRL researchers have developed two 'smart' software tools that enhance the quality of mobile network operation while reducing costs.

The 'Quokka' network-performance management tool is being evaluated for commercialisation by US telecommunications leader, Lucent Technologies. The other tool – 'Carman' (formerly known as 'Cardinal'), which manages the clearing of customer reported faults – has been implemented nationally and will be used to help Telstra meet new service-level guarantees for MobileNet® customer service.

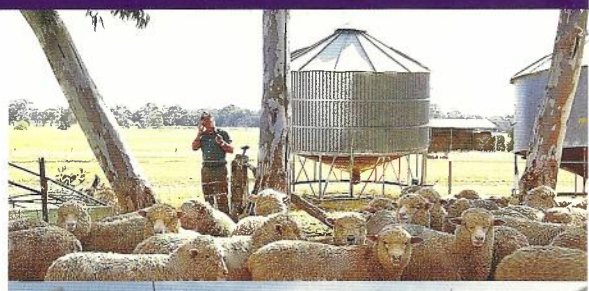
Some faults which affect mobile service quality may not become obvious until they are reported by customers. Typically, a mobile network cell is monitored for hundreds – in some cases thousands – of network performance indicators. Telstra MobileNet®, for example, comprises thousands of cells that generate hundreds of thousands of performance-indicator graphs daily. Isolating abnormal data patterns or 'signatures' manually is a slow process that can result in delays of days or weeks in identifying hidden network problems – enough time for the problem to affect customer service.

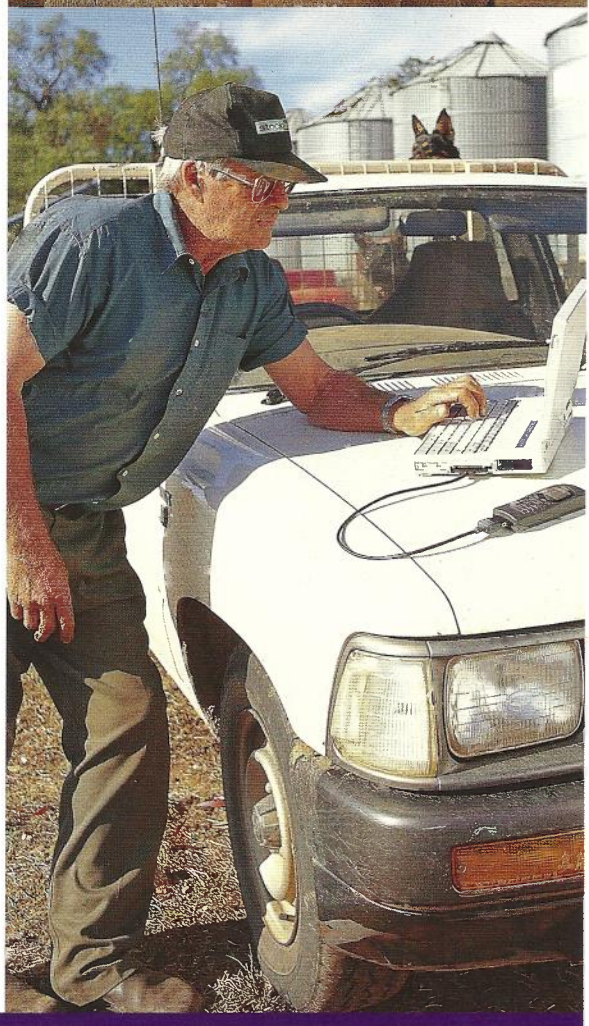
TRL has used artificial intelligence techniques to capture the combined knowledge of experts working in mobile network performance management to develop the two complementary software tools, which automatically:

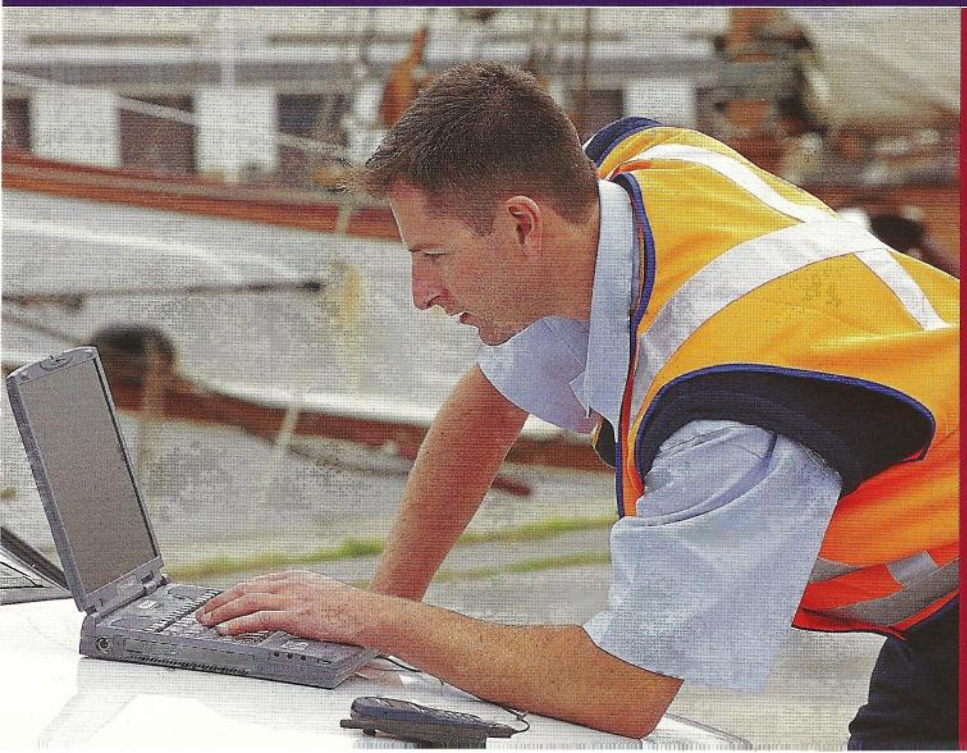
- analyse fault and performance data
- recognise related or abnormal patterns
- make a diagnosis
- keep track of corrective action

While Quokka analyses *network performance* data, Carman is designed to cluster diverse *customer fault* reports into a pattern that may be traced back to a single network fault. Carman enables MobileNet® Customer Service Representatives (CSRs) to accurately report on the status of a customer-reported fault in response to further queries.

Quokka's power and efficiency was noticed by Lucent engineers, who first came across the software tool during a site visit to TRL's labs in Melbourne. Lucent has since signed a contract with Telstra to commercialise Quokka globally, and is adapting it for its use in the US.



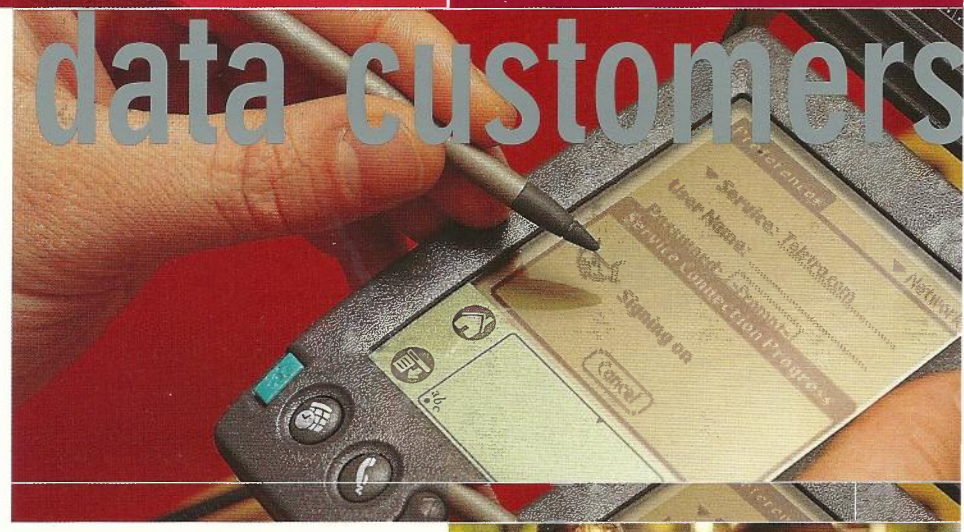




"TRL has used artificial intelligence **techniques** to capture the combined knowledge of experts."

"... these recommendations should **enable** Telstra to meet the **high service** guarantee levels requested by **corporate** mobile data **customers.**"

mobile data customers

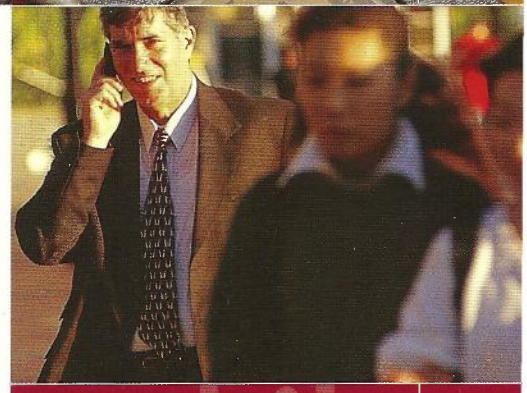


Service guarantees for mobile data customers

TRL has been working hand-in-hand with Telstra's mobiles business unit, Telstra OnAir, and others to develop new mobile services, such as e-commerce, web browsing and mobile multimedia. While the mobility factor of these online services will attract corporate customers such as banks, these customers will also demand the high levels of service security, reliability and quality similar to levels offered by fixed-line services.

The problem is that radio channels are inherently more 'noisy' and more open to signal interference than wires or cables. However, TRL researchers have applied their knowledge to an analysis of GSM radio channel performance in various environments. The result has been a set of recommendations for a 'channel allocation strategy' in Telstra's GSM network.

Once implemented, these recommendations should enable Telstra to meet the high service guarantee levels requested by corporate mobile data customers.



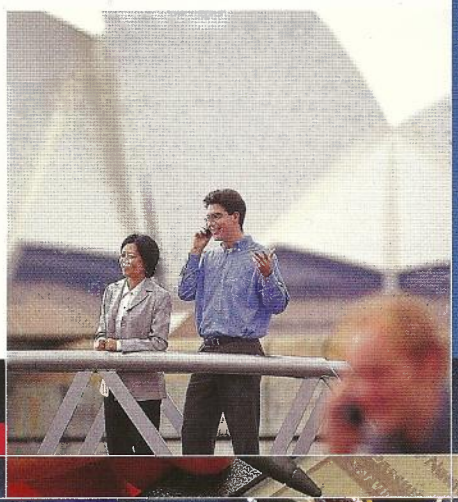
mobile

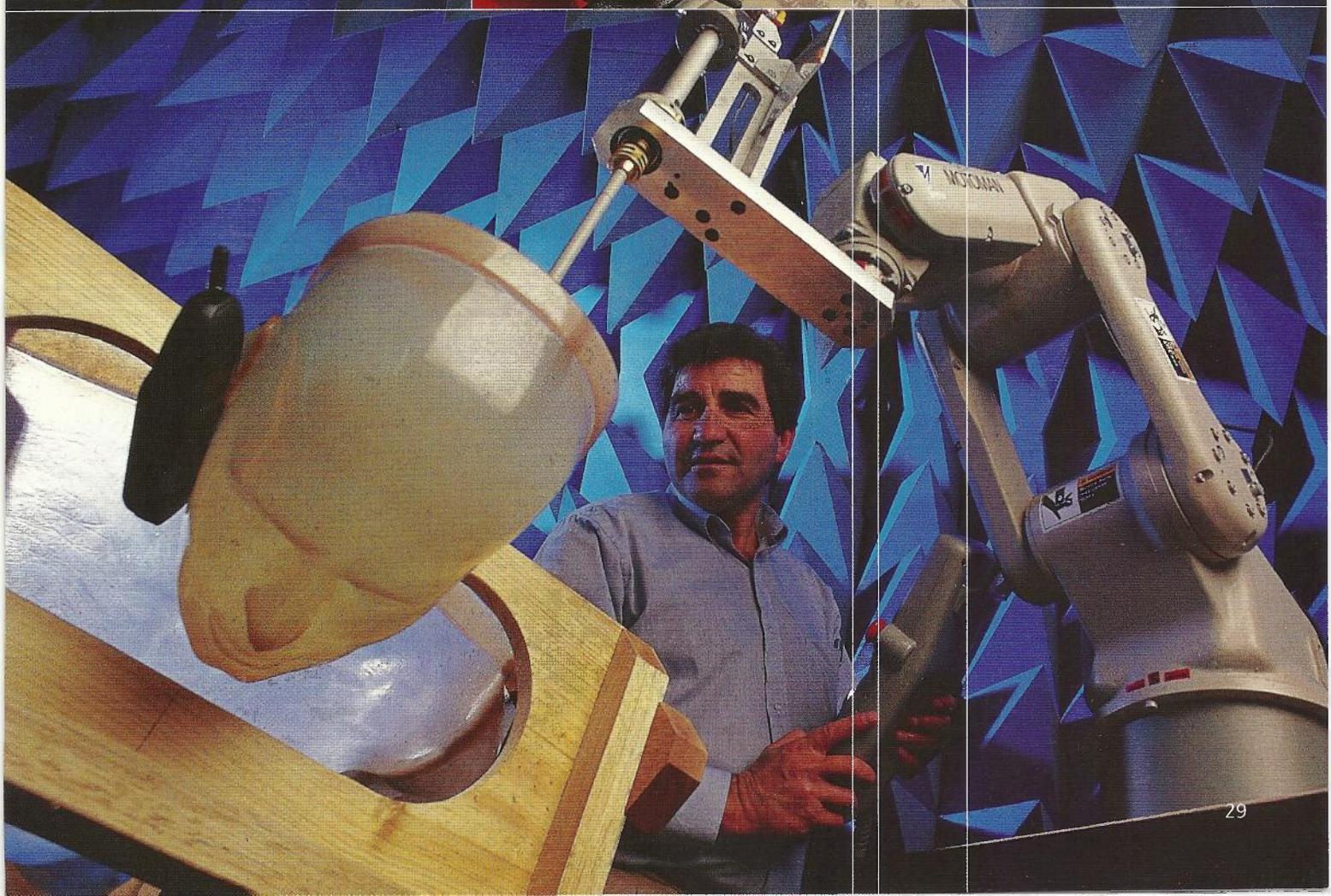
Accurately measuring EME Levels

As part of Telstra's ongoing commitment to EME (electromagnetic emissions) safety, TRL has developed a new experimental facility to accurately predict absorbed radio frequency (RF) fields in the human body when it is exposed to emissions from radio equipment.

