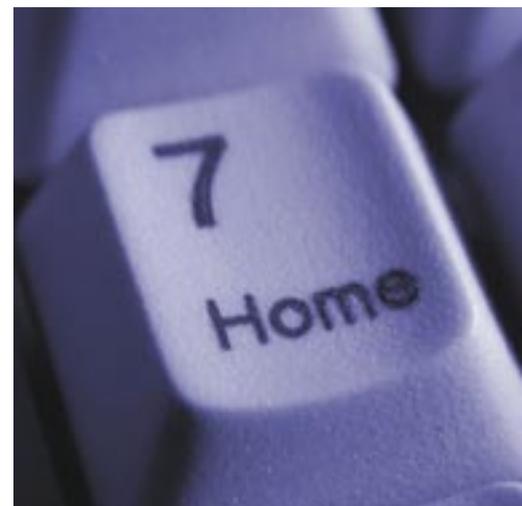




Caring for the Future

The impact of technology
on aged & assisted living



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Summary Report

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What is Aged and Assisted Digital Living?

This report examines the interaction between two major trends – the ageing of the population, and improvements in digital technology in the home.

In 1984 just 10 per cent of the Australian population was over 65. In 2005 the figure was 13 per cent, but over the next 30 years the proportion will increase to 25 per cent or more. We are living longer and, as we get older, we are increasingly living alone, and with disabilities. The costs to society are increasing, and governments and individuals are looking at ways to reduce the burden.

At the same time, we are witnessing a technological revolution. Increasingly, the most innovative uses of digital technology are taking place in the home. Terms like “intelligent home”, “digital home” and “connected home” are being used to describe the convergence of a range of technologies – consumer electronics, computers, communications, home automation – and their increased use in a domestic setting.

These two significant trends – **an ageing population and the growth of connected home technologies** – have both occurred because of improvements in technology. People are living longer because of improved sanitation, better diets, more effective drugs, and greater medical knowledge.

High technology is entering the home because of the effects of Moore’s law, which states that the number of transistors on a computer chip doubles every 18 months to two years. Similar improvements are taking place in data storage, communications bandwidth, display technologies, and a number of other areas. This means that virtually all digital devices are becoming less expensive and more powerful each year. Home automation and home theatre systems, once the preserve of the wealthy, have dropped in price to the extent where their usage is commonplace.

These two trends are increasingly interrelated. Connected home and related digital technologies are increasingly being employed to help older people live more independent and productive lives. And these technologies are not just being used to assist older people, but also those with disabilities. Estimates vary, but the proportion of the Australian population who need daily assistance due to a disability, is as high as 15 per cent – some three million Australians. The needs of the aged and of many of those with disabilities are very similar.

This report provides an overview of the ways digital and connected home technologies are being used in aged and assisted living in Australia in 2005. It examines the key technologies and how they are being used. It looks at the issues from both the demand and supply sides – what do consumers want, and what products are available? The technology is changing so fast that these two questions

provide different answers. This report attempts to help bridge that gap.

Digital technology brings benefits not only to the individual, but also to society. More and more older people are ending up in the acute care sections of hospitals purely because they can’t cope at home. They are putting a strain on the public health system, and making it harder for people who really need to be in hospital to find a place. Technology has the potential to extend their physical independence, so they can stay in their homes longer. It gives them a more dignified life, and it saves public and private money.

Complete independence may not always be possible. It depends on the person’s age and ability and on the type and severity of disability present. But even small improvements can make significant differences to quality of life and to the expense involved in caring for the aged or disabled.

We are all growing older. As we do so we may well come to regard the digital home, and its ability to enhance and maintain an individual and fulfilling lifestyle, as the greatest gift technology can bring. As the baby boomers near retirement age, a generation that has grown up with technology will find that it is not just useful for work and play, but that it has become one of the necessities of life. There are four key areas where technology can help: health, home automation, communications and lifestyle.



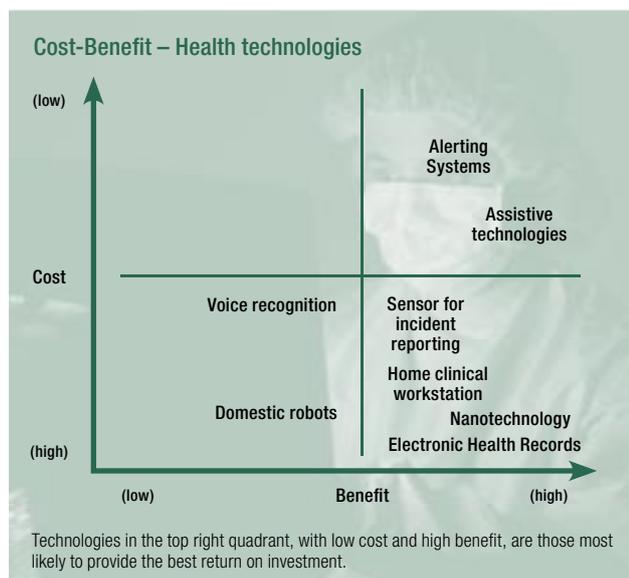


Health

Nearly one-quarter of Australians over 60 need help in managing their health – an enormous burden on the public health care system. If just a small proportion can manage some aspect of their healthcare through the use of technology, the potential savings to the community will be enormous.

Older people are more likely than other age groups to live alone, regardless of whether or not they have a disability. About 7 per cent live in cared accommodation because of their high level of need for support. Retirement villages specify mature age limits and are intended for retired people, but are not necessarily targeted at people with disabilities. Some villages have independent housing, some have cared accommodation and others have a mix of options. Almost half of all retirement village residents need help at least some of the time. Clearly, an improvement to health care is one area where technology can make a significant difference.

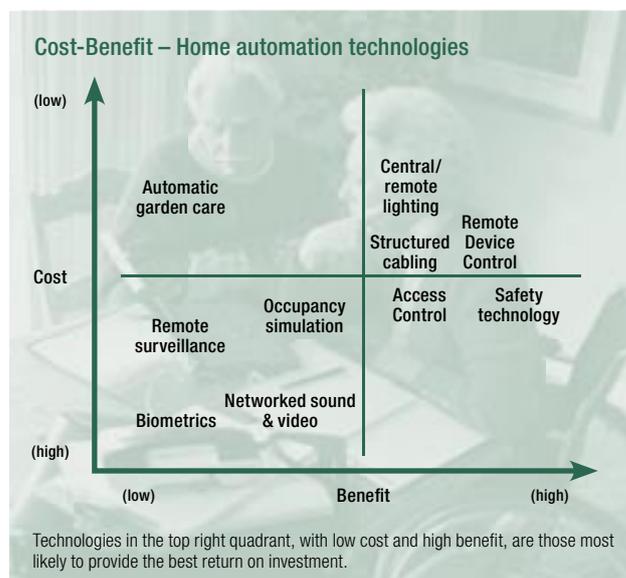
The term “telemedicine” has historically referred to the use of telecommunications technology to provide, enhance, or expedite health care services, through accessing off-site databases, linking clinics or physicians’ offices to central hospitals, or transmitting x-rays or other diagnostic images for examination at another site. Now telemedicine is moving into the home, through the development of technologies such as smart phones and smart homes, connecting PC technologies, communications and entertainment. It is in the area of healthcare that the increased capabilities and falling costs of digital technology are having the most significant effect on people’s lives.



Home automation, security and safety

The need to maximise independence at home is of high importance in maintaining quality of life as well as decreasing the number of carer support hours needed by the individual. A number of new technologies are being developed which have the potential to enable people to remain in their homes for longer periods and later in life than was previously possible, postponing the need to live in high-dependency, assisted care institutions.

Home automation is a luxury for most of us, but a necessity for many who find even the most basic of household chores difficult or impossible. Many homes are now designed with assistive living in mind and feature automated operation of lighting, windows, blinds and appliances. We all like to be secure and for many older people, particularly those living alone, security is paramount. Access control is made easier with appropriate technology and at prices that are now affordable for most applications.





Communication

The key tool in maintenance of social networks, including family ones, is communication. Communication is important to us all, but for people whose mobility is limited, or who live alone, it can become paramount. Communications technologies, in particular telephony and the internet, greatly improve the quality of life of the aged and disabled.

An array of increasingly sophisticated technologies is providing people with many different ways to communicate. The convergence of services from the mass media, IT, and telecommunications industries has led to development of a variety of products, such as VoIP (voice over internet protocol), broadband and mobile TV, and mobile data and content.

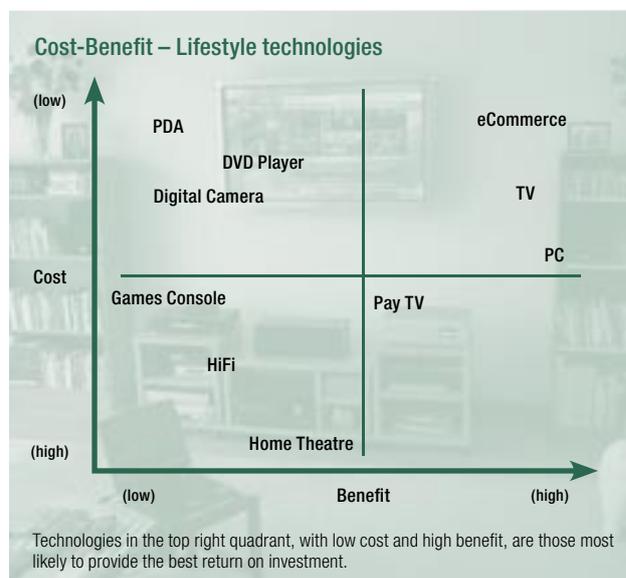
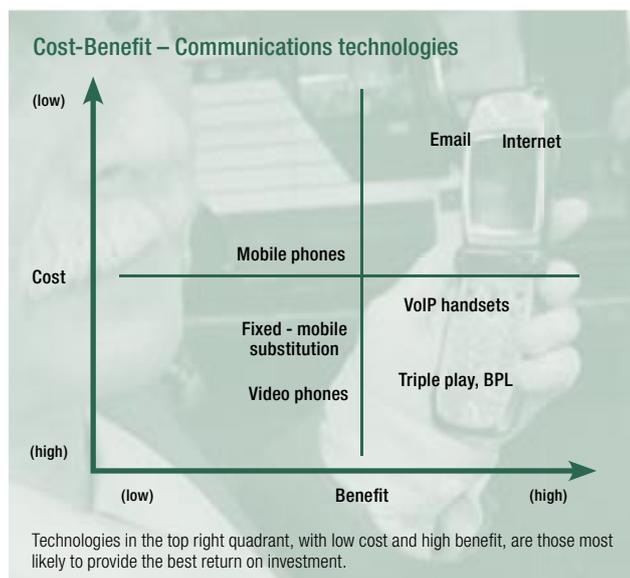
Many of these new technologies can assist persons with mild cognitive impairment to remain engaged socially for as long as possible. They can also provide on-site carers with social support to make them less isolated, and allow family members to keep track, online, of the health of ageing relatives.

Lifestyle

The various home automation and digital technologies can be of enormous benefit to the aged and the disabled, improving their quality of life by enhancing and even enabling their independence. But in the wider community the most popular uses for this technology in recent years has been for lifestyle reasons – mainly to provide entertainment.

The aged and disabled enjoy entertainment as much as anyone else. Indeed, the provision of entertainment in the home may hold a more important part in their lives because of their relative lack of mobility. The enhancement of entertainment and other lifestyle experiences through the usage of digital technology is therefore an important issue, though one in which usage by the aged and disabled may not differ significantly from the population in general.

But lifestyle is not only about entertainment. One increasingly important aspect of the digital revolution is the use of the internet as a transactional medium. Home banking and shopping via the internet are technologies that can significantly improve independence and quality of life of the aged and disabled. Goods and services can be conveniently purchased online and delivered direct to the home, greatly improving the access of these services to people with restricted mobility.

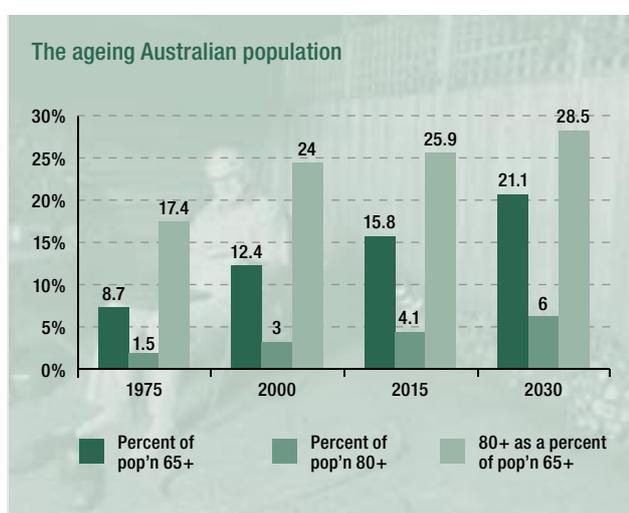




Megatrend One – An Ageing Population

According to the Australian Bureau of Statistics, the proportion of the Australian population aged 65 and over will more than double between 1975 and 2030, from 8.7 to 21.1 per cent of the population. The proportion aged 80 and over will quadruple, from 1.5 per cent to 6 per cent.

Government policies are often based on the extent to which people are able to live independently. Australians typically experience three main living arrangements over a lifecycle: living with parents, living with a partner (for part of this time with children) and living alone in old age if the partner dies.



AUSTRALIAN POPULATION AGED PERCENTAGES FOR 1975, 2000, 2015, 2030				
YEAR	TOTAL POPULATION (1000 ^s)	PERCENT OF POP'N 65+	PERCENT OF POP'N 80+	80+ AS A PERCENT OF POP'N 65+
1975	13,900	8.7	1.5	17.4
2000	19,165	12.4	3	24
2015	21,697	15.8	4.1	25.9
2030	23,497	21.1	6	28.5

Other living arrangements may also include living in a group household or alone before possibly forming a long-term partnership, or living as a single parent or alone after separation or divorce. Changes in these living arrangements have major implications in areas such as aged care, and in the development of government policies and spending priorities.

Where do the aged live?

There are a variety of living environments which people may progressively move to as they age. This has been described as the "continuum of care" The levels within the continuum of

care are home, independent apartment living, assisted living facility, skilled nursing facility, and 24 hour care unit.

Each move along the care continuum escalates the cost of care and sometimes reduces quality of life. Furthermore digital home technologies can play a major role in allowing seniors to stay in a particular care level before moving on to a higher level of dependency.

In 2026, the ABS expects the number of persons living alone in Australia to increase from 1.8 million in 2001 to between 2.8 million and 3.7 million. This is an increase of between 57 per cent and 105 per cent. In 2001, people aged 65 or above comprised 37 per cent of lone person households. This proportion is projected to increase to between 41 per cent and 50 per cent by 2007.

In Australia in 2002-03, 83 per cent of older person households lived in their own home, and 13 per cent lived in rented accommodation. Although most older Australians live in private dwellings, some live in non-private dwellings.



Most of those living in non-private dwellings are in cared accommodation for the aged and retired.

The proportion of older Australians in institutions increases steadily with age, though the overall proportion in each age group living in institutions continues to fall.

Between 1981 and 2001, the number of persons in psychiatric hospitals or institutions in Australia decreased from 21,700 to 6100, while the number in accommodation for the aged or retired increased from 27,400 to 147,700. There is substantial evidence to suggest that one consequence of the deinstitutionalisation of people with a psychiatric or intellectual disability has been an increased rate of imprisonment of such people.



Older people with disabilities living in cared accommodation 1998 and 2003



Source: ABS 1998 and 2003 Surveys of Disability, Ageing and Carers

Disabled persons

In 1993, the UN General Assembly adopted “Standard Rules on the Equalisation of Opportunities for Persons with Disabilities”. While they are not legally binding, the Standard Rules provide a basis for economic and technical cooperation, and act as an instrument for policy-making. They relate to such issues as medical care, support services, and accessibility. Such rules, which incorporate fundamental perspectives on human rights, underpin the need for comprehensive services for every person, regardless of age, mental or physical disability, or level of illness.

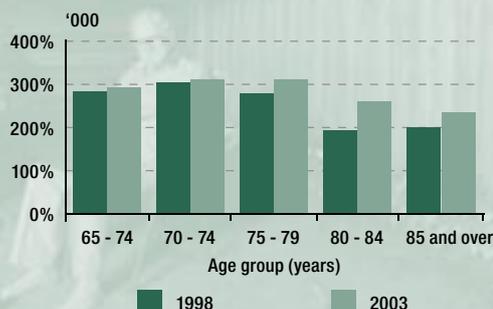
In 2003, more than half of Australians aged 65 years or above (56 per cent) had a disability. Persons aged 65 years or above are more likely to have disabilities than younger persons, and the probability of getting a disability increases with age. Due largely to an increase in the total number of older persons between 1998 and 2003, from 2.3 million to 2.5 million, the number of older disabled people increased from 1.2 million to 1.4 million.

The severity of disabilities also tends to increase as people age. As a result, people tend to need increased help with day-to-day and health-related activities as they age. With baby boomers getting older and greater numbers of people generally living to older ages, questions of how to meet the needs of increased numbers of disabled aged persons are becoming critical.

The Australian government report Australia’s Health 2004 states that the most common diseases managed by general practitioners in people aged 65 years and over were cardiovascular (38.4 per cent), musculoskeletal (22.2 per cent), respiratory (18.8 per cent), skin (17.6 per cent), and endocrine and metabolic (15.7 per cent).

The report also states that dementia, including Alzheimer’s disease, causes the maximum level of severe to profound

Number of aged disabled persons in Australia in 1998 and 2003, by age group



Source: ABS 1998 and 2003 Surveys of Disability, Ageing and Carers

disability of all health conditions affecting the aged. In 1998, it was reported in 22 per cent of persons aged 85 years and over. Of approximately 97,800 dementia sufferers aged 65 years and over, 2.8 per cent had mild or moderate disability, while a staggering 96 per cent had profound or severe disability. The Australian Government has made dementia a National Health Priority. Over a period of five years, it will invest \$321 million in early intervention, further care services, and carer training, to extensively improve life quality for persons suffering from dementia.

After dementia, the most disabling conditions were other mental health conditions, diseases of the eye, and stroke. Among older disabled people, in 1998, the most common health conditions were arthritis, affecting 801,000 people, and hearing conditions, affecting 663,900 people. Everyday activities were restricted for 54 per cent of persons aged 65 or above with a long term disability. About 21 per cent of the population aged 65 or above had a profound or severe disability. Of persons aged 85 or above, 65 per cent had a profound or severe disability, compared with 11 per cent of the population aged 65-74 years.

Disability can also be defined as a restriction, limitation or impairment, which has lasted, or will probably last, for at least six months. Core activity limitation relates to self-care, mobility, or communication. Levels of limitation are profound, severe, moderate and mild. Persons with a profound core-activity limitation either are unable to perform these tasks, or always need supervision or help. Persons with severe core activity limitations sometimes need help with these tasks, have trouble understanding or being understood by others, or find it easier communicating with sign language or other non-spoken types of communication.



Megatrend Two – Digital Technology in the Home

Converging technologies in the home have become something of a cliché in recent years. The digitisation of media, the growth of the internet, the emergence of structured cabling standards, and plummeting prices have brought to the market a range of new technologies that are revolutionising how we live, work and play in the home.

Australians are early adopters of technology. Automatic teller machines were introduced to Australia earlier than any other country. Australia adopted VCRs and mobile phones almost overnight. The market for plasma TVs and iPods and digital cameras is booming. It has become a mark of success to have lots of devices on our person or in our lounge room.

In 2004 Australians bought 210,000 digital camcorders, 808,000 games consoles, and an astonishing 1.28 million digital cameras and 1.48 million DVD players. Nearly 300,000 portable digital music players – mostly Apple's ubiquitous iPod – were sold in the last three months of 2004 alone.

The average Australian home now has 1.07 DVD players, 2.14 TVs, and 1.43 mobile phones. Nearly two-thirds of homes are connected to the internet, and over 80 per cent have at least one PC, with two or more increasingly common.

There are now over 18 million mobile phones in Australia, for a population of just over 20 million. And they are much more than phones – they are cameras, instant messengers and PDAs (personal digital assistants). The mobile phone is the one device most of us take with us wherever we go.

Falling prices and improvements to the technology are changing the way we use technology in the home. People are starting to integrate computers with their home entertainment systems – Microsoft's new Media Center is the most significant step down that path in recent years. The PC can be used to control the TV and the hifi, using integrated disk storage for music, film and video and recording.

Microsoft's new Xbox 360 and the Sony's Playstation 3 have been pre-announced and will be widely available in Australia in 2006 (the Xbox 360 will be released on 2 March 2006, the Playstation 3 later in the year). These two devices will redefine home entertainment, with more power at lower prices than the current breed of PCs, and with graphics capabilities equal to that of high-definition TV. The Xbox 360 has a Teraflop of processing power, the sort of grunt available only on multimillion dollar supercomputers a few years ago. It will not be sold only as a games machine, but also as a home entertainment hub.

Higher capacity broadband internet will see the delivery of all manner of content – including TV – over that medium. Analyst company Forrester Research talks about the "extended internet" as a set of technologies for "directly connecting the

digital world to the physical world". Gartner, another tech watcher, talks about the "Supranet". Telstra and its rivals are gearing up for the post-3G NGN (Next Generation Network), which will integrate phone, internet and broadcast into one interoperable interconnected whole.