Measurements are conducted on different 'body phantom shells' containing a special mixture that simulates the electrical properties of the human body. A computer-controlled robotic arm positions a miniature electric or magnetic field probe in a precise and repeatable pattern. The probe's measurements are used to calculate the energy absorbed inside the body during exposure to radio emission equipment. This estimate of energy absorption – known as the specific energy absorption rate (SAR) – provides a basis for RF safety limits in national and international RF exposure standards.

TRL is now able to measure the SAR induced inside the human body from exposure to various radio sources – such as small base-station antennas and mobile phones – far more accurately than other estimating techniques, which are based on ambient field exposure levels outside the body. This will enable Telstra to deliver its mobile and radio services more efficiently, while ensuring it complies with Government mandated RF safety standards.





"... focus on delivering higher performance and broadband service to rural and remote parts of Australia."

Wired into wireless

In anticipation of the Australian Communications Authority's (ACA) plans for upcoming spectrum auctions and the recent emergence of several narrowband and broadband wireless local loop technologies, TRL recently conducted a study on the applicability of wireless/satellite, which will significantly impact fixed, mobile and broadband business.

The findings are assisting Telstra to identify new opportunities to reduce costs, provide better services and compete effectively in the access market, with a particular focus on delivering higher performance and broadband service to rural and remote parts of Australia.

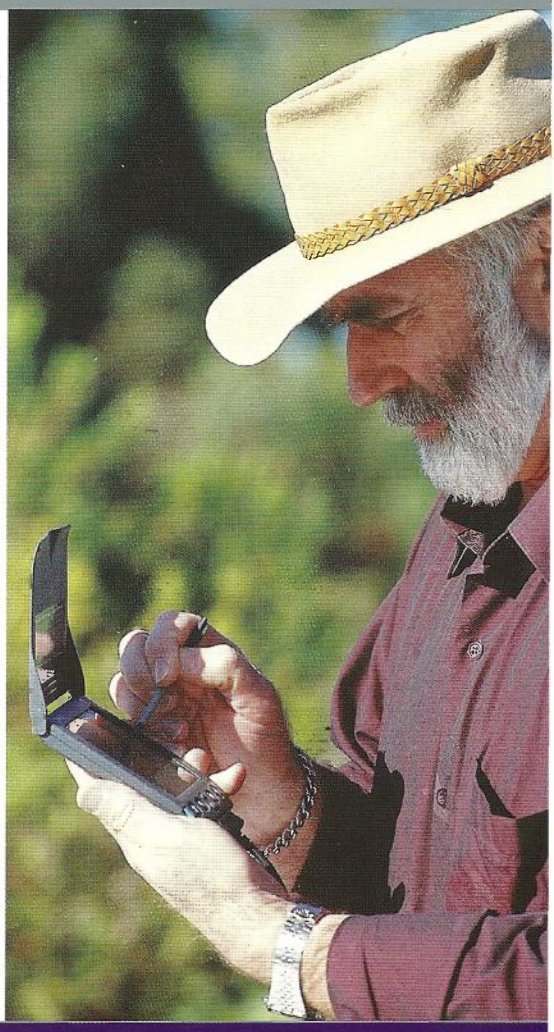
The study has also provided a framework for evaluating the potential value of spectrum and likely competitive impacts from the use of wireless/satellite technologies by other operators.

Wireless in the local loop offers a potentially cost-effective solution for providing the 'last mile' broadband access where traditional copper and fibre are not viable solutions – due to factors, such as low population density, difficult terrain, or filled cable ducts.

A three-tiered approach was adopted in order to establish drivers for the use of wireless/satellite technologies in Telstra's access network. This included:

- A product view covering basic access, Internet access, dedicated medium speed data and high speed data including ATM and broadcast
- A customer view covering residential, small and medium enterprises and corporate customers
- A geographic view, where remote, rural, suburban and urban factors were taken into consideration

The study also considered recently introduced technologies just entering the market place such as the Local Multichannel Distribution System, (LMDS), broadband satellite systems and evolved GSM and CDMA cellular mobile technologies.



Software makes EME Assessment Easier

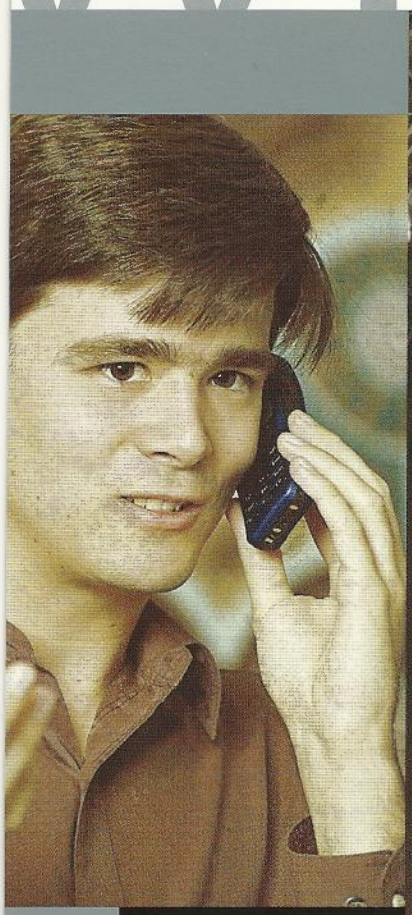
A new software program that gives Telstra information about radio emission levels in a format that is easily understood by local councils and building owners is making development of base station sites easier and faster.

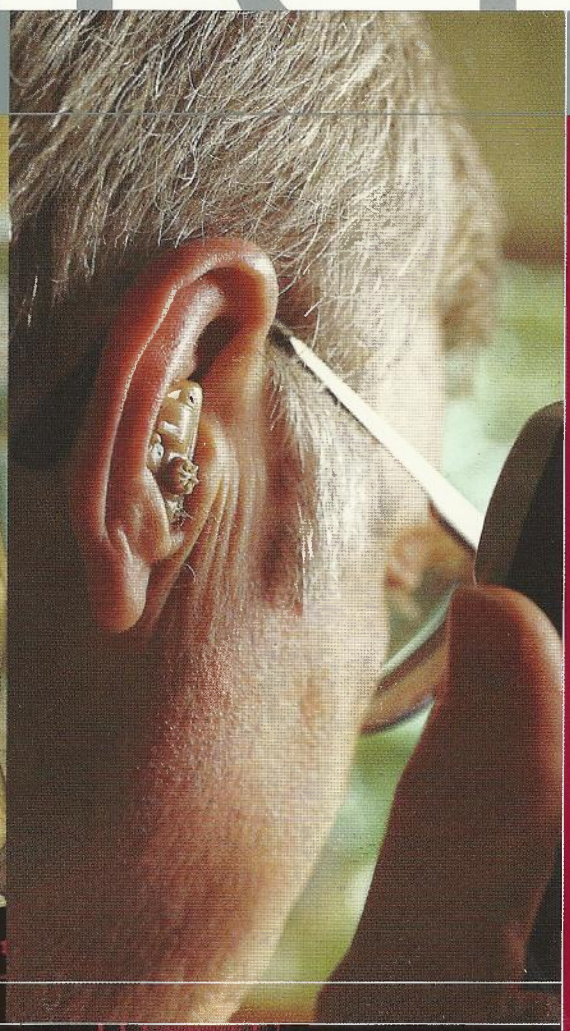
The Mobile Base Station Field Intensity Plotting (MBSFIP) program is a software tool for the assessment of radio frequency field intensity around mobile base station sites.

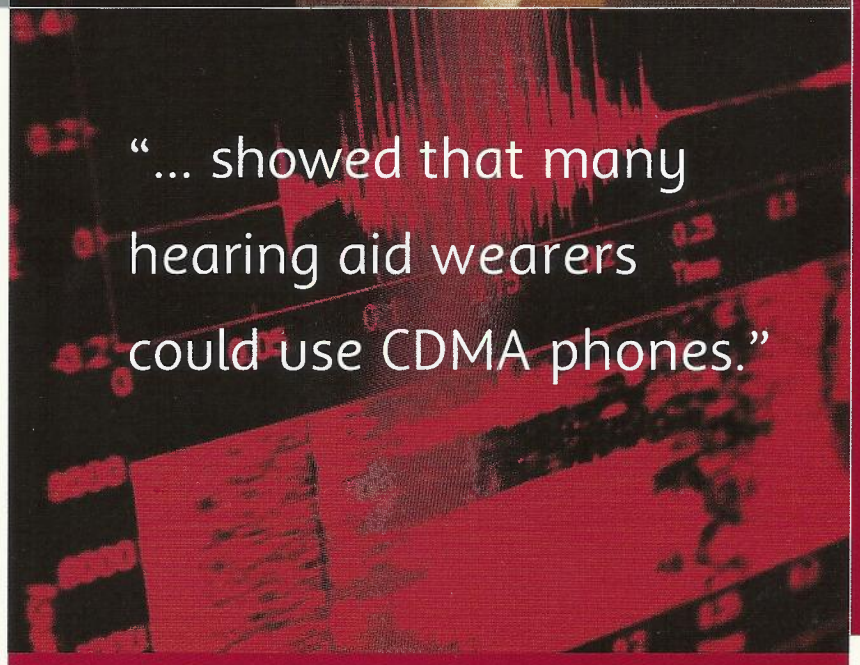
The tool works by setting up individual transmission system parameters for 900 or 1800MHz GSM systems as well as for 800 MHz CDMA systems. The field strength at each point in a survey area is calculated and displayed in a pictorial format. This easy-to-understand format means there is less uncertainty about emission levels from base stations and better understanding of site proposals by local councils and building owners.

The software program also enables mobile base station sites – which are shared with Telstra's competitors – to be accurately assessed. This can be achieved by calculating the total emission levels, or emissions on a per-carrier basis, if required.

Overall, the program demonstrates Telstra's due diligence and careful approach to site development and operation in the area of electromagnetic (EME) emission assessment.







"... showed that many hearing aid wearers could use CDMA phones."

Working with the hearing-impaired on mobiles

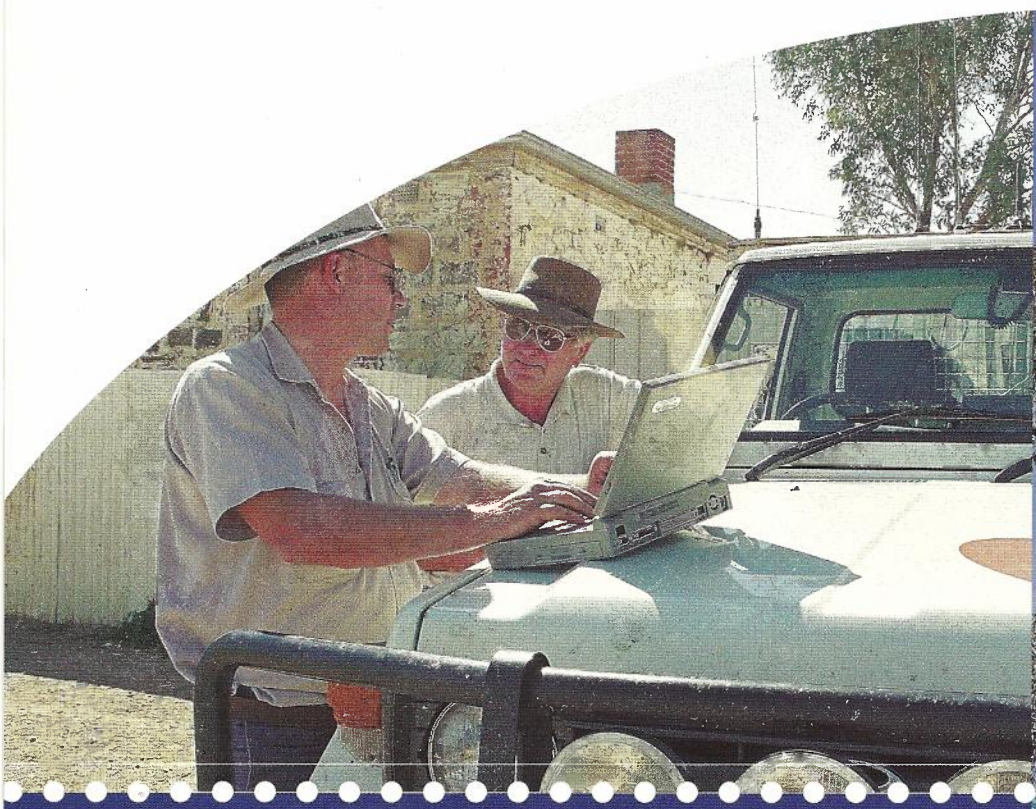
Hearing aid manufacturers and hearing-impaired groups have been working with TRL over many years to address concerns about digital mobile phone access.