As well as the confluence of the two key issues of aging populations and the rapid development of ICT, simultaneous convergence within ICT is also occurring. For example, Motorola is developing real-time communications which integrate content, communications and computing. Whole new classes of device are being developed.

Competing models of technology

The connected home market is growing quickly, but there is massive confusion over standards and connectivity. A number of different industries are targeting the home, but they are coming from many different directions. Each of them has a very different understanding of what constitutes a connected home, and of what technologies will drive it.

The computer industry view

The first of these is the computer industry, best typified by Microsoft and Intel, who essentially define the hardware and software architectures that people use. Home computers are increasingly being promoted as entertainment hubs, suitable not only for internet access and game playing, but for controlling and distributing video, and for home automation control.

The IT industry sees the connected home as one controlled by PCs. The best example is Microsoft's Windows Multimedia Center and the many PCs being shipped with this software. In this view of the world, a fully-functioned PC will act as a server for all digital content (video, music, etc.) with the media over which this content is distributed a secondary issue. The source of the content (disk, internet, broadcast, etc.) is a secondary issue – all the content is digital, so can be treated in the same manner.

In this view of the world, home automation will not even be a secondary area of functionality – it will be an add-on if you really want it.

The consumer electronics view

The second view is based around consumer electronics. The increased digitisation of television and music has seen the convergence of HiFi and TV technology, into a new product area known as home theatres or home cinemas. This trend is greatly strengthened by the emergence of affordable high resolution large-screen TVs (using LCD, plasma or projection



technology), the growth of the widescreen format, and the increased availability of digital content on both free-to-air and pay TV.

Digital TV has been introduced to Australia, allowing much higher definition, better reception, and a degree of interactivity. All digital media share the same technology, can be stored on the same devices, and can be transmitted through the same networks.

The consumer electronics industry sees the connected home as one centred around home entertainment and home entertainment devices. These will be digital, of course, but they will not be computer controlled. PCs and other computing devices will be simply other components on the network, which may be wired or wireless. Sony, the leader in consumer electronics, is readying its new Playstation 3, due in Australia in mid 2006, as the central controlling device for this model of the connected home.

The cabling industry view

The third model is based around the cabling industry. There has been an increasing trend in recent years towards integrated multipurpose cabling in the home, enabling telephone, data networking and video to be fed to any outlet in the house. This is often linked to smart lighting and automated access and security systems. Australian company Clipsal (now French-owned) is a world leader in this technology, but there are many other players.

The cabling industry sees the connected home as one based upon structured cabling, which will provide the infrastructure to which all devices will connect. Umbrella organisations like the Smart Wired House initiative are promoting structured cabling, partly as a standardisation effort and partly in an attempt to pre-empt the threat from wireless networking.

The cabling view of the connected is, of course, cable-centric. All devices hang off an intelligent cabling network, where control resides. Home automation, computer local area networking, telephone, the electrical cabling, video and music streaming, are all subsets of the structured cabling backbone

The content view

The fourth view is that of content providers and telecommunications carriers. The growth of pay TV and the introduction of digital TV has meant a vast increase in the amount of digital content available to the consumer. Add to that the digitisation of music, the increased ease with which digital content can be distributed via the internet, and the interactivity capabilities of digital TV, and we are in the midst of a digital content revolution.

The content providers such as Foxtel, and the telecommunications carriers such as Telstra and Optus, see the connected home as one that is part of a much larger network of content and communication, from where much of the connected home's functionality will be drawn. We have already witnessed the first moves in this direction, with the Foxtel IQ, a more expensive and more limited version (though more integrated with Foxtel's content) of digital recorders that have been available for some time.

Telstra is promoting a view of the digital home where all services – entertainment, communication, home automation – are connected to an intelligent hub (owned by Telstra, of course) which provides communication with the outside world.

While it is difficult to predict the effects of rapidly changing technology, it is possible to predict that it will have an effect on all age levels. Technological change will bring favourable outcomes such as physical workload reduction, communication facilitation, compensation for infirmity, and improved safety of individuals.

Most new technologies reach what many analysts call an "inflection point", the stage at which the technology is sufficiently mature and there are enough suppliers and users to ensure a critical mass of activity. That is now happening with technology in the home.





Health and Digital Technology

Most western countries are seeking to improve the quality of life for aged, disabled and chronically ill persons. They are looking to do this by fostering increased independence, and through the more efficient and cost-effective delivery of health services. Technology plays a key role in this process.

The development of technologies such as smart phones and smart homes, connecting PC technologies, communications and entertainment, are bringing medical technology into the domestic environment. Indeed, it is in the area of healthcare that the increased capabilities and falling costs of digital technology are having the most significant affect on people's lives.

The rising cost of healthcare

Healthcare costs continue to rise in most countries. Ageing populations mean they will continue to do so. For example, in the twenty years leading up to the turn of the century, US expenditure on national health care increased by 50 per cent, to more than \$US1.5 trillion annually. In 2005-06 the Australian Government will spend \$45 billion on health and aged care, more than double spent in 1996-97.

Many attempts have been made to curb the increase, including the introduction of various cost-cutting strategies, including policies of targeting shorter hospital stays for patients. In Australia successive governments are tinkering with the health care and health insurance systems in an attempt to reduce the rate of increase in expenditure. Increased costs by health funds have become a major political issue.

New assistive technologies have the potential to enable much greater quality of life in a home environment. This will reduce many of the costs incurred by already overstretched health care institutions. The implementation of technology

is inextricably linked to the issue of who pays, and how much they are willing to pay. There is always a tradeoff.

Methods of utilisation management that involve, for example, cost control of patient treatment are closely linked to a health organisation's ROI (return on investment) This is the bottom line when organisations such as nursing homes decide whether to implement new technologies.

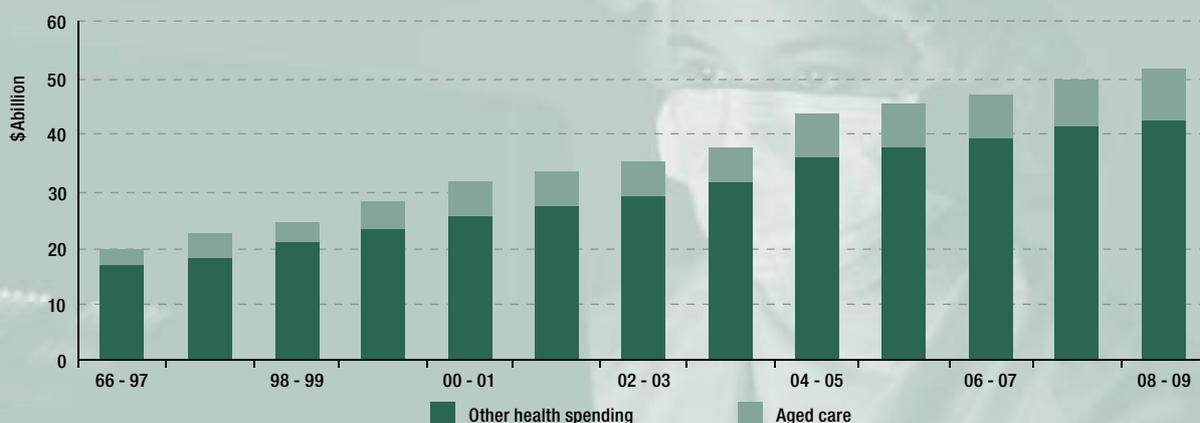
Intel has suggested a solution to the problem of delivering high quality care and independence to the ageing US population while reducing healthcare costs. The solution comprises three components: concentrating on prevention rather than treatment, shifting care from costly clinical settings to the home, and shifting some care responsibility from official providers to individual users, and the user's friends and family.

Intel suggests that many solutions can be facilitated by a variety of proactive computer technologies in the digital home. In 2003, a US study of war widows and widowers, and veterans, asked them to rate their health on a five-point scale, which ranged from "very poor" to "very good". More respondents (61 per cent) thought that there was no way to improve their health, compared with 55 per cent of respondents in 1997. Telemedicine and assistive technologies have the potential to improve this perception.

Telemedicine

The term "telemedicine" has historically referred to the use of telecommunications technology to provide, enhance, or expedite health care services, by such means as accessing off-site databases, linking clinics or physicians' offices to central hospitals, or transmitting x-rays or other diagnostic images for examination at another site. With the rapid evolution of

Government Health Care Expenditure in Australia



Source Australian Government Budget Papers



telecommunications technology into the home (see Chapter Five), the term is also being used to describe the increased trend towards the delivery of health services by electronic means into the domestic environment. Often this is called “telecare”.

The external data network is a crucial part of any home telecare system, so that the patient’s doctor and family can access up-to-date information concerning the patient’s well-being. Six major overall technology trends have been identified in the health care industry. They are:

- Cost management, for example, by using clinical care management software
- Making technology useful for wider range of patients, rather than just high risk patients
- The movement towards electronic health records (EHRs).
- Hybrid of health company insourcing and outsourcing programs
- Consumer electronics are bringing health care into the home
- Wireless technologies and remote patient monitoring.

The last two of these are of particular relevance in the context of this report. A number of companies have developed technologies that are bringing disease management into people’s homes. These include large multinational consumer electronics companies like Intel, Samsung Electronics, Motorola and Qualcomm, but a number of smaller Australian companies are also very active in the development of assistive technologies that are helping the aged and chronically ill live independent lifestyles:

- Perth-based Austco (www.austco.com) now has its products installed in 27 countries, and recently entered the US market. Its original products were designed for calling nurses in hospitals and similar institutions, and are now also being used in aged care facilities and private homes. One of its systems provides a complete dementia care system, integrating motion sensors and monitoring systems to alert carers about any extraordinary behaviour. Different behaviour profiles can be selected for different individuals.
- SmartLink (www.smartlink.com.au) is a Melbourne based company that provides a range of telephone-based emergency call and communications systems. This includes monitoring hardware and software, wireless accessories such as pendants and “man down” alarms, and related equipment.
- Also based in Melbourne is Smart-Caller (www.smartcaller.com.au), which was founded in 1980. Its background is in telephony and paging systems, but in 1990 it divested itself of that part of its business to concentrate on the growing market for what it calls “ageing in place” technologies. Smart-Caller has developed a range of technologies to cater for the

increasing trend for aged people living alone, rather than in institutions. One such system connects monitors and alarms to designated mobile phone numbers, sending context-based text alerts and allowing two-way loud-speaking voice communication if a smoke alarm, for example is activated.

Significant research is also being conducted in this area by Australia’s academic institutions. The modular home clinical workstation, developed by the University of New South Wales and National ICT Australia, comprises:

- testing for blood pressure (BP), ECG, lung function, and blood oximetry
- accurate measurement of patient temperature and weight
- a device worn by a mobile patient with an emergency button for telephone connection. The device also has a triaxial accelerometer, which continually monitors acceleration forces in the x, y, and z axes, so it can detect falls and measure energy expenditure.