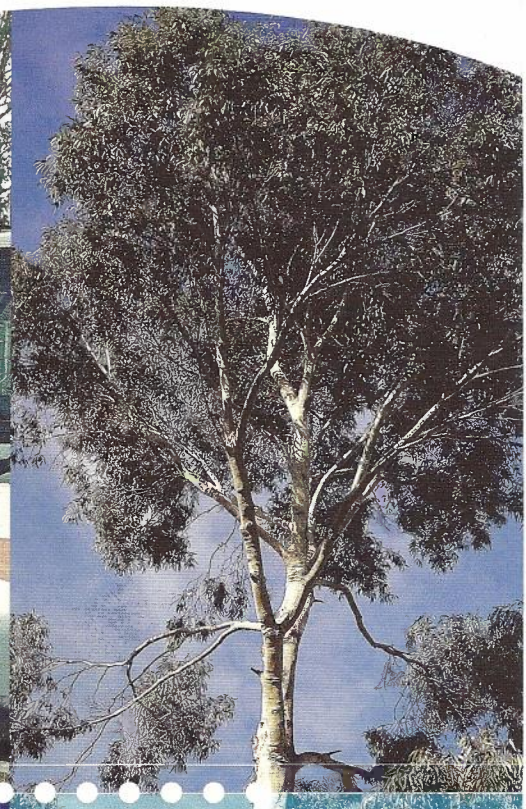
One of these concerns relates to the fact that, in certain hearing aids, radio signals generated by a mobile phone may be detected and amplified by the hearing aid's sensitive circuitry causing discomfort to the wearer.

In 1995, Telstra and other Australian carriers contributed technical advice and funding to a National Acoustic Laboratories' (NAL) study on the use of GSM digital mobile phones with hearing aids. This work resulted in an Australian standard for hearing aid performance and the development of specialist accessories for GSM phones.

With the introduction of Telstra's CDMA mobile network, TRL again worked with NAL on a study which showed that many hearing aid wearers could use CDMA phones. In those cases where interference was a concern, users could adopt hands-free options and accessories. The study also recommended that, in consultation with an audiologist or audiometrist, an affected wearer could upgrade his or her hearing aid to one that was less susceptible to interference.

Mobile phones have become a part of life for millions of Australians. Telstra offers mobile phones which may be connected to the MobileNet® Digital GSM or to the CDMA Freedom™ mobile networks. Telstra has made hands-free accessories available in Telstra Shops and has prepared advice for hearing-impaired customers about choosing between GSM or CDMA services and what best fits their needs.





"Much of the work was carried out in remote areas of Victoria."

TRL supports the introduction of the CDMA network

As a result of the Federal Government's decision to close the analogue (AMPS) mobile network on December 31 1999, Telstra committed to building a replacement network based on Code Division Multiple Access (CDMA) technology.

After extensive evaluation, CDMA was chosen as the preferred network as it would enable Telstra to both keep pace with growth in the Australian mobiles market and provide a service for customers living and travelling in rural and remote Australia.

In the early stages of implementation, Telstra received feedback from customers that the CDMA network coverage in some parts of rural Australia was not exactly the same as the former analogue system.

It was recognised that while CDMA and analogue coverage are comparable, they could not be identical.

Telstra was committed to responding to any customer issues and this is where Telstra Research Laboratories (TRL) stepped in.

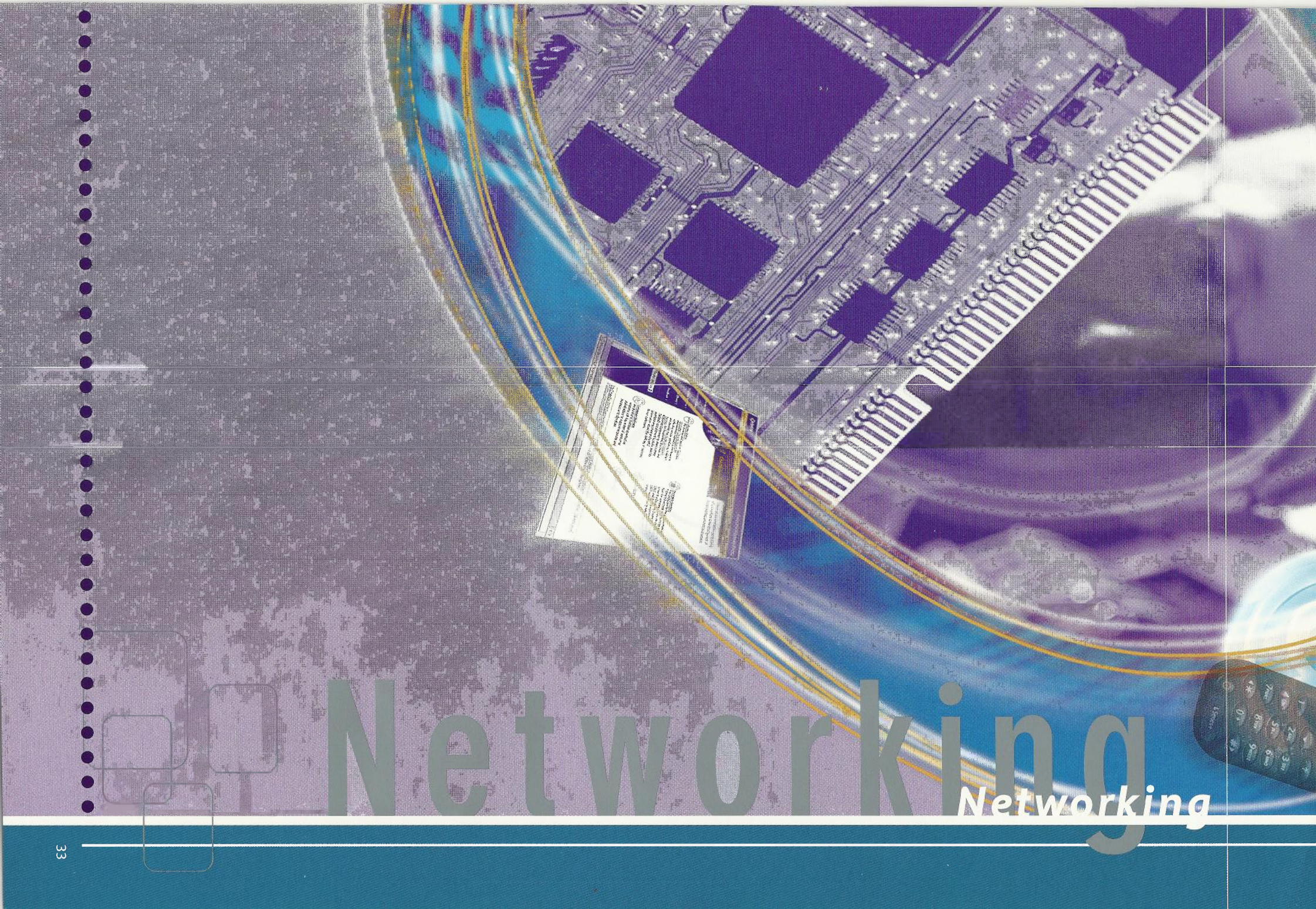
TRL worked with Telstra's mobiles business unit, OnAir, to develop guidelines for the use and installation of repeaters – a method for amplifying and transmitting CDMA signals. The use of repeaters would provide customers with a fast solution and extended mobile coverage.

The team's skills covered a range of activities including; building test hardware and specialised installations, detailed analysis of results and formulation of design and installation guidelines.

The project team helped determine site locations for testing and developed project plans in order to meet the tight deadlines. Specialised hardware for mounting and testing CDMA repeater performance and its impact on the broader CDMA network was developed and the results then analysed by the TRL team.

Much of the work was carried out in remote areas of Victoria, with testing conducted at night and over weekends to minimise disruption to the network and ensure project deadlines were met.

The CDMA Repeater Design and Installation Guidelines are now in use to design and install CDMA repeaters which are playing a crucial role in the CDMA network roll-out for rural Australia and in heavily shadowed urban areas such as tunnels.


Networking

Networking

The transition to the Internet era is unstoppable – and Telstra is making major investments in its networks to ensure Australia is at the forefront of the new Internet world. To support Telstra's data, Internet and broadband growth and ensure that its telecommunications infrastructure is Internet-ready, with high quality, robustness and scalability, Telstra has developed a Data Mode of Operation, or DMO, project.

DMO was established to consolidate Telstra's multiple data and Internet based networks and supporting systems into a single, new generation network, supported by an enhanced service managed capability, to meet the explosive growth in data and Internet products.

The transformation of Telstra's core network through the DMO strategy is accompanied by changes in the customer access network to optimise it for broadband and high-speed data services.

One of Telstra's broadband objectives is to ensure that regardless of the delivery technology – ADSL, cable or satellite – the service will be transparent to customers.

Once people are connected, there will be little emphasis on the access technology and more on the services provided.

Managing, maintaining and constantly improving all these networks to ensure superior customer service is a huge undertaking – and one in which TRL features prominently.

TRL continues to investigate and develop a range of innovative technologies and monitoring and management tools to prepare our networks to support the new age services. TRL has developed a number of ways to 'keep an eye' on what is happening in the networks, enabling us to fix – even anticipate – faults and maintain and improve services.

For example, a new system developed by TRL helps prevent network congestion from mass-calling events, such as radio phone-in competitions. With the click of a mouse, traffic managers can 'see' unusual call volumes and protect the rest of the network from their impact.

TRL has also devised a way of automatically detecting faults in the telephone network. This innovative architecture enables a pattern of faults to be detected and eventually, may also be capable of assigning the job automatically to a field crew. Faults can now be fixed before they become a problem for customers.

"...regardless of the delivery technology – ADSL, cable or satellite – the service will be transparent to customers."

DMO network underpins data revolution

The recent exponential growth of Internet services has fuelled a data communications revolution that is changing the way we work, live, study and relax. More and more people are using personal computers at home to surf the web or send email. Businesses are investing in more complex corporate Intranets – in many cases, to support electronic commerce. Experts tell us that over the next few years, the telephony paradigm will recede into the background and data will dominate.

To gear up for the data future, Telstra established a Data Mode of Operation (DMO) program in 1998 to identify the infrastructure that it would need to progressively put in place to satisfy customer demand for new and existing services, now and in the years to come.

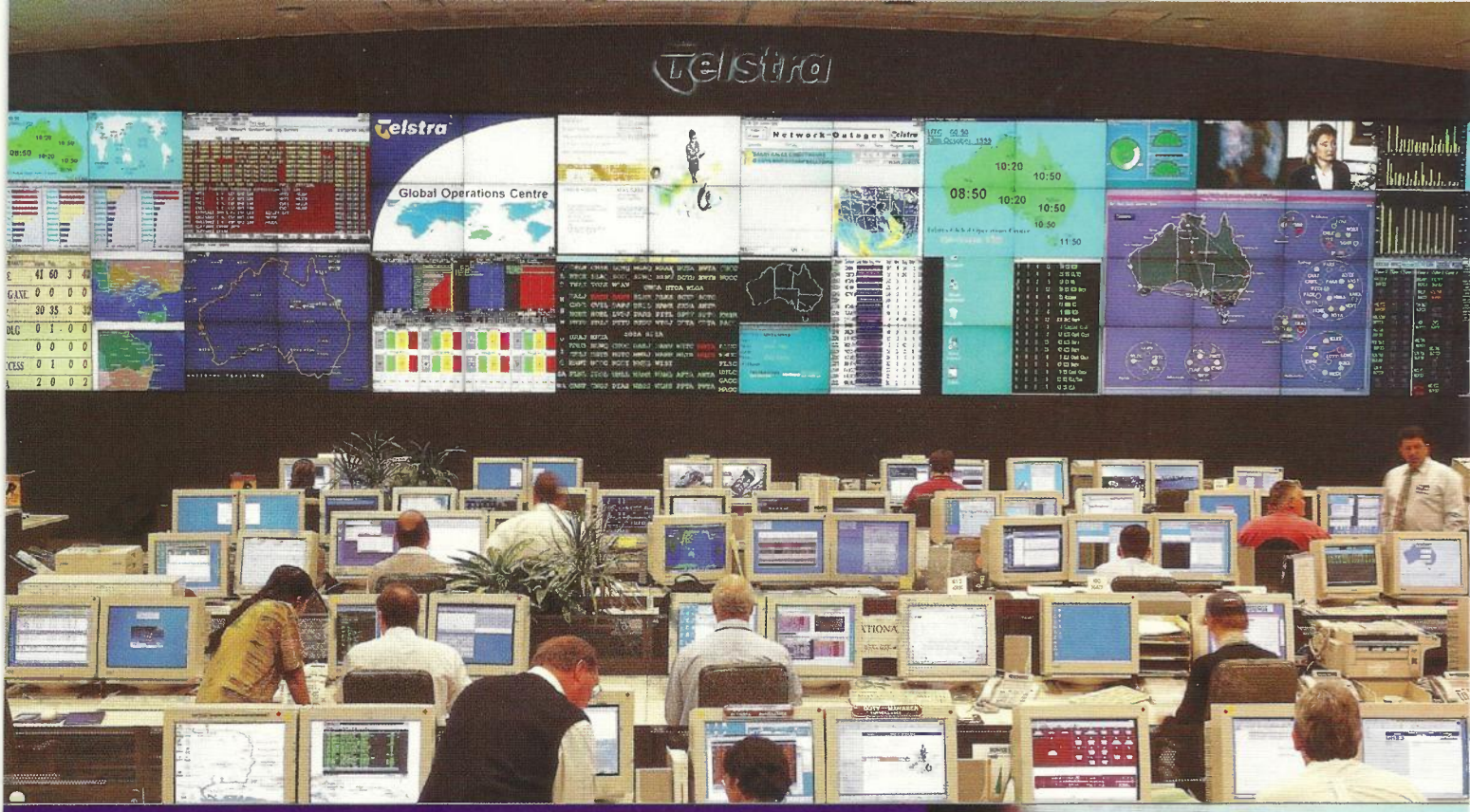
TRL provided the technical knowledge and leadership skills to drive many aspects of DMO to a successful conclusion. Its researchers developed the vision for Telstra's future network, led the network evaluation team and contributed to the DMO business case and contract negotiation.