Incident reporting

Incident reporting (IR) is a process whereby medical staff report any action that resulted in, or might have resulted in, a negative outcome. Possible incidents include a patient falling out of bed, medical equipment malfunctioning, and administration of incorrect medication. IR can identify factors that might lead to negative events.

IR is being incorporated into automated telemedicine systems, to improve safety and care techniques in assisted living and aged living settings, both community-based and private. For example, when incorporated into a home system for an elderly person living alone, IR can sound an alert to possible problems in managing health, or furniture placement in the environment.

This can have a roll-on effect, providing feedback to improve assistive technology, physical environmental layouts, and associated software. Repeated iterations of this process would be part of an overall quality management process. In addition to this, more efficient, user-centric aged and assisted living environments would evolve, in a more cost-effective way.

Alerting systems and sensors

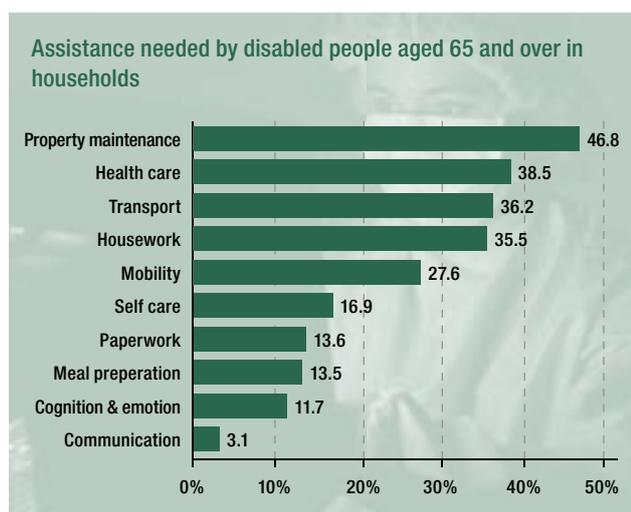
Urgent warnings are delivered to clinicians by alerting systems. For example, health authorities can alert clinicians about disease outbreaks, bioterrorist attacks, or medication alerts. Text-enabled mobile phones, alphanumeric pagers, and wireless palmtop computers can all receive the messages, so that clinicians can react rapidly regardless of their physical location. Also, alerts can be sent when changes occur in patients attached to monitoring equipment.



Computer-based prescribing

The most common cause of negative clinical events is medication error. More accurate information about patients and medications can reduce the most common prescribing errors. Around 70 per cent of Australian GPs prescribe electronically.

Soon, it may be indefensible not to use computer support when prescribing, since it reduces serious errors by 55 per cent and overall errors by more than 80 per cent. Benefits will increase even further if there is an integrated electronic patient record system. The Australian Government's Health Connect program, in particular, has been involved in developing standard electronic health records, but general progress towards such standards remains slow.



Assistive technologies

Disabled people may need help with activities such as preparing meals, moving around in the home, property maintenance, housework, and managing their health. As they age, their requirements tend to increase. In 2003 the ABS estimated the total number of disabled people aged 65 and over in Australian households at 1,232,200 – over one million. The ABS also found that 69 per cent of them reported a need for some assistance.

The main activities they reported needing help with were property maintenance, health care, transport, housework and mobility. Less common needs were assistance with self care, meal preparation, and paperwork. Some people needed assistance with cognition or emotional issues, such as thinking through problems. Between 1998 and 2003, the proportion of older disabled people who needed assistance with self care, health care, and mobility increased significantly.

Almost all people with severe or profound activity limitations need assistance in at least one core activity area. A majority

require mobility assistance, just over half with self care, and around 10 per cent with communication. They are also very likely to need help with other daily tasks such as transport, property maintenance, health care, and housework. Approximately a one-third need assistance with meal preparation and paperwork, and more than a quarter with cognition or emotion.

By assisting people at home with the activities of daily living and compensating for any deficits of function caused by dementia, people are able to stay at home longer and maintain higher levels of independence. There are a number of proactive computing applications being developed to assist ageing persons in the home environment. These are designed to predict the user's needs and proceed to meet such needs. Wireless sensors, for example, can also be used to gather behavioural and biological data, to be used as input for the computer applications. The ultimate goal is to increase the independence of seniors by developing computerised assistants.

Assistive digital technologies include the following:

- Radio/ultrasound/remote controlled appliances
- Captioning
- Phone amplifier and Talking watches, clocks
- Personal amplification system/hearing aid
- Portable scanner with word processing templates
- Alternate keyboards
- Mouth stick/Head Master/Tracker with on-screen keyboard
- Voice output devices



Health technologies summary

TRENDS	ISSUES	TECHNOLOGIES	OPPORTUNITIES
Greater industry awareness of need to make concerted efforts to introduce new technologies	There is a need for guidelines to base decisions on.	UN Standard Rules on the Equalisation of Opportunities for Persons with Disabilities comprise one such instrument for policy-making	Use guidelines such as the UN Standard Rules as a basis for economic and technical cooperation. This will also indicate that the focus for industry is not entirely on profits, but largely on the well-being of its clients.
Growing government investment in health and aged care needs: doubled since 1996	There are many competing parties seeking to gain funding	Money spent in such areas as hospitals, aged care, other health.	Seek funding for joint Government/ industry research and development of technologies
Increasing number of disabled persons	The need to expand services accordingly	Telemedicine and assistive technologies	Industry members should collaborate to achieve maximum short and long term gains
Increasing development of sensor technology	Could make some existing technologies obsolete	Sensors which gather data for proactive customised health applications	Research new ways to incorporate sensors into aged and assisted living environments
Disease management is shifting to people's homes	Technology needs to keep up-to-speed. Cultural issues mean one solution does not necessarily suit everyone.	Large consumer electronics companies are developing related key technologies, smart homes and smart phones	Survey users and potential users to best determine their needs, in different cultural groups. Possibly find a niche market for users with special needs.
Consumers becoming more aware of Smart Home concept	Technology has to be cutting-cutting-edge, so that it doesn't become obsolete before it's even sold. There is a growing market for retrofitting technology to existing homes and institutions.	Smart Wired™ House, which has integrated wiring for television, telephone, internet, audio, lighting, security and garden irrigation, has been developed by the Copper Development Centre Australia Limited (CDC).	Partners in the Smart Wiring™ initiative include Clipsal, HPM, Krone, Pirelli, Belden, Universal Systems, LG Electronics, Switched on Living, Cisco, BHP, Crane Copper Tube and MCK Metals Pacific. This demonstrates the potential for multi-industry collaboration.
Incident Reporting (IR) becoming increasingly important part of clinical practice	Could be incorporated into automated telemedicine systems	A web-based IR system has been trialed in US	Use IR to help guide development of better services
Clinical science is producing more and more knowledge, at a rate too fast for clinicians to fully absorb	Need to integrate online medical knowledge for real progress in telemedicine from point of view of providing health workers with real-time updates on medical issues	Online medical knowledge databases in infancy	Software development companies can place themselves at the key early development stage of medical knowledge databases Could liaise with Government Health Connect program directors
Medical emergency alerting systems	Provides quick way of communicating with health workers. Would there be a possibility of hackers misusing system? This raises usual questions about security of system and applications of cryptography.	National emergency "cascade" systems	Extend alert systems into aged care facilities as a matter of course. Possibly extend to private households, although this might be inadvisable due to possible negative reactions such as community panic in event of disease warning, for example.
Increasing needs of persons as they age	Some needs are more widespread than others, for example property maintenance, health care, transport, housework, and mobility Overall aim is to reduce dependence as much as possible	Domestic Robots	Target key areas of need
Nanotechnology applications expanding	New scientific area with some applications probably not even dreamt of	Nanotechnology at cutting-edge of developing futuristic assistive technologies. Includes development of drug delivery by nano particle attachment to protein	Collaborate with scientists such as Professor Gordon Wallace, who is developing artificial muscle fibres using nanofibres.
Technology originally designed for disabled persons often gets adopted by general non-disabled users	Recognition of this fact should lead to even more research and development in the area of assistive technologies	IBM's ViaScribe is an advanced form of voice-recognition technology which lecturers can use in lecture theatres. It does not require training up of user profiles.	Find ways of adapting more existing technologies for the general market place. Better still, have more than one working version, to cater for different market demographics.
Synchronous (real-time) communication increasingly important	Associated technology, such as web connectivity, needs to be failsafe, especially in medical institutions.	Online medical databases have huge potential for revolutionising immediacy of medical interventions	Database development companies can lead the way in this field



Communication

The key tool in maintenance of social networks, including family ones, is communication. Communication is important to us all, but for people whose mobility is limited, or who live alone, it can become paramount. Chapter Four examined the use of telemedicine, which by its nature (“tele” means “distant”) uses communications technologies to facilitate its functionality.

Both telephony and the internet comprise an array of increasingly sophisticated technologies which provide users with many different ways to communicate. The convergence of services from the mass media, IT, and telecommunications industries has led to development of a variety of products, such as VoIP (Voice over Internet Protocol), broadband and mobile TV, and mobile data and content.

Converging networks

These communications will become increasingly seamless, with virtually uninterrupted communication possible as the user moves from their home to their car and to external places such as work. Telstra and other carriers are talking of the “Next Generation Network” (NGN), which will merge all existing communications networks into one “supernet”.

The distinction between the telephone, television and internet networks will disappear. This process has already begun, with some carriers offering “triple play” (pay TV, telephone, internet) services over the one network. The first such service in Australia has been provided by TransACT in Canberra. Other technologies, such as BPL (broadband over power lines), being implemented by Aurora Energy in Tasmania, also hold significant promise.

Radical new thinking is required in market strategies for new wireless technologies due to the turbulent environment now faced by providers. Media such as books, films, and music are being digitised, devices are getting smarter, and broadband is exploding. Many companies are developing a number of cutting-edge technologies to enhance communication.

These include connected home technologies such as telephone with a rich visual display, a PC-like keyboard, and a sensor network that looks for sudden declines in social contact. These types of technologies can assist persons with mild cognitive impairment to remain engaged socially for as long as possible. They can also provide on-site carers with social support to make them less isolated, and allow family members to keep track, online, of the health of ageing parents.

Ageed and assisted living environments comprise a niche market which is affected by some variables differing from those impacting the general communications market. Therefore, it might make sense to experiment in a foothold

market such as carefully selected aged care institutions before committing to an overall strategy on mobile services to the aged and disabled. But examples of communications services specifically designed for the aged and disabled are emerging.

Post-och Telestyrelsen (PTS), the Swedish government’s postal and telecommunications regulatory agency, has been experimenting with services which allow aged and disabled persons to access postal and telecommunications services. They are mainly designed for persons with visual or hearing disabilities, but may extend to other groups.

Trials of electronic communications and post services for disabled persons, carried out for PTS, indicated that there is a need for increased flexibility and mobility for disabled users, and also better information about the services available, including the aids needed to use the services. Usability and accessibility were found to be main factors enabling disabled persons to use the new technologies. The analysis found that email and the internet presented the least problems generally, while most limitations related to chat and mobile telephony.

Telephony

Telephony has the potential to greatly improve the lives of aged and disabled persons. As well as the obvious concern over how technology can provide enhanced telephony services to persons with special needs, more basic needs exist. For example, an elderly or disabled person may need assistance in noting down and remembering advice given, in relation to obtaining support when making telephone calls.

There are just over 20 million people in Australia. As at 30 June 2005 there were 18.42 million mobile phone connections, an increase of 12 per cent in the previous twelve months, and representing a penetration rate of over 90 per cent of the Australian population. It is also predicted that mobile voice service spending will grow to \$US339 billion in Asia, Europe and the US by 2007. The trend towards cheaper mobile hardware, expected to be as low as \$15 for a low-end handset, and less than \$10 for a minimal handset by 2010, will most likely extend to more advanced handsets with the assistive features needed by the aged and disabled.

Convergence between telecommunication services, broadcasting, media content and the internet are exhibited in new generation mobile phones. The next generation of mobile telephony is 3G (third generation). It follows from 1G (analogue) and 2G (digital). 3G is also digital, but is distinguished by higher bandwidth, enabling its use as a data communications medium, and the use of phones as internet browsers.

It is likely that the mobile telecommunications industry will



benefit financially if equal consideration is given to the needs of individuals, institutions and social groupings as is given to the affordances of the technology itself. For disabled persons, this includes consideration of special needs, such as sight, hearing, or motor-related impairment, which can be addressed with various enhancements to the technology.

Fixed versus mobile

While there is a trend of convergence of fixed and mobile telephony, debate still continues as to the whether mobile telephony will eventually replace landline-based telephony completely. After peaking in the mid 1990s, the number of landline connections in Australia continues to drop, declining by 2 per cent in 2005. This has led some to predict the eventual demise of fixed lines.

Fixed-to-mobile substitution (FMS) will cause lost revenue of around \$30 billion to fixed-line carriers in Asia-Pacific in 2005.

This is due to a number of factors, including cost savings from fixed services being outweighed by mobility needs, the difference in prices narrowing significantly, and many new customers in developing markets choosing a mobile as their only phone.

VoIP

Industry specialists assert that it is difficult to imagine landlines becoming completely redundant, since they offer convenience, reliability and security superior to mobiles and VoIP. For example, for older and/or disabled persons living alone, the safety of access to a landline in case of emergency is of paramount importance. This safety could be compromised by having a mobile with flat batteries, or one that is out of range of the service provider network.

Fixed line carriers also face competition from low-cost voice over internet protocol (VoIP) services. VoIP is a technology that allows telephone communication over the internet, with the assistance of a microphone, headphones, and the appropriate software, or with a special internet handset. VoIP technology was given a massive publicity boost when an internet auction company acquired VoIP pioneer Skype for \$US2.6 billion in mid-2005.

VoIP networks are becoming commonplace in the Australian business environment. VoIP technology will be utilised by an IBM company, Cerulean, which has been commissioned in 2005 to design, build and maintain a commercial Radio Over internet Protocol (ROIP) solution for Country Energy. This will enable transmission of two-way radio traffic, in the form of Real-Time Transport protocol (RTP) packets to be transported over the IP network.

There are many other examples of VoIP systems being deployed in Australia and internationally. VoIP could provide a cost-effective means of communicating for aged or disabled persons, living alone or institutionally. VoIP handsets can be programmed to perform a number of functions unavailable or available in a more limited fashion on normal telephones.

Many of these features are of interest to the aged and disabled. The growth of VoIP telephony, and the merging of the telephone and internet networks, will mean many innovations in handset design that will greatly facilitate communication for the visually and aurally impaired.

Videophones

While the concept of video phones has appealed to many people for decades, successful implementation has been elusive. There are a number of hurdles to overcome:

- Regular and wireless telephone networks are not designed (and usually lack the bandwidth) to carry moving pictures
- Cost and capacity
- The need for the user at the other end to have a video phone
- People are used to the telephone being audio based and may even relish the visual solitude of a phone call.

Many disabled people want video communication so they can see the person they are talking to. The importance of family and friends to aged and disabled persons should not be underestimated. The ability not only to communicate verbally, or exchange still photographs, but also to see their loved ones in real-time video would be a great comfort to many.

For many years now PCs with low-cost video cameras have enabled rudimentary video telephony via the internet. The widespread use of broadband and improved software has made PC-based videoconferencing commonplace in business, and the adoption of similar technology in the home is gradually making the concept more viable. One of the much-touted benefits of 3G mobile telephony is video phone calls, so it seems likely that the technology will gradually become more widespread and more accepted.

Use of computers and the internet by the aged

According to researchers at Sydney University, while older people are the fastest growing age group of internet users, very little is known about them or their internet usage. Further research is being conducted by researchers at the university.

For internet technology companies to be successful, they need to invest in researching complex human factors and apply resultant knowledge about user interaction with the internet. Critical factors which drive uptake include whether the services fulfil personal needs, enhance lifestyle, and are



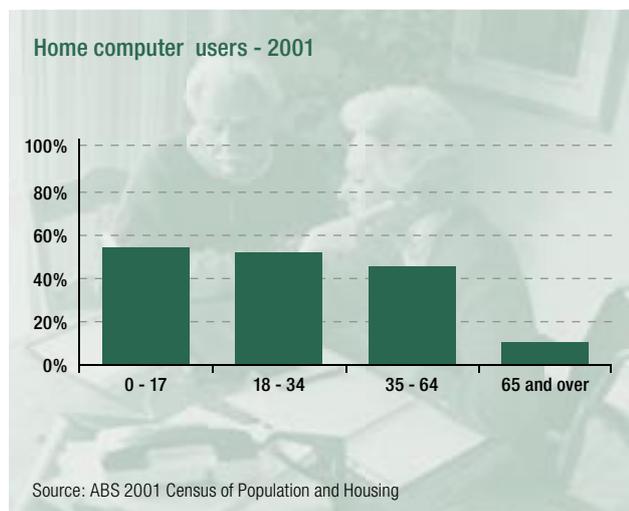
affordable and cost effective in the long term.

According to Harold Hartfield of the Australian Federation of Disabilities Organisations, access of information over the internet has the power to become “enabling in life as opposed to disabling”. He cites how video streaming over IP, combined with high speed broadband, provides the means for real time communication for deaf people via Auslan, their own language.

Similarly, suitable adaptive screen reader technology allows the blind and vision impaired to access the internet independently, and voice recognition technology provides independent access to the internet for users with severe dexterity issues.

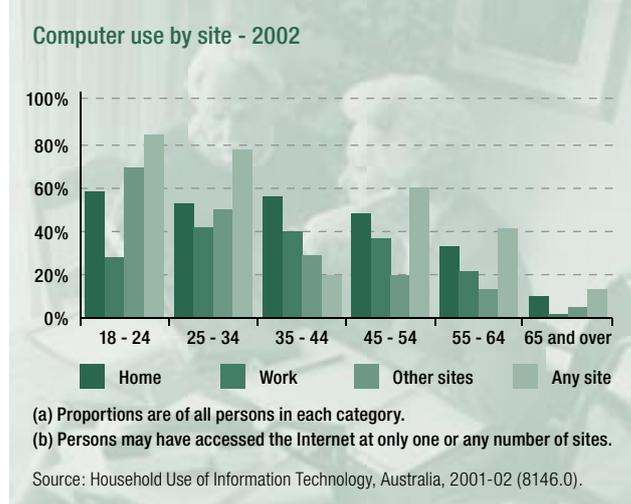
While older people are not as likely to use a computer or the internet as younger ones, the percentage using these technologies is increasing. It is more likely that they will use the computer and internet at home for private or personal use.

Older persons are more likely to spend a larger amount yearly on services and goods bought via the internet than other age groups, but a smaller proportion of older people access government services via the internet.



In 2002, 18 per cent of older people used a computer at home, 3 per cent at work, and 10 per cent at other sites. Of the 18 per cent who used a home computer, the main purposes were private and personal (92 per cent). Other purposes included educational (19 per cent), business or work (16 per cent) and community or voluntary (13 per cent).

Of the 222,000 older persons who used the internet at home in 2002, the most commonly reported purposes were private or personal (91 per cent). Other purposes included educational (18 per cent), business or work (15 per cent) and community or voluntary (9 per cent).



AGE GROUP (YEARS)	HOME PER CENT	WORK PER CENT	OTHER SITES PER CENT	ANY SITE PER CENT
18-24	57	28	69	84
25-34	52	42	49	78
35-44	55	39	29	69
45-54	45	36	19	58
55-64	32	21	12	42
65 and over	10	2	5	13
PERSONAL INCOME (C)				
\$0-\$39,999	37	20	29	52
\$40,000-79,999	61	59	36	80
\$80,000 and over	76	78	40	89
All adults	43	30	31	58

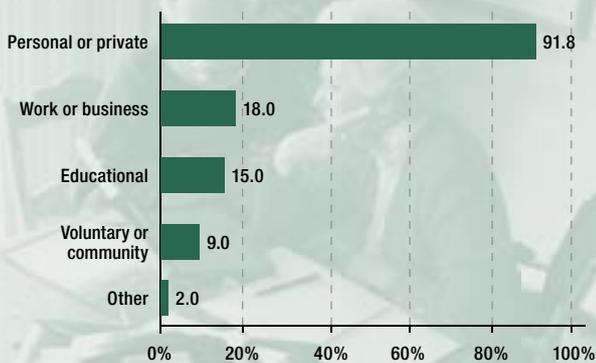
(a) Proportions are of all persons in each category.
 (b) Persons may have accessed the internet at only one or any number of sites.
 (c) In 2000-01.
 Source: Household Use of Information Technology, Australia, 2001-02 (8146.0).

During 2002, only 2 per cent of the older population bought services or goods via the internet. Proportionally, the most common type of purchase was from the travel and accommodation category (47 per cent of older people who used the internet).

The next most common purchases for the older population were computer software (31 per cent) and financial services (21 per cent). Proportionally, older persons were more likely to buy services or goods from overseas than younger age groups. A



Internet use at home - Users aged 65 and over - 2003



Source: Household Use of Information Technology, Australia, 2001-02 (8146.0).

greater proportion of older users (44 per cent) spent in excess of \$1,000 on internet purchases annually than younger age groups.

In 2002, the older population was the least likely to access government services, comprising just 2 per cent of all adults who accessed them. Proportionally, the older population was more likely to use the internet for bill payments, such as rates payments, than other age groups.

In 2002, older internet users stated that they did not order goods and services via the internet primarily because they had not bothered to try, or they had no need. They also cited security concerns.