A DMO network will provide a consolidated and flexible platform for delivering new data services. For example, the architecture will allow:

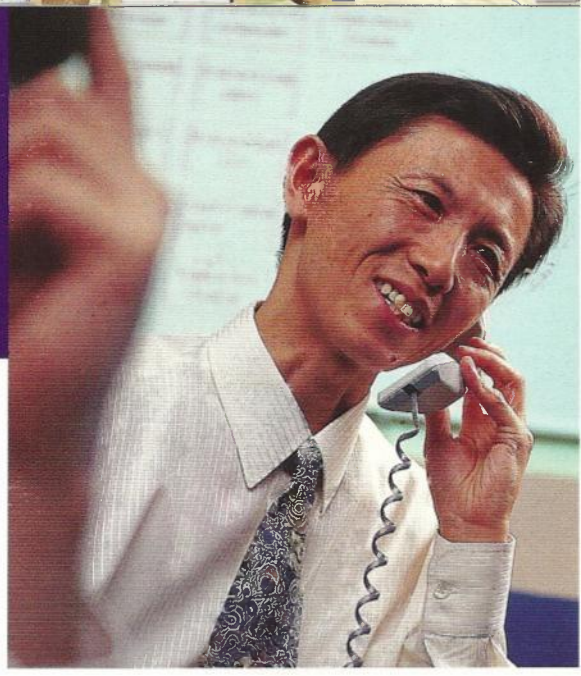
- customers to use any type of access technology to reach any service provider and service
- service providers to rapidly activate new services and develop new products
- service personalisation and virtual Intranets for businesses

"Researchers developed the vision for Telstra's future network."

flexible platform



"...enabling Telstra to fix faults before they become a problem for customers."



Intelligent software nips faults in the bud

Keeping Telstra's massive network in sound working order is no mean feat. Because the network is largely buried underground or suspended by poles in many different types of environment and climate, it's vulnerable to damage from weather, animals, plants, humans and machinery.

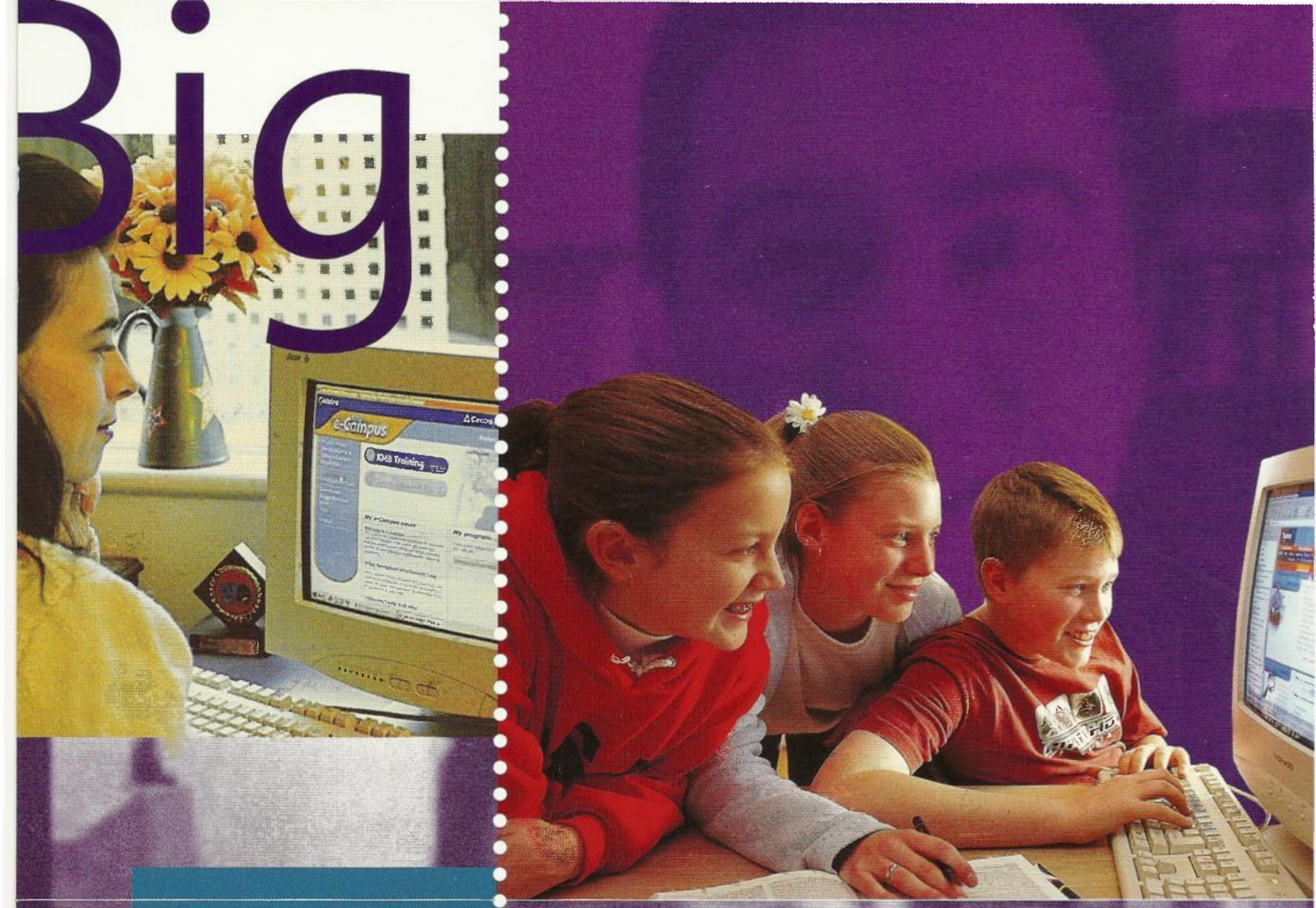
Indeed, running the network is a major operation that is carried out 24 hours a day, 7 days a week by highly skilled technical staff. Even accounting for the fact that Telstra's network is one of the most sophisticated and technically superior networks in the world, it is not immune from the occasional fault.

In the past, these faults were often not identified until complaints were received from customers, requiring field crews to go out and locate the problem. The resulting delays in fault rectification led to customer dissatisfaction.

TRL has developed an innovative Fault Management Integration (FMI) system architecture to detect automatic cable failure soon after a failure occurs. This system architecture makes inferences about faults using routine data from telephone exchanges. A call to a faulty number, for example, will result in a call failure record at the nearest exchange; this customer fault report can then be cross-referenced to another fault report, and so on.

In partnership with IBM-GSA, TRL has developed a related Test And Diagnosis Server (TADS) intelligent system, which collects relevant fault information from telephone exchanges along with customer fault reports, and analyses the data for fault patterns. When a customer reports a fault, TADS tries to match it against known fault patterns to decide whether the report is related to a known problem. TADS can also schedule a test to check the customer's line condition. These actions can be initiated with a simple click of a hot-button located on the PC of a Telstra service consultant.

TADS consolidates fault information for field staff so that they can deal with the actual fault, rather than respond to individual customer reports related to the fault. TADS also enables Telstra consultants to provide customers with more accurate fault information. TRL is now working to make TADS even more proactive, so that when it detects an underlying fault pattern, it automatically creates a ticket of work for field crews, enabling Telstra to fix faults before they become a problem for customers.



Keeping Big Pond® *Advance up to speed*

TRL has developed a web-based traffic monitoring tool that has enabled Telstra to accurately monitor the performance of its Big Pond® Advance (cable Internet access) service for the first time.

When Telstra first introduced its cable Internet service a few years ago, it was difficult to measure upload and download speeds and volumes at the customer end of the network. TRL recognised the requirement for a monitoring system and demonstrated the feasibility of such a system based on data already collected in the cable network. The business unit that manages the Big Pond® Advance service then gave TRL the go-ahead to develop the system.

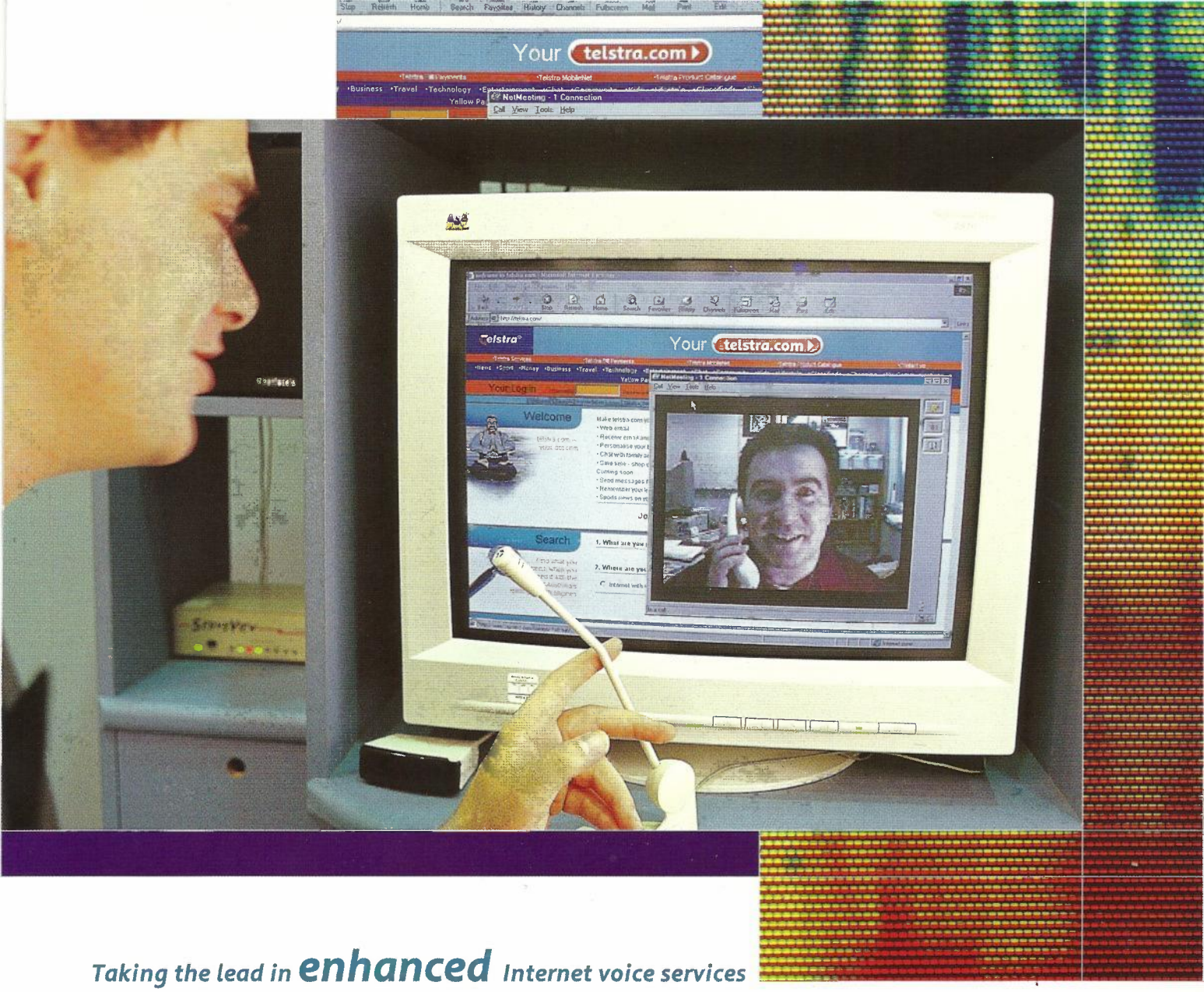
Big Pond® Advance personnel with authorised access can click into the monitoring data through a web interface, on the Telstra Intranet.

The website maintained at TRL can provide information about various traffic and performance metrics on a given day in a particular capital city. The information includes the speed of data transfers as experienced by customers and variations in data volumes throughout the day and for various specific services such as web browsing, news and email. The tool is network-based and does not rely on access to customer equipment or additional customer software.

In addition, as it only measures traffic statistics, it protects customers' privacy by ensuring that no part of their information is seen.

This traffic monitoring information is used to maintain and continually improve Big Pond® Advance services. Improvements may involve relocating servers in the network, adding more routers, or changing tariffs to reduce excessive loads.

"...enabled Telstra to accurately monitor the performance of its Big Pond® Advance for the first time."



Taking the lead in **enhanced** *Internet voice services*

In recent years, the global telecommunications market has shown a massive surge of interest in using Internet Protocol (IP) networks to carry telephony services.

While call traffic volumes carried on data networks are still lower than those carried by traditional telephony equipment, the trend towards VoIP appears irreversible.

Traditional telephony networks have been designed and optimised to deliver a single application – voice – which they do very well. However, VoIP networks operate in a totally different way. The difference becomes important for enhanced voice services such as International FreeCall and Priority One3. These have been efficiently handled by centralised components within the telephony network collectively known as the 'Intelligent Network' (or IN).

Telecommunications operators globally have invested heavily in building and operating IN infrastructure.

However issues arise when trying to integrate IN services and infrastructure with the new VoIP networks. Therefore, until VoIP hardware vendors develop a solution, this gap in the IP voice services market will only be claimed by those operators able to devise an interim solution.

Telstra has taken the lead in Australia by designing and validating an innovative way of providing IN services over a VoIP infrastructure. The method involves interfacing traditional telephony IN components to Telstra's VoIP platform, enabling Telstra to deploy fully featured telephony services within an Internet environment.

"...enabling Telstra to deploy fully featured telephony services within an Internet environment."

"With one mouse click, this expert system enables traffic managers to see how many calls the target is receiving"

traffic management

Condor on the lookout

to prevent network overload

Most people who have ever tried to call a popular radio phone-in competition would know that there was probably a large number of people also trying to reach the same number at the same time. But what these callers probably wouldn't consider is the fact that often mass-calling events (such as radio phone-in competitions) can affect the telephone network if calls are not managed properly.

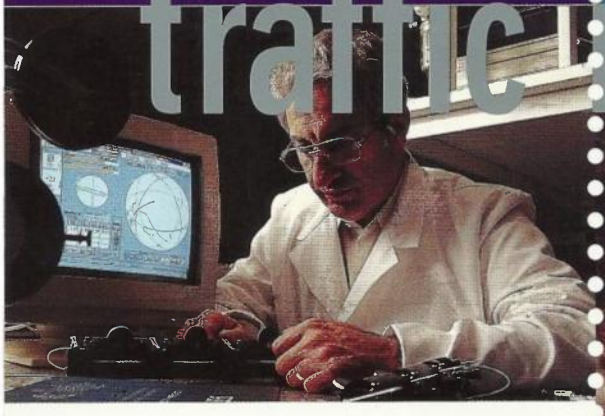
At TRL, a new system, known as Condor, has been developed to provide traffic managers with real-time visual representations of call volumes, including an early detection of mass-calling events.

Condor, which is accessible through a web-browser, can sift through data generated by thousands of calls per second to identify a mass-calling event, and report the targeted phone number. With one mouse click, this expert system enables traffic managers to see how many calls the target is receiving, how many are being answered, and how that compares to total traffic load.

At the same time, the system assesses this information to suggest a course of action and protects other customers from the effects of the overload by ensuring that the targeted call centre receives only as many calls as it can handle.

Graphical displays are updated in real-time from the Condor server to keep network managers informed of progress and to indicate whether further action should be taken. Researchers are confident that the Condor prototype can be developed into a fully automated tool capable of taking over the management of overload events from network managers.

Technology and product managers can also use Condor to review the overload event. When it's linked to another TRL-developed system – known as NIMON – managers can assess Condor's earlier control actions and the extent of the overload. Automatic analysis will check whether any calls were affected, either by the overload or by Condor's actions. This evaluation component has confirmed the benefits of Condor for both Telstra and its customers.



optical fibre network

Lowering the costs of long distance communications

Delivering more affordable, long-distance communications across Australia is one of Telstra's goals and TRL is developing technology solutions to help drive down long distance costs.

One such technology is Wavelength Division Multiplexing (WDM). The technology that makes WDM systems attractive for long distance communications is the optical amplifier, which boosts the power of each colour signal every 100 km.

In a WDM system, an optical fibre carries many colours (or wavelengths) of light instead of one. This more efficient resource use leverages Telstra's investment in optical fibre 'plant' and significantly extends its value.

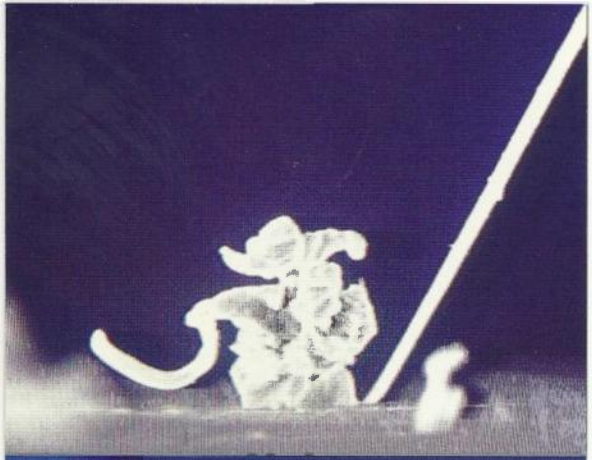
Telstra first deployed its WDM systems in 1998 between Melbourne and Sydney. It has since been installed on other busy routes and now links with international submarine cables on Australia's west coast.

At the time of writing, Telstra has deployed WDM systems with an optical reach nearly twice that of systems elsewhere. This has involved the use of special techniques – such as dispersion compensation – to adapt the optical fibre network for high-speed WDM transmission. As a result, Telstra will be able to expand network capacity more rapidly in the fast changing communications environment.

TRL is developing technologies for even more efficient, higher speed WDM links, further adding to Telstra's ability to rapidly expand capacity.

The rapid growth of the Internet and the introduction of broadband access have increased the demand for network capacity, a demand that can only be met by optical fibre technologies.

Future optical networks will be able to route high-speed signals optically on the basis of colour. TRL is developing architectures based on wavelength-routing for Telstra's core and metropolitan networks.



Monitoring zinc whiskers

zinc detection

"... a unique, compact battery-operated detector unit to monitor the presence of airborne zinc whiskers."

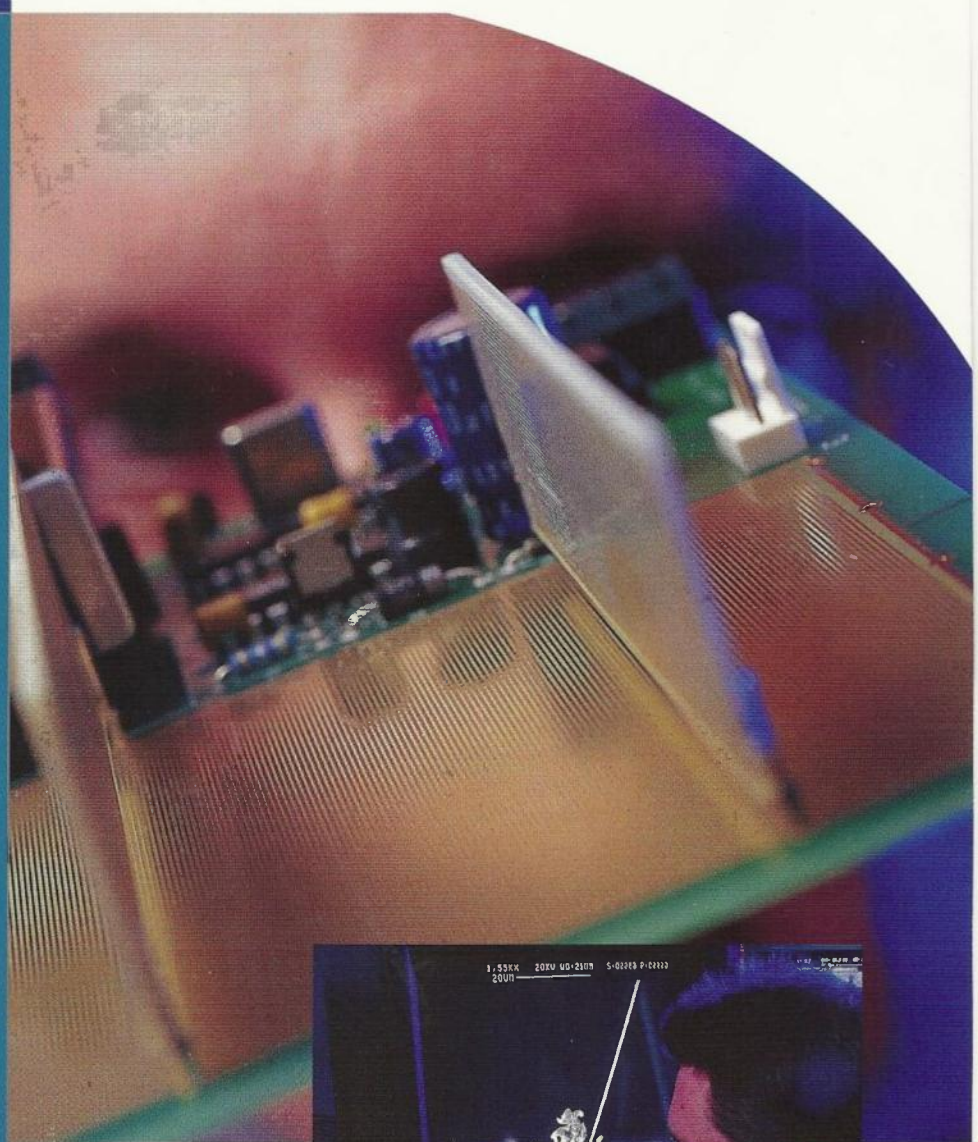
TRL has designed and developed a unique, compact battery-operated detector unit to monitor the presence of airborne zinc whiskers – which measure around a thousandth of a millimetre in diameter and several millimetres in length – in Telstra's equipment and systems. Previously, the presence of zinc whiskers could only be determined by tedious manual methods.

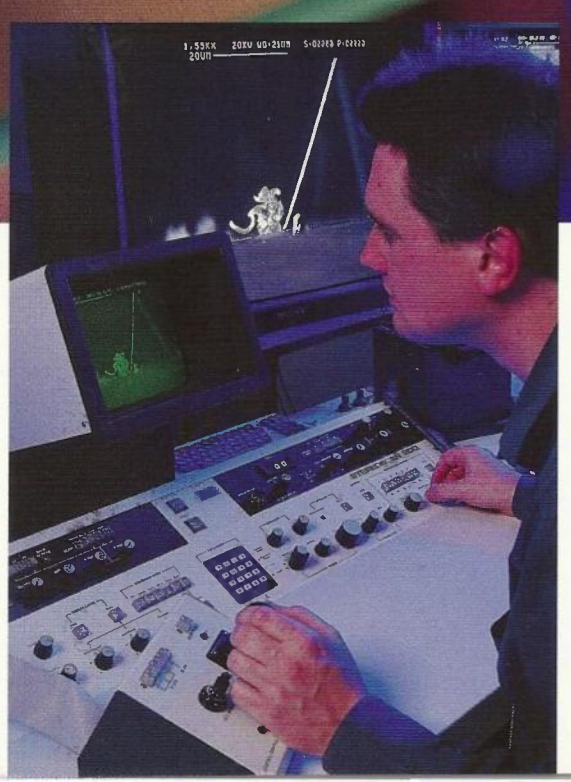
Zinc whiskers 'grow' on the zinc plated metal work used widely throughout Telstra and other enterprises worldwide. When these highly electrically conductive needle-like and virtually invisible whiskers break away from the metal panels, they can impact sensitive electronic circuitry resulting in equipment failure.

The zinc whisker detectors have been deployed at one of Telstra's major data processing centres to establish a baseline prior to removal of the zinc plated floor tiles – the major source of whisker contamination. This baseline information will provide solid evidence of changing risk levels from zinc whisker contamination as floor tiles are replaced.

Detector units have also been deployed at a number of exchange sites around Sydney, and in various installations in Queensland, where the presence of whiskers has been detected.

The detectors may also be placed in sites where, although there is no known history of the presence of zinc whiskers, abnormally high levels of equipment outages are experienced.



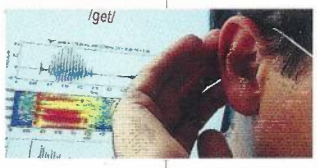


Partnerships

Partnerships

Partnerships

Forging partnerships is an important part of Telstra's strategy for business growth. Partnerships can contribute expertise, business assets, customer bases and market coverage. Partnering is an important strategy to meet customer requirements in a telecommunications environment that is both highly competitive and constantly changing. No one company can go it alone in providing customers with all that the new environment has to offer.



For Telstra, our partnerships must -

- Add shareholder value
- Mutually grow revenue
- Enhance our communication and information services
- Deliver value to customers
- Foster information and opportunity transfer

Our partnerships are with a range of sectors – vendors, suppliers, government departments, other companies (even in some cases competitors), other Telstra business units, the community generally and, the most important partnership of all – with our customers.