Characteristics of adult internet users

The number of adults using the internet has grown rapidly, increasing from 31 per cent of all people 18 years or above in 1998 to 58 per cent in 2002. This strong growth has taken place in all age groups. The likelihood of internet use decreases with age.

During 2002, the site where adults were most likely to use the internet was home. This was especially the case for adults with incomes less than \$40,000 in 2000-01. Adults with incomes of \$40,000 and over were much more likely to use the internet at work than adults with lower incomes. Persons aged 18-24 years were most likely to use the internet at sites other than work or home.

Use of IT by selected population groups in 2003

In 2003, computer and internet use data was collected in ABS household collections for three selected population groups. These were people aged 15 years or above with a disability, people aged 60 years or above, and children aged 5-14

years. The data is not directly comparable with that for 2002 presented above, due to the different surveys used.

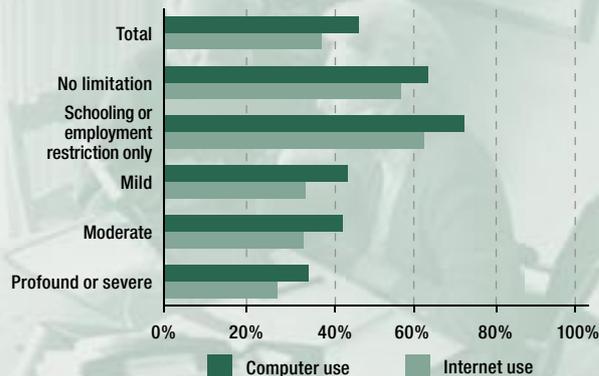
Of persons aged 15 years and over with a disability:

- 48 per cent reported having used a computer
- 39 per cent had accessed the internet
- 41 per cent most likely to have used computer at home (92 per cent of these persons were using for private or personal reasons)
- 30 per cent most likely to have used internet at home (94 per cent of these persons were using for private or personal reasons)

Of persons aged 60 years and over:

- 29 per cent reported having used a computer

Computer and internet use by disabled persons by level of disability - 2003

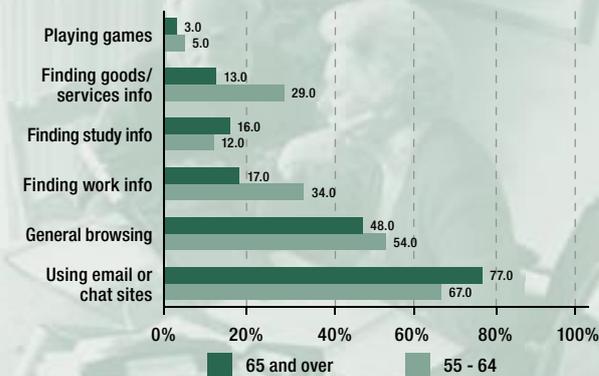


(a) Persons aged 15 and over

(b) Excludes disfigurements or deformities without any limitations

Source: Household Use of Information Technology, Australia, 2002 and 2003 (8146.0)

Comparison of home internet activities of older age brackets - 2000



Percentages are of all adults who accessed the internet at home.

Source: Household Use of Information Technology, Australia, 2000 (ABS cat. no. 8146.0).



- 21 per cent reported having used the internet
- About three times more likely to use a computer or internet at home than work
- 95 per cent of those using a computer at home were most likely to have done so for private or personal reasons
- 96 per cent of those using the internet at home were most likely to have done so for private or personal reasons

As can be seen from the chart on the previous page, in the year 2000, the 55-64 age bracket used the internet for finding information about goods and services at a rate more than double that of the 65 and over age bracket. Therefore, it may be reasonable to surmise that, as the 55-64 year olds age, they will cause an increase in this internet usage for the oldest age group.

Communications technologies summary

TRENDS	ISSUES	TECHNOLOGIES	OPPORTUNITIES
Converging communications networks	Existing telecommunications models threatened	3G, Fixed to mobile substitution, NGN, VoIP	Development of specialised hardware (e.g. handsets) and
Increased bandwidth	Digitisation of all communications	Video phones, video streaming	Closer contact through new devices
Increased reliance on telephone	Falling prices, "anywhere any time" capability	Greater functionality in fixed and mobile phones	Specialised telephony services
Grandparents to outnumber grandchildren	Creates "the inverse family pyramid"	Communication technologies such as the internet	Market technology as a "glue" to hold the extended family together
Ageing persons	Need for family to keep track of health of ageing parents	Home communication technologies	Develop increasingly user-friendly, mobile communications
Older population quickest growing age group of internet users	Very little is known about their internet usage	Online surveys to collect data about use and attitudes	Collaborate with organisations for seniors such as ASSCA to conduct research
Older internet users tending to spend more on internet purchases than younger ones	Little known about why they act the way they do	Technologies such as cookies could help build up a picture of usage	Market more online goods and services specifically to the older population
Minor proportion of older people access government services via internet	What can be done to increase that proportion?	Research	Reduce amount of face-to-face and telephone contact with government staff. Reduction of staff numbers
Bundling of services such as landline, mobile phone, and internet into packages by competing service providers	Competition between existing carriers and new carriers	Triple play, Broadband over power line (BPL)	Development of services packages specifically aimed at the aged and disabled





Home Automation, Security and Safety

The need to maximise independence at home is of high importance in maintaining quality of life as well as decreasing the number of carer support hours needed by the individual. A number of new technologies are being developed which have the potential to enable people to remain in their homes for longer periods and later in life than was previously possible, postponing the need to live in high-dependency, assisted care institutions.

Home automation is sometimes called domotics (from the Latin domus, house). It refers to the application of information, robotic and control technologies to domestic appliances and the house itself.

Home automation enhances home and lifestyle by deriving more benefits from electronic and electrical home equipment. Basic home automation includes structured wiring for telephone, internet, video and local area network (LAN). More advanced home automation includes multi-room audio, home theatre, lighting control, keyless entry and security. The technology can also include the control of blinds, air-conditioning, exhaust and ceiling fans, watering, and other appliances such as programmable wall switches, touch screens, telephones and personal computer.

For example, the Australian Smart Wired™ House initiative, which specifies integrated wiring for television, telephone, internet, audio, lighting, security and garden irrigation, has been developed by the Copper Development Centre Australia Limited (CDC). Partners in the Smart Wiring™ initiative include Clipsal, HPM, Krone, Pirelli, Belden, Universal Systems, LG Electronics, Cisco, BHP, Crane Copper Tube and MCK Metals Pacific.

A key aspect of many home automation systems is the incorporation of security and safety features. Many people perceive that crime rates are rising, and the increase in the number of people living alone adds to concerns about security. These issues are of importance to all of us, regardless of age or level of well-being.

One study found that security ranks ahead of house size, energy efficiency, communications, land size, and usability in factors people take into account when purchasing a home. Aged persons, disabled persons, and chronically ill persons may need greater assistance in attaining heightened safety levels. It has also been suggested that women generally, regardless of age or health, benefit from the availability of increased security, and most aged people living alone are women. Current technologies such as surveillance technologies and remote monitoring enable greater levels of security and safety than ever before.

Sensor networks, often use for telemedicine, can also

monitor the activities of residents. These can be used for medical purposes, but they can also provide data input which will trigger assistance potentially required in household tasks such as cooking.

Users can access their home networks via a number of familiar interfaces such as televisions and telephones. According to Intel, the users “will not need to learn new technology to receive assistance”. This outcome has enormous potential in providing user-friendly technology which is more likely to be embraced by possible users.

There is some confusion in the user community over the term “home automation”. CRS’s 2005 Connected Home Report found that many respondents to the survey that this report was based on had never heard of the term, or did not know what it meant. One question in the survey, which asked about preferred suppliers for home automation products, placed B&D Roller Doors as the supplier with by far the highest brand awareness, indicating that to many people home automation means nothing more the radio-controlled opening of a garage door. True home automation vendors, such as Clipsal or Hager B&R, were hardly mentioned.

Structured cabling systems

A number of vendors supply and manufacture structured cabling systems which provide a backbone for home automation. Leading suppliers in Australia include Clipsal, Hager B&R and Hills Industries. Market leader Clipsal manufactures the C-Bus product range which comprises a group of wired and wireless devices, including wall plates, plug adaptors, remote control and a gateway which enables a C-Bus wireless network to be linked to a Cat-5 wired network.

A wireless remote control lets a user control buttons on the wireless wall plate and plug adaptor units remotely. Since it uses radio frequency (RF) communication, unlike an infrared (IR) remote, it does not need to be pointed directly at the unit to be controlled. This has obvious advantages for a variety of disabled users. Integrated systems can also incorporate touch screens, switch labelling technology, multi-room audio system, an infrared distribution system, and universal remote controls.

Research has found that electronic aids to daily living will generally decrease frustration and increase independence of users. They do not necessarily have to be manufactured specifically for the disability market, but can be generally available commercial technology. Details of some assistive technologies trialled in the multiple case study, suppliers, availability, and cost are summarised in the table on the following page.



SOLUTION TRIALLED	MANUFACTURER/SUPPLIER	AVAILABLE IN AUSTRALIA	COST (\$A)
Simplicity Environmental Control	Quartet, ^a Rehab Engineering	Yes	POA
PowerLink2	Ablenet, ^b Rehab Engineering	Yes	\$324.00
Switch adapted remote (customized)	Rehab Engineering	Yes	\$150.00
Multi CD player/stereo (IR)	Panasonic, ^c Radio Rentals	Yes	\$499.00
Dynavox2 IR ECU optionis	SST, ^d Rehab Engineering	The new model is the DynaVox 3100	\$11 626.00
Adapted telephone with handset mount	Adapted	No	N/A
Adapted touch lamp with extended base	Adapted	No	N/A
Telephone extension cord (to allow it to be placed in accessible position)	Generic, many suppliers	Yes	Approx. \$10.00
IR TV	Philips, ^e Radio Rentals	Yes	\$399.00
Modified electric bed control	Custom-Made	No	N/A
Access 35 telephone	Telstra, ^e Dick Smith	Yes	\$149.00
Large button trainable remote control unit	Remotec, ^f Dick Smith Electronics	Yes	\$89.95

^aMassachusetts, USA;^bMinneapolis, USA;^cMinoshima, Japan;^dSentient Systems Technology, Pittsburgh, USA;^eSydney, Australia;^fLondon, UK.

Control systems

A number of home automation systems include software to provide an interface to home automation systems providing manual control, scheduling, and monitoring via a standard PC.

It is possible to have a number of different heating and cooling methods, such as electric floor, ceiling or panel heating, solar heating, hydronic heating, and ducted cooling and heating. There are numerous ways of controlling them, some basic, some more advanced.