As telecommunications companies like Telstra break out of their traditional core business of carrying communication signals, different industries are working together for the first time. A new approach is required, based on imagination, innovation and collaboration.

Partnerships share both the risks and the rewards. They help meet challenges and find solutions.

TRL brings a valuable technical insight and telecommunications knowledge to partnership alliances. Through our detailed understanding of technology, and the impact of that technology on Telstra's network and customers, TRL researchers can identify and evaluate new technical developments of potential value, for not only Telstra, but also the wider industry.

For instance, TRL is working with researchers at Lucent Technologies in the United States and the United Kingdom to better understand what customers will want from third generation mobile phones – what kind of services will be relevant to their lives, and at what price.

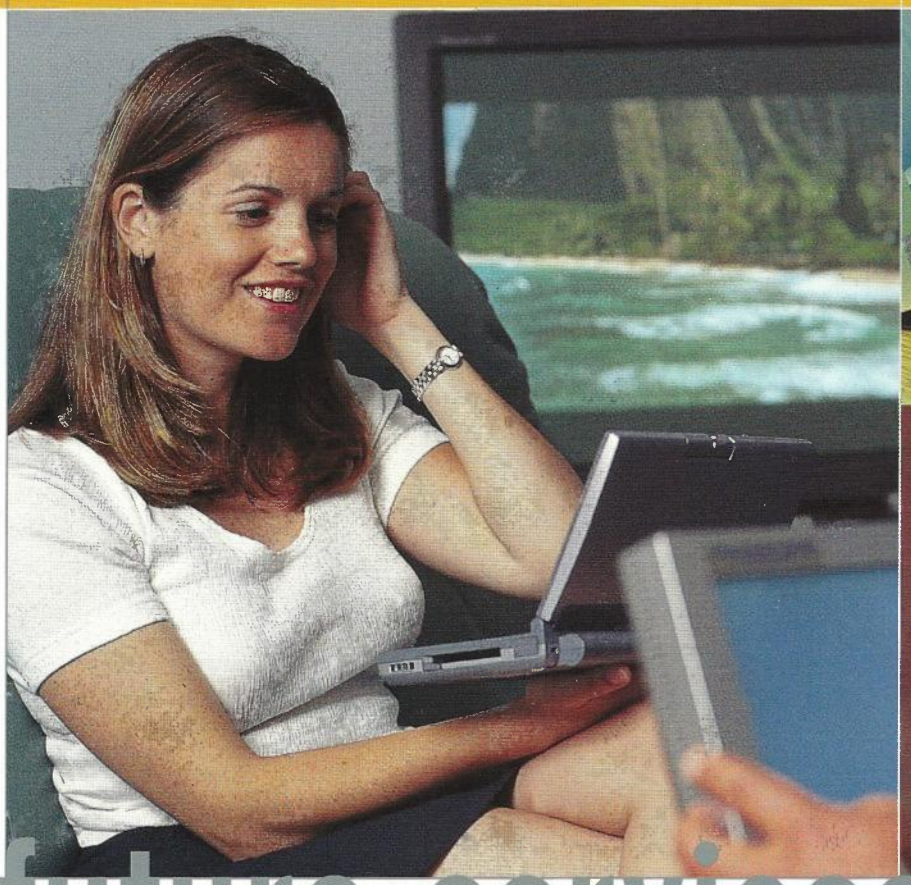
In another initiative to encourage e-business, TRL has developed software which issues digital certificates to people and computer systems to ensure online security. This software has been licensed by a local high-tech company, Adacel, to develop it further for global markets.

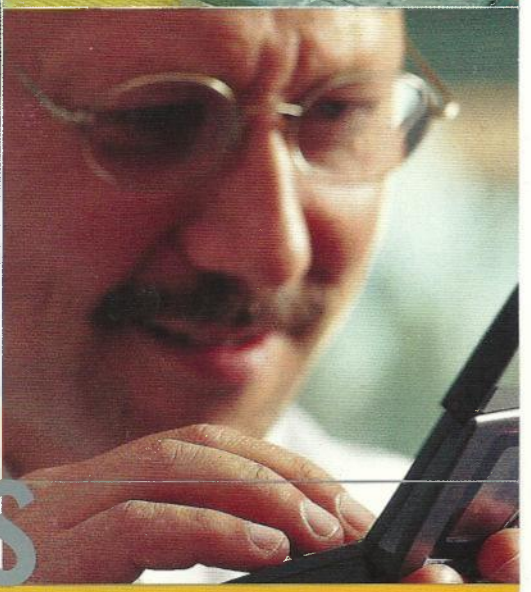
TRL is working with Bionic Ear Institute scientists to see whether their work on how the brain processes the speech signals it receives from the ear can improve the performance of speech recognition systems, particularly in noisy situations associated with mobiles and payphones. It is hoped the benefits are mutual – improved and new services for our customers, and improvements to the bionic ear.

TRL is also making available to the wider market its specialist electronic evaluation services, which provide assessment and failure analysis of integrated circuits and other semi-conductor devices. The telecommunications, electronic engineering, defence, law enforcement and university research industries are now availing themselves of these world-class services.

TRL continues to support Telstra's business units in in-house, project-based partnerships, providing skills in areas such as software engineering, artificial intelligence and neural networking, systems integration, interface design, human factors research, broadband services and optical fibre technologies.

"Partnerships share both the **risks and the rewards.** They help meet challenges and find solutions."





future services

Collaboration with Lucent on 3G mobiles

Third-generation (3G) mobiles hold the promise of an entirely new world of communications in which the boundaries between telephony, mobiles and the Internet will be indistinguishable – but which services will users want?

Will they want to use a 3G mobile phone to read email and do banking transactions, or to look at a friend's holiday video and listen to the latest music tracks while viewing video clips? Or will they want to do it all?

To find the answer to these and other questions, a project team at TRL is collaborating with Lucent Technologies in the USA and the UK. The collaboration has included a large trial of 3G services and has involved people from different market segments.

It's important research for anyone following predictions by experts that by 2005, the amount of data traffic in cellular mobile networks will overtake voice and will require connection speeds of up to 2Mbit/s.

Today's cellular networks cannot cost-effectively cope with high-volume, high-bit-rate data traffic, hence the need for mobile network operators worldwide to develop third-generation (3G) wireless networks. (To put the new terminology into context, analogue and digital mobile voice networks account for the first and second generations, respectively).

Participants involved in the research trial have been sending and receiving video images and accessing high-quality sound recordings in various settings. They then assessed the value of the trial services to their working and personal lives. The results have given Telstra and Lucent a deeper understanding of features that will make future services friendly and easy-to-use, as well as identifying features that will be undesirable from the user's perspective.

3G mobiles hold the promise of an entirely new world of communications, in which the boundaries between telephony, mobiles and the Internet will be indistinguishable. The two companies have also been investigating the most cost-effective options for building and operating 3G networks. A key issue is minimising the number of base station sites required to support high-bit-rate services (which tend to require smaller cells), while accommodating the vast numbers of users predicted for 3G mobile networks.

"3G mobiles hold the promise of an entirely new world of communications."

"...it has achieved mainstream corporate acceptance globally"

e-directory and e-security software to improve e-business

TRL's early involvement with standards-based electronic directory and security software has resulted in the licensing of two globally competitive software items that will be essential for the growth of e-business.

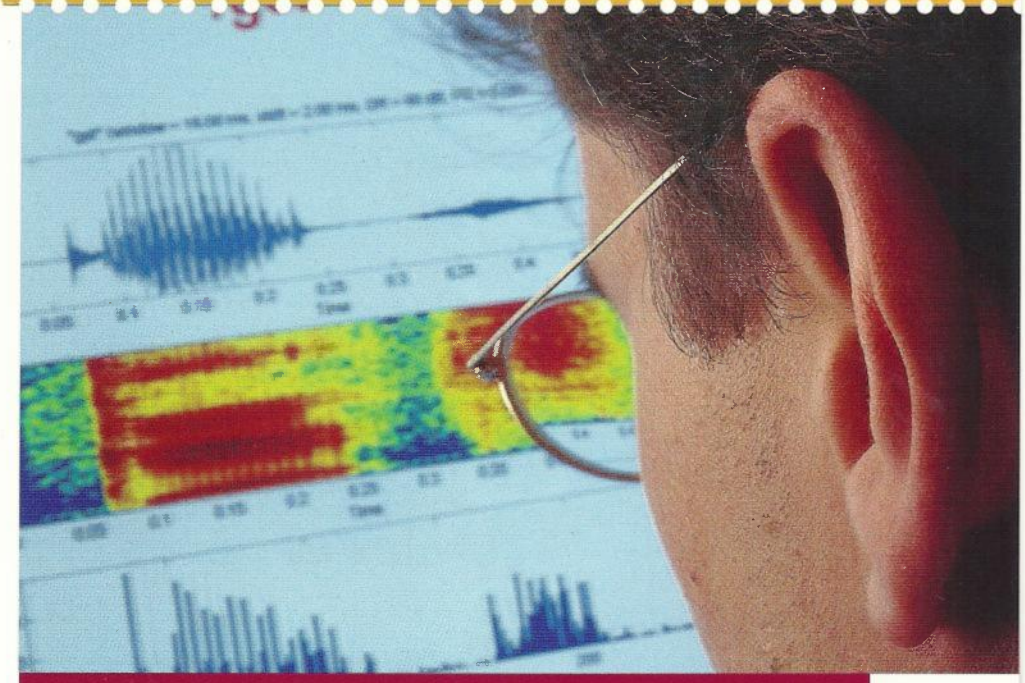
One of the developments is a Certification Authority (CA) that issues digital certificates to people and computer systems.

The certificates are used in association with individual public and private software 'keys' to verify the identity of each party involved in an electronic transaction. Messages or transaction data can thus be encrypted to ensure they can't be read by outside parties. They can also be digitally 'signed' so that a user's or computer's identity can be verified.

Telstra has used the TRL-developed CA in trials of several services planned for the future. Local high-tech company, Adacel, has licensed the CA software to develop it further for global markets.

The second item of licensed software is an online directory product known as View500, which TRL developed and trialed as Telstra's online corporate directory. The directory, accessible to all staff, carries information such as an employee's (or business unit's) name, address, phone and fax number.

Because View500 was one of the first online directories to conform to the international X.500 standard, it has achieved mainstream corporate acceptance globally, and is used within several large corporations and government departments. (In this context, a standard is a 'universal' electronic format designed to operate across different software or hardware platforms.) View500 has also been licensed for further commercial development to Adacel, as well as to the global telecommunications equipment provider, Nortel.



Speech recognition

research to help improve bionic ear

The Bionic Ear Institute (BEI) has been modelling the way the brain processes the speech signals it receives from the ear.

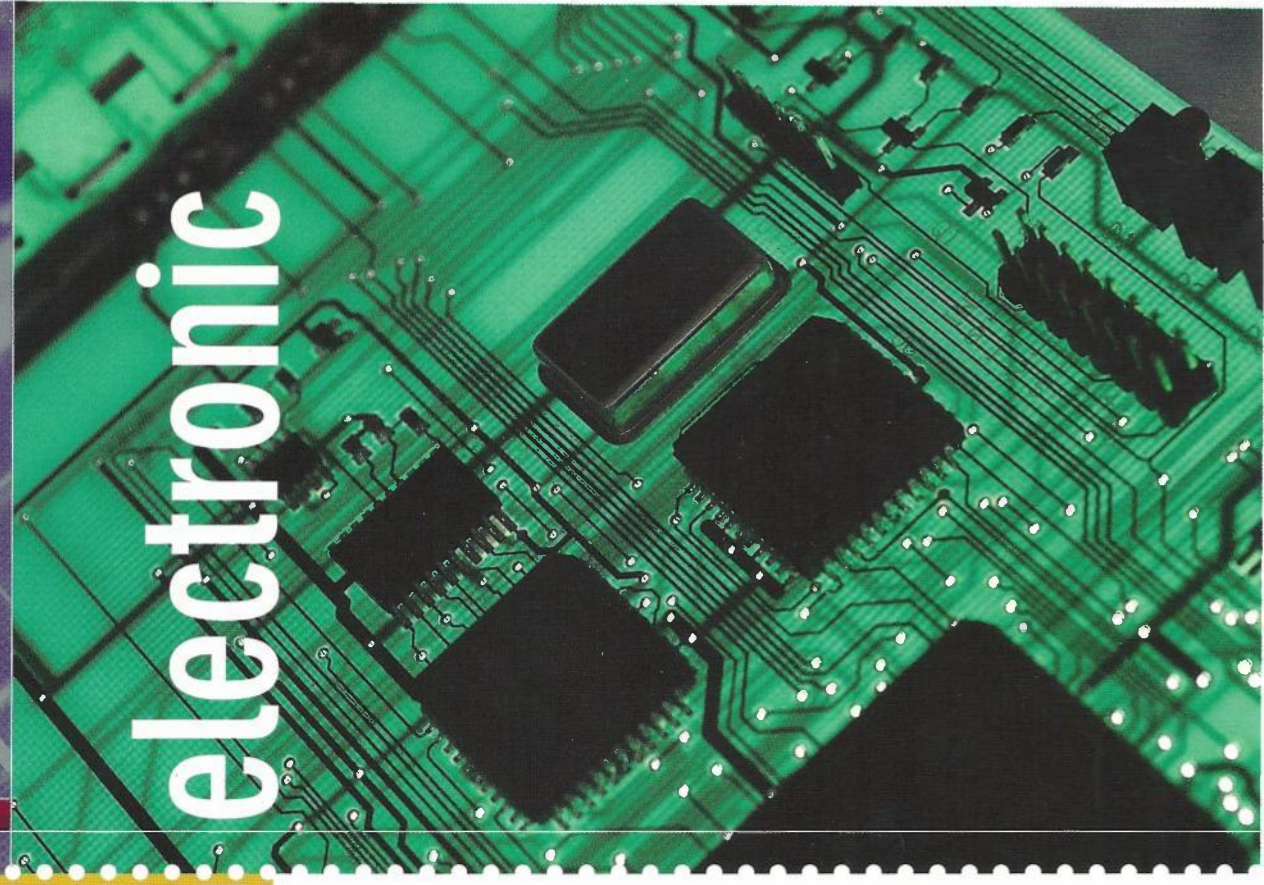
These models can be used for different applications – improving the performance of cochlear implants for the deaf, and improving speech recognition accuracy in telecommunications access systems.