BASIC HOME AUTOMATION CONTROL	ADVANCED HOME AUTOMATION CONTROL
When security disarmed on return home, enable cooling/heating	Integrate timer and thermostat functions within home automation
When security armed on leaving home, disable cooling/heating	Change mode settings such as timing and temperature
Enable pre-cooling/heating with mobile phone	Graphical user interface (GUI) on touch screen
Use motorised zone dampers to air condition specific rooms, so saving energy	Use infra-red to detect movement, so that room occupancy is detected and automatic damper control occurs
Control zones by using programmable wall switches	
Use standard timers and thermostats	

Controls for people with special needs

While home automation would generally be considered as a luxury for the non-disabled person, it is more of a necessity for a disabled user, to provide any real semblance of independence. People with special needs, such as persons

confined to wheelchairs, need easier control of lighting and appliances than the non-disabled user. This can be achieved in a number of ways, including:

- Extensive automatic lighting as move through house from room to room
- Customised task lists scheduled to perform automatically at preset times on preset days
- Entire customised checklists of tasks executed by pressing a single button
- Special application computer software to control automated devices, and utilise computer hearing, vision, and mobility assistive options
- Interface to custom controls which user finds easier to use
- Large switching sections on touch screen
- Speech recognition software to voice-control devices
- IR remote controls for touch screens and light switches
- When line-of-sight control is not optimum, RF control options
- Use SMS commands or voice menus on phone to remote control
- Control remote sound sources such as multi-room hifi.

Security

Home automation based security enhancing technologies include:

- Central locking
- Controlled access using smart cards or biometrics
- Remote surveillance via central control
- Embedded unobtrusive technology
- Back-up modes in case of subsystem failures.



Deterrence and back-to-base security

Two key features of advanced home security systems are deterrence and an effective response from back-to-base security. These are enabled by a number of technologies, including:

- Back-to-base station reporting
- Monitoring and control by mobile phone SMS
- Incorporated lighting control
- Gate or door access using fingerprint recognition or PINs
- Encrypted network security.
- Occupancy simulation (Internal response to external approach, using infra-red detectors and lighting)
- Automatic forward illumination.
- Illumination of all inside and/or outside lights.
- Biometric fingerprint scanner

Safety

A number of technologies are available to enhance safety in the home. These include smoke detectors and fire sprinklers, ceiling fans automated to switch off if smoke is detected, and irons and other appliances set up to turn off automatically when leaving home and after preset time periods.

Home automation technologies summary

TRENDS	ISSUES	TECHNOLOGIES	OPPORTUNITIES
Increased interest in home automation from existing home owners	Existing homes not fitted out with technology	Retrofitable wireless system	Develop and market further retrofitable systems
Numerous devices	Could end up with remote for each one	Universal infrared remote control	Develop progressively simpler universal remotes
Infrared remote controls well-established	Disabled person needs to be able to point the IR control towards the appliance	Radio frequency (RF) remote control	Develop more RF controls so user doesn't need to point. Design other technologies which are less restrictive for user.
Users looking for more user-friendly technologies	Technology not universally simple	Development of interfaces which are familiar such as TVs and phones	Design and produce more intuitive technology
Increase in some violent crimes, and burglary is of concern	Aged, disabled and chronically ill persons are more vulnerable	Security systems with back-to-base monitoring	Develop retrofitable systems. Perhaps entire streets or suburbs could be marketed to, with cost reduction for bulk sales of basic systems which can be added to later
Disabled persons live as independently as possible	May have difficulty holding or using conventional house keys	Biometric technology enables door lock access by fingerprint eg. ekey TOCA system	Develop even more sophisticated biometric technologies. Manufacture in bulk to reduce cost. This can be used in group homes or assisted living environments
More technology-savvy criminals	Could reconstruct fingerprint from basic biometric equipment which is operated by pressing motion	Biometric equipment using swiping action leaves smudged fingerprints behind eg. ekey TOCA system	Develop technology which doesn't require direct touch. Maybe could just hold hand near a scanner momentarily Individualise for special needs eg. No limbs due to thalidomide, use eye scanning hardware/software
Aged persons often become more forgetful	Can result in safety risks such as irons left on	Can set to switch off automatically when leaving home and after preset time periods	Develop more devices which switch off automatically e.g., if a person started running bath water, left room, after a few minutes of room sensors not detecting movement, tap water turned off
Malicious attempts to hack into computer systems to cause problems or access information	Reduced network security	Use encrypted messages for network communication	Invest in research, particularly sophisticated cryptography





Lifestyle – Devices, Entertainment and eCommerce

Various home automation and digital technologies can be of enormous benefit to the aged and the disabled, improving their quality of life by enhancing and even enabling their independence. But in the wider community the most popular uses for this technology in recent years has been for lifestyle reasons – mainly to provide entertainment.

The aged and disabled enjoy entertainment as much as anyone else. Indeed, the provision of entertainment in the home may hold a more important part in their lives because of their relative lack of mobility. The enhancement of entertainment and other lifestyle experiences through the usage of digital technology is therefore an important issue, though one in which usage by the aged and disabled may not differ significantly from the population in general.

But lifestyle is not only about entertainment. One increasingly important aspect of the digital revolution is the use of the internet as a transactional medium. Home banking and shopping via the internet are technologies that can significantly improve independence and quality of life of the aged and disabled. Goods and services can be conveniently purchased online and delivered direct to the home, greatly improving the access of these services to people with restricted mobility.

Device usage by age

An increasing number of digital electronic devices are becoming available for use in the home. Some have been

available for some time, but widespread usage has occurred only in recent years as prices have dropped to affordable levels.

The data in this section has been extracted from the CRS Connected Home Report 2005. This survey of over 1000 Australian households, selected at random, asked a number of demographic questions, including age of respondent, and included questions about whether a range of electronic devices were installed in the respondent's home. The data in the table above and on the following pages shows not whether the person uses the device, or how they use it, but whether they live in a house which contains the device type. Responses to the survey were broken down by the age of respondent.

The data shows that, generally speaking, usage (as defined by the likelihood of a random person living in a household containing such a device) of various electronic devices does not vary significantly by age, excepting that it tends to decline sharply for people over 60.

- Desktop and laptop PCs: PC usage is reasonably constant across age groups, but declines significantly over 60. Nevertheless, more than half of over 60s live in a home with at least one PC. Note that laptop owners also often own a desktop PC.
- Games consoles and PDAs: As might be expected, Over 60s are not big users of games consoles – they are around seven times less likely to live in a house equipped with such

Percentage of households with devices, by age of respondent							
DEVICE TYPE	AVERAGE	UNDER 20	20 - 30	30 - 40	40 - 50	50 - 60	OVER 60
Desktop PCs	71.9	77.6	72.1	77.5	78.9	77.5	55.2
Laptop PCs	28.0	30.8	38.4	30.5	35.2	28.1	13.2
38.5	38.5	77.3	59.1	53.7	47.2	29.4	5.3
PDAs	9.6	11.9	9.6	12.5	14.1	6.5	4.9
Digital Cameras	47.3	55.2	61.7	49.1	58.3	48.2	25.6
Digital Camcorders	16.7	29.9	16.4	21.1	18.2	16.7	8.4
Mobile Phones	83.1	91.0	87.4	86.2	92.9	89.9	63.6
DVD Players	77.4	92.5	89.6	83.8	81.3	81.2	55.6
CRT TVs	97.7	98.5	95.6	98.3	97.5	98.8	97.8
Non-CRT TVs	6.3	12.1	10.4	7.1	7.7	1.8	3.6
HiFi Systems	75.5	69.2	77.6	83.7	83.3	78.6	60.2
mp3 type Players	17.4	34.8	21.6	14.7	27.2	12.2	6.3
Pay TV	23.8	23.5	26.6	27.9	28.4	27.0	13.2
Home Theatre	15.4	17.6	24.5	19.6	18.6	13.2	5.0

Source: 2005 Connected Home Report, CRS



a device than the population generally. But PDA (personal digital assistant) use is only around half the cross-population average.

- Digital cameras and digital camcorders: Usage is about half the cross-population average. Digital camcorders are most popular in households with young children.
- Mobile phones: Usage is down, but still around two-thirds of over 60s live in a house with at least one mobile phone.
- DVD players: Usage rates are down a little from the cross-population average, but most over 60s live in a home with at least one DVD player.
- CRT and non-CRT TVs: Over 60s are just as likely to have a TV as the general population – usage is practically universal. But only around half as many of them live in a house with a non-CRT (plasma, LCD, projection, etc.) TV.
- Hifi systems and mp3 type players. Over 60s are likely to have a hifi, but significantly less likely than other people. Usage of portable mp3 type players is very low, at around one-third of the cross-population average.
- Pay TV and home theatre: Only around half as many homes inhabited by over 60s have pay TV compared to the population generally, and only about one-third as many have a home theatre.

The data indicates a consistently lower level of usage of most entertainment devices amongst the over 60s. This could be a function of conservative buying habits (they were not brought up in the era of easy credit and instant gratification), but may also be a function of conservative usage habits – some older users may feel intimidated by the technology. The existing data is descriptive only – we recommend research into the reasons behind the discrepancies.

Digital camera in household - by age of respondent



Mobile phone in household - by age of respondent



Desktop PC in household - by age of respondent

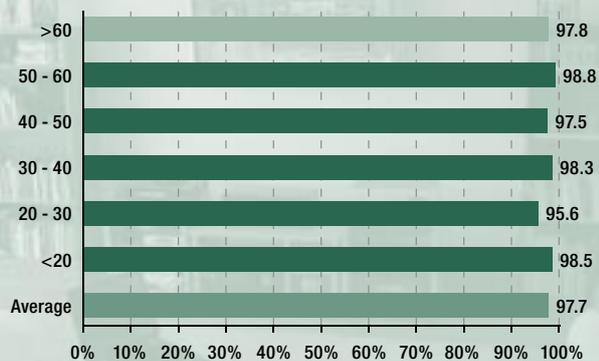


DVD player in household - by age of respondent

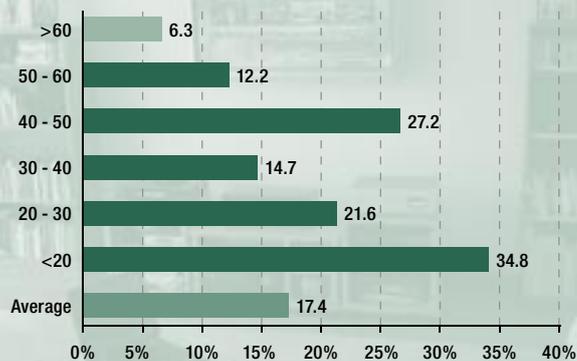




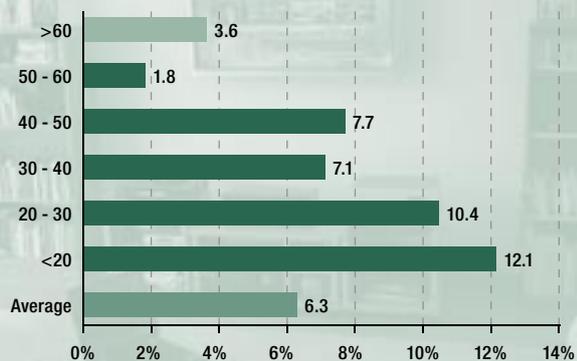
CRT TV in household - by age of respondent