TRL researchers are working with BEI scientists on a three-year project to see whether knowledge gained from research on the responses of neurons in the brain stem could be used to improve the performance of speech-recognition systems, particularly in noisy situations. This would help Telstra improve services that previously may not have worked properly in the noisy environments associated with mobile phone and payphone use.

Telstra is particularly interested in speech recognition for Interactive Voice Response (IVR) platforms. IVR computer platforms are behind telephone services – such as telephone banking and bill payment – that require the user to press buttons in response to pre-recorded instructions.

The use of speech recognition to control such services offers greater convenience. For instance, instead of having to press '1' for reservations and '2' for timetables, a customer would only need to say 'reservations' or 'timetables'. The user does not need to go through many menu levels to reach a selection, because speech recognition allows for more choices. For example, if you phoned a stock quote service, you would simply state the name of the company you were interested in. Alternatively, it would not be practicable to use a telephone keypad for selecting one company from thousands of others.

TRL is aiming to develop a more effective speech recognition system that will open the door not only to improvements in existing services, but to entirely new types of services. The research will also be used by the Bionic Ear Institute to improve its cochlear implant technology.



world class micro electronic

TRL evaluation services reach wider markets

World class micro electronic evaluation services provided by Telstra are now available to the wider telecommunications and electronic engineering industries.

Recognised as one of the most comprehensive analysis facilities in Australia, TRL's specialists provide assessment and failure analysis of integrated circuits and other semi-conductor devices.

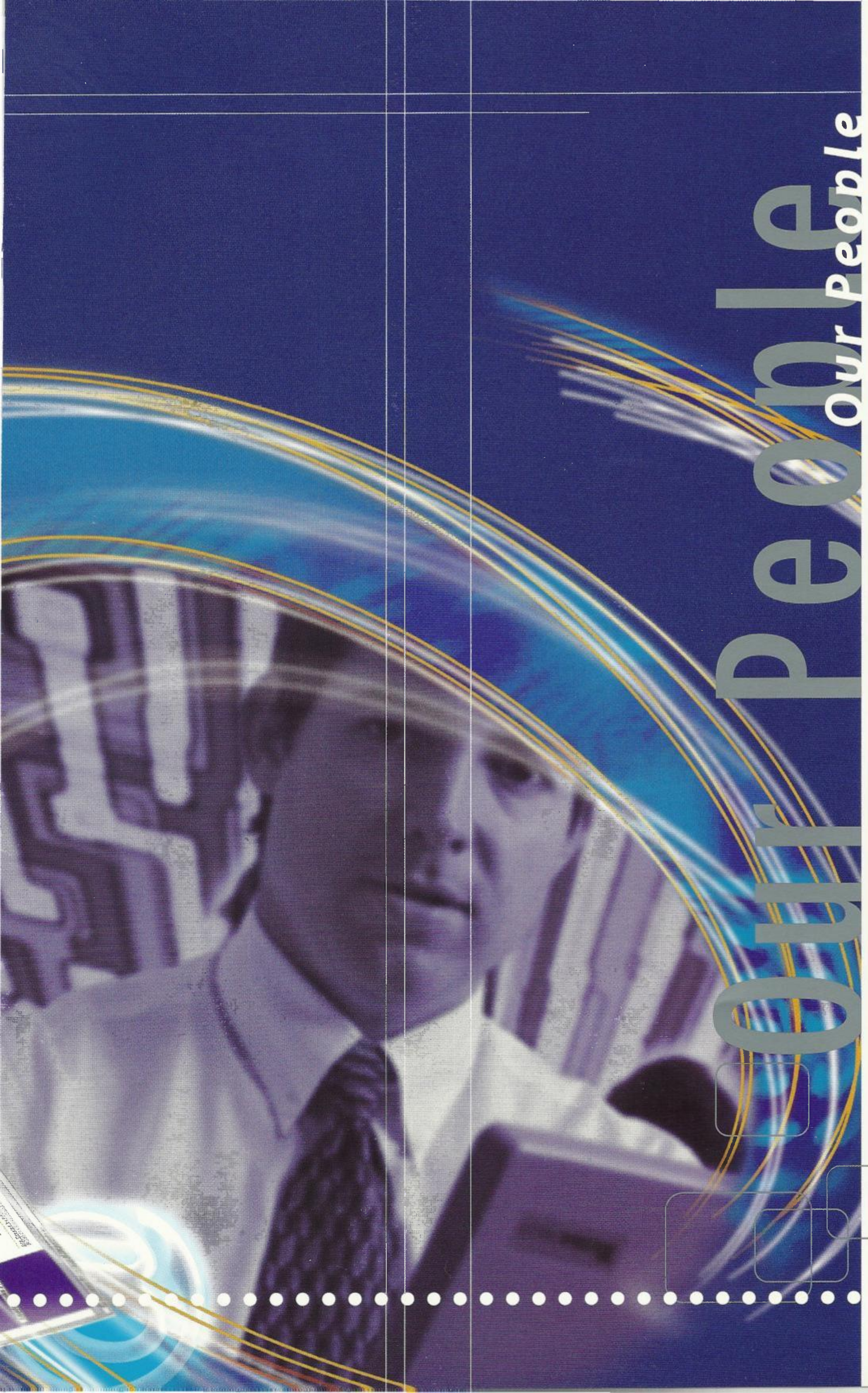
TRL's assessment of quality, reliability, design and cause of failure of semi-conductor devices makes use of a variety of cutting edge techniques such as Low Light Level Emission Imaging, and timing and voltage acquisition from integrated circuits using Electron-Beam testing.

For many years, TRL has evaluated and improved performance reliability of communication equipment such as switching networks and transmission networks, and contributed to Telstra's leading position within the rapidly developing telecommunications industry.

This specialist role for Telstra's telecommunication needs has provided TRL with unique skills and experience which can now be used by other organisations requiring detailed evaluation of electronic circuit and semi-conductor performance.

TRL's services are now being used by a wide variety of industries, such as defence, law enforcement and university research, and have assisted the performance evaluation of electronic circuitry used in diverse applications including automotive electronics, radio transmitters and smart card readers and terminals.

TRL services include the assessment of performance of electronic circuits and other semi-conductors, analysis of suitability of components and materials, and evaluation of options for performance improvements in terms of materials or circuit design.



Our People

Our People

Finding bright and innovative graduates to fill positions at Telstra Research Labs is becoming harder. And that's not because there's no quality candidates out there. On the contrary, the quality is still there, but there's just not enough of it going around. The fast pace of the telecommunications industry, combined with increasing competition for the pool of graduates coming out of Australia's universities each year, means that finding enough people to hire is becoming a lot harder for Telstra's prestigious research laboratories than it used to be.

With a national shortage of mobile communications and Internet skills in Australia* – skills desperately needed by the telecommunications industry – Telstra is being forced to adopt a stronger graduate recruitment strategy.

In an effort to encourage university graduates to join TRL, an aggressive two-pronged recruiting program is under way, targeting talented students with specific degrees from the top 15 universities around the country. Relevant degree courses include engineering, computer science and IT as well as sciences such as mathematics, physics, psychology economics and econometrics.

Telstra offers an Undergraduate Education Fellowship Program, which is extremely selective and competition for placements is strong. Between 10 and 15 students in the second last year of their degree are offered a cash incentive of $9,000 plus payment to work on a defined short-term project during their summer break.

The second critical recruitment activity involves approaching universities directly and promoting TRL to students. Telstra has a high standard for recruitment and often has to project to over two years ahead. By getting more directly involved with the universities, a bank of goodwill is created.

* Federal Government figures predict a shortage of almost 200,000 skilled people in the IT industry over the next five years – *The Australian*, pg 53, 2/5/00

Name: Tom Lord

Degrees: Electrical Engineering & Science

Studied: University of Sydney

"TRL has a good budget for research and an attractive graduate package, but it was the opportunity to work with a leading telecommunications organisation that clinched my decision to come to Telstra."

Name:
Vivek Mittal

Degrees: Bachelor of Science (Computer) & Bachelor of Engineering (Electrical & Computer)

Studied: Monash University

"With the current IT shortage, most of my university colleagues were offered jobs six months before graduation. I was approached by other IT companies, but had no hesitation in accepting TRL's job offer ... it's a positive, exciting place to work and it has given me the chance to participate in a variety of innovative projects."

Rewarding Research Excellence

Calvin Stein and Adam Kowalczyk are the first recipients of Telstra's new Distinguished Research Fellow Award.

The Award for research excellence, which recognises the contributions of outstanding individuals who have exhibited sustained and effective technical leadership in R&D at TRL, is the first of its kind for Telstra and is indicative of the organisation's support for groundbreaking research amid an increasingly competitive telecommunications environment.

Telstra Board Director, Dr John Stocker, presented the awards to Calvin and Adam.

Calvin, who joined Telstra in 1987, has brought to fruition a series of major new products and platforms for Telstra in the areas of intelligent networks and Internet-related voice services. He was responsible for obtaining three international patents for telecommunications devices and systems. In recent years, Calvin has been responsible for a new stream of products – such as 'click to call', virtual second line and the doorphone. These services have been truly groundbreaking.

Adam joined Telstra in 1984 after a research career in academia. Adam created and sustained a new and important area of research – machine learning and neural network theory. With his strong leadership and his support of other researchers, he has brought a very wide range of data mining applications to practical use in Telstra.

Working at Telstra Research Labs

Anthony Beitz
Beng (Elec) Hons, BSc
6 years with TRL

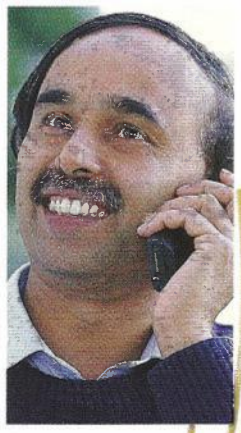
"TRL offered me the type of work I was seeking."

All the projects I am involved with are in the multimedia products area – I have multiple roles in both technical and managerial areas. One of my current roles is coordinator of the Multimedia Products Research Group. I am also involved with R&D for advanced forms of information navigation – such as personalised access, automatic clustering, intelligent indexing and natural language interfaces.

Being exposed to leading edge technologies and having a fair amount of client contact, I have obtained an insight into Telstra's future direction and feel as though I am able to influence the company's decisions about this direction.

I was offered a scholarship by Telstra the year before I graduated and I came to TRL for holiday experience. Upon completion of my degree, I was offered full-time work with TRL and didn't hesitate in accepting the offer because of the difficulty in obtaining good research work in Australia, not to mention that TRL was offering me the kind of work I was seeking.

I am constantly learning on the job. I still like the technical side, but I am also taking on new responsibilities in my management role. Being involved in a rapidly evolving industry and having multiple responsibilities, means that I have to be a generalist and be adaptable – and that's the way I like it.



Amanda Jenkins
B Ed; Grad Dip Sociology
5 years with TRL

"The pursuit of excellence is a high priority at TRL."

There's a strong international focus at TRL. We're a group with many nationalities and there's international links represented in our work.

We also have a strong email network. There have been times when I've put a question out and found people going out of their way to offer assistance. We have very active staff associations and staff committees – Equal Employment Opportunity and Occupational Health & Safety Committees and an effective communication work group. I think they're really positive examples of the atmosphere here at the Labs.

I focus on user-needs analysis, actually getting out and talking to potential or actual users of products. I'm also a project leader, so I'm responsible for administrative and management functions, and ensuring that people work effectively as a team. The project I'm leading is developing a community-of-interest application (called *eLaunceston*), which is a web-based application to support and facilitate the interaction of a closed user-group online.

Chris Rowles
BSc; BCommunicationEng; MEnvSci
16 years with TRL

"You can start with an idea one day and, by the end of the week, you've got a project."

When I left university, I was offered a job which I thought was one of the best opportunities in the world – working for a small company undertaking unique work in semi-conductors. Then I came to Telstra (TRL), one of the few advanced technology R&D companies in Australia no longer surviving from day to day.

Working in applications and service management, I see my primary role as facilitating the movement of ideas into the business. Being able to spark things and motivate people is something I really enjoy.

One of the jobs I've worked on that has made a big contribution to Telstra was a range of systems we built for Mobiles – for network performance monitoring, fault detection and service assurance. It's great to be involved in a project you've taken from concept through to delivery and see that, years later, the systems are still doing the job we designed them for.