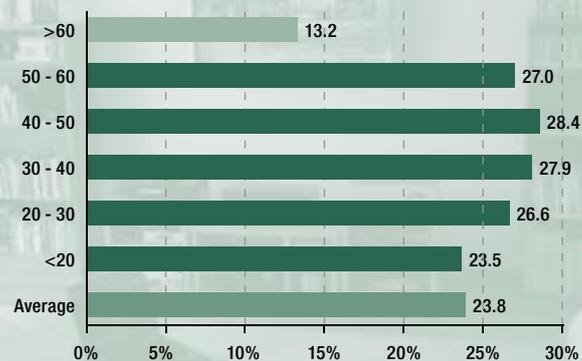
mp3 type player in household - by age of respondent



Non-CRT TV in household - by age of respondent



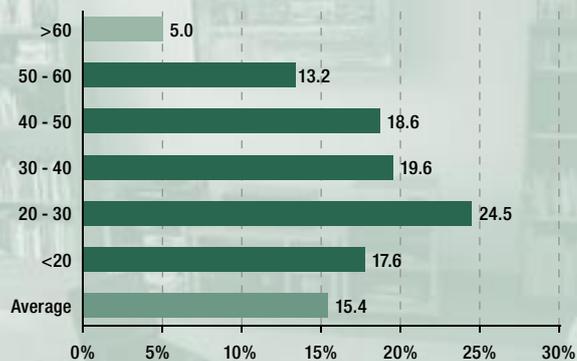
Pay TV in household - by age of respondent



HiFi system in household - by age of respondent



Home theatre in household - by age of respondent





Entertainment and home automation

To support the use of digital devices used for entertainment, it is usual for some sort of cabling system or network to be installed. Structured cabling can be installed in new premises or retrofitted to old, preferably during renovations. Wireless systems may also be installed – these are generally easier to install, but typically suffer some performance constraints. An adequate cabling system or wireless network will ensure that changing needs are catered for, and low-voltage electrical wiring will not need to be retrofitted. For example, wiring can be installed to cater for current and future requirements for:

- Broadband internet
- Computer local area network (LAN)
- Telephone
- Video cameras and video intercom
- Other security devices
- Home automation
- Multi-room audio systems
- Control of automatic watering.

There is a proliferation of entertainment systems available, of varying degrees of sophistication and expense. A typical system may include the following features:

- Allows users to control and listen to audio sources from various locations in a home
- Utilises digital audio distribution technology for system integration and communication
- Audio distribution technology enables interference-free audio reproduction
- Allows integration of audio products with home automation products: e.g. volume can be controlled from same device which controls lighting
- Any input audio source can be made available in any audio zone
- Compatibility with multiple audio sources, including digital audio
- Handheld remote control infra-red signals can be routed through system by connecting emitters and targets
- Infra-red commands can be stored by system and activated by programmed commands

eCommerce

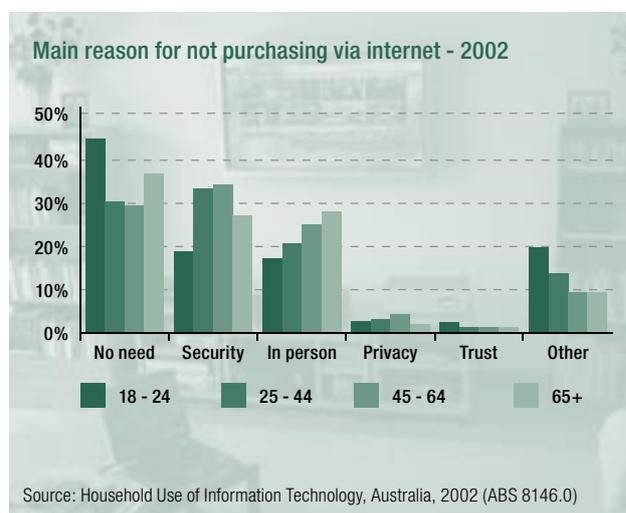
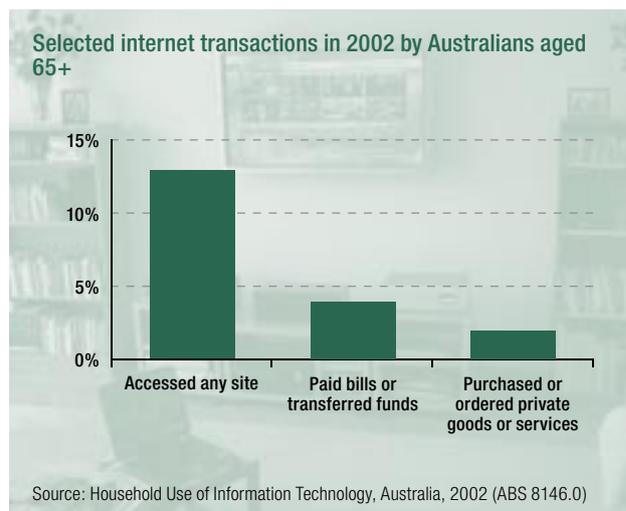
Internet commerce is the placing or receiving orders for goods and services via the internet or web, with or without associated on-line payments. This is also often known as eCommerce (electronic commerce) or eBusiness.

The ABS has reported that during 2002-03, 39 per cent of Australian businesses which used the internet reported

placing orders for services and goods over the internet. For the same period, 19 per cent of businesses which used the internet indicated receipt of orders via the internet or web. Numbers have grown considerably since that time, and eCommerce is now regarded as a natural way of doing business.

For the year ended 30 June 2003, the approximate value of internet income worldwide was \$24.3 billion. This represented around 1 per cent of the total income of all businesses, and roughly 5 per cent of the total income for businesses which received some orders via the internet or web.

There has been an emergence of new markets, which have had varying success. There is little doubt that eCommerce is the wave of the future, with an increasing number of small and medium businesses participating in this new forum.





During 2002, only 2 per cent of the older population bought services or goods via the internet. Proportionally, the most common type of purchase was from the travel and accommodation category (47 per cent of older people who used the internet). The next most common purchases for the older population were computer software (31 per cent) and financial services (21 per cent).

Proportionally, older persons were more likely to buy services or goods from overseas than younger age groups. A greater proportion of older people (44 per cent of users) spent more than \$1000 on internet purchases annually than those in younger age groups. Proportionally, the older population is more likely to spend a larger amount per annum on services and goods bought via the internet than other age groups.

In 2002, most of the older internet users who did not order goods and services via the internet said that they had not done so primarily because they had not bothered to try or had no need (36 per cent). Security concerns were cited by 26 per cent of older internet users (a smaller proportion than in younger age groups). The least likely reasons for the older age group were privacy and trust concerns.

Lifestyle technologies summary

TRENDS	ISSUES	TECHNOLOGIES	OPPORTUNITIES
Availability of increasing number of electronic devices for use in home	Correct wiring needs to be fitted to building	Structured pre-wiring ideal, rather than retrofitting	Market structured wiring to individuals and group living environments, while emphasising cost saving and flexibility of product
Increasing range of entertainment systems available	Confusing for potential purchaser	Backbone structured cabling systems (e.g. Clipsal 8050 series1) or wireless networks.	Marketing: Spell out clearly why your product is worth the money you are asking, as opposed to customer buying cheap entertainment systems at department store half-yearly sales. Don't bamboozle them with technical jargon.
Multiple users want to experience different entertainment simultaneously	Most networked technology currently in-home only allows for one central control	Multi-zone digital media distribution system	Develop improved multi-user systems, so appealing to a wider market. Make them modular, so can easily expand with growing household.
Emergence of new markets on internet	Varying success	Huge variety of goods and services available	For year ended 30 June 2003, approximate value of internet income was \$A24.3 billion. Is your organisation getting its share?
Internet use has grown rapidly	Various demographic types and levels of use	Online purchasing technologies such as order placement databases	See last question above
Older internet users tending to spend more on internet purchases than younger ones	Little known about why they act the way they do	Technologies such as cookies could help build up a picture of usage	Market more online goods and services specifically to the older population



Suggestions for Further Research

During the research for this report it became obvious that there are many key areas ripe for further research. There is extensive literature on the subject, in both the academic and commercial fields, but there is very little primary research, particularly of the people most likely to be affected. We know a lot about the technology, but we know very little about the wants, needs and views of the people most affected by the technology – the aged and disabled themselves.

We believe that a report based on such research would be an extremely valuable addition to knowledge in this field. Feedback from professionals interviewed as part of the data collection process has also given valuable pointers as to what more can be done. The only way to properly assess the impact of technology and aged and assisted living, in Australia and internationally, is to do that research.

Health

- Investigating “different persons’ points-of-view: the carers, cared for, how people look after people, the process”
- Carers’ technology skills, any deficiencies in same, and their attitudes towards technology, including online data management systems
- Detection of cognitive decline by connected home technology, with the aim of reducing cost of treatment of illness relating to social isolation
- Developing clinical and technical standards relating to assistive Smart Housing technology
- Preventative health (one of CSIRO’s Flagship Research programs, as mentioned in Australian Government, Department of Health and Ageing, 2003 report). This could involve an investigation of how IT can facilitate preventative help measures.

Home automation

- It has been claimed that “nearly all adults with learning disabilities will be living in poverty”. How can technology redress this situation, for example, in providing employment at home? How can the problem of not being able to afford the technology be solved in the first place?

Communication

- Connectivity challenges
- Needs for technology in various settings
- Case studies of successful use of technology, to increase technology adoption, based on the models of success
- Older people and their internet use
- Disabled and chronically ill people and their internet use
- Confidentiality and privacy issues, including associated legal matters

- Unique characteristics of content innovation enabled by mobile phones.
- Layers of innovation in mobile phone.
- Evolving patterns of use of mobile phones.
- Barriers to innovation such as intellectual property regimes, evolving technology expectations, illegal activities and privacy concerns.

Lifestyle

- It has been stated that “ageing in the twenty-first century will be strongly influenced by the pattern of social stratification [and that] gender, ethnicity and age are three dimensions by which people are stratified”. How can “the response to the ageing of ethnic minorities...be flexible and sensitive to the interests and needs of different minority groups”?

Note: This report is a summary report only. The full report contains expanded chapters, a section on carers and attitudes to technology, four appendices, and an extensive reference and bibliography. For copies of the full report, please contact Connection Research Services, the Copper Development Centre, or Connection Magazines.

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