At TRL, you can start with an idea one day and by the end of the week, you've almost got a project. I guess that's the reason I've been here sixteen years. Every time I've felt I'm getting a little bit bored, something new happens that's really exciting and I think 'where else could I do this?'

Ganesh Bharatula
BSc, MSc, Mtech
16 years with TRL

"Opportunities to understand business areas and conduct research come automatically at TRL."

For new graduates, TRL is the best place to enter the industry because it's not narrowly focused – we've got research areas ranging from radio communications and opto-electronics to human communications. Once you gain the basic skills and expertise, the opportunities are there for you to study further, or to move to another part of Telstra.

My training has been largely on the job, but there have also been opportunities for short-term courses on project leadership, interpersonal skills, team building and financial training. At the same time, from interacting with your seniors, you learn quite a bit about managing projects. That's how you pick up good ideas.

From what I know of other research organisations, TRL has some of the best communications research facilities in Australia. In our library you can access research papers, journals, documents and books. We have good laboratories and equipment, particularly for radio-related research. Likewise our computing facilities are the latest available.

Luisa Conte
BSc (Physics) (Hons)
4 years with TRL

"There are big problems to be solved and there are big prospects for the future."

The kind of work I do now is different from the job I had when I first came here. I have moved from the technical area more to project management.

Project management means still having the technical expertise, but also leading and establishing new projects. It means managing resources and managing relationships with internal Telstra business units that support our work. Being a project manager also implies people management, understanding how to make a team of people with different characters work effectively together.

In terms of technical expertise, you can find whatever you can think of here. It's also important for us know what other countries and other companies are doing, to put our work in a global context. I've been Telstra's representative in an industry forum called DAVIC, the Digital Audio Visual Council. We have been trying to achieve international acceptance of techniques developed and patented at TRL, like the invisible video watermarking technique.

We need to understand what may be useful to the business, and start early to make sure the technology is mature when it's needed.

John Santos
B Eng (Hons)
7 years with TRL

"It's a constantly changing work flow, it's not monotonous or predictable."

TRL offers graduates the opportunity to continue learning. Some people see the continuation of their university life is in doing a Masters or PhD, and certainly, there is an analogy to be drawn with working at TRL, where the learning doesn't stop and your contributions can really count.

What makes my work interesting is that it's fairly leading-edge research. I have access to a benchful of equipment which you probably could not see anywhere else in Australia. It's one of the reasons I like to hang around here.

In the Lab, I use state-of-the-art measuring equipment applicable to the digital video service that Telstra will launch in the near future. I also undertake research on power line communications, which I took up as a break from digital TV. It's a constantly changing work flow – it's not monotonous or predictable. If you don't know an answer (and quite often you won't), you go out and find it. That's what research is about and that's the challenge of this job.

I like having the opportunity to mix with experts from different disciplines. That's rewarding because you're working in a field that's not traditionally yours, but you can quickly become skilled at it.

Naomi Baker
BSc (Hons), MSc (Computer Science)
5 years with TRL

"It's not the kind of thing you get the chance to do in most companies."

The work on Quokka (an intelligent fault monitoring system for mobile networks) has involved the user interface — getting the look and feel of it right — and creating the underlying database. More recently, my work has focused on developing an expert system for the GSM version of Quokka.

Quokka is one of the most enjoyable jobs I have worked on. I had never written an expert system before, although I'd done the theory at uni. It involved working out what sort of information clients would need and how to convert that into rules for the expert system. It's not the kind of thing you get the chance to do in most companies.

I recently met some of the people using Quokka over in Adelaide and for the first time I got to see how they used the tool. When we came back we could see what we had to do to help them. I am currently researching caching for the Internet, which is a totally different area. Having the chance to do this sort of work as well will better prepare me for the future.

Here, you feel as though your suggestions are actually listened to. This is a good alternative to a university — you have the chance to do research but with the view of getting it used by the industry. There's a sense of accomplishment in having something you've helped build being used out there.

ADSL (Asymmetric Digital Subscriber Line)
A technology that transforms ordinary copper phone lines into high-speed digital lines – Up to 1.5Mbit/s downstream (from the exchange to the end user) and up to 256k upstream.
See also xDSL

AMPS (Advanced Mobile Phone Service)
A family of analog wireless standards which, since the late 1980s, was the principal technology used in mobile cellular networks in the USA. In Australia it was the first mobile network, but at the end of 1999 it was replaced by CDMA.

ATM (Asynchronous Transfer Mode)
A high-bandwidth, low-delay, packet-based switching protocol that allows voice, video, text and data to be multiplexed together into a single transmission network with different qualities of service.

B2B (Business to Business) and B2C (Business to Customer)
Business transactions with other businesses or customers.

Big Pond®
Telstra's public Internet service.

Big Pond® Advance
Telstras fast, broadband Internet service delivered over hybrid optical fibre/coaxial cable, satellite or ADSL.

broadband
A general term used to describe transmission at bandwidths higher than 1 Mbit/s (e.g. high-speed data and video services).

browser
Desktop computer application offering an easy-to-use graphical interface for browsing and retrieving information over the Internet. Microsoft™ Internet Explorer and Netscape™ Navigator are the most widely used browsers.

cable modem
A device used for high-speed connections between a PC and the Internet over the pay TV network. Can deliver data at up to 100 times the speed of standard telephone modems.

call centre
The 'front end' of an organisation or business, comprising a group of people equipped to communicate with customers about bill queries, service issues, technical support, service access and other customer service functions.

CDMA (Code Division Multiple Access)
A digital standard, designed for use in cellular mobile networks, which assigns a unique code to each user and spreads transmission of user channels across a wide band of radio frequencies. CDMA mobile technology was introduced in Australia from January 2000.

certification authority
A trusted electronic system that issues electronic certificates to authenticate user-identity and verify the integrity of transactions or information transfer.

circuit
In traditional PSTNs, telephone connections are made as fixed 64 kbit/s channels or circuits. The alternative to a circuit-switched network is a packet-switched network.

CORBA (Common Object Request Broker Architecture)
An architecture and specification for creating, distributing and managing distributed program objects in a network. It allows programs at different locations and developed by different vendors to communicate in the network through an 'interface broker'.

CSR (Customer Service Representative)
A person responsible for service and sales at a call-centre.

digital TV
The digital transmission and processing of video signals provide a number of benefits over conventional analog TV. These benefits include more TV channels, better picture quality and greater reliability.

DMO (Data Mode of Operation)
Code-name for Telstra's five-year project to adapt its core network for optimal delivery of data, as well as voice. By upgrading its core switching and routing infrastructure, Telstra will be better positioned to deliver new and existing data services such as the Internet.

DSL (Digital Subscriber Line)
See xDSL

DVB (Digital Video Broadcasting)
A European standard for digital TV transmission; an alternative to the ASTC digital compression standard used in the USA.

DWDM (Dense Wavelength Division Multiplexing)
See WDM.

Extranet
See Intranet.

firewall
Network security system comprising software and hardware to control the flow of data between a private network and the Internet.

GPRS (Generalised Packet Radio Service)
An always-on data service (e.g. for Internet access) using packet switching rather than circuit switching. It is compatible with GSM and is regarded a second generation plus (2G+) mobile technology.

groupware
Computer software that enables a group of people to work collaboratively on tasks through having common access to a shared virtual environment.

GSM (Global System for Mobile communications)
European digital standard for mobile phones based on time division multiple access (TDMA). TDMA allows several conversations to share a single radio channel by each transmitting digitised voice within its allocated timeslot. GSM is the second-generation mobile network used in Australia.

HFC (Hybrid Fibre Coaxial cable)
A shared broadband access architecture using optical fibre between exchanges and hubs in suburban streets, and coaxial cables between the hubs and customers to carry Foxtel pay TV and Big Pond® Cable services.

home networking
The connection of a home PC or PCs to other electronic appliances within the home (such as a printer or alarm system), so that they can all be linked to the public communications network for remote access and automated control.

HTML (Hyper-Text Markup Language)
A computer language used to write and format pages for Web publication. Incorporates Webpage features such as hyperlinks, frames, headings, etc.

HTTP (Hyper-Text Transfer Protocol)
A Web protocol that enables a client computer to communicate with a remote server via a browser.

IN (Intelligent Network)
A telecommunications network architecture that employs computers to customise services for specific needs, such as call diversion, call waiting and number portability.

Internet (or the Net)
A global inter-network of computer networks, connected via Internet Protocol (IP) and the world's telecommunications infrastructure. IP enables applications such as email, the web, file transfer and other services to run across different networks and operating systems.

IM (Instant Messaging)
Instant Messaging (IM) is a rapidly growing area of Internet communications involving the spontaneous delivery of short messages between 'buddies' or friends.

IP (Internet Protocol)
Part of the 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.

IP-VPN
See VPN.

ISP (Internet Service Provider)
Company that connects individuals or organisations to the Internet. Can range in size from an individual operating dial-up access, to providers operating substantial network backbones and fast cable modem access (e.g. Telstra's Big Pond® services).

Intranet
A network connecting an affiliated set of client computers using standard Internet protocols such as TCP/IP and HTTP. Many Intranets now take the form of an IP-based network of nodes behind a firewall, connected by a secure virtual private network (VPN or IP-VPN). Intranets between cooperating companies can be called Extranets.

IVR (Interactive Voice Response)
Automated customer service or information selection based on pre-recorded voice prompts controlled by a touch-tone telephone or speech-recognition system.

Mbit/s or Gbit/s (megabits or gigabits per second)
Units for measuring rate of digital information transfer a megabit per second is a rate of one

million bits per second; a gigabit, one thousand million bits. New optical fibre technologies can transfer information a the rate of one thousand gigabits, or one terabit, per second.

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

multiplexing
Carriage of multiple channels over a single transmission medium; any process by which a dedicated circuit can be shared by multiple users. Typically, data streams are interspersed on a bit or byte basis (time division), or separated by different carrier frequencies (frequency division).

narrowband
Communication technologies 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.

neural networks
A form of artificially intelligent software that attempts to mimic nerve cell/brain functioning to allow computers to handle tasks that may be too difficult for conventional software techniques.

optical fibre
A strand of hi-tech glass that carries signals in the form of laser light pulses. An optical fibre pair can carry many thousands of telephone conversations simultaneously, or a mix of video and voice. An optical fibre cable may contain tens or even hundreds of fibres.

PABX (private automatic branch exchange)
A small-scale switching system located in an office or building that provides voice and data extension lines and an access point to the public network.

packet
In a packet-switched network such as the Internet, data is packaged and routed in 'blocks' or packets, each having a header with the network destination address. Packet-switched networks are also described as 'connectionless', because the paths selected by routers can vary from moment to moment as each router is updated with current network information.

PIM (Personal Information Manager)
A device, usually with wireless connection, that displays personal information (e.g. telephone numbers, addresses, email and calendar)

portal
An individual's customised 'gateway' to the Internet. A portal is a web page designed to allow different users to tailor and aggregate content according to individual preference. Web portals include global and special instant messaging, email, and chat facilities to encourage the development of electronic communities.

PSTN (Public Switched Telephone Network)
Generic term for public dial-up telephone networks.

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

QoS (Quality of Service)
For corporate data services, business customers require different levels of telecommunications service (e.g. fast access, reliability and error-free performance) for different needs. Target service levels are specified in service level agreements between the telecommunications provider and customer.

regenerator
A device used in digital networks to pick up the attenuating signal and send an identical but stronger signal to the next part of the network.

repeater
A device used to amplify and equalise an analogue communication signal weakened and distorted through long fixed or wireless circuits. It has a similar function to a regenerator in digital systems.

RSVP (Resource reSerVation Protocol)
A signalling protocol on the Internet that provides network applications with a means of asking routers to reserve bandwidth.

SMS (Short Messaging Service)
Text based message service on mobile phones

Third Generation (3G) Mobiles
Analogue and digital mobile voice networks account for the first and second generations, respectively. 3G mobiles are the next generation mobile networks that will handle high bit-rate data connections.

VDSL (Very-high rate Digital Subscriber Line)
See xDSL.

video compression
A method of transmitting analog television signals over a 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.

VoD (Video-on-Demand)
A service through which customers could access large remote 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.

VoIP (Voice on Internet Protocol)
Voice calls over the Internet.

VPN (Virtual Private Network)
A private network provided on a public network infrastructure. An IP-VPN is a VPN provided over the Internet.

WAP (Wireless Access Protocol)
A protocol that enables mobile phones equipped with the appropriate browser to access Web pages from the public Internet.

WDM (Wavelength Division Multiplexing)
A technology that enables lightwaves of different wavelength to be multiplexed down a single optical fibre, resulting in the creation of 16 or more 'virtual' fibres. Dense Wavelength Division Multiplexing (DWDM) is an advanced version of WDM that can carry many hundreds of wavelengths over longer distances.

Web (or www - World-Wide Web)
A series of interlinked computer documents 'marked up' with HTML to display text, graphics, images and sound. Users browse the documents via a graphical user interface. Web sites are like multimedia magazines, with interactive features and links to related sites.

WML (Wireless Markup Language)
Code for marking up web pages for access by WAP-equipped mobile phones.

xDSL
A technology that enables the copper telephone network to carry data-streams of up to 6 Mbit/s (e.g. video signals). The 'x' denotes that there is more than one DSL technology (e.g. ADSL, HDSL and VDSL).

